CEQA INITIAL STUDY GRASSLAND BYPASS PROJECT - LONG-TERM STORM WATER MANAGEMENT PLAN FOR THE GRASSLAND DRAINAGE AREA

Prepared for

GRASSLAND AREA FARMERS
SAN LUIS & DELTA-MENDOTA WATER AUTHORITY
LOS BANOS, CALIFORNIA

by

Summers Engineering, Inc.
Hanford, California

October 2019

Appendices

1 Environmental Checklist Form

1. Project title:	Grassland Bypass Project - Long-Term Storm Water Management Plan for the Grassland Drainage Area
2. Lead agency name and address:	San Luis & Delta-Mendota Water Authority P.O. Box 2157 Los Banos, CA 93635 (209) 832-6200
3. Contact person and phone number:	Joseph C. McGahan Drainage Coordinator Summers Engineering, Inc. P.O. Box 1122 Hanford, CA 93232-1122 (559) 582-9237
4. Project location:	Grasslands watershed in Fresno and Merced Counties
5. Project sponsor's name and address:	Grassland Basin Drainers San Luis & Delta-Mendota Water Authority P.O. Box 2157 Los Banos, CA 93635
6. General plan designation:	Agricultural (Merced and Fresno Counties);
7. Zoning:	Exclusive Agriculture (Merced and Fresno Counties)
8. Other public agencies whose approval is required (e.g., permits, financing approval, or participation agreement).	a. Reclamation for use of San Luis Drain b. Central Valley Regional Water Quality Control Board for Waste Discharge Requirements (WDRs) c. U.S. Fish & Wildlife Service informal/formal consultations d. California Department of Fish & Wildlife consultations for North Grasslands Wildlife Area

	e. Fresno County Department of Public Works and Planning for crossing of Russell Avenue
a. In order to utilize the San Luis Drain (Drain) for storm water discharge, Reclamation has confirmed that the Drain is authorized to convey storm water. The Grassland Basin Drainers (GBD), as project proponents, will need to obtain an Agreement with Reclamation allowing use of the Drain as a conveyance for storm water from irrigated lands. Interested parties could include one or more of the following: the Grassland Water District, Reclamation and the U.S. Fish and Wildlife Service, the Central Valley Regional Water Quality Control Board (CVRWQCB), and downstream stakeholders and other parties that are interested in the management of storm water flows to the San Joaquin River. b. The Waste Discharge Requirements (WDRs) issued for the Grassland Bypass Project (GBP) will likely need to be modified by the CVRWQCB to allow discharges of storm water after 2019 in Mud Slough. c. Under the federal Endangered Species Act, Sections 7 and 10, informal/formal consultations between Reclamation and the US Fish and Wildlife Service may be required. d. The proposed West Pipeline affects Russell Avenue. A permit will need to be obtained from Fresno County to cross the road.	

9. Have California Native American tribes traditionally and culturally affiliated with the project area requested consultation pursuant to Public Resources Code section 21080.3.1?	Yes ☒ No ☐
If so, has consultation begun?	Yes ☒ No ☐

On August 23, 2017, the Dumna Wo Wah Tribal Government requested formal notice and information on proposed projects implemented in the Grassland watershed under Public Resources Code section 21080.3.1. A description of this project was mailed to the tribal government on March 22, 2019, in advance of completion of Section 2.17 of this Initial Study. The results of this consultation are presented in Section 2.17.

1.1 Description of Project

The Grassland Basin Drainers (GBD), under the umbrella of the San Luis & Delta-Mendota Water Authority, and as the project proponents, have developed a plan for management of storm water that, since the beginning of the Grassland Bypass Project in 1996, has been conveyed through the San Luis Drain (Drain) along with the Grassland Bypass Project's subsurface drainage from agricultural operations and the reuse area. Proposed modifications to the Grassland Bypass Project include continued implementation of components of the Westside Regional Drainage Plan (SJVDP 1990) to manage subsurface drain water. The Grassland Bypass Project has been subject to previous review under the California Environmental Quality Act (CEQA), including preparation and certification of the Final Environmental Impact Statement and Environmental Impact Report for the Grassland Bypass Project, 2010-2019 (August 2009, SCH No. 2007121110) (Grassland Bypass Project Final EIS/EIR). The discharge of agricultural drainage will cease by the end of 2019, and agricultural subsurface drainage will be managed by the GAF participating districts and at the SJRIP. Going forward, the Grassland Bypass Project, as proposed to be modified, is referred to as a Long-Term Storm Water Management Plan (LTSWMP) for the period January 1, 2020 through December 31, 2045.

The Project Area is primarily located in the northwestern portion of Fresno County and a portion of the south-central section of Merced County. This area consists of the Grassland Drainage Area (GDA) as well as adjacent land to the north through which subsurface drainage has historically flowed. The reuse facility, known as the San Joaquin River Improvement Project (SJRIP), is located in the north central section of the GDA on property containing approximately 6,000 acres with planned expansion of up to 1,500 additional acres of reuse area (including approximately 1000 acres already developed for salt-tolerant crops).The inclusion of the San Joaquin River to Crows Landing for compliance monitoring adds Stanislaus County to the Project Area.

The proposed LTSWMP should strive to achieve the following objectives:

1. To eliminate, to the extent feasible, storm water drainage discharged from the GDA into wetland water supply conveyance channels.

2. To facilitate storm water management that maintains the viability of agriculture in the Project Area and protects water quality in the San Joaquin River.

3. To keep storm water drainage from breaking into irrigation and wetland water supply channels and causing damage.

4. To avoid ponding of storm water that could impact the integrity of water supply channels and impact soil and water quality.

5. To avoid unplanned/inadvertent/unmanaged ponded water containing selenium (Se) that could impact birds within the GDA as well as downstream habitat and water quality in the wetland areas and wildlife refuges.

6. To provide an outlet for storm water to flow to the San Joaquin River from the GDA (similar to what occurred historically and before the Use Agreement for use of the Drain), that also protects the integrity and quality of wetlands and wildlife refuges.

The proposed LTSWMP involves continued local management and downstream coordination of rain induced flows to the San Joaquin River utilizing the Drain as conveyance to avoid impacting wetland water delivery channels. As stated in Appendix A, *Plan Formulation Report*, the alternative evaluated herein is Alternative C (Proposed Project), which is continued use of the

Drain at its current capacity combined with the use of existing and new short-term storage basins to reduce discharges to Mud Slough (North).

The Proposed Project analyzed in this CEQA Initial Study considers modifications to the previously analyzed Grassland Bypass Project and includes features to address the capacity limitations of the GBC and Drain, storm event frequency and magnitude, and available storm water management tools to minimize discharges. It also considers some enhancements to existing facilities including securing ownership of land for purposes of the drain water reuse facility (SJRIP), new pump/conveyance systems, additional short-term storage basins, and a remote shut-off system for operation of tile sumps.

1.1.1 Limitations of the Grassland Bypass Channel and SLD for Managing Storm Flows and Proposed Project Measures

The maximum design flow in the Drain is 300 cfs as it was originally designed. However, the 2010 Use Agreement has limited the permitted flow in the Drain to 150 cfs. This is because the connection facilities between the GDA and the Drain are limited to 150 cfs. These facilities include a culvert underneath the Main Drain, Main Canal, and Helm Canal and the four-mile earth-lined GBC which connects the GDA drainage system to the Drain. The Proposed Project as modified would continue to use the existing Grassland Bypass Channel and related culvert, drain and canals to handle storm flows up to 150 cfs, would include an automated system to turn off tile sumps during storm events, would improve the SJRIP delivery system to allow storm flows to be conveyed to more areas to make limited use of the SJRIP reuse area in the winter and of existing regulating ponds (with 500 acre feet [AF] capacity) that discharge to the reuse area, and to add new short-term storage basins (approximately 200 acres) to handle up to 1,000 AF of storm water when storm flows are greater than 150 cfs (without ponding against canals or in the reuse area).

Before the Grassland Bypass Project (GBP), the San Luis Drain contained sediment that had been deposited during operations prior to the GBP. The 20 years of operation of the GBP has deposited additional sediment which further restricts the capacity of the Drain. As a result, the use agreements (including the 2010 Use Agreement) have limited the allowable flow in the Drain to 150 cfs. One purpose of this limitation was to prevent any suspension of sediment which might be discharged to Mud Slough (North). A Sediment Management Plan was evaluated in the 2009 Final EIS/EIR (Reclamation 2009b) to return the Drain to its original capacity of 300 cfs. This plan allowed for placement of removed sediments on agricultural, industrial and/or residential lands. Removal commenced under the plan in 2015, 2016, 2017 and 2018 using excavators to remove the sediment and trucks to haul it to the SJRIP. As of August 2018, approximately 180,000 cubic yards of sediment has been removed for the Drain between Site A and Henry Miller Avenue (approximately 14 miles). All removed sediment was hauled to the SJRIP and used to fill in unneeded drains. Future sediment removal will be accomplished similar to the 2017-2018 removal, but the location of the placement area likely will change due to the logistics of hauling material that is further away from the SJRIP. Measured selenium levels in the Drain sediment are below the threshold for application on industrial and residential sites. A planned industrial site has been located adjacent to the Drain at Highway 152, and an estimated 100,000 cubic yards could be placed at this location. This would be sufficient to store all of the remaining sediment in the Drain. Due to the narrow time-window available for sediment removal and the logistics related to hauling distances, the removal is expected to take an additional year to accomplish, to December 31, 2020. Approximately 95,000 cy of sediment remain in the Drain and need to be removed, resulting in approximately 35 trips per day for 45 days in 2020 and 2021. The nature and intensity of sedimentation and hauling activities associated with the Proposed Project are consistent with, and well within the scope of, the activities previously analyzed in in detail in the Grassland Bypass Project Final EIS/EIR (August 2009, SCH No. 2007121110) for the 2010-2019 Project timeframe.

The type of construction equipment to be used includes the following:

- Excavators (2)
- Graders (2)
- Sweeper (1)
- Dozer (1)
- Water truck (1)
- Hauling trucks (8)

All of this equipment is under current use in removing sediment buildup from the Drain.

Concerning sediment removal, the US Fish and Wildlife Service (USFWS) has reviewed the current removal project and determined the following:

> "Where the old Kesterson Reservoir site is to the west of the SLD, we suggest the operators work from the west side of the SLD and stockpile sediment on the Bureau of Reclamation's land. Where Refuge lands are on both sides of the SLD, we request that the sediment be stored on top of the levee, as we saw in the south Grasslands project. In both instances, the sediment would be kept away from Refuge lands-and thus the project would not have the potential to damage Refuge resources." (USFWS 2017)

1.1.2 Storm Event Frequency and Magnitude

There were only three years during the first 20-year period of the GBP in which discharges were made to wetland channels because the capacity of the GBC and Drain were exceeded: water years (October to September) 1997, 1998, and calendar year 2005. These periods totaled 42 days which corresponds to 0.6 % of the duration of the Grassland Bypass Project operations.

Since the start of the GBP, there have been significant improvements in irrigation method efficiency (more than 70% of the GDA is now irrigated with high efficiency irrigation methods) as well as improvements drainage management practices. For this reason, the analysis herein focuses on recent time periods to look at the magnitude of storm flows that need to be managed under this Project. One is the period October through May of 2014-15, and the other one is the October through May time period of 2015-16. Water year 2015 (Oct 14 –Sept 15) was a critically dry year, and water year 2016 (Oct 15 – Sept 16) was a dry year type on the San Joaquin River. However, rainfall events during both year types caused spikes in flow that were discharged through the GBP. (See Appendix A, Figures 8, 9, 10 and 11, which are the daily flow events compared with the rainfall amounts that occurred.) Typically, rain events occurring in late fall are soaked up by the dry soil, and little or no discharge is caused by these rain events. However, once the soils become saturated, even small rainfall events will spike the flows and cause discharges through the GBP. In the two periods of 2014/15 and 2015/16, the maximum flow rate experienced was 98 cfs in the 2014/15 period and 109 cfs in the 2015/2016 period. Increased flows due to storm events have occurred in each of the most recent water years, WY 14-15 (Appendix A, Figures 8 and 9), a critical year; WY 15-16 (Appendix A, Figures 10 and 11), a dry year type; and WY 16-17 (Appendix A, Figure 12 and 13), a wet year type.

Flows in the 1998 and 2005 periods were much higher than those in recent years. Taking into account the flows discharged to wetland channels, the peak flows discharged at Site A were 230 cfs in 1998 and 234 cfs in 2005 (Table 1-1 below). These years were classified as wet years, and were substantially higher than the 2014/15 and 2015/16 periods which were critically dry and dry years, respectively. Year 2017 is the most recent year classified as "wet", however Site A flows peaked at 134 cfs, much lower than either 2005 or 1998 periods.

Based on historic flows and the tools available for storm water management, it is expected that rain events will cause storm water discharges through the GBP in all year types. The peak flow rate and volume discharged will be dependent on the duration and magnitude of the rainfall that occurs. Table 1-1 is an estimate of the magnitude measured in terms of flows (cfs) of these storm events.

Table 1-1 Maximum Storm Events of Record

Maximum Flows (cfs)						
Date	PE-14+FC-5	To GWD	Site A	Site B	Site A + GWD	Site B + GWD
Jan-Feb 1997	185	Not Available	95	90	Not available	Not available
Feb 1998	230	90	140	150	230	240
Feb 2005	Not available	75	159	138	234	213
Dec 2014	Not available	0	98	102	98	102
March 2016	Not available	0	109	90	109	90
February 2017	Not available	0	134	116	134	116

Source: Project records

Notes:

Site A. This is a monitoring station approximately 1 mile downstream of the location where the Grassland Bypass Channel discharges into the San Luis Drain.

Site B. This is the location where the flows from the Grassland Bypass Project that are conveyed in the San Luis Drain are discharged to Mud Slough North.

1.1.3 Available Storm Water Management Tools/Other Project Features

To minimize impacts to the wetland areas and the San Joaquin River from discharges to a storm water facility, a small number of management tools are currently available to the GBD. These include source control projects, shallow groundwater pumping, and drainage reuse on the SJRIP. The Proposed Project would add specific enhancements and new facilities specified herein. Features associated with these management tools are shown on Figure 1, Drainage Reuse Expansion and Development. These tools are as follows:

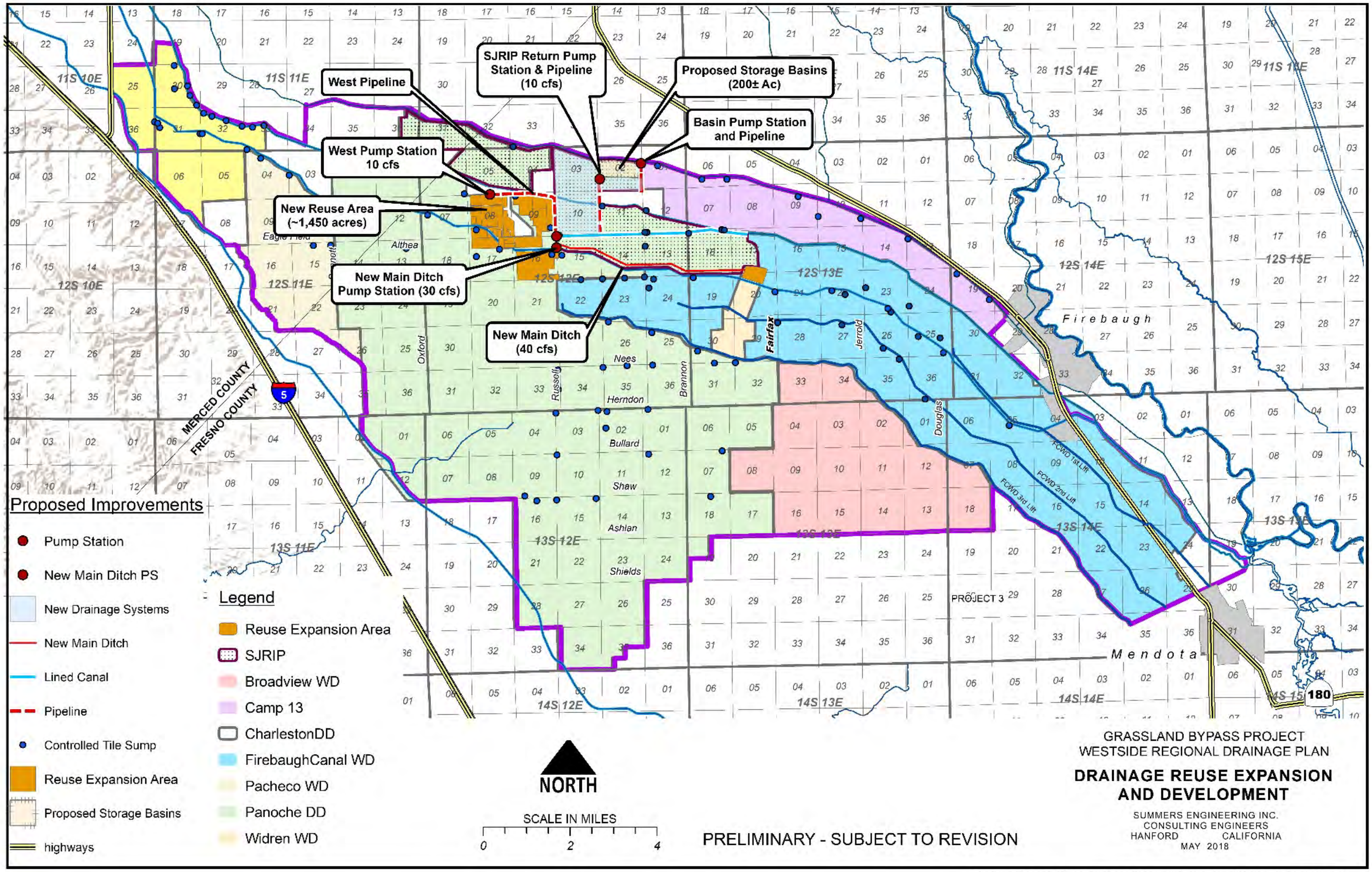
1.1.3.1 Turn Off Tile Sumps

Most tile discharges are controlled through a pump which discharges into deep collector drains through which it flows to the GBP. As part of a Storm Event Plan, tile sumps would be turned off. Turning off tile sumps will utilize a portion of the shallow soil profile for storage. This action alone is insufficient in some instances, since, as the soil profile saturates, drain water will seep into drains or overtop sumps. Even with the sumps turned off, subsurface water will accrete into the deep collector drains and would be discharged with the storm water.

Remote tile sump control in an enhancement to existing sumps that will be provided through the implementation of a Supervisory Control and Data Acquisition (SCADA) system that will allow all of the tile pumps to be shut off from the appropriate district office. This improvement involves installation of radio and shutoff relays at each discharging tile pump throughout the GDA. Communications and repeater towers will be erected as required (two to four towers expected) to send the control signal from the SCADA computer at the district office to each of the pumps.

These towers will range in height from 20 to 80 feet and are consistent with power line and other communication towers within the GDA, i.e., shorter than existing cellular communication and high-wire towers but taller than regular power poles. This will allow all discharging tile sumps to be remotely disabled prior to storm events and then reactivated after the storm event has passed. This enhancement improves the control and efficiency available for the measure of shutting off tile sumps but for the reasons mentioned above, may not be sufficient for the complete rainy season or in the case of larger rainfall events.

Figure 1 Drainage Reuse and Development



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1.1.3.2 Regulating Ponds/Reservoirs Usage

1.1.3.2.1 Existing Ponds

A regulating reservoir or pond is defined most often as a small storage reservoir constructed to regulate an irrigation water supply by collecting and storing water for a relatively short period. There are currently some minimal regulating basins within the GDA, including those in Panoche Drainage District and Pacheco Water District. These existing facilities provide approximately 500 AF capacity, and storm water stored in these ponds can be either diverted and reused on the SJRIP reuse area, used at other areas within the GDA, or discharged into the SLD.

A concern with the use of regulating ponds in the GDA is the potential for possible exposure of wildlife to water with elevated selenium if storage basins cannot promptly be drained. The plan is to accumulate storm water in the ponds as needed to reduce peak flows during high rainfall events beginning in December for subsequent release of the storm water through the SLD or to the reuse area to the extent they can be used, given capacity constraints, to irrigate salt tolerant crops without ponding. To avoid impacts to wildlife, appropriate management protocols are implemented for as long as the basins contain water (see Section 1.1.4). The short-term storage basins would collect drainage during storm events in an attempt to reduce peak flows and the associated discharge to the Drain, and then distribute the storm water to the reuse area during the irrigation season and to the Grassland Bypass Channel (GBC) outside of the irrigation season. The short-term storage basins would be managed in such a way as to prevent the evapo-concentration of selenium and other constituents. Water in the basins would be distributed to the SJRIP as soon as practical, as long as some demand for the water exists. In rare cases, captured water may be discharged to the GBC to the Drain to prevent evapo-concentration if there is not sufficient reuse capacity to drain the basins. Depending on water quality, some of the water may be blended into regional irrigation systems as well. By late May, the ponds would be emptied.

1.1.3.2.2 Proposed Short-Term Storage Basins and Pump Stations

The Proposed Project also includes new short-term storage basins that total approximately 200 acres in size with the ability to hold an additional 1,000± AF of storm-induced drainage from the GDA. They would be operated in a similar manner as the existing ponds explained above, i.e., filling begins with the first significant storms (typically December), and ponds are emptied by May. The increased capacity reduces the quantity that must flow during the storm event to the GBC, the Drain, and ultimately to Mud Slough (North). This guards against both flow in the GBC exceeding the channel capacity as well as selenium concentrations in Mud Slough exceeding the water quality objective.

The short-term storage basins will consist of approximately four miles of levees (interior and exterior) amounting to approximately 300,000 cubic yards of compacted embankment and rip-rap for levee protection. Levees will have a top width of 12 to 16 feet and a depth of approximately 6 feet. The basins are to be designed with clean and steep slopes, and water will be kept deep or the basins will be empty, in order to minimize attractiveness of the basins for waterbirds.

> A new pump station will be constructed at a major regional drain in order to capture winter runoff. This pump station will have an estimated capacity of 10 cfs and will consist of a pre-cast concrete sump, pump and motor, electrical controls, manifold and appurtenances. The pump station will connect to a mile long pipeline (21”) to convey water into the storage basins for short term storage. A second pump station of similar design will be installed at the storage basins with a mile long pipeline (also 21”) that will convey water from the basins into the

SJRIP conveyance system and for connections to regional canals for blending with other water supplies.

> Current land use at the proposed storage basin site is salt tolerant cropland (Jose Tall Wheatgrass) within the existing San Joaquin River Improvement Project. The conversion of 200 acres of this land to storage basins would provide a tool to reduce the amount of water discharged to the GBC and Drain during large storm events in the non-irrigation season.

> The estimated construction time for the basins is approximately 4 months. The estimated construction time for the 2 pump stations and associated pipelines is approximately 3 months, and may or may not be concurrent with the basin construction. Construction periods would typically be limited to May through November (7 months) when storm events and flooding are unlikely, and adjusted according to the protective requirements for special status species as necessary.

> Short-term storage basins construction equipment will include (but not be limited to):

- 2 excavators
- 2 dozers
- 3 scrapers
- 3 graders
- 1 water trucks
- 2 sheep's foot compactors.

> The basin pump station and pipeline construction equipment will include (but not be limited to):

- 2 excavators.
- 1 off-road forklift
- 1 backhoe
- 1 grader
- 1 welder

1.1.3.3 Reuse Area Expansion

The Grassland Bypass Project Final EIS/EIR (Reclamation 2009b) stated that the SJRIP facility would be implemented on up to 6,900 acres of land within the GDA (August 2009, SCH No. 2007121110, p. 2-14). It included the following description:

> "To continue to apply the salty water to the lands developed in Phase I, it will be necessary to install subsurface drainage systems. Installation of tile drainage systems will be required to maintain salt balance in the root zones and to maintain the productivity of the reuse area on a long-term basis. Such installation would not be a prerequisite for commencement of reuse, would be prioritized based upon available funding and the needs of particular crops, and would be expected to proceed throughout Phase II. Currently (and for the foreseeable future) any tile water captured within the reuse areas is blended back with the reuse area irrigation supply and used on whatever crop is located downslope. Salt, Se, and other drainage constituents would be collected in the water coming out of the subsurface drainage systems, continue to be recirculated and utilized on site or, during any continuation of the Grassland

> Bypass Project, be discharged subject to load reduction obligations." (*Id*. at p. 2-18.)

The proposed expansion of 1,450 acres will take the existing reuse facility from 6,100 acres analyzed in the 2009 Final EIS/EIR to 7,550 acres of useable reuse area. This additional acreage would be managed in the same manner as the existing acreage with the same biological monitoring requirements established by the USFWS in their Biological Opinion (see USFWS 2009). This Initial Study addresses the additional acreage, much of which is already planted to salt tolerate Jose Tall Wheatgrass, and only a change in ownership (private to district) would be needed for implementation.

Because the salt tolerant crops within the SJRIP have very little water demand in the winter, reuse capacity is very limited in the period between November and February with greater reuse in the March to May period, depending on hydrologic conditions. Small existing reservoirs in Pacheco and Panoche Water District provide limited water storage capacity within the GDA (see Section 1.1.3.2.1 above). In combination with pond usage, the maximum managed flow with facilities within the GDA is approximately 50 cfs for 15 days[1]. Once this maximum is reached, discharge of some sort is required. The primary environmental concern is an increased potential for ponding of seleniferous water within the fields of the SJRIP, which could be an attractive nuisance to wildlife, particularly birds. The amount that could be discharged to the SJRIP is less than what would be needed (i.e., only a partial solution), and other impacts would be created if the area is not enlarged to handle agricultural drainage. Therefore, an additional area of approximately 1,450 acres is proposed on farmed land generally on the southwest side of the existing SJRIP facility. Mitigation measures contained in the Grassland Bypass Project Final EIS/EIR for the existing reuse facility would continue to be implemented and would apply to the additional reuse area. This existing mitigation includes a contingency plan[2] in the event of inadvertent flooding in the reuse area due to breakage of a water supply canal or delivery facility.

1.1.3.4 Additional Conveyance Activities

Additional conveyance activities are proposed for agricultural drainage and storm water conveyance within the GDA for the existing reuse area and its expansion and for storm water conveyance to the Grassland Bypass Channel during the winter months. These activities are listed below.

- **RP-1 Ditch Extension and Lining.** The existing 3 miles of RP-1 Ditch will be replaced with a concrete lined channel and the ditch will be extended 1.8± miles to the eastern side of the SJRIP. The channel's capacity will also be increased from approximately 25 cfs to 45 cfs. Construction work will involve the placement of approximately 34,000 cubic yards of compacted embankment to build the canal pad, excavation of approximately 38,000 cubic yards of material to cut the design cross section, and placement of approximately 470,000 square feet of unreinforced concrete lining, along with miscellaneous appurtenances such as turnouts and road crossings. As a delivery channel, most of the ditch would be above grade with the invert extending approximately 24" below the existing top of ground. The alignment of the existing and proposed ditch is within an area historically farmed. Estimated construction time is 4 months. Construction equipment will include (but not be limited to):

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[1] The maximum diversion rate could be as high as 70 cfs but this assumes that some pumps will be inaccessible due to wet conditions. 15 days comes from 3" over 6000 acres.

[2] This plan is presented in the *San Joaquin River Water Quality Improvement Project, Phase I Wildlife Monitoring Report*, 2005 (H.T.Harvey & Associates 2006).

  - 1 Dozer/Trencher
  - 2 Excavators
  - 2 Graders
  - 2 Sheep's foot compactors
  - 1 Backhoe
  - 1 Water Truck
  - 6 Cement trucks

  The RP-1 Ditch extension and lining activities would significantly improve operational flexibility of the SJRIP by extending conveyance capacity to the far east section of the SJRIP (near Fairfax Avenue). Currently, there is only limited conveyance capacity to that portion of the reuse area, which underutilizes the overall reuse capacity of the SJRIP. This improvement, when combined with the proposed short-term storage basins and other conveyance activities, will increase the GBP's capacity to manage storm-induced flows.

- **RP-1 Pump Station Enlargement and Pipeline**. A new electric pump station with a capacity of approximately 25 cfs will be installed in the Russell Avenue Drain near the existing RP-1 Pump Station. The pump station will consist of a pre-cast concrete sump, two low lift pumps, a manifold to connect to the new pipeline, electrical controls, and necessary appurtenances. A new pipeline will transmit the pumped water from the new pump station to the RP-1 Ditch, a distance of approximately 750 feet. The trench for the new pipeline would be approximately 6 feet deep and would run parallel to an existing pipeline installed for a similar purpose. The construction area for this project has been extensively disturbed during previous construction activities. The pipe is expected to be 30" or 36" in diameter and likely to be reinforced concrete or PVC. Estimated on-site construction time is expected to be three weeks. Construction equipment will include (but not be limited to):
  - 2 excavators.
  - 1 off-road forklift
  - 1 backhoe
  - 1 grader
  - 1 welder
  - 1 Sweeper
  - 1 Water Truck

  The proposed increase in the RP-1 pump-rate capacity would significantly improve operational flexibility of the SJRIP by increasing the conveyance capacity to the far east section of the SJRIP (near Fairfax Avenue). Currently, there is only limited conveyance capacity to that portion of the Reuse Area, which underutilizes the overall reuse capacity of the SJRIP. This improvement, when combined with the proposed short-term storage basins and other conveyance activities, will increase the GBP's capacity to manage storm-induced flows.

- **West Pump Station and Pipeline.** A new pump station and pipeline will be installed on the westside of the SJRIP that will allow water to be pumped to the easterly SJRIP, where there is more crop water demand. The pump station will consist of a pre-cast concrete sump, 2 pumps (5± cfs each), a manifold, electrical controls and miscellaneous appurtenances. The pipeline is expected to be 21" diameter PVC pipe. Approximately 2.5 miles of pipe will be installed along existing field roads at a depth of 5 feet, discharging ultimately at the Russell Drain near the RP-1 pump station. An encroachment permit from Fresno County will be required to cross Russell Avenue. Estimated total on-site construction time is expected to be 3 months. Construction equipment will include (but not be limited to):

- 2 excavators.
- 1 off-road forklift
- 1 backhoe
- 1 grader
- 1 welder
- 1 sweeper
- 1 water truck

The proposed pump station and pipeline would connect the westerly portion of the SJRIP (~1,800 acres) with the 4,000 acres of the SJRIP east of Russell Avenue and increase the rate of drawdown for the storage basins. This improvement, when combined with the proposed storage basins and other conveyance activities, will increase the GBP's capacity to manage storm-induced flows.

- **SJRIP Return System.** A new electric pump station and pipeline will be installed on a major return drain within the SJRIP that will convey water to the RP-1 Ditch. The pump station will have a capacity of 10 cfs and will consist of a pre-cast concrete pump sump, 2 pumps, manifold, electrical controls and other appurtenances. The pipeline is expected to be 21" diameter PVC, approximately ¾ of a mile in length, in a trench 5 feet deep, and will discharge into the RP-1 Ditch. Estimated on-site construction time for both the pipeline and the pump station is approximately 3 months. Construction equipment will include (but not be limited to):
  - 2 excavators.
  - 1 off-road forklift
  - 1 backhoe
  - 1 grader
  - 1 welder
  - 1 Sweeper
  - 1 Water Truck

  The proposed pump station and pipeline would improve the operation efficiency of the SJRIP by capturing internal return flows and returning them to the RP-1 ditch, which will allow for recirculation of this water over the largest possible area. This improvement, when combined with the proposed short-term storage basins and other conveyance activities, will increase the GBP's capacity to manage storm-induced flows.
- **New Subsurface Drainage.** New subsurface drainage systems are proposed for up to 1,100 acres within the existing reuse area. Drains are to be placed approximately 8 feet

below the ground surface with a spacing of approximately 400 feet. This area is currently planted to Jose Tall Wheatgrass. Construction would occur over a 3 month period. Construction equipment would include (but not be limited to):

- 1 trencher.
- 1 front loader
- 1 grader.

The proposed subsurface drainage systems would be located on a series of fields with a shallow water table that inhibits cultivation and operations. The proposed systems would improve the reuse capacity of the affected fields, which would contribute to an increased rate of drawdown of the short-term storage basins. Subsurface drain water collected by these systems would be discharged into the SJRIP conveyance system for reuse.

1.1.4 Continued Implementation and Refinement of Existing Mitigation Measures

Mitigation Measures identified in the Grassland Bypass Project Final EIS/EIR (August 2009, SCH No.2007121110) would continue to be implemented in order to ensure that the Proposed Project does not result in new potentially significant impacts or result in an increase in the severity of impacts identified in the earlier analysis Refinements to existing mitigation measures have been included where indicated, based on information gained through operation of the GBP, including monitoring through 2018.

1.1.4.1 Discharge of Storm Water to Mud Slough

Selenium levels in Mud Slough (North) have reduced gradually each year since the implementation of the Grassland Bypass Project and Westside Regional Drainage Plan. The transition to the Long-Term Storm Water Plan Management Plan would continue this trend, resulting in substantially reduced discharges into Mud Slough. The analysis in Section 2.10 of this Initial Study indicates a less-than-significant impact to Mud Slough, and no new mitigation measures are required.

As a result, the Se WQO would be met during most of the year, with only occasional exceedances of the 5 ppb 4-day average that would be short in duration. Refinements to the existing mitigation measures to further reduce the less-than-significant impacts from the expected periodic exceedances will be implemented for the Proposed Project, as follows:

- Establish a Mud Slough (North) water quality goal of 3 ppb Se, 4-day average. For every 3 months that meet this 3 ppb performance goal, 1 exceedance of 5 ppb 4-day average is allowed.
- If 5-ppb 4-day average not met with proposed management practices (shut off electric sumps), analyze operational data and develop adaptive management approach to implement additional corrective actions.
- Organize the Mitigation Sub-Committee comprised of local wildlife agencies as required in the 2010 Use Agreement to utilize funds deposited in the Supplemental Mitigation Project Fund to develop mitigation projects such as:
  - Refuge water supply augmentation (such as USF&WS Blue Goose unit)
  - Increased water flows in Mud Slough after drain flows cease
  - Habitat restoration projects
  - Species specific habitat establishment

1.1.4.2 Impacts Related to Reuse Area

The 2009 Final EIS/EIR (Section 6.2.2.1.4) reported that drainage reuse at the SJRIP (In-Valley Treatment/Drainage Reuse Facility), which involves application of subsurface drain water on the surface of fields to irrigate salt-tolerant crops, has the potential to result in highly seleniferous subsurface drain water ponding in fields at the reuse facility, which can create a hazard to birds. Continued implementation of "[t]he following Measures 1 through 4 [is] required to mitigate for significant adverse impacts under CEQA associated with continued operation and expansion of the In-Valley Treatment/Drainage Reuse Facility. Mitigation 5 is required if Mitigations 1, 2, and 3 do not sufficiently reduce the exposure to Se" (Section 6.2.2.4):

- **MITIGATION 1: AVOIDING BURROWING OWLS**

  In conformance with federal and state regulations regarding the protection of raptors, a pre-construction survey for burrowing owls will be completed in conformance with CDFG recommendations, no more than 30 days prior to the start of construction. If no burrowing owls are located during these surveys, no additional action would be warranted. However, if breeding or resident owls are located on, or within 250 feet of, the proposed construction site, the following mitigation measures will be implemented:

  - A 250-foot buffer, within which no new activity would be permissible, will be maintained between project activities and nesting burrowing owls. This protected area will remain in effect until August 31, or may be terminated earlier at the CDFG's discretion based upon monitoring evidence that indicate that young owls are foraging independently.

  Owls may be evicted from the construction area to avoid take of individual owls via construction activities. However, CDFG does not permit the eviction of burrowing owls from burrows during the nesting season (February 1 through August 31). Eviction outside the nesting season may be permitted pending evaluation of eviction plans and receipt of formal written approval from the CDFG authorizing the eviction. If accidental take (disturbance, injury, or death of owls) occurs, the CDFG will be notified immediately.

- **MITIGATION 2: REDUCE EXPOSURE POTENTIAL BY REDUCING ATTRACTIVENESS OF IRRIGATION DITCHES FOR NESTING**

  The majority of shorebird nesting on the existing reuse site consists of killdeer and recurvirostrids nesting within, or adjacent to, the irrigation ditches that deliver drainwater to the site. Adults nesting near irrigation ditches feed primarily in these ditches, though this is more typical of recurvirostrids than killdeer. Reducing the attractiveness of the ditches and their immediate surroundings as nesting and foraging habitat is necessary to minimize the level of shorebird exposure to Se.

  Unused ditches have been filled in to prevent shallow ponded water from becoming an attractive nuisance. Sediment that has collected on the bottom of operational ditches will be removed to remove potential nest substrate when water levels are low. Smooth sides and borders will be maintained along irrigation ditches to inhibit the common killdeer and recurvirostrid practice of using rough surfaces such as disked areas to conceal nests.

- **MITIGATION 3: REDUCE EXPOSURE POTENTIAL BY HAZING BIRDS FROM NESTING NEAR, AND FORAGING IN, IRRIGATION DITCHES**

  Shorebird use of the existing project site is not homogenous (H.T. Harvey & Associates 2004, 2005). As noted above, shorebird nests at the existing project site are concentrated in the vicinity of irrigation ditches. Additionally, stilts and avocets are semicolonial, often nesting in close vicinity to each other. Hazing will be performed to reduce exposure by reducing the number of nesting birds. Methods of hazing may include firing noise making devices such as cracker shells, 15-mm bird bombs, and bird whistlers from a vehicle to discourage breeding birds from establishing nest sites. In addition, propane-operated cannons will be left operating on a 24-hour basis, if required. Cannon locations will be changed periodically to lessen acclimation.

- **MITIGATION 4: FLOODED FIELD CONTINGENCY PLAN**

  In the spring of 2003, a pasture at the existing reuse area site attracted waterfowl when it was inadvertently flooded. This flooded area created ideal ecological conditions for shorebird foraging and nesting and thus, a number of pairs responded opportunistically and bred in the field. Recurvirostrid eggs collected near the pasture had highly elevated Se concentrations compared to other recurvirostrid eggs collected elsewhere on the site. The Panoche Drainage District has since developed a contingency plan for accidental flooding. This plan is presented in the *San Joaquin River Water Quality Improvement Project, Phase I Wildlife Monitoring Report*, 2005 (H.T.Harvey & Associates 2006). The plan includes provisions for immediate removal of unintended drain water as well as for increased monitoring near flooded sites. The provisions of this plan will be implemented in the event of ponding at the reuse area.

- **MITIGATION 5: PROVIDE COMPENSATION BREEDING HABITAT**

  If after employing Mitigation Measures 1, 2, and 3, monitoring (described in Section 15) determines nesting shorebirds are exposed to elevated Se levels as a result of the Proposed Action, compensation habitat for residual impacts will be provided. (See compensation habitat protocols contained in the Final EIS/EIR, pages 6-49 through 6-52 which are incorporated by reference.)

Mitigation measures for the reuse area also were established in August 2007 in a Mitigated Negative Declaration (MND) for the expansion of the SJRIP (URS Corporation 2007, as cited in Final Biological Opinion, 2010-2019 Use Agreement for the Grassland Bypass Project, U.S. Fish and Wildlife Service [USFWS 2009]). These measures for the additional 2,900 acres of expansion (over the 4,000-acre facility at that time) included the following (USFWS 2009, pp. 27-29), which will continue to be implemented for the Proposed Project:

> Closing, piping, or netting drains[3].

> Hazing birds to discourage nesting and foraging near drainage ditches.

> Implement flooded field contingency plan.

> Provide for compensation breeding habitat if necessary.

> Collaborate with the Service to refine and implement tiered contaminant monitoring program.

> Avoid the loss of sensitive habitats within a 151-acre parcel adjacent to the SJRIP (south of the Main Canal).

Beginning in 2016 and continuing in 2018, the Grassland Area Farmers have implemented scent dog surveys to gauge the presence or absence of kit fox. A request has been made to the USFWS based on the results of these surveys to eliminate the tiered contaminant monitoring program and the requirement to avoid losses within the 151-acre parcel mentioned above.

See Section 2.4 of this Initial Study for explanation of refinements to the 2009 biological mitigation measures for the expanded reuse area and new short-term storage basins, derived from Appendix B, *Biological Resources Impact Analysis*. The measures are similar to the 5 types of measures listed above with some changes based on monitoring of the area since 2001 and expanding use of the measures to

[3] Netting did not work, so it is no longer implemented. Have reverted to closing or piping drains.

apply to construction and operation of new features such as the short-term storage basins. The revised biological mitigation measures are summarized below.

Mitigation Measure BIO-1: Conduct a Preconstruction Survey for Burrowing Owl and Implement Avoidance Measures. No more than 15 days before the start of initial ground-disturbing activities for the Project, a qualified biologist(s) knowledgeable of the species will conduct a take avoidance survey for the presence of burrowing owls within 500 ft of the area scheduled for disturbance.

Mitigation Measure BIO-2a: Reduce Se Exposure Potential by Reducing Attractiveness of Irrigation Ditches for Nesting. Sediment that has collected on the bottom of the ditches will be periodically removed and irrigation ditches within the proposed expansion areas will be maintained with smooth sides and borders to reduce nesting attractiveness in and near irrigation ditches.

Mitigation Measure BIO-2b: Reduce Se Exposure Potential by Reducing Attractiveness of Regulating Pond/Basins for Nesting. The attractiveness of the existing regulating pond and the proposed basins to nesting shorebirds will be reduced through active management practices, including removing sediment and vegetation that has collected on the bottom of the basins and maintaining smooth bottoms, sides and borders of the basins.

Mitigation Measure BIO-2c: Reduce Se Exposure Potential by Hazing Waterbirds from the Project Site During Nesting Season. Waterbirds shall be hazed from the Project site during the waterbird nesting season (March 15 to July 15) to reduce exposure of waterbirds to selenium by discouraging waterbirds from feeding where they could be exposed to selenium.

Mitigation Measure BIO-2d: Reduce Se Exposure Potential by Hazing Waterbirds from the Regulating Pond/Basins When Water is Present. Waterbirds shall be hazed from the existing regulatory pond and proposed basins to reduce exposure of waterbirds to selenium by discouraging waterbirds from feeding or nesting where they could be exposed to selenium.

Mitigation Measure BIO-2e: Implement a Flooded-Field Contingency Plan. A contingency plan for accidental or inadvertent flooding has been developed for the SJRIP. The plan includes provisions for immediate removal of unintentionally released drainwater as well as for increased monitoring and hazing near flooded sites.

Mitigation Measure BIO-2f: Monitor Mitigation Success and Provide Compensation Breeding Habitat. The above mitigation measures will be implemented to reduce the exposure of birds to selenium. To evaluate the success of these measures, monitoring will be implemented to determine whether nesting waterbirds are still exposed to elevated selenium levels as a result of the Project. If they are, compensation habitat for residual impacts will be provided, following the protocol outlined below that has been adapted from a protocol developed by USFWS (1995) for determining and mitigating impacts on nesting waterbirds at evaporation basins.

Mitigation Measure BIO-2g: Conduct Preconstruction Nest Surveys for Infrastructure Installation Occurring During the Nesting Season. Preconstruction nest surveys will be completed for all Project-related infrastructure installation activities that occur between February 1 and August 31 to comply with California Fish and Game Code Section 3503.5. A qualified wildlife biologist shall conduct preconstruction surveys of all potential nesting habitats (including for raptors) within 500 feet of construction activities for presence of breeding or nesting birds. Surveys shall be conducted no more than 5 days prior to construction activities with a second survey conducted no more than 24 hours prior to the onset of construction. If active nests are found, no-disturbance buffers shall be implemented around each nest. If a nest is found in an area where ground disturbance is scheduled to occur, the area will be avoided either by delaying ground disturbance in the area until a qualified wildlife biologist has determined that the young have fledged or by re-siting the proposed Project component(s) to avoid the area.

1.1.4.3 Mitigation for Unidentified Cultural Resources

The 2009 EIS/EIR found that no impacts to historic properties were anticipated by continuation of the Grassland Bypass Project because it did not propose actions that may cause effects to historical properties. All actions are proposed to occur within the GDA and, in essence, continue similar operations to those conducted under the existing Use Agreement on lands previously disturbed by agricultural production. Future expansion of drainage water treatment facilities or management facilities at the San Joaquin River Water Quality Improvement Project (SJRIP) reuse facility that result from the implementation of this alternative would have no potential to affect historical properties. However, in recognition that land disturbance in the future could have impacts, the following mitigation strategies discussion was included:

“In general, projects that include ground-disturbing activities such as grading and excavation have the potential to impact historic and prehistoric archaeological resources and may impact historic architectural resources if buildings would be demolished, moved, or altered—or if the setting of an historic resource would be substantially changed. Projects that entail minor surface disturbance or construction would likely result in negligible impacts to cultural resources, but not in every case. On the other hand, large-scale impacts can result from projects that require large degrees of ground disturbance. In essence, as the intensity of construction impacts increases, the potential to impact cultural resources increases. The identification of specific impacts and mitigation measures that are appropriate for a specific project will depend on both the nature of the cultural resources that are present and on the nature of the project. In some instances, mitigation measures must be developed in consultation with multiple agencies and other interested parties. In some circumstances, impacts to historical resources or properties cannot be mitigated to less-than-significant levels. The possible procedures for first identifying and evaluating known and unknown historical resources and then mitigating any potential impacts to those resources caused by Project actions are listed below:

- “Conduct cultural resource inventories and evaluations of significance for resources identified per NHPA Section 106 (36 CFR Part 800) and/or CEQA Guidelines Section 15064.5.
- “Conduct consultation with local Native Americans.
- “Avoid potentially significant sites through project redesign.
- “If potential historical properties are identified that cannot be avoided, perform site evaluations.
    - Develop mitigations for eliminating, reducing, rectifying, or compensating for the impacts anticipated.

- Perform data recovery or HABS/HARE[4] documentation if impacts to significant historical properties cannot be avoided or mitigated.
- Consult with the State Historic Preservation Officer, Indian Tribes, Consulting Parties, and Advisory Council on Historic Preservation, as appropriate through the federal lead agency." (pp. 9-6, 9-7)

These standard protocols need some further clarification and refinement to address features of the Proposed Project not part of the 2009 Grassland Bypass Project. Additional cultural resource investigation was conduction for the LTSWMP project features presently sited. The cultural resources study (AECOM 2019) consisted of a records search at the Southern San Joaquin Information Center for the project area within Fresno County, and a records search at the Central California Information Center for the project area within Merced County, both of the California Historical Resources Information System (CHRIS); a search of the California Native American Heritage Commission's (NAHC) Sacred Lands File and outreach to the Native American individuals listed by the NAHC as interested parties, as it pertains to Assembly Bill (AB) 52; and a partial built environment survey of the Project area. An archaeological field survey was not conducted due to saturated soils, but a site visit was performed on February 15, 2019.

Based on the 2019 investigation, impacts to known historic resources were less than significant. At issue is the potential for not previously identified resources to be impacted. This situation would be addressed in similar fashion to the mitigation strategies identified in 2009 (listed above). With the need for construction of and modifications to existing drainage management facilities (such as the pipelines, storage basins, and SCADA) in areas adjacent to historic-age canals, additional investigations will be conducted.

As noted in Section 2.5 of this Initial Study, if cultural resources are uncovered during ground disturbing activities associated with the project, work will stop within 50 feet of the initial find and a qualified professional archaeologist shall be notified regarding the discovery. The archaeologist shall determine whether the resource is potentially significant as per the CRHR and develop appropriate mitigation. The Applicant shall comply with the mitigation requirements identified by the archaeologist and approved by the SLDMWA.

In the unlikely event that human remains are discovered during project implementation, work in the immediate vicinity of the discovery will be suspended and the SLDMWA will notify the Fresno or Merced County Coroner, depending on location of discovery. If the remains are deemed Native American in origin, the Coroner will contact the NAHC and identify a Most Likely Descendant pursuant to Public Resources Code Section 5097.98 and California Code of Regulations Section 15064.5. Work may be resumed at the landowner's discretion, but will only commence after consultation and treatment have been concluded. Work may continue on other parts of the project while consultation and treatment are conducted.

1.2 Surrounding Land Uses and Setting

The Grassland Bypass Project is located in the Grasslands Watershed in Fresno and Merced Counties as shown on Appendix A, Figure 1-Watershed Location Map, which ultimately discharges into the Lower San Joaquin River. The Grassland Drainage Area (GDA) and project features including the channels containing drainage flows along with downstream wetland areas and wildlife refuges are shown on Appendix A, Figure 2, GBP Location Map. Storm water flows are generated by rainfall throughout the GDA, which flow overland into several regional drains. Appendix A, Figure 22 shows the major drains (shown in red) that discharge to the GBP. Rainfall collected in these open drains is discharged to the GBP. A handful of ephemeral creeks from the Coastal Mountain Range have the potential to discharge

[4] Historic American Building Survey/ Historic American Engineering Record

flows into GDA. Panoche/Silver Creek (Appendix A, Figure 23) is one of the larger creeks with this potential. However, Districts within the GDA have taken measures to intercept and divert these flows away from the Grassland Bypass Project. The inclusion of the San Joaquin River to Crows Landing for compliance monitoring adds Stanislaus County to the Project Area, but none of the Proposed Project improvements occur within this county or alter/affect land or other physical resources of this county.

The larger Project Area is primarily located in the northwestern portion of Fresno County and a portion of the south-central section of Merced County. This area consists of the GDA as well as adjacent land to the north through which subsurface drainage has historically flowed. The reuse facility, known as the San Joaquin River Improvement Project (SJRIP), is located in the north central section of the GDA on property containing approximately 6,000 acres with planned expansion to up to 7,500 acres of reuse area. The shape of this property is irregular, conforming to the adjacent canals of the area, with access provided via Russell Avenue, a paved county road.

Though the region is sparsely populated, small urban clusters within the vicinity of the Proposed Action include the cities of Los Banos in Merced County and Firebaugh and Mendota in Fresno County. These communities, all located along State Highway 33, provide services for farms and ranches in the area. The largest of these cities, Los Banos, has been urbanizing over the last 25 years and now serves as a bedroom community for commuters to the Silicon Valley. Hence, while Los Banos relies less on agriculture than in the 1960s, other parts of the area remain highly dependent on farming.

Land use within the Project Area consists largely of agriculture. Agriculture is the dominant industry within the GDA. Farmers have raised crops in the area for more than 100 years. Primary crops include almonds, pistachios, cotton, melons, alfalfa hay, other field crops and grains. Virtually all crops are irrigated because average annual rainfall is less than 10 inches per year and most crops require more than 22 acre-inches of water per year (Wichelns and Houston 1996, cited in Reclamation 2009). Nut trees (almonds and pistachios) are the dominant crops grown in the GDA and are among the top five crops in each of the counties (Merced and Fresno) comprising most of the Project Area. Irrigation and drainage districts include the Panoche and Charleston drainage districts; Firebaugh Canal, and Pacheco water districts; and the Camp 13 Drainage District, which is a portion of the Central California Irrigation District. Land uses include wildlife refuge/wetlands areas including the Grassland Resource Conservation District and the California Department of Fish and Wildlife’s North Grasslands Wildlife Area (China Island, Gadwall, and Salt Slough units) of approximately 7,400 acres of wetlands, riparian habitat and uplands. These restored and created wetlands (and the San Luis National Wildlife Refuge [NWR] mentioned below) are now habitat for Swainson’s hawk and sandhill crane and other waterfowl and special status species, and they drain into the San Joaquin River.

The San Joaquin River flows through the eastern portion of the Project Area, down the center of the San Joaquin Valley. In the northern reaches of the Project Area, the river flows through San Luis NWR, which also contains Mud Slough and Salt Slough, each a tributary to the river. The San Luis NWR covers 26,000 acres, and the USFWS has easements on approximately 90,000 acres of additional habitat. The state and federal wildlife management areas together support approximately 500,000 waterfowl, 250,000 shorebirds, and 47 species listed as endangered, threatened, or sensitive. North of the Project Area, the river runs through rural residential and agricultural areas until it enters the Delta near the community of Vernalis, below the confluence with the Stanislaus River. The Merced River flows into the San Joaquin River from the east near the northern tip of the Project Area, at the Stanislaus County/Merced County line, just downstream of the refuge. See Section 2.9, Hydrology and Water Quality, for additional information.

The project features involving the remaining sediment removal from the SLD and storm water conveyance in the SLD drain occur in Merced County. The expansion of the SJRIP reuse area with additional pump stations, new pipelines, new subsurface drainage on 1,100 acres in existing reuse area, ditch extension/canal lining, and the new short-term storage basins are located primarily in Fresno

County. The installation of the SCADA communication system for remote operation of the tile sumps would occur in both counties. Consequently, much of the environmental impact discussion for this Initial Study is focused on Fresno County with Merced County cited as appropriate.

1.3 Environmental Factors Potentially Affected

The environmental factor checked below would be potentially affected by this project, but it does not involve any impact that is a “Potentially Significant Impact” that cannot be mitigated to less than significant, as indicated by the checklist on the following pages.

- ☐ Aesthetics
- ☐ Agriculture and Forestry Resources
- ☐ Air Quality
- ☒ Biological Resources
- ☐ Cultural Resources
- ☐ Geology/Soils
- ☐ Greenhouse Gas Emissions
- ☐ Hazards & Hazardous Materials
- ☐ Hydrology/Water Quality
- ☐ Land Use/Planning
- ☐ Mineral Resources
- ☐ Noise
- ☐ Population/Housing
- ☐ Public Services
- ☐ Recreation
- ☐ Transportation/Traffic
- ☐ Tribal Cultural Resources
- ☐ Utilities/Service Systems
- ☐ Wildfire
- ☐ Mandatory Findings of Significance

1.4 Determination:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a “potentially significant impact” or “potentially significant unless mitigated” impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☒ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated or otherwise not made more severe pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, and an Addendum to the EIR/EIS shall be adopted.

Signature	
Date	type date here
Printed Name	Federico Barajas
	Executive Officer San Luis & Delta-Mendota Water Authority

2 Evaluation of Environmental Impacts

An evaluation of potential environmental impacts (i.e., adverse effect on the environment in comparison to existing conditions), is provided in the checklist sections to explain each question and the designation according to 4 categories of impact and mitigation: Potentially Significant Impact, Less than Significant with Mitigation Incorporated, Less than Significant Impact, and No Impact.

2.1 Aesthetics

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Have substantially adverse effect on a scenic vista?	☐	☐	☐	☒
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state 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?	☐	☐	☐	☒

Discussion

The Proposed Project proposes to add the following facilities and modify operational activities to address storm water management for 2020-2036:

- Turn off tile sumps during storm events using a new remote communication system (SCADA),
- Improve the existing main distribution canal with a concrete lined channel.
- Construct 3 pump stations (electric) and pipelines to improve drain water distribution flexibility,
- Construct 200 acres of new storage basins (1,000± AF capacity) and associated pump/pipeline infrastructure to move water into and out of the basins when storm flows are greater than 150 cfs in the Drain.
- Make limited use of the SJRIP drain water reuse area in the winter and of existing regulating basins that discharge to the reuse area.
- Enlarge the SJRIP reuse area by 1,450 acres that will take the existing reuse facility from 6,100 acres to 7,550 acres of useable reuse area.
- New subsurface drainage would be added to 1,100 acres in a portion of the existing reuse area.

Equipment used to remove sediments from the Drain would be used to make these improvements and to continue to remove sediments from the Drain for an additional two years past the current UA expiration, to December 31, 2021. Construction activity would occur in the dry season (approximately May through November). The estimated construction time for the basins is approximately 4 months. The estimated construction time for the 2 pump stations and associated pipelines is approximately 3 months and may or may not be concurrent with the basin construction. Canal/culvert improvements would take one month to complete. Construction periods will be limited to May through November when storm events and flooding are unlikely Future storm water flows in the Drain would primarily occur during the wet season (October through April)

The Tile Sump SCADA control system will include the construction of approximately 4 communication and repeater towers. Each tower would consist of a prefabricated steel truss and 6' by 6' by 4' deep concrete footing. These towers will range in height from 20 to 80 feet and are consistent with power line and other communication towers within the GDA, i.e., shorter than existing cellular communication and high-wire towers but taller than regular power poles.

a) All of the modifications occur within a rural area in agricultural use/production, and sediment removal occurs on a portion of the Drain that runs through the Grasslands Ecological Area. These areas are not scenic vistas from the ground given the lack of roads, residences, and general public recreation sites in the affected portions. While there are public wildlife refuges and private hunting clubs within the Project Area in the vicinity of the Drain and the San Joaquin River, the new communication towers (SCADA system), conveyance of storm water, and expansion of the reuse area would not affect users' enjoyment/views of these areas. The refuges are managed primarily for waterfowl and other species, not for high intensity general recreation.

b) The changes to storm water conveyance facilities and reuse area and the addition of SCADA communication towers would not damage any scenic resources. No trees would be removed, and no historic buildings or structures would be adversely affected by enlarging the GBC, if selected, or by construction of pump stations, pipelines, and reuse area enlargement or completion of sediment removal from the Drain. Sediments will be placed along the Drain right-of-way for drying and subsequently hauled away.

c) There is a very limited impact on the area's rural agricultural and wetland habitat character from the construction activities, communications towers, or the continued operation of the Drain to carry storm flows. Equipment use in the agricultural areas is ongoing to plant and harvest crops and to operate the drain water reuse area, while sediment removal from the Drain in the segment through the wetlands (ending at Mud Slough) is short term and temporary overall and not entirely at any one location during the dry season in 2020. There is no contribution to any existing cumulative impacts to visual resources in this rural area.

d) Both the construction and sediment removal activities occur during daylight hours and do not involve the use of lighting or materials that would create glare. Continued operation of the Drain to carry storm water does not involve any new lighting.

2.2 Agricultural and Forest Resources

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	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?	☐	☐	☐	☒
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)) or timberland (as defined in 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?	☐	☐	☐	☒

Discussion

The Proposed Project is to maintain existing farmland in productive use. If storm water flows are uncontrollable and are created by rainfall events without a discharge to the north from the Grassland Drainage Area, there would be ponding of water at the low end of farm fields and against existing canal facilities such as the Outside Canal or the Main Canal or the Delta-Mendota Canal, threatening the integrity of canal levees (see Appendix A, Figure 14), possibly resulting in bank failure. This would be a significant event that could jeopardize water deliveries to agricultural areas outside of the Grassland Drainage Area and to private, state and federal wetland areas. The pump station, pipeline, subsurface drainage, and canal improvements would be completed on areas previously farmed or used as farm access roads and are located on land that is zoned A-1, Agricultural (Merced County) and AE-20 (Fresno County). The proposed short-term storage basins would be constructed on land that has been used for drainage reuse as part of the SJRIP for many years. Some of the proposed parcels hold Williamson Act contracts. See the applicable land use and zoning codes below for both counties.

> **Merced County**

Chapter 18.02 A-1, A-1-40, A-2 AGRICULTURAL ZONES
18.02.010 Purpose.

A. The purpose of this chapter is to achieve the following:

1. Provide a suitable environment for the preservation, development, and growth of agriculture.

2. Protect the agricultural industrial community and its related uses from encroachments of non-related or incompatible uses.

3. Preserve and encourage the economic stability of agriculture.

4. Ensure compatibility of adjacent land uses with agricultural zones.

B. The purpose of each agricultural zone is to achieve the following:

1. General Agricultural (A-1) Zone. The purpose of the general agricultural zone (A-1) is to provide for areas for more intensive farming operations dependent on higher quality soils, water availability and relatively flat topography, and agricultural commercial and/or industrial uses dependent on proximity to urban areas or location in sparsely populated low traffic areas. Parcels smaller than forty (40) acres down to a minimum of twenty (20) acres can be considered where agricultural productivity of the property will not be reduced.

> **Fresno County**

The County's Agriculture and Land Use Element (Fresno County 2000) defines agricultural land as follows:

Productive (Prime) Agricultural Land: Soils which are suitable for the production of most climatically adapted irrigated crops. Such land includes the following soils:

1. All land which qualifies for rating as Class I or II soils in the Natural Resources Conservation Service land use capability classifications;

2. Land which qualifies for rating with a Storie index rating of 80 through 100; and

3. Land which supports livestock used for the production of food and fiber and which has an annual carrying capacity equivalent to at least one (1) animal unit per acre as defined by the USDA.

Potentially Productive Agricultural Land: Soils which within the realm of economic possibility can be altered using certain reclamation or modification practices to make them more productive for essential food crops such as grain and vegetables. Included are certain Class III and IV soils and soils with a Storie index of 60-80.

Resource land use designations include the following for agriculture:

- Agriculture: This designation provides for the production of crops and livestock, and for location of necessary agriculture commercial centers, agricultural processing facilities, and certain nonagricultural activities. (See Table LU-3 for list of typical uses.)
- Irrigated Agriculture: This designation provides for the production of crops, necessary agricultural processing facilities, and certain nonagricultural activities. (See Table LU-3 for list of typical uses.) Irrigated agriculture requires a system that delivers at least one (1)-acre foot of water per acre per year.

Goal LU-A. To promote the long-term conservation of productive and potentially- productive agricultural lands and to accommodate agricultural-support services and agriculturally-related activities that support the viability of agriculture and further the County's economic development goals.

To implement this goal are several policies including the following which is most relevant to the Proposed Project:

- Policy LU-A.2. The County shall allow by right in areas designated Agriculture activities related to the production of food and fiber and support uses incidental and secondary to the on-site agricultural operation.

Fresno County's 2040 General Plan Review (Fresno County 2017) reaffirms this goal and policy.

The Zone Map identifies the zoning designation as AE-20 Agricultural Zone for the entire area affected by the Proposed Project. Fresno County has designated the following permissible uses for the AE district that applies to the GDA:

SECTION 816 "AE" EXCLUSIVE AGRICULTURAL DISTRICT

The "AE" District is intended to be an exclusive district for agriculture and for those uses which are necessary and an integral part of the agricultural operation. This district is intended to protect the general welfare of the agricultural community from encroachments of non-related agricultural uses which by their nature would be injurious to the physical and economic well-being of the agricultural district.

The "AE" District shall be accompanied by an acreage designation which establishes the minimum size lot that may be created within the District. Acreage designations of 640, 320, 160, 80, 40, 20, 5 are provided for this purpose. Parcel size regulation is deemed necessary to carry out the intent of this District. (Amended by Ord. 490.38 adopted 11-21-67)

SECTION 816.1 - USES PERMITTED (Excerpts)

The following uses shall be permitted in the “AE” Districts, except as otherwise provided in Subsection K of Section 816.2 for Interstate Interchange Impact Areas. All uses shall be subject to the Property Development Standards in Section 816.5. (Amended by Ord. 490.95 adopted 11-27-73; Ord. 490.174 re-adopted 5-8-79)

A. The maintaining, breeding, and raising of livestock of all kinds, except as provided in Sections

816.2 and 816.3. (Amended by Ord. 490.117 adopted 10-5-76; Ord. T-038-306 adopted 5-22-90)

B. The maintaining, breeding, and raising of poultry of all kinds, subject to the provisions of Section 868. (Added by Ord. T-038-306 adopted 5-22-90)

C. The raising of tree, vine, field, forage, and other plant life crops of all kinds. (Amended by Ord. T-077-352, adopted 3-2-04)

D. One family dwellings and accessory buildings and farm buildings of all kinds, when located upon farms and occupied or used by the owner, farm tenant or other persons employed thereon or the non-paying guests thereof; provided, however, that a residence once constructed and used for one of the foregoing uses, and no longer required for such use shall acquire a nonconforming status and may be rented for residential purposes without restriction.

F. The harvesting, curing, processing, packaging, packing, shipping, and selling of agricultural products produced upon the premises, subject to the provisions of 855-N.32. (Amended by Ord. T-077-352, adopted 3-2-04)

I. The use, storage, repair and maintenance of tractors, scrapers, and land leveling and development equipment when operated in conjunction with, or as part of, a bona fide agricultural operation. (Amended by Ord. 490.117 adopted 10-5-76)

S. Value-added agricultural uses and facilities subject to the provisions of Section 855-N.32 and Section 874. (Added by Ord. T-077-352, adopted 3-2-04)

SECTION 816.2 - USES PERMITTED SUBJECT TO DIRECTOR REVIEW AND APPROVAL

The following uses shall be permitted subject to review and approval as provided for in Section 872.

C. Communications equipment buildings and microwave relay structures.

D. Electrical transmission substations and electric distribution substations.

The maintenance and storage of agricultural equipment designed to be used solely for the harvesting of crops, which equipment must be located by the owner thereof upon his own premises when not operated as a secondary occupation in conjunction with, or as part of, a bona fide agricultural operation. (Added by Ord. 490.117 adopted 10-5-76)

a) Under the Proposed Project, no farmland is to be converted to nonagricultural uses. Sediments removed from the Drain would be stockpiled initially adjacent to the Drain in previously disturbed area (right-of-way) and then transported either to the SJRIP, where it will be used to fill in un-needed drains or build up ditch embankments, or transported to a planned commercial site, where it will be used as fill to bring the site to proper grade. See also Section 2.6, Geology and Soils.

b) The GBC and SLD are located in Merced County on land zoned A-1 and planned for Agricultural in the Merced County General Plan, Land Use Policy Diagram (http://web2.co.merced.ca.us/pdfs/planning/generalplan/landusemaps/draft_general_plan_county.pdf) All other facilities and improvements are located in Fresno County and are subject to the requirements of the Fresno County General Plan 2000 (and Draft 2040 General Plan under review at present), AE District (http://www.co.fresno.ca.us/home/showdocument?id=20123). Enlargement of irrigation and drainage conveyance facilities to support agricultural uses are permitted in this Agricultural zone. The GBC is adjacent to two parcels that are enrolled in the Merced County Williamson Act Program. However the proposed construction work and new facilities will not affect any agricultural operations and will have no impact on Merced County Williamson Act Program parcels adjacent to the GBC parcel. The Merced County wetland areas/wildlife refuges are also planned Agricultural and located in the A-2 Exclusive Agricultural Zone which allows for open space functions including wildlife habitat. Expansion of the reuse area with related pump stations, conveyance, and canal improvements, GBC and its connections will not impact any adjacent farmland or refuges. The proposed short-term storage basins (200 acres) could be located on parcels in the identified 200 acres that are enrolled in the Fresno County Williamson Act Program, however the proposed basins would support agricultural operations and are not inconsistent with the intention of the Williamson Act to maintain land in agricultural use and not stimulate conversion of land to urban uses. The basin land would not permanently convert to a nonagricultural use.

c) No timberland or forest land is affected by the Proposed Project which occurs in agricultural (new facilities) and open space/wetland habitat (sediment removal from the Drain) areas. No trees would be removed to complete the improvements and sediment removal.

d) The reuse area expansion, pump stations, conveyance, and communication facility improvements would be constructed in an agricultural area, and ongoing sediment removal would continue in portions of the Drain traversing wetland habitat areas and would not result in loss of any forest land.

e) No farmland would be permanently converted to other land uses. The additional reuse area would change from current field crops to Jose Tall Wheatgrass in for some parcels, while others are already planted to Jose Tall Wheatgrass. Rather, the Proposed Project is needed to facilitate storm water management that maintains the viability of agriculture in the Project Area and protects water supply channels to the wetland management areas that drain to the San Joaquin River. The affected area does not contain forestland, only trees that are part of the wildlife management areas.

2.3 Air Quality

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	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?	☐	☐	☐	☒

Discussion

The Grassland Bypass Project is located in the San Joaquin Valley Air Pollution Control District (Valley Air District). The Valley Air District's Rule 2020 Exemptions specifies emission units that are not required to obtain an Authority to Construct or Permit to Operate. An agricultural source that would be exempt involves "equipment or operations that emit air contaminants and that are used on the production of crops or the raising of fowl or animals" (Section 3.1). Furthermore, the Valley Air District adopted District Rule 4550-Conservation Management Practices in 2004 applicable to farmers with 100 acres or more of contiguous or adjacent farmland. A CMP plan must be prepared and implemented for each crop. For crop management practice changes, a CMP modification application form is required. The GBD will consult with the Valley Air District to see if any modification of existing CMP plans or new applications are required for the affected properties in the addition to the reuse area.

Air quality impacts are typically assessed when a proposed project has the potential to either generate new or exacerbate existing sources of air pollutants either from construction or from operation of the project over the long term. A project is consistent with an air quality plan if it will not result in an increase in the frequency or severity of existing air quality violations or cause or contribute to new violations with respect to criteria pollutants or delay timely attainment of air quality standards or emissions reductions in an air quality plan. Since the Proposed Project would involve limited use of mostly existing equipment to enlarge the reuse area and add subsurface drains in a portion of the existing area; to build levees to create 200 acres of new short-term storage basins; and to construct electric (not diesel) pump stations, pipelines, and line canals(see Sections 1.1.3.2 and 1.1.3.4) and also to complete removal of sediments from the Drain, activities that are short term and temporary in an agricultural area for the facilities and in wetland habitat area for the sediment removal, this use would not introduce new point sources or worsen existing sources of air pollutants, and a full quantification of emissions and evaluation of air quality impacts was not deemed necessary. The primary concern in agricultural areas is fugitive dust emissions/particulate matter generated by ongoing ploughing/soil disturbance.

Using project size (i.e., vehicle trips, housing units, square footage of development) and type (land use), the Valley Air District has pre-quantified emissions and determined a size below which it is reasonable to conclude that a project would not exceed applicable thresholds of significance for criteria pollutants.

These types of projects do not address agriculture. However, the small project analysis level by vehicle trips addressed 5 categories of urban land use with vehicle trips ranging from 1,453 trips/day for residential housing to 1,707 trips/day for institutional land use projects. Given the improvements proposed for the GDA and the estimated number of workers needed to construct the improvements, a comparison would be 10 workers/day driving into and out of the project area (i.e., 2 trips per day) for a total of 20 trips per day during construction, and only 9 workers/day during project operation (8 workers existing), which is substantially less than the lowest threshold of 1,453 trips/day for a project that occurs January through December. These project trips would only be during the May through November construction period and during the operation of the reuse area (primarily March through November). (SJVAPCD 2017)

a) The short term use of equipment to enlarge the SJRIP reuse area, add new subsurface drains in an existing part of the reuse area, add levees to create new storage basins, construct three new pump stations and expand one pump station (to add 25 cfs capacity) and pipelines, make canal improvements, and add the SCADA system within an area in agricultural production would not be large enough to interfere with implementation of the Valley Air District's air quality plan and any CMP by any affected landowner. Construction activities would be completed within 7 months (some work concurrent) during the May through November months. Removal of sediments from the Drain is a short term and temporary maintenance activity at any location within the remaining 18± miles of Drain needing clearance after December 31, 2018, and work would be limited to the dry season. The installation of the tile sump control SCADA allows for radio-control shutoff of the sumps rather than the use of a truck for a person to go out to the locations and operate the sumps "by hand." This reduction in truck use during Project operation would reduce emissions from this source over the long term operation of the Project. Use of electrical controls for the pump stations (rather than diesel pumps) require 1 worker using 1 truck (and 1 round trip per day for commuting to work) that would not impact emissions substantially.

b) Short term, temporary contributions to emissions and particulates are from the use of equipment over a 6 month period (May through November) in an agricultural area. Some additional tilling of the soil would occur with planting the additional reuse area with Jose Tall Wheatgrass compared to existing conditions but not significantly because the wheatgrass would replace tilling for previous crops on approximately 30% of the area. A water truck would be used to ensure dust is minimized at the construction sites. The 200-acre storage basin sites do not require disturbance of the ground (for base of basins), just the building of levees to contain the water.

c) The increase in emissions/particulate matter from the levee, pipeline and canal improvements is very small due to limited ground disturbance/trenching. These short term, small construction impacts would not be cumulatively considerable. A water truck would be used to minimize dust at the construction sites and all construction vehicles would be Tier 4 compliant. Sediments that are removed from the SLD will retain sufficient moisture to prevent dust generation and will be stockpiled within the SJRIP or planned commercial site. An evaluation of the emissions related to construction activities is included in Section 2.8.

d) Agricultural workers (if present) would not be exposed to substantial particulates. People do not live in close proximity to the construction locations. The basins, pump station, and pipeline are located approximately 2.5 miles from the city of Dos Palos at their closest point. The Drain is located at the edge of the city of Los Banos, mostly within the Los Banos and North Grasslands Wildlife Management Areas. It ends at Mud Slough within the San Luis NWR.

e) There are no odors emanating from the reuse area changes, levee, pipeline/canal construction or from the sediments, and there are no residences close to these areas.

2.4 Biological Resources

Material in this section is supported by Appendix B, *Biological Resources Impact Analysis*.

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	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 Game or US Fish and Wildlife Service?	☐	☐	☒	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?	☐	☐	☒	☐
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?	☐	☐	☐	☒

Discussion

The Proposed Project is making changes to existing infrastructure and farmed areas on existing agricultural land to accommodate storm water flows. No natural habitat is being modified for the new pump station, pipeline, reuse area, subsurface drains at the existing reuse area, communication towers, canal, and sediment removal activities. Sediments have been placed previously in the adjacent Drain right-of-way to dry and are then placed as fill material for unneeded drains at the reuse area or potentially on an area planned for commercial development. The proposed short-term storage basins would be located within the existing SJRIP on lands currently planted to Jose Tall Wheatgrass.

The 2009 EIS/EIR for the Grassland Bypass Project analyzed the biological impacts from the existing project and identified mitigation measures to substantially lessen or avoid those impacts. The Proposed Project modifications continue these mitigation efforts and extend them as appropriate for the modifications. Continued implementation of these mitigation measures is included in the discussion below. The Proposed Project does not require “new” mitigation measures; therefore, the “less than significant with mitigation incorporated” box is not checked. For the new short-term storage basins, the proposed site is an area previously planted with salt tolerant crops that will not affect nearby wetlands but could be characterized as an attractive nuisance to wildlife who would be discouraged from using the basins during its operation from December to May by hazing in order to minimize their exposure to Se, similar to hazing being conducted for irrigation ditches. At a public information meeting on June 18, 2019, a representative from the Grassland Water District (GWD) indicated his understanding that "holding ponds" take off the peak flows greater than 150 cfs (reducing the potential for water to get into the wetland supply channels), and that he is comfortable that the hazing will work to protect waterbirds (Ortega 2019, personal communication). Existing mitigation measures in practice at present have been shown to be sufficient to minimize the basins' attractiveness to waterbirds.

Appendix B, *Biological Resources Impact Analysis*, reports on the results of recent biological surveys (September 2018) within the Project Area that could be affected by any of the proposed improvements, and it is the basis for the impact analyses below including mitigation. The report calls for additional surveys as follows (p. 5):

> "Preconstruction nest surveys will be completed for all Project-related construction activities that occur between February 1 and August 31 to comply with California Fish and Game Code Section 3503.5. A qualified wildlife biologist shall conduct preconstruction surveys of all potential nesting habitats (including for raptors) within 500 feet of construction activities for presence of breeding or nesting birds. Surveys shall be conducted no more than 5 days prior to construction activities with a second survey conducted no more than 24 hours prior to the onset of construction. If active nests are found, no-disturbance buffers shall be implemented around each nest as follows: a 500-foot buffer shall be created around any confirmed active special-status raptor nest (including burrowing owl); a 300-foot buffer shall be created around active nests of non-raptor special-status bird species. The buffers will be implemented until it is determined by a qualified biologist that young have fledged. If a nest is found in an area where ground disturbance is scheduled to occur, the area will be avoided either by delaying ground disturbance in the area until a qualified wildlife biologist has determined that the young have fledged or by re-siting the proposed Project component(s) to avoid the area."

a) Concerning the potential for special status species to be impacted and the feasibility of mitigation for those impacts, Appendix B provides the following information:

   i. No **special-status plant species** were observed during the field surveys. Forty plant species, most nonnative, were observed within the Project site. CNPS (2018) identifies 26 CRPR species that have occurred historically in the study area. All these special-status plant species were determined to be absent from the Project site. Several of the 26 species that have been documented in the CNPS query of the surrounding region can tolerate and, in some cases, become established as a result of disturbances associated with agricultural practices, particularly in some of the soils found on the site (e.g., alkaline soils). However, no plants were observed on the site despite confirmed observations to the northeast of the site. None of the other queried plant species that can tolerate disturbance are expected to occur on the site.

   ii. San Joaquin kit foxes are unlikely to forage at the Project site because small mammal burrows are mostly absent. In addition, no mammalian excavations showing signs of use by American badger, kit fox, red fox, or coyote were observed during surveys. No evidence was found to indicate San Joaquin kit fox presence on the Project site during scent-dog surveys in 2015 and 2018.

   iii. Multiple **special-status wildlife species** are documented by the CNDDB to have occurred in the study area (CNDDB 2018). Most were absent or unlikely to occur on the Project site. However, those species that are present or could possibly occur are the following bird species (see Appendix B, Table 1 and Section 5.3).

      i. Two special-status bird species, the burrowing owl (*Athene cunicularia*) and the loggerhead shrike (*Lanius ludovicianus*) were observed during the surveys.

ii. Swainson's hawk (*Buteo swainsoni*) is assumed present because Swainson's hawks have nested on the existing SJRIP reuse site. The proposed Project site has both foraging habitat and trees appropriate for nesting.

iii. Bird species that could possibly occur include:

1. Mountain plover (*Charadrius montanus),*
2. Northern harrier (breeding) (*Circus cyaneus)*,
3. Tricolored blackbird (*Agelaius tricolor*), and
4. Yellow-headed blackbird (*Xanthocephalus xanthocephalus*),

Management activities at the existing SJRIP reuse site have greatly reduced selenium-related impacts on nesting shorebirds by eliminating nesting habitat where possible and hazing potentially nesting birds from the site. Hazing of birds during the nesting season, diligent water management, and modification of drains to discourage avian use have resulted in fewer killdeer nesting on the site, and in only one recurvirostrid nest since 2011.

A major concern for bird species is the potential for impacts from selenium contained in the storm water and held in the proposed storage basins and from enlargement of the reuse area for irrigation with drain water no longer discharged to the San Luis Drain. It is important to note that the proposed storage basins will not operate as evaporation basins, but will be drained as soon as practical according to the reuse capacity of the SJRIP. As discussed in Appendix B (Section 6.1), water samples from the sources of drain water used to irrigate the existing SJRIP reuse site ranged from 14 to 78 ppb selenium from 2013 to 2018 (Panoche Drainage District data), with an average of 41 ppb. These sources exceeded the 32 ppb threshold that CH2M Hill et al*.* (1993, cited in Appendix B) associated with a high probability of reproductive effects, including reduced hatchability and increased occurrence of embryonic deformities (Table 2).

See Section 2.4 of this Initial Study for explanation of refinements to the 2009 biological mitigation measures for the expanded reuse area and new short-term storage basins, derived from Appendix B, *Biological Resources Impact Analysis*. The measures are similar to the 5 types of measures listed above with some changes based on monitoring of the area since 2006 and expanding use of the measures to apply to construction and operation of new features such as the short-term storage basins. Specific impact statements and mitigation measures to reduce the potentially significant impacts to less than significant for special status species are excerpted below from Appendix B (Section 7.2):

Impact BIO-1. The Project Could Result in Mortality of, and Loss of Habitat for, Burrowing Owls. Implementing the Project would impact suitable burrowing owl habitat and could result in injury or mortality of individual burrowing owls during construction. Disturbance of habitat during the breeding season (February 1 through August 31) could result in displacement of breeding birds and the abandonment of active nests. Specifically, ground disturbance during construction could contribute to the incidental loss of fertile eggs or nestlings or otherwise lead to nest abandonment. Given the abundance of similar-quality burrowing owl habitat in the region, the loss of habitat on the Project site would not constitute a significant impact. However, any reductions in the numbers of this rare species, directly or indirectly (through nest abandonment or reproductive suppression), would constitute a significant impact. Furthermore, raptors, including owls, and their nests are protected under state laws and regulations, including the California Fish and Game Code Section 3503.5. Incorporation of the following mitigation measure into the conditions of approval would ensure that if burrowing owls are present, their presence would be detected, the risk of mortality would be avoided to the maximum extent feasible, and impacts would be reduced to a less-than-significant level.

Mitigation Measure BIO-1: Conduct a Preconstruction Survey for Burrowing Owl and Implement Avoidance Measures. No more than 15 days before the start of initial ground-disturbing activities for the Project, a qualified biologist(s) knowledgeable of the species will conduct a take avoidance survey for the presence of burrowing owls within 500 ft of the area scheduled for disturbance as described in Appendix B's Appendix D of the *Staff Report on Burrowing Owl Mitigation* (CDFG 2012). If burrowing owls are detected within the area scheduled for disturbance, site-specific avoidance measures, consistent with the best practices presented in the *Staff Report on Burrowing Owl Mitigation* (CDFG 2012), will be implemented under the direction of the qualified biologist. Appropriate measures will be selected by the qualified biologist and will include establishment of no-disturbance buffer zones, as described in CDFG (2012), to avoid impacts on occupied burrowing owl burrows. If occupied burrowing owl burrows cannot feasibly be avoided during the nonbreeding season (September 1–January 31), burrowing owls may be passively excluded under the direction of the qualified biologist, provided the conditions in CDFG (2012) are met, including development of a burrowing owl exclusion plan and performance of appropriate site monitoring before, during, and after exclusion.

Impact BIO-2. The Project Could Result in the Mortality of Migratory Birds or Active Nests. Based on waterborne and egg-selenium levels at the SJRIP, lethal and sublethal effects on waterbirds breeding at the expansion Project site are probable (waterbirds here are separated from other birds potentially occurring on the site, such as birds of prey and passerines, for which there is evidence that selenium impacts are not as significant—see Section Appendix B, 7.2.1). Water samples from the sources of drainwater used to irrigate the SJRIP reuse site averaged 41 ppb selenium from 2013 to 2018 (Panoche Drainage District data). Such levels are well above the level of waterborne selenium (32 ppb) associated with a high probability of reduced hatchability and increased probability of teratogenesis for sensitive species of waterbirds (CH2M Hill et al. 1993). The repeated and prolonged exposure of breeding waterbirds in this region to selenium, resulting in lethal and sublethal effects, would constitute a significant impact.

The effects of selenium exposure at the Project site would be concentrated among migratory waterbird species, of which individuals, nests, and eggs are protected by the California Fish and Game Code. Hence, the exposure of these species to selenium impacts is discussed under this criterion. Adverse impacts on nesting migratory bird species for the duration of the Project due to exposure to selenium would constitute a significant impact.

Waterbird use of the regulating pond and proposed short-term storage basins could negatively impact waterbirds through dietary selenium exposure. Increased water being stored in the existing ponds and storm water temporarily stored in the proposed basins will potentially provide an attractive foraging habitat for waterbirds. The water is expected contain high enough selenium concentrations that long-term exposure could result in reproductive impairment to sensitive waterbird species. If the duration of the exposure is long enough, reproductive impairment is possible even if the waterbirds forage on the Project and nest elsewhere in the vicinity of the Project.

Because of the conditions on the Project site and the avian species that may use the site for nesting, these impacts would not 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 impeded the use of native wildlife nursery sites. However, if waterbirds nest on the Project site, impacts on nesting birds from selenium exposure would be significant. Incorporation of Mitigation Measures BIO-2a through BIO-2f into the conditions of approval would ensure that adverse effects of selenium exposure on nesting waterbirds are avoided or substantially lessened to a less-than-significant level. Note that Mitigation Measures BIO-2a, BIO-2c, BIO2e, and BIO2f have been implemented at the SJRIP reuse site, where they have significantly reduced the number of nesting shorebirds exposed to selenium. These mitigation measures are provided in their entirety below from Appendix B.

Mitigation Measure BIO-2a: Reduce Selenium Exposure Potential by Reducing Attractiveness of Irrigation Ditches for Nesting. Sediment that has collected on the bottom of the ditches will be periodically removed and irrigation ditches within the proposed expansion areas will be maintained with smooth sides and borders to reduce nesting attractiveness in and near irrigation ditches. Removing sediment that has collected on the bottom of the ditches will remove potential nest substrate that is exposed when water levels are low. Smoothing the ditch banks and borders and removing weedy vegetation will reduce the attractiveness of the area for nesting, because killdeer and recurvirostrids often use rough surfaces, such as disced areas, to conceal nests. This measure will be implemented as long as agricultural reuse water is used to irrigate crops on the site.

Mitigation Measure BIO-2b: Reduce Selenium Exposure Potential by Reducing Attractiveness of Regulating Pond/Storage Basins for Nesting. The attractiveness of the existing regulating pond and the proposed short-term storage basins to nesting shorebirds will be reduced through active management practices, including removing sediment and vegetation that has collected on the bottom of the ponds and maintaining smooth bottoms, sides and borders of the ponds. Maintaining flat smooth pond bottoms will remove potential nest substrate that is exposed when water levels are low. Smoothing the interior levees and borders and removing weedy vegetation will reduce the attractiveness of the area for nesting, because killdeer and recurvirostrids often use rough surfaces, such as disced areas, to conceal nests. Water within the existing pond and proposed basins will be managed to be as deep as possible to minimize the surface area of foraging habitat for waterbirds. Water entering the existing pond and proposed basins will fill a cell to the maximum depth before subsequent cells are filled. Maintaining steep interior levee slopes of at least a 1:3 ratio will also minimize shallow water foraging habitat for waterbirds. This measure will be implemented as long as the regulating pond and proposed basins are utilized, and agricultural reuse water is used to irrigate crops on the site.

Mitigation Measure BIO-2c: Reduce Exposure Potential by Hazing Waterbirds from the Project Site During Nesting Season. Waterbirds shall be hazed from the Project site during the waterbird nesting season (March 15 to July 15) to reduce exposure of waterbirds to selenium by discouraging waterbirds from feeding where they could be exposed to selenium. Methods of hazing could include, but not be limited to, firing noisemaking devices such as cracker shells, deploying 15-millimeter “bird bombs,” and using bird whistlers from a vehicle to discourage birds from congregating for feeding or establishing nest sites on the Project. In addition, propane-operated cannons can be left operating for 24 hours, if required. If cannons are used, their locations will be changed periodically to lessen habituation by birds to the noise. This measure will be implemented as long as agricultural reuse water is used to irrigate crops on the site.

