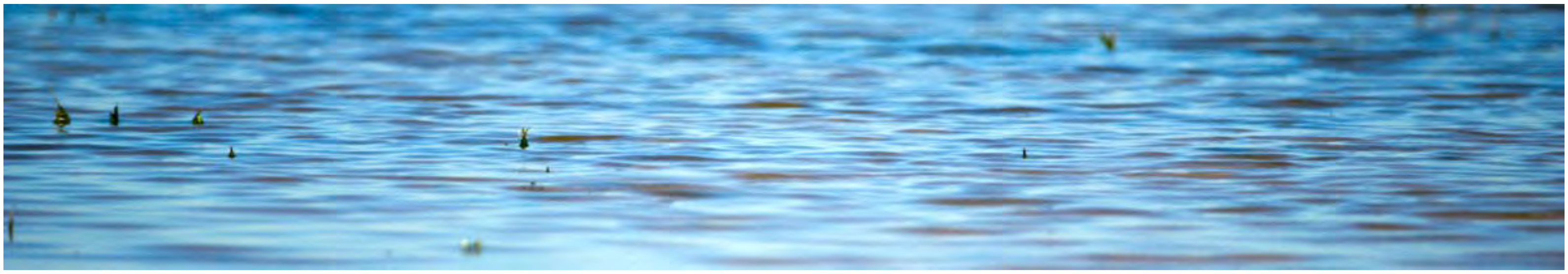
Appendix A Notice of Preparation and Initial Study



NOTICE OF PREPARATION AND INITIAL STUDY OF AN ENVIRONMENTAL IMPACT REPORT AND PUBLIC SCOPING MEETING

FOR THE PALMS GROUNDWATER RECOVERY PROJECT

Prepared for:

Buena Vista Water Storage District

June 16, 2020

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NOTICE OF PREPARATION AND INITIAL STUDY OF AN ENVIRONMENTAL IMPACT REPORT AND PUBLIC SCOPING MEETING

FOR THE PALMS GROUNDWATER RECOVERY PROJECT

Prepared for:

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June 16, 2020

Project No. 1610807, Task 1.1008

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Table of Contents

List of Tables

List of Figures

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1.0 Notice of Preparation

1.1 NOTICE OF PREPARATION

Notice is hereby given that the Buena Vista Water Storage District (BVWSD or District) (Lead Agency) will prepare an Environmental Impact Report (EIR) for the proposed Palms Groundwater Recovery Project (Recovery Project). The EIR will address the potential physical and environmental effects of the Recovery Project for each of the environmental topics outlined in the California Environmental Quality Act (CEQA). The District will use the EIR when considering approval of the proposed Recovery Project. Responsible Agencies, which are public agencies other than the District that have a role in approving or implementing the Recovery Project, will also need to consider the EIR when issuing approvals for the implementation of the Recovery Project. The District has prepared this Notice of Preparation (NOP) / Initial Study (IS) to provide Responsible Agencies, Trustee Agencies, and other Interested Parties with a description of the proposed Recovery Project and to identify potential environmental effects pursuant to State CEQA requirements. The NOP/IS for the proposed Recovery Project is available for review on the District's website at http://bvh2o.com/Projects.html. Under CEQA, a Lead Agency (in this case, the District) shall conduct an IS to determine if a project may have a significant effect on the environment (CEQA Guidelines Section 15063[a]). If the Lead Agency determines there is substantial evidence that any aspect of the project may cause a significant effect on the environment, the Lead Agency shall prepare an EIR, or one of the other options listed in CEQA Guidelines Section 15063(b)(1). The District has prepared an IS and made a determination that the Recovery Project may cause a significant effect on the environment, so an EIR will be prepared.

1.2 PUBLIC REVIEW AND COMMENT PERIOD

Further notice is hereby given that the District invites comments on the scope and content of the EIR in response to this NOP/IS. Pursuant to Section 15082 of the State CEQA Guidelines, this NOP/IS will be circulated for a 30-day review period. At a minimum, responses to this NOP/IS should focus on the potentially significant environmental effects that the proposed Recovery Project may have on the physical environment that should be addressed in the EIR, ways in which those effects might be minimized, and potential alternatives to the proposed Recovery Project that should be addressed in the EIR. In your response, include your name, the name of your agency or organization (if applicable), and contact information. Comments on the NOP/IS may be received in writing at the above District mailing address to the attention of Tim Ashlock, or via email to tim@bvh2o.com, by 8:30 a.m. on July 17, 2020. In addition, comments may be provided at the Public Scoping Meeting, noticed below.

1.3 PUBLIC SCOPING MEETING

Further notice is hereby given that the District has scheduled a Public Scoping Meeting at the time and location indicated below. The purpose of the Public Scoping Meeting is to describe the proposed Recovery Project and the environmental review process, and to receive verbal input. The

District will consider all comments, written and oral, in determining the final scope of the evaluation to be included in the EIR.

Public Scoping Meeting:
Thursday, July 2, 2020, 11:00 a.m.
https://zoom.us/j/89798178986
Password: 546152
or
Dial in: 1-669-900-6833
Password: 546152

1.4 PROJECT DESCRIPTION

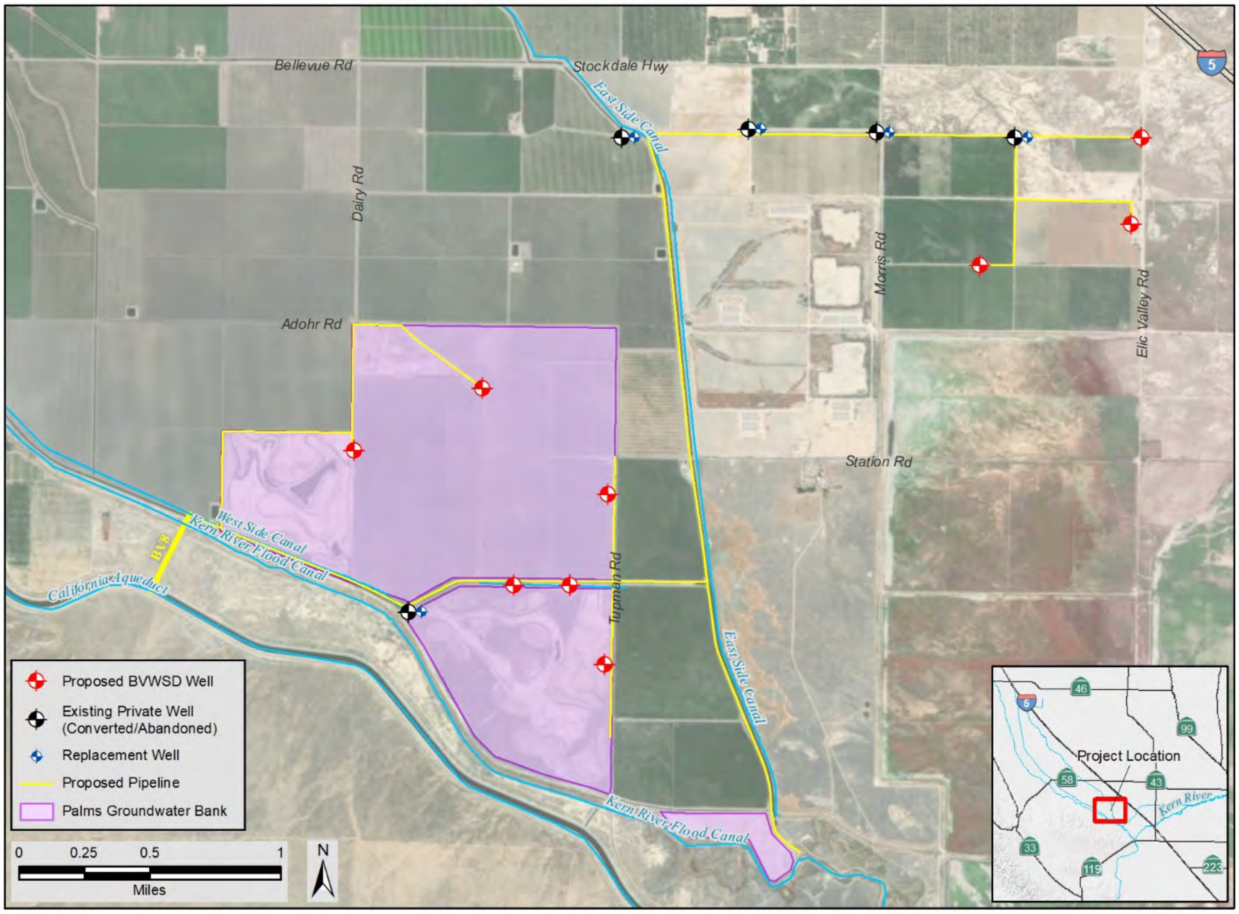
1.4.1 *Introduction*

The District is located in the southern San Joaquin Valley, approximately 16 miles west of the city of Bakersfield and encompassing the town of Buttonwillow. The District has a gross area of approximately 49,000 acres and lies within a portion of the lower Kern River Watershed characterized by heavy clay soils originating from former swamp and overflow lands.

The District is divided into two distinct service areas. The principal service area, known as the Buttonwillow Service Area, is situated north of the historic Buena Vista Lake. The smaller service area, lying east of the historic Buena Vista Lake, is known as the Maples Service Area.

The District has successfully followed a conjunctive management policy by which surface water is recharged when available and stored in the principal aquifer system for recovery by pumping in years when surface water is insufficient to meet demands. Conjunctive management within the District begins with deliveries of surface water from the Kern River and the California Aqueduct with these two sources generating an average annual supply sufficient to meet District-wide demands. Thus, during years when supplies are above average, surface water is recharged, and during years when supplies are limited, recharged water is pumped as a supplemental source of supply.

A high proportion of recharge in the District takes place through seepage from facilities constructed by the District including canals, laterals and recharge basins. In January 2016, the District approved construction of the Palms Groundwater Banking Project (Palms Project) in the southern portion of the Buttonwillow Service Area. The Palms Project is a groundwater replenishment and water banking project that covers approximately 1,150 acres and includes features needed to apply surface water for groundwater recharge (**Figure 1-1**).



14May2020 RS Z:\Projects\1610807_BV-Palm Springs\1610807_G008_ProjectLocation.mxd

Figure 1-1. Project Location and Site/

An Initial Study/Mitigated Negative Declaration (IS/MND) (SCH # 2015121030) was prepared for the Palms Project in 2015, and the Notice of Determination was filed in January 2016. Initial construction of the recharge portion of the project was completed in 2016. The recharge ponds were subsequently enlarged and today are located within an area of approximately 1,150 acres. To date, the District has recharged approximately 27,166 acre-feet of surplus water in the Palms Project, 14,164 acre-feet in 2017 and 13,002 acre-feet in 2019. High quality water recharged at the Palms Project flows to aquifers that are sources for domestic and municipal wells providing water to residents of Taft, Tupman, and to the disadvantaged community of Buttonwillow, and replenishes groundwater under the Tule Elk Reserve.

The purpose of this Initial Study is to analyze the potential environmental impacts of the Recovery Project.

1.4.2 *Project Facilities and Construction*

In order to extract water banked within the District, including but not limited to water recharged in District canals and the Palms Project, the District would utilize a suite of 14 wells: nine proposed new wells and five replacement wells (**Figure 1-1**).

Conveyance pipes would be installed to connect new and replacement wells for the Recovery Project water delivery system. Construction activities would include excavation and trenching to install the wells, and approximately 11.9 miles of conveyance pipe. The total area of disturbance would be approximately 72 acres. The new and replacement wells would be drilled to a depth of up to 500 feet and include an 18-inch casing. Trench depths would be 5 feet for pipes less than 24 inches and 6 feet for pipes greater than 24 inches in diameter. Trench widths would be 3 feet for pipe sizes less than or equal to 24 inches and 6 feet for pipes greater than 24 inches. Anticipated construction activities would begin in the fall of 2020 and be completed within 11 months. Staging areas for the construction equipment and materials would be adjacent to the Recovery Project area on previously disturbed land. Construction vehicles for the pipeline would consist of a front wheel loader, two excavators, two water trucks, backhoe, and three pickup trucks. Construction equipment for the well construction would consist of a drilling rig, air compressor, backhoe, and pipe trailer.

The water pipelines will connect to the District's existing turnout at the California Aqueduct at BV8. BV8 can be used to either input water to the Aqueduct or to withdraw water from the Aqueduct.

1.4.3 *Project Operation*

Available surplus water supply will continue to be recharged at the Palms during wet years. The District anticipates recharging up to 100,000 acre-feet annually through the Palms Project when surplus water supply is available. The District also recharges groundwater through their existing canal system during wet years, a District practice for many decades.

Water recovered by the District will be distributed to District water users or exchanged with other districts or sold to other industrial or municipal users. This Recovery Project may also discharge into the California Aqueduct to satisfy existing and future water contracts between the District and other Public Water Agencies.

The Recovery Project will be managed so that groundwater elevations will, in the long term, improve from those observed historically. Annual water recovery will be limited to no more than 25,000 acre-feet. Wells will be pumped at a rate of no more than 5 cfs, and the wells selected for recovery will be selected to optimize groundwater recovery and minimize impacts to groundwater levels.

For landowners, there would be an alternative delivery option of groundwater recovery to provide flexibility by allowing private pumping in lieu of surface water deliveries. Landowners would have the option, in addition to surface water delivery, utilize on-farm wells to pump water for irrigation needs or continue to receive surface water deliveries through the District canals and pipelines. No additional District facilities would need to be constructed for this alternative delivery option. Landowners interested in this optional delivery method would be required to sign up for the District program, and participation would be limited by the amount of water available for recovery, no more than 25,000 acre-feet per year.

This alternative delivery option would allow wider participation and flexibility for water users. It is anticipated that water users south of Perral Road in the Buttonwillow Service Area would be eligible to participate in the program. The water pumped from landowner wells would be treated as recovered water, leaving a similar amount of water (SWP, Kern River, or other water) available for a different beneficial use.

1.4.4 *Water Quality*

For the District to use the California Aqueduct (Aqueduct) to convey the recovered groundwater, approval of the Department of Water Resources (DWR) is required. It is DWR policy to assist with the conveyance of water to provide a reliable water supply, and to protect the State Water Project (SWP) water quality within the Aqueduct. In order to facilitate this policy, DWR provides an implementation process to accept Non-SWP Project water into the Aqueduct. To do so, the District is required to submit a Pump-In Proposal (PIP) to DWR which identifies the water sources, planned operation, inflow water quality, and any anticipated impacts to SWP water quality and/or operations. The PIP will also include a water quality monitoring plan in order to continuously demonstrate that the water quality is consistent with that of the Aqueduct water.

In order to ensure that water quality will meet DWR requirements, aquifer isolation zone water quality testing will be conducted. The wells will then be designed to collect water from portions of the aquifer with favorable water quality. This method will likely be used during construction of the first few wells and may be discontinued for wells constructed after the local water quality parameters are better understood.

1.4.5 *Memorandum of Understanding*

On October 26, 1995, the Kern Water Bank Authority and its Member Entities (including Buena Vista Water Storage District, Rosedale-Rio Bravo Water Storage District, Kern Delta Water District, Henry Miller Water District, and West Kern Water District, as the "Adjoining Entities," entered into a Memorandum of Understanding (MOU), which provides that "…any future project within the Kern Fan Area, the Parties hereto shall use good faith efforts to negotiate an agreement substantially similar in substance to this MOU…" In subsequent years, a Joint Operating Committee has been formed among these parties, which utilizes multiple groundwater models to assess impacts to groundwater from banking and recovery operations. Therefore, the District will either amend the existing MOU or develop a new MOU, or join the Joint Operating Committee, to address the operation and monitoring of the Recovery Project.

1.4.6 *Project Objectives*

The Recovery Project has the following primary objectives:

- Increase conjunctive management on the west side of Kern County by improving the District's ability to meet demands during periods when supply of surface water is limited with previously banked water supplies.

- Improve conveyance of previously stored water throughout the District and to neighboring Districts.
- Provide water for urban use in Kern County and possibly elsewhere.

1.4.7 *Project Benefits*

The Recovery Project will provide up to 25,000 acre-feet of banked groundwater to the District's water customers in dry years, while meeting the requirements of the Sustainable Groundwater Management Act.

1.4.8 *Need for Project*

The District has a net irrigated acreage maximum of about 40,000 acres. Currently about half the District lands are planted with permanent crops, as growers migrate away from row crops. The conversion to permanent crops may increase the water demand by 1 acre-foot per acre. In the short term, this conversion typically reduces demand, as a pistachio tree will not reach full demand for water until about the 12^{th} year, with the first year being as low as 0.25 acre-feet per acre. The Recovery Project will allow for the highs and lows of the District's water supply to be managed in a manner that ensures full production of permanent crops regardless of the current years water supply.

With the District's Kern River Water Supply as well as its State Water Project water supply, the District should be able to meet future demands. This Recovery Project will help in meeting those demands, as well as being available to partner with others to help meet their water supply needs.

1.5 AGENCY REVIEW AND APPROVALS

The District is required to apply for approval from the California Department of Water Resources to pump into the California Aqueduct.

1.6 PROBABLE ENVIRONMENTAL IMPACTS

The EIR will address environmental impacts of the Recovery Project's construction and operation activities and will propose mitigation measures to address significant impacts that are identified. The following describes the anticipated environmental issues that will be addressed in the EIR.

- **Biological Resources –** The Recovery Project area contains natural lands with native habitat that may be suitable for special-status species. The EIR will evaluate potential impacts of the Recovery Project on terrestrial special-status animal and plant species, sensitive habitats, mature native trees, and migratory birds that may occur in the Recovery Project area.
- **Cultural Resources –** Based on archival records search, background studies, and on-foot surface reconnaissance cultural resources survey, one prehistoric archaeological site has been recorded in the Recovery Project's vicinity. The EIR will include an evaluation of whether the site will be impacted and provide mitigation, if necessary, to reduce impacts.

Concurrently with release of this NOP, the District will extend invitations to consult with Native American tribes that are traditionally and culturally affiliated with the geographic area of the Recovery Project and that have filed written request to be notified of opportunities to consult. Because the time period for tribes to respond will remain open through the NOP process, it is uncertain at this time whether the Recovery Project could impact tribal cultural resources. The EIR will, therefore, include a discussion of potential impacts to these resources.

- **Hydrology and Water Quality –** Through the use of groundwater modeling and hydrogeologic analyses, the EIR will evaluate changes in local groundwater quality, storage, and levels within the groundwater basin as a whole and their subbasins, as appropriate. The EIR will describe potential impacts of recovery activities and evaluate compliance with the Groundwater Sustainability Plan(s) under the Sustainable Groundwater Management Act.

Impacts Not Found Significant. The EIR will also explain why other effects were determined to not be potentially significant and were not discussed in detail in the EIR. For example, the Recovery Project site is in an agricultural area, would not damage scenic resources, or produce light and glare; therefore, no significant aesthetic impacts are anticipated. The Recovery Project would not result in additional service/utility demands related to police or fire protection, schools, parks and recreation, or wastewater generation. Impacts to air quality, agriculture and forestry resources, geology, hazards and hazardous materials, population and housing, mineral resources, and wildfire are also expected to be less than significant, or less than significant with mitigation incorporated, and therefore will be discussed in this section.

Other Sections. The EIR will include additional topics as required by the CEQA Guidelines including growth inducement, cumulative impacts, and alternatives.

The EIR will also examine a reasonable range of alternatives to the Recovery Project, including the CEQA-mandated No Project Alternative, and other potential alternatives that may be capable of avoiding or substantially reducing any of the significant effects of the Recovery Project.

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2.0 Initial Study

Project Information

#1. Project title:	Buena Vista Water Storage District Palms Groundwater Recovery Project
#2. Lead agency name and address:	Buena Vista Water Storage District
#3. Contact person and phone number:	Tim Ashlock (661) 324-1101
#4. Project location:	Buena Vista Water Storage District, and an annexed area located to the east of the Buena Vista Water Storage District (*see* Figure 1-1).
#5. Project sponsor's name and address:	Same as lead agency
#6. General plan designation:	Agriculture
#7. Zoning:	Agriculture
#8. Description of project: (Describe the whole action involved, including but not limited to later phases of the project, and any secondary, support, or off-site features necessary for its implementation. Attach additional sheets if necessary.)	The Recovery Project includes the development of conveyance pipelines and wells to facilitate the recovery of previously stored groundwater.
#9. Surrounding land uses and setting: Briefly describe the project's surroundings:	The Recovery Project is located near the unincorporated community of Buttonwillow, Kern County, in an area dominated by agricultural production. Several other small, unincorporated communities such Lokern and Tupman are located within the vicinity of the Recovery Project. The city of Bakersfield is located approximately 23 miles east of the Recovery Project site.
#10. Other public agencies whose approval is required (e.g., permits, financing approval, or participation agreement.)	California Water Resources Control Board, and the San Joaquin Valley Air Pollution Control District
#11. Have California Native American tribes traditionally and culturally affiliated with the project area requested consultation pursuant to Public Resources Code (PRC) Section 21080.3.1? If so, is there a plan for consultation that includes, for example, the determination of significance of impacts to tribal cultural resources, procedures regarding confidentiality, etc.?	Yes. Consultation is described in more detail in Cultural Resources and Tribal Cultural Resources.

Note: Conducting consultation early in the California Environmental Quality Act (CEQA) process allows tribal governments, lead agencies, and project proponents to discuss the level of environmental review, identify and address potential adverse impacts to tribal cultural resources, and reduce the potential for delay and conflict in the environmental review process. (*See* PRC Section 21080.3.2.) Information may also be available from the California Native American Heritage Commission’s Sacred Lands File per PRC Section 5097.96 and the California Historical Resources Information System administered by the California Office of Historic Preservation. **Please also note** that PRC Section 21082.3(c) contains provisions specific to confidentiality.

Environmental Factors Potentially Affected

Several environmental resources were found to have "potentially significant impacts," and will be discussed further in the subsequent EIR. The environmental factors listed as "Yes" in **Table 2-1** would be potentially affected by the Recovery Project, involving at least one impact that has "Potentially Significant" as indicated by the checklist on the following pages.

Table 2-1. Environmental Resources with Potentially Significant Impacts

Environmental Resources	Yes or No?
Aesthetics	No
Agriculture and Forestry Resources	No
Air Quality	No
Biological Resources	**Yes**
Cultural Resources	**Yes**
Energy	No
Geology/Soils	No
Greenhouse Gas Emissions	No
Hazards and Hazardous Materials	No
Hydrology/Water Quality	**Yes**
Land Use/Planning	No
Mineral Resources	No
Noise	No
Population/Housing	No
Public Services	No
Recreation	No
Transportation	No
Tribal Cultural Resources	**Yes**
Utilities/Service Systems	No
Wildfire	No
Mandatory Findings of Significance	**Yes**

Evaluation of Environmental Impacts

#1. A brief explanation is required for all answers except "No Impact" answers that are adequately supported by the information sources a lead agency cites in the parentheses following each question. A "No Impact" answer is adequately supported if the referenced information sources show that the impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone). A "No Impact" answer should be explained where it is based on project-specific factors as well as general standards (e.g., the project will not expose sensitive receptors to pollutants, based on a project-specific screening analysis).

#2. All answers must take account of the whole action involved, including off-site as well as on-site, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts. Operations and maintenance impacts of the proposed project are routine, minimal, and essentially the same as current operations and maintenance of the existing facilities. There is no potential for a significant impact to any resource category from project operations and maintenance of the existing and proposed facilities.

#3. Once the lead agency has determined that a particular physical impact may occur, then the checklist answers must indicate whether the impact is potentially significant, less than significant with mitigation, or less than significant. "Potentially Significant Impact" is appropriate if there is substantial evidence that an effect may be significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required. "Beneficial impact" is also identified where appropriate to provide full disclosure of any benefits from implementing the proposed project.

#4. "Less-than-Significant Impact with Mitigation Incorporated" applies where the incorporation of mitigation measures has reduced an effect from "Potentially Significant Impact" to a "Less-than-Significant Impact." The lead agency must describe the mitigation measures, and briefly explain how they reduce the effect to a less-than-significant level (mitigation measures from "Earlier Analyses," as described in (5) below, may be cross-referenced).

#5. Earlier analyses may be used where, pursuant to the tiering, program EIR, or other CEQA process, an effect has been adequately analyzed in an earlier EIR or negative declaration (Section 15063[c][3][D]). In this case, a brief discussion should identify the following:

#5 -a. Earlier Analysis Used. Identify and state where they are available for review.

#5 -b. Impacts Adequately Addressed. Identify which effects from the above checklist were within the scope of and adequately analyzed in an earlier document pursuant to applicable legal standards, and state whether such effects were addressed by mitigation measures based on the earlier analysis.

#5 -c. Mitigation Measures. For effects that are a "Less-than-Significant Impact with Mitigation Measures Incorporated," describe the mitigation measures which were incorporated or refined from the earlier document and the extent to which they address site-specific conditions for the project.

#6. Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts (e.g., general plans, zoning ordinances). Reference to a previously prepared or outside document should, where appropriate, include a reference to the page or pages where the statement is substantiated.

#7. Supporting Information Sources: A source list should be attached, and other sources used or individuals contacted should be cited in the discussion.

#8. This is only a suggested form, and lead agencies are free to use different formats; however, lead agencies should normally address the questions from this checklist that are relevant to a project's environmental effects in whatever format is selected.

#9. The explanation of each issue should identify:

#9 -a. the significance criteria or threshold, if any, used to evaluate each question; and

#9 -b. the mitigation measure identified, if any, to reduce the impact to less than significance.

Significance thresholds are identified for certain resources, but others are not explicitly identified because there is clearly no impact or the checklist question itself serves as the significance threshold.

2.1 Aesthetics

#1. **AESTHETICS**. Except as provided in PRC Section 21099, **would the project**:

#1 -a. Have a substantial adverse effect on a scenic vista?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#1 -b. Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a State scenic highway?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#1 -c. In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from a publicly accessible vantage point.) If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#1 -d. Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

2.1.1 *Environmental Setting*

The Recovery Project is located west of Interstate 5, near the unincorporated community of Buttonwillow, Kern County. The Recovery Project site is zoned as letter “A” (signifying, exclusive agriculture) (Kern County, 2020). The project area is flat and is comprised of dirt roads, open water canals, and various agricultural crops (*see* **Figure 2-1**). There are no designated scenic vistas within the vicinity of the Recovery Project (Caltrans 2019).

Figure 2-1. View of the Palms Recovery Project Area.

2.1.2 *Discussion*

#1 -a, b, c, and d. Have a substantial adverse effect on a scenic vista, Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a State scenic highway, In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage point.) If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality, or Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?

There are no significant view-sheds, scenic vistas, or scenic highways located in the vicinity of the Recovery Project (Caltrans, 2019). The Recovery Project would be constructed in agricultural land and would consist of buried pipelines for conveying recovered water, and new well structures in an area that already contains wells. There would be little change to the visual character of the site and surrounding area. Construction would take approximately 11 months and would require several vehicles and equipment onsite, which is not substantially different that normal agricultural operations. Following the completion of construction activities all construction related equipment would be removed and the site would be restored to pre-construction conditions. The Recovery Project would not change the existing views, nor would it create new sources of light or glare. All construction activities would occur during daylight hours. Therefore, there would be **no impact** to visual resources and this topic will not be evaluated further in the EIR.

2.2 Agriculture and Forestry Resources

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

#2 -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?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#2 -b. Conflict with existing zoning for agricultural use, or a Williamson Act contract?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#2 -c. Conflict with existing zoning for, or cause rezoning of, forest land (as defined in PRC Section 12220(g)), timberland (as defined by PRC Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104(g))?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#2 -d. Result in the loss of forest land or conversion of forest land to non-forest use?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#2 -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?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

2.2.1 *Environmental Setting*

The Recovery Project site is designated as exclusive agriculture (Kern County 2020). The Recovery Project consists of Prime Farmland and Grazing land, as delineated by the Farmland

Mapping and Monitoring Program (FMMP) (D.O.C. 2018). The Recovery Project is located on parcels currently under active Williamson Act contracts (Kern County, 2010). However, the land is currently fallow open space, as it is being used for groundwater recharge.

2.2.2 *Discussion*

#2 -a and b. 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? Conflict with existing zoning for agricultural use, or a Williamson Act contract?

The Recovery Project would be implemented on the outer edges of agricultural parcels, along the established dirt roads which are primarily barren. Implementation of the Recovery Project would not convert farmland to non-farmland. The land will continue to be fallow open space, used for groundwater recharge so would not conflict with existing Williamson Act contracts. There would be **no impact** to agricultural land, and this topic will not be evaluated further in the EIR.

#2 -c and d. Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code Section 12220(g)), timberland (as defined by PRC Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104(g))? Result in the loss of forest land or conversion of forest land to non-forest use?

The Recovery Project site is not forest land, timberland, or timberland zoned as Timberland Production, therefore, no loss or conversion of forest land to non-forest land would be necessary. There would be **no impact** to forestland or timberland and this topic will not be evaluated further in the EIR.

#2 -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?

The Recovery Project would not convert farmland to non-agricultural use. The Recovery Project's purpose is to benefit agriculture by providing irrigation water supplies in years with limited surface water supplies. There would be **no impact** to agriculture or forestland and this topic will not be evaluated further in the EIR.

2.3 Air Quality

#3. AIR QUALITY. Where available, the significance criteria established by the applicable air quality management district or air pollution control district may be relied on to make the following determinations. **Would the project:**

#3 -a. Conflict with or obstruct implementation of the applicable air quality plan?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? **Yes.**	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#3 -b. 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?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? **Yes.**	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#3 -c. Expose sensitive receptors to substantial pollutant concentrations?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? **Yes.**	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#3 -d. Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.

2.3.1 *Environmental Setting*

The Recovery Project is located in the San Joaquin Valley Air Basin (S.J.V.A.B.) within Kern County. The San Joaquin Valley Air Pollution Control District (S.J.V.A.P.C.D.) is responsible for obtaining and maintaining air quality conditions in the County.

The Federal Clean Air Act and California Clean Air Act required the U.S. Environmental Protection Agency (EPA) and California Air Resource Boards (C.A.R.B.) to establish health-based air quality standards at the federal and state levels. National Ambient Air Quality Standards (N.A.A.Q.S.) and California Ambient Air Quality Standards (C.A.A.Q.S.) were established for the following criteria pollutants: carbon monoxide (C.O.), ozone (O_3), sulfur dioxide ($S.O._{2.}$), nitrogen dioxide ($N.O._{2.}$), particulate matter less than 10 microns in diameter (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and lead. Areas of the state are designated as attainment, nonattainment, maintenance, or unclassified for the various pollutant standards according to the Federal Clean Air Act and California Clean Air Act.

An "attainment" designation for an area signifies that pollutant concentrations did not violate the N.A.A.Q.S. or C.A.A.Q.S. for that pollutant in that area. A "nonattainment" designation indicates that a pollutant concentration violated the standard at least once, excluding those occasions when a violation was caused by an exceptional event, as identified in the criteria. A "maintenance" designation indicated that the area previously categorized as nonattainment is currently categorized as attainment for the applicable pollutant; though the area must demonstrate continued attainment for a specific number of years before it can be re-designated as an attainment area. An "unclassified" designation signifies that data does not support either an attainment or a nonattainment status. The EPA established N.A.A.Q.S. in 1971 for six air pollution constituents. States have the option to add other pollutants, to require more stringent compliance, or to include different exposure periods. C.A.A.Q.S. and N.A.A.Q.S. are listed in **Table 2-2**.

Table 2-2. Federal and California Ambient Air Quality Standards and Attainment Status.

Pollutant	Averaging Time	California Standards Concentration	Federal Primary Standards Concentration
Ozone (O_3)	8-hour	0.070 parts per million. (137 micrograms per cubic meter).	0.070 parts per million (137 micrograms per cubic meter.) (*See* Note #1.)
	1-hour	0.09 parts per million. (180 micrograms per cubic meter).	(None; *see* Note #2.)
Respirable Particulate Matter (PM_{10})	24-hour	50 micrograms per cubic meter.	150 micrograms per cubic meter.
	Annual Arithmetic Mean	20 micrograms per cubic meter.	(None.)
Fine Particulate Matter ($PM_{2.5}$)	24-hour	(None.)	35 micrograms per cubic meter.
	Annual Average	12 micrograms per cubic meters.	12 micrograms per cubic meter.
Carbon Monoxide	8-hour	9 parts per million. (10 milligrams per cubic meter.)	9 parts per million. (10 milligrams per cubic meter).
	1-hour	20 parts per million. (23 milligrams per cubic meter).	35 parts per million. (40 micrograms per cubic meter).
Nitrogen Dioxide	Annual Average	0.03 parts per million. (57 micrograms per cubic meters.)	0.053 parts per million. (100 micrograms per cubic meters.)
	1-hour	0.18 parts per million. (339 micrograms per cubic meters.)	0.100 parts per million. (188 micrograms per cubic meters.)
Lead	30-day Average	1.5 micrograms per cubic meters.	(None.)
	Rolling 3-Month Average	(None.)	0.15 micrograms per cubic meter.

Pollutant	Averaging Time	California Standards Concentration	Federal Primary Standards Concentration
	Quarterly Average	(None.)	1.5 micrograms per cubic meter.
Sulfur Dioxide	24-hour	0.04 parts per million. (105 micrograms per cubic meter.)	0.14 parts per million (for certain areas)
	3-hour	(None.)	(None.)
	1-hour	0.25 parts per million. (655 micrograms per cubic meter.)	0.075 parts per million. (196 micrograms per cubic meter.)
Sulfates	24-hour	25 micrograms per cubic meter.	No Federal Standard.
Hydrogen Sulfide	1-hour	0.03 parts per million. (42 micrograms per cubic meter.)	No Federal Standard.
Vinyl Chloride	24-hour	0.01 parts per million. (26 micrograms per cubic meter.)	No Federal Standard.

Notes:

#1. On October 1, 2015, the national 8-hour ozone (O_3) primary and secondary standards were lowered from 0.075 to 0.070 ppm.

#2. 1-Hour ozone standard revoked effective June 15, 2005, although some areas have continuing obligations under that standard.

Source: C.A.R.B. 2019, EPA 2016

Under the N.A.A.Q.S., Kern County is designated as nonattainment for 8-hour ozone, and $PM_{2.5}$ (C.A.R.B. 2018). Under C.A.A.Q.S., Kern County is designated nonattainment for 1-hour ozone, 8-hour ozone, $PM_{2.5}$, PM_{10} (C.A.R.B. 2018).

The area's air quality monitoring network provides information on ambient concentrations of air pollutants in the S.J.V.A.B. S.J.V.A.P.C.D. operates several monitoring stations in Kern County, air quality data was obtained from the Bakersfield-California Avenue station. **Table 2-3** compares a 5-year summary of the highest annual criteria air pollutant emissions collected at this station with applicable C.A.A.Q.S., which are more stringent than the corresponding N.A.A.Q.S. Due to the regional nature of these pollutants, O_3, $PM_{2.5}$, and PM_{10} are expected to be fairly representative of the Recovery Project.

As indicated in **Table 2-3**, O_3, $PM_{2.5}$, and PM_{10} standards have been exceeded over the past 5 years.

Table 2-3. Ambient Air Quality Monitoring Data Measured at the Bakersfield-California Avenue Monitoring Station.

Pollutant Standards, 1-Hour Ozone	2014	2015	2016	2017	2018
Maximum 1-hour concentration (ppm)	0.102*	0.104*	0.092*	0.122*	0.107*
Days Exceeding[a] C.A.A.Q.S. 1-hour (>0.09 parts per million)	3	6	0	11	8
Pollutant Standards, 8-Hour Ozone	2014	2015	2016	2017	2018
National maximum 8-hour concentration (parts per million).	0.092*	0.096*	0.085*	0.104*	0.098*
State max. 8-hour concentration (parts per million).	0.093*	0.097*	0.086*	0.104*	0.098*
Days Exceeding[a] N.A.A.Q.S. 8-hour. (>0.075 parts per million.) (*See* note #1.)	20	28	30	47	34
Days Exceeding[a] C.A.A.Q.S. 8-hour. (>0.070 parts per million.) (*See* note #1.)	39	54	63	87	64
Pollutant Standards, Particulate Matter (PM_{10})	2014	2015	2016	2017	2018
National max. 24-hour concentration (micrograms per cubic meter).	430.1*	104.7	90.9	138.0	136.1
State max. 24-hour concentration (micrograms per cubic meter).	419.5*	103.6*	92.2*	143.6*	142.0*
State max. 3-year average concentration (micrograms per cubic meter).	41	44	44	44	43
State annual average concentration (micrograms per cubic meter).	N/A	44.1	40.9	42.6	N/A
Days Exceeding[a] N.A.A.Q.S. 24-hour (>150 micrograms per cubic meter).	N/A	0	0	0	0
Days Exceeding[a] C.A.A.Q.S. 24-hour (>50 micrograms per cubic meter).	N/A	121.4	121.4	98.7	N/A
Pollutant Standards, Particulate Matter ($PM_{2.5}$)	2014	2015	2016	2017	2018
National max. 24-hour concentration (micrograms per cubic meter).	101.9*	107.9*	66.4*	101.8*	98.5*
State max. 24-hour concentration (micrograms per cubic meter).	101.9	111.9	66.4	101.8	98.5
State annual average concentration (micrograms per cubic meter).	18.6*	16.6*	15.9*	15.9*	15.6*
Days Exceeding[a] N.A.A.Q.S. 24-hour (>35 micrograms per cubic meter).	39.3	32.3	25.5	30.2	40.3

2.3.2 *Discussion*

#3 -a and b. Conflict with or obstruct implementation of the applicable air quality plan? 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?

The Recovery Project would generate criteria pollutants from the use of gasoline and diesel-powered vehicles and equipment, and earthmoving activities. Construction of the Recovery Project would require approximately 383 round trips to drop off all required material and equipment to the site. An additional 3,080 truck trips, or 14 trips per day, would be required for workers commuting to the site during construction. A total of 3,463 trips would be required to implement the project.

To streamline the process of assessing significance of criteria pollutant emissions from common construction projects, S.J.V.A.P.C.D has developed a screening tool, the Small Project Analysis Level (SPAL) to assist in determining if constructing a project in the County would exceed the construction significance threshold for criteria pollutants. The tool uses project type and size, and S.J.V.A.P.C.D. pre-quantified emissions to determine a size below which it is reasonable to conclude that a project would not exceed applicable thresholds of significance for criteria pollutants (S.J.V.A.P.C.D., 2017). Construction of a project that does not exceed the screening level are considered to have a less-than-significant impact on air quality (**Table 2-4**). The proposed project would result in a total of 3,463 trips during the entire construction period, which is significantly lower than the SPAL threshold.

Table 2-4. Small Project Analysis Level by Vehicle Trips.

Land Use Category	Project Size
Residential Housing	1,453 trips per day
Commercial	1,673 trips per day
Office	1,628 trips per day
Institutional	1,707 trips per day
Industrial	1,506 trips per day

Source: S.J.A.P.C.D. 2012

However, since the Recovery would disturb more than 1 acre, the District would obtain the following permits: SWRCB N.P.D.E.S. for general construction activity (Order 2009-0009 DWQ as amended by Order 2012-0006-DWQ), and SWPPP. The District would also need to submit a Dust Control Prevention Plan, which is required for non-residential developments that include 5 acres or more of disturbed surface area (S.J.V.A.P.C.D 2004). The Recovery Project would comply with all BMPs outlined in the above-mentioned permits. The Recovery Project would also comply with all S.J.V.A.P.C.D. rules and regulations. S.J.V.A.P.C.D. Regulation VIII implements measures to reduce ambient concentrations of PM_{10} and oxides of nitrogen (NO_x). Implementation of the following mitigation measure would ensure that S.J.V.A.P.C.D. practices would be implemented during construction, and this impact would be **less-than-significant with mitigation**. This topic will not be evaluated further in the EIR.

Mitigation Measure AQ-1: District Regulation VIII Fugitive PM_{10} Prohibitions Best Management Practices

All projects are subject to S.J.V.A.P.C.D. rules and regulations in effect at the time of construction. Control of fugitive dust is required by S.J.V.A.P.C.D. Regulation VIII. The District shall implement or require its contractor to implement all of the following measures as identified by S.J.V.A.P.C.D.:

- Apply water to unpaved surfaces and areas
- Use non-toxic chemical or organic dust suppressants on unpaved roads and traffic areas
- Limit or reduce vehicle speed on unpaved roads and traffic areas
- Maintain areas in a stabilized condition by restricting vehicle access
- Install wind barriers
- During high winds, cease outdoor activities that disturb the soil
- Keep bulk materials sufficiently wet when handling
- Store and hand material in a three-sided structure
- When storing bulk material, apply water to the surface or cover the stage pile with a tarp
- Don’t overload haul trucks. Overlanded trucks are likely to spill bulk materials
- Cover haul trucks with a tarp or other suitable cover. Or, wet the top of the load enough to limit visible dust emissions
- Clean the interior of cargo compartments on emptied haul trucks prior to leaving the site
- Prevent track-out by installing a track-out control device
- Clean up track-out at least once a day. If along a busy road or highway, clean up track-out immediately
- Monitor dust-generating actives and implement appropriate measures for maximum dust control

Implementation of the above-mentioned mitigation measure and acquisition of a N.P.D.E.S. construction activity general permit and SWPPP, and submitting a Dust Control Prevention Plan, would reduce significant impacts to a **less-than-significant** level. This topic will not be evaluated further in the EIR.

#3 -c. Expose sensitive receptors to substantial pollutant concentrations?

Some members of the population are especially sensitive to emissions of air pollutants and should be given special consideration during the evaluation of the Recovery Project air quality impacts. These people include children, senior citizens, and persons with pre-existing respiratory or cardiovascular illnesses, and athletes and other who engage in frequent exercise, especially outdoors. Sensitive receptors include schools, residences, playgrounds, childcare centers, athletic facilities, long-term health care facilities, rehabilitation centers, convalescent centers, and retirement homes. The Recovery Project is located in a predominately agricultural area; however, a residential property resides approximately 300 feet from the Recovery Project site.

During construction, most of the particulate matter (PM), emissions are released in the form of fugitive dust during ground disturbance activities, mostly during the drilling and grading phases. PM emissions are also generated in the form of equipment exhaust and re-entrained road dust from vehicle travel. Impacts from PM emissions would be temporary and would go back to normal after completing the construction phase. Given the short-term emissions, and incorporation of Mitigation Measure AQ-1, impacts would be **less-than-significant with mitigation**. This topic will not be evaluated further in the EIR.

#3 -d. Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?

Human response to odors is subjective, and sensitivity to odor varies from person to person. Typically, odors are considered an annoyance rather than a health hazard. However, a person's response to odor can range from psychological (e.g., irrigation, anger, anxiety) to physiological (e.g., circulatory and respiration reaction, nausea, headaches, etc.). During construction, the Recovery Project would generate odor from the use of diesel fuels that could affect the nearby residence, though this impact would be short-term and nonsignificant. During operation, the Recovery Project would consist of the operation of electrically powered pump. No odors would be generated by this use. Potential odor effects would be **less-than-significant** and would not be evaluated further in the EIR.

2.4 Biological Resources

#4. BIOLOGICAL RESOURCES. Would the project:

#4 -a. Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	Have Potentially Significant Impact? **Yes.**	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#4 -b. 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 the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#4 -c. Have a substantial adverse effect on State or Federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#4 -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?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#4 -e. Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#4 -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?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

2.4.1 *Environmental Setting*

The Recovery Project site and surrounding areas is almost entirely comprised of agricultural land and associated facilities. Topography is generally flat, with an average elevation of approximately 280 feet above mean sea level. The Tule Elk Reserve borders the eastern side of the Recovery Project.

2.4.2 *Discussion*

#4 -a. Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or the U.S. Fish and Wildlife Service?

The Recovery Project has the potential to have a substantial adverse effect on special-status species located within the vicinity of the site. This impact is likely **potentially significant**. Therefore, impacts to special-status species will be evaluated further in the EIR.

#4 -b. 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 the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?

The Recovery Project has the potential to have a substantial adverse effect on riparian habitat or other sensitive natural communities. However, the Recovery Project is located in an agricultural dominant area and as such is unlikely to contain any riparian habitat or other sensitive natural communities. Therefore, this impact is likely **less than significant**, however, potential impacts related to riparian habit or other sensitive natural communities will be evaluated further in the EIR.

#4 -c. Have a substantial adverse effect on state- or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?

Aquatic habitat within the Recovery Project is limited to irrigation canals that are frequently maintained, generally lack vegetation, and provide very poor aquatic habitat. Therefore, impacts associated with disturbance of small portions of several canals during construction would likely be **less-than-significant**, however, potential impacts to wetlands will be evaluated further in the EIR.

#4 -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?

The Recovery Project does not contain aquatic habitat that could support fish. The Recovery Project has the potential to interfere substantially with the movement of native resident and wildlife species or with established native resident or migratory wildlife corridors or impede the use of native wildlife nursey sites. This impact is likely **less than significant**, however impacts related to the movement corridors will be evaluated further in the EIR.

#4 -e. Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?

The 2004 Kern County General Plan, which is currently being updated, includes several policies and implementation measures designed to protect and conserve threatened and endangered species and oak trees (Kern County 2004a). No oak trees are present onsite, therefore, there is **no impact** and this topic will not be evaluated further in the EIR.

#4 -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?

The Recovery Project is within the area anticipated to be covered by the Kern County Valley Floor Habitat Conservation Plan. A draft of the plan was issued many years ago (Kern County Planning Department 2006), but a final plan has not been released. The majority of the site is within the "White Zone," which is of lower conservation concern and not identified for acquisition of preserve areas, and a small portion of the site is within the "Green Zone,' which is defined as habitat of moderate importance for conservation purposes. The Recovery Project is north of the existing Metropolitan Bakersfield Habitat Conservation Plan area and the plan area for the Bakersfield Habitat Conservation Plan that is currently in development. Therefore, implementing the Recovery Project would not conflict with any provisions, guidelines, goals, or objectives related to biological resources anticipated to be included in a potential final and adopted version of this plan, there would be **no impact**, and this topic will not be evaluated further in the EIR.

2.5 Cultural Resources

#5. CULTURAL RESOURCES. Would the project:

#5 -a. Cause a substantial adverse change in the significance of a historical resource pursuant to CCR Section 15064.5?	Have Potentially Significant Impact? **Yes.**	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#5 -b. Cause a substantial adverse change in the significance of an archaeological resource pursuant to CCR Section 15064.5?	Have Potentially Significant Impact? **Yes.**	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#5 -c. Disturb any human remains, including remains interred outside of dedicated cemeteries?	Have Potentially Significant Impact? **Yes.**	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.

2.5.1 *Environmental Setting*

Cultural resources are defined as buildings, sites, structures, or objects, each of which may have historic, architectural, archaeological, cultural, or scientific importance. All potential impacts to cultural resources from the implementation of the Recovery Project will be discussed further in the subsequent EIR, and the level of impact may change from what is stated below.

2.5.2 *Discussion*

a and b) Cause a substantial adverse change in the significance of a historical resource pursuant to in CCR Section 15064.5? Cause a substantial adverse change in the significance of an archaeological resource pursuant to CCR Section 15064.5?

The Recovery Project has the potential to have a substantial adverse change in the significance of a historic resource or archaeological resource pursuant to CCR Section 15064.5. This impact is likely **potentially significant.** Potential impacts on historic and archaeological resources will be evaluated further in the EIR.

c) Disturb any human remains, including remains interred outside of dedicated cemeteries?

Although unlikely, the Recovery Project has the potential to disturb human remains, including remains interred outside of dedicated cemeteries, therefore this impact is likely **potentially significant**. Potential impacts on human remains will be evaluated further in the EIR.

2.6 Energy

#6. ENERGY. Would the project:

#6 -a. Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?	Have Potentially Significant Impact? No	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes**.	Have No Impact? No.	Have Beneficial Impact? No.
#6 -b. Conflict with or obstruct a State or local plan for renewable energy or energy efficiency?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

2.6.1 *Environmental Setting*

Southern California Edison, and Southern California Gas (Kern County 2004a). In 2018, the total electricity consumption for Kern County was approximately 15,942 million kilowatts per hour (kWh) (California Energy Commission [CEC] 2018). The District would install nine new wells and five replacement wells, which would be configured with new electrical pumps.

2.6.2 *Discussion*

#6 -a. Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?

The proposed project is not likely to result in significant environmental impacts due to wasteful, inefficient, or unnecessary consumption of energy resources. The project would involve the use of diesel-fueled vehicles during constructions, however, use of these vehicles would be temporary and nonsignificant. The proposed project involves the installation of 250 horsepower pump motors in all proposed new wells, and replacement wells. The Recovery Project would be limited to the recovery of previously banked water at generally higher groundwater levels which would result in lower energy usage. Energy use will not be wasteful, inefficient, or unnecessary, therefore the impact is **less than significant** and will not be evaluated further in the EIR.

#6 -b. Conflict with or obstruct a State or local plan for renewable energy or energy efficiency?

Kern County does not have a local plan for renewable energy or energy efficiency. The proposed project would comply with the state's Climate Commitment to reduce the reliance on non-renewable energy sources by half by 2030 (CEC 2015). There would be **no impact** and this topic will not be evaluated further in the EIR.

2.7 Geology and Soils

#7. GEOLOGY AND SOILS. Would the project:

#7 -a. Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:					
#7 -a. 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 California Geological Survey Special Publication 42.)	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#7 -a. ii. Strong seismic ground shaking?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#7 -a. iii. Seismic-related ground failure, including liquefaction?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#7 -a. iv. Landslides?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#6 -b. Result in substantial soil erosion or the loss of topsoil?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#7 -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?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.

		Incorporated? No.			
#7 -d. Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994, as updated),), creating substantial direct or indirect risks to life or property?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#7 -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?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#7 -f. Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? **Yes.**	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.

2.7.1 *Environmental Setting*

The Recovery Project sites are located on the following soil types: Buttonwillow clay drained, and Lokern clay drained (NRCA, 2020). There are several small unnamed Quaternary faults located within 6 miles of the Recovery Project (CGS 2010a). There are no Alquisto-Priolo fault zones located within the vicinity of the site (CGS 2020a).

Inelastic subsidence typically occurs in the clay layers within aquifers and aquitards due to the withdrawal of water in storage within these layers during over-pumping, which induces the permanent rearrangement or collapse of the clay layer structure (BVGSA, 2020). According to DWR (2014), the Kern County Subbasin was rated at a high risk for future subsidence due to 1) a significant number of wells (51%) with water levels at or below historic lows; 2) documented historical subsidence; and 3) documented current subsidence.

The Buena Vista Groundwater Sustainability Agency (BVGSA) covers an agricultural area of Kern County located in the trough of California's southern San Joaquin Valley approximately sixteen miles west of the city of Bakersfield. The boundaries of the BVGSA coincide closely with those of the District. Concerns regarding historical subsidence within the BVGSA have been limited to areas in the northern portion of the District, between Milepost 195 and 215 of the California Aqueduct. Subsidence has not been observed to have affected infrastructure in the Recovery Project area (BVGSA, 2020).

2.7.2 *Discussion*

#7 -a. Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:

#7 -a. 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 California Geological Survey Special Publication 42.)

The Recovery Project is not located within an Alquisto-Priolo Earthquake fault zone (CGS 2020a). Surface fault rupture is most likely to occur on active faults (i.e., faults showing evidence of displacement within the last 11,700 years). Damage from surface fault rupture is generally limited to a linear zone a few yards wide. Since the Recovery Project is not located within the vicinity of an active fault line, there would be **no impact** and this topic will not be evaluated further in the EIR.

#7 -a. ii, iii and iv. Strong seismic ground shaking, Seismic-related ground failure, including liquefaction or landslides?

The Recovery Project facilities, wells and conveyance pipes, would either be buried or extend only a few feet above ground, and would not pose a direct risk to people during seismic activity. If a seismic event should cause a pipeline break or well to collapse, the water would be released underground in a low gradient, agricultural area, posing minimal risk to people or structures. Therefore, there would be no significant impact to people or structures from any seismic-related activity as a result of implementation of the Recovery Project. If additional water treatment facilities are determined to be needed, these facilities would be subject to a separate CEQA process at the time they are proposed. The Recovery Project is not located within a known liquefaction or landslide zone (CGS 2020b). Impacts related to seismic activities, including liquefaction or landslides would be **less-than-significant** and will not be evaluated further in the EIR.

#7 -b, c, and d. Result in substantial soil erosion or the loss of topsoil? 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? Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994, as updated), creating substantial direct or indirect risks to life or property?

Soils present at the Recovery Project site consist of, buttonwillow clay drained, and Lokern clay drained, which are considered expansive soils, however, the soils in the project area have been extensively farmed and managed for agricultural purposes (NRCA 2020). The pipelines would be buried within these soils' types. The Recovery Project is not located on unstable soils and implementation of the proposed project would not result in instability or excessive soil erosion.

Because construction activities would disturb an area larger than 1 acre, the District is required by law to obtain coverage under the SWRCB N.P.D.E.S. stormwater permit for general construction activity, including preparation and submittal of a Notice of Intent (NOI) to discharge with the Central Valley Regional Water Quality Control Board. The District is required to prepare a SWPPP and comply with the conditions of the N.P.D.E.S. general stormwater permit for construction activities. The SWPPP shall describe the construction activities to be conducted, BMPs that would be implemented to prevent soil erosion and contaminated stormwater discharges into waterways, and inspection and monitoring activities that would be conducted.

Topsoil may be stripped and stockpiled for later reuse on the site. With the implementation of a Dust Control Plan or Construction Notification form loss of topsoil would be minimized during construction. Operation of the Recovery Project would not create the potential for soil erosion or loss of topsoil as the area is in a cultivated agricultural field and is topographically flat. Therefore, impacts related to soil erosion, unstable soils, or expansive soils would be **less-than-significant** and these topics will not be evaluated further in the EIR.

Inelastic land subsidence is a major concern in areas of active groundwater extraction due to risks to canal and infrastructure damage, permanent reduction in the groundwater storage capacity of the aquifer, well casing collapse, and increased flood risk in low lying areas.

The BVGSA proposes to monitor subsidence as described in the BVGSA Groundwater Sustainability Plan. In addition, the BVGSA discourages groundwater extraction from beneath the E-clay, in part, because of the potential for extraction from this confined zone to induce subsidence (BVGSA 2020). Recovery wells constructed as part of the Recovery Project will not be constructed below the E-clay. Given that the range of groundwater elevations expected during implementation of the Recovery Project will be within the range of elevations that has been experienced in the past, the risk of subsidence which result in damage to infrastructure is **less-than-significant** and these topics will not be evaluated further in the EIR.

#7 -e. Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?

The Recovery Project would not require the use of septic tanks or alternative wastewater disposal systems. Temporary portable restrooms would likely be provided for construction workers. Therefore, there would be **no impact** and this topic will not be evaluated further in the EIR.

#7 -f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

The Recovery Project sites are located on marine and non-marine sedimentary rock that consist of alluvium, lake, playa, and terrace deposits, and is from the Pleistocene-Holocene ages (CGS 2010b). Sediments associated with Holocene-age alluvium are too young to contain paleontologically sensitive resources and the likelihood of finding paleontological resources is unlikely. However, since the exact age of the bedrock is unknown and paleontological resources are found almost exclusively in sedimentary rock, there is a chance of discovering unknown paleontological resources within the Recovery Project site. With implementation of the below mentioned mitigation measure impacts would be **less-than-significant with mitigation**.

Mitigation Measure CR-2: Avoid Potential Effects on Paleontological Resources.

In the event that a paleontological resource is uncovered during Recovery Project implementation, all ground-disturbing work within 165 feet (50 meters) of the discovery shall be halted. A qualified paleontologist shall inspect the discovery and determine whether further investigation is required. If the discovery can be avoided and no further impacts will occur, no further effort shall be required. If the resource cannot be avoided and may be subject to further impact, a qualified paleontologist shall evaluate the resource and determine whether it is "unique" under CEQA, Appendix G, part VII. The determination and associated plan for protection of the resource shall be provided to the District for review and approval. If the resource is determined not to be unique, work may commence in the area. If the resource is determined to be a unique paleontological resource, work shall remain halted, and the paleontologist shall consult with the District staff regarding methods to ensure that no substantial adverse change would occur to the significance of the resource pursuant to CEQA. Preservation in place (i.e., avoidance) is the preferred method of mitigation for impacts to paleontological resources and shall be required unless there are other equally effective methods. Other methods may be used but must ensure that the fossils are recovered, prepared, identified, catalogued, and analyzed according to current professional standards under the direction of a qualified paleontologist. All recovered fossils shall be curated at an accredited and permanent scientific institution according to Society of Vertebrate Paleontology standard guidelines; typically, the Natural History Museum of Los Angeles County and University of California, Berkeley accept paleontological collections at no cost to the donor. Work may commence upon completion of treatment, as approved by the District.

With the incorporation of Mitigation Measure CR-2, potentially significant impacts related to paleontological resources would be reduced to **less-than-significant** and will not be evaluated further in the EIR.

2.8 Greenhouse Gas Emissions

#8. GREENHOUSE GAS EMISSIONS. Would the project:

#8 -a. Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#8 -b. Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

2.8.1 *Environmental Setting*

Kern County has not adopted a local plan for reducing greenhouse gas (GHG) emissions. The S.J.V.A.P.C.D. has adopted the *Guidance for Valley Land-use Agencies Addressing GHG Emissions Impacts for New Projects under CEQA* (S.J.V.A.P.C.D. 2009). The guidance addresses stationary source projects and development projects.

2.8.2 *Discussion*

#8 -a. Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

GHG emissions would be generated during the construction phase of the Recovery Project. Temporary GHG emissions, primarily for the use of diesel-powered vehicles, would occur during construction. Equipment that would be used during project implementation is described in the project description. Due to the short-term impacts from the construction phases and minimal impacts during operation, impacts related to the generation of greenhouse gas emissions would be **less than significant** and will not be evaluated further in the EIR.

#8 -b. Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

California has more than 10 Executive Orders directing state agencies to implement programs to reduce GHG emissions to meet 2030 target of 40 percent below 1990 levels (California, 2018). C.A.R.B. is the primary state agency responsible implementing GHG reduction programs. Kern County does not have an adopted local greenhouse gas reduction plan. The S.J.V.A.P.C.D. provides guidance for addressing GHG emissions from stationary source projects and development projects, but not for development of groundwater banking projects. Therefore, there is no conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of GHG. There would be **no impact** and this topic will not be evaluated further in the EIR.

2.9 Hazards and Hazardous Materials

#9. HAZARDS AND HAZARDOUS MATERIALS. Would the project:

#9 -a. Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#9 -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?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#9 -c. Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#9 -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?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#9 -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 or excessive noise for people residing or working in the project area?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#9 -f. Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#9 -g. Expose people or structures, either directly or indirectly, to a significant risk of loss, injury or death involving wildland fires?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

2.9.1 *Environmental Setting*

To identify known hazardous materials and contaminated sites, a database search was conducted for all data sources in the Cortese List (enumerated in PRC Section 65962.5), including: the GeoTracker database, a groundwater information management system that is maintained by the State Water Resources Control Board (SWRCB); the Hazardous Waste and Substances Site List (i.e., the EnviroStor database), maintained by the California Department of Toxic Substances Control (DTSC); and EPA's Superfund Site database (DTSC 2020, SWRCB 2020a and 2020b, CalEPA 2016). There were no hazardous materials sites identified within 0.25 mile of the CCSB borrow site. There are also no known naturally occurring asbestos hazards in the vicinity of the CCSB borrow site (DOC 2000).

2.9.2 *Discussion*

#9 -a, b, c, d, f, and g. Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials? 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? Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school? 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? f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan? Expose people or structures, either directly or indirectly, to a significant risk of loss, injury or death involving wildland fires?

The Recovery Project would be implemented adjacent to active agriculture, farm roads, and canals. The Recovery Project is located away from population centers; involving hazardous materials; and would rely on electric power rather than liquid fuels. The closest school is the Elk Hills Elementary School located approximately 1 mile southeast of the proposed project. The Recovery Project would not expose people to increased risks from wildland fire as the site is comprised entirely of farmland and are not located within a high severity fire zone. The Recovery Project would not affect emergency response plans as facilities would not interfere with traffic routes or response vehicle transport. There would be **no impact** and these topics will not be evaluated further in the EIR.

#9 -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 or excessive noise for people residing or working in the project area?

Kern County has established an Airport Land Use Compatibility Plan which has been incorporated into the General Plan (Kern County 2012). The purpose of the Airport Land Use Compatibility Plan is to establish procedures and criteria by which the Kern County and affected incorporated cities can address compatibility issues when making planning decisions. The Elk Hills – Buttonwillow Airport is located approximately 3 miles west of the Recovery Project. The Recovery Project is not within the Elk Hills – Buttonwillow Airport Influence Area (Kern County 2012). There would be **no impact** and this topic will not be evaluated further in the EIR.

2.10 Hydrology and Water Quality

#10. HYDROLOGY AND WATER QUALITY. Would the project:

#10 -a. Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes**.	Have No Impact? No.	Have Beneficial Impact? No.
#10 -b. Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?	Have Potentially Significant Impact? **Yes.**	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#10 -c. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:					
#10 -c. i. result in substantial erosion or siltation on- or off-site;	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes**.	Have No Impact? No.	Have Beneficial Impact? No.
#10 -c. ii. substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite;	Have Potentially Significant Impact? **Yes.**	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#10 -c. iii. 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; or	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes**.	Have No Impact? No.	Have Beneficial Impact? No.
#10 -c. iv. impede or redirect flood flows?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation	Have Less-than-Significant Impact? **Yes**.	Have No Impact? No.	Have Beneficial Impact? No.

		Incorporated? No.			
#10 -d. In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?	Have Potentially Significant Impact? **Yes.**	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#10 -e. Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes**.	Have No Impact? No.	Have Beneficial Impact? No.

2.10.1 *Environmental Setting*

The District, established in 1924, is a public agency, which supplies surface water from the Kern River and State Water Project (SWP) via the California Aqueduct and pumps groundwater to agricultural customers, primarily. The District's principal source of surface water is the Kern River. The District has utilized Kern River water under a schedule of long-standing diversion rights. Typically, surface water supplies meet the majority of the Districts water demand, the remaining water demands are meet from privately-owned wells.

2.10.2 *Discussion*

#10 -a. Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?

In order to evaluate the impacts to water quality, water pumped from the proposed wells would need to be tested during and after the construction of the wells. In the event that water quality monitoring finds that the existing groundwater is not the same or better than the water in the California Aqueduct, then blending will be used to meet water quality standards in the Aqueduct. If additional water treatment facilities are determined to be needed, these facilities would be subject to a separate CEQA process at the time it is proposed. This impact is **less-than-significant,** and impact to water quality or waste discharge requirements will not be evaluated further in the EIR.

#10 -b. Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?

The Recovery Project will recover groundwater banked in existing District recharge facilities, including the District canals and the Palms Groundwater Bank. Groundwater modeling will be conducted to evaluate the potential impact of the proposed operational scenario. The results of the groundwater modeling will be included in the EIR. This impact is **potentially significant** and will be evaluated further in the EIR.

#10 -c. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:

#10 -i, ii, iii, and iv) Result in substantial erosion or siltation on- or off-site; Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite; 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; or Impede or redirect flood flows?

The Recovery Project will not alter the existing drainage pattern of the site or the area, therefore there will be **no impact** and this topic will not be evaluated further in the EIR.

#10 -d. In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?

The Recovery Project is not located in a flood hazard, tsunami, or seiche zone, therefore there will be **no impact** and this topic will not be evaluated further in the EIR.

#10 -e. Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?

The Recovery Project purpose is to enhance groundwater management by increasing the District's ability to recharge groundwater in wet years and return that banked water in dry years. Groundwater levels would decrease when water is groundwater is pumped to meet to local demands or for delivery to agricultural users, however the Recovery Project would be operated to provide a long-term benefit to the basin. Therefore, the impact is **less-than-significant,** and this topic will not be evaluated further in the EIR.

2.11 Land Use and Planning

#11. LAND USE AND PLANNING. Would the project:

#11 -a. Physically divide an established community?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#11 -b. Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

2.11.1 *Environmental Setting*

The Recovery Project site is zoned as agriculture (Kern County 2020). The Recovery Project is located in a rural area and are surrounded by various agricultural crops and water conveyance canals.

2.11.2 *Discussion*

#11 -a and b. Physically divide an established the community, and cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?

The Recovery Project would be developed within existing farm roads, in areas zoned for agriculture (Kern County 1988). The Recovery Project is located outside of existing communities and are consistent with existing zoning. There are no adopted HCPs, NCCPs, other local, regional, or state habitat conservation plans within the site or vicinity, *see* Section 2.11 “Biological Resources”. There would be **no impact** and these topics will not be evaluated further in the EIR.

2.12 Mineral Resources

#12. MINERAL RESOURCES. Would the project:

#12 -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?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#12 -b. Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

2.12.1 *Environmental Setting*

The Recovery Project sites are located within a Surface Mining and Reclamation Act of 1975 (S.M.A.R.A.) study area for aggregate materials in the Bakersfield production-consumption region. The Recovery Project is locations are designated as mineral resource zone [MRZ]-3 (areas containing mineral deposits, the significance of which cannot be evaluated from available data) (DOC 2009).

2.12.2 *Discussion*

#12 -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?

The Recovery Project is located in a S.M.A.R.A. study area and though unlikely, have the potential to contain mineral resources. The Recovery Project would include the construction of nine new wells and approximately 11.9 miles of conveyance pipeline. The pipelines would be installed primarily in or along the edge of existing dirt roads within agricultural fields. The Recovery Project is not located in areas of known significant mineral deposits. Although unlikely, there is potential for the temporary loss of access to a small amount of mineral resources, however, the amount that could be lost would be minimal and would not affect the overall availability of mineral resources in Kern County. Therefore, this impact would be **less-than-significant,** and loss of available mineral resources will not be evaluated further in the EIR.

#12 -b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?

The Recovery Project is not located within the vicinity of a locally important mineral resource recovery site. There would be **no impact** and this topic will not be evaluated further in the EIR.

2.13 Noise

#13. NOISE. Would the project:

#13 -a. Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or in other applicable standards of other agencies?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#13 -b. Generation of excessive groundborne vibration or groundborne noise levels?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? **Yes.**	Have No Impact? No.	Have Beneficial Impact? No.
#13 -c. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within 2 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?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

2.13.1 *Environmental Setting*

The Recovery Project is located in a predominately agricultural area. The closest sensitive receptor is located approximately 300 feet from the Recovery Project. Interstate 5 is located approximately 0.5 mile from the eastern most pipeline segment. The Kern County Code of Ordinances states that construction related noise is limited to the hours of 6:00 a.m. to 9:00 p.m. on weekdays and 8:00 a.m. to 9:00 p.m. on weekends (Kern County 2020).

2.13.2 *Discussion*

#13 -a. Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or in other applicable standards of other agencies?

Construction of the Recovery Project would temporarily increase the ambient noise levels within the vicinity of the project site due to the use of heavy machinery during construction activities. Increase ambient noise would occur intermittently during the construction of the well. All work at the Recovery Project sites would be limited to the hours identified in Kern County's Noise Ordinance.

Although construction activities would for the most part occur only during the daytime hours, uncontrolled construction noise could still be considered disruptive to residents adjacent to the Recovery Project. The closest residence is approximately 300 feet from the Recovery Project; however, impacts would be short-term and nonsignificant. Typical composite noise levels for construction activities, and distances of various noise contours from construction sites are presented in **Table 2-5**.

Table 2-5. Typical Noise Levels During Construction.

		Approximate Distance (feet) to Reduce Noise to Given dBA, Leq)[1]		
Construction Activity	Noise Level at 50 feet (dBA), equivalent continuous sound level in decibels [Leq])[2]	60	65	70
Ground Clearing	84	790	450	250
Excavation	89	1,400	800	450
Well drilling (driver)	80	430	235	150
Foundation	78	400	220	130
Erection	85	890	500	280
Finishing (exterior)	89	1,400	800	450

Notes:

1 EPA, Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances, December 1971; United States Department of Transportation, Federal Highway Administration, Office of Planning, Environment, and Realty, Roadway Construction Noise Model, June 28, 2017.

2 Calculations assume a 6 dBA reduction for each doubling of distance from the noise source.

dBA = A-weighted decibels

Leq = equivalent continuous sound level in decibels

During operations, minimal noise would be generated from the use of existing electric well motors and pumps. Impacts related to noise levels would be **less-than-significant** and will not be evaluated further in the EIR.

#13 -b. Generation of excessive groundborne vibration or groundborne noise levels?

Ground vibration would only be caused during construction activities and would primarily occur during well drilling. Vibrations could be detectable by nearby sensitive receptors. One residence is located approximately 300 feet from the Recovery Project. The closest proposed well is approximately 0.5 east of this residence. Construction activities associated with the installation of the all proposed well would be short-term. No adverse levels of vibration would be generated during project operations. Therefore, impact related to groundborne vibration or noise levels would be **less-than-significant** and will not be analyzed further in the EIR.

#13 -c) For a project located within-the vicinity of a private airstrip or-an airport land use plan or, where such a plan has not been adopted, within 2 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?

Kern County has established an Airport Land Use Compatibility Plan which has been incorporated into the General Plan (Kern County 2012). The Elk Hills – Buttonwillow Airport is located approximately 3 miles west of the Recovery Project. The Recovery Project is not within the Elk Hills – Buttonwillow Airport Influence Area (Kern County 2012). The Recovery Project would not expose people residing or working in the area to excessive noise levels. There would be **no impact** and this topic will not be analyzed further in the EIR.

2.14 Population and Housing

#14. POPULATION AND HOUSING. Would the project:

#14 -a. Induce substantial unplanned 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)?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#14 -b. Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

2.14.1 *Environmental Setting*

The Recovery Project is located in an unincorporated area of Kern County. The population was estimated in 2019 to be 916,464 in Kern County (Department of Finance [DOF] 2019).

2.14.2 *Discussion*

#14 -a and b) Induce substantial unplanned 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) or displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?

The Recovery Project would increase the amount of water available for domestic and municipal wells that provide water to residences located within the District boundaries and the surrounding towns, as well as replenish groundwater under the Tule Elk Reserve. The Recovery Project is located in a primarily agricultural area away from population centers; therefore, the Recovery Project would not be growth inducing. The Recovery Project would not result in the development of new housing, nor would it displace people or housing. The Recovery Project would not require additional employees to operate. There would be **no impact** and these topics will not be evaluated further in the EIR.

2.15 Public Services

#15. PUBLIC SERVICES. Would the project:

#15 -a. Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the 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:	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
Fire protection?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
Police protection?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
Schools?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
Parks?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
Other public facilities?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

2.15.1 *Environmental Setting*

The Kern County Sheriff and California Highway Patrol provide law enforcement services for the unincorporated Kern County. The Kern County Fire Department provides fire protection to residents of the unincorporated areas of the County, and the cities of Arvin, Delano, Maricopa, McFarland, Ridgecrest, Shafter, Tehachapi and Wasco (Kern County 2004b). A mutual agreement between the County and the cities of Bakersfield, Taft, and California City allows for protection and assistance in the jurisdiction of each as needed. The County also has a mutual aid contract with U.S.F.W.S. and a service agreement with the Bureau of Land Management.

2.15.2 *Discussion*

#15 -a. Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the 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:

The Recovery Project would not require new or altered government facilities, as the Recovery Project would not increase the need for public services from the existing conditions. There would be **no impact** and these topics will not be evaluated further in the EIR.

2.16 Recreation

#16. RECREATION. Would the project:

#16 -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?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#16 -b. Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

2.16.1 *Environmental Setting*

The Tule Elk Reserve borders the eastern side of the proposed project. The Tule Elk Reserve protects a small herd of Tule elk that were once in danger of extinction, as well as offering recreational benefits to the public by having picnic areas and interpretive exhibits for public use (DPR 2020).

2.16.2 *Discussion*

#16-a and b. 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 or include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?

The Recovery Project is not growth inducing and would not increase the use of existing parks or recreational facilities or require the construction or expansion of recreational facilities. There would be **no impact** and these topics will not be evaluated further in the EIR.

2.17 Transportation

#17. TRANSPORTATION. Would the project:					
#17 -a. Conflict with a program plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#17 -b. Conflict or be inconsistent with CEQA Guidelines Section 15064.3, subdivision (b)?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#17 -c. Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#17 -d. Result in inadequate emergency access?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

2.17.1 *Environmental Setting*

The Recovery Project is located near the town of Buttonwillow, Kern County. Access to the site is provided via Interstate 5. There are no transit or on-street bicycle/pedestrian facilities near the Recovery Project site.

2.17.2 *Discussion*

#17 -a, b, c, and d). Conflict with a program plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities or be inconsistent with CEQA Guidelines Section 15064.3, subdivision (b)? Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)? Result in inadequate emergency access?

The Recovery Project would not conflict with any program plan, ordinance, or policies. Construction traffic would utilize existing public roads to deliver equipment, supplies, and workers to and from the site. Construction of the Recovery Project would result in a total of 3,463 vehicle trips. The Recovery Project would be implemented in agricultural fields and along dirt roads located on the edge of the agricultural fields. Therefore, the Recovery Project would not require any road closures or result in inadequate emergency access. Since no new roads are being developed, there would be no increase hazards due to a geometric design feature or incompatible uses. Therefore, the impact is **less-than-significant,** and these topics will not be evaluated further in the EIR.

2.18 Tribal Cultural Resources

#18. TRIBAL CULTURAL RESOURCES. Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in PRC 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:

#18 -a. Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in PRC Section 5020.1(k), or	Have Potentially Significant Impact? **Yes.**	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#18 -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 PRC Section 5024.1. In applying the criteria set forth in subdivision (c) of PRC Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.	Have Potentially Significant Impact? **Yes.**	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.

2.18.1 *Environmental Setting*

A Tribal Sacred Lands search has not yet been completed for the project. The District sent a letter to the Torres Martinez Desert Cahuilla Indians in accordance with requirements of Assembly Bill 52 (PRC Section 21080.3.1). A request for consultation has not been received. Should a request for consultation be received, a summary report of the consultation process included in the subsequent EIR for review by the District Board of Directors prior to their consideration of the project. All potential impacts to tribal cultural resources from the implementation of the Recovery Project will be discussed further in the subsequent EIR, and the level of impact may change from what is stated below.

2.18.2 *Discussion*

#18 -a and b) Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in PRC 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 listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in PRC Section 5020.1(k)? 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 PRC Section 5024.1. In

applying the criteria set forth in subdivision (c) of PRC Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.

The Recovery Project has the potential to cause a substantial adverse change in the significance of a tribal cultural resource as defined in PRC sections 21074, 5020.1(k), or pursuant to criteria set forth in section 5024.1(c). Therefore, impacts related to tribal cultural resources are considered **potentially significant** and will be analyzed further in the EIR.

2.19 Utilities and Service Systems

#19. UTILITIES AND SERVICE SYSTEMS. Would the project:

#19 -a. Require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#19 -b. Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry, and multiple dry years?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#19 -c. Result in a determination by the wastewater treatment provider that 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?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#19 -d. Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#19 -e. Comply with Federal, State, and local management and reduction statutes and regulations related to solid waste?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

2.19.1 *Environmental Setting*

The Recovery Project and vicinity are served by PG&E, Southern California Edison, and Southern California Gas (Kern County 2004a). Sewage disposal is handled by both public and private agencies, and by private individual systems. Several incorporated and unincorporated communities are severed by wastewater treatment plants managed by community service districts. The closest wastewater treatment plant is the Bakersfield wastewater plant. Domestic water is serviced to the public by various water purveyors consisting of public and private water systems. The Kern County Waste Management Department currently owns and operates 7 Class II Landfills, the closest one being the Taft Landfill located approximately 8.5 miles south of the proposed project. (Kern County 2004b).

2.19.2 *Discussion*

#19 -a. Require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?

No utility services would need to be constructed or expanded as a result of the Recovery Project. There would be **no impact** and this topic will not be evaluated further in the EIR.

#19 -b. Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry, and multiple dry years?

The Recovery Project would not require a water supply. There would be **no impact** and this topic will not be evaluated further in the EIR.

#19 -c. Result in a determination by the wastewater treatment provider that 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?

See Question "a" above. The Recovery Project would not result in a significant amount of wastewater. There would be **no impact** and this topic will not be analyzed further in the EIR.

#19 -d and e) Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals? Comply with Federal, State, and local management and reduction statues and regulations related to solid waste?

The Recovery Project would not create substantial amounts of solid waste, and as such would not exceed the capacity of local infrastructure. The Taft Landfill has a remaining capacity of approximately 7,380,708 cubic yards, with a maximum permitted throughput of 800 tons/day. Minimal waste would be generated during construction and no increase in waste production would occur during the operation of the Recovery Project. The project would comply with federal, state, and local management and reduction statues and regulations related to solid waste. There would be **no impact** and these topics will not be evaluated further in the EIR.

2.20 Wildfire

#20. WILDFIRE. If located in or near State responsibility areas or lands classified as very high fire hazard severity zones, **would the project:**

#20 -a. Substantially impair an adopted emergency response plan or emergency evacuation plan?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#20 -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?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#20 -c. Require the installation or maintenance 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?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.
#20 -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?	Have Potentially Significant Impact? No.	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? **Yes.**	Have Beneficial Impact? No.

2.20.1 *Environmental Setting*

The Recovery Project is not located in a high severity fire zone (CALFIRE 2007a and 2007b). The Kern County Fire Department provides fire protection for residents of the unincorporated areas of the County and the cities of Arvin, Delano, Maricopa, McFarland, Ridgecrest, Shafter, Tehachapi and Wasco (Kern County 2004b).

2.20.2 *Discussion*

#20 -a, b, c, and d) Substantially impair an adopted emergency response plan or emergency evacuation plan? 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? Require the installation or maintenance 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? 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?

The Recovery Project is located in a high severity fire zone; however, implementation of the proposed project would not increase the fire risk. There would not be an increase in the number of users at the site that could impair emergency response or evacuation. Additionally, the short-term, temporary nature of construction and the intermittent nature of material drop-off via large trucks at the site would not pose a risk to emergency response or evacuation during an emergency. The Recovery Project would not require any infrastructure that would exacerbate fire risk or the risk of flooding, slope instability, or drainage changes. There would be **no impact** and these topics will not be evaluated further in the EIR.

2.21 Mandatory Findings of Significance

#21. MANDATORY FINDINGS OF SIGNIFICANCE. Would the project:

#21 -a. Have the potential to substantially 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, substantially reduce the number or restrict the range of an endangered, rare, or threatened species, or eliminate important examples of the major periods of California history or prehistory?	Have Potentially Significant Impact? **Yes.**	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#21 -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)?	Have Potentially Significant Impact? **Yes.**	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.
#21 -c. Have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	Have Potentially Significant Impact? **Yes.**	Have Less-than-Significant Impact with Mitigation Incorporated? No.	Have Less-than-Significant Impact? No.	Have No Impact? No.	Have Beneficial Impact? No.

2.21.1 *Discussion*

#21 -a. Would the project have the potential to substantially 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, substantially reduce the number or restrict the range of an endangered, rare, or threatened species, or eliminate important examples of the major periods of California history or prehistory?

The analysis conducted in this IS concludes that implementation of the Recovery Project could have a potentially significant impact on the environment. This impact would be **potentially significant** and will be evaluated further in the subsequent EIR.

#21 -b. Would the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in

connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)

The Recovery Project has the potential to have cumulative impacts on water quality. To consider cumulative impacts[1] to the environment, past, present, and reasonably foreseeable probable future projects that discharge non-project water into the California Aqueduct would need to be considered and analyzed for potential cumulative impacts to water quality. Impacts to water quality or quantity are considered **potentially significant** and will be discussed further in the subsequent EIR.

#21 -c. Would the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?

The Recovery Project would have the potential to cause substantial adverse effects on human beings from potential impacts to water quality or quantity. This impact would be **potentially significant** and will be discussed further in the subsequent EIR.

[1] The CEQA Guidelines, Section 15355 state, "The cumulative impact from several projects is the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time."

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Gigi Gable..............................Report Editing

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Appendix B Comments received on the Notice of Preparation and Initial Study

NATIVE AMERICAN HERITAGE COMMISSION

7/1/2020

Governor's Office of Planning & Research

Jun 19 2020

STATE CLEARINGHOUSE

NAHC HEADQUARTERS
1550 Harbor Boulevard
Suite 100
West Sacramento,
California 95691
(916) 373-3710
nahc@nahc.ca.gov
NAHC.ca.gov

June 16, 2020

Tim Ashlock
Buena Vista Water Storage District
525 North Main Street
Buttonwillow, CA 93206

Re: 2020060315, Palms Groundwater Recovery Project, Kern County

Dear Mr. Ashlock:

The Native American Heritage Commission (NAHC) has received the Notice of Preparation (NOP), Draft Environmental Impact Report (DEIR) or Early Consultation for the project referenced above. The California Environmental Quality Act (CEQA) (Pub. Resources Code §21000 et seq.), specifically Public Resources Code §21084.1, states that a project that may cause a substantial adverse change in the significance of a historical resource, is a project that may have a significant effect on the environment. (Pub. Resources Code § 21084.1; Cal. Code Regs., tit.14, §15064.5 (b) (CEQA Guidelines §15064.5 (b)). If there is substantial evidence, in light of the whole record before a lead agency, that a project may have a significant effect on the environment, an Environmental Impact Report (EIR) shall be prepared. (Pub. Resources Code §21080 (d); Cal. Code Regs., tit. 14, § 5064 subd.(a)(1) (CEQA Guidelines §15064 (a)(1)). In order to determine whether a project will cause a substantial adverse change in the significance of a historical resource, a lead agency will need to determine whether there are historical resources within the area of potential effect (APE).

CEQA was amended significantly in 2014. Assembly Bill 52 (Gatto, Chapter 532, Statutes of 2014) (AB 52) amended CEQA to create a separate category of cultural resources, "tribal cultural resources" (Pub. Resources Code §21074) and provides 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. (Pub. Resources Code §21084.2). Public agencies shall, when feasible, avoid damaging effects to any tribal cultural resource. (Pub. Resources Code §21084.3 (a)). AB 52 applies to any project for which a notice of preparation, a notice of negative declaration, or a mitigated negative declaration is filed on or after July 1, 2015. If your project involves the adoption of or amendment to a general plan or a specific plan, or the designation or proposed designation of open space, on or after March 1, 2005, it may also be subject to Senate Bill 18 (Burton, Chapter 905, Statutes of 2004) (SB 18). Both SB 18 and AB 52 have tribal consultation requirements. If your project is also subject to the federal National Environmental Policy Act (42 U.S.C. § 4321 et seq.) (NEPA), the tribal consultation requirements of Section 106 of the National Historic Preservation Act of 1966 (154 U.S.C. 300101, 36 C.F.R. §800 et seq.) may also apply.

The NAHC recommends consultation with California Native American tribes that are traditionally and culturally affiliated with the geographic area of your proposed project as early as possible in order to avoid inadvertent discoveries of Native American human remains and best protect tribal cultural resources. Below is a brief summary of portions of AB 52 and SB 18 as well as the NAHC's recommendations for conducting cultural resources assessments.

Consult your legal counsel about compliance with AB 52 and SB 18 as well as compliance with any other applicable laws.

AB 52

AB 52 has added to CEQA the additional requirements listed below, along with many other requirements:

1. Fourteen Day Period to Provide Notice of Completion of an Application/Decision to Undertake a Project: Within fourteen (14) days of determining that an application for a project is complete or of a decision by a public agency to undertake a project, a lead agency shall provide formal notification to a designated contact of, or tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, to be accomplished by at least one written notice that includes:

- **a.** A brief description of the project.
- **b.** The lead agency contact information.
- **c.** Notification that the California Native American tribe has 30 days to request consultation. (Pub. Resources Code §21080.3.1 (d)).
- **d.** A "California Native American tribe" is defined as a Native American tribe located in California that is on the contact list maintained by the NAHC for the purposes of Chapter 905 of Statutes of 2004 (SB 18). (Pub. Resources Code §21073).

2. Begin Consultation Within 30 Days of Receiving a Tribe's Request for Consultation and Before Releasing a Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report: A lead agency shall begin the consultation process within 30 days of receiving a request for consultation from a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project. (Pub. Resources Code §21080.3.1, subds. (d) and (e)) and prior to the release of a negative declaration, mitigated negative declaration or Environmental Impact Report. (Pub. Resources Code §21080.3.1(b)).

- **a.** For purposes of AB 52, "consultation shall have the same meaning as provided in Gov. Code §65352.4 (SB 18). (Pub. Resources Code §21080.3.1 (b)).

3. Mandatory Topics of Consultation If Requested by a Tribe: The following topics of consultation, if a tribe requests to discuss them, are mandatory topics of consultation:

- **a.** Alternatives to the project.
- **b.** Recommended mitigation measures.
- **c.** Significant effects. (Pub. Resources Code §21080.3.2 (a)).

4. Discretionary Topics of Consultation: The following topics are discretionary topics of consultation:

- **a.** Type of environmental review necessary.
- **b.** Significance of the tribal cultural resources.
- **c.** Significance of the project's impacts on tribal cultural resources.
- **d.** If necessary, project alternatives or appropriate measures for preservation or mitigation that the tribe may recommend to the lead agency. (Pub. Resources Code §21080.3.2 (a)).

5. Confidentiality of Information Submitted by a Tribe During the Environmental Review Process: With some exceptions, any information, including but not limited to, the location, description, and use of tribal cultural resources submitted by a California Native American tribe during the environmental review process shall not be included in the environmental document or otherwise disclosed by the lead agency or any other public agency to the public, consistent with Government Code §6254 (r) and §6254.10. Any information submitted by a California Native American tribe during the consultation or environmental review process shall be published in a confidential appendix to the environmental document unless the tribe that provided the information consents, in writing, to the disclosure of some or all of the information to the public. (Pub. Resources Code §21082.3 (c)(1)).

6. Discussion of Impacts to Tribal Cultural Resources in the Environmental Document: If a project may have a significant impact on a tribal cultural resource, the lead agency's environmental document shall discuss both of the following:

- **a.** Whether the proposed project has a significant impact on an identified tribal cultural resource.
- **b.** Whether feasible alternatives or mitigation measures, including those measures that may be agreed to pursuant to Public Resources Code §21082.3, subdivision (a), avoid or substantially lessen the impact on the identified tribal cultural resource. (Pub. Resources Code §21082.3 (b)).

7. Conclusion of Consultation: Consultation with a tribe shall be considered concluded when either of the following occurs:

a. The parties agree to measures to mitigate or avoid a significant effect, if a significant effect exists, on a tribal cultural resource; or

b. A party, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached. (Pub. Resources Code §21080.3.2 (b)).

8. Recommending Mitigation Measures Agreed Upon in Consultation in the Environmental Document: Any mitigation measures agreed upon in the consultation conducted pursuant to Public Resources Code §21080.3.2 shall be recommended for inclusion in the environmental document and in an adopted mitigation monitoring and reporting program, if determined to avoid or lessen the impact pursuant to Public Resources Code §21082.3, subdivision (b), paragraph 2, and shall be fully enforceable. (Pub. Resources Code §21082.3 (a)).

9. Required Consideration of Feasible Mitigation: If mitigation measures recommended by the staff of the lead agency as a result of the consultation process are not included in the environmental document or if there are no agreed upon mitigation measures at the conclusion of consultation, or if consultation does not occur, and if substantial evidence demonstrates that a project will cause a significant effect to a tribal cultural resource, the lead agency shall consider feasible mitigation pursuant to Public Resources Code §21084.3 (b). (Pub. Resources Code §21082.3 (e)).

10. Examples of Mitigation Measures That, If Feasible, May Be Considered to Avoid or Minimize Significant Adverse Impacts to Tribal Cultural Resources:

a. Avoidance and preservation of the resources in place, including, but not limited to:

i. Planning and construction to avoid the resources and protect the cultural and natural context.

ii. Planning greenspace, parks, or other open space, to incorporate the resources with culturally appropriate protection and management criteria.

b. Treating the resource with culturally appropriate dignity, taking into account the tribal cultural values and meaning of the resource, including, but not limited to, the following:

i. Protecting the cultural character and integrity of the resource.

ii. Protecting the traditional use of the resource.

iii. Protecting the confidentiality of the resource.

c. Permanent conservation easements or other interests in real property, with culturally appropriate management criteria for the purposes of preserving or utilizing the resources or places.

d. Protecting the resource. (Pub. Resource Code §21084.3 (b)).

e. Please note that a federally recognized California Native American tribe or a non-federally recognized California Native American tribe that is on the contact list maintained by the NAHC to protect a California prehistoric, archaeological, cultural, spiritual, or ceremonial place may acquire and hold conservation easements if the conservation easement is voluntarily conveyed. (Civ. Code §815.3 (c)).

f. Please note that it is the policy of the state that Native American remains and associated grave artifacts shall be repatriated. (Pub. Resources Code §5097.991).

11. Prerequisites for Certifying an Environmental Impact Report or Adopting a Mitigated Negative Declaration or Negative Declaration with a Significant Impact on an Identified Tribal Cultural Resource: An Environmental Impact Report may not be certified, nor may a mitigated negative declaration or a negative declaration be adopted unless one of the following occurs:

a. The consultation process between the tribes and the lead agency has occurred as provided in Public Resources Code §21080.3.1 and §21080.3.2 and concluded pursuant to Public Resources Code §21080.3.2.

b. The tribe that requested consultation failed to provide comments to the lead agency or otherwise failed to engage in the consultation process.

c. The lead agency provided notice of the project to the tribe in compliance with Public Resources Code §21080.3.1 (d) and the tribe failed to request consultation within 30 days. (Pub. Resources Code §21082.3 (d)).

SB 18

SB 18 applies to local governments and requires local governments to contact, provide notice to, refer plans to, and consult with tribes prior to the adoption or amendment of a general plan or a specific plan, or the designation of open space. (Gov. Code §65352.3). Local governments should consult the Governor's Office of Planning and Research's "Tribal Consultation Guidelines," which can be found online at: https://www.opr.ca.gov/docs/09_14_05_Updated_Guidelines_922.pdf.

Some of SB 18's provisions include:

1. Tribal Consultation: If a local government considers a proposal to adopt or amend a general plan or a specific plan, or to designate open space it is required to contact the appropriate tribes identified by the NAHC by requesting a "Tribal Consultation List." If a tribe, once contacted, requests consultation the local government must consult with the tribe on the plan proposal. A tribe has 90 days from the date of receipt of notification to request consultation unless a shorter timeframe has been agreed to by the tribe. (Gov. Code §65352.3 (a)(2)).
2. No Statutory Time Limit on SB 18 Tribal Consultation. There is no statutory time limit on SB 18 tribal consultation.
3. Confidentiality: Consistent with the guidelines developed and adopted by the Office of Planning and Research pursuant to Gov. Code §65040.2, the city or county shall protect the confidentiality of the information concerning the specific identity, location, character, and use of places, features and objects described in Public Resources Code §5097.9 and §5097.993 that are within the city's or county's jurisdiction. (Gov. Code §65352.3 (b)).
4. Conclusion of SB 18 Tribal Consultation: Consultation should be concluded at the point in which:
   - **a.** The parties to the consultation come to a mutual agreement concerning the appropriate measures for preservation or mitigation; or
   - **b.** Either the local government or the tribe, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached concerning the appropriate measures of preservation or mitigation. (Tribal Consultation Guidelines, Governor's Office of Planning and Research (2005) at p. 18).

Agencies should be aware that neither AB 52 nor SB 18 precludes agencies from initiating tribal consultation with tribes that are traditionally and culturally affiliated with their jurisdictions before the timeframes provided in AB 52 and SB 18. For that reason, we urge you to continue to request Native American Tribal Contact Lists and "Sacred Lands File" searches from the NAHC. The request forms can be found online at: http://nahc.ca.gov/resources/forms/.

NAHC Recommendations for Cultural Resources Assessments

To adequately assess the existence and significance of tribal cultural resources and plan for avoidance, preservation in place, or barring both, mitigation of project-related impacts to tribal cultural resources, the NAHC recommends the following actions:

1. Contact the appropriate regional California Historical Research Information System (CHRIS) Center (http://ohp.parks.ca.gov/?page_id=1068) for an archaeological records search. The records search will determine:
   - **a.** If part or all of the APE has been previously surveyed for cultural resources.
   - **b.** If any known cultural resources have already been recorded on or adjacent to the APE.
   - **c.** If the probability is low, moderate, or high that cultural resources are located in the APE.
   - **d.** If a survey is required to determine whether previously unrecorded cultural resources are present.

2. If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
   - **a.** The final report containing site forms, site significance, and mitigation measures should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum and not be made available for public disclosure.
   - **b.** The final written report should be submitted within 3 months after work has been completed to the appropriate regional CHRIS center.

3. Contact the NAHC for:

a. A Sacred Lands File search. Remember that tribes do not always record their sacred sites in the Sacred Lands File, nor are they required to do so. A Sacred Lands File search is not a substitute for consultation with tribes that are traditionally and culturally affiliated with the geographic area of the project's APE.

b. A Native American Tribal Consultation List of appropriate tribes for consultation concerning the project site and to assist in planning for avoidance, preservation in place, or, failing both, mitigation measures.

4. Remember that the lack of surface evidence of archaeological resources (including tribal cultural resources) does not preclude their subsurface existence.

a. Lead agencies should include in their mitigation and monitoring reporting program plan provisions for the identification and evaluation of inadvertently discovered archaeological resources per Cal. Code Regs., tit. 14, §15064.5(f) (CEQA Guidelines §15064.5(f)). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American with knowledge of cultural resources should monitor all ground-disturbing activities.

b. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the disposition of recovered cultural items that are not burial associated in consultation with culturally affiliated Native Americans.

c. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the treatment and disposition of inadvertently discovered Native American human remains. Health and Safety Code §7050.5, Public Resources Code §5097.98, and Cal. Code Regs., tit. 14, §15064.5, subdivisions (d) and (e) (CEQA Guidelines §15064.5, subds. (d) and (e)) address the processes to be followed in the event of an inadvertent discovery of any Native American human remains and associated grave goods in a location other than a dedicated cemetery.

If you have any questions or need additional information, please contact me at my email address: Nancy.Gonzalez-Lopez@nahc.ca.gov.

Sincerely,

Nancy Gonzalez

Nancy Gonzalez-Lopez
Cultural Resources Analyst

cc: State Clearinghouse

RICHARD C. SLADE & ASSOCIATES LLC
CONSULTING GROUNDWATER GEOLOGISTS

MEMORANDUM

July 16, 2020

To: Mr. Tim Ashlock
Engineer-Manager
Buena Vista Water Storage District
Sent via email (tim@bvh2o.com)

Cc: Mr. Greg Hammett
General Manager
West Kern Water District
Sent via email (GHammett@wkwd.org)

RCS Job No. 369-KRN20

From: Anthony Hicke and Richard Slade
Richard C. Slade & Associates LLC (RCS)

Re: Comments Regarding Notice of Preparation (NOP) of an
Environmental Impact Report (EIR) and Initial Study
Palms Groundwater Recovery Project (PGRP), Dated June 16, 2020
Prepared for Buena Vista Water Storage District (BVWSD)
Kern County, California

Introduction

Provided herein are comments related to the referenced NOP for the BVWSD Palms Groundwater Recovery Project (Palms Project). On behalf of the WKWD, RCS reviewed the documentation available from http://bvh2o.com/PALMS-NOP.pdf, and also attended the July 2, 2020 meeting in which the document was presented. RCS provided verbal comments/questions at that meeting related to the proposed project. The purpose of this Memorandum is to help memorialize and clarify those comments, as well as to provide additional questions/comments regarding the project.

Comments

The following comments are provided in no particular order or hierarchy.

- Page 1-4 of NOP – "The Recovery Project will be managed so that groundwater elevations will, in the long term, improve from those observed historically."
    - Recovery wells proposed for the Palms Project surround two sides of the WKWD North Wellfield; specifically, the Palms project wells are located east of and north of the WKWD North Wellfield. Past performance of the WKWD North Wellfield wells has shown that declines in regional water levels affects their ability to produce water and can also affect water quality.

MEMORANDUM

- The NOP documentation appears to focus primarily on basin-wide water level impacts of the Palms Project. Analyses for the EIR should specifically consider pumping water level impacts and water quality impacts to WKWD wells due to their proximity to the proposed project wells.
    - Example - If the Palms project wells are pumping a significant volume of groundwater to the Aqueduct as part of a banking contract, it is presumable that this pumping would occur during a dry rainfall period, when natural aquifer recharge is low. This pumping could occur for an extended period of time. The requested analyses should consider the water drawdown interference induced in the WKWD wells during an extended extraction period by the project wells, and also how those drawdown effects could impact the ability of the WKWD to extract groundwater of acceptable quality from their North Wellfield wells which are necessary to meet the demands of their customers.
    - What protections will there be for the WKWD if they have to deepen pump installations, or even if the WKWD wells lose their ability to pump water at rates necessary for their operations?
    - What protections will there be for WKWD if future water quality changes impact WKWD's ability to extract groundwater of acceptable quality for their operations?

- During construction of the WKWD North wellfield wells, BVWSD expressed concern about constructing wells that were perforated across a clay layer that had been identified in the area. Water quality differed in the aquifers above and below the clay layer, based on the data collected by RCS during the testing of the new water wells and groundwater monitoring wells at the NW Wellfield. Ultimately, WKWD agreed to construct wells so that they were not perforated both above and below the identified clay layer. Page 1-4 of the NOP states the project wells would be constructed to depths "up to 500 ft". RCS assumes the EIR will include the following:
    - Defining which geologic formations from which the proposed BVWSD wells produce water.
    - Considering/defining the correlation/continuity of the aquifers in the region (using geophysical electric logs) into which the proposed Palms Project wells are to be perforated.
    - Identifying whether or not perforations in the project wells are in the same zones as those in the WKWD wells.
- Will the recharge water quality have any effects on the quality of the water produced by WKWD at its North Wellfield?

MEMORANDUM

- The Rosedale Rio Bravo Water Storage District (WSD)/Irvine Ranch Project has a “Phase 2” component that is located just north of the eastern-most BV Palms project wells, which are, in turn, located just north of the WKWD north wellfield.
    - o The EIR should consider cumulative effects of the operation of the Rosedale Rio Bravo WSD/Irvine Ranch Project and the Palms Project as part of the Palms Project EIR
- RCS recently emailed pertinent hydrogeologic data derived from the construction of the WKWD North Wellfield monitoring wells to Mr. Tim Ashlock; these data should be considered and/or implemented as appropriate into any modeling work performed for the Palms Groundwater project.
- On pages 1-4 and 1-5, the following is stated:

    “For landowners, there would be an alternative delivery option of groundwater recovery to provide flexibility by allowing private pumping in lieu of surface water deliveries. Landowners would have the option, in addition to surface water delivery, utilize on-farm wells to pump water for irrigation needs or continue to receive surface water deliveries through the District canals and pipelines. No additional District facilities would need to be constructed for this alternative delivery option. Landowners interested in this optional delivery method would be required to sign up for the District program, and participation would be limited by the amount of water available for recovery, no more than 25,000 acre-feet per year.

    “This alternative delivery option would allow wider participation and flexibility for water users. It is anticipated that water users south of Perral Road in the Buttonwillow Service Area would be eligible to participate in the program. The water pumped from landowner wells would be treated as recovered water, leaving a similar amount of water (SWP, Kern River, or other water) available for a different beneficial use.”

    - o Perral Road is roughly 10 to 15 miles north of the spreading project. Is it reasonable to consider extractions along Perral Road as extracting water spread at the Palms Project? Does the hydrogeology of the region support such an assertion? Under the project as proposed, if 25,000 acre feet (25KAF) of water are spread at the Palms Project, can 25KAF be extracted 10 to 15 miles north of the project by private pumpers and be attributed to the Palms Project spreading?
- From page 1-5:

    “In order to ensure that water quality will meet DWR requirements, aquifer isolation zone water quality testing will be conducted. The wells will then be designed to collect water from portions of the aquifer with favorable water quality. This method will likely be used during construction of the first few wells and may be discontinued for wells constructed after the local water quality parameters are better understood.”

MEMORANDUM

  - o Does the existing data available from prior Palms Project work support the assertion that recharge at ground surface will recharge the aquifers with favorable water quality mentioned in the passage above?

- The EIR should consider possibly phasing the construction of the project wells, and provide specifics on the phasing plan, if possible.
- The EIR should include some historic and more recent groundwater elevation contour maps to show groundwater flow directions in the region during both dry periods and wet periods.
- Figure 1-1 of the NOP shows that a number of the proposed extraction wells for the Palms project are located outside of (east of) the BVWSD boundary and relatively distant from the area of spreading. This also places the WKWD North Wellfield between the Palms Project recharge area and the recovery wells outside of the BVWSD boundary. During prior meetings, it was mentioned by BVWSD that these wells were to help achieve water quality standard necessary for recovery operations when water was pumped back into the aqueduct. The EIR should specifically analyze the effects of these “distant” extraction wells, and the effects of pumping from these distant wells on groundwater levels and water quality in the area, including the effects on WKWD north wellfield operations.

State of California – Natural Resources Agency
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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

July 17, 2020

Tim Ashlock
General Manager
Buena Vista Water Storage District
Post Office Box 756
Buttonwillow, California 93206
tim@bvh2o.com

Subject: Palms Groundwater Recovery Project (Project)
Notice of Preparation (NOP)
State Clearinghouse No. 2020060315

Dear Mr. Ashlock:

The California Department of Fish and Wildlife (CDFW) received an NOP for an Environmental Impact Report (EIR) from the Buena Vista Water Storage District (BVWSD), as Lead Agency, for the Project pursuant the California Environmental Quality Act (CEQA) and CEQA Guidelines.[1]

Thank you for the opportunity to provide comments and recommendations regarding those activities involved in the Project that may affect California fish and wildlife. Likewise, CDFW appreciates the opportunity to provide comments regarding those aspects of the Project that CDFW, by law, may be required to carry out or approve through the exercise of its own regulatory authority under the Fish and Game Code.

CDFW ROLE

CDFW is California's **Trustee Agency** for fish and wildlife resources and holds those resources in trust by statute for all the people of the State (Fish & G. Code, §§ 711.7, subd. (a) & 1802; Pub. Resources Code, § 21070; CEQA Guidelines § 15386, subd. (a)). CDFW, in its trustee capacity, has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species (*Id.*, § 1802). Similarly, for purposes of CEQA, CDFW is charged by law to provide, as available, biological expertise during public agency environmental review efforts, focusing specifically on

[1] CEQA is codified in the California Public Resources Code in section 21000 et seq. The "CEQA Guidelines" are found in Title 14 of the California Code of Regulations, commencing with section 15000.

projects and related activities that have the potential to adversely affect fish and wildlife resources.

CDFW is also submitting comments as a **Responsible Agency** under CEQA (Pub. Resources Code, § 21069; CEQA Guidelines, § 15381). CDFW expects that it may need to exercise regulatory authority as provided by the Fish and Game Code. As proposed, for example, the Project may be subject to CDFW's lake and streambed alteration regulatory authority (Fish & G. Code, § 1600 et seq.). Likewise, to the extent implementation of the Project as proposed may result in "take" as defined by State law of any species protected under the California Endangered Species Act (CESA) (Fish & G. Code, § 2050 et seq.), related authorization as provided by the Fish and Game Code will be required.

CDFW has jurisdiction over fully protected species of birds, mammals, amphibians and reptiles, and fish, pursuant to Fish and Game Code sections 3511, 4700, 5050, and 5515. Take of any fully protected species is prohibited and CDFW cannot authorize their incidental take.

PROJECT DESCRIPTION SUMMARY

Proponent: BVWSD is the Project applicant and Lead Agency for the purpose of CEQA.

Objective: The Recovery Project has the following primary objectives:

- Increase conjunctive management on the west side of Kern County by improving the BVWSD's ability to meet demands during periods when supply of surface water is limited with previously banked water supplies.

- Improve conveyance of previously stored water throughout the BVWSD area and to neighboring districts.

- Provide water for urban use in Kern County and possibly elsewhere.

Project Description: The Project is the construction and replacement of a suite of 14 wells, including nine new wells and five replacement wells. Additionally, conveyance pipelines would be installed to connect these wells to the water delivery system. Construction activities would include excavation and trenching to install the wells, and approximately 11.9 miles of conveyance pipe. The total area of disturbance would be approximately 72 acres. The new and replacement wells would be drilled to a depth of up to 500 feet and include an 18-inch casing. Staging areas for the construction equipment and materials would be adjacent to the Project area on previously disturbed land. The water pipelines will be connected to BVWSD's existing turnout at the

California Aqueduct at BV8, which can be used to either input water to, or withdraw water from, the California Aqueduct.

Location: The Project is located in the BVWSD service area, approximately 4 miles south of the unincorporated community of Buttonwillow, Kern County, California, within Sections 2 to 5, 8 to 11, 14, and 15; Township 30 South; Range 24 East; Mount Diablo Base & Meridian.

Timeframe: Construction activities are expected to begin in the fall of 2020 and be completed within 11 months.

COMMENTS AND RECOMMENDATIONS

CDFW offers the comments and recommendations below to assist BVWSD in adequately identifying and/or mitigating the Project's significant, or potentially significant, direct and indirect impacts on fish and wildlife (biological) resources. Editorial comments or other suggestions may also be included to improve the CEQA document.

Aerial imagery of the Project boundary and its surroundings within the Project boundary shows nearby riparian corridors, riparian-lined canal corridors, large trees, Valley saltbush and Great Valley mesquite scrub habitat, upland grassland, and agricultural habitats. Tule Elk State Natural Reserve, managed by the California Department of Parks and Recreation, is located adjacent to the Project boundary. Based on a review of the Project description, a review of California Natural Diversity Database (CNDDB) records, and the surrounding habitat, several special-status species could potentially be impacted by Project activities.

Project-related construction activities within the Project boundary including but not limited to construction and operation of additional water banking facilities and introduction of surface water flows for storage could impact the following special-status plant and wildlife species and habitats known to occur in the area: the State threatened and federally endangered San Joaquin kit fox (*Vulpes macrotis mutica*); the State and federally endangered Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*); the State and federally endangered giant kangaroo rat (*Dipodomys ingens*); the State and federally endangered and State fully protected blunt-nosed leopard lizard (*Gambelia sila*); the State threatened Swainson's hawk (*Buteo swainsoni*), Nelson's antelope squirrel (*Ammospermophilus nelsoni*), and tricolored blackbird (*Agelaius tricolor*); the California Rare Plant Rank (CRPR) 1B.1 alkali-sink goldfields (*Lasthenia chrysantha*), oil nest straw (*Stylocline citroleum*), and slough thistle (*Cirsium crassicaule*); the CRPR 1B.2 recurved larkspur (*Delphinium recurvatum*); and the State species of special concern American badger (*Taxidea taxus*), Tulare grasshopper mouse (*Onychomys torridus tularensis*), San Joaquin pocket mouse (*Perognathus inornatus*), burrowing owl

(*Athene cunicularia*), Le Conte's thrasher (*Toxistoma lecontei*), western pond turtle (*Emys marmorata*), San Joaquin coachwhip (*Masticophis flagellum ruddocki*), California glossy snake (*Arizona elegans occidentalis*), western spadefoot (*Spea hammondi*), and coast horned lizard (*Phrynosoma blainvillii*).

Please note that the CNDDB is populated by and records voluntary submissions of species detections. As a result, species may be present in locations not depicted in the CNDDB but where there is suitable habitat and features capable of supporting species. Therefore, a lack of an occurrence record in the CNDDB is not tantamount to a negative species finding. In order to adequately assess any potential Project related impacts to biological resources, surveys conducted by a qualified wildlife biologist/botanist during the appropriate survey period(s) and using the appropriate protocol survey methodology are warranted in order to determine whether or not any special-status species are present at or near the Project area.

CDFW recommends that the following modifications and/or edits be incorporated into the EIR.

I. Mitigation Measure or Alternative and Related Impact Shortcoming

Would the Project 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 the United States Fish and Wildlife Service (USFWS)?

COMMENT 1: San Joaquin Kit Fox (SJKF)

Issue: SJKF occurrences have been documented within the Project boundary (CDFW 2020a). The Project has the potential to temporarily disturb and permanently alter suitable habitat for SJKF and directly impact individuals if present during construction, recharge, and other activities.

SJKF den in a variety of areas such as rights-of-way, agricultural and fallow or ruderal habitat, dry stream channels, and canal levees, and populations can fluctuate over time. SJKF are also capable of occupying urban environments (Cypher and Frost 1999). SJKF may be attracted to Project areas due to the type and level of ground-disturbing activities and the loose, friable soils resulting from intensive ground disturbance. SJKF will forage in fallow and agricultural fields and utilize streams and canals as dispersal corridors. As a result, there is potential for SJKF to occupy all suitable habitat within the Project boundary and surrounding area.

Specific impact: Without appropriate avoidance and minimization measures for SJKF, potential significant impacts associated with construction include habitat loss, den collapse, inadvertent entrapment, reduced reproductive success, reduction in health and vigor of young, and direct mortality of individuals.

Evidence impact is potentially significant: Habitat loss resulting from land conversion to agricultural, urban, and industrial development is the primary threat to SJKF (Cypher et al. 2013). Western Kern County supports relatively large areas of high suitability habitat and one of the largest remaining populations of SJKF (Cypher et al. 2013). The Project area is within this remaining highly suitable habitat, which is otherwise intensively managed for agriculture. Therefore, subsequent ground-disturbing activities have the potential to significantly impact local SJKF populations.

Recommended Potentially Feasible Mitigation Measure(s)
To evaluate potential impacts to SJKF associated with subsequent land conversion, ground disturbance and construction, CDFW recommends conducting the following evaluation of project areas and implementing the following mitigation measures.

Recommended Mitigation Measure 1: SJKF Habitat Assessment

For all Project-specific components including construction and land conversion, CDFW recommends that a qualified biologist conduct a habitat assessment in advance of Project implementation, to determine if the Project area or its immediate vicinity contains suitable habitat for SJKF.

Recommended Mitigation Measure 2: SJKF Surveys and Minimization

CDFW recommends assessing presence/absence of SJKF by having qualified biologists conducting surveys of Project areas and a 500-foot buffer of Project areas to detect SJKF and their sign. CDFW also recommends following the USFWS (2011) “Standardized recommendations for protection of the San Joaquin kit fox prior to and during ground disturbance”.

Recommended Mitigation Measure 3: SJKF Take Authorization

SJKF detection warrants consultation with CDFW to discuss how to avoid take or, if avoidance is not feasible, to acquire an Incidental Take Permit (ITP) prior to ground-disturbing activities, pursuant to Fish and Game Code section 2081 subdivision (b).

COMMENT 2: Blunt-nosed Leopard Lizard (BNLL)

Issue: BNLL have been documented in suitable habitat within and adjacent to the Project boundary (CDFW 2020a). Suitable BNLL habitat includes areas of grassland and upland scrub that contain requisite habitat elements, such as small mammal burrows. BNLL also use open space patches between suitable habitats, including disturbed sites, unpaved access roadways, and canals.

Specific impact: Without appropriate avoidance and minimization measures for BNLL, potentially significant impacts associated with ground-disturbing activities include habitat loss, burrow collapse, reduced reproductive success, reduced health and vigor of eggs and/or young, and direct mortality.

Evidence impact is potentially significant: Habitat loss resulting from cultivation, agricultural, urban, industrial development, petroleum and mineral extraction, and construction of communication and irrigation infrastructure is the primary threat to BNLL (ESRP 2020a). The range for BNLL now consists of scattered parcels of undeveloped land within the valley floor and the foothills of the Coast Range (USFWS 1998). Some undeveloped areas with suitable BNLL habitat occur within the Project and surrounding area; therefore, ground disturbance and conversion of suitable habitat has the potential to significantly impact local BNLL populations.

Recommended Potentially Feasible Mitigation Measure(s)
To evaluate potential impacts to BNLL associated with subsequent development, CDFW recommends conducting the following evaluation of Project areas and implementing the following mitigation measures.

Recommended Mitigation Measure 4: BNLL Habitat Assessment

CDFW recommends that a qualified biologist conduct a habitat assessment in advance of project implementation, to determine if the Project area or its immediate vicinity contains suitable habitat for BNLL.

Recommended Mitigation Measure 5: BNLL Surveys

If suitable habitat is present, then prior to initiating any vegetation- or ground-disturbance activities, CDFW recommends conducting surveys in accordance with the “Approved Survey Methodology for the Blunt-nosed Leopard Lizard” (CDFW 2019). This survey protocol, designed to optimize BNLL detectability, reasonably assures CDFW that ground disturbance will not result in take of this fully protected species.

CDFW advises that BNLL surveys be completed no more than one year prior to initiation of ground disturbance. Please note that protocol-level surveys must be conducted on multiple dates during late spring, summer, and fall of the same calendar year, and that within these time periods, there are specific protocol-level date, temperature, and time parameters that must be adhered to. As a result, protocol-level surveys for BNLL are not synonymous with 30-day “preconstruction surveys” often recommended for other wildlife species. In addition, the BNLL protocol specifies different survey effort requirements based on whether the disturbance results from maintenance activities or if the disturbance results in habitat removal (CDFW 2019).

Recommended Mitigation Measure 6: BNLL Take Avoidance

BNLL detection during protocol-level surveys warrants consultation with CDFW to discuss whether take of BNLL can be avoided during ground-disturbing Project activities.

COMMENT 3: San Joaquin Antelope Squirrel (SJAS)

Issue: SJAS have been documented to occur within areas of suitable habitat within the Project vicinity (CDFW 2020a). Suitable SJAS habitat includes areas of grassland, upland scrub, and alkali sink habitats that contain requisite habitat elements, such as small mammal burrows.

Specific impact: Without appropriate avoidance and minimization measures for SJAS, potential significant impacts include loss of habitat, burrow collapse, inadvertent entrapment of individuals, reduced reproductive success such as reduced health or vigor of young, and direct mortality of individuals.

Evidence impact is potentially significant: Habitat loss resulting from agricultural, urban, and industrial development is the primary threat to SJAS. Very little suitable habitat for this species remains along the western floor of the San Joaquin Valley (ESRP 2020b). Areas of suitable habitat within the Project represent some of the only remaining undeveloped land in the vicinity, which is otherwise intensively managed for agriculture. As a result, ground-disturbing activities within the Project may have the potential to significantly impact local populations of SJAS.

Recommended Potentially Feasible Mitigation Measure(s)
To evaluate potential impacts to SJAS associated with subsequent development, CDFW recommends conducting the following evaluation of Project areas and implementing the following mitigation measures.

Recommended Mitigation Measure 7: SJAS Habitat Assessment

CDFW recommends that a qualified biologist conduct a habitat assessment in advance of project implementation, to determine if the Project area or its immediate vicinity contains suitable habitat for SJAS.

Recommended Mitigation Measure 8: SJAS Surveys

In areas of suitable habitat, CDFW recommends that a qualified biologist conduct focused daytime visual surveys for SJAS using line transects with 10- to 30-meter spacing of Project areas and a 50-foot buffer around those areas. CDFW further advises that these surveys be conducted between April 1 and September 20, during daytime temperatures between 68° and 86° F (CDFG 1990a), to maximize detectability.

Recommended Mitigation Measure 9: SJAS Avoidance

If suitable habitat is present and surveys are not feasible, CDFW advises maintenance of a 50-foot minimum no-disturbance buffer around all small mammal burrow entrances until the completion of Project activities.

Recommended Mitigation Measure 10: SJAS Take Authorization

SJAS detection warrants consultation with CDFW to discuss how to avoid take or, if avoidance is not feasible, to acquire a State ITP prior to ground-disturbing activities, pursuant to Fish and Game Code section 2081 subdivision (b).

COMMENT 4: Tipton Kangaroo Rat (TKR)

Issue: TKR have been documented to occur within areas of suitable habitat within and adjacent to the Project (CDFW 2020a). Suitable TKR habitat includes areas of grassland, upland scrub, and alkali sink habitats that contain requisite habitat elements, such as small mammal burrows.

Specific impact: Without appropriate avoidance and minimization measures for TKR, potential significant impacts include loss of habitat, burrow collapse, inadvertent entrapment of individuals, reduced reproductive success such as reduced health or vigor of young, and direct mortality of individuals.

Evidence impact is potentially significant: Habitat loss resulting from agricultural, urban, and industrial development is the primary threat to TKR. Very little suitable habitat for this species remains along the western floor of the San Joaquin Valley (ESRP 2020c). Areas of suitable habitat within the Project represent some of the only remaining undeveloped land in the vicinity, which is otherwise intensively managed for agriculture. As a result, ground-disturbing activities within the Project may have the potential to significantly impact local populations of TKR.

Recommended Potentially Feasible Mitigation Measure(s)
To evaluate potential impacts to TKR associated with subsequent development, CDFW recommends conducting the following evaluation of Project areas and implementing the following mitigation measures.

Recommended Mitigation Measure 11: TKR Habitat Assessment

CDFW recommends that a qualified biologist conduct a habitat assessment in advance of Project implementation, to determine if the Project area or its immediate vicinity contains suitable habitat for TKR.

Recommended Mitigation Measure 12: TKR Avoidance

If suitable habitat is present, CDFW advises maintenance of a 50-foot minimum no-disturbance buffer around all small mammal burrow entrances of suitable size for TKR use.

Recommended Mitigation Measure 13: TKR Surveys

If burrow avoidance is not feasible, CDFW recommends that focused protocol-level trapping surveys be conducted by a qualified wildlife biologist that is permitted to do so by both CDFW and USFWS, to determine if TKR occurs in the Project area. CDFW advises that these surveys be conducted in accordance with the USFWS (2013) “Survey Protocol for Determining Presence of San Joaquin Kangaroo Rats,” well in advance of ground-disturbing activities in order to determine whether impacts to TKR could occur.

Recommended Mitigation Measure 14: TKR Take Authorization

TKR detection warrants consultation with CDFW to discuss how to avoid take or, if avoidance is not feasible, to acquire an ITP prior to ground-disturbing activities, pursuant to Fish and Game Code section 2081 subdivision (b).

COMMENT 5: Giant Kangaroo Rat (GKR)

Issue: GKR have been documented within areas of suitable habitat adjacent to the Project area (CDFW 2020a). Suitable GKR habitat includes areas of grassland, upland scrub, and alkali sink habitats that contain requisite habitat elements, such as small mammal burrows.

Specific impact: Without appropriate avoidance and minimization measures for GKR, potential significant impacts include loss of habitat, burrow collapse, inadvertent entrapment of individuals, reduced reproductive success such as reduced health or vigor of young, and direct mortality of individuals.

Evidence impact is potentially significant: Habitat loss resulting from agricultural and petroleum development is the primary threat to GKR. Very little suitable habitat for this species remains along the western floor of the San Joaquin Valley (ESRP 2020d). Areas of suitable habitat within the Project vicinity represent some of the only remaining undeveloped land in the vicinity, which is otherwise intensively managed for agriculture. As a result, ground-disturbing activities within the Project may have the potential to significantly impact local populations of GKR.

Recommended Potentially Feasible Mitigation Measure(s)
To evaluate potential impacts to GKR associated with subsequent development, CDFW recommends conducting the following evaluation of Project areas and implementing the following mitigation measures.

Recommended Mitigation Measure 15: GKR Habitat Assessment

CDFW recommends that a qualified biologist conduct a habitat assessment in advance of Project implementation, to determine if the Project area or its immediate vicinity contains suitable habitat for GKR.

Recommended Mitigation Measure 16: GKR Surveys

In areas of suitable habitat, CDFW recommends that a qualified biologist conduct focused daytime visual surveys for GKR using line transects with 10- to 30-meter spacing of Project areas and a 50-foot buffer around those areas. Surveys should focus on the identification of their characteristic habitat types and burrow systems (burrow openings 50 to 55 mm in diameter) (CDFW 1990b).

Recommended Mitigation Measure 17: GKR Avoidance

If suitable habitat is present and surveys are not feasible, CDFW advises maintenance of a 50-foot minimum no-disturbance buffer around all small mammal burrow entrances until the completion of Project activities.

Recommended Mitigation Measure 18: GKR Take Authorization

GKR detection or presence of characteristic habitat or burrow systems warrants consultation with CDFW to discuss how to avoid take or, if avoidance is not feasible, to acquire an ITP prior to ground-disturbing activities, pursuant to Fish and Game Code section 2081 subdivision (b).

COMMENT 6: Swainson's Hawk (SWHA)

Issue: SWHA have been documented within the Project area. Review of recent aerial imagery indicates that trees capable of supporting nesting SWHA occur along nearby waterways and Tule Elk Reserve. Landscape trees may also provide suitable nesting habitat. In addition, grassland and agricultural land in the surrounding area provide suitable foraging habitat for SWHA, increasing the likelihood of SWHA occurrence within the vicinity.

Specific impact: Without appropriate avoidance and minimization measures for SWHA, potential significant impacts associated with Project activities include loss of forging and/or nesting habitat, nest abandonment, reduced reproductive success, and reduced health and vigor of eggs and/or young.

Evidence impact would be significant: Lack of suitable nesting habitat in the San Joaquin Valley limits the local distribution and abundance of SWHA (CDFW 2016). The trees within the Project represent some of the only remaining suitable nesting habitat in the local vicinity. Depending on the timing of construction, activities including noise, vibration, and movement of workers or equipment could affect nests and have the potential to result in nest abandonment, significantly impacting local nesting SWHA. In addition, agricultural cropping patterns can directly influence distribution and abundance of SWHA. For example, SWHA can forage in grasslands, pasture, hay crops, and low growing irrigated crops; however, other agricultural crops such as orchards and vineyards are incompatible with SWHA foraging (Estep 2009, Swolgaard et al. 2008).

Recommended Potentially Feasible Mitigation Measure(s)
To evaluate potential impacts to SWHA associated with subsequent development, CDFW recommends conducting the following evaluation of Project areas and implementing the following mitigation measures.

Recommended Mitigation Measure 19: Focused SWHA Surveys

To evaluate potential Project-related impacts, CDFW recommends that a qualified wildlife biologist conduct surveys for nesting SWHA following the entire survey methodology developed by the SWHA Technical Advisory Committee (SWHA TAC 2000) prior to Project initiation. SWHA detection during protocol-level surveys warrants consultation with CDFW to discuss how to implement Project activities and avoid take.

Recommended Mitigation Measure 20: SWHA Avoidance

CDFW recommends that if Project-specific activities will take place during the SWHA nesting season (i.e., March 1 through August 31), and active SWHA nests are present, a minimum ½-mile no-disturbance buffer be delineated and maintained around each nest, regardless if when it was detected by surveys or incidentally, until the breeding season has ended or until a qualified biologist has determined that the birds have fledged and are no longer reliant upon the nest or parental care for survival, to prevent nest abandonment and other take of SWHA as a result of Project activities.

Recommended Mitigation Measure 21: Tree Removal

CDFW recommends that the removal of known raptor nest trees, even outside of the nesting season, be replaced with an appropriate native tree species planting at a ratio of 3:1 at or near the Project area or in another area that will be protected in perpetuity. This mitigation would offset the local and temporal impacts of nesting habitat loss.

Recommended Mitigation Measure 22: SWHA Take Authorization

If SWHA are detected and a ½-mile no-disturbance nest buffer is not feasible, consultation with CDFW is warranted to determine if the Project can avoid take. If SWHA take cannot be avoided, issuance of an ITP prior to Project activities is warranted to comply with CESA

COMMENT 7: Tricolored Blackbird (TRBL)

Issue: TRBL are known to occur in the Project vicinity (CDFW 2020a, UC Davis 2020). Review of aerial imagery indicates that the Project boundary includes flood-irrigated agricultural land, which is an increasingly important nesting habitat type for TRBL, particularly in the San Joaquin Valley (Meese et al. 2017).

Specific impact: Without appropriate avoidance and minimization measures for TRBL, potential significant impacts associated subsequent development include nesting habitat loss, nest and/or colony abandonment, reduced reproductive success, and reduced health and vigor of eggs and/or young.

Evidence impact would be significant: As mentioned above, flood-irrigated agricultural land is an increasingly important nesting habitat type for TRBL, particularly in the San Joaquin Valley (Meese et al. 2014). This nesting substrate is present within the Project vicinity. TRBL aggregate and nest colonially, forming colonies of up to 100,000 nests (Meese et al. 2014). Approximately 86% of the global population is found in the San Joaquin Valley (Kelsey 2008, Weintraub et al. 2016). In addition, TRBL have been forming larger colonies that contain progressively larger proportions of the species' total population (Kelsey 2008). In 2008, for example, 55% of the species' global population nested in only two colonies, which were located in silage fields (Kelsey 2008). Nesting can occur synchronously, with all eggs laid within one week (Orians 1961). For these reasons, depending on timing, disturbance to nesting colonies can cause nest entire colony site abandonment and loss of all unfledged nests, significantly impacting TRBL populations (Meese et al. 2014).

Recommended Potentially Feasible Mitigation Measure(s)
To evaluate potential impacts to TRBL associated with subsequent development, CDFW recommends conducting the following evaluation of Project areas and implementing the following mitigation measures.

Recommended Mitigation Measure 23: TRBL Surveys

CDFW recommends that construction be timed to avoid the typical bird-breeding season of February 1 through September 15. If Project activity that could disrupt nesting must take place during that time, CDFW recommends that a qualified wildlife biologist conduct surveys for nesting TRBL no more than 10 days prior to the start of implementation to evaluate presence/absence of TRBL nesting colonies in proximity to Project activities and to evaluate potential Project-related impacts.

Recommended Mitigation Measure 24: TRBL Colony Avoidance

If an active TRBL nesting colony is found during preconstruction surveys, CDFW recommends implementation of a minimum 300-foot no-disturbance buffer, in accordance with CDFW's "Staff Guidance Regarding Avoidance of Impacts to Tricolored Blackbird Breeding Colonies on Agricultural Fields in 2015" (CDFW 2015), until the breeding season has ended or until a qualified biologist has determined that nesting has ceased and the young have fledged and are no longer reliant upon the colony or parental care for survival. It is important to note that TRBL colonies can expand over time and for this reason, CDFW recommends that an active colony be reassessed to determine its extent within 10 days prior to Project initiation.

Recommended Mitigation Measure 25: TRBL Take Authorization

In the event that a TRBL nesting colony is detected during surveys, consultation with CDFW is warranted to discuss whether the Project can avoid take; if take avoidance is not feasible, to acquire an ITP, pursuant to Fish and Game Code section 2081 subdivision (b), prior to any Project activities.

COMMENT 8: Special-Status Plants

Issue: Special-status plant species meeting the definition of rare or endangered under CEQA section 15380 are known to occur within the Project and surrounding area. Alkali-sink goldfields, oil nest straw, slough thistle, and recurved larkspur have been documented within the Project area.

Specific impact: Without appropriate avoidance and minimization measures for special-status plants, potential significant impacts associated with subsequent construction include loss of habitat, loss or reduction of productivity, and direct mortality.

Evidence impact would be significant: Alkali-sink goldfields, oil nest straw, slough thistle, recurved larkspur, and many other special-status plant species are threatened by grazing and agricultural, urban, and energy development. Many historical occurrences of these species are presumed extirpated (CNPS 2019). Though new populations have recently been discovered, impacts to existing populations have the potential to significantly impact populations of plant species.

Recommended Potentially Feasible Mitigation Measure(s)
To evaluate potential impacts to special-status plants associated with subsequent development, CDFW recommends conducting the following evaluation of Project areas and implementing the following mitigation measures.

Recommended Mitigation Measure 26: Special-Status Plant Surveys

CDFW recommends that individual Project sites be surveyed for special-status plants by a qualified botanist following the “Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities” (CDFG 2018b). This protocol, which is intended to maximize detectability, includes the identification of reference populations to facilitate the likelihood of field investigations occurring during the appropriate floristic period.

Recommended Mitigation Measure 27: Special-Status Plant Avoidance

CDFW recommends that special-status plant species be avoided whenever possible by delineating and observing a no-disturbance buffer of at least 50 feet from the outer edge of the plant population(s) or specific habitat type(s) required by special-status plant species. If buffers cannot be maintained, then consultation with CDFW may be warranted to determine appropriate minimization and mitigation measures for impacts to special-status plant species.

Recommended Mitigation Measure 28: Listed Plant Species Take Authorization

If a State-listed plant species is identified during botanical surveys, consultation with CDFW is warranted to determine if the Project can avoid take. If take cannot be avoided, take authorization is warranted. Take authorization would occur through issuance of an ITP, pursuant to Fish and Game Code section 2081 subdivision (b).

COMMENT 9: Burrowing Owl (BUOW)

Issue: BUOW occur within and in the vicinity of the Project (CDFW 2020a). BUOW inhabit open grassland containing small mammal burrows, a requisite habitat feature used by BUOW for nesting and cover. Habitat both within and surrounding the Project supports grassland habitat. Therefore, there is potential for BUOW to occupy or colonize the Project.

Specific impact: Potentially significant direct impacts associated with subsequent activities and land conversion include habitat loss, burrow collapse, inadvertent entrapment, nest abandonment, reduced reproductive success, reduction in health and vigor of eggs and/or young, and direct mortality of individuals.