Mitigation Measure BIO-2d: Reduce Exposure Potential by Hazing Waterbirds from the Regulating Pond/Storage Basins When Water is Present. Waterbirds shall be hazed from the existing regulatory pond and proposed basins to reduce exposure of waterbirds to selenium by discouraging waterbirds from feeding or nesting where they could be exposed to selenium. Methods of hazing could, but not be limited to, include firing noisemaking devices such as cracker shells, deploying 15-millimeter “bird bombs,” and using bird whistlers from a vehicle to discourage birds from congregating for feeding or establishing nest sites on the Project. In addition, propane-operated cannons can be left operating for 24 hours, if required. If cannons are used, their locations will be changed periodically to lessen habituation by birds to the noise. The levees around these ponds and access roads to the ponds will need to be maintained to allow access during wet conditions that may muddy roads. This measure will be implemented as long as the regulating pond and proposed basins are utilized,

Mitigation Measure BIO-2e: Implement a Flooded-Field Contingency Plan. A contingency plan for accidental or inadvertent flooding has been developed for the SJRIP. The plan includes provisions for immediate removal of unintentionally released drainwater as well as for increased monitoring and hazing near flooded sites. This plan, presented in Appendix B's Appendix D, will be implemented for the proposed expansion Project and should be incorporated into the Project's conditions of approval.

Mitigation Measure BIO-2f: Monitor Mitigation Success and Provide Compensation Breeding Habitat. The above mitigation measures will be implemented to reduce the exposure of birds to selenium. To evaluate the success of these measures, monitoring will be implemented to determine whether nesting waterbirds are still exposed to elevated selenium levels as a result of the Project. If they are, compensation habitat for residual impacts will be provided, following the protocol outlined in Appendix B (Section 7.2.3) that has been adapted from a protocol developed by USFWS (1995) for determining and mitigating impacts on nesting waterbirds at evaporation basins. The amount of monitoring required, and the basis for evaluating selenium levels and triggering the compensation requirement, are included in the protocol.

Mitigation Measure BIO-2g: Conduct Preconstruction Nest Surveys for Infrastructure Installation Occurring During the Nesting Season. Preconstruction nest surveys will be completed for all Project-related infrastructure installation activities that occur between February 1 and August 31 to comply with California Fish and Game Code Section 3503.5. A qualified wildlife biologist shall conduct preconstruction surveys of all potential nesting habitats (including for raptors) within 500 feet of construction activities for presence of breeding or nesting birds. Surveys shall be conducted no more than 5 days prior to construction activities with a second survey conducted no more than 24 hours prior to the onset of construction. If active nests are found, no-disturbance buffers shall be implemented around each nest as follows: a 500-foot buffer shall be created around any confirmed active special-status raptor nest (including burrowing owl); a 300-foot buffer shall be created around active nests of non-raptor special-status bird species. The buffers will be implemented until it is determined by a qualified biologist that young have fledged. If a nest is found in an area where ground disturbance is scheduled to occur, the area will be avoided either by delaying ground disturbance in the area until a qualified wildlife biologist has determined that the young have fledged or by re-siting the proposed Project component(s) to avoid the area.

b) Effects on adjacent habitat in the NWR and WMAs would be noise from equipment use within the Drain to remove sediment. Wildlife would move away from the activity to other areas within the refuge and return as desired once the sediments are removed from the Drain and then later from the right-of-way when dry. Sediment removal would occur during the summer months and be completed before the wetlands are watered/flooded up for the waterfowl migration period. Sediment removal moves from location to location and is not prolonged at a specific area.

c) According to Appendix B, the results of a query of the CNDDB (2018) for sensitive habitats indicate that no sensitive habitats are present on or within 5 miles of the Project site. Additionally, hydric soils are not present, and the flat land lacks depressions capable of holding standing water. Therefore, the site does not support vernal pools or wetlands. Therefore, wetlands would not be affected by construction of any of the proposed facilities.

The sediment removal in the portion of the Drain that traverses the NWRs is disruptive to the Drain and adjacent right-or-way, but it does not physically modify the existing wetlands and other habitat. Workers and equipment in the Drain disturb wildlife, but this disturbance is short term and temporary. Project proponents will consult with USFWS and CDFW as occurs at present to avoid damage to NWR resources. As stated in Section 1.1.1: Concerning sediment removal, the US Fish and Wildlife Service (Service) has reviewed the current sediment removal project and determined the following:

"Where the old Kesterson Reservoir site is to the west of the SLD, we suggest the operators work from the west side of the SLD and stockpile sediment on the Bureau of Reclamation's land. Where Refuge lands are on both sides of the SLD, we request that the sediment be stored on top of the levee, as we saw in the south Grasslands project. In both instances, the sediment would be kept away from Refuge lands-and thus the project would not have the potential to damage Refuge resources." (USFWS 2017)

The storm water discharge into Mud Slough would continue, although discharges would be limited to only storm-induced flows and would be substantially less than historic discharges. This impact is covered in Section 2.9.

d) Improvements on existing farmland and service roads would not affect the movement of wildlife. The new short-term storage basins will need to be managed to discourage foraging by waterfowl (see, e.g. Section 1.1.4, Mitigation Measure 3, Hazing regarding hazing for irrigation canals) and (a) above. Sediment removal in the Drain would not inhibit wildlife movement. The 87-mile San Luis Drain has been operational and a feature in the refuges since its construction in 1974. Appendix B, Section 4.4 provides the following concerning wildlife movement:

"Because the Project site comprises fallowed and regularly disced land vegetated primarily by nonnative species, it does not provide high-quality habitat for migratory birds or bats. The habitat provides only limited food resources (primarily insects) for some migrant songbirds and migratory bats; therefore, it does not represent a unique or important resource for these animals.

"Because of the density of agricultural development in the study area and the lack of continuous, well-vegetated pathways through the Project site, there are no movement corridors on the site that meet the criteria described above." (Appendix B, page 22)

Because of the conditions on the Project site and the avian species that may use the site for nesting, the impacts (through dietary selenium exposure), see (a) above, would not 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) The improvements to the area to add new pump stations, pipelines, canal lining, reuse area expansion, new storage basins, subsurface drains at the existing reuse area, and communication towers plus the sediment removal are consistent with current Agricultural land use designations and zoning. Concerning biological resources, the Proposed Project would not conflict with any local policies or ordinances and would support the goals and policies of the Fresno County General Plan (Fresno County 2000). Trees on the Project site that may be removed are nonnative ornamental trees or weedy species and are not protected by general plan policies.

f) Habitat Conservation Plans (HCPs) are long-term agreements between an applicant and the U.S. Fish and Wildlife Service (USFWS). A Natural Community Conservation Plan (NCCP) is a managed by the California Department of Fish and Wildlife to use an ecosystem approach to the protection and perpetuation of biological diversity. Project proponents (SLDMWA for the GBD) have engaged in consultations with both of these resource agencies, Reclamation, and the Grassland Water District on April 20, 2018.

As stated in Appendix B (Section 7.2.5), the Project site is not located in an area covered by an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan. Therefore, implementation of the Proposed Project would not conflict with any adopted conservation plan.

Concerning the Project vicinity, there is one HCP in portions of Madera and Fresno Counties: the PG&E San Joaquin Valley Operations and Maintenance HCP for USFWS Region 8, issued 12/14/2007 and effective to 12/14/2037 that applicable to the PG&E's utility/infrastructure uses (https://ecos.fws.gov/ecp0/conservationPlan/plan?plan_id=4229) . "PG&E's San Joaquin Valley O&M HCP plan area is defined to include PG&E's gas and electrical transmission and distribution facilities, the lands owned by PG&E and/or subject to PG&E easements for these facilities, private access routes to infrastructure associated with O&M activities, minor facility expansion areas, and mitigation areas for impacts resulting from covered activities" https://ecos.fws.gov/docs/plan_documents/thcp/thcp_838.pdf. The Proposed Project modifications do not interfere with this Plan.

In 1990, the Central Valley Habitat Joint Venture (CVHJV) partnership developed its first strategic plan to deliver partnership-based waterfowl habitat conservation, the *Central Valley Habitat Joint Venture Implementation Plan* (1990 Plan), and the USFWS is the administering agency. The partners have combined their efforts to cooperatively meet the habitat needs of migrating and resident bird species in the Central Valley of California associated with four international bird conservation initiatives. This plan was updated in 2006, and this *Central Valley Joint Venture Implementation Plan* (2006 Plan) incorporates new information and broadens the scope of conservation activities to include objectives for shorebirds, waterbirds, and riparian songbirds. As part of its expanded responsibility to provide habitat for shorebirds, waterbirds and riparian birds along with waterfowl, the CVHJV has increased its boundaries to include most of the Central Valley watershed in 9 subareas or basins, Grasslands Water District is one of the partners located in the San Joaquin Basin. The 2006 Plan is a first step in developing sound conservation objectives for each of the following:

- Wintering Waterfowl
- Breeding Waterfowl
- Non-breeding Shorebirds
- Breeding Shorebirds
- Waterbirds
- Breeding Riparian Songbirds

The plan is expected to be updated in the near future.

2.5 Cultural Resources

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Cause a substantial adverse change in the significance of a historical resource pursuant to 15064.5?	☐	☐	☒	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to 15064.5?	☐	☐	☒	☐
c) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☒	☐

Discussion

Cultural resources are defined as prehistoric and historic archeological sites, architectural properties (e.g., buildings, bridges, and structures), and traditional properties with significance to Native Americans or other ethnic groups. For the purposes of the present document, the term "historic properties" are those resources eligible for listing in the National Register of Historic Places (NRHP)(36 Code of Federal Regulations [CFR] 60.4). Any property eligible for listing in the NRHP is by default considered eligible for the California Register of Historical Resources (Public Resources Code, Section 5024.1). Archeological and historic architectural properties provide scientifically important information about California's history and cultural heritage. The California Register of Historical Resources (California Register) includes buildings, sites, structures, objects and districts significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California.

A confidential Cultural Resources Technical Report (AECOM 2019) was prepared to support this Initial Study, and report findings are provided primarily in this section. Direct and indirect CEQA Area of Potential Effects (C-APE) were developed in order to study the potential impacts of the Proposed Project. The Direct C-APE includes the footprints of all the areas that would be subject to ground disturbance by the project. The Indirect C-APE would account for indirect impacts to resources (i.e., visual effects to the setting of built environment resources) that would not be physically impacted by the project.

Concerning the environmental setting, the Cultural Resources Technical Report (AECOM 2019) provides substantial information on area prehistory with a generalized cultural sequence for the project vicinity that includes the following periods: Paleo-Indian Period (11,550 to 8550 B.C.), Lower Archaic Period (8550 to 5550 B.C.), Middle Archaic Period (5550 to 550 B.C.), Upper Archaic Period (550 B.C. to A.D. 1100), and Emergent Period (A.D. 1100 to Historic).

The technical report indicates that the Project Area is ethnographically attributed to the Northern Valley Yokuts, part of the California Penutian language family, whose territory lay between the foothills of the Diablo and Coast Ranges and the Sierra Nevada, extending roughly from the Calaveras River at the north to the northward bend of the San Joaquin River near the modern community of Mendota at the south (Wallace 1978:462, cited in AECOM 2019). Historically, the arid territory west of the San Joaquin River was more sparsely populated than lands bordering the tributaries flowing from the Sierras to the San Joaquin on the eastern valley margins. Northern Valley Yokuts people living near the river and its tributaries depended heavily on fishing for subsistence, and spawning king salmon, white sturgeon, and other fish provided a valuable food source. Tule marshlands surrounding the watercourses attracted geese, ducks, and other water birds, while elk and pronghorn antelope inhabited the plains. However, the importance of these bird and mammal species to the Northern Valley Yokuts diets is not known (Wallace 1978:464). Valley oak acorns were ground into meal, as were smaller seed crops.

The report provides the historical context for the Project Area with excerpts provided below.

"Formed in 1855 from a portion of Mariposa County, Merced County is named for the river whose original appellation, *El Rio de Nuestra Señora de la Merced* was bestowed by Gabriel Moraga and Father Pedro Muñoz during their 1806 to 1810 exploration of the San Joaquin Valley (Kyle et al. 2002:209-210). Likewise, Fresno County was formed a year later from portions of Mariposa, Merced, and Tulare counties. Fresno is Spanish for "ash tree" and the area was named such for its abundance of these trees growing along the San Joaquin River (Gudde 1998:138).

"Although Fresno and Merced counties have a combined total of five Mexican ranchos within their boundaries, no rancho is located within the project area (Beck and Haase 1974). *Rancho Sanjon de Santa Rita* land grant, is the nearest rancho to the project area located approximately 6.5 miles to the north, cites "Los Dos Palos" or "The Two Trees" as a boundary marker (Online Archive of California [OAC] 184?). The town of Dos Palos is located roughly 3.5 miles northeast of the northernmost project area and was established by cattle baron Henry Miller, who purchased the land grant in the 1860s (Kyle et al. 2002:214-215). Miller and Charles Lux went on to become the largest producer of cattle in California, and controlled or owned over two and a half million acres of land in the United States (Kyle et al. 2002:215).

"In 1870-1871, a severe drought in the vicinity of the project area was the motivation for local farmers and ranchers to establish the "first major corporate venture in the San Joaquin Valley" to provide for a regular supply of water (Hattersley-Drayton 2002:11). The San Joaquin and Kings River Canal and Irrigation Company (SJ&KRC&IC) was incorporated in 1871 by a group of prominent businessmen of California, and with one million dollars of capital, the San Joaquin and Kings River Canal or "Main" Canal was constructed (Hattersley-Drayton 2002:11). Miller granted SJ&KRC&IC the right-of-way for the Main Canal to be constructed through the Miller and Lux property in exchange for water at a very low rate; and Miller and Lux became stockholders in the irrigation company (Hattersley-Drayton 2002:11).

"Ten years later, Miller and Lux extended the Main Canal nearly 30 miles to Crows Landing (Byrd 1996:3 and Treadwell 1981:73, as cited Hattersley-Drayton 2002:11). To irrigate lands higher and further west than those served by the Main Canal, the Outside Canal was constructed south and roughly parallel to the Main Canal, by Miller and Lux in 1896. The Outside Canal pulled water from the Fresno Slough from a point slightly south of the Main Canal diversion, and terminated in Merced County near Los Banos (Freeman and Jones 2009). The development of these canals and their laterals opened up farming on the west side of the San Joaquin Valley. "By 1908, Miller owned or controlled more than 80 percent of [SJ&KRC&IC…and Miller and Lux and SJ&KRC&IC] had virtually become one" (Hattersley-Drayton 2002:11)." (AECOM 2019)

Under CEQA, a cultural resource is considered a "historical resource" if it meets any of the criteria found in Section 15064.5(a) of the CEQA Guidelines. Under CEQA, the lead agency determines whether projects may have a significant effect on archaeological and historical resources. CEQA Guidelines Section 15064.5 defines what constitutes a historical resource, including 1) a resource determined by the State Historical Resources Commission to be eligible for the California Register of Historical Resources (CRHR) (including all properties on the National Register); 2) a resource included in a local register of historical resources, as defined in Public Resources Code Section 5020.1(k); 3) a resource identified as significant in a historical resource survey meeting the requirements of Public Resources Code Section 5024.1(g); or 4) any object, building, structure, site, area, place, record, or manuscript that the lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California, provided that the lead agency's determination is supported by substantial evidence in light of the whole record. Generally, a resource shall be considered to be historically significant if it meets the criteria for listing on the California Register.

The cultural resources study consisted of a records search at the Southern San Joaquin Information Center for the project area within Fresno County, and a records search at the Central California Information Center (CCIC) for the project area within Merced County, both of the California Historical Resources Information System (CHRIS); a search of the California Native American Heritage Commission's (NAHC) Sacred Lands File and outreach to the Native American individuals listed by the

NAHC as interested parties, as it pertains to Assembly Bill (AB) 52; and a partial built environment survey of the Project Area. An archaeological field survey was not conducted due to saturated soils, but a site visit was performed on February 15, 2019.

The records searches did not identify any archaeological resources in the 1.0-mile radius of the project footprint, only built environment resources. The previously recorded historic-age built environment resources in the Project Area include the Main Canal (P-27-000082 Merced County) and the Outside Canal (P-10-005796 Fresno County; P-24-000434 Merced County) (Attachment A). The Delta-Mendota Canal (P-10-005166) is adjacent to the “Proposed Reuse Expansion” area.

- The Main Canal (P-27-000082 Merced County) was constructed in 1874 by the San Joaquin and Kings River Canal and Irrigation Company (SJ&KRC&IC) owned by cattle barons Miller and Lux. Segments of the canal were recorded in the mid-1990s/early-2000s and found ineligible for listing in the National Register of Historic Places (NRHP), but were not evaluated for the CRHR. The most recent recordation in 2017 (Rogers) re-evaluated the Main Canal as historically significant under NRHP and CRHR Criteria A/1 and is considered a historical resource for CEQA.

- The Outside Canal (P-10-005796 Fresno County; P-24-000434 Merced County) was also built by the Miller and Lux-owned SJ&KRC&IC and was determined ineligible for the NRHP by consensus through Section 106 process in 2000, but was not evaluated for the CRHR. The results of the CCIC did not include the previous recordation from 1996 that determined the resource as an individual property that was ineligible for listing in the NRHP. The recordations provided by the SSJVIC did not include historic evaluations.

Based on results from the CCIC there are no previous recordations or evaluations of the historic-age Helm Canal or the San Luis Drain located in the Project Area on file. The Outside Canal was previously determined ineligible for the NRHP, and the Main Canal is a historical resource for the purposes of CEQA. These four historic-age water conveyance structures are still in use as their original purpose of conveyance of irrigation water or drainage water in an agricultural area. The San Luis Drain’s proposed use will be only for the storm water component of drainage water from the GDA.

The Delta-Mendota Canal (DMC) traverses the “Proposed Reuse Expansion” south of Eagle Field. The Delta Mendota Canal (P-10-005166 Merced County; P-39-00089 Fresno County) was previously recorded and evaluated and determined eligible for listing in the NRHP as a key component in the original Central Valley Project (CVP) and is considered a historical resource for CEQA. This historical resource would not be subject to any adverse effects from the Proposed Project. And is not discussed further

A limited survey of the C-APE was conducted due to saturated soils and inaccessibility to the project footprint. Four historic-age (45 years and older) built environment water conveyance structures were surveyed that may be affected by Project improvements. From north to south these resources are the San Luis Drain, Helm Canal, Main Canal, and Outside Canal. Notes and photographs were taken during the survey of these earth-lined water conveyance structures. Because of muddy conditions, the portions of the Main Canal and Outside Canal for proposed improvements east of North Russell Avenue were inaccessible, but points were surveyed within the Project Area.

The AECOM 2019 technical report identified two historic-age built environment resources in the proposed reuse expansion area around Eagle Field. The Eagle Field Airport was built in 1945 as an Army Air Forces training base and later disposed of by the Federal government in 1948 and 1954 (California Military Museum 2016). Portions of the World War II airport facility are still extant and are privately owned. A water pump and pump house dating to 1942 were recorded and evaluated in 2003 for an US Army Corps of Engineers project and were both found ineligible for listing in the NRHP, but not evaluated for CRHR (OHP 2011).

As noted in the 2009 Final EIS/EIR (Section 9.2.3, p.9-6), in general, projects that include ground-disturbing activities such as grading and excavation have the potential to impact historic and prehistoric archaeological resources and may impact historic architectural resources if buildings would be demolished, moved, or altered—or if the setting of an historic resource would be substantially changed.

Projects that entail minor surface disturbance or construction would likely result in negligible impacts to cultural resources, but not in every case. On the other hand, large-scale impacts can result from projects that require large degrees of ground disturbance. In essence, as the intensity of construction impacts increases, the potential to impact cultural resources increases.

The Proposed Project does not involve large-scale excavation, and most of the area has been disturbed by previous farming (primarily the top 12 inches of soil), conveyance construction, and road construction activities. The depth of disturbance involved in placing new facilities in an area that has been farmed or subject to earlier road and canal construction determines in part whether there is the potential to affect surface and buried resources. Another issue is the potential for above ground facilities such as the SCADA communications towers and equipment boxes to affect historic resources. The short-term storage basins would be on top of the ground surface and contained by raised levees that do require limited excavation. The Proposed Project's improvements include the following facilities and the depth of disturbance (feet) below the ground surface:

> Levees (8 miles, 12-16 ft wide) for new storage basins	<3
> Subsurface drains added to 1,100 ac in reuse area	8
> RP-1 ditch extension	2
> RP-1 pipeline (30-36 inches in diameter) trench	6
> West pipeline	5
> SJRIP return pipeline	5
> SCADA system concrete footings	4

Any human remains encountered during ground-disturbing activities are required to be treated in accordance with CEQA Guidelines Section 15064.5(e), Public Resources Code Section 5097.98, California Health and Safety Code (CHSC) Section 7050.5. California law protects Native American burials, skeletal remains, and associated grave goods regardless of their antiquity, and provides for the sensitive treatment and disposition of those remains. Specifically, Section 7050.5 of the CHSC states that in the event of discovery or recognition of any human remains in any location other than a dedicated cemetery, there shall be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent remains until the coroner of the county in which the remains are discovered has determined whether or not the remains are subject to the coroner's authority.

If the human remains are determined to be of Native American origin, the county coroner must contact the Native American Heritage Commission (NAHC) within 24 hours of this identification. An NAHC representative will then identify a Native American Most Likely Descendant to inspect the site and provide recommendations for the proper treatment of the remains and associated grave goods. In addition, CEQA Guidelines Section 15064.5 specifies the procedures to be followed in case of the discovery of human remains on non-federal land. The disposition of Native American burials falls within the jurisdiction of the NAHC Historical Resources.

a) **Historical Resources:** None of the Proposed Project activities, including constructing temporary storm water storage in short-term storage basins, planting salt-tolerant crops in existing agricultural lands, improving existing water conveyances, installing subsurface drainage within existing reuse area, or installing adjacent new conveyances, would result in a substantial adverse change to known or potential historical resources in the Project Area (the four canals including the DMC and the San Luis Drain). The Proposed Project activities, including the installation of below grade (approximately 5 to 6 foot depth) pipelines, alteration of the non-historic age dirt-lined RP-1 Canal adjacent to the Outside Canal with a concrete lining, and installation of pump stations, would not result in demolition, destruction, relocation, or alteration such that the significance of an historical resource would be impaired.

   The Proposed Project's expansion of the reuse area will be adjacent to portions of the Eagle Field Airport; however, there will be no physical changes to the airport itself or any associated features.

The proposed reuse expansion area in the vicinity of the Eagle Field Airport is currently planted to Jose Tall Wheatgrass, and no changes to the cropping pattern or irrigation methods are proposed.

The location of the proposed SCADA tower is dependent upon a radio survey that allows for some flexibility in siting to avoid resources if present. Once the tower location has been identified, an additional records search and survey would be required and conducted to determine if archaeological or built-environment resources are present. If resources are present and avoidance is not feasible, the resources would be recorded and evaluated prior to certification of the CEQA document in order to assess their historical significance as historical resources or unique archaeological resources, per Section 15064.5 of the CEQA Guidelines or Section 21083.2 of the Public Resources Code.

b) **Archaeological Resources:** No archaeological resources were identified in the records searches performed for this project. However, conditions were not suitable for an archaeological survey of the Project Area and much of the C-APE has not been previously surveyed. Based on the soils types and alluvial deposition there is a low to moderate potential for resources to be present. Therefore, AECOM recommends that an archaeological survey be conducted in order to determine if there are archaeological sites (prehistoric or historic period) within the Project Area. If resources are present in the Project Area and avoidance is not feasible, the resources should be recorded and evaluated prior to certification of the CEQA document in order to assess their historical significance as historical resources or unique archaeological resources, per Section 15064.5 of the CEQA Guidelines or Section 21083.2 of the Public Resources Code.

Although no previously identified prehistoric resources have been identified in the C-APE, several isolated artifacts were discovered during a previous study just over 1.0-mile north of the proposed lined channel within the C-APE (Bureau of Reclamation 1983, cited in AECOM 2019). The presence of these artifacts warranted archaeological monitoring during ground disturbing activities. If the results of the archaeological survey of the current C-APE are positive, AECOM recommends mitigation in the form of preparation of an archaeological testing plan (including geoarchaeology) and/or an archaeological monitoring plan. All ground disturbing activities should be monitored by a qualified archaeologist. Due to the previously identified isolated artifacts, AECOM recommends mitigation in the form of construction worker training. Prior to construction, the construction contractor and subcontractors shall be informed of the legal and regulatory consequences of knowingly destroying cultural resources or removing artifacts, human remains, bottles, and other significant cultural materials from the site. Significant cultural materials include but are not limited to aboriginal human remains; chipped stone; groundstone; shell and bone artifacts (both human and animal); concentrations of fire-cracked rock; bottle glass; ceramics; ash and charcoal; and historic features such as privies or building foundations/remains.

If cultural resources are uncovered during ground disturbing activities associated with the Project, work will stop within 50 feet of the initial find and a qualified professional archaeologist shall be notified regarding the discovery. The archaeologist shall determine whether the resource is potentially significant as per the CRHR and develop appropriate mitigation. The Applicant shall comply with the mitigation requirements identified by the archaeologist and approved by the SLDMWA.

c) **Human Remains:** In the unlikely event that human remains are discovered during Project implementation, work in the immediate vicinity of the discovery will be suspended and the SLDMWA will notify the Fresno or Merced County Coroner, depending on location of discovery. If the remains are deemed Native American in origin, the Coroner will contact the NAHC and identify a Most Likely Descendant pursuant to Public Resources Code Section 5097.98 and California Code of Regulations Section 15064.5. Work may be resumed at the landowner’s discretion, but will only commence after consultation and treatment have been concluded. Work may continue on other parts of the Project while consultation and treatment are conducted.

2.6 Energy

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?	☐	☐	☐	☒
b) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?	☐	☐	☐	☒

Discussion:

The Proposed Project is located in an agricultural region within the Grassland Drainage Area, and modifications to the previously analyzed project in 2009 will include a number of components that will utilize electrical energy for operation. These components include:

- Up to four new pump stations to convey drain water throughout the SJRIP. These pump stations will improve operational flexibility throughout the SJRIP and increase the reuse capacity of the project.
- Up to two new pump stations to divert storm-induced flows into the proposed storage basins and an additional two new pump stations to convey water from those basins onto the SJRIP for reuse.
- SCADA transmitters and receivers for remote operation of existing tile sumps.
- Up to four new tile pumps for proposed subsurface drainage systems on the SJRIP.

All of the new pump stations will be driven with premium-efficiency, inverter-duty electrical motors. Most of the pump stations will also include variable frequency drives so that pump flow rate can be adjusted to match flow demand. The estimated total annual power consumption for the Proposed Project electrical components is 280,000 kwh/year, which is approximately equivalent to the power consumption of 40 California households. The use of high efficiency motors is consistent with California's energy conservation goals.

There is no local plan for renewable energy or energy efficiency. The incremental change in energy use would not be expected to exert a significant strain on electrical power supplies in the region. The Proposed Project modifications would not result in a new significant impact to energy resources or in significant impacts to utilities and infrastructure substantially more severe than the activities identified and analyzed in the previous environmental document.

a) The electrical motors driving the pump stations will be the premium efficiency motors designed to minimize electrical waste. Variable frequency drives will further improve operational efficiency and reduce waste by preventing over-pumping. SCADA transmitters and receivers will not use a substantial amount of power. The overall project will operate as efficiently as practical. The incremental increase in electrical consumption would not be expected to exert a significant strain on electrical power supplies in the region.

b) None of the Proposed Project components conflict or obstruct any renewable energy plan. All of the electrical motors will operate at the highest efficiency practical for their use.

2.7 Geology and Soils

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Directly or indirectly cause 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?	☐	☐	☒	☐
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 direct or indirect 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?	☐	☐	☐	☒
f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☒

Discussion

The surface soils of the San Joaquin Valley are a heterogeneous assemblage of alluvium consisting of channel gravels, riverbank sand, silt, and clay, derived from granitic and sedimentary sources (University of California Davis 2008; U.S. Department of Agriculture 2019, cited in AECOM 2019). Most of these sediments were deposited in the Pleistocene and Holocene during times of increased precipitation by runoff from the surrounding Sierra Nevada, Tehachapi, and Coastal ranges. The bedrock beneath the alluvium consists of older marine sediments deposited during the mid-Mesozoic to Cenozoic eras. A series of turbidity currents, likely caused by undersea earthquakes, landslides, or volcanic eruptions, moved large amounts of sediments downslope to a rapidly subsiding ocean basin. The variable and mixed marine sedimentary, volcanic, and metamorphic rock formations found in the San Joaquin Valley, such as mudstone, sandstone, shale, basalt, andesite, and serpentine, are the result of such erosions and depositions (DeCourten 2010, cited in AECOM 2019). A review of the Santa Cruz sheet geologic map (Jennings and Strand 1958, cited in AECOM 2019) indicates the project site is located in recent Quaternary Great Valley sedimentary fan and basin deposits which are less than 10,000 years in age.

The Project Area in Merced and Fresno Counties contain the San Joaquin Fault Zone and is located east of the Ortigalita Fault.
http://www.conservation.ca.gov/cgs/information/outreach/Documents/Simplified_Fault_Activity_Map.pdf

According to the Fresno County 2040 General Plan Background Report (Fresno County 2017), Chapter 8, Hazards and Safety (page 8-6):

> "The Ortigalita fault zone is approximately 50 miles long, originating near Crow Creek in western Stanislaus County and extending southeast to a few miles north of Panoche in western Fresno County. Most of the fault is considered active due to displacement during Holocene time and is designated an earthquake fault zone under the Alquist-Priolo Earthquake Fault Zoning Act of 1994. As illustrated in Figure 4.20, the southernmost extension of the fault lies in Fresno County."

Concerning a high water table which affects the potential for liquefaction during a seismic event, the 2009 Final EIS/EIR noted in Section 5.1.1 the following environmental setting:

> "In the western San Joaquin Valley, sediments eroded from the Coast Range form gently sloping alluvial fans. The alluvium is more than 800 feet thick along the Coast Range and thins to 0 foot near the valley axis (Miller et al. 1971). The alluvium is a mixture of gravel, sand, silt, and clay.
>
> "The groundwater system is divided into a lower confined zone and upper semiconfined zone, separated by the Corcoran Clay (Figure 5-2). In the upper fan areas, the water table is typically located several hundred feet below land surface. In contrast, most downslope areas are underlain by a shallow water table within 7 feet of land surface (Belitz and Heimes 1990). The shallow water table is located within the semiconfined zone, and tile drainage systems are employed to manage water table depth.
>
> "Shallow water levels since 2000 continue to show spatial and seasonal variability, but have remained fairly stable over time (Figure 5-3); in some wells, water levels may have declined slightly as a result of long-term reductions in water table recharge and possible increases in pumpage (for example, Well 12S/12E-32J3)." (pp. 5-2, 5-3)

In Section 5.2.3.2.1 of the 2009 Final EIS/EIR, the modelling results for shallow groundwater for the 2010 Use Agreement with full buildout of the reuse facility were:

> "The groundwater flow model projects no net change in mean water table depth beneath the drained areas of the GDA during the project period (Figure 5-5a). The mean depth to water beneath drained areas remains at 6.4 feet below land surface. Beneath the SJRIP reuse facility, the mean depth to groundwater increases 1.5 feet during the project period (Figure 5-5b). The increased depth to water is the result of the additional tile drainage systems added to presently undrained land areas as part of the continued Grassland Bypass Project. The new drainage systems remove excess water table recharge and, therefore, lower the water table.
>
> "Model results indicate that about 138 square miles would be affected by a water table within 7 feet of land surface, which is the same condition as the No Action Alternative." (pp. 5-11, 5-13)

The Proposed Project modifications are to improve existing water and drainage conveyance and management facilities to handle storm water over the long term, past 2019. The existing reuse facility would continue to recycle drain water and be expanded and also to take a portion of the storm flows greater than 150 cfs if practical. The Proposed Project modifications do not involve construction of any new buildings or structures that would place people at risk of loss, injury, or death.

The 2009 Final EIS/EIR (Section 5.2.3.2) stated that in the GDA, estimated soil selenium increases from 11 µg/L in 2008 to 21 µg/L in 2019, and boron increases from 0.9 to 1.3 mg/L. In the SJRIP during the same time period, soil selenium concentrations increase from 73 to 124 µg/L, and boron concentrations increase from 3.4 to 5.5 mg/L. The increase in soil selenium and boron concentrations relative to existing conditions is considered to be a significant unavoidable impact of irrigating western San Joaquin Valley soils. The concentrations will not affect agricultural productivity, but may with time influence selenium concentrations in underlying shallow groundwater and agricultural drain water. See Section 2.10 for additional discussion of soil and groundwater quality in the reuse area and GDA.

a) Because the new facilities include pipelines, pump stations, levees, and communication towers that would be near a seismically active area, they could be damaged during a seismic event. However, there is little risk to people at work or at home from temporary damage to these facilities.

   i. Faults have been delineated in the area, but a site-specific analysis has not been done given the lack of impact to people. The Proposed Project is not located within the Alquist-Priolo earthquake hazard zone for the Ortigalita Fault.

   ii. Seismic ground shaking is influenced by the proximity of the Project site to an earthquake fault, the intensity of the seismic event, and the underlying soil composition. An earthquake on the San Andrea Fault to the west of the Project Area is likely to produce a larger seismic event than earthquakes on the smaller faults in the Project Area. However, a seismic event on either could damage the concrete and PVC pipeline/water conveyance facilities which would be of concern if the facilities were broken during the rainy season or for a storm event that would cause flooding. However, the existing facilities have not experienced seismic damage to date; therefore, the hazard risk associated with the new improvements is similar to/no greater than the existing condition hazard, a less-than-significant impact.

   iii. At issue is whether the soils underlying the Project site are subject to liquefaction during a seismic event. Fresno County's 2040 General Plan Background Report states that soil types in the valley area are not conducive to liquefaction, because they are either too coarse or too high in clay content (Fresno County 2017b). Liquefaction could occur in areas with a high water table which could damage the pump stations, pipelines, canal lining, subsurface drains, levees, and communication tower footings. Much of the GDA is underlain by a shallow water table, especially at the SJRIP reuse facility as indicated above. However, the existing facilities have not experienced seismic damage to date; therefore, the hazard risk associated with the new improvements is similar to/no greater than the existing condition hazard, a less-than-significant impact.

   iv. The Project Area is relatively flat and is not in the vicinity of slopes that would be susceptible to landslides. There is no danger of landslide damage to the facilities.

b) Project construction and operation would not cause soil erosion. The improvements are to convey storm water away from fields during the non-irrigation season using drains to avoid overland flow/surface runoff that could erode soils and to hold some of the storm water in a storage basins for subsequent release to the GBC or to the reuse area when practical. The Proposed Project would not alter the natural land form by clearing, grubbing, grading, or removing vegetation such as trees whose roots would hold the soil together.

c) Project construction and operation would not contribute to or result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse. Rather, subsidence in the Project Area is being caused by groundwater pumping (primarily below the Corcoran Clay layer) which has created an overdraft condition that has affected the Main Canal and large areas in the San Joaquin Valley. The reduction in surface water deliveries since the 1990's has created an increased groundwater pumping demand in some areas. This demand has resulted in recent increases in land subsidence along the San Joaquin River. Studies by the U.S. Army Corps of Engineers, California Department of Water Resources, Reclamation, and the U.S. Geological Survey indicate that subsidence rates have been more than 0.5 feet per year in and around the most serious areas of concern (Reclamation 2018). This increased subsidence poses difficulties for local, state, and federal agencies with existing or planned infrastructure in the area including conveyance capacity, operations, and maintenance.

d) The Proposed Project is not located on expansive soils. The alluvium is a mixture of gravel, sand, silt, and clay. Soil types are primarily chateau clay, wekoda clay, and agnal silty clay and cerini clay loam. Section 4.3 of Appendix B includes the following information:

“The landform of Tranquillity-Tranquillity, wet, complex, saline-sodic soils is fan skirts. This soil type consists of somewhat poorly drained soils formed from alluvium derived from calcareous sedimentary rock. It does not pond and very rarely floods (NRCS 2018). The landform of Deldota clay is also fan skirts. This soil type consists of somewhat poorly-drained soils formed from alluvium derived from sedimentary rock. Deldota clay does not pond and very rarely floods (NRCS 2018). The landform of Chateau clay is also fan skirts. This soil type consists of poorly-drained soils formed from alluvium derived from sedimentary rock. Chateau clay does not pond and very rarely floods (NRCS 2018). The landform of Wekoda clay occurs on flood plains on basin floors. This soil type consists of poorly-drained soils formed from alluvium derived from sedimentary rock. Wekoda clay does not pond and very rarely floods (NRCS 2018). The landform of Cerini clay loam soils occurs on alluvial fans. This soil type consists of well-drained soils formed from alluvium derived from calcareous sedimentary rock. Cerini clay loam does not pond and very rarely floods (NRCS 2018).” (page 20)

e) Septic tanks or private waste water systems would not be affected by the improvement and reuse area expansion, nor from sediment removal from the Drain. The reuse area’s disposal of agricultural drain water (at the reuse facility) would not be impacted by the improvements to manage storm water.

f) The depth of soil disturbance is only 2 to 8 feet which is not sufficient to encounter paleontological resources.

2.8 Greenhouse Gas Emissions

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	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 any applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☐	☒

Discussion

Naturally occurring GHGs include water vapor (H_2O), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (NO_2), and ozone (O_3). Several classes of halogenated substances that contain fluorine, chlorine, or bromine are also GHGs, but they are, for the most part, solely a product of industrial activities. Chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) are halocarbons that contain chlorine, while halocarbons that contain bromine are referred to as bromofluorocarbons (i.e., halons). In the amended CEQA Guidelines Section 15364.5, greenhouse gas emissions (GHGs) include, but are not limited to, carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. In California, due to stringent air pollution control rules and regulations, natural gas is the only fossil fuel used to fire steam turbine, gas turbine, or combined cycle power plants. The primary concern here is for emissions that would be generated from equipment use (carbon dioxide and nitrous oxide through the burning of fossil fuels) rather than the emissions associated with ongoing agricultural practices (methane and nitrous oxide) and industrial activities (nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride). As stated in Section 12.2.1 (p. 12-11) of the 2009 Final EIS/EIR, the GHG of most concern is CO_2 since it is generated in extremely large quantities by the burning of fossil fuels, can last in the atmosphere for two centuries, and forces climate change more than any other GHG. In California, CO_2 is the major component of power plant GHG emissions, about 99.995 percent.

The Proposed Project would involve limited use of construction equipment (excavator, backhoe, graders, scrapers, trencher, sheep’s foot compactor, and water trucks) for the pipeline installations, crossing Russell Avenue, installation of subsurface drains to a portion of the reuse area, 3 new electric pump stations and 1 expanded pump station with electric controls, communications towers, and levees to create a storage basin ; to extend a ditch and line a canal (approximately 8 hours per day for up to 22 days/month, up to 7 months, May through November); and also to complete removal of sediments from the Drain. All construction vehicles will be Tier 4 compliant and these activities are short term and temporary in an agricultural area for the conveyance and reuse area improvements including the new short-term storage basins and in wetland habitat area for the sediment removal. The tile sump control in the GDA would use electric power but not substantially (i.e., on or off events during the rainy season, not continuous operation).

a) This equipment use involves the combustion of fossil fuels, a direct impact on the production of CO_2 and CH_4 with an indirect effect on CO_2 from the manufacturing of cement and from power production (generation of electricity from fossil fuels rather than hydropower) during project construction. This agricultural/storm water management type of use would not substantially introduce new sources or worsen existing sources of GHG emissions over project operation, and a full quantification of emissions and evaluation of GHG impacts was not deemed necessary for this non-development type of project. Operation of the new tile sump control system using electric power would result in minimal increased indirect GHG emissions from power generation by PG&E that are neither substantial nor significant (compared to existing conditions) and are more than offset by reductions in direct emissions from truck use for manual operation of the tile sumps. The SJRIP uses 8 workers and 4 trucks at present, and the proposed expansion would not increase this number of workers and trucks.

A CalTrans emissions model was used to estimate the impacts to air quality and emissions of GHGs for all of the construction and operational components of the Proposed Project. This modeling used a conservative approach, assuming that all of the construction work for the canal lining, pump stations, pipelines, subsurface drainage systems and ½ of the SLD sediment removal would occur in the same year. This construction schedule is unlikely; however, it would estimate a worst-case air quality and GHG emissions impact. Table 2.8.1 below shows the results of the construction modeling.

Table 2.8_1 GHG Emissions from Project Construction

	NO x	ROG	PM10	PM2.5
*Threshold (lb per day)**	*54*	*54*	*82*	*54*
Storage Basins	6.05	3.04	30	6.5
Sediment Removal (per year)	4.88	.94	0.2	4.3
Pump Station (4 total)	1.85	.68	5	1.1
Pipelines (all)	4.51	1.51	20	4.3
Lined Canal	5.29	1.4	6	1.5
Subsurface Drainage system	2.63	1.32	9.8	2.1
Total Emissions (lb per day)	25.21	8.89	71	19.9

*Thresholds per Bay Area Air Quality Management District

In the absence of Valley Air District thresholds, the BAAQMD thresholds were used. Even with this conservative modeling approach, the estimated construction emissions (short term, peak emissions) are well below the thresholds of significance.

Operation of the Proposed Project will not contribute to GHG emissions compared to existing conditions. All of the proposed pump stations will include electrically powered motors, and all of the proposed land for the reuse area expansion is already farmed. Operational emissions are substantially less than construction emissions. Operations at the expanded reuse area would be the same as for existing conditions, since the change is in ownership.

b) Plans, policies, and regulations are under consideration at the federal and state levels, and they focus on energy efficiency for vehicle use and goals for reducing overall GHGs at the state level. Local policies for reducing GHGs include the following:

Merced County: The Climate Change chapter of the Merced County General Plan Update Background Report (November 2012) provides the baseline emissions inventory for 1990 and 2005 for Merced County. The GHG emissions inventory is designed to assist policy makers and planners with identifying the current emission sources, relative contribution from each source, and the overall magnitude of Merced County's GHG emissions. This aids in development of more specific and effective policies and emissions control strategies to reduce GHG emissions consistent with State mandates (i.e., AB 32). Local governments, such as the County, will play a role in achieving the emission reduction goals mandated in AB 32 and SB 375. The County's 2012 Report (Chapter 12 Climate Change, (http://web2.co.merced.ca.us/pdfs/planning/generalplan/DraftGP/BackroundRpt_2030/MCGPU_BR_Ch12_Climate-2012-11-30.pdf) found that:

- Agricultural activities are the dominant source of GHG emissions within Merced County (69 percent of total 2010 emissions in unincorporated Merced County, and 42 percent of total 2010 countywide emissions, including the incorporated cities).
- Transportation activities are the second leading source of GHG emissions (during 2010, 23 percent in unincorporated Merced County and 39 percent in total Merced County).

- Agricultural activities in the unincorporated area include the raising of livestock that produce methane which has a greater impact on climate change than does carbon dioxide.

Fresno County: A Climate Action Plan is a comprehensive and focused plan that includes strategies to guide efforts for reducing GHG emissions. While Fresno County does not have its own Climate Action Plan, described below is the principal regional plan relating to climate change that applies to Fresno County and are most relevant to the Proposed Project in the GDA (Fresno County 2017b).

> **"San Joaquin Valley Air Pollution Control Board Climate Change Action Plan**. The SJVAPCD adopted the Climate Change Action Plan (CCAP) in August 2008, which required the District Air Pollution Control Officer to develop guidance for assessing and reducing project-specific GHG emissions. In December 2009, the SJVAPCD adopted the Guidance for Valley Land-use Agencies in Addressing GHG Emissions Impacts for New Projects Under CEQA. The SJVAPCD also adopted a new district policy, Addressing GHG Emission Impacts for Stationary Source Projects Under CEQA When Serving as the Lead Agency. Both the guidance and policy rely on Best Performance Standards (BPS), which assess the significance of project-specific GHG emissions. (page 9-4)

According to the Valley Air District (SJVAPCD), GHG emission from development projects, primarily occur through energy consumption and vehicle miles traveled (VMT). For development projects, BPS includes project design elements, land use decisions, and technologies that reduce GHG emissions. Project proponents can reduce GHG emissions from energy consumption through building designs that increase energy efficiency, water conservation, and the use of energy efficient appliances. For development projects, BPS also includes project design elements, land use decisions, and technologies that reduce GHG emissions during project operation over time. Project proponents can reduce GHG emissions from energy consumption through building designs that increase energy efficiency, water conservation, and the use of energy efficient appliances.

The Valley Air District's CEQA guidelines are for land use agencies and apply to stationary sources and development projects (SJVAPCD 2009). The Proposed Project herein is not a stationary source of emissions associated with land development. Rather, it is a project comprised of Improvements to primarily agricultural land for management of storm water. Emissions are associated primarily with the use of equipment during construction, and some of this equipment is used for ongoing agricultural operations in the GDA. Ongoing activity involves the planting of an expanded reuse area with Jose Tall Wheatgrass and the use of pump stations operated with electric power instead of diesel and with manual operation that would require a person to drive to each pump station in a truck or other vehicle (1 new worker and 1 round trip per day to the facility). The existing reuse area requires 8 workers and 4 trucks who can also handle the expansion, i.e., no increase. Although the Valley Air District has not developed GHG emission thresholds of significance, those thresholds have been developed by the Bay Area Air Quality Management District (BAAQMD). Because the GHG emissions are lower than the thresholds established by the BAAQMD, it would not result in sufficient emissions to be more than a less-than-significant impact.

To the extent that the Proposed Project can increase energy efficiency, water conservation, and the use of energy efficient appliances (i.e., equipment) by reducing equipment use that relies on fossil fuels and improving operational efficiencies (primarily through better remote tile sump control using electronic controls rather than persons driving trucks into the area for manual operation), it would contribute to meeting future GHG emission reduction targets.

2.9 Hazards and Hazardous Materials

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	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?	☐	☐	☐	☒
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?	☐	☐	☐	☒

Discussion

According to the California Health and Safety Code Section 25501(o), “hazardous material” means a material that, because of its quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment. Hazardous materials include, but are not limited to, hazardous substances, hazardous waste, and any material which a handler or the administering regulatory agency has a reasonable basis for believing would be injurious to the health and safety of persons or harmful to the environment if released into the workplace or environment. A number of properties may cause a substance to be considered hazardous including toxicity, ignitibility, corrosivity, or reactivity.

The Proposed Project modifications (to the 2009 project) do not involve bringing additional lands into agricultural production, and therefore, are not adding pesticide use over the existing condition. Vehicle maintenance is not a large scale activity as would occur at commercial vehicle maintenance businesses. However, the equipment used for the storm water management facilities and improvements and for removal of the last sediments from the Drain will be maintained and operated according to the participating District's maintenance schedule and spill prevention procedures related to petroleum products.

Concerning the sediments removed from the Drain, they are not a hazardous waste based on analysis of previously removed material contained in Appendix C of this Initial Study, Sediment Removal from the San Luis Drain, 2016-2018 (April 25, 2018) . Highlights of the report are summarized here. The Grassland Basin Drainers have removed 180,000 cubic yards of sediment from approximately 14 miles of the SLD. Sediment samples were collected from the San Luis Drain in October 2015, May 2018, and August 2018 (The sampling is described in the memo dated October 23, 2015 in Appendix C.) The primary concern is selenium (Se) because of its toxicity to waterbirds, but samples before 2018 (and 2018 tested only for Se) were tested for the following chemicals of concern:

- Aluminum
- Arsenic
- Barium
- Cadmium
- Chromium (Total)
- Chromium – VI
- Copper
- Lead
- Manganese
- Mercury
- Molybdenum
- Nickel
- Selenium
- Zinc

The samples were compared to the Sediment Management Plan that was incorporated into the 2009 Final EIS/EIR for the Grassland Bypass Project. The criteria in the Sediment Management Plan allows for spreading of sediment on agricultural land without on-site monitoring if the sediment concentrations of Se are less than 10 µg/g (mg/kg) dry weight, and on commercially or residentially developed lands if the concentration is less than 100 mg/kg wet weight (see Table 3 of the Sediment Management Plan). Most of selenium sample results were less than 10 mg/kg dry weight and all were well below the 100 mg/kg wet weight threshold for commercial or industrial applications. All results are also well below the hazardous level of 100 mg/kg wet weight (State of California Title 22). None of the other chemicals of concern were at hazardous levels.

Sediment removed from the San Luis Drain between 2016 and 2018 was placed as fill material for unneeded drains within the San Joaquin River Improvement Project (SJRIP). In 2016, San Luis Drain sediment was used to fill a drain in the westerly portion of the SJRIP; and in 2017, a drain in the easterly portion of the SJRIP was filled (see Figure 1 in the report). Since 2001, operation of the SJRIP has included efforts to fill in unneeded drainage channels. Left unattended, these channels collect seleniferous groundwater and become an attractive nuisance to wildlife. Once filled in, water can no longer pond in the channels. Photos showing the removal and placement of the sediments are included in the report in Appendix C.

The Fresno County 2040 General Plan Background Report currently under review identifies 9 public and private airports in the county (Fresno County 2017b, p. 8-58): Specific land use policy plans have been developed for 5 airports in Fresno County: Fresno Air Terminal, Coalinga Airport, Harris Ranch. Airport, Sierra Sky Park Airport, and Fresno Chandler Downtown Airport. In addition, a single land use policy plan has been prepared for four public use general aviation airports located in Firebaugh, Mendota, Reedley, and Selma. None of these facilities is located close to or within 2 miles of the Project site. Land use and safety considerations pertaining to the facilities within 2 miles of the GDA are summarized below.

a) While there is potential for construction equipment and vehicles to have an accidental release of petroleum products during transport to the Project site or while in use at the Project site, this accidental spill is likely to be less than 5 gallons of product which would not pose a hazard to people or the environment. The District's vehicle maintenance procedures and its Spill Prevention Plan provides for onsite cleanup of small spills and proper disposal of the spill material in compliance with local regulations. Given the use of this equipment in agricultural and the Drain that traverses wildlife refuge areas, not on heavily congested roadways in urban areas, traffic hazards are not anticipated.

b) The release of Se into the environment from the sediments removed from the Drain is not an issue given the low amounts of Se in the sediments. See additional information above and in Appendix C. It is unlikely that any upset (i.e., fire, flood, earthquake, other emergency) would immediately and completely release hazardous materials (including gasoline for equipment operation/vehicle use) into the air or onto the ground. The Proposed Project would not occur in the rainy season or during storm events.

c) The sites for construction of the storage basins, pumps, conveyance, reuse area expansion, subsurface drains, and communication towers are in an agricultural area, while sediment removal from the Drain is in a wildlife refuge. Neither of these areas are within one-quarter mile of any school.

d) The sites for construction of new improvements and sediment removal are not located on any hazardous materials disposal sites or sites with leaking underground storage tanks or other active cleanup and abatement activities (i.e., not on the "Cortese list").

e) The Project site is not located within an airport land use plan of within 2 miles of a public use airport as it is within an extensive agricultural area and wildlife refuge. The nearest public airport is Los Banos Municipal Airport which is a city-owned, public-use airport located one mile (1.6 km) west of the central business district of Los Banos, a city in Merced County, California. The affected portion of the San Luis Drain is located on the eastside of the city.

f) An online search (http://www.tollfreeairline.com/california/merced.htm) indicates that there is one private facility in the vicinity of the sites for construction at the existing reuse area and new storage basins and sediment removal in the Drain: Emmett Field Airport – 76CL in Dos Palos. The new communication towers south of Althea Avenue are not tall enough to interfere with operations at the airport in Dos Palos. Other facilities are located at distant farms and near the cities of Merced and Fresno. Airports avoid being in close proximity to waterfowl habitat areas, such as the wetlands in the Grassland Water District, federal wildlife refuges, and state Wildlife Management Areas, due to concerns about bird aircraft strike hazard (BASH).

g) Concerning emergency response plans of any public or private agency, the improvements and sediment removal would not interfere with access to people and animals in case of emergency or for them to use existing roadways identified in an emergency evacuation plan. No new canals are being added. Existing roads are sufficient to traverse the GDA. Therefore, the Project will not impair implementation of, or physically interfere with, an emergency response or evacuation plan.

h) Work within the GDA, an agricultural area, would not subject people to risk of wildland fires. Sediment removal in the Drain occurs within wildlife refuges that are dominated by wetlands, not vegetation that poses risk of a wildland fire.

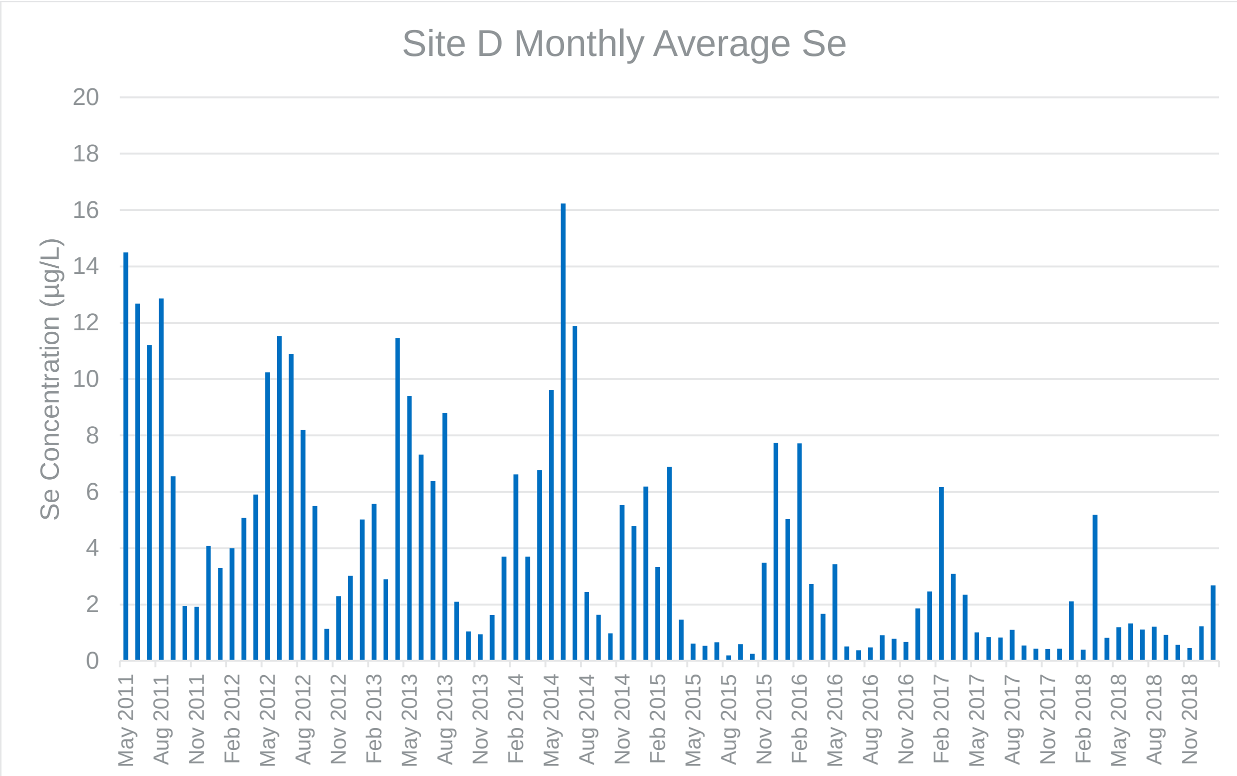
2.10 Hydrology and Water Quality

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	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)?	☐	☐	☐	☒
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?	☐	☐	☐	☒

Discussion

Discharges from the Project Area enter the San Joaquin River at the mouth of Mud Slough. Recent historical conditions reflect the result of the past projects on water quality. Specifically, selenium levels in Mud Slough (North) have reduced gradually each year since the implementation of the Grassland Bypass Project and Westside Regional Drainage Plan. The transition to the Long-Term Storm Water Plan Management Plan would continue this trend, resulting in significantly reduced discharges into Mud Slough. Figure 2 below shows the average monthly selenium concentrations at Mud Slough (North) (Site D) from 2011 to the end of 2018, illustrating a reducing trend in selenium concentrations, with recent spikes in concentrations occurring in months with significant rainfall.

Figure 2. Average Monthly Selenium Concentrations in Mud Slough (North), 2011 to 2018



A summary of the existing water quality conditions is provided here, followed by the impact analysis comparing the Proposed Project to the existing conditions baseline as required under CEQA.

A Surface Water Resources Technical Report was prepared to provide a quantitative and qualitative analysis to address the water quality questions above, especially questions a and b. Prepared by AECOM in April 2019, the report is attached to this Initial Study as Appendix D. Data in the report focus on two time periods: 1997 to 2015, since the Grassland Bypass Project has been implemented, and 2015 to 2017, more recent conditions when drainwater from the GDA was not conveyed to the San Luis Drain during summer months. The longer period of record provides context for more recent flows and water quality in the Project Area. The recent data for 2015-2017 was used to represent existing conditions. Recent flow and quality data include periods associated with the Drain's conveyance of stormwater runoff, post-storm drainage flows, and seepage into the Drain. The recent water quality data also includes summer periods of no inflow from the GDA when water quality in the Drain is affected by evaporation and seepage.

There is a general trend of decreasing flows between 2006 and 2014 and the elimination of summer flows to the Drain starting in 2015. Prior to 2015, the Drain flow appears to consist of a combination of year-round drainage and winter storm-induced drainage flows. From 2015, the flow appears to be mainly storm flows with a small component of post-storm drainage.

Hydrological conditions varied during Water Years 2015 to 2017, the period representing existing conditions. Water Year 2015 was critically dry, Water Year 2016 was below normal/dry, and Water Year 2017 was wet. Regardless of year type, flow in the Drain was maintained below 150 cfs.

Water quality data presented in Appendix D include data compiled by Bureau of Reclamation (Reclamation), site-specific data for the San Luis Drain (Sites A and B) complied by Summers Engineering, and publicly available gage data for flow and electrical conductivity (EC) published by the U.S. Geological Survey (USGS). These data were collected at the entrance to the Drain (Site A), the exit from the Drain (Site B), Mud Slough upstream from the Drain (Site C), Mud Slough downstream from the

Drain (Site D), and Salt Slough (Site F), as well as at the San Joaquin River at Fremont Ford (Site G), Hills Ferry (Site H), Crows Landing (Site N) and Vernalis. While Appendix D provides data and analysis for these locations downstream of the GDA, the focus here is the impact at Mud Slough (North), Site D, where storm water flows from the Drain would have the most direct impact on surface waters. Site D is located in Mud Slough approximately 0.6 mile downstream from the Drain.

Mud Slough (North), one of the two major west-side tributaries of the San Joaquin River, is historically the major carrier of agricultural drainage from the GDA to the San Joaquin River. Drainage originates from the GDA, travels via the San Luis Drain, and is discharged directly into Mud Slough. Flow in Mud Slough (North) upstream of the discharge point consists of wetland releases from the northern and southern GWD and from Volta Wildlife Management Area, as well as operational spills from the Delta-Mendota Canal and Central California Irrigation District's Main Canal and flood flows from Los Banos Creek. Mud Slough (North) downstream of the discharge point is often dominated by water originating from GDA via the Drain, but it also carries a blend of subsurface tile drainage water and discharges from surrounding duck clubs.

Appendix D's Figure 12 shows Se concentrations for the same period for Mud Slough at Sites C and D. The Drain is the major source of Se to Mud Slough, as shown by the comparison of Se concentrations in Sites C and D. However, since most of the flow into Mud Slough is from the watershed upstream from the Drain, the Se discharged into Mud Slough via the Drain is diluted by flow in Mud Slough. Because both flow volume and Se concentration has been decreasing in the Drain, there has also been a general trend of decreasing concentrations at Site D. Since water year 2015, Se concentrations at Site D have been less than ±10 µg/L in the winter and ±1 µg/L or less (background levels) in the summer. Se concentrations in Salt Slough at Site F are ±1 µg/L or less year-round (see Figure 13).

Appendix D's Figure 14 shows boron concentrations for the same period for Mud Slough at Sites C and D as well as boron concentrations at Salt Slough at Site F. Prior to summer 2013, boron concentrations in Mud Slough were typically 1 to 4 mg/L at Site C, increasing to over 6 mg/L at Site D. The exception is March and April 2006, when concentrations were over 10 mg/L at Site D. Higher concentrations at Site D occurred during the summer when drain water was discharging. Since summer 2013, concentrations at Site D have been over 10 mg/L in both winter and summer months, although measurements have been below 10 mg/L since February 2016. Boron concentrations in Salt Slough at Site F were 2 mg/L or less year-round, except during October to December 2002.

Appendix D's Figure 15 shows EC for the same period for Mud Slough at Sites C and D and for Salt Slough at Site F. Prior to summer 2013, the EC in Mud Slough at Site C was about 700 to 3,700 µS/cm, while the EC in Mud Slough at Site D increased to about 1,000 to 5,000 µS/cm; this increase at Site D is due to discharge from the Drain. Since 2013, summer measurements at Site D have been as high as 12,000 µS/cm or more. Higher EC has also been found in Mud Slough at Site C, with measurements up to 6,800 and 12,800 µS/cm during summers 2014 and 2015 respectively, likely due to evaporative concentration. EC in Salt Slough has been about 700 and 2,300 µS/cm during the full time period (1997 to 2017).

The impacts to surface water resources are focused on water quality and are primarily based on changes in the Se, salt, and boron concentrations in the San Joaquin River and Mud Slough. The degree of water quality impact is based on the concentration in the receiving water relative to the water quality objectives (WQOs) contained in the Basin Plan for the San Joaquin River Basin. An impact would be considered an adverse effect and significant if it resulted in an increase in the frequency of exceedances in the WQOs over what was measured under existing conditions (Water Years 2015 to 2017). An effect would be considered beneficial if it resulted in a decrease in the frequency of exceedances in the WQOs.

Current Basin Plan WQOs and performance goals for Se, boron, and molybdenum for the lower San Joaquin watershed are summarized in Table 2.10-1.

Table 2.10-1 Water Quality Objectives and Performance Goals for the Lower San Joaquin River

Waterbody	Selenium	Boron	Molybdenum
Mud Slough (North) and the San Joaquin River from Sack Dam to the mouth of the Merced River	5 μg/L, 4-day average (WQO) 15 μg/L, monthly mean (performance goal, 2016-2019) 20 μg/L, maximum	2.0 mg/L, monthly mean, March 15-September 15 5.8 mg/L, maximum	19 μg/L, monthly mean 50 μg/L, maximum
San Joaquin River, from Merced River to Vernalis	5 μg/L, 4-day average 12 μg/L, maximum	*Dry Season (March 15 to September 15)* 0.8 mg/L, monthly mean, 2.0 mg/L, maximum, *Wet Season (September 16 to March 14)* 1.0 mg/L, monthly mean, 2.6 mg/L, maximum, *Critical Year:* 1.3 mg/L, monthly mean	10 μg/L, monthly mean 15 μg/L, maximum
Salt Slough	2 μg/L, monthly mean 20 μg/L, maximum	2.0 mg/L, monthly mean, March 15-September 15 5.8 mg/L, maximum	19 μg/L, monthly mean 50 μg/L, maximum
Water Supply Channels in the Grassland Watershed	2 μg/L, monthly mean 20 μg/L, maximum	--	--

Source: Basin Plan (Regional Board 2016)

mg/L = milligrams per liter

μg/L = micrograms per liter

The Proposed Project is the continuation of the 2009 Grassland Bypass Project beyond 2019 for conveyance of storm-induced drainage from the GDA using the San Luis Drain. The dry-weather discharge of drain water to the Drain would be discontinued. Key assumptions in drain water management include recirculation of drain water collected in sumps and reuse of drain water from sumps. The SJRIP reuse area would be used to apply excess drain water from GDA sumps to salt-tolerant crops. Sumps for tile drains would be turned off prior to storm events and storm runoff up to an equivalent volume of 3 inches of rain on the SJRIP could be reused within the 7,550 acres of the SJRIP reuse area prior to discharge.

The Proposed Project also includes construction of short-term storage basins at locations that would allow storm water to be diverted out of the channels and into the basins. The approximate combined volume of these new and existing basins would be about 1,500 acre-feet (500 acre-feet of storage is available in the existing Panoche and Pacheco storage basins). Additional pump stations and conveyance facilities are planned to divert stormwater flows into the basins and to release the flows from the basins. Total diversion capacity for the pump stations are expected to be 50 cfs.

Storm water runoff would be managed within the GDA through diversions to the existing and proposed storage basins. As an example the first 5 cfs of stormwater runoff could be conveyed to the Grassland Bypass Channel and the next 25 cfs could be pumped to and stored within the District's storage basins. The pumps and basins could also be used to divert smaller storm events, storm events occurring late in the season, or flows up to the full diversion capacity of the pumps. It is possible that these basins could completely contain the flows generated by such events. Once the rainfall subsides, the captured water would be conveyed to the SJRIP for reuse whenever practical. Depending on time of year, some water could be stored in the storage basins for a month or more. Total flow from the GDA to the San Luis Drain would not exceed 150 cfs due to capacity limitations in the siphon under the Main Canal.

The Proposed Project does not affect groundwater used for irrigation and domestic purposes. The groundwater issue is focused on perched (generally within 20 feet of ground surface) groundwater which is unusable and will adversely affect crop production when it intrudes on the root zone. In Section 5.2.3.2.1 of the 2009 Final EIS/EIR, the modelling results for shallow groundwater for the 2010 Use Agreement with full buildout of the reuse facility were:

> "The groundwater flow model projects no net change in mean water table depth beneath the drained areas of the GDA during the project period (Figure 5-5a). The mean depth to water beneath drained areas remains at 6.4 feet below land surface. Beneath the SJRIP reuse facility, the mean depth to groundwater increases 1.5 feet during the project period (Figure 5-5b). The increased depth to water is the result of the additional tile drainage systems added to presently undrained land areas as part of the continued Grassland Bypass Project. The new drainage systems remove excess water table recharge and, therefore, lower the water table.
>
> "Model results indicate that about 138 square miles would be affected by a water table within 7 feet of land surface, which is the same condition as the No Action Alternative." (pp. 5-11, 5-13)

Ongoing operation and expansion of the SJRIP reuse area with tile drainage under the Proposed Project would not substantially change these results (i.e., no potentially significant impacts).

a) Water quality in Mud Slough (North) downstream of the Drain is expected to improve relative to existing conditions due to the GAF modifying operation of the drainage system, including the integration of storage basins to reduce storm event discharge and turning off sumps prior to and during wet weather flows using the new SCADA system. The Se, boron, salt, and molybdenum concentrations are expected to decrease due to turning off drainage sumps prior to and during wet weather flows, However, on rare occasions Se concentrations are predicted to be above WQOs (5 µg/L 4-day average) in dry and critically dry years when dilution flows in Mud Slough upstream of the Drain are reduced (see Appendix D, Attachment A). When evaluated on an event basis (which could include one or more consecutive days), exceedances would occur on average once every 3.5 years. These exceedances would occur less frequently than EPA guidelines which allow for a violation of water quality standards once every 3 years. Se concentrations in Mud Slough (North) downstream of the Drain were not above the Se performance goal of 15 µg/L monthly mean under existing conditions.

   The Se concentrations are expected to be reduced under the Proposed Project, a beneficial effect. However, because the WQO would change from the monthly mean of 15 µg/L to a 4-day average of 5 µg/L, the frequency of exceedances of the applicable water quality criteria would be increased as compared to existing conditions due to the reduced WQO. Therefore, while there may be an increase in the number of exceedances for Se due to the decrease in the WQO used as the criterion (i.e., threshold of significance), it is expected that the water quality in Mud Slough (North) as it relates to Se conditions would be improved; and the frequency of exceedances of the WQO is considered a less-than-significant impact.

   Monthly average boron concentrations in Mud Slough downstream of the Drain are expected to be greater than 2 mg/L in some months during both the wet and dry season. When there is no flow from the Drain, concentrations would be the same as found in Mud Slough (North) upstream of the Drain (occasionally above a 2 mg/L monthly average), but stormwater discharges from the Drain could occasionally contribute to exceedances of the 2 mg/L monthly average WQO downstream of the Drain in April. Because boron concentrations are expected to decrease during winter months due to turning off drainage sumps prior to and during wet weather flows, the frequency of exceedances above the WQO are expected to decrease as compared to existing conditions. Therefore, changes to boron concentrations would have a less-than-significant impact in comparison to existing conditions.

b) No new wells will be installed by the Proposed Project, and no increase in pumping of existing wells is expected as a result of the project.

   The 2009 Final EIS/EIR stated the following for the drain water reuse facility:

   > "Projected soil salinity concentrations at the SJRIP facility increase. The impacts would be limited to at most 6,900 acres (6 percent of the GDA). The treatment facility would be managed to

optimize consumptive use of water, and impacted soils could be reclaimed and saline shallow groundwater removed when an alternative means for salt disposal becomes available under Phase III. The Proposed Action is therefore considered to have a less-than-significant adverse impact relative to existing conditions." (p. 5-20).

The expansion of the reuse area by 650 acres and the use of storm water collected in the storage basins for irrigation of salt tolerant crops would not substantially impact shallow groundwater. Compared to existing conditions, the impact is less than significant.

c) Rather than discharge of storm-induced drain flows directly to Mud Slough, much of the water would be held in storage basins and released to the SJRIP when soils are not completely saturated. The existing drainage pattern would remain generally unchanged by the project with the exception of the addition of new short-term storage basins which will have capacity of approximately 1,000 acre feet. The existing and new storage basins would capture and hold approximately 1,500 acre feet of storm-induced drainage water during storm events. This captured water would ultimately be diverted to the SJRIP for reuse, reducing the overall volume of water discharged to Mud Slough (North) through the SLD. This is a less than significant impact. No increase in erosion or siltation compared to existing conditions is anticipated.

d) The existing drainage pattern would remain generally unchanged by the Proposed Project with the exception of the addition of new short-term storage basins which would occupy approximately 200 acres of the existing SJRIP. The storage basins would capture and hold up to 1,500 acre feet of storm-induced drain water during storm events. This captured water would ultimately be diverted to the SJRIP for reuse, reducing the overall volume of water discharged to Mud Slough (North) through the SLD. During operations, the basins would be flooded, however the amount of off-site runoff would be reduced.

e) The Proposed Project would construct minor alterations to the existing drainage system through the construction of storage basins. However, these would not result in an increase in drainage production or flow.

f) There is no other water degradation from the proposed management of storm water at the reuse facility or in Mud Slough (North).

g) The Proposed Project modifications to the 2009 Grassland Bypass Project do not include addition of new housing units in the GDA, either directly or indirectly.

h) No structures are proposed that would impede flood flows. The levees associated with the new storage basins in a previously farmed area of approximately 200 acres is adjacent to the Main Canal and would not affect that canal. The above ground levees could "direct" storm water onto adjacent fields within the reuse area during the winter where existing surface water runoff to existing drains would convey waters to the San Luis Drain and subsequently to Mud Slough or into the storage basins and held for irrigation of the reuse area.

i) The storm water management facilities do not pose a hazard to people or structures given the location in an agricultural area. The new basin levees would be designed to hold up to an additional 1,000 AF of storm drainage. Failure of a levee is unlikely but would affect the reuse area, not developed land with structures.

j) The new short-term storage basins would have a water depth of only 5 feet, and it is not likely to produce a seiche that would pose a risk to people and structures. The affected portion of the GDA is relatively flat and not located in a coastal area subject to tsunamis or mudflows.

2.11 Land Use and Planning

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	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?	☐	☐	☐	☒

Discussion

The reuse area expansion, new short-term storage basins, pump stations, pipelines, subsurface drains, channel improvements, and communication system improvements occur entirely within the GDA, an agricultural area with active production of crops and with some pasture land. (see Section 2.2 above). The closest established community is South Dos Palos which is 2.5 miles northeast of the West pump station and pipeline.

a) All of the activities occur outside of the community of Dos Palos, and there are no other residential or commercial enclaves that would be "divided". These activities do not create any physical barriers that change the connectivity between areas of a community. Connectivity is typically provided by roadways, pedestrian paths, and bicycle paths.

b) As shown in Section 2.2, the sites for construction of the storage basins and reuse area expansion and related improvements are located in an area designated agricultural. The improvements take storm water away from the fields to maintain their productivity and to minimize ponding of water that would be an attractive nuisance to waterbirds in the adjacent wildlife refuges and wetland habitat areas. Sediments removed from the Drain would be dried and stockpiled along the Drain right-of-way until their use on agricultural fields or other sites is determined.

c) There are no HCPs that address the Project site. See Section 2.4 (f) on the one HCP in portions of Madera and Fresno counties that could occur in the vicinity of the Proposed Project: the PG&E San Joaquin Valley Operations and Maintenance HCP for USFWS Region 8. Also see the *Central Valley Joint Venture Implementation Plan* (2006 Plan) discussion.

2.12 Mineral Resources

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	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?	☐	☐	☐	☒
d) 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?	☐	☐	☐	☒

Discussion

Mineral resources in Merced County are described in the following report: Mineral Land Classification of Merced County, California, Open File Report 99-08, by John P. Clinkenbeard, California Department of Conservation, Division of Mines and Geology, Sacramento, 1999 (located at ftp://ftp.consrv.ca.gov/pub/dmg/pubs/ofr/OFR_99-08/OFR_99-08_Text.pdf).

In summary, approximately 38 square miles of Merced County, in ten resource areas, have been classified MRZ-2a or MRZ-2b for concrete aggregate in this study. This represents approximately 2% of the land area of the county. The ten identified resource areas contain an estimated 1.18 billion tons of concrete aggregate resources with approximately 574 million tons in western Merced County and approximately 605 million tons in eastern Merced County. (Due to the cost of transporting aggregate, two distinct market regions exist in Merced County, one in the west and one in the east.) In addition to concrete aggregate, parts of the county have been classified MRZ-3a for lode gold, clay, and diatomite /gypsite. These are areas in which further exploration might uncover significant deposits of the identified commodities. The alluvial deposits of the San Joaquin Valley support almost all of the current mining operations in Merced County and, historically, have supplied the majority of the county's construction aggregate needs. Occurrences of kaolinitic clay are associated with the Ione Formation in eastern Merced County. Most of the construction aggregate mined in the county has come from sand and gravel deposits along Los Banos Creek in western Merced County and the Merced River in eastern Merced County.

A classification study on portland cement concrete (PCC) aggregate in the Fresno Production-Consumption (P-C) Region was completed in 1984. Results of that study were published by DMG as Special Report 158 - Mineral Land Classification: Aggregate Materials in the Fresno Production-Consumption Region (Cole and Fuller, 1988). Special Report 158 included the urban and urbanizing parts of Fresno and Madera counties, centered around the cities of Fresno and Madera, as a single P-C region. The original classification study of the Fresno Production-Consumption (P-C) Region, published in 1988, assisted the State Mining and Geology Board (SMGB) in a subsequent process called designation. Designation is the formal recognition by the SMGB of lands containing resources of regional or statewide significance that are needed to meet the demands of the future. In 1988, the SMGB designated sand and gravel resource areas of regional significance in the Fresno P-C Region (California Department of Conservation, 1988). (CDC 1999)

For purposes of identification of available aggregate resources, incompatible uses of land are defined as improvements of high cost, such as high-density residential developments, intensive industrial developments, commercial developments, and major public facilities. Lands that have compatible uses are defined as those that are nonurbanized or that have very low density residential development (one unit per 10 acres), land that does not have high-cost improvements, and lands used for agriculture, silviculture, grazing, or open space (CDC 1999).

According to the 2040 General Plan Draft Background Report (Fresno County 2017b):

> "In Fresno County, land along the San Joaquin River and Kings River is mapped as Mineral Resource Zone 2 (MRZ-2), which means mineral resources are present and available in this area. While both areas contain MRZ-2 deposits, the San Joaquin River Resource Area also contains MRZ-1 deposits primarily surveyed in the western side of Fresno County. All remaining areas surveyed were classified as MRZ-3(County of Fresno 2010)." (page 7-112).

Figure 7-15 in that report shows no mineral occurrences and producers within the GDA. The nearest mineral resource sites are located primarily along the San Joaquin River and west of Interstate 5. Therefore, the Proposed Project in the GDA does not contain now nor does it preclude designation of lands as MRZ-2 in the future.

a) The short-term storage basins, reuse area expansion, and conveyance improvements are not located in an area designated for concrete aggregate extraction nor would they interfere with existing extraction activities primarily located west of I-5. They would not result in the loss of availability of any known mineral resource. Neither would the addition of communication towers for the tile sump control SCADA in the GDA (including Fresno County) inhibit extraction of any important mineral resource.

b) The storage basins, reuse area expansion, and conveyance and communication system improvements are not located in a protected mineral resource zone. Construction and operation of these modified facilities would not make construction aggregate unavailable for extraction.

2.13 Noise

Would the project result in:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	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?	☐	☐	☐	☒
c) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☐	☒
d) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☒
e) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐
f) 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?	☐	☐	☐	☒
g) 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

Noise is generally defined as unwanted sound produced by human activities such as the operation of equipment that interfere with communication, work, rest, recreation, or sleep. The Noise section of the Health and Safety Element of the 2030 Merced County General Plan (adopted 2013, Amended 2016, http://www.co.merced.ca.us/DocumentCenter/View/6766/2030-General-Plan?bidId=) contains exterior noise standards for noise-sensitive areas affected by traffic, railroad, or airport noise sources in the County, including residential areas, hospitals, nursing homes, office buildings, playgrounds and parks, and others (Table HS-1, p. HS-10). Agriculture is not identified as a noise-sensitive land use. Both noise levels and ground vibration that exceed the standards are of concern. In addition to these and interior standards, there are policies in this section that address ways to reduce or eliminate existing and future conflicts between land uses and noise. Note Policy HS-7.3: Existing Rural Sources (RDR). Discourage new noise sensitive land uses in rural areas with authorized existing noise generating land uses (p. HS-12).

Fresno County's most pervasive source of noise throughout the county is roadway traffic from highways. Other expressways and arterials within the unincorporated County also have substantial local influences on noise levels. The most intense traffic noise sources tend to be those with heavy truck traffic and/or high proportions of nighttime traffic. Besides roadway noise, railroads, airports, and fixed sources of noise also affect localities throughout the County. (Fresno County 2017b). The 2040 Draft General Plan Policy Document contains the following goal HS-G.6 Construction-related Noise: The County shall regulate construction-related noise to reduce impacts on adjacent uses in accordance with the County's Noise

Control Ordinance (RDR) (Fresno county 2017a). The Proposed Project modifications do not result in construction noise impacts on sensitive land uses such as residential neighborhoods, schools, and hospitals that are not present in the GDA.

Community noise levels depend on the intensity of nearby human activity. Noise levels are generally considered low when ambient levels are below 45 dBA, moderate in the 45- to 60-dBA range, and high above 60 dBA. In rural and undeveloped areas, Ldn can fall below 35 dBA. Levels above 75 to 80 dBA are more common near major freeways and airports. Typical noise levels from both mobile and stationary sources are included in Table 2.12-1.

Table 2-12-1 Typical Stationary and Mobile Noise Source Sound Levels in dBA

Noise Source	Sound Level in dBA
Sprayer, handheld	**10-20**
Noise at ear level from rustling leaves	20
Room in a quiet dwelling at midnight	32
Soft whisper at 5 feet	34
Large department store	50 to 65
Room with window air conditioner	55
Leaf blower/vac	55-105
Conversational speech	60 to 75
Pump station equipment with noise abatement	**62**
Sprayer, powered, truck- or trailer-mounted	65-105
Passenger car at 50 feet	69
Vacuum cleaner in private home at 10 feet	69
Tractor, agricultural	**76-110**
Ringing alarm at 2 feet	80
Brush/weed cutter	90-97
Roof-top air conditioner	85
Small bulldozer (Cat D3) or excavator (Cat 320)	**74-80**
Heavy bulldozer at 50 feet	87
All-terrain vehicle (ATV)	87-109
Heavy city traffic	90
Lawn mower	91-98
Chainsaw	100-120
Jet aircraft at 500 feet overhead	115
Human pain threshold	120
Construction blast	120 to 145 at 50 feet

Sources: Equipment manufacturer specification sheets, Noise Control Reference Handbook, Industrial Acoustics Company

Note:

Bold indicates equipment used in the Proposed Project.

a) While the Proposed Project includes the use of heavy equipment during daylight hours between May and November, this use would not occur in close proximity to any of the sensitive land uses within urban areas. While sediment removal from the Drain within the wetland areas could disturb adjacent wildlife, this use is short term and temporary; and wildlife would be able to move way and return as desired given the scale of these habitat areas.

b) Agricultural workers as well as Project workers would be exposed to equipment noise and possible ground vibration that would be short term and temporary. Earphones can be worn if any noise levels are bothersome to any individual worker.

c) Ambient noise is commonly referred to as “background noise.” It would include other agricultural equipment operating at the same time in the Project vicinity. However, the equipment use associated with the Proposed Project is all short term and temporary during the daytime, so it would not contribute to permanent overall ambient noise levels in the agricultural and wetland habitat areas.

d) The Proposed Project could increase temporary ambient noise levels in the affected areas of the GDA, but this would not be substantial largely because the equipment would not be used all at once. Within the agricultural area where other farm equipment could be in use at the same time, the Project equipment would only be in use for up to 7 months. A possible short term increase in ambient levels in an agricultural area where sensitive land uses are not present is a less-than-significant impact.

e) The Proposed Project is not located in an area covered by an airport land use plan, as there are no public airports within 2 miles of the construction sites.

f) Neither would the Proposed Project activities occur within the vicinity of a private airstrip. See Section 2.9 (f).

2.14 Population and Housing

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	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)?	☐	☐	☐	☒
g) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
h) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

Discussion

The Proposed Project involves modifications to existing water conveyance facilities and a new storage basins and pump stations in agricultural and sediment removal in wetland habitat areas using existing labor in the Dos Palos/Los Banos area of Merced County and from the Firebaugh and Mendota areas of Fresno County. It involves no more than 10 workers onsite at any one time during construction and 9 workers during project operation at the reuse area. Most of the workers (8) are existing employees of Panoche Drainage District involved in operating the existing SJRIP reuse area and related subsurface drains, and no additional workers are needed for the expanded facility. The new pump stations require only 1 worker per day. A substantial impact is where the project would influence population growth and that growth could not be supported by existing or new public services (such as fire protection, police protection, schools, utilities, and other essential service provided by local governments).

a) The Project is not large enough to need to attract workers from outside these two counties who would need to relocate. Nor would the improved infrastructure serve other than storm water management and conveyance. Therefore, it would not stimulate the production of housing or worker relocation such that it would not induce any population growth

b) The affected construction sites do not involve the direct removal of any existing housing units nor would it result in the indirect displacement of housing through any change in land use.

c) See b above. The Proposed Project modifications do not have people living onsite or close to the construction sites either in housing or in homeless encampments.

2.15 Public Services

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the 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:	☐	☐	☐	☒
Fire protection?	☐	☐	☐	☒
Police protection?	☐	☐	☐	☒
Schools?	☐	☐	☐	☒
Parks?	☐	☐	☐	☒
Other public facilities?	☐	☐	☐	☒

Discussion

The Proposed Project provides the capture and conveyance of storm water flows and the management of runoff from storm events to benefit agricultural and wetland habitat land uses by protecting the integrity of water supply channels to both of these uses. The primary public facility affected is the federal San Luis Drain and the discharge of storm waters into Mud Slough in the San Luis NWR operated by USFWS. However, the wetlands in the Grassland Water District would benefit by not having storm water discharge enter water supply canals during major storm events.

a) The Proposed Project modifications do not add a substantial number of people whether as residents or as nonresident workers to the Project Area within Merced and Fresno counties who could then affect the levels of public services including the response time for public safety personnel or the capacity of sewage treatment plants, water plants, and solid waste disposal facilities. The San Luis NWR and Los Banos Wildlife Management Area provide the following recreational opportunities: wildlife viewing, fishing, and hunting. However, fishing is not permitted in Mud Slough due to historical discharges of Se. This is the basis for the mitigation measure for Mud Slough contained in the 2009 Final EIS/EIR. With the Proposed Project limiting storm water discharges to Mud Slough, the water quality may improve sufficiently to allow fishing in the future at the discretion of the USFWS (see Section 2.16).

2.16 Recreation

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) 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?	☐	☐	☐	☒
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?	☐	☐	☐	☒

Discussion

The Proposed Project modifications do not add activities that would affect urban land uses including neighborhood and regional parks that provide intensive recreational opportunities such as playgrounds and sports fields. The future discharges into Mud Slough (North) will be limited to uncontrollable storm flows and will not exceeded the current capacity of the Drain (150 cfs). Hydrologic modeling indicates that the Proposed Project components, once fully implemented, will cause the Se water quality criteria to be met under most conditions, and water quality in Mud Slough (North) will be of better quality regarding Se than in the past. Under these future conditions, Mud Slough (North) could be opened to recreational fishing at the discretion of USFWS.

The proposed site for the proposed short-term storage basins is within the existing SJRIP and planted to Jose Tall Wheatgrass. The new basins will be managed to discourage waterfowl from foraging there during the winter months.

a) Because the Project can be operated with only 1 additional employee (for the pump stations), there is no impact on existing neighborhood and regional parks.

b) The Project does not stimulate either residential (population) or economic growth that would require new recreational facilities.

2.17 Transportation/Traffic

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Conflict with an applicable plan, ordinance policy establishing a measure 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?	☐	☐	☐	☒
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 substantially decrease the performance or safety of such facilities?	☐	☐	☐	☒

Discussion

The construction of the new short-term storage basins, new and expanded pump stations, and new/expanded pipelines and canals, new subsurface drainage at the reuse facility, and expansion of the reuse facility, and installation of one communication tower and two repeater towers for a SCADA system for tile sump control do not involve increases in vehicular traffic to regional roadways or the overall circulation system in the Project Area. With maximum of 10 workers onsite for approximately seven months (10 trips per day on public roads), rural roads are sufficient to handle Project traffic consisting of 5 pickup trucks and SUVs. Road access to the construction sites is from Russell Avenue, a county roadway. The West pipeline construction will impact Russell Avenue, and a permit from Fresno County will be required. Heavy equipment is left onsite until the construction task is completed; it is not moved on local roadways on a daily basis.