Evidence impact is potentially significant: BUOW rely on burrow habitat year-round for their survival and reproduction. Habitat loss and degradation are considered the greatest threats to BUOW in California's Central Valley (Gervais et al. 2008). The Project and surrounding area contain remnant undeveloped land but is otherwise intensively managed for agriculture; therefore, subsequent ground-disturbing activities associated with subsequent constructions have the potential to significantly impact local BUOW populations. In addition, and as described in CDFW's "Staff Report on Burrowing Owl Mitigation" (CDFG 2012), excluding and/or evicting BUOW from their burrows is considered a potentially significant impact under CEQA.

Recommended Potentially Feasible Mitigation Measure(s) (Regarding Environmental Setting and Related Impact)
To evaluate potential impacts to BUOW associated with subsequent development, CDFW recommends conducting the following evaluation of Project areas and implementing the following mitigation measures.

Recommended Mitigation Measure 29: BUOW Habitat Assessment

CDFW recommends that a qualified biologist conduct a habitat assessment in advance of Project implementation, to determine if the Project area or its vicinity contains suitable habitat for BUOW.

Attachment 1

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE
RECOMMENDED MITIGATION MONITORING AND REPORTING PROGRAM (MMRP)

PROJECT: Palms Groundwater Recovery Project

RECOMMENDED MITIGATION MEASURES	STATUS/DATE/INITIALS
Before Disturbing Soil or Vegetation	
Recommended Mitigation Measure 1: SJKF Habitat Assessment	
Recommended Mitigation Measure 2: SJKF Surveys and Minimization	
Recommended Mitigation Measure 3: SJKF Take Authorization	
Recommended Mitigation Measure 4: BNLL Habitat Assessment	
Recommended Mitigation Measure 5: BNLL Surveys	
Recommended Mitigation Measure 7: SJAS Habitat Assessment	
Recommended Mitigation Measure 8: SJAS Surveys	
Recommended Mitigation Measure 10: SJAS Take Authorization	
Recommended Mitigation Measure 11: TKR Habitat Assessment	
Recommended Mitigation Measure 13: TKR Surveys	
Recommended Mitigation Measure 14: TKR Take Authorization	
Recommended Mitigation Measure 15: GKR Habitat Assessment	
Recommended Mitigation Measure 16: GKR Surveys	
Recommended Mitigation Measure 18: GKR Take Authorization	
Recommended Mitigation Measure 19: Focused SWHA Surveys	
Recommended Mitigation Measure 21: Tree Removal	
Recommended Mitigation Measure 22: SWHA Take Authorization	

RECOMMENDED MITIGATION MEASURES	STATUS/DATE/INITIALS
Recommended Mitigation Measure 23: TRBL Surveys	
Recommended Mitigation Measure 25: TRBL Take Authorization	
Recommended Mitigation Measure 26: Special-Status Plant Surveys	
Recommended Mitigation Measure 28: Listed Plant Species Take Authorization	
Recommended Mitigation Measure 29: BUOW Habitat Assessment	
Recommended Mitigation Measure 30: BUOW Surveys	
Recommended Mitigation Measure 32: BUOW Passive Relocation and Mitigation	
Recommended Mitigation Measure 33: Habitat Assessment (Other Species of Special Concern)	
Recommended Mitigation Measure 34: Surveys (Other Species of Special Concern)	
Recommended Mitigation Measure 36: Stream and Wetland Mapping	
Recommended Mitigation Measure 37: Stream and Wetland Habitat Mitigation	
During Construction	
Recommended Mitigation Measure 6: BNLL Take Avoidance	
Recommended Mitigation Measure 9: SJAS Avoidance	
Recommended Mitigation Measure 12: TKR Avoidance	
Recommended Mitigation Measure 17: GKR Avoidance	
Recommended Mitigation Measure 20: SWHA Avoidance	
Recommended Mitigation Measure 24: TRBL Colony Avoidance	
Recommended Mitigation Measure 27: Special-Status Plant Avoidance	
Recommended Mitigation Measure 31: BUOW Avoidance	

RECOMMENDED MITIGATION MEASURES	STATUS/DATE/INITIALS
Recommended Mitigation Measure 35: Avoidance (Other Species of Special Concern)	

Recommended Mitigation Measure 30: BUOW Surveys

If suitable habitat is present on or in the vicinity of the Project area, CDFW recommends assessing presence or absence of BUOW by having a qualified biologist conduct surveys following the California Burrowing Owl Consortium's "Burrowing Owl Survey Protocol and Mitigation Guidelines" (CBOC 1993) and the "Staff Report on Burrowing Owl Mitigation" (CDFG 2012), which suggest three or more surveillance surveys conducted during daylight with each visit occurring at least three weeks apart during the peak breeding season (i.e., April 15 to July 15), when BUOW are most detectable. In addition, CDFW advises that surveys include a minimum 500-foot buffer area around the Project area.

Recommended Mitigation Measure 31: BUOW Avoidance

CDFW recommends that no-disturbance buffers, as outlined in the "Staff Report on Burrowing Owl Mitigation" (CDFG 2012), be implemented prior to and during any ground-disturbing activities. Specifically, CDFW's Staff Report recommends that impacts to occupied burrows be avoided in accordance with the following table unless a qualified biologist approved by CDFW verifies through non-invasive methods that either: 1) the birds have not begun egg laying and incubation; or 2) that juveniles from the occupied burrows are foraging independently and are capable of independent survival.

Location	Time of Year	Level of Disturbance		
		Low	Med	High
Nesting sites	April 1-Aug 15	200 m*	500 m	500 m
Nesting sites	Aug 16-Oct 15	200 m	200 m	500 m
Nesting sites	Oct 16-Mar 31	50 m	100 m	500 m

* meters (m)

Recommended Mitigation Measure 32: BUOW Passive Relocation and Mitigation

If BUOW are found within these recommended buffers and avoidance is not possible, it is important to note that according to the Staff Report (CDFG 2012), excluding birds from burrows is not a take avoidance, minimization, or mitigation method and is instead considered a potentially significant impact under CEQA. If it is necessary for Project implementation, CDFW recommends that burrow exclusion be conducted by qualified biologists and only during the non-breeding season, before breeding behavior is exhibited and after the burrow is confirmed empty through non-invasive methods, such as surveillance. CDFW recommends replacement of occupied burrows with artificial burrows at a ratio of one burrow collapsed to one artificial burrow constructed (1:1) to mitigate for evicting BUOW and the loss of burrows. BUOW may attempt to colonize or re-colonize an area that will be impacted; thus, CDFW recommends ongoing surveillance at a rate that is sufficient to detect BUOW if they return.

COMMENT 10: Other State Species of Special Concern

Issue: Tulare grasshopper mouse, San Joaquin pocket mouse, San Joaquin coachwhip, western spadefoot, coast horned lizard, California glossy snake, Le Conte's thrasher, and American badger can inhabit grassland and upland scrub habitats (Shuford and Gardali 2008, Thomson et al. 2016). All the species mentioned above have been documented to occur in the vicinity of the Project, which supports requisite habitat elements for these species (CDFW 2020a).

Specific impact: Without appropriate avoidance and minimization measures for these species, potentially significant impacts associated with ground disturbance include habitat loss, nest/den/burrow abandonment, which may result in reduced health or vigor of eggs and/or young, and direct mortality.

Evidence impact is potentially significant: Habitat loss threatens all of the species mentioned above (Thomson et al. 2016). Habitat within and adjacent to the Project represents some of the only remaining undeveloped land in the vicinity, which is otherwise intensively managed for agriculture. As a result, ground-and vegetation-disturbing activities associated with development of the Project have the potential to significantly impact local populations of these species.

Recommended Potentially Feasible Mitigation Measure(s)
To evaluate potential impacts to special-status species associated with subsequent development, CDFW recommends conducting the following evaluation of project areas and implementing the following mitigation measures.

Recommended Mitigation Measure 33: Habitat Assessment

CDFW recommends that a qualified biologist conduct a habitat assessment in advance of project implementation, to determine if project areas or their immediate vicinity contain suitable habitat for the species mentioned above.

Recommended Mitigation Measure 34: Surveys

If suitable habitat is present, CDFW recommends that a qualified biologist conduct focused surveys for applicable species and their requisite habitat features to evaluate potential impacts resulting from ground and vegetation disturbance.

Recommended Mitigation Measure 35: Avoidance

Avoidance whenever possible is encouraged via delineation and observance a 50-foot no-disturbance buffer around dens of mammals like the American badger as well as the entrances of burrows that can provide refuge for small mammals, reptiles, and amphibians.

Would the Project have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by CDFW or USFWS?

COMMENT 11: Wetland and Riparian Habitats

Issue: The Project area is in the immediate vicinity of numerous waterways, riparian and wetland areas. Development within the Project has the potential to involve temporary and permanent impacts to these features.

Specific impact: Project activities have the potential to result in the loss of riparian and wetland vegetation, in addition to the degradation of wetland and riparian areas through grading, fill, and related development.

Evidence impact is potentially significant: The Project vicinity includes stream and wetland features within an agricultural landscape that also maintains undeveloped habitats. Riparian and associated floodplain and wetland areas are valuable for their ecosystem processes such as protecting water quality by filtering pollutants and transforming nutrients; stabilizing stream banks to prevent erosion and sedimentation/siltation; and dissipating flow energy during flood conditions, thereby spreading the volume of surface water, reducing peak flows downstream, and increasing the duration of low flows by slowly releasing stored water into the channel through subsurface flow. Within the San Joaquin Valley, modifications of streams to accommodate human uses has resulted in damming, canalizing, and channelizing of many streams, though some natural stream channels and small wetland or wetted areas remain (Edminster 2002). The Fish and Game Commission policy regarding wetland resources discourages development or conversion of wetlands that results in any net loss of wetland acreage or habitat value. Construction activities within these features also has the potential to impact downstream waters as a result of Project site impacts leading to erosion, scour, and changes in stream morphology.

Recommended Potentially Feasible Mitigation Measure(s)
To evaluate potential impacts to wetland and riparian habitats associated with subsequent development, CDFW recommends conducting the following evaluation of project areas and implementing the following mitigation measures.

Recommended Mitigation Measure 36: Stream and Wetland Mapping

CDFW recommends that formal stream mapping and wetland delineation be conducted by a qualified biologist or hydrologist, as warranted, to determine the baseline location, extent, and condition of streams (including any floodplain) and wetlands within and adjacent to the Project area. Please note that while there is overlap, State and Federal definitions of wetlands differ, and complete stream mapping commonly differs from delineations used by the United States (U.S.) Army Corps of Engineers specifically to identify the extent of Waters of the U.S. Therefore, it is advised that the wetland delineation identify both State and Federal wetlands in the Project area as well as the extent of all streams including floodplains, if present, within the Project area. CDFW advises that site map(s) depicting the extent of any activities that may affect wetlands, lakes, or streams be included with any Project site evaluations, to clearly identify areas where stream/riparian and wetland habitats could be impacted from Project activities.

Recommended Mitigation Measure 37: Stream and Wetland Habitat Mitigation

CDFW recommends that the potential direct and indirect impacts to stream/riparian and wetland habitat be analyzed according to each Project activity. Based on those potential impacts, CDFW recommends that the EIR include measures to avoid, minimize, and/or mitigate those impacts. CDFW recommends that impacts to riparian habitat (i.e., biotic and abiotic features) take into account the effects to stream function and hydrology from riparian habitat loss or damage, as well as potential effects from the loss of riparian habitat to special-status species already identified herein. CDFW recommends that any losses to stream and wetland habitats be offset with corresponding riparian and wetland habitat restoration incorporating native vegetation to replace the value to fish and wildlife provided by the habitats lost from Project implementation. If on-site restoration to replace habitats is not feasible, CDFW recommends offsite mitigation by restoring or enhancing in-kind riparian or wetland habitat and providing for the long-term management and protection of the mitigation area, to ensure its persistence.

Editorial Comments and/or Suggestions

Federally Listed Species: CDFW recommends consulting with USFWS regarding potential impacts to federally listed species. Take under the Federal Endangered Species Act (FESA) is more broadly defined than CESA; take under FESA also includes significant habitat modification or degradation that could result in death or injury to a listed species by interfering with essential behavioral patterns such as breeding, foraging, or nesting. Consultation with the USFWS in order to comply with FESA is advised well in advance of any Project activities.

Lake and Streambed Alteration: Project activities have the potential to substantially change the bed, bank, and channel of lakes, streams, and associated wetlands onsite and/or substantially extract or divert the flow of any such feature that is subject to CDFW's regulatory authority pursuant Fish and Game Code section 1600 et seq. Fish and Game Code section 1602 requires an entity to notify CDFW prior to commencing any activity that may (a) substantially divert or obstruct the natural flow of any river, stream, or lake; (b) substantially change or use any material from the bed, bank, or channel of any river, stream, or lake (including the removal of riparian vegetation): (c) deposit debris, waste or other materials that could pass into any river, stream, or lake. "Any river, stream, or lake" includes those that are ephemeral or intermittent as well as those that are perennial.

CDFW is required to comply with CEQA in the issuance of a Lake or Streambed Alteration Agreement (LSAA); therefore, if the CEQA document approved for the Project does not adequately describe the Project and its impacts to lakes or streams, a subsequent CEQA analysis may be necessary for LSAA issuance. For information on notification requirements, please refer to CDFW's website (https://wildlife.ca.gov/Conservation/LSA) or contact CDFW staff in the Central Region Lake and Streambed Alteration Program at (559) 243-4593.

Nesting Birds: CDFW has jurisdiction over actions with potential to result in the disturbance or destruction of active nest sites or the unauthorized take of birds. Fish and Game Code sections that protect birds, their eggs and nests include sections 3503 (regarding unlawful take, possession or needless destruction of the nest or eggs of any bird), 3503.5 (regarding the take, possession or destruction of any birds-of-prey or their nests or eggs), and 3513 (regarding unlawful take of any migratory nongame bird).

CDFW encourages Project implementation to occur during the bird non-nesting season; however, if Project activities must occur during the breeding season (i.e., February through mid-September), the Project applicant is responsible for ensuring that implementation of the Project does not result in violation of the Migratory Bird Treaty Act or relevant Fish and Game Codes as referenced above.

To evaluate Project-related impacts on nesting birds, CDFW recommends that a qualified wildlife biologist conduct pre-activity surveys for active nests no more than 10 days prior to the start of ground disturbance to maximize the probability that nests that could potentially be impacted by the Project are detected. CDFW also recommends that surveys cover a sufficient area around the work site to identify nests and determine their status. A sufficient area means any area potentially affected by a project. In addition to direct impacts (i.e., nest destruction), noise, vibration, and movement of workers or equipment could also affect nests. Prior to initiation of construction activities, CDFW recommends that a qualified biologist conduct a survey to establish a behavioral baseline of all identified nests. Once construction begins, CDFW recommends that a qualified biologist continuously monitor nests to detect behavioral changes resulting from the project. If behavioral changes occur, CDFW recommends that the work causing that change cease and CDFW be consulted for additional avoidance and minimization measures.

If continuous monitoring of identified nests by a qualified wildlife biologist is not feasible, CDFW recommends a minimum no-disturbance buffer of 250 feet around active nests of non-listed bird species and a 500-foot no-disturbance buffer around active nests of non-listed raptors. These buffers are advised to remain in place until the breeding season has ended or until a qualified biologist has determined that the birds have fledged and are no longer reliant upon the nest or parental care for survival. Variance from these no-disturbance buffers is possible when there is compelling biological or ecological reason to do so, such as when the construction area would be concealed from a nest site by topography. CDFW recommends that a qualified wildlife biologist advise and support any variance from these buffers and notify CDFW in advance of implementing a variance.

ENVIRONMENTAL DATA

CEQA requires that information developed in environmental impact reports and negative declarations be incorporated into a database, which may be used to make subsequent or supplemental environmental determinations (Pub. Resources Code, § 21003, subd. (e)). Accordingly, please report any special-status species and natural communities detected during Project surveys to the CNDDB. The CNNDB field survey form can be found at the following link: http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/CNDDB_FieldSurveyForm.pdf. The completed form can be mailed electronically to CNDDB at the following email address: CNDDB@wildlife.ca.gov. The types of information reported to CNDDB can be found at the following link: http://www.dfg.ca.gov/biogeodata/cnddb/plants_and_animals.asp.

FILING FEES

The Project, as proposed, would have an impact on fish and/or wildlife, and assessment of filing fees is necessary. Fees are payable upon filing of the Notice of Determination by the Lead Agency and serve to help defray the cost of environmental review by CDFW. Payment of the fee is required in order for the underlying project approval to be operative, vested, and final (Cal. Code Regs, tit. 14, § 753.5; Fish & G. Code, § 711.4; Pub. Resources Code, § 21089).

CONCLUSION

CDFW appreciates the opportunity to comment on the NOP to assist BVWSD in identifying and mitigating Project impacts on biological resources.

If you have questions regarding these comments, please contact Annette Tenneboe, Senior Environmental Scientist (Specialist), at the address on this letterhead, by phone at (559) 243-4014 extension 231, or by email at Annette.Tenneboe@wildlife.ca.gov.

Sincerely,

DocuSigned by:
Julie Vance
FA83F09FE08945A...

Julie A. Vance
Regional Manager

Attachment 1

ec: Office of Planning and Research
State Clearinghouse
state.clearinghouse.opr.ca.gov

Craig Bailey
Annette Tenneboe
California Department of Fish and Wildlife

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DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

July 16, 2020

Mr. Tim Ashlock
Buena Vista Water Storage District
P.O. Box 756
Buttonwillow, California 93206

SCH# 2020060315, Notice of Preparation and Initial Study for the Palms Groundwater Recovery Project EIR

Dear Mr. Ashlock:

The California Department of Water Resources (DWR) State Water Project Analysis Office (SWPAO) and Division of Operations and Maintenance (O&M) have reviewed the Buena Vista Water Storage District's Notice of Preparation and Initial Study for the proposed Palms Groundwater Recovery Project (Recovery Project) and have the following comments. DWR is providing these comments pursuant to DWR's regulatory responsibilities under Cal. Code Regs. Tit. 23, § 600 et seq. and Cal. Code Regs. Tit. 14, § 15096.

Project Description

The Buena Vista Water Storage District (BVWSD) has a conjunctive management which includes groundwater recharge and groundwater water banking. The Recovery Project would extract water banked within the District, including but not limited to water recharged in District canals and the Palms Groundwater Banking Project (Palms Project). The extracted water would be distributed to BVWSD water users, exchanged with other water districts or sold to industrial or municipal users. The Recovery Project may discharge water into the California Aqueduct.

The Recovery Project would construct nine new wells, replace five existing wells and construct conveyance pipes. The new and replacement wells would be drilled to a depth of up to 500-feet and include an 18-inch casing. Approximately 11.9 miles of conveyance pipe would be installed to connect the new and replacement wells to the BVWSD's existing turnout at the California Aqueduct at BV8.

Specific Comments

1.4.2 Project Facilities and Construction

Section 1.4.2 states, "[t]he water pipelines will connect to the District's existing turnout at the California Aqueduct at BV8. BV8 can be used to either input water to the Aqueduct or to withdraw water from the Aqueduct."

According to DWR records, the BV-8 turnout is not currently a turn-in, therefore it is not able to input water. The EIR needs to provide supporting evidence that the current BV-8 turnout is a turn-in/turnout. If the Recovery Project needs to modify BV-8 to a turn-in/turnout, that action needs to be added to the Project Facilities and Construction section. In addition, BVWSD will need permission from DWR to make any such modifications.

1.5 AGENCY REVIEW AND APPROVALS

The Recovery Project may require multiple approvals from DWR. If a modification at turnout at the California Aqueduct at BV8, BVWSD will need permission from DWR to make the modification. In addition, as the NOP/IS indicates, DWR approval is required to pump into the California Aqueduct. This is accomplished through a turnout agreement which must be executed prior to connecting the proposed wells to the SWP.

2.7 Geology and Soils and 2.71 Environmental Setting

The NOP/IS states that subsidence which impacts infrastructure in the Recovery Project area has not been observed. The Recovery Project is within Basin 5-022 and the Buena Vista Groundwater Sustainability Agency (BVGSA) jurisdiction. The Sustainable Groundwater Management Act (SGMA) classifies Basin 5-022 as critically over drafted.

The NOP/IS subsidence analysis focuses on the extraction wells, explaining that because the BVGSA discourages groundwater extraction from beneath E-clay, recovery wells constructed as part of the Recovery Project will not be constructed below the E-clay. The analysis concludes, "[g]iven that the range of groundwater elevations expected during implementation of the Recovery Project will be within the range of elevations that has been experienced in the past, the risk of subsidence which result in damage to infrastructure is less-than-significant and these topics will not be evaluated further in the EIR."

DWR finds the subsidence evaluation in the NOP/IS inadequate for our responsible agency purposes. DWR requests the EIR include a Geology and Soils section which includes the reports and analysis which are the basis for the conclusion that, due to the project design feature where recovery wells would not be constructed below the E-clay, the risk of subsidence in Basin 5-022 is less than significant.

Please provide DWR with a copy of any subsequent project environmental or other documentation when it becomes available for public review by sending the document to:

Pedro Villalobos, Chief
State Water Project Analysis Office
Department of Water Resources
1416 Ninth Street, Suite 1620
Sacramento, California 95814

and

Donald Walker, Chief
Project Management
Operations and Maintenance Division
Department of Water Resources
1416 Ninth Street, Room 641-3
Sacramento, California 95814

Thank you for the opportunity to comment on the project. If you have any questions, please contact Pedro Villalobos at (916) 653-4313 or Pedro.Villalobos@water.ca.gov.

Sincerely,

nancy finch

Nancy Finch
Senior Attorney
Office of the Chief Counsel
Department of Water Resources
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(661) 634-1400

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Bakersfield, CA 93308

July 16, 2020

50 - Environmental

Mr. Tim Ashlock
Buena Vista Water Storage District
P.O. Box 756
Buttonwillow, CA 93206

Re: Notice of Preparation for an Environmental Impact Report for the Palms Groundwater Recovery Project

Dear Mr. Ashlock:

The Kern County Water Agency (Agency) would like to thank you for the opportunity to review and comment on the Notice of Preparation for an Environmental Impact Report (EIR) for the Palms Groundwater Recovery Project (Project).

The Agency was created by the California State Legislature in 1961 to contract with the California Department of Water Resources (DWR) for State Water Project (SWP) water. The Agency has contracts with water districts throughout Kern County to deliver SWP water. The Agency also manages and/or is a participant in multiple groundwater banking projects, including the Kern Water Bank, Pioneer Property and Berrenda Mesa banking projects. Therefore, the Agency is uniquely qualified to provide comments on the Project.

The Agency is generally supportive of projects that seek to improve the water supply and reliability of Kern County water users. However, the proposed Project has the potential to significantly impact other water users within Kern County.

Comment 1: Use of turnout BV-8 as a turn-in will require new agreements between the Agency, Buena Vista Water Storage District and DWR.

Buena Vista Water Storage District's (Buena Vista) existing turnout BV-8 may only withdraw water from the California Aqueduct (Aqueduct). Any use of BV-8 as a turn-in to pump water into the Aqueduct will require new agreements between the Agency, Buena Vista and DWR.

Comment 2: The EIR should include an impact analysis for all proposed recovery wells.

In the Notice of Preparation, Buena Vista relies upon the Buena Vista Groundwater Sustainability Agency's Groundwater Sustainability Plan (GSP) to conclude that the

Project recovery wells will have a less-than-significant impact and require no further analysis (p. 2-25). The GSP does not specifically address monitoring impacts for the Project and is too general to rely upon for subsidence monitoring along the Aqueduct. Therefore, the EIR should include an impact analysis for the Project's proposed recovery wells.

If you have any questions, please contact Monica Tennant of my staff at (661) 634-1419.

Sincerely,

Holly Melton

Holly Melton
Water Resources Manager

July 15, 2020

Tim Ashlock, General Manager
Buena Vista Water Storage District
P.O. Box 756
Buttonwillow, CA 93206
(661) 324-1101
tim@bvh20.com

Subject: Notice of Preparation and Initial Study of an Environmental Impact Report and Public Scoping Meeting for the Palms Groundwater Recovery Project

Dear Mr. Ashlock:

The Kern Water Bank Authority (KWBA) appreciates the opportunity to provide comments on the Notice of Preparation and Initial Study of an Environmental Impact Report and Public Scoping Meeting (NOP/IS) for the Palms Groundwater Recovery Project (Project). The project description states, in part, that: "In order to extract water banked within the District, including but not limited to water recharged in District canals and the Palms Project, the District would utilize a suite of 14 wells: nine proposed new wells and five replacement wells..." The new and replacement wells would be drilled to a depth of up to 500 feet. Conveyance pipes would be installed to connect new and replacement wells for the Project water delivery system to the District's existing turnout at the California Aqueduct at BV8. The maximum amount of water to be recovered per year is 25,000 acre-feet.

Pursuant to California Environmental Quality Act Guidelines section 15082, the NOP must provide "sufficient information describing the project and the potential environmental effects to enable the responsible agencies to make a meaningful response" including "[p]robable environmental effects of the project." Some of the information that will be necessary for the KWBA to evaluate the Project includes:

- Additional discussion and analysis of the Project's operations. The Project description lacks important details regarding the scope and impact of the proposed recharge and recovery operations. For example, the description states that water extracted pursuant to the Project is not limited to water recharged in the Palms project but instead it may include water recharged in District canals and at other unknown locations. The EIR must specify operationally where and when all water intended for extraction pursuant to the Project was recharged, banked, and the hydrologic connectivity between those points and recovery under the Project. This information must be provided in conjunction with prior CEQA analyses associated with those recharge activities, and must provide a complete analysis of the impacts from recovering water that was not recharged in the vicinity of the Project's recovery wells.

- An analysis of the Project's proposed complete recovery operations including reliance upon recovery of water outside the District needed to blend with the poor-quality water recovered within the District. In recent discussions regarding the Project, District personnel have indicated Buena Vista has purchased land outside the District to recover better quality groundwater to blend with poorer quality groundwater within the District so that water quality standards for delivering water to the California Aqueduct could be met. However, the Project does not include recharging any water in the vicinity of the out-of-District wells. The EIR should provide an analysis of this proposed unbalanced recovery arrangement with respect to groundwater levels, groundwater quality, and SGMA sustainability goals, especially with respect to the out-of-District lands.
- Proposed Project operations will include an "alternative delivery option" wherein District landowners would pump groundwater for irrigation needs and forego District surface water deliveries. The pumped groundwater would be "treated as recovered water, leaving a similar amount of water (SWP, Kern River, or other water) available for a different beneficial use." The EIR should provide analysis regarding the hydrologic connectivity between landowners deemed eligible for this alternative delivery option—which Buena Vista has determined include landowners up to 12 miles away from the Project (Perral Road)—and the Project's stored water supply. The EIR should further provide clear examples of how water under this delivery arrangement would be accounted, including how Buena Vista's rights to surface water are impacted by such reductions in surface water deliveries.
- An analysis of the cumulative groundwater impacts of all existing and reasonably foreseeable probable future projects. This should consider the cumulative impacts of Buena Vista's groundwater recharge, storage, recovery and sales programs, including information and analysis regarding the ability of Buena Vista to meet both the demands of the district's landowners as well as all banking and sales obligations. This analysis should evaluate a worst-case scenario wherein Buena Vista is required to meet all current and expected obligations during a multi-year drought, including evaluation of groundwater level changes resulting from cumulative pumping, Project pumping, and landowner groundwater pumping. The analysis should also include the adjoining banking programs.
- Information on the Project's proposed plans to monitor groundwater levels and quality, including the sampling of recovery well quality, the installation and monitoring of dedicated monitoring wells for both groundwater levels and quality, and the development of a monitoring plan.
- Detailed historic information on groundwater levels and quality throughout the District and in the Project area to substantiate any analyses provided in the EIR.
- An analysis of the cumulative effects the Project may have on existing groundwater recovery and pump-in programs especially with respect to water quality and deliveries to the California Aqueduct.

- Information regarding the Project's total cumulative annual recovery limits, as the NOP/IS indicates that no more than 25,000 acre-feet will be recovery while also suggesting that another 25,000 acre-feet will be recovered under the "alternative delivery option" by which landowners in certain portions of the District merely pump groundwater from their own wells.
- Information regarding the undefined term "the District's Kern River Water Supply," including the specific quantity of water relied upon by the District under this alleged right, the basis of the right, and any and all limitations of this right.
- Information regarding the likely sources of surface water to be recharged at the Project, and analysis of the impacts of utilization of those surface water sources, including long term water-supply considerations. The NOP/IS provides that up to 100,000 acre-feet of water will be recharged by related Project facilities, and that up to 25,000 acre-feet will be recovered for use by District landowners for sale to municipal and industrial water users out of the region. Detailed information on water sources for the Project including information regarding the underlying water right(s) or contract(s) relied upon is required, particularly with respect to water that may be sold or otherwise provided to others. The NOP/IS's refusal to specifically identify useful information water resources necessarily relied upon by and for the Project is insufficient under *Vineyard Area Citizens for Responsible Growth v. City of Rancho Cordova* (2007) 40 Cal.4th 412.
- A detailed analysis of the conveyance facilities anticipated to be used for the project, including offsite facilities, especially with respect to existing agreements and/or rights of way and the impacts any anticipated deliveries may have on other projects.
- A draft MOU for the operation of the project.

Finally, and perhaps most importantly, the Department of Water Resources developed mitigation measures to reduce or otherwise mitigate impacts, including cumulative effects, from the Kern Water Bank and other water banking programs on the Kern Fan to less than significant (see attached). KWBA would expect the Project to consider, adopt and implement substantially similar measures for the Project.

Thank you for the opportunity to provide input for your proposed EIR. Please call if you have any questions.

Sincerely,
Kern Water Bank Authority,

Jonathan D. Parker,
General Manager

cc: KWBA Board of Directors

Mitigation Measures for KWBA Resolution

7.1-2 *KWBA will establish a program that meets the following requirements in accordance with the Long-Term Project Recovery Operations Plan regarding Kern Water Bank Project (2016 KWB Long-Term Operations Plan, Attachment A):*

A. *Monitor and Report Groundwater Conditions to KWBA's Board of Directors and the Public*

1) *KWBA will monitor groundwater levels monthly, except during periods of no recovery when monitoring will occur at least quarterly. KWBA may rely on monitoring conducted by the Kern Fan Monitoring Committee to meet these requirements.*

2) *KWBA will report current groundwater levels to its Board of Directors at each monthly regular meeting, and will make the reports available to the public on its website (http://www.kwb.org/).*

3) *KWBA will regularly update its Groundwater Model (Model) to actual conditions and use the Model to project future groundwater conditions. KWBA will endeavor to use the best practicable science and latest information available in all modeling and technical matters. KWBA will report the results of its modeling to its Board of Directors and will make the results available to the public on its website (http://www.kwb.org/). Recovery of banked groundwater in any calendar year beyond March 15 of that year shall not commence (or continue) until the Model has been run for projected KWB operations and the results have been reported to* KWBA's Board of Directors and made available to the public*. Model data for a preceding year becomes available at different times in the following year. Modeling at the beginning of any given year will necessitate estimating certain model input data for the preceding year (e.g., Kern River losses). These estimates will be replaced with actual data at regular intervals when the model is updated.*

B. *Implement Proactive Measures (in addition to A above)*

1) *KWBA will use its Model as a tool to evaluate potential groundwater impacts resulting from its project operations. The Model will be periodically run and updated as projected recovery plans become known or changed and the Model will assume such conditions as described in A.3.*

2) *The Model will be used to:*

a) *Forecast groundwater levels.*

b) *Forecast and predict the contribution of KWB Operations to groundwater level declines in the area.*

c) *Determine water level conditions with "Without KWB Operations" for purposes of evaluating the potential impact of "With KWB Operations". The "Without KWB Operations" is the water level that would have been at any particular well location absent "KWB Operations."*

d) *Identify, based upon an analysis of "Without KWB Operations" versus "With KWB Operations," if a* ***negative potential impact ("NPI")*** *has or is likely to occur for which the measures described at D, E, and F may be operative.* ***NPI*** *is determined according to C.1 below.*

e) *Forecast any localized areas for special attention and/or additional monitoring where groundwater levels will decline 30 or more feet below the "Without KWB Operations" groundwater level.*

f) *Identify wells at risk of potential impacts during recovery operations.*

3) *KWBA will provide notification on its website if the Model shows that an* ***NPI*** *has or is likely to occur, including steps that potentially affected landowners must follow if the landowner desires to make a claim to KWBA regarding potential well impacts due to KWBA's recovery operations.*

C. *Implement Triggers and Actions*

The actions described in sections D, E, and F will be implemented in consultation with affected landowners/well owners that make a claim to KWBA regarding well impacts relating to KWBA's recovery operations and groundwater level declines, subject to the following:

1) *The trigger for mitigation shall be based upon an analysis and comparison of Model generated "Without KWB Operations" versus "With KWB Operations." When "With KWB Operations" are 30 feet deeper than the "Without KWB Operations" at an operative well, and the well has (or is expected to) experience mechanical failure or other operational problems due to declining water levels, a* ***negative potential impact ("NPI")*** *is triggered. If KWBA enters into a joint operations agreement with other water banks in the area, the depth at which a* ***NPI*** *is triggered shall provide an equivalent measure of potential impact as described in the 2016 KWB Long-Term*

Operations Plan.

2) *For a well owner to be eligible for mitigation as provided below, the affected landowner shall submit a claim to KWBA, in accordance with the Government Claims Act, which shall, at a minimum, provide information concerning the condition of the well and casing and pumping equipment of the well, and other information that is relevant to the landowner's claim. Upon receipt of a claim, KWBA shall use the Model (or the results of modeling as reported to the Board and the public) to determine whether an* ***NPI*** *exists at the landowner's well and respond with the appropriate action described below.*

3) *KWBA will provide mitigation and/or compensation for the KWB Operations' contribution to the adverse impact. Mitigation and/or compensation is not required for a well owner's lack of well maintenance, normal wear and tear, depreciation, failure of well equipment, well casing degradation, etc., or other reasons not relating to KWB Operations.*

D. ***Implement Action for Agricultural Wells When Well Adjustment Is Needed and Available***

1) *Trigger: When the Model predicts* ***NPI*** *for an operational agricultural well outside the current operating range of the pump but within the potential operating range of the well.*

2) *KWBA actions will be completed within 60 days (provided that the land/well owner cooperates) from receipt of a claim as follows:*

   a) *Field verify (with the affected landowner if requested) static depth to groundwater levels within the well and compare to Model values to determine if flow stoppage is due to groundwater level decline due to KWB operations. If needed:*

      - *Obtain right-of-entry permit and well data release from well owner.*

      - *Collect pump manufacturer data, the in-situ pump setting, and casing depth information.*

   b) *Compare pump setting information with Model projected pumping water levels throughout the year to determine pump submergence levels and evaluate the necessity and feasibility of lowering the well pump to meet the landowner's needs to provide the least-cost short and long-term solution.*

c) Develop a cost estimate to complete the necessary work.

d) Develop and submit a report to the landowner informing the landowner of the findings and proposed actions, including denying the claim because groundwater declines are not due to KWB operations.

3) *At KWBA's option, it may reduce or adjust pumping of its wells as necessary to prevent, avoid, or eliminate the **NPI**, using the Model to identify the well or wells that may require reduction or adjustment in pumping.*

4) *If groundwater declines are due to KWB operations, unless D.3 occurs, once agreement is reached between KWBA and the landowner pursuant to D.2.b and all cost estimates have been completed, pay costs associated with the landowner claim (considering C.3 above), including the cost to complete the necessary work.*

E. *Implement Action for Agricultural Wells When Well Adjustment Is Unavailable*

1) *Trigger: When the Model predicts **NPI** for an operational agricultural well outside the current and potential operating range of the well.*

2) *KWBA actions will be completed within 60 days (provided that the land/well owner cooperates) from receipt of a claim as follows:*

a) Field verify (with the affected landowner if requested) static depth to groundwater levels within the well and compare to Model values to determine if flow stoppage is due to groundwater level decline due to KWB operations. If needed:

- *Obtain right-of-entry permit and well data release from well owner.*
- *Collect pump manufacturer data, the in-situ pump setting, and casing depth information.*

b) Identify water of an equivalent water quantity and quality suitable for agricultural uses for the affected landowner from an alternate source at no greater cost to the affected landowner or, with the consent of the affected landowner, identify acceptable mitigation (for example, drill and equip a new well) to provide the least-cost short- and long-term solution, including an estimate to complete the necessary work.

Develop and submit a report to the landowner informing the landowner of the findings and resulting proposed actions, including denying the claim because groundwater declines are not due to KWB operations.

3) *At KWBA's option, it may reduce or adjust pumping of its wells as necessary to prevent, avoid, or eliminate the **NPI** using the Model to identify the well or wells that may require reduction or adjustment in pumping.*

4) *If groundwater declines are due to KWB operations, unless E.3 occurs, once an agreement is reached between KWBA and the landowner to provide mitigation pursuant to E.2.b and all cost estimates have been completed, pay costs associated with the landowner claim (considering C.3 above), including the cost to complete the necessary work.*

F. *Implement Action for Domestic Wells*

1) *Trigger: When the Model predicts **NPI** for a domestic well that is outside the current operating range of the pump but within the potential operating range of the well production.*

2) *KWBA's actions will be completed within 60 days (provided that the land/well owner cooperates) from receipt of a claim as follows:*

   a) *Field verify (with the affected landowner if requested) static depth to groundwater levels within the well and compare to Model values to determine if flow stoppage is due to groundwater level decline. If needed:*

      - *Obtain right-of-entry permit and well data release from well owner.*

      - *Collect pump manufacturer data, the in-situ pump setting, and casing depth information.*

   b) *Identify availability and cost of a permanent connection to the nearest water service provider.*

   c) *Identify acceptable mitigation (for example, lower the domestic submersible pump bowl setting sufficient to restore and maintain service or drill and equip a new well that complies with applicable county well standards) to provide the least-cost short- and long-term solution, including an estimate to complete the necessary work.*

d) Develop and submit a report to the landowner informing the landowner of the findings and resulting proposed actions, including denying the claim because groundwater declines are not due to KWB operations.

e) If necessary for emergency health and safety concerns, provide interim in-home water supplies within 14 days after receipt of the claim until a permanent mitigation action is implemented or the claim has been denied because groundwater declines are not due to KWB operations.

3) *At KWBA's option, it may reduce or adjust pumping of its wells as necessary to prevent, avoid, or eliminate the **NPI** using the Model to identify the well or wells that may require reduction or adjustment in pumping.*

4) *If groundwater declines are due to KWB operations, unless F.3 occurs, once an agreement is reached for KWBA to provide mitigation pursuant to F.2.c above and all cost estimates have been completed, pay costs associated with the landowner claim (considering C.3 above), including the cost to complete the necessary work.*

7.1-7 *KWBA will implement the following measures in accordance with the KCWA and KWBA CVC Agreement (Attachment B):*

a) *KWBA will monitor water levels frequency, evaluating groundwater conditions on a weekly/monthly basis.*

b) *KWBA will coordinate water operations with KCWA*.

c) *KWBA will manage recharge operations to help ensure that groundwater gradient is away from the CVC during shallow groundwater conditions. Should groundwater conditions develop that might induce piping behind the CVC's liner, KWBA will minimize recharge adjacent to the CVC either by reducing inflow to adjacent ponds or increasing the setbacks of adjacent ponds.*

7.2-2 *KWBA will implement the following measures:*

b) *Hazardous waste sites would be subject to the county public health department and/or the CVRWQCB oversight with the responsible parties. KWBA will cooperate with the regulatory agency(s) during the process and provide pertinent groundwater elevations and water quality data the regulatory agencies may request.*

c) *On an annual basis, KWBA shall report the status of shallow groundwater level monitoring activities and water quality analysis in areas of contamination to the Kern Fan Monitoring Committee.*

d) *KWBA will continue to monitor and evaluate the nature and extent of any current and future contamination and remediation within KWB Lands as follows:*

   i. *For all evaluation and monitoring activities performed by third parties on KWB Lands, KWBA shall obtain reports and sampling data as soon as they become available. Monitoring and evaluation shall continue until verification by third party documentation, regulatory correspondence, and/or laboratory analysis is obtained that indicates soil or groundwater contamination has been remedied and no longer provides a threat to groundwater quality.*

   ii. *On an annual basis, KWBA shall report the status of contamination for each issue and provide water quality data monitoring activities, where available, to the Kern Fan Monitoring Committee. Any newly discovered contamination shall be reported to the Kern Fan Monitoring Committee immediately.*

7.2-3 *KWBA will implement the following measures:*

a) *Prior to construction, identify all plugged and abandoned wells through agency contacts. This includes identification of abandoned wells through the DOGGR website, field verification of an abandoned well prior to construction, notifying DOGGR of intent to construct a recharge pond adjacent to or over an abandoned well.*

b) *Modify excavation and grading activities to ensure the near surface seals and wellhead remain undamaged.*

c) *If the top of an abandoned well or wellhead is damaged during pond construction, appropriate authorities (i.e., DOGGR, CVRWQCB, and/or Kern County Environmental Health) will be notified as to the nature and extent of the damage along with plans to repair the damage, as needed and in accordance with existing regulations.*

7.4-3 *KWBA will implement the following terms required of KWBA as specified in the 1997 Monterey IS and Addendum, in this 2016 KWBA Resolution, and KWB HCP/NCCP, including Appendix A (Kern Water Bank Operations Manual), Appendix C (Kern Water Bank Vegetation Management Plan, and Appendix D (Kern Water Bank Waterbird Management Plan):*

a) *Biological Monitor*

A qualified biologist shall monitor all ground disturbing activities during construction in the Sensitive Habitat Sector and will oversee measures undertaken to reduce the take of listed species.

b) *Construction Practices*

i. *Delineation of Disturbance Areas – During construction, KWBA shall clearly delineate disturbance area boundaries by stakes, flagging, or by reference to terrain features, as <u>provided in the KWB HCP/NCCP</u> ~~directed by CDFG and USFWS~~ to minimize degradation or loss of adjacent wildlife habitats during operation.*

ii. *Signage – During construction, KWBA shall post signs and/or place fencing around construction sites to restrict access of vehicles and equipment unrelated to site operations.*

iii. *Resource Agency Notification – At least 20 working days prior to initiating ground disturbance for project facilities in designated salvage/relocation areas, KWBA shall notify the Fresno Field Office of CDF<u>W</u>~~G~~ and the Sacramento Field Office of USFWS of its intention to begin construction activities at a specific location and on a specific date. The agencies will have ten working days to notify the KWBA of their intention to salvage or relocate listed species in the construction area. If KWBA is notified, it shall wait an additional five days to allow the salvage/relocation to take place.*

iv. *Salvage and Relocation – KWBA shall allow time and access to USFWS and/or CDF<u>W</u>~~G~~, or their designees, to relocated listed species, at the Resource Agencies' expense, from construction areas prior to disturbance of areas that have been identified by the Resource Agencies as having known populations of the listed species they wish to salvage or relocate.*

v. *Construction Site Review – All construction pipes, culverts, or similar structures with a diameter of three inches or greater that are stored at a construction site on the Kern Water Bank for one or more overnight periods shall be thoroughly inspected for trapped kit foxes and other animals before the subject pipe is subsequently buried, capped, or otherwise used or moved in any way. Pipes laid in trenches overnight shall be capped. If during construction a kit fox or other animal is discovered inside a pipe, that section of pipe shall not be moved or, if necessary, shall be moved only once to remove it from the path of construction activity until the animal has escaped.*

vi. *Employee Orientation – An employee orientation program for construction crews, and others who will work on-site during construction, shall be conducted and shall consist of a brief consultation in which persons knowledgeable in endangered species biology and legislative protection explain endangered species concerns. The education program shall include a discussion of the biology of the listed species, the habitat needs of these species, their status under FESA and CESA, and measures being taken for the protection of these species and their habitats as a part of the project. The orientation program shall be conducted on an as needed basis prior to any new employees commencing work* *on the Kern Water Bank. Every two years or at the beginning of construction for the Supply/Recovery canal, a refresher course will be conducted for employees previously trained. A fact sheet conveying this information shall also be prepared for distribution to all employees. Upon completion of the orientation, employees shall sign a form stating that they attended the program and understand all protection measures. These forms shall be filed at KWBA's office and shall be accessible by CDWF~~G~~ and USFWS.*

vii. *Standards for Construction of Canals – Concrete-lined canals will have a side slope of 1.5 to 1 or less and the sides will have a concrete finish which will assist in the escape of animals. If canals are determined by CDFW~~G~~ or USFWS to be substantial impediments to kit fox movement, plank or pipe crossings will be provided across concrete canals in areas identified as having high kit fox activity.*

c) *On-Going Practices*

i. *Equipment Storage - All equipment storage and parking during site development and operation shall be confined to the construction site or to previously disturbed off site areas that are not habitat for listed species.*

ii. *Traffic Control - KWBA's project representative shall establish and issue traffic restraints and signs to minimize temporary disturbances. All construction related vehicle traffic shall be restricted to established roads, construction areas, storage areas, and staging and parking areas. Project related vehicles shall observe a 25 MPH speed limit in all project areas except on county roads and state and federal highways.*

iii. *Food Control - All food-related trash items such as wrappers, cans, bottles, and food scraps generated both during construction and during subsequent facility operation shall be disposed of in closed containers and shall be regularly removed from the site. Food items may attract kit foxes onto a project site, consequently exposing such animals to increased risk of injury or mortality.*

iv. *Dog Control - To prevent harassment or mortality of kit foxes or destruction of kit fox dens or predation on this species; no domestic dogs or cats, other than hunting dogs, shall be permitted on-site.*

v. *Pesticide Use - Use of rodenticides and herbicides on the site shall be permitted in accordance with the Vegetation Management Plan, which incorporates by reference the Interim Measures for Use of Rodenticides in Kern County, and which will incorporate by reference any other applicable laws, rules, and regulations regarding the use of pesticides as they take effect.*

d) *Project Representatives*

KWBA shall designate a specific individual as a contact representative between KWBA, USFWS, and CDFW~~G~~ to oversee compliance with protection measures-detailed herein. KWBA shall provide written notification of the contact representative to CDFW~~G~~ and USFWS within 30 days of issuance of the Permits and the Management Authorizations. Written notification shall also be provided by KWBA to CDFW~~G~~ and USFWS in the event that the designee is changed.

e) *Notification Regarding Dead, Injured or Entrapped Listed Animals*

Any employee or agent of KWBA who kills or injures a San Joaquin kit fox, blunt nosed leopard lizard, Tipton kangaroo rat, San Joaquin antelope squirrel, or other listed species listed as a threatened or endangered animal under FESA or CESA, or who finds any such animal either dead, injured, or entrapped on the Kern Water Bank shall report the incident immediately to KWBA's representative who shall, in turn, report the incident or finding to USFWS and CDFW~~G~~. In the event that such observations are of entrapped animals, escape ramps or structures shall be installed immediately to allow the animal(s) to escape unimpeded. In the event that such, observations are of injured or dead animals, KWBA shall immediately notify USFWS and CDFW~~G~~ by telephone or other expedient means. KWBA shall then provide formal notification to USFWS and CDFW~~G~~, in writing, within three working days of the finding of any such animal(s). Written notification shall include the date, time, location, and circumstances of the incident.

The USFWS contact for this information shall be the Assistant Field Supervisor for Endangered Species, Sacramento Field Office. The CDFW~~G~~ contact shall be the Environmental Services Supervisor at the San Joaquin Valley-Southern Sierra Region Headquarters.

USFWS or CDFW~~G~~ will be notified if any other animal, which is otherwise a listed species, is found dead or injured.

f) *Construction of Supply/Recovery Canal*

Within 60 days prior to the construction of the supply/recovery canal within the zone marked within the Map of the Kern Water Bank, KWBA shall conduct a limited survey within the area of the Kern Water Bank, which will be affected by that construction, with the sole goal of identifying potential San Joaquin kit fox dens. KWBA shall contact USFWS and CDFW~~G~~ pursuant to the salvage procedures set forth above if any kit fox dens are found.

g) *Take Avoidance Protocol for Fully Protected Species*

Although a population of blunt nosed leopard lizards was relocated to the Kern Water Bank, there is no known present occurrence of them. Existing data on the blunt nosed leopard lizard at the Kern Water Bank indicates that populations, if they exist, occur within habitat set asides (either sensitive, compatible, or conservation bank habitat), thus the likelihood of take from project construction, operation, and maintenance is negligible. However, in the future adaptive management measures may expand to areas of suitable habitat.

Three other species, which may be found on the Kern Water Bank, are also state designated fully protected species: American peregrine falcon, Greater sandhill crane, and White-tailed kite. The likelihood of the take of any of these species from project construction, operation, and maintenance is negligible due to their mobility and preferred habitats. ~~However, to avoid any take of these species, the same take avoidance protocol as set out for the blunt nosed leopard lizard shall apply to each of these three species.~~

<u>KWBA will comply with the terms of the NCCP Approval and Take Authorization as it relates to</u> ~~Until such time that the KWBA obtains appropriate authorization for take of the~~ state-designated fully protected <u>species</u> ~~blunt-nosed leopard lizard by the Fish and Game Commission, t~~ <u>T</u>he following take avoidance protocol shall apply in any areas that contain suitable habitat <u>for fully protected species not covered by authorization for take of state-designated fully protected species identified in this subsection (g)</u> ~~of the blunt-nosed leopard lizard~~:

i. *A qualified biologist shall survey any areas proposed for project related disturbance that contain suitable habitat for <u>fully protected species</u> ~~the blunt-nosed leopard lizard~~ to determine the likelihood of presence. ~~Suitable habitat consists of valley and foothill grasslands, saltbush scrubland, iodine bush grassland, and alkali flats.~~*

ii. *If <u>these fully protected species</u> ~~blunt nosed leopard lizards~~ are found to occur in areas proposed for project facilities construction or maintenance, ~~consideration of~~ avoidance should take place. ~~first. If avoidance is not practicable, then the blunt nosed leopard lizard will be trapped and relocated prior to disturbance at KWBA's expense in accordance with the applicable annual management plan. This work must be done by or under the direction of USFWS staff by persons with appropriate experience and with their own take for scientific purposes permits. This procedure will avoid any violation of state law~~.*

The use of a biological monitor, and special construction activities and on- going practices will result in a heightened awareness and education regarding sensitive biological resources, which will reduce the potential for impacts on special-status species. In addition, the use of a project representative as a liaison between the KWBA and the resource agencies will expedite notification regarding any take of a listed animal. ~~While take of a fully protected species is not anticipated, this mitigation outlines avoidance protocol to further reduce the likelihood of said take.~~ Together these mitigation measures and the beneficial net increase of habitat for special- status species through implementation of the HCP/NCCP will reduce any potential impact to a less-than-significant level.

7.11-1 *KWBA will implement the following measures:*

c) *Provide a comprehensive Worker Environmental Awareness Program (WEAP) that will include all training requirements identified in Best Management Practices, Worker Site Specific Health and Safety Plan, and mitigation measures, including training for all field personnel (e.g., KWBA employees, agents, and contractors).*

The WEAP shall include protocols and training for responding to and handling of hazardous materials and hazardous waste management, and emergency preparedness, release reporting, and response requirements. KWBA will ensure that all construction workers at risk of inhaling dust shall be provided masks with filters designed to trap spores of the size of Valley Fever fungus.

7.11-4 *KWBA will implement the following measures:*

c) *KWBA shall implement the following measures before and during ground-disturbing activities to reduce health hazards associated with potential exposure to hazardous substances.*

i. *If stained or odorous soil is discovered during project-related construction activities, KWBA shall retain a qualified environmental professional to conduct a Phase II Environmental Site Assessment and/or other appropriate testing. Recommendations in the Phase II Environmental Site Assessment to address any contamination that is found shall be implemented before continuing with ground-disturbing activities in these areas.*

ii. *As required by law, notify the appropriate federal, state, and local agencies if evidence of previously undiscovered soil or groundwater contamination (e.g., stained soil, odorous groundwater) or if unknown or previously undiscovered underground storage tanks are encountered during construction activities.*

7.13-1a *KWBA will implement the following measures to minimize potential adverse impacts on cultural resources:*

a) *Prior to ground disturbance for new pond or well construction and associated facilities, an analysis to identify the potential presence of archaeological resources on the project site shall be conducted. The analysis shall include, at a minimum, a records check and literature survey from the appropriate California Historical Resources Information System (CHRIS) center and a Phase I Cultural Resources Investigation by an archaeologist meeting the Secretary of the Interior's Standards. If resources are known to exist on a project site, the analysis shall include an assessment of the resource and shall include measures for the in-situ protection, or the recovery, preservation, study, and curation of the resource, as appropriate. The analysis and the measures developed shall be consistent with the practices and intent described in Section 21083.2 et seq. of the Public Resources Code, as well as Sections 15064.5 et seq. and 15126.4(b) of the California Code of Regulations, and shall be consistent with current professional archaeological standards. The archaeologist shall prepare a report of the results of any study prepared, following accepted professional practice. Copies of the report shall be submitted to the KWBA and to the appropriate CHRIS information center. KWBA shall also consult, as appropriate, with the Native American Heritage Commission and appropriate Native American tribal representatives to address Native American cultural values with respect to archaeological contexts and places of traditional use or importance.*

b) *As a condition of all contracts for new pond or well construction and associated facilities and prior to ground-disturbing activities, all earth-moving and excavation contractor employees shall attend an orientation session informing them of the potential for inadvertently discovered cultural resources and/or human remains and protection measures to be followed to prevent destruction of any and all cultural resources discovered on site. The applicant's designated project construction manager, a qualified archaeologist, and a qualified cultural resource manager/monitor from a local California Native American tribe shall conduct the orientation (unless the local tribe opts not to participate). The orientation will include information regarding the potential for objects to occur on site, a summary of applicable environmental law, procedures to follow if potential cultural resources are found, and the measures to be taken if cultural resources and/or human remains are unearthed as part of the project.*

c) *Construction areas for new ponds and wells and associated facilities shall be staked prior to earthmoving by a qualified archaeologist in consultation with the contractor to indicate the construction area, construction staging area, and buffer. No earthmoving, parking, or materials storage will be allowed outside the staked areas. Prior to construction, the archaeologist shall survey the area to identify any surface artifacts within the staked area. An archaeologist and qualified cultural resource manager/monitor from a local California Native American tribe (unless the local tribe opts not to participate) shall be present during any grubbing or topsoil grading within the staked area. If previously unknown buried cultural resources, such as flaked or ground stone, historic debris, building foundations, or nonhuman bone (unless determined to be from present day grazing operations), are discovered during ground-disturbing activities, work will stop in that area and within an appropriate buffer area, as determined by the archaeologist. The archaeologist shall assess the significance of the affected cultural resources and, if necessary, develop feasible and appropriate treatment measures in consultation with the project staff, such as avoidance, capping with geotextile and fill, or Phase III data recovery consistent with applicable standards adopted pursuant to the National Historic Preservation Act.*

d) *In the event of the discovery of a burial, human bone, or suspected human bone, all excavation or grading in the vicinity of the find shall halt immediately, the area of the find shall be protected, and KWBA immediately shall notify the County Coroner of the find and comply with the provisions of PRC Section 5097 with respect to Native American involvement, burial treatment, and re-burial, if necessary.*

7.13-1b *KWBA will implement the following measures to minimize potential adverse impact on previously unknown potentially unique, scientifically important paleontological resources:*

a) *Before the start of any well-drilling activities, KWBA shall retain a qualified paleontologist or other qualified individual to train all personnel involved with earthmoving and/or well drilling activities regarding the possibility of encountering fossils, the appearance and types of fossils likely to be seen during construction, and proper notification procedures should fossils be encountered (this training can take place at the same time as the orientation required by 7.13-1a).*

b) *In the event that paleontological resources are discovered, KWBA will notify a qualified paleontologist. The paleontologist will document the discovery as needed, evaluate the potential resource, and assess the significance of the find under the criteria set forth in CEQA Guidelines Section 15064.5. If fossil or fossil bearing deposits are discovered during construction, excavations within 50 feet of the find will be temporarily halted or diverted until the discovery is examined by a qualified paleontologist. The paleontologist will notify the appropriate agencies to determine procedures that would be followed before construction is allowed to resume at the location of the find. If KWBA determines that avoidance is not feasible, the paleontologist will prepare an excavation plan for mitigating the effect of the project on the qualities that make the resource important. The plan will be submitted to KWBA for review and approval prior to implementation. The analysis and measures developed shall be consistent with the Conformable Impact Mitigation Guidelines developed by the Society of Vertebrate Paleontology and current professional paleontological standards.*

12-1 *KWBA will implement the following measures:*

a) ***Pump Efficiency Monitoring**: KWBA will conduct pump efficiency monitoring to ensure that all KWB pumps are monitored and evaluated at regular intervals during recovery periods.*

   i. *Daily Pump Efficiency Monitoring: Pumps shall be monitored daily for their total water volume pumped (acre-feet [AF]) and electricity consumption (kilowatt-hours [kWh]), which will be used to calculate a daily energy efficiency value (i.e., kWh/AF).*

   ii. *Pump Efficiency Software: Metro or an equivalent water system management program will be used to provide up-to-date and streamlined methods to analyze KWB's individual pump and total system efficiency.*

b) ***Pump Rehabilitation, Retrofits, and Replacement**: KWBA shall use data from the Pump Efficiency Monitoring component to strategically and actively rehabilitate, retrofit, and/or replace pumps as needed during recovery periods.*

   i. *Pump Prioritization and Testing: Pump rehabilitation, retrofit, and replacement shall be prioritized by accounting for the relative efficiency of each pump with respect to the total pump system and water volume pumped through each pump. Data obtained from the Pump Efficiency Monitoring component shall be used to prioritize which pumps will be rehabilitated, retrofitted, and/or replaced. In addition efficiency testing by external entities if available (e.g., pump company, Pacific Gas & Electric Company [PG&E]) or other similar analysis will also be used for the prioritization process.*

   ii. *Schedule: KWBA shall rehabilitate, retrofit, and/or replace pumps/wells at the earliest possible time without substantially disturbing ongoing O&M activities, but at a minimum will rehabilitate, retrofit, and/or replace at least an annual average of 5 pumps per year during a prolonged recovery period such as occurred between 2013 and 2016.*

c) ***Reporting**: KWBA will maintain a quarterly and annual reporting program that will be publicly available online. Annual reports will cover calendar years and be posted online by March 30 to cover the previous year. Quarterly reports will be posted online within 30 days of the end of each calendar quarter. The annual and quarterly reports will include, but are not limited to, the following components:*

   i. *KWB O&M Totals: Total quarterly electricity consumption for recovery pumping activities along with total acre-feet recovered shall be provided online. A running total of the annual electricity consumption and acre-feet recovered by quarter shall also be provided.*

   ii. *Pump Efficiency: A summary of the pump efficiency (kWh/acre-feet) for each of KWB's pumps will be provided quarterly. Similar to the KWB O&M Totals, a running annual average efficiency for each pump shall be provided. These data shall be used to identify the 5 pumps per year that will be rehabilitated, retrofitted, or replaced. If a pump/well is adjusted for depth, notes shall be made within the reports to explain these changes in pump efficiency.*

   iii. *Electricity Efficiency Actions: Each report should include actions taken in the previous quarter to rehabilitate, retrofit, and/or replace pumps. Any other energy efficiency measures taken will be reported. When information is available from PG&E's Advanced Pumping Efficiency Program or other similar programs, annual electricity savings from these actions shall be included in the quarterly and annual reports to clearly show the electricity savings associated with rehabilitation, retrofit, and/or replacement actions. If annual energy savings cannot be determined through pre- and post-pump improvement testing, KWBA shall report the empirical annual energy savings (kWh/year) from these improvements in its annual reports.*

   iv. *Identifying Next Steps: Each annual report will include the list of 5 or more pumps planned to be evaluated for potential rehabilitation, retrofit, or replacement during that year. If all five of the least efficient pumps are not scheduled for rehabilitation, retrofit, and/or replacement in the coming year, the annual report shall explain what KWB operation requires the pump to remain in service that year.*

d) ***Pump Compliance:** KWBA will only purchase new pumps that comply with United States Department of Energy pump efficiency regulations (10 CFR Part 429 and 431) when those regulations become effective in the marketplace in 2020.*

e) ***Future Increases in Technology and Emissions Standards:** KWBA shall actively consider replacing older pumps with new pumps with increased efficiency technology. All future requirements for pumps at the federal, state, and/or local level shall be complied with.*

Appendix C Sensitive Species List

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (East Elk Hills (3511934) OR West Elk Hills (3511935) OR Lokern (3511945) OR Buttonwillow (3511944) OR Tupman (3511933) OR Taft (3511924) OR Mouth of Kern (3511923) OR Rio Bravo (3511943) OR Fellows (3511925))
 AND Taxonomic Group IS (Ferns OR Gymnosperms OR Monocots OR Dicots OR Lichens OR Bryophytes)

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Astragalus hornii var. hornii Horn's milk-vetch	PDFAB0F421	None	None	GUT1	S1	1B.1
Atriplex cordulata var. cordulata heartscale	PDCHE040B0	None	None	G3T2	S2	1B.2
Atriplex cordulata var. erecticaulis Earlimart orache	PDCHE042V0	None	None	G3T1	S1	1B.2
Atriplex coronata var. vallicola Lost Hills crownscale	PDCHE04371	None	None	G4T3	S3	1B.2
Atriplex minuscula lesser saltscale	PDCHE042M0	None	None	G2	S2	1B.1
Atriplex subtilis subtle orache	PDCHE042T0	None	None	G1	S1	1B.2
Caulanthus californicus California jewelflower	PDBRA31010	Endangered	Endangered	G1	S1	1B.1
Cirsium crassicaule slough thistle	PDAST2E0U0	None	None	G1	S1	1B.1
Delphinium recurvatum recurved larkspur	PDRAN0B1J0	None	None	G2?	S2?	1B.2
Eremalche parryi ssp. kernensis Kern mallow	PDMAL0C031	Endangered	None	G3G4T3	S3	1B.2
Eriastrum hooveri Hoover's eriastrum	PDPLM03070	Delisted	None	G3	S3	4.2
Eriogonum temblorense Temblor buckwheat	PDPGN085P0	None	None	G2	S2	1B.2
Eschscholzia lemmonii ssp. kernensis Tejon poppy	PDPAP0A071	None	None	G5T2	S2	1B.1
Lasthenia chrysantha alkali-sink goldfields	PDAST5L030	None	None	G2	S2	1B.1
Lasthenia glabrata ssp. coulteri Coulter's goldfields	PDAST5L0A1	None	None	G4T2	S2	1B.1
Madia radiata showy golden madia	PDAST650E0	None	None	G3	S3	1B.1
Monolopia congdonii San Joaquin woollythreads	PDASTA8010	Endangered	None	G2	S2	1B.2
Puccinellia simplex California alkali grass	PMPOA53110	None	None	G3	S2	1B.2
Stylocline citroleum oil neststraw	PDAST8Y070	None	None	G3	S3	1B.1

Record Count: 19

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (East Elk Hills (3511934) OR West Elk Hills (3511935) OR Lokern (3511945) OR Buttonwillow (3511944) OR Tupman (3511933) OR Taft (3511924) OR Mouth of Kern (3511923) OR Rio Bravo (3511943) OR Fellows (3511925))
 AND Taxonomic Group IS (Fish OR Amphibians OR Reptiles OR Birds OR Mammals OR Mollusks OR Arachnids OR Crustaceans OR Insects)

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	Threatened	G2G3	S1S2	SSC
Ammospermophilus nelsoni Nelson's antelope squirrel	AMAFB04040	None	Threatened	G2	S2S3	
Anniella alexanderae Temblor legless lizard	ARACC01030	None	None	G1	S1	SSC
Arizona elegans occidentalis California glossy snake	ARADB01017	None	None	G5T2	S2	SSC
Athene cunicularia burrowing owl	ABNSB10010	None	None	G4	S3	SSC
Bombus crotchii Crotch bumble bee	IIHYM24480	None	Candidate Endangered	G3G4	S1S2	
Buteo swainsoni Swainson's hawk	ABNKC19070	None	Threatened	G5	S3	
Charadrius alexandrinus nivosus western snowy plover	ABNNB03031	Threatened	None	G3T3	S2S3	SSC
Charadrius montanus mountain plover	ABNNB03100	None	None	G3	S2S3	SSC
Coccyzus americanus occidentalis western yellow-billed cuckoo	ABNRB02022	Threatened	Endangered	G5T2T3	S1	
Dendrocygna bicolor fulvous whistling-duck	ABNJB01010	None	None	G5	S1	SSC
Dipodomys ingens giant kangaroo rat	AMAFD03080	Endangered	Endangered	G1G2	S1S2	
Dipodomys nitratoides brevinasus short-nosed kangaroo rat	AMAFD03153	None	None	G3T1T2	S1S2	SSC
Dipodomys nitratoides nitratoides Tipton kangaroo rat	AMAFD03152	Endangered	Endangered	G3T1T2	S1S2	
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Eumops perotis californicus western mastiff bat	AMACD02011	None	None	G5T4	S3S4	SSC
Falco mexicanus prairie falcon	ABNKD06090	None	None	G5	S4	WL
Gambelia sila blunt-nosed leopard lizard	ARACF07010	Endangered	Endangered	G1	S1	FP

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Lanius ludovicianus loggerhead shrike	ABPBR01030	None	None	G4	S4	SSC
Lytta hoppingi Hopping's blister beetle	IICOL4C010	None	None	G1G2	S1S2	
Masticophis flagellum ruddocki San Joaquin coachwhip	ARADB21021	None	None	G5T2T3	S2?	SSC
Onychomys torridus tularensis Tulare grasshopper mouse	AMAFF06021	None	None	G5T1T2	S1S2	SSC
Perognathus inornatus San Joaquin pocket mouse	AMAFD01060	None	None	G2G3	S2S3	
Phrynosoma blainvillii coast horned lizard	ARACF12100	None	None	G3G4	S3S4	SSC
Plegadis chihi white-faced ibis	ABNGE02020	None	None	G5	S3S4	WL
Protodufourea zavortinki Zavortink's protodufourea bee	IIHYM77020	None	None	G1	S1	
Sorex ornatus relictus Buena Vista Lake ornate shrew	AMABA01102	Endangered	None	G5T1	S1	SSC
Spea hammondii western spadefoot	AAABF02020	None	None	G3	S3	SSC
Taxidea taxus American badger	AMAJF04010	None	None	G5	S3	SSC
Thamnophis gigas giant gartersnake	ARADB36150	Threatened	Threatened	G2	S2	
Toxostoma lecontei Le Conte's thrasher	ABPBK06100	None	None	G4	S3	SSC
Vireo bellii pusillus least Bell's vireo	ABPBW01114	Endangered	Endangered	G5T2	S2	
Vulpes macrotis mutica San Joaquin kit fox	AMAJA03041	Endangered	Threatened	G4T2	S2	
Xanthocephalus xanthocephalus yellow-headed blackbird	ABPBXB3010	None	None	G5	S3	SSC

Record Count: 34

CNPS California Native Plant Society

Inventory of Rare and Endangered Plants

*The database used to provide updates to the Online Inventory is under construction. View updates and changes made since May 2019 here.

Plant List

24 matches found. *Click on scientific name for details*

Search Criteria

Found in Quads 3511945, 3511944, 3511943, 3511935, 3511934, 3511933, 3511925 3511924 and 3511923;

Modify Search Criteria Export to Excel Modify Columns Modify Sort Display Photos

Scientific Name	Common Name	Family	Lifeform	Blooming Period	CA Rare Plant Rank	State Rank	Global Rank
Allium howellii var. howellii	Howell's onion	Alliaceae	perennial bulbiferous herb	Mar-Apr	4.3	S3	G3G4T3
Amsinckia furcata	forked fiddleneck	Boraginaceae	annual herb	Feb-May	4.2	S4	G4
Astragalus hornii var. hornii	Horn's milk-vetch	Fabaceae	annual herb	May-Oct	1B.1	S1	G4G5T1T2
Atriplex cordulata var. cordulata	heartscale	Chenopodiaceae	annual herb	Apr-Oct	1B.2	S2	G3T2
Atriplex cordulata var. erecticaulis	Earlimart orache	Chenopodiaceae	annual herb	Aug-Sep(Nov)	1B.2	S1	G3T1
Atriplex coronata var. coronata	crownscale	Chenopodiaceae	annual herb	Mar-Oct	4.2	S3	G4T3
Atriplex coronata var. vallicola	Lost Hills crownscale	Chenopodiaceae	annual herb	Apr-Sep	1B.2	S2	G4T2
Atriplex minuscula	lesser saltscale	Chenopodiaceae	annual herb	May-Oct	1B.1	S2	G2
Atriplex subtilis	subtle orache	Chenopodiaceae	annual herb	Jun,Aug,Sep(Oct)	1B.2	S1	G1
Azolla microphylla	Mexican mosquito fern	Azollaceae	annual / perennial herb	Aug	4.2	S4	G5
Caulanthus californicus	California jewelflower	Brassicaceae	annual herb	Feb-May	1B.1	S1	G1
Cirsium crassicaule	slough thistle	Asteraceae	annual / perennial herb	May-Aug	1B.1	S1	G1
Delphinium recurvatum	recurved larkspur	Ranunculaceae	perennial herb	Mar-Jun	1B.2	S2?	G2?
Eremalche parryi ssp. kernensis	Kern mallow	Malvaceae	annual herb	Jan,Mar,Apr,May(Feb)	1B.2	S3	G3G4T3
Eriastrum hooveri	Hoover's eriastrum	Polemoniaceae	annual herb	(Feb)Mar-Jul	4.2	S3	G3
Eriogonum gossypinum	cottony buckwheat	Polygonaceae	annual herb	Mar-Sep	4.2	S3S4	G3G4

Eriogonum temblorense	Temblor buckwheat	Polygonaceae	annual herb	(Apr)May-Sep	1B.2	S2	G2
Eschscholzia lemmonii ssp. kernensis	Tejon poppy	Papaveraceae	annual herb	(Feb)Mar-May	1B.1	S2	G5T2
Lasthenia glabrata ssp. coulteri	Coulter's goldfields	Asteraceae	annual herb	Feb-Jun	1B.1	S2	G4T2
Madia radiata	showy golden madia	Asteraceae	annual herb	Mar-May	1B.1	S3	G3
Monolopia congdonii	San Joaquin woollythreads	Asteraceae	annual herb	(Jan)Feb-May	1B.2	S2	G2
Puccinellia simplex	California alkali grass	Poaceae	annual herb	Mar-May	1B.2	S2	G3
Stylocline citroleum	oil neststraw	Asteraceae	annual herb	Mar-Apr	1B.1	S3	G3
Trichostema ovatum	San Joaquin bluecurls	Lamiaceae	annual herb	Jul-Oct	4.2	S3	G3

Suggested Citation

California Native Plant Society, Rare Plant Program. 2020. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 31 August 2020].

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The California Lichen Society
California Natural Diversity Database
The Jepson Flora Project
The Consortium of California Herbaria
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Questions and Comments
rareplants@cnps.org

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Project information

NAME

The Palms Recovery Phase

LOCATION

Kern County, California

DESCRIPTION

This project includes construction of facilities to extract and convey water stored at the Palms Groundwater Bank in western Kern County.

Local office

Sacramento Fish And Wildlife Office

(916) 414-6600

(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Log in to IPaC.
2. Go to your My Projects list.
3. Click PROJECT HOME for this project.
4. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS

Buena Vista Lake Ornate Shrew Sorex ornatus relictus There is **final** critical habitat for this species. Your location overlaps the critical habitat. https://ecos.fws.gov/ecp/species/1610	Endangered
Giant Kangaroo Rat Dipodomys ingens No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6051	Endangered
San Joaquin Kit Fox Vulpes macrotis mutica No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2873	Endangered
Tipton Kangaroo Rat Dipodomys nitratoides nitratoides No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7247	Endangered

Reptiles

NAME	STATUS
Blunt-nosed Leopard Lizard Gambelia silus No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/625	Endangered
Giant Garter Snake Thamnophis gigas No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4482	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog Rana draytonii There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened

Fishes

NAME	STATUS
Delta Smelt Hypomesus transpacificus There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/321	Threatened

Crustaceans

NAME	STATUS
Vernal Pool Fairy Shrimp Branchinecta lynchi There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/498	Threatened

Flowering Plants

NAME	STATUS
Kern Mallow Eremalche kernensis No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/1731	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

This location overlaps the critical habitat for the following species:

NAME	TYPE
Buena Vista Lake Ornate Shrew Sorex ornatus relictus https://ecos.fws.gov/ecp/species/1610#crithab	Final

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)
Burrowing Owl Athene cunicularia This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9737	Breeds Mar 15 to Aug 31
Common Yellowthroat Geothlypis trichas sinuosa This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/2084	Breeds May 20 to Jul 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Lawrence's Goldfinch Carduelis lawrencei — Breeds Mar 20 to Sep 20
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9464

Le Conte's Thrasher toxostoma lecontei — Breeds Feb 15 to Jun 20
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8969

Long-billed Curlew Numenius americanus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/5511

Nuttall's Woodpecker Picoides nuttallii — Breeds Apr 1 to Jul 20
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Song Sparrow Melospiza melodia — Breeds Feb 20 to Sep 5
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Spotted Towhee Pipilo maculatus clementae — Breeds Apr 15 to Jul 20
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/4243

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

Whimbrel Numenius phaeopus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9483

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season ( )
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

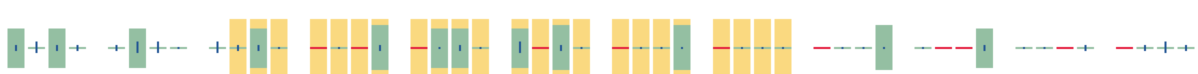
No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

■ probability of presence ■ breeding season | survey effort – no data

SPECIES JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

Burrowing Owl
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)



Common Yellowthroat
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

Golden Eagle
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

Lawrence's Goldfinch
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

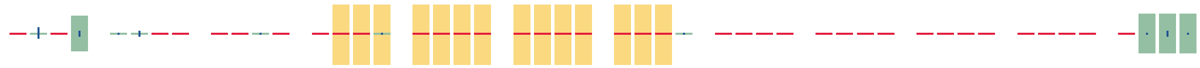
Le Conte's Thrasher
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Long-billed Curlew
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

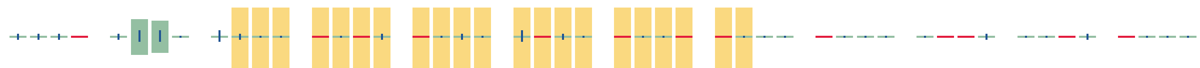
Nuttall's Woodpecker
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

Song Sparrow
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

Spotted Towhee
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)



Tricolored Blackbird
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Whimbrel
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures and/or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ “What does IPaC use to generate the migratory birds potentially occurring in my specified location”. Please be aware this report provides the “probability of presence” of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the “no data” indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER EMERGENT WETLAND

- PEM1C
- PEM1A
- PEM1Ah

FRESHWATER FORESTED/SHRUB WETLAND

- PSSC

FRESHWATER POND

- PUSC
- PUBFx
- PUBF
- PUSCx

RIVERINE

- R2UBHx
- R4SBCx
- R4SBC
- R5UBFx
- R5UBF

A full description for each wetland code can be found at the National Wetlands Inventory website

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Appendix D Groundwater Modeling Report

November 24, 2020

MEMORANDUM

To: Tim Ashlock, Buena Vista Water Storage District

From: Michael Maley, PE, PG, CHg

Re: Groundwater Modeling of the Proposed Buena Vista Water Storage District Palms Groundwater Recovery Project

1. INTRODUCTION

This report provides a summary of groundwater modeling conducted in support of the Buena Vista Water Storage District's (BVWSD or District) Palms Groundwater Recovery Project (Recovery Project). The model results presented in this report represent the status of the modeling work that has been done to date for evaluating potential project alternatives and in support of California Environmental Quality Act (CEQA) compliance requirements.

2. BACKGROUND

2.1 Buena Vista Water Storage District

BVWSD is located in Kern County, approximately sixteen miles west of the City of Bakersfield in the trough of California's southern San Joaquin Valley (**Figure 1**). Land use within BVWSD is primarily agricultural. As with neighboring districts, there has been a shift in recent years from row crops to permanent crops. For example, between 2008 and 2015 the percentage of land planted in permanent crops grew from 9 percent to 42 percent, a conversion which increases winter water demands and reduces the ability of growers to reduce demand in droughts (BVWSD 2014, 2016; BVGSA, 2020).

BVWSD controls an average entitlement of approximately 150,000 acre-feet per year (AFY) of surface water from the Kern River, based on the Miller-Haggin Agreement of 1888. In 1973, BVWSD contracted with the Kern County Water Agency (KCWA) for an additional surface water supply from the State Water Project (SWP) delivered via the California Aqueduct. The contract provided for an annual firm supply of 21,300 AFY and a surplus supply of 3,750 AFY. The water conveyance systems in and around BVWSD consist of a network of levees and diversions to control the high flows of the Kern River, as well as a system of canals and drains that deliver surface water to, and collect runoff from, the lands within BVWSD. BVWSD provides water to two services areas, the larger is the Buttonwillow Service Area (BSA) to the northwest and the smaller Maples Service Area (MSA) to the southeast (**Figure 1**).

BVWSD receives surface water from the Kern River, the California Aqueduct and the Friant-Kern Canal. Kern River and Friant-Kern Canal flows are delivered via the Kern River channel, and

BVWSD's Main, Outlet, and Alejandro canals (BVWSD 2014, 2016; BVGSA, 2020). Altogether, there are approximately 240 miles of pipelines, lined and unlined canals and drainage ditches within BVWSD with seepage from the unlined canals recharging groundwater. BVWSD operates all of the water conveyance and control facilities within its service area and maintains flow records for each reach of District canal.

2.2 Palms Groundwater Banking Project Overview

The District has successfully followed a conjunctive management policy by which surface water is recharged when available and stored in the principal aquifer system for recovery by pumping in years when surface water is insufficient to meet demands. Using this conjunctive management policy, water available during years of above average surface water flow is recharged, and during years when supplies are limited, recharged water is pumped as a supplemental source of supply. A high proportion of recharge in the District takes place through seepage from facilities constructed by the District including canals, laterals and recharge basins.

In January 2016, the District approved construction of the Palms Groundwater Banking Project (Palms Project) in the southern portion of the Buttonwillow Service Area. The Palms Project is a groundwater replenishment and water banking project that covers approximately 1,150 acres and includes features needed to apply surface water for groundwater recharge (**Figure 2**). An Initial Study/Mitigated Negative Declaration (SCH # 2015121030) was prepared for the Palms Project in 2015, and the Notice of Determination was filed in January 2016. Initial construction of the recharge portion of the project was completed in 2016. The recharge ponds were subsequently enlarged and today are located within an area of approximately 1,150 acres. To date, the District has recharged approximately 27,166 acre-feet of surplus water in the Palms Project (14,164 acre-feet in 2017 and 13,002 acre-feet in 2019).

2.3 Palms Groundwater Recovery Project Description

The current analysis is for the Recovery Project that will provide up to 25,000 acre-feet (AF) of banked groundwater to the District's water customers in dry years, while meeting the requirements of the Sustainable Groundwater Management Act. The overall purpose of the Recovery Project is to enhance groundwater management by increasing the District's ability to recharge groundwater in wet years and return that banked water in dry years. Additionally, enhanced groundwater management would benefit agriculture by providing irrigation water supplies in years with limited surface water supplies. The Recovery Project has the following primary objectives:

- Increase conjunctive management on the west side of Kern County (County) by improving the District's ability to meet demands during periods when supply of surface water is limited with previously banked water supplies
- Improve conveyance of previously stored water throughout the District and to neighboring Districts
- Provide water for urban use in County and possibly elsewhere
- Recover banked groundwater of suitable water quality that can be blended, as needed, to meet water quality standards for pump-in to the California Aqueduct (Aqueduct)

There are two areas of pumping. One is located adjacent to the Palms Recharge Ponds and the second area is an annexed area to the northeast where BVWSD has purchased property for the Recovery Project (**Figure 2**).

The Recovery Project will be managed so that groundwater elevations will, in the long term, improve from those observed historically. Available surplus water supply will continue to be recharged at the Palms Project during wet years. The District anticipates recharging up to 100,000 AFY when surplus water supply is available through the Palms Project and their existing canal system during wet years, a District practice for many decades. Annual water recovery by the Recovery Project will be limited to no more than 25,000 AFY. Wells will be pumped at a rate of no more than 5 cubic feet per second (2,250 gallons per minute), and the wells selected for recovery will be selected to optimize groundwater recovery and minimize impacts to groundwater levels.

2.4 Nearby Groundwater Banking Operations

Several prominent groundwater banking facilities are located near the Recovery Project. These include facilities operated by the following:

- Kern Water Bank
- Rosedale-Rio Bravo Water Storage District, and
- West Kern Water District.

The Kern Water Bank is located to the east of the Recovery Project (**Figures 3** and **4**). To operate the facility, the Kern Water Bank has constructed significant infrastructure that includes approximately 7,000 acres of recharge ponds, 85 recovery wells, 36 miles of pipeline, and a 6-mile long canal. The recharge ponds can recharge up to 72,000 acre-feet per month. The ponds are shallow - only a few feet deep - and were constructed by building a low levee on the downslope sides of each pond. The recovery wells average about 750-feet deep and produce as much as 5,000 gallons per minute of water. They are distributed throughout the water bank and spaced 1/3 of a mile or more apart (KWB 2020).

Rosedale-Rio Bravo Water Storage District (RRBWSD) operates groundwater recharge projects located to the northeast of the Recovery Project and north of the Kern Water Bank (**Figure 3**). The recharge facilities consist of recharge basins, improved unlined channels and natural channels. The facilities generally follow the alignment of the Goose Lake Slough. RRBWSD has constructed a network of groundwater recharge basins and channels cover approximately 1,180 acres as of the end of 2017 (RRBWSD 2013, 2019). Nearly all of RRBWSD's surface water supplies are recharged into the groundwater aquifer. Extractions are primarily by private wells (RRBWSD 2013, 2019).

The West Kern Water District (WKWD) is a retail agency that provides water directly to residential, commercial and industrial customers over a large service area located south and west of the Recovery Project (**Figure 3**). In 2015 WKWD served 6,712 active connections; however, about 80 percent of water is delivered to industrial customers, primarily oil exploration companies and power plants (WKWD 2016, 2019).

WKWD has a contract with the KCWA to deliver water from the SWP. WKWD's SWP supply is delivered to BVWSD in exchange for BVWSD's water from the Kern River. The Kern River water is physically recharged in WKWD's South Ponds, located near the Kern River, just west of Enos Lane. West Kern does have an annual option to "buy back" exchanged SWP water for their own use; up to 6,500 AF annually out of their potential 25,000 AF. A total of Recovered groundwater is extracted for use inside WKWD and to support exchange programs with other local water districts (WKWD 2016, 2019). A total of 5 percent of recharged water is considered a non-recoverable loss to benefit the Subbasin, leaving 95 percent of this water available for recovery and use in and outside of WKWD.

WKWD also has North Ponds, just east of BVWSD East Side canal, adjacent and north of Station Road. WKWD acquires a water supply from various sources to recharge in the North Ponds to bank in order to recover in a similar destination to the South Ponds. The banked supply water is wheeled through BVWSD's canal system. In the North Ponds, a total of 6 percent of recharged water is considered a non-recoverable loss to benefit the Subbasin, leaving 94 percent of this water available for recovery and use in and outside of WKWD

The North Project Management Area is shown in **Figure 4** and has recharge ponds that recharge into the shallow aquifer in that region. The South Project Management Area has recharge ponds that recharge into the unconfined aquifer in that region. WKWD's south wellfield consists of eight wells and the north wellfield consists of five wells.

3. REGIONAL SETTING

3.1 Physical Setting

BVWSD lies within the lower Kern River watershed, where historic runoff created heavy clay soils from former swamp and overflow lands along the northern fringe of Buena Vista Lake (**Figures 1** and **3**). BVWSD is made up largely of reclaimed swamp lands located in and along the pre-development course of the lower Kern River. After exiting the Southern Sierra Nevada mountains near Bakersfield, the Kern River flows south and then southwest across the southern San Joaquin Valley, through the topographic axis of the valley toward its ultimate terminus at a drainage basin which was once Tulare Lake (BVWSD 2014, 2016; BVGSA, 2020).

The Recovery Project is located in the southern portion of the BSA, which is a 26-mile long, three- to five-mile wide strip of land that lies west of the Kern River alluvial fan between the Elk Hills and Buttonwillow Ridge (BVWSD 2014, 2016; BVGSA, 2020). The pre-development course of the lower Kern River followed the valley's topographic axis from the Buena Vista Lakebed northward toward the Tulare Lakebed. Because of the asymmetry of the San Joaquin Valley's topography, the axial trough where the BSA lies borders the western edge of the valley. Land surface elevations in the BVWSD range from 290 feet above sea level in the south to 235 feet above sea level in the north (**Figure 1**).

Most precipitation occurs in the winter with little occurring during the summer months of June through August. By contrast, rates of evaporation and transpiration are low in the cooler, wetter months and peak during the hot, dry summer growing season. Average annual precipitation is 5.64 inches and the average reference evapotranspiration rate is 57.06 inches (Western Regional Climate Center 2016).

3.2 Geology

BVWSD overlies the Kern County Subbasin (DWR Basin No. 5-022.14) which comprises the entire southern end of the San Joaquin Valley Groundwater Basin. The subbasin covers about 3,040 square miles and is bounded on the east, south and west by the topographic slope break between the valley fill and the surrounding dissected foothills (**Figure 1**). To the north, the basin is delineated by the boundary between Kern, Kings, and Tulare counties, a political boundary which does not define a change in geological or flow conditions.

BVWSD lies near the western margin of the Kern Subbasin and occupies the overflow lands west of the Kern River alluvial fan within the Buttonwillow Syncline, lying between the Elk Hills and Buttonwillow Ridge (Dale et al, 1966). Land surface elevations in BVWSD range from 290 feet above msl in the south to 235 feet above msl in the north. The groundwater gradient, which is generally flat along a north-south alignment north of 7th Standard Road, steepens south of this boundary with a gradient of 5 to 6 feet per mile (BVGSA, 2020).

The water conveyance systems in and around the district consist of a network of levees and diversions to control the high flows of the Kern River, as well as a system of canals that delivers surface water to the lands within the BVWSD (**Figure 3**).

The BSA is made up largely of reclaimed swamp lands. The aquifer beneath the BSA consists of a sequence of interbedded, laterally discontinuous, sandy and silty sediments (BVWSD 2014, 2016; BVGSA, 2020). Down to a depth of about 200 feet, silty sediments tend to predominate, but from 200 to 600 feet, sandy and silty sediments occur in approximately equal proportions (**Figure 5**). The Corcoran Clay, or another stratigraphically-equivalent clay, has been mapped or inferred to exist under the BSA and MSA. The clay layer lies from 450 to 600 feet below the ground surface under the central portion of the BSA but rises to about 100 feet below the surface under the south end and 250 feet below the surface under the north end (Sierra Scientific 2013).

3.3 Groundwater Conditions

Water level measurements were obtained from the California Department of Water Resources (DWR) state-wide water level database, and from BVWSD who has measured groundwater levels in nearby wells between two and four times a year since about 1993. Hydrographs grouped by geographic location, to the north, east, and in close proximity to the Recovery Project, are shown on **Figure 6**.

The upper graph on **Figure 6** presents groundwater level trends in areas north and west of the Recovery Project. Overall, the groundwater levels show a relatively stable to slightly declining trend from 1970 to 2000. Following 2000, groundwater levels have declined by upwards of 100 feet through 2017. It should be noted that this period represents a period of unusually dry climatic conditions culminating in a statewide historic drought period from 2012 through 2016. The drought-related reductions in local and imported water supplies available to Kern County caused an increased demand on groundwater.

The middle and lower graphs on **Figure 6** show that groundwater level data for wells in close proximity and to the east of the Recovery Project are generally similar. Overall, the groundwater levels show a decreasing trend from 1960 to 1993. However, the initiation of the Kern Water Bank around 1993 and increased banking by BVWSD, WKWD and other nearby agencies shows a significant increase in groundwater levels from 1993 to 2000. As noted above, the unusually dry climatic conditions from 2000 to 2016 produced a general declining trend in groundwater levels. However, significant increases are noted in 2005 and 2011 as a result of increased groundwater banking during these wet years due to the increased availability of local and imported surface water supplies.

The groundwater flow directions can be interpreted from groundwater elevation contours. **Figure 7** shows regional groundwater level contours for 2015 for BVWSD (GEI 2017: BVWSD 2016). The groundwater gradient, which is generally flat along a north-south alignment north of 7th Standard Road, steepens south of this boundary with a gradient of 5 to 6 feet per mile extending almost the entire distance to the southeast end of the GSA. The groundwater elevations near the Recovery Project are lower than areas to the northwest of the project, and this indicates that water generally flows in a southeasterly direction. Local groundwater flow direction near the Recovery Project appears to be in an easterly direction. **Figure 7** shows that groundwater elevations in the vicinity of the Recovery Project where groundwater levels range from 160 feet above msl to the west to 110 feet above msl in the southeast corner of the BSA.

Figure 8 shows the depth to groundwater map for BVWSD (GEI 2017: BVWSD 2016). In the vicinity of the Recovery Project, depth to groundwater ranged from over 180 feet in the southeast to about 130 feet to the northwest. This provides an indication of the potentially available capacity for aquifer storage at the Recovery Project site.

3.4 Groundwater Use

While most of the groundwater pumping within BVWSD is attributable to on-farm pumping from approximately 200 privately-owned wells, BVWSD maintains and operates seven production wells within BVWSD with an eighth well lying outside BVWSD's boundaries along the Alejandro Canal near the Kern River Channel. The majority of irrigation wells in BVWSD are completed to depths between 200 and 600 feet with perforated intervals around 150 feet to the bottom, in a 21-inch (minimum) diameter bore hole. Pumping lifts vary with hydrology and location; however, the average lift has been approximately 100 feet in recent years (BVWSD 2014, 2016; BVGSA, 2020).

BVWSD has established a "*Landowner Well Use Program*", which is a voluntary program to assist BVWSD in satisfying water demands during dry years by making unused well capacity available in return for reimbursement to participating well owners for energy charges in addition to capital replacement and maintenance costs. As noted earlier, this program is part of BVWSD's drought response effort (BVWSD 2014, 2016; BVGSA, 2020).

3.5 Regional Water Quality

Groundwater quality in the region is variable and depends on the quality of the recharge water, the chemical changes that occur as surface water percolates into the aquifer, and chemical changes that occur within the aquifer (Dale et al. 1966). Groundwater in the southern San Joaquin Valley can be divided into three groups based on geography: east side, west side, and axial trough (Dale et al. 1966).

East side groundwater quality is of the bicarbonate type with low total dissolved solids (TDS). This groundwater is characteristic of the surface waters which drain the granitic Sierra Nevada Range to the east of the basin (Dale et al. 1966). Groundwater quality in the east side reflects the quality of the Kern River, the primary source of recharge.

West side groundwater quality is of the sulfate or chloride type with higher TDS concentrations than the east side. This groundwater quality is characteristic of the surface waters that drain the Miocene-Pliocene marine sediments of the Temblor Range to the west of the basin (Dale et al. 1966; Sierra Scientific Services 2013). This water quality is found in a strip along the west side of basin. There is less surface runoff from the west than from the east, therefore groundwater quality of the sulfate type is less prevalent than of the bicarbonate type (Sierra Scientific Services 2013).

Groundwater quality in the axial trough is a mixture of east side and west side groundwater, as well as surface water that percolates to the aquifer. Groundwater is of sodium type but varies in concentration and chemical character. Axial trough groundwater typically has higher TDS concentrations than water in the east side. The boundary between the axial trough and west side groundwater may be the West Side Canal, which forms the western border of the Recovery Project boundary (Dale et al. 1966).

4. SUPERPOSITION GROUNDWATER MODEL

4.1 Approach

The Superposition Model has been used since 2016 as part of the ongoing evaluations for the Recovery Project (GEI, 2017). During this time, the Superposition Model was used as a screening model to evaluate various alternatives for the recovery of banked groundwater up to a rate of 25,000 AFY for use by BVWSD. The following text summarizes the setup and application of the Superposition Model for the Recovery Project. Additional details on the approach, setup and validation of the Superposition Model are presented in **Attachments A**, **B** and **C**.

A superposition modeling approach was selected as the most suitable method to support the groundwater impacts analysis. As detailed in the following section, this superposition approach enables the Project-related changes to be calculated throughout the basin and superimposed upon the groundwater system so that the accumulated effects of the Project over time can be determined.

4.2 Superposition Model

The modeling used to simulate the Recovery Project is based on the principle of superposition. The principle of superposition, as applied to a groundwater system, means that the result of multiple stresses on an aquifer system is equal to the sum of the results of the individual stresses. Additional information about applying the principle of superposition to numerical groundwater models is provided in **Attachment A**.

Superposition allows the groundwater impacts analysis to assess the effects of the Project on the groundwater system in isolation from other acting stresses (e.g., pumping, recharge, etc.) without having to obtain data of non-project related stresses to simulate the Project. Using a superposition model, calculation of groundwater impacts is inherently precise because flow quantities other than Project related components are set to zero (Leake 2011).

When the Principle of Superposition is used in groundwater modeling, the model results are presented in terms of change in groundwater levels rather than in absolute values of groundwater elevations. Therefore, the model results provide the relative change in groundwater levels due to the Recovery Project; in other words, a superposition model directly calculates the groundwater level impacts from the Recovery Project. By applying the Principle of Superposition, the relative change in groundwater levels can be added (superimposed) to measured or simulated groundwater elevations to determine a predicted groundwater elevation associated with Project impacts. This means that calculated changes in groundwater levels can then be added to other groundwater level distributions to determine the combined effects on the groundwater system (Reilly et al. 1987).

4.3 Groundwater Model Setup

For the groundwater modeling analysis, a regional groundwater Superposition Model will be used to simulate the changes in groundwater levels from proposed recovery operations. The Superposition Model used for the BVWSD Recovery Project was previously developed and used for the Supplemental Environmental Impact Report (SEIR) for the Kern River Water Allocation Plan for Kern Delta Water District (KDWD). The Draft SEIR was completed in 2017 (ESA 2017) and the groundwater modeling was described in the Groundwater Impacts Assessment Report (Todd Groundwater 2017) which was an appendix to the SEIR.

Following the general methodology for applying superposition methods to groundwater modeling (Reilly et al. 1987), the Kern County Superposition Model was developed from the existing, previously calibrated, USGS Central Valley Hydrologic Model (CVHM) (Faunt 2009). CVHM is a three-dimensional (3D) computer model developed by the USGS to simulate surface water and groundwater flow across the entire Central Valley (Faunt 2009). The geologic framework and aquifer properties of CVHM are based on a comprehensive geologic analysis (USGS Sediment Texture Analysis) that provides a regionally consistent evaluation of aquifer properties based on the analysis of local well logs (Faunt, Hanson and Belitz 2009). Additional details on the setup and modifications of the Superposition Model are presented in **Attachment B**.

4.4 Superposition Model Validation

Although the underlying CVHM Base Model was calibrated by the USGS to data obtained throughout the Central Valley – presumably using reasonable care in developing the geologic framework and determining aquifer properties – it is appropriate to demonstrate that the use of the Kern County Superposition Model built from the CVHM for the specific objectives of this impact analysis reasonably reproduces historical groundwater level changes.

Developing an appropriate validation scenario can be challenging in a heavily operated groundwater basin because validation requires simulating a set of historical groundwater stresses that show a clear cause and effect relationship. Since the Superposition Model results provide the change in groundwater levels, there is no base case to remove the effects from other background stresses. To achieve this, validation scenarios were developed to test the ability of the Superposition Model to evaluate regional groundwater impacts by simulating a historical period during which field data were obtained that measured changes that occurred under similar hydrologic conditions. Additional details on the setup and results of the Validation Scenarios are presented in **Attachment C**.

An initial validation scenario compared an analytical model simulation based on pumping tests at the WKWD North Wellfield which is located adjacent to the Recovery Project (**Figure 4**). In July 2020, WKWD provided detailed data on aquifer testing, groundwater pumping and measured water levels for the North Wellfield, including October 2012 through December 2014 pumping data from the five WKWD groundwater production wells. This period was the beginning of a significant drought period and groundwater pumping associated with the nearby groundwater banks was also occurring. Consequently, the measured groundwater elevations at the WKWD North Wellfield wells would be affected by this pumping and could be used as a comparison to modeled groundwater recovery pumping. Based on this comparison, modifications were made to the hydraulic conductivity in the Superposition Model for the BVWSD area as described in both **Attachments B** and **C.**

A previous validation scenario had been constructed to evaluate groundwater level changes resulting from recharge operations at the Kern Water Bank from 1993 to 1998 (Todd Groundwater 2017). This period represents the initial recharge operations at the Kern Water Bank and other nearby recharge facilities prior to significant recovery activities. This scenario evaluated the capability of the Superposition Model to simulate the effects of major changes in groundwater levels as a result of managed aquifer recharge. The previous scenario was rerun using the modified hydraulic conductivities from the WKWD validation scenarios. Based on the model validation, the Superposition Model provides a useful planning tool to evaluate potential groundwater changes resulting from the Palms Project.

Since the pumping and recharge conditions imposed for the validation scenario meet or exceed those proposed for the both the Palms and Recovery Projects, the validation scenario results provide a means to determine the relative percentage of uncertainty that is appropriate for the Palms Project. The validation scenarios indicate a relative level of uncertainty of approximately 15 percent (**Attachment C**). This would apply to the overall model results with the acknowledgement that uncertainties for a specific location may have a larger or smaller percentage.

The groundwater modeling performed for this report is intended as an initial screening-level analysis to evaluate the overall feasibility of using BVWSD's ponds with higher discharge volumes. To accommodate uncertainty in the conceptual model, the Recovery Project scenario uses reasonable, but conservative, assumptions based on the available site data so as not to overestimate the capacity of the shallow aquifer. The model validation demonstrates the capability of the Superposition Model, as it is configured for this study, to reasonably simulate the change in groundwater levels and trends based on the comparison to measured data.

5. RECOVERY PROJECT SCENARIO

The Superposition Model was used to evaluate a number of potential alternatives for the Recovery Project. The Recovery Project Scenario, described below, provides an assessment of the recovery operations of 14 wells to pump the recharged groundwater for use by BVWSD.

5.1 Approach

Two operational scenarios were run to assess changes in groundwater conditions from the combined Palm and Recovery Projects. The original project description (Scenario A) included an assumption of 100 percent recovery of the recharged water as a worst-case scenario with respect to groundwater level impacts. The Reduced Recovery Alternative (Scenario B), the Recovery Project would recover 90 percent of the recharged water, with the remaining 10 percent of the Palms Project recharge remaining in the groundwater basin as a *leave-behind*. The two different Recovery Project operation scenarios were setup as follows:

- *Scenario A* simulates the combined Palms and Recovery Project operations using an assumption of 100 percent recovery of the Palms Project recharged water as a worst-case scenario with respect to groundwater level impacts. The simulated recovery pumping occurs at a rate of 25,000 AFY over a six-month period over four consecutive years (**Figure 9**).

- *Scenario B* simulates the combined Palms and Recovery Project operations using an assumption of 90 percent recovery of the Palms Project recharged water as a most-likely case scenario with respect to groundwater level impacts. The simulated recovery pumping occurs at a rate of 25,000 AFY over a six-month period over three consecutive years. During the fourth year, the simulated recovery pumping occurs at a rate of 15,000 AFY (**Figure 9**). The same pumping rate occurs during the first 3 months, reduced pumping occurs in the fourth month, and no pumping during final two months of the fourth-year extraction period.

The relatively straightforward operational strategy used for this scenario helps to evaluate a direct cause-and-effect relationship that applies a maximum recharge and recovery operational condition where 100,000 AF of recharge occurs in a single year and recovery occurs at the Recovery Project maximum rate of 25,000 AFY over a period of four consecutive years. No additional recharge is included in the Project scenario.

5.2 Recovery Project Scenario Setup

The objective of this scenario is to simulate a relatively straightforward operational strategy that assumes a high volume of recharge (100,000 AF) occurring in a single-year followed by four consecutive years of pumping at the Project-specified maximum pumping of the combined wellfield of 25,000 AFY. Historical, BVWSD typically has smaller recharge volumes and smaller groundwater recovery pumping that occurs over a longer period of time. Also, it is not unusual for recharge and recovery to occur during the same year.

The Recovery Project scenario presented in this report represents the most recent configuration of recovery wells based on technical and logistical concerns. The recovery project consists of two areas of pumping and will include facilities needed for recovery and treatment of stored groundwater. One area is located adjacent to the Palms Project and the second area is an annexed area to the northeast where BVWSD has purchased property for the Recovery Project (**Figure 2**). The Recovery Project scenario consists of four operational stages that are outlined below:

- Year 1 – Recharge of 100,000 AF of water at Palms Project recharge sites operated by BVWSD distributed over an eight-month period in a manner consistent with past high-volume recharge events by BVWSD.
- Year 2 – No recharge or recovery to allow for some dissipation of the mound (conservative assumption on groundwater impacts).
- Years 3 through 6 – Recovery pumping of 25,000 AFY from 14 Project wells shown on **Figure 2**. A uniform pumping rate is applied to each well with the pumping spread over a six-month period consistent with past BVWSD pumping operations.
- Years 7 through 11 - No recharge or recovery to evaluate long-term recovery from operations.

Because this is a superposition model, only the combined Palms and Recovery Project operations were simulated. The 14 proposed groundwater pumping locations were located as shown on **Figure 2**. No other pumping is included in the scenario. The simulation was run over the 11-year simulation period using one-month stress periods.

5.3 Evaluation of Scenario Results

The Superposition Model results are presented in terms of change in groundwater levels rather than in absolute values of groundwater elevations. Therefore, the model results provide the relative change in groundwater levels due to the combined Palms and Recovery Projects; in other words, a superposition model directly calculates the groundwater level impacts resulting from the combined Palms and Recovery Projects. Model results are presented using a variety of maps and graphs to provide for a comprehensive analysis of Project-related impacts on groundwater resources. Techniques used to present the results of the groundwater impacts analysis are summarized briefly below:

- *Groundwater Level Change Maps* – contour maps that show the simulated change in groundwater levels in the vicinity of the Recovery Project. This analysis provides a direct assessment of the spatial distribution of groundwater level impacts of the combined Palms and Recovery Projects.
- *Change Hydrographs* – hydrographs that show the change in groundwater levels over time for representative locations in the vicinity of the combined Palms and Recovery Projects to provide a direct assessment of the magnitude of impacts of the Palms Project operations on groundwater levels over time.
- *Superposition Hydrographs* – simulated groundwater elevation changes are superimposed onto hydrographs (based on measured groundwater elevation data) to evaluate -related impacts due to the combined Palms and Recovery Projects relative to historical groundwater elevation data. This analysis evaluates the scale of the impacts of the Palms Project compared to the historical variation in groundwater levels from monitoring wells in the vicinity. The superposition hydrographs are compared to historical data for Scenario B.

Collectively, these maps and graphs, along with additional model results, illustrate how the Project will impact groundwater in the vicinity of the Recovery Project. The results of the groundwater impacts analysis using the Superposition Model is summarized below.

5.4 Palms Project Scenario Groundwater Change Maps

A series of groundwater level change maps are provided that show the simulated change in groundwater levels at key intervals during the simulated operations of the combined Palms and Recovery Projects. These illustrate the spatial distribution of groundwater level change resulting from the proposed Recovery Project operations and are discussed below.

Figure 10 shows the distribution of the change in groundwater levels representing the maximum mounding at the end of the Year 1 recharge event. Both Scenarios A and B use the same recharge setup, so **Figure 10** is the same for both Scenarios A and B. The maximum increase of groundwater levels of up to 100 feet occur in the center of the Palms Project, and mounding of 10 to 50 feet covers a large area of Palms Project area. Lesser amounts of mounding extend into WKWD and the western areas of the Kern Water Bank.

Figure 11 shows the distribution of the residual mound prior to the initiation of recovery pumping in Year 3. This map is the same for both Scenarios A and B. This represents the buildup of groundwater levels as groundwater flows away from the recharge area to the surrounding areas over the 20 months between the end of recharge and the beginning of the recovery.

Figure 12 shows the distribution of the cumulative groundwater level change for the simulation after the first year of recovery pumping in Year 3 of the simulation. This map is the same for both Scenarios A and B. Drawdown shown on **Figure 12** is the result of the first year of Recovery Project pumping in Simulation Year 3 imposed on the residual mound from the Palms Project (**Figure 11**). Therefore, the change in groundwater levels relative to the beginning of the scenario as shown on **Figure 12** show the maximum cumulative groundwater level change of less than 10 feet occurs near the recovery wells. Adjacent areas in WKWD, RRBWSD and Kern Water Bank still have elevated groundwater levels of 0 to 4 feet resulting the Palms Project recharge.

Figure 13 shows the distribution of the cumulative groundwater level change for Scenario A after the fourth year of recovery pumping in Year 6 of the simulation. The contours show the maximum cumulative groundwater level change relative to the start of the simulation of 20 to 35 feet occurs near the recovery wells. The cumulative groundwater level declines of 2 to 10 feet cover the area of Recovery Project and extend further into western areas in RRBWSD and across the western half of the Kern Water Bank primarily west of Interstate 5. An area of the residual mound remains to the north in BVWSD.

Figure 14 shows the distribution of the cumulative groundwater level change for Scenario B, which assumes 90 percent recovery of the Palms Project recharge. The contours show the maximum cumulative groundwater level change of 20 to 30 feet occur near the recovery wells. Because groundwater pumping is reduced the fourth year of recovery of Scenario B, the cumulative groundwater level declines are 0 to 2 feet less than those in Scenario A (**Figure 13**).

5.5 Recovery Project Scenario Groundwater Change Hydrographs

The Superposition Model was used to simulate a series of hydrographs for the Recovery Project Scenario. These change hydrographs show the change in groundwater levels over time for representative locations in the vicinity of the Recovery Project. This analysis provides a direct assessment of the magnitude of impacts of the Recovery Project on groundwater levels over time.

Figure 15 shows the locations of the simulated Recovery Project wells used for the Palms Scenario including interim reference names. There are two areas of pumping. One is located within the Palms Project site and the second area is an annexed area to the northeast where BVWSD has purchased property for the Recovery Project.

Figure 16 shows the simulated change in groundwater levels at the Recovery Project wells for Scenario A. The upper graph on **Figure 16** provides the hydrographs for the seven wells located within the Palms Project site. Here the mounding from the recharge reaches a maximum of about 100 feet at the end of the recharge period and a residual mound of 15 feet remains at the beginning of the first pumping period. Drawdowns over the pumping periods are generally on the order of about 20 feet for all of the wells. The cumulative groundwater level declines range from 15 to 25 feet at the end of fourth pumping period with drawdown increasing with each successive pumping period.

The lower graph on **Figure 16** provides the hydrographs for the seven wells located within the annexed area northeast Palms Project site. Here the mounding is less. The mounding reaches a maximum of 8 to 28 feet at the end of the recharge period and a residual mound of 7 to 12 feet remains at the beginning of the first pumping period. The drawdowns, however, are on the order of about 20 feet for each successive pumping period reflecting the influence of higher hydraulic conductivities in this area. The cumulative groundwater level declines range from 10 to 18 feet at the end of the fourth pumping period.

Figure 17 shows the hydrographs for Scenario B at the same locations shown on **Figure 15**. The difference between Scenarios A and B occurs in the fourth year of pumping during which Scenario B pumps 10,000 AF less. As a result, the graphs are identical until the end of the fourth year of pumping when groundwater levels are about 2 to 3 feet higher due to the reduced pumping. **Figure 18** shows the locations of the simulated monitoring points placed in the Superposition Model to document the spatial distribution of response from the combined Palms and Recovery Project operations. These do not reflect actual monitoring points; however, future simulations would include monitoring points at specific locations of interest for the groundwater impacts assessment.

Figure 19 shows the simulated change in groundwater levels produced by the Superposition Model for the Recovery Project Scenario at the simulated monitoring points. The upper graph on **Figure 19** provides the hydrographs for the six simulated monitoring points located near the center of the Palms Project site. These show responses similar to the recovery wells. The effects of the Palms Project operations diminish the further away the simulated monitoring points are located. This is also seen on the lower graph on **Figure 19** where the responses in simulated monitoring points located farther from the center show cumulative groundwater level changes of five feet or less.

Figure 20 shows the hydrographs for Scenario B for the same locations shown on **Figure 18**. The change after the fourth year of pumping is generally 0 to 11 feet for the monitoring points closer to the center and 0 to 2 feet for the monitoring points further from the center. The magnitude of effects is a function of the distance from the Recovery Project wells.

5.6 Recovery Project Scenario Superposition Hydrographs

Superposition hydrographs provide a means to assess the effect of the Recovery Project at various locations. For this analysis, the simulated groundwater elevation change is added, or superimposed, onto the measured groundwater elevation data to evaluate Project-related impacts relative to historical groundwater elevation data. This analysis evaluates the scale of the impacts of the Recovery Project compared to the historical variation in groundwater levels over time. The superposition hydrographs add the change in groundwater levels from Scenario B to the measured historical groundwater elevations for the selected wells.

For the superposition hydrographs assessment, the recharge event is assumed to occur in 2011, which was a wet hydrologic year where water was available for potential recharge. The recovery pumping is assumed to occur during 2013 through 2016, which was a period of critically dry drought conditions. This period was selected because if represents a recent period where extreme conditions were experienced in the Kern County Subbasin.

A representative selection of wells that have periods of measurements over the 2011 to 2016 period were selected to provide an assessment of the relative change resulting from the combined Palms and Recovery Project operations relative to the historical groundwater level variations observed at these locations. **Figure 21** shows the locations of the selected wells relative the Recovery Project. These hydrographs are shown on **Figures 22** through **26**, and a brief summary is listed below:

- **Figure 22** shows BVWSD monitoring wells near to the Recovery Project. Due to their proximity, these wells show the greatest groundwater level changes. The early mounding as a result of the recharge increases groundwater levels about 60 feet relative to the historical. Maximum drawdown from recovery pumping is about 10 feet at these locations.
- **Figure 23** shows monitoring wells in the western RRBWSD near the Recovery Project. The early mounding as a result of the recharge increases groundwater levels about 2 to 10 feet relative to the historical. Maximum drawdown from recovery pumping ranges from about 1 to 5 feet at these locations.
- **Figure 24** shows Kern Water Bank (KWB) monitoring wells along the western margin of KWB which is closest to the Recovery Project. The early mounding as a result of the recharge increases groundwater levels about 5 to 20 feet relative to the historical. Maximum drawdown from recovery pumping is about 1 to 4 feet.
- **Figure 25** shows monitoring wells in the central RRBWSD area. Due to their distance from the Recovery Project (**Figure 21**), the change in groundwater levels is negligible.
- **Figure 26** shows monitoring wells in the Pioneer Project and the WKWD South wellfield. Due to their distance from the Recovery Project (**Figure 21**), the change in groundwater levels is negligible.

5.7 Groundwater Impacts Assessment

The results of these Recovery Project scenarios indicate that most of the drawdown associated with the recovery wells occurs within and adjacent to BVWSD and the Recovery Project. The simulations results indicate that drawdowns of 0 to 10 feet would be expected at areas adjacent to BVWSD as a result of the Recovery Project recovery wells after four years of full recovery of a recharge volume of 100,000 AF.

6. CUMULATIVE SCENARIO

For the Cumulative Scenario, the C2VSimFG-Kern model used for the 2020 GSPs was used. For the GSPs, the Kern County Subbasin GSAs developed a set of projects to meet the sustainability goals for the Subbasin. The following discussion provides a brief overview of how the C2VSimFG-Kern model was applied for the 2020 GSPs and how it was applied to evaluate the cumulative impacts of the combined Palms and Recovery Project operations.

6.1 C2VSimFG-Kern Model

The Kern County Subbasin Coordination Agreement refers to the local groundwater-surface water model (C2VSimFG-Kern) as the agreed upon method for generating coordinated water budgets for the Kern County Subbasin. Appendices 2 and 4 of the Kern County Subbasin Coordination Agreement include a technical report (Maley and Brush 2020) on the development and application of C2VSimFG-Kern for these purposes. The following provides a brief overview of this technical report.

The primary objective of the C2VSimFG-Kern model is to fulfill the GSP requirement for a coordinated subbasin-wide water budget analysis, while also providing information required to fulfill other GSP requirements. C2VSimFG-Kern was updated to include local water budget data provided by water and irrigation districts, municipalities, and GSAs in the Subbasin. The C2VSimFG-Kern was provided to DWR so the Kern County Subbasin revisions can be incorporated into their master version of the C2VSim model.

The C2VSimFG-Kern results were used to assess whether the simulated groundwater levels would meet the minimum threshold and measurable objective (MT/MO) for the 186 proposed representative monitoring well (RMW) locations spread across the Kern County Subbasin based on MT/MO assigned to each of the 186 locations by their respective GSA or management area (**Figure 27**). A requirement of SGMA is for groundwater levels not to cross their minimum thresholds (MT) to the extent that undesirable results would occur in the basin, and moreover, that proposed SGMA projects and management actions would lead to meeting the measurable objectives.

Because C2VSimFG-Kern is not fully calibrated, the results are presented as relative change (which does not require calibration) instead of simulated groundwater levels using the superposition method. Future change in groundwater level was determined for each of the 186 locations for each of the six projected future simulations. The change was calculated from the simulated March 2015 groundwater levels from the model. The projected-future change in groundwater levels was then applied to the measured March 2015 groundwater level at the monitoring location (i.e., the result was superimposed on top of the simulated change in groundwater levels of the projected future C2VSimFG-Kern scenarios relative to the measured March 2015 groundwater level).

Based on the historical C2VSimFG-Kern results, an estimated level of uncertainty of the overall water budget was determined to be on the order of 10 to 20 percent (Maley and Brush 2020). The C2VSimFG-Kern simulated groundwater levels provide a reasonable approximation of observed groundwater levels in the central part of the Kern County Subbasin producing simulated water budget components that generally match historical values compiled by local agencies. The model is well suited to estimating the impacts of management actions on Subbasin groundwater storage. Notwithstanding some limitations, C2VSimFG-Kern is considered to be the best available information and well-suited as a planning tool to estimate the impacts of the proposed SGMA projects and management actions on groundwater conditions in the Kern County Subbasin.

6.2 SGMA Baseline with Projects Simulation

Potential-future conditions were simulated over a 50-year planning horizon under a range of potential climatic conditions including Baseline (repeat of historical hydrology and climate change analyses for 2030 and 2070 climate change conditions following DWR guidance). Projected water budgets are required by GSP regulations to represent future conditions over a 50-year GSP planning and implementation horizon.

The Baseline Scenarios simulate potential future groundwater conditions in the Kern County Subbasin aquifer if the recent hydrology were repeated with current expected surface water availability and current land use. The Baseline condition was developed that projects water supply, demand and operations based on current land use and expected water supply availability over 50 years. C2VSimFG-Kern simulation results for the last timestep of the historical simulation (September 30, 2015) were used as initial conditions for all projected future simulations, including initial conditions for the root zone, saturated and unsaturated aquifer zones, and small watersheds.

The Baseline Scenarios were run both with and without SGMA projects. Proposed future projects and management actions were provided by the GSAs. The types of proposed SGMA projects and management actions are summarized as follows:

- Demand Reduction is the volume of water reduced by changing the land use
- New Supply groups together planned increases in imported water supplies,
- Other Supply groups together proposed projects to increase local water supplies such as increased use of surface water, recycled water and low-quality groundwater.

The Baseline Scenario with SGMA Projects simulates the proposed SGMA projects and management actions applied to the Baseline Scenario. **Figure 28** shows the implementation of the SGMA projects by volume and time period as presented in the Coordination Agreement (Maley and Brush 2020). No other changes were made except for the addition of the SGMA projects to provide a direct comparison of the relative benefits of about 422,000 AFY from proposed SGMA projects and management actions. Collectively, the C2VSimFG-Kern simulation results indicate that the currently-proposed SGMA projects and management actions, once fully implemented, provide a reasonable approach to achieve sustainable management of the groundwater basin and can be adaptively managed to meet future challenges as necessary. The projects included in the Projected-Future Baseline with Projects scenario are described in the Kern County Subbasin GSPs (KGA 2020; KRGSA 2020; HMGSA 2020), and excepts from those GSPs describing these projects are provided in **Attachment D**.

6.3 Cumulative Scenario Setup

The proposed recharge and recovery pumping rates of the combined Palms and Recovery Project operations were added to the C2VSimFG-Kern model's SGMA Baseline with Projects Scenario developed for the Kern County Subbasin GSPs under the Coordination Agreement. No other changes were made to the scenario. The purpose of this scenario is to assess the potential effects of the Recovery Project on top of the effects from the possible projects and management actions listed in the Kern County Subbasin GSPs (see **Attachment D**). The projected-future conditions are based on assumptions of future climatic conditions, water management operations and configurations of the proposed SGMA projects. These assumptions are based on historical climatic conditions and planned future water operations as provided by the local water districts.

The Cumulative Scenario setup is limited to adding the recharge at the Palms Project during scenario wet years. These wet years are equivalent to the historical hydrology years of 1998, 2006 and 2011. The Cumulative Scenario follows the 90 percent recovery methodology of Scenario B where pumping occurs at a rate of 25,000 AFY over six months in the years after the recharge event until the total recovery equals 90 percent of the total recharge.

The Cumulative Scenario includes recharge at different volumes. This was done primary to fit straightforward cycles of groundwater recharge followed by a complete 90 percent recovery of the recharge to provide a clear cause and effect analysis of the simulation results without consideration of the effects of recharge account carryover to later years.

- 1998 hydrology equivalent – 100,000 AF recharge event occurred in simulation years 2036 and 2056 followed by four years of pumping of 90 percent of recharge total.
- 2006 hydrology equivalent – 50,000 AF recharge event occurred in simulation years 2036 and 2056 followed by two years of pumping of 90 percent of recharge total.
- 2011 hydrology equivalent – 75,000 AF recharge event occurred in simulation years 2036 and 2056 followed by three years of pumping of 90 percent of recharge total.
- Final two years of simulation - 25,000 AF recharge event occurred in simulation year 2069 followed by one year of pumping of 90 percent of recharge total.

This distribution is graphically displayed on **Figure 29** (blue bars above the 0 line). Over the 50-year simulation, the total recharge is 525,000 AF with 472,500 AF of pumping to recover 90 percent of the Palms Project recharge. The remaining 10 percent of the recharge (52,500 AF) is left in the aquifer. The distribution of recovery pumping from the Palms Project over the 50-year duration of the Cumulative Scenario is depicted as the red bars below the 0 line on **Figure 29**.

6.4 Cumulative with Deferred Recovery Scenario Setup

As discussed below, the simulation results indicated that groundwater elevations at some RMW locations adjacent to the Recovery Project recovery wells fall below their MT. There are many potential mitigation measures that are possible for addressing this issue. For this scenario, the approach was to apply the recharge following the same schedule as for the Cumulative Scenario, but to stop Recovery Project pumping prior to groundwater levels at the RMW locations reaching their MTs. This scenario was developed to test whether deferring the pumping to a later period would keep groundwater levels above MTs.

This pumping was then applied during a later period in the 50-year simulation when simulated groundwater levels were higher, thus simulating a deferred recovery mitigation measure. As a result, the total recharge and pumping over the 50-year simulation period is the same as the Cumulative Scenario. The distribution of recharge and pumping from the combined Palms and Recovery Project operations over the 50-year duration of the Cumulative with Deferred Recovery Scenario is shown as the green bars below the 0 line on **Figure 29** to provide a comparison to the Cumulative Scenario.

6.5 Groundwater Impacts Assessment

The simulation results of the Cumulative Scenario are provided on a series of hydrographs from RMW locations in the vicinity of the Recovery Project. **Figures 30, 31, 32** and **33** provide the results of the RMW locations in the vicinity of the Recovery Project. The locations of the RMWs are shown on **Figure 27**. The graphs show the MT/MO for each RMW location along with the SGMA Baseline and Baseline with Project Scenarios.

The Recovery Project Cumulative Scenario results are presented within context of the SGMA simulations. These results indicate the potential for recovery pumping by the Recovery Project to cause the groundwater levels at the WKWD North Wellfield (**Figure 30**) and the far western areas of RRBWSD (**Figure 31**) to fall below the MT (red line) during simulation years. Conversely, groundwater levels during the recharge events are higher than those without the existing Palms Recharge Project.

Other RMW locations more distant from the Recovery Project (WKWD South Wellfield, RRBWSD, KRGSA (City of Bakersfield) and the Pioneer Project) show negligible effects from the Recovery Project operations (**Figures 32** and **33**). **Figure 32** shows hydrographs of RMWs in the vicinity of the Recovery Project while **Figure 33**shows hydrographs of RMWs further away (distal) from the Recovery Project . The Kern Water Bank did not include RMW locations in their GSP so the KWB does not have MT/MOs for assessment under the cumulative analysis. However, it can be assumed that they will show similar effects as a function of distance from the Recovery Project as seen in the other RMW locations. Therefore, there is the potential for effects like those seen in the WKWD North Wellfield to occur in the western Kern Water Bank. These effects will diminish to negligible in the central and eastern areas of the Kern Water Bank.

The Recovery Project Cumulative with Deferred Recovery Scenario shows that groundwater levels at the WKWD North Wellfield (**Figure 30**) and the far western areas of RRBWSD (**Figure 31**) are generally higher than those with the Baseline with Project Scenarios. By deferring the recovery pumping, these RMW locations still have some benefit of the Recovery Project recharge. The deferred pumping occurs during a period when the simulated groundwater levels for the planned SGMA projects are above the MTs for the WKWD North Wellfield and the far western RRBWSD RMW locations.

In the GSPs for the WKWD and RRBWSD, the definition of the potential undesirable results from groundwater levels falling MTs is defined in terms of number of wells within an area and duration of the occurrence. Excerpts taken from the WKWD and RRBWSD GSPs defining undesirable results is provided below.

- West Kern Water District (excerpt taken from WKWD 2019, Section 5.4.2, page 5-3)–
    - *An undesirable result would occur when the minimum threshold for groundwater levels are exceeded in at least three adjacent management areas that represent at least 15 percent of the Subbasin, or that represent greater than 30 percent of the Subbasin (as measured by each management area; see Section 7.0 for more information about Subbasin management areas). Each GSAs will set minimum thresholds by each of Chapter GSP that participates in the KGA*.
- Rosedale-Rio Bravo Water Storage District/Rosedale-Rio Bravo Management Agency (RRBMA) (excerpt taken from RRBWSD 2019, Section 5.1, page 69)
    - *The RRBMA will seek to maintain at least two water level monitoring points for each monitoring zone. To the extent that average water levels in of designated monitoring points has exceeded the minimum threshold of the monitoring zone, it will be considered an undesirable result. To the extent that two of the North, Central, and South of River zones exceed this criterion, the RRBMA will consider it an undesirable result. To the extent that either the South or East zones exceed this criterion, the RRBMA will consider it an undesirable result*.

As described above, undesirable results are defined in terms of sustained exceedances of minimum thresholds for multiple wells over an extended period of time. The results of the Recovery Project Cumulative with Deferred Recovery Scenario indicate that active measures are available for Recovery Project operations to reduce the effects on groundwater levels to limit potential undesirable results.

The operations used for the Cumulative Scenario represent an aggressive operational strategy to represent a maximum operational scenario consistent with the hydrological conditions presented over the 50-year Baseline Scenario. Actual operations would be dependent upon actual hydrologic conditions which would affect the availability of surface water for recharge and local water demand.

7. CLOSURE

The conclusions and recommendations presented herein are professional opinions based on the model simulations described herein. The findings and professional opinions presented in this memorandum are presented within the limits prescribed by the client contract and in accordance with generally accepted professional engineering, geologic and modeling practices. There is no other warranty, either expressed or implied, regarding the conclusions, recommendations, and opinions presented in this report.