Sediment removal from the Drain may consist of up to 20 truck-trips per day while the sediment is hauled from the Drain to the stockpile point on the SJRIP or other location. This could require use of state highways 33, 165, and 152 during weekdays but not all trips at peak travel times, rather trips would occur throughout the day. The Proposed Project modifications do not involve sufficient vehicular traffic (or any other motorized or non-motorized vehicles/bicycles) to impact normal operation of any portions of the circulation system in this rural portion of Merced and Fresno counties.

a) The Proposed Project modifications do not involve sufficient vehicular traffic to affect levels of service on any county or state roadways.

b) There would be no impact to air traffic given the distance of the activity from public and private airports. See Section 2.8 (e) and (f).

c) The proposed equipment is similar to equipment used for cultivating crops, and it would be used primarily in an area where the majority of existing road use is by farm equipment and trucks. Sediments removed from the Drain involve limited equipment use on the refuge access roads.

d) The proposed equipment use would not inhibit emergency access to any of the area. Equipment would not block local farm roads and wildlife refuge access roads (during SLD sediment removal) to fire trucks and other response vehicles.

e) The proposed equipment use would be limited to the agricultural and wildlife habitat areas and not affect these other policies, plan, and programs for other types of transportation in urban areas.

2.18 Tribal Cultural Resources

Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resource Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a)	Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or	☐	☐	☐	☒
b)	A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resources Code section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.	☐	☐	☐	☒

Discussion

See Section 2.5 Cultural Resources for a discussion of historical resources. The California Register of Historical Resources (California Register) includes buildings, sites, structures, objects and districts significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California. Some of the listed resources in Merced County can be found at http://ohp.parks.ca.gov/ListedResources/?view=county&criteria=24 and in Fresno County at http://ohp.parks.ca.gov/ListedResources/?view=county&criteria=10 . None of these listed resources are water delivery facilities or other structures located in the GDA.

The confidential Cultural Resources Technical Report prepared for the Proposed Project (AECOM 2019) reported that:

> “The project area is ethnographically attributed to the Northern Valley Yokuts, part of the California Penutian language family, whose territory lay between the foothills of the Diablo and Coast Ranges and the Sierra Nevada, extending roughly from the Calaveras River at the north to the northward bend of the San Joaquin River near the modern community of Mendota at the south (Wallace 1978:462). Historically, the arid territory west of the San Joaquin River was more sparsely populated than lands bordering the tributaries flowing from the Sierras to the San Joaquin on the eastern valley margins. Northern Valley Yokuts people living near the river and its tributaries depended heavily on fishing for subsistence, and spawning king salmon, white sturgeon, and other fish provided a valuable food source. Tule marshlands surrounding the watercourses attracted geese, ducks, and other water birds, while elk and pronghorn antelope inhabited the plains. However, the importance of these bird and mammal species to the Northern Valley Yokuts diets is not known (Wallace 1978:464). Valley oak acorns were ground into meal, as were smaller seed crops.
>
> “Northern Valley Yokuts people were subdivided into tribelets of approximately 300 people, each guided by a single headman and centered near a main village. These villages, located on low mounds near large watercourses, had seasonally fluctuating populations as residents moved through the surrounding territory collecting plant resources. Houses consisted of oval to round single-family dwellings 25 to 40 feet in diameter constructed from bent poles and tule mats. Communities built earth-covered sweathouses and ceremonial lodges in each village. Tribal

> names north and west of the San Joaquin River are poorly recorded, as more dense Yokuts populations lived east of the river. The nearest identified tribal territory to the Project area is that of the Nopchinchi (Wallace 1978:462).
>
> “In the early nineteenth century, Spanish efforts to missionize valley populations disrupted Northern Valley Yokuts lifeways, and an 1833 malaria epidemic decimated the population. Following the secularization of the missions in 1834, and their traditional resource use areas quickly being lost to American settlers, many of the surviving Northern Valley Yokuts worked as manual laborers on ranches (Wallace 1978).”

As of July 1, 2015, California Assembly Bill 52 of 2014 (AB 52) was enacted and expands CEQA by defining a new resource category, “tribal cultural resources.” Assembly Bill 52 establishes that “[a] project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment” (Public Resources Code Section 21084.2). It further states that the lead agency shall establish measures to avoid impacts that would alter the significant characteristics of a tribal cultural resource, when feasible (Public Resources Code Section 21084.3). Public Resources Code Section 20184.3 (b)(2) provides examples of mitigation measures that lead agencies may consider to avoid or minimize impacts to tribal cultural resources. Public Resources Code Section 21074 (a)(1)(A) and (B) defines tribal cultural resources as “sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe” and meets either of the following criteria: a. Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or b. A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.

AB 52 also establishes a formal consultation process for California Native American tribes regarding those resources. The formal consultation process must be completed before a CEQA document can be released if a California Native American tribe traditionally and culturally affiliated with the geographic area of the proposed project requests consultation from the lead agency (Public Resources Code Section 21080.3.1). California Native American tribes to be included in the process are those that have requested notice of any proposed projects within the jurisdiction of the lead agency.

The Proposed Project modifications do not involve excavation of known sites previously utilized by any Native American tribes. Any human remains encountered during ground-disturbing activities are required to be treated in accordance with CEQC Guidelines Section 15064.5(e), Public Resources Code Section 5097.98, California Health and Safety Code (CHSC) Section 7050.5. California law protects Native American burials, skeletal remains, and associated grave goods regardless of their antiquity, and provides for the sensitive treatment and disposition of those remains. Specifically, Section 7050.5 of the CHSC states that in the event of discovery or recognition of any human remains in any location other than a dedicated cemetery, there shall be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent remains until the coroner of the county in which the remains are discovered has determined whether or not the remains are subject to the coroner’s authority. If the human remains are determined to be of Native American origin, the county coroner must contact the NAHC within 24 hours of this identification. An NAHC representative will then identify a Native American Most Likely Descendant to inspect the site and provide recommendations for the proper treatment of the remains and associated grave goods. In addition, CEQA Guidelines Section 15064.5 specifies the procedures to be followed in case of the discovery of human remains on non-federal land. The disposition of Native American burials falls within the jurisdiction of the NAHC

a) The cultural resources investigation for the Proposed Project (AECOM 2019) identified one historical resource recorded in 2017, the Main Canal. The DMC was previously recorded as well. Three other conveyance facilities are of historic age along with Eagle Field but they are not recorded. Project features would not disturb the adjacent canals or Eagle Field during construction or operation. The SCADA towers can be located away from the canals if necessary or the canals can be recorded.

b) The Authority has contacted the Amah Mutsun Tribal Band, the Dumna Wo Wah Tribal Government, the North Valley Yokuts Tribe, and the Southern Sierra Miwuk Nation and provided each tribal entity with a project description and a request for consultation. No responses were received.

2.19 Utilities and Service Systems

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒
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 storm water 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?	☐	☐	☐	☒
h) Result in a potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?	☐	☐	☐	☒
i) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?				

Discussion

The Proposed Project is to develop improvements to existing drainage facilities and the reuse area in order to continue to convey storm water collected from the GDA to the SJRIP and, when necessary, the federal San Luis Drain and to discharge the storm water at Mud Slough after 2019, for a period of 25 years to 2045. It also includes new short-term storage basins, new pump stations/pipelines, and subsurface drainage and the installation of a tile sump control SCADA system. During Project construction, a portable toilet will be used and serviced regularly.

a) There will be no discharge of wastewater to a community sewer system,

b) No new water or wastewater facilities will be installed. Conveyance improvements such as new pipelines, canal lining, ditch expansion, and new pump stations will be completed, but these do not affect any public water treatment plants or water distribution lines.

c) The Proposed Project is the construction of new facilities and improvements to or modifications to existing storm water drainage facilities including pump stations, lined canals, pipeline, storage basins, subsurface drainage systems in the expanded reuse area. The new facilities' construction and operation over time have potentially significant impacts discussed in Sections 2.4 and 2.9. Storm water management is being enhanced over the long term with no impacts to the existing facilities.

d) The Proposed Project modifications do not add residents or employment to the area such that no new water supplies are required. No new lands would be placed in agricultural production. The reuse area expansion changes the crop to Jose tall wheatgrass from annual field crops such as cotton. No new wetlands would be created. The construction crew will bring their own daily water supply to the site.

e) No new wastewater treatment is needed, and no demand will be placed on existing municipal or private septic systems.

f) There would be no need for material to go to a solid waste disposal facility. Excavated soil for the pipelines, communication tower footings, and canal expansion can be redistributed onsite. The sediments removed from the Drain are not a hazardous waste as explained in Section 2.8. Appendix B, Section 6.1, discusses trace element concerns for wildlife but these are not associated with waste disposal but rather with exposure to elements like selenium in water at the reuse area and short-term storage basins.

g) The Project will comply with all solid waste regulations; however, minimal waste material would be generated. Soil and sediments can be reused within the Project Area.

h) The construction process involves the use of gasoline to power the construction equipment. Engines will not be allowed to idle, and equipment will be stored onsite during construction. The installation of the tile sump control SCADA will result in an energy savings due to a reduction in truck trips to manually operate the tile sumps.

i) The construction and operation of the Proposed Project modifications do not interfere with the use of renewable energy by other agencies and landowners in the Project Area.

2.20 Wildfire

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
Is the project located in or near state responsibility areas or lands classified as high fire hazard severity zones?	☐ Yes		☒ No	
If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project:				
a) Substantially impair an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
b) Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?	☐	☐	☐	☒
c) Require the installation of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?	☐	☐	☐	☒
d) Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?	☐	☐	☐	☒

Discussion

The 2018 California Strategic Fire Plan "…reflects CAL FIRE's focus on (1) fire prevention and suppression activities to protect lives, property, and ecosystem services, and (2) natural resource management to maintain the state's forests as a resilient carbon sink to meet California's climate change goals and to serve as important habitat for adaptation and mitigation. A vision for a natural environment that is more fire resilient; buildings and infrastructure that are more fire resistant; and a society that is more aware of and responsive to the benefits and threats of wildland fire; all achieved through local, state, federal, tribal, and private partnerships."

CAL FIRE provides maps for the state of California showing zones of moderate, high and very high risk of fire severity.

In western Fresno and Merced County, a moderate fire severity zone has been identified adjacent to and westerly of Interstate 5 (I-5), which transitions to a high fire severity zone further west into the Coastal Mountain range. The most westerly component of the proposed project is located 6.5 miles from I-5 and the zone identified as a moderate fire severity zone. None of the project components are located within an identified fire hazard severity zone.

a) The Proposed Project is not located in or near a state responsibility area or high fire severity zone and will not impair any emergency response or evacuation plan.

b) The Proposed Project is not located in or near a state responsibility area or high fire severity zone and will not exacerbate wildfire risks or increase potential exposure to pollutants from a wildfire.

c) The Proposed Project is not located in or near a state responsibility area or high fire severity zone and will not require additional infrastructure that could result in and increase fire risk.

d) The Project will not expose people or structures to significant risks. The project does not include changes to topography that would increase the risk of downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes.

2.21 Mandatory Findings of Significance

Does the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) 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) 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.)	☐	☐	☒	☐
c) Have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☐	☒

Discussion

a) The Proposed Project will reduce the storm-induced drainage discharges from the GDA and result in improved water quality in Mud Slough (North) compared to existing conditions. The small incremental effects to a sensitive community such as the nearby habitat in the NWR and WMAs would be due primarily to noise from equipment use within the Drain to remove sediment, not from equipment use in the affected portions of the GDA. Concerning impacts to biological resources, specifically waterfowl, the issue is Se exposure from all sources regionally. Exposure to high selenium drain water on the Project site (reuse area and short-term storage basins) is limited due to ongoing measures in the reuse area and at irrigation ditches and the proposed mitigation measures for the new storage basins. No important examples of prehistoric or historic cultural resources would be removed or damaged by the new project features to support continued farming at the expanded reuse area. Construction is limited in extent and depth, and standard mitigation protocols to conduct further site surveys and records searches and monitoring are sufficient to avoid contributing to or triggering a cumulative impact to cultural resources. Ongoing coordination with resources agencies and affected tribes will maintain impacts to either no impact or a less than significant level.

Other impacts to the environment are a result of short-term construction impacts (e.g., noise) that are less than significant.

b) The following limited, incremental impacts to the identified resources are not triggering cumulatively considerable impacts nor are they contributing in a substantial manner to existing cumulative issues for the following reasons:

Biological Resources: Considering other sources of selenium exposure regionally, the unmitigated exposure of waterbirds to high-selenium drain water on the Project site would contribute to significant cumulative impacts on breeding waterbirds by causing reproductive losses. However, continued implementation and refinement of the mitigation measures described previously would reduce these impacts to less-than-significant levels (see Appendix B, Section 7.3). Most of the cumulative harm regionally is from the unmitigated exposure of waterbirds from ponded water in other areas with Se-rich soils that contribute to significant cumulative impacts on breeding waterbirds by selenium causing reproductive losses. Therefore, the incremental impacts from the Proposed Project do not trigger the exposure problem and are not cumulatively considerable. Furthermore, the nearby wildlife refuges with high quality water supplies used to provide waterfowl habitat would minimize the Project's incremental, less-than-significant impacts by providing alternative nesting and foraging areas.

Greenhouse Gas Emissions: As provided in Section 2.8, GHG emission are estimated to be substantially less than the significance thresholds developed by the BAAQMD. Considering that the construction impacts will be short term and temporary, and that standard management practices (such as Tier 4 compliant vehicles) will be implemented, this impact is less than significant. Operational impacts of farming at the reuse area and completion of removal of sediments from the Drain are minor and would not contribute substantially to regional emissions. The SCADA system would reduce reliance on manual operation of the sumps that would utilize gasoline.

Hydrology: The Proposed Project would reduce the storm-induced drainage discharges from the GDA and result in improved water quality in Mud Slough (North) and downstream to the San Joaquin River compared to existing conditions. Therefore, it does not substantially contribute to an existing cumulative impact to surface water quality from other sources of selenium, salt, and boron both upstream and downstream. The 2009 Final EIS/EIR, Section 5.2.4 Cumulative Effects, noted that the area underlain by a water table within 10 feet of land surface increased by about 20,000 acres per year during the period 1991-1997 and that salt has been imported and deposited into western San Joaquin Valley soils and water. The water table rise and salinization of soil and groundwater was identified as a significant regional problem. The regional cumulative impact of water table rise and salinization of soil and groundwater from long-term irrigation of agriculture (and water deliveries to the federal wildlife refuges) continues, and it is not substantially more severe due to the Proposed Project, especially with water conservation practices employed throughout the GDA.

c) Because the Proposed Project modifications do not encourage employment and population growth, do not impact public facilities, and do not degrade air quality, there are no other impacts to be discussed in addition to those under b above.

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Appendix A Plan Formulation Report

DRAFT

PLAN FORMULATION REPORT
LONG TERM STORM WATER MANAGEMENT PLAN FOR THE GRASSLAND DRAINAGE AREA

Prepared for

GRASSLAND BASIN DRAINERS
SAN LUIS & DELTA-MENDOTA WATER AUTHORITY
LOS BANOS, CALIFORNIA

Prepared by

Summers Engineering, Inc.
Hanford, California

March 27, 2019

Table of Contents

TABLES

FIGURES

ACRONYMS & ABBREVIATIONS

AF	Acre-Feet
CDEC	California Data Exchange Center
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act of 1970
cfs	cubic feet per second
CVRWQCB	Central Valley Regional Water Quality Control Board
DMC	Delta Mendota Canal
Drain (or SLD)	San Luis Drain
EC	electrical conductivity
EIS/EIR	Environmental Impact Statement/Environmental Impact Report
GBC	Grassland Bypass Channel
GBD	Grassland Basin Drainers
GBP	Grassland Bypass Project

GDA	Grassland Drainage Area
GWD	Grassland Water District
LTSWMP	Long-Term Storm Water Management Plan
NEPA	National Environmental Policy Act of 1969, as amended
ppb	parts per billion
Reclamation	U.S. Bureau of Reclamation, Mid-Pacific Region
Regional Board	Central Valley Region Water Quality Control Board
SCADA	Supervisory Control and Data Acquisition
Se	Selenium
Service	U.S. Fish and Wildlife Service
SJRIP	San Joaquin River Improvement Project
SLD	San Luis Drain
TMML	Total Maximum Monthly Load
WDRs	Waste Discharge Requirements
WQO	Water Quality Objective
WY	Water Year

SECTION 1
Plan Formulation Background

1.1 INTRODUCTION

The Grassland Bypass Project (GBP) covered in the 2010 use agreement and 2009 Final EIS/EIR (Reclamation 2009a and 2009b) did not include a long-term storm water management plan. As this use agreement comes to a close, the Grassland Basin Drainers (GBD), under the umbrella of the San Luis and Delta Mendota Water Authority, need to develop a plan for management of storm water that had previously been handled in the San Luis Drain along with the GBP's subsurface drainage from agricultural operations and the reuse area (San Joaquin River Improvement Project or SJRIP). This section presents background information including existing storm water flow conditions and issues relating to storm water.

1.1.1 Grassland Bypass Project Summary

The Grassland Bypass Project was initiated in 1996 as a way to convey subsurface drainage water away from the Grassland Drainage Area (GDA) without the drainage mixing in channels within the wetland refuge areas. Prior to the Grassland Bypass Channel Project (Bypass Project or GBP), water was conveyed through wetland channels through a flip flop type system. Since 1996, drainage discharge from the Grassland Drainage Area has been conveyed through the Bypass Project into the San Joaquin River, except for three instances in which storm water events required discharge into the wetlands (Jan and Feb 1997 for 9 days, Feb 1998 for 26 days 3,289 AF, and Feb 2005 for 7 days 269 AF).

Permission for the Grassland Bypass Project to utilize a portion of the San Luis Drain is provided through a Use Agreement between the U.S. Bureau of Reclamation and the San Luis Delta-Mendota Water Authority. The first use agreement was dated November 3, 1995 and was amended September 30, 1998. The "2001 Use Agreement" was entered into on September 28, 2001. The 2010 Use Agreement was signed on December 22, 2009 and covers the period January 1, 2010 through December 31, 2019. Waste discharge requirements (WDRs) were also issued for the project by the Central Valley Regional Water Quality Control Board (CVRWQCB). The first issuance was in July 24, 1998, the second issuance was in September 7, 2001, and the third and current waste discharge requirements were issued in July 31, 2015.

1.1.2 Project Location

The location of the upcoming Long-Term Storm Water Management Plan (LTSWMP or Project) is the Grasslands Watershed in Fresno and Merced Counties as shown on Figure 1-Watershed Location Map, which ultimately discharges into the Lower San Joaquin River. The Grassland Drainage Area and project features including the channels containing drainage flows along with downstream wetland areas and wildlife refuges are shown on Figure 2, Grassland Bypass Project Location Map.

1.2 EXISTING STORM WATER FLOWS

Monitoring Locations referenced in the tables are shown in Figure 2 and Figure 3. Figure 4 is a schematic that shows various monitoring locations that will be referred to in this analysis. A general description of the important sites are:

- **Site J (Camp 13 Canal) and Site K (Agatha Canal).** The sites discharge into the Grassland Water District and downstream areas such as state and Federal Refuges. Prior to the Grassland Bypass Project (and the Flip-Flop system) drainage discharges, both from subsurface drainage, surface discharges and storm water, were discharged at these sites, and also entered Salt Slough. Concerns about the effects of avian exposure to selenium led to the Regional Board adopting a 2 ppb selenium water quality objective for selenium in areas utilized for waterfowl habitat. With the determination that selenium concentrations were high in drainage discharges to these channels, an effort was made to remove the drainage water from wetland delivery channels. This culminated in the current Grassland Bypass Project. If the amount of water from the Grassland Bypass Project cannot be handled in the San Luis Drain, then water is again diverted to one or both of these channels. In uncontrolled flooding, Salt Slough could also be affected.
- **Site A.** This is a monitoring station approximately 1 mile downstream of the location where the Grassland Bypass Channel discharges into the San Luis Drain.
- **Site B.** This is the location where the flows from the Grassland Bypass Project that are conveyed in the San Luis Drain are discharged to Mud Slough North. The San Luis Drain was constructed with weep holes to alleviate pressure on the concrete panels due to hydraulic pressure from water ponded in adjacent refuges. Significant seepage enters the Drain between Site A and Site B through these weep holes. Thus, flows and salt load at Site B are often greater than at Site A.
- **Site D.** This is a monitoring point in Mud Slough downstream of the discharge from the San Luis Drain (Site B). Additional flows at Site D come from discharges from wetland activities within Grassland Water District and State and Federal refuges and a small amount of agricultural discharges outside of the GDA. Usually the flows at Site D are higher than Site B.
- **Site H** (an alternate is **Site R**). These sites are in the San Joaquin River between where Mud Slough North discharges into the San Joaquin River and the confluence of the Merced River.
- **Site N (Crows Landing).** This is the point in the San Joaquin River for determining the compliance with the selenium water quality objective. It is downstream of the Merced River.
- **Vernalis.** This site is not shown on the Figure 4. It is located in the San Joaquin River upstream of the Sacramento/San Joaquin Delta. It is a compliance point for the salinity objective. The Tuolumne and Stanislaus rivers discharge into the San Joaquin River upstream of Vernalis.

1.2.1 Historical Routing of Flows

In the period prior to 1990, the historic discharge of storm runoff was into the wetlands area at Agatha and Camp 13 (see Figure 2). The natural slope of the land in the Grassland Drainage Area is to the north and east, and the storm water followed this path. With the implementation of the Grassland Bypass Project, there was a major shift in the routing of the storm water. Starting with the first discharges under the first use agreement in 1997 compliance with selenium and salinity objectives had to be met for all water discharged from the San Luis Drain, including subsurface drainage water and storm water commingled in the system. Along with this change came an assumption that the Grassland Basin Drainers were somehow responsible for and could manage the storm water. The Grassland Bypass Project has been very successful in reducing subsurface drainage water and after 2019, is expected not to discharge subsurface drainage into the San Luis Drain. The project also has been successful, with the few exceptions noted above, in managing storm water. However, there are no mechanisms available to prevent discharges of storm water into wetland habitats from the Grassland Drainage Area or upslope areas, and storm water will continue to be the ongoing issue. The success in managing storm water can be attributed to the availability of access to discharge to the San Luis Drain (other than for the exceptions mentioned above).

1.2.2 Storm Event Problems

The storm event problems described herein define the continuation of past problems/existing conditions (e.g., as in 2005 when storm flows could not be handled fully in the San Luis Drain) into the future if there is no project to resolve these problems. The Grassland Bypass Project has faced high rainfall events since its inception. The first two years of the project, 1997 and 1998, were extremely wet years in which there was significant above normal rainfall within the Grassland Drainage Area. Flows through the Grassland Bypass Project were projected to exceed the 150 cfs maximum permissible flow into the Drain as defined in the use agreement and discharges were made into the wetland channels. A subsequent wet year in 2005 also required discharge into the wetland channels. These discharges, although of short duration, brought selenium (Se) into the wetland channels at levels exceeding the 2 ppb water quality objective for those channels, creating management issues for wetland managers and requiring prescribed post-event monitoring. These discharge events would continue if the LTSWMP does not proceed. Table 1-1 (Maximum Storm Events of Record) shows storm event discharges out the Grassland Bypass Project and into the wetland areas during storm event periods for 1997, 1998 and 2005. Recent storm periods are also shown for 2014/15 and 2015/16 even though no storm water was discharged into the wetland areas.

Table 1-1 Maximum Storm Events of Record

Maximum Flows (cfs)						
Date	PE-14+FC-5	To GWD	Site A	Site B	Site A + GWD	Site B + GWD
Jan-Feb 1997	185	Not Available	95	90	Not available	Not available
Feb 1998	230	90	140	150	230	240
Feb 2005	Not available	75	159	138	234	213
Dec 2014	Not available	0	98	102	98	102
March 2016	Not available	0	109	90	109	90

Note:

Source: Project records

The Grassland Basin Drainers have developed measures to manage irrigation-related drainage flows under the Grassland Bypass Project. These practices have been a four-step process including: 1) source control and recirculation, 2) shallow groundwater pumping, 3) drainage water reuse and 4) treatment and disposal. The final step remains in development, and while likely essential for the long-term, the combination of the first three items has led to the successful management of the region's subsurface drainage. The Grassland Basin Drainers have been very successful in reducing the selenium load to the San Joaquin River, having reduced the flow by 90+% in 2015 from what it was before the Grassland Bypass Project started. Furthermore, in 2015, there was no flow in the San Luis Drain from March through October, and similar no flow conditions held true in 2016 and 2017, despite the wet year and increased available irrigation supplies. However, Table 1-1 shows the storm flows that have been discharged. The normal drainage reduction measures are not applicable to storm water events because a substantial amount of water comes at the same time, and the ability to irrigate crops in the reuse area is limited during the normal rainfall periods of November through March. Also, regulations to protect shorebirds preclude ponding flood water in the reuse area fields.

Early rain events tend to be absorbed in the soil profile which can be evident in the following figures. However, as the soil profile becomes saturated, there is excess storm water that cannot be controlled which equates to increased storm water flows as well as accretion flows of shallow groundwater into drainage conveyance channels.

- Figure 5 – shows flows as the sum of two of the main discharge points from the Grassland Drainage Area (see Figures 3 for location) during the two early project years of 1997 and 1998. Spikes in flows are evident, and the peaks can be observed.
- Figure 6 – shows flows during the February 1998 storm period. Key information to be taken from the figure are the maximum storm flows of 230 to 240 cfs as measured at the combination of PE-14 and FC-5 (see Figure 3 for location) or as the combination of Site A and Discharge to Grassland or Site B and Discharge to Grassland.
- Figure 7 – depicts PE-14 and FC-5 flows compared to precipitation for the period October 1997 through March 1998. As precipitation accumulates, the ground gets saturated and runoff increases. Note especially the rainfall compared to flows on February 1, 1998.
- Figure 8 – shows flows at the San Luis Drain inlet (Site A) as compared to precipitation for the period October 2014 through May 2015.
- Figure 9 – shows flows at the San Luis Drain outlet as compared to precipitation for the same period as Figure 8. Peak flows of 102 cfs are observed even though this is a critical year type for the San Joaquin River.
- Figure 10 – shows flows at Site A for the period of October 2015 through May 2016 as compared to rainfall. This period was a dry year type on the San Joaquin River. Peak flows of over 100 cfs were observed on March 5.
- Figure 11 – shows the flows and rainfall for the Outlet of the San Luis Drain for the same period as Figure 10, that is October 2015 through May 2016. Again, this period was a dry year type for the San Joaquin River.
- Figure 12 – shows flows and rainfall at Site A for the period October 2016 through February 2017. This period was a wet year on the San Joaquin River.
- Figure 13 - shows flows and rainfall at the Outlet for the period October 2016 through February 2017. This period was a wet year on the San Joaquin River.

Figures 14 through 16 are photographs taken during the February 1998 rainfall period showing flood impacts. The photographs depict the localized flooding that occurs if there is no outlet for the storm waters.

- Figure 14 shows the flooding that occurred along the Main Canal. The lands on the downstream (left) side are within Grassland Water District. This shows the danger to the canal if no outlet is available. Water will pond against the canal banks and ultimately break through the banks. This would be a significant event and could jeopardize water deliveries to agricultural areas outside of the Grassland Drainage Area and to private, state and federal wetland areas.
- Figures 15 and 16 show the storm water in the Grassland Bypass Channel itself at its capacity of 150 cfs. The bypass channel would need to be enlarged to allow flows over 150 cfs into the San Luis Drain.

1.2.3 Without Project Conditions

The continuation of past problems into the future without a project to resolve storm water problems within the Grasslands Watershed and GDA is called the No Project/No Action Alternative. The No Project/No Action Alternative is to allow storm water discharges into the wetlands, ponding against irrigation canals, and flooding to continue as described above (in Section 1.2.2). It is the baseline for the evaluation of environmental effects under the National Environmental Policy Act (NEPA), while existing conditions is the baseline for determination of environmental impacts under the California Environmental Quality Act (CEQA). Under CEQA, a project that continues into the future without change is a No Project scenario; however, here the storm water conveyance part of the Grassland Bypass Project comes to a close on December 31, 2019, and there is no mechanism in place to manage fully these storm waters. Other components of the Grassland Bypass Project previously evaluated will continue, but these other components (i.e., reuse area, drainage conveyance, sumps, and sediment removal in the Drain) are to be modified in order to operate the project after 2019. These modifications require additional examination as the CEQA Proposed Project. The existing condition captures some of the storm water management tools, at least in part, but enhancements/improvements are needed for future operation. The existing condition regarding storm water discharge and surface water quality is comprised of several recent years of Grassland Bypass Project operation data.

SECTION 2

Purpose and Need / Objectives

The purpose of the Grassland Bypass Project was to provide for the conveyance of drainage waters to Mud Slough (north) and the San Joaquin River without discharging subsurface drainage water into the wetland channels. Part of the use agreement (and also incorporated into the waste discharge requirements) were water quality selenium load limits that could be discharged to the San Joaquin River. The current 2010 use agreement is set to expire December 31, 2019. At that time the GBD's use of the San Luis Drain expires.

However, the 2010 use agreement contemplates the need for a long-term storm water management plan after the use agreement expires on December 31, 2019. Paragraph III. G.2. states: "No longer than Year Seven (2016), the Draining Parties shall begin developing a long-term storm water management plan, which may include evaluation of utilizing the San Luis Drain to bypass storm water flows around some wetland areas." The purpose of this plan formulation report is to explore options for storm water management by outlining the activities and procedures necessary to manage excess storm water after December 31, 2019.

The future storm water management plan (the Project) should strive to achieve the following preliminary objectives:

1. To eliminate, to the extent feasible, storm water drainage discharged from the Grassland Drainage Area into wetland water supply conveyance channels.

2. To facilitate storm water management that maintains the viability of agriculture in the Project Area and protects water quality in the San Joaquin River.

3. To keep storm water drainage from breaking into irrigation water supply channels and causing damage.

4. To avoid ponding of storm water that could impact the integrity of water supply channels and impact soil and water quality.

5. To avoid unplanned/inadvertent/unmanaged ponded water containing selenium that could impact birds within the GDA as well as downstream habitat and water quality in the wetland areas and wildlife refuges.

6. To provide an outlet for storm water to flow to the San Joaquin River from the Grassland Drainage Area (similar to what occurred historically and before the Use Agreement for use of the San Luis Drain), that also protects the integrity and quality of wetlands and wildlife refuges.

These objectives form the basis for evaluating the project alternatives along with other criteria often used to evaluate federal water project alternatives. Each alternative should be evaluated for how well it meets these six objectives.

SECTION 3
Preliminary Project Alternatives

The four preliminary management alternatives for handling rain induced flows include the following:

> **Alternative A**. Storage ponds large enough to store storm water flows generated by rain events,
>
> **Alternative B**. Continued local management and downstream coordination as under the Grassland Bypass Project with use of the San Luis Drain as the primary facility to route rain induced flows up to 300 cfs to the San Joaquin River without impacting wetland channels, and/or
>
> **Alternative C**. A combination of regulating shrot-term storage basins and local management (primary tool) and downstream coordination with use of the San Luis Drain (secondary tool) to route rain induced flows to both the regulating ponds and to the San Luis Drain (Alternatives A plus B).

All of these preliminary alternatives need to be designed to consider the limitations of the GBP and SLD, storm event frequency and magnitude, and available storm water management tools to minimize discharges. All of these are common elements added to the Project alternatives. These limitation factors are discussed below (Section 3.1.2) followed by the storm water management tools (Section 3.1.3). Enhancements to existing tools are clearly identified, as these may involve additional CEQA/NEPA analysis.

3.1.1 Limitations of the GBP and SLD

The maximum design flow in the San Luis Drain is 300 cfs as it was originally designed. However, the Use Agreement has limited the permitted flow in the San Luis Drain to 150 cfs. This is because the connection facilities between the Grassland Drainage Area and the San Luis Drain are limited to 150 cfs. These facilities include a culvert underneath the Main Drain, Main Canal, and Helm Canal and the four-mile earth-lined Grassland Bypass Channel (GBC) which connects the GDA drainage system to the San Luis Drain.

In addition, there has been sediment buildup in the San Luis Drain. Before the Grassland Bypass Project, the San Luis Drain contained sediment that had been deposited during operations prior to the GBP. The 20 years of operation of the Grassland Bypass Project has deposited additional sediment which further restricts the capacity of the San Luis Drain. As a result, the use agreements (including the 2010 Use Agreement) have limited the allowable flow in the San Luis Drain to 150 cfs. One purpose of this limitation was to prevent any suspension of sediment which might be discharged to Mud Slough (north). A Sediment Management Plan was evaluated in the 2009 Final EIS/EIR (Reclamation 2009b). This plan allowed for placement of removed sediments in agricultural land. Removal commenced under the plan in 2015, 2016, 2017, and 2018. From 2015 to 2018, approximately 180,000 cubic yards of sediment, amounting to 65% of the total sediment, has been removed from the San Luis Drain and used to fill unneeded drains within the SJRIP. The work was again accomplished in accordance with the Sediment Management Plan, with the modification that sediment was first placed adjacent to the San Luis Drain to dry and then picked up and taken to the SJRIP reuse area.

Proposed Improvements: Future sediment removal will be accomplished in the near term similar to the 2018 removal, but the location of the placement area likely will change due to the logistics of hauling material that is further away from the SJRIP.

Concerning sediment removal, the US Fish and Wildlife Service (Service) has reviewed the current removal project and determined the following:

> "Where the old Kesterson Reservoir site is to the west of the Drain, we suggest the operators work from the west side of the Drain and stockpile sediment on the Bureau of Reclamation's land. Where Refuge lands are on both sides of the Drain, we request that the sediment be stored on top of the levee, as we saw in the south Grasslands project. In both instances, the sediment would be kept away from Refuge lands-and thus the project would not have the potential to damage Refuge resources." (USFWS 2017)

3.1.2 Storm Event Frequency and Magnitude

3.1.2.1 Frequency: History of Storm Events

Table 3-1 (San Joaquin River Water Year Types) is a listing of the water year types in the San Joaquin River Basin. Of the 32 years listed, 13 years were classified as above normal or wet year types. Discharge to the Grassland Bypass Project has varied over time as well, and these discharges are also shown in the base flow tabulations.

Table 3-1: Hydrologic Year Types.

Water Year	Hydraulic Year Type	-	Water Year	Hydraulic Year Type
1986	Wet		2003	Below Normal
1987	Critical		2004	Dry
1988	Critical		2005	Wet
1989	Critical		2006	Wet
1990	Critical		2007	Critical
1991	Critical		2008	Critical
1992	Critical		2009	Dry
1993	Wet		2010	Above Normal
1994	Critical		2011	Wet
1995	Wet		2012	Dry
1996	Wet		2013	Critical
1997	Wet		2014	Critical
1998	Wet		2015	Critical
1999	Above Normal		2016	Dry
2000	Above Normal		2017	Wet
2001	Dry		2018	Below Normal
2002	Dry			

Water year is October to September.

Hydrologic year type based on 3-River index for the San Joaquin Basin.

However, as listed previously in Table 1-1, there were only three years during the first 20-year period of the Grassland Bypass Project in which discharges were made to wetland channels: years 1997, 1998, and 2005. These periods totaled 42 days which corresponds to 0.6 % of the time.

Over time, the Grassland Drainers have been able to develop tools improving their management of storm water. The analysis herein focuses on recent time periods to look at the magnitude of storm flows that needs to be managed under this Project. One is the period October through May of 2014-15 and the other one is the October through May time period of 2015-16. Water year 2015 (Oct 14 –Sept 15) was a critically dry year, and water year 2016 (Oct 15 – Sept 16) was a dry year type on the San Joaquin River. However, rainfall events during both year types caused spikes in flow that were discharged through the Grassland Bypass Project. Shown on the attached Figures 8 through 13 are these daily flow events compared with the rainfall amounts that occurred. As can be seen, late in the fall when rainfall occurs spikes in discharge tend not to occur because the soils in the area are dry and tend to soak up the rainwater. Once the soils become saturated, even small rainfall events tend to spike the flows and cause discharges through the Grassland Bypass Project. In the two periods of 2014/15 and 2015/16, the maximum flow rate experienced was 98 cfs in the 2014/15 period and 109 cfs in the 2015/2016 period. Increased flows due to storm events have occurred in each of the most recent water years, WY 14-15 (Figures 8 and 9) a critical year, WY 15-16 (Figures 10 and 11) a dry year type and WY 16-17 (Figure 12 and 13) a wet year type.

Flows in the 1998 and 2005 periods were much higher than those in the recent years. Taking into account the flows discharged to wetland channels, the peak flows discharged at Site A were 230 cfs in 1998 and 234 cfs in 2005 (Table 1-1). These years were classified as wet years, and it stands to reason that the peak flows might be higher than the 2014/15 and 2015/16 periods which were critically dry and dry years, respectively.

It is likely that ongoing storm flows will occur in any year type and are dependent on the rainfall that occurs. Table 1-1 is an estimate of the magnitude measured in terms of flows (cfs) of these storm events.

3.1.2.2 Analysis of Discharge Impacts

The following questions address the potential concerns of local and downstream water users applicable to any project or strategy to manage storm water from the GDA.

- What are the loads that can be allocated to storm water activities?

Regardless of water year type, rainfall events will generate storm-induced flows that are beyond the management capacity of GDA and the SJRIP. Figure 10 shows the area rainfall and associated discharge through Site A for water year 2016 (a dry year type) and Figure 12 shows the same for water year 2017 (a wet year type). In both cases, storm events generate discharge from the GDA into the San Luis Drain.

New water quality objectives for the Lower San Joaquin River were adopted by the Regional and State Boards. During the non-irrigation season, the EC objective is 1550 micromhos/cm as a 30 day running average except during extended dry periods when concentrations shall not exceed 2470 micromhos/cm. Water years 2012 through 2016 was an extended dry period with an EC objective of 2470 µs/cm (monthly average).

Figure 17 shows the salt load as discharge at the Outlet (Site B) since the inception of the Grassland Bypass Project in 1997. Since the peak discharge of 220,000 ton in 1997 the discharge has been reduced by 80% to less than 50,000 ton.

Salt and selenium loads at Site N attributed to storm discharges can be calculated. Figure 18 shows the EC analysis of the impact of Site A to the San Joaquin River at Crows Landing (Site N) from January 2010 to December 2018. The figure shows the measured EC at Site N (per CDEC) as well as the calculated EC at Site N without the flows from Site A. As would be expected, eliminating Site A discharge reduces the EC at Site N. The day to day reduction is highly variable with an average reduction in EC of approximately 5%. The conductivity levels can be compared to proposed salinity objectives for the San Joaquin River from the mouth of the Merced River to Vernalis of 1550 µs/cm, increasing to 2470 µs/cm for extended dry periods (water years 2013 to 2016 were extended dry periods). These water quality objectives were not exceeded at Site N in any month for the 2010 to 2018 period.

Figure 19 shows the rain fall, discharge from the GDA through the San Luis Drain, superimposed over the selenium concentrations in the San Joaquin River at Crows Landing (Site N). As would be expected, Site N selenium concentrations rise when there is discharge from the GDA, however water samples from Site N have not exceeded the selenium WQO since June of 1997.

Figure 20 shows the discharge at the Outlet (Site B) for water year 2017 for flow and selenium compared to the selenium levels at Mud Slough (north) Site D and the San Joaquin River at Crows Landing (Site N). Figure 21 shows the same data for water year 2018.

Table 3-2 (Selenium Load) shows the selenium load at Site N (Crows Landing) attributable to the storm water flows at Site A. These loads are compared to the TMML selenium load values to meet water quality objectives at Site N. The loads are all below the TMML load values for a dry/below normal year and only exceeded in one month by 2 pounds (March) for a critical year.

Table 3-2: Selenium Load

	Selenium Load (Site B)	TMML Load Values to meet WQO at Crows Landing Water Year Type			
		CRIT	D/BN	AN	WET
October 2015	0	55	233	260	328
November 2015	10	55	233	260	328
December 2015	50	152	319	398	211
January 2016	104	151	319	398	211
February 2016	92	93	185	472	488
March 2016	94	92	184	472	488
April 2016	33	101	193	490	506
May 2016	28	105	197	497	512
June 2016	0	69	130	212	354

- Are there land use practices, such as farming, that affect the discharges and the selenium and salt concentrations?

General farming practices create a pathway for water to penetrate into the soil for efficient irrigation. This is accomplished through tilling, creating furrows or borders and applying soil amendments such as gypsum. These practices would also generally minimize runoff as compared to non-farming activities. The selenium in the soils is naturally occurring and not caused by farming. Salinity is both naturally occurring in the soil and shallow groundwater as well as brought in by irrigation. The operation of subsurface drains allows for the salt balance in the soil to be maintained by removing the salt in the shallow groundwater and that brought in by irrigation.

- Where does the storm water originate?

The storm water originates in the lower Grassland Drainage Area. Figure 22 shows the major drains (shown in red) that discharge to the Grassland Bypass Project. Rainfall is collected in these open drains and discharged to the Grassland Bypass Project. Panoche/Silver Creek (Figure 23) can only discharge to the Grassland Bypass if it is conveyed in reverse flow through irrigation systems.

- What tile water is in the discharge, and can it be controlled?

The subsurface tile systems discharge to the same drains that convey storm water. However, the tile systems can be shut off during storm events provided that they are accessible. The drains themselves will receive accretion flows of subsurface water that cannot be controlled. The concentrations of salinity and selenium in the storm water as discussed in Section 1.2.2 are reflective of these accretion flows that work their way into the storm water flows.

- What is impact to downstream users such as US Fish and Wildlife Service (USFWS) and California Department of Fish and Wildlife (CDFW)?

Downstream water quality impacts would include salt and selenium impacts to the San Joaquin River (measured at Crows Landing [Site N]. As noted earlier, even with the proposed drainage management tools, rain events will cause storm-induced discharges even in Critically Dry year types. An analysis was made to estimate the Site N conductivity and selenium concentrations based on historic discharges and loads. Figure 18 shows the monthly average EC for Site N from January 2010 to December 2018 as well as the calculated EC for the same time period if discharge from Site B were to be removed. Although the elimination of Site B discharges does lower the EC at Site N, EC water quality objective is met in all months for both cases.

Figure 20 and 21 shows the Site B discharge for significant storm events for 2017 and 2018, along with selenium concentrations for Site B, Site D, and Site N. These events are the two most recent, most reflective of current conditions, and represent a wet year (2017) and a below normal year (2018). In all cases, selenium levels at Site N are well below the 5 ppb WQO, many below the detection limit. This indicates that storm that discharges from the GDA are not impacting selenium levels in the San Joaquin River. Selenium levels at Site D exceeded the WQO four times in the 2017 event, with the highest reading at 8.44 ppb, and twice in the 2018 event, with the highest reading at 7.04 ppb.

- What if there is no outlet for the storm water, and it ponds against the Outside or Main Canal?

Storm water flows are uncontrollable and are created by rainfall events. Without a discharge to the north from the Grassland Drainage Area, there would be ponding of water against existing canal facilities such as the Outside Canal, the Main Canal or the Delta-Mendota Canal and possible breakthrough (see photo Figure 14), i.e., breaking of the banks into those facilities. This would be a significant event and could jeopardize water deliveries to agricultural areas outside of the Grassland Drainage Area and to private, state and federal wetland areas.

- What would be the impacts if the land is taken out of production and not irrigated?

Storm water is generated by rainfall and therefore would need to be dealt with regardless of agricultural activities. Agricultural districts manage the storm water by regulating the drainage conveyance facilities and routing the flows. If large portions of land were to be taken out of production (i.e., retired), the base of financial support from those productive lands would be lost, decreasing or ultimately eliminating available funding for infrastructure maintenance and storm water management activities so that some or all of the storm water would flow unmanaged. In this scenario, storm flows would saturate the soils, pond at the ends of fields and up against the major canals, where it would supersaturate the canal embankments and put the integrity of the canal at risk. The ponded water would accumulate selenium from accreted groundwater, which would concentrate as the ponds evaporated. In extremely wet years, levee breaches of the DMC or other major canals could occur, which would result in major impacts to the regional water conveyance system affecting the entire Central Valley.

Appendix G in the 2009 Final EIS/EIR found that the total estimated value of crops grown in the GDA and the SJRIP reuse facility in 2007 was estimated to be $237.8 million based on farm-level prices (see Table G-5). This estimate is based on acreages in Table G-4 plus the 2007 acreage in the SJIRP reuse facility. (Value per acre is based on data from Fresno County and represent farm level rather than retail price.) Farm revenues were projected to rise to a peak of $233.8 million in 2019. Large scale land retirement would substantially reduce farm revenues (and profits). As a result, regional economic activity will also be affected (reduced) because of the many linkages between production agriculture and myriad other sectors of the economy.

- What would be the impact of using the historic wetland channels to discharge rainfall-induced drainage?

Discharge of storm water into the wetland channels would be through the Camp 13 and Agatha Canals. These were the historic discharge points prior to the flip flop system within the Grassland Drainage Area, and these discharge points would likely have substantial capacity. During the term of the Grassland Bypass Project discharges have been made to the Agatha Canal 3 times, Jan-Feb 1997, Feb 1998 and Feb 2005. However, discharging any drainage water through these locations, which are fresh water delivery sites for the wetlands areas, would have the subsequent issues of selenium contamination from the storm water. Therefore, the impacts of bypassing the storm water into the wetland channels would most likely be substantial, and the environmental priority should focus on eliminating such discharges.

The year 2005 is the most recent year in which there were storm discharges to Grassland channels. In this year, selenium levels exceeded the 2 ppb each day that discharges occurred. Salinity and boron levels were also elevated. Turning off the tile sumps and potential use of the SJRIP would help to minimize Se in the storm water, however the 2 ppb selenium water quality objective would not likely be met. Discharging storm water to the wetland channels would be unacceptable due to impacts to the wetlands. Grassland Water District and the wildlife agencies would be concerned that this alternative would expose wildlife to elevated levels of Se.

3.1.3 Storm Water Management Tools

It will be necessary to minimize impacts to the wetland areas and the San Joaquin River from discharges to a storm water facility through a number of management tools that are currently available to the Grassland Basin Drainers. These tools are not a substitute for any of the project alternatives but would apply to all of the project alternatives in developing a comprehensive LTSWMP. These tools are as follows:

3.1.3.1 Turn Off Tile Sumps

Most tile discharges are controlled through a pump which discharges into deep collector drains through which it flows to the Grassland Bypass Project. As part of a Storm Event Plan, tile sumps would be turned off to the extent possible during storm events. Turning off tile sumps will utilize a portion of the shallow soil profile for storage. Even with the sumps turned off, subsurface water will accrete into the deep collector drains and would mingle with the storm water.

Proposed Improvements: Remote tile sump control is an enhancement to existing sumps that will be provided through the implementation of a Supervisory Control and Data Acquisition

(SCADA) system that will allow all of the tile pumps to be shut off from the appropriate district office. This improvement involves installation of radio and shutoff relays (electric) at each discharging tile pump throughout the GDA. Communications and repeater towers will be erected as required (two to four towers expected) to send the control signal from the SCADA computer at the district office to each of the pumps.

- Advantage: Utilizes shallow soil profile for storage and will reduce the selenium concentration of discharged water.
- Limitation: Will not prevent subsurface drainage from accreting into drains and mingling with storm water.

3.1.3.2 Pond Usage

A storage basin or pond is defined most often as a small reservoir constructed to regulate an irrigation water supply by collecting and storing water for a relatively short period. There are some minimal storage basins within the Grassland Drainage Area including those in Panoche Drainage District and Pacheco Water District. These facilities are limited to approximately 500 acre feet capacity. The basins would collect drainage during storm events to reduce peak flows and the associated discharge to the SLD, and then distribute the storm water to the reuse area or to the Grassland Bypass Channel (GBC) and SLD if there is insufficient reuse capacity. The existing storage basins would be managed in such a way as to prevent the evapo-concentration of selenium and other constituents. Water in the basins would be distributed to the SJRIP beginning in late February or discharged to the GBC to the SLD as soon as practical and consistent with procedures to avoid their use by wildlife. Hazing and other wildlife protection measures would be implemented according to the recommendations of a biologist. Depending on water quality, some of the water may be blended into regional irrigation systems as well. By late May, the ponds would be emptied.

Proposed Improvements: The Proposed Project includes new short-term storage basins that total approximately 200 acres in size with the ability to hold an additional 1,000 AF of storm-induced drainage from the GDA. They would be operated in a similar manner as the existing ponds explained above, i.e., filling begins with the first significant storm event and ponds are emptied by May). However, the greater capacity means less discharge to the GBC and SLD and greater retention for discharge to the reuse area than occurs at present.

- Advantage: Panoche and Pacheco have storage basins that can take drainage
- Advantage: Stored water would be diverted to SJRIP reuse area as capacity became available
- Limitation: Limited to 500 AF capacity at present, and additional basins needed
- Limitation: Possible exposure of wildlife to water with elevated selenium if regulating basins cannot promptly be drained (see Section 3.1.3.3 below)

3.1.3.3 Reuse

Because the salt tolerant crops within the SJRIP have very little water demand in the winter, reuse capacity is very limited in the wintertime. Currently, there are no ponds within the reuse area, and the ability to store water is limited, in part because of the need to prevent ponding of water at the lower ends of the fields. In combination with pond usage, the maximum managed flow with existing facilities within the Grassland Drainage Area is approximately 50 cfs for 15 days[1]. Once this maximum is reached, discharge or storage of some sort is required.

Proposed Improvements: The proposed acquisition of 1,450 acres would expand the existing reuse facility to 7,550 acres of useable reuse area. Approximately 1,000 acres of this acquisition is land that has been planted to salt tolerant crops as an individual District project to manage subsurface irrigation drainage and is not part of the current San Joaquin River Improvement Project. The proposal would be to acquire title to the leased acreage so that it is permanently dedicated and available for reuse and fully integrated into the existing reuse facility. Thus, the "expansion" would bring up to an additional 1,450 acres into the reuse project used as a management tool under any stormwater use agreement, but the actual management of 1,000 of the 1,450 acres would not be changed. Additional acquired acres would be subject to the same biological monitoring requirements established by the USFWS in their Biological Opinion (see USFWS 2009), as amended.

- Advantage: SJRIP could handle as much as 50 cfs for 15 days.
- Advantage: Increased summer reuse capacity.
- Limitation: The amount that could be discharged to the SJRIP is less that what would be needed during storm events (i.e., only a partial solution), and other impacts would be created.

3.2 EVALUATION OF PRELIMINARY ALTERNATIVES

Federal planning criteria have been used on U.S. Bureau of Reclamation (USBR) projects to assist in the formulation and evaluation of alternative plans and projects and to determine which alternatives best address planning objectives. These criteria were described in the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (March 10, 1983): effectiveness, efficiency, acceptability, and completeness. In March 2013, the 1983 study was superseded by the Principles and Requirements for Federal Investments in Water Resources established pursuant to the Water Resources Planning Act of 1965 (Public Law 89-8), as amended (42 U.S.C.1962a-2) and consistent with Section 2031 of the Water Resources Development Act of 2007 (Public Law 110-114). The 2013 Principles and Requirements confirmed the following under Section H. Design of Alternatives:

> "Alternative plans, strategies, or actions are to be formulated in a systematic manner to ensure that a range of reasonable alternatives are evaluated. The final analysis should include, at a minimum, the following concepts in order to support full disclosure and promote transparency in the decision making process. Each alternative plan, strategy or action is to be formulated to consider the following four criteria: completeness, effectiveness, efficiency, and acceptability." (p. 12)

Initial LTSWMP alternatives are developed and evaluated herein consistent with the four criteria effectiveness, efficiency, acceptability, and completeness based on the definitions contained in the Principles and Requirements:

[1] The maximum diversion rate could be as high as 70 cfs but this assumes that some pumps will be inaccessible due to wet conditions. 15 days comes from 3" over 6000 acres.

- **Effectiveness** is the extent to which an alternative alleviates the specified problems and achieves the specified opportunities (formerly objectives). The specified problems and opportunities against which effectiveness is measured for the Project are as follows:
    1. To eliminate, to the extent feasible, storm water drainage discharged from the Grassland Drainage Area into wetland water supply conveyance channels.
    2. To facilitate storm water management that maintains the viability of agriculture in the Project Area and protects water quality in the San Joaquin River.
    3. To keep storm water drainage from breaking into irrigation water supply channels and causing damage.
    4. To avoid have impacts on wetland soil and water quality.
    5. To avoid unplanned/inadvertent/unmanaged ponded water containing selenium that could impact birds within the GDA as well as downstream habitat and water quality in the wetland areas and wildlife refuges.
    6. To provide an outlet for storm water to flow to the San Joaquin River from the Grassland Drainage Area (similar to what occurred historically and before the Use Agreement for use of the San Luis Drain), that also protects the integrity and quality of wetlands and wildlife refuges.
- **Efficiency** is the extent to which an alternative alleviates the specified problems and realizes the specified opportunities at the least cost.
- **Acceptability** is the viability and appropriateness of an alternative from the perspective of the Nation’s general public and consistency with existing Federal laws, authorities, and public policies. It does not include local or regional preferences for particular solutions or political expediency.
- **Completeness** is the extent to which an alternative provides and accounts for all features, investments, and/or other actions necessary to realize the planned effects, including any necessary actions by others. It does not necessarily mean that alternative actions need to be large in scope or scale. (Previously, necessary features/actions included mitigation measures if required to realize planned effects.)

3.2.1 Alternative A. Storage Ponds

The use of both existing and newly-constructed/additional storage basins would operate as regulating reservoirs and are subject to the limitations identified in Section 3.1.3.2. Alternative A would also include the management tools of turning off tile sumps during storm events and limited use of the SJRIP reuse area in the winter if practical, i.e., soil profile not saturated with rain water. The new storage basins would need to exceed the existing storage basins (500 AF capacity) by 1,600 acres in order to handle all of the storm water (up to 8,000 AF) without the ability to divert some of the flow to the GBC and San Luis Drain. An estimate of the cost for basin capacity of 8,000 AF is shown in Table 3-3. The “Total Cost” includes the annual costs for 20 years.

Table 3-3 Cost Estimate to Develop Storage Basins

Option A - Storage Basins	Capital Cost in 2017 $	O&M Cost in 2017 $	Total Cost
Purchase Land	$ 14,400,000		$ 14,400,000
Construct Basins	$ 5,000,000	$ 100,000	$ 7,000,000
Inlet Pump Stations	$ 2,500,000	$ 25,000	$ 3,000,000
Tile System Shutoff	$ 850,000	$ 8,500	$ 1,020,000
Totals	$ 22,750,000	$ 133,500	$ 25,420,000
Annual divided by 20 years			$ 1,271,000
Rounded:			$ 1,300,000
Estimated Acre-Feet			6,300
Cost per acre-Foot			$ 206

Effectiveness: Alternative A could substantially meet objectives 1 and 2 as long as the capacity was sufficient to handle all anticipated storm flows and the need for conversion of productive agricultural land is minimized. Large ponds adjacent to water supply channels could put the channels in jeopardy. Concerning objective 4, wetland soil and water quality could be affected with large ponds adjacent to wetlands. Meeting objective 5 would be difficult given the size of the basins to hold back storm flows for December through April period (up to 5 months during the winter), until water can be reused. Even with the sumps turned off, there would be selenium in the water diverted to the basins, which could concentrate as the basins water evaporates. Measures are available to discourage waterfowl use of the reservoirs, but the magnitude of the new basins (1,600 additional acres) makes some wildlife exposure to Se likely. Objective 6 would not be met as there would be no discharge to any channel leading to the San Joaquin River.

Efficiency: Alternative A alleviates the specified problems associated with unmanaged storm flows and realizes most of the specified opportunities for an annual cost of $1,300,000 or $206/AF of managed storm water. Because existing storage are not adequate, construction of new basins would be necessary. To the extent these new ponds remove agricultural lands from active production (1,600 acres of mixed ag use), there is a negative cost of lost production and agricultural land value. Maintenance would include maintaining levees and control structures, as well as mitigation.

Acceptability: Alternative A needs to be acceptable to the Bureau of Reclamation, both local and regional general publics (in particular, downstream water users), local farmers, Grassland Water District, and State and Federal wildlife agencies. The wildlife agencies and the general public are likely to be skeptical of any ponds that could expose wildlife to elevated levels of Se, a clear disadvantage, especially the size of basins needed to manage all of the storm water downstream water users may resist the loss of all of the storm flows that have gone into the River historically. This alternate would meet the National Toxics Rule for selenium because there would be no storm water discharge to Mud Slough (north) with elevated levels of selenium.

Completeness. Alternative A requires further explanation of new ponds and the linkage of all ponds/reservoirs. The Grassland Basin Drainers would develop the ponds and be responsible for maintenance of the ponds. However, more work needs to be done to identify all features (including possible use of the SJRIP reuse area), investments, and/or other actions necessary to realize the planned effects, including any necessary actions by others. Large ponds could impact conveyance channels.

3.2.2 Alternative B. Local Management/Coordination with Use of the San Luis Drain

Local management and coordination with downstream water users (including Grassland Water District) and continuing to use the Grassland Bypass Project for conveyance of storm water to the San Luis Drain is similar to the activities that occur at present under the current use agreement with Reclamation that expires at the end of 2019. Modifications would be to increase the capacity of the existing Grassland Bypass Channel to handle storm flows (without ponding against canals or in the reuse area) up to 300 cfs, to turn off tile sumps during storm events, and to make limited use of the SJRIP reuse area in the winter and of existing regulating ponds that discharge to the reuse area.   An estimate of the cost is shown in Table 3-4. This cost does include the cost of the new SCADA system. The "Total Cost" includes the annual costs for 20 years.

Table 3-4 Cost Estimate for Local Management and to Increase GBC Capacity to SLD

Option B - Local Management//Coordination with Use of San Luis Drain	Capital Cost in 2017 $	O&M Cost in 2017 $	Total Cost
Remove sediment in the San Luis Drain	$ 4,600,000	$ 100,000	$ 6,600,000
Enlarge the Grassland Bypass Project connection to the San Luis Drain	$ 1,260,000	$ 30,000	$ 1,860,000
Enlarge the existing outlet from the San Luis Drain to Mud Slough	$ 475,000	$ 10,000	$ 675,000
Tile System Shutoff SCADA	$ 850,000	$ 8,500	$ 1,020,000
Downstream mitigation	$ 150,000	$ 330,000	$ 6,750,000
Totals	$ 7,335,000	$ 478,500	$ 16,905,000
Annual divided by 20 years			$ 845,250
Estimated Acre-Feet			6,300
Cost per acre-Foot			$ 134

Effectiveness: Alternative B could substantially meet objectives 1, 3, and 5 as long as the GBC capacity was sufficient to handle all anticipated storm flows. Objective 2 would maintain viability of agriculture the Se objective in Mud Slough would likely not be met. Concerning objective 4, wetland soil and water quality would be unaffected from ponding but the SJRIP operation could affect wetland and soil quality. Turning off the tile sumps would assist in reducing the amount of Se conveyed in the channel and subsequently ending up in sediment in both the channel and SLD. The sediment could be managed as occurs at present which is acceptable to the USFWS. For objective 6, storm water would stay out of the wetland supply channels and flow to the San Joaquin River similar to what has occurred historically since the Grassland Bypass Project was implemented but water quality objective would likely not be met.

Efficiency: Alternative B alleviates the specified problems associated with unmanaged storm flows and realizes most of the specified opportunities for an annual cost of $845,000 or $134/AF of managed storm water. Expanding the existing channel would require minimal if any additional acreage, so there would not be any lost production. Maintenance costs would include periodic removal of sediment containing Se, maintenance of conveyance facilities, and downstream mitigation. Timing would be difficult as the sediment removal and new structures would have to be constructed by the December 31, 2019 deadline.

Acceptability: Alternative B needs to be acceptable to the Bureau of Reclamation, the Central Valley Regional Water Quality Control Board (Regional Board), both local and regional general publics (in particular, downstream water users), local farmers, Grassland Water District, and State and Federal wildlife agencies. The wildlife agencies are likely to be less concerned that this alternative would expose wildlife to elevated levels of Se, a clear advantage over ponds under Alternative A. However, the Regional Board is likely to be concerned with the frequency of exceedances of selenium WQO in Mud Slough (North). Of the three options listed for storm induced flows, it appears that the continued use of the San Luis Drain would provide the most benefit to wetland areas. Downstream stakeholders have expressed concern for continued discharge of storm waters. The impact has been analyzed in Section 3.1.2.2. Alternative B does not meet the National Toxics Rule for selenium in Mud Slough (north).

Completeness. Alternative B requires enlarging the capacity of the Grassland Bypass Channel (preferred) for conveyance of storm water to the San Luis Drain rather than to other wetland water supply channels. Providing a way to handle historic storm water flows would benefit other stakeholders also (i.e., Grassland WD and state and federal refuges). This alternative would require conveyance system enlargement and maintenance to include sediment removal and some use of the SJRIP to reuse storm flows to the extent possible. Timing would be difficult as the sediment removal and new structures would have to be constructed by the December 31, 2019 deadline.

3.2.3 Alternative C. Combination of Storage Basins and Use of San Luis Drain

This alternative is a combination of some of the improvements to the short-term storage basins approach under Alternative A with use of the San Luis Drain included under Alternative B, along with some expansion of the reuse area. The project will acquire approximately 1,000 acres of existing reuse area currently held in lease and increase the size of the SJRIP by 450 acres for a total of 1,450 acres. Additional components will include expanded drainage conveyance systems; installation of a SCADA system to remotely turn off tile sumps during storm events; construction of short-term storage basins and conveyance to capture drainage flows. The existing capacity of the Grassland Bypass Channel and that of the connections to the San Luis Drain (~150 cfs) will remain as they are. The expansion of the storage basins would be limited to an additional 200 acres for 1,000 AF of holding capacity. This alternative would also require expansion of the reuse area to allow for discharge of the storm water to the reuse area as soon as practical and without leading to water ponding on the surface of the reuse area. If the soils at the reuse area are too wet to handle the discharge from the reservoirs, then the storm water would be discharged to the Drain once capacity of the basins is reached. This approach minimizes the size of the new storage basins but does increase the size of the reuse area to a maximum of 7,550 acres of useable reuse area (1,450 acres over the present area of 6,100 acres). An estimate of the cost is shown in Table 3-5. The “Total Cost” includes the annual costs for 20 years.

Table 3-5 Cost Estimate for Combination of Short-term Storage Basins and Use of the San Luis Drain

Option C - Combination of Storage Basins and Use of the San Luis Drain	Capital Cost in 2017 $	O&M Cost in 2017 $	Total Cost
Additional Reuse Land Purchase & Development	$ 22,355,900	$ 270,055	$ 27,757,000
Drainage Reuse Infrastructure	$ 3,224,800	$ 75,000	$ 4,724,800
Short-term Storage Basins	$ 3,746,300	$ 75,000	$ 5,246,300
Tile System Shutoff	$ 850,000	$ 8,500	$ 1,020,000
Remove sediment in the San Luis Drain	$ 4,600,000	$ 100,000	$ 6,600,000
Totals	$ 34,927,000	$ 858,555	$ 45,348,100
Annual divided by 20 years			$ 2,267,405
Say			$ 2,268,000
Estimated Acre-Feet			6,300
Cost per acre-Foot			$ 360

Concerning the criteria of effectiveness, efficiency, acceptability, and completeness, Alternative C is a combination of the analyses presented for each alternative (A and B) separately with the following additional considerations.

Effectiveness: This alternative combines the most effective components of Alternative A to minimize discharge, while taking advantage of existing and new reuse capacity to minimize basin size. With 1,400 fewer acres of storage basins than in Alternative A, Alternative C would have a smaller potential impact on waterfowl (objective 5). Furthermore, proper design and operation of the basins can reduce the attractiveness of the basins to waterfowl. Pond size would be less than Alternate A but the SJRIP operation could affect wetland and soil quality. Concerning objective 6, less storm water would be discharged to the SLD and the River than occurred historically; and the SCADA sump shut-off system will reduce the selenium concentration of the discharged water, resulting in less Se discharged and meeting of Mud Slough (north) water quality objectives.

Efficiency: Alternative C alleviates the specified problems associated with unmanaged storm flows and realizes most of the specified opportunities for an annual cost of $2,268,000 or $360/AF of managed storm water. Expansion of the existing SJRIP would occupy approximately 1450 acres of active farmland, however the majority of this acreage is already being farmed to forage crops so the change in farming practices would be minimal. The basins would be located on parcels within the existing SJRIP. This land conversion would reduce the reuse capacity by approximately 600 acre feet per year, which would be made up by the SJRIP expansion previously noted. These basins would triple the current storage capacity for drainage management and dramatically reduce the discharge to Mud Slough (North). Maintenance costs would include periodic removal of sediment containing from the basins, pump maintenance, and farming practices related to the operation of the expanded reuse area. This alternate has the highest cost but is implementable under the time constraints.

Acceptability: The concerns are the same as for Alternatives A and B with the emphasis on changes to both advantages and disadvantages. The alternative meets the National Toxics Rule criterion for selenium in Mud Slough (north).

Completeness: Alternative C includes the most useful features of Alternatives A and B, providing an effective and manageable amount of storage to minimize discharge, and a discharge outlet that will prevent uncontrolled ponding and protect the integrity of canal levees.

3.2.4 Summary Results

Table 3-6 presents a summary of the evaluation above using + for positive effect, 0 for neutral, and – for negative effect.

Table 3-6 Preliminary Evaluation of LTSWMP Alternatives

Evaluation Criteria	A. Storage Ponds	B. GBP to SLD	C. Storage and SLD
Effectiveness:			
1. Eliminate storm water drainage discharged into wetland water supply conveyance channels.	+	+	+
2. Facilitate storm water management that maintains viability of agriculture and protects water quality in the San Joaquin River.	+	+/–	+
3. Keep storm water drainage from breaking into irrigation water supply channels and causing damage.	–	+	+
4. Avoid Impacts on wetland soil and water quality.	–	0	0
5. Avoid ponded water containing Selenium that could impact birds within the GDA and downstream in the wetland areas/wildlife refuges.	–	+	0
6. Provide an outlet for storm water to flow to the San Joaquin River similar to what occurred historically while meeting the other preliminary objectives.	–	0	+
Efficiency	0	0	–/+
Acceptability	–/+	+/–	+
Completeness	–	–	+
Summary scores (+ and –)	3+/6–	5+/3–	7+/1–

3.2.5 Proposed Project

The alternative with the least negative effects is Alternative C, Combined Storage and Use of the SLD. It would use all of the storm water management tools: turn off tile sumps, use existing regulating ponds, and use the SJRIP reuse area in winter plus a combination of reduced Alternative A and a reduced Alternative B. Alternate C has the most positive effects, and although the most costly of the three alternatives, it has the best likelihood of being implemented by December 31, 2019.

3.3 IMPLEMENTATION (SUBSEQUENT PROCESS)

In order to utilize the San Luis Drain for storm water discharge, authorization to utilize the San Luis Drain to convey storm water will need to be confirmed by the Bureau of Reclamation and a new Use Agreement will need to be created between the San Luis & Delta-Mendota Water Authority and the Bureau of Reclamation. The goal would be to have in place before December 31, 2019, both the completed Use Agreement and any necessary environmental approvals. The Waste Discharge Requirements for the Grassland Bypass Project will need to be modified by the Regional Board to allow discharges of storm water after December 31, 2019.

SECTION 4
References

Bureau of Reclamation (Reclamation). 2009. Final Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for Continuation of the Grassland Bypass Project, 2010 – 2019. December 30.

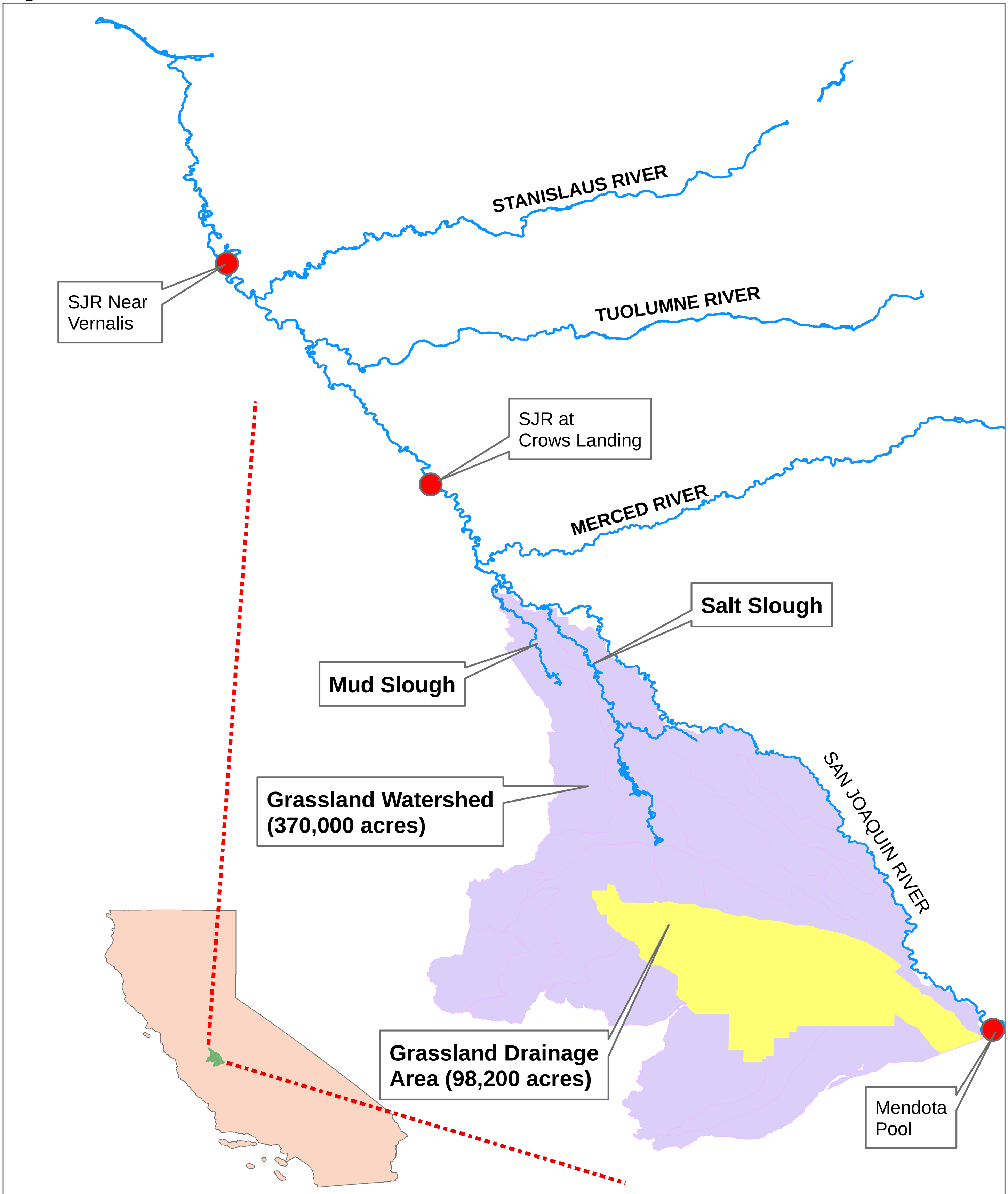
Bureau of Reclamation (Reclamation). 2009. Agreement for Use of the San Luis Drain for the Period January 1, 2010 through December 31, 2019. Agreement No._10-WC-20-3975 Bureau of Reclamation and the San Luis & Delta-Mendota Water Authority. December

Council on Environmental Quality (CEQ). 2013, Principles and Requirements for Federal Investments in Water Resources. March.

Council on Environmental Quality (CEQ). 1983, Principles and Guidelines for Federal Investments in Water Resources. March 10.

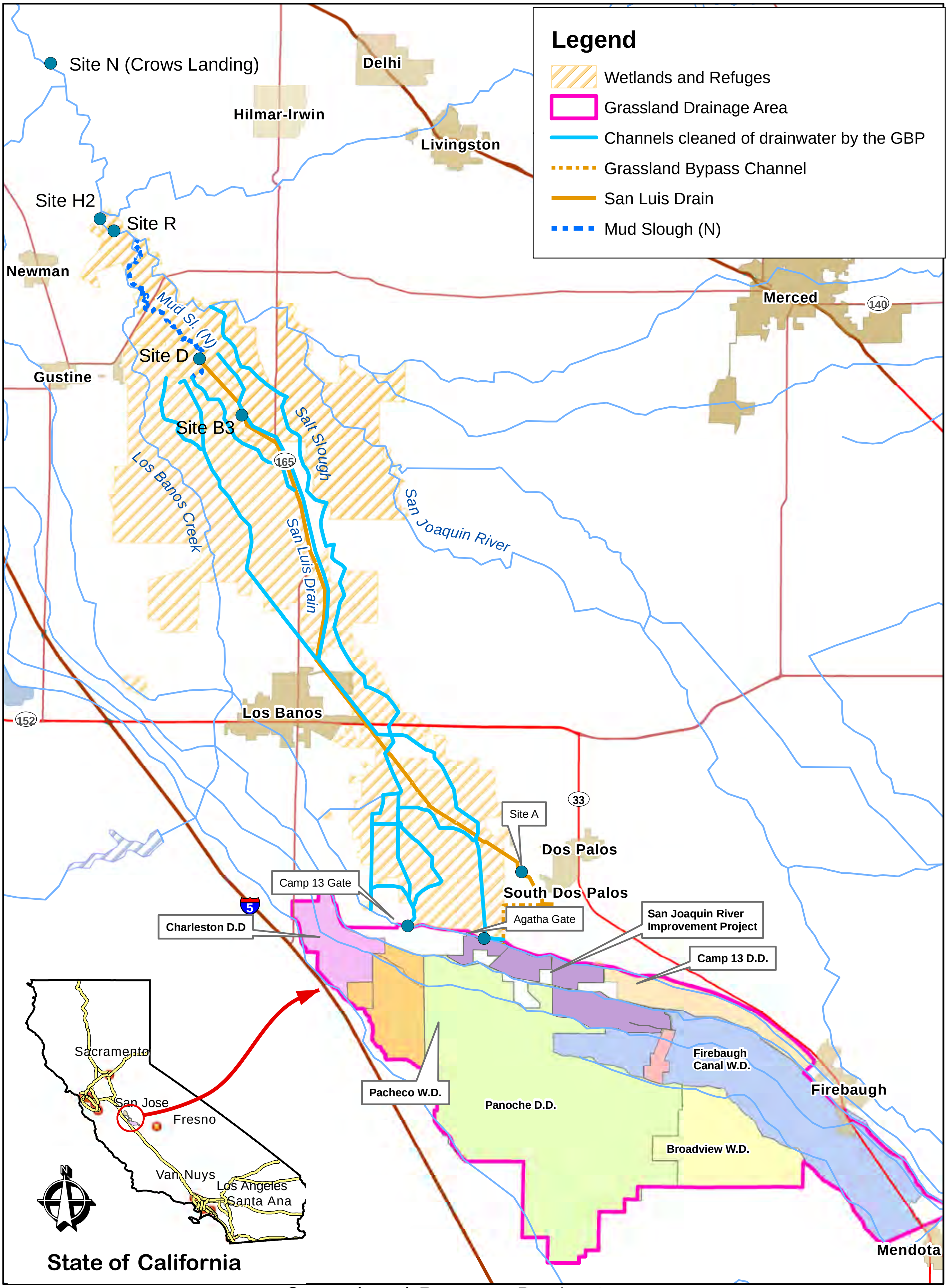
United States Department of the Interior, Fish and Wildlife Service (USFWS). 2017. San Luis National Wildlife Refuge Complex. Letter from Kim Forrest, Refuge Manager to Joseph McGahan, President, Summers Engineering, Inc. October 3.