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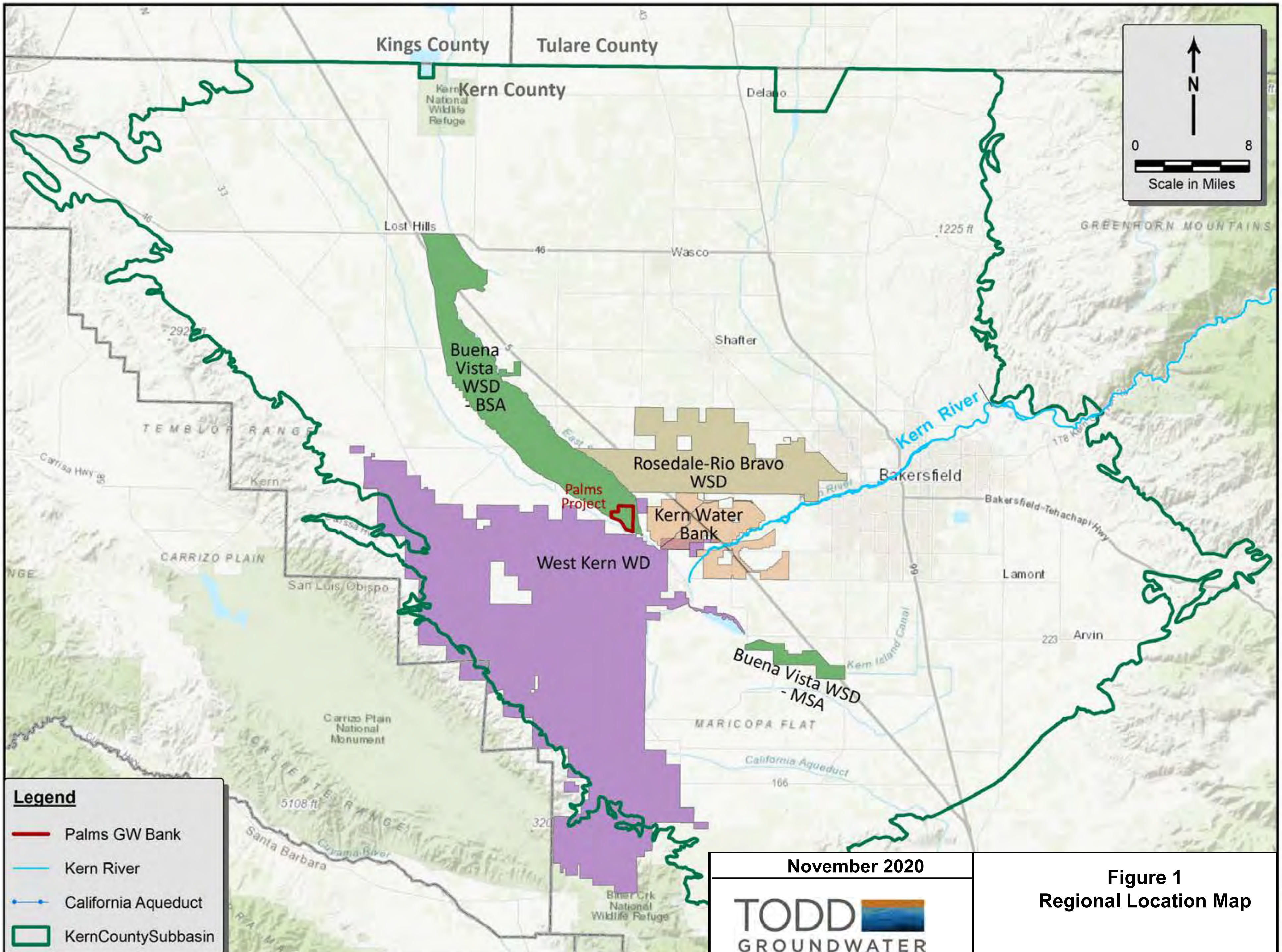
List of Figures (following text)

List of Attachments (following figures)

FIGURES



November 2020

TODD GROUNDWATER

Figure 1
Regional Location Map

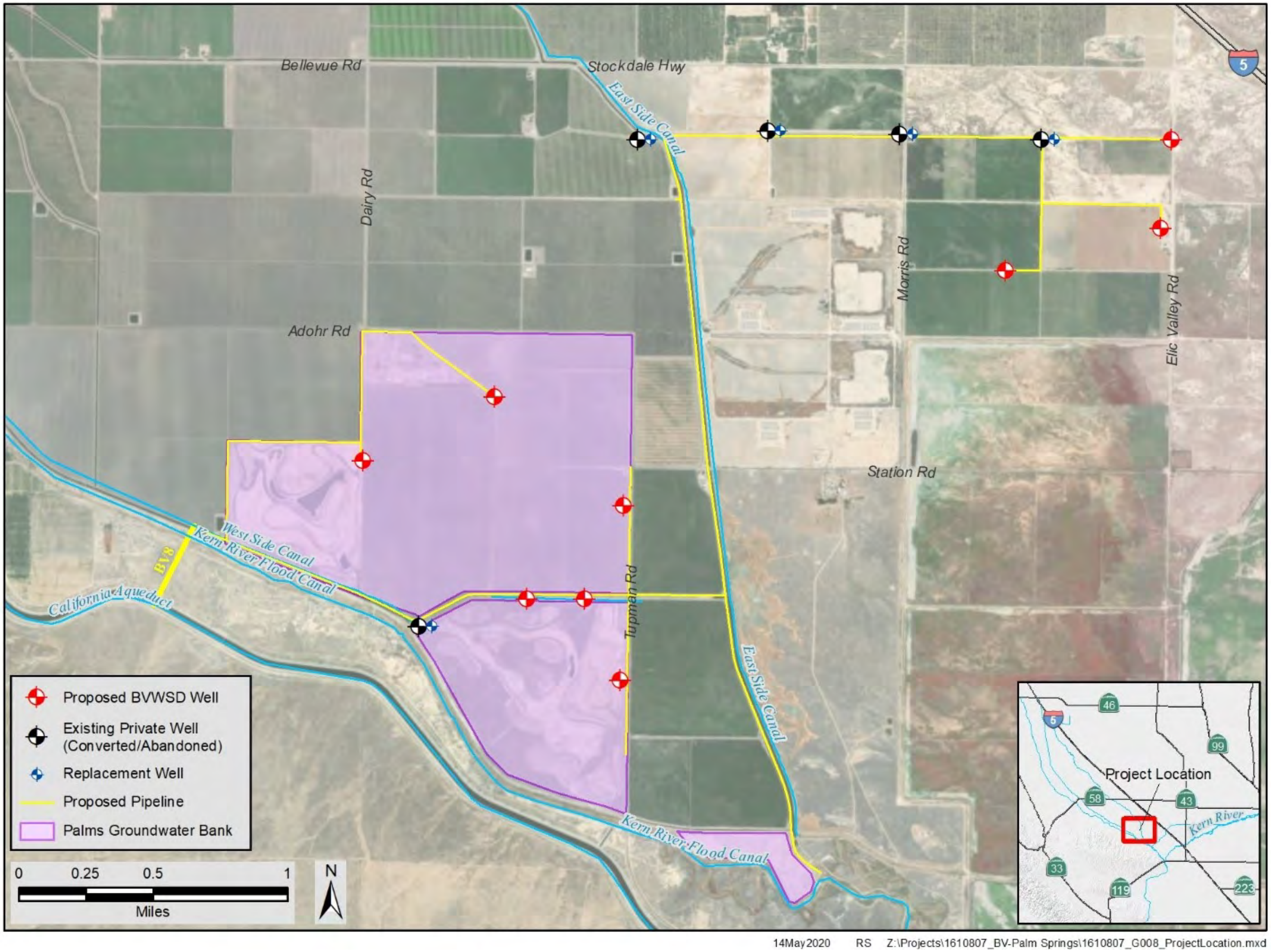


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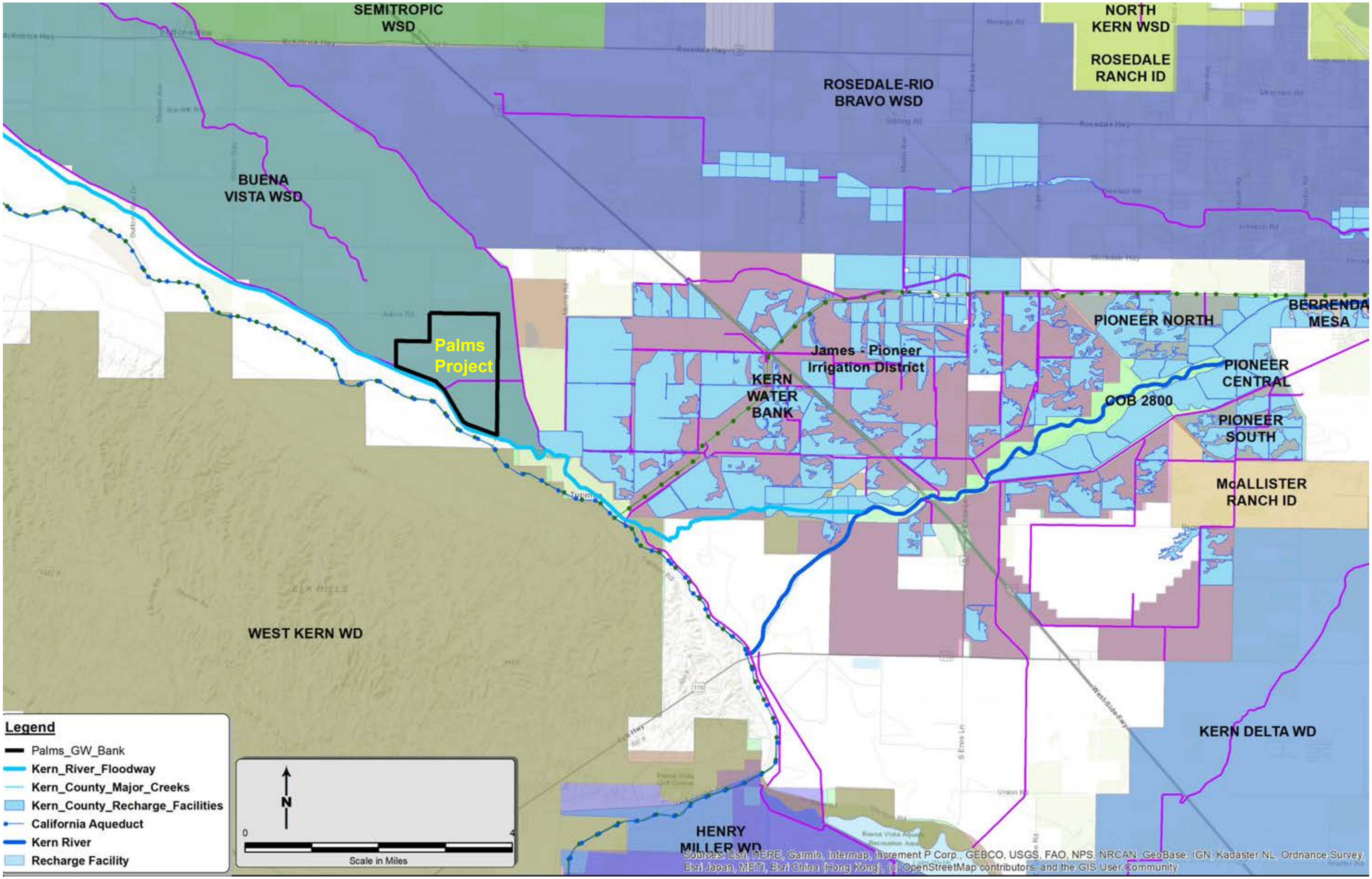
Figure 2
BVWSD Palms and Recovery Project Locations



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TODD GROUNDWATER

Figure 3
Regional Water Districts and Groundwater Banking Operations

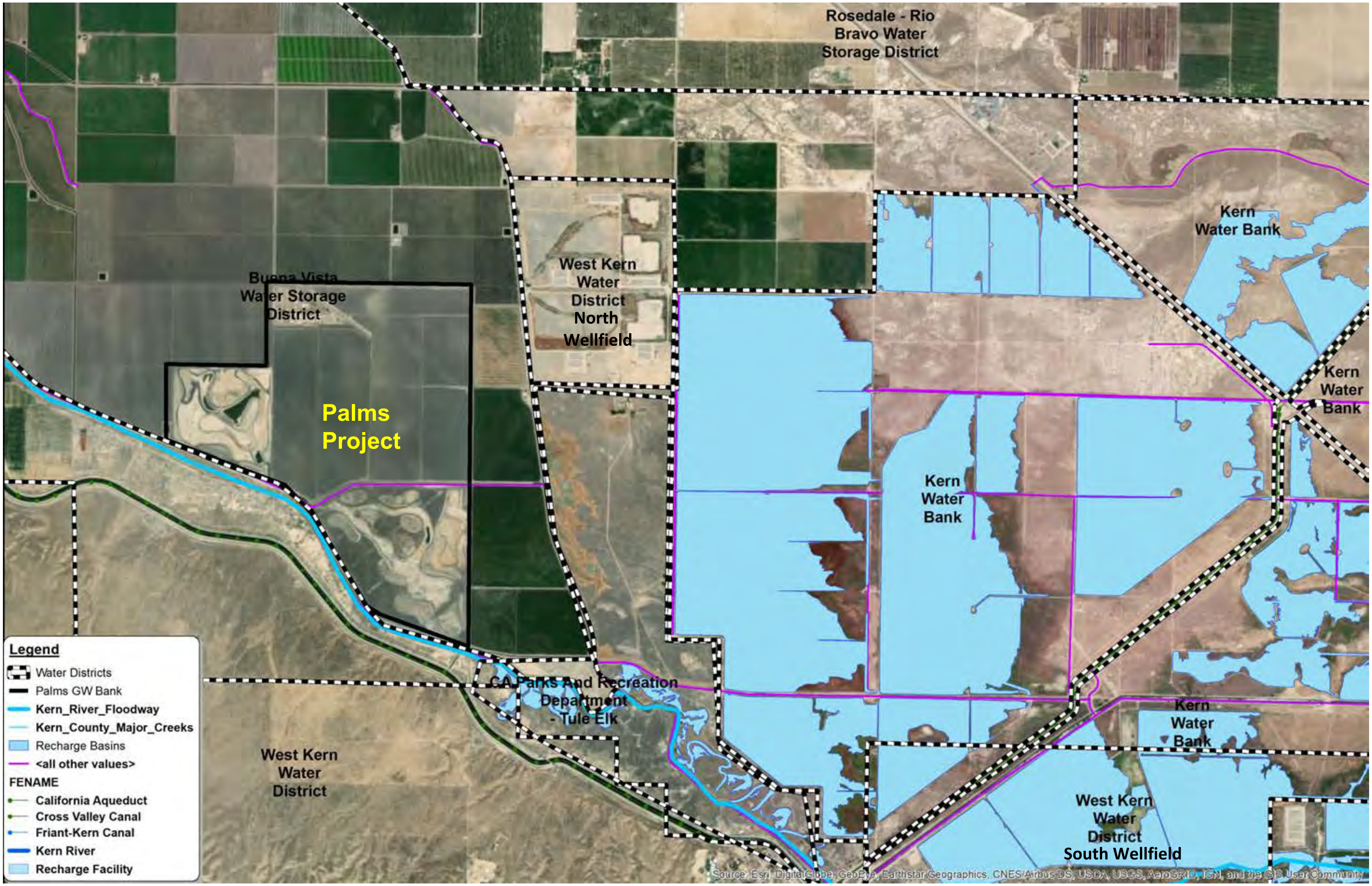

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Figure 4
Location of Nearby Groundwater Banking Operations

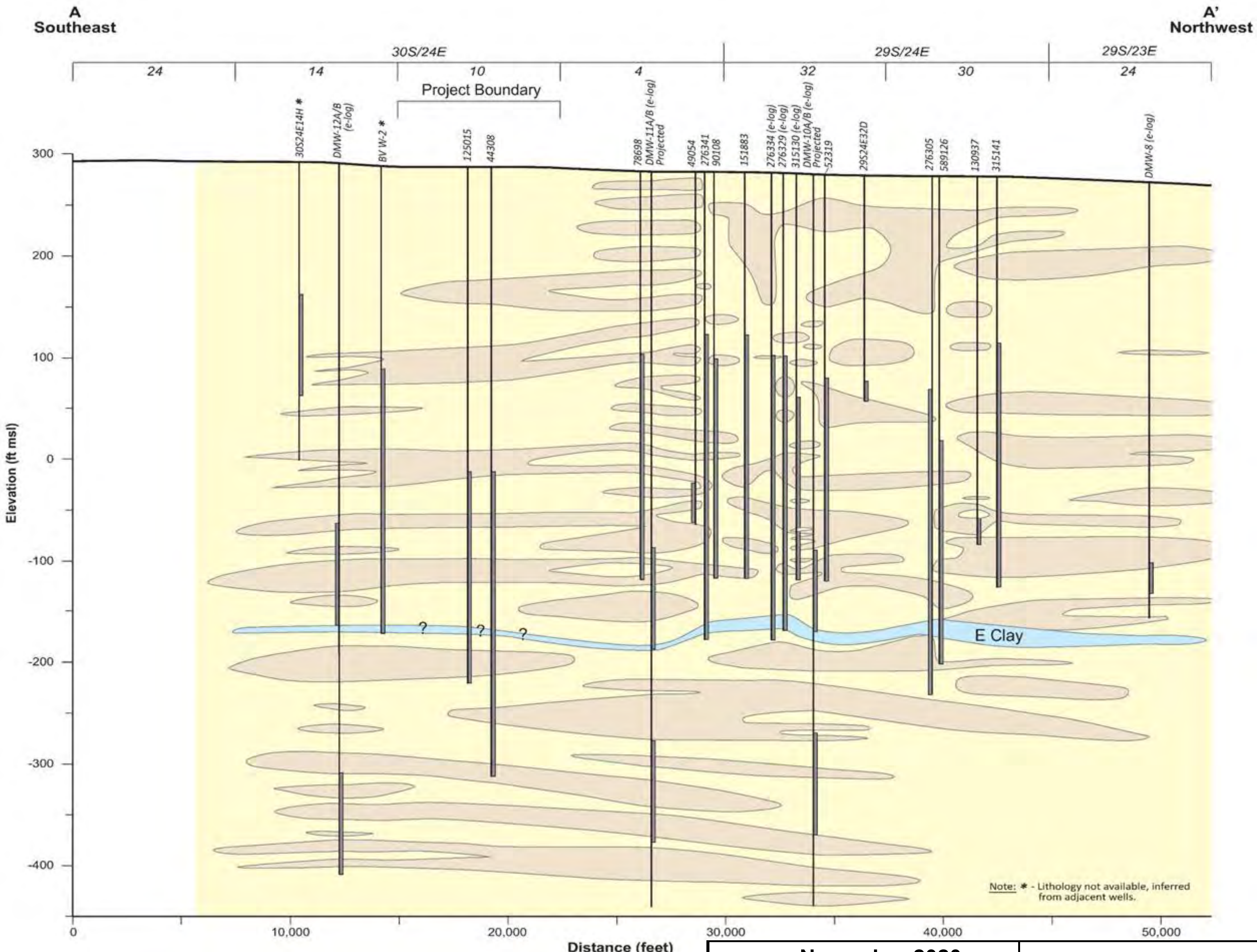

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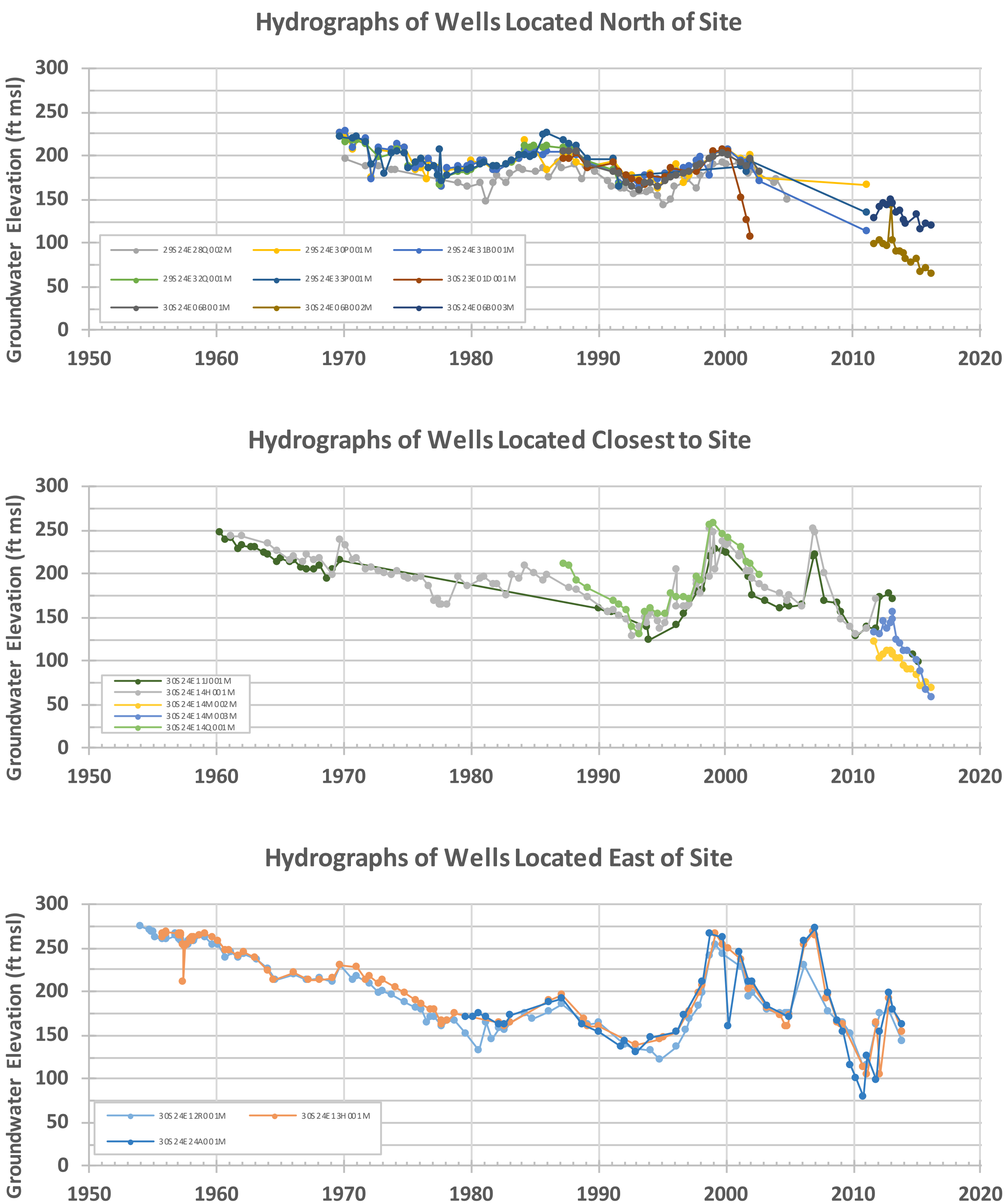
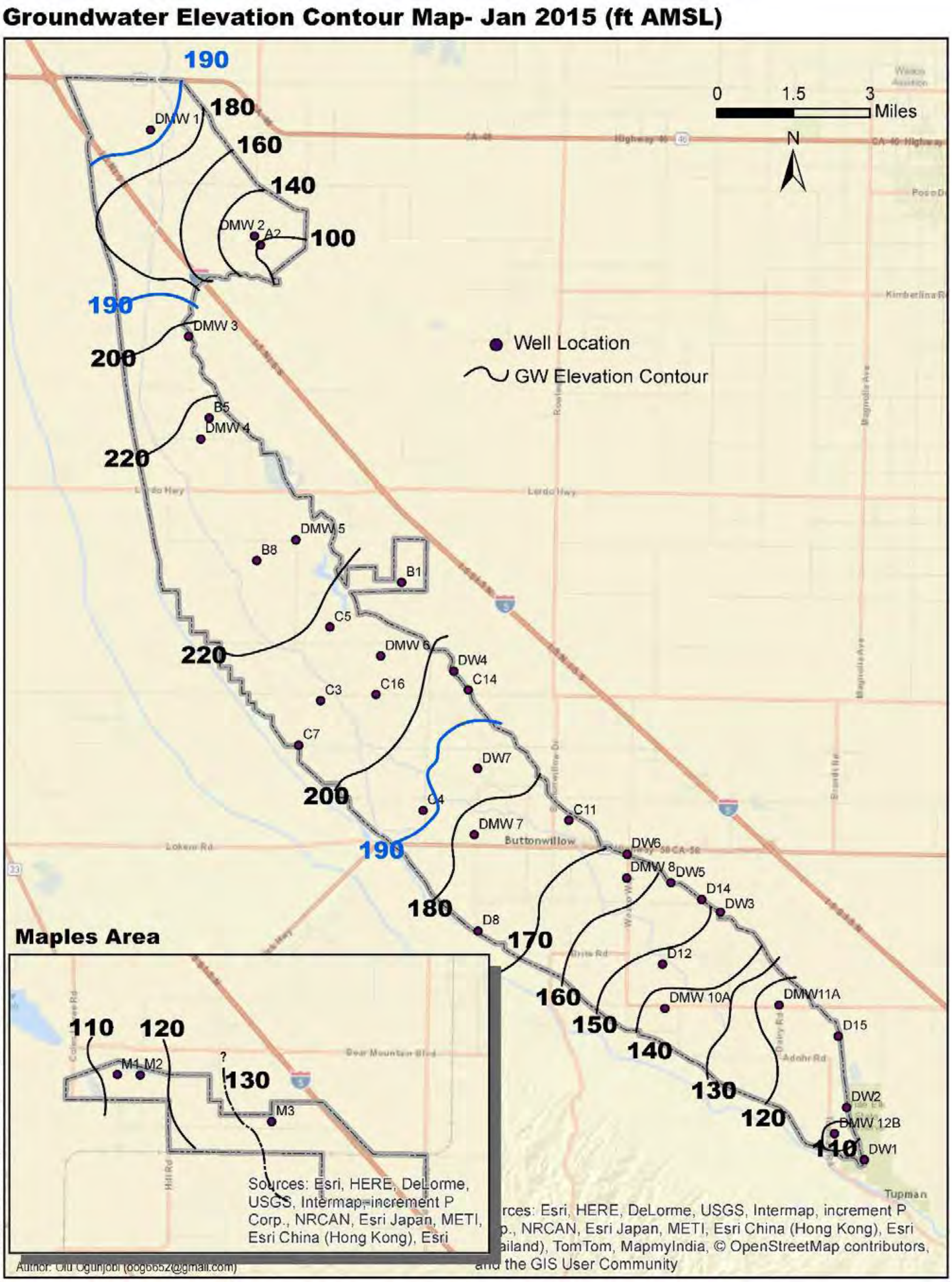
Figure 5
Local Cross Section through the Palms Project Site



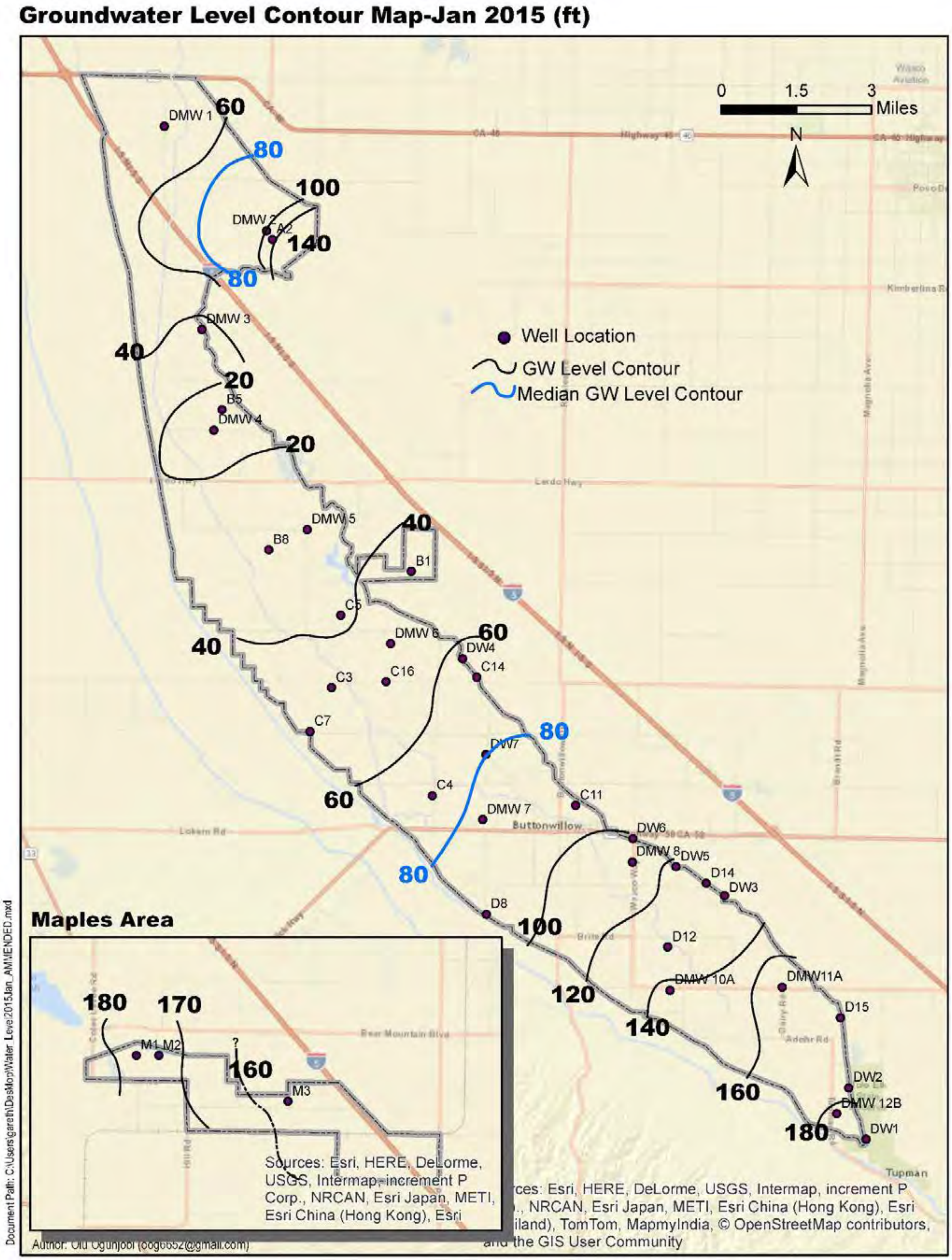
November 2020	Figure 6
TODD GROUNDWATER	Representative Hydrographs Showing Regional Groundwater Trends near Recovery Project



November 2020

TODD GROUNDWATER

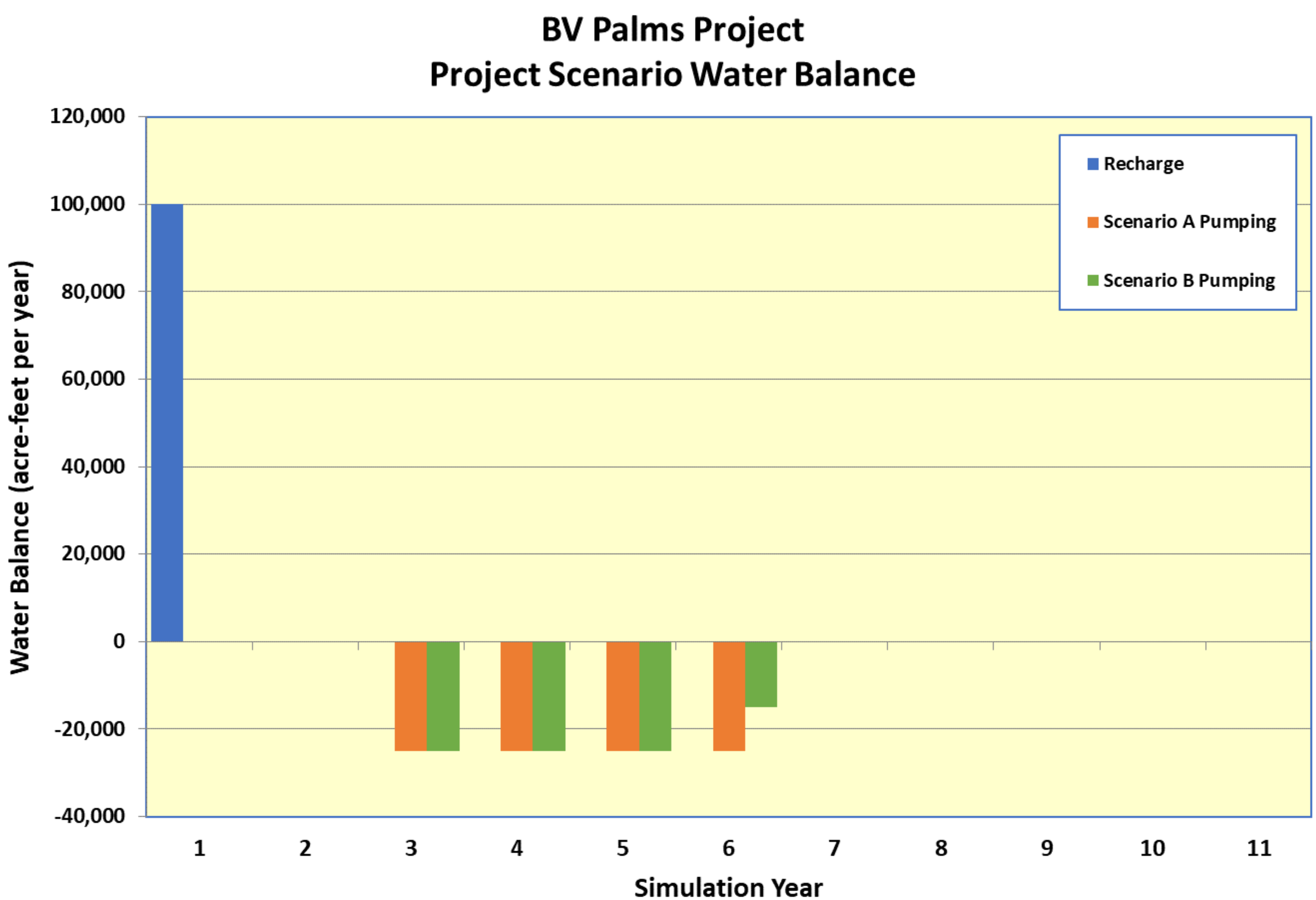
Figure 7
January 2015 Groundwater Elevation Map of the Buena Vista WSD



November 2020

TODD GROUNDWATER

Figure 8
January 2015 Depth to Groundwater Map Across Buena Vista WSD

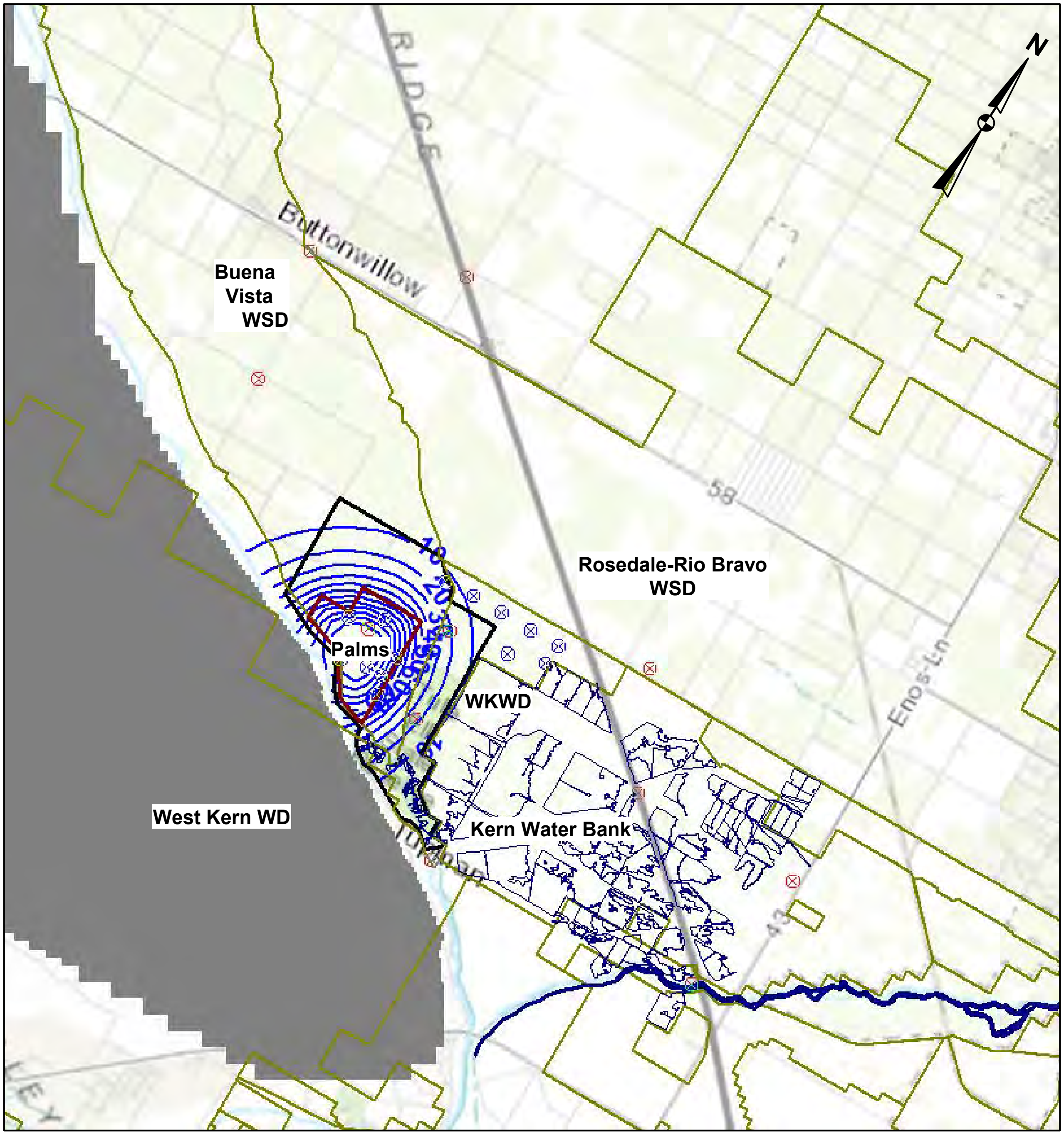


November 2020

TODD GROUNDWATER

Figure 9
Simulated Recharge and Recovery Operations for Scenarios A and B

Palms Scenario A and B
Maximum Mounding
Year 1



Legend

10 — Change in Groundwater Level Contour (feet)

Water District Boundary

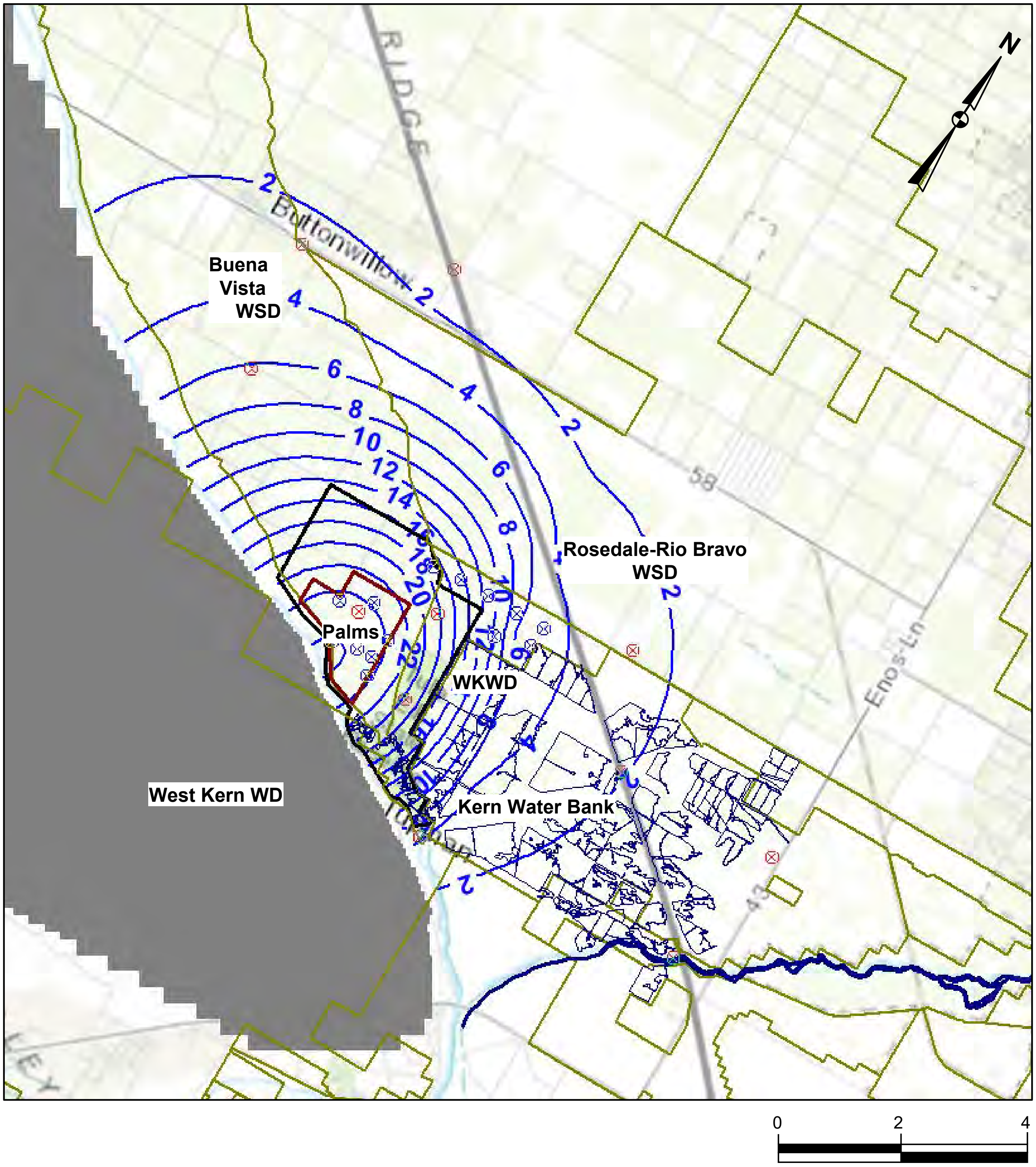
Recharge Pond

November 2020

TODD GROUNDWATER

Figure 10
Scenario A and B Maximum Groundwater Mound after One Year of Palms Project Recharge

Palms Scenario A and B
Residual Model Prior to Pumping
Year 3



Legend

10 — Change in Groundwater Level Contour (feet)

Water District Boundary

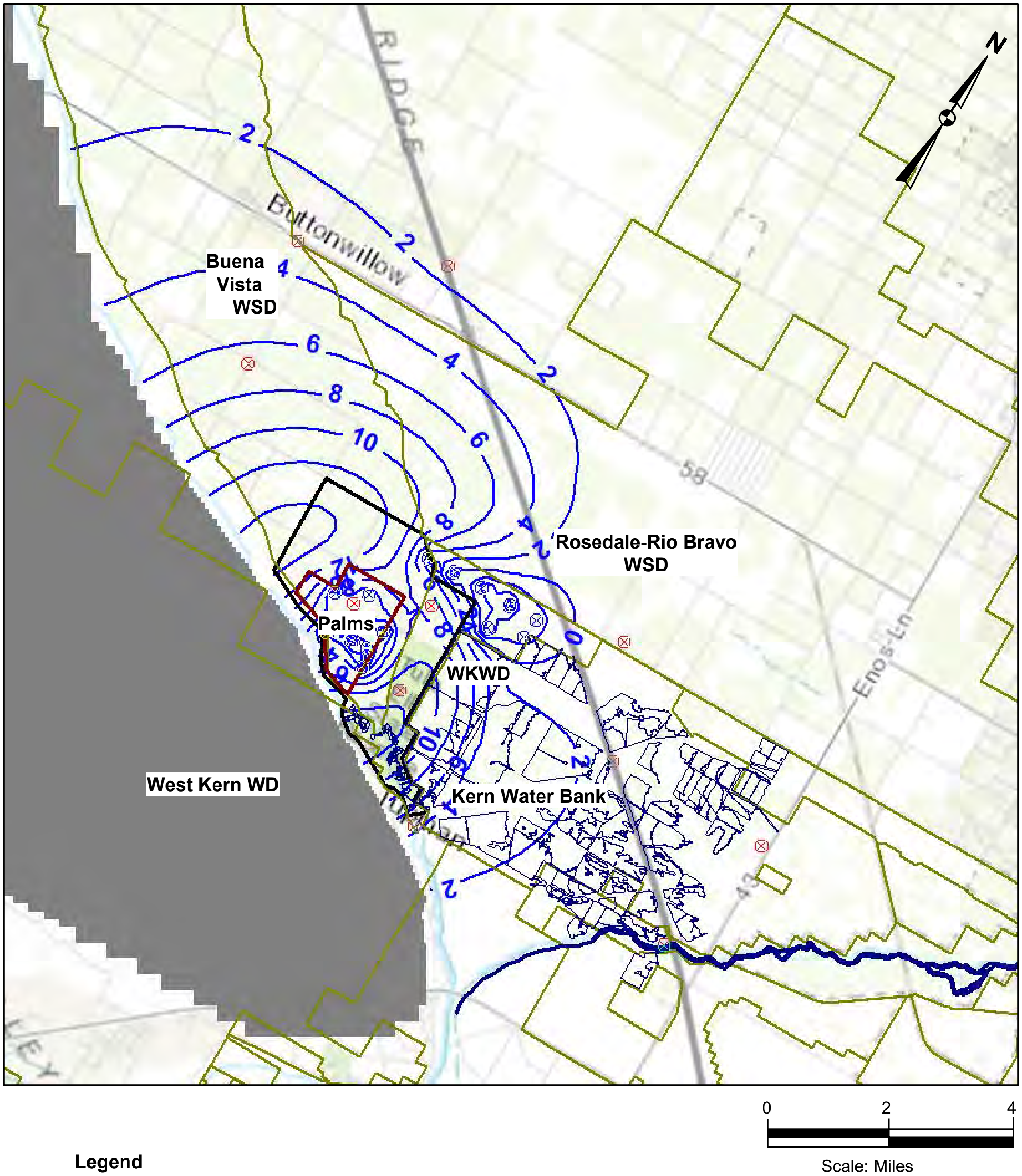
Recharge Pond

November 2020

TODD GROUNDWATER

Figure 11
Scenario A and B Residual Mound Prior to Start of Recovery Project Pumping

Palms Scenario A and B
Drawdown after One Year of Pumping



Legend

10 — Change in Groundwater Level Contour (feet)

Water District Boundary

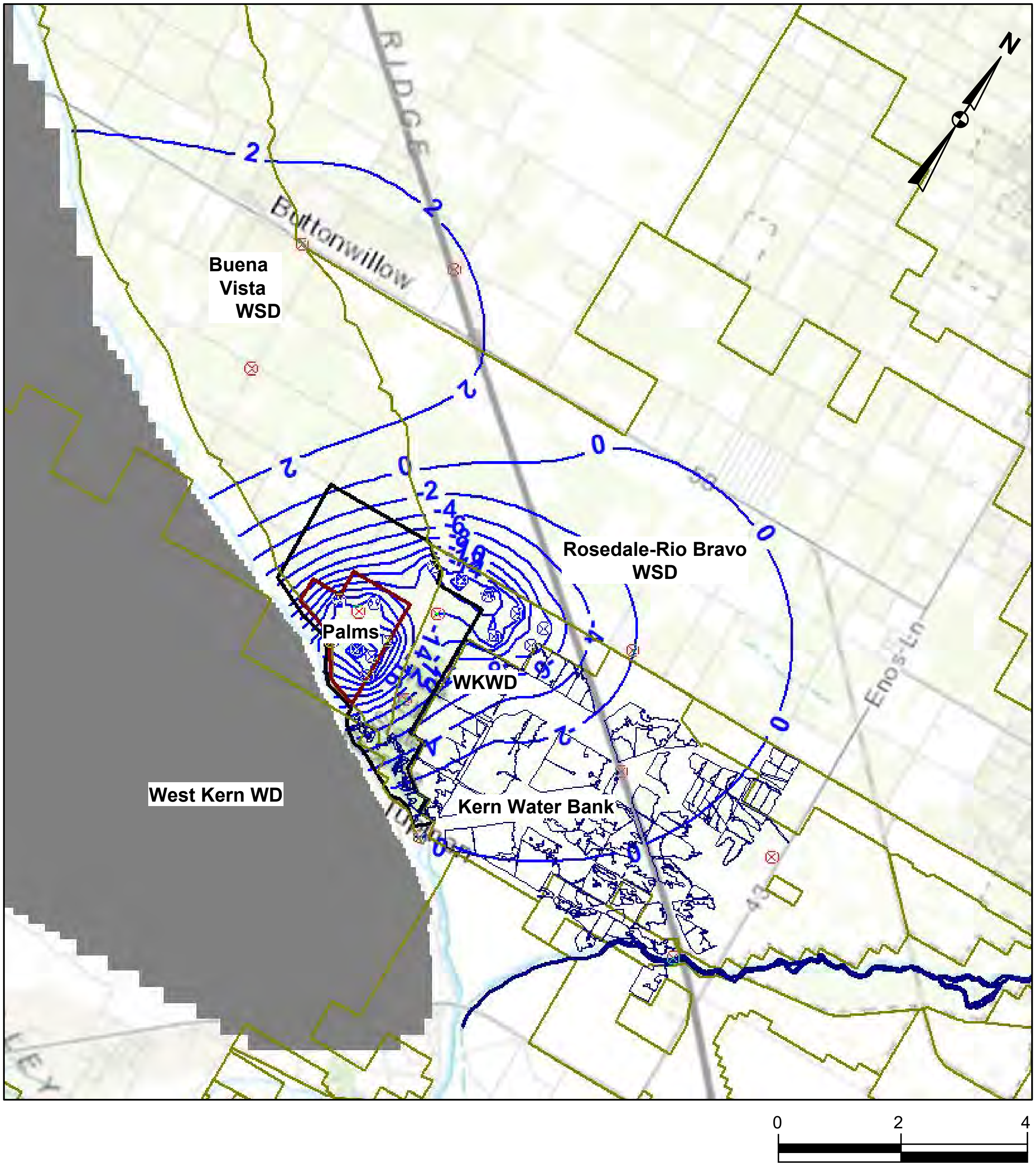
Recharge Pond

November 2020

TODD GROUNDWATER

Figure 12
Scenario A and B Groundwater Level Change at End of First Year of Recovery Project Pumping

Palms Scenario A
Maximum Drawdown
After Four Years of Pumping



Legend

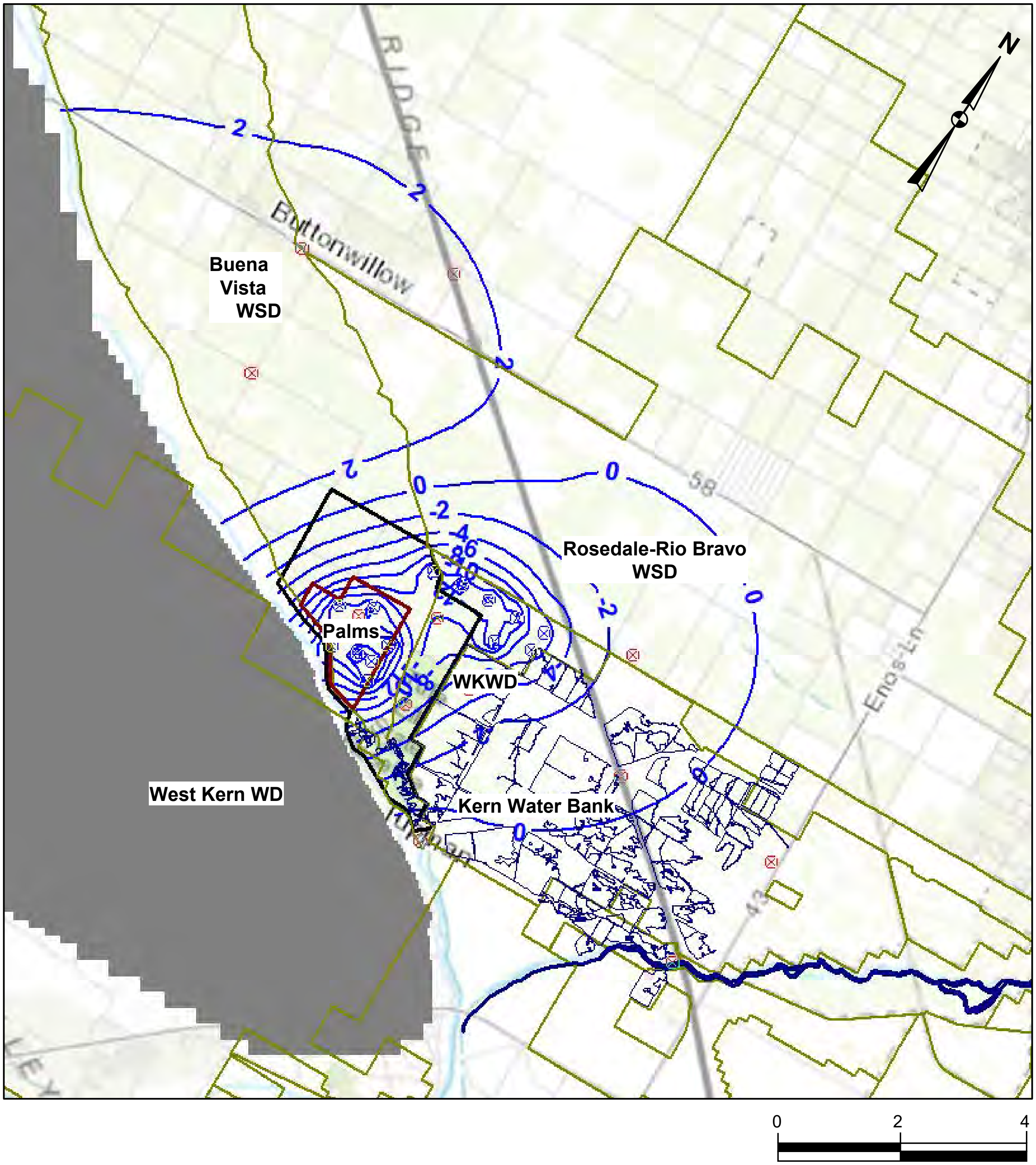
- 10 — Change in Groundwater Level Contour (feet)
- Water District Boundary
- Recharge Pond

November 2020

TODD GROUNDWATER

Figure 13
Scenario A Groundwater Level Change at end of Fourth Year of Recovery Project Pumping

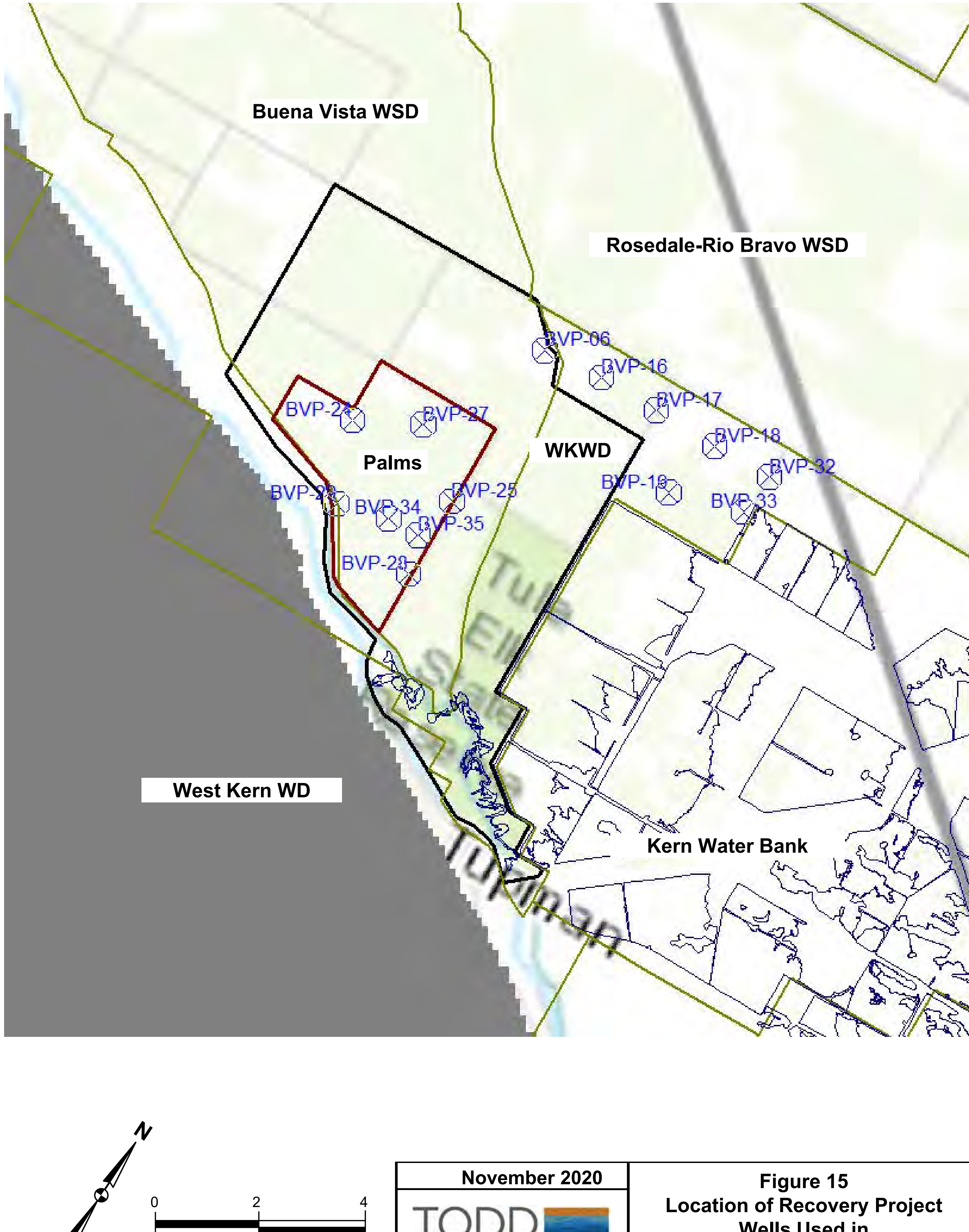
Palms Scenario B
Maximum Drawdown
After Four Years of Pumping



Legend

- 10 Change in Groundwater Level Contour (feet)
- Water District Boundary
- Recharge Pond

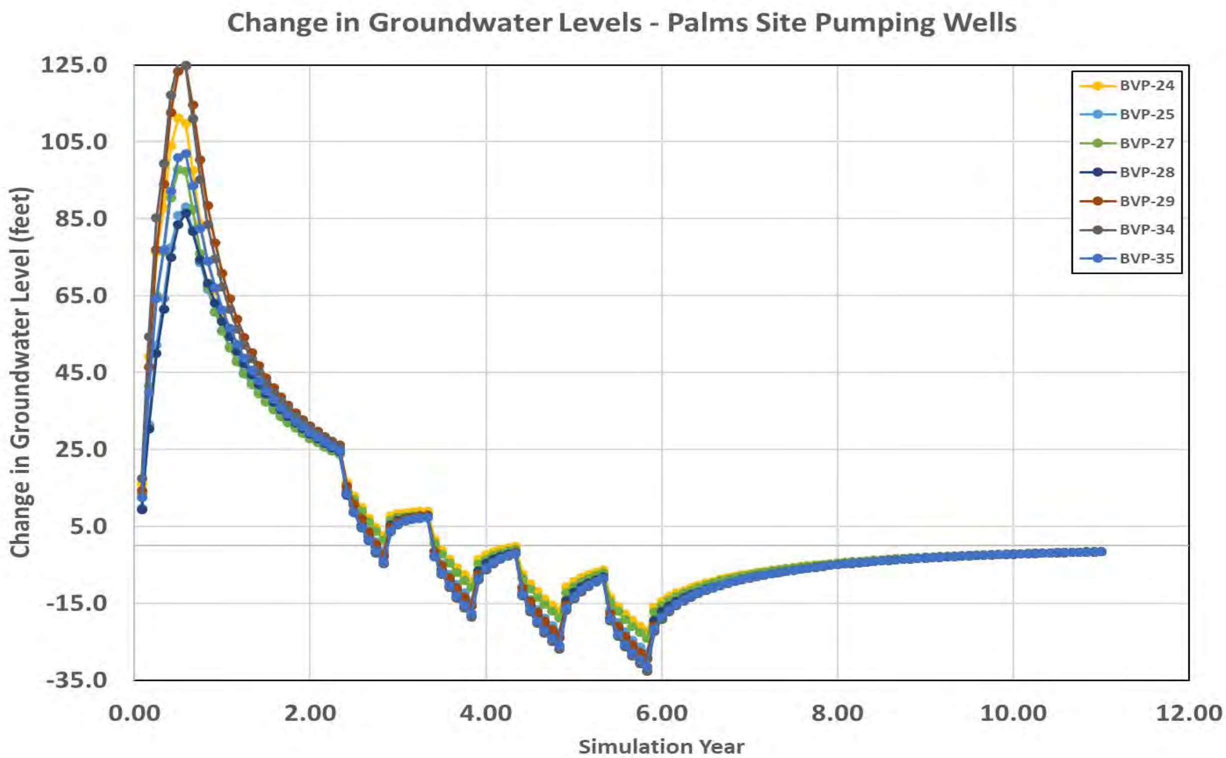
November 2020	Figure 14 Scenario B Groundwater Level Change at end of Fourth Year of Recovery Project Pumping
TODD GROUNDWATER	

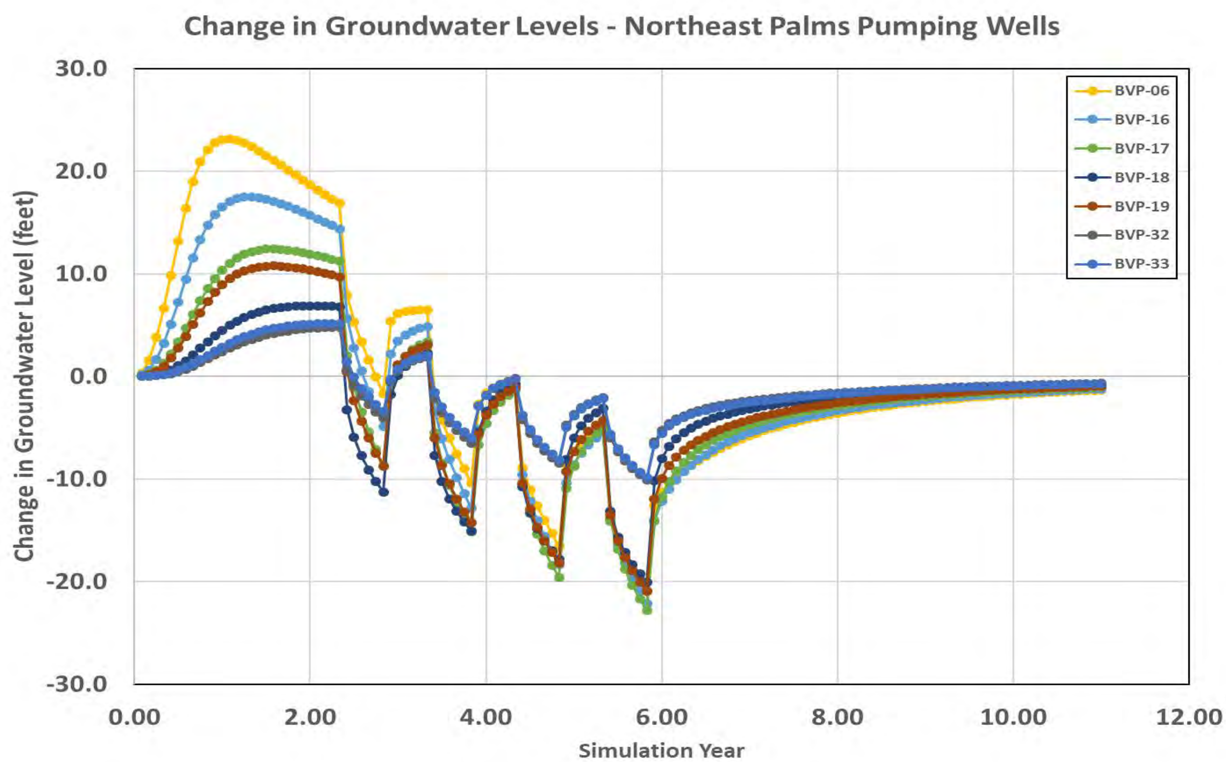


November 2020

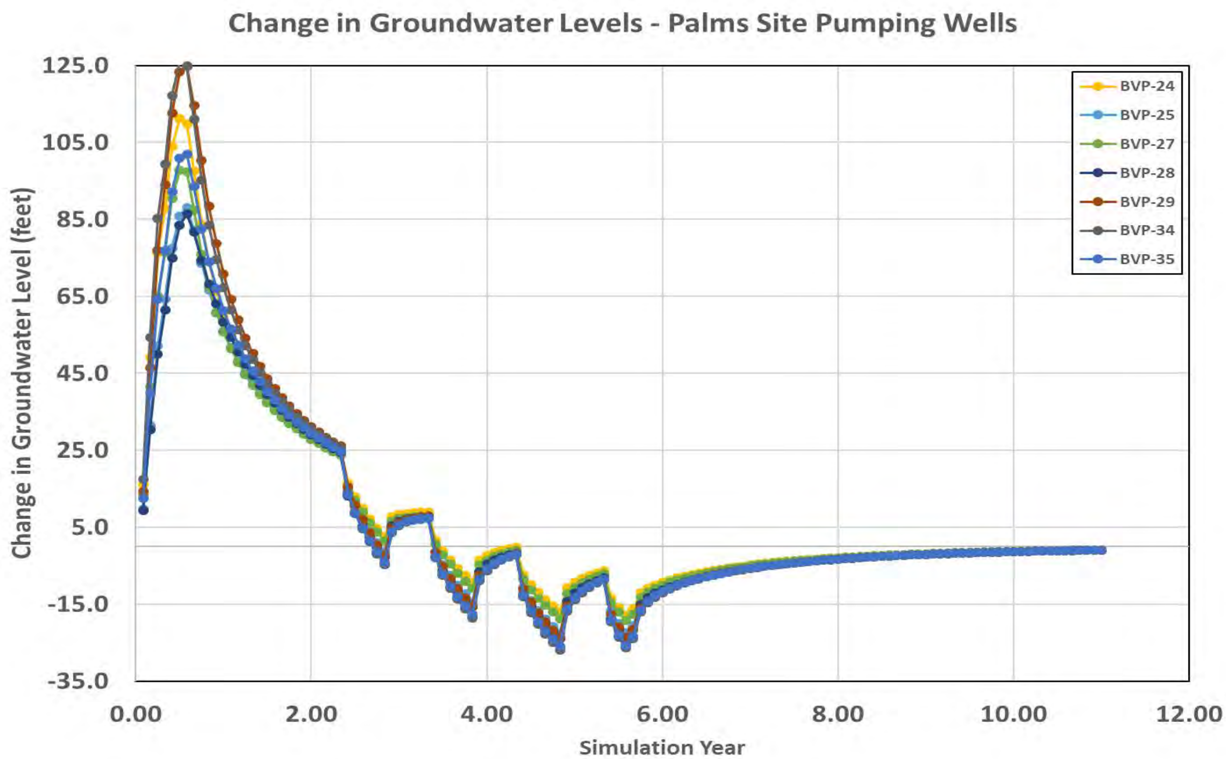
TODD GROUNDWATER

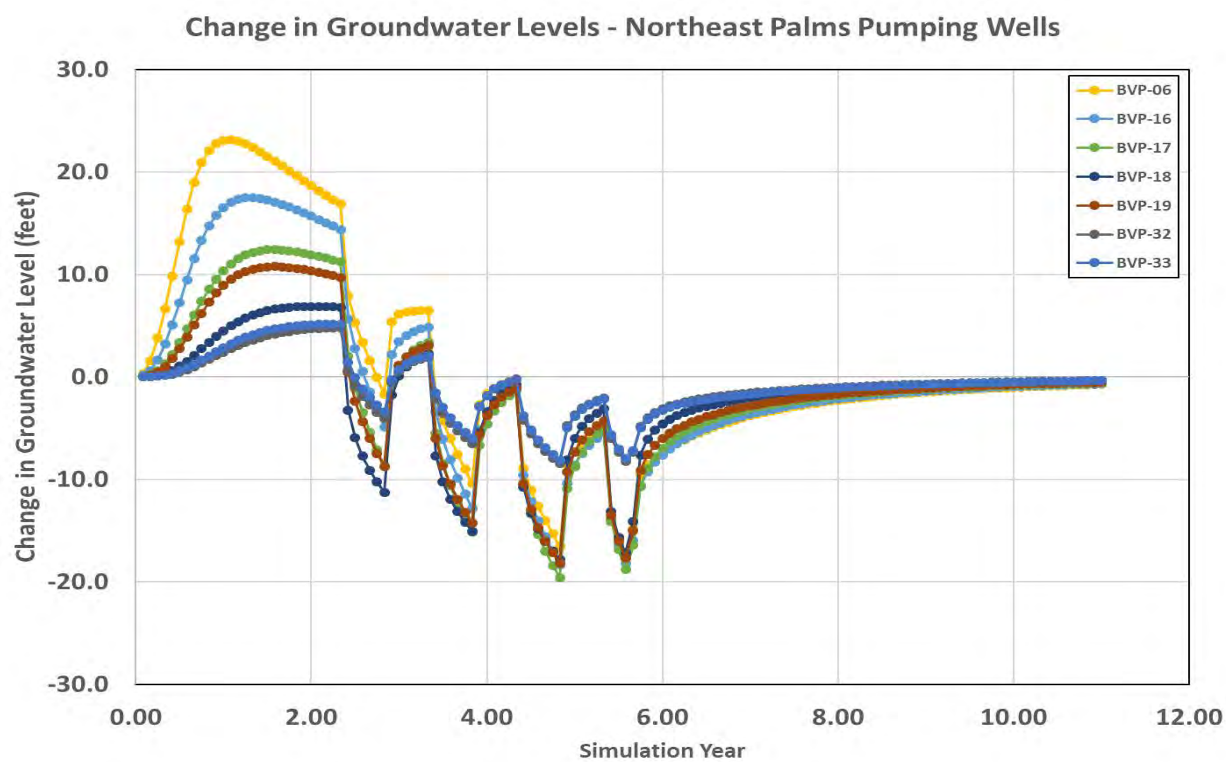
Figure 15
Location of Recovery Project Wells Used in Project Scenarios A and B



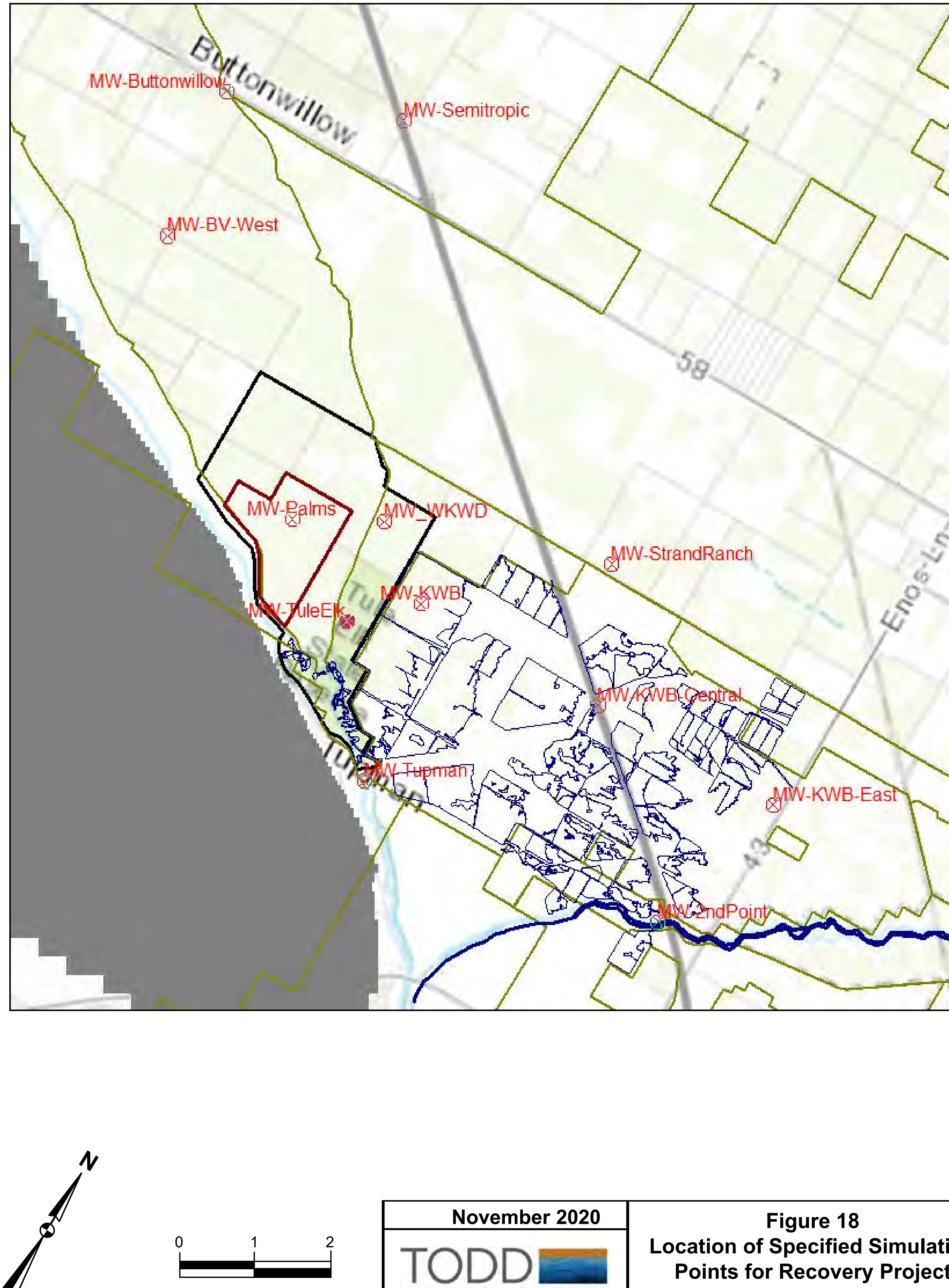


November 2020	**Figure 16** **Hydrographs of Scenario A Groundwater Level Change in Recovery Project Wells**
TODD GROUNDWATER	





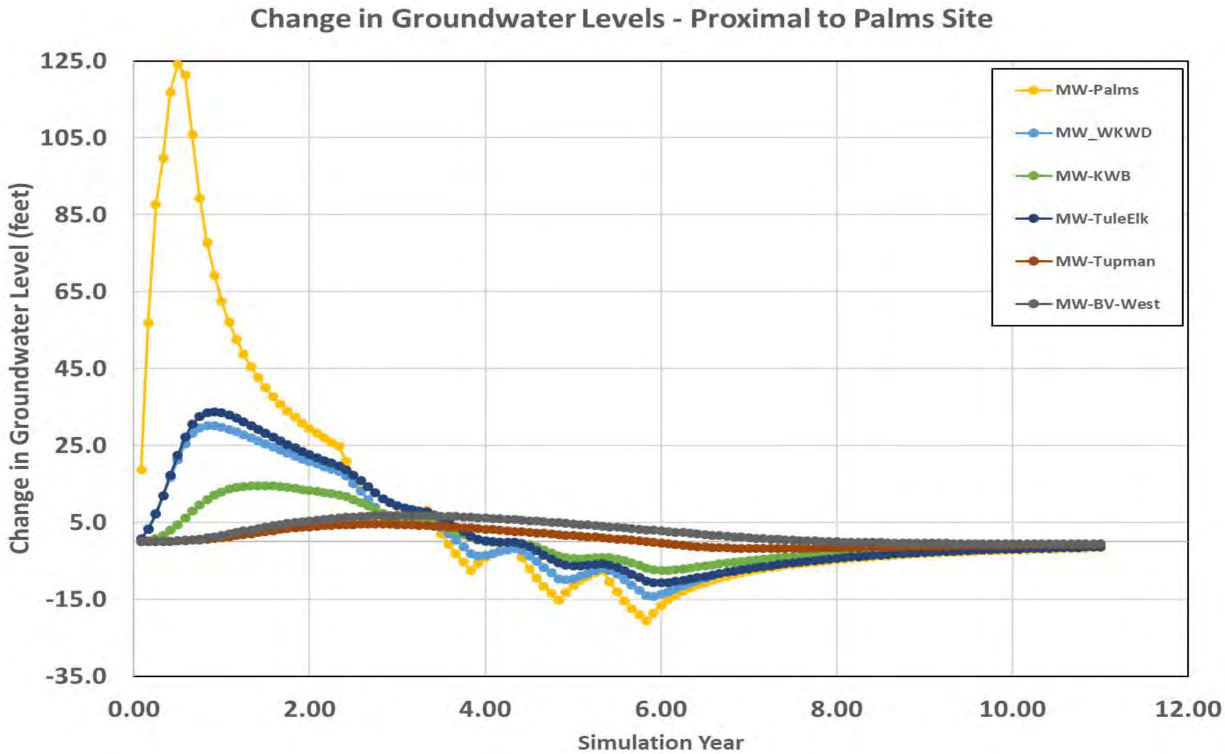
November 2020	Figure 17
TODD GROUNDWATER	Hydrographs of Scenario B Groundwater Level Change in Recovery Project Wells

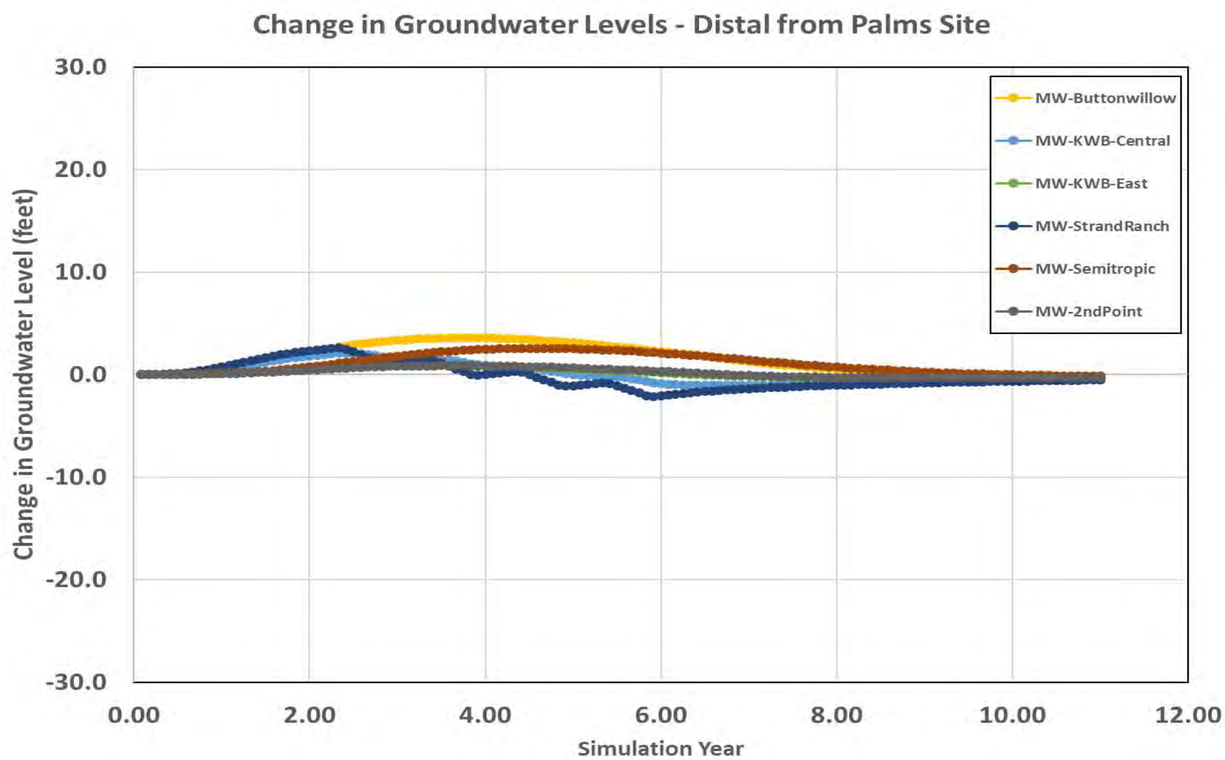


November 2020

TODD GROUNDWATER

Figure 18
Location of Specified Simulation Points for Recovery Project Scenarios

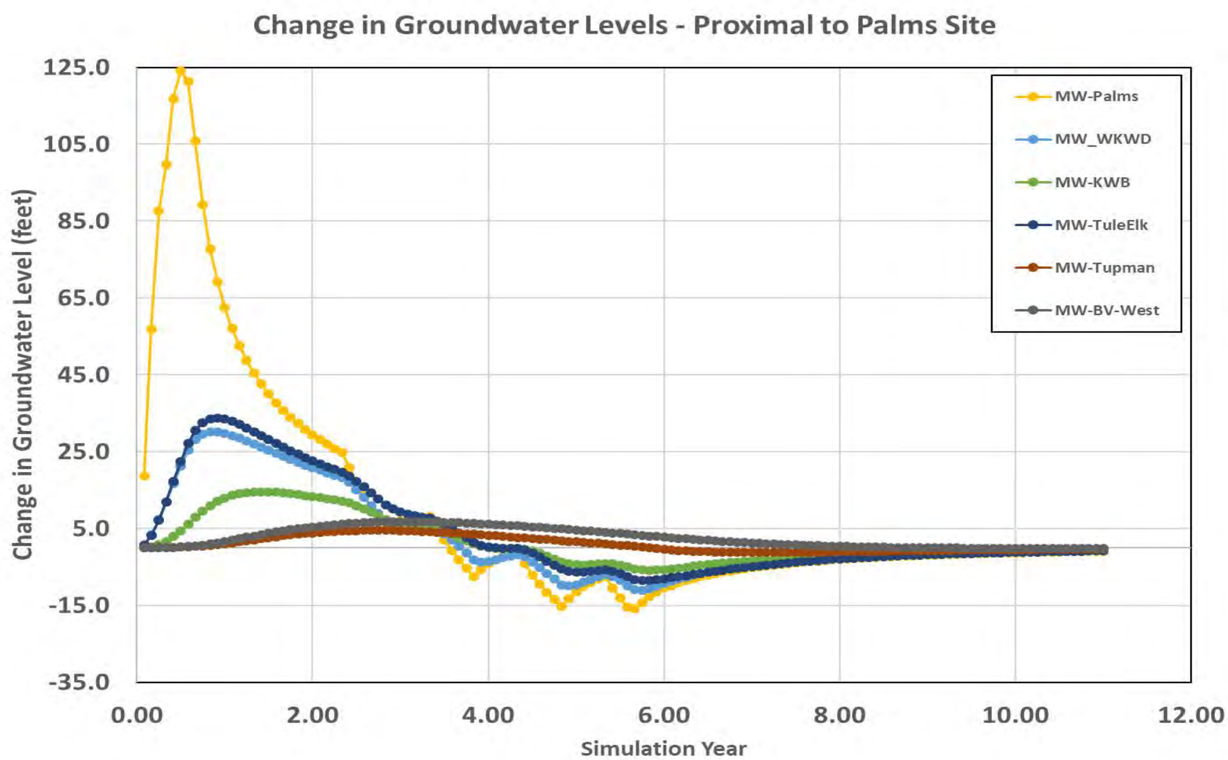


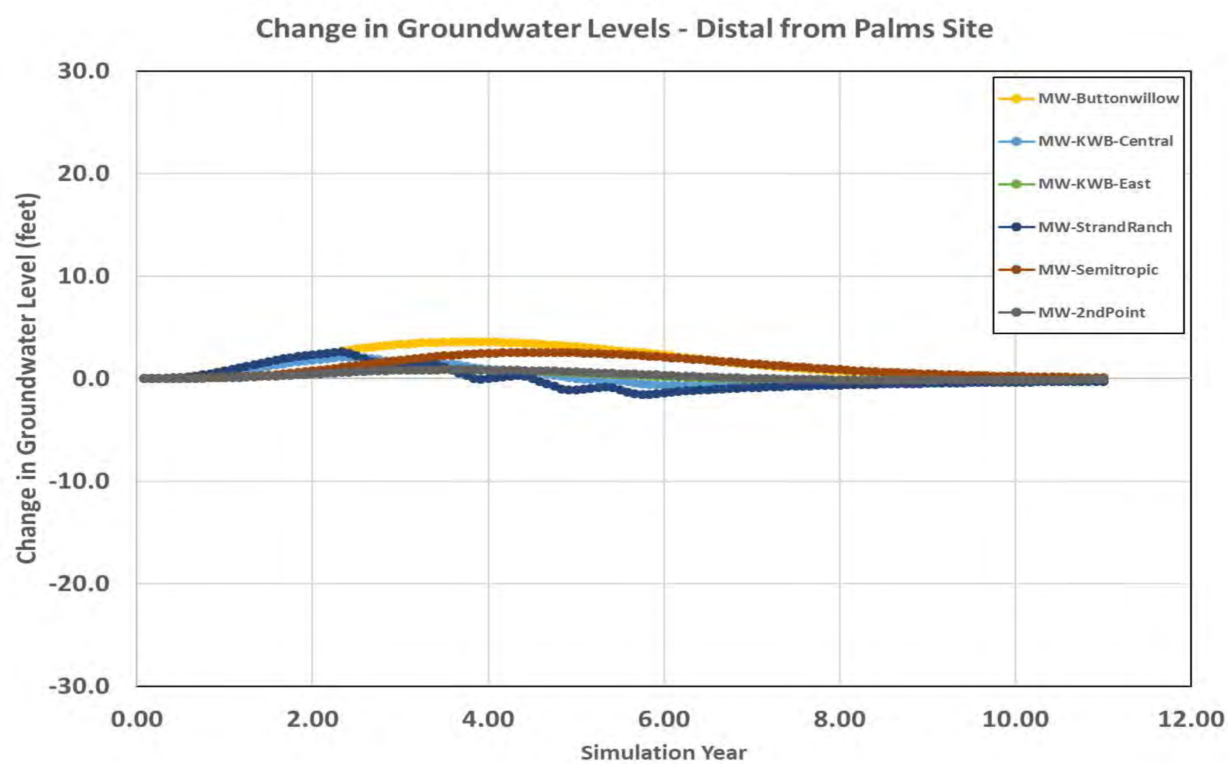


November 2020

TODD GROUNDWATER

Figure 19
Hydrographs of Scenario A Groundwater Level Change at Specified Simulation Points

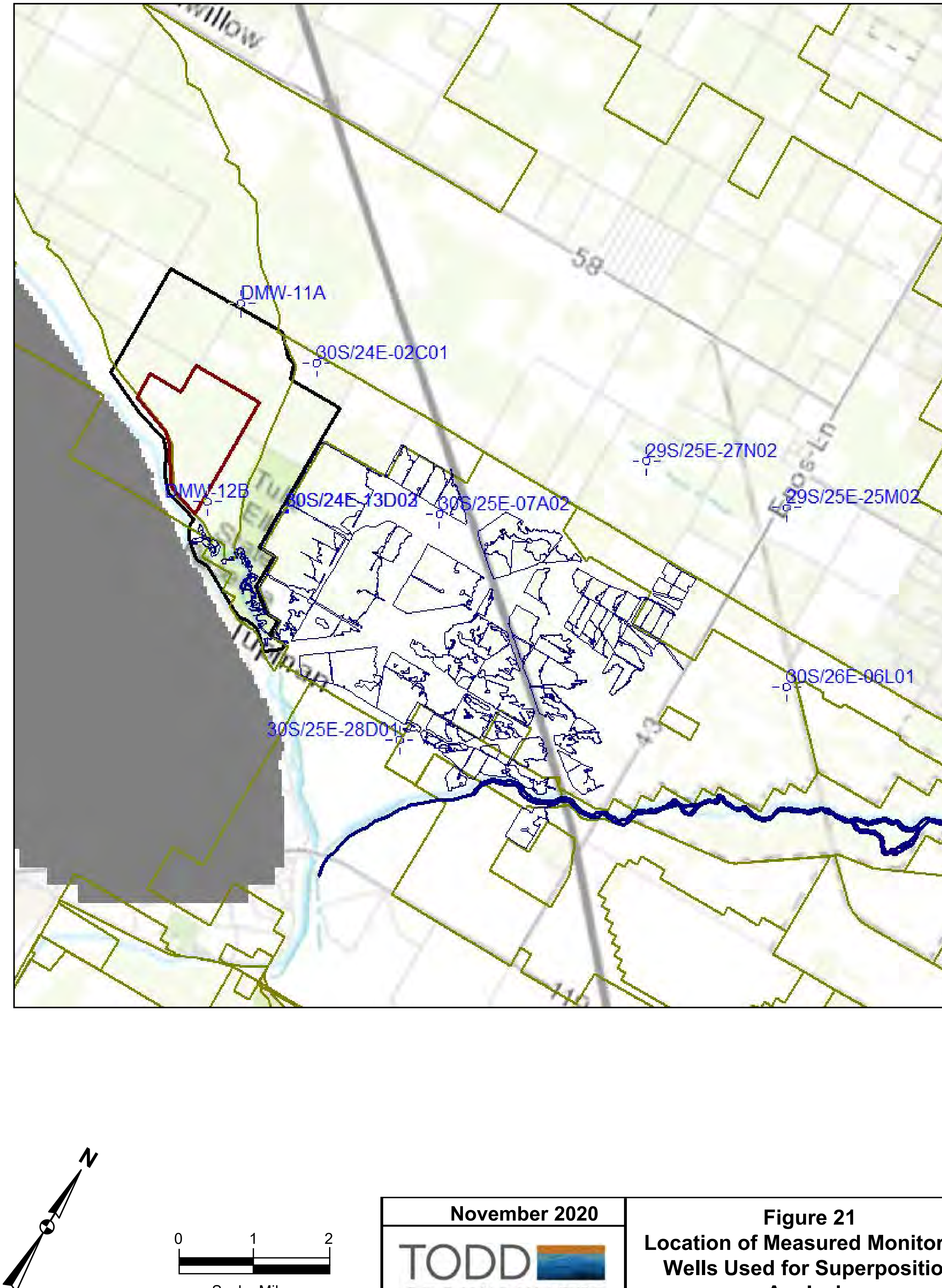




November 2020

TODD GROUNDWATER

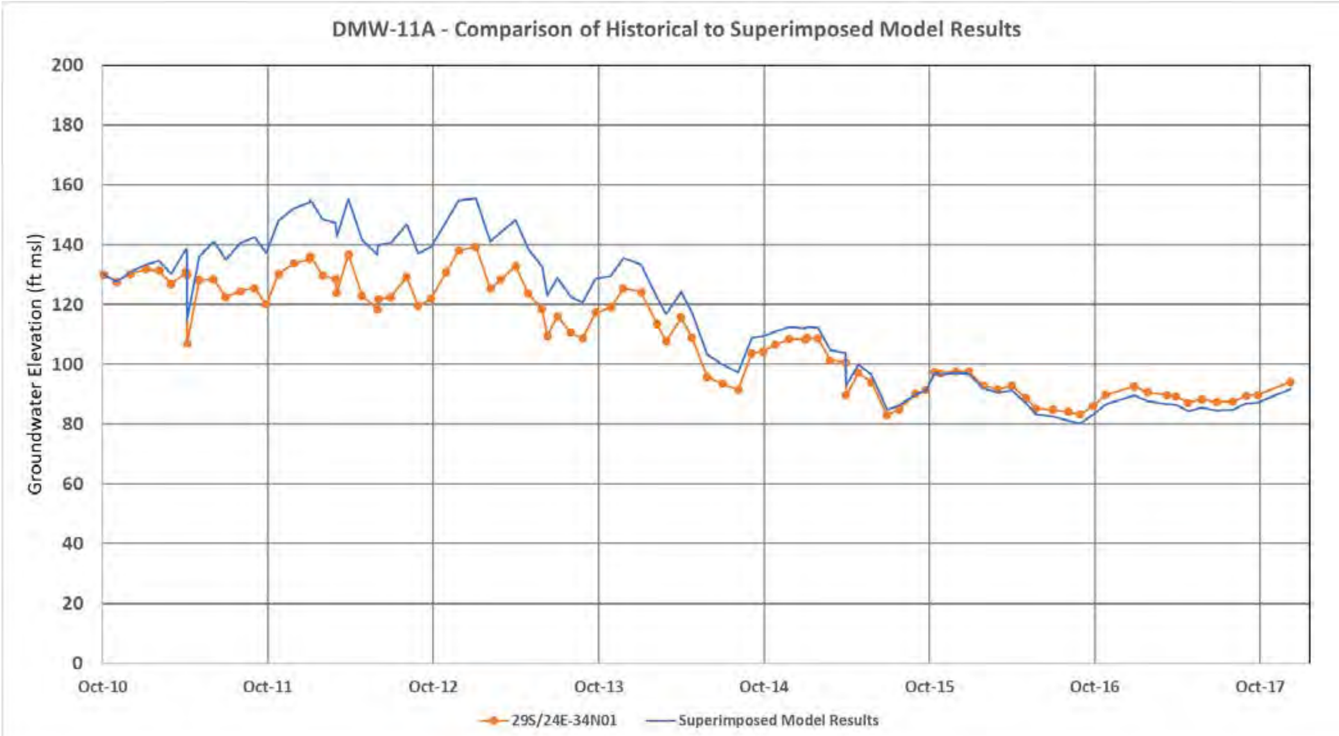
Figure 20
Hydrographs of Scenario B Groundwater Level Change at Specified Simulation Points

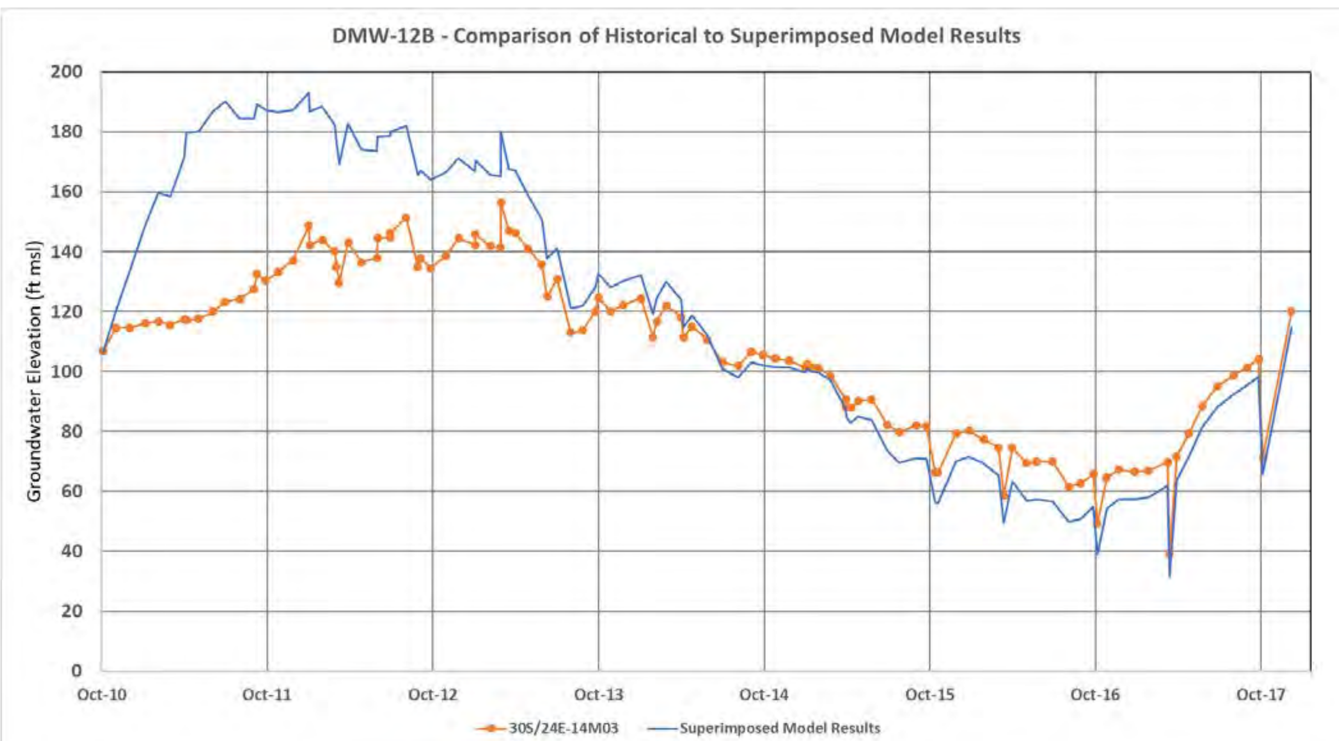


November 2020

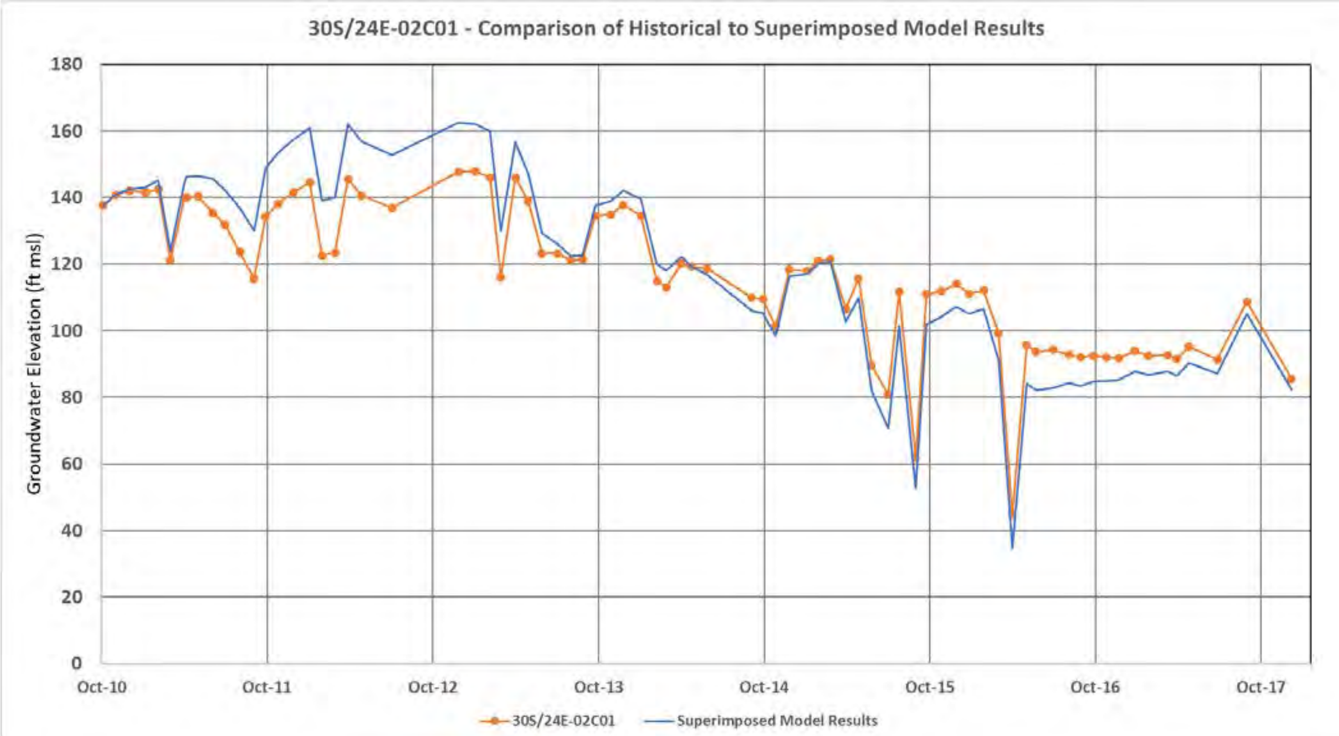
TODD GROUNDWATER

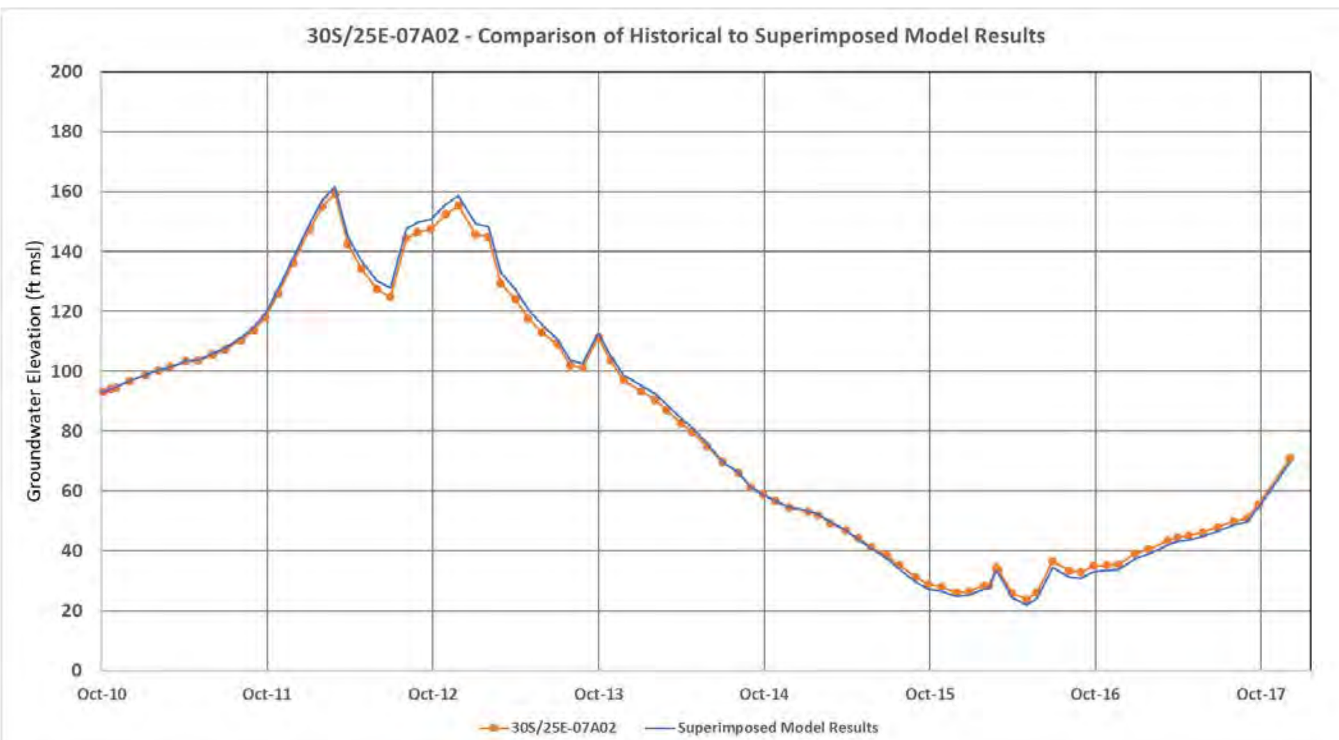
Figure 21
Location of Measured Monitoring Wells Used for Superposition Analysis



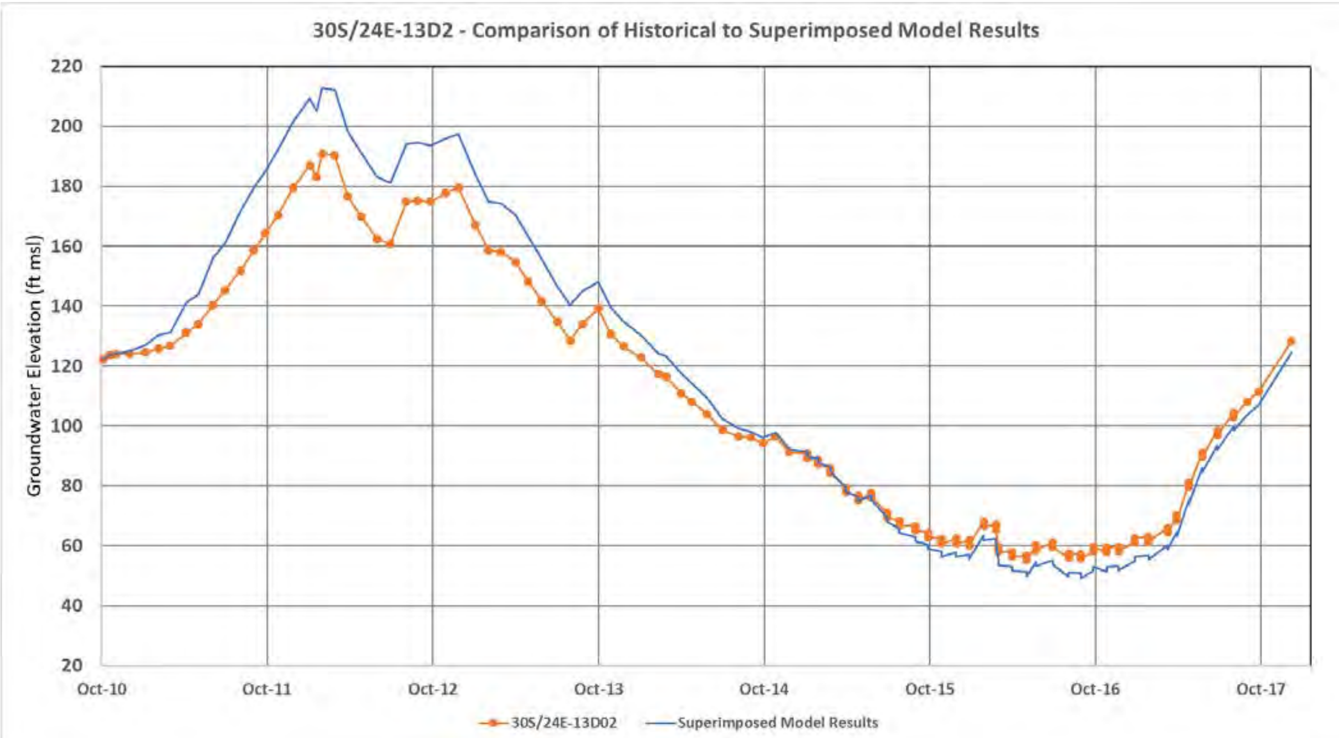


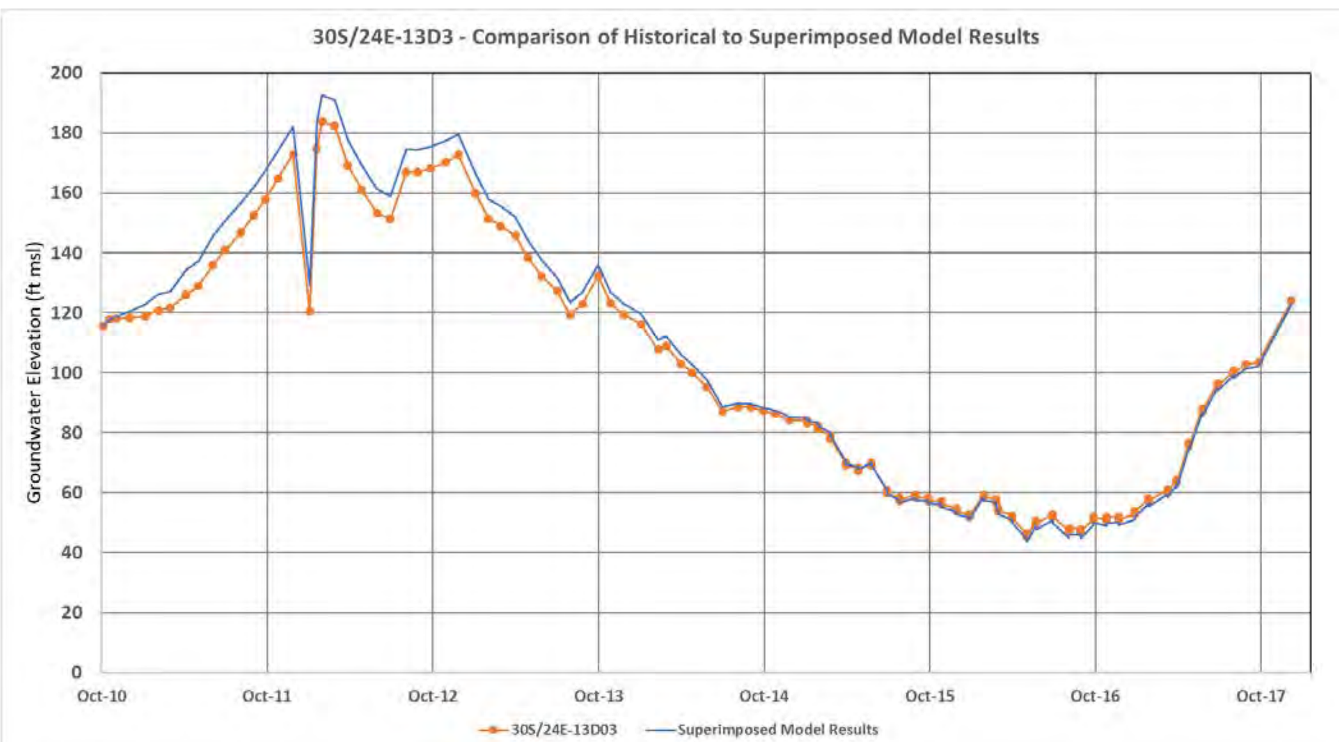
November 2020	Figure 22 Superposition Hydrographs of Scenario B onto Measured Water Levels at BVWSD Wells
TODD GROUNDWATER	





November 2020	**Figure 23** **Superposition Hydrographs of Scenario B onto Measured Water Levels at KWB and RRBWSD Wells**
TODD GROUNDWATER	

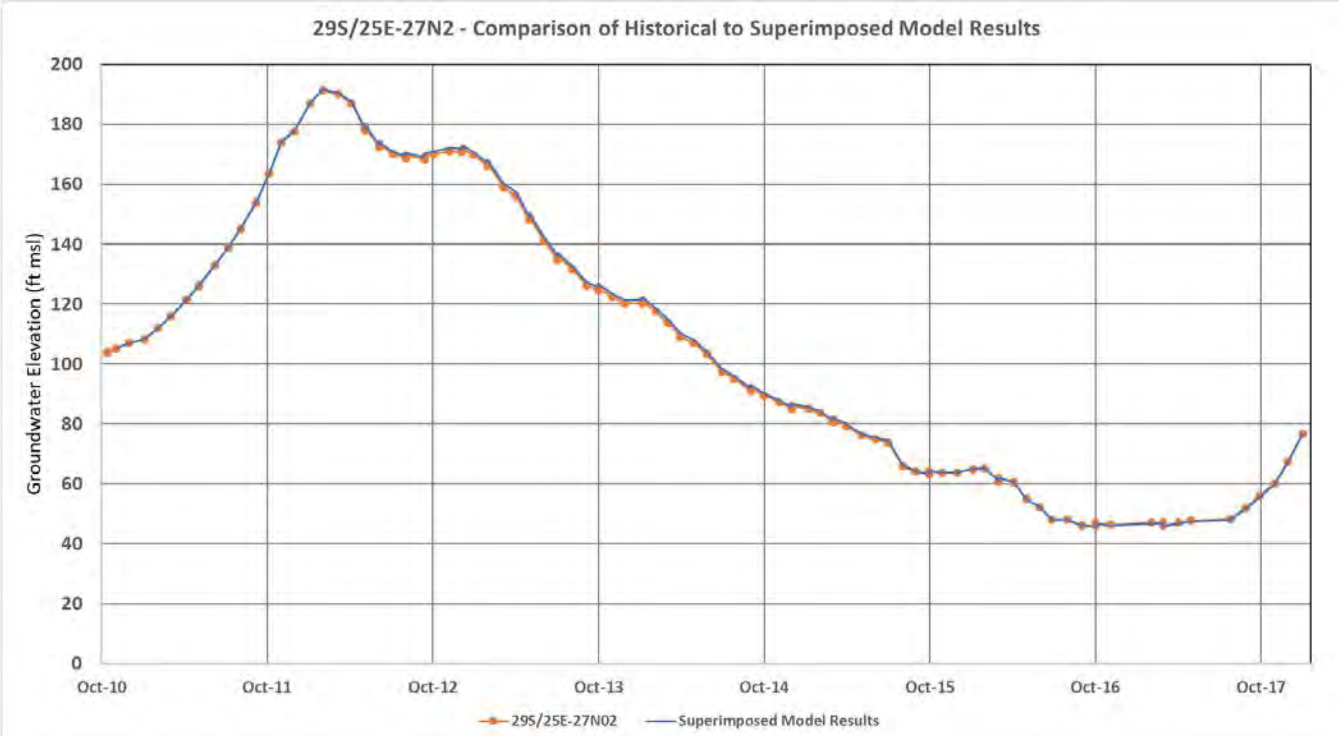


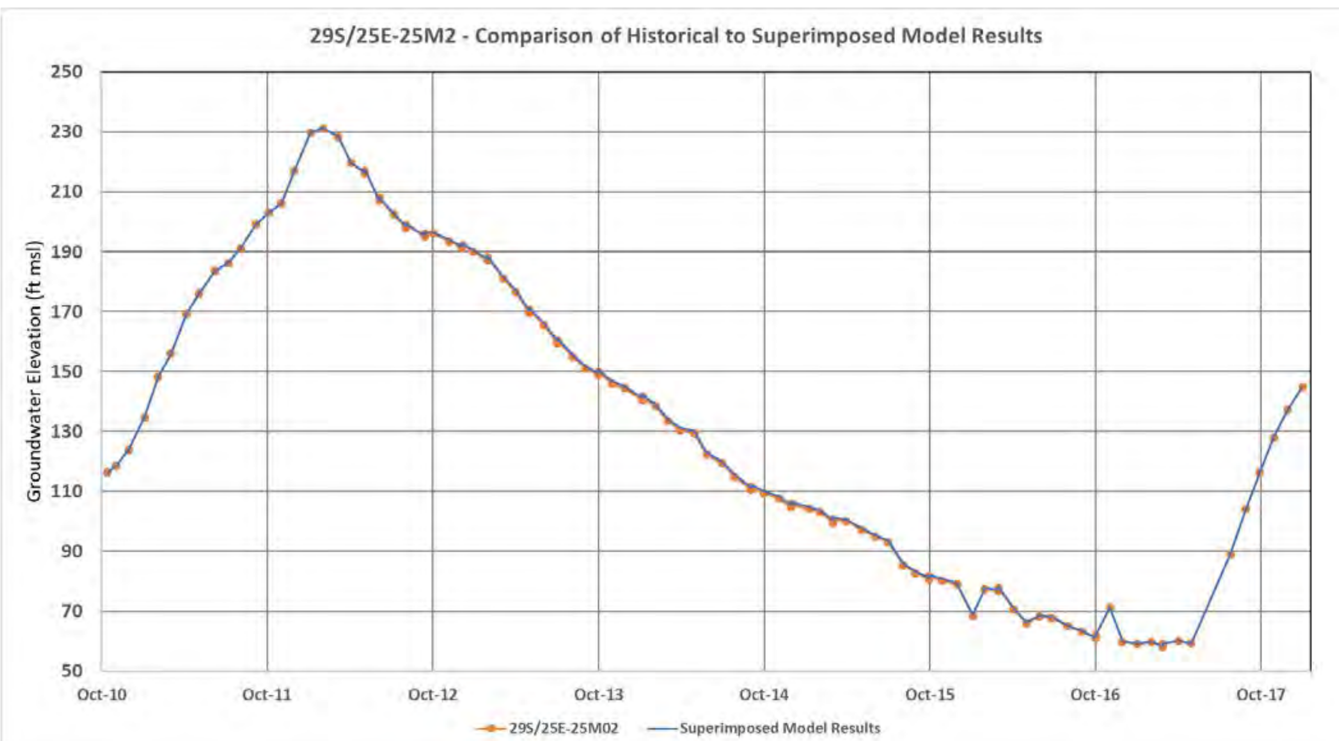


November 2020

TODD GROUNDWATER

Figure 24
Superposition Hydrographs of Scenario B onto Measured Water Levels at KWB Wells

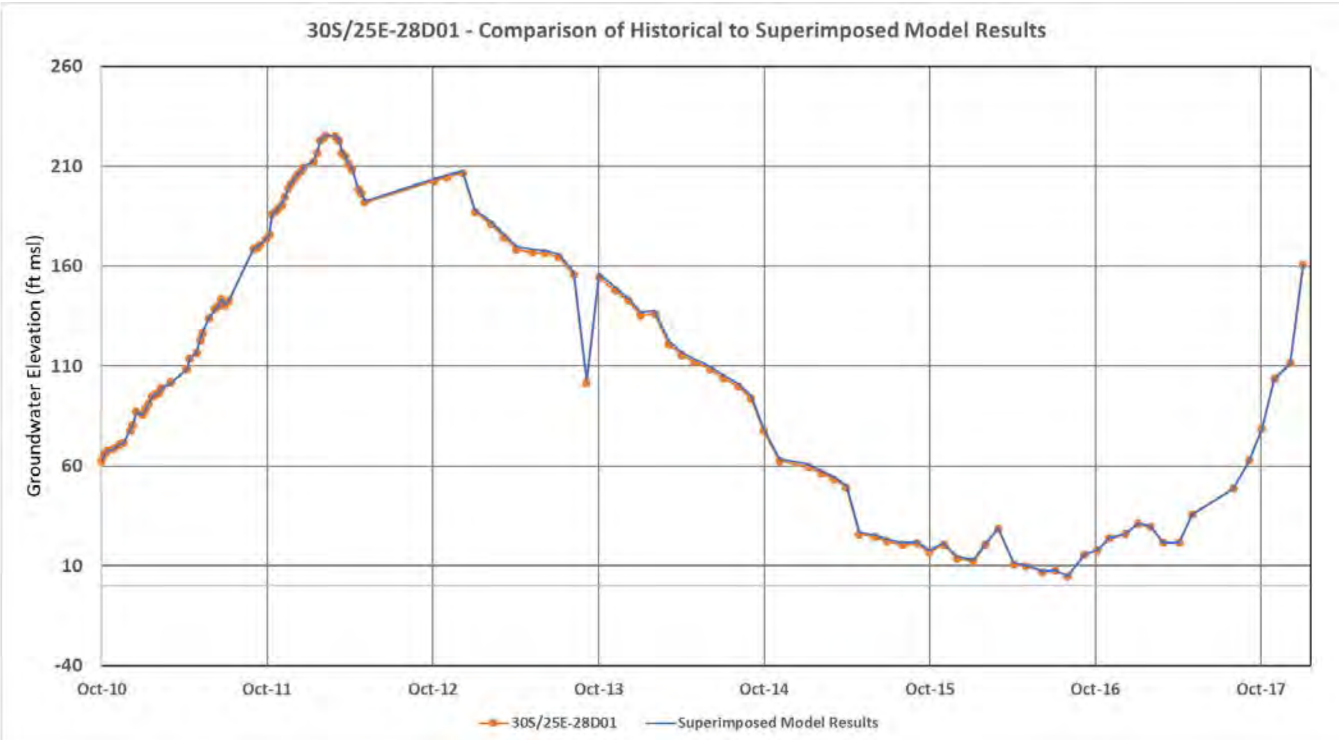


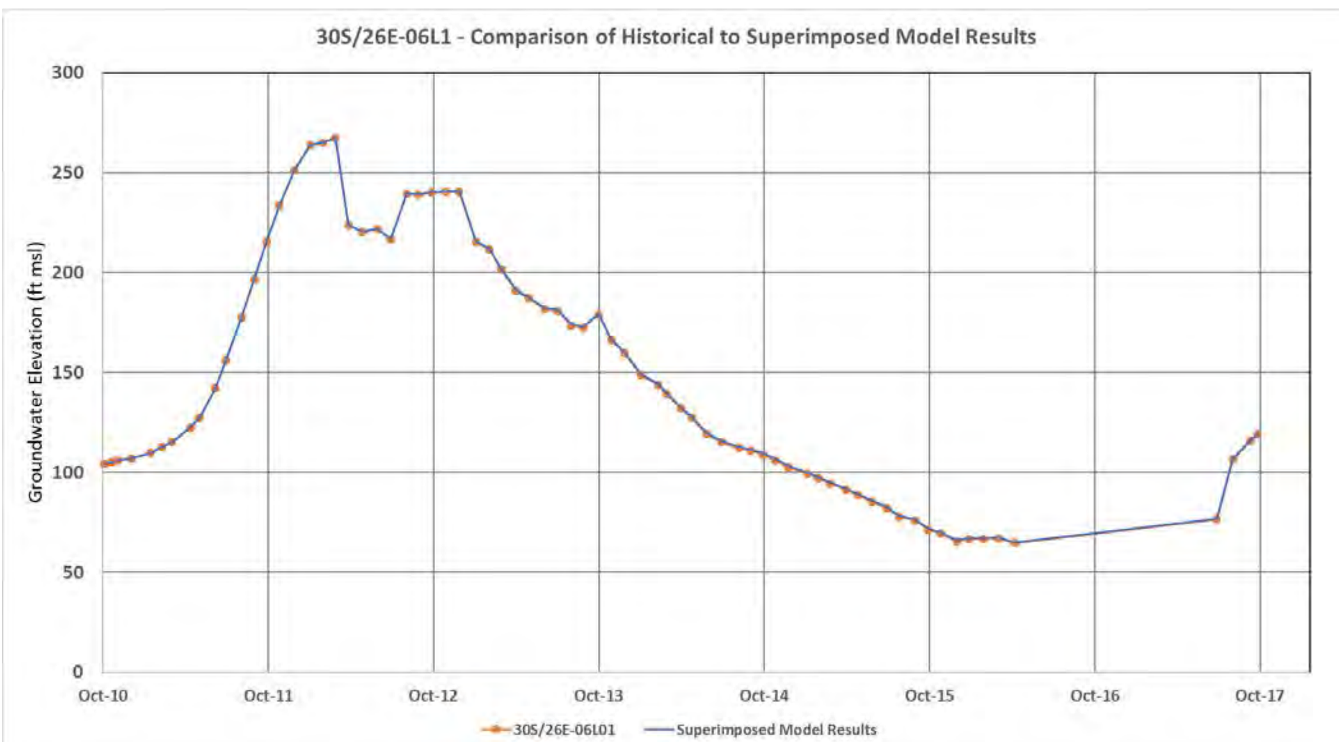


November 2020

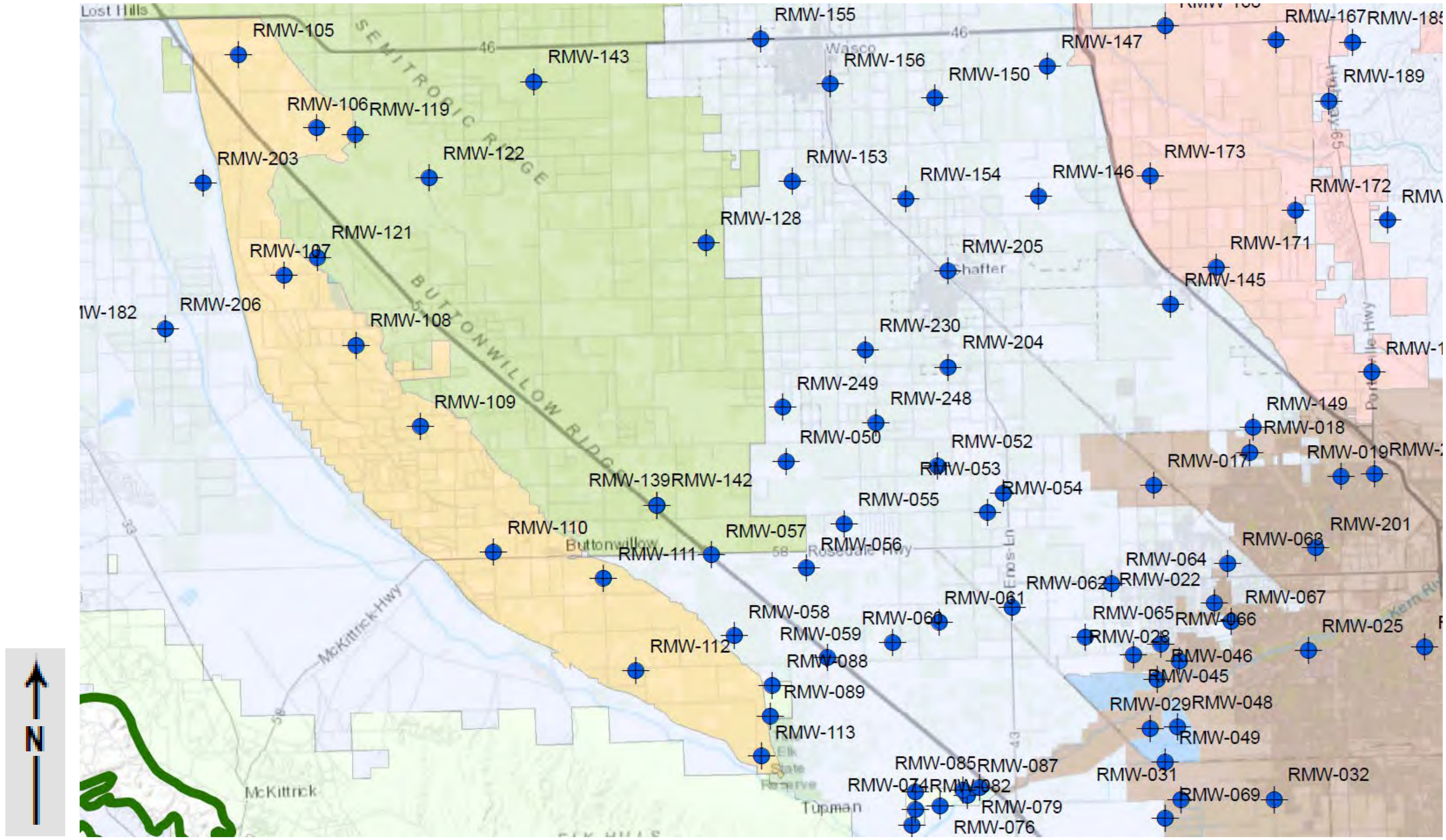
TODD GROUNDWATER

Figure 25
Superposition Hydrographs of Scenario B onto Measured Water Levels at Eastern RRBWSD Wells





November 2020	**Figure 26** **Superposition Hydrographs of Scenario B onto Measured Water Levels at WKWD and Pioneer**
TODD GROUNDWATER	



Legend

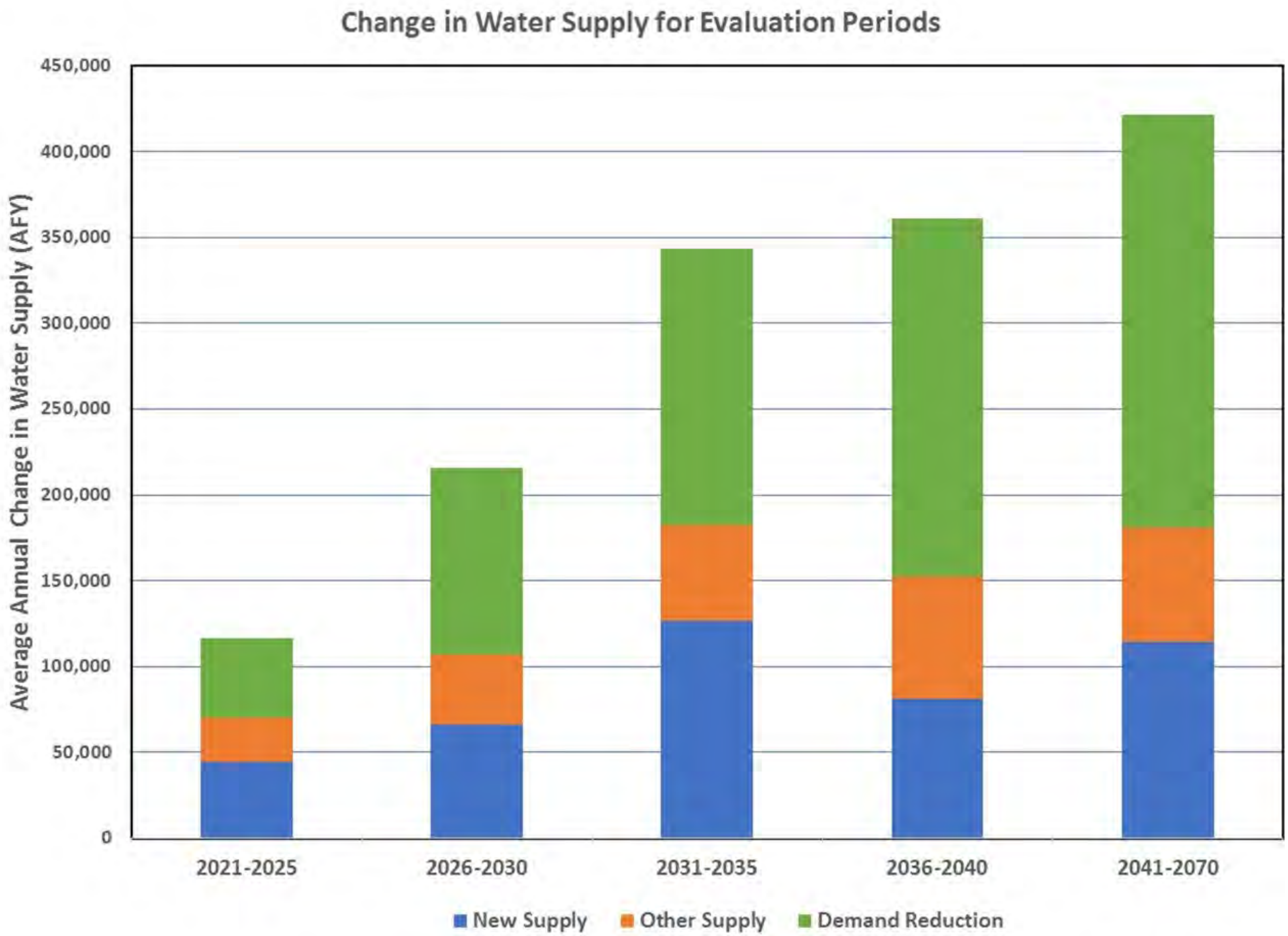
- Regional Monitoring Well (RMW) Location
- Kern County Line

Subbasin Name

- Kern County Subbasin

0 10
Scale in Miles

November 2020	Figure 27 Regional Monitoring Well (RMW) Locations
TODD GROUNDWATER	

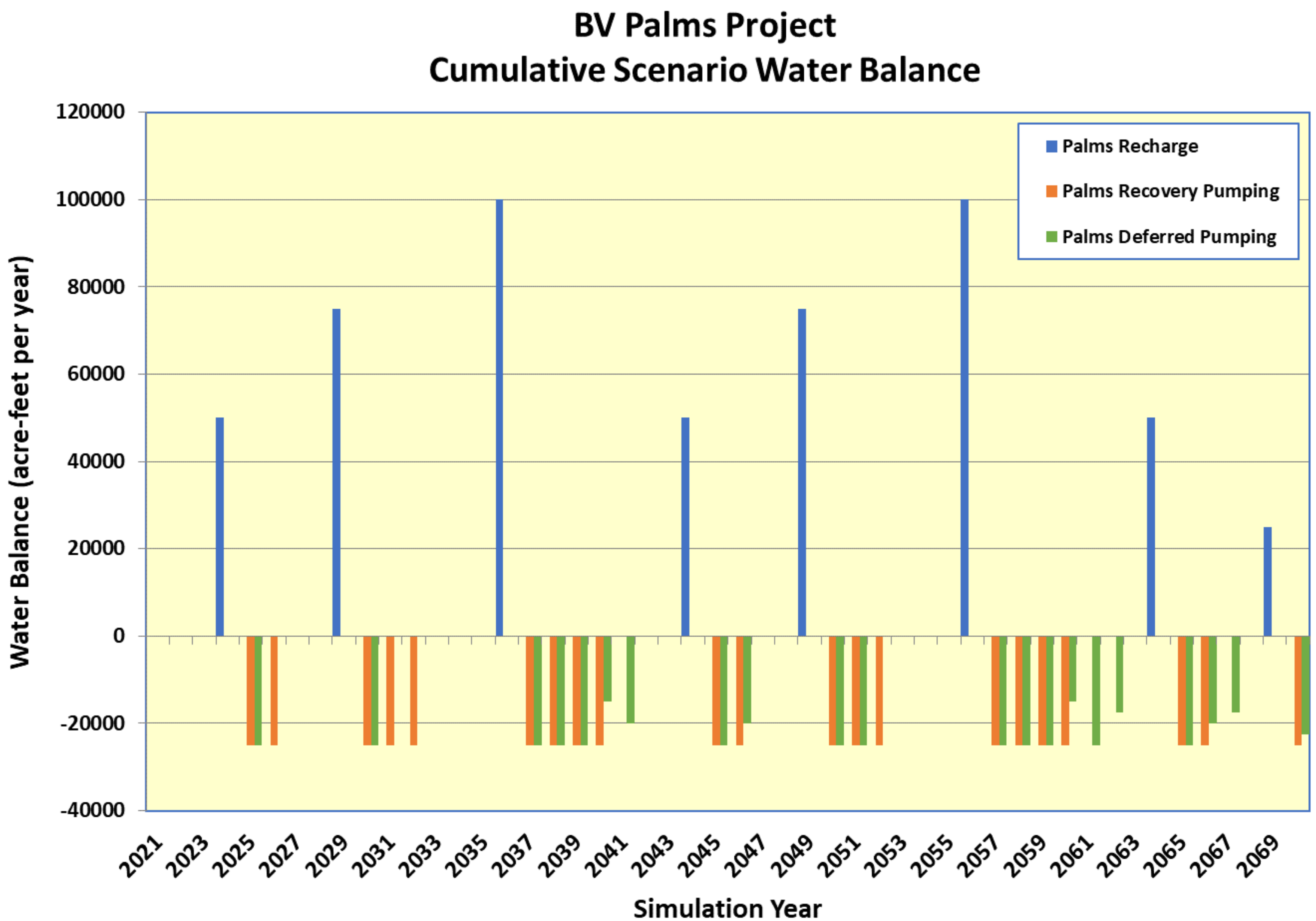


Source: Kern County Subbasin Coordination Agreement, Appendices 2 and 4, Figure 15