Figure 1



Watershed Location Map
Lower San Joaquin River

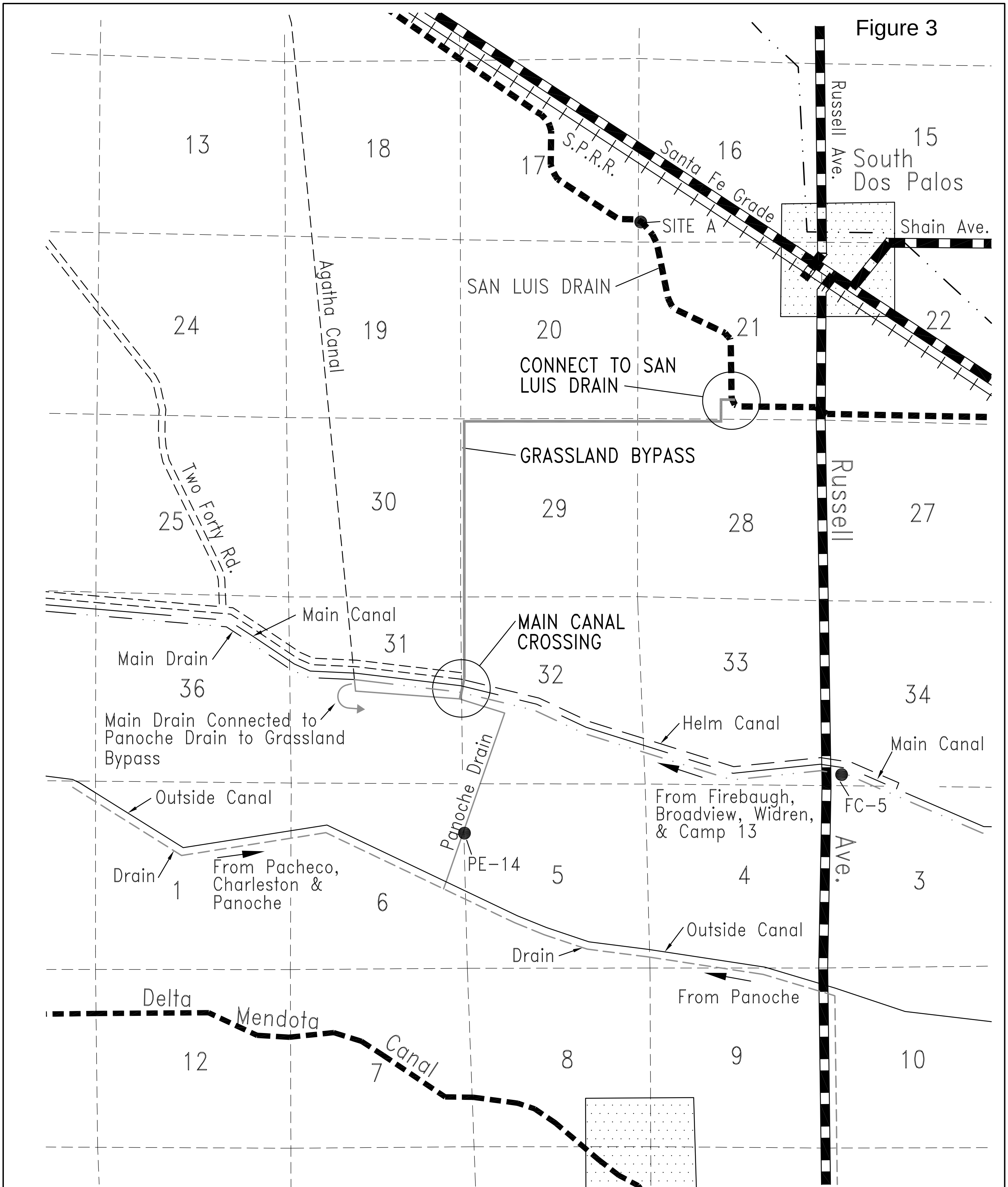
Figure 2



Grassland Bypass Project Location Map

Prepared by:
Summers Engineering, Inc.
Consulting Engineers
Hanford California

Figure 3



LOCATION MAP
Grassland Bypass Channel

SUMMERS ENGINEERING, INC.
Consulting Engineers
HANFORD CALIFORNIA

DECEMBER 2017

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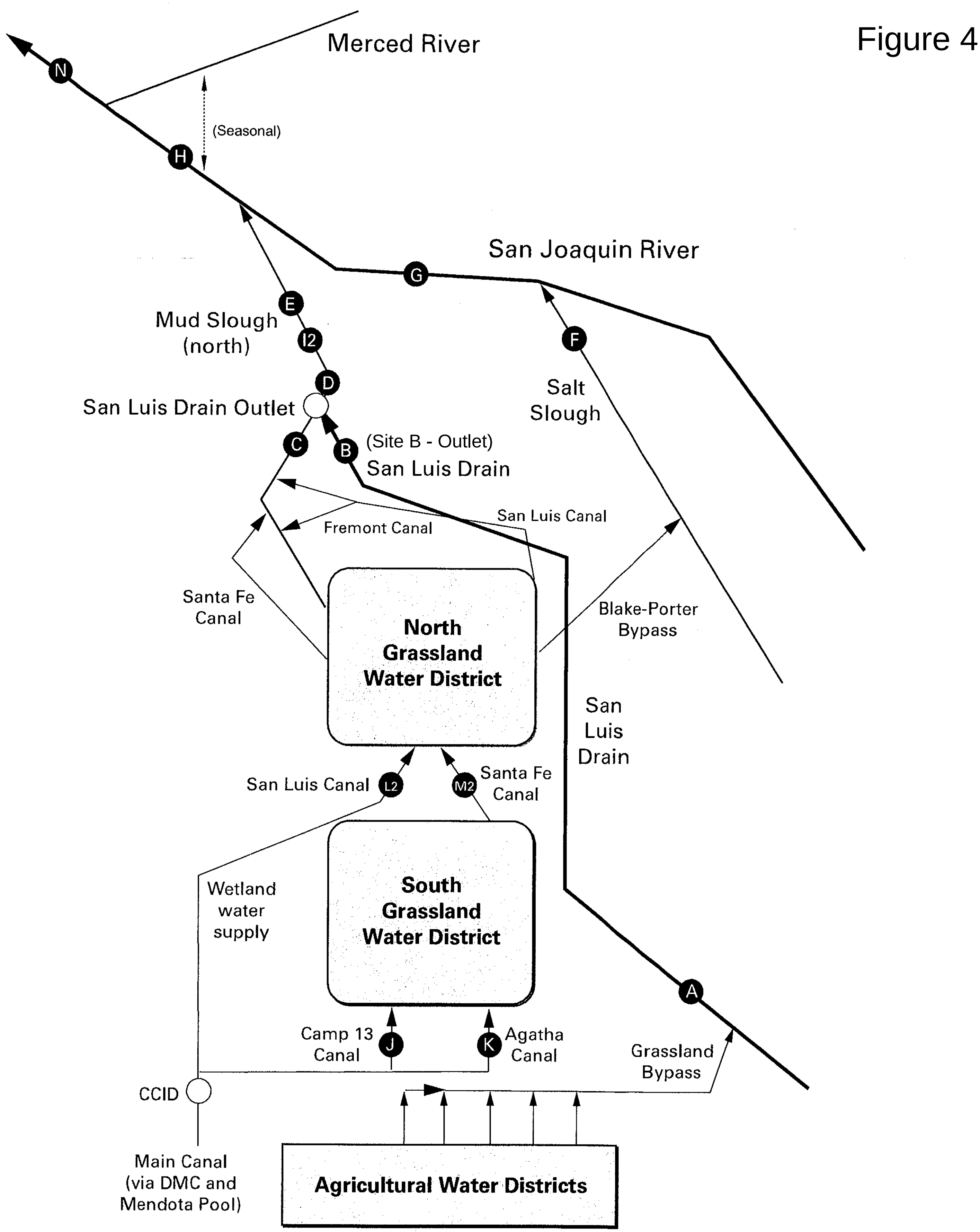
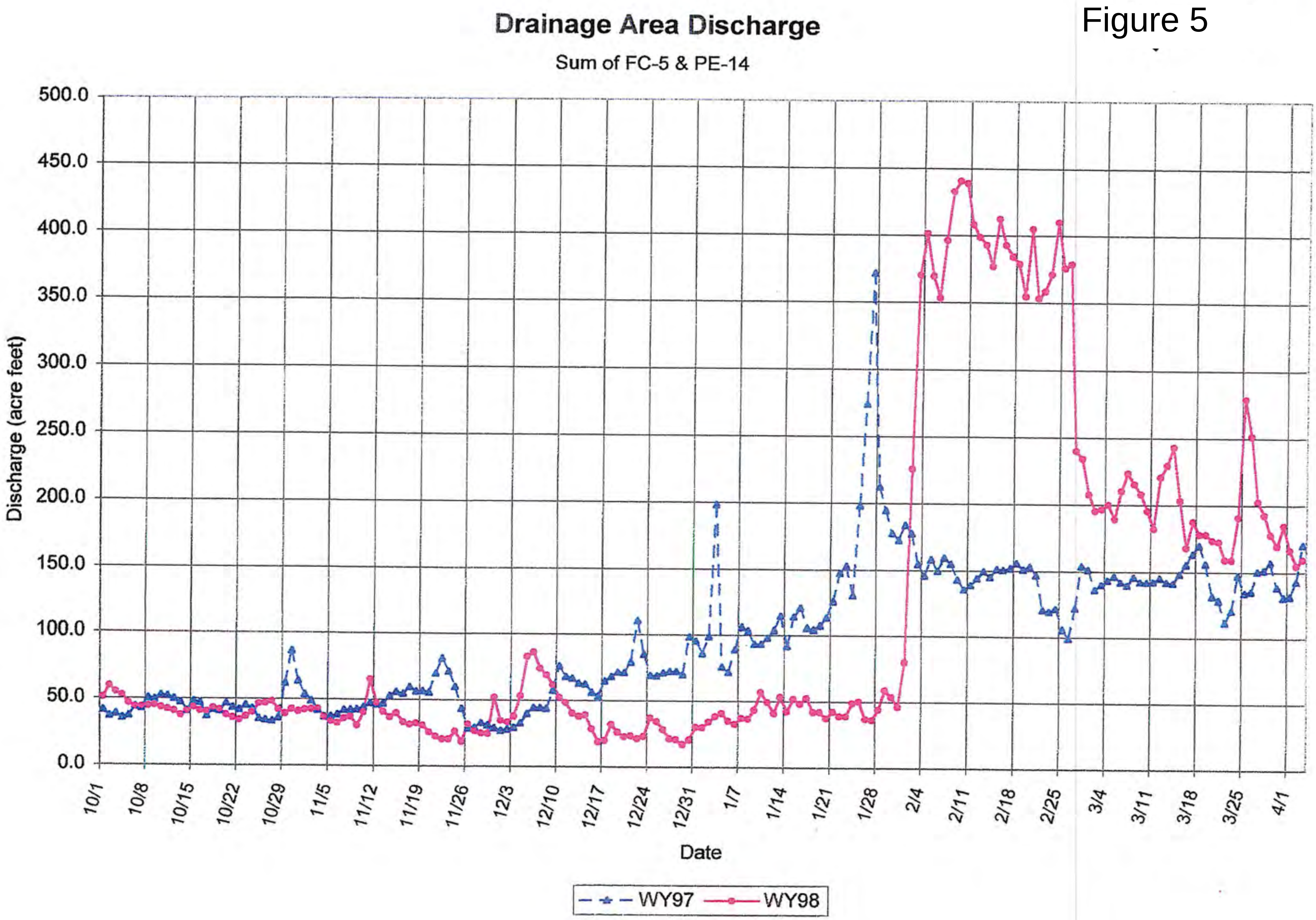


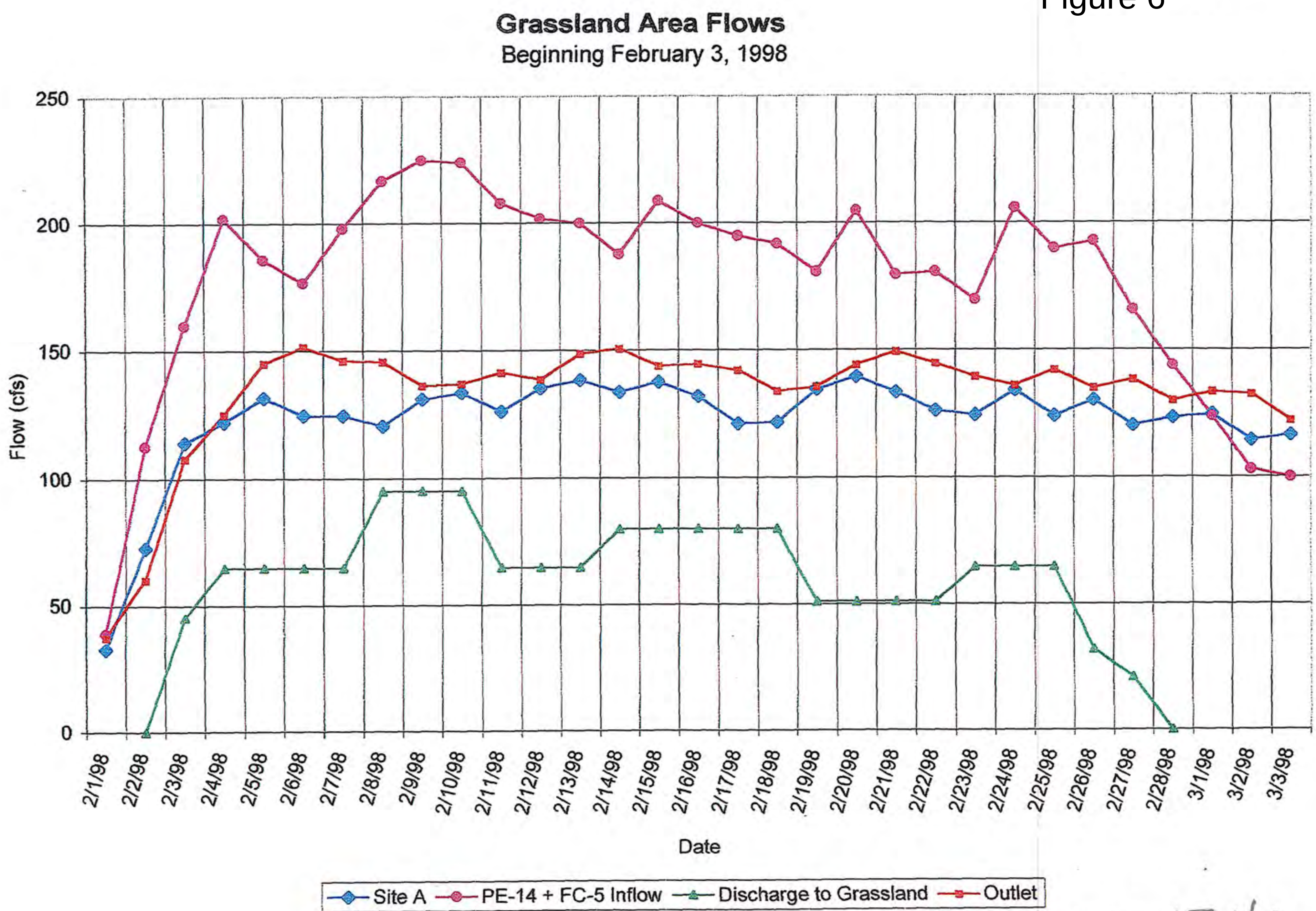
Figure 4
Merced River
(Seasonal)
San Joaquin River
Mud Slough
(north)
San Luis Drain Outlet
(Site B - Outlet)
San Luis Drain
Salt
Slough
San Luis Canal
Fremont Canal
Santa Fe
Canal
North
Grassland
Water District
Blake-Porter
Bypass
San
Luis
Drain
San Luis Canal
Santa Fe
Canal
Wetland
water
supply
South
Grassland
Water District
Camp 13
Canal
Agatha
Canal
Grassland
Bypass
CCID
Main Canal
(via DMC and
Mendota Pool)
Agricultural Water Districts
N
H
G
E
I2
D
F
C
B
L2
M2
A
J
K

Figure 5



Drainage Area Discharge
Sum of FC-5 & PE-14
Discharge (acre feet)
500.0
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31
1/7
1/14
1/21
1/28
2/4
2/11
2/18
2/25
3/4
3/11
3/18
3/25
4/1
Date
WY97
WY98

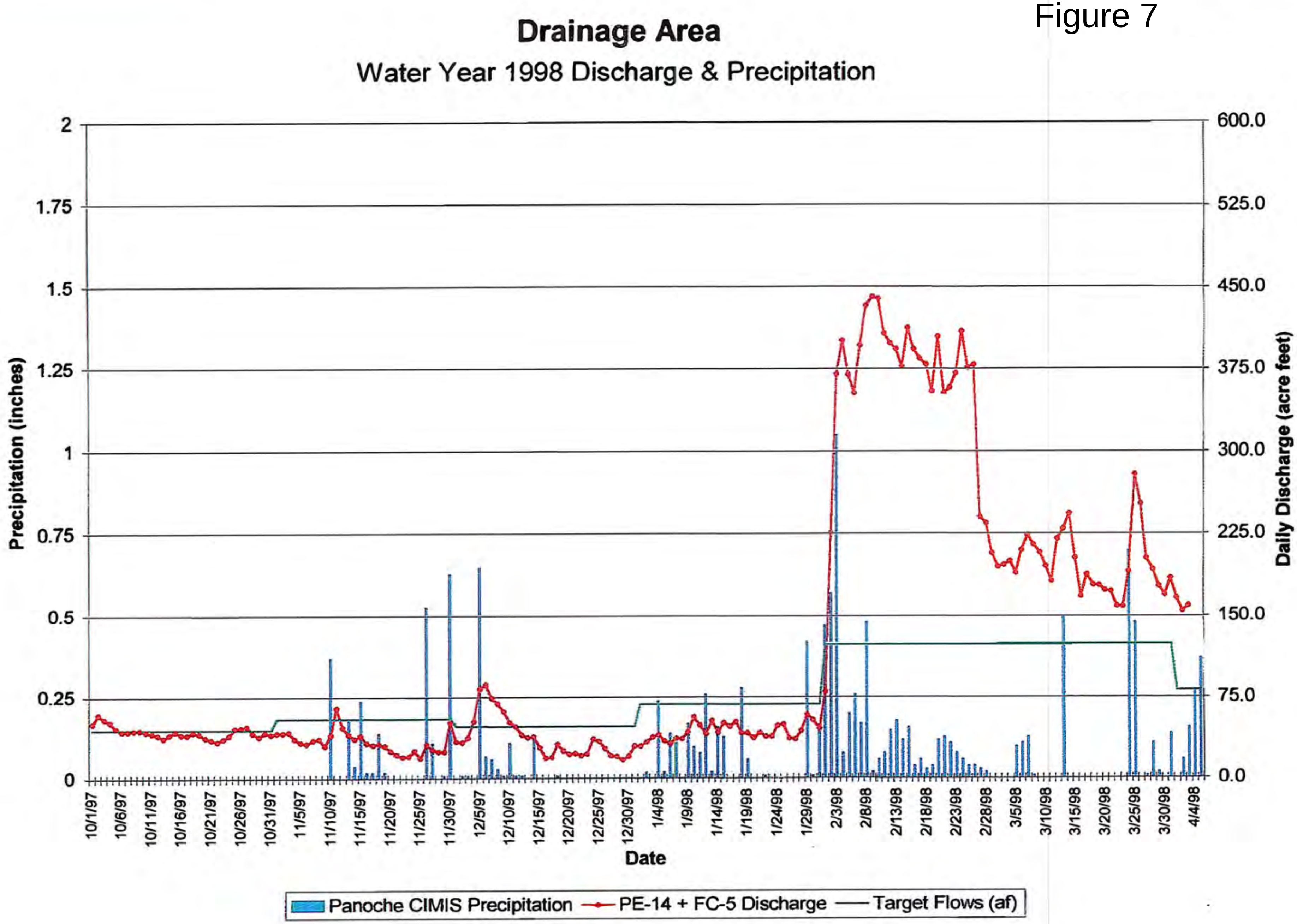
Figure 6



Site A Max 140 cfs
Disch to GWD 90 cfs
230 cfs

Site B Max 150 cfs
90 cfs
240 cfs

Figure 7



Drainage Area
Water Year 1998 Discharge & Precipitation
Precipitation (inches)
Daily Discharge (acre feet)
Date
Panoche CIMIS Precipitation
PE-14 + FC-5 Discharge
Target Flows (af)

Figure 8

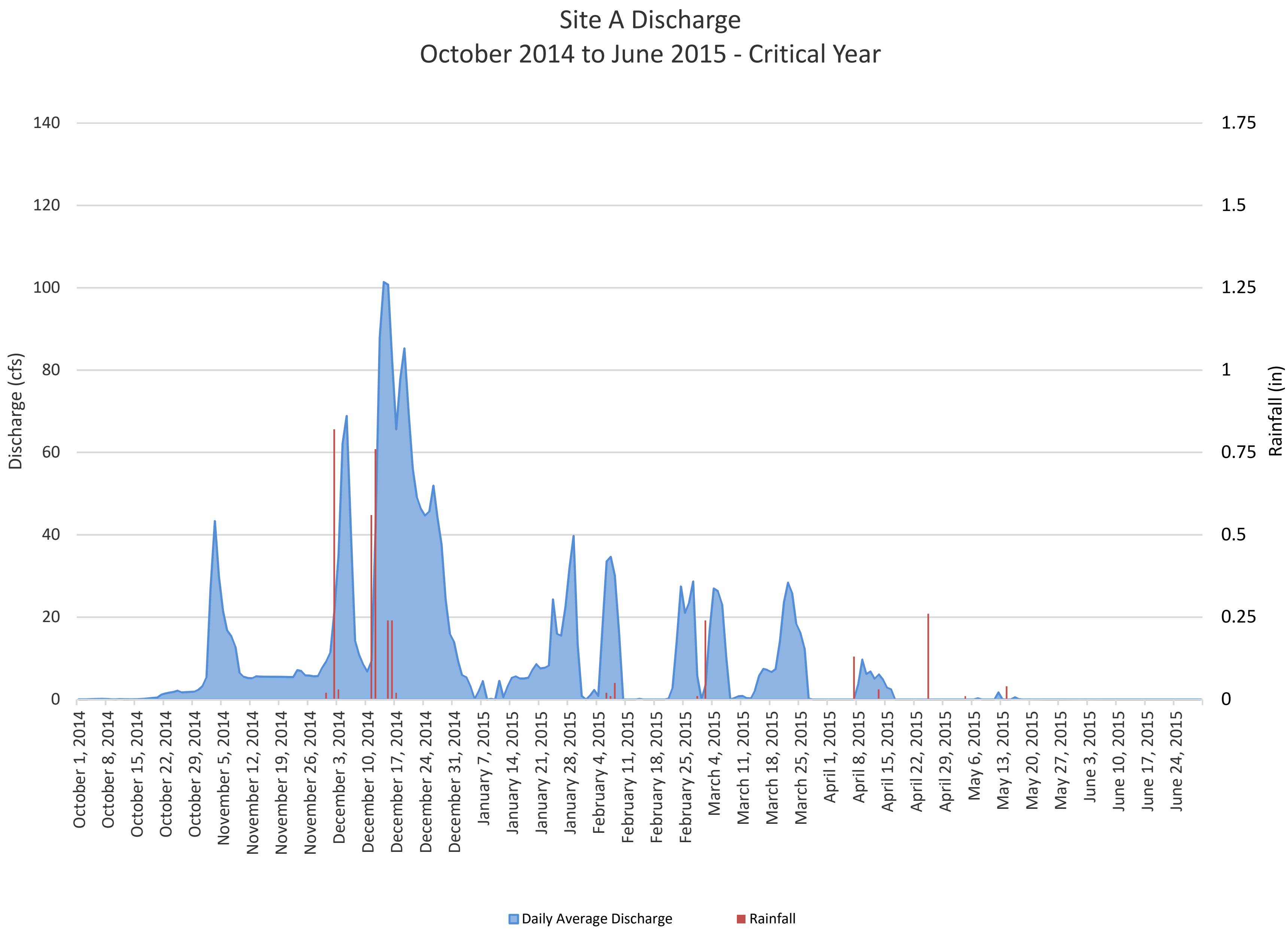


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Figure 9

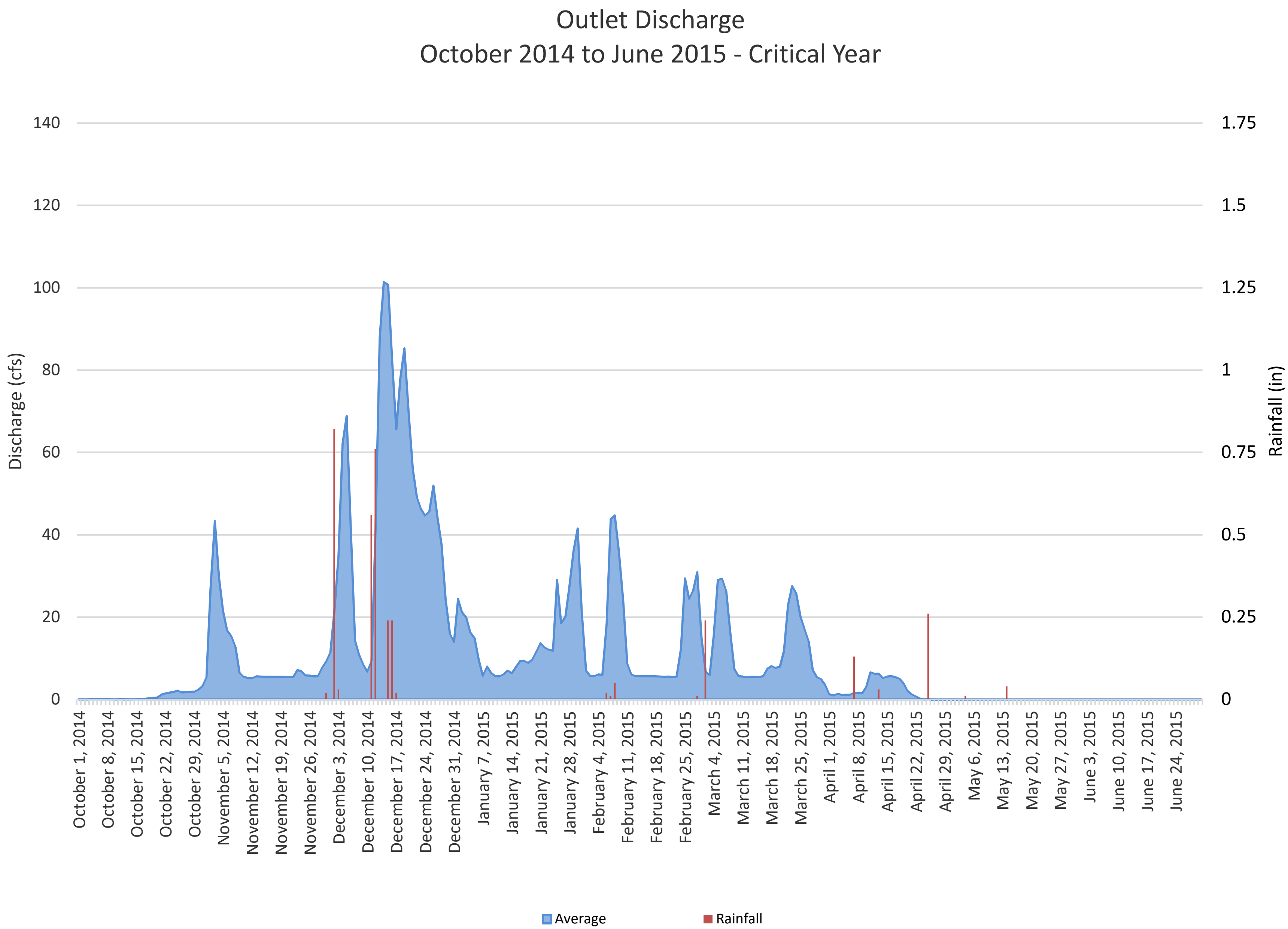

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Figure 10

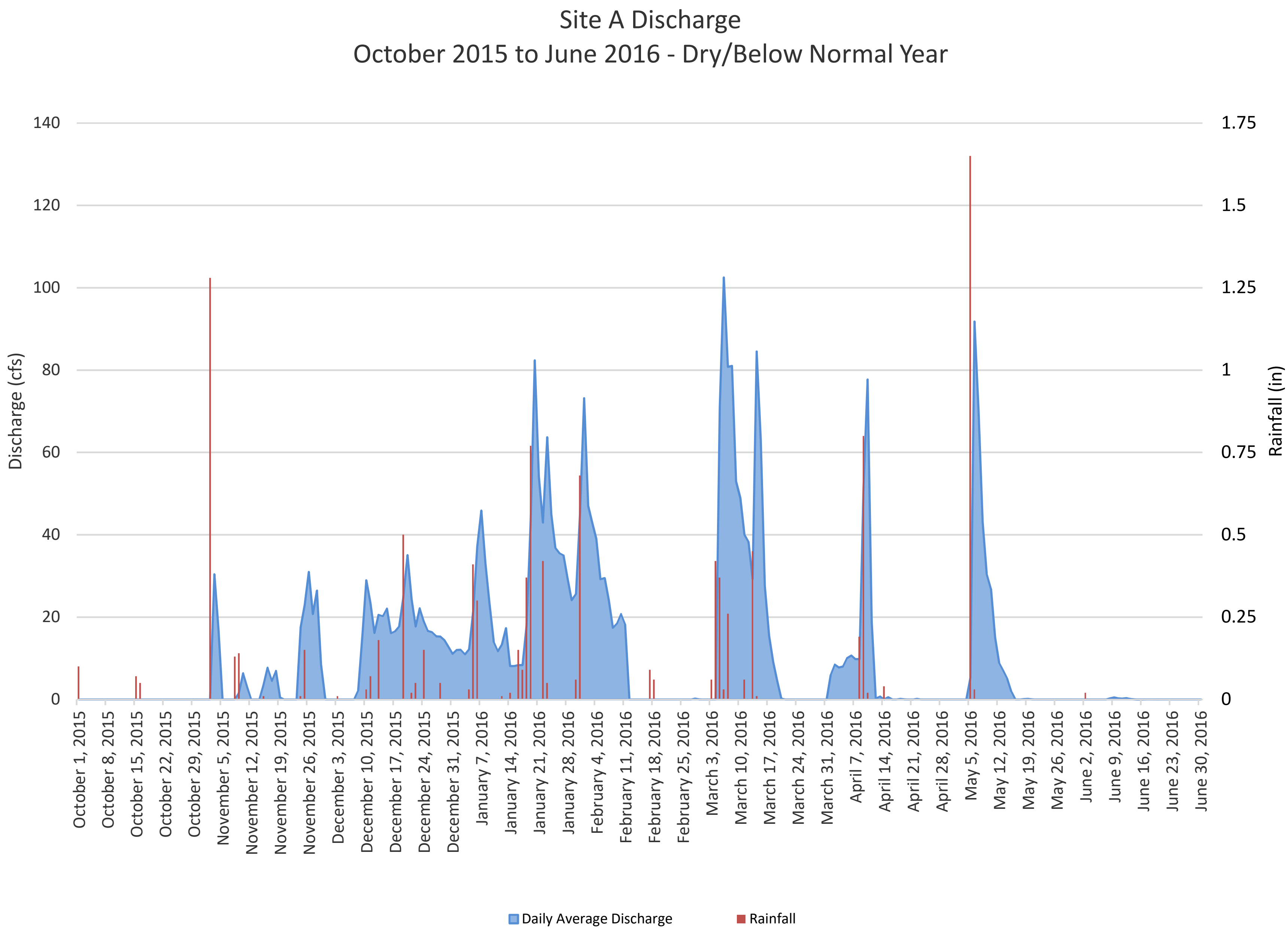

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Figure 11

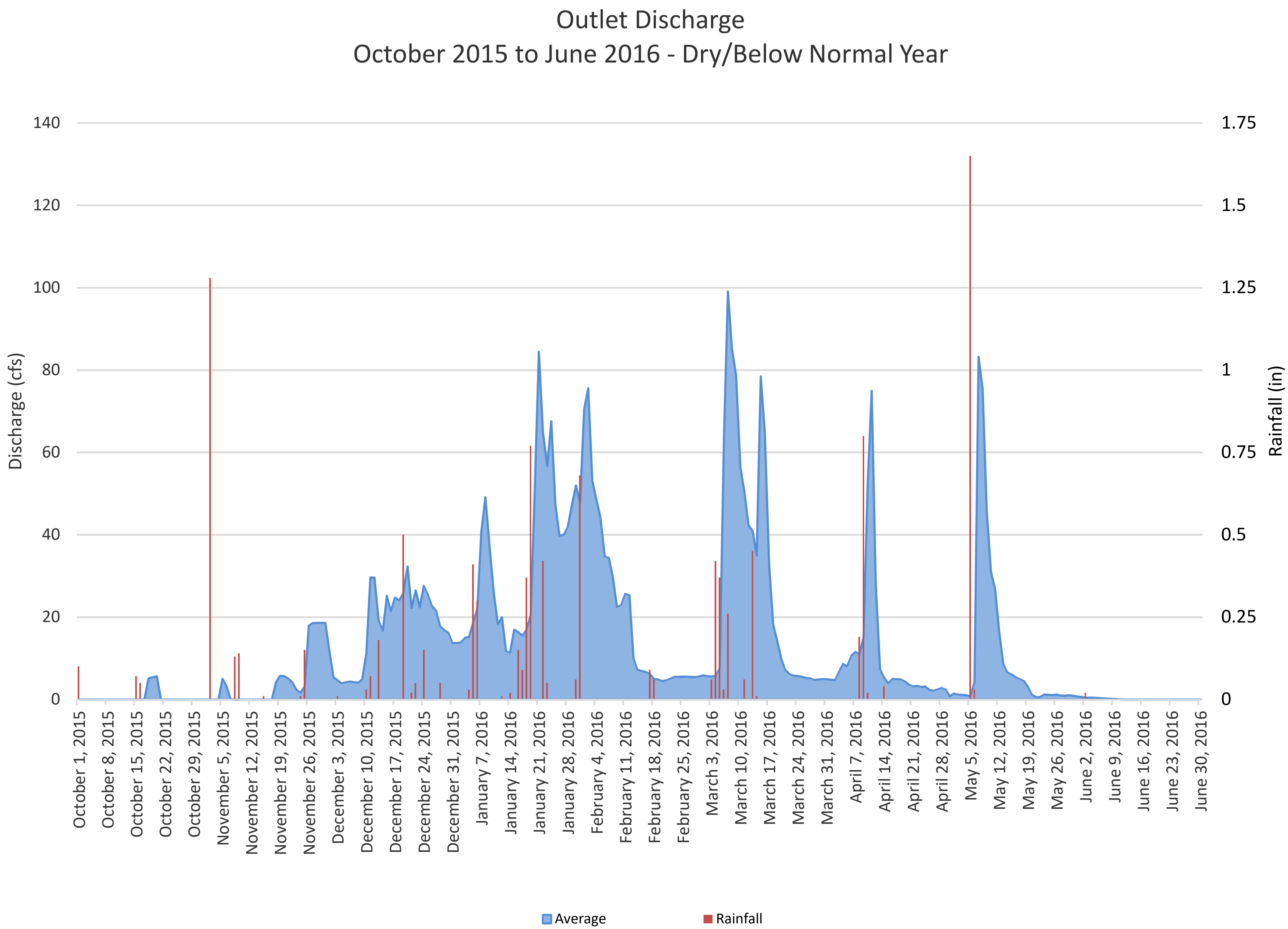

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Figure 12

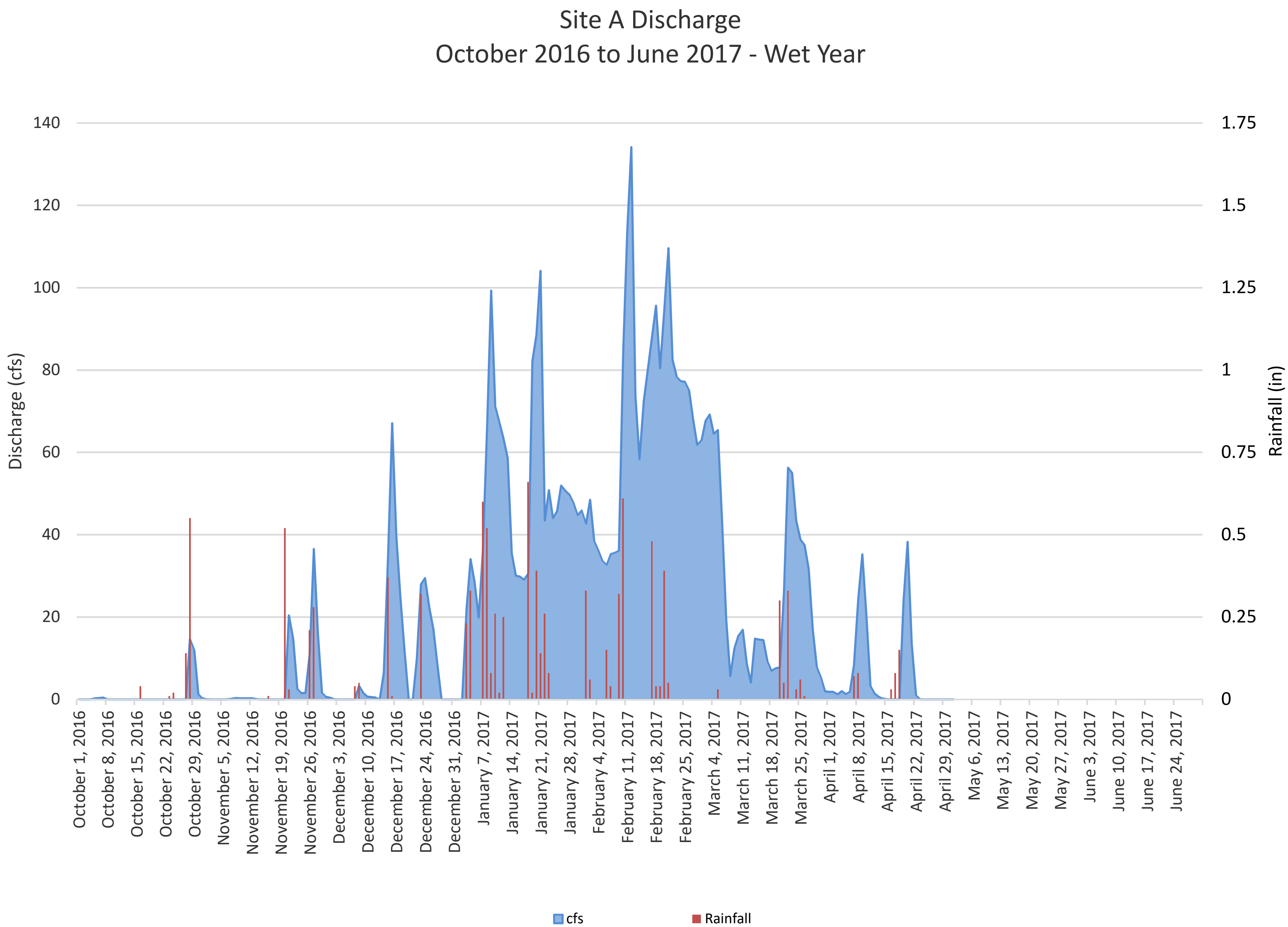

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Figure 13

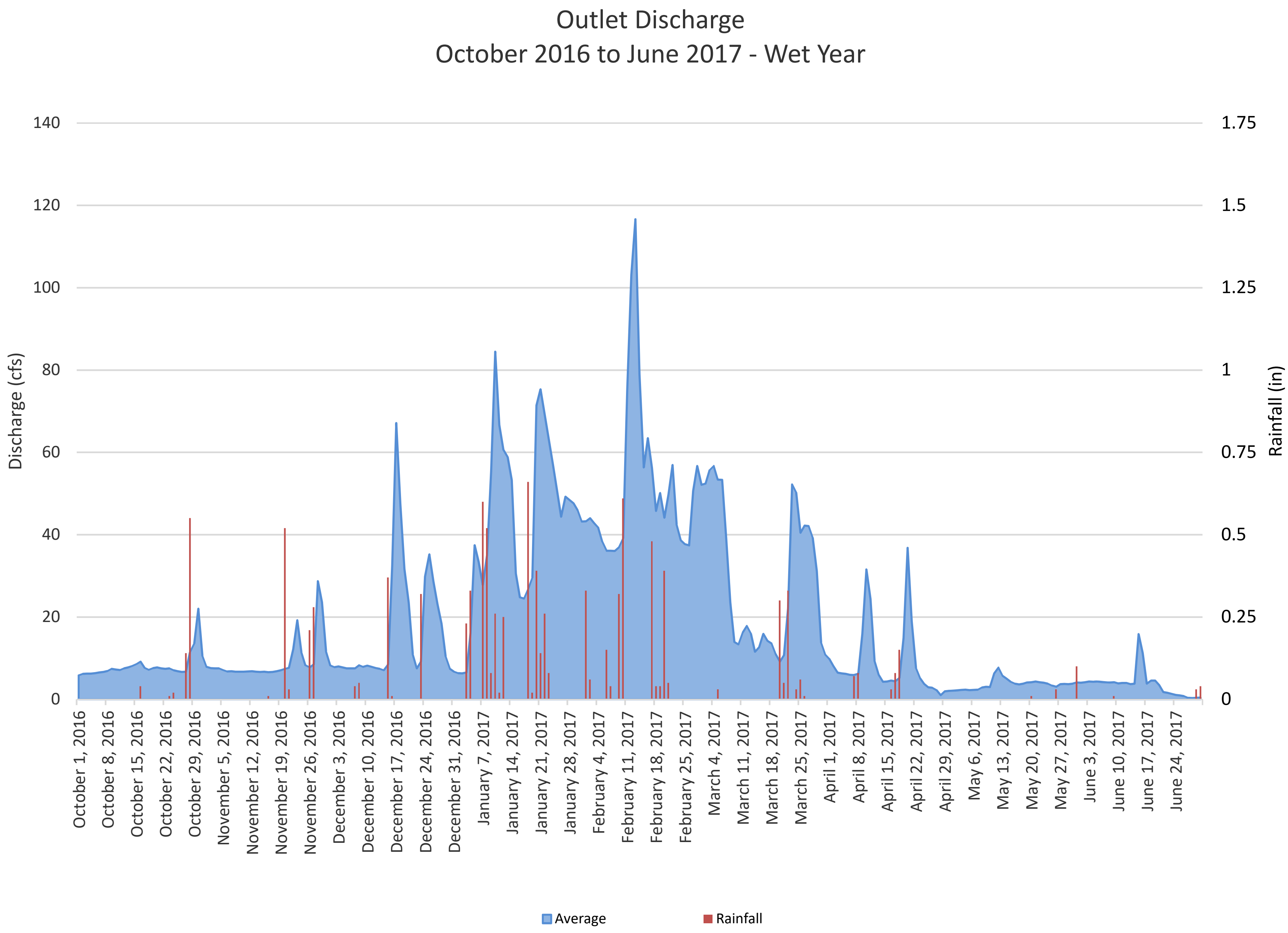

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Figure 14

2/10/98 LOOKING EASTERLY ALONG MAIN CANAL
AND MAIN DRAIN FROM CAMP 13

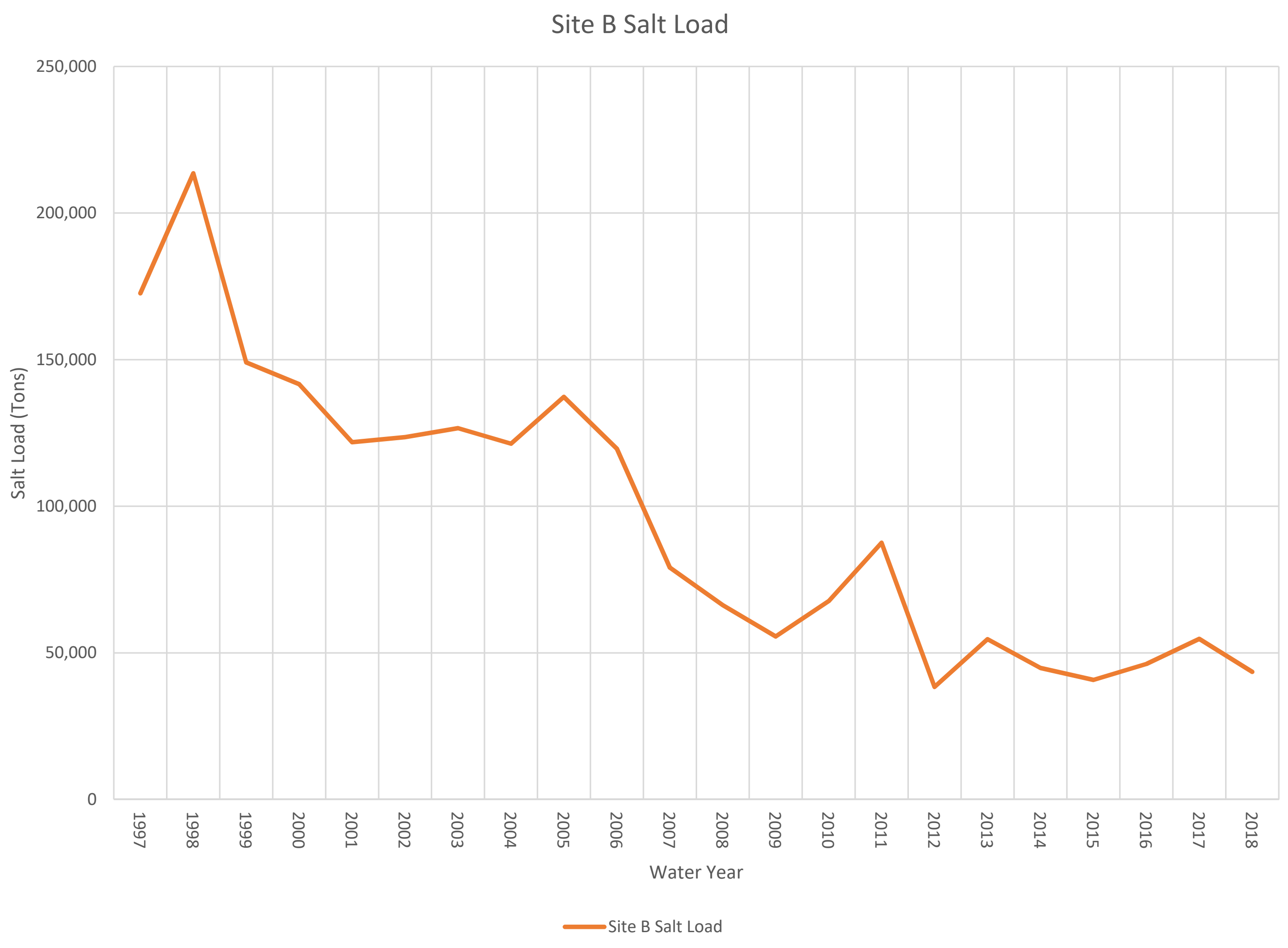
Figure 15

2/3/98 GRASSLAND BYPASS CHANNEL 160 CFS

Figure 16

2/3/98 Grassland Bypass Channel 160 cfs

Figure 17



Site B Salt Load
250,000
200,000
150,000
100,000
50,000
0
Salt Load (Tons)
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Water Year
Site B Salt Load

Figure 18

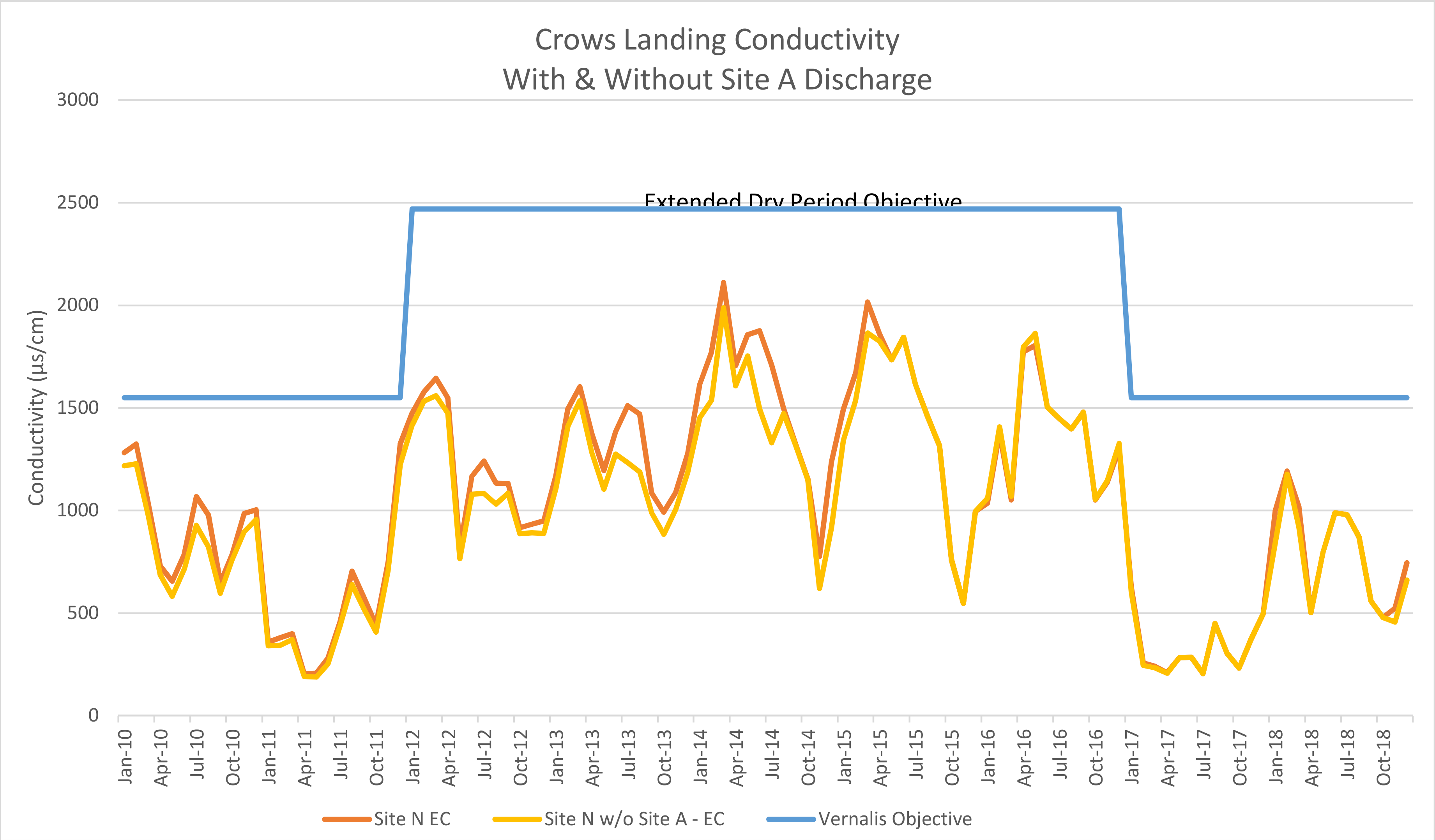


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Figure 19

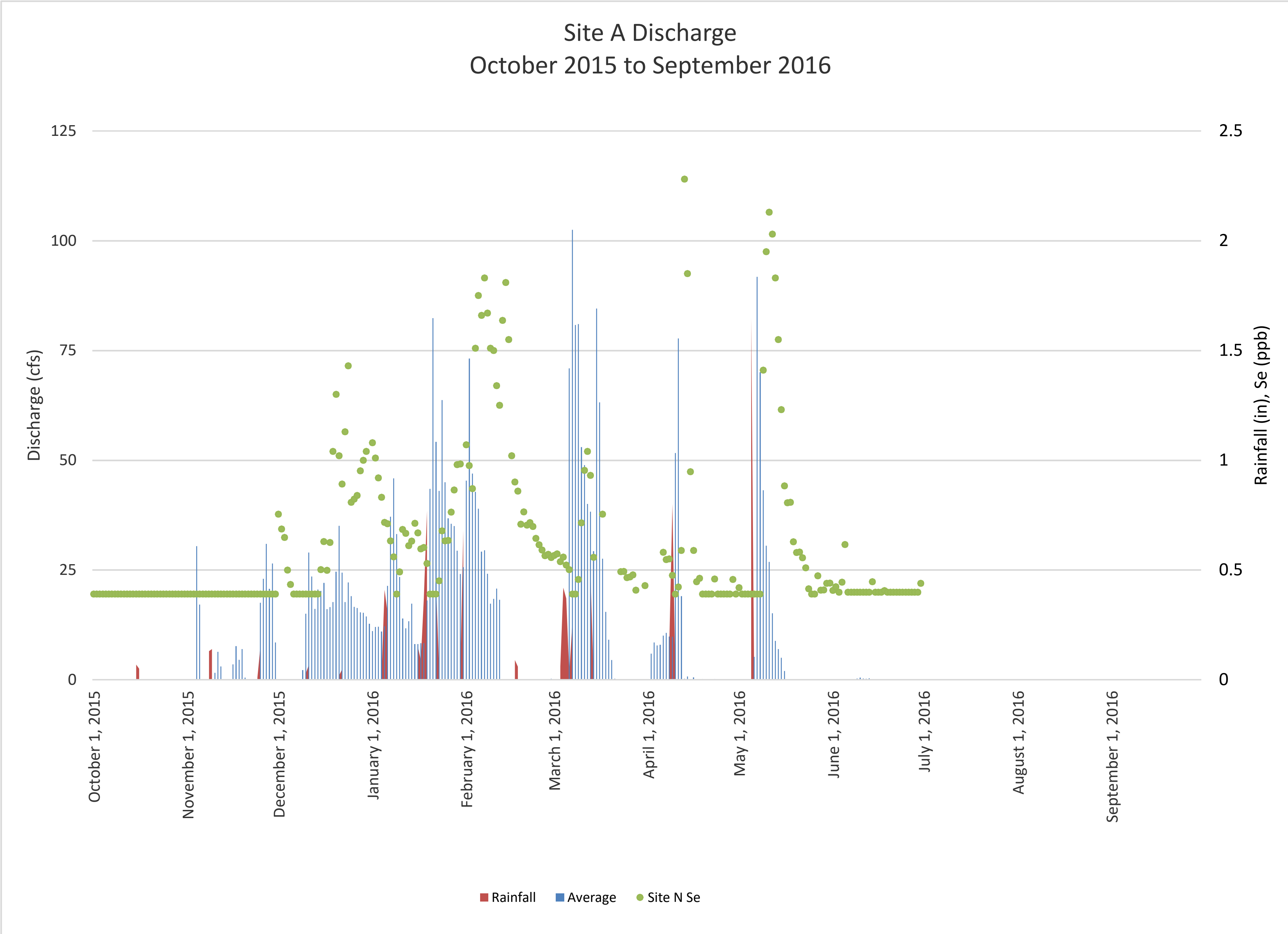

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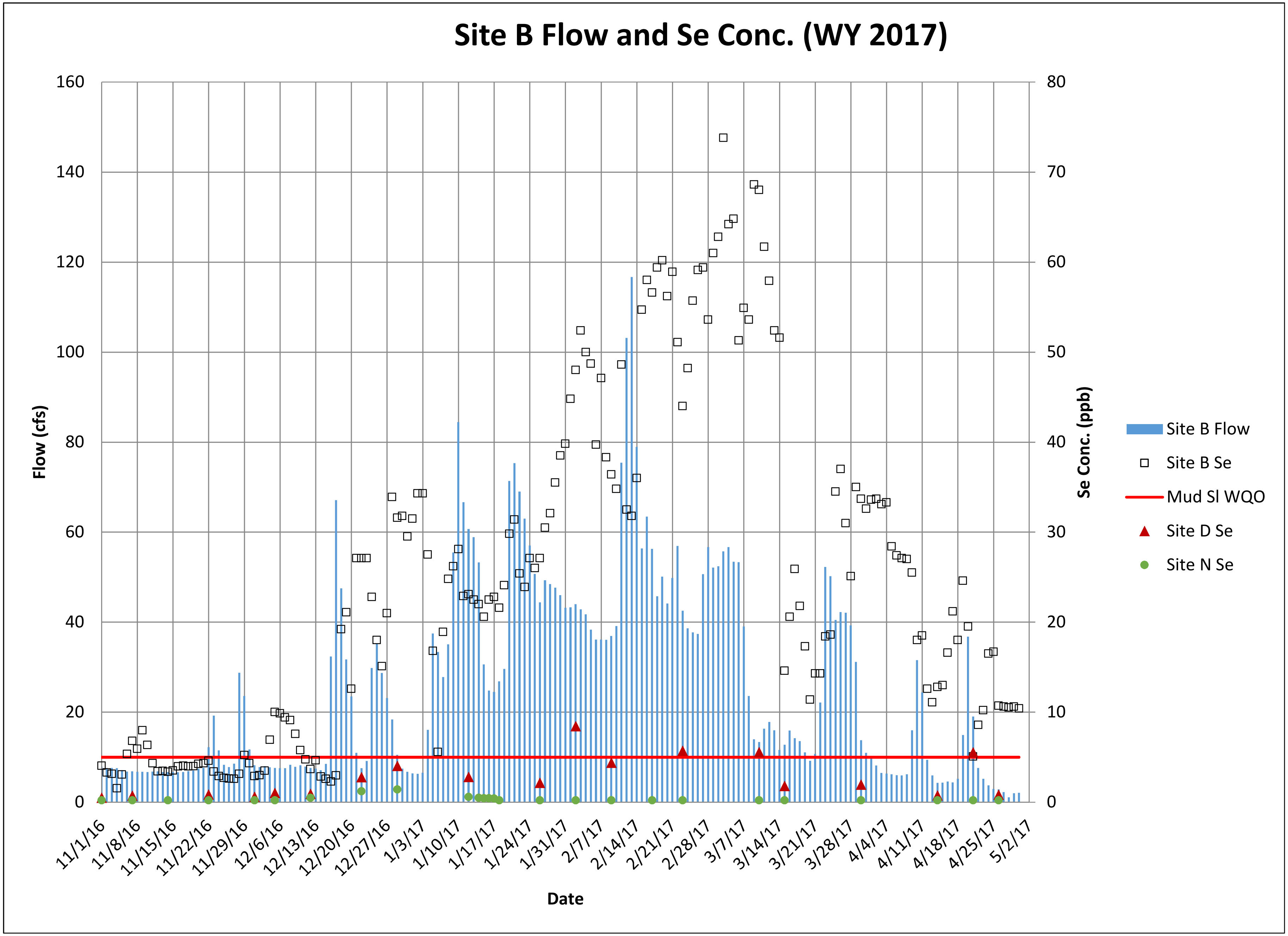
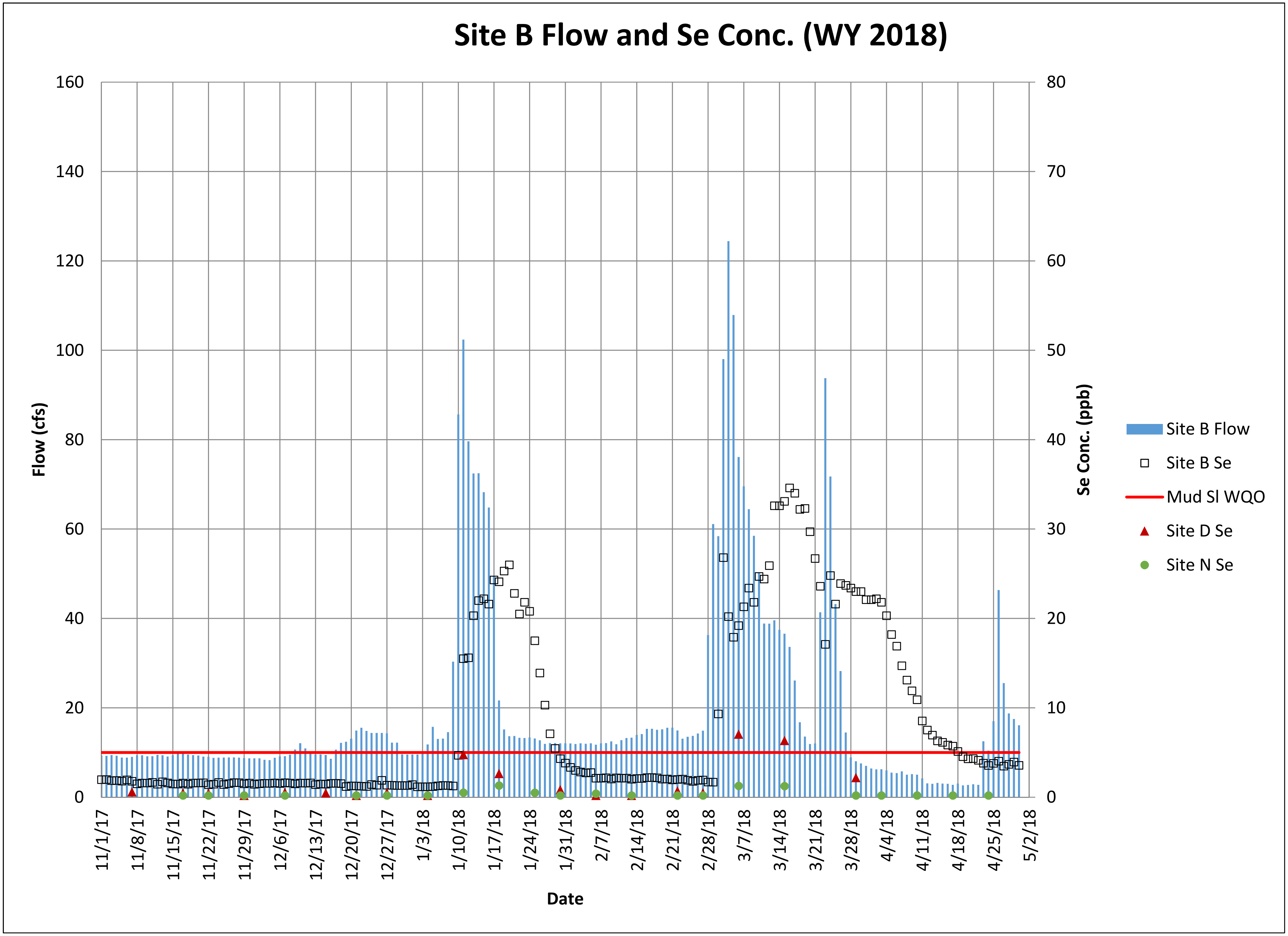
Figure 20



Site B Flow and Se Conc. (WY 2017)
Flow (cfs)
Se Conc. (ppb)
Date
160
140
120
100
80
60
40
20
0
80
70
60
50
40
30
20
10
0
11/1/16
11/8/16
11/15/16
11/22/16
11/29/16
12/6/16
12/13/16
12/20/16
12/27/16
1/3/17
1/10/17
1/17/17
1/24/17
1/31/17
2/7/17
2/14/17
2/21/17
2/28/17
3/7/17
3/14/17
3/21/17
3/28/17
4/4/17
4/11/17
4/18/17
4/25/17
5/2/17
Site B Flow
Site B Se
Mud Sl WQO
Site D Se
Site N Se

Figure 21


Site B Flow and Se Conc. (WY 2018)
Flow (cfs)
Se Conc. (ppb)
Date
0
20
40
60
80
100
120
140
160
0
10
20
30
40
50
60
70
80
11/1/17
11/8/17
11/15/17
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12/27/17
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3/14/18
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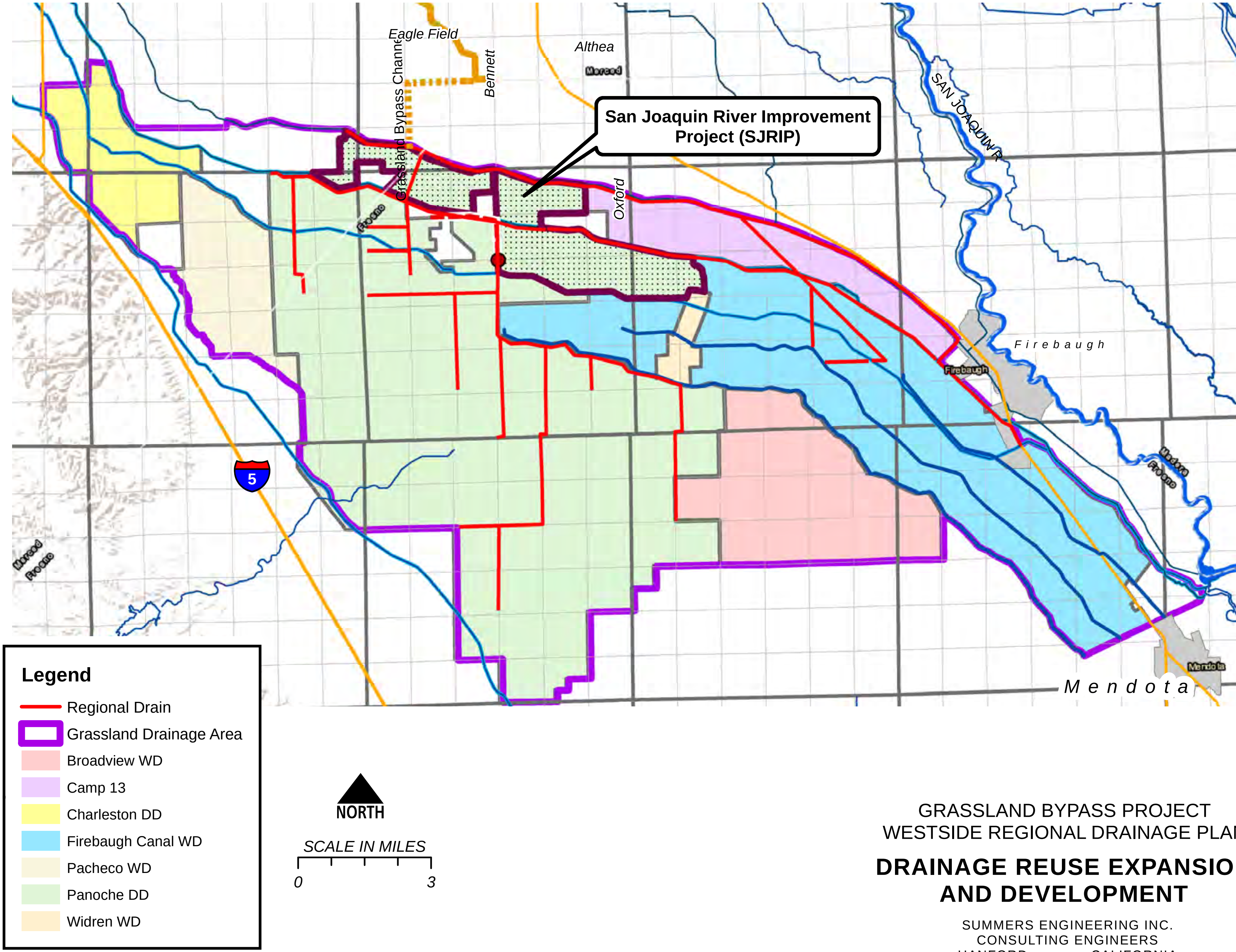
4/25/18
5/2/18
Site B Flow
Site B Se
Mud Sl WQO
Site D Se
Site N Se

Figure 22



GRASSLAND BYPASS PROJECT
WESTSIDE REGIONAL DRAINAGE PLAN

DRAINAGE REUSE EXPANSION AND DEVELOPMENT

SUMMERS ENGINEERING INC.
CONSULTING ENGINEERS
HANFORD CALIFORNIA
JULY 2019

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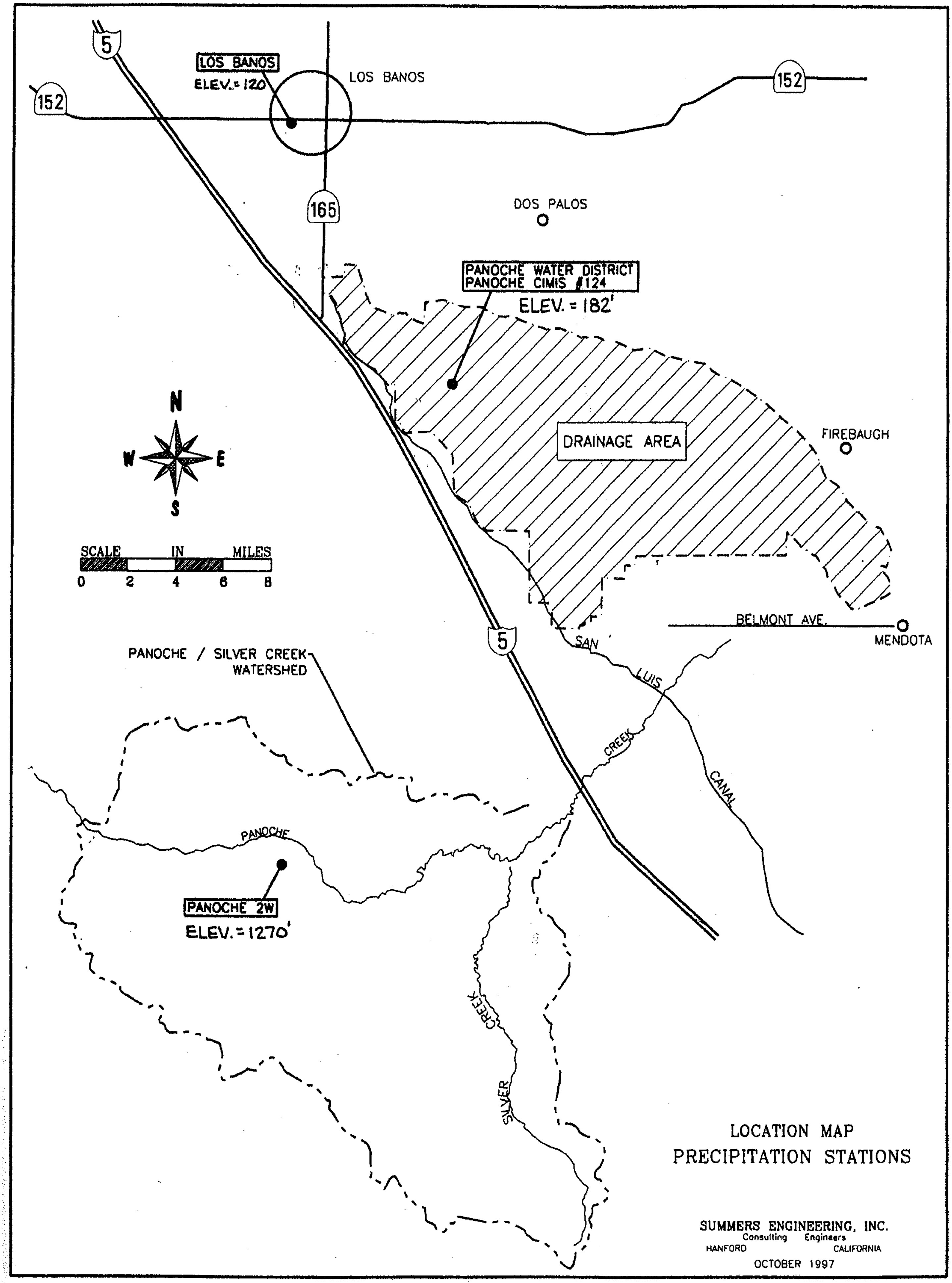
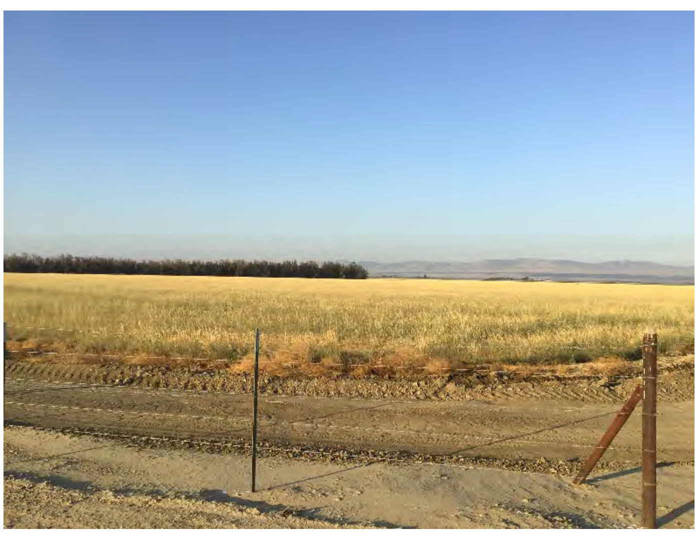
Figure 23



5
152
LOS BANOS
ELEV. = 120
LOS BANOS
165
DOS PALOS
PANOCHE WATER DISTRICT
PANOCHE CIMIS #124
ELEV. = 182'
N
W
E
S
DRAINAGE AREA
FIREBAUGH
SCALE IN MILES
0 2 4 6 8
BELMONT AVE.
MENDOTA
PANOCHE / SILVER CREEK WATERSHED
SAN LUIS CANAL
CREEK
PANOCHE
PANOCHE 2W
ELEV. = 1270'
CREEK
SILVER
LOCATION MAP
PRECIPITATION STATIONS
SUMMERS ENGINEERING, INC.
Consulting Engineers
HANFORD CALIFORNIA
OCTOBER 1997

Appendix B Biological Resources



H.T. HARVEY & ASSOCIATES
Ecological Consultants

San Joaquin River Water Quality Improvement Program Proposed Expansion and Proposition 84 Storm Water Improvements Biotic Report

Project 1960-18

Prepared for:

San Luis & Delta-Mendota Water Authority
Grassland Basin Drainers
c/o Joseph C. McGahan
Summers Engineering
P.O. Box 1122
Hanford, CA 93232

Prepared by:

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December 2018

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Table of Contents

Figures

Photos

Tables

Appendices

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Section 1. Introduction

1.1 Purpose of this Report

The Long Term Storm Water Management Plan for the Grassland Basin Drainers Project calls for the San Luis & Delta-Mendota Water Authority (SLDMWA) to construct a 200-acre reservoir with an approximate capacity of approximately 1,000 acre feet (AF) to temporarily store storm water to prevent, to the extent possible, storm water from entering the San Luis Drain. In addition to construction of this reservoir, the SLDMWA proposes to expand the existing 6,100-acre San Joaquin River Water Quality Improvement Project (SJRIP) agricultural drainwater reuse area (hereafter referred to as the "existing SJRIP reuse site") by approximately 1,680 acres within the Panoche Drainage and Firebaugh Canal Water Districts. These actions, collectively referred to herein as the Project, requires converting 200 acres of salt tolerant crops within the existing SJRIP reuse area to a leveed reservoir, converting approximately 1,680 acres of currently tilled and untilled farmlands to salt-tolerant crops that will be irrigated with subsurface drainwater, installing four pump stations and approximately 4.3 miles of pipeline, and improving approximately 4.4 miles of ditch to concrete-lined canal to convey water from the existing SJRIP reuse site.

This report presents the findings of a biological resources impact analysis conducted for the Project. The purpose of the analysis was to determine whether implementing the Project would result in significant impacts on biological resources and to identify measures to avoid, minimize, or mitigate any significant impacts to a less-than-significant level. This report will inform California Environmental Quality Act (CEQA) compliance documentation for the Project, which will be prepared by SLDMWA. Additionally, if federal funding for the Project is provided by the U.S. Bureau of Reclamation (Reclamation), this report will inform National Environmental Policy Act (NEPA) documentation prepared by that agency.

This report:

- summarizes the environmental laws and regulations that apply to the Project;
- outlines the methods by which habitats and other biological resources within the Project site were identified;
- describes the Project site's habitats, including those that may fall under the jurisdiction of resource agencies, as well as the site's potential to support special-status species;
- identifies impacts on biological resources that would result from constructing the Project; and
- identifies mitigation measures to reduce potentially significant impacts to a less-than-significant level.

The Project is described in further detail in the following section.

1.2 Project Description

The presence of salt, selenium, boron, and other naturally occurring (but potentially toxic) elements in surface and groundwater supplies presents environmental challenges for agricultural regions throughout the western San Joaquin Valley. Compounding the problem is a phenomenon in which saline subsurface groundwater accumulates and becomes concentrated in some locations because of the region's dense clay layers and inadequate natural drainage. To farm in these conditions, subsurface drains are often installed to remove saline water from the root zone of salt-intolerant crops. The purpose of the proposed Project is to temporarily store storm water and create additional acreage on which salty agricultural drainwater may be reused (to irrigate salt-tolerant crops) and disposed of without flushing the drainwater through the Grassland Bypass Project to the San Joaquin River and the San Francisco Bay.

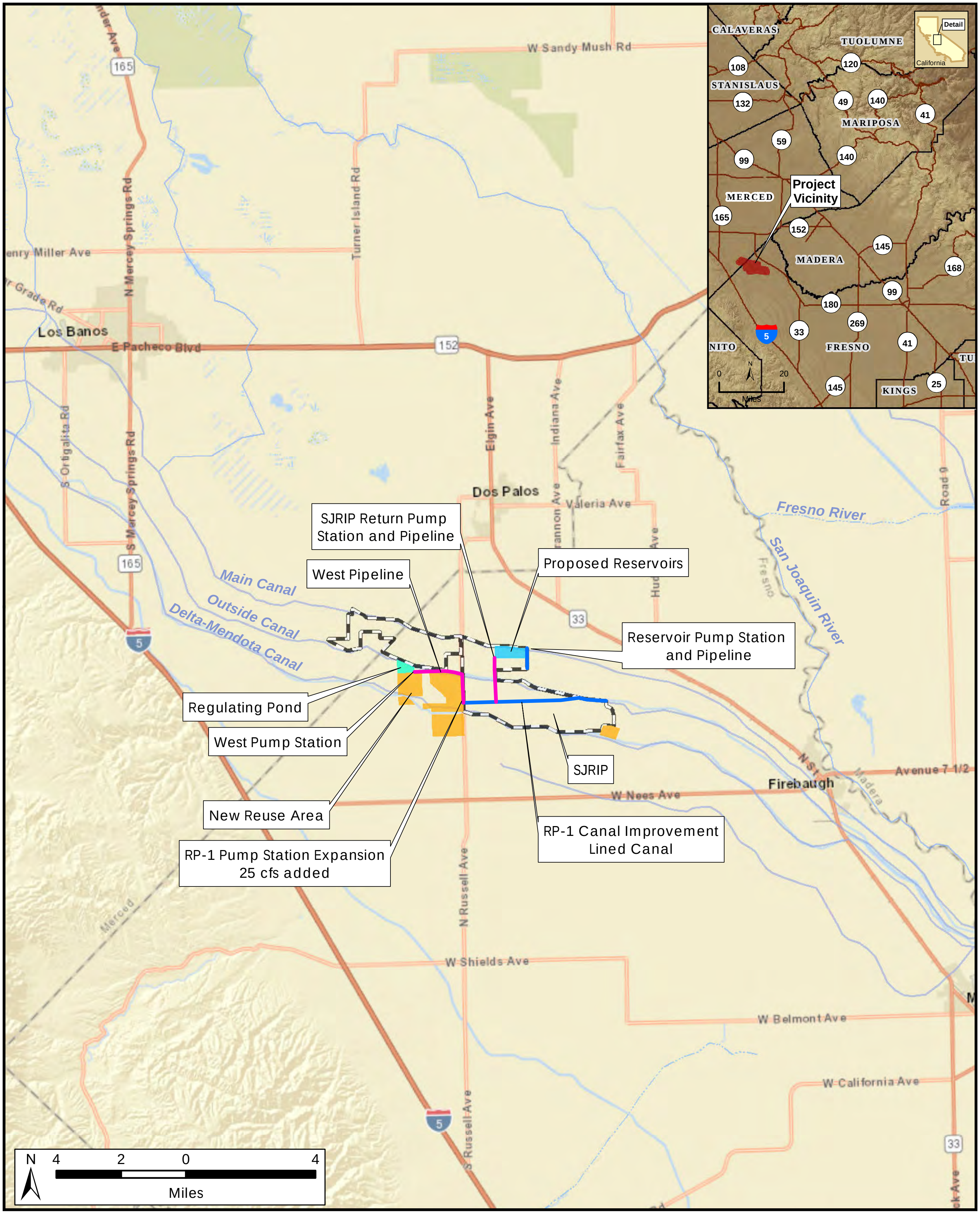
SLDMWA implemented the existing SJRIP reuse site to reduce the amount of salt and selenium delivered through the Grassland Bypass Project to the San Luis Drain and Mud Slough. The Panoche Drainage District (one of the partner agencies in the SLDMWA), acting as the lead agency under CEQA, prepared a negative declaration for the existing SJRIP reuse site in September 2000. The SJRIP was initiated on approximately 4,000 acres in 2001, and later was expanded to approximately 6,100 acres. The SJRIP uses agricultural drainwater to irrigate salt-tolerant crops such as Jose tall wheatgrass (*Agropyron elongatum*), alfalfa (*Medicago sativa*), and pistachios (*Pistacia vera*).

The SJRIP was included as part of SLDMWA's Grasslands Bypass Project in 2001 (URS 2001) and its extension, the Grasslands Bypass Project, 2010-2019. The Grasslands Bypass Project Final EIR/EIS (Reclamation and SLDMWA 2009) authorized the SJRIP to be implemented on up to 6,900 acres.

The proposed Project would add 1,680 acres to the SJRIP and allow SLDMWA to dispose of all its drainwater within the SJRIP. The added area also will allow SLDMWA to rotate fields of salt-tolerant crops in and out of production, better ensuring long-term viability.

The site of the proposed Project is approximately 6.5 miles northwest of Firebaugh in Fresno County (Figure 1). The majority of the proposed expansion is located west of Russell Avenue and south of the Delta-Mendota Canal though one parcel borders the southeast corner of the existing SJRIP site (Figure 2). The site comprises tilled and fallowed agricultural fields. Agricultural uses border the site in all directions, though it surrounds an inactive airfield that includes scraped roads, some buildings, and some degraded alkali scrub habitat. The Project site would be irrigated with agricultural drainwater and farmed.

Proposed modifications that would result from the Project include temporary storm water storage, planting salt-tolerant crops, improving existing water conveyances, and installing new conveyances. These actions would be accomplished using typical farm machinery. The proposed improvements and additions to conveyance facilities would move water from the northwesterly region of SLDMWA's drainage area to the Project site. These proposed modifications are further described below and depicted on Figures 1 and 2.



N:\Projects\1960-10\18\Report\SJRIP_ReuseExp_BioticReport\Figure 1 Vicinity Map.mxd

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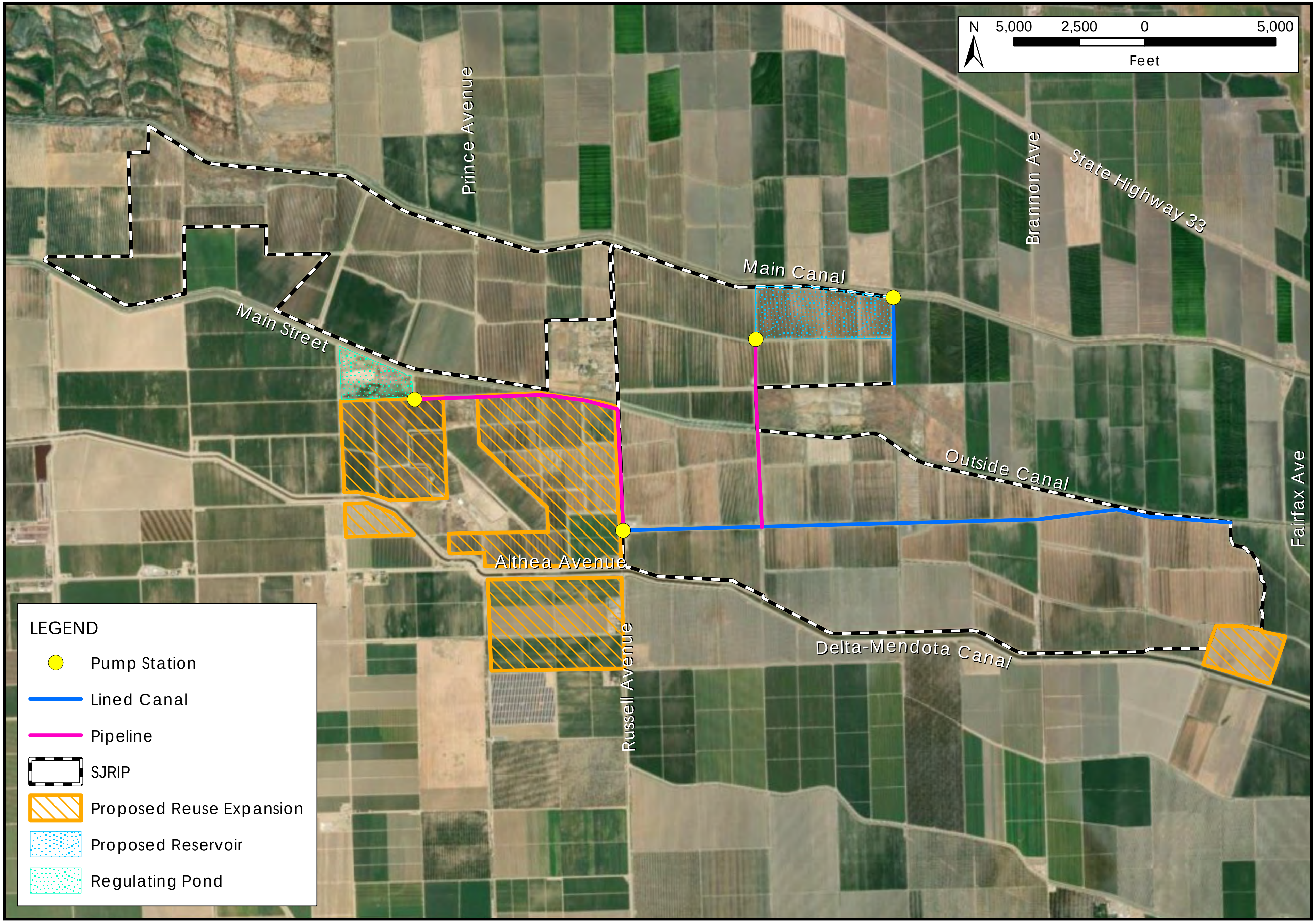
Figure 1. Vicinity Map of the San Joaquin River Water Quality Improvement Project
Proposition 84 Storm Water Improvements and SJRIP Expansion Biotic Report (1960-18)
December 2018



N:\Projects\1960-10\18\Report\SJRIP_ReuseExp_BioticReport\Figure 2 Project Site.mxd

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Figure 2. San Joaquin River Water Quality Improvement Project Site Map
Proposition 84 Storm Water Improvements and
SJRIP Expansion Biotic Report (1960-18)
December 2018

- **West Pump Station and West Pipeline.** Located near the siphon under the Outside Canal, this pump station would convey drainwater from the west end of the drainage area to the RP-1 Pump Station in the existing SJRIP reuse area. This pump station would have a capacity of approximately 10 cubic feet per second (cfs). The pipeline is expected to be 21 inches in diameter and be installed within existing farm roads at a depth of 5 ft.

- **RP-1 Pump Station Expansion and Distribution Canal.** The capacity of the existing RP-1 Pump Station would be increased by 25 cfs through the addition of a second pump. The existing RP-1 conveyance ditch would be replaced with a concrete-lined canal with a capacity of 50 cfs. A pipeline approximately 750 ft long will connect the new pump to the improved ditch.

- **SJRIP Return Pump.** A new return pump station and pipeline would be constructed to capture drainwater from the SJRIP and pump it through a 21 in pipeline buried 5 ft within existing roads to the new RP-1 conveyance canal. This pump station would have a capacity of 10 cfs.

- **Incorporation of Regulating Pond and New Reservoir and Pump Stations.** The Project includes the incorporation of an approximately 90-acre regulating pond and a new regulating reservoir approximately 200 acres in size with the ability to hold an approximately 1,000 AF of storm-induced drainage. The reservoir, which may contain multiple cells, would likely begin collecting water with the first significant storms (typically December) and would likely be emptied by May. A new pump station and pipeline would be constructed to collect winter runoff. The capacity of this pump station would be 25 cfs.

Preconstruction nest surveys will be completed for all Project-related infrastructure installation activities that occur between February 1 and August 31 to comply with the California Fish and Game Code Section 3503.5. A qualified wildlife biologist shall conduct preconstruction surveys of all potential nesting habitats (including for raptors) within 500 feet of construction activities for presence of breeding or nesting birds. Surveys shall be conducted no more than 5 days prior to construction activities with a second survey conducted no more than 24 hours prior to the onset of construction. If active nests are found, no-disturbance buffers shall be implemented around each nest as follows: a 500-foot buffer shall be created around any confirmed active special-status raptor nest (including burrowing owl); a 300-foot buffer shall be created around active nests of non-raptor special-status bird species. The buffers will be implemented until it is determined by a qualified biologist that young have fledged. If a nest is found in an area where ground disturbance is scheduled to occur, the area will be avoided either by delaying ground disturbance in the area until a qualified wildlife biologist has determined that the young have fledged or by re-siting the proposed Project component(s) to avoid the area.

The Project would be situated on flat, developed land in the San Joaquin Valley at an elevation of approximately 150 feet above sea level. The San Joaquin Valley has an inland Mediterranean climate characterized by long, hot, dry summers and short, foggy winters. According to the Western Regional Climate Center (2018), average daily high and low temperatures at the Madera weather station (045233) since 1928 are 98.2°F and 61.4°F in July and 55.2°F and 35.7°F in December, and average total annual precipitation is 10.99 in. The Project site is mapped on the Oxalis and Dos Palos California, 7.5-minute U.S. Geological Survey (USGS) topographical quadrangles.

Section 2. Methods for Assessing Biological Resources

2.1 Background Research

Before conducting fieldwork, H. T. Harvey & Associates biologists reviewed published information about threatened, endangered, and other special-status species and sensitive habitats that may occur in the vicinity of the Project. The focus of this background review was the area on and within 5 miles of the Project, which is referred to herein as the *study area* (Figure 3).

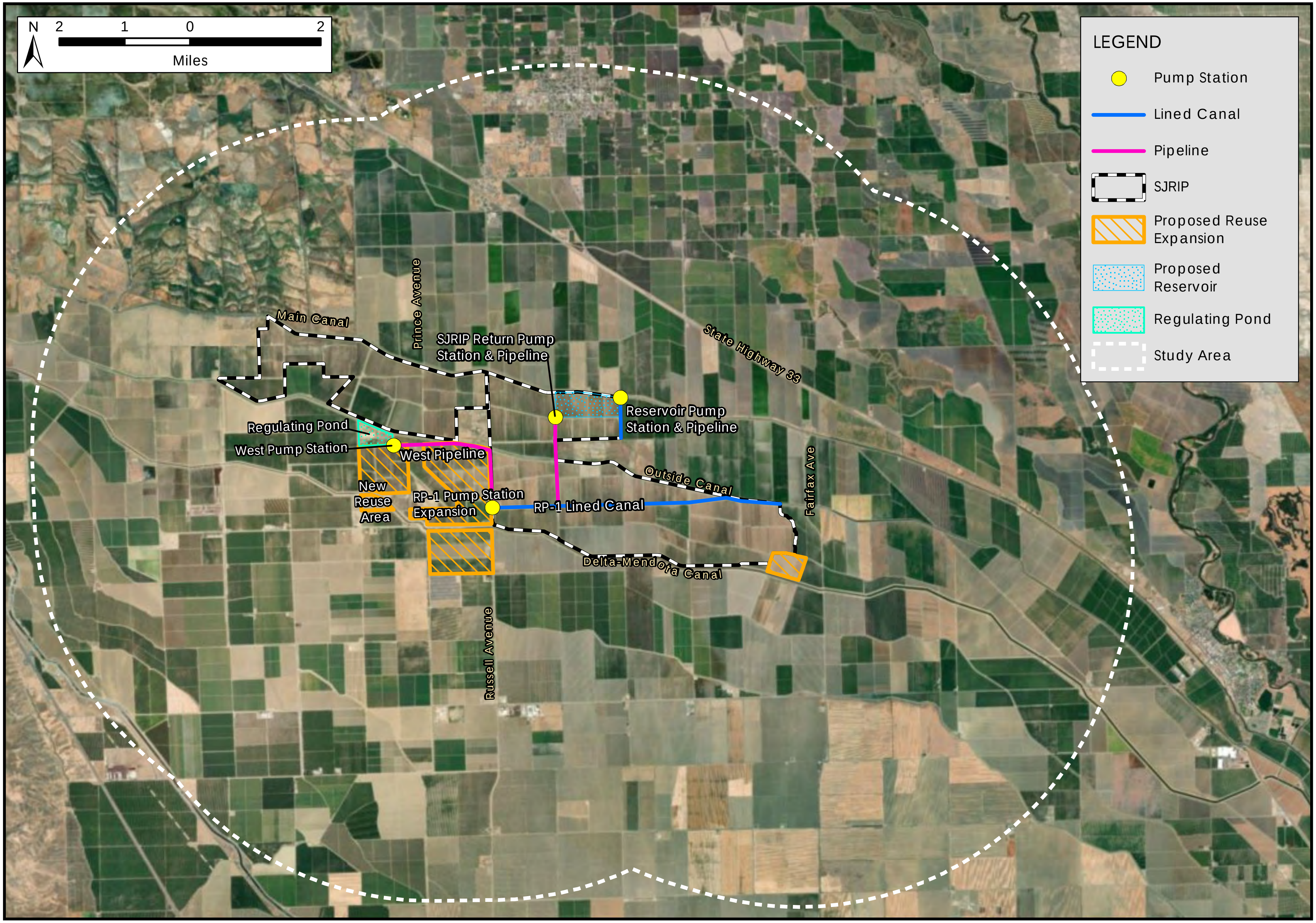
For purposes of this assessment, *special-status species* are considered to be:

- plant and wildlife species listed or proposed for listing as threatened or endangered under the federal Endangered Species Act (ESA), and species listed as threatened, endangered, or rare under the California Endangered Species Act (CESA);
- wildlife listed as fully protected under the California Fish and Game Code (Section 3511);
- wildlife designated by the California Department of Fish and Wildlife (CDFW) as species of special concern; and
- plants ranked as rare or endangered by the California Native Plant Society (CNPS).

A query of special-status plant and wildlife occurrences documented in CDFW's California Natural Diversity Database (CNDDB) was performed for the two 7.5-minute USGS quadrangles in which the Project is located and the 12 surrounding quadrangles. In addition, updated information was obtained from Calflora (2015) and CNPS's online Inventory of Rare, Threatened, and Endangered Plants of California (CNPS 2015) to determine which special-status plant species have been reported to occur in the 12 quadrangles. The California Consortium of Herbaria (California Consortium of Herbaria 2015) and *The Jepson Manual* (Baldwin et al. 2012) provided supplemental information about the distribution and habitats of vascular plants in the region. The National Wetlands Inventory (USFWS 2015) and applicable technical publications also were reviewed.

2.2 Field Survey

Reconnaissance-level field surveys of the Project site were conducted by H. T. Harvey & Associates qualified biologists; survey results are reported in Section 4. The purpose of these surveys was to collect information to support an assessment of the Project's impacts on biological resources. Because the land immediately surrounding the Project is private property (occupied by agricultural, residential, and commercial land uses), the biologists did not survey these properties on foot. Instead, the area within 200 feet of the Project, where access was not available, was assessed using high-powered binoculars.



N:\Projects\1960-10\18\Report\SJRIP_ReuseExp_BioticReport\Figure 3 Study Area Horiz.mxd

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Figure 3. San Joaquin River Water Quality Improvement Project Study Area
Proposition 84 Storm Water Improvements and
SJRIP Expansion Biotic Report (1960-18)
December 2018

On September 4 and 6, 2018, an H. T. Harvey & Associates qualified plant biologist surveyed the Project site. The biologist identified biotic habitats, evaluated botanical resources, assessed habitat suitability for special-status plant species that could occur on the site, and evaluated potentially jurisdictional habitats such as waters of the United States. The vegetation survey was conducted primarily from a vehicle driven along the proposed canal improvement and pipeline routes and along field margins.

On September 4 and 12, 2018, H. T. Harvey & Associates qualified wildlife biologists surveyed the Project site for other special-status wildlife. The biologist evaluated wildlife habitat resources and surveyed for sign of special-status species that could occur on the Project site. The wildlife survey was conducted primarily from a vehicle driven along the proposed canal improvement and pipeline routes and along field margins. Areas that could not be accessed by vehicle were surveyed on foot to ensure 100% visual coverage of the site.

On September 10, 11, and 12, 2018, an ecological scent-detection dog team, consisting of an H. T. Harvey & Associates dog handler and two dogs, surveyed the accessible portions of the Project for sign of San Joaquin kit fox (*Vulpes macrotis mutica*), an endangered species (Figure 4). Surveys were conducted during this period to maximize the chances of detecting scat from both resident and dispersing San Joaquin kit foxes (juvenile San Joaquin kit foxes have dispersed from their parents' territories by this time of year). The existing SJRIP reuse site was also surveyed by scent-dog teams for sign of San Joaquin kit fox on October 5, 6, 19, and 20 and November 2 and 3 by the same handler and dogs (Figure 4). The SJRIP was also previously surveyed in the fall of 2015 (Figure 5).