November 2020

TODD GROUNDWATER

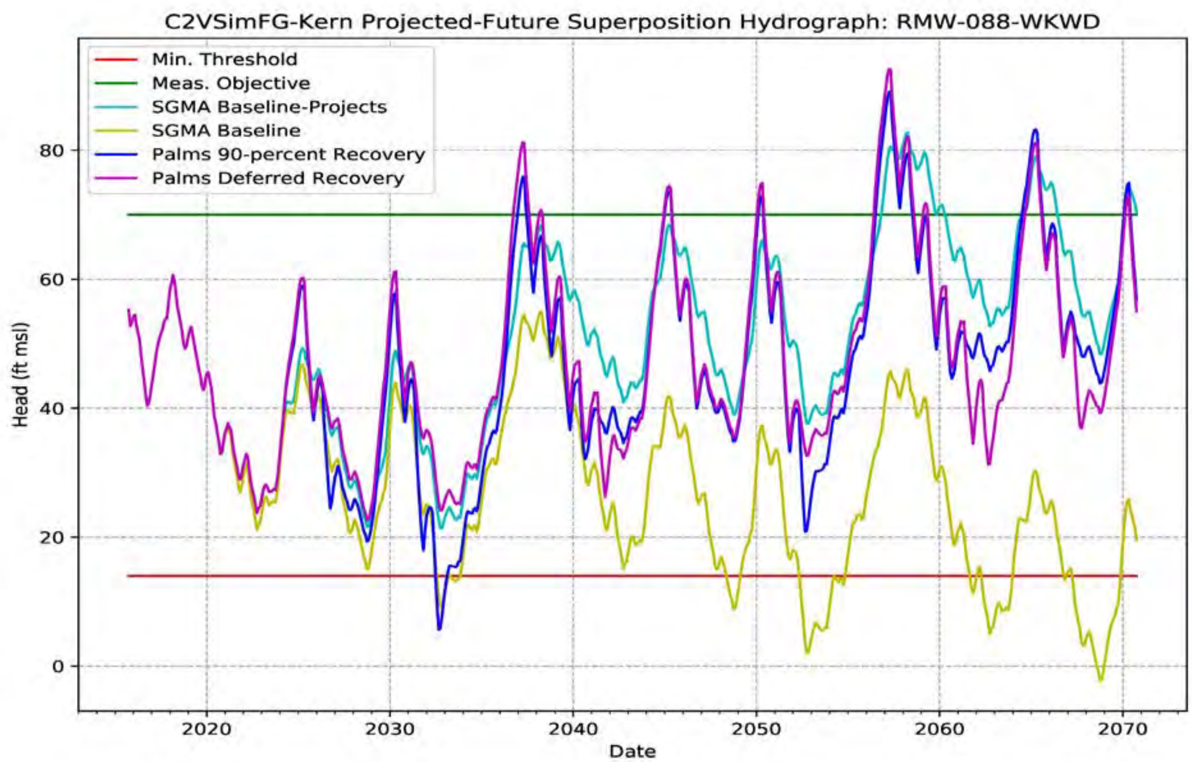
Figure 28
Average Annual Benefit of Proposed SGMA Projects and Management Actions

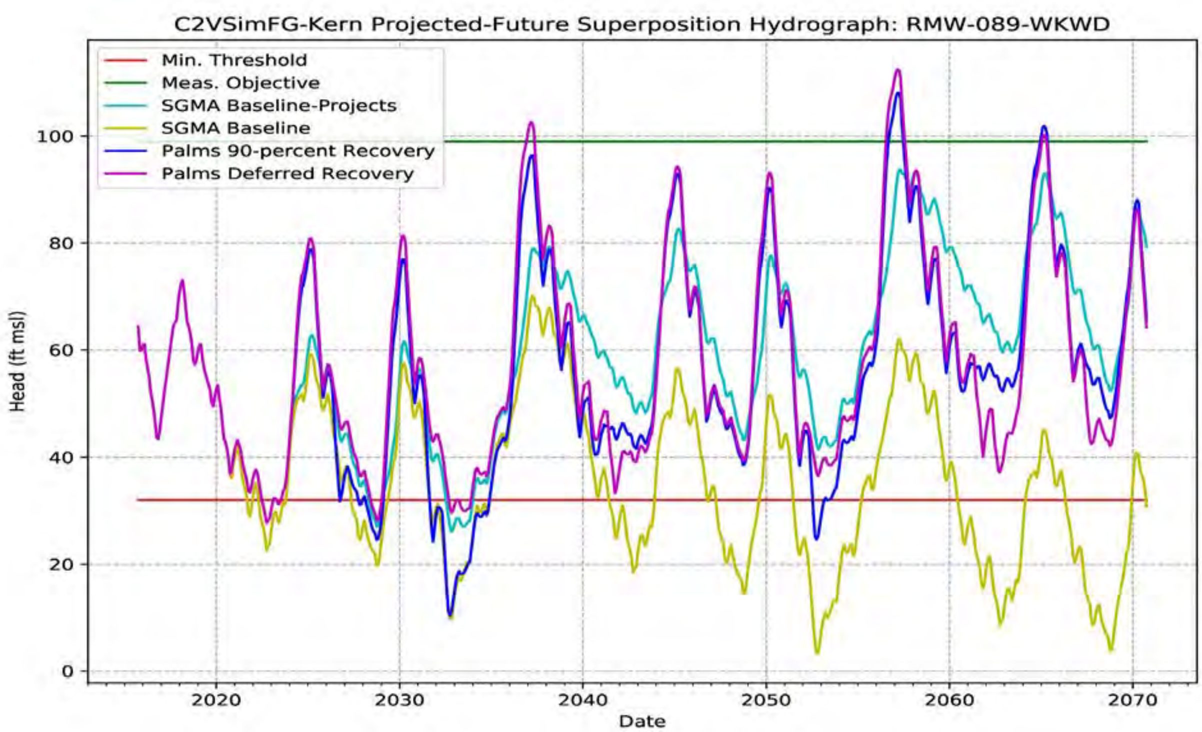


November 2020

TODD GROUNDWATER

Figure 29
Cumulative Project Scenario Simulated Recharge and Recovery Operations

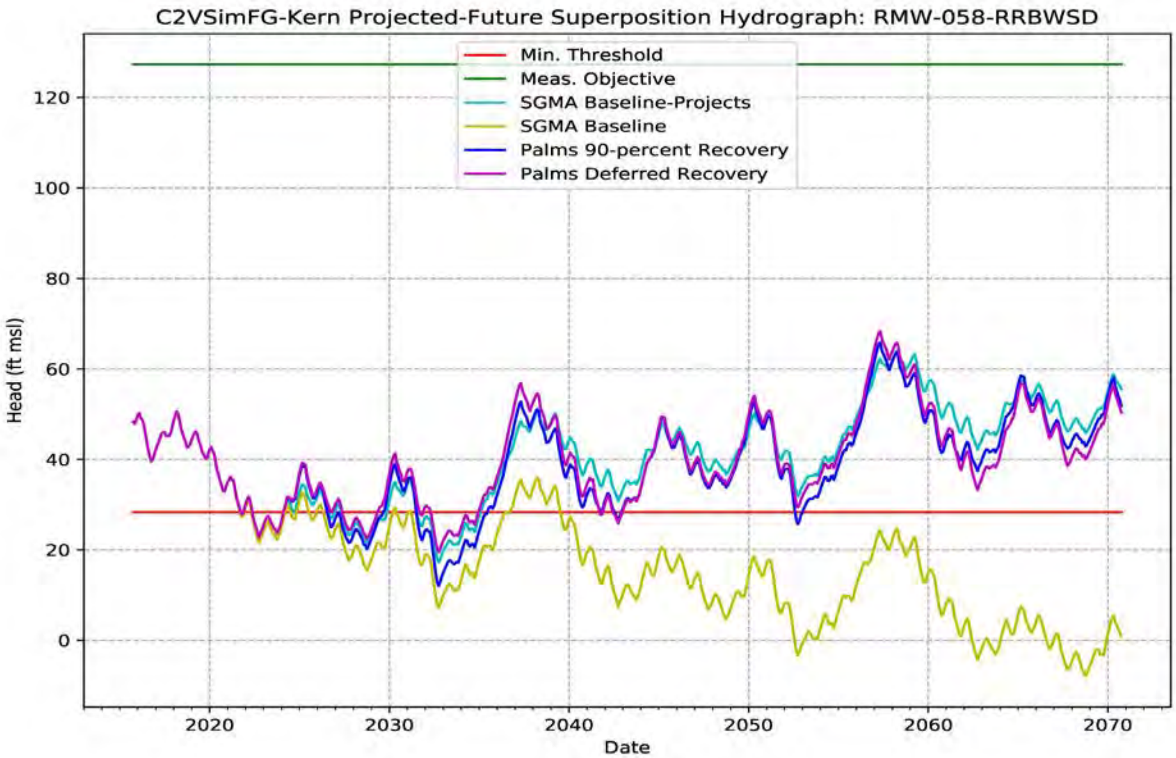


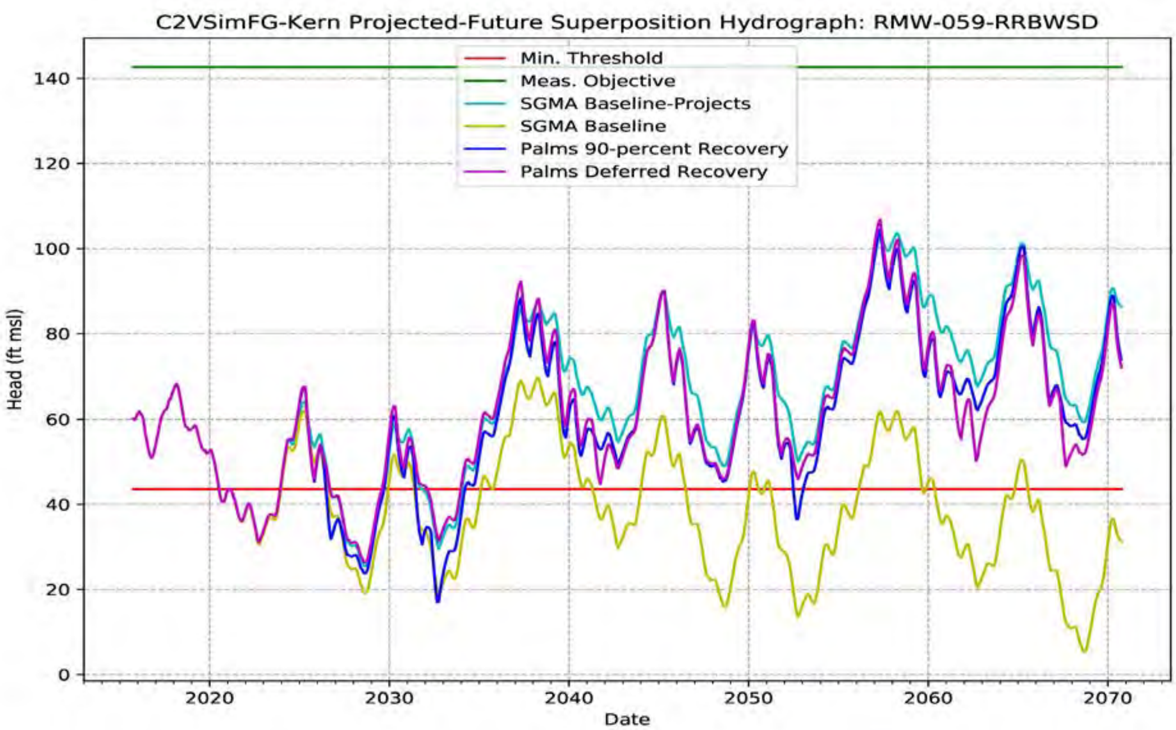


November 2020

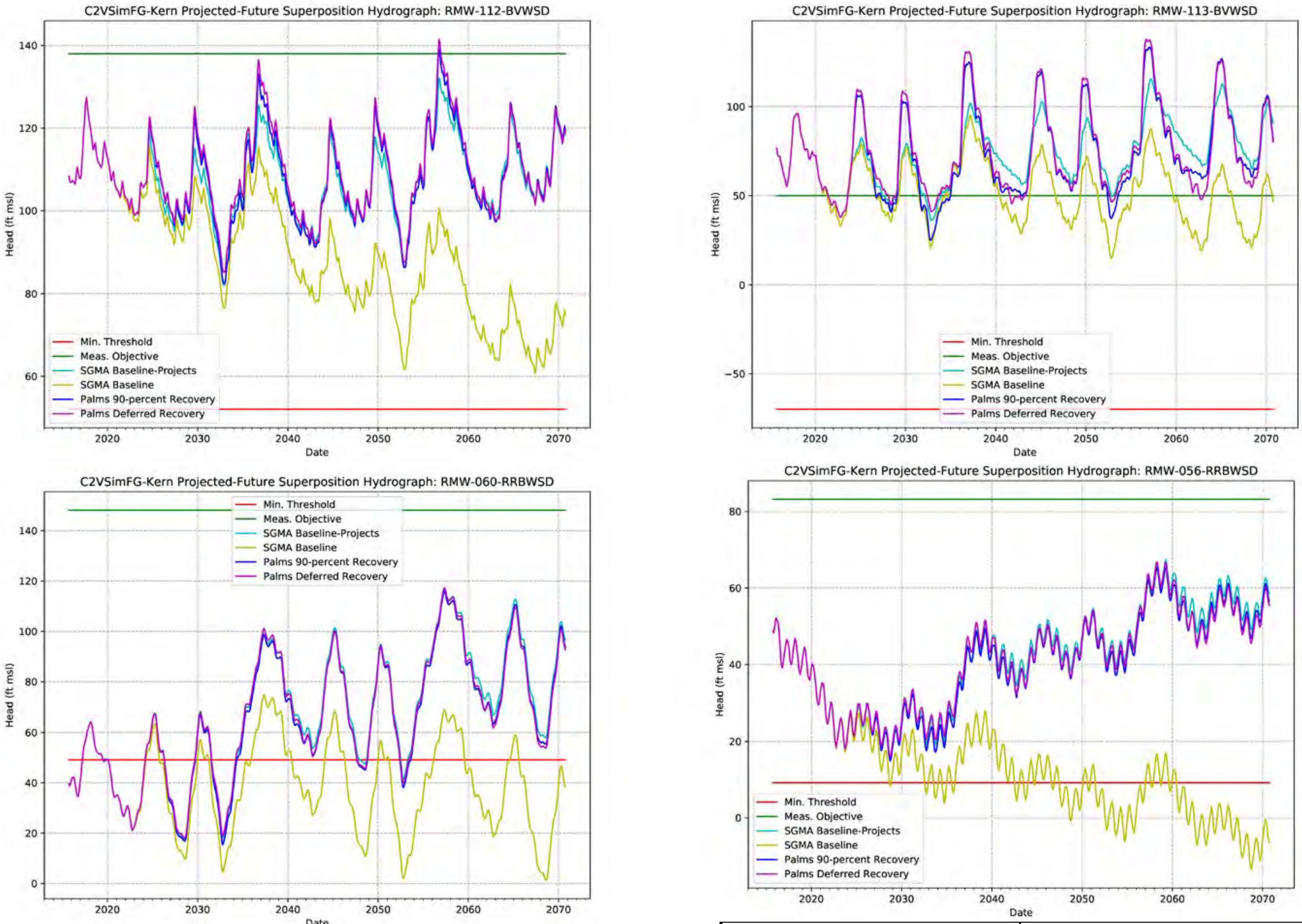
TODD GROUNDWATER

Figure 30
Cumulative Scenario Hydrographs of WKWD North Locations

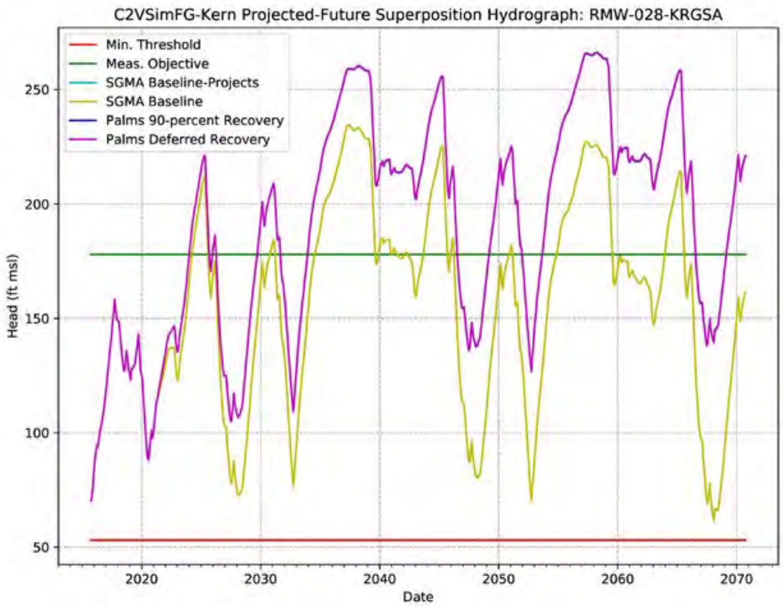


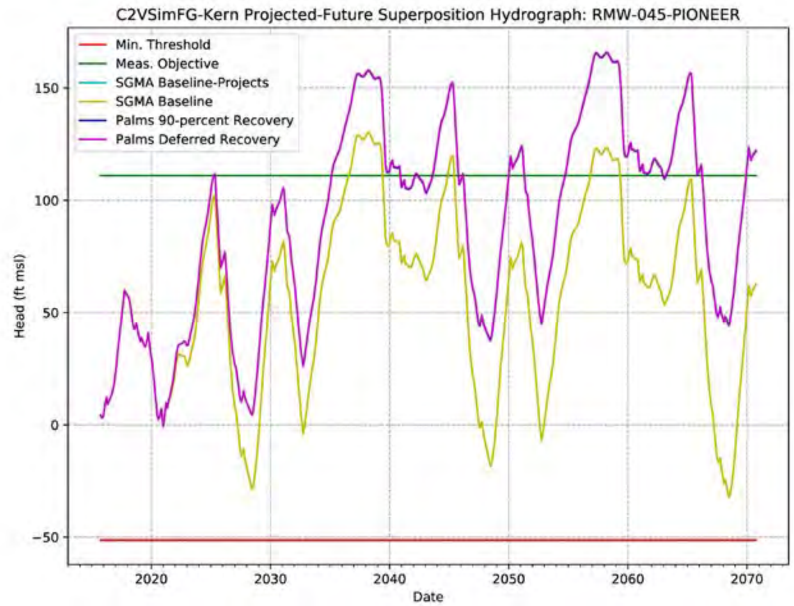


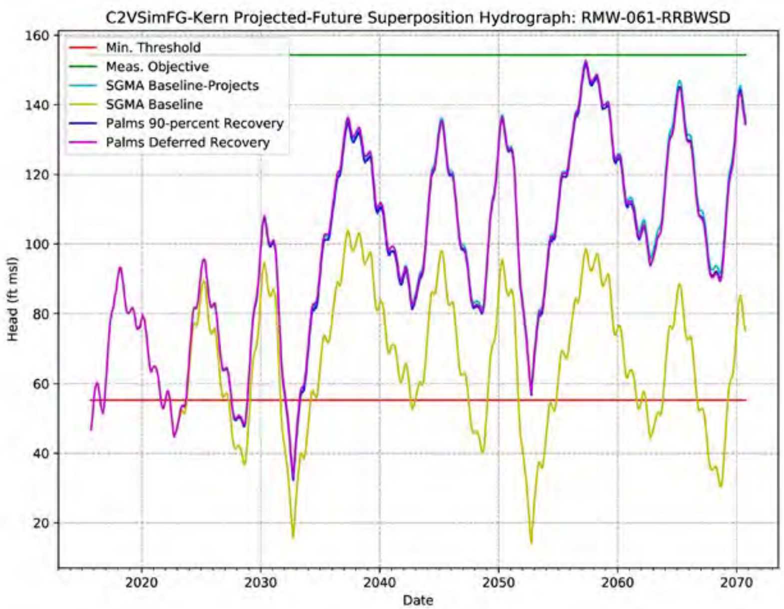
November 2020	**Figure 31** **Cumulative Scenario Hydrographs of Western RRBWSD Locations**
TODD GROUNDWATER	

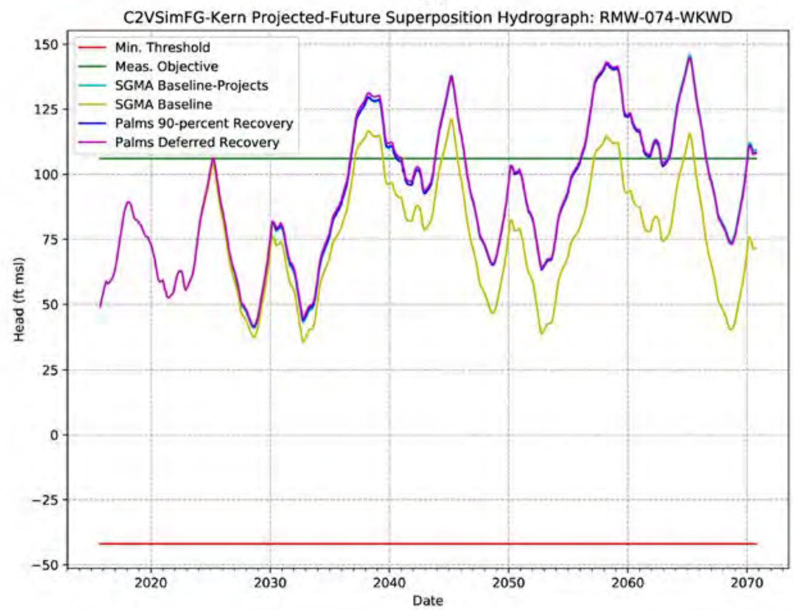


November 2020	Figure 32 Cumulative Scenario Hydrographs in Vicinity of Recovery Project Site
TODD GROUNDWATER	









November 2020

TODD GROUNDWATER

Figure 33
Cumulative Scenario Hydrographs Distal from Recovery Project Site

ATTACHMENTS

Attachments A through D

ATTACHMENT A

SUPERPOSITION MODELING APPROACH

A. SUPERPOSITION MODELING APPROACH

The model analysis described in this report uses the principle of superposition for simulating impacts to groundwater as a result of the Proposed Project.

A.1 CONCEPTUAL UNDERSTANDING

The principle of superposition, as applied to a ground-water system, means that the result of multiple stresses on an aquifer system is equal to the sum of the results of the individual stresses. A superposition modeling approach enables the Project-related changes to be calculated throughout the basin and superimposed upon the groundwater system so that the accumulated effects of the Project over time can be determined. For a detailed discussion of the application of superposition to ground-water problems, the reader is referred to Reilly et al. (1987).

The purpose of the groundwater impacts analysis is to evaluate the change in groundwater levels as a result of the Proposed Project's recharge and pumping. **Figure A-1** provides a conceptual example of the anticipated effects of the Proposed Project that require analysis. When surface water is diverted to a recharge basin, a groundwater mound forms under the facility during operations resulting in higher groundwater levels (see top diagram, **Figure A-1**). The volume of groundwater in the aquifer represented by the relative change in groundwater levels is referred to as the change of groundwater in storage. Similarly, groundwater recovery pumping would result in increased drawdown (i.e., lowering) of groundwater levels in a pattern that is greatest near the pumped well and diminishes with increasing distance.

A.2 PRINCIPLE OF SUPERPOSITION

The groundwater flow equation is derived from the fundamentals of groundwater hydraulics, including Darcy's Law and the Law of Conservation of Mass (Todd and Mays, 2004; Bear and Verruijt, 1987; Freeze and Cherry, 1979; Bouwer, 1978). This equation can be used to calculate the changes in groundwater levels resulting from the Project-related changes in recharge or pumping. The Principle of Superposition, in general terms, states that the net change in groundwater levels due to the Proposed Project can be calculated independently from other pumping and recharge occurring in the basin. Furthermore, the net change in groundwater levels can be added to other groundwater level distributions to determine the combined effects on the groundwater system (Reilly et al., 1987; Bennett, 1976)

Mathematically, the Principle of Superposition within groundwater systems is based from the equation of groundwater flow derived on Darcy's Law (Todd and Mays, 2004; Bear and Verruijt, 1987; Freeze and Cherry, 1979; Bouwer, 1978), which is provided below:

$$\frac{d}{dx}\left(Tx\frac{dh}{dx}\right)+\frac{d}{dy}\left(Ty\frac{dh}{dy}\right)+W=S\frac{dh}{dt} \quad (1)$$

where *h* = groundwater level or head
T = transmissivity
W = water sink or source term representing the water balance
S = Storage Coefficient

This differential equation is linear in terms of the groundwater head (*h*) – that is, anywhere that *h* appears in this equation, it is only to a single power; for example, it is not squared or cubed. Because the equation is linear in *h*, any number of equations – representing, for example, multiple different stresses on the groundwater system - can be summed to provide the total change to the system resulting from all of the individual stresses. Furthermore, the right-hand side of the equation shows that the change in head (*dh*) is a function of time (*dt*). This indicates that Equation 1 can be used to superimpose the effect of the changes in multiple, transient (i.e., time-varying) stresses to determine the accumulated impact of these stresses on groundwater levels over time. This means that calculated changes in groundwater levels associated with an action (such as the Proposed Project) can be added to other groundwater level distributions to determine the combined effects on the groundwater system (Reilly et al., 1987; Bennett, 1976).

Figure A-2 provides an example of the application of the Principle of Superposition. The example shows the effects of pumping from two different wells on groundwater levels measured at a single monitoring location. The pumping rates are different, and the timing of the pumping varies (top and middle panels on **Figure A-2**). The drawdown associated with each well can be calculated independently and then added together. The bottom panel depicts the total, accumulated effect of the pumping at both wells on the water levels measured at the single monitoring location when the two independent calculations are superimposed to provide the combined drawdown.

A.3 General Methodology

The development of a superposition model is typically based on modification of an existing, calibrated, historical groundwater model. The advantage of this approach is that the superposition model incorporates the aquifer basin structure, hydrostratigraphy and parameter values determined through calibration of the pre-existing model. The general methodology requires that the initial simulated groundwater level for the aquifer and all model boundaries be set equal to zero, making all initial fluxes in the model also equal to zero. A detailed discussion of the application of superposition to groundwater hydraulics is provided by Reilly et al. (1987). The conversion of an existing groundwater model to a superposition model requires some modification. The general process for setting up a superposition model includes:

- The model layer top and bottom elevations are recalculated relative to the initial groundwater elevations to provide a saturated thickness that preserves the hydrogeology of the aquifer system.
- All boundary conditions not associated with the Project are removed.
- All head-dependent boundary conditions representing subsurface flow, such as constant head boundaries, are set to an elevation of zero.
- Elevations of natural features included in the model, such as streambed elevations, are also recalculated relative to the initial groundwater elevations.
- All aquifer properties, including hydraulic conductivities, transmissivities and aquifer storage from the existing groundwater model are maintained and remain fixed for the analysis.

As a result, the superposition modeling approach incorporates detailed information about the hydrostratigraphy and distributions of stresses throughout the basin-wide groundwater system, yet it is relatively simple to use. The use of a superposition modeling approach thus enables the groundwater impacts analysis to assess the effects of the Project on the groundwater system in isolation from other acting stresses (e.g., pumping, recharge, etc.) without having to obtain data of non-project related stresses. Using a superposition model, calculation of groundwater impacts is inherently precise because flow quantities other than Project-related components are set to zero (Leake, 2011). Thus, use of the superposition modeling technique allows for the formulation of the Proposed Project scenarios, and simulation of Proposed Project-related changes directly, in a manner that incorporates all of the details of the Proposed Project while mitigating the need to collect non-project related data that may not be obtainable.

A.4 APPLICATION OF SUPERPOSITION MODELS

A superposition modeling approach was selected as the most suitable method to support the groundwater impacts analysis. The superposition approach enables Project-related changes to be calculated throughout the basin and superimposed upon the groundwater system so that the accumulated effects of the Project over time can be determined.

A.4.1 Superposition Model Results

When the Principle of Superposition is used in groundwater modeling, the model results are presented in terms of change in groundwater levels rather than in absolute values of groundwater elevations. Therefore, the model results provide the relative change in groundwater levels due to the Proposed Project; in other words, a superposition model directly calculates the groundwater level impacts from the Proposed Project. By applying the Principle of Superposition, the relative change in groundwater levels can be added (superimposed) to measured or simulated groundwater elevations to determine a predicted groundwater elevation associated with Project impacts.

The water balance derived from a superposition model represents the change in the groundwater flux as a result of the simulated changes. Therefore, a positive flux may represent an increase in inflow or a decrease in outflow as a result of the Proposed Project. Likewise, a negative flux may represent an increase in outflow or a decrease in inflow as a result of the Proposed Project.

A.4.2 Assessment of Non-Linearities

The Principle of Superposition is derived for systems in which the change in groundwater is a linear function of the change in stresses. In natural settings, however, changes in a groundwater system may occur in a nonlinear manner. Nonlinearities are not uncommon in practice: indeed Reilly et al. (1987) noted that superposition models are commonly applied without significant modifications to simulate mildly nonlinear systems as long as the effects of the nonlinearity are small relative to the dimensions of the aquifer system. Methods for handling more complex nonlinearities have been advanced by Reilly and Harbaugh (2004), Durbin et al. (2008), Leake (2011), Takahashi and Peralta (1995), among others, who summarize practices to address complex nonlinearities in superposition models. Nonetheless, it is always best-practice to evaluate the likely degree and significance of any nonlinearities on a project-specific basis (Reilly et al., 1987; Reilly and Harbaugh, 2004; Morrison, 2006).

Following standard practice, the effects of nonlinearity are within an acceptable range that allow for use of the Superposition Model as a quantitative tool to support the groundwater impacts analysis (Reilly et al., 1987; Reilly and Harbaugh, 2004; Durbin et al., 2008; Morrison, 2006; Leake, 2011).

A.5 RELATED APPLICATIONS OF SUPERPOSITION MODELS

The Principle of Superposition is routinely applied in the solution of both analytical and numerical groundwater flow problems (Reilly et al., 1987). In contrast to a model that attempts to describe and predict each and every basin-wide stress – many of which may not be readily quantifiable – the superposition technique has the benefit that it focuses on calculating the water level changes that result from the specific stresses of interest and superimposing those upon the basin-wide system. Major advantages of the superposition technique are summarized by Reilly et al. (1987) as follows.

- The effects of a specified stress (i.e., groundwater pumping, managed recharge) on the system can be evaluated even if other stresses are unknown.
- The effects of a change in stress on the system can be evaluated even if the initial conditions are unknown.
- The effect of one stress on the system can be isolated from the effects of all other stresses on the system.

The superposition model approach has been applied for other comparable projects. **Table A-1** provides a representative list of reports documenting the use of a superposition models that are publicly available using an internet search. The superposition approach is a standard, well-established method that has been accepted for evaluating groundwater impacts, supporting groundwater management, and providing regulatory compliance. The use of superposition models has been increasing in recent years with several applications for complex projects, especially in western United States.

Table A-1 Representative Reference List of Superposition Model Applications

Citation	Location	Purpose of Model	Review Agency
Pollyea, 2019	Oklahoma	Long-range fluid pressure caused by oilfield wastewater disposal	USGS, Virginia Tech
Gailey, Fogg, et al., 2019	California Central Valley	On-farm groundwater recharge with surface water releases	UC Davis
Peeters et al., 2018	Gloucester Basin, Australia	Environmental impact assessment of coal development	Australian Dept Enviro and Energy
Todd GW, 2017	Kern County, California	Groundwater impacts analysis, Kern River Water Allocation Plan	Local Water Agencies
Fio et al., 2016	Upper Salinas Valley, California	Long-term water resources management plan	Monterey County WRA
Leake, et al., 2013	Parker-Palo Verde-Cibola, Arizona and California	Effects of groundwater withdrawals on Adjudicated Colorado River flow depletion	USGS, US Bureau of Reclamation
Riesterer et al., 2013	Pahrump Valley, Nevada	Groundwater impacts analysis, Hidden Hills Solar Energy Generating System	Nye County Water District
CH2MHill, 2010	Hanford Site, Washington	optimization of a large groundwater remedy at the 200-ZP-1 OU	US Department of Energy
Barroll, 2006, 2012	Taos Valley, New Mexico	Water rights administration under the 2006 Taos Adjudication Settlement	New Mexico State Engineer
Sukow, 2012	Eastern Snake Plain, Idaho	Support development of a Comprehensive Aquifer Management Plan	Idaho Dept. of Water Resources
Leonard Rice Engineers, 2012	Denver-Julesburg Basin, Colorado	Compliance with Colorado Ground Water Rules of discharge to streams	Colorado Div. of Water Resources
Leake, et al., 2008	Colorado River Valley from Lake Mead to Yuma	Assessment of possible depletion of water in the Colorado River by pumping wells	USGS
Leake, et al., 2008	Lower Colorado River Valley	Effects of pumping on Adjudicated Colorado River flow depletion (US Supreme Court, 2006)	USGS, US Bureau of Reclamation
Kendy and Bredehoeft, 2006	Gallatin Valley, Montana	Groundwater impacts analysis of irrigation pumping on streamflow	Gallatin Conservation Dist.
Wylie, 2005	Eastern Snake Plain, Idaho	Resolution of conflicts among water users and in future water administration	Idaho Depart. of Water Resources
Larson, et al., 2005	Roswell Underground Water Basin, New Mexico	Evaluate impacts associated with proposed changes in pumping patterns	New Mexico State Engineer
Bergeron and Freeman, 2005	Hanford Site, Washington	Estimate concentrations in groundwater for a specific constituent inventory	US EPA
Leake et al., 2005	Little Colorado River Area, Arizona	Effects of groundwater withdrawals on stream flow depletion	USGS
CH2MHill, 2004	Sacramento Valley, California	Groundwater impacts analysis, Sacramento River Settlement Contracts	US Bureau of Reclamation
Roark, 2001	Santa Fe Group Aquifer System, New Mexico	Surface water/groundwater interactions of Rio Grande River with aquifer system	City of Albuquerque
McAda, 2001	Rio Grande Valley, New Mexico	Induced infiltration from the Rio Grande surface-water system from pumping	City of Albuquerque
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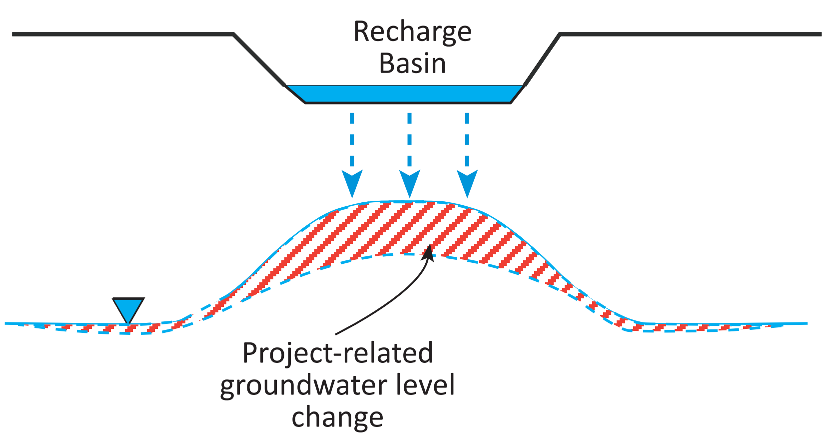
ATTACHMENT A

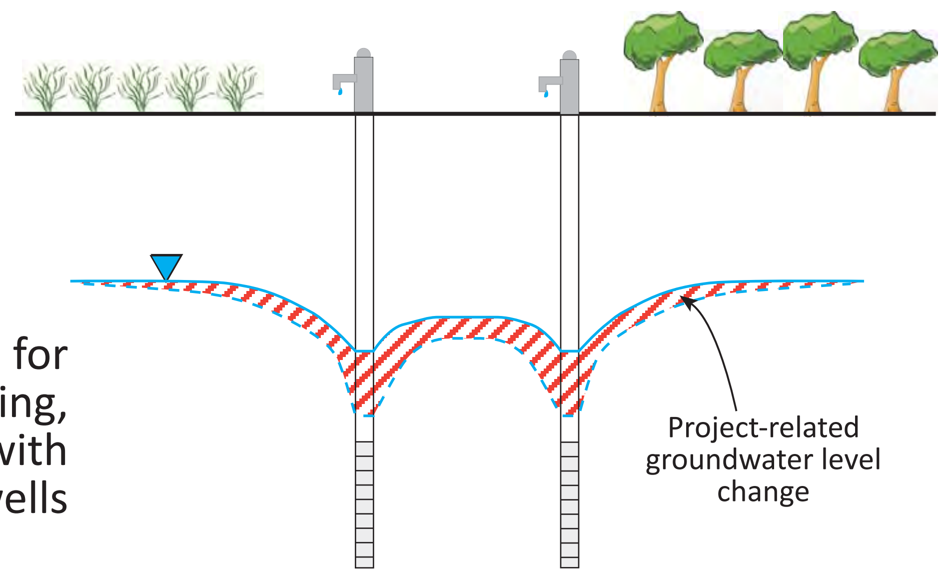
FIGURES



Reduction in surface water available for *local recharge or banking* results in lower groundwater levels with largest impact underneath facility

The volume of water in the zone of "Project-related groundwater level change" represents the change in groundwater storage in the aquifer

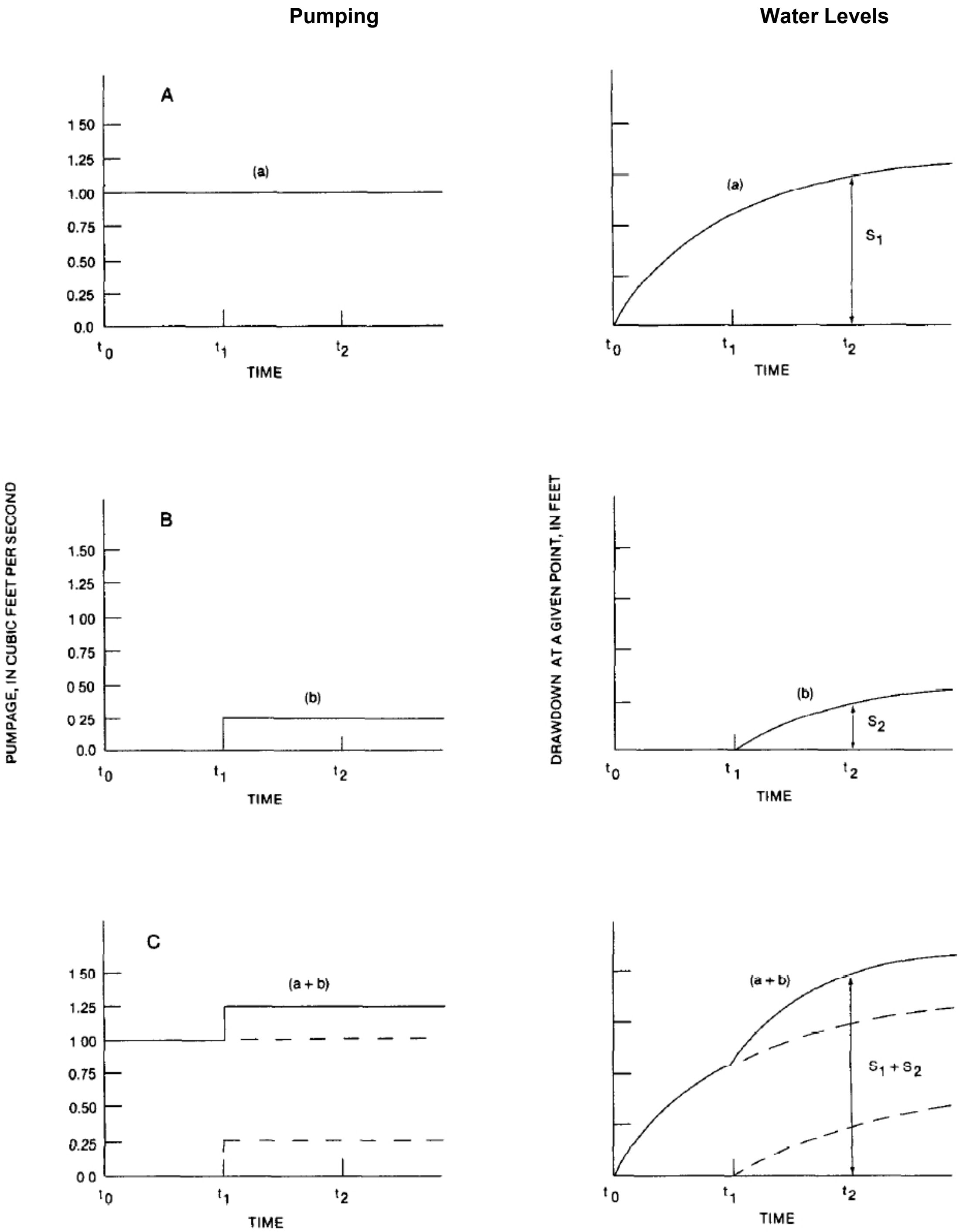
Reduction in surface water available for *irrigation* results in increased pumping, which lowers groundwater levels with largest impact at pumping wells



June 2020

TODD GROUNDWATER

Figure A-1
Conceptual Project Impacts on Groundwater Levels



Superposition of well solutions: A, Initial pumpage starting at t_1, and its resulting drawdown, s_2, at t_2
B, Change in pumpage from the initial rate starting at t_1 and its resulting drawdown, s_2, at t_2
C, Total pumpage starting at initial rate and increasing at t_1, and its resulting drawdown, $s_1 + s_2$, as obtained by superposition.

Source: Figure 6 from Reilly, Franke and Bennett, 1987, The Principle of Superposition and Its Application in Ground-Water Hydraulics, U.S. Geological Survey, Techniques of Water-Resources Investigations, Book 3, Chapter B6

June 2020

TODD GROUNDWATER

Figure A-2
USGS Example of Principle of Superposition

ATTACHMENT B

SUPERPOSITION MODEL SETUP

B. SUPERPOSITION MODEL SETUP

The Superposition Model used for the BVWSD Recovery Project was previously developed and used for the Supplemental Environmental Impact Report (SEIR) for the Kern River Water Allocation Plan for Kern Delta Water District (KDWD). The Draft SEIR was completed in 2017 (ESA, 2017) and the groundwater modeling was described in the Groundwater Impacts Assessment Report (Todd Groundwater, 2017) which is an appendix to the SEIR. A summary of the USGS Central Valley Hydrologic Model (CVHM) and the process used to develop the KDWD Superposition Model from CVHM is discussed below. In applying the model to BVWSD some additional modifications were made to the Superposition Model based on local data and model requirements. These are listed at the end of this section.

B.1 SUPERPOSITION MODEL BACKGROUND

Following the general methodology for applying the Principle of Superposition to groundwater modeling (Reilly et al., 1986), the Superposition Model was developed from the existing, previously calibrated, USGS CVHM (Faunt, 2009), referred to here as the Base Model. CVHM is a three-dimensional computer model developed by the USGS to simulate surface water and groundwater flow across the entire Central Valley (Faunt, 2009). The geologic framework and aquifer properties of CVHM are based on a comprehensive geologic analysis (USGS Sediment Texture Analysis) that provides a regionally consistent evaluation of aquifer properties based on the analysis of local well logs (Faunt et al., 2009).

B.1.1 Central Valley Hydrologic Model (CVHM) Overview

CVHM simultaneously accounts for changing water supply and demand across the landscape and simulates surface water and groundwater flow across the entire Central Valley (Faunt et al., 2009). CVHM is designed to simulate water usage in the Central Valley on a regional scale.

CVHM uses a uniform grid spacing of one square mile that is oriented parallel to the valley axis, about 34 degrees west of north. In order to adequately represent the growing season, the annual hydrologic cycle in CVHM is divided into 12 monthly stress periods.

CVHM simulates the Central Valley Aquifer by subdividing the subsurface into 10 layers (**Figure B-1**). The top layer (Layer 1) represents the land surface. Model Layers 2 and 3 represent the shallow aquifer. Model Layers 4 and 5 represent the Corcoran Clay Member of the Tulare Formation, or its equivalent, where present. Model Layers 6 through 10 represent the deeper aquifers.

For the CVHM, the bottom of the model was specified on the basis of well-completion records to incorporate the vertical intervals of the aquifer system being stressed by pumpage. The model bottom extends to 1,800 feet below land surface, and where the Corcoran Clay is present, to 1,500 feet below the Corcoran Clay (**Figure B-1**). For the most part, saline water is deeper than the model bottom (Faunt et al., 2009).

CVHM has a recognized deficiency in accurately representing the recharge volumes from the numerous groundwater banking operations in Kern County in the model (Faunt, 2009); this deficiency - rather than model structure and parameterization - is considered to be the primary factor impacting the CVHM calibration in Kern County. Since these water budget terms are not used in the Superposition Model, this deficiency is not considered to appreciably affect the use of the CVHM as the Base Model. Therefore, CVHM is considered the best model available to serve as the Base Model for the Superposition Model.

B.1.2 USGS Sediment Texture Analysis Overview

The USGS Sediment Texture Analysis was used to develop aquifer properties for the CVHM and subsequently used to develop the Superposition Model. The USGS conducted the Sediment Texture Analysis by compiling and describing lithology for approximately 8,500 driller's logs to better define aquifer properties for the heterogeneous valley-fill deposits of the Central Valley aquifer system (Faunt et al., 2009). The geologic descriptions on each log were classified using a discrete binary texture classification of either "coarse-grained" or "fine-grained" similar to those originally defined by Page (1986). The coarse-grained sediment texture is defined as consisting of sand, gravel, pebbles, boulders, cobbles, or conglomerate. Fine-grained sediment texture is defined as consisting principally of clay, lime, loam, mud, or silt. The basis for calculating aquifer properties from texture data is based on the spatial correlation between saturated hydraulic conductivity[1] and pore-size distributions in geologic media (Faunt et al., 2009).

The spatial distribution of the sediment texture, both horizontally and vertically, was developed by applying a geostatistical analysis. For this analysis, the percentage of coarse-grained sediment texture was computed for each 50-foot depth interval. The utilization of the percentage of coarse-grained deposits, or texture, was based on a methodology developed in earlier works by Page (1986) and Burow et al. (2004). The geostatistical analysis applied a three-dimensional kriging technique to map the percentage of coarse-grained deposits onto a one-mile spatial grid at 50-foot depth intervals from land surface down to 3,000 feet below land surface across the Central Valley (Faunt et al., 2009).

The results of the USGS Sediment Texture Analysis show substantial heterogeneity and systematic variation in the texture of the sediments in the Central Valley that reflect the observed regional, spatial, and vertical heterogeneity in the aquifer system. These characteristics were correlated to known sediment source areas, independently mapped geomorphic provinces, and factors affecting the development of alluvial fans (Faunt et al., 2009). In the San Joaquin Valley, especially on the eastern side, the areas of coarse-grained texture are more widespread than the areas of fine-grained texture and occur along the major rivers. In the southern part of the San Joaquin Valley, the alluvial fans derived from the Sierra Nevada are much coarser grained than the alluvial fans to the north. In contrast to the eastern San Joaquin Valley, the western San Joaquin Valley generally is finer-grained and is underlain by the Corcoran Clay Member of the Tulare Formation. These finer textures reflect the source material consisting of shales and marine deposits from the Coast Range. These rocks generally yield finer-grained sediments than the granitic parent rocks that make up the alluvial fans on the eastern side of the valley (Faunt et al., 2009).

USGS used the Sediment Texture Analysis as the geologic basis for determining aquifer properties for the 10-layer CVHM (**Figure B-1**). The layering for CVHM matches that used for the USGS Sediment Texture Analysis; therefore, the aquifer properties derived from USGS Sediment Texture Analysis were incorporated into CVHM (Faunt et al., 2009; Faunt, 2009). The aquifer properties were updated during calibration, and the final parameters used are documented in USGS publications (Faunt et al., 2009). The method for developing the aquifer properties from the USGS Sediment Texture Analysis is described more fully in the CVHM model documentation (Faunt et al., 2009). In summary, the assumptions used to develop the aquifer properties for CVHM include:

- The horizontal hydraulic conductivity is calculated as the weighted arithmetic mean of the percentage of coarse- and fine-grained sediments defined by the sediment texture analysis multiplied by the assigned hydraulic conductivities for each texture. For the San Joaquin Valley,

[1] Hydraulic conductivity (K) is a coefficient of proportionality that describes the rate at which water can move through a permeable medium.

the coarse-grained hydraulic conductivity is 2.4×10^{-1} feet per day, and fine-grained hydraulic conductivity is $3.3\times10^{+3}$ feet per day.

- Vertical hydraulic conductivity between layers is calculated as a weighted power mean of the percentage of coarse- and fine-grained sediment textures between the midpoints of adjacent 50-foot layers multiplied by the assigned hydraulic conductivities for each texture.
- Specific yield was calculated using a linear relation based on the percentage of coarse-grained deposits. Where there were no coarse-grained deposits, the specific yield was 0.09. Where the deposits are all coarse-grained, the specific yield was 0.40. The median and average values are 0.23 and 0.24, respectively, well within previously estimated values of specific yield (Faunt et al., 2009).
- The specific storage is calculated by calculating the weighted arithmetic mean of the percentage of coarse- and fine-grained sediments multiplied by the assigned porosity for each texture. This value is then multiplied by the compressibility of water (1.4×10^{-6} per foot) to determine the specific storage.

This method for estimating aquifer properties using the USGS Sediment Texture Analysis approach has been applied successfully in previous groundwater-flow models in the San Joaquin Valley (Phillips and Belitz, 1991; Belitz et al, 1993; Burow et al., 2004; Phillips et al., 2007). The value of using the CVHM aquifer properties derived from the USGS Sediment Texture Analysis in the Superposition Model is that the aquifer properties are derived from a comprehensive regional analysis based on a consistent set of geologic data and developed by technically-credible methods.

B.2 SUPERPOSITION MODEL SETUP

The Superposition Model is derived from the CVHM, which covers the entire Central Valley. The CVHM was developed using the MODFLOW One-Water Hydrologic Flow Model (OWHM), which utilizes the MODFLOW-2005 Farm Process Package (FMP2) (Schmid and Hanson, 2009). The Superposition Model does not use FMP2, so the Superposition Model is setup to run in MODFLOW 2005 with the Groundwater Vistas version 6 MODFLOW interface. Length units in the Superposition Model were converted from meters, used in the CVHM, to feet for convenience of analysis.

B.2.1 Model Setup

The Superposition Model covers all of the Study Area as well as areas outside the Study Area. The eastern, southern and western boundaries are extended to natural basin boundaries where the alluvial sediments terminate against bedrock units. The northern boundary extends into portions of Kings and Tulare counties (**Figure B-2**). The final selection of the northern boundary was determined through an iterative process of evaluating initial model results so that the boundary was sufficiently far from Project-related actions to have minimal effect on the analysis of groundwater impacts (Todd Groundwater, 2017).

The Superposition Model was setup to run in MODFLOW 2005 using the model data processor Groundwater Vistas version 6 MODFLOW interface (ESI, 2011). Model grid dimensions, aquifer properties, and boundaries for the Superposition Model were derived directly from the CVHM (Faunt et al., 2009). For the conversion of the CVHM to the Superposition Model, the following changes were made:

- Length units, including all model dimensions and aquifer properties, used in the model were converted from meters used in the CVHM to feet for convenience for analysis.

- The model grid spacing was refined by a factor of four (4), from 5,280 feet to 1,320 feet, to improve the spatial resolution of the simulated groundwater level changes related to the Proposed Project. This results in a 16-fold increase in grid spacing compared to CVHM, with each new model cell 40 acres in size. This grid spacing increases the resolution for assessing drawdown and mounding during the model simulations.

B.2.2 Model Domain

The CVHM (Faunt, 2009) simulates groundwater flow over the entire Central Valley. For the Superposition Model, the model domain needed to cover the Study Area and sufficient areas beyond the Study Area so that boundary effects did not influence simulation results. For the western, southern and eastern boundaries of the Superposition Model , the model domain could be extended to the natural boundary of the Central Valley Aquifer that represents the transition from the alluvial sediments in the Central Valley to the bedrock units of the surrounding Coast Range, Tehachapi Mountains and Sierra Nevada. Using the natural boundaries is preferable because the model can simulate the natural boundary effects associated with the margin of the groundwater basin.

To the north and northwest, the CVHM extends hundreds of miles beyond the Study Area. To reduce the computational overhead of simulating areas unnecessary for this analysis, a standard modeling technique was applied for defining a constant head boundary at a distance sufficiently distant from the Study Area so that the constant head boundary would not influence groundwater simulations in the Study Area. Using the MODFLOW processor Groundwater Vistas (Version 6) (ESI, 2011), the Telescopic Mesh Refinement (TMR) feature was used to setup a more refined model within a subregion of the larger-scale model. The northern boundary of the Superposition Model was selected as shown on **Figure B-2**.

Using the TMR process, the model grid spacing was changed from 5,280 feet to 1,320 feet, reducing each model cell to 40 acres in size. This grid spacing increases the resolution for assessing drawdown and mounding during the Superposition Model simulations.

B.2.3 Model Layering

The CVHM characterizes the Central Valley aquifers with ten model layers (**Figure B-1**). Given the prevailing hydrostratigraphy within the Project Area and the objectives of the impact analysis, these ten layers were grouped together within the Superposition Model to form four model layers as follows to simplify the analysis and presentation of model results:

- Superposition Model Layer 1 groups together CVHM model layers 1, 2 and 3 to simulate the Shallow Aquifer above the local regional confining layers in Kern County.
- Superposition Model Layer 2 groups together CVHM model layers 4 and 5 to simulate an interval with increased clay layers, including the E-clay member of the Tulare Formation, the 300-foot clay, or the local equivalent, that locally can form an aquitard limiting vertical flow.
- Superposition Model Layer 3 groups together CVHM model layers 6 and 7 to simulate the main production zone for the Deep Aquifer in Kern County.
- Superposition Model Layer 4 groups together CVHM model layers 8, 9 and 10 to simulate the lower portions of the Deep Aquifer in Kern County that is generally below the primary production zone.

Following the process outlined by Reilly et al. (1987), Model Layer 1 was defined as the top of the groundwater surface: its initial value was set to zero so that calculations made with the model would directly represent the change from the initial condition, consistent with the use of superposition methods. The thickness of the model layers represents the saturated thickness below the top of the groundwater surface.

The upper surface of the Superposition Model was defined as the water table prior to January 1997. The CVHM simulation results for December 1996 groundwater elevations were used to define the top of Model Layer 1. Areas along the margin of the groundwater basin where the 1997 water table was below the bottom of a Superposition Model layer were considered to be unsaturated and were converted to No Flow cells in the Superposition Model.

Also, following the process outlined by Reilly et al. (1987), the top surface of the Superposition Model was set to have a zero groundwater elevation. Therefore, the bottom elevations of the Superposition Model layers represent the saturated aquifer thicknesses as of December 1996. A spreadsheet process was used to calculate the depth of the appropriate CVHM model layer elevation below the upper surface of the Superposition Model.

B.2.4 Aquifer Properties

A key criterion of selecting CVHM as the Base Model was to take advantage of the comprehensive USGS Sediment Texture Analysis (Faunt et al., 2009) to develop the spatial distribution of aquifer properties. Accordingly, final aquifer properties were extracted from the CVHM and applied to the Superposition Model in a manner to preserve the hydraulic characteristics.

This step required that the aquifer properties from the 10-layer CVHM model be composited and mapped to the 4-layer Superposition Model using standard procedures for calculating the equivalent property values in a layered aquifer system (Todd and Mays, 2004; Bear and Verruijt, 1987; Freeze and Cherry, 1979; Bouwer, 1978). The key aquifer properties extracted from CVHM include:

- Horizontal Hydraulic Conductivity (K_H) assumes groundwater flow is generally parallel to the geologic layering; therefore, the equivalent K_H was calculated using a thickness-weighted average following the above referenced standard procedures. As a result, the equivalent K_H was determined mainly by the layers with the highest K_H values.
- Vertical Hydraulic Conductivity (K_Z) assumes groundwater flow is generally perpendicular to the geologic layering; therefore, the equivalent K_Z was calculated using a harmonic mean following the above referenced standard procedures. As a result, the hydraulic resistances of the layers are additive, so that the equivalent K_Z was mainly determined by the layers with the lowest K_Z values.
- Specific Storage (S_S) assumes that the porosity remains nearly constant, therefore, the equivalent specific storage was calculated using a thickness-weighted average following the above referenced standard procedures.

For the Superposition Model, the aquifer properties of hydraulic conductivity and aquifer storage are derived directly from the CVHM. A key part of using CVHM is to take advantage of the USGS Sediment Texture Analysis (Faunt et al., 2009) used to develop the spatial distribution of aquifer properties from a comprehensive analysis of geologic data from well logs. The final aquifer properties used for the CVHM were extracted and applied to the Superposition Model in a manner to preserve the hydraulic characteristics. These aquifer properties include:

- Horizontal Hydraulic Conductivity (K_h)
- Vertical Hydraulic Conductivity (K_z)
- Specific Storage (S_s)

To correlate the aquifer properties from multiple CVHM model layers to the Superposition Model model layers, standard techniques were applied for calculating aquifer properties in layered aquifer systems. For determining the equivalent K_h for a layered aquifer, a weighted average based on layer thickness was applied (Todd and Mays, 2004; Bear and Verruijt, 1987; Freeze and Cherry, 1979; Bouwer, 1978) using the following equation:

$$\mathrm{K_h} = \sum \frac{K_i\, d_i}{d} \qquad (B1)$$

where K_h = horizontal hydraulic conductivity of the multilayer system
K_i = horizontal hydraulic conductivity of an individual layer within the multilayer system
d_i = thickness of an individual layer within the multilayer system
d = thickness of the entire multilayer system.

Equation B1 states that the K_h of the multilayer system is equal to the sum of the product of the K_h times the percentage thickness of the layer to the total thickness of the multilayer system. In other words, the contribution of each layer to the composite K_h is the proportional to its thickness relative to the total thickness. This same process can also be used for calculating the composite values for the storage properties of S_y and S_s.

K_z requires use of a different equation. For determining the equivalent K_z for a layered aquifer, a harmonic mean is applied (Todd and Mays, 2004; Bear and Verruijt, 1987; Freeze and Cherry, 1979; Bouwer, 1978) using the following equation:

$$K_\mathrm{z} = \frac{d}{\sum {d_\mathrm{i}}/{K_\mathrm{i}}} \qquad (B2)$$

where K_z = vertical hydraulic conductivity of the multilayer system
K_i = vertical hydraulic conductivity of an individual layer within the multilayer system
d_i = thickness of an individual layer within the multilayer system
d = thickness of the entire multilayer system.

For the vertical groundwater flow, *Equation B2* calculates K_z as the total thickness of the multilayer system divided by the summation of the layer thickness divided by the K_i of the individual layer. In this manner, the K_z calculated by *Equation B2* is controlled by the most resistive layer to groundwater flow. In physical terms, a single continuous clay layer can strongly limit vertical groundwater flow and form a confining layer. Therefore, a single clay layer has a strong influence on determining the K_z. A high K_z would require a continuous vertical sequence of permeable sediments without intervening clay layers.

The equivalent aquifer properties were calculated for each model layer following the referenced standard procedures (Todd and Mays, 2004; Bear and Verruijt, 1987; Freeze and Cherry, 1979; Bouwer, 1978). The calculation was performed for the center point of each CVHM grid. A natural neighbor interpolation method was applied to distribute the aquifer properties from CVHM to the refined Superposition Model grid to preserve the CVHM aquifer properties. In CVHM, the aquifer properties from the USGS Sediment Texture Analysis were input into the MODFLOW Layer Property Flow Package and then modified using the MODFLOW Multiplier File, which applies multiplier arrays to modify aquifer properties during calibration. Therefore, the final aquifer properties were derived from the output files rather than the input files.

The aquifer properties and thicknesses from the appropriate CVHM model layers were tabulated, and the calculation for each aquifer property was done on a cell-by-cell basis. The thicknesses were calculated relative to the December 1996 groundwater surface to represent the saturated thickness. Only those portions of the aquifer below the December 1996 groundwater surface were included in the calculation. The average value for each of the primary aquifer properties by model layer used in the original Superposition Model based on the original CVHM values is listed in **Table B-1**.

Table B-1 Spatial Average of Aquifer Properties Derived from Original CVHM

Aquifer Property	Model Layer 1	Model Layer 2	Model Layer 3	Model Layer 4
Saturated Thickness (ft)	267	31	334	1,050
Horizontal Hydraulic Conductivity (ft/d)	180	0.8	56	33
Vertical Hydraulic Conductivity (ft/d)	0.20	0.0006	0.046	0.01
Specific Storage (1/ft)	3.4×10^{-04}	2.8×10^{-07}	3.7×10^{-07}	3.6×10^{-07}

B.2.5 Boundary Conditions

For the conversion of CVHM to the Superposition Model, "background" boundary conditions (i.e., inflows and outflows not associated with the Proposed Project) were removed (as per Reilly et al., 1987). This step is consistent with the principle of superposition in that the result of multiple stresses on an aquifer system is equal to the sum of the results of the individual stresses. Therefore, the boundary conditions for recharge, evapotranspiration, pumping wells, and farm processes present in the CVHM were not included in the Superposition Model since these parameters do not change as a result of the Proposed Project.

The superposition methodology requires that most of the existing CVHM boundary conditions be either removed from the simulation, set to an initial value of zero (representing no change at the beginning of the calculations) or otherwise modified such that the Proposed Project changes that are to be superimposed on the system are the only deterministic stresses that are placed upon the model. The exceptions are natural boundaries that may influence Project conditions. The boundary conditions used in the Superposition Model include the following:

- The constant head boundary placed along the northern model boundary represents the interaction with the Central Valley Aquifer to the north (**Figure B-2**). The constant head boundary was set to an elevation of zero, consistent with the superposition methodology.
- Streams, including the Kern, White and Tule rivers were converted from the Streamflow Routing Package to the Drain Package. The Drain Package allows groundwater to exit to the surface if groundwater levels rise to the level of the streambed but does not allow for induced recharge from the streams to the aquifer. Since changes to stream recharge from the Proposed Project are simulated using the MODFLOW Recharge Package, the use of a passive drain provides a means to allow groundwater discharge to the simulated rivers. The streambed elevations were modified to represent the relative height of the streambed above the top of the initial groundwater surface following the superposition methodology (Reilly et al., 1987).
- Geologic faults in the CVHM were remapped onto the finer grid of the Superposition Model, and the same aquifer properties were applied to the faults as in the original model.

- Initial conditions were taken directly from the CVHM simulation results for December 1996 to accommodate the initial month of the Study Period (January 1997).

Boundary conditions for remaining boundaries included in the CVHM (e.g., recharge, evapotranspiration, pumping wells, and farm processes) were removed from the Superposition Model. The assumption is that these conditions will remain the same during the Proposed Project; therefore, following the Principle of Superposition (Reilly et al., 1987), the Superposition Model does not include them in the simulation. Boundary conditions representing faults in the CVHM were remapped onto the finer grid of the Superposition Model. The same aquifer properties were used to define the fault flow properties. As noted above, a constant head boundary was placed at the northern boundary of the Superposition Model to simulate interactions of subsurface groundwater flow in the Central Valley outside of the Superposition Model.