Detection dog surveys differ from traditional human survey efforts in that the transect coverage area depends on terrain and localized weather conditions, especially wind speed and direction and the amount of relative humidity. Survey transects were selected to optimize detection and make efficient use of survey time. Surveyors paid special attention to areas near which kit foxes often defecate, such as perimeter roads, game trails, and human-made objects. The survey tracks of both the handler and the dog were recorded using a handheld Global Positioning System (GPS) unit carried by the handler and a second GPS unit attached to the working vest of the detection dog.

While performing the surveys, each dog ranged and quartered ahead of the handler, searching for the target scent. If the dog alerted to a potential target, the handler was responsible for reading and interpreting the dog's body language, as well as the appearance of the scat sample, and either confirming an "alert" with a play reward or determining a "false alert" to a nontarget and moving the dog on. If scat were found, qualitative and quantitative data, such as the Universal Transverse Mercator coordinates, the amount of scat, a description of the specific location, and the estimated age of the scat, were collected at each scat location. Identified scat samples were collected and stored and kept in a cold, dark environment until they could be analyzed for species verification. The handler also opportunistically recorded the GPS locations of all observed mammalian excavations potentially used or excavated by American badgers (*Taxidea taxus*), kit foxes, red foxes (*Vulpes vulpes*), or coyotes (*Canis latrans*).

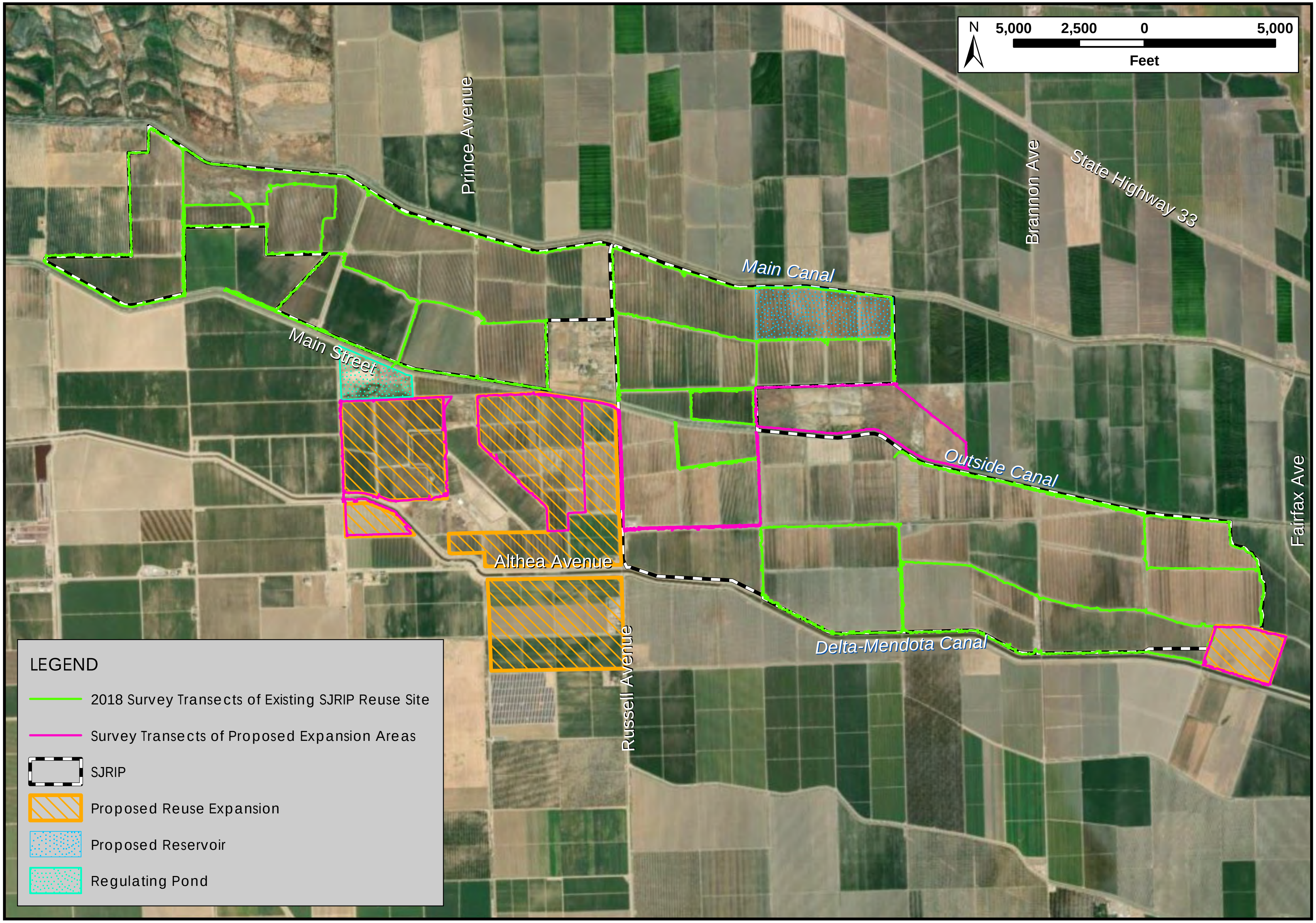

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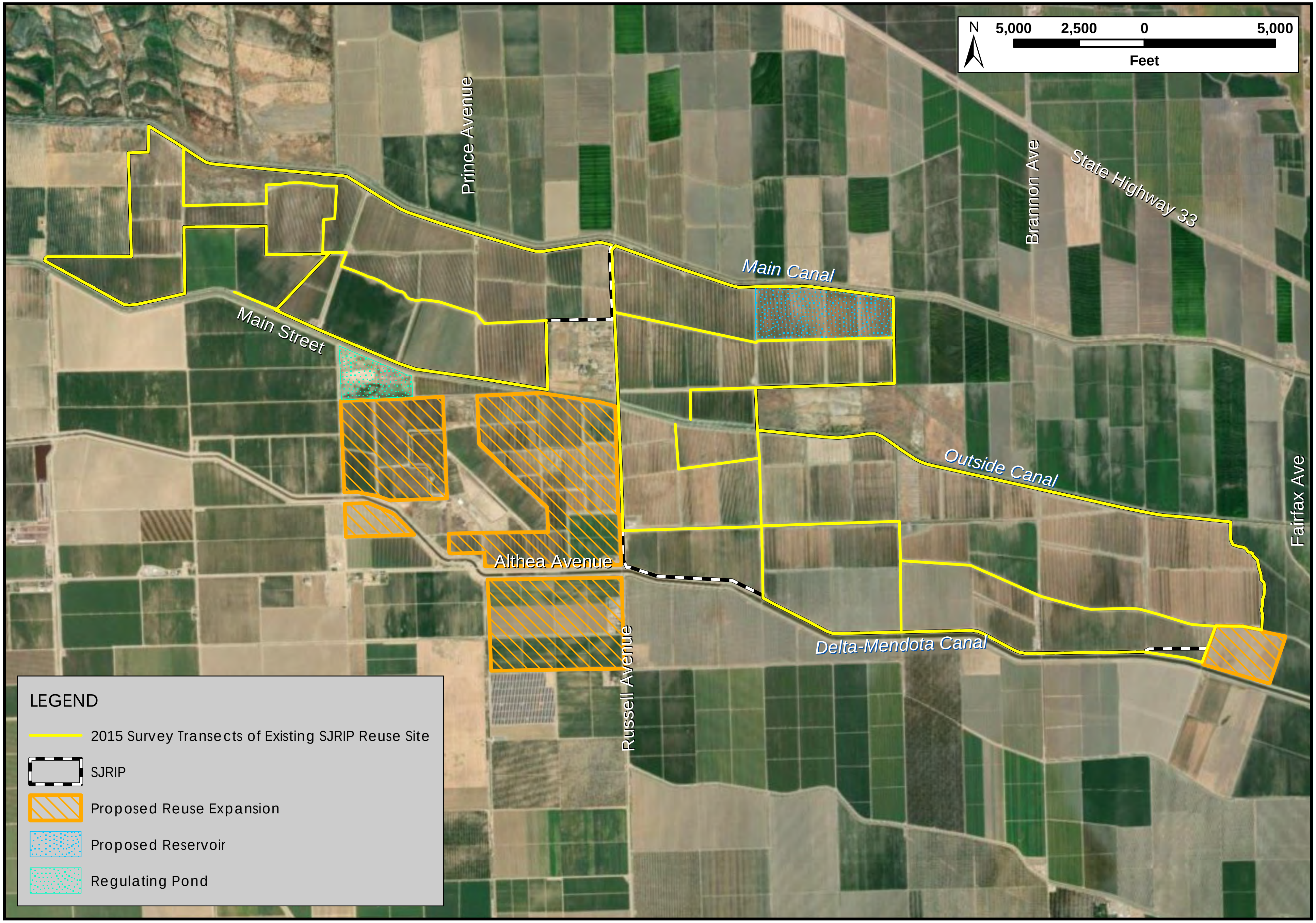
Figure 4. Detection Dog Teams' 2018 Survey Tracks at the San Joaquin River Improvement Project Site

Proposition 84 Storm Water Improvements and SJRIP Expansion Biotic Report (1960-18)
December 2018



N:\Projects\1960-10\18\Report\SJRIP_ReuseExp_BioticReport\Figure 5 Transects of Scent-Dog Teams in 2015 Surveys for San Joaquin Kit Fox.mxd

H. T. HARVEY & ASSOCIATES
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Figure 4. Detection Dog Teams' 2015 Survey Tracks at the San Joaquin River Improvement Project Site

Proposition 84 Storm Water Improvements and SJRIP Expansion Biotic Report (1960-18)
December 2018

Section 3. Regulatory Setting

3.1 Local Regulations

3.1.1 Fresno County General Plan

The *Fresno County General Plan* (Fresno County 2000) is the County's overarching planning document. It provides a comprehensive, long-term plan for the physical development of the county. Mandatory elements of the *Fresno County General Plan* that have bearing on the proposed Project are land use, open space, and conservation. The Project site is designated for agricultural land uses under the *Fresno County General Plan*.

Project Applicability: The *Fresno County General Plan* contains policies that apply to the Project. The Project would be implemented in compliance with all applicable local policies related to land use, open space, and conservation.

3.2 State Regulations

3.2.1 California Environmental Quality Act

CEQA is a state law that requires state and local agencies, such as the SLDMWA, to document and consider the environmental implications of their actions and to refrain from approving projects with significant environmental effects if there are feasible alternatives or mitigation measures that can substantially lessen or avoid those effects. CEQA requires the full disclosure of the environmental effects of agency actions, such as approval of a general plan update or the projects covered by that plan, on resources including air quality, water quality, cultural resources, and biological resources. The State Resources Agency promulgates guidelines for implementing CEQA, known as the State CEQA Guidelines.

Section 15380(b) of the State CEQA Guidelines provides that a species not listed on the federal or state lists of protected species may be considered *rare* if the species can be shown to meet certain specified criteria. These criteria have been modeled after the definitions in the ESA and CESA and the section of the California Fish and Game Code dealing with rare or endangered plants or wildlife. Section 15380(b) was included in the guidelines primarily to address situations in which a public agency is reviewing a project that may have a significant effect on a species that has not yet been listed by the federal government or the state but that is locally or regionally rare.

All potentially rare or sensitive species, and habitats capable of supporting rare species, should be considered during environmental review, in accordance with Section 15380(b). Supporting this environmental review, agencies and groups have established lists of such species. CDFW has produced three watch lists (amphibians and reptiles, birds, and mammals) of state species of special concern. Species on these lists are of limited distribution, or the extent of their habitats has been reduced substantially. Because populations of these species are highly vulnerable to threats, these populations should be monitored. Although these species may receive special attention during environmental review, they do not have specific statutory protection associated with their classification as species of special concern.

Additionally, CNPS, a nongovernmental conservation organization, has developed ranks for vascular plant species of concern in California. The California Rare Plant Ranks (CRPRs) are defined as follows:

- CRPR 1A—plants presumed extirpated in California and either rare or extinct elsewhere
- CRPR 1B—plants rare, threatened, or endangered in California and elsewhere
- CRPR 2A—plants presumed extirpated in California but common elsewhere
- CRPR 2B—plants rare, threatened, or endangered in California but more common elsewhere
- CRPR 3—plants about which more information is needed—a review list
- CRPR 4—plants of limited distribution—a watch list

These rankings are further described by the following threat ranks:

- 0.1—seriously threatened in California (more than 80% of occurrences threatened/high degree and immediacy of threat)
- 0.2—moderately threatened in California (20–80% of occurrences threatened/moderate degree and immediacy of threat)
- 0.3—not very threatened in California (less than 20% of occurrences threatened/low degree and immediacy of threat or no current threats known)

Although CNPS is not a regulatory agency, and plants in these ranks have no formal regulatory protection, plants designated as CRPR 1B, 2A, or 2B are, in general, considered special-status species as defined by Section 15380; therefore, adverse effects on these species may be considered significant. Impacts on plants designated as CRPR 3 or 4 also are considered during CEQA review, but because these species typically are not as rare as those designated as CRPR 1B, 2A, or 2B, impacts on them are less frequently considered significant.

Section 15380(b) also requires that habitats capable of supporting rare species be considered during environmental review. CDFW ranks certain rare or threatened plant communities, such as wetlands, meadows, and riparian forest and scrub, as "threatened" or "very threatened." These communities are tracked in the CNDDB. Impacts on CDFW-designated sensitive plant communities, or any such community identified in local or regional plans, policies, or regulations, must be considered and evaluated under CEQA (State CEQA Guidelines, Appendix G). Furthermore, aquatic, wetland, and riparian habitats also are afforded protection under applicable federal, state, and local regulations, and generally are subject to regulation, protection, or consideration by the U.S. Army Corps of Engineers (USACE), the applicable Regional Water Quality Control Board (RWQCB), CDFW, or the U.S. Fish and Wildlife Service (USFWS).

Project Applicability: All potential impacts on biological resources will be considered during CEQA review of the Project, as informed by this report.

3.2.2 California Endangered Species Act

CESA (California Fish and Game Code, Chapter 1.5, Sections 2050–2116) prohibits the take of any plant or wildlife species listed or proposed for listing as rare (plants only), threatened, or endangered. Under CESA, CDFW has jurisdiction over state-listed species (California Fish and Game Code Section 2070) and regulates activities that may result in take of individuals (*take* is defined as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill"). Habitat degradation or modification is not expressly included in the definition of *take* under the California Fish and Game Code. However, CDFW has interpreted *take* to include the "killing of a member of a species which is the proximate result of habitat modification."

Project Applicability: Marginally suitable habitat for San Joaquin kit fox is present in portions of the study area. Tricolored blackbirds (*Agelaius tricolor*) may forage on the Project site and the Swainson's hawk (*Buteo swainsoni*) is known to have nested adjacent to the Project site within the existing SJRIP reuse area annually from 2001 through 2018 (H. T. Harvey & Associates 2002–2013, 2015a, 2015b, 2016, 2017, 2018, H. T. Harvey & Associates Unpublished data). Any potential impacts on state listed species will be considered during CEQA review of the Project, as informed by this report.

3.2.3 California Fish and Game Code

The California Fish and Game Code includes regulations governing the use of, and the effects on, many of the state's fish, wildlife, and sensitive habitats. CDFW exerts jurisdiction over the beds and banks of rivers, lakes, and streams according to provisions of Sections 1601–1603 of the code. The code requires that a streambed alteration agreement be completed before material is added to or removed from the beds or banks of a watercourse or water body and before riparian vegetation is removed.

Certain sections of the California Fish and Game Code pertain to protecting wildlife species. For example, Section 2000 prohibits the take of any bird, mammal, fish, reptile, or amphibian except as provided by other sections of the code.

Sections 3503, 3513, and 3800 (and other sections and subsections) protect native birds, including their nests and eggs, from all forms of take. Disturbance that causes nest abandonment or loss of reproductive effort is considered take by CDFW. Raptors (e.g., eagles, hawks, and owls) and their nests are specifically protected under Section 3503.5, which states that it is "unlawful to take, possess, or destroy any birds in the order Falconiformes or Strigiformes (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto."

Bats and other nongame mammals are protected by California Fish and Game Code Section 4150, which states that all nongame mammals or parts thereof may not be taken or possessed except as provided in the code or in accordance with regulations adopted by the California Fish and Game Commission. Activities resulting in mortality of nongame mammals (e.g., destruction of a roost occupied by nonbreeding bats, resulting in the death of bats, or disturbance that causes the loss of a maternity colony of bats, resulting in the death of young) may be considered take by CDFW.

Project Applicability: Most native bird, mammal, and other wildlife species found on the Project site and in the immediate vicinity are protected by the California Fish and Game Code. Any potential impacts on these species will be considered during CEQA review of the Project, as informed by this report.

3.2.4 California Water Code and Porter-Cologne Water Quality Control Act

All wastewater discharges in the state, whether to land or to water (including groundwater), are subject to regulation under the California Water Code and the Porter-Cologne Water Quality Control Act. Entities that propose to discharge wastewater must meet waste discharge requirements (WDRs) set by the applicable RWQCB.

Project Applicability: The RWQCB has issued WDRs for the 2010-2019 Use Agreement which will be amended to include the Project.

3.3 Federal Regulations

3.3.1 National Environmental Policy Act

NEPA requires that federal agencies review their proposed actions (e.g., provision of federal funding for project implementation) through a process that evaluates the potential environmental effects of the proposed action and of reasonable and prudent alternatives that would avoid or minimize significant effects. The requirements for NEPA compliance are identified by NEPA and by the guidelines of the Council on Environmental Quality and the federal agency undertaking the action. NEPA grants considerable discretion to federal agencies regarding the procedures for NEPA review. Consequently, the timeline and requirements for NEPA compliance vary substantially among federal agencies and the actions they undertake.

Federal agencies conduct NEPA reviews for their proposed actions by preparing exemptions, categorical exclusions, or environmental assessments (EAs) as part of the agencies' internal authorization process. If an EA concludes with a finding of no significant impact, no further NEPA documentation is required. If the EA determines that a project may result in significant environmental effects, or if significant effects are presumed initially, preparation of an environmental impact statement (EIS) is required for NEPA compliance. In general, the significance of an action's effects is determined in terms of their context and intensity, but the federal agency's NEPA guidance may provide additional direction regarding significance determinations. An EIS evaluates the potential effects of both the proposed action and reasonable alternatives to the action; an EIS also discusses means to mitigate adverse effects. NEPA compliance that is achieved through an EIS is completed with a record of decision regarding the proposed action.

Project Applicability: Federal funding may be provided by Reclamation; such funding would create a federal nexus for the Project and trigger the requirement to complete the NEPA process. The federal lead agency would be Reclamation, and the proposed action would be the provision of federal funding to the Project. This report would support the lead agency's NEPA review of the Project's potential effects on biological resources, given that the Project is facilitated by the federal funding action.

3.3.2 Endangered Species Act

The ESA is intended to protect species that are federally listed as threatened or endangered, and their habitats, from unlawful take, and to ensure that federal actions do not jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat (defined in Section 3[5][A] of the ESA). Under the ESA, *take* is defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or…attempt to engage in any of the specifically enumerated conduct." USFWS's regulations define *harm* as "an act which actually kills or injures wildlife." Such an act "may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering" (Title 50, Code of Federal Regulations [CFR], Section 17.3). Activities that may result in take of individuals or adverse modification of critical habitat are regulated by USFWS.

Project Applicability: Marginally suitable habitat for San Joaquin kit fox is present in portions of the study area. No critical habitat for any federally listed species is present in the study area, no federally listed species were observed during general or focused surveys, and none are reasonably expected to be found on the Project site. Any potential impacts on federally listed species will be considered during CEQA review of the Project, as informed by this report.

3.3.3 Migratory Bird Treaty Act

The federal Migratory Bird Treaty Act (MBTA) (Title 16, United States Code, Section 703) prohibits killing, possessing, or trading migratory birds except in accordance with regulations prescribed by the Secretary of the Interior. The MBTA protects whole birds, parts of birds, and bird eggs and nests, and it prohibits the possession of nests of protected bird species, whether active or inactive. An active nest, as described by the U.S. Department of the Interior in its April 15, 2003, Migratory Bird Permit Memorandum, must contain eggs or young. Nest starts (nests that are under construction and do not yet contain eggs) are not protected.

Project Applicability: All native bird species found in the study area are protected under the MBTA. Any potential impacts on these species will be considered during CEQA review of the Project, as informed by this report.

3.3.4 Clean Water Act

Under Section 404 of the Clean Water Act, USACE is responsible for regulating the discharge of fill material into waters of the United States. Waters of the United States and their lateral limits are defined in 33 CFR 328.3(a) and include streams that are tributary to navigable waters up to the ordinary high-water mark and their adjacent wetlands. Wetlands that are not adjacent to waters of the United States are termed "isolated wetlands" and, depending on the circumstances, may also be subject to USACE jurisdiction.

Project Applicability: The Project site does not contain any mesic soils or wetlands.

Section 4. Results of Biological Resource Assessment

4.1 Overview of Survey Results

No special-status plant species were observed during the field surveys. Forty plant species, most nonnative, were observed within the Project site (Appendix A).

Two special-status wildlife species, the burrowing owl (*Athene cunicularia*) and the loggerhead shrike (*Lanius ludovicianus*) were observed during the surveys. Approximately 30 California ground squirrel (*Otospermophilus beecheyi*) burrow entrances (California ground squirrel burrows are used by burrowing owls) were observed within the proposed Project areas, mostly occurring on the berms of ditches. The burrows occurred in a few clusters, and were not widespread.

San Joaquin kit foxes are unlikely to forage at the Project site because small mammal burrows are mostly absent. In addition, no mammalian excavations showing signs of use by American badger, kit fox, red fox, or coyote were observed during surveys. No evidence was found to indicate San Joaquin kit fox presence on the Project site during scent-dog surveys in 2015 and 2018. H. T. Harvey & Associates' scent dog teams are highly successful at detecting foxes when present. In core kit fox habitat on Carrizo Plain, H. T. Harvey & Associates' scent dog teams detected 6.1 San Joaquin kit fox scats per mile of survey effort and independent genetic testing of a subsample of 24 of the scats collected confirmed all were San Joaquin kit fox scat (H. T. Harvey & Associates Unpublished data). Based on the negative scent-detection dog survey results at the Project site, the poor quality of habitat present, the lack of recent observations of San Joaquin kit foxes in the vicinity (CNDDB 2018), and the distance between the Project site and appropriate kit fox habitat, San Joaquin kit foxes are deemed to absent from the Project site.

4.2 Project Site Plant Communities and Associated Wildlife

The entire Project site is situated on developed land, mostly consisting of agricultural fields (1,680 acres) (Figure 6). Appendix A presents a complete list of the plant species observed on the Project site.

The dominant crop is Jose tall wheatgrass (*Thinopyrum ponticum*) (Photo 1), with two fields planted to tomatoes. Several fields in Section 9 and 16 had been recently tilled at the time of the surveys, and supported little vegetation (Photo 2). Plants associated with tilled fields were generally restricted to the field

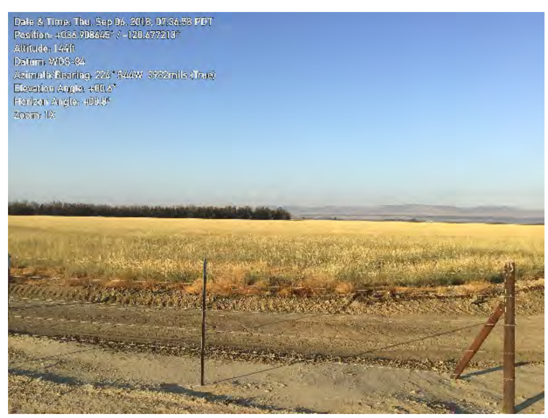

Photo 1. A field of Jose tall wheatgrass

margins, and included weedy colonizing species such as bearded sprangletop (*Leptochloa fusca*), prickly lettuce (*Lactuca serriola*), heliotrope (*Heliotropium curassavicum*), and prickly lettuce (*Lactuca serriola*) (Figure 6).

A strip of fallow land occurs south of W Althea Ave and north of the Delta-Mendota Canal (Photo 3) and is nearly entirely dominated by saltgrass (*Distichlis spicata*). There are two strands of Eucalyptus (*Eucalyptus* sp.) trees on the Project site (Figure 6). In these stands, heavy tree debris that includes leaf litter, fallen branches, and shedding bark generally excludes understory growth of other plant species.

Photo 2. Tilled field

An extensive network of agricultural canals is present throughout much of the Project site. Plants in the canals are actively managed, and thus, the canals support limited vegetation (Photo 4). The canals contain standing water, and support limited and isolated patches of aquatic and riparian plants such as common water hyacinth (*Eichhornia crassipes*) (Figure 6).

Photo 7. Fallowed Field

Photo 5. Canal

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Figure 6. San Joaquin River Water Quality Improvement Project Habitat Map
Proposition 84 Storm Water Improvements and
SJRIP Expansion Biotic Report (1960-18)
December 2018

The proposed canal improvement areas are located within existing agricultural canals or developed habitat (Figure 6). Scattered weedy species such as Canadian horseweed (*Erigeron canadensis*), five-hook bassia, and prickly lettuce compose what little vegetation is present. The lack of vegetation is due to ongoing land management that includes grading, spraying, and vegetation removal.

The following wildlife species, summarized in Appendix B, were observed or heard on the Project site: red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), loggerhead shrike, killdeer (*Charadrius vociferous*), common raven (*Corvus corax*), great egret (*Ardea alba*), great blue heron (*Ardea herodias*), black phoebe (*Sayomis nigricans*), horned lark (*Eremophila alpestris*), western meadowlark (*Sturnella neglecta*), red-winged blackbird (*Agelaius phoeniceus*), savannah sparrow (*Passerculus sandwichensis*), and mourning dove (*Zenaida macroura*). Signs (i.e., burrows, tracks, or scat) of California ground squirrels and Botta's pocket gophers (*Thomomys bottae*) were also observed primarily along field and canal margins within the Project site.

4.3 Soils

Four primary soil types underlie the proposed reuse expansion and reservoir sites (Figure 7): 285 - Tranquillity-Tranquillity, wet, complex, saline-sodic, 0 to 1 percent slopes, 470 - Chateau clay, partially drained, 0 to 1 percent slopes, 472 - Wekoda clay, partially drained, 0 to 1 percent slopes, and 479 - Cerini clay loam, 0 to 2 percent slopes. Three primary soil types underlie the proposed pipeline (Figure 6): 468 - Deldota clay, partially drained, 0 to 1 percent slopes, 470 - Chateau clay, partially drained, 0 to 1 percent slopes, and 472 - Wekoda clay, partially drained, 0 to 1 percent slopes. Four primary soil types underlie the proposed lined canal (Figure 6): 285 - Tranquillity-Tranquillity, wet, complex, saline-sodic, 0 to 1 percent slopes, 468 - Deldota clay, partially drained, 0 to 1 percent slopes, 470 - Chateau clay, partially drained, 0 to 1 percent slopes, and 472 - Wekoda clay, partially drained, 0 to 1 percent slopes.

The landform of Tranquillity-Tranquillity, wet, complex, saline-sodic soils is fan skirts. This soil type consists of somewhat poorly drained soils formed from alluvium derived from calcareous sedimentary rock. It does not pond and very rarely floods (NRCS 2018). The landform of Deldota clay is also fan skirts. This soil type consists of somewhat poorly-drained soils formed from alluvium derived from sedimentary rock. Deldota clay does not pond and very rarely floods (NRCS 2018). The landform of Chateau clay is also fan skirts. This soil type consists of poorly-drained soils formed from alluvium derived from sedimentary rock. Chateau clay does not pond and very rarely floods (NRCS 2018). The landform of Wekoda clay occurs on flood plains on basin floors. This soil type consists of poorly-drained soils formed from alluvium derived from sedimentary rock. Wekoda clay does not pond and very rarely floods (NRCS 2018). The landform of Cerini clay loam soils occurs on alluvial fans. This soil type consists of well-drained soils formed from alluvium derived from calcareous sedimentary rock. Cerini clay loam does not pond and very rarely floods (NRCS 2018).

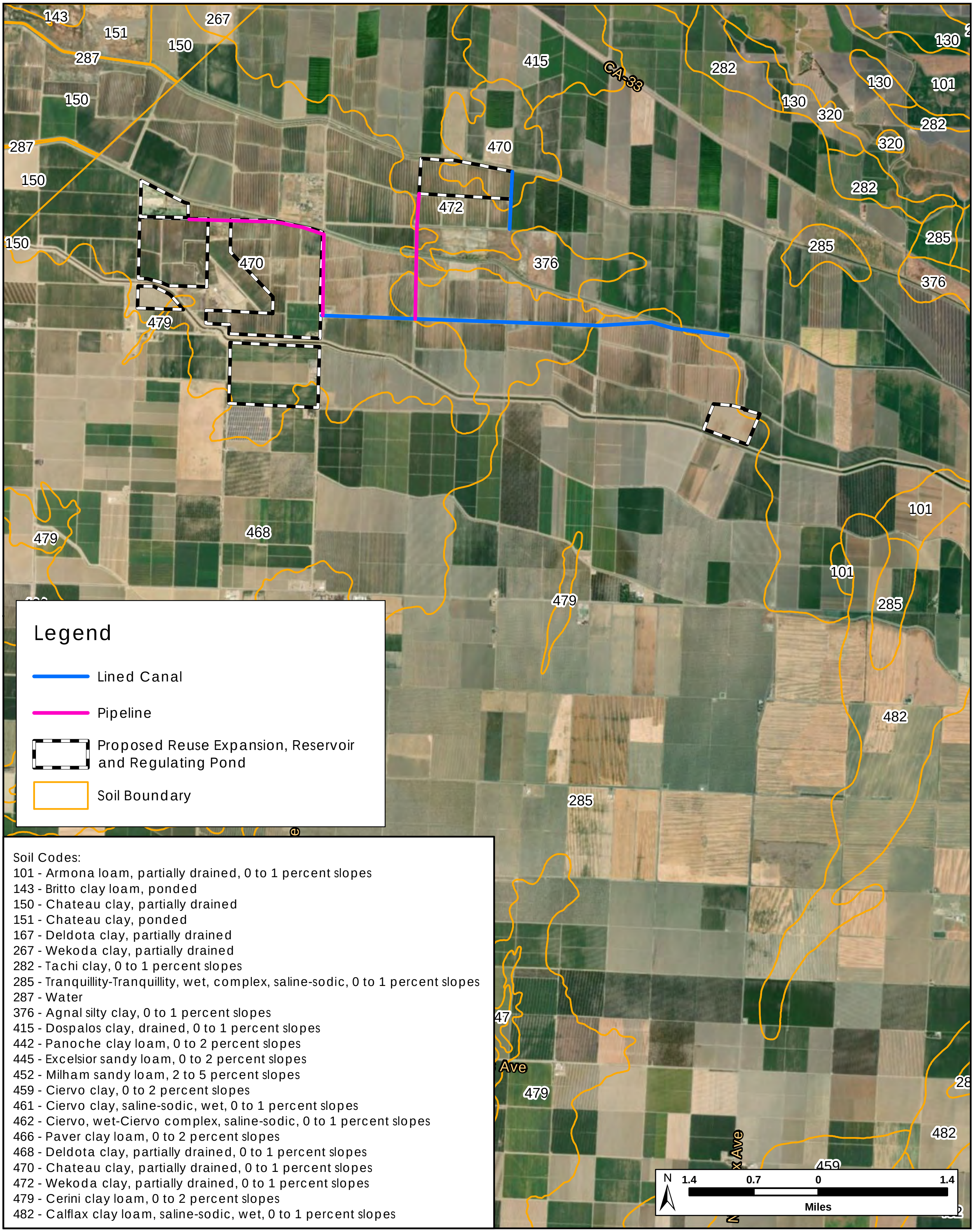

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Figure 7. Soils Map
Proposition 84 Storm Water Improvements and SJRIP Expansion Biotic Report (1960-18)
December 2018

4.4 Wildlife Movement

Because the Project site comprises fallowed and regularly disced land vegetated primarily by nonnative species, it does not provide high-quality habitat for migratory birds or bats. The habitat provides only limited food resources (primarily insects) for some migrant songbirds and migratory bats; therefore, it does not represent a unique or important resource for these animals.

Movement corridors have become an increasingly important focus of conservation biology because their preservation or restoration can provide considerable benefits species, population dynamics and ecosystem function. However, in the three decades since the corridor concept began to appear frequently in the conservation biology literature, there has been much debate over the value of corridors, how they should be managed, and even how they should be defined. This analysis relies on the following criteria to define corridors:

- A corridor must have a specific function with respect to the population biology of a particular target species.
- A corridor must be explicitly identifiable, by its function, as either a habitat corridor or a conduit corridor.
- The quality of the habitat in a corridor is a crucial component of the corridor's value to the target species.

Because of the density of agricultural development in the study area and the lack of continuous, well-vegetated pathways through the Project site, there are no movement corridors on the site that meet the criteria described above.

4.5 Sensitive and Regulated Plant Communities and Habitats

The results of a query of the CNDDB (2018) for sensitive habitats indicate that no sensitive habitats are present on or within 5 miles of the Project site. Additionally, hydric soils are not present, and the flat land lacks depressions capable of holding standing water. Therefore, the site does not support vernal pools or wetlands.

4.6 Nonnative and Invasive Species

The habitat present on the Project site provides little biological value. Several nonnative plant species ranked as moderately or highly invasive by the California Invasive Plant Council (Cal-IPC) were found throughout the site (Cal-IPC 2018). For instance, the highly invasive yellow star thistle (*Centaurea solstitialis*) is present on site; this plant causes severe ecological impacts on physical processes, plant and wildlife communities, and vegetation structure. Moderately invasive species, including blessed milkthistle (*Silybum marianum*), ripgut brome, Bermudagrass (*Cynodon dactylon*), Russian thistle (*Salsola tragus*), five-hook bassia, and hare barley (*Hordeum murinum* ssp. *leporinum*) are also present and can also have substantial ecological impacts (Cal-IPC 2018).

Section 5. Special-Status Species Overview

CEQA requires the assessment of a Project's effects on species protected under federal, state, or local laws and regulations. These species, typically classified as rare, threatened, or endangered, are referred to as *special-status species*, as described in Section 2.1, "Background Research." The laws and ordinances relevant to the Project's potential impacts on special-status species are described in Section 3, "Regulatory Setting."

Information concerning special-status species that may occur on the Project site and in the surrounding vicinity was collected from several sources and reviewed by H. T. Harvey & Associates biologists, as described in Section 2, "Methods for Assessing Biological Resources." The specific habitat requirements, locations of known occurrences of each special-status species, and field data collected from the study area were the principal criteria used to determine the potential for the species to occur on the Project site. Figure 8 depicts the locations of observations of special-status plant and wildlife species in the vicinity of the site, as recorded in the CNDDB (2018). This figure depicts general locations where special-status species are known to occur or have occurred in the past.

5.1 Plant Species

CNPS (2018) identifies 26 CRPR species that have occurred historically in the study area. All these special-status plant species were determined to be absent from the Project site for at least one of the following reasons: (1) specific edaphic requirements for the species, such as clay or alkaline soils, are lacking; (2) appropriate plant communities are lacking; (3) vernal pools and other wetland habitats are lacking; and (4) site conditions are highly degraded (Appendix C).

Several of the 26 species that have been documented in the CNPS query of the surrounding region can tolerate and, in some cases, become established as a result of disturbances associated with agricultural practices, particularly in some of the soils found on the site (e.g., alkaline soils). For example, Parry's rough tarplant (*Centromadia parryi* ssp. *rudis*) (CRPR 4.2) can tolerate repeated disturbance, but no plants were observed on the site despite confirmed observations to the northeast of the site. None of the other queried plant species that can tolerate disturbance are expected to occur on the site. Other species found in the CNPS query, such as chaparral ragwort (*Senecio aphanactis*) (CRPR 2B.2) and forked fiddleneck (*Amsinckia furcata*) (CRPR 4.2), occur in habitats that are not found on the Project site, and therefore these species are not expected to be present.

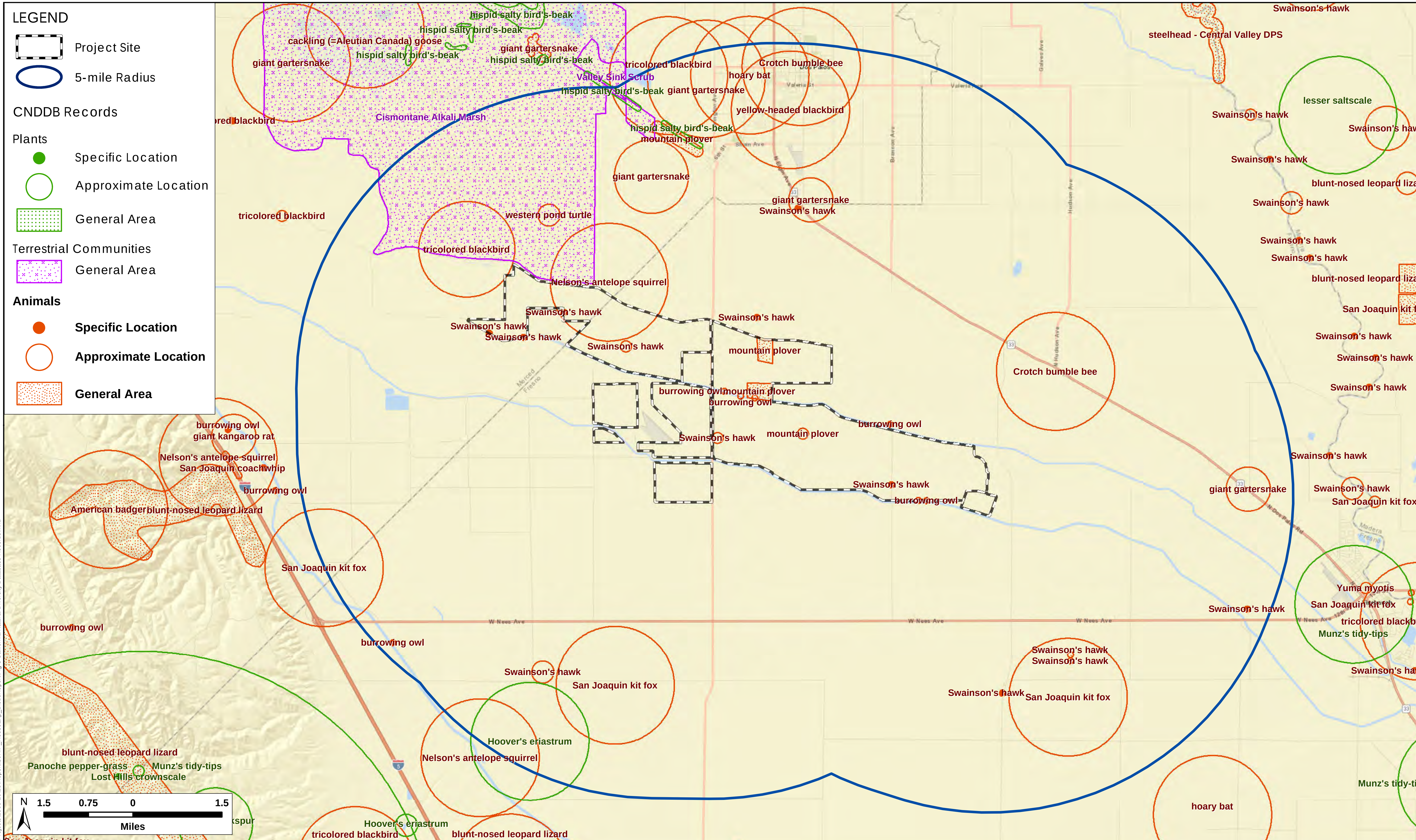

Figure 8. California Natural Diversity Database Records
Proposition 84 Storm Water Improvements and
SJRIP Expansion Biotic Report (1960-18)
December 2018

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5.2 Wildlife Species

Multiple special-status wildlife species are documented by the CNDDB to have occurred in the study area (CNDDB 2018). H. T. Harvey & Associates evaluated the habitat needs of these species to assess their potential to occur on site. The species, their listing status, their habitat requirements, and their potential to occur on the Project site are listed below in Table 1. Detailed descriptions of the species that occur or could occur on the site (*present* or *possible*) are provided in Section 5.3.

Table 1. Special-Status Wildlife Species and Their Potential to Occur on the Project Site

Name	Federal/State Listing Status[1]	Habitat	Potential to Occur on Project Site
Reptiles			
Blunt-nosed leopard lizard *Gambelia sila*	FE/SE	Found in sparsely vegetated alkali and desert scrub habitats, in areas of low topographic relief. Seeks cover in small mammal burrows or under shrubs or other structures; does not excavate burrows.	**Absent.** The Project site contains no suitable habitat because small mammal burrows and vegetation cover are mostly lacking. The most recent CNDDB records of this species in the area date to 1990 and are approximately 8 miles from the Project site.
Giant garter snake *Thamnophis gigas*	FT/ST	Found in freshwater marshes and low-gradient streams with emergent vegetation; adapted to drainage canals and irrigation ditches with mud substrate.	**Absent.** Freshwater marshes and streams are absent from the site. The few patches of marshy vegetation in Project site canals are too small and too isolated from suitable habitat.
San Joaquin whipsnake *Masticophis flagellum ruddocki*	-/SSC	Found in sparse grasslands and saltbush scrub communities with little to no trees.	**Unlikely.** Suitable habitat is not present owing to frequent discing of the Project site.
Western pond turtle *Actinemys marmorata*	-/SSC	Primarily inhabits slow-moving streams and rivers, but can occur in almost any permanent or ephemeral aquatic habitat and nearby upland habitats.	**Absent.** The few patches of marshy vegetation in Project site canals are too small and too isolated from suitable habitat. The nearest record is 3 miles north of the West Pump Station and over 11 miles from the Project site.

Name	Federal/State Listing Status[1]	Habitat	Potential to Occur on Project Site
Birds			
Burrowing owl *Athene cunicularia*	-/SSC	Found in open, dry grasslands, agricultural lands, and rangelands. Often associated with burrowing animals, such as ground squirrels.	**Present.** The Project site contains suitable habitat where California ground squirrel burrows are present, and the species was observed during a survey of the Project site.
Loggerhead shrike *Lanius ludovicianus*	-/SSC	Nests in isolated tall shrubs and dense trees in open landscapes. Forages in scrublands, agricultural fields, and grasslands.	**Present.** Suitable foraging and breeding habitats are present, and the species was observed during a survey of the Project site.
Mountain plover *Charadrius montanus*	-/SSC	Winters in south and central California in sparse and/or short grasslands and plowed fields.	**Possible.** Some suitable foraging habitat is present.
Northern harrier (breeding) *Circus cyaneus*	-/SSC	Nests in marshes and grasslands, usually with tall vegetation. Forages in open habitats.	**Possible.** Suitable foraging habitat is present, and marginally suitable breeding habitat is present.
Swainson's hawk *Buteo swainsoni*	-/ST	Nests in trees near foraging areas that include grasslands and agricultural croplands, especially alfalfa.	**Present.** Swainson's hawks have nested on the adjacent existing SJRIP reuse site. The proposed Project site has both foraging habitat and trees appropriate for nesting.
Tricolored blackbird *Agelaius tricolor*	-/ST	Found in freshwater emergent wetlands, annual grasslands, agricultural areas, and valley foothill riparian habitats.	**Possible.** Breeding habitat is absent, but this species may forage on the Project site.
Yellow-billed cuckoo *Coccyzus americanus*	PT/SE	Prefers desert riparian woodlands, but is also found in orchards adjacent to river bottoms.	**Absent.** Suitable habitat is absent from the Project site. The most recent CNDDB record of this species dates to 1950, and the observation occurred approximately 10 miles east of the Project site. The species is considered extirpated from the San Joaquin Valley.
Yellow-headed blackbird *Xanthocephalus xanthocephalus*	-/SSC	Nests in tall emergent vegetation of marshes. May forage widely, including in agricultural fields.	**Possible.** Breeding habitat is absent, but suitable foraging habitat is present.

Name	Federal/State Listing Status[1]	Habitat	Potential to Occur on Project Site
Mammals			
American badger *Taxidea taxus*	-/SSC	Inhabits a wide variety of habitats, including open woodland, grassland, and agricultural land. Prefers areas with friable soils and abundant small mammal burrows.	**Unlikely.** Suitable habitat is not present owing to frequent discing and flood irrigation of the Project site.
California mastiff bat *Eumops perotis*	-/SSC	Found in open, semiarid to arid communities, including agricultural lowlands, conifer and deciduous woodlands, coastal scrub, grasslands, and chaparral; roosts primarily in cliff faces, and rarely in anthropogenic structures such as high buildings and bridges.	**Unlikely.** The Project site does not contain suitable roosting habitat for this species, but this species frequently forages 50 miles from roosts and could forage over the site.
Giant kangaroo rat *Dipodomys ingens*	FE/SE	Found in annual grasslands on the western side of the San Joaquin Valley. Requires level terrain and sandy loam soils for burrowing.	**Absent.** Suitable habitat is not present on the Project site.
Pallid bat *Antrozous pallidus*	-/SSC	Found in many habitats including grasslands, agricultural lands, openings of coniferous and oak forests, riparian habitats, oak savannas, and arid and semiarid habitats. Roost mostly in crevices and cavities of rocky outcrops, trees, buildings, and bridges.	**Unlikely.** The Project site contains some suitable roosting habitat where trees with exfoliating bark are present.
San Joaquin antelope squirrel *Ammospermophilus nelsoni*	-/ST	Inhabits western San Joaquin Valley from 200 to 1,200 feet in elevation on dry, sparsely vegetated loam soils in broken terrain with gullies and washes.	**Absent.** The most recent record of this species in the vicinity was in 1981 from the Tummey Hills approximately 20 miles from the Project site (CNDDB 2018). Suitable habitat is absent from the Project site owing to frequent discing and the absence of gullies and washes.

Name	Federal/State Listing Status[1]	Habitat	Potential to Occur on Project Site
San Joaquin kit fox *Vulpes macrotis mutica*	FE/ST	Found in desert alkali scrub and annual grasslands; may forage in adjacent agricultural habitats.	**Absent.** The Project site contains marginal habitat because repeated discing and flood irrigation has degraded habitat for small mammal prey species. In addition, no mammalian excavations suitable for use by this species were detected during surveys, and scent-dog surveys over multiple years did not detect this species on the Project site.
Townsend's big-eared bat *Corynorhinus townsendii*	-/SC	Found in many habitats, including native prairies, active agricultural areas, coastal habitats, and coniferous forests. Less common in areas of human disturbance. Roost in caves and cavernous structures, including abandoned buildings.	**Absent.** Roosting habitat is absent for this species.
Tulare grasshopper mouse *Onochomys torridus tularensis*	-/SSC	Found in hot, arid valleys and scrub deserts in the southern San Joaquin Valley. Requires abundant supply of insects for food.	**Absent**. The species has not been detected in the vicinity since 1932 (CNDDB 2018). Suitable habitat is not present owing to frequent discing and flood irrigation of the Project site.
Western red bat *Lasiurus blossevillii*	—/SSC	Found primarily in mature stands of broadleaf trees bordering riparian habitat. Roosts exclusively in foliage.	**Absent.** The Project site is far from riparian habitat.

[1] Listing status abbreviations:

- = not listed under the federal Endangered Species Act.
FE = listed as endangered under the federal Endangered Species Act.
FT = listed as threatened under the federal Endangered Species Act.
PT = proposed to be listed as threatened under the federal Endangered Species Act.
SC = a candidate for listing under the California Endangered Species Act.
SE = listed as endangered under the California Endangered Species Act.
ST = listed as threatened under the California Endangered Species Act.
SSC = designated a species of special concern by the California Department of Fish and Wildlife.

5.3 Special-Status Wildlife Species with Potential to Occur on the Project Site

5.3.1 Burrowing Owl

Federal Status: None; State Status: Species of Special Concern. Burrowing owls are completely dependent on fossorial (adapted for burrowing or digging) mammals for nesting and roosting burrows. Burrowing owls are known to favor areas with short, sparse vegetation (Coulombe 1971, Haug and Oliphant 1990, Plumpton and Lutz 1993), which is the condition typically found in active squirrel colonies. In addition, burrowing owls may select areas that have a high density of available burrows (Plumpton and Lutz 1993). In California, the burrowing owl occupies lower-elevation, open, dry grasslands, deserts, and shrub-steppe habitats. Common mammalian commensals in California include American badgers and ground squirrels. In northern California, burrowing owls are chiefly associated with California ground squirrel colonies that provide nesting, roosting, and escape burrows for the species.

The greatest threats to burrowing owls in California from rapid urbanization of farmland in the Central and Imperial Valleys and cultivation of crops such as vineyards and orchards that are not compatible with burrowing owls (Gervais et al. 2008)

Distribution. In the northern and southern coastal zones (excluding most of Monterey County), the Central Valley, and southeastern California, burrowing owls can be present year-round. Burrowing owl populations have been greatly reduced or extirpated from the San Francisco Bay Area (Trulio 1997). Along the southern coast to Los Angeles, these owls have been eliminated from virtually all private land and occur in only small populations on some federal lands. They also have apparently disappeared from the Coachella Valley. The remaining major population densities of burrowing owls in California are located in the Central and Imperial Valleys (DeSante et al. 1997).

Potential to Occur on the Project Site: Present. Twelve burrowing owls were observed on the banks of ditches within the proposed Project site west of Russell Avenue and two owls were observed at the east end of the Project site (Figure 9). Ground squirrel burrows were observed on ditch banks scattered throughout the proposed Project site. There is potential for burrowing owls to use other portions of the proposed Project site because ground squirrel burrows are present and because the site contains nonnative cropland habitats that provide foraging opportunities for owls.

5.3.2 Loggerhead Shrike

Federal Status: None; State Status: Species of Special Concern. Loggerhead shrikes establish breeding territories in open habitats with relatively short vegetation that allows for visibility of prey. They can be found in grasslands, scrub habitats, riparian areas, other open woodlands, ruderal habitats, and developed areas, including golf courses and agricultural fields (Yosef 1996). Ideal breeding habitat for loggerhead shrikes comprises short grass habitat with many perches, shrubs or trees for nesting, and sharp branches or barbed-wire fences for impaling prey. Shrikes nest earlier than most other passerines, especially in the West where populations are sedentary. The breeding season may begin as early as late February, and lasts through July (Yosef 1996). Nests are typically established in shrubs and low trees, including sagebrush, willows, and mesquite (*Prosopis* sp.), although brush piles also may be used when shrubs are not available.

The causes of loggerhead shrike declines in California and the west are not entirely clear, but evidence suggests that a combination of habitat degradation and pesticide exposure play important roles (Humple 2008).

N:\Projects\1960-10\18\Report\SJRIP_ReuseExp_BioticReport\Figure 9 Locations of Burrowing Owls Observed at the Proposed Expansion Area.mxd

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Figure 9. Locations of Burrowing Owls Observed at the Proposed Expansion Area
Proposition 84 Storm Water Improvements and SJRIP Expansion Biotic Report (1960-18)
December 2018

Distribution. The loggerhead shrike is distributed throughout much of California, except in higher-elevation and heavily forested areas including the Coast Ranges, the Sierra Nevada, the southern Cascades, the Klamath and Siskiyou Ranges, and the highest parts of the Transverse Ranges (Humple 2008).

Potential to Occur on the Project Site: Present. This species was observed during a survey of the Project site. Suitable nesting habitat is available in trees on the Project site and shrubs on adjacent properties, and suitable foraging habitat is present across the entire site.

5.3.3 Mountain Plover

Federal Status: None; State Status: Species of Special Concern (Wintering). This small shorebird breeds in the short-grass prairies east of the Rockies, and winters in large flocks in California's Central and Imperial Valleys and interior Coast Ranges, and in the deserts of northern Mexico. The California range supports 50% to 88% of the global population of the species during the winter months. Mountain plovers begin arriving on their California wintering grounds between mid-September and mid-October, and form loosely affiliated flocks of 2 to more than 1,000 birds (Knopf and Wunder 2006). They forage in flat grasslands with low vegetation, such as grazed pastures and fallow or burned fields (Knopf and Rupert 1995), where they hunt for a variety of invertebrates such as beetles, wasps, moths, butterflies, and grasshoppers, hidden in cracks and crevices in the ground (Knopf 1998). Mountain plovers leave for their breeding grounds in the high plains on the eastern slope of the Rocky Mountains between early and mid-March, often after coalescing into increasingly large flocks in staging habitats along the lower Colorado River Valley (Knopf and Wunder 2006).

Habitat loss and degradation, primarily on the breeding grounds, but also on the wintering grounds, are the primary threats to mountain plovers (Hunting and Edson 2008).

Distribution. The current winter distribution of this species in California includes the western Central Valley including the Sacramento Valley in Colusa, Yolo, and Solano counties and the San Joaquin Valley from Stanislaus to Kern County; the winter distribution also includes Imperial and Riverside counties in the Imperial Valley (Hunting and Edson 2008).

Potential to Occur on the Project Site: Possible. The closest occurrence of this species documented in the CNDDB (2018) is adjacent to the Project site (Figure 7), on the existing SJRIP reuse site. Mountain plovers were present in low numbers when the SJRIP was first established (winters of 2003 and 2004); they were observed in unplanted, mostly barren fallow fields before salt-tolerant crops were planted throughout the site (CNDDB 2018). There have been no records of mountain plovers occurring there since the site was fully planted. If mountain plover currently utilize the Project site, it is likely that a similar pattern will occur at the site.

5.3.4 Northern Harrier

Federal Status: None; State Status: Species of Special Concern (Nesting). The northern harrier nests in marshes and grasslands, usually those with tall vegetation and moisture sufficient to reduce the accessibility of nest sites to predators. Northern harriers forage in a variety of open habitats, especially during the nonbreeding season.

The primary threats to breeding harriers are loss and degradation of nesting and foraging habitat by agricultural practices and other human disturbances (Davis and Niemela 2008).

Distribution. Northern harriers are widely distributed throughout North America and much of California.

Potential to Occur on the Project Site: Possible. Although no occurrences have been documented in the CNDDB (2015) in the study area they have often been observed using the existing SJRIP reuse site (H. T. Harvey & Associates 2003-2018). Although suitable foraging habitat is present on the Project site, only marginally suitable nesting habitat is present.

5.3.5 Swainson's Hawk

Federal Status: None; State Status: Threatened. Swainson's hawks occupy grassland, rangeland, and agricultural environments, typically along riparian woodlands that provide nesting, roosting, and perching trees. Swainson's hawk habitat is usually open, low-relief grass, crop, or forb-dominated cover with low, sparse structure and scattered large, deciduous trees (Olendorff 1973). Individuals commonly forage in alfalfa and other hay fields. These fields may be most suitable because they are not routinely tilled and may be treated with less pesticide than are row crops (Bechard et al. 2010).

Home range sizes vary greatly by location, with larger sizes found in areas with unsuitable crop types such as taller standing crops, unharvested row crops, orchards, and vineyards (Estep 1989, Woodbridge 1991). Smaller home ranges occur in alfalfa, fallow fields, and dry pastures (Estep 1989, Woodbridge 1991). Radio-telemetry studies indicate that nesting adults can forage as far as 18.6 miles from the nest (Bechard et al. 2010).

Swainson's hawks generally are considered complete annual migrants, with no overlap between nesting and wintering grounds. They occupy similar habitats in both the breeding and nonbreeding ranges (Goldstein et al. 1996). Throughout much of its North American range, the species migrates from nesting areas in temperate North America to South America. However, recent satellite telemetry studies have revealed that most of California's Central Valley population winters in central Mexico (Bradbury et al. in prep.). Southward migration for California Swainson's hawks occurs from August through November and February through April (Bechard et al. 2010). In the Central Valley, the biggest threat to Swainson's hawks has been the conversion of foraging habitat to agricultural uses such as cotton and vineyards and orchards that are unsuitable for Swainson's hawk foraging (Bloom 1980).

Distribution. In North America, Swainson's hawks breed from western Canada and southeastern Alaska south through the western United States to northern Mexico. In North America, they occupy nesting habitats only and do not overwinter (with the exception of a small overwintering population in the San Joaquin Valley). In California, Swainson's hawks occur primarily in the Central Valley but also occur in scattered locations in the Klamath Basin, northeastern plateau (Bloom 1980), Mojave Desert, and a few other arid locations featuring appropriate habitat (Polite 1990).

Potential to Occur on the Project Site: Present. The nearest CNDDB (2018) record of this species is a 2001 observation of a nest located immediately east of the proposed expansion site within the existing SJRIP reuse area (Figure 7). Other more recent nests are known from the Project site study. The field surveys of the Project site were conducted after Swainson's hawks have typically migrated from the San Joaquin Valley; however, suitable nesting trees are present both on the site and in the vicinity, and suitable foraging habitat could be present in the vicinity (depending on which crops are planted). Swainson's hawks have nested on and adjacent to the existing SJRIP reuse site since its establishment and have been observed foraging in Jose tall wheatgrass (H. T. Harvey & Associates 2003-15). As Jose tall wheatgrass will likely be the primary crop planted on the Project site, Swainson's hawks nesting near the Project site will likely forage on the site.

5.3.6 Tricolored Blackbird

Federal Status: None; State Status: Threatened. Tricolored blackbirds nest in a variety of vegetation types, including freshwater marshes dominated by cattails or bulrushes, willows, blackberries, thistles, and nettles (Neff 1937). A variety of upland and agricultural areas also are used as breeding habitat (DeHaven et al. 1975, Beedy et al. 1991, Cook 1996). In the San Joaquin Valley, many large colonies occur in silage and grain fields (Collier 1968, Cook 1996) (recently, the largest colonies have been found in grain fields). Less commonly used nesting substrates include giant reed (*Arundo donax*), safflower (*Carthamus tinctorius*) black mustard (*Brassica nigra*) (Orians 1961, DeHaven et al. 1975), saltcedar, riparian scrublands and forests with species such as Fremont cottonwood (*Populus fremontii*) and Oregon ash (*Fraxinus latifolia*), and mulefat (*Baccharis salicifolia*) (Beedy et al. 1991, Hamilton et al. 1995). Nesting colonies typically are found near standing or flowing fresh water. A breeding colony requires the following habitat features: accessible water, protected (i.e., flooded or surrounded by thorny or spiny vegetation) nesting sites, and a suitable foraging area with an adequate insect prey base within a few miles of the nesting colony (Beedy and Hamilton 1997).

Tricolored blackbirds usually forage within about 3 miles of the nesting colony, but may forage as far away as about 8 miles in rare cases (Orians 1961, Beedy and Hamilton 1997). High-quality foraging areas include irrigated pastures, lightly grazed rangelands, dry seasonal pools, mowed alfalfa fields, feedlots, and dairies (Beedy and Hamilton 1999). However, habitat within the foraging range of an individual is seldom comprises entirely high-quality foraging habitat, and low-quality habitats, such as cultivated row crops, orchards, vineyards, and heavily grazed rangelands, often are interspersed among high-quality foraging areas (Beedy and Hamilton 1999).

Following a temporary 6 month emergency listing of the species in 2015, based on a "dramatic decline" in the population, the California Fish and Game Commission voted to list the tricolored blackbird as a threatened species on April 19, 2018, and a Notice of Findings to that affect was adopted by the California Fish and Game Commission on August 23, 2018. **Distribution.** The tricolored blackbird occurs mostly within California, although a few nesting colonies exist in Oregon, Washington, Nevada, and coastal Baja California (Beedy 2008). In California, tricolored blackbirds occur in a large continuous distribution that extends from Sonoma County to Santa Barbara County along the coast and across the Central Valley from Tehama County to Kern County. A large, disjunct portion of the range extends across coastal southern California, and a smaller disjunct area exists in southern and eastern Kern County and northern Los Angeles County. Several small disjunct populations are scattered across northern California.

Tricolored blackbirds form large, often multispecies, flocks during the nonbreeding, winter period in California and range more widely than during the reproductive season. The Sacramento–San Joaquin River Delta and coastal areas are important wintering areas (Beedy 2008). This species is rarely observed in winter in the southern San Joaquin Valley or the Sacramento Valley north of Sacramento County (Beedy and Hamilton 1999) and banding study data show that at least some individuals are permanent residents of the Central Valley (Neff 1942, DeHaven and Neff 1973). The primary threat to tricolored blackbirds is the loss and degradation of wetland nesting habitats and upland foraging habitats by human activities (Beedy and Hamilton 1999).

Potential to Occur on the Project Site: Possible. The closest occurrence recorded in the CNDDB (2018) is a nesting colony located approximately 6 miles northwest of the Project site north of the Outside Canal in marsh habitat within privately owned duck clubs (Figure 8) which was last observed in 2010. This species was not observed during surveys of the Project site. Although there is no nesting habitat on the Project site, suitable foraging habitat is present.

5.3.7 Yellow-Headed Blackbird

Federal Status: None; State Status: Species of Special Concern. In the Central Valley, important foraging areas for nesting yellow-headed blackbirds tend to be found in pastures and in cropland, especially alfalfa fields where insect prey is abundant (Crase and DeHaven 1972, Twedt and Crawford 1995) and rice fields up to 0.5 mile from freshwater marshes supporting breeding colonies (Twedt and Crawford 1995). During breeding, adults forage primarily on insects and feed young almost entirely with aquatic insects, such as damselflies (Willson 1966, Orians 1980).

Yellow-headed blackbirds winter primarily in sexually segregated flocks in agricultural fields and pastures. Occasionally, they mix with other blackbird species. They arrive at their California breeding grounds in April or May and breed almost exclusively in marshes with tall emergent vegetation, such as cattails or tules, in open areas over fairly deep water (Orians and Willson 1964). They can nest singly or in loose colonies, and males can be paired with as many as six females. Habitat loss, particularly the draining of wetlands, is the major threat to this species (Jaramillo 2008).

Distribution. Yellow-headed blackbirds are short- to medium-distance migrants that breed throughout much of the interior western United States and winter primarily in Arizona, New Mexico, Texas, and Mexico, as well as in a few locations in California (Twedt and Crawford 1995, Jaramillo 2008). In California, they winter in isolated sites in the Central Valley and Delta region, as well as in the Lower Colorado River Valley and the Imperial Valley (Crase and DeHaven 1972, Rosenberg et al. 1991, Twedt and Crawford 1995, Jaramillo 2008).

Potential to Occur on the Project Site: Possible. This species was not observed during surveys of the Project site, and the site lacks the dense marsh vegetation the species prefers for nesting. Suitable foraging habitat is present in the irrigated field crops on the site.

5.3.8 Pallid Bat

Federal Status: None; State Status: Species of Special Concern. Pallid bats are most commonly found in oak savanna and in arid and semiarid environments. They are colonial, and colony sizes may range in size from a few individuals to more than a hundred (Wilson and Ruff 1999, Sherwin and Rambaldini 2005). In late fall and winter, males and females share a common wintering roost, but females leave the wintering roost in early spring to form maternity colonies. In California, maternity colonies may be active from May to October (Gannon 2003).

Typically, pallid bats use separate day and night roosts (Hermanson and O'Shea 1983). In general, day roosts are more enclosed, protected spaces than are night roosts, which often are located in open buildings, porches, garages, highway bridges, and mines. Pallid bats commonly day-roost in rocky outcrops, trees, buildings, or bridges (Zeiner et al. 1990, Ferguson and Azerrad 2004). Roosts generally have unobstructed entrances/exits, and are high above the ground, warm, and inaccessible to terrestrial predators (Sherwin and Rambaldini 2005). The roosts are very susceptible to human disturbance, and urban development has been cited as the most significant factor contributing to the regional decline of this species (Miner and Stokes 2005).

Distribution. Pallid bats occur throughout California with the exception of the northwest corner of the state and the high Sierra Nevada (Hall 1981, Zeiner et al. 1990).

Potential to Occur on the Project Site: Unlikely. No pallid bats have been documented in the CNDDB (2018) within 5 miles of the Project site, and the closest record is more than 15 miles away from the Project site.

5.3.9 San Joaquin Kit Fox

Although the San Joaquin kit fox is considered absent from the Project site, the following description of the species is provided in acknowledgement of the concern surrounding its conservation.

Federal Status: Endangered; State Status: Threatened. The San Joaquin kit fox typically occurs in annual grassland or mixed shrub/grassland habitats throughout low, rolling hills and in valleys (Morrell 1972). These foxes will use grazed grassland habitat, as well as grasslands with scattered shrubs or structures such as power lines and wind turbines. The foxes also live adjacent to, and forage in, tilled and fallow fields and irrigated row crops (Warrick et al. 2007). They are primarily nocturnal, and their diet varies geographically, seasonally, and annually, but throughout most of the species' range, diet consists primarily of rodents, rabbits, ground-nesting birds, and insects (Scrivner et al. 1987). Giant kangaroo rats are a favored prey item (Cypher et al. 2000). San Joaquin kit foxes require underground dens for temperature regulation, shelter, reproduction, and predator avoidance (Morrell 1972). They commonly modify and use dens constructed by other animals, such as California ground squirrels, American badgers, and coyotes, and will use human-made structures as well (USFWS 1998). Dens are usually situated in loose-textured soils in areas with low slopes (USFWS 1998). Large scale conversion of suitable foraging and denning habitat in the Central Valley to agriculture and urbanization, and predation pressure from coyotes are some of the major threats to San Joaquin kit fox (USFWS 1998).

Distribution. Before 1930, the range of the San Joaquin kit fox included most of the San Joaquin Valley and adjacent foothills. The species' range extended from southern Kern County north to Tracy in San Joaquin County on the west side of the valley, and on the east side of the valley, its range extended north to La Grange in Stanislaus County (Grinnell et al. 1937). Additional kit fox localities include the Hollister area of San Benito County, areas of the Salinas River Valley of San Luis Obispo and Monterey counties, the Carrizo Plain, and a narrow band of suitable habitat in Contra Costa, San Joaquin, and northeastern Alameda counties (Jensen 1972, Swick 1973).

Populations of the San Joaquin kit fox appear to be increasingly isolated from one another owing to developments such as cities, aqueducts, irrigation canals, surface mining, road networks, petroleum fields, and other industrial projects (USFWS 1998).

Potential to Occur on the Project Site: Absent. The nearest recorded San Joaquin kit fox occurrence was documented approximately 7 miles southwest of the proposed expansion site in 1920 (CNDDB 2018). San Joaquin kit foxes have not been recorded in the project vicinity since 1975 (CNDDB 2018). The lack of sufficient numbers of small mammal burrows on the site indicates that there are poor foraging conditions onsite for kit foxes. Additionally, no mammalian excavations suitable for use by San Joaquin kit foxes were observed. Lastly, extensive surveys in 2015 (Figure 5) and 2018 (Figure 4) by scent-detection dogs trained to detect San Joaquin kit fox sign did not detect any such sign on the project site. The determination that San Joaquin kit fox are absent from the project site is based on the absence of sign observed by qualified biologist during more than a decade of monitoring the SJRIP, the results of the scent-dog surveys, the poor quality of habitat on the project site, the lack of recent San Joaquin kit fox occurrences in the project vicinity (CNDDB 2018), and distance between the project site and occupied kit fox habitat.

Section 6. Regional Trace Element Concerns

The project would expand the capacity of the existing SJRIP that reuses subsurface drainwater generated by local farming practices. The pumps and water conveyances associated with the Project will bring the same drainwater applied to the existing SJRIP to be applied to salt-tolerant crops within the expanded area. This drainwater is known to contain salts, selenium, boron, and other naturally occurring elements. The purpose of the project is to protect the San Joaquin River from these drainwater constituents. The possible detrimental biological effects of these constituents is described below.

6.1 Selenium

Selenium is a dietary microelement essential to the normal physiological function of animals. However, toxic concentrations of selenium in birds result in decreased egg hatchability and increased teratogenesis (embryo deformities), among other complications. Selenium exists in four oxidation states: elemental selenium (Se^{0}), selenide (Se^{-2}), selenite (Se^{+4}), and selenate (Se^{+6}). Selenate and selenite are the two inorganic forms found in evaporation basin water, with selenate predominant (Presser and Ohlendorf 1987). Both forms are not readily available to wildlife and thus do not pose a danger. However, both can be biotransformed by soil microflora into a number of organic forms (Ogle et al. 1988). Many of these organic forms, which are volatile, are released into the atmosphere and are harmless. The organic form selenomethionine is available to wildlife through the diet (Maier and Knight 1994). The bioconcentration and conversion of selenium to selenomethionine, the most toxic form to wildlife, is much slower for selenate than for selenite (Ogle et al. 1988), which is fortunate because the dominant inorganic form in drainwater in the San Joaquin Valley is selenate. If selenite were dominant, biocycling processes would be faster, resulting in more readily available selenomethionine at higher concentrations.

Once selenium is converted to the organic form selenomethionine, it bioaccumulates through the food chain and becomes available to aquatic birds that feed in areas were drainwater pools (Ogle et al. 1988). One of the most selenium-sensitive species that feeds in such areas is the black-necked stilt (*Himantopus mexicanus*), and the most sensitive life stage is the embryo (Ohlendorf et al. 1993).

6.1.1 Toxicokinetics

Selenomethionine is the primary form available for ingestion by animals (Ohlendorf 1989). In birds, selenomethionine is absorbed by the methionine active transport system in the small intestine (Scott et al. 1982) where it is then distributed by serum alpha and beta globulins and erythrocytes. Organic selenium is stored in the liver, pancreas, kidneys, and muscle (Ensminger et al. 1983). Excretion of excess selenium in birds is through the egg (Heinz and Fitzgerald 1993) or through the formation of dimethyl selenide $(CH_3)_2Se$, which is volatile and exhaled out the lungs (Donaldson 1980).

6.1.2 Thresholds

Selenium threshold levels for wildlife (Table 2) have been discussed in Skorupa and Ohlendorf (1991), in the *Cumulative Impacts of Agriculture Evaporation Basins on Wildlife* (CH2M Hill et al. 1993), in Maier and Knight (1994) and elsewhere. Maier and Knight (1994) also presented a comprehensive review of the literature. Safe water, dietary, and tissue selenium concentrations are <2 parts per billion (ppb), <3 parts per million (ppm) (dry weight [wt]), and <3 ppm (dry wt), respectively (Maier and Knight 1994). The thresholds presented in Table 2 were developed for waterbird species most sensitive to selenium exposure. Avian species are known to have differing sensitivities to selenium exposure, showing differing rates of both teratogenesis and rates of egg hatchability impairment, with freshwater species tending to be the most sensitive (ducks, American coots [*Fulica americana*], and eared grebes [*Podiceps nigricollis*]) (Ohlendorf 2003). Eggs are considered the best biotic indicator, of the thresholds described in Table 2, for assessing selenium transfer and toxic biological effects in birds (Skorupa and Ohlendorf 1991, Ohlendorf et al. 1993). Hatchability of eggs when incubated to full term is thought to be a better benchmark for setting selenium exposure thresholds because it is a more sensitive measure than teratogenesis (Janz et al 2003).

Table 2. Selenium Thresholds for Waterbirds

Water (ppb)	Food Chain (ppm)	Bird Egg (ppm)	Bird Liver (ppm)	Expected Effects
<2.3	<1.7	<3	<10	Background; low probability of reproductive effect in birds.
2.4–7.8	1.8–3.5	3–7.9	10–30	Elevated; possible reproductive effects; site-specific studies needed.
7.9–32	3.6–7.4	8–18	10–30	Probability of reduced hatchability effects. Threshold levels for livers are not well known so the range of 10–30 ppm is considered to be elevated, with a possibility of reduced hatchability.
>32	>7.4	>18	>30	High probability of reproductive effects, including reduced hatchability and increased occurrence of embryo deformities (teratogenesis).

Source: CH2M Hill et al. 1993.

Notes: ppb = parts per billion; ppm = parts per million.

Rates of hatchability impairment have been published for several species including black-necked stilts, American Avocets, and red-winged blackbirds, but not for killdeer (Table 3). The rates of hatchability impairment in Table 3 are not directly comparable because the studies used different methodologies and measured different endpoints.

Table 3 Hatchability of Bird eggs in Relation to Selenium Concentrations in Eggs

Species	Egg Selenium Concentration (ppm dry wt.)	Effect	Notes	References
Black-necked Stilt	6-7	Hatchability EC 10	Field study – Se measured in randomly selected egg from each clutch – hatch success of each clutch compared to that of group with lower range of Se concentrations	USDOI 1998
Black-necked stilt	21-31	Hatchability EC 10	Same data as above but different data analysis approach	Adams et al. 2003
American Avocet	60	Low bound of a concentration range associated with reproductive impairment of 20% of clutches	Field study – measured viability of clutches from which sampled egg Se ranging from 0 to 100 ppm analyzed by grouped by intervals of 20 (0-20, 20-40, etc.)	USDOI 1998
Red-winged Blackbird	22	Threshold for adverse effects	Field study examined hatchability of eggs incubated to full term	Harding 2008

Note: Table adapted from Janz et al. 2010.

Though selenium induced hatchability impairment has not been published for killdeer, some inference can be drawn from other studies. Killdeer sensitivity to selenium, measured by rates of teratogenesis, has been shown to occur between the sensitivities of black-necked stilts and American avocets (Janz et al. 2010). It follows, then, that the rate of hatchability impairment in killdeer would likely occur between that of stilts and avocets. For black-necked stilts, reported rates of hatchability impairment range from a clutch-wise EC 10 (concentration at which at least one egg in 10% of the clutches would not hatch) of between 6 and 7 ppm selenium (USDOI 1998) and an EC10 of between 21- and 31-ppm selenium (Adams et al. 2003, using the same data as USDOI 1998 but analyzed differently). American avocets have been shown to be far less sensitive to selenium than most other bird species studied. The lower boundary of a concentration range associated with reproductive impairment in 20% of clutches (with 13.5% impairment being the background level) is 60 ppm selenium (USDOI 1998). Groups of avocet clutches with egg-selenium values of between 20 and 40 ppm and 40 and 60 ppm did not differ in hatchability rates from the control group (zero to 20 ppm).

One of the most detailed avian selenium response studies of a passerine (songbird) examined red-winged blackbird nesting over three years (2003-2005) in Canadian lakes that had elevated selenium resulting from coal mining (Harding 2008). This study found that egg-selenium uptake in red-winged blackbirds was not linear, with rates of uptake decreasing as environmental selenium increased. The study also found that both red-winged blackbird egg hatchability and nestling survival were not impacted until egg-selenium levels reached 22 ppm.

6.1.3 Exposure of Birds to Selenium at the Existing SJRIP Reuse Site

Water samples from the sources of drainwater used to irrigate the existing SJRIP reuse site averaged 41 ppb selenium (range from 18 to 78 ppb selenium) from 2013 to 2018 (Panoche Drainage District data). These sources often exceeded the 32 ppb threshold that CH2M Hill et al. (1993) associated with a high probability of reproductive effects, including reduced hatchability and increased occurrence of embryonic deformities (Table 2).

Biological monitoring of the existing SJRIP reuse site has included collecting the eggs (for selenium and boron content analysis) of birds nesting on the site. The study birds are from three species groups: killdeer, recurvirostrids (black-necked stilts and American avocets combined), and red-winged (*Agelaius phoeniceus*) blackbird. Eggs from the three groups also were collected from the vicinity of the SJRIP to provide reference data on regional selenium and boron concentrations. Selenium concentrations in eggs collected from the SJRIP from 2003 to 2018 were significantly higher than selenium concentrations in eggs collected from reference areas during the same period within all three species groups (t-tests, Table 4).

Table 4. Geometric Mean Egg-Selenium Concentrations from the Existing SJRIP Reuse Site, 2003 to 2018

	Selenium		
Species **Location**	**n**	**Geometric Mean ppm Se (dry wt)[a]**	**Range**
Killdeer			
Existing SJRIP reuse site	156	15.7	2.61–54.7
Off-site reference samples[b]	146	4.7	1.86–39.3
Significance difference ($t = 14.0323$, $df = 300$, $P < 0.0001$) between sites.			
Recurvirostrids (black-necked stilts and American avocets)			
Existing SJRIP reuse site[c]	95	24.9	3.39–98.9
Off-site reference samples	149	10.2	1.72–43.6
Significance difference ($t = 9.3926$, $df = 242$, $P < 0.0001$) between sites.			
Red-winged blackbirds[d]			
Existing SJRIP reuse site	174	7.6	1.96–20.9
Off-site reference samples	113	4.0	2.37–7.99
Significance difference ($t = 13.0906$, $df = 285$, $P < 0.\ 0001$) between sites.			

[a] ppm Se, dry wt = parts per million selenium dry weight.
[b] Off-site reference sampling ended after 2013.
[c] There has only been one SJRIP reuse site recurvirostrid nests to collect from since 2011.
[d] No red-winged blackbird eggs were collected in 2005.

Yearly geometric-mean selenium levels in killdeer eggs collected between 2001 and 2018 at the existing SJRIP reuse site have ranged from 6.2 to 28.9 ppm (dry wt.), whereas recurvirostrid egg-selenium annual geometric-mean levels have ranged from 8.7 to 68 ppm (dry wt) from 2003 to 2018 (H. T. Harvey & Associates 2004–2013, 2015a, 2015b; 2016, 2017, 2018, and H. T. Harvey & Associates unpublished data). The lower and upper ends of the ranges occurred in years when the sample size was low (n<4) for both species groups, so the values from all the survey years together (Table 4) are more likely to accurately describe selenium exposure in killdeer and recurvirostrids.

Management activities at the existing SJRIP reuse site have greatly reduced selenium-related impacts on nesting shorebirds by eliminating nesting habitat where possible and hazing potentially nesting birds from the site. Hazing of birds during the nesting season, diligent water management, and modification of drains to discourage avian use have resulted in fewer killdeer and recurvirostrids nesting on the site. The number of recurvirostrid nests in the existing SJRIP reuse site decreased from more than 30 in 2003 to two in each year from 2009 through 2011, and to zero from 2012 to 2017. A single black-necked stilt nest was detected on the project in 2018 (H. T. Harvey & Associates 2004–2013, 2015a, 2015b; 2016, 2017, 2018, and H. T. Harvey & Associates unpublished data). It is anticipated that these management approaches would have the same effect on recurvirostrid nesting within the proposed expansion areas.

Yearly geometric-mean selenium levels in red-winged blackbird eggs collected between 2003 and 2018 at the existing SJRIP reuse site have ranged from 5.9 to 13.5 ppm (dry wt), and the overall geometric mean during that period was 7.6 ppm (dry wt) (Table 4). The number of red-winged blackbirds nesting on the site has not been measured; however, it appears to be decreasing (H. T. Harvey & Associates 2004-2013, 2015a, 2015b; H. T. Harvey & Associates unpublished data). The most likely reason for the decline of birds detected during monitoring is the increase in harvesting of the pasture crops on the reuse site. The hay from the site, mostly Jose-tall wheatgrass, is sold to offset project costs and is harvested on a fairly tight schedule, which shortens the amount of time in which each pasture is suitable for red-winged blackbird nesting (the period between when pasture crops are a suitable height for nest building and when mowing occurs is too short for most birds to complete a nest cycle). Thus, passerine nests in the pastures of the existing SJRIP and in Jose tall wheatgrass fields on the Project site are less likely to be successful, whether they are affected by selenium toxicity or not.

6.2 Other Constituents

Arsenic, boron, and molybdenum may cause impacts on wildlife at evaporation basins in the San Joaquin Valley where drainwater pools (Ohlendorf et al. 1993). Potential effects caused by these elements are summarized in this section.

Arsenic exists in four oxidation states: elemental arsenic, arsinide (-3), arsenite (+3), and arsenate (+5). Arsenate is 60 times less toxic to humans than arsenite (Tanji and Grismer 1989). Arsenate is the form found in ponded drainwater (Tanji and Grismer 1989, CH2M Hill et al. 1993). Arsenate does not accumulate in the water column for two reasons: (1) it is absorbed strongly by clay minerals in the pond bottom, and (2) soil microflora transform arsenate to volatile organic forms that are released into the atmosphere. Arsenate will bioconcentrate in aquatic invertebrates and fish, but biomagnification in the food chain does not occur (Eisler 1988). Avian eggs and invertebrates from drainwater ponds with elevated water-arsenic concentrations did not exhibit elevated tissue-arsenic levels (Ohlendorf et al. 1993). Few aquatic invertebrates from drainwater ponds have levels above 30 ppm arsenic. Because of the physical and chemical properties of arsenate in ponded drainwater, arsenic is not readily available to biotic systems and thus does not pose a danger to wildlife.

Molybdenum exists in six oxidation states (0, +2, +3, +4, +5, and +6), and molybdate anion (+6) is the only form found in ponded drainwater (Tanji and Grismer 1989). Aquatic flora and fauna, as well as birds, appear to be resistant to molybdenum salts (Eisler 1989, CH2M Hill et al. 1993). The low risk of molybdenum toxicosis at evaporation basins is further supported by Ohlendorf et al. (1993). They reported that only 16 of 97 avian eggs analyzed for molybdenum had concentrations above the detection level of 3 ppm. The highest individual egg concentration was 16 ppm molybdenum. They further suggested that the embryotoxic threshold for eggs was between 23 and 33 ppm molybdenum.

Boron has only one oxidation state (+3). Boric acid is the primary form found in drainwater ponds, but it may convert to borax as evaporation concentrates the salts (Tanji and Grismer 1989). Boron bioconcentrates in aquatic organisms (plants and invertebrates), but evidence is lacking that biomagnification occurs in aquatic ecosystems (Maier and Knight 1991).

Although boron water concentrations are elevated in the drainwater used on the SJRIP site, the ecological risk to wildlife is probably low (CH2M Hill et al. 1993). In killdeer and red-winged blackbird eggs collected from the SJRIP from 2003 to 2018, egg-boron concentrations were significantly higher than boron concentrations in eggs collected from reference areas during the same period (t-tests, Table 5). In recurvirostrid eggs, there was no significant difference between egg-boron concentrations at the existing SJRIP reuse site and those in the reference areas (t-tests, Table 5). In another study, most sets of shorebird eggs from drainwater ponds averaged <5 ppm boron (Ohlendorf et al. 1993), and current information indicates that slightly elevated egg-boron does not cause embryotoxicity (Ohlendorf et al. 1993).

Table 5. Geometric Mean of Egg-Boron Concentrations from the Existing SJRIP Reuse Site, 2003 to 2015

Species Location	Boron n	 Geometric Mean ppm B (dry wt)[a]	 Range
Killdeer			
Existing SJRIP reuse site	156	3.0	0.31–25.7
Off-site reference samples[b]	146	1.5	ND–10.1
Significance difference t =5.8437, df = 300, $P < 0.0001$) between sites.			
Recurvirostrids			
Existing SJRIP reuse site[c]	95	3.4	0.69–14.4

Species Location	n	Boron Geometric Mean ppm B (dry wt)[a]	Range
Off-site reference samples	149	2.9	0.05–31.2
No significant difference (t =-1.1614, df = 241, *P* = 0.2466) between sites.			
Red-winged blackbirds[d]			
Existing SJRIP reuse site	174	7.9	0.68–28.2
Off-site reference samples	113	4.0	ND–28.8
Significant difference (t =6.4784, df = 285, *P* < 0.0001) between sites.			

[a] ppm B, dry wt = parts per million boron dry weight.

[b] Off-site reference sampling ended after 2013.

[c] There have been no existing SJRIP reuse site recurvirostrid nests to collect from since 2011.

[d] No red-winged blackbird eggs were collected in 2005.

In summary, of the four elements of potential concern, selenium poses the greatest ecological risk to wildlife exposed to drainwater. The greatest risk is reduced hatchability and increased teratogenesis in shorebirds that ingest elevated selenium through food-chain biomagnification.

Section 7. Impacts and Mitigation Measures

7.1 Significance Criteria

CEQA and the State CEQA Guidelines provide guidance on evaluating the impacts of projects on biological resources and determining which impacts would be significant. The act defines a *significant effect on the environment* as "a substantial adverse change in the physical conditions which exist in the area affected by the proposed project." Under State CEQA Guidelines Section 15065, a project's effects on biological resources are deemed significant if the project would:

- 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, or
- reduce the number or restrict the range of a rare or endangered plant or animal.

In addition to the Section 15065 criteria, which trigger mandatory findings of significance, Appendix G of the State CEQA Guidelines provides a checklist to consider when analyzing the significance of project effects. The following significance criteria (Table 6) were used to evaluate the project's impacts on biological resources using the identified measurements and significance thresholds.

Table 6. Application of Significance Criteria

Criterion	As Measured by...	Significance Threshold	Source
(1) 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 CDFW or USFWS?	The potential for the project to disrupt essential behaviors for survival or reproduction or result in the loss of species or their habitat.	Direct, indirect, and/or cumulative impacts result in a substantial adverse effect at a population level.	State CEQA Guidelines Appendix G checklist item (a)

Criterion	As Measured by...	Significance Threshold	Source
(2) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by CDFW or USFWS?	Acreage of temporary and permanent losses of vegetation, including riparian habitat or another sensitive natural community. Potential for facilitating the establishment and spread of noxious weeds and invasive and nonnative plants. Acreage of lost foraging habitat for wildlife.	Temporary and/or permanent losses of or disturbance to habitat occur, resulting in substantial adverse effects at a scale relevant to the resource.	State CEQA Guidelines Appendix G checklist item (b)
(3) 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) through direct removal, filling, hydrological interruption, or other means?	Acreage of affected jurisdictional wetland habitats.	Jurisdictional wetland habitats are degraded or removed.	State CEQA Guidelines Appendix G checklist item (c)
(4) 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?	Loss of clearly identified corridor or nursery habitat or disruption in the use of these habitats.	Ecological services are reduced sufficient to substantially interfere with the target species use, survival, and/or reproduction in corridors and/or nursery habitats.	State CEQA Guidelines Appendix G checklist item (d)
(5) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	Inconsistency with goals and objectives of relevant local policies or ordinances.	Direct conflict with a goal or objective of a local policy or ordinance occurs.	State CEQA Guidelines Appendix G checklist item (e)
(6) Conflict with the provisions of an adopted habitat conservation plan; natural community conservation plan; or other approved local, regional, or State habitat conservation plan?	Inconsistency with goals and objectives of relevant conservation plans.	Direct conflict with a goal or objective of a relevant conservation plan occurs.	State CEQA Guidelines Appendix G checklist item (f)

Notes: CDFW = California Department of Fish and Wildlife; USFWS = U.S. Fish and Wildlife Service.

7.2 Potential Effects of the Project

The following potential biological effects of the proposed Project were identified by considering each significance criterion (Table 6) in light of the Project description, the environmental setting of the Project site, the biological resource issues of concern for the Project, and the data collected from the nearby SJRIP. For each impact determined to be potentially significant, mitigation measures are recommended to avoid or reduce the impact to less than significant levels.

7.2.1 Impacts Found to Be Less Than Significant

Special-Status Species

The Project site provides suitable foraging and nesting habitat for loggerhead shrikes, and suitable foraging (but not nesting) habitat for mountain plovers, northern harriers, tricolored blackbirds, and yellow-headed blackbirds. The proposed Project is unlikely to change the suitability of the site for these species, except for the mountain plover, which prefers foraging in recently tilled farmlands to planted crops. Nevertheless, foraging habitat is regionally abundant for all five species and the Project site would continue to provide foraging habitat to various degrees for all five species after completion. Consequently, substantial adverse impacts would not occur to these species through a reduction in available foraging habitat.

Further, Project construction activities are scheduled to begin in the fourth quarters (October – December) of 2019 through 2021, continuing into the first quarter (January – March) of the following year. This construction schedule is mostly outside the breeding season (typically, February 1 through August 31). As described in the Project description, preconstruction nest surveys will be completed for all project activities that occur between February 1 and August 31 to comply with California Fish and Game Code Section 3503.5. Potential impacts on nesting loggerhead shrikes from selenium exposure are covered below in "Selenium Effects on Wildlife Species Other Than Waterbirds," while potential impacts on nesting waterbirds is discussed in Section 7.2.3.

Swainson's Hawks

No Swainson's hawks were observed during the survey performed on September 4 and 12, 2018. However, most Swainson's hawks have typically begun their southward fall migration and have left the San Joaquin Valley by October, and potentially suitable nesting habitat is located on the project site and within 0.5 mile of the site. Swainson's hawks have nested adjacent to the Project site within the existing SJRIP reuse area annually from 2001 through 2018 (H. T. Harvey & Associates 2002–2013, 2015a, 2015b, 2016, 2017, 2018, H. T. Harvey & Associates Unpublished data).

The conversion of the Project site to Jose tall wheatgrass from fallow and row crop agriculture would not represent a net effect on the availability of foraging habitat for Swainson's hawks and therefore would not constitute a significant adverse impact. Project construction activities are scheduled to begin in the fourth quarters (October – December) of 2019 through 2021, continuing into the first quarter (January – March) of the following year. This construction schedule is outside the nesting season for Swainson's hawks in the Central

Valley (April – August) and so potential impacts to nesting Swainson's hawks would be avoided. Therefore, potential impacts of the Project on Swainson's hawk are considered less than significant.

Selenium Effects on Wildlife Species Other Than Waterbirds

The project site is used by wildlife species other than birds, and these animals may be exposed to selenium. Selenium accumulation was documented in several mammal species at Kesterson National Wildlife Refuge (NWR) in Merced County in the 1980s (Clark 1987, Paveglio and Clifton 1988, Clark et al. 1989), although Clark (1987) noted that mammals appear much less susceptible to selenium-induced embryonic abnormalities than birds. The above-mentioned studies, and many of the studies mentioned in this section, were conducted at Kesterson NWR. Though the SJRIP project receives agricultural drainwater as Kesterson NWR did at the time of the studies, significant differences exist relative to the potential exposure to selenium at the SJRIP project site. For instance, the habitats present and the duration that ponded water is accessible to wildlife are considerably different, which greatly alters potential selenium exposure to wildlife. When Kesterson NWR was receiving drainwater, it comprised a combination of wetland and upland habitats Reclamation land managed as a wildlife refuge by the USFWS. Agricultural drainwater was delivered through the San Luis Drain to a series of 12 evaporation ponds. Unlike the SJRIP where water does not pool permanently, these ponds contained emergent vegetation and shallow, vegetated banks, and some contained islands. Compared to the vegetation in the SRIP and proposed Project site that is primarily comprised of irrigated crops and the regulating pond that would be designed to discourage use by waterbirds, the NWR's habitat elements were intended to support greater numbers and more diverse wildlife, which provided more pathways (plants, invertebrates, fish) for possible selenium accumulation by wildlife.

In a study conducted at Kesterson NWR, coyotes (n=13) and San Joaquin kit foxes (n=2) were sampled for evidence of selenium bioaccumulation and selenium toxicosis (Paveglio and Clifton 1988). In that study, hair-selenium levels in the San Joaquin kit foxes did not differ from those found in two control groups; however, liver-selenium levels in two of the coyotes sampled were at levels associated with chronic selenium toxicosis in dogs, and one of those two coyotes exhibited physical anomalies consistent with selenium toxicosis. The authors attributed the apparent difference in selenium uptake between San Joaquin kit foxes and coyotes to feeding habits. Both species preyed primarily on small mammals, according to scat and stomach content analysis. Coyotes, however, were more diverse in their feeding habits and included American coots as the second most common item in their diets (28% of the volume of 11 stomachs). No trace of coots was found in San Joaquin kit fox scats. The American coot was among the waterbird species that showed significant accumulated selenium levels at Kesterson NWR.

Clark (1987) found no adverse effects in a study on the impacts of selenium on mammals at Kesterson NWR, although significant selenium accumulation was found in several species of small mammals, including the California vole (*Microtus californicus*), house mouse (*Mus musculus*), western harvest mouse (*Reithrodontomys megalotis*), and ornate shrew (*Sorex ornatus*). Based on examinations of five embryonic litters from three species, mammals appear to be much less susceptible to selenium-induced embryonic abnormalities than birds (Clark 1987). A study of raccoons (*Procyon lotor*) at Kesterson NWR, conducted in 1986, reported similar results (Clark et al. 1989). Liver-selenium levels in eight raccoons sampled at Kesterson NWR were within the range of levels associated with chronic selenium toxicosis in dogs, but no adverse effects were observed in the raccoons.

Selenium bioaccumulation also has been documented in the livers of gopher snakes (*Pituophis catenifer*) and bullfrogs (*Rana catesbeiana*, Ohlendorf et al. 1988), as well as in invertebrates and fish (Ohlendorf 1989). Selenium is reported to be toxic to developing frog embryos and tadpoles, with toxicity increasing with the duration of exposure—selenium concentrations of 2,000 ppb were found to produce cranial and vertebral deformities and lowered survival (Ohlendorf 1989). Selenium thresholds for lethal or sublethal effects have not been established for any reptile species, and Ohlendorf (1989) reported finding no reports of toxic effects of selenium in reptiles.

Insects emerging from irrigation ditches on the project site may represent another pathway for selenium to accumulate in predators of aerial insects. Such predators known to be present in the vicinity include swallows, lesser nighthawks (*Chordeiles minor*), western kingbirds (*Tyrannus verticalis*), loggerhead shrikes, and possibly bats. Current data on the effects of selenium on these and other wildlife species are insufficient to allow predictions of adverse effects on aerial insectivores based on selenium concentrations in the drainwater intended for use at the Project site.

Santolo and Yamamoto (1999) studied blood-selenium levels in American kestrels (*Falco sparverius*), red-tailed hawks, northern harriers, barn owls (*Tyto alba*), and loggerhead shrikes, at Kesterson Reservoir, in its surrounding area, and in control areas in other parts of California, from 1994 to 1998. In all of these raptor species, except the loggerhead shrike, blood-selenium levels were higher in birds captured at Kesterson Reservoir than in birds captured from the surrounding area and other control areas. In loggerhead shrikes, birds collected from the Kesterson Reservoir and the surrounding area had significantly higher blood-selenium levels than shrikes from the other control areas.

Egg-selenium levels in American kestrel eggs collected during this study were lower than was predicted based on blood-selenium levels. Eggs collected from American kestrels with blood-selenium levels ranging from 3.1 to 27 ppm were predicted to range from 7.3 to 52.9 ppm selenium. The actual levels in these eggs, however, ranged from 2.9 to 5.0 ppm selenium. Other studies (Smith et al. 1988, Heinz 1996, Wiemeyer and Hoffman 1996, Yamamoto et al. 1998) have suggested that predatory birds such as black-crowned night herons (*Nycticorax nycticorax*), screech owls (*Otus asio*), and American kestrels accumulate and transfer selenium to eggs to a lesser degree than waterbirds such as mallards and black-necked stilts.

Songbirds and other non-waterbirds responses to selenium exposure is less studied than it is to waterbirds. The study selenium uptake in red-winged blackbirds by Harding (2008) described previously in Section 6.1.3 found that egg-selenium uptake in red-winged blackbirds was not linear, with rates of uptake decreasing as environmental selenium increased. The study also found that both red-winged blackbird egg hatchability and nestling survival were not impacted until egg-selenium levels reached 22 ppm. Egg selenium concentrations in

174 red-winged blackbird eggs collected on the existing reuse site from 2003 to 2018 have ranged from 1.96 to 20.9 ppm, with a geometric of 7.6 ppm.

A tiered monitoring program, designed to measure selenium levels in constituents of the San Joaquin kit fox food chain, was added to the biological monitoring program at the SJRIP in 2008. The first tier in the program consisted of monitoring selenium levels in the crops grown at the site. If selenium concentrations from any sample of these crops exceeded the level of concern (LOC) threshold for dietary effects on mammals of 3 ppm (established in the BO; USFWS 2001), the second tier was triggered. The second tier consisted of monitoring the potential small mammal prey of the San Joaquin kit fox. For dietary exposure to selenium in mammals such as kit fox, the BO established an LOC threshold of 3 ppm and a toxicity threshold of 7 ppm. Any small mammal samples exceeding the 3-ppm LOC threshold triggered the third tier of monitoring. In the third tier, hair and blood samples were collected from coyotes foraging in the SJRIP; these samples were analyzed to determine selenium bioaccumulation levels in predators that foraged in drainwater-irrigated cropland.

Data on the selenium concentrations in small mammals, including house mice, western field mice, and deer mice (*Peromyscus maniculatus*), were collected at the SJRIP between 2008 and 2015. Small mammals also were collected from the vicinity of the SJRIP to provide reference data on regional selenium concentrations. Whole-body selenium concentrations in small mammals collected from the SJRIP from 2008 to 2015 were significantly higher than selenium concentrations in small mammals collected from reference areas during the same period (t-tests, Table 7). However, small mammal selenium exposure at the SJRIP appeared to be lower than existed at Kesterson NWR in 1984, when the whole-body selenium concentration of 10 small mammals (including California voles, house mice, and western harvest mice) had a geometric mean of 10.5 ppm (dry wt). Only 3 of the 152 samples from the SJRIP exceeded 10 ppm selenium (dry wt), whereas half of the samples from Kesterson NWR did (Clark 1987).

Table 7. Geometric Mean of Small Mammal Whole-Body Selenium Concentrations from the SJRIP Reuse Site, 2008 to 2015

	Selenium		
Location	**n**	**Geometric Mean ppm Se (dry wt)[a]**	**Range**
SJRIP reuse site	152	4.00	1.32–25.2
Off-site reference samples[b]	35	1.54	0.844–2.63
Significant difference ($t = 6.7445$, $df = 185$, $P < 0.0001$) between sites.			

[a] ppm Se, dry wt = parts per million selenium dry weight.
[b] Off-site reference sampling ended after 2013.

The *Final Biological Opinion, 2010–2019 Use Agreement for the Grasslands Bypass Project Merced and Fresno Counties* (USFWS 2009) added requirements to the existing tiered contaminant-monitoring program at the SJRIP. It stipulated that coyote hair samples found to have between 5 and 10 ppm selenium would trigger habitat mitigation for the San Joaquin kit fox at a ratio of 0.5 to 1; and coyote hair samples found to have levels greater than 10 ppm selenium, or coyote blood samples with greater than 1 ppm selenium, would trigger habitat mitigation for the San Joaquin kit fox at a ratio of 1 to 1 (1 acre of mitigation habitat provided for each acre impacted by the SJRIP). If coyote hair samples contain less than 5 ppm selenium and coyote blood samples contain less than 1 ppm selenium, no habitat mitigation is required.

Although the results of the 2008 tiered contaminant-monitoring program triggered the third tier, H. T. Harvey & Associates ecologists were unable to obtain a coyote from which to collect hair and blood samples until 2010. In that year, ecologists were able to collect three hair samples and two blood samples from coyotes shot on the SJRIP. Again on December 8, 2011, a hair and a blood sample was obtained from a coyote shot on the SJRIP site (Table 8).

Table 8. Coyote Blood-and-Hair-Selenium Concentrations from the SJRIP Reuse Site, 2010 and 2011

	2010 Collection Dates			2011 Collection Date	Geometric Mean
Sample Type	**April 1**	**Nov. 29**	**Dec. 15**	**Dec. 8**	**2010–2011**
Blood selenium (ppm)	0.269	NA	0.282	0.292	0.281
Hair selenium (ppm)	0.743	0.970	0.578	1.32	0.861

Notes: NA = not applicable; ppm = parts per million.

The analysis of samples from these four coyotes demonstrated that mammalian predators on and in the vicinity of the SJRIP are not accumulating hazardous levels of selenium from their prey. As shown in Table 8, the selenium levels in both blood and hair samples from coyotes are within normal background levels for mammals (U.S. Department of the Interior 1998) and well below the thresholds established in BO that would trigger the provision of compensatory habitat mitigation for the San Joaquin kit fox. Based on these results, the potential selenium impacts of the expansion Project on wildlife other than waterbirds is considered less than significant.

7.2.2 Sensitive Species

Criterion 1. 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 CDFW or USFWS

Impact BIO-1. The Project Could Result in Mortality of, and Loss of Habitat for, Burrowing Owls

Twelve burrowing owls were observed during the survey performed on September 12, 2018 within Section 9, and suitable burrows are found scattered throughout the proposed expansion areas. These owls were concentrated in one area and appeared to represent one or two family groups. An additional pair of burrowing owls was located just outside the southeastern corner of the proposed expansion area. Implementing the Project would impact suitable burrowing owl habitat and could result in injury or mortality of individual burrowing owls during construction. Disturbance of habitat during the breeding season (February 1 through August 31) could result in displacement of breeding birds and the abandonment of active nests. Specifically, ground disturbance during construction could contribute to the incidental loss of fertile eggs or nestlings or otherwise lead to nest abandonment.

Given the abundance of similar-quality burrowing owl habitat in the region, the loss of habitat on the Project site would not constitute a significant impact. However, any reductions in the numbers of this rare species, directly or indirectly (through nest abandonment or reproductive suppression), would constitute a significant impact. Furthermore, raptors, including owls, and their nests are protected under state laws and regulations, including the California Fish and Game Code Section 3503.5.

Incorporation of the following mitigation measure into the conditions of approval would ensure that if burrowing owls are present, their presence would be detected, the risk of mortality would be avoided to the maximum extent feasible, and impacts would be reduced to a less-than-significant level.

Mitigation Measure BIO-1: Conduct a Preconstruction Survey for Burrowing Owl and Implement Avoidance Measures. No more than 15 days before the start of initial ground-disturbing activities for the Project, a qualified biologist(s) knowledgeable of the species will conduct a take avoidance survey for the presence of burrowing owls within 500 ft of the area scheduled for disturbance as described in Appendix D of the *Staff Report on Burrowing Owl Mitigation* (CDFG 2012).

If burrowing owls are detected within the area scheduled for disturbance, site-specific avoidance measures, consistent with the best practices presented in the *Staff Report on Burrowing Owl Mitigation* (CDFG 2012), will be implemented under the direction of the qualified biologist. Appropriate measures will be selected by the qualified biologist, and will include establishment of no-disturbance buffer zones, as described in CDFG (2012), to avoid impacts on occupied burrowing owl burrows. If occupied burrowing owl burrows cannot feasibly be avoided during the nonbreeding season (September 1–January 31), burrowing owls may be passively excluded under the direction of the qualified biologist, provided the conditions in CDFG (2012) are met, including development of a burrowing owl exclusion plan and performance of appropriate site monitoring before, during, and after exclusion.

Level of Significance: Less than significant with mitigation.

7.2.3 Migratory Wildlife and Wildlife Movement Corridors

Criterion 4. 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

Impact BIO-2. The Project Could Result in the Mortality of Migratory Birds or Active Nests

Based on waterborne and egg-selenium levels at the SJRIP, lethal and sublethal effects on waterbirds breeding at the expansion Project site are probable (waterbirds here are separated from other birds potentially occurring on the site, such as birds of prey and passerines, for which there is evidence that selenium impacts are not as significant—see Section 7.2.1). Water samples from the sources of drainwater used to irrigate the existing SJRIP reuse site averaged 41 ppb selenium (range from 18 to 78 ppb selenium) from 2013 to 2018 (Panoche Drainage District data). Such levels are above the level of waterborne selenium (32 ppb) associated with a high probability of reduced hatchability and increased probability of teratogenesis for sensitive species of waterbirds (CH2M Hill et al. 1993). Egg-selenium monitoring at the SJRIP site has found elevated egg-selenium levels in both recurvirostrids and killdeer (H. T. Harvey & Associates 2002–2013, 2015a, 2015b, 2016, 2017, 2018). Egg-selenium levels in both groups have been significantly higher than in similar sets of reference eggs collected from the vicinity. Annual geometric means of egg-selenium levels from recurvirostrid eggs have varied, but from 2003 to 2015, most means also were above the level (18 ppm) associated with an increased probability of teratogenesis and reduced hatchability (H. T. Harvey & Associates 2015b). The repeated and prolonged exposure of breeding waterbirds in this region to selenium, resulting in lethal and sublethal effects, would constitute a significant impact.

The effects of selenium exposure at the Project site would be concentrated among migratory waterbird species, of which individuals, nests, and eggs are protected by the California Fish and Game Code. Hence, the exposure of these species to selenium impacts is discussed under this criterion. Adverse impacts on nesting migratory bird species for the duration of the Project due to exposure to selenium would constitute a significant impact.

Waterbird use of the regulating pond and proposed reservoir could negatively impact waterbirds through dietary selenium exposure. Increased water being stored in the existing ponds and storm water temporarily stored in the proposed reservoirs will potentially provide an attractive foraging habitat for waterbirds. The water is expected contain high enough selenium concentrations that long-term exposure could result in reproductive impairment to sensitive waterbird species. If the duration of the exposure is long enough, reproductive impairment is possible even if the waterbirds forage on the Project and nest elsewhere in the vicinity of the Project.

Because of the conditions on the Project site and the avian species that may use the site for nesting, these impacts would not 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. However, if waterbirds nest on the Project site, impacts on nesting birds from selenium exposure would be significant. Incorporation of Mitigation Measures BIO-2a through BIO-2f into the conditions of approval would ensure that adverse effects of selenium exposure on nesting waterbirds are avoided or minimized to a less-than-significant level. Note that Mitigation Measures BIO-2a, BIO-2c, BIO2e, and BIO2f have been implemented at the SJRIP reuse site, where they have significantly reduced the number of nesting shorebirds exposed to selenium. The number of recurvirostrid nests on the SJRIP reuse site has decreased from more than 30 in 2003, to two in each year from 2009 through 2011, and to zero from 2012to 2017 and only one in 2018 (H. T. Harvey & Associates 2004–2013, 2015a, 2015b; 2016, 2017, 2018, H. T. Harvey & Associates unpublished data). These management approaches would similarly limit shorebird nesting within the proposed Project site.

When the SJRIP was first established, most nesting by killdeer and recurvirostrids occurred in or next to the irrigation ditches that delivered drainwater to the site. Adults associated with nests near irrigation ditches also fed primarily in these ditches, although this was more typical of recurvirostrids than of killdeer. Efforts to reduce the attractiveness of the ditches and their immediate surroundings was successful, and similar efforts in the proposed expansion areas will maintain the reduced the level of shorebird exposure to selenium by discouraging nesting activity close to selenium-laden foraging habitat.

In spring 2003, a pasture at the SJRIP reuse site attracted waterbirds when it was inadvertently flooded. This flooded area created ideal ecological conditions for waterbird foraging and nesting, so several pairs responded opportunistically and bred in the field. Recurvirostrid eggs collected near the pasture had elevated selenium concentrations compared to recurvirostrid eggs collected elsewhere on the site. Accidental or inadvertent flooding could occur within the proposed expansion areas.

Additionally, there is potential for disturbance associated with Project infrastructure installation, including the west pump station and west pipeline, the RP-1 pump station and associated distribution canal, the SJRIP return pump, and the regulating reservoir and associated pump stations, to cause avian nest abandonment in violation of California Fish and Game Code Section 3503.5.

Mitigation Measure BIO-2a: Reduce Selenium Exposure Potential by Reducing Attractiveness of Irrigation Ditches for Nesting. Sediment that has collected on the bottom of the ditches will be periodically removed and irrigation ditches within the proposed expansion areas will be maintained with smooth sides and borders to reduce nesting attractiveness in and near irrigation ditches. Removing sediment that has collected on the bottom of the ditches will remove potential nest substrate that is exposed when water levels are low. Smoothing the ditch banks and borders and removing weedy vegetation will reduce the attractiveness of the area for nesting, because killdeer and recurvirostrids often use rough surfaces, such as disced areas, to conceal nests. This measure will be implemented as long as agricultural reuse water is used to irrigate crops on the site.

Mitigation Measure BIO-2b: Reduce Selenium Exposure Potential by Reducing Attractiveness of Regulating Pond/Reservoir for Nesting. The attractiveness of the existing regulating pond and the proposed reservoir to nesting shorebirds will be reduced through active management practices, including removing sediment and vegetation that has collected on the bottom of the ponds and maintaining smooth bottoms, sides and borders of the ponds. Maintaining flat smooth pond bottoms will remove potential nest substrate that is exposed when water levels are low. Smoothing the interior levees and borders and removing weedy vegetation will reduce the attractiveness of the area for nesting, because killdeer and recurvirostrids often use rough surfaces, such as disced areas, to conceal nests. Water within the existing pond and proposed reservoir will be managed to be as deep as possible to minimize the surface area of foraging habitat for waterbirds. Water entering the existing pond and proposed reservoir will fill a cell to the maximum depth before subsequent cells are filled. Maintaining steep interior levee slopes of at least a 1:3 ratio will also minimize shallow water foraging habitat for waterbirds. This measure will be implemented as long as the regulating pond and proposed reservoir are utilized, and agricultural reuse water is used to irrigate crops on the site.

Mitigation Measure BIO-2c: Reduce Exposure Potential by Hazing Waterbirds from the Project Site During Nesting Season. Waterbirds shall be hazed from the Project site during the waterbird nesting season (March 15 to July 15) to reduce exposure of waterbirds to selenium by discouraging waterbirds from feeding where they could be exposed to selenium. Methods of hazing could include, but not be limited to, firing noisemaking devices such as cracker shells, deploying 15-millimeter "bird bombs," and using bird whistlers from a vehicle to discourage birds from congregating for feeding or establishing nest sites on the Project. In addition, propane-operated cannons can be left operating for 24 hours, if required. If cannons are used, their locations will be changed periodically to lessen habituation by birds to the noise. This measure will be implemented as long as agricultural reuse water is used to irrigate crops on the site.

Mitigation Measure BIO-2d: Reduce Exposure Potential by Hazing Waterbirds from the Regulating Pond/Reservoir When Water is Present. Waterbirds shall be hazed from the existing regulatory pond and proposed reservoir to reduce exposure of waterbirds to selenium by discouraging waterbirds from feeding or nesting where they could be exposed to selenium. Methods of hazing could, but not be limited to, include firing noisemaking devices such as cracker shells, deploying 15-millimeter "bird bombs," and using bird whistlers from a vehicle to discourage birds from congregating for feeding or establishing nest sites on the Project. In addition, propane-operated cannons can be left operating for 24 hours, if required. If cannons are used, their locations will be changed periodically to lessen habituation by birds to the noise. The levees around these ponds and access roads to the ponds will need to be maintained to allow access during wet conditions that may muddy roads. This measure will be implemented as long as the regulating pond and proposed reservoir are utilized,

Mitigation Measure BIO-2e: Implement a Flooded-Field Contingency Plan. A contingency plan for accidental or inadvertent flooding has been developed for the SJRIP. The plan includes provisions for immediate removal of unintentionally released drainwater as well as for increased monitoring and hazing near flooded sites. This plan, presented in Appendix D, will be implemented for the proposed expansion Project and should be incorporated into the Project's conditions of approval.

Mitigation Measure BIO-2f: Monitor Mitigation Success and Provide Compensation Breeding Habitat. The above mitigation measures will be implemented to reduce the exposure of birds to selenium. To evaluate the success of these measures, monitoring will be implemented to determine whether nesting waterbirds are still exposed to elevated selenium levels as a result of the Project. If they are, compensation habitat for residual impacts will be provided, following the protocol outlined below that has been adapted from a protocol developed by USFWS (1995) for determining and mitigating impacts on nesting waterbirds at evaporation basins. The amount of monitoring required, and the basis for evaluating selenium levels and triggering the compensation requirement, are included in the protocol.

Compensation Habitat Protocol Summary

In 1995, the USFWS formulated compensation habitat protocols for avian impacts associated with agricultural drainwater evaporation basins with elevated levels of waterborne selenium. The motivation for developing the protocol was to create a risk-based approach to compensating for impacts, with increased accuracy, minimize monitoring costs, and provide incentives to minimize contaminant risk. The foundation of this approach was the observation that both nonlethal and lethal impacts result from avian exposure to elevated levels of selenium and that impacts could not be determined by mortality counts alone. Therefore, the USFWS provided a risk-based approach that relied on egg-selenium levels as an easily verified measure of avian exposure to selenium and associated impacts.

The SJRIP differs from the agricultural drainwater evaporation basins the USFWS's original compensation habitat protocol was developed for in that the vast majority of the SJRIP does not provide nesting habitat or dietary exposure to elevated selenium. Rather, shorebirds (primarily recurvirostrids and killdeer) are likely to be exposed to elevated levels of selenium while foraging in irrigation ditches and irrigated fields and pastures, which are ephemeral in distribution and extent. Therefore, a modified form of the protocol was proposed and accepted for the SJRIP that replaced the acreage of evaporation pond habitat with the number of active stilt, avocet and killdeer nests found on the SJRIP to calculate selenium exposure to nesting shorebirds. Though the proposed Project will include a regulating pond and a temporary storm water storage pond that are more similar to evaporation basins, a compensation habitat protocol based on the number of nests effected, rather than the amount of flooded acreage, provides a more accurate model for a mitigation approach to selenium-related impacts on the Project site, which will become incorporated into the SJRIP.

As mentioned, the compensation habitat protocol is based on measures of selenium concentrations in the eggs of shorebirds and the number of nesting recurvirostrids exposed to elevated levels of selenium at a particular location. Egg-selenium levels represent an accurate and repeatable measure of risk exposure in these birds (e.g., see Ohlendorf et al. 1993). A premise of this risk-based approach is that habitats that expose more birds to elevated selenium or to higher concentrations of selenium require relatively more compensation than do habitats that have lower selenium concentrations or that expose fewer birds.

The USFWS presented an "eggwise" protocol and a "henwise" protocol, and concluded that the henwise protocol is statistically "cleaner" and uses more detailed exposure-response data actually collected from studies of recurvirostrids nesting at evaporation basins. Thus, the henwise approach is employed here. It is modified slightly to render it more appropriate for calculating impacts to nesting waterbirds at a site where the primary potential exposure route is drainwater applied to crops as opposed to an evaporation basin. The formula for calculating compensation (mitigation) habitat is:

Compensation Habitat = CC x NN

Where:

CC = HU x [(F1 x L1) + (F2 x L2) + (F3 x L3) + (F4 x L4) + (F5 x L5)]

Where:

CC = compensation coefficient, the multiple of a site's breeding shorebird population that, on average, would be required in predominately shallow wetland acreage to replace lost production;

HU = the relative habitat quality for the Project's mitigation site (HU = 2);

F1 = the proportion of randomly sampled eggs containing 0 to 5 ppm selenium;

F2 = the proportion of randomly sampled eggs containing 5.0 to 20 ppm selenium;

F3 = the proportion of randomly sampled eggs containing 20 to 40 ppm selenium;

F4 = the proportion of randomly sampled eggs containing 41 to 70 ppm selenium;

F5 = the proportion of randomly sampled eggs containing more than 70 ppm selenium;

L1 = the proportion of production lost when egg selenium is from 0 to 5 ppm selenium (L1 = 0.0 from premise HP3 in Appendix E);

L2 = the proportion of production lost when egg selenium is from 5.1 to 20 ppm selenium (L2 = 0.1889 from premise HP3 in Appendix E);

L3 = the proportion of production lost when egg selenium is from 21 to 40 ppm selenium (L3 = 0.2551 from premise HP3 in Appendix E);

L4 = the proportion of production lost when egg selenium is from 41 to 70 ppm selenium (L4 = 0.5083 from premise HP3 in Appendix E); and

L5 = the proportion of production lost when egg selenium is from over 70 ppm selenium (L5 = 0.9261 from premise HP3 in Appendix E).

Habitat utility (HU) in this equation has been modified from USFWS's model (see premises GP-7 and GP-8 in Appendix E), which was based on observations of the performance of a mitigation site under optimal circumstances in the Tulare Lake Basin, where population densities of recurvirostrids are much higher than in the vicinity of the expansion Project (Shuford et al. 1998). Habitat Utility for this version of the compensation habitat formula has been calculated based upon the performance of mitigation provided for the SJRIP site for the previous 10 years (2009-2018). There has been an average of 0.5 successful shorebird nests per acre (Table 9) during this period (H. T. Harvey & Associates 2010–2013, 2015a, 2015b, 2016-2018, H. T. Harvey & Associates Unpublished data,), which indicates a successful nest for every 2 acres of mitigation habitat provided. A value of 2, therefore, will be used for HU in the current model for the SJRIP, which would be re-evaluated every three years based upon the performance of the mitigation site.

Table 9. SJRIP Mitigation Site Performance 2009-2018

	Total Nests	Hatched Nests	Mitigation Acres	Hatched Nest/Acre
2009	38	24	50	0.48
2010	20	6	50	0.12
2011	19	6	50	0.12
2012	22	12	20	0.60
2013	22	10	15	0.67
2014	20	9	15	0.60
2015	20	11	15	0.73
2016	20	12	15	0.80
2017	16	10	15	0.67
2018	9	0	15	0
			Mean	**0.5**

In the Compensation Habitat formula, NN, or number of nests, replaces EH, the evaporation basin surface area in the original protocol calculation. In the original protocol, EH is used as a measure of degree of exposure, with larger basins providing more habitat for more birds than relatively smaller basins. This project is much larger than the evaporation pond projects and the majority of the area within the project does not provide habitat for nesting shorebirds. Therefore, the average number of nests per year (NN) is used as a direct measure of the number of birds potentially exposed to drainwater in the system. Values are derived from monitoring data and plugged into the equation to calculate compensation habitat acreage requirements.

At the Project site, the primary species expected to be exposed to elevated levels of selenium are recurvirostrids (American avocet and the black-necked stilt) and killdeer. Killdeer eggs have contained significantly less selenium than recurvirostrid eggs at the SJRIP reuse site (H. T. Harvey & Associates 2002–2013, 2015a, 2015b, 2016, 2017, 2018, H. T. Harvey & Associates Unpublished data). Thus, if killdeer egg-selenium levels are combined with the recurvirostrid levels, the killdeer results are likely to dilute the estimates of impacts on avocets and stilts. Therefore, the compensation acreage for killdeer will be calculated separately from that for stilts and avocets. Compensation habitat acreages for the two groups will then be combined to determine the total amount of compensation habitat to be provided.

A number of evaporation basin operators have adopted the USFWS protocol approach, or a similar approach, for determining mitigation habitat acreages. This approach involves an iterative monitoring/mitigation adjustment process in which the initial amount of compensation habitat provided is based on 3 years of monitoring. (SLDMWA is responsible for hiring a qualified biologist to conduct this monitoring, which will begin the first year that agricultural reuse water is applied to the Project site.) That amount of compensation habitat is then provided for the following 3 years. After 3 more years of monitoring, the compensation habitat amount is adjusted based the monitoring results for those 3 years, and so forth. This iterative process rewards operators for reducing or eliminating impacts by reducing subsequent mitigation requirements. Likewise, if increased numbers of birds are affected, mitigation requirements increase accordingly. This approach is recommended for the expansion Project.

Biological monitoring will be implemented to determine the level of impacts and appropriate mitigation. This monitoring will need to include both:

1. egg sampling for selenium analysis sufficient to determine the compensation coefficient (from the above equations) for both recurvirostrids and killdeer, and
2. a census effort sufficient to determine the number of nests for both recurvirostrids and killdeer.

Biological monitoring has been conducted at the SJRIP since 2001. The monitoring plan has been developed by SLWDMA in consultation with USFWS and has been adapted over the years. A description of the current monitoring plan can be found in the *San Joaquin River Water Quality Improvement Project, Phase I Wildlife Monitoring Report 2014* (H. T. Harvey & Associates 2015b). The monitoring has included the above two elements (i.e., egg sampling and a census effort) since 2006. This same monitoring design will be applied to the Project site.

Compensation habitat has been provided at various sites near the SJRIP reuse site since 2006. The compensation habitat typically has been placed within rice fields designed to maximize use by nesting waterbirds, specifically black-necked stilts and American avocets, by the addition of large nesting islands. If implementation of the expansion Project results in a compensation habitat requirement, the appropriate acreage will be added to the compensation habitat provided for the SJRIP reuse site. To compensate for exposing waterbirds to selenium, the compensation habitat will require fresh water. The water supply to the compensation habitat will be sampled in May of each year, and will not exceed 2.0 ppb total recoverable selenium.

Based on the above henwise protocol for compensation habitat using killdeer nest numbers and egg-selenium results from the past three years on the Project, F1 is zero, F2 is 0.67, F3 is 0.3, and F4 is 0.03, and F5 is zero. The resulting compensation coefficient is 0.807, the average number of killdeer nests is 12 and the resulting compensation habitat calculation is 9.7 acres. There has only been one black-necked stilt nest in the past three years, so the compensation habitat values for recurvirostrids for the same period are F3 is 1, and F1, F2, F4, and F5 are zero. The resulting compensation coefficient is 0.968, the average number of killdeer nests is 0.33 and the resulting compensation habitat calculation is 0.2 acres. Based on these calculations for killdeer and recurvirostrids the project would provide at least 9.9 acres (9.7 +0.2) of compensation habitat for the next three years.

Level of Significance: Less than significant with mitigation.

Mitigation Measure BIO-2g: Conduct Preconstruction Nest Surveys for Infrastructure Installation Occurring During the Nesting Season. Preconstruction nest surveys will be completed for all Project-related infrastructure installation activities that occur between February 1 and August 31 to comply with California Fish and Game Code Section 3503.5. A qualified wildlife biologist shall conduct preconstruction surveys of all potential nesting habitats (including for raptors) within 500 feet of construction activities for presence of breeding or nesting birds. Surveys shall be conducted no more than 5 days prior to construction activities with a second survey conducted no more than 24 hours prior to the onset of construction. If active nests are found, no-disturbance buffers shall be implemented around each nest as follows: a 500-foot buffer shall be created around any confirmed active special-status raptor nest (including burrowing owl); a 300-foot buffer shall be created around active nests of non-raptor special-status bird species. The buffers will be implemented until it is determined by a qualified biologist that young have fledged. If a nest is found in an area where ground disturbance is scheduled to occur, the area will be avoided either by delaying ground disturbance in the area until a qualified wildlife biologist has determined that the young have fledged or by re-siting the proposed Project component(s) to avoid the area.

7.2.4 Local Resource Protection Policies

Criterion 5. Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance

The Project would not conflict with any local policies or ordinances, and will support the goals and policies of the *Fresno County General Plan* (Fresno County 2000). Trees on the Project site that may be removed are nonnative ornamental trees or weedy species and are not protected by general plan policies.

Level of Significance: No impact.

7.2.5 Habitat Conservation Plans

Criterion 6. Conflict with the provisions of an adopted habitat conservation plan; natural community conservation plan; or other approved local, regional, or state habitat conservation plan

The Project site is not located in an area covered by an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan. Therefore, implementation of the Project would not conflict with any adopted conservation plan.

Level of Significance: No impact.

7.3 Cumulative Effects

Cumulative impacts are impacts associated with the action alternatives that are not significant on their own but, when combined with the impacts of other Projects and plans in the region, can have incremental effects that would result in a significant effect. The implication is that numerous insignificant effects can create a significant effect.

The Project site comprises primarily disced and fallowed agricultural fields on developed land and has limited value to special-status plant and wildlife species. However, potentially suitable nesting habitat is present on the Project site for several species of birds, including several special-status species, and marginally suitable day-roosting habitat for pallid bats is also present on the site.

Surveys for roosting bats did not detect any bats on the Project site, and the Project will avoid impacts to breeding bats. Similarly, the Project will avoid construction impacts to nesting birds and implementation of the mitigation measures prescribed to minimize the impacts of selenium exposure on sensitive bird species would reduce any cumulative impacts on these birds to negligible levels.

The impacts of high selenium levels on nesting waterbirds have been well documented in the San Joaquin Valley (CH2M Hill et al. 1993). The cumulative impacts report by CH2M Hill et al. (1993) evaluated the cumulative effects of 24 evaporation basins, which in 1993 totaled 6,715 acres in surface area. That report concluded that evaporation basins produced significant adverse cumulative impacts on the reproduction of shorebirds and other waterbirds in region. However, many of the evaporation basins that were operating in 1993, including the only two evaporation basins in Fresno County, have closed. As mitigation for unavoidable impacts on breeding, wintering, and migrating birds caused by selenium ingestion, operators of the remaining evaporation basins have either established or proposed compensation habitats, per USFWS recommendations. Generally, compensation habitats have been successful in reducing impacts caused by selenium ingestion at individual evaporation basins to less-than-significant levels.

Considering other sources of selenium exposure regionally, the unmitigated exposure of waterbirds to high-selenium drainwater on the Project site would contribute to significant cumulative impacts on breeding waterbirds by causing reproductive losses. Implementation of the mitigation measures described above would reduce these cumulative impacts to less-than-significant levels.

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Appendix A. Plant Species Observed during the SJRIP Expansion Project Survey

Family Name	Scientific Name	Common Name	Native or Introduced?	Cal-IPC Impact Rating[1]
Amaranthaceae	*Amaranthus albus*	Prostrate pigweed	Introduced	—
	Amaranthus blitoides	Mat amaranth	Native	—
Asteraceae	*Ambrosia acanthicarpa*	Flatspine bur ragweed	Native	—
	Baccharis salicifolia ssp. *salicifolia*	Mule-fat	Native	—
	Centaurea solstitialis	Yellow star thistle	Introduced	High
	Erigeron bonariensis	Asthmaweed	Introduced	—
	Erigeron canadensis	Canadian horseweed	Native	—
	Helianthus annuus	Common sunflower	Native	—
	Lactuca serriola	Prickly lettuce	Introduced	—
	Pseudognaphalium luteoalbum	Jersey cudweed	Introduced	—
	Silybum marianum	Blessed milkthistle	Introduced	Limited
	Sonchus oleraceus	Common sowthistle	Introduced	—
Boraginacae	*Amsinckia* sp.	Fiddleneck	Native	—
	Heliotropium curassavicum var. *oculatum*	Salt heliotrope	Native	—
Brassicaceae	*Brassica nigra*	Black mustard	Introduced	Moderate
	Sisymbrium sp.	Hedgemustard	Introduced	Limited–Moderate
Chenopodiaceae	*Bassia hyssopifolia*	Five-hook bassia	Introduced	Limited
	Chenopodium album	Lambs quarters	Introduced	—
	Salsola tragus	Russian thistle	Introduced	Limited
Convolvulaceae	*Convolvulus arvensis*	Field bindweed	Introduced	—
Euphorbiaceae	*Chamaesyce serpens*	Matted sandmat	Introduced	—
Croton setiger	*Croton setiger*	Dove weed	Native	—
Geraniaceae	*Erodium cicutarium*	Redstem stork's bill	Introduced	Limited
Malvaceae	*Malva* sp.	Mallow	Introduced	—
	Malvella leprosa	Alkali mallow	Native	—
Myrtaceae	*Eucalyptus tereticornis*	Forest red gum	Introduced	—
Poaceae	*Agropyron elongatum*	Jose tall wheatgrass	Introduced	—

Family Name	Scientific Name	Common Name	Native or Introduced?	Cal-IPC Impact Rating[1]
	Bromus diandrus	Ripgut brome	Introduced	Moderate
	Bromus madritensis	Red brome	Introduced	High
	Cynodon dactylon	Bermudagrass	Introduced	Moderate
	Distichlis spicata	Saltgrass	Native	—
	Echinochloa crus-galli	Barnyardgrass	Introduced	—
	Hordeum murinum ssp. *leporinum*	Hare barley	Introduced	Moderate
	Polypogon monspeliensis	Annual rabbitsfoot grass	Introduced	Limited
	Sorghum halepense	Johnsongrass	Introduced	—
Polygonaceae	*Persicaria hydropiper*	Marshpepper knotweed	Introduced	—
	Rumex crispus	Curly dock	Introduced	Limited
Solanaceae	*Datura wrightii*	Jimsonweed	Native	—
Typhaceae	*Typha* sp.	Cattail	Native	—
Zygophyllaceae	*Tribulus terrestris*	Puncturevine	Introduced	—

Notes: No plants assigned a California Rare Plant Rank were observed on the Project site.

Cal-IPC Impact Rating = California Invasive Plant Council Invasive Plant Inventory rating.

[1] Cal-IPC impact rating categories:

High—These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.

Moderate—These species have substantial and apparent—but generally not severe—ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, although establishment generally depends on ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.

Limited—These species are invasive, but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic.

Appendix B. Wildlife Species Observed during the SJRIP Expansion Project Survey

Family Name	Common Name	Scientific Name
Birds		
Accipitridae	Red-tailed hawk	Buteo jamaicensis
Alaudidae	Horned lark	*Eremophila alpestris*
Ardeidae	Great egret	*Ardea alba*
	Great blue heron	*Ardea herodias*
Charadriidae	Killdeer	*Charadrius vociferous*
Columbidae	Mourning dove	*Zenaida macroura*
Corvidae	Common raven	*Corvus corax*
Emberizidae	Savannah sparrow	*Passerculus sandwichensis*
Falconidae	American Kestrel	*Falco sparverius*
Icteridae	Brewer's blackbird	*Euphagus cyanocephalus*
	Red-winged blackbird	*Agelaius phoeniceus*
	Western meadowlark	*Sturnella neglecta*
Laniidae	Loggerhead shrike	*Lanius ludovicianus*
Passeridae		
Strigidae	Great horned owl	*Bubo virginianus*
Tyrannidae	Black phoebe	*Sayornis nigricans*
Mammals		
Canidae	Domestic dog	*Canis lupus familiaris*
Sciuridae	California ground squirrel	*Otospermophilus beecheyi*

Appendix C. Special-Status Plant Species Considered but Rejected for Analysis

Scientific Name	Common Name	Rationale for Rejection from Further Consideration: Lack of Suitable Soils	Lack of Appropriate Plant Community	Lack of Vernal Pool or Wetland Habitat	Highly Degraded Site Conditions
Allium howellii var. howellii	Howell's onion		x		x
Amsinckia furcata	Forked-fiddleneck	x			x
Atriplex cordulata var. *cordulata*	Heartscale				x
Atriplex coronata var. *vallicola*	Lost Hills crownscale				x
Atriplex depressa	brittlescale				x
Atriplex minuscula	Lesser saltscale				x
Atriplex subtilis	Subtle orache				x
Centromadia parryi ssp. rudis	Parry's rough tarplant				x
Chloropyron molle ssp. *hispidum*	Hispid bird's-beak		x		x
Chloropyron palmatum	Palmate-bracted bird's beak		x		x
Convolvulus simulans	Small-flowered morning-glory	x			x
Cryptantha hooveri	Hoover's cryptantha	x			x
Deinandra halliana	Hall's tarplant	x			x
Delphinium recurvatum	Recurved larkspur	x	x		x
Eriastrum hooveri	Hoover's eriastrum		x		x
Eryngium racemosum	Delta button-celery		x	x	x
Goodmania luteola	Golden goodmania		X		x
Layia munzii	Munz's tidy-tips				x
Lepidium jaredii var. *album*	Panoche pepper-grass				x
Madia radiata	Showy golden madia	x			x
Monolopia congdonii	San Joaquin woollythreads		x		x
Navarretia prostrata	Prostrate navarretia			x	x
Puccinellia simplex	California alkali grass		X	X	x
Sagittaria sanfordii	Sanford's arrowhead				x

Scientific Name	Common Name	Rationale for Rejection from Further Consideration: Lack of Suitable Soils	Lack of Appropriate Plant Community	Lack of Vernal Pool or Wetland Habitat	Highly Degraded Site Conditions
Senecio aphanactis	Chaparral ragwort	x	x		x
Trichocoronis wrightii var. wrightii	Wright's trichocoronis				x

Appendix D. Contingency Plan for Biological Monitoring of Accidental Flood Events on the Project Site

San Joaquin River Water Quality Improvement Project
Biological Monitoring Contingency Plan

<u>Background</u>

Panoche Drainage District adopted a negative declaration for the Phase 1 San Joaquin River Water Quality Improvement Project (SJRIP) on September 19, 2000. This project provided for the application of subsurface drainwater on salt-tolerant crops on lands in the in-valley treatment area referred to as SJRIP reuse site. The negative declaration was adopted with the following impact avoidance measure: "A biological monitoring program will be developed in collaboration with U.S. Fish and Wildlife Service that would be capable of detecting migratory bird impacts and, if necessary, capable of providing the data for formulating project adjustments to avoid such impacts" (Panoche Drainage District. 2000, page 2, paragraph 5, "Impact Avoidance Measures").

Accordingly, a monitoring program was developed with input from the U.S. Fish and Wildlife Service (USFWS), and H. T. Harvey & Associates was contracted to perform the monitoring. Monitoring began in spring 2001. The program was then modified based on the initial monitoring results from 2001 to respond to the conditions in the SJRIP. Modifications included sampling red-winged blackbird eggs in addition to black-necked stilt, American avocet, and killdeer eggs; sampling eggs from both within the site and from non-SJRIP lands in the vicinity; and significantly increasing the number of eggs sampled and analyzed. The modified program has been implemented annually since 2006.

It was known that the subsurface drainwater that would be applied to the crops on the SJRIP reuse site would have fairly high levels of selenium, and it was indicated in the initial study for the project that "…irrigation with drainwater will be monitored/controlled to avoid the ponding of water such that wetlands containing water high in selenium would not be created on the site." (Panoche Drainage District. 2000). Nevertheless, in spring 2003, a pasture was inadvertently flooded at the SJRIP and attracted waterbirds Stilt and avocet eggs collected near the pasture had elevated selenium concentrations.

Field staff operating the SJRIP were immediately instructed to not allow ponding of the kind that inadvertently occurred in 2003, consistent with statements in the initial study. A procedure was then established to prevent ponding of this sort, and a contingency plan was developed to respond to ponding in the unlikely event that it recurs. The contingency plan described below has been implemented at the existing SJRIP reuse site since 2006 and will be implemented at the project site.

<u>Contingency Plan in the Event of Inadvertent Flooding</u>

If inadvertent flooding occurs due to the breakage of a supply canal or delivery facility, ponded water will be eliminated through the discharge of the water into a tail-water return system or by pumping the water into one of the supply channels in the project or a tail-water return system. This will be performed to prevent any ponding of water over 24 hours on any lands within the project.

Project field personnel will be tasked with daily monitoring of water conditions on the project site during the breeding season for birds (March through July). Any ponding that occurs will be reported to the Drainage Coordinator and through him to USFWS and the California Department of Fish and Wildlife (CDFW). Immediate collection of water samples will be made and analyzed for selenium and boron content.

In the event of inadvertent flooding for a period longer than 24 hours, an event-specific monitoring plan will be developed to monitor the impacts on bird species resulting from exposure to ponded water. Any monitoring program will include:

1) the date of the event,
2) selenium concentration of the floodwater,
3) number of birds using the flooded area, and
4) duration of exposure;

and, if nesting occurs, will also include:

5) selenium and boron concentrations in eggs,
6) hatchability of eggs, and
7) the assessment of collected embryos.

The results will be included in the annual monitoring report. The exposure effects will be determined using the egg effect equation provided mitigation measure 5f of the *San Joaquin River Water Quality Improvement Project Proposed Expansion Project Biological Resources Impact Analysis*. This equation was modified for use at the SJRIP from the equation developed by USFWS for use at evaporation basins (USFWS 1995). The number of birds exposed (number of nest attempts at the reuse site) and the degree of exposure (egg-selenium content) will be the main factors determining the amount of required mitigation. USFWS and/or CDFW will have the option of collecting supplemental monitoring data and biological samples, in full coordination with SLDMWA.

<u>References</u>

Panoche Drainage District. 2000. San Joaquin River Water Quality Improvement Project, Phase I. Negative Declaration/Initial Study. August 14, 2000.

[USFWS] U.S. Fish and Wildlife Service. 1995. Compensation Habitat Protocol for Drainwater Evaporation Basins. Sacramento, California.

Appendix E. U.S. Fish and Wildlife Service Compensation Habitat Protocol for Drainwater Evaporation Basins

EXHIBIT 6

U.S. Fish and Wildlife Service

Description:

Final Compensation Habitat Protocols.

COMPENSATION HABITAT PROTOCOL
USFWS
FOR DRAINWATER EVAPORATION BASINS
January 1995

INTRODUCTION

Two compensation protocols are presented here. Both protocols share a common set of general premises (labeled GP-l to GP-8 below). The two protocols differ with regard to their risk function premises. One is based on the same eggwise risk function premises (labeled EP-l to EP-4 below) employed in 1991 (Skorupa l99la), and the other is based on newly available henwise risk function premises (labeled HP-l to HP-3 below). Both protocols retain most of the conceptual criteria proposed by the U.S. Fish and Wildlife Service (Service) in 1991 (Skorupa 199la).

The Service has developed a risk-based approach for compensation to increase accuracy, minimize monitoring costs, and provide incentive to minimize contaminant risk. Compensation protocols based primarily on dead-body counts are inadequate. Adverse impacts to wildlife caused by evaporation basins include both lethal and nonlethal impacts (*e.g.*, Euliss *et al.* 1989; Barnum 1992; CH2M-Hill *et al.* 1993; White l993). Nonlethal impacts, by definition, cannot be accounted for by body counts. Body counts for each lifestage (embryonic, juvenile, adult) are extremely expensive to obtain and are inherently biased toward underestimating true impacts (*i.e.*, there are numerous circumstances that result in dead bodies going uncounted, but rarely, if ever, is a dead body counted more than once). The Service prefers a risk-based approach that employs easily verified measures of wildlife exposure to contaminants and exposure-response risk functions. Given adequate risk- functions, not only are measures of exposure more reliable (*i.e.,* less uncertain) than body counts, they are orders of magnitude less expensive to obtain.

Any compensation protocol should be based on clearly stated premises that are amenable to empirical validation and, when applicable, periodic re-evaluation. Furthermore, any compensation scheme must be realistic to implement, that is, it should optimize the certainty/cost ratio by relying on data that can be measured with high certainty and can be collected with relatively low cost. Therefore, the protocols developed here are based on measures of selenium concentrations in the eggs of recurvirostrids (stilts and avocets) and nest densities of recurvirostrids. Selenium concentrations in recurvirostrid eggs and recurvirostrid nest densities can be measured with a high degree of replicability (certainty), and usually require only a day per week during the breeding season (per study site) to obtain the necessary samples and/or data. Recurvirostrid eggs sampled at evaporation basins have generally proven to be reliable indicators of basin-specific contaminant conditions (*e.g.*, Ohlendorf *et al.* 1993; Skorupa 1994), and there exists a substantial base of scientific data from both laboratory and field studies relevant to estimating risk functions (*e.g.*, Ohlendorf *et al.* 1986; Heinz *et al.* 1987; Schroeder *et al.* 1988; Ohlendorf 1989; Williams *et al.* 1989; Heinz *et al.* 1989; Whiteley and Yuill 1989; Skorupa and Ohlendorf 1991; CH2M-Hill *et al.* 1993; Ohlendorf *et al.* 1993).

RISK-BASED APPROACH

Our approach for compensation is based on the degree of basin contamination and the extent of wildlife exposure. Basins exposing more birds to higher concentrations of selenium require more compensation habitat and vice-versa. Presently, this generally translates into two factors being the primary determinants of compensation habitat obligations: (1) the size of a basin (all else equal, bigger basins attract more wildlife), and (2) the concentration of selenium in water discharged to a basin (as reflected in recurvirostrid eggs). As alternative habitats (see alternative habitat protocol) are established and standard design and operating procedures for evaporation basins are modified to discourage use of the basins by wildlife, these changes will translate into reduced compensation obligations through reduced exposure of wildlife.

GENERAL PREMISES (GP)

Basin Design and Operation

(GP-1) On-shore vegetation control at basins will effectively eliminate most nesting habitat for waterfowl.

One caveat applicable to premise GP-l is that removal of on-shore vegetation at evaporation basins may have minimal impact on the number of breeding ducks that are foraging at evaporation basins because ducks are commonly known to be capable of nesting long distances (miles) away from the nearest shoreline of their foraging areas. One locally specific example of this is illustrated by the only duck nest (a gadwall nest) monitored by the Service on Kern NWR during the dry breeding season of 1989. The nest was more than 3 kilometers (ca. 2 miles) from the nearest known potential shallow water foraging area, an evaporation pond, and the concentration of selenium in a random sample egg (7.3 ppm, or about 3-4 times a normal background concentration) confirmed that the hen was probably foraging for significant amounts of time at the distant evaporation pond.

(<u>GP-2</u>) Zn-basin control of submergent aquatic vegetation (*e.g.*, widgeon-grass) will effectively eliminate most nesting habitat for eared grebes (*Podiceps nigricollis*).

(<u>GP-3</u>) Removal of all islands and wave-break levees will effectively eliminate most nesting habitat for terns.

The combined implications of the above premises are a shift in species composition of breeding birds at evaporation basins to nearly complete dominance by shorebirds. Recurvirostrids would be, by far, the primary shorebird taxa of focus for compensation purposes. USFWS 1987-1989 nest records revealed that recurvirostrids comprised about 75% of all breeding birds even prior to complete implementation of the above stated premises (*e.g.*, Skorupa *et al.* 1993; CH2M-HILL *et al.* 1993). With complete implementation, recurvirostrids are expected to comprise greater than 90% of all breeding birds at evaporation basins. Thus, selenium in recurvirostrid eggs is the most appropriate standard for assessing wildlife exposure. Accordingly, recurvirostrid exposure-response data will be preferred for estimating wildlife risks associated with the operation of evaporation basins (recurvirostrids are neither the most sensitive nor least sensitive taxa to selenium)

The focus on recurvirostrid data may not be appropriate during the nonbreeding season when waterfowl and species of shorebirds other than recurvirostrids such as sandpipers and phalaropes are more prominent (*e.g.*, Jehl 1988; CH2M-Hill *et al.* 1993). By default, compensation protocols must rely primarily on breeding season data due to a lack of extensive "response" data for nonbreeding birds. Consequently, compensation obligations can be met by providing breeding season habitat. Therefore, true compensation habitat obligations are necessarily underestimated. Presumably, however, the year- round alternative habitat obligations required for effective hazing and for creating a bird safe local landscape around evaporation basins will eliminate the primary risks to nonbreeding birds such as directly fatal poisoning, impaired ability to migrate, impaired ability to avoid predators, immune suppression, and various long-term demographic consequences associated with impaired, body condition (*e.g.*, adult longevity, age of first breeding, fecundity, etc.).

<u>Predation Losses</u>

(<u>GP-4</u>) The inherent viability (= hatchability) of a recurvirostrid egg is a probabilistic function of its selenium content at the time of oviposition.

Accordingly, basin operators are obligated to compensate for all selenium-caused inviability of eggs. The fact that a predator "naturally removes" an already "doomed" egg does not release a basin operator from the obligation to compensate for that egg. A chemically inviable egg's fate (and a basin operator's responsibility) has already been determined at the time of oviposition (*i.e.,* when the egg leaves the hen's body). This is more a question of legal liability with regard to definitions of "take" than a question of biology. From a liability perspective, one must distinguish between the number of eggs chemically destroyed and the net biological impact of that destruction. Under statutes such as the Migratory Bird Treaty Act an operator assumes liability for any verifiable "take" without consideration of whether the "take" has population-level impacts or not (*i.e.*, "take" is unconditionally prohibited).

As a matter of biology, some reviewers of the draft Compensation Habitat Protocol advocated releasing operators from compensating for chemically inviable eggs that are subsequently predated up until the normal "background level" of predation is exceeded. The primary problem with that approach is that background levels of predation depend on the quality of the nesting habitat. Recurvirostrids show a very strong attraction to islands as nesting habitat. Such preferred (high quality) nesting habitat would be associated with near-zero background predation rates under undisturbed natural conditions or artificial conditions that mimic historically pristine conditions. For example, H.T. Harvey and Associates (1995) reported for Westlake Farms' section 3 alternative habitat (which possessed continuously isolated islands throughout the breeding season) a 5% nest predation rate and Sidle and Arnold (1982) reported for an island in the Mud Lake Waterfowl Production Area of North Dakota a 0% nest predation rate. The island they studied was thought to have supported the largest colony of breeding avocets documented in the scientific literature up to that publication date. Subsequently, if the "background level" of nest predation is established based on the good quality nesting habitat that recurvirostrids naturally seek out, the legal and biological perspectives converge on the same outcome, virtually all chemically-induced inviability of eggs should be compensated for.

<u>(GP-5)</u> Eggs lost to predators (or other causes of nest failure) in compensation wetlands do not provide a compensation benefit.

In the extreme case of total loss of eggs to predators in a compensation wetland, it is obvious that no compensation benefit has been provided. The relative habitat utility of compensation wetlands is devalued in direct proportion to predation losses and other sources of nest failure to yield the operational habitat utility. Not only is it important to maximize the attractiveness of compensation habitat to breeding birds (= habitat utility), it is also important to maximize the reproductive output from compensation habitat (= operational habitat utility). Thus, successful efforts to provide predator-safe nesting sites at compensation wetlands will yield higher operational habitat utility and lower compensation habitat obligations.

Relative Habitat Utility

The long-term average density of breeding birds attracted to an evaporation basin or compensation wetland is a measure of the site's attractiveness or utility as nesting habitat (*i.e.*, the degree to which the habitat is utilized for nesting). Relative habitat utility is the attractiveness of one type of habitat, such as evaporation basins, relative to the attractiveness of another type of habitat, such as compensation wetlands. It is important to recognize the distinction between habitat utility and habitat quality. Habitat utility is established by the level of use, whereas habitat quality is established by the outcome of that use. Habitat utility is not a measure of habitat quality.

(GP-6) The primary determinants of habitat utility are predator-safe nesting sites and areas of shallow water supporting at least a threshold density of aquatic invertebrates.

Recurvirostrids exhibit a strong attraction to (predator-safe) islands or perceived islands, such as internal levees of artificial ponds, as nesting sites. Although recurvirostrids are known to utilize a wide variety of nesting substrates (Grinnell *et al.* 1918; Bent 1927; Johnsgaard 1981), the highest densities of nests occur on islands (*e.g.*, Sidle and Arnold 1982; Salmon *et al.* 1991).

The densities of birds at saline-sink wetlands are generally believed to be food-limited in some fashion (*e.g.*, Mono Basin Ecosystem Study Committee 1987) and the Service's Waterfowl Management Handbook recommends maintaining a density of at least 100 midge larvae per square meter to "...successfully attract and hold shorebirds." (Eldridge 1992). A study of foraging behavior among black-necked stilts (*Himantopus mexicanus*) at a manmade pond system in Puerto Rico revealed that abundance of invertebrates was a strong determinant of where the stilts were foraging (Cullen 1994). Cullen's study seems particularly relevant because his focal species (black-necked stilt), study site (manmade salt ponds), and primary aquatic invertebrate (waterboatman) all match-up well with Tulare Basin evaporation basins.

(GP-7) On a unit basis, Predominantly shallow compensation wetlands with islands will exhibit about 2.5 times the habitat utility for breeding recurvirostrids as a traditional evaporation basin without islands.

In the first season (1994) of nest monitoring at Westlake Farms' demonstration wetland, it was estimated that 2.0 avian nesting attempts per acre were supported within the intensively monitored area (Cell G; Medlin 1994). Between 1987-1993, traditional evaporation basins without islands supported 0.41 to 1.41 avian nesting attempts per acre with a median of 0.81 (N=9 cases of relatively complete nest monitoring effort in space and time; USFWS, unpubl. data; see exhibit titled, Appendix of Unpublished Data). Additional estimates of habitat utility for compensation wetlands are needed to get a good sense for how variable they might be over time and between different sites, but the first-season data from Westlake Farms' demonstration wetland and alternative wetland currently constitute the best available information. The high habitat utility achieved by Westlake Farms in 1994 appears, to some extent, to be dependent on maintaining predominantly shallow wetlands. By comparison, the Corcoran Sewage Ponds, which are physically more similar to evaporation basins (*i.e.*, offer just a near-shore strip of shallow water) supported only 0.67 nesting attempts per acre in 1989 (Skorupa 1991a). Thus, the relative habitat utility of a predominantly shallow, compensation wetland with islands is estimated at (2.0)/(0.8l) = 2.47 times the habitat utility of traditional evaporation basins without islands.

(GP-8) The relative, habitat utility of predominantly shallow compensation wetlands is devalued by about 30% due to nest predation and other causes of nest failure.

In the first season (1994) of nest monitoring at Westlake Farms' demonstration wetland, it was estimated that about 50% of avian nesting attempts within the intensively monitored area survived to hatching (Cell G; Medlin 1994). H.T. Harvey and Associates (1995) reported a nesting success rate of 95% for recurvirostrids nesting at Westlake Farms' alternative habitat in section 3. Accordingly the average nest failure rate for these two sites was about 30%. Additional estimates of devaluation factors for the relative habitat utility of compensation wetlands are needed to get a good sense for how variable they may be over time and between different sites, but the first-season data from Westlake Farms' demonstration wetland currently constitute the best available information. Based on currently available data, an operational relative habitat utility of 0.59:1 for evaporation basins versus compensation wetlands is employed in this protocol.

Actual performance at properly designed compensation wetlands may consistently come closer to the 95% nest success observed in section 3 than to the 50% observed at Westlake Farms' section 16 demonstration wetland in 1994 because anti-predator designs, and water delivery capacity were not completed to design specifications at section 16 in time for the 1994 breeding season. As actual performance in designing compensation wetlands up to specification on schedule is demonstrated, the predation devaluation factor will be revised. Presumably, over time, improved management techniques for maintaining predominantly shallow wetlands without compromising the predator safety of nesting sites will be developed so that in the future there will be little devaluation of relative habitat utility at compensation wetlands.

EGGWISE PREMISES (EP)

Eggwise Exposure-Response Risk Functions

(EP-l) There is an elevated probability of contaminant-mediated juvenile mortality due to immune dysfunction when eggs contain 3.9 ppm or more selenium (all selenium concentrations are presented on a dry weight basis).

A study of selenium exposure and the ability of mallard (*Anas platyrhynchos*) ducklings to survive a disease challenge (Whiteley and Yuill 1989) led to the suggestion that disease resistance may be affected more by the selenium concentration in a duckling's egg than by dietary exposure to elevated selenium after the duckling hatches. Duckling mortality following a challenge with duck hepatitis virus 1 (DHV1) was twice as high (67%, N=24 vs. 30%, N=37) among ducklings from eggs that averaged 3.9 ppm selenium than among ducklings from eggs with background concentrations of selenium (averaging 0.4 to 1.7 ppm).

(<u>EP-2</u>) There is an elevated probability of direct embryotoxicity, and an elevated probability of contaminant-mediated post-hatch juvenile mortality (due to depressed growth rates) when eggs contain 10 ppm or more selenium.

The logistic regression for eggs. of black-necked stilts reported in Ohlendorf *et al.* (1986) shows that <u>for individual eggs</u> the threshold for embryotoxicity is about 10 ppm egg-selenium (Skorupa and Ohlendorf 1991). By comparison, a <u>population-level</u> (geometric mean) threshold of 8 ppm egg-selenium was reported by Skorupa and Ohlendorf (1991). For compensation purposes, individual-level risk functions are the most appropriate functions because they directly determine biological impacts.

Embryonic exposure to 10 ppm or more egg-selenium was associated with depressed rates of growth among recurvirostrid chicks (Skorupa *et al.* unpubl. data; see Appendix of Unpublished Data). Early growth rates are strong predictors of juvenile survivorship in shorebirds (Cairns 1982). Contaminant-depressed growth rates can be expected to cause increased juvenile mortality.

Because the eggs in the study of recurvirostrid chicks were artificially incubated and the chicks were fed only uncontaminated food after hatching, it was demonstrated that egg-selenium alone is sufficient to cause post-hatch growth depression in recurvirostrids (as was also found for mallard ducklings by Heinz *et al.* 1989) and therefore can serve as a direct predictor for such effects.

(<u>EP-3</u>) For eggs containing 3.9 to 9.9 ppm selenium it is estimated that the average long-term probability of contaminant-mediated juvenile mortality is about 10%.

Based on Whiteley and Yuill (1989; see EP-l for a summary), a <u>minimum</u> contaminant mortality add-on of (67-30%)=37% is the assumed response to a pathogen challenge or similar "stress." It is presumed that this mortality is at least partially compensatory (*i.e.*, compensated for in part by reduced competition and therefore density-dependent increased viability of the survivors; Hill 1988) and that stresses "events" are intermittent (not occurring every year). Therefore the effect has been reduced arbitrarily by one-half, or down to 18.5%. Furthermore, it is presumed that not all chicks are exposed to pathogens, parasites, or other stresses during a stress event. Therefore the contaminant-mediated mortality has been arbitrarily reduced again to 10%. Although the resultant "10% premise" is simply an educated guess, a crude guess is still preferable to completely neglecting the empirically demonstrated immunobiological risk for chicks hatched from eggs with 3.9 ppm selenium or more. As more immunobiological research is completed, this educated guess can be revised.

(EP-4) Between about 10 to 100 ppm egg-selenium the central probability of embryotoxicity or juvenile mortality is about 30%.

Heinz *et al.* (1989) experimentally demonstrated that when mallard eggs averaged about 11 ppm, 37 ppm, and 60 ppm selenium (from selenomethionine), production of 6-day-old ducklings declined by about 10%, 45%, and 100% compared to eggs that averaged less than 3 ppm selenium (background levels).

Ohlendorf *et al.* (1986) presented field data showing that as black-necked stilt eggs go from 10 ppm selenium to 60 ppm selenium the production of viable embryos should decline by about 35% to 70%.

In nature, the percent loss of avian production at the lower end of the 10 ppm to 60 ppm egg-selenium range will be higher than suggested by the above studies because the above studies do not fully assess the risk associated with the post-hatch to recruitment phase of the reproductive cycle. For example, the Ohlendorf *et al.* (1986) data are for losses expected to occur between fertilization and hatch, but at Kesterson Reservoir losses occurring between hatch and recruitment were also thought to be substantial (Ohlendorf 1989; Williams *et al.* 1989).

Also, at evaporation basins, the upper range of egg-selenium extends to about 100 ppm (excluding extreme outliers). That is substantially beyond the upper end of 60 ppm in the response curve for Kesterson Reservoir stilts (Ohlendorf *et al.* 1986).

In light of the studies by Heinz *et al.* (1989) and Ohlendorf *et al.* (1986), and their limitations, the "30% premise" proposed here would have to be considered a low estimate of the central probability for embryo or juvenile toxicity. An apparently low estimate was chosen intentionally because reproductive data for American avocets (*Recurvirostra americana*) indicate less sensitivity to selenium poisoning than is typically exhibited by ducks or stilts (Skorupa *et al.* 1993; CH2M-Hill 1994). Consequently, the "30% premise" attempts to take that species difference into consideration. Applying a Single point-estimate risk function across an order of magnitude of embryo exposure to selenium is imprecise, but is dictated by the imprecision of available eggwise exposure-response data (*e.g.*, see the wide confidence boundaries on Ohlendorf *et al.*'s (1986) exposure-response curves). As more detailed eggwise exposure-response data for recurvirostrids at evaporation basins become available, this premise could be revised.

COMPENSATION COEFFICIENTS: EGGWISE BASIS

Based on general premises GP-1 to GP-8, and the eggwise risk function premises EP-l to EP-4, compensation coefficients for each evaporation basin can be calculated using the following equation:

$$CC = HU \times [(F1 \times L1) + (F2 \times L2)]$$

where,

CC = Compensation coefficient the multiple of an evaporation basin's acreage that, on average, would be required in predominantly shallow wetland acreage to replace lost production,

F1 = the weighted proportion of randomly sampled eggs at an evaporation basin containing 3.9 to 9.9 ppm selenium, where all species/year estimates are weighted equally (see example below),

F2 = the weighted proportion of randomly sampled eggs at an evaporation basin, containing 10 or more ppm selenium, where all species/year estimates are weighted equally,

L1 = proportion of production lost when egg contamination is from 3.9 to 9.9 ppm selenium (L1 = 0.10 from premise EP-3),

L2 = proportion of production lost when egg contamination is 10 ppm selenium or more (L2 = 0.30 from premise EP-4),

HU = the relative habitat utility of evaporation basins (HU = 0.59; from premises GP-7 and GP-8).

Egg-selenium data for stilts and avocets, and from all years sampled at each evaporation basin, are weighted equally to derive the coefficients Fl and F2 for this first iteration of the calculations. Because there has been no compensation for historic impacts of evaporation basins, all available egg-selenium data are utilized to reflect average pre-compensation conditions. As compensation calculations are updated at regular intervals, and egg-selenium is systematically monitored at all evaporation basins, the calculations can be based on egg-selenium data more uniformly matched to a specific compensation period.

Example Calculation of a Compensation Coefficient

If the proportions of contaminated eggs sampled from each taxa were distributed as shown below:

TAXON-YEAR	PROPORTION OF EGGS WITH 3.9 TO 9.9 PPM SELENIUM	PROPORTION OF EGGS WITH 10 PPM OR MORE SELENIUM
Stilts – Year 1	0.25	0.10
Stilts – Year 2	0.30	0.20
Stilts – Year 1	0.05	0.0
Stilts – Year 2	0.25	0.10
Stilts – Year 3	0.35	0.50

then,

F1 = (0.25) + (0.3) + (0.05) + (0.25) + (0.35) / 5 = 1.2/5 = 0.24

and,

F2 = (0.1) + (0.2) + (0.0) + (0.1) + (0.5) / 5 = 0.9/5 = 0.18

and,

CC = 0.59 [(0.24) (.10) + (0.18) (.30)] = 0.047

In this example, an area of compensation wetlands 4.7% the size of the evaporation basin would be required to compensate for estimated contaminant damage (*i.e.*, 4.7 acres of compensation wetlands per 100 acres of evaporation basin).

Tulare Basin Compensation Coefficients: Eggwise Basis

Based on randomly sampled recurvirostrid eggs collected in 1986-1993 the following compensation coefficients have been calculated for evaporation basins in the Tulare Basin:

EVAPORATION BASIN	SAMPLE SIZE	F1	F2	COMPENSATION COEFFICIENT
Souza	--	----	----	---
Lindemann	--	----	----	---
Britz South Dos Palos	--	----	----	---
Sumner Peck	38	0.04	0.96	0.1723
Britz Davenport 5-Pts.	5	0.33	0.67	0.1381
Stone Land Company	18	0.22	0.17	0.0431
Lemoore Naval Air Station	8	0.26	0.0	0.0153
Westlake Farms North	51	0.16	0.02	0.130
Fabry Farms	9	0.0	0.93	0.1646
Meyers Ranch	2	N/A	N/A	N/A
Barbizon Farms	--	----	----	.---
TLDD North	49	0.27	0.0	0.0159
Westlake Farms South	22	0.86	0.03	0.0561
Liberty Farms	18	0.85	0.10	0.0679
Pryse Farms	71	0.57	0.25	0.0779
Bowman Farms	15	0.33	0.67	0.1381
Morris Farms	29	0.24	0.76	0.1487
Martin Farms	10	0.53	0.47	0.1145
Smith Farms	--	----	----	---
Four-J Corporation	15	0.45	0.48	0.1115
Nickell	--	----	----	---
TLDD Hacienda	34	0.70	0.27	0.0891
TLDD South	62	0.30	0.60	0.1239
Westfarmers	286	0.12	0.83	0.1540
Carmel Ranch	10	0.40	0.0	0.0236
Lost Hills Ranch	13	0.27	0.0	0.0159
Rainbow Ranch	68	0.42	0.57	0.1257
Chevron Land Company	--	----	----	---

Tulare Basin Compensation Acreage: Eggwise Basis

From the compensation coefficients listed above, the following acreages of shallow compensation wetlands would be required to balance the loss of avian production on evaporation basins:

EVAPORATION BASIN	EVAPORATION BASIN ACREAGE	COMPENSATION COEFFICIENT	COMPENSATION ACREAGE
Souza	10	No Data	No Data
Lindemann	100	No Data	No Data
Britz South Dos Palos	50	No Data	No Data
Sumner Peck	100	0.1723	17
Britz Davenport 5-Pts.	25	0.1381	3
Stone Land Company	210	0.0431	9
Lemoore Naval Air Station	80	0.0153	1
Westlake Farms North	260	0.0130	3
Fabry Farms	7	0.1646	1
Meyers Ranch	59	Insufficient Data	Insufficient Data
Barbizon Farms	95	No Data	No Data
TLDD North	301	0.0159	5
Westlake Farms South	740	0.0561	42
Liberty Farms	(160)	0.0679	11
Pryse Farms	(40)	0.0779	3
Bowman Farms	15	0.1381	2
Morris Farms	35	0.1487	5
Martin Farms	13	0.1145	1
Smith Farms	7	No Data	No Data
Four-J Corporation	25	0.1115	3
Nickell	20	No Data	No Data
TLDD Hacienda	1026	0.0891	91
TLDD South	1832	0.1239	227
Westfarmers	542	0.1540	83
Carmel Ranch	180	0.0236	4
Lost Hills Ranch	90	0.0159	1
Rainbow Ranch	100	0.1257	13
Chevron Land Company	65	No Data	No Data
TOTALS	6107 (5760 sampled)	---	525

NOTES: Evaporation basin acreage in parentheses are for sites that routinely had less than the full system capacity flooded up during most of the study period. Other acreages are from an October, 1994, Regional Water Quality Control Board statistical compilation.

HENWISE PREMISES (HP)

Henwise Exposure-Response Risk Functions

(HP-1) For any given exposure category (egg-selenium) the magnitudes of embryonic and post-hatch losses are approximately equal.

Heinz *et al.* (1987) found that when mallard hens were fed diets supplemented with 10 ppm selenium as selenomethionine and the ducklings they produced were fed the same diet (as would occur in nature), there was both a 47% depression in egg hatchability and a 51% depression of post-hatch juvenile survival as compared to a control group. In a follow-up study, Heinz *et al.* (1989) fed mallard hens diets supplemented with 1, 2, 4, 8, and 16 ppm selenium as selenomethionine, but fed a clean diet to all the ducklings those hens produced. As would be expected, the embryotoxic effects were about the same as in the 1987 study (*i.e.*, at the 8 ppm treatment level there was a 42% depression in egg hatchability), but the depression in post-hatch juvenile survivorship was much lower (only 18%). Field studies at Kesterson Reservoir suggested that, at high levels of contamination, post-hatch losses may greatly exceed embryonic losses (Ohlendorf 1989; Williams *et al.* 1989). For recurvirostrids, a depression in egg hatchability on the order of 10% was reportedly associated with a 100% depression in juvenile survivorship. Birds hatched in the wild face many stresses and risks that birds hatched in captivity (such as in Heinz's studies) don't face and that can magnify the post-hatch effects of contaminant exposure. Thus, a 1:1 premise for embryonic versus post-hatch adverse effects likely underestimates total reproductive impairment.

Under the premise that embryonic and post-hatch losses follow similar response curves it is possible to estimate total reproductive losses from embryonic losses alone. For example, if the proportion of embryonic losses is represented as "p" then the proportion of embryos surviving to hatch will be 1-p. If post-hatch mortality is about equal to embryo mortality (= p), then proportional post-hatch mortality will equal $p(1-p)$ or $p-p^2$. Thus, total proportional reproductive losses will equal embryo mortality (= p) plus post-hatch mortality (= $p-p^2$), which together add up to $2p-p^2$. Because a rigorous set of embryonic exposure-response data for recurvirostrids, on a henwise basis, has been collected at evaporation basins (Ohlendorf *et al.* 1993; Skorupa 1994), a fairly precise henwise-based risk function can be developed.

Henwise-based compensation calculations are presented for comparison to the eggwise-based calculations. The henwise-based protocol is statistically cleaner because only hens (not eggs) are independent data points. It also utilizes more detailed exposure-response data that was actually collected from studies of recurvirostrids nesting at evaporation basins. Additionally, it precisely incorporates the substantial species differences in sensitivity to selenium between stilts and avocets. Another advantage is that henwise compensation is the most appropriate approach from a population genetics perspective. Losses attributable to a given number of genetically distinct hens are replaced by an equal number of genetically distinct hens. By comparison, on an eggwise basis, 40 hens that each lost 1 egg could be compensated for by only 10 hens each producing 4 eggs. The disadvantage of the henwise approach is that you cannot compensate for a "partial hen." Any hen that is reproductively impaired, regardless of degree, is compensated for. That disadvantage, however, is counterbalanced by uncertainties regarding effects of selenium exposure on immune dysfunction, adult longevity, and age of first breeding (among other factors), all of which could impose demographic impacts on recurvirostrid populations that this compensation protocol does not take into account.

(<u>HP-2</u>) The long-term ratio of breeding stilts to avocets at evaporation basins is approximately 1:1.

Surveys conducted by the Service during, 1987-1989 revealed an overall 1:1 ratio of breeding stilts and avocets (*i.e.*, 2,285 stilt vs. 2,254 avocet nest 12 records; Skorupa *et al.*, unpubl. data; see Appendix of Unpublished Data), although basin-specific ratios can be highly variable from year to year. Likewise, it was estimated that approximately a 1:1 ratio of stilts and avocets was attracted to Westlake Farm's demonstration wetland near Kettleman City during the 1994 breeding season (*i.e.*, estimates of 199 stilt vs. 180 avocet nesting attempts; Medlin 1994).

(<u>HP-3</u>) Weighting the stilt and avocet data equally, estimates of $2p - p^2$ for exposure categories of 0-5 ppm, 5.1-20 ppm, 21-40 ppm, 41-70 ppm, and ≥71 ppm egg-selenium are:. 0.0, 0.1889, 0.2551, 0.5083, and 0.9261 respectively.

The above henwise risk function is based on 354 stilt clutches and 229 avocet clutches that survived to full-term incubation and that also had a randomly selected sample egg analyzed for selenium (Skorupa *et al.*, unpubl. data; see Appendix of Unpublished Data). The data were collected during 1983-1994 at Kesterson Reservoir, Volta Wildlife Management Area, Grasslands Resource Conservation District, and at evaporation basins and reference sites within the Tulare Lake Basin. Clutches were classified as impaired or normal based on whether or not they contained any fail-to-hatch eggs. Based on 141 recurvirostrid clutches with a sample egg containing 0-5 ppm selenium, the background value for p (the proportion of impaired clutches) was estimated as 0.08. By comparison, Holmes (1972) estimated that the normal proportion of impaired clutches among western sandpipers (*Calidris mauri*) nesting on the Yukon-Kuskokwim Delta of Alaska was 0.09. Like recurvirostrids, western sandpipers are shorebirds that normally produce four-egg clutches. Due to its remoteness, presumably the Yukon-Kuskokwim Delta is a relatively uncontaminated environment. Thus, background p = 0.08 (and background 1-p = 0.92) was taken to represent normal reproductive performance (*i.e.*, zero contaminant-induced reproductive depression), and all measures of reproductive depression for other egg-selenium (exposure) categories were calibrated accordingly (*i.e.*, {(calibrated p) = 1 - [(1-raw p) / (0.92)]}).

COMPENSATION COEFFICIENTS: HENWISE BASIS

Based on general premises GP-1 to GP-8, and the henwise risk function premises HP-1 to HP-3, compensation coefficients for each evaporation basin can be calculated using the following equation:

$$CC = HU \times [(F1 \times L1) + (F2 \times L2) + (F3 \times L3) + (F4 \times L4) + (F5 \times L5)]$$

where,

CC = compensation coefficient the multiple of an evaporation basin's acreage that, on average, would be required in predominantly shallow wetland acreage to replace lost production,

Fl = the proportion of randomly sampled eggs containing 0 to 5 ppm selenium,

F2 = the proportion of randomly sampled eggs containing 5.1 to 20 ppm selenium,

F3 = the proportion of randomly sampled eggs containing 21 to 40 ppm selenium,

F4 = the proportion of randomly sampled eggs containing 41 to 70 ppm selenium,

F5 = the proportion of randomly sampled eggs containing 71 or more ppm selenium,

L1 = proportion of production lost when egg contamination is from 0 to 5 ppm selenium (Li = 0.0 from premise HP-3),

L2 = proportion of production lost when egg contamination is from 5.1 to 20 ppm selenium (L2 = 0.1889 from premise HP-3),

L3 = proportion of production lost when egg contamination is from 21 to 40 ppm selenium (L3 = 0.2551 from premise HP-3),

L4 = proportion of production lost when egg contamination is from 41 to 70 ppm selenium (L4 = 0.5083 from premise HP-3),

L5 = proportion of production lost when egg contamination is 71 or more ppm selenium (L5 - 0.9261 from premise HP-3),

HU = the relative habitat utility for evaporation basins (MU - 0.59; from premises GP-7 and GP-8).

Tulare Basin Compensation Coefficients: Henwise Basis

Based on randomly sampled recurvirostrid eggs collected in 1986-1993 the following compensation coefficients have been calculated for evaporation basins in the Tulare Basin:

EVAPORATION BASIN	SAMPLE SIZE	F1	F2	F3	F4	F5	COMPENSATION COEFFICIENT
Souza	--	----	----	----	----	----	----
Lindemann	--	----	----	----	----	----	----
Britz South Dos Palos	--	----	----	----	----	----	----
Sumner Peck	38	----	.021	.016	.034	.029	.03079
Britz Davenport 5-Pts.	5	----	.080	0.20	----	----	.01192
Stone Land Company	18	0.94	0.06	----	----	----	0.0007
Lemoore Naval Air Station	8	0.88	0.12	----	----	----	0.0134
Westlake Farms North	51	0.86	0.12	0.02	----	----	0.0164
Fabry Farms	9	0.11	0.33	0.33	0.22	----	0.1524
Meyers Ranch	--	----	----	----	----	----	----
Barbizon Farms	--	----	----	----	----	----	----
TLDD North	49	0.86	0.14	----	----	----	0.156
Westlake Farms South	22	0.55	0.45	----	----	----	0.0502
Liberty Farms	18	0.17	0.83	----	----	----	0.0925
Pryse Farms	71	0.38	0.61	0.01	----	----	0.0695
Bowman Farms	15	0.07	0.53	0.40	----	----	0.1193
Morris Farms	29	0.03	0.55	0.28	0.14	----	0.1454
Martin Farms	10	----	0.80	0.20	----	----	0.1192
Smith Farms	--	----	----	----	----	----	----
Four-J Corporation	15	0.13	0.87	----	----	----	0.0969
Nickell	--	----	----	----	----	----	----
TLDD Hacienda	34	0.09	0.85	0.06	----	----	0.1038
TLDD South	62	0.03	0.89	0.06	0.02	----	0.1142
Westfarmers	286	0.01	0.23	0.38	0.33	0.05	0.2091
Carmel Ranch	10	0.90	0.10	----	----	----	0.0112
Lost Hills Ranch	13	1.00	----	----	----	----	0.0000
Rainbow Ranch	68	0.03	0.72	0.18	0.03	0.03	0.1328
Chevron Land Company	--	----	----	----	----	----	----

Tulare Basin Compensation Acreage: Henwise Basis

From the compensation coefficients listed above, the following acreages of shallow compensation wetlands would be required to balance the loss of avian production on evaporation basins:

EVAPORATION BASIN	EVAPORATION BASIN ACREAGE	COMPENSATION COEFFICIENT	COMPENSATION ACREAGE
Souza	10	No Data	No Data
Lindemann	100	No Data	No Data
Britz South Dos Palos	50	No Data	No Data
Sumner Peck	100	0.3079	31
Britz Davenport 5-Pts.	25	0.1192	3
Stone Land Company	210	0.0007	0
Lemoore Naval Air Station	80	0.0134	1
Westlake Farms North	260	0.0164	4
Fabry Farms	7	0.1524	1
Meyers Ranch	59	Insufficient Data	Insufficient Data
Barbizon Farms	95	No Data	No Data
TLDD North	301	0.0156	5
Westlake Farms South	740	0.0502	37
Liberty Farms	(160)	0.0925	15
Pryse Farms	(40)	0.0695	3
Bowman Farms	15	0.1193	2
Morris Farms	35	0.1454	5
Martin Farms	13	0.1192	2
Smith Farms	7	No Data	No Data
Four-J Corporation	25	0.0969	2
Nickell	20	No Data	No Data
TLDD Hacienda	1026	0.1038	106
TLDD South	1832	0.1142	209
Westfarmers	542	0.2091	113
Carmel Ranch	180	0.0112	2
Lost Hills Ranch	90	0.00	0
Rainbow Ranch	100	0.1328	13
Chevron Land Company	65	No Data	No Data
TOTALS	6107 (5760 sampled)	---	554

NOTES: Evaporation basin acreages in parentheses are for sites that routinely had less than the full system capacity flooded up during most of the study period. Other acreages are from an October 1994, Regional Water Quality Control Board statistical compilation.

CONCLUDING DISCUSSION

Based on best available information and empirically testable premises, it is estimated that about 550 acres of shallow nondrainwater wetlands would be needed to compensate for breeding season avian losses on about 5,760 acres of Tulare Basin evaporation basins. Overall, that's a ratio of approximately 0.10 acres compensation for every acre of evaporation pond. For the ten basins (ca. 5,000 acres) that were listed as active by the Regional Water Quality Control Board as of October 1994, it is estimated that about 490 acres of compensation wetlands would be needed. The cumulative compensation acreage is nearly identical for eggwise versus henwise calculations; however, obligations for individual basins often differ under the two sets of calculations. The henwise risk functions are more responsive to the nonlinear increase in risk associated with increasing exposure to selenium. Consequently, the main difference between eggwise and henwise calculations is that highly contaminated evaporation basins bear a higher proportion of the total obligation for compensation under the henwise protocol. The Service, as well as most reviewers of the draft Compensation Habitat Protocol, prefer the henwise calculations because they are based on more detailed and qualitatively superior (*i.e.*, nonlinear) response functions.

It was envisioned that the task of setting compensation obligations would be a continuous cyclic process whereby there would be an initial iteration of compensation obligations that would be in effect for a 3-year period, then any new data collected or research findings reported during the compensation cycle would be incorporated into an updated iteration of compensation obligations, which in turn would be in effect for another 3-year compensation cycle and so on. The only way to realistically implement such a process is to base the compensation protocol on data that can be measured with reasonable certainty and at low cost. Thus, this protocol relies principally on measures of egg-selenium, exposure-response, functions, and long-term average comparative habitat utility (which is based on nest densities and therefore is responsive to changes in absolute abundances of breeding birds) for evaporation ponds versus compensation wetlands.

Egg-selenium can be measured with greater certainty and precision than any other biological variable potentially relevant to assessing compensation obligations, and therefore provides the single most appropriate and equitable foundation upon which to build a compensation protocol. The structure of the protocol built upon that foundation will change as the state of knowledge regarding exposure-response functions and comparative habitat utility change. Accordingly, research and monitoring resources can be efficiently focused on those topics.

The Service prefers the concept of long-term relative habitat utility (HU) to site-specific absolute counts of birds or nests because site-specific absolute counts vary unpredictably from year-to-year under even under relatively constant basin management and are of dubious certainty due to the myriad of potential biases in effect (for several reviews of such biases see the papers in Ralph and Scott 1981). For example, at TLDD South in June, 1990, within the same week, a standard park'n'drive count of birds conducted by two experienced observers (Todd Sloat & William Erickson, UCD Dept. Wildlife and Fisheries Biology hazing research team) was followed by an intensive on-foot simultaneous count of snowy plovers by 19 observers deployed to achieve rapid complete coverage of the basin. The standard count yielded an estimate of 45 snowy plovers inhabiting the basin, whereas the complete coverage simultaneous count yielded an estimate of 95 snowy plovers inhabiting the basin...more than a 100% difference (Skorupa 1990). Despite the large uncertainty in the accuracy of standard park'n'drive absolute counts, the **relative** utility of habitats can be measured with good certainty if the biases affecting absolute counts are relatively uniform between habitats. If as envisioned by the Service, compensation habitat is Concentrated at one or two regional compensation sites of well-documented and relatively constant habitat utility, then changes in HU due to changing nest densities monitored at evaporation basins will directly track absolute numbers of breeding birds.

Additionally, it is important to remember that the compensation protocols presented here do not explicitly address many potential impacts of evaporation basins on avian populations, including:

(1) Historic contaminant-induced louses not previously compensated.

Some basins were operational in the 1970's, and all basins were operational by 1985 (Westcot *et al.* 198a). The earliest studies (1984-1986) of environmental contamination and avian exposure to contaminants at evaporation basins revealed "potentially harmful levels" of exposure to selenium and impaired avian reproduction (Barnum and Gilmer 1986; Fujii 1968; Schroeder *et al.* 1988). From those earliest studies in the mid 1960's until the early 1990's avian exposure to selenium has been fairly constant (Skorupa *et al.*, unpubl. data; see Appendix of Unpublished Data). The first compensation wetland, however, was not established until 1994. Consequently, markedly elevated avian exposure to selenium at evaporation basins has gone completely uncompensated for a decade or more.

(2) Contaminant-induced losses not detected among birds nesting outside the normal search radius of biologists conducting nest monitoring.

Agricultural fields and other "cover" habitat within several miles of an evaporation basin could harbor nesting ducks that are foraging at evaporation basins. See discussion of this topic under premise GP-1 above for an example. Biologists monitoring avian nests at evaporation basins rarely search for nests outside the perimeter levees of the basin system. Thus, adverse effects (if any) suffered by nesting ducks or any other species of waterbirds "commuting" to an evaporation basin would not be detected or compensated.

(3) Losses due to hazing during the breeding season.

Losses due to off-road vehicle activity associated with hazing efforts have been documented at one evaporation basin for western snowy plovers (*Charadrius alexandrinus*) and for recurvirostrids (Skorupa 1991b). These losses were discovered incidentally, and adverse impacts of hazing could easily have gone undetected at other evaporation basins.

(4) Losses due to levee grading, vegetation removal and managed water level fluctuations during the breeding season.

Several incidents of levee grading during the breeding season have been documented at three evaporation basins with the resultant loss of hundreds of recurvirostrid eggs (Skorupa 1991b; Skorupa *et al.*, unpubl. data; see Appendix of Unpublished Data). Vegetation removal at two pond systems during the breeding season has been documented to have caused substantive (but not fully monitored) losses of waterbird eggs (Skorupa pers. comm.). Managed water level fluctuations during the breeding season have also been documented to have caused losses of waterbird eggs (particularly eared grebes and black- necked stilts) at several evaporation basins (Skorupa *et al.*, unpubl. data; see Appendix of Unpublished Data).

(5) Losses due to the use of automobile tires for levee stabilization.

The occurrence of losses of recurvirostrid chicks trapped inside automobile tires used to stabilize basin levees was documented at one evaporation basin (Skorupa *et al.*, unpubl. photographs).

(6) Losses due to other physical barriers such as wave-induced foam, open pit blinds, and experimental shoreline, netting.

Most ponds produce a ring of wave-induced foam along downwind shorelines. Foam encrustation of the down or feathers of recurvirostrid chicks has been documented to cause juvenile mortality (Main and Anthony 1995). Several ponds retain concrete pit blinds, presumably originally intended for duck hunting, that are generally left uncovered. A variety of dead and dying wildlife and other animals have been found trapped in these blinds ranging from recurvirostrid chicks, to long-tailed weasels (*Mustela frenata*), to domestic sheep (*Ovis* spp.) (Skorupa *et al.*, pers. obs.). Experimental shoreline netting at one evaporation basin has been documented to cause mortality of juvenile and adult shorebirds (Skorupa *et al.*, unpubl. photographs; Barnum *et al.*, in prep.).

(7) Losses due to contaminants other than selenium.

Although concentrations of trace elements other than selenium in avian eggs at evaporation basins do not exceed concentrations demonstrated to cause embryotoxicity (Ohlendorf *et al.* 1993), concentrations of arsenic and boron in the food chain at some evaporation basins are high enough to cause post-hatch adverse effects (*e.g.*, Camardese *et al.* 1990; Hoffman *et al.* 1990). In addition, the spatial distribution of eared grebe colonies experiencing complete failure of eggs (directly bathed in drainwater) is not explained by the selenium content of the water (Skorupa *et al.*, unpubl. data; see Appendix of Unpublished Data). Finally, in addition to a possible role in the grebe reproductive failures, the high salinity of drainwater has been documented to cause adverse effects (severe feather damage) for ruddy ducks (Euliss *et al.* 1989).

(8) Secondary hazards to predators of birds and their eggs.

Peregrine falcons (*Falco peregrinus*), northern harriers (*Circus cyaneus*), and burrowing owls (*Athene cunicularia*) have been observed preying on shorebirds at evaporation basins (Skorupa *et al.*, pers. obs.). Gopher snakes (*Pituophis catenifer*), and mammalian predators have been observed preying on avian eggs at evaporation basins (Skorupa *et al.*, pers. obs.). No studies of secondary hazards have quantified the risk that such predators are exposed to at evaporation basins. A peregrine falcon that was too weak to fly was recovered from a wheat field near an evaporation basin in 1992. A blood sample from the peregrine revealed a markedly elevated concentration of selenium as did feather samples. The peregrine quickly recovered when placed on a clean diet (consistent with selenium poisoning, but not conclusively diagnostic). A fresh cinnamon teal (*Anas cyanoptera*) carcass that a peregrine falcon was observed feeding from was recovered at the same evaporation basin and found to exhibit markedly elevated selenium concentrations (Detwiler 1991; White 1993; Skorupa *et al.*, unpubl. data; see Appendix of Unpublished Data).

(9) Nonlethal impacts during the breeding season.

Lower mean body weights have been documented for breeding black-necked stilt hens collected from a medium-selenium and a high-selenium evaporation basin as compared to hens collected from a low-selenium evaporation basin (White 1993). The implications, if any, of this generally reduced body condition with regard to average adult longevity or other "fitness" parameters is unknown. Barnum (1992) notes, however, that poor body condition has been linked to lowered fitness (*i.e.,* survival and future reproductive success) in several species of waterfowl.

(10) Lethal and nonlethal impacts occurring outside the breeding season.

There is a general lack of information on this topic. Barnum (1992) summarized available information on trends in body condition of birds wintering at evaporation ponds. He concluded that in general waterbirds wintering on evaporation ponds appeared to exhibit lower overall body condition, significantly enlarged salt glands, and elevated concentrations of breast and/or liver-selenium. He further noted a general trend suggesting that increasing selenium exposure results in decreasing body condition; a trend that was statistically significant only for ruddy ducks (*Oxyura jamaicensis*). Based on a large program of experimental research conducted on behalf of the San Joaquin Valley Drainage Program, it was estimated that survival of wintering birds would be protected by not permitting food items to become contaminated with more than 10 ppm selenium on a dry weight basis (Heinz 1989; Patuxent Wildlife Research Center 1990). The widespread occurrence of food items with greater than 10 ppm selenium at evaporation basins (Moore *et al.* 1989) establishes the plausibility of substantive biological impacts outside the breeding season. As mentioned earlier, to the extent that such impacts may occur, they may also be partially or wholly alleviated by the provision of year-round alternative habitat as part of hazing and mitigation requirements.

Finally, there is a very important caveat associated with this protocol that was brought to our attention via the review comments of Ms. Carolyn Marn, a Ph.D. candidate at Oregon State University who conducted her Ph.D. research at Tulare Basin evaporation basins (for details see Ms. Marn's letter in the collection of comment letters, USFWS exhibit #10). Ms. Marn outlines mathematically several permutations of regional demographic conditions for avian populations under which our proposed Compensation Habitat Protocol would provide inadequate compensation. Since those conditions require the regional population of birds to behave as a demographically closed population, which the Service currently views as unlikely (especially for species that are not year-round territory holders), the outcomes modeled by Ms. Marn are probably not applicable (but, that has not been factually established). Nonetheless, Ms. Marn's line of reasoning does bring up the issue that if our protocol works regionally because of a demographic subsidy from outside the region, then strictly speaking there may extra-regional demographic impacts that would constitute yet another class of impacts that this compensation protocol does not explicitly address.

Appendix C Report on Sediment Removal from the San Luis Drain April 25, 2018

Report on Sediment Removal from the San Luis Drain
April 25, 2018

The San Luis & Delta Mendota Water Authority (Authority) is performing maintenance sediment removal on the portion of the San Luis Drain (Drain) that is part of the Grasslands Bypass Project (GBP-Order No. R5-2015-0094). Sediment removal from the Drain is a component of the continuing operation of the GBP and was provided for in the GBP's 2009 EIS/EIR. As part of the GBP, the San Joaquin River Improvement Project (SJRIP) was created and encompasses approximately 6,000 acres that are set aside for GBP water quality projects, specifically, the reuse of drainage water with elevated levels of salts and selenium.

As part of the Use Agreement for the Grassland Bypass Project, a long term storm water plan development was envisioned. The plan is in the formulation process but one option is for continued Use of the San Luis Drain after the current Use Agreement expires in December of 2019. The removal of sediment from the San Luis Drain will likely be required to attain the necessary flow capacity to convey storm water in wet years.

The Grassland Basin Drainers have removed sediment both in 2016 and in 2017. In 2016 approximately 30,000 c.y. were removed and in 2017 approximately 105,000 c.y. were removed. Sediment samples were collected from the San Luis Drain in October 2015, prior to the initiation of sediment removal activities. The sampling is described in the attached memo dated October 23, 2015. The attached **Table 1** provides the selenium results of the samples.

Table 1: SLD Sediment Selenium Results.

Site	Se (mg/Kg)			Site	Se (mg/Kg)	
	Dry wt.	Wet wt.			Dry wt.	Wet wt.
1	2.7j	1.9j		6	3.8j	2.7j
2	2.8j	2.0j		7	4.1j	2.9j
3	2.2j	2.1j		8	1.2j	0.85j
4	1.9j	1.3j		9	2.1j	1.5j
5	2.2j	1.7j				

j = result detected below the reporting limit.

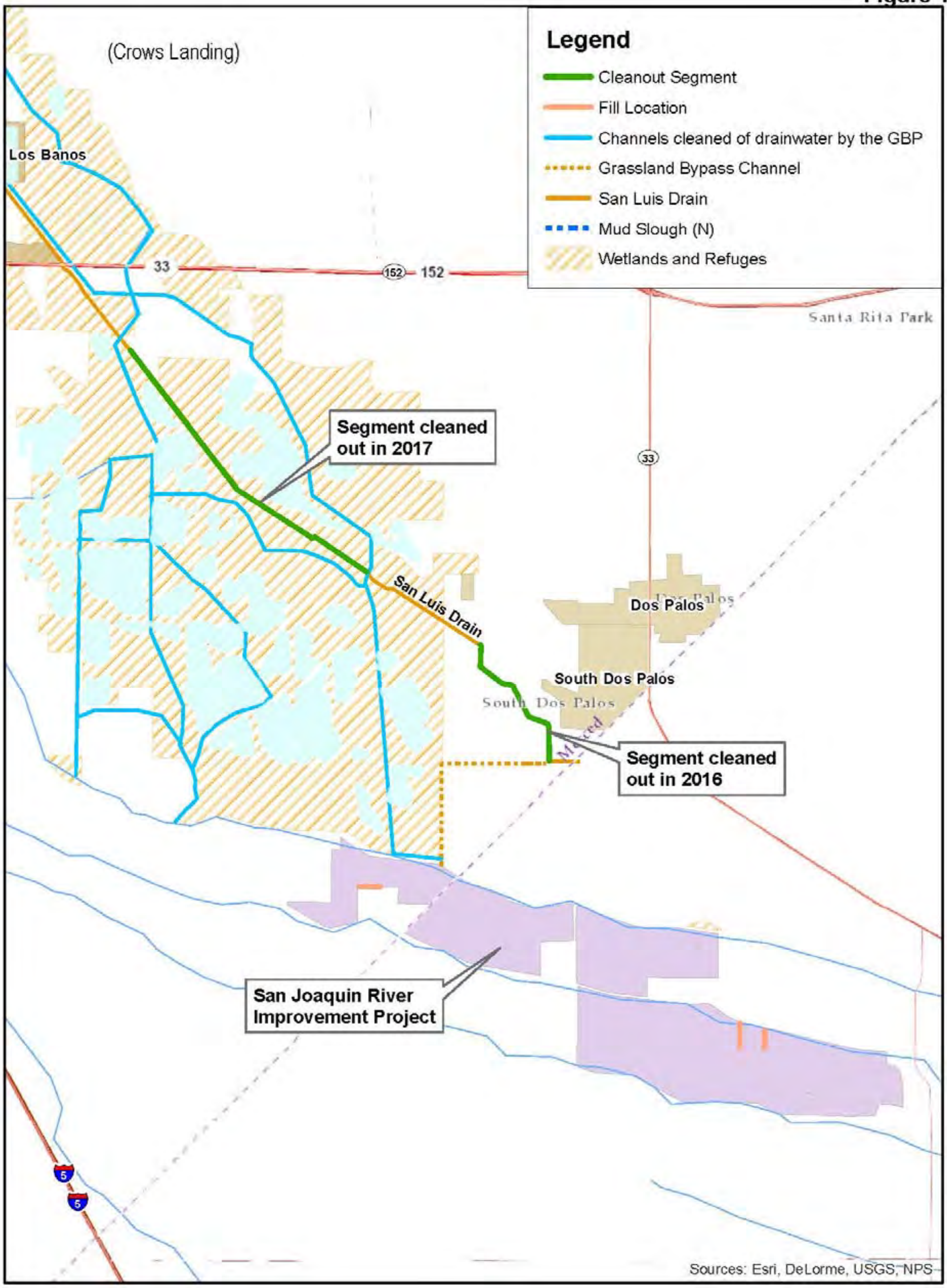
The samples were compared to the sediment management plan that was incorporated into the 2009 EIS/EIR for the Grassland Bypass Project. The criteria in the sediment management plan allows for placement of sediment on agricultural land without on-site monitoring if the sediment concentrations are less than 10 ug/g (mg/kg) dry weight (see Table 3 of the Sediment Management Plan). The samples in Table 1 were all less than 10 mg/kg dry weight. All results are also well below the hazardous level of 100 mg/kg wet weight (State of California Title 22)

Sediment removed from the San Luis Drain in both 2016 and 2017 was placed as fill material for unneeded drains within the San Joaquin River Improvement Project (SJRIP). Although the criteria for placement of sediment on agricultural lands was used, the potential for leaching from this application is less than if it were spread across an irrigated field. In 2016, San Luis Drain sediment was used to fill a drain in the westerly portion of the SJRIP and in 2017, a drain in the easterly portion of the SJRIP was filled (see Figure 1). Since 2001, operation of the SJRIP has included efforts to fill in unneeded drainage channels. Left unattended, these channels collect seleniferous groundwater and become an attractive nuisance to wildlife. Once filled in, water can no longer pond in the channels. Photos are attached showing the removal and placement of the sediments.

The nine samples collected from sediment in the San Luis Drain were from sampling sites generally evenly spaced along the segment that was to be cleaned of sediment. The selenium results for all nine samples were below the 10 ppb dry weight threshold and were detected below the reporting limit ("j" flag). Although the sampling frequency of the sediment in the San Luis Drain was less than the frequency suggested in the sediment management plan, the consistency of the results combined with the very low detections indicated that more frequent sampling was not required.

On 26 May 2016, the San Luis Delta-Mendota Water Authority filed a Report of Waste Discharge (RWD) for requesting coverage under *Waiver of Reports of Waste Discharge and Waste Discharge Requirements for Specific Types of Discharge within the Central Valley Region,* Resolution R5-2013-0145. On August 11, 2016 the Regional Board determined that this activity qualified for coverage under the waiver.

Figure 1



Prepared by:
Summers Engineering, Inc.
Consulting Engineers
Hanford California

Preparation of sediment
for removal

Placement of sediment prior
to loading in trucks

Loading sediment
in trucks

Placement of sediment in reuse area

SUMMERS ENGINEERING
887 N. Irwin St. – PO Box 1122
Hanford, CA 93232

MEMORANDUM

TO: The Files of the Grassland Basin Drainers

FROM: Chris Linneman

DATE: October 23, 2015 (Rev. April 25, 2018)

SUBJECT: San Luis Drain Sediment Sample Collection

On Friday, October 23, 2015, Juan Cadena and I collected sediment samples from a drain within the SJRIP and along the portion of the San Luis Drain targeted for cleanout. Samples were collected into glass jars and delivered to APPL laboratories for analysis.

Sample collection on the San Luis Drain began downstream of the Swift Avenue bridge and ended approximately 1.65 miles downstream of Mallard Avenue. At this point, standing water in the drain prevented safe sample collection. A total of 12 samples were collected, three at the destination drain within the SJRIP and 9 from the San Luis Drain. The sample designations and locations are listed in the table below.

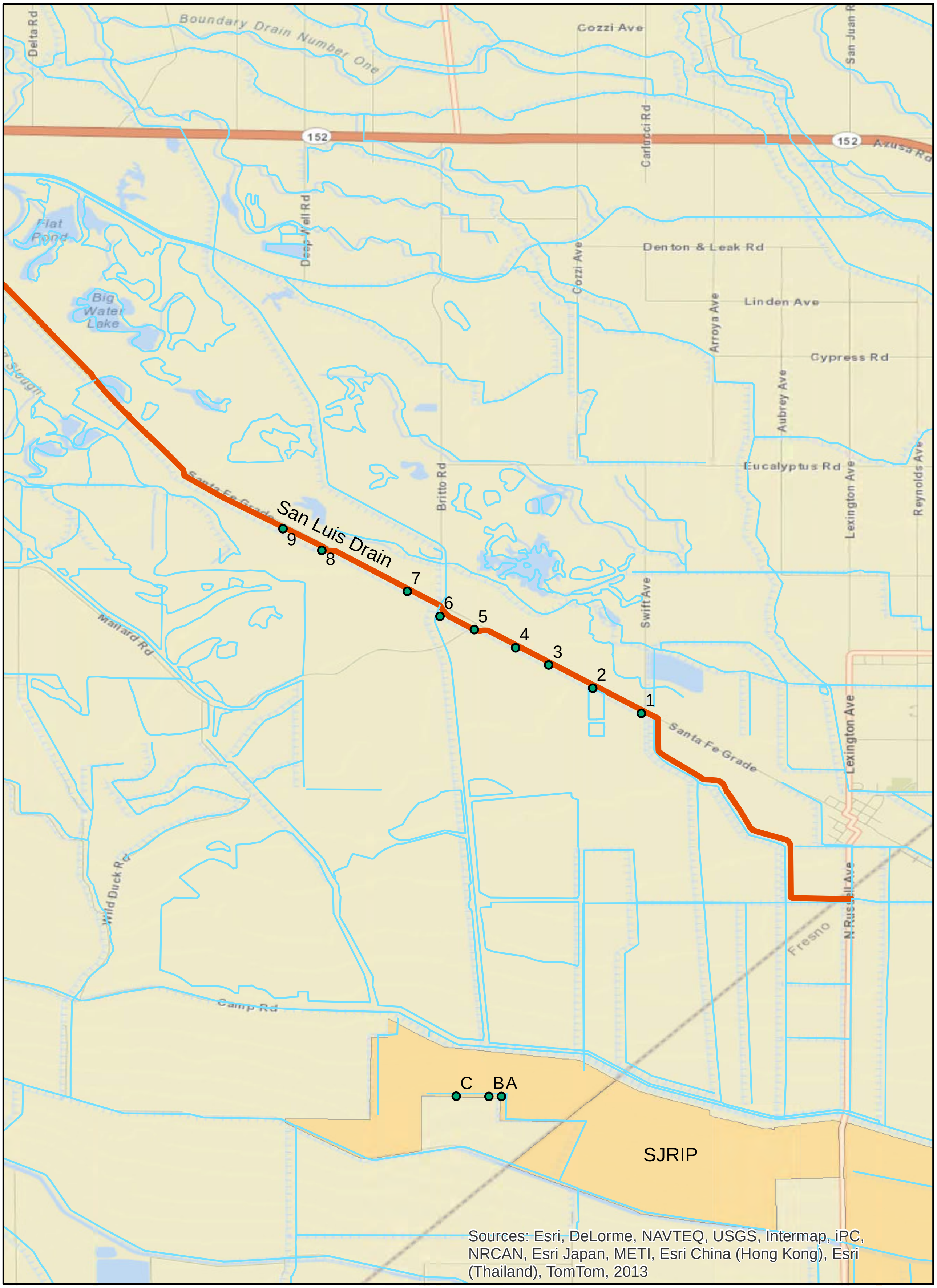
Designation	Source	Latitude	Longitude
Sample A	Drain on SJRIP	36.927278	-120.699833
Sample B	Drain on SJRIP	36.927273	-120.70152
Sample C	Drain on SJRIP	36.927304	-120.705867
Sample 1	SLD	36.978075	-120.681254
Sample 2	SLD	36.981427	-120.687711
Sample 3	SLD	36.984498	-120.693568
Sample 4	SLD	36.986785	-120.697958
Sample 5	SLD	36.98921	-120.703464
Sample 6	SLD	36.990978	-120.708029
Sample 7	SLD	36.994273	-120.712352
Sample 8	SLD	36.9997	-120.723715
Sample 9	SLD	37.002588	-120.728877

Significant ponded water was encountered downstream of Mallard Road (Sample 6), after which, samples were collected where the sediment extended up the lining and was safely reachable for collection.

All collected samples were analyzed for:

- Aluminum
- Arsenic
- Barium
- Cadmium
- Chromium (Total)
- Chromium – VI
- Copper
- Lead
- Manganese
- Mercury
- Molybdenum
- Nickel
- Selenium
- Zinc

Attached are the results of the sampling.



Sediment Sample Locations

Samples Collected Oct 23, 2015

Metals Dry Weight Analysis

Analyte	SAMPLE SITE DESIGNATION												Unit*
	A	B	C	1	2	3	4	5	6	7	8	9	
Aluminum	15000.00	20200.00	20000.00	17400.00	18600.00	24500.00	18200.00	27100.00	26200.00	20900.00	29000.00	21600.00	mg/Kg
Arsenic	4.20	3.70	5.20	5.40	4.80	6.00	5.00	5.50	6.10	6.20	5.70	5.30	mg/Kg
Barium	119.00	140.00	144.00	184.00	165.00	187.00	169.00	199.00	200.00	162.00	199.00	179.00	mg/Kg
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/Kg
Chromium	49.40	56.50	53.90	60.70	60.10	71.00	68.20	84.60	84.40	66.40	95.50	76.70	mg/Kg
Copper	27.10	30.20	27.20	23.20	24.80	32.40	27.40	35.30	36.20	31.90	39.10	31.00	mg/Kg
Lead	7.40	6.70	7.30	6.30	6.30	7.90	6.70	8.70	8.70	6.60	9.50	7.60	mg/Kg
Manganese	379.00	518.00	585.00	601.00	577.00	866.00	572.00	763.00	939.00	927.00	1020.00	917.00	mg/Kg
Molybdenum	0.54	0.96	0.90	0.14	ND	ND	ND	ND	ND	ND	ND	0.11	mg/Kg
Nickel	46.20	53.20	54.20	46.70	45.40	56.30	48.10	59.90	61.00	49.40	64.20	52.40	mg/Kg
Selenium	3.80	6.70	4.20	2.70	2.80	2.20	1.90	2.20	3.80	4.10	1.20	2.10	mg/Kg
Zinc	50.00	59.40	69.40	57.30	57.10	70.80	59.40	72.90	76.90	64.90	78.00	70.90	mg/Kg
Mercury	0.50	0.72	0.39	0.56	0.84	0.99	0.88	0.96	1.00	1.10	1.00	1.10	mg/Kg
Chromium+6	ND	ND	ND	ND	15.00	ND	0.54	ND	ND	ND	0.68	0.45	mg/Kg

* Dry Weight

Metals Wet Weight Analysis

Analyte	SAMPLE SITE DESIGNATION												Unit*
	A	B	C	1	2	3	4	5	6	7	8	9	
Aluminum	10300	14700	14900	12200	13200	23600	12400	20600	18500	14800	19800	15600	mg/Kg
Arsenic	2.9	2.7	3.9	3.8	3.4	5.8	3.4	4.2	4.3	4.4	3.9	3.8	mg/Kg
Barium	81.5	102	107	129	117	180	115	151	141	115	136	129	mg/Kg
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/Kg
Chromium	33.9	41	40.1	42.6	42.7	68.3	46.5	64.2	59.5	47.1	65.1	55.4	mg/Kg
Copper	18.6	21.9	20.2	16.3	17.6	31.2	18.7	26.8	25.5	22.6	26.7	22.4	mg/Kg
Lead	5.1	4.9	5.4	4.4	4.5	7.6	4.6	6.6	6.1	4.7	6.5	5.5	mg/Kg
Manganese	260	376	435	422	410	833	390	579	662	657	699	662	mg/Kg
Molybdenum	0.37J	0.7	0.67	0.10J	ND	ND	ND	ND	ND	ND	ND	0.078J	mg/Kg
Nickel	31.7	38.6	40.3	32.8	32.3	54.2	32.8	45.5	43	35	43.8	37.8	mg/Kg
Selenium	2.6J	4.9	3.1	1.9J	2.0J	2.1J	1.3J	1.7J	2.7J	2.9J	0.85J	1.5J	mg/Kg
Zinc	34.3	43.1	51.6	40.2	40.6	68.1	40.5	55.3	54.2	46	53.2	51.2	mg/Kg
Mercury	0.34	0.52	0.29	0.39	0.60	0.95	0.60	0.73	0.72	0.77	0.68	0.82	mg/Kg
Chromium+6	ND	ND	ND	ND	10.5	ND	0.37J	ND	ND	ND	0.47J	0.32J	mg/Kg

* Wet Weight

Appendix D Surface Water Resources Technical Report

Appendix D

Surface Water Resources Technical Report

Table of Contents

TABLES

FIGURES

ACRONYMS & ABBREVIATIONS

µg/L	microgram(s) per liter
µmhos/cm	micromhos per centimeter
µS/cm	microSiemen(s) per centimeter
Authority	San Luis and Delta–Mendota Water Authority
CCID	Central California Irrigation District
CDEC	California Data Exchange Center
CEQA	California Environmental Quality Act of 1970
cfs	cubic feet per second
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWA	Clean Water Act
Drain	San Luis Drain
DWR	Department of Water Resources
EC	electrical conductivity
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
GAF	Grassland Area Farmers
GDA	Grassland Drainage Area
GWD	Grassland Water District
mg/L	milligram(s) per liter
mmhos/cm	millimhos per centimeter
NEPA	National Environmental Policy Act of 1969
NPDES	National Pollutant Discharge Elimination System
NRDC	Natural Resources Defense Council
ppb	parts per billion
ppm	parts per million
Reclamation	Bureau of Reclamation, Mid-Pacific Region
Regional Board	Central Valley Regional Water Quality Control Board
SDIP	South Delta Improvements Project
Se	selenium
Service	U.S. Fish and Wildlife Service
SFEI	San Francisco Estuary Institute
SJR	San Joaquin River
SJRIP	San Joaquin River Water Quality Improvement Project
State Board	State Water Resources Control Board
TDS	total dissolved solids
TMDL	Total Maximum Daily Load

TMML	Total Maximum Monthly Load
USGS	U.S. Geological Survey
VAMP	Vernalis Adaptive Management Plan
WDRs	Waste Discharge Requirements
WQOs	water quality objectives

Appendix D - Surface Water Resources Technical Report

This chapter describes water resources in the Project Area and the potential for impacts to those resources from the No Action, Proposed Action, and Alternative Action alternatives for the Long Term Storm Water Management Plan (LTSWMP) by the Grassland Basin Drainers (GBD).

1.1 AFFECTED ENVIRONMENT

1.1.1 Background

The area of interest for potential impacts on water resources consist of areas located in the western San Joaquin valley from the Grassland Drainage Area (GDA) in the south to the San Joaquin River at Vernalis in the north (Figure 1).

1.1.1.1 Hydrogeologic Setting

The lower San Joaquin River Basin is characterized by an arid climate with annual evaporation rates exceeding precipitation rates. Despite the arid climate, the lower San Joaquin River Basin is a highly productive agricultural area due to the use of imported irrigation supply water. However, irrigated agriculture development has historically led to water quality problems in the lower San Joaquin River to the extent that it has been listed as a water quality limited segment by the California State Water Resources Control Board (State Board) under Section 303(d) of the Federal Clean Water Act (CWA) (State Board 2017).

Soil composition, hydrogeology, and precipitation in the Project Area have resulted in water quality problems in the San Joaquin River. Soils on the west side of the San Joaquin River Basin are marine in origin, fine-textured and saline, and high in selenium (Se) and other trace elements such as boron and molybdenum. Se and salts originate from sediments in the Coastal Range foothills that have eroded through natural processes and are subsequently mobilized through irrigation. In addition to the naturally occurring salts and trace elements found in the historic marine sediments, high levels of evapotranspiration can increase salt concentrations in the soil. Application of irrigation water dissolves salts and trace elements found in the soil, accelerating their movement into the shallow groundwater. Approximately half the soluble salts in the crop root zone are derived from the soil. Agricultural drains have been installed in sections of the Project Area to lower the water table and the outcome has been drainwater with high constituent concentrations discharging to the lower San Joaquin River.

1.1.1.2 History of Grassland Area Farmers Drainage Management

Drainage from the Project Area originates from the GDA. The GDA is comprised of approximately 97,400 acres of irrigated farmland and extends from Charleston Drainage District in the north near State Highway 165 to the Firebaugh Canal Water District in the south near State Highway 180 (Figure 1). Drainwater from the GDA is managed by the Grassland Area Farmers (GAF), the regional drainage entity formed under the umbrella of the San Luis and Delta-Mendota Water Authority (the Authority) responsible for the implementation of the Grassland

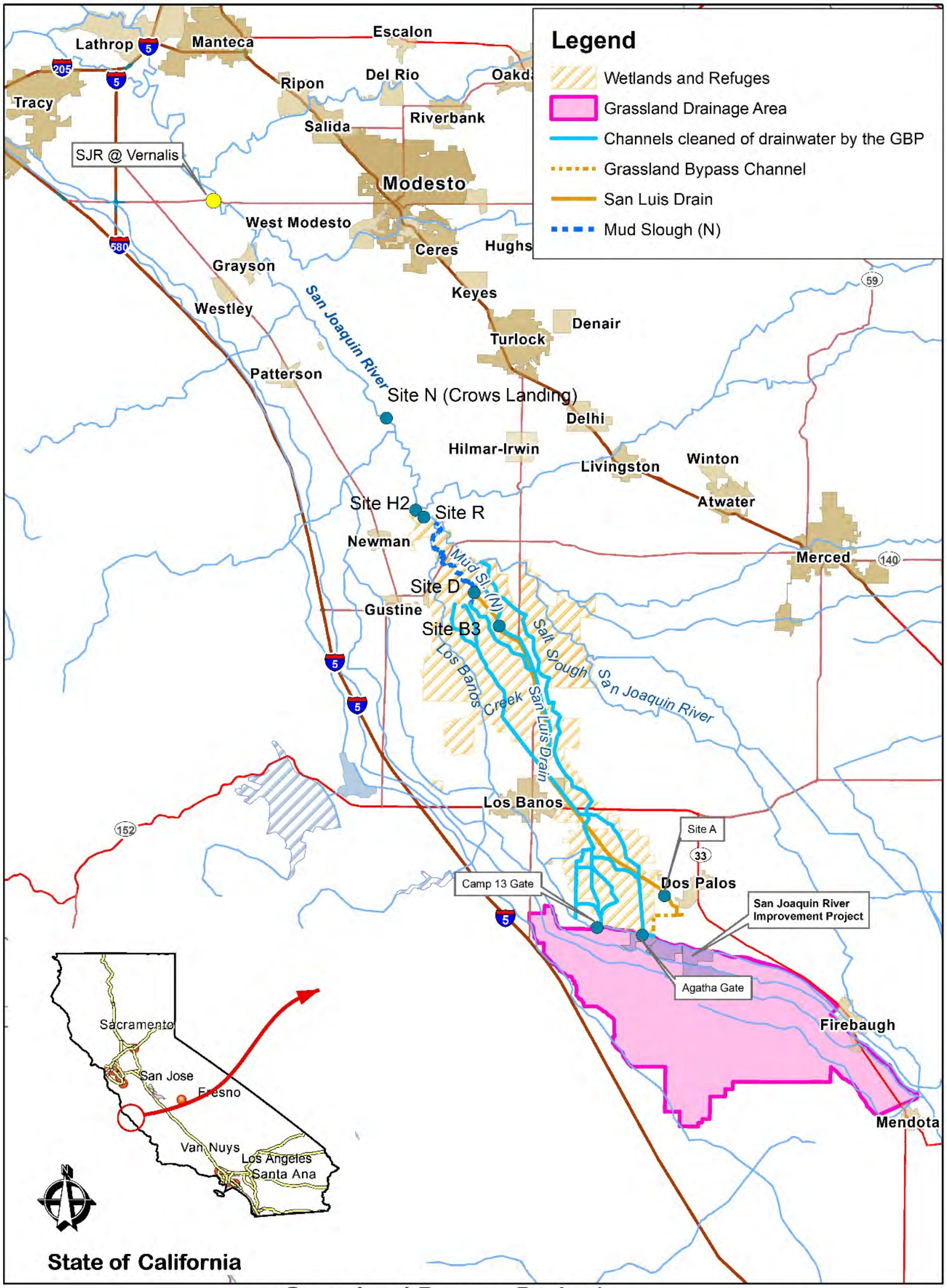
Bypass Project through December 31, 2019 and now the Grassland Basin Drainers (GBD) for the proposed LTSWMP for the period January 1, 2020 through December 31, 2035.

Water quality in the region downstream (north) of the GDA has changed extensively since the start of the Grassland Bypass Project. Prior to 1985, drainwater was conveyed through wetland channels and was used in the Grassland Resource Conservation District, a collection of federal, state, and private wetlands containing a diversity of bird, animal, and plant species. Concerns over elevated concentrations of salt and trace elements endangering waterfowl and their habitat, most notably Se, resulted in ending this practice. Drainwater deliveries to the wetlands ended in 1985 when wetlands were prohibited from receiving any water with Se concentrations greater than 2 micrograms per liter (µg/L). Drainwater was then conveyed in alternating wetland channels (i.e., “flip-flop” system) and discharged via Salt Slough and Mud Slough to the San Joaquin River. This resulted in poor water quality in Salt Slough. Additionally, when canals and drains were used for clean water, they were flushed for at least 24 hours before the clean water going to the wetlands could be transported in those canals. This meant that at sometimes during the year, wetlands were prevented from receiving otherwise available water.

To address the situation described above, the Grassland Bypass Project was implemented in 1996 to improve water quality in Salt Slough and water supply channels used to deliver water to the Grassland Water District (GWD) and wetlands. The Grassland Bypass Project involved the construction of the Grassland Bypass Channel and use of 28 miles of the lower portion of the San Luis Drain (the Drain) to allow for the discharge of subsurface drainage from the GDA through 6 miles of Mud Slough (north) to the San Joaquin River. As a result of the Grassland Bypass Project, drainage was removed from 93 miles of wetland water supply canals, including Salt Slough and most of Mud Slough, which allowed full use of Central Valley Project Improvement Act (CVPIA) water for wetlands management. Drainage was also removed from 6.6 miles of the San Joaquin River (between Salt Slough and Mud Slough (north)).

Discharges from the Project Area enter the San Joaquin River at the mouth of Mud Slough and therefore discharges have no direct impact in the San Joaquin River between Mendota Dam and Mud Slough.

Figure 1 Project Area and Vicinity



Grassland Bypass Project Location Map

Prepared by:
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1.1.2 Regulatory Setting

This section describes key federal and state surface water regulations and summarizes the regulatory background for the Project Area.

1.1.2.1 Federal and State Water Regulations

1.1.2.1.1 Clean Water Act

The Clean Water Act (CWA) is the primary federal legislation governing water quality. It established the basic structure for regulating pollutant discharges to waters of the United States. The objective of the act is "to restore and maintain the chemical, physical, and biological integrity of the nation's waters."

The CWA provides two general types of pollution control standards:

- Effluent standards that are technology-derived standards that limit the quantity of pollutants discharged from a point source such as a pipe, ditch, tunnel, etc., into a waterbody; and
- Ambient water quality standards that are based on beneficial uses and limit the concentration of pollutants in waters.

The National Pollutant Discharge Elimination System (NPDES) permitting system was established under the CWA Section 402 to regulate discharges from point sources into navigable waters. Management of nonpoint source discharges, such as agricultural discharges, is regulated under Section 319 of the CWA. Section 319 requires the States to submit an assessment report that identifies navigable waters that are not expected to achieve applicable water quality standards or goals, identify categories of nonpoint sources or specific sources that add significant pollution to contribute nonattainment of water quality standards or goals, and describe the process to develop best management practices and measures to control each category of nonpoint source or specific sources. The nonpoint source control program is implemented by the States.

Section 305(b) of the CWA requires the States to perform a biannual assessment of the water quality of navigable water within the state. The assessment is required to analyze the extent to which beneficial uses are supported and provide an analysis of the extent to which elimination of pollution and protection of beneficial uses has been achieved. The assessment is also required to describe the nature and extent of nonpoint sources of pollution and provide recommendations for control programs.

Section 303(d) of the CWA requires the States to identify waters that are not expected to meet water quality standards after application of effluent limitation for point sources, develop a priority ranking, and determine the Total Maximum Daily Load (TMDL) of specific pollutants that may be discharged into the water and still meet the water quality standards.

1.1.2.1.2 Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act of 1969, Division 7 of the California Water Code, authorized the State Board to provide comprehensive protection for the State's waters through water allocation and water quality protection. The State Board sets water quality standards by adopting water quality control plans under the Porter-Cologne Act. In addition, the Porter-Cologne Act established the responsibilities and authorities of the nine Regional Water

Quality Control Boards (Regional Boards), which include preparing water quality plans for areas within the region (Basin Plans), identifying water quality objectives (WQOs), and issuing NPDES permits pursuant to the CWA. WQOs are defined as limits or levels of water quality constituents and characteristics established for reasonable protection of beneficial uses or prevention of nuisance.

In addition to implementing the NPDES permitting program, the Porter-Cologne Act authorizes the Regional Boards to issue Waste Discharge Requirements (WDRs). Generally, WDRs are issued for discharges that are exempt from the CWA's NPDES permitting program, discharges that may affect groundwater quality, and/or wastes that may be discharged in a diffused manner. Discharges of subsurface agricultural drainage, tailwater, and stormwater from agricultural lands to surface water are often regulated by WDRs. WDRs are established and implemented to achieve the WQOs for receiving waters established in the Basin Plans.

1.1.2.2 Regional and Project-Specific Regulatory Background

1.1.2.2.1 Basin Plan

The *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins* (Basin Plan; Regional Board 2016) stipulates beneficial uses, WQOs, and the implementation program used to achieve WQOs in the Project Area. Current Basin Plan requirements have been developed through a series of amendments supported by technical TMDL reports over the last 20 years and more.

In May 1996, the Regional Board adopted a Basin Plan amendment to address Se concentrations in agricultural drainage discharges from the Project Area (Resolution No. 96-078). The amendment identified Se WQOs for Mud Slough (north), Salt Slough, wetland water supply channels, and the lower San Joaquin River. It prohibited the discharge of agricultural subsurface drainage to the wetland supply channels and to Salt Slough unless WQOs were met and identified a compliance time schedule and interim performance goals for Se in the lower San Joaquin River based on water year type. It also prohibited the discharge of Se from agricultural subsurface drainage systems in the Grassland watershed to the San Joaquin River in amounts exceeding 8,000 pounds per year for all water year types beginning January 10, 1997. The 1996 Basin Plan amendment was based in part upon recommendations from a 1995 Consensus Letter sent to the Regional Board's chairman by the Authority, the U.S. Bureau of Reclamation Mid-Pacific Region (Reclamation), the U.S. Environmental Protection Agency (EPA), and the U.S. Fish and Wildlife Service (Service).

The technical TMDL reports for Se in Salt Slough, the Grassland Marshes, and the lower San Joaquin River were completed subsequent to the 1996 Basin Plan amendment (Regional Board 1999, 2000, and 2001). The TMDL for the lower San Joaquin River established monthly load allocations for the GDA that were designed to meet Se objectives in the San Joaquin River at Crows Landing. Se WQOs are currently being met in Salt Slough and the Grassland Marshes and Se loads have been reduced in the lower San Joaquin River with implementation of the Grassland Bypass Project.

In 2004, the Regional Board prepared the salt and boron TMDL for the lower San Joaquin River and adopted the Basin Plan amendment for the control of salt and boron discharges (Resolution No. R5-2004-0108). Load allocations were established for irrigated lands and waste load allocations were established for point sources to achieve compliance with salinity WQOs in the lower San Joaquin River at the Airport Way Bridge near Vernalis. Load allocations were implemented through revisions to applicable waste discharge requirements or waivers of waste discharge requirements for dischargers in the lower San Joaquin River watershed. The control program was phased, with full compliance required in high priority areas between 2014 and 2018. Since implementation of this program, salt and boron concentrations in San Joaquin River at Vernalis have been reduced and are consistently below water quality standards. As a result, the San Joaquin River at Vernalis was delisted for salt and boron and the specific reference to the salinity WQO at Vernalis was removed from the Basin Plan in 2009 (Resolution No. R5-2009-0069). Nevertheless, salinity continues to be a constituent of concern in the San Joaquin River upstream of Vernalis and boron continues to be a constituent of concern in the San Joaquin River upstream of the Merced River.

In May 2010, the Regional Board adopted a Basin Plan amendment for the control of Se in the lower San Joaquin Basin (Resolution No. R5-2010-0046). The amendment prohibited the discharge of agricultural subsurface drainage water to the San Joaquin River from Sack Dam to Mud Slough (north) beginning October 1, 2010, unless Se WQOs were met. The amendment also prohibited the discharge of agricultural subsurface drainage water to Mud Slough (north) and the San Joaquin River from the Mud Slough confluence to the Merced River beginning December 31, 2019, unless Se WQOs are met.

Current Basin Plan WQOs and performance goals for Se, boron, and molybdenum for the lower San Joaquin watershed are summarized in Table 1.

Table 1 Water Quality Objectives and Performance Goals for the Lower San Joaquin River

Waterbody	Selenium	Boron	Molybdenum
Mud Slough (North) and the San Joaquin River from Sack Dam to the mouth of the Merced River	5 µg/L, 4-day average (WQO) 15 µg/L, monthly mean (performance goal, 2016-2019) 20 µg/L, maximum	2.0 mg/L, monthly mean, March 15-September 15 5.8 mg/L, maximum	19 µg/L, monthly mean 50 µg/L, maximum
San Joaquin River, from Merced River to Vernalis	5 µg/L, 4-day average 12 µg/L, maximum	*Dry Season (March 15 to September 15)* 0.8 mg/L, monthly mean, 2.0 mg/L, maximum, *Wet Season (September 16 to March 14)* 1.0 mg/L, monthly mean, 2.6 mg/L, maximum, *Critical Year:* 1.3 mg/L, monthly mean	10 µg/L, monthly mean 15 µg/L, maximum
Salt Slough	2 µg/L, monthly mean 20 µg/L, maximum	2.0 mg/L, monthly mean, March 15-September 15 5.8 mg/L, maximum	19 µg/L, monthly mean 50 µg/L, maximum
Water Supply Channels in the Grassland Watershed	2 µg/L, monthly mean 20 µg/L, maximum	--	--

Source: Basin Plan (Regional Board 2016)
mg/L = milligrams per liter
µg/L = micrograms per liter

1.1.2.2.2 Waste Discharge Requirements

In March 1996, the Regional Board issued an NPDES Permit (Order No. 96-092, NPDES No. CA0093917) to the Authority for the discharge of shallow groundwater from the Drain to Mud Slough (north). Subsurface inflow had accumulated in the Drain after entering through a series of pressure relief valves along the Drain's invert. This water was discharged prior to the onset of the Grassland Bypass Project.

In July 1998, the Regional Board adopted Order No. 98-171 (Regional Board 1998) for the first phase of the Grassland Bypass Project, recinding Order No. 96-092, and authorizing the discharge of agricultural subsurface drainage, tailwater, and stormwater from the Project Area to Mud Slough (north). The 1998 WDR included the following requirements:

- Compliance with specific monthly and annual Se load limits. The Se load limits were reduced most years, consistent with the compliance schedule.
- Continuation of the compliance monitoring program. This program included monitoring of water quality, flow, biota, toxicity, and sediment in the Drain, Mud Slough, San Joaquin River, and the channels in the GWD.
- Development of short- and long-term drainage management plans for Se load reductions. The short-term plan addressed activities that were implemented through September 30, 2001, and the long-term plan addressed activities related to drainwater management after that date.

In September 2001, the Regional Board adopted Order No. 5-01-234 (Regional Board 2001) for the second phase of the Grassland Bypass Project which continued the separation of GDA drainage from wetland water supply conveyance channels for the period of September 2001 to December 2009. The 2001 WDR included the following requirements:

- Implementation of a biological, water quality, and stormwater monitoring program (Monitoring and Reporting Program No. 5-01-234).
- Maintaining a maximum flow rate of 150 cubic feet per second (cfs) at the Drain terminus and maximum flow velocity of 1 foot per second (ft/sec) within the Drain.
- Meeting maximum monthly and annual Se load limits for the GDA and the Drain.

In July 2015, the Regional Board adopted Order No. R5-2015-0094 (Regional Board 2015) for the collection, transport and discharge of agricultural subsurface drainage flows and storm water from the GDA to Mud Slough (north) during the third phase of the Grassland Bypass Project. The 2015 WDR requires compliance with the project's monitoring and reporting program, Storm Event Plan, and Se load reduction strategies; it limits the Drain's discharge rate to 150 cfs and flow velocity to 1 ft/sec; and it also limits the spatial extent and duration of agricultural subsurface drainage discharges in downgradient areas. Provisions of 2015 WDR include the following:

- The discharge of agricultural subsurface drainage water to Salt Slough and the wetland water supply channels is prohibited unless a Storm Event Plan is being implemented or water quality objectives for Se are being met.
- Se loads discharged from the GDA are required to comply with the monthly Se load allocations designed to meet Se objectives in the San Joaquin River at Crows Landing.

- The discharge of agricultural subsurface drainage water to Mud Slough (north) is prohibited after December 31, 2019 unless water quality objectives for Se are being met.

In July 2015, the Regional Board also adopted WDR for growers in the GDA for discharges that could affect groundwater (Order No. R5-2015-0095, amended by R5-2016-0015). This order is similar to the Irrigated Lands Regulatory Program general order with respect to groundwater monitoring and reporting requirements. Under this order, growers are required to obtain coverage for agricultural discharges to groundwater through a third-party entity or apply for individual coverage. Member agencies are also required to minimize percolation of waste to groundwater, minimize excess nutrient application, and to protect wellheads from surface intrusion.

1.1.2.2.3 Use Agreement

The Grassland Bypass Project is based upon an agreement between Reclamation and the Authority to use a 28-mile segment of the Drain to convey agricultural subsurface drainage water from the GDA to Mud Slough (north). The first use agreement was signed on November 3, 1995, and it allowed the Authority to convey drainage water in the Drain from September 27, 1996 to September 30, 2001. The second use agreement was executed on September 27, 2001, and it allowed the Authority to use the Drain through December 31, 2009. The third use agreement was signed on December 22, 2009, and it allows the Authority to continue to use the Drain through December 31, 2019. Additional details of each use agreement are described below.

The original 1995 use agreement (*Agreement for Use of the San Luis Drain*, Agreement No. 6-07-20-W1319) established a comprehensive multiagency monitoring program and required monthly load limits for Se. The monitoring program was used to ensure that environmental commitments were being met.

The 2001 use agreement (*Agreement for Use of the San Luis Drain,* Agreement No. 01-WC-20-2075) specified operational conditions for the second phase of the Grassland Bypass Project. It required the development of long-term management plans for compliance with Se and salinity WQOs and an updated sediment management plan. It also required the Authority to maintain a maximum flow rate of 150 cfs in the Drain, meet maximum monthly and annual Se and salinity load limits, and continue the monitoring program established in the 1995 Use Agreement.

The 2009 use agreement (*Agreement for Continued Use of the San Luis Drain*, Agreement No. 10-WC-20-3975) specified operational conditions for the third phase of the Grassland Bypass Project. It established maximum monthly and annual Se and salinity load limits through 2019, provided a high rainfall exception for the load values, and established incentive fees and mitigation obligations for impacts to Mud Slough (north) and the San Joaquin River. Annual load allocations were reduced each year through 2018. Monthly load limits were designed to meet the TMDL's Se load allocations for the GDA by 2011 and monthly loads were further reduced from 2015 to 2017. Salt loads were reduced in a similar manner.

1.1.2.3 Selenium Total Maximum Monthly Load for Discharges from the San Luis Drain

The lower San Joaquin River between Mud Slough and the Merced River is designated by the State Board as a water quality limited segment for Se under CWA Section 303(d) (State Board 2017). Previous listings also included Se impairments in sections of the San Joaquin River from Mendota Pool to Mud Slough and from the Merced River to the Delta Boundary. Pursuant to the 303(d) listings, the State Board developed a TMDL for Se in the lower San Joaquin River as stipulated by the USEPA. The USEPA specified that the 4-day average Se concentration should not exceed 5 micrograms per liter (µg/L) more than once every 3 years, on average.

Total maximum monthly loads (TMMLs) for Se were developed for the GDA in the August 2001 Regional Board staff report titled *Total Maximum Daily Load for Selenium in the Lower San Joaquin River* (Regional Board 2001). Design flows by year type and monthly grouping were used to calculate maximum loads for the San Joaquin River at Crows Landing. Calculated loads from background sources and a 10 percent margin of safety were then subtracted from the Crows Landing loads to produce a load allocation for GDA. A monthly load limit was developed rather than a daily limit because monthly control measures were deemed more feasible than daily control measures due to the diffuse nature of Se. Table 2 lists the load allocations for the GDA specified by the 2001 TMDL report which are still applicable.

To allow time for a control program to be developed, a compliance time schedule was developed by the Regional Board to meet the 4-day average Se WQO in the San Joaquin River. WDRs and Use Agreements incorporated annual reductions to meet interim performance goals and the compliance time schedule. The initial interim performance goals and the compliance time schedule were revised in the 2010 Basin Plan amendment. The current compliance time schedule requires that a monthly mean Se performance goal of 15 µg/L be met for Mud Slough (north) and the San Joaquin River from the Mud Slough confluence to the Merced River from December 31, 2015 to December 31, 2019. The Se WQO of 5 µg/L calculated as a 4-day average is required to be met thereafter.

Table 2 Selenium TMMLs for the Grassland Drainage Area by Year Type (pounds) from the 2001 TMDL for Selenium

Month	Critical	Dry/Below Normal	Above Normal	Wet
January	151	319	398	211
February	93	185	472	488
March	92	184	472	488
April	101	193	490	506
May	105	197	497	512
June	69	130	212	354
July	70	131	214	356
August	75	137	225	366
September	57	235	264	332
October	55	233	260	328
November	55	233	260	328
December	152	319	398	211
Annual Load	1075	2496	4162	4480

Source: Regional Board 2001

1.1.3 Grassland Drainage Area

The GDA encompasses about 97,400 acres of the Grassland watershed on the western side of the San Joaquin River, roughly between Los Banos to the north and Mendota to the south, as shown on Figure 1. Districts within the GDA include Charleston Drainage District, Pacheco Water District, Panoche Drainage District, Camp 13 Drainage District, Firebaugh Canal Water District, Broadview Water District, and Widren Water District. In addition to district areas, the GDA includes approximately 6,000 acres of land dedicated to subsurface drainage disposal under the San Joaquin River Water Quality Improvement Project (SJRIP).

Permanent crops (nuts, grapes, and tree crops) make up about 12,000 acres (12 percent) of the total acreage in the GDA. Annual crops grown in the GDA vary from year to year due to economic factors, water availability, contractual requirements, and weather. Irrigation deliveries to districts within the GDA are supplied from the Delta-Mendota Canal, the San Luis Canal, or both. Some water is also supplied by groundwater pumping, particularly during dry years.

Subsurface drainage systems (tile drains) were put in place in many areas of the GDA to manage shallow groundwater. Of the 97,400 acres in the GDA, approximately 9,500 acres are not irrigated, about 53,900 acres are irrigated agricultural lands that are not tile drained, and about 33,100 acres (approximately 38 percent) are irrigated agricultural lands that use subsurface drainage systems to remove saline groundwater from the crop root zone (Regional Board 2015a). The Se, electrical conductivity (EC), and boron concentrations in subsurface drainage are typically elevated compared to ambient surface waters (shown in Table 3).

The subsurface drainage collected by tiled areas in the GDA is discharged from various sumps and directed towards the SJRIP reuse area. The drainage diverted to the SJRIP is usually mixed with freshwater before being applied to salt-tolerant crops. Subsurface drainage not reused within the SJRIP is diverted to the Grassland Bypass Channel.

Table 3 Selenium, Boron, and Electrical Conductivity of Drainage Sump Flows

District	Se Concentration of Sump Flows[1] (µg/L)	Electrical Conductivity (EC) of Sump Flows (µS/cm)	Boron Concentration of Sump Flows (mg/L)
Charleston Drainage District	135	5,506[a]	5.1
Pacheco Water District	92	5,037	0.0
Panoche Drainage District	188	4,940	8.6
Camp 13 Drainage District	54	5,922	12.3
Firebaugh Canal Water District	185	7,441	26.7
Average[b]	131	5,769	10.5

Source: Linneman, C., February 4, 2008; GBP 00_07 Data.xls

NA = Not available.

1. Based on average annual load and volume of tile sump production.
a. Excludes October 2001 through January 2002, October 2002 through February 2003, September 2003 through February 2004, and June 2007 through September 2007.
b. Excludes Broadview Water District

Started in 2001, the SJRIP included the construction of distribution facilities and the planting of salt tolerant crops on agricultural land. The planted acreage has increased from the original 1,821 acres to more than 5,200 acres, which is irrigated with drainage water or blended water (subsurface drainage and “fresh” irrigation water). Future phases of the SJRIP area involve the development of additional acreage, installation of more subsurface drainage systems, and implementation of treatment and salt disposal components (Regional Board 2015a).

The SJRIP project also involves an extensive biological contaminant monitoring program, one component of which is for bird eggs. This biological monitoring started in 2002 and has examined the levels of Se in a small sample of bird eggs each year. In line with this project, the member districts and GDA growers have tried to discourage birds from inhabiting or nesting in the SJRIP. The program involves hazing birds during the nesting season, diligent water management, and modification of drains to discourage avian use.

1.1.4 Regional Hydrology

Flows in and to the San Joaquin River play a major role in dictating water quality found in the river. From a regional perspective, flows in the San Joaquin River are controlled mostly by dams on east-side tributaries and on the mainstem upstream from Fresno. Prior to October 2009, the lower San Joaquin River received very little inflow from water stored in Millerton Reservoir (located on the San Joaquin River upstream of Fresno). However, restoration flows are now released from Friant Dam to the San Joaquin River in accordance with an approved restoration flow schedule based on water year type. With the exception of flood flows which are routed through flood control channels that bypass sections of the river, releases from Friant Dam are currently limited to the carrying capacity of the most constrained river reach.

Major contributors of flow to the San Joaquin River in the Project Area include the upstream flows in the San Joaquin River above the Salt Slough confluence, Salt and Mud Slough flows (the major west-side tributaries of the San Joaquin River), and flows from the Merced River. By far the largest of these sources is the Merced River, which accounted for approximately 40 to 75 percent of the annual flow in the San Joaquin River measured near Crows Landing (based on flow during Water Years 2002 to 2018). The largest flows in the lower San Joaquin River occur during the late winter and spring from January through May. The lowest flows occur during the late summer in August and September.

1.1.4.1 Precipitation

Water quality in the San Joaquin River system is influenced by seasonal and annual variations. Mean precipitation increases heading northward. Average annual precipitation at the Los Banos Detention Reservoir Precipitation Gauge is approximately 9 inches per water year but varies from 3.5 to 24 inches (Figure 2). Almost all of the rainfall occurs from November through April.

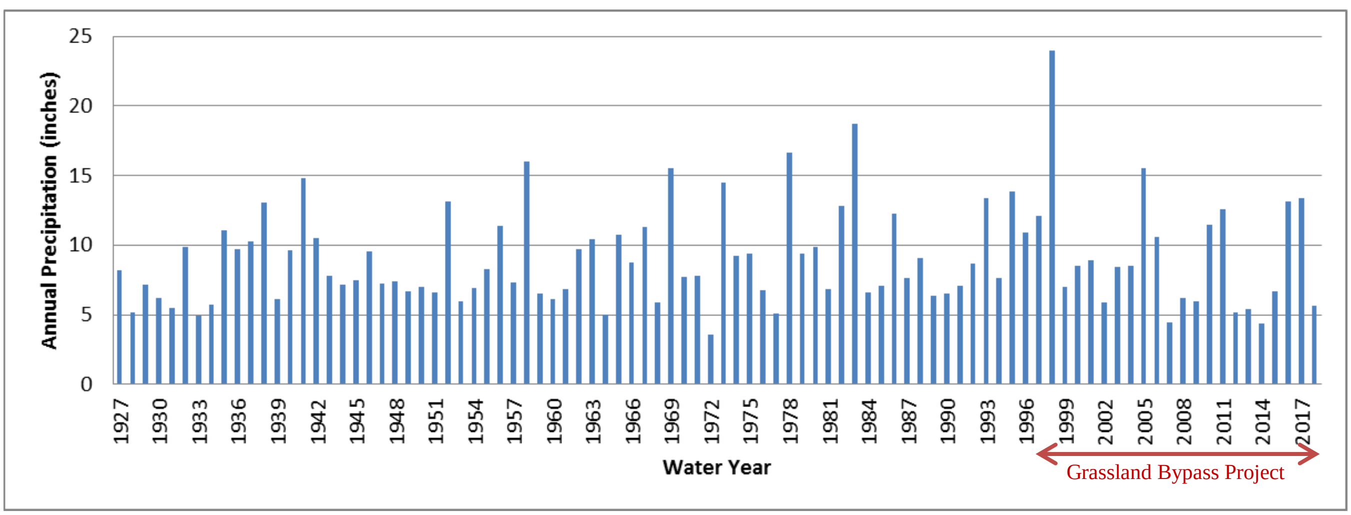


Figure 2 Precipitation at Los Banos Detention Reservoir Gauge

1.1.4.2 Water Year Classification

For the purposes of classifying and reporting flows, water year types have been established by the California Department of Water Resources (DWR). A water year extends from October 1 of one year to September 30 of the next year, and is classified in the San Joaquin River Basin according to total annual unimpaired runoff (i.e., runoff uninfluenced by man’s activities) in the

San Joaquin, Merced, Tuolumne, and Stanislaus rivers (Table 4). According to the San Joaquin Valley water year hydrologic classification, Water Years 1997, 1998, 2005, 2006, 2011, and 2017 were wet; Water Years 1999, 2000, and 2010 were above normal; Water Years 2003, 2009, and 2018 were below normal; Water Years 2001, 2002, 2004, 2012, and 2016 were dry; and Water Years 2007, 2008, 2013, 2014, and 2015 were critically dry (DWR 2018).

Table 4 San Joaquin Valley Water Year Hydrologic Classification

Year Type	Unimpaired Runoff (millions of acre-feet)
Wet	> 3.8
Above Normal	> 3.1 to < 3.8
Below Normal	> 2.5 ≤ 3.1
Dry	> 2.1 ≤ 2.5
Critical	≤ 2.1

Source: DWR 2018

1.1.5 Lower San Joaquin River and Tributaries

This section describes flow and water quality in sections of the lower San Joaquin River and its tributaries which may be affected by the Proposed Action, Alternative Action, and No Action alternatives. These areas include:

- San Luis Drain;
- Mud Slough (north) and Salt Slough; and
- San Joaquin River from Sack Dam to Vernalis.

Flow and water quality data are based on the Grassland Bypass Monitoring Program results for Water Years 1997 to 2017, when available. Water quality data presented here include data compiled by Bureau of Reclamation (Reclamation), site-specific data for the San Luis Drain (Sites A and B) complied by Summers Engineering, and publicly available gage data for flow and EC published by the U.S. Geological Survey (USGS). These data were collected at the entrance to the Drain (Site A), the exit from the Drain (Site B), Mud Slough upstream from the Drain (Site C), Mud Slough downstream from the Drain (Site D), Salt Slough (Site F), as well as at the San Joaquin River at Fremont Ford (Site G), Hills Ferry (Site H), Crows Landing (Site N) and Vernalis.

Data are presented focusing on two time periods – 1997 to 2017, since the Grassland Bypass Project has been implemented, and 2015 to 2017, more recent conditions when drainwater from the GDA was not conveyed to the San Luis Drain during summer months. The longer period of record provides context for more recent flow and quality in the Project Area. The recent data was used to represent existing conditions. Recent flow and quality data include periods associated with the Drain’s conveyance of stormwater runoff, post-storm drainage flows, and seepage into the Drain. The recent water quality data also includes summer periods of no inflow from the GDA when water quality in the Drain is affected by evaporation and/or seepage.

1.1.5.1 San Luis Drain

Since 1996, a portion the San Luis Drain has been used to convey drainwater and stormwater from the GDA to Mud Slough (north). Drainage channels within the GDA convey water towards

Panoche Drain and Main Drain. Drainage from Charleston Drainage District, Pacheco Water District, and Panoche Drainage District flows towards the Panoche Drain and drainage from Firebaugh Canal Water District and the Camp 13 Drainage District flows towards the Main Drain. The commingled drainwater from the respective districts is reused in the SJRIP or conveyed to the Grassland Bypass Channel, a 4-mile-long earthen ditch constructed between the Panoche and Main drains and the San Luis Drain at Russell Avenue.

Flow into the San Luis Drain is limited to 150 cfs and velocity is limited to 1 foot per second. When implementing the Storm Event Plan, excessive storm flows can be diverted to Agatha Canal and Camp 13 Ditch. Excess storm flows from the Drain that are routed through wetland supply channels are not discharged to the wetlands.

Water from the GDA is conveyed to the Drain near Site A and is discharged from the Drain at Site B. The distance between Site A and Site B is about 28 miles; storm flows take about a day to travel between Sites A and B.

1.1.5.1.1 Flow

Figure 3 shows a time series of the daily flow measured at Sites A and B. Time Series A shows data collected during 1997 to 2017 and Time Series B focuses on the last few years when drainwater from the GDA was no longer conveyed to the San Luis Drain during summer months. There is a general trend of decreasing flows between 2006 and 2014 and the elimination of summer flows to the Drain starting in 2015. Prior to 2015, the drain appears to consist of a combination of year-round drainage and winter stormwater. From 2015, the flow appears to be mainly storm flows with a small component of post-storm drainage.

Hydrological conditions varied during Water Years 2015 to 2017, the period representing existing conditions. Water Year 2015 was critically dry, Water Year 2016 was below normal/dry, and Water Year 2017 was wet. Regardless of year type, flow in the Drain was maintained below 150 cfs.

Flow volumes measured at Site A was compared to flow volumes measured at Site B to estimate the amount of seepage into the Drain. The increase in flow volume between Sites A and B is shown in Figure 4. To evaluate seasonal trends, data were aggregated by month for the time periods associated with 1997 to 2014 and 2015 to 2017. These periods show the same general trend – an increase in flow between Sites A and B in the winter and no increase in the summer. The exception is summer 2017, when there was a small amount of flow from Site B, while there was no flow into Site A. This was likely due to infiltration of subsurface inflows into the Drain.

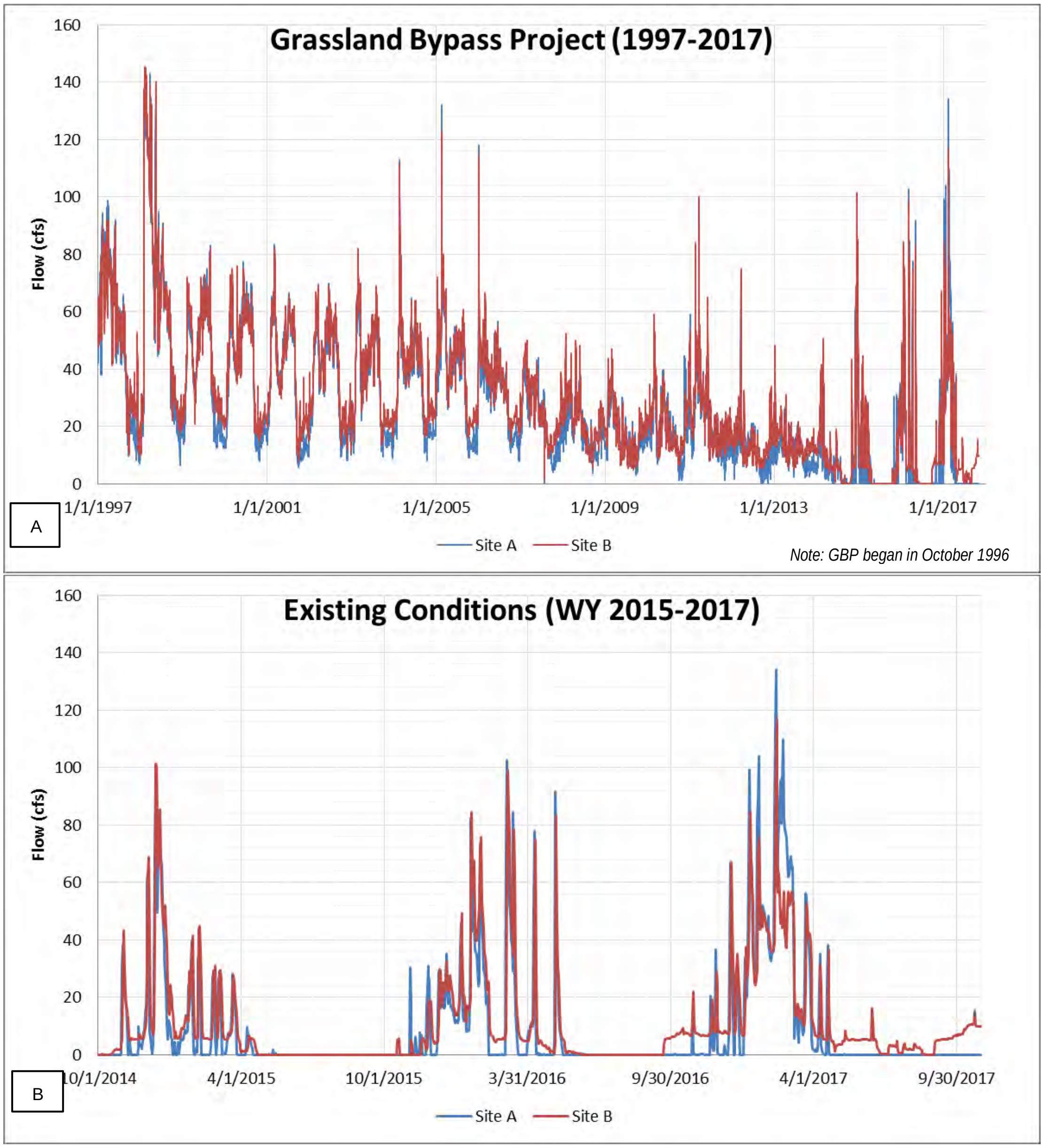


Figure 3 Flow in the San Luis Drain during the Grassland Bypass Project (Time Series A) and for Existing Conditions (Time Series B)

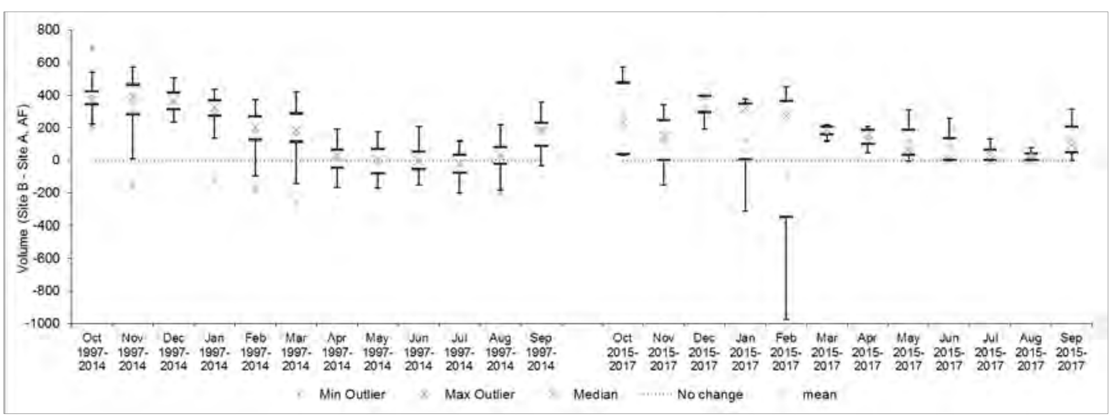


Figure 4 Monthly Change in Flow Volume between Site A and Site B

1.1.5.1.2 Water Quality

Figure 5 shows a time series of Se concentrations measured at Sites A and B. Time Series A shows data collected during 1997 to 2017 and Time Series B focuses on the last few years when drainwater from the GDA was no longer conveyed to the San Luis Drain during summer months. There is a general trend of decreasing concentration after 2008, with concentrations decreasing from ±60 µg/L to ±20 µg/L after 2014.

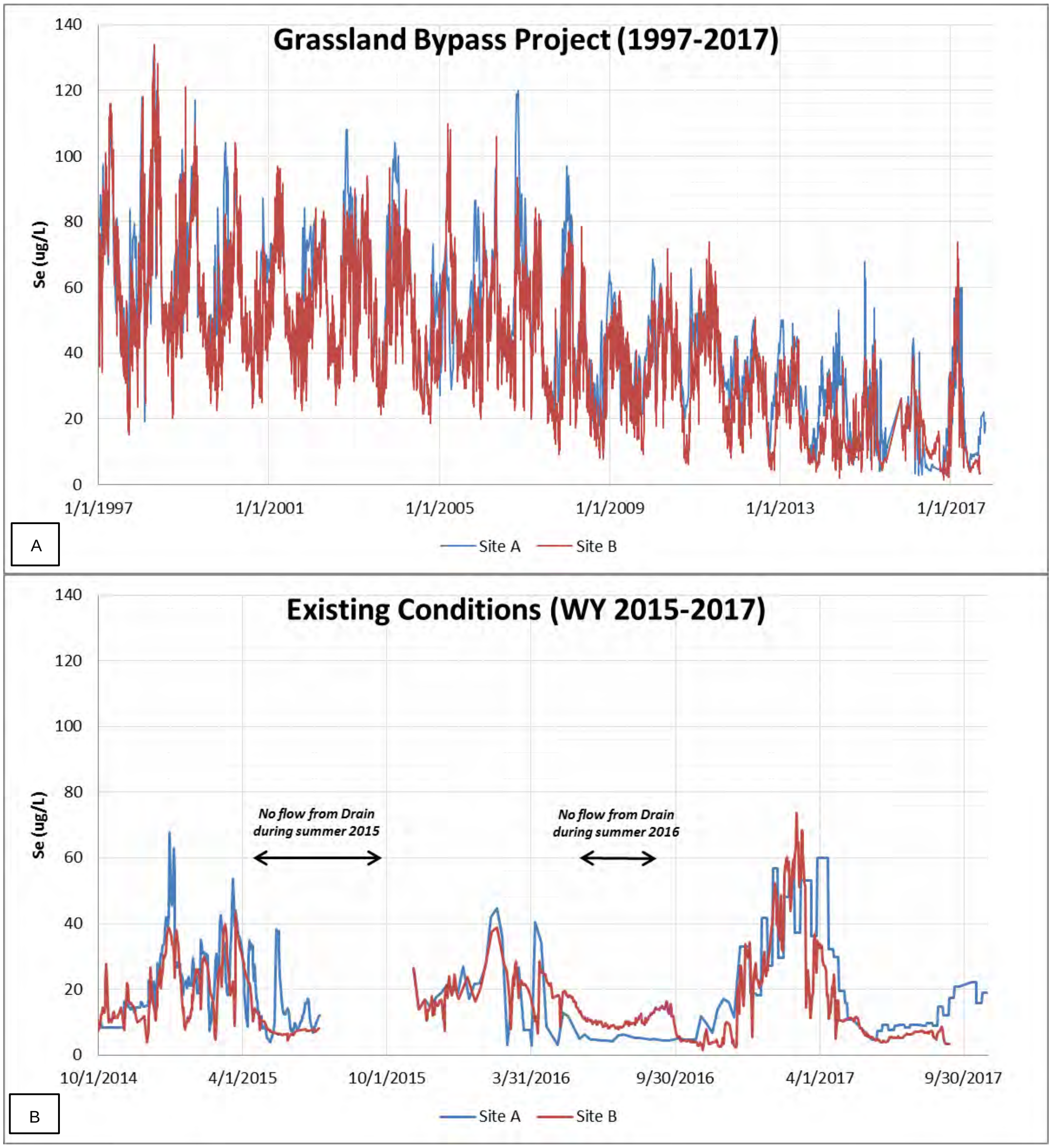


Figure 5 Selenium Concentration in the San Luis Drain during the Grassland Bypass Project (Time Series A) and for Existing Conditions (Time Series B)

Figure 6 shows the monthly variability in Se concentrations for Sites A and B for the period of 1997 to 2014 and the period of 2015 to 2017. Both periods show in increase in concentrations in the winter and spring. The more recent time period is associated with reduced Se concentrations despite summer months with standing water in the Drain potentially affected by evapoconcentration.

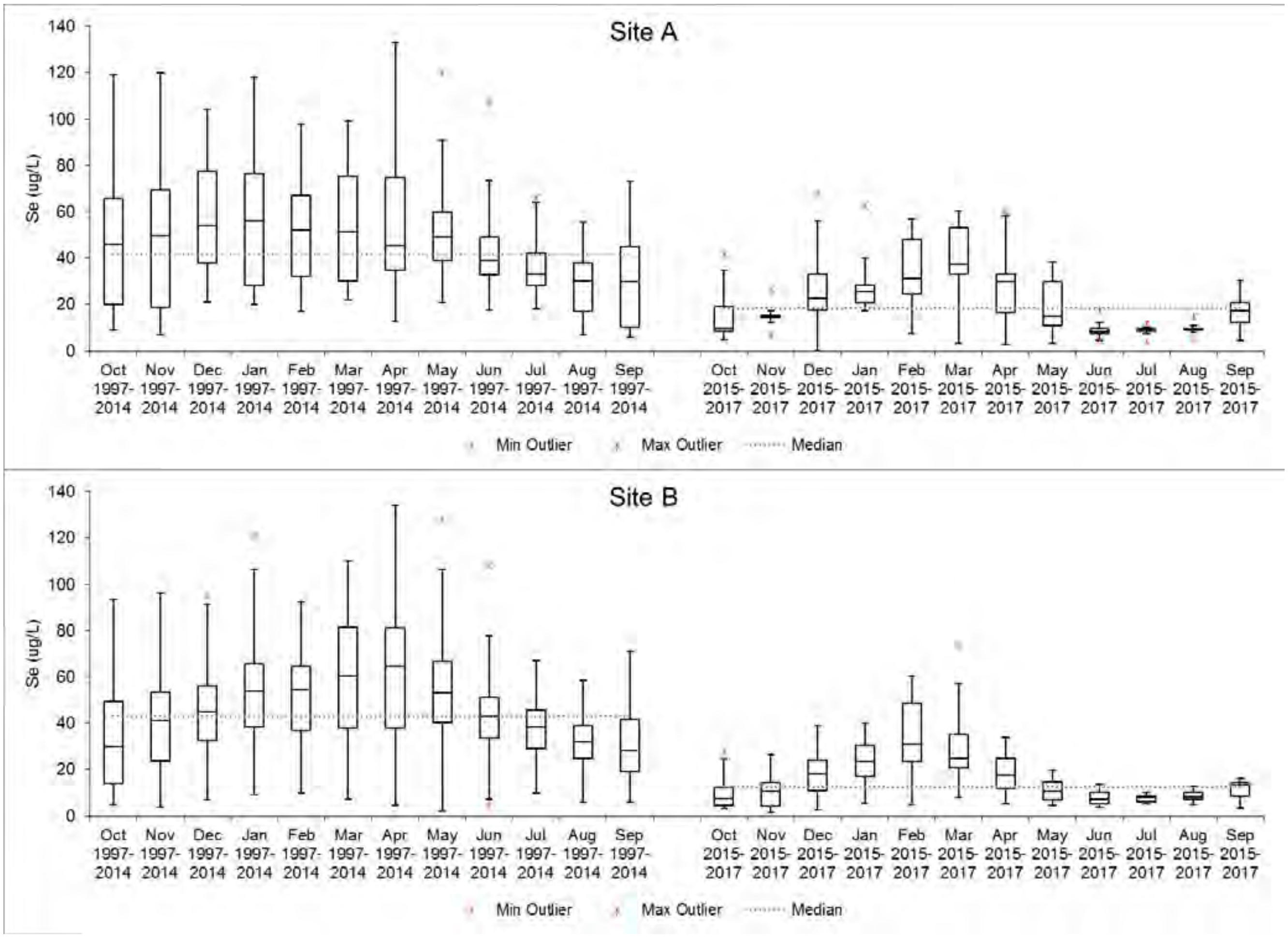


Figure 6 Monthly selenium concentrations at Site A and Site B

Figure 7 shows a time series of boron concentrations measured at Sites A and B. Time Series A shows data collected during 1997 to 2017 and Time Series B focuses on the last few years when drainwater from the GDA was no longer conveyed to the San Luis Drain during summer months. Starting in the fall of 2010, there has been an increase in boron concentrations within the Drain, with a sharp increase occurring in the summer of 2013. Prior to 2010, concentrations were between 5 and 10 mg/L, increasing to 10 mg/L to over 30 mg/L afterwards. The trend is an increase during the summer then a sudden decrease in the fall around September. Since summer 2015, there has been no inflow into the Drain from GDA; the increase in boron concentrations is likely due to evaporative concentration with possible contributions from subsurface seepage from adjacent lands.

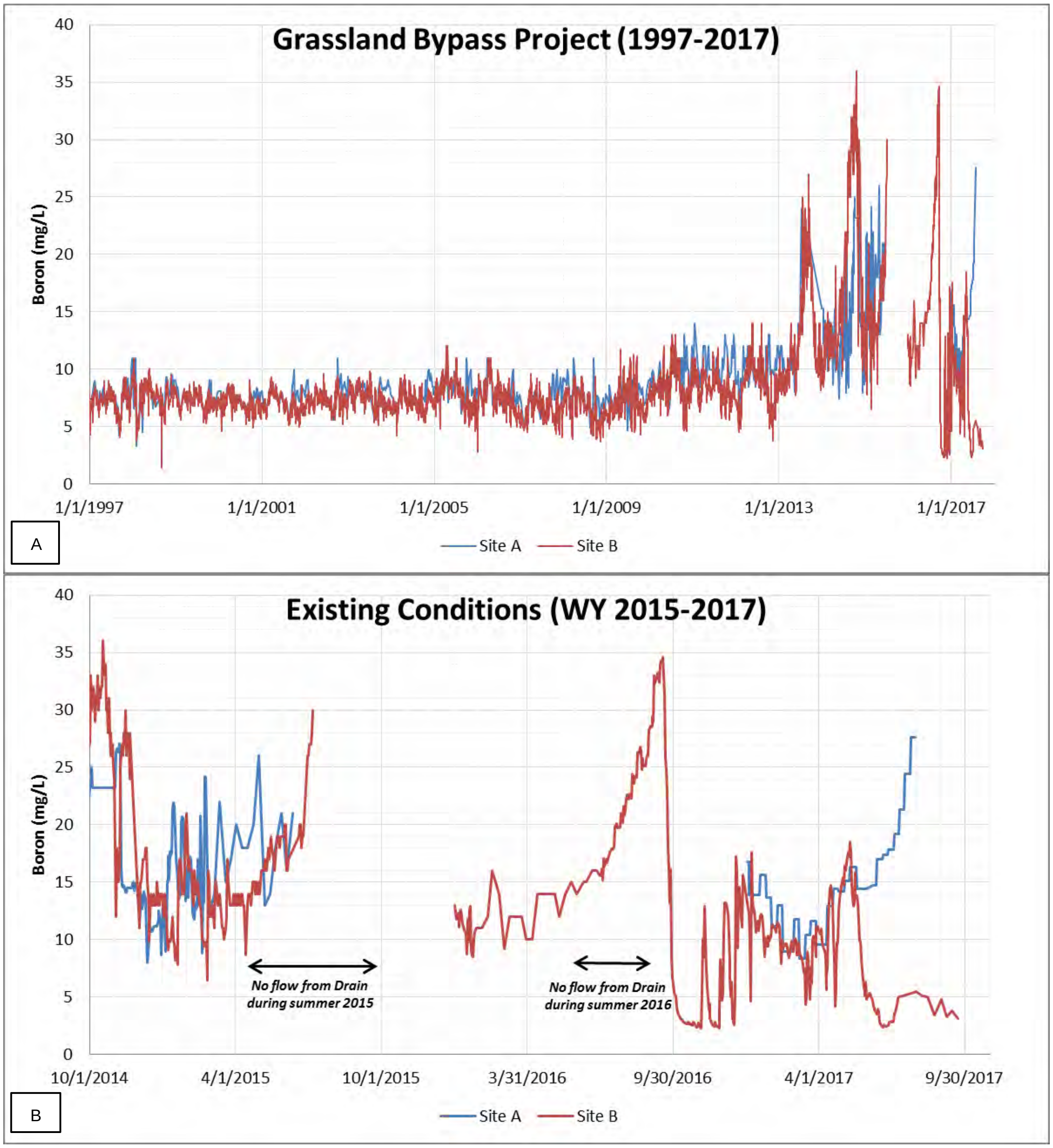
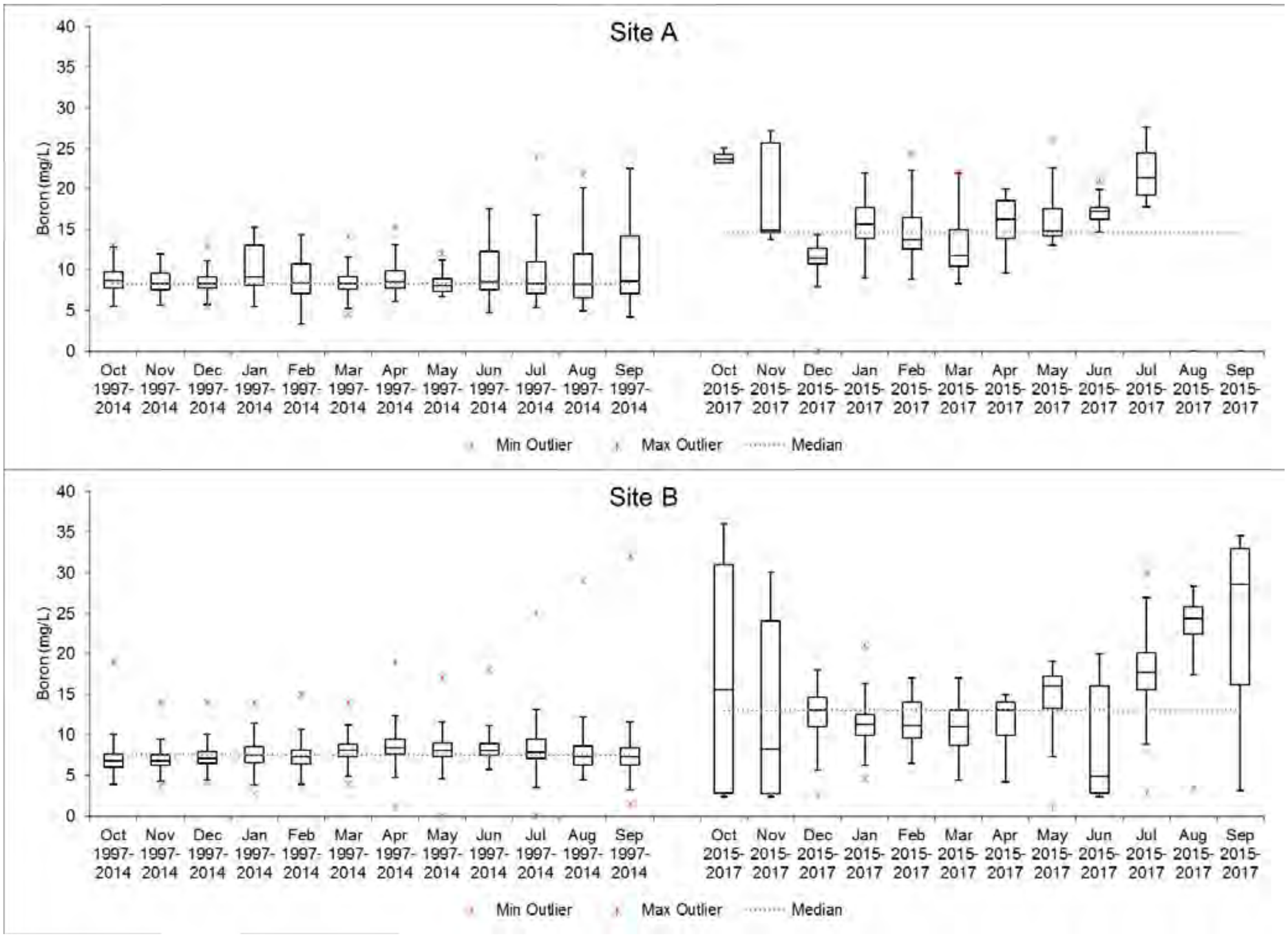


Figure 7 Boron in the San Luis Drain

Figure 8 shows the monthly variability in boron concentrations for Sites A and B for the period of 1997 to 2014 and the period of 2015 to 2017. Prior to 2014, boron concentrations were relatively constant throughout the year. Since then, there has been an increase in variability and overall concentration. Since 2015, concentrations in the Drain during summer months reflect the concentration of standing water in the Drain and the apparent increase may be due to evaporation.



Note: Insufficient data for August and September 2015-2017 at Site A. Outliers higher than 40 mg/L removed during July 2015 at Site B.

Figure 8 Monthly Boron Concentrations at Site A and Site B

Figure 9 shows a time series of EC measured at Sites A and B. Time Series A shows EC concentrations during 1997 to 2017 and Time Series B focuses on the last few years when drainwater was no longer discharged during summer months. Starting in summer 2013, there has been an increase in variability and concentration. The trend is an increase during the summer then a sudden decrease in the fall around September. This pattern is likely due to evaporative concentration with possible contributions from subsurface seepage, at least in some years.

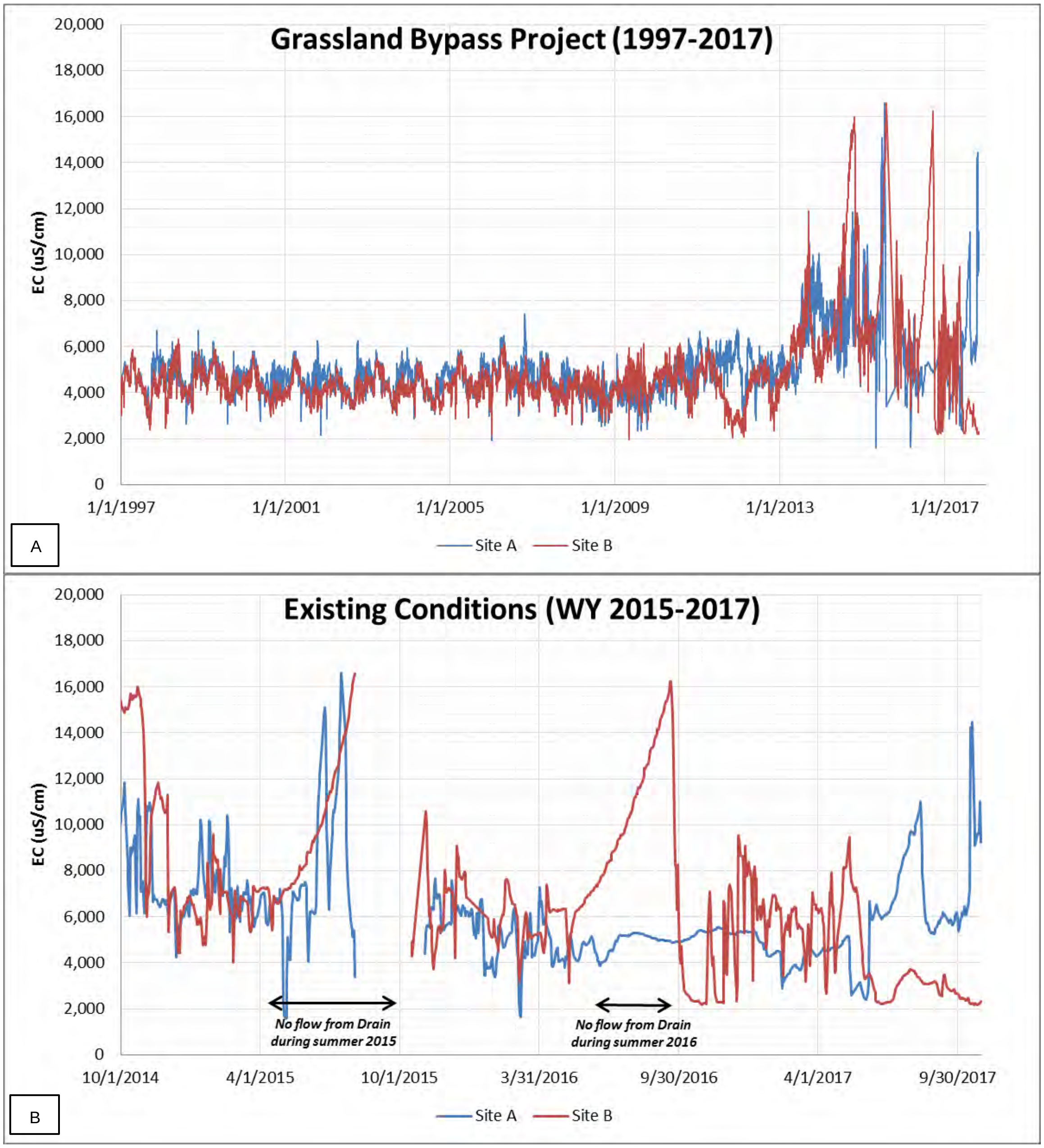


Figure 9 Electrical Conductivity in the San Luis Drain

Figure 10 shows the monthly variability in EC for Sites A and B for the period of 1997 to 2014 and the period of 2015 to 2017. Since 2015, the increase in variability has occurred primarily during June through November and the increase in EC has occurred in June through September, primarily at Site B, possible due to subsurface seepage.

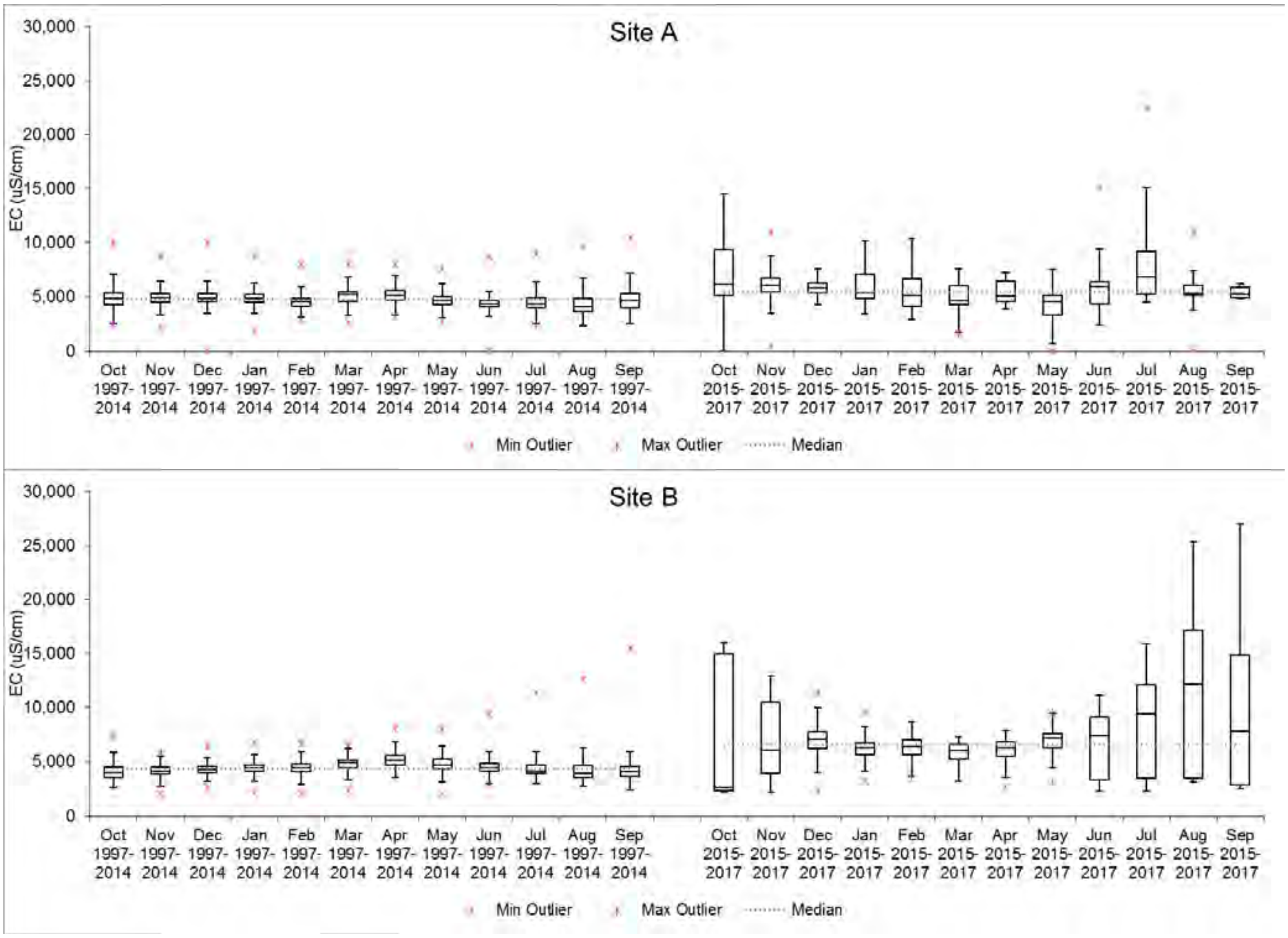


Figure 10 Monthly EC at Site A and Site B

1.1.5.2 Mud Slough (North) and Salt Slough

Mud Slough (north), one of the two major west-side tributaries of the San Joaquin River, is currently the major carrier of agricultural drainage from the GDA to the San Joaquin River. Drainage originates from the GDA, travels via the San Luis Drain, and is discharged directly into Mud Slough. Flow in Mud Slough (north) upstream of the discharge point consists of wetland releases from the northern and southern GWD and from Volta Wildlife Management Area, as well as operational spills from the Delta-Mendota Canal and CCID's Main Canal and flood flows from Los Banos Creek. Mud Slough (north) downstream of the discharge point is often dominated by water originating from GDA via the Drain, but also carries a blend of subsurface tile drainage water and discharges from surrounding duck clubs.

Salt Slough, the other major west-side tributary of the San Joaquin River, is located on the eastern side of the Kesterson National Wildlife Refuge. Since 1996, water in this channel comes only from wetland discharges, runoff from non-GDA farmland, and occasional flood flows. It is a blend of surface tailwater, operational spills, and wetland drainage from the surrounding area. Wetland channels located in the Grassland Subarea include 23 miles of Salt Slough and approximately 70 miles of water supply channels to privately, state-, and federally owned wetlands and national wildlife refuges.

Site C is located in Mud Slough approximately 0.5 mile upstream from the Drain and Site D is located in Mud Slough approximately 0.6 mile downstream from the Drain. Site F is located in Salt Slough at Highway 165.

1.1.5.2.1 Flow

Figure 11 shows a time series of the daily flow measured at Site C (Mud Slough upstream of the Drain), Site D (Mud Slough downstream of the Drain), and Site F (Salt Slough). The difference between the flows at Site C and D is the contribution from the Drain. As seen in the detail associated with Water Years 2015 to 2017, the overall shape of hydrograph and the timing of the peak discharge in Mud Slough is dominated by flow originating upstream of the Drain (Site C), while a small increase in peak flow is found downstream of the Drain (Site D). Salt Slough (Site

F) has higher base flow than Mud Slough and the system appears to be less flashy (i.e., less responsive to direct rainfall runoff).

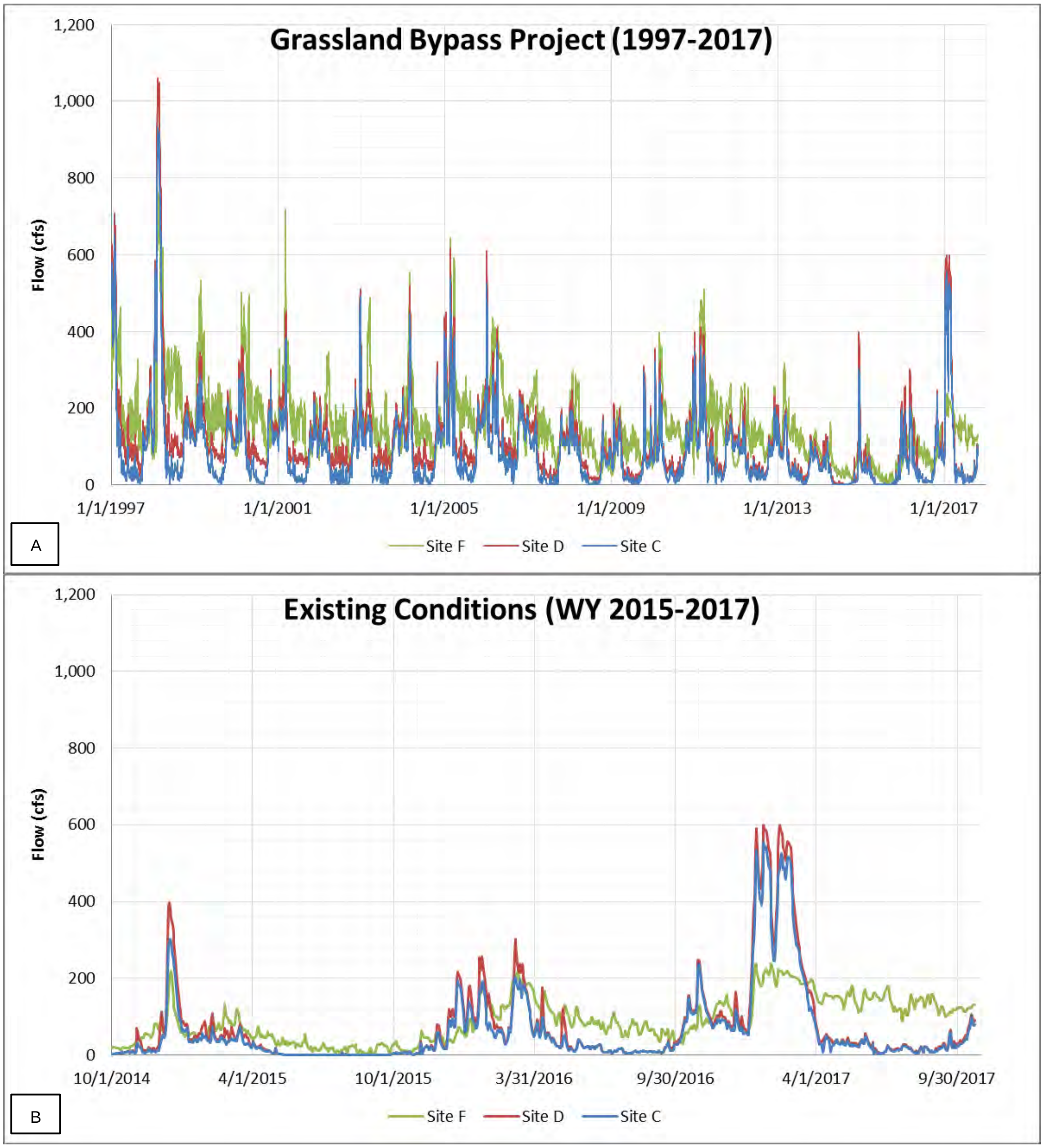


Figure 11 Flow in Mud Slough (North) and Salt Slough

1.1.5.2.2 Water Quality

Figure 12 shows Se concentrations for the same period for Mud Slough at Sites C and D. The Drain is the major source of Se to Mud Slough, as shown by the comparison of Se concentrations in Sites C and D. However, since most of the flow into Mud Slough is from the watershed upstream from the Drain, the Se discharged into Mud Slough via the Drain is diluted by flow in Mud Slough. Because both flow volume and Se concentration has been decreasing in the Drain, there has also been a general trend of decreasing concentrations at Site D. Since water year 2015, Se concentrations at Site D have been less than ±10 µg/L in the winter and ±1 µg/L or less (background levels) in the summer. Se concentrations in Salt Slough at Site F are ±1 µg/L or less year-round (see Figure 13).

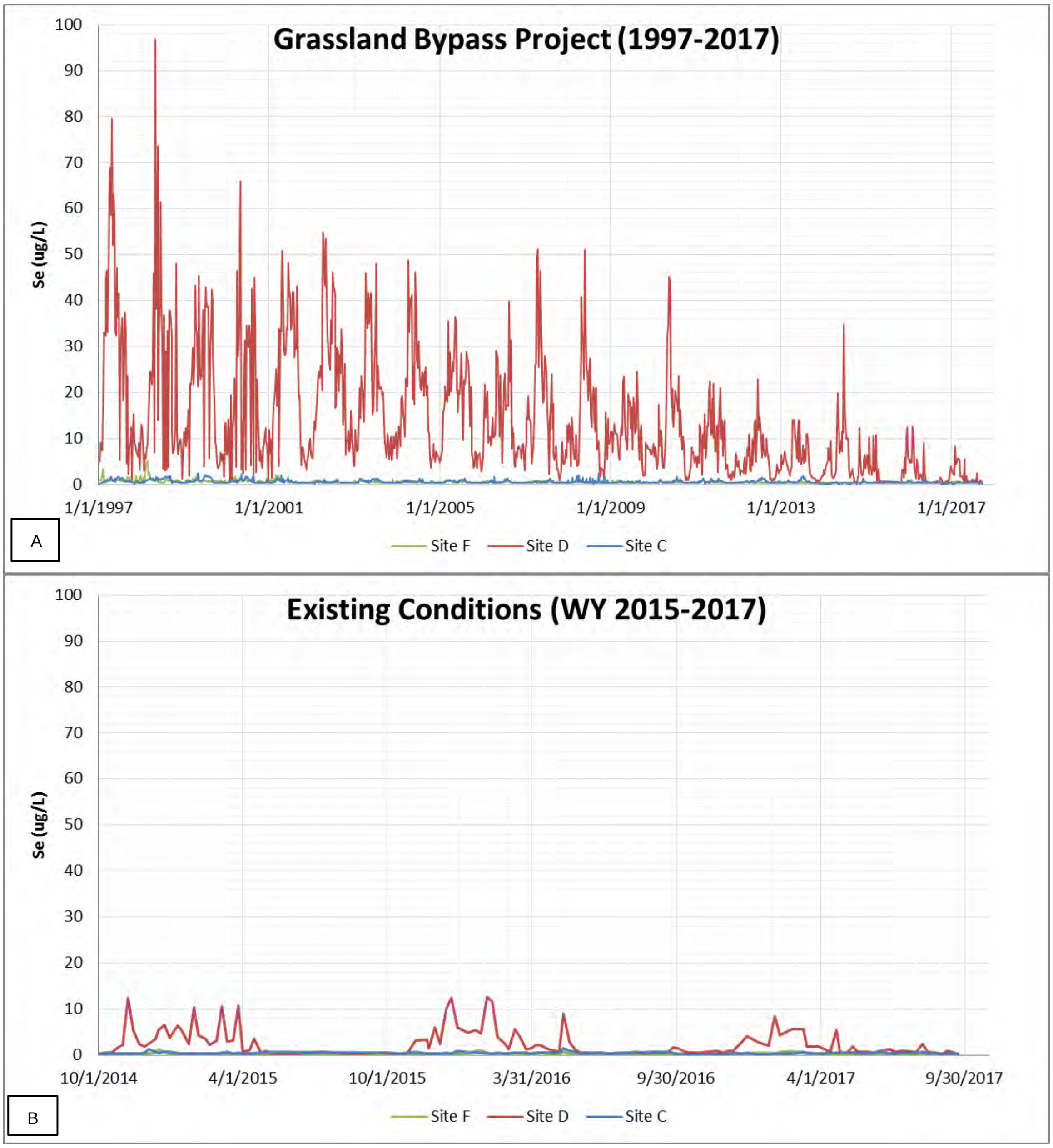


Figure 12 Selenium in Mud Slough (North) and Salt Slough

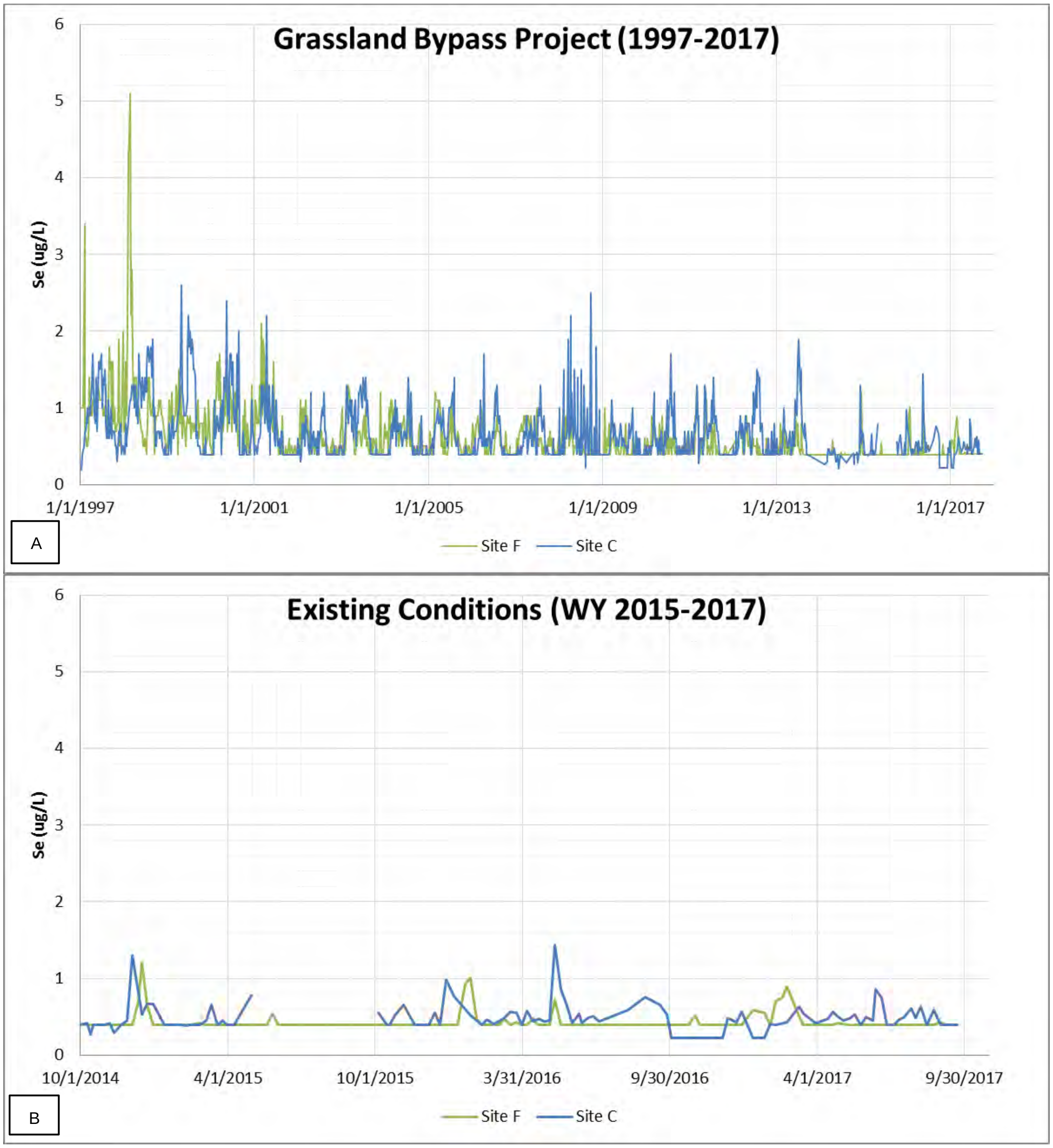


Figure 13 Detail of Selenium in Mud Slough (North) at Site C and Salt Slough at Site F

Figure 14 shows boron concentrations for the same period for Mud Slough at Sites C and D as well as boron concentrations at Salt Slough at Site F. Prior to summer 2013, boron concentrations in Mud Slough were typically 1 to 4 mg/L at Site C, increasing to over 6 mg/L at Site D. The exception is March and April 2006, when concentrations were over 10 mg/L at Site D. Higher concentrations at Site D occurred during the summer when drainwater was discharging. Since summer 2013, concentrations at Site D have been measures over 10 mg/L in both winter and summer months although measurements have been below 10 mg/L since

February 2016. Boron concentrations in Salt Slough at Site F were 2 mg/L or less year-round, except during October to December 2002.

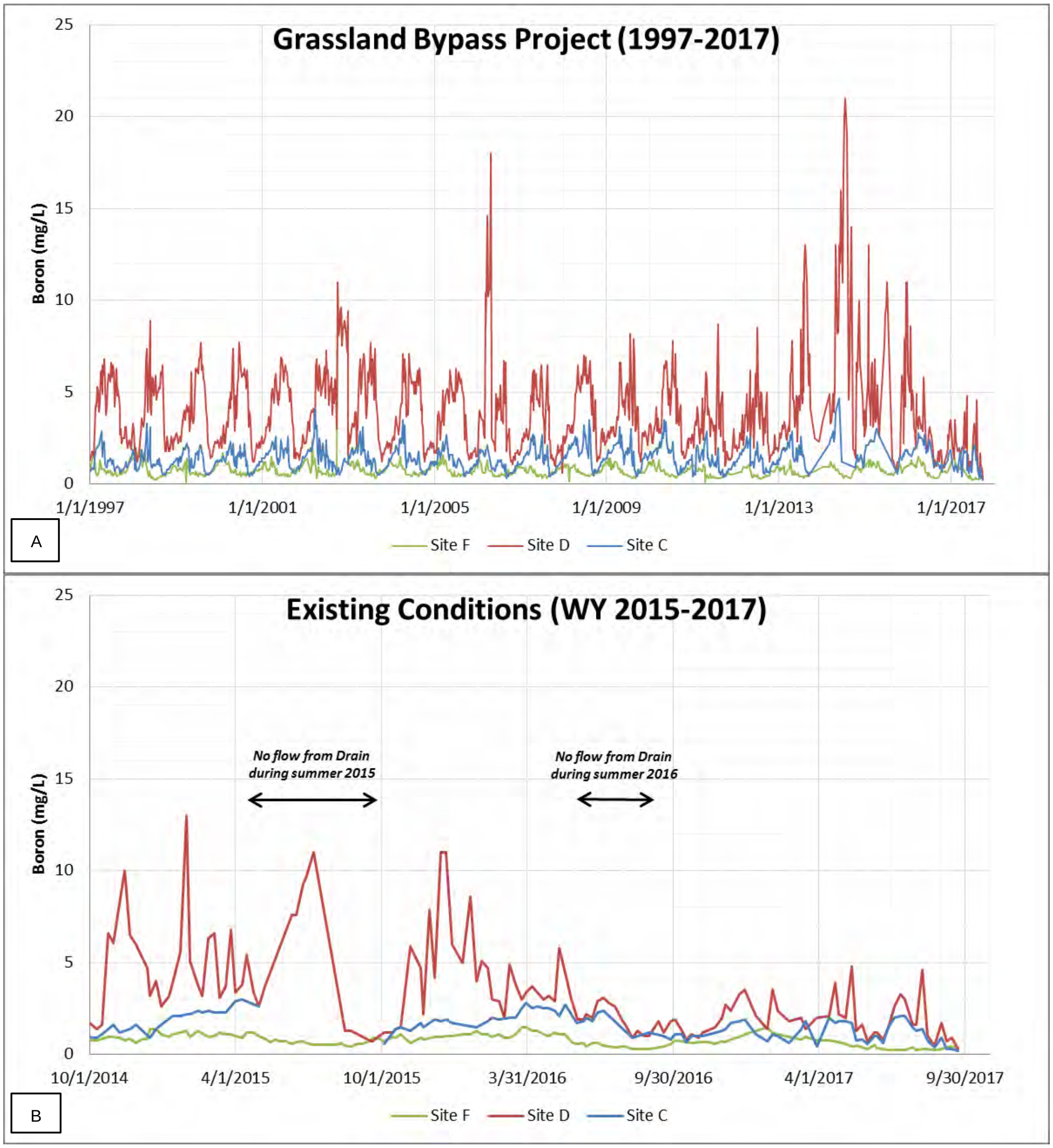


Figure 14 Boron in Mud Slough (North) and Salt Slough

Figure 15 shows EC for the same period for Mud Slough at Sites C and D and for Salt Slough at Site F. Prior to summer 2013, the EC in Mud Slough at Site C was about 700 to 3,700 µS/cm, while the EC in Mud Slough at Site D increased to about 1,000 to 5,000 µS/cm; this increase at Site D is due to discharge from the Drain. Since 2013, summer measurements at Site D have been as high as 12,000 µS/cm or more. Higher EC has also been found in Mud Slough at Site C, with measurements up to 6,800 and 12,800 µS/cm during summers 2014 and 2015 respectively, likely due to evaporative concentration. EC in Salt Slough has been about 700 and 2,300 µS/cm during the full time period (1997 to 2017).

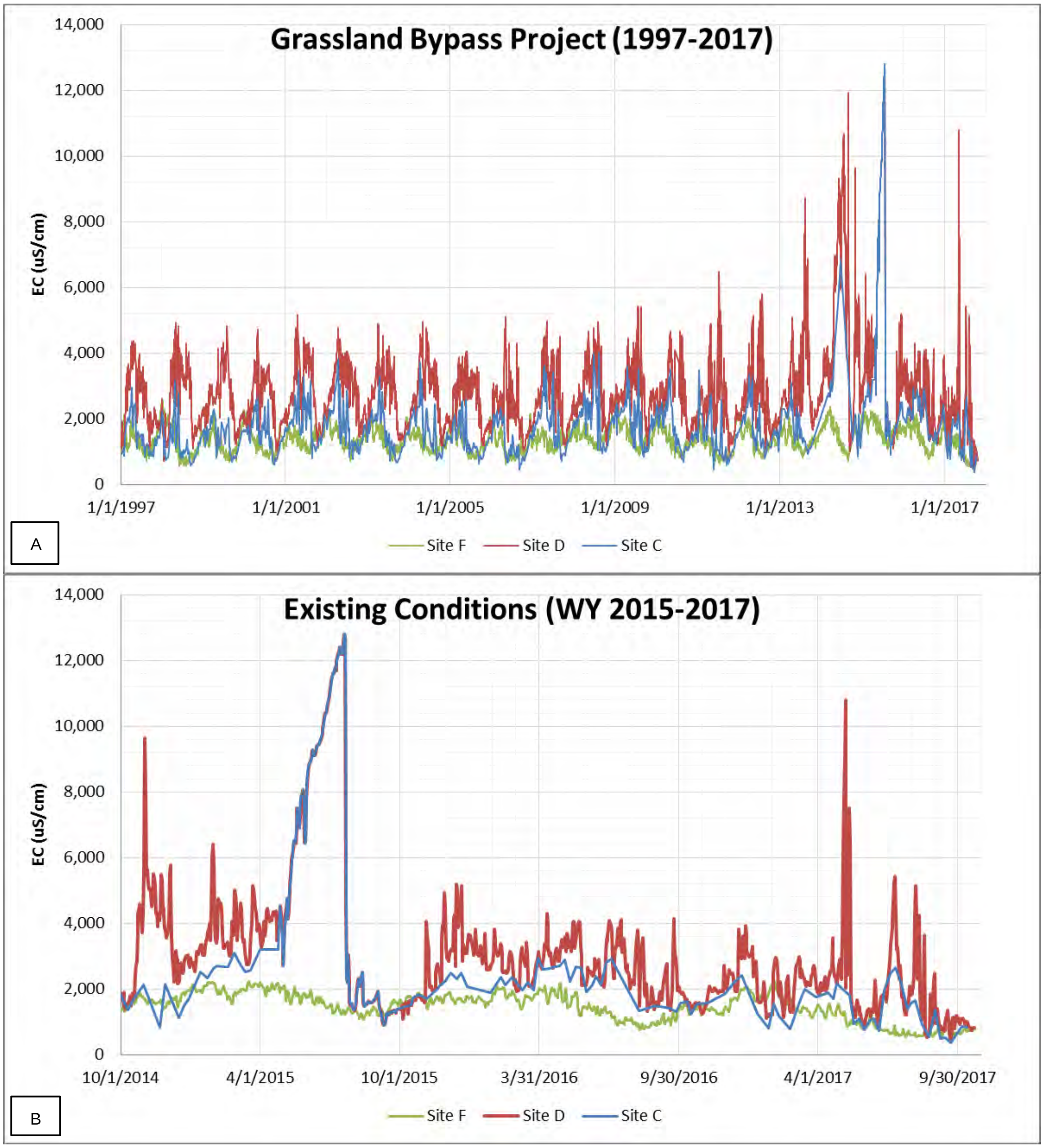


Figure 15 Electrical Conductivity in Mud Slough (North) and Salt Slough

1.1.5.3 San Joaquin River from Sack Dam to Vernalis

Upstream of Salt Slough, the San Joaquin River conveys water released from Friant Dam and receives drainage from east-side tributaries including Fresno River, Bear Creek, as well as return flows from other non-GDA agricultural districts including San Luis Canal Company and CCID. Tile drainage from the GDA does not enter the San Joaquin River upstream of Salt Slough.

At Fremont Ford (Site G), the San Joaquin River is influenced by inputs from Salt Slough as well as inflows from further upstream. Drainage that discharges to the San Joaquin River at Salt Slough is a mixture of drainage from non-GDA farmland and wetlands.

Hills Ferry (Site H) is located at the San Joaquin River downstream of it confluence with Mud Slough (north). Agricultural drainage that discharges to the San Joaquin River at Mud Slough is a mixture of drainage from wetlands and GDA and non-GDA farmland. The Hills Ferry location is also influence by wet season inflows from Merced River flood channels as well as inflows originating upstream of Mud Slough.

Crows Landing (Site N) is located at the San Joaquin River downstream of its confluence with the Merced River. The GDA, other agricultural lands, Los Banos Creek, Merced River, Orestimba Creek, all other sites previously discussed, and regional groundwater all contribute to flows found in the San Joaquin River at this site.

Vernalis is located at the San Joaquin River downstream of its confluences with the major west-side tributaries – the Merced River, the Tuolumne River, and the Stanislaus River. Discharges from the GDA, together with all other inputs in the watershed, contribute to water quality at Vernalis.

1.1.5.3.1 Flow

Figure 16 shows flow in the San Joaquin River. Site G (Fremont Ford) is located downstream of the river’s confluence with Salt Slough and upstream of the river’s confluence with Mud Slough (north), Site H (Hills Ferry) is located downstream of the river’s confluence with Mud Slough and just upstream of the river’s confluence with the Merced River, Site N (Crows Landing) is located on the San Joaquin River between the confluence with the Merced and Tuolumne Rivers, and Vernalis is located downstream of the Tuolumne and Stanislaus Rivers. As seen in the detail associated with Water Years 2015 to 2017, there can be a large variance in river flow during wet and dry years.

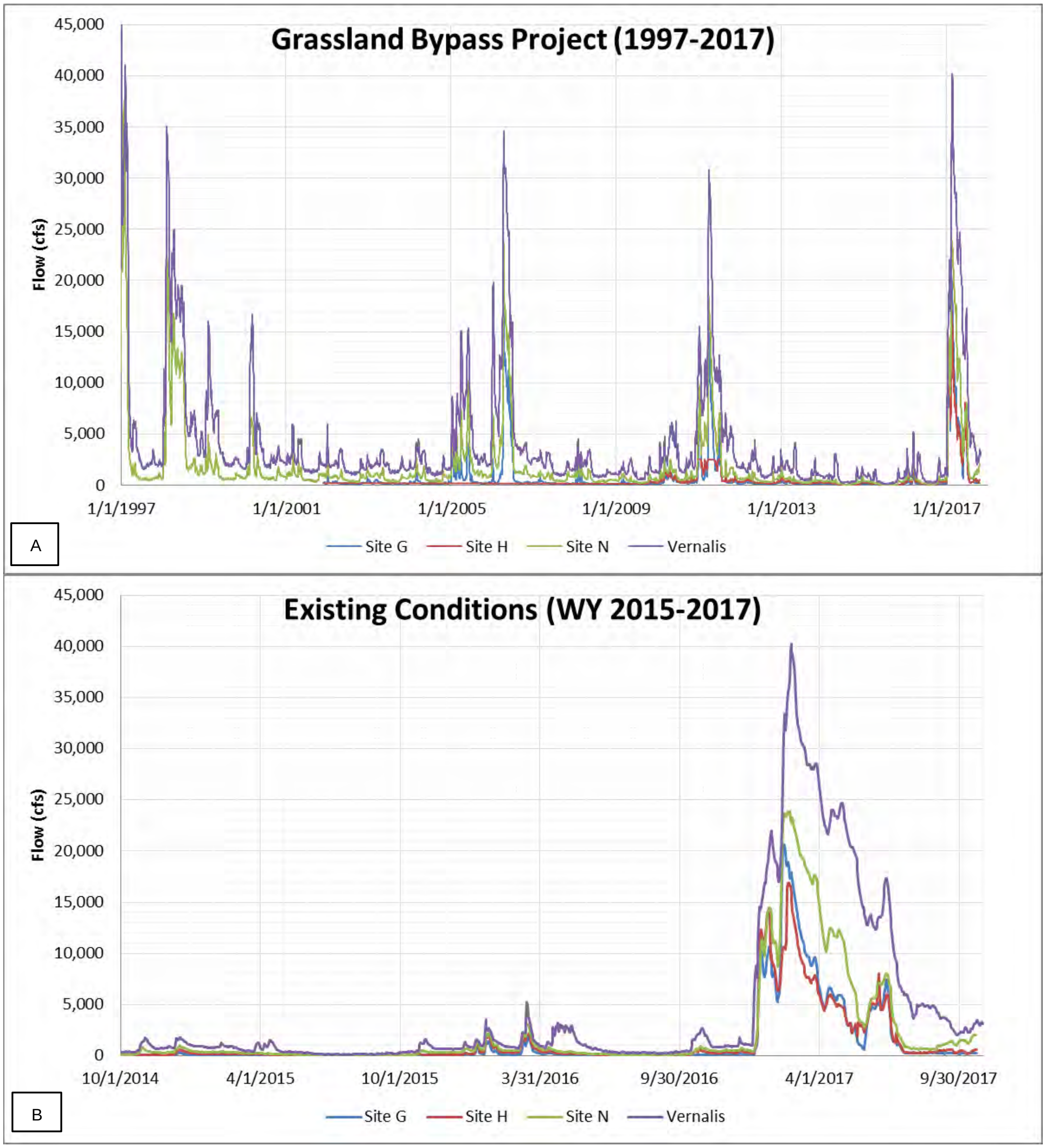


Figure 16 Flow in the lower San Joaquin River

1.1.5.3.2 Water Quality

Figure 17 shows Se concentrations for the San Joaquin River at Sites G, H, and N. Prior to 2014, concentrations at Fremont Ford (Site G) have been found at ±2 µg/L or less, while concentrations were occasionally as high as ±10 to 15 µg/L at Hills Ferry (Site H) and ±6 to 10 µg/L at Crows Landing (Site N). In addition, there were several, potentially anomalous, high readings at Hills Ferry between August 2009 and January 2010. Higher Se concentrations were not found in Drain or in Mud Slough during the same time period. As seen in the detail associated with Water Years 2015 to 2017, Se concentrations have been ±3 µg/L or less at the river stations in recent years, below the Basin Plan WQO of a 5 µg/L 4-day average.

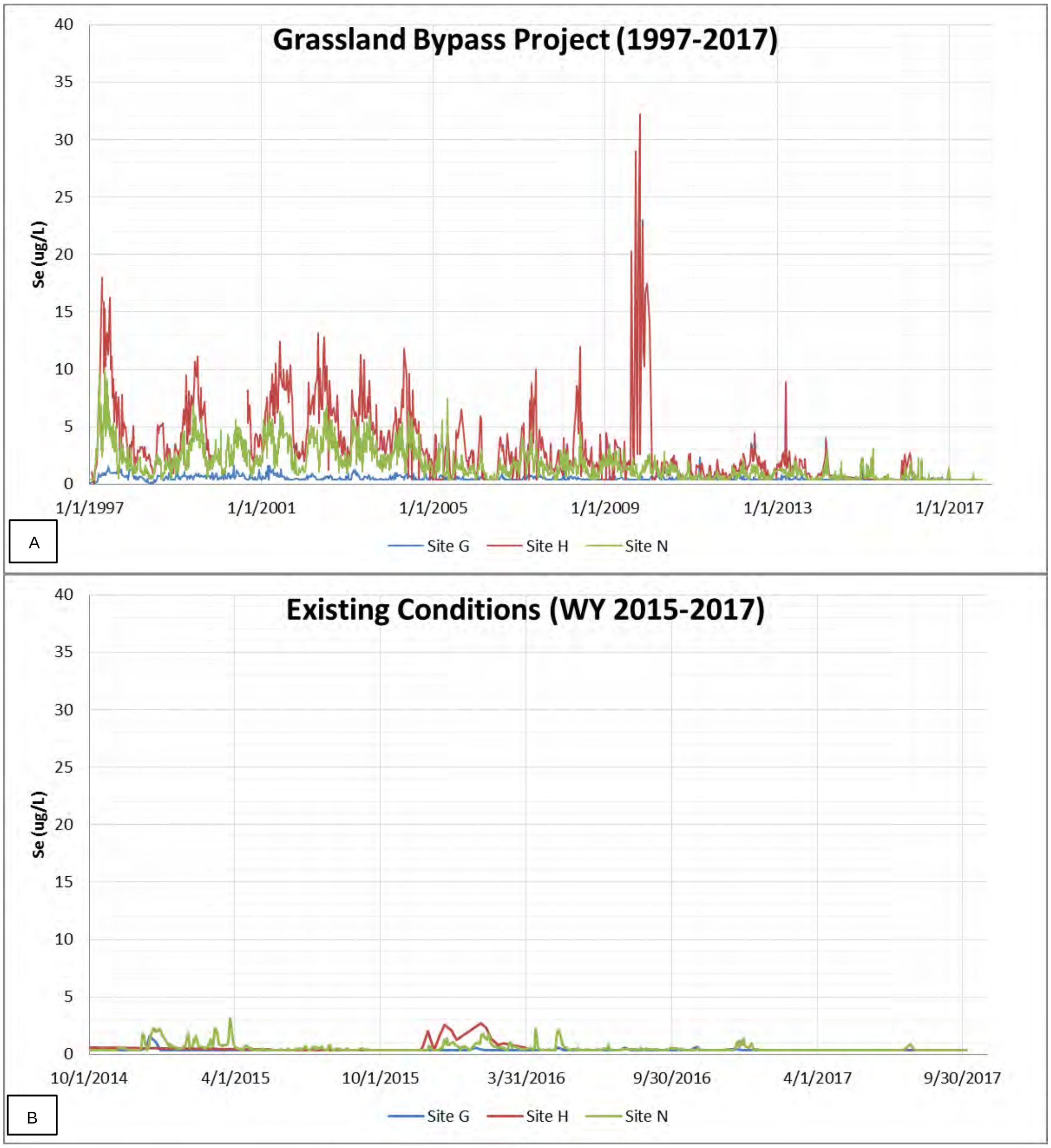


Figure 17 Selenium in the lower San Joaquin River

Figure 18 shows boron concentrations for the San Joaquin River at Sites G, H, and N. Concentrations are typically 3 mg/L or less at the river stations. Concentrations at G and H are below the water quality objective of 5.8 mg/L (2.0 mg/L monthly mean) and at Site N below the water quality objective of 2.0 mg/L (0.8 mg/L monthly mean).

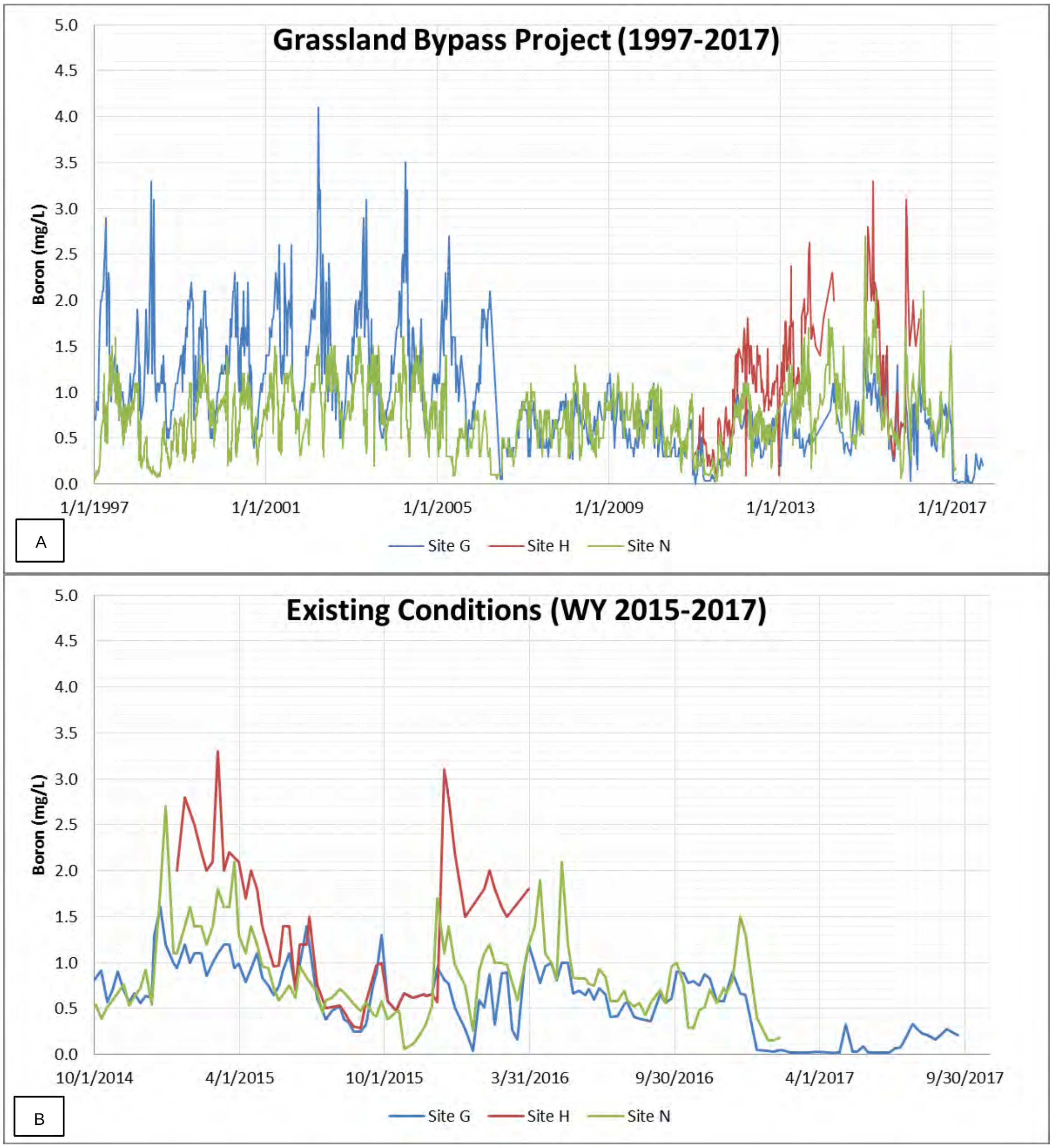


Figure 18 Boron in the lower San Joaquin River

Figure 19 shows EC measured in the San Joaquin River at Sites G, H, N, and Vernalis. EC was typically 3,000 µS/cm or less at the river stations. EC greater than 4,000 µS/cm occurred at Site G (June 2016) and at Site H (June 2014, January 2015, and June 2015).

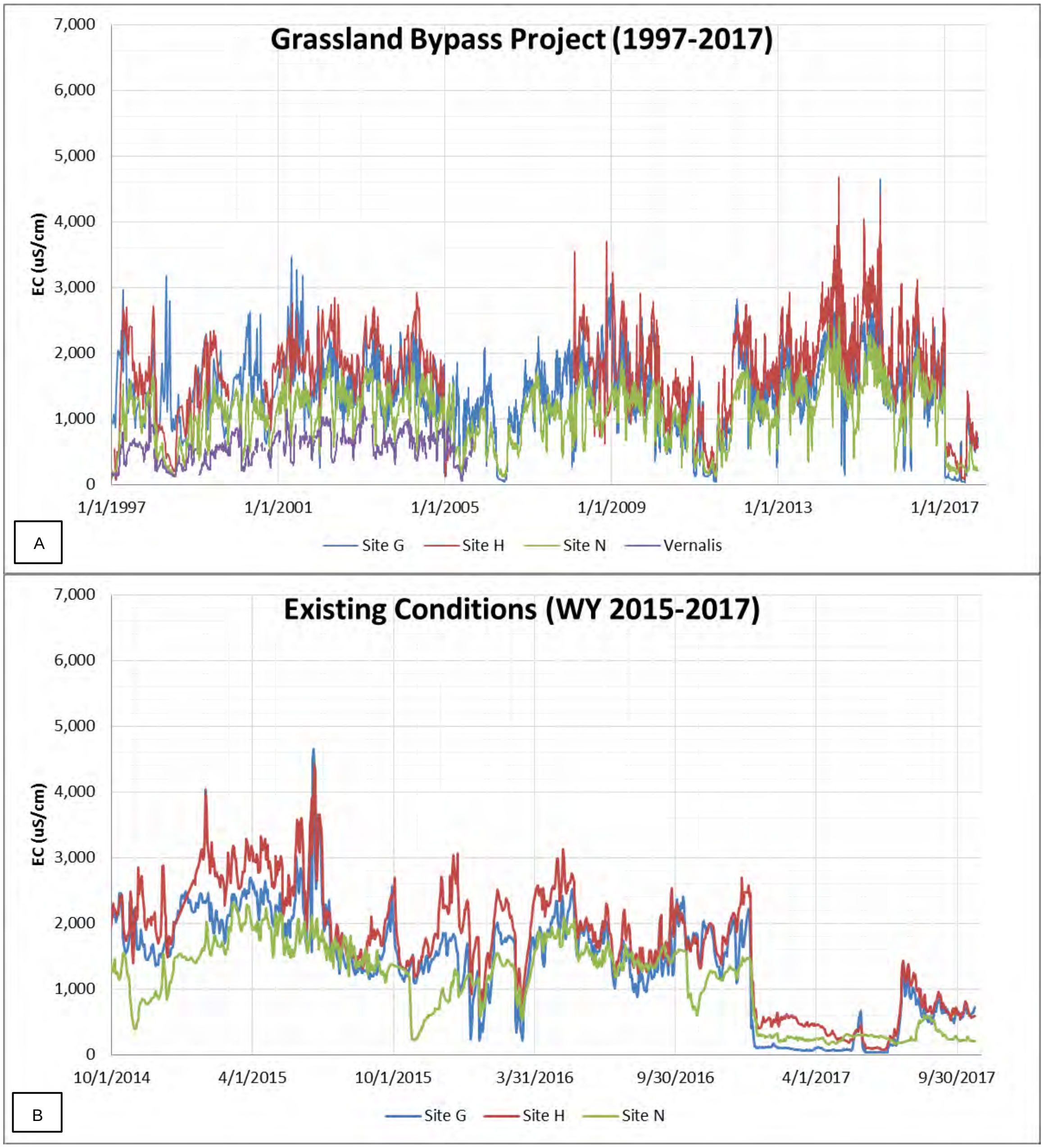


Figure 19 Electrical Conductivity in the lower San Joaquin River

1.1.6 Sediment Accumulation in the San Luis Drain

The 2009 use agreement between the Authority and Reclamation for use of the San Luis Drain stipulates that the Authority is responsible for sediments that accumulate in the Drain due to its use of the Drain. Since the sediments may contain high concentrations of Se, velocity in the Drain is limited to 1 foot per second, corresponding to a flow of 150 cfs, to prevent the mobilization of the deposited sediment and discharge to Mud Slough.

A Sediment Management Plan was evaluated in the 2009 Final EIS/EIR (Reclamation 2009b) to return the Drain to its original capacity of 300 cfs. This plan allowed for placement of removed sediments on agricultural land. Removal commenced under the plan in 2015, 2016 and 2017 using excavators to remove the sediment and trucks to haul it to the SJRIP. In 2015 and 2016, sediment was removed from the Drain, immediately placed in trucks, and moved to the SJRIP reuse area. Approximately 20,000 cubic yards (cy) were removed in these two years. In 2017, the removal was expanded and approximately 4 miles of the Drain was cleaned (approximately 120,000 cubic yards). The work was again accomplished in accordance with the Sediment Management Plan, with the modification that sediment was first placed adjacent to the Drain to dry and then picked up and taken to the SJRIP reuse area.

1.2 ENVIRONMENTAL CONSEQUENCES

1.2.1 Key Impact and Evaluation Criteria

The impacts to surface water resources are focused on water quality and are primarily based on changes in the Se, salt, and boron concentrations in the San Joaquin River and Mud Slough. The degree of water quality impact is based on the concentration in the receiving water relative to the WQOs contained in the Basin Plan for the San Joaquin River Basin. An impact would be considered an adverse effect and significant if it resulted in an increase in the frequency of exceedances in the WQOs over what was measured under existing conditions (Water Years 2015 to 2018). An effect would be considered beneficial if it resulted in a decrease in the frequency of exceedances in the WQOs. The Action Alternatives were assumed to have no significant impact on water supply, as recycling on farm or at the SJRIP facility does not affect water supply contracts.

A consequence of reducing Se discharged from the GDA is the corresponding reduction in salt load discharged from the area. The EC predicted at Mud Slough downstream of the Drain and the San Joaquin River at Hills Ferry, Crows Landing, and Vernalis were compared to existing conditions to determine the significance of this reduction.

The SJRIP has been operating since 2001 to dispose of drainwater generated in the GDA. Existing operations have included activities associated with Phases I and II of this In-Valley Treatment/Drainage Reuse Facility. The impact evaluation criteria for these and subsequent phases of the Project are based on the likelihood of ponding or surface runoff from the land due to irrigation with drainwater. An impact would be considered significant if the application of the drainwater would cause substantial amounts of water to either pond on the surface or run off the land into a surface drainage system.

The primary concern with sediment accumulation is that sediment will restrict the capacity of the Drain in a manner that limits its flow conveyance if sediment is not removed during operations and maintenance activities. The other concern is the potential for a significant increase in Se concentration of the sediment in the Drain that could affect discharges. Therefore, the impact evaluation criterion is that the capacity of the Drain should not be reduced below 150 cfs (which is the existing conveyance limitation near the GDA) through sediment accumulation. Furthermore, future sediment removal will be accomplished similar to the 2017 removal, but the location of the placement area likely will change due to the logistics of hauling material that is further away from the SJRIP. Selenium levels measured in the Drain sediment in 2018 are below the threshold for application on industrial and residential sites. Therefore, the potential to impact surface water runoff is lessened.

1.2.2 Environmental Impacts and Mitigation

1.2.2.1 Methods Used to Evaluate Impacts

Water balance models were developed for the GDA (stormwater model) and receiving waters above Vernalis (for Se, boron, and EC) (receiving water model). The stormwater model was used to calculate the volume of stormwater runoff from the agricultural fields which is collected in the drainage system. The receiving water model was used to predict the Se, salt, and boron concentrations in Mud Slough and the San Joaquin River. Details of the models are provided in Attachment A. A brief description is provided below.

Stormwater runoff was analyzed on a per storm basis for storms occurring between November and May. Inputs to the stormwater model included total precipitation, rainfall intensity, and rainfall duration. Outputs included total volume of runoff per storm, flow duration, time to peak runoff, and daily flow.

The receiving water model was used to predict Se, salt, and boron concentrations in Mud Slough and the San Joaquin River. The output from the stormwater model was used as input to the receiving water model. Stormwater management operations were simulated, and flows less than the Drain's capacity were assumed to be conveyed to and discharged from the Drain. Flows greater than the Drain's capacity were assumed to accumulate upstream of the Drain.

1.2.2.2 Stormwater and Drainwater Discharge to the Drain

Under the Action Alternatives, agricultural drainwater discharge to the Drain would be discontinued but stormwater would continue to be conveyed to the Drain. Under the No Action Alternative, both drainwater and stormwater discharge to the Drain would be discontinued.

The following assumptions were made regarding future conditions:

- Because of the extensive drainage collection system already in place, drainwater would continue to be produced on farms; however, drainwater from sumps would be recycled either on farm or within district areas, including the existing lands developed for the SJRIP reuse area (6,100 acres) and proposed expansion (1,450 acres), and not discharged beyond the GDA.
- The Panoche and Main Drains would be closed at the edge of the GDA during dry weather to prevent drainwater from exiting from the GDA through the conveyance system. Indirect outflow could occur during the irrigation season through groundwater seepage; however, seepage from GDA district areas upstream of the SJRIP and discharge from SJRIP areas containing tile drains would be captured and applied to the SJRIP reuse area.
- Seepage from non-GDA lands into feeder channels for the Grassland Bypass Channel and subsurface inflow to the Drain would continue as at present. The seepage/subsurface inflow consists of drainwater from nondistrict lands, surface water runoff (both stormwater and non-stormwater), and groundwater seepage.
- Sumps for tile drains in the GDA would be turned off prior to storm events.
- Panoche and Pacheco would direct stormwater runoff to existing regulating reservoirs with a capacity of 500 acre feet. Additional regulating reservoirs are proposed to add capacity of an additional 1,000 AF.
- Runoff volume up to an equivalent volume of 3 inches of rain on the SJRIP could be reused within the 7,550 acres of the SJRIP reuse area prior to discharge.

1.2.2.3 No Action Alternative

Under the No Action (No Project) Alternative, the Panoche and Main Drains would be closed at the edge of the GDA during both dry weather and storms, preventing water from the GDA from being conveyed to the Grassland Bypass Channel. The discussion of the impacts for the No Action Alternative is provided by area: within the GDA, other agricultural areas outside of the GDA, wetlands, Mud Slough (north), and San Joaquin River (Mud Slough to Merced River).

1.2.2.3.1 Grassland Drainage Area

During the irrigation season, excess drainwater from sumps would be recycled as part of the drainage management program. This would be used to replace an equivalent amount of irrigation deliveries and, therefore, would not increase the total volume of applied water during the irrigation season.

Most areas within the GDA are drained by deep drainage canals that presently discharge to the Grassland Bypass Channel. With the Grassland Bypass Channel blocked (for example at Panoche Drain and Main Canal), these lands would no longer have a stormwater drainage outlet. Some lands within this area may experience the impacts/adverse effects of waterlogged soils and loss of productivity, runoff conveyed by the deep drainage canals may overflow, and ponding may occur. Up to 1,000 acres of agricultural lands may flood in most years due to winter storms. The ponding could persist for extended periods of time especially during the winter and spring when the water table is high and evaporation is low. This ponding would be left to infiltrate, would constitute a nuisance to the farmers, and may attract wildlife. The Se concentrations in these ponds are expected to be similar to average concentrations found in stormwater conveyed by the Drain during Water Years 2015 to 2018 (approximately 20 µg/L) but may occasionally be higher (50 µg/L or more). These concentrations are greater than ecological risk guidelines for surface waters and could affect wildlife species that are sensitive to Se through dietary exposure from the aquatic food chain.

Panoche and Pacheco would direct stormwater runoff to existing regulating reservoirs. When stormwaters recede, ponded water in existing regulating reservoirs would be diverted to the SJRIP reuse area or other areas within the GDA as capacity became available.

Prior to the Grassland Bypass Project, stormwater from rainfall within the GDA and surrounding areas was discharged into the wetland water supply channels but this activity would not be allowed in the future by the Grassland Water District (GWD). Under the No Action Alternative, stormwater runoff is expected to cause substantial ponding within the lower portions of the GDA in most years. Because Se concentrations in the ponded water would likely be greater than ecological risk guidelines for surface waters, substantial ponding within the lower portions of the GDA is a potentially significant impact.

1.2.2.3.2 Other Agricultural Areas Outside of the Grassland Drainage Area

Some of the seepage in the Grassland Bypass Channel comes from agricultural areas outside of the GDA. These areas are primarily located north of the GDA adjacent to the Grassland Bypass Channel. If the Grassland Bypass Channel is blocked, drainage from these areas would no longer be captured by the Grassland Bypass Project. This uncontrolled drainage may discharge into existing drains, which may ultimately end up in the GWD and wetland water supply channels. For example, drainage from the Poso Drain Area, which is located north of the GDA, could enter Poso Drain and flow to the GWD. Impacts to wetland channels are discussed below.

1.2.2.3.3 Wetlands

If the discharges to the Grassland Bypass Channel from areas outside of the GDA are blocked, water from surface flow or seepage may enter other existing drainage channels. Some of these drains may flow towards the Grassland wetlands. When discharges mix with water in the wetlands (or in wetland channels), Se concentration may increase; since the Se concentration in the wetland canals is often near or at the WQO of 2.0 µg/L, the addition of the seepage could raise the concentrations at or above the WQO. This is a potentially significant impact for Se and a less-than-significant impact for boron, molybdenum, and salinity.

Concentrations in Salt Slough would not change compared to existing conditions because Salt Slough is not directly connected to the GDA. There would be no impact in Salt Slough.

1.2.2.3.4 San Luis Drain

In the No Action Alternative, subsurface inflows would continue to infiltrate into the Drain when groundwater levels are high, resulting in a stagnant pool of water in the Drain. The quality of these inflows is expected to be similar to groundwater concentrations in adjacent wetlands. During summer months, the constituents in the water would become concentrated through evaporation; and if the outlet gates remain open, some of this water would to be discharged to Mud Slough. In recent years, boron and salinity concentrations have been found to increase during summer and decrease when winter flows are conveyed by the Drain. Se concentrations were stable in the summer (e.g., summer 2016), but increased in the winter.

Under the No Action Alternative, water quality in the Drain is expected to be similar to existing conditions during summer months, but it would no longer be influenced by winter stormwater (dilution flows) and minor amounts of drainwater (with higher levels of Se) from the GDA. Instead, rainfall/precipitation would directly influence the quality of the winter Drain water. This is a less-than-significant impact for boron and salinity and a minor beneficial effect for Se.

1.2.2.3.5 Mud Slough (North) Downstream of Current San Luis Drain Discharge

Under the No Action Alternative, water quality and flow in Mud Slough (north) downstream of the current discharge point would be similar to water quality and flow in Mud Slough (north) upstream of the current discharge point. Therefore, water quality is predicted to improve as compared to existing conditions for Se, boron, salt, and molybdenum. Se WQOs would be achieved in this section of Mud Slough under the No Action Alternative and boron WQOs would be met on a more frequent basis (boron concentrations are expected to be greater WQOs (2.0 mg/L monthly mean, March 15 to September 15) approximately 25 percent of the time, consistent with the 1997 to 2017 sampling results for Site C). This alternative would have a moderate beneficial effect in this reach of Mud Slough as compared to existing conditions.

1.2.2.3.6 San Joaquin River (Mud Slough to Merced)

Water quality in the San Joaquin River downstream of Mud Slough is predicted to improve as compared to the existing conditions for Se, boron, salt, and molybdenum and Se and boron WQOs are both expected to be achieved in this section of the San Joaquin River under the No Action Alternative. This alternative would have a moderate beneficial effect in this reach of the San Joaquin River as compared to existing conditions.

1.2.2.3.7 Sediment Accumulation in the San Luis Drain

No additional sediment input or accumulation would occur from the GDA, which would be an improvement over existing conditions.

1.2.2.3.8 San Joaquin River Water Quality Improvement Project

Over an extended period of time under the No Action Alternative, the reuse capacity of the SJRIP reuse area may be diminished due to salt accumulation within the crop root zone to the point where the production of salt-tolerant crops declines. If the reuse capacity is diminished, fields in the lower portion of the region could become waterlogged and unfarmable and may be abandoned. Water table rise may occur at the lower elevations. If the reuse facility becomes inoperative, individual districts and farmers would have to recycle drainwater "on farm and within districts."

1.2.2.4 Stormwater Discharge of ≤150 cfs (Proposed Action)

The Proposed Action is the continuation of the Grassland Bypass Project beyond 2019 for conveyance of stormwater from the GDA using the San Luis Drain. The dry-weather discharge of drainwater to the Drain would be discontinued. Key assumptions in drainwater management under this alternative include recirculation of drainwater collected in sumps and reuse of drainwater from sumps. The SJRIP reuse area would be used to apply excess drainwater from GDA sumps to salt-tolerant crops. Sumps for tile drains would be turned off prior to storm events and storm runoff up to an equivalent volume of 3 inches of rain on the SJRIP could be reused within the 7,550 acres of the SJRIP reuse area prior to discharge.

The Proposed Action also includes construction of regulating reservoirs at locations that would allow excess stormwater to be diverted out of the channels and into the reservoirs. The approximate combined volume of these reservoirs would be about 1,500 acre feet (an additional 500 acre-feet of storage is available in the existing Panoche and Pacheco regulating reservoirs). Additional pump stations and conveyance facilities would be required to divert stormwater flows into the reservoirs and to release the flows from the reservoirs. Total diversion capacity for the pump stations are expected to be 50 cfs.

Stormwater runoff would be managed within the GDA through diversions to existing and proposed regulating reservoirs. The first 5 cfs of stormwater runoff would be conveyed to the Grassland Bypass Channel and the next 25 cfs would be pumped to and stored within the District's regulating reservoirs. The pumps and regulating reservoirs could also be used to divert smaller storm events, storm events occurring late in the season, or flows up to the full diversion capacity of the pumps. It is possible that these ponds could completely contain the flows generated by such events. Once the rainfall subsides, the captured water would be conveyed to the SJRIP for reuse whenever practical. Depending on time of year, some water could be stored in the regulating reservoirs for a month or more. Total flow from the GDA to the San Luis Drain would not exceed 150 cfs due to capacity limitations in the siphon under the Main Canal.

1.2.2.4.1 Grassland Drainage Area

During dry weather, water quality in surface drains and supply canals would be similar to existing and No Action conditions for constituents of concern (Se, boron, and salt) due to similar levels of recycling in the Proposed Action. During wet weather, there would be less potential for ponded water in low-lying areas because excess stormwater flows would be diverted to new regulating reservoirs. This alternative would have a moderate beneficial effect in the GDA as compared to the existing and No Action conditions.

1.2.2.4.2 Mud Slough Upstream of San Luis Drain Discharge, Salt Slough, Wetland Channels, and San Joaquin River Upstream of Mud Slough

The water quality in sloughs and rivers upstream of the discharge point would not change relative to existing conditions, and, therefore, have no impact.

Under flood conditions, runoff from the Panoche/Silver Creek watershed has historically resulted in emergency releases of floodwaters to wetland supply channels at Camp 13 Ditch and Agatha Canal if drainage from the GDA exceeded the maximum capacity of the Grassland Bypass Channel of 150 cfs. During periods of heavy rain, bypass of the Grassland Bypass Channel was necessary to protect the structural stability of the channel, to prevent resuspension of sediment in the Drain, and to prevent introduction of a large sediment load into the Drain. The Proposed Action includes the diversion of excess stormwater flows to the new regulating reservoirs, discharging the remaining flows through the Grassland Bypass and the Drain. The headgates to the Camp 13 Ditch and Agatha Canal would remain closed. Therefore, there would be no flood releases to the wetland supply channels (a beneficial effect or no impact under CEQA). Flood flows are not released to wetland channels in the No Action Alternative; therefore, there would be no change and no impact compared to No Action.

1.2.2.4.3 San Luis Drain

Water quality in the Drain is expected to remain similar to existing conditions or improve under the Proposed Action because sumps would be turned off prior to wet weather flows (a beneficial effect or no impact under CEQA). The Proposed Action also represents an improvement to water quality in the Drain, i.e., a moderate beneficial effect compared to No Action.

1.2.2.4.4 Mud Slough (North) Downstream of San Luis Drain Discharge

Water quality in Mud Slough (north) downstream of the Drain is expected to improve relative to existing conditions due to the GBD modifying operation of the drainage system, including the integration of regulating reservoirs to reduce discharge and turning off sumps prior to and during wet weather flows using the new SCADA system. However, water quality would still be poorer at this site as compared to the No Action Alternative due to the Se, boron, salt, and molybdenum contribution in stormwater discharges from the GDA and the No Action assumption of no discharge to Mud Slough.

Although the Se, boron, salt, and molybdenum concentrations are expected to decrease due to turning off drainage sumps prior to and during wet weather flows, on rare occasions Se concentrations are predicted to be above WQOs (5 µg/L 4-day average) in dry and critically dry years when dilution flows in Mud Slough upstream of the Drain are reduced (see Attachment A). When evaluated on an event basis (which could include one or more consecutive days), exceedances would occur on average once every 3.5 years. These exceedances would occur less frequently than EPA guidelines which allow for a violation of water quality standards once every 3 years. Se concentrations in Mud Slough (North) downstream of the Drain were not above the Se performance goal of 15 µg/L monthly mean during existing conditions.

The Se concentrations are expected to be reduced under the Proposed Action, a beneficial effect. However, because the WQO would change from the monthly mean of 15 µg/L to a 4-day average of 5 µg/L, the frequency of exceedances of the applicable water quality criteria would be increased as compared to existing conditions due to the reduced WQO. Therefore, while there may be an increase in the number of exceedances for Se due to the decrease in the WQO used as the criterion, it is expected that the water quality in Mud Slough (North) as it relates to Se conditions would be improved and the frequency of exceedances is considered a less-than-significant impact (i.e., the EPA allows a violation of water quality standards at a frequency no greater than once every 3 years).

Monthly average boron concentrations in Mud Slough downstream of the Drain are expected to be greater than 2 mg/L in some months during both the wet and dry season. When there is no flow from the Drain, concentrations would be the same as found in Mud Slough (North) upstream of the Drain (occasionally above a 2 mg/L monthly average), but stormwater discharges from the Drain could occasionally contribute to exceedances of the 2 mg/L monthly average WQO downstream of the Drain in April. Because boron concentrations are expected to decrease during winter months due to turning off drainage sumps prior to and during wet weather flows, the frequency of exceedances above the WQO are expected to decrease as compared to existing conditions. Therefore, changes to boron concentrations would have a less than significant impact in comparison to existing conditions.

Concentrations of Se, boron, molybdenum, and salt would increase compared to the No Action Alternative (an adverse effect) due to the No Action assumption of no discharge to Mud Slough.

1.2.2.4.5 San Joaquin River (Mud Slough to Merced River)

Water quality in the San Joaquin River downstream of Mud Slough (North) and upstream of the confluence with the Merced River is expected to improve relative to existing conditions due to lower Se, boron, salt, and molybdenum concentrations in stormwater from the GDA. However, water quality is predicted to be poorer at this site as compared to the No Action Alternative due to the wet weather discharges from the Drain, as opposed to the No Action assumption of no discharge.

The San Joaquin River downstream of Mud Slough (North) and upstream of the confluence with the Merced River is subject to the 5 µg/L 4-day average Se WQO after 2019. Although Se concentrations are expected to decrease in this reach, water quality modeling predicted one event that exceeded the WQO in the 21 years of modeled hydrological flow. A single exceedance is considered a less-than-significant impact (i.e., the EPA allows a violation of water quality standards at a frequency no greater than once every 3 years).

Boron concentrations are also expected to decrease with the Proposed Action. Modeled concentrations show no exceedance of the 2.0 mg/L monthly mean WQO for boron.

Concentrations of Se, boron, molybdenum, and salt would increase compared to the No Action Alternative.

1.2.2.4.6 San Joaquin River (Merced River to Crows Landing or Vernalis)

Water quality in the San Joaquin River from the confluence with the Merced River to Crows Landing is expected to improve relative to existing conditions due to lower Se, boron, salt, and molybdenum concentrations in stormwater from the GDA. However, water quality is predicted to be poorer at this site as compared to the No Action Alternative due to the wet weather discharges from the Drain, as opposed to the No Action assumption of no discharge.

Se concentrations in the San Joaquin River downstream of the Merced River is expected to meet the 5 µg/L 4-day average Se WQO (see Attachment A).

With the exception of a single modeled event out of 21 years simulated that occurred during a dry year, boron concentrations are expected to meet mean monthly and maximum WQOs associated with wet season, dry season, and critical years in the San Joaquin River downstream of the Merced River. A single exceedance is considered a less than significant impact (i.e., the EPA allows a violation of water quality standards at a frequency no greater than once every 3 years).

1.2.2.4.7 Sediment Accumulation in the San Luis Drain

Sediment has been found to accumulate in the Drain. Once additional sediment accumulates to the extent that it would pose a problem to the use of the Drain or to downstream resources, the sediment would be removed in accordance with the proposed Use Agreement, applicable laws and regulations, and the Sediment Management Plan. This impact is less than significant.

1.2.2.4.8 San Joaquin River Water Quality Improvement Project

The Proposed Action would operate the SJRIP area in a similar manner as existing conditions. The SJRIP reuse area dedicates specific lands for the irrigation of salt-tolerant crops with subsurface drainwater. Ponding is prevented by operating tailwater and subsurface drainage return systems and by controlling the rate of drainwater application; therefore, no significant impacts would result.

1.2.2.5 Stormwater Discharge of ≤300 cfs (Alternative Action)

The Alternative Action is similar to the Proposed Action in all aspects except for the construction and operation of new regulating reservoirs, which would not occur. Instead, the capacity of the siphon under the Main Canal and the capacity of the Grassland Bypass Channel would be increased to convey flows up to 300 cfs. This would allow for additional water to be conveyed to the Drain in the rare case when there is more than 150 cfs of stormwater runoff from the GDA.

1.2.2.5.1 Grassland Drainage Area

Impacts to the GDA are the same as those predicted for the Proposed Action, with the exception that the potential for ponding in the GDA during large storm events would be reduced because more stormwater flow would be able to be conveyed through the Drain.

1.2.2.5.2 Mud Slough Upstream of San Luis Drain Discharge, Salt Slough, Wetland Channels, San Joaquin River Upstream of Mud Slough

Impacts to these river reaches are the same as those predicted for the Proposed Action.

1.2.2.5.3 San Luis Drain

Impacts to the Drain are the same as those predicted for the Proposed Action.

1.2.2.5.4 Mud Slough (North) Downstream of San Luis Drain Discharge

Impacts to Mud Slough (north) downstream of the Drain are greater than those predicted for the Proposed Action. Concentrations are expected to be higher during the rare storm event when more than 150 cfs is conveyed through the Drain. The amount of water conveyed through the Drain is also greater during smaller storms, since there is no additional storage in the regulating reservoirs (only the proposed action has an additional 1,000 acre-feet of storage) to divert small flows. Therefore, there are more exceedances when there are limited dilution flows in Mud Slough (north) upstream of the Drain (Site C). Se concentrations are expected to be greater than the 5 µg/L 4-day average Se WQO more frequently during both wet and dry years, a potentially significant impact.

1.2.2.5.5 San Joaquin River (Mud Slough to Merced)

Impacts to the San Joaquin River from Mud Slough to the Merced River are the same as those predicted for the Proposed Action, with the exception that concentrations are expected to be higher during the rare storm event when more than 150 cfs is conveyed through the Drain.

1.2.2.5.6 San Joaquin River (Merced River to Crows Landing)

Impacts to the San Joaquin River downstream of the Merced River are the same to those predicted for the Proposed Action, with the exception that concentrations are expected to be higher during the rare storm event when more than 150 cfs is conveyed through the Drain.

1.2.2.5.7 Sediment Accumulation in the San Luis Drain

Impacts from sediment accumulation under the Alternative Action would be similar to those described under the Proposed Action, with the exception that maintenance activities for the Drain would need to be completed prior to conveying flows greater than 150 cfs.

1.2.2.5.8 San Joaquin River Water Quality Improvement Project

Impacts from the SJRIP reuse facility would be the same as described for the Proposed Action.

1.2.3 Cumulative Effects

Cumulative effects are impacts associated with the action alternatives that are not significant on their own but, when combined with the impacts of other projects and plans in the region, can have incremental effects that would result in a significant effect. The implication is that numerous insignificant effects can create a significant effect. This section discusses other plans and programs in the Central Valley and Bay-Delta regions that could have significant cumulative effects.

1.2.3.1 Central Valley Project Improvement Act

The CVPIA amends the previous authorizations of the Central Valley Project (CVP) to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic uses and fish and wildlife enhancement as a project purpose equal to power generation. In response to these requirements the U.S. Department of the Interior has developed programs to improve environmental conditions and modify operations, management, and physical facilities of the CVP. The primary element in the CVPIA affecting the Project Area involves the delivery of surface water supplies for fish and wildlife refuges on the San Joaquin

River tributaries. Refuges in the Project Area receiving approximately 270,000 acre-feet per year are hydrologically connected to San Joaquin River in the Project vicinity. Delivery of this water to wetlands and its subsequent release back to the San Joaquin River, primarily during April and May, could result in higher river flows that could provide additional assimilative capacity in the San Joaquin River and tributaries for Se during these months. This is a potential beneficial effect for the San Joaquin River.

Wetland water releases are elevated in TDS and organic carbon, constituents of concern to municipal drinking water supplies. Therefore, the load of organic carbon and TDS discharged to the San Joaquin River may increase as a result of implementation of the CVPIA. The Final Programmatic EIS indicated impacts to drinking water agencies that remove water from the Delta could be significant during the spring and early summer for dissolved organic carbon (Reclamation 1999). Impacts for TDS were less than significant for the Delta following mitigation and less than significant (generally less than 10 percent different) for the San Joaquin River at Vernalis. Grassland Bypass Action Alternatives would result in less salt, boron, and Se discharged compared to existing conditions. Therefore, the Project Alternatives would not contribute to the cumulative impact of nonproject actions on the San Joaquin River and south Delta.

1.2.3.2 San Joaquin River Restoration Settlement

A litigation Settlement among the Natural Resources Defense Council (NRDC), Friant Water Users Authority, the U.S. Department of the Interior, and the U.S. Department of Commerce in the case of NRDC v. Rodgers was approved in late 2006 by the U.S. District Court in Sacramento. The Settlement ended an 18-year legal dispute over the operation of Friant Dam and resolved longstanding legal claims brought by a coalition of conservation and fishing groups led by the NRDC.

The Settlement provides for substantial river channel improvements and sufficient water flow to sustain a salmon fishery upstream from the confluence of the Merced River tributary, while providing water supply certainty to Friant Division water contractors. At the heart of the Settlement is a commitment to provide continuous flows in the San Joaquin River to sustain naturally reproducing Chinook salmon and other fish populations in the 153-mile stretch of the San Joaquin River between Friant Dam and the Merced River. Accomplishing this goal will require funding and constructing extensive channel and structural improvements in many areas of the river, including some that have been without flows (except for occasional flood releases) for decades. Interim and restoration flows are currently being released to the approximately 60 miles of previously dry river through the San Joaquin River Restoration Program. Additional levee improvements and seepage management projects will be needed to provide additional capacity in section of the river; once complete, full restoration flows will be released to the river.

Action Alternatives would result in less Se, boron, salt, and molybdenum in the lower San Joaquin River, which would be consistent with fisheries restoration in the lower San Joaquin River.

1.2.4 Impact Summary

Impacts are presented for the No Action and the twoAction Alternatives. Impacts are discussed by affected area. Significance determinations under the California Environmental Quality Act of

1970 (CEQA) are based on the identified criteria in the previous discussion and on comparisons to the existing conditions baseline, which is represented by Water Years 2015 to 2018 and had no dry season drainage discharged to the Drain. The impact/effects terminology in this technical report is consistent with the National Environmental Policy Act of 1969 (NEPA) as implemented by the US. Bureau of Reclamation. NEPA requires a comparison of the Action Alternatives with a No Action baseline, which is the reasonably foreseeable future condition without the project. CEQA requires a determination of impact significance or no impact based on existing conditions. These impacts are discussed below.

1.2.4.1 No Action Alternative

1.2.4.1.1 Impacts in Sloughs and in the San Joaquin River Upstream of the Confluence with the Merced River

- During storm events, substantial ponding could occur in low-lying areas of the GDA and non-GDA lands that previously drained to the Grassland Bypass Channel. (Some lands within this area may experience waterlogged soils and loss of productivity.) This ponding means water on the ground surface that may have elevated Se concentrations, a potentially significant impact (adverse effect).
- Se, boron, molybdenum, and salinity in Mud Slough and the San Joaquin River downstream of Mud Slough would improve under this alternative. Since WQOs for Se and boron would be achieved more frequently in Mud Slough than under existing conditions, this is a beneficial effect for Se and boron.

1.2.4.1.2 Impacts in Wetlands

- Uncontrolled flow from outside of the GDA (that formerly discharged to the Grassland Bypass Channel) may enter into wetland supply channels resulting in Se concentrations higher than WQOs. Concentrations of molybdenum, boron, and salinity could also increase due to uncontrolled flow. This is a potentially significant impact for Se and a less-than-significant impact for boron, molybdenum, and salinity.

1.2.4.1.3 Impacts to San Joaquin River Downstream of the Merced River

- Se, boron, and salinity concentrations in the San Joaquin River downstream of the confluence with the Merced River are predicted to decrease as compared to existing conditions. Decreases in the Se, boron and salinity concentrations are predicted to result in fewer exceedances of applicable WQOs. These are beneficial effects for Se, boron, and salinity.

1.2.4.1.4 Sediment Accumulation in San Luis Drain

- No additional sediment input or accumulation would occur from the GDA, which would be an improvement over existing conditions.

1.2.4.2 Proposed Action

1.2.4.2.1 Impacts in Sloughs and in the San Joaquin River Upstream of the Confluence with the Merced River

- Concentrations of Se, boron, molybdenum, and salinity would decrease in Mud Slough and in the San Joaquin River between Mud Slough and the Merced River relative to existing conditions as a result of this alternative, a beneficial effect under NEPA and no impact under CEQA.
- Concentrations of Se, boron, and salinity in Salt Slough and in the San Joaquin River upstream of Mud Slough would remain the same as existing conditions, i.e., no impact.
- On rare occasions, Se concentrations are expected to be above WQOs (5 µg/L 4-day average) in Mud Slough (North) downstream of the Drain in dry and critically dry years when dilution flows in Mud Slough upstream of the Drain are reduced. Because selenium concentrations are currently below performance objectives (15 µg/L monthly mean), the exceedance frequency of applicable water quality criteria would be increased due to the WQO decrease rather than a physical change to existing conditions. The impact of an increase in the number of exceedance is considered less than significant because exceedance would be rare and within allowances recommended by the EPA
- Because boron concentrations are expected to decrease during winter months, the frequency of excursions above the boron WQO in Mud Slough (North) downstream of the Drain are expected to decrease as compared to existing conditions, a beneficial effect or no impact.
- Concentrations of Se, boron, molybdenum, and salinity would increase downstream of the Drain compared to the No Action Alternative, an adverse effect.

1.2.4.2.2 Impacts in Wetlands

- Occasional temporary increases in Se, boron, molybdenum, and salinity in wetland water supply channels are predicted during high flow storm events. The frequency of these events is predicted to decrease compared to existing conditions, a beneficial effect or no impact.
- Compared to the No Action Alternative, Se, boron, molybdenum, and salinity concentrations in wetlands and wetland supply channels from seepage and uncontrolled flows are expected to decrease due to the ability to bypass flows around the wetlands through use of the Drain, a beneficial effect.

1.2.4.2.3 Impacts in the San Joaquin River Downstream of the Merced River

- Se, boron, molybdenum, and salinity concentrations in the San Joaquin River downstream of the Merced River would decrease relative to existing conditions under this alternative and WQO for Se and boron are expected to be met, a beneficial effect or no impact.
- Se, boron, molybdenum, and salinity concentrations in the San Joaquin River downstream of the Merced River are predicted to increase as compared to the No Action Alternative, an adverse effect.

1.2.4.2.4 Sediment Accumulation in the Drain

- Additional sediment would accumulate in the Drain over the duration of the Proposed Action. Sediment accumulation would be monitored and sediments would be removed in accordance with a Sediment Management Plan, a less than significant impact.

1.2.4.3 Alternative Action

1.2.4.3.1 Impacts in Sloughs and in the San Joaquin River Upstream of the Confluence with the Merced River

- Impacts are greater than those predicted for the Proposed Action. Concentrations are expected to be higher during the rare storm event when more than 150 cfs is conveyed through the Drain. The amount of water conveyed through the Drain is also greater during smaller storms since there is no additional storage in the regulating reservoirs (the proposed action has an additional 1,000 acre-feet of storage) to divert small flows. Therefore, there are more exceedances when there are limited dilution flows in Mud Slough (north) upstream of the Drain (Site C). Se concentrations are expected to be greater than the 5 µg/L 4-day average Se WQO more frequently during both wet and dry years, a potentially significant impact.

1.2.4.3.2 Impacts in Wetlands

- Impacts are the same as those predicted for the Proposed Action, with the exception that the potential for emergency releases of floodwaters to wetland supply channels would be reduced because more stormwater flow would be able to be conveyed through the Drain.

1.2.4.3.3 Impacts in the San Joaquin River Downstream of the Merced River

- Impacts are the same as those predicted for the Proposed Action, with the exception that concentrations are expected to be higher during the rare storm event when more than 150 cfs is conveyed through the Drain.

1.2.4.3.4 Sediment Accumulation in the Drain

- Impacts are the same as those predicted for the Proposed Action, with the exception that maintenance activities for the Drain would need to be complete prior to conveying flows greater than 150 cfs.

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