Streams were simulated using the Streamflow Routing (SFR) Package in CVHM. In the Superposition Model domain, the CVHM simulated the Kern, White and Tule rivers. These rivers are generally situated above the top of the groundwater surface except at their westernmost extent; however, these rivers typically are not flowing across the valley. Therefore, the rivers were converted to the MODFLOW drain package. The drain package allows groundwater to exit from the aquifer to the streambed but does not allow for induced recharge from the streams to the aquifer. This is considered a realistic representation of actual river conditions across the valley and provides a conservative assessment of impacts to groundwater elevations. Following the process outlined by Reilly et al. (1987), the elevations of the drain package were modified to represent the vertical distance between the bottom of the riverbed and the top of the Superposition Model.

B.3 Modifications for BVWSD Palms Model

The Superposition Model was further modified to accommodate the requirements for simulating the Recovery Project (**Figure B-3**). The following describes the changes that were made.

For the Recovery Project the model grid in the vicinity of the Recovery Project was reduced 6-fold relative to the previous Superposition Model used for the KDWD SEIR (Todd Groundwater, 2017). The purpose of this change was to provide sufficient grid density, or calculation points, to define the drawdown from the combined Recovery Project wellfield. The grid size over the Palms Site was reduced from 1,320 feet to 220 feet (**Figure B-4)**. As shown on **Figure B-4**, the model grid was reduced in three stages from the areas with a 1,320-foot grid spacing to areas with 220-foot grid spacing. This represents a 24-fold increase in grid density compared to the original 5,280-foot grid spacing in the original CVHM (Faunt et al., 2009) version of the model. The purpose of this was to make the transition more gradual so as not to introduce model instability or unnecessarily long run times.

The Elk Hills are an area where older sedimentary rocks crop out at the surface. These older sedimentary rocks correlate to strata that occur significantly deeper below the Recovery Project site. Because of the original coarse grid size in the CVHM, the delineation of the Elk Hills was not highly accurate. However, for simulating the Recovery Project, this boundary needed a higher degree of accuracy. The area of inactive model cells in Model Layer 1 was remapped to match the change in topographic slope noted on satellite images of the Recovery Project area. The current boundary with the Elk Hills is shown in **Figure B-4**.

Based on the validation to the WKWD data set (see **Attachment C**), the horizontal and vertical hydraulic conductivity in Model Layer 1 was reduced by 80 percent over the western portion of Kern County essentially to the west of Interstate 5 (**Figure B-5**). The specific storage was increased by 34 percent over the same area. The basis for this change to the aquifer parameters is twofold. First, a similar type of modification was made in the development of CVHM specific areas and layers to improve the model calibration (Faunt et al., 2009). This provided a mechanism to correct the texture model (Faunt, 2009) calculations which were limited due to a lack of data in the western areas of the Central Valley. Several similar examples of this type of approach was used in areas north of Kern County (Faunt et al., 2009). Second, it is assumed that a lack of calibration data in western Kern County was due to poor water quality limiting the number of wells. Therefore, the change in the Model Layer 1 horizontal hydraulic conductivity to better match drawdowns at the WKWD facility is warranted. Additional discussion of the validation scenarios used as the basis for making these modifications to the aquifer properties is provided in **Attachment C**.

B.4 References

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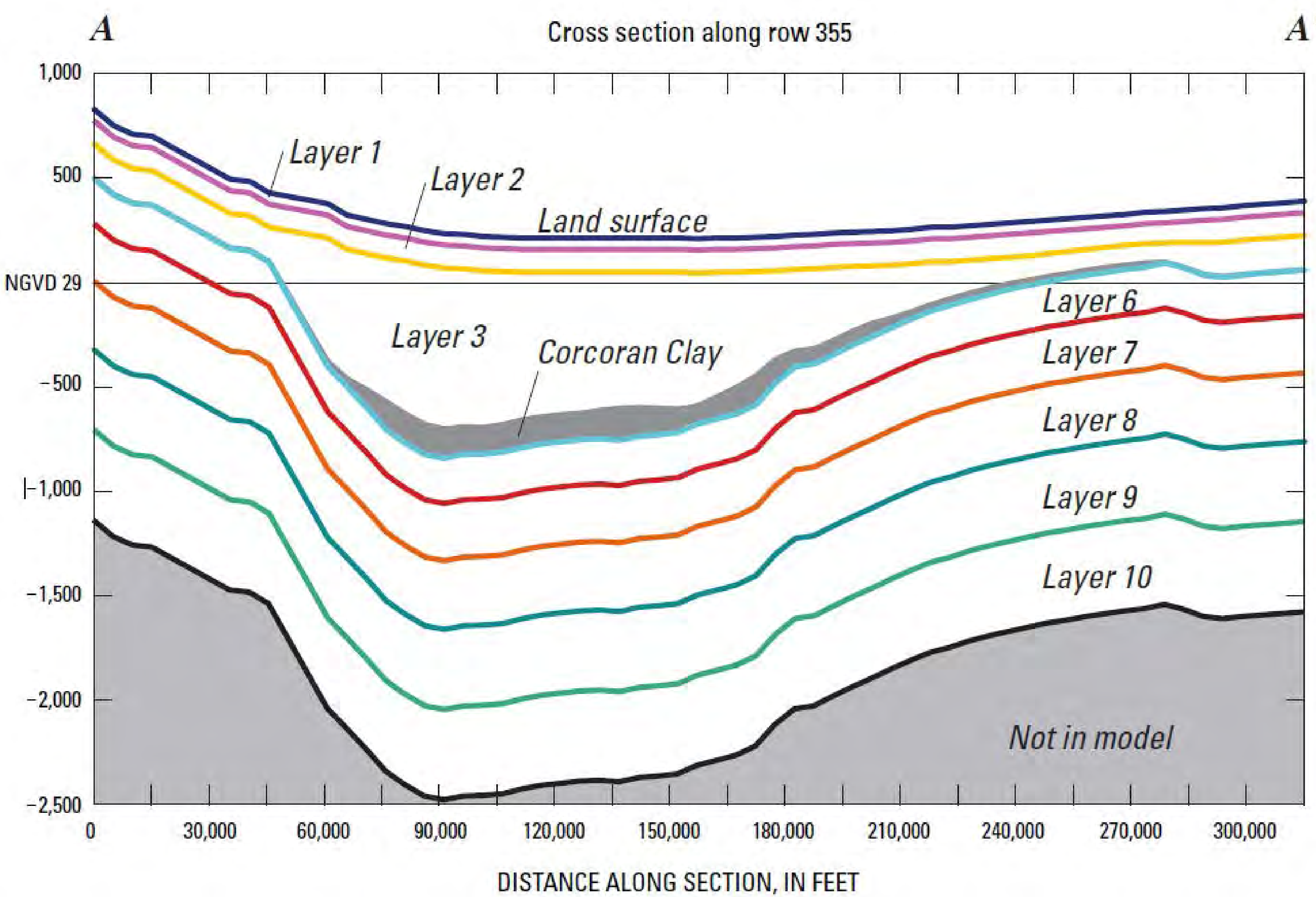
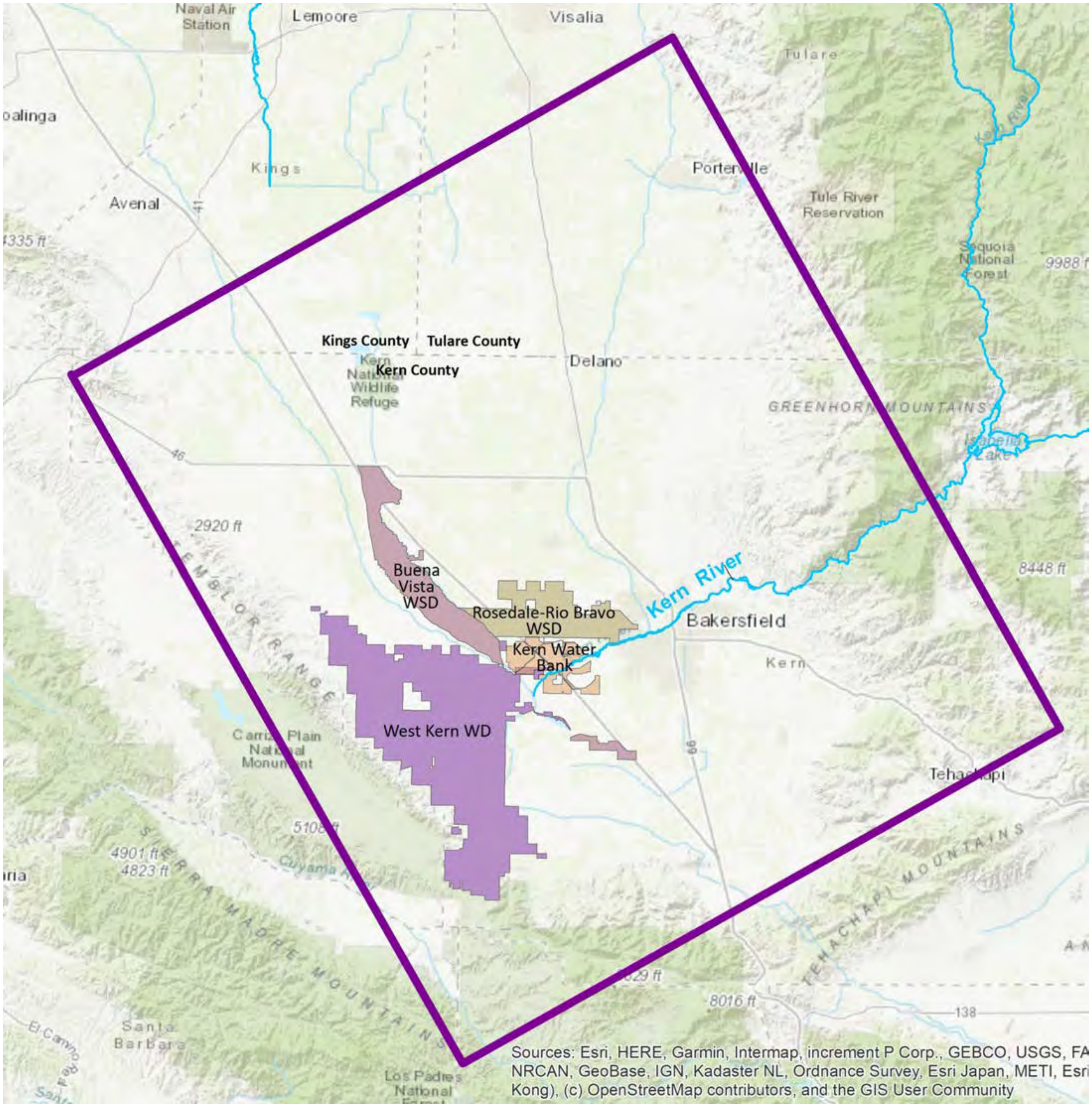
ATTACHMENT B

FIGURES



November 2020	Figure B-1 Conceptual Cross Section Showing Model Layers in USGS Central Valley Hydrologic Model
TODD GROUNDWATER	



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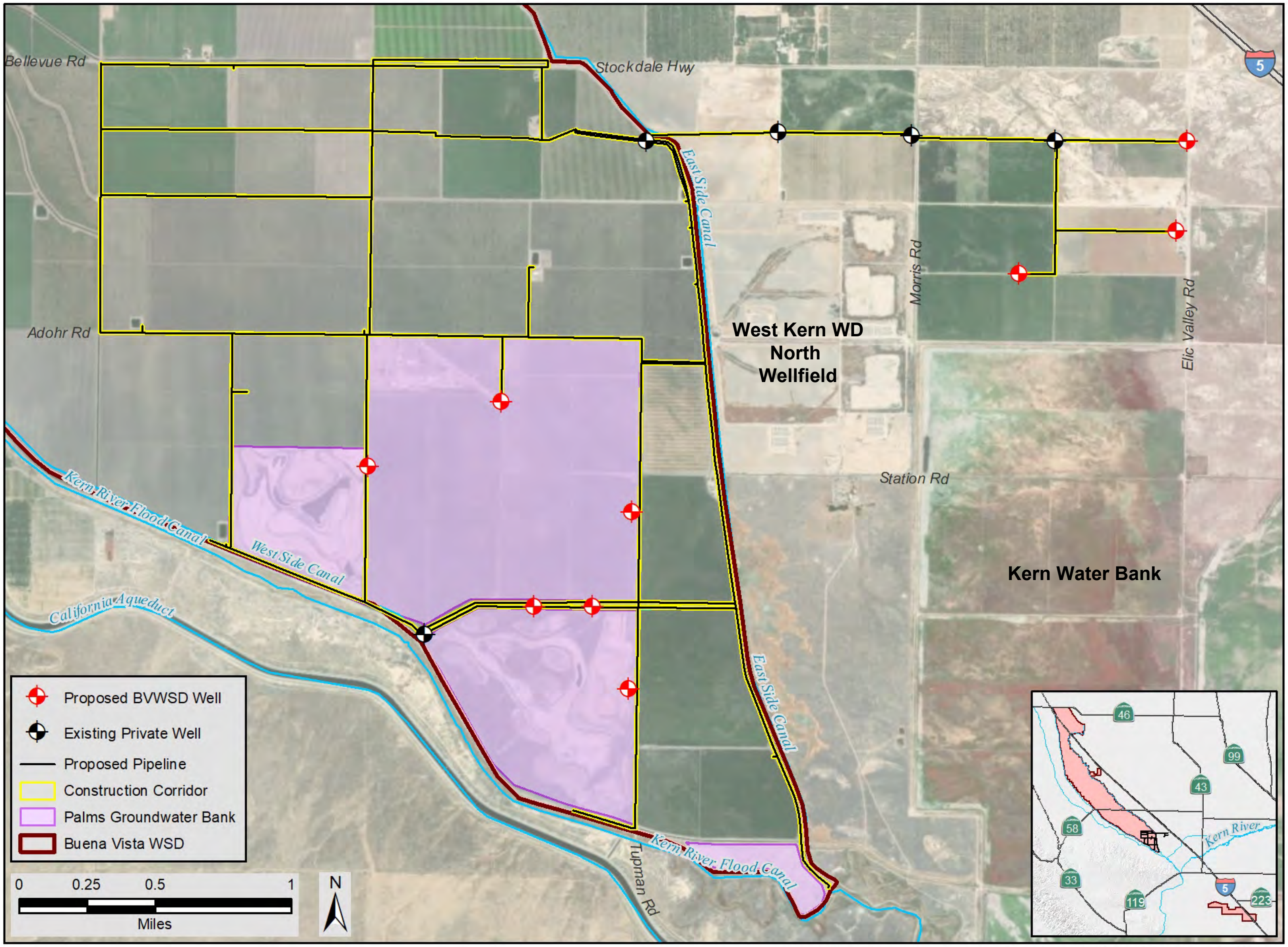
0 5 10

Scale: Miles

November 2020

TODD GROUNDWATER

Figure B-2
Kern County Superposition Model Domain



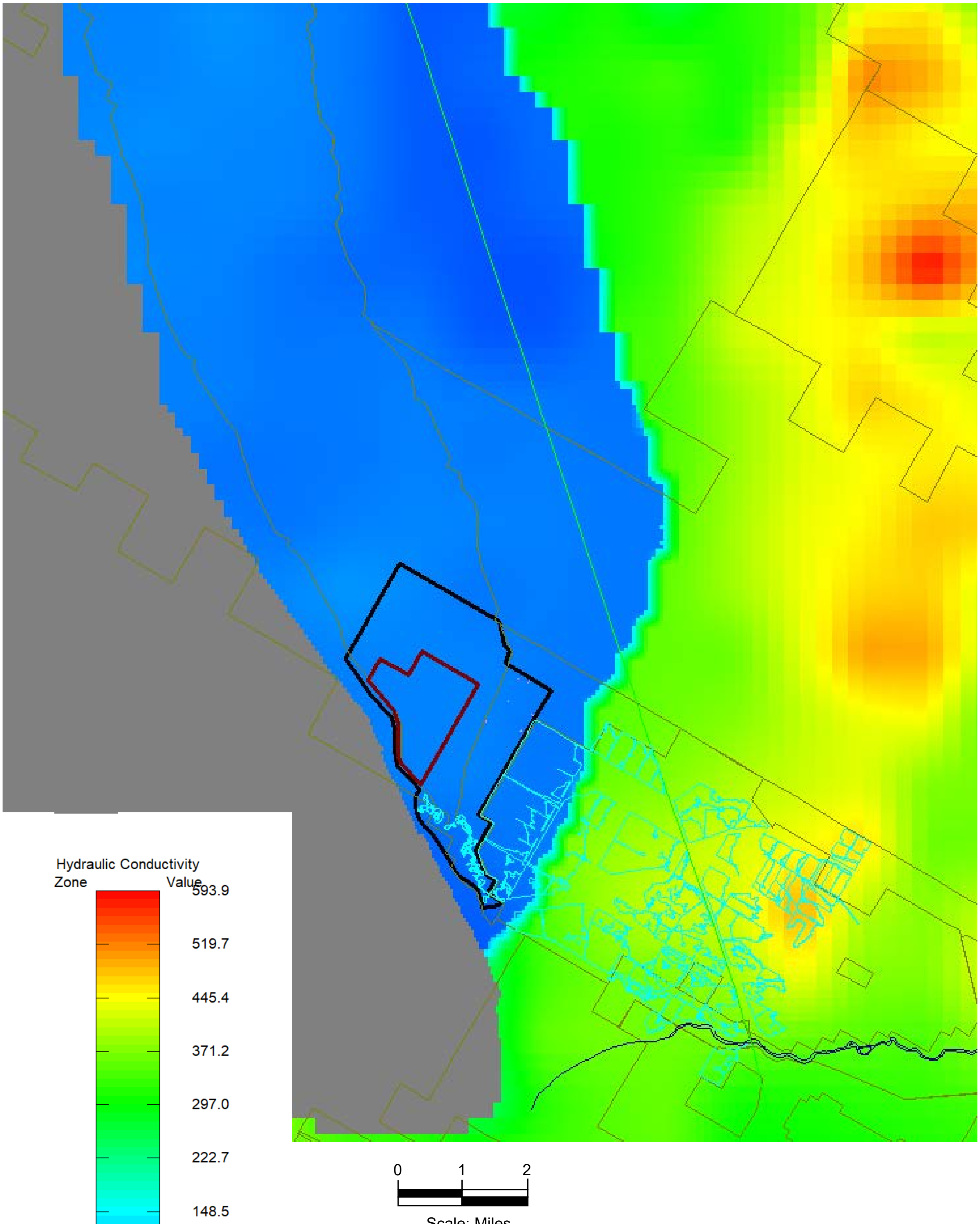
05Mar2020 RS Z:\Projects\1610807_BV-Palm Springs\1610807_G008_ProjectLocation.mxd

November 2020	Figure B-3 BVWSD Palms and Recovery Project Layouts
TODD GROUNDWATER	

November 2020

TODD GROUNDWATER

Figure B-4
Superposition Model Grid and Active Simulation Area



November 2020

TODD GROUNDWATER

Figure B-5
Horizontal Hydraulic Conductivity in Model Layer 1

ATTACHMENT C

RECOVERY PROJECT MODEL VALIDATION

C. RECOVERY PROJECT MODEL VALIDATION

A validation analysis was performed for the Superposition Model by comparing simulations results to field measured groundwater level data and comparing those to a similar set of residuals from the Superposition Model. The validation analysis assesses of the relative uncertainty of the Superposition Model results for simulating observed changes in groundwater levels. The section documents the results of model validation analyses performed on the superposition model used for the Recovery Project.

C.1 MODEL VALIDATION APPROACH

Although the underlying CVHM Base Model was calibrated by the USGS to data obtained throughout the Central Valley – presumably using reasonable care in developing the geologic framework and determining aquifer properties – it is appropriate to demonstrate that the use of the Superposition Model built from the CVHM for the specific objectives of this impact analysis reasonably reproduces historical groundwater level changes. To achieve this, a series of validation scenarios were developed to test the ability of the Superposition Model to simulate changes in groundwater levels resulting from local groundwater pumping and recharge in the vicinity of the Recovery Project based on a comparison to field-measured groundwater level data.

The objective of the validation scenarios was to assess whether the CVHM was appropriately simulating changes in groundwater levels as a result of groundwater recharge or pumping in the vicinity of the Recovery Project. A validation analysis was performed for the Superposition Model by comparing field measured groundwater level data to simulated change in groundwater levels from the Superposition Model. The approach was to evaluate cases where a reasonably clear cause-and-effect relationship could be established of a change in groundwater levels in response to pumping or recharge without being overly influenced by other aquifer stresses. For this, three validation scenarios were developed and are discussed in more detail in the following sections:

1. WKWD Validation Scenario #1
2. WKWD Validation Scenario #2
3. Kern Water Bank (KWB) Validation Scenario.

The following section summarizes the validation scenario setup and results.

C.2 WEST KERN WATER DISTRICT (WKWD) VALIDATION SCENARIO

To validate the model to groundwater pumping in the area, a validation scenario was developed based on aquifer test data from the West Kern Water District (WKWD) North Wellfield that is located adjacent to the Recovery Project (**Figure C-1**). The overall approach was to assess the ability of the model to simulate these condition consistent with the application of a screening-level model assessment.

C.2.1 2011 WKWD Aquifer Tests Analysis

For the WKWD validation scenarios, aquifer testing data from five groundwater extraction wells in WKWD North Wellfield was used (**Figure C-1**). These include:

- NW-1 – screened at depth of 270 to 570 feet in upper aquifer (RCS, 2011a)
- NW-2 – screened at depth of 650 to 980 feet in lower aquifer (RCS, 2011b)
- NW-3 – screened at depth of 245 to 545 feet in upper aquifer (RCS, 2011c)
- NW-4 – screened at depth of 220 to 540 feet in upper aquifer (RCS, 2012), and
- NW-5 – screened at depth of 220 to 540 feet in upper aquifer (RCS, 2011d).

The four wells completed in the upper aquifer are screened in an equivalent zone to the proposed Recovery Project wells. The fifth well, NW-2, is completed in a deeper zone that is considered to be below a regional confining layer that separates the upper and lower aquifers in this area.

Following well installation, 24-hour aquifer tests were run on each well and the change in groundwater levels were monitored in the pumping well during the test. However, measurements from the pumping well are affected by well efficiency. Aquifer test data can be used to determine the specific capacity of the well for operational matters; however, the well efficiency makes for a higher uncertainty for defining aquifer properties. Response of the aquifer and definition of aquifer properties are best defined by monitoring the change in groundwater levels at a nearby monitoring well. For three of the aquifer tests, the change in groundwater level data was collected from other wells. The aquifer test results from the WKWD North Wellfield wells from non-pumping well is summarized in **Table C-1**.

Table C-1 - WKWD Aquifer Test Summary and Analytical Analysis

Pumping Well	Monitor Well	Distance	Trans-missivity	Storage Coefficient	Pumping Rate	Measured Drawdown - 24 hours	Calculated Drawdown - 24 hours	Calculated Drawdown - 6 months
		(feet)	(gpd/ft)	dimensionless	(gpm)	(feet)	(feet)	(feet)
NW-1	NW-5	2,348	264,400	1.10E-03	2,995	3.0	3.4	10.1
NW-3	NW-1	2,705	189,400	6.00E-04	2,500	5.3	3.9	11.7
NW-3	NW-5	2,351	189,400	6.00E-04	2,500	4.6	4.3	12.2
NW-4	NW-1	4,035	150,200	1.00E-03	2,536	1.8	2.3	12.0
NW-4	NW-3	1,582	150,200	1.00E-03	2,536	5.7	5.7	15.6
NW-4	NW-5	2,699	150,200	1.00E-03	2,536	2.5	3.7	13.6

The drawdown from a pumping well can be estimated using standard analytical equations. For this analysis, drawdown was calculated using the Theis equation for non-steady radial flow into a well from an aquifer of uniform thickness and infinite areal extent (Todd and Mays, 2004; Kruseman and de Ridder, 1994; Freeze and Cherry, 1979; Lohman, 1972). For this application, it is considered appropriate to use the confined solution of the Theis equation (Lohman, 1972). The Theis equation is stated as *Equation C1* below:

$$\Delta h = \frac{Q}{4\pi T} W(u) \qquad (C1)$$

where Δh is the change in groundwater levels or drawdown after a period of pumping from the pumping well, *Q* is the discharge rate from the aquifer into the well, *T* is the aquifer transmissivity, and *W(u)* is the well function.

The well function *W(u)* represents an integral that cannot be solved directly, but its value is given by the infinite series (Lohman, 1972; Kruseman and de Ridder, 1994) as shown in *Equation C2*:

$$W(u) = -0.577216 - ln(u) + u - \frac{u^2}{2*2!} + \frac{u^3}{3*3!} - \frac{u^4}{4*4!} + \cdots \qquad (C2)$$

The variable *u* in *Equation C2* is defined by *Equation C3* stated below (Lohman, 1972; Kruseman and de Ridder, 1994):

$$u = \frac{r^2 * S}{4Tt} \qquad (C3)$$

where *r* is the distance to an observation well, *S* is the storage coefficient, *T* is transmissivity and *t* is time since the start of pumping.

The calculation of the well function (*W(u)*) in *Equation C2* is needed to solve *Equation C1*. Determination of the variable *u* in the well function requires several input data parameters as shown in *Equation C3*. Most of these parameters can be taken directly from the provided data sets. For the change in groundwater levels, the change was calculated individually for each pair of pumping well to observation locations by applying *Equation C1*.

The aquifer tests were for 24 hours, so the calculated drawdown for 6 months is calculated (**Table C-1**) using the method described above. The calculated drawdown for 24 hours is provided to verify that the calculation is performing correctly (**Table C-1**). Differences between the measured and calculated drawdowns are related to variability associated with the curve-fitting aspects of applying the Theis equation. The 6-month drawdown was calculated to provide some guidance in understanding the expected drawdown from operating large groundwater recovery wells at the WKWD North Wellfield, due to its close proximity to the Recovery Project.

C.2.2 WKWD Validation Scenario #1

One method to validate a model is to compare an analytical calculation to the numerical model results. These represent different solutions to the same basic groundwater flow equation; however, the analytical method applies a uniform set of aquifer properties over an aquifer of infinite areal extent whereas the numerical model allows for the spatial variation of the aquifer properties and applied boundary conditions. As a result, the analytical method cannot fully represent the entire numerical model. Therefore, the comparison is performed where there is a clear cause-and-effect relationship. In this case, the analytical method was used to evaluate drawdown from pumping for a period of six months.

To validate the model to groundwater pumping in the area, the approach was to use the results of another model developed based on local aquifer tests for the WKWD Groundwater Banking Project (GEI, 2009) located just north of the Recovery Project. The overall approach was to be consistent with a nearby analysis as an initial screening-level assessment.

The GEI (2009) groundwater model simulation was conducted using the analytical computer model *WinFlow* (by Environmental Simulations, Inc.) to simulate recharge mounding and groundwater level drawdown effects caused by Project recharge and pumping, respectively. The model is based on local aquifer characteristics developed for the WKWD site. A hydraulic conductivity of 61 ft/day and a storage coefficient of 0.008 were used for the simulation. The scenario consisted of nine production water wells, each well pumping at a rate of 2,000 gallons per minute (gpm). For the proposed maximum annual recovery of 24,000 AFY this would require pumping for approximately 300 days (GEI, 2009). The resulting drawdown for this simulation is provided as the left panel on **Figure C-2**.

A comparable scenario was set up in the Superposition Model. The initial scenario produced significantly lower drawdowns for the simulated pumping as compared to the WKWD simulations. The horizontal hydraulic conductivity was modified over the Recovery Project area by a percentage applied to hydraulic conductivity from the original CVHM model. This approach is consistent with the aquifer parameter modifications made in the calibration of CVHM. The aquifer parameters were modified by a set percentage factor to improve the model calibration (Faunt, Hanson, and Belitz, 2009). These percentage factors were developed for several specific areas and layers. This was to provide a mechanism to correct the texture model calculations (Page, 1986; Burow et al., 2004) which were limited due to a lack of data in the western areas of the Central Valley. Several similar examples of this type of approach were used in areas north of Kern County (Faunt, Hanson, and Belitz, 2009).

The process was repeated until a reasonable match to the WKWD simulation results was produced. The right panel of **Figure C-2** shows the resulting comparison of WKWD simulations to the Superposition Model. There is a generally good agreement for the area of maximum drawdown of greater than 20 feet in the vicinity of the WKWD pumping wells. Likewise, there is relatively good agreement with the 15-foot drawdown contour. This indicates that the Superposition Model provides a reasonable simulation of drawdowns near the pumping wells. The Superposition Model 5- and 10-ft drawdown contours lie outside of the WKWD simulation results for those same contours. This indicates that the Superposition Model will provide a relatively conservative assessment of drawdowns in areas away from the pumping wells.

C.2.3 WKWD Validation Scenario #2

A second validation scenario was developed based on data provided by WKWD in June 2020. Based on these data, a validation scenario was developed from October 2012 through December 2014. The scenario consisted of the following:

- Monthly groundwater pumping volumes for the five WKWD North Wellfield wells from November 2012 through December 2014.
- Groundwater levels for the five WKWD North Wellfield wells and six monitoring wells from July 2012 through January 2020.

Developing an appropriate validation scenario is challenging in a heavily operated groundwater basin because validation requires simulating a set of historical groundwater stresses that show a clear cause and effect relationship. In reviewing the groundwater level data, it became clear that the groundwater level declines were greater than might be predicted based on the WKWD North Wellfield aquifer test data (**Table C-1**). The period from November 2012 through December 2014 was the beginning of a regional drought and groundwater banking operations to the east of the Recovery Project conducted extensive groundwater recovery operations. Therefore, as part of the validation scenario, groundwater banking recovery pumping from the following Kern County Subbasin banks from this period was added to the validation scenario:

- Kern Water Bank
- Rosedale-Rio Bravo
- Buena Vista Water Storage District
- West Kern Water District
- Semitropic Water Storage District
- Pioneer Project, and
- Berrenda Mesa project.

During the period from October 2012 through December 2014, a total of approximately 1.8 million AF of groundwater was pumped by the various Kern County Subbasin groundwater banking recovery operations. During that same period, groundwater pumping from the five WKWD North Wellfield wells was 18,728 AF, which is approximately 0.1 percent of the total groundwater pumping for that period.

The actual measured change in groundwater levels that occurred within the aquifer is observed from 454 groundwater level measurements collected from 5 pumping wells and six monitoring wells located in and around the WKWD North Wellfield. The measured change in groundwater levels is calculated as the difference of the measured groundwater elevation during the simulation period minus the groundwater elevation from October 2012, prior to pumping by the WKWD North Wellfield wells. For wells with data that did not extend back that far, an October 2012 groundwater level was interpolated based on the changes observed in other wells in WKWD and adjacent areas.

For each of these 11 locations, the simulated groundwater level change was compared to the calculated groundwater level change based on the measured data for that well. **Figures C-3** and **C-4** provide a representative set of hydrographs from four pumping wells and four monitoring wells screened in the upper aquifer. A comparison of simulated and measured groundwater level changes shows a reasonable agreement with the overall timing and magnitude of the groundwater level changes associated with the groundwater pumping at the WKWD North Wellfield wells and from the other groundwater bank recovery pumping occurring in the Kern County Subbasin.

In addition to visual comparisons such as presented in **Figure C-3 and C-4**, the difference between the measured and simulated change in groundwater levels at the monitoring locations (referred to as the residual) was evaluated using summary statistics similar to those commonly used to evaluate model calibration, as follows:

- The residual mean is computed by dividing the sum of the residuals by the number of residual data values. The residual mean tests whether the model results are biased towards over- or underestimating groundwater levels. The residual mean for this validation scenario is -19 feet. The closer this value is to zero, the better the validation.
- The absolute residual mean is a measure of the overall error in the model. The absolute residual mean is computed by taking the square root of the square of the residuals and dividing that by the number of measurements. The absolute residual mean for this validation scenario is 27 feet.
- The ratio of the absolute residual mean divided by the range of observed groundwater elevations provides a means to assess the absolute residual mean in context with the scale of the simulation. The ratio for the validation scenario is 0.14 feet. Typically, a validation is considered good when this ratio is below 0.15 (ESI, 2011).

The statistical results provide an assessment of the relative uncertainty of the Superposition Model results for simulating observed changes in groundwater levels. Considering these results in context with the overall range of measurements of 198 feet, the residual mean of -19 feet represents a relative percentage difference of 9.5 percent. For the absolute residual mean of 27 feet, the average percentage difference is 14 percent. Much of the uncertainty is the highly variable groundwater levels from the pumping wells. By using monthly pumping volumes, the model does not have sufficient data to simulate the short-term drawdowns. In addition, the model does not simulate additional drawdown due to well efficiency. In spite of these limitations, the WKWD Validation Scenario #2 demonstrates that the Superposition Model, using the modified CVHM aquifer properties, is able to reasonably simulate the relative change in groundwater levels when the reported recharge volumes for the groundwater banking projects are used.

C.2.4 Model Modifications Resulting from WKWD Validation Scenarios

Validation scenarios #1 and #2 resulted in a change in aquifer hydraulic conductivity and specific storage in select areas of the model. Theis approach to modifying the model corresponds to the methodology used to make a similar modification in CVHM where specific areas and layers were modified by a set percentage factor to improve the model calibration (Faunt, Hanson and Belitz, 2009). This was used to provide a mechanism to correct the texture model (Faunt, 2009) calculations which were limited due to a lack of data in the western areas of the Central Valley. Several similar examples of this type of approach in areas north of Kern County (Faunt, Hanson and Belitz, 2009).

The modification of aquifer properties was applied over the western portion of Kern County essentially to the west of Interstate 5 (**Figure B-5**). It is assumed that a lack of calibration data in CVHM were available from the western Kern County due to poor water quality limiting the number of wells that no similar correction was applied in Kern County as to areas to the north. Because of these factors, the change in the Model Layer 1 horizontal hydraulic conductivity to better match drawdowns at the WKWD facility is considered to be warranted.

As a result of the two validation scenarios using the WKWD data sets, Model Layer 1 hydraulic conductivity and specific storage were changed to better match drawdowns at the WKWD facility. Both the horizontal and vertical hydraulic conductivities in Model Layer 1 were reduced to 20 percent of the original value used in CVHM. The specific storage was increased by 33 percent% of the original value used in CVHM. The modified aquifer properties resulting from the validation analysis are generally consistent with the aquifer test results presented in **Table C-1**.

C.3 KERN WATER BANK (KWB) VALIDATION SCENARIO

To test the ability of the Superposition Model to evaluate regional groundwater impacts, a validation scenario was constructed to evaluate groundwater level changes resulting from recharge operations at the Kern Water Bank (KWB) from 1993 to 1998. The KWB validation scenario was initially used in the Supplemental EIR for the Kern Delta Water District Water Allocation Plan (Todd Groundwater, 2017). It was constructed to evaluate groundwater level changes resulting from recharge operations at the Kern Water Bank from 1993 to 1998. This period represents the initial recharge operations at the Kern Water Bank and other nearby recharge facilities prior to significant recovery activities. This validation scenario was setup to evaluate the ability of the Superposition Model to simulate the effects of major changes in groundwater levels as a result of managed aquifer recharge.

C.3.1 KWB Validation Setup

The KWB validation scenario evaluated the capability of the Superposition Model to simulate the effects of major changes in groundwater levels as a result of managed aquifer recharge. The KWB Validation Scenario was rerun using the modified hydraulic conductivities from the WKWD validation scenarios.

Detailed records of the volume of groundwater recharged is available for the various groundwater banking operations in and around the Kern Water Bank (**Figure C-5**). Unpublished groundwater banking data used for the validation scenario was provided directly by Kern County Water Agency, Kern Water Bank Authority and neighboring agencies for the following facilities:

- Kern Water Bank
- Pioneer Project
- COB 2800 project
- Rosedale-Rio Bravo recharge facilities
- Buena Vista Water Storage District recharge facilities
- Berrenda Mesa project, and
- Kern River channel recharge.

During the period from 1993 to 1998, nearly 3.1 million AF of water was recharged in the Kern Water Bank and other nearby recharge facilities. In response to these large recharge events groundwater levels increased from 50 to 200 feet across the banking areas as documented by numerous local monitoring wells. Therefore, a clear quantification of the volume of recharge over this period is available. These volumes were applied monthly in the Superposition Model at the appropriate facility using the MODFLOW Recharge Package to Model Layer 1 in a manner analogous to that which is also being used to simulate the Palms Project.

By comparison, the maximum 6-year change in recharge water for the Palms Project is 0.1 million AF, which is about 6 percent of the Kern Water Bank recharge volume of 3.1 million AF. Therefore, the validation scenario incorporates larger changes than would be imposed by the Palms Project indicating that the validation scenario simulates larger scale change than those being considered for the Palms Project, which is an appropriate and standard procedure for validation in scientific and engineering investigations (Reilly et al., 1987) because if the Superposition Model is shown to perform well under the more extreme Kern Water Bank recharge scenario, it can be confidently concluded that the model will perform well simulating the more moderate conditions for the Palms Project.

C.3.2 KWB Validation Scenario Results

The actual measured change in groundwater levels is observed from 1,495 groundwater level measurements collected from 26 monitoring wells located in and around the Kern Water Bank between 1993 and 1998. The measured change in groundwater levels is calculated as the difference of the measured groundwater elevation during the simulation period minus the groundwater elevation from late 1992, prior to large recharge events. Monitoring wells with insufficient data (i.e., the last four months of 1992) were excluded from the data set.

For each of these 26 monitoring wells, the simulated groundwater level change was compared to the calculated groundwater level change based on the measured data for that well. **Figure C-6** provides a representative set of hydrographs from four monitoring wells located in different areas of the Kern Water Bank. A comparison of simulated and measured groundwater level changes indicates a strong agreement with the overall timing and magnitude of the groundwater level changes associated with these recharge events.

In addition to visual comparisons such as presented in **Figure C-6**, the difference between the measured and simulated change in groundwater levels (referred to as the residual) at the monitoring locations was evaluated. **Table C-2** provides a well-by-well summary of the calibration statistics for the 26 monitoring wells used to assess the results of the validation scenario.

The KWB Validation Scenario demonstrates that the level of accuracy of the Superposition Model is suitable to simulate future groundwater level changes on the scale of the Palms Project. A summary of summary statistics commonly used to evaluate model calibration are as follows:

- The correlation coefficient ranges from 0 to 1 and is a measure of the closeness of fit of the data to a 1 to 1 correlation. A correlation of 1 is a perfect correlation. The correlation coefficient of 0.84 for the validation scenario indicates a strong correlation between simulated and observed groundwater level change.
- The residual mean is computed by dividing the sum of the residuals by the number of residual data values. The residual mean tests whether the model results are biased towards over- or underestimating groundwater levels. The closer this value is to zero, the better the validation. The residual mean for this validation scenario of -3.8 feet is considered minor. A negative value indicates this minor bias is towards overestimating the change in groundwater levels in the Superposition Model.
- The residual standard deviation evaluates the scatter of the data. A lower standard deviation indicates a closer fit between the simulated and observed data. The standard deviation for the validation scenario is 25.3 feet.
- The absolute residual mean is a measure of the overall error in the model. The absolute residual mean is computed by taking the square root of the square of the residuals and dividing that by

the number of measurements. The absolute residual mean for this validation scenario is 19.8 feet.

- The ratio of the absolute residual mean divided by the range of observed groundwater elevations provides a means to assess the absolute residual mean in context with the scale of the simulation. The ratio for the validation scenario is 0.097 feet. Typically, a validation is considered good when this ratio is below 0.15 (ESI, 2011).

Considering these results in context with the overall range of measurements of 204 feet, the residual mean of -3.8 feet represents a relative percentage difference of about 2 percent. For the absolute residual mean of 19.8 feet, the average percentage difference is 9.7 percent and the median percentage difference is 15 percent (**Table C-2**). Based on these results, this validation scenario demonstrates that the Superposition Model, using the modified CVHM aquifer properties determined by the WKWD

Table C-2 - KWB Validation Scenario Statistical Results by Monitoring Well

Well	Residual Mean (feet)	Residual Standard Deviation (feet)	Absolute Residual Mean (feet)	Groundwater Elevation Range (feet)	Percentage Variation (%)
29S/26E-31H01	-5.42	17.30	15.11	119.7	13%
29S/26E-31H02	-22.99	16.90	24.46	116.9	21%
29S/26E-35H01	-24.48	11.68	24.48	86.0	28%
29S/26E-35H03	-14.88	10.34	15.00	80.3	19%
29S/26E-35H04	-11.78	9.03	12.36	83.5	15%
30S/24E-13D01	-17.27	13.03	17.27	110.5	16%
30S/24E-13D02	-18.85	12.48	18.85	105.4	18%
30S/24E-13D03	-18.44	13.45	18.46	99.9	18%
30S/25E-04J02	2.37	26.97	22.72	153.1	15%
30S/25E-04J03	-0.03	22.85	18.61	150.1	12%
30S/25E-04J04	17.12	29.23	24.01	148.5	16%
30S/25E-07A02	-15.95	13.68	16.87	123.9	14%
30S/25E-07A03	-14.98	11.62	15.45	118.8	13%
30S/25E-07A04	-5.98	10.04	8.86	116.0	8%
30S/25E-14C02	6.75	35.89	32.09	154.4	21%
30S/25E-16L01	6.39	28.93	21.94	165.7	13%
30S/25E-16L02	-3.52	18.88	15.55	149.3	10%
30S/25E-16L03	4.26	26.64	21.24	150.4	14%
30S/25E-21G02	12.80	33.42	25.07	146.7	17%
30S/25E-21G03	10.46	26.74	20.07	147.2	14%
30S/25E-22R02	1.26	9.71	7.57	90.6	8%
30S/25E-22R03	-3.86	10.03	8.37	89.7	9%
30S/26E-04J02	26.63	25.69	33.11	178.3	19%
30S/26E-04J03	34.14	26.66	36.62	155.8	24%
30S/26E-25A02	-22.50	8.77	22.55	64.8	35%
30S/26E-25A03	-21.14	9.20	21.26	57.5	37%
Composite	-3.83	25.29	19.86	204.4	10%

validation scenarios, is able to simulate the relative change in groundwater levels when the reported recharge volumes for the groundwater banking projects are used.

C.3.3 Superposition Model Uncertainty Assessment

Because the recharge rates and groundwater pumping volumes in the WKWD and KWB validation scenarios are comparable or exceed on a local scale to those produced by the either the Palms or Recovery Project, the simulation results of the Recovery Project Scenarios should have a similar relative percentage difference as that determined for the KWB validation scenario. Based on the validation scenario results, the uncertainty is in the range of +/- 15 percent. Therefore, for example, if simulation results for the Recovery Project scenarios produce a change in groundwater levels of 10 feet, then relative accuracy of the simulation would be approximately +/- 1.5 feet based on the median percentage difference. Therefore, using the example of a simulated 10-foot change in groundwater levels, the range of groundwater level changes that would likely occur would be 8.5 to 11.5 feet, which is a reasonable accuracy range for Project-related impacts. This validation scenario demonstrates that the level of accuracy of the Superposition Model is suitable to simulate potential-future groundwater level changes on the scale of the Recovery Project.

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ATTACHMENT C

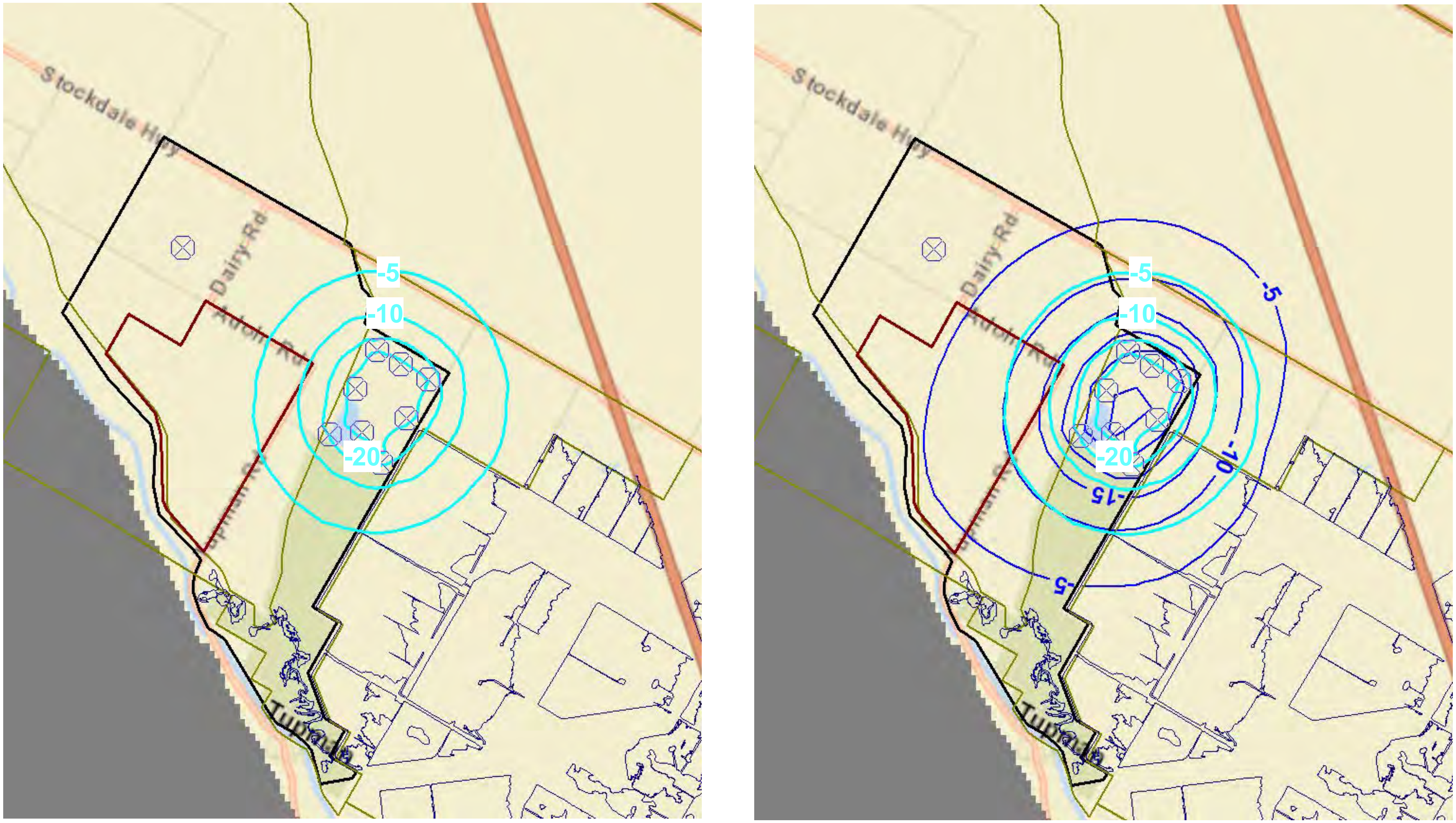
FIGURES

November 2020

TODD GROUNDWATER

Figure C-1
West Kern Water District
North Wellfield
Well Location Map

Calculated Drawdown (GEI, 2009) Simulated Drawdown Overlay



Legend

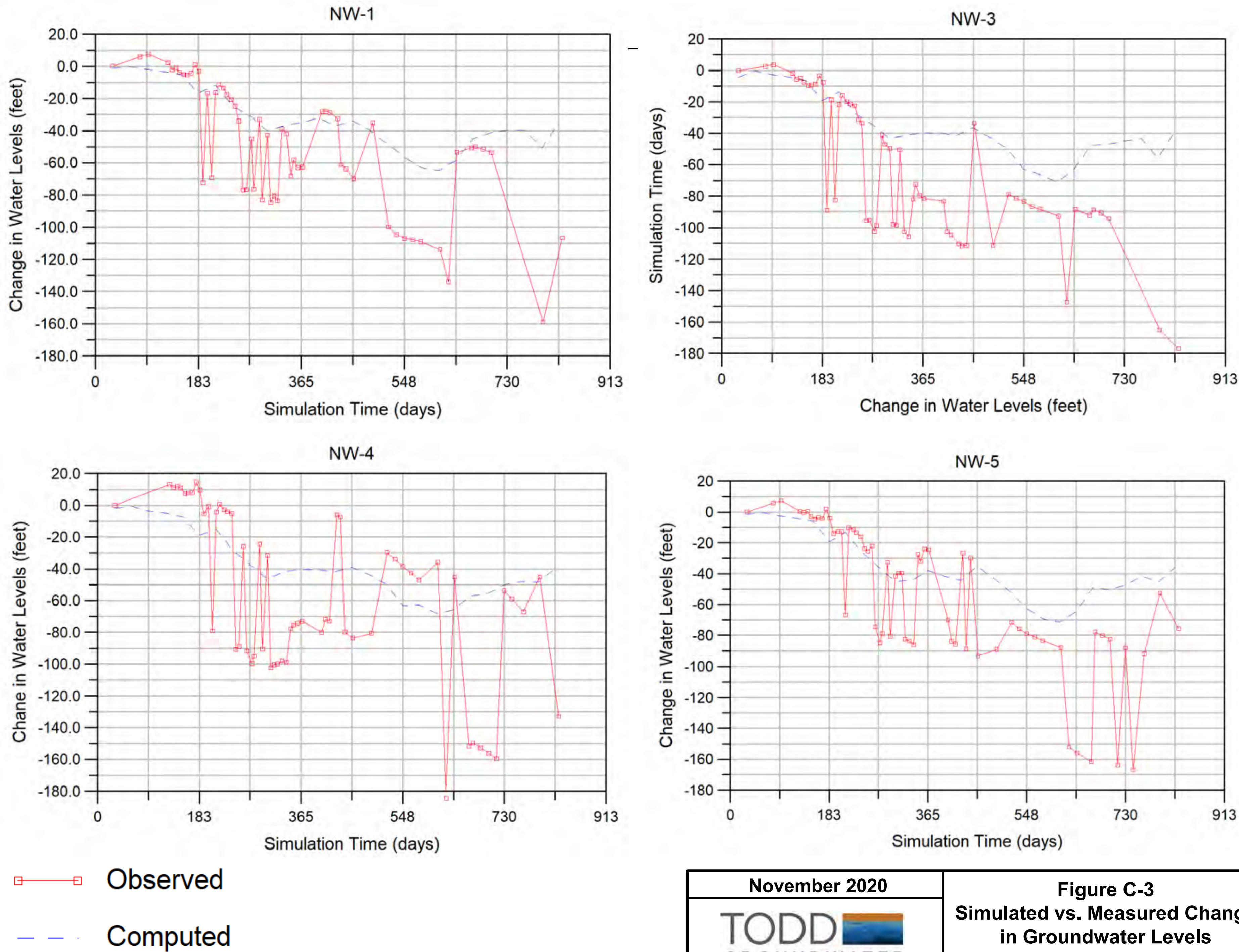
-5 — GEI 2009 Calculated Drawdown (feet)

-5 — Validation Scenario Simulated Drawdown (feet)

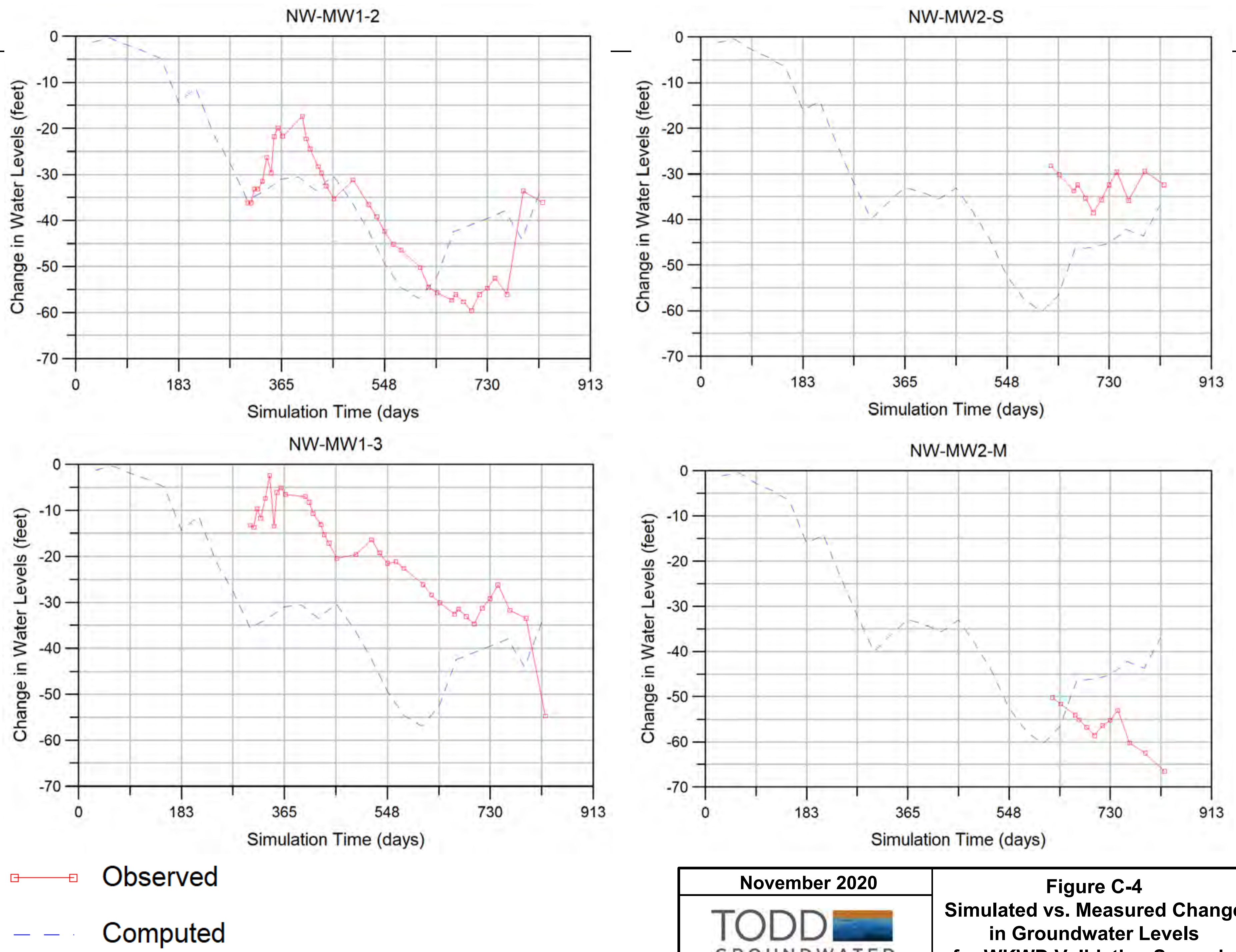
N

Scale: Miles (0, 1, 2)

November 2020	Figure C-2 Simulated vs. Measured Groundwater Level Change for WKWD Validation Scenario
TODD GROUNDWATER	



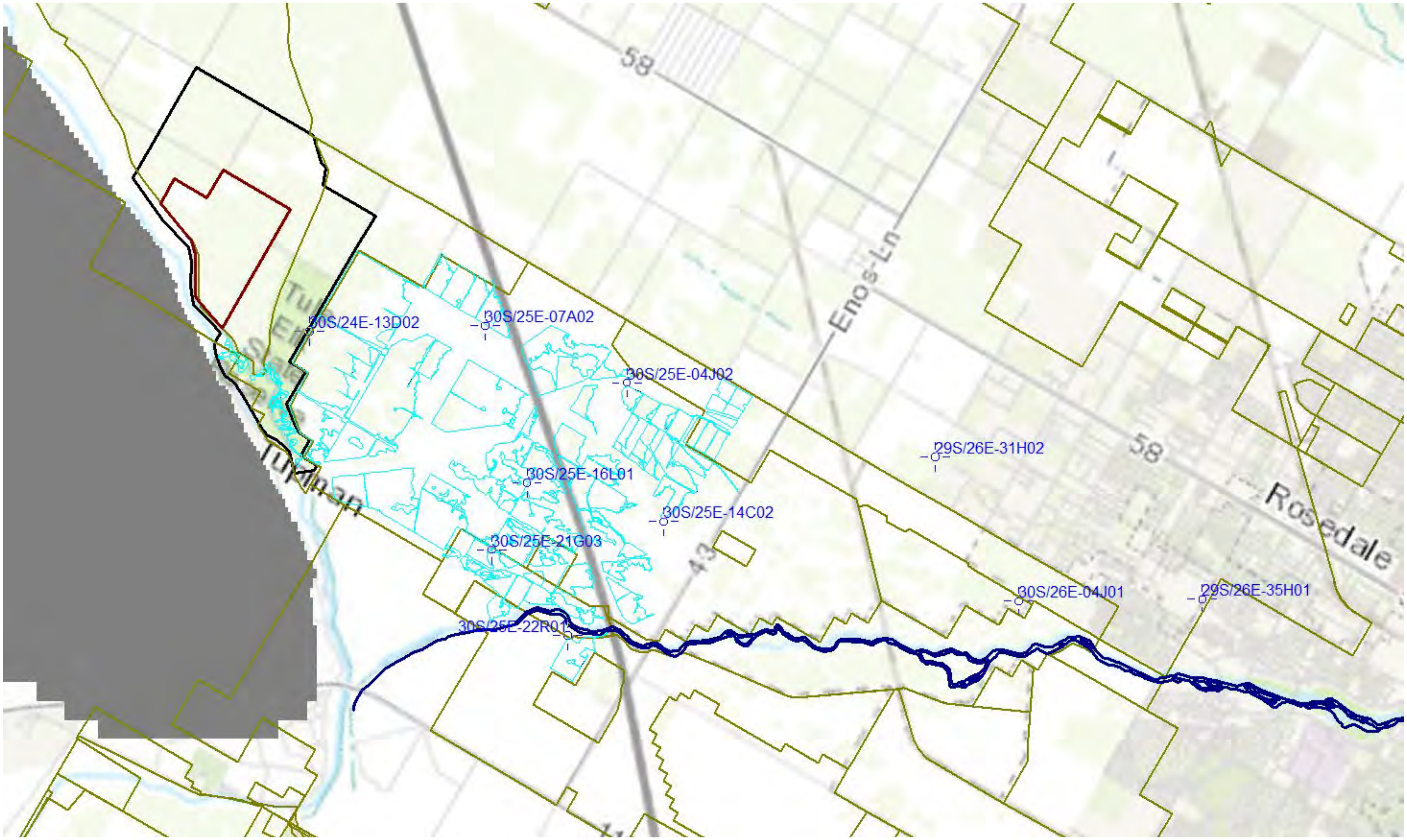
November 2020	Figure C-3 Simulated vs. Measured Change in Groundwater Levels for WKWD Validation Scenario
TODD GROUNDWATER	



November 2020

TODD GROUNDWATER

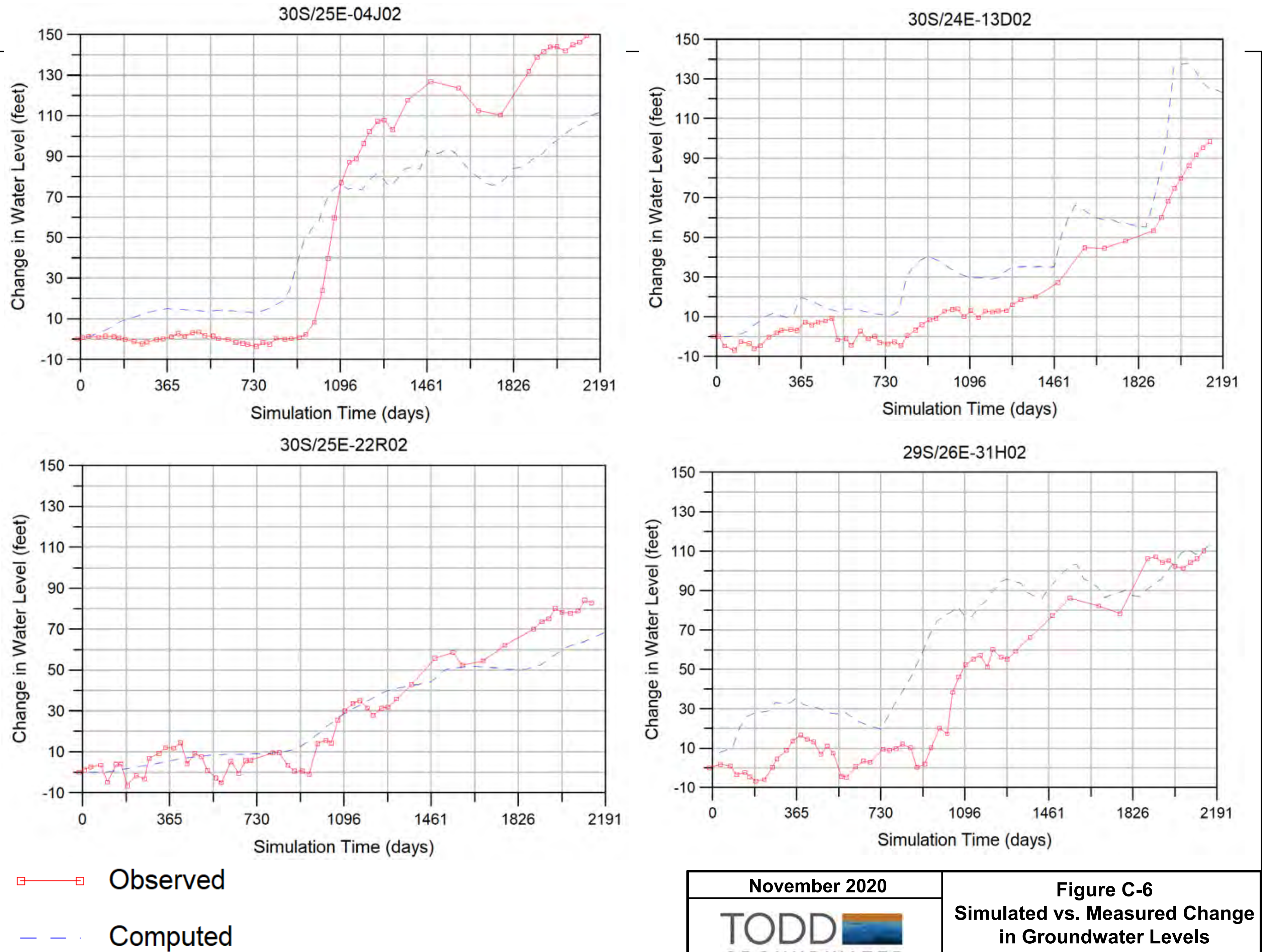
Figure C-4
Simulated vs. Measured Change in Groundwater Levels for WKWD Validation Scenario



N

0 1 2
Scale: Miles

November 2020	Figure C-5 Location of Monitoring Locations Used for KWB Validation Scenario
TODD GROUNDWATER	



November 2020

TODD GROUNDWATER

Figure C-6
Simulated vs. Measured Change in Groundwater Levels for KWB Validation Scenario

ATTACHMENT D

Recovery Project Cumulative Scenario Project Lists

D. RECOVERY PROJECTS CUMULATIVE SCENARIO PROJECT LISTS

The Kern County Subbasin Coordination Agreement refers to the local groundwater-surface water model (C2VSimFG-Kern) as the agreed upon method for generating coordinated water budgets for the Kern County Subbasin. Appendices 2 and 4 of the Kern County Subbasin Coordination Agreement include a technical report (Maley and Brush, 2020) on the development and application of C2VSimFG-Kern for these purposes including the setup and results of the Projected-Future Baseline with SGMA Projects Scenario.

The projects descriptions included in this **Appendix D** are excerpts taken from their respective GSPs and describe the projects included in the Projected-Future Baseline with SGMA Projects Scenario that was included in the 2020 Kern County Subbasin GSPs as listed below:

- Kern Groundwater Authority Groundwater Sustainability Plan, January 2020
- Final Groundwater Sustainability Plan (GSP), Kern River Groundwater Sustainability Agency (KRGSA), January 2020
- Henry Miller Water District Groundwater Sustainability Plan, Kern County Subbasin, January 2019

KERN GROUNDWATER AUTHORITY GSA

Groundwater Sustainability Plan

SGMA Project and Management Actions

January 2020

4 Projects and Management Actions

4.1 Proposed Projects and Management Actions

Projects and management actions for the KGA have been developed at the management area level. Table 4-1 (provided at the end of this section) provides a summary list of all projects and management actions being considered for implementation by each member agency, including the project title, implementation status, a brief description of the project, and benefits associated with the project. The details of each proposed project and management action can be found in each member agency's management area plan.

In addition to the projects and management actions that are proposed by the KGA members, the KGA has identified projects and management actions that it will implemented to further the coordination of groundwater management in the Subbasin. Table 4-2 list these proposed projects and management actions. These efforts will be managed by the KGA and will be cost-share through agreements with KGA members and other GSAs in the Subbasin, as appropriate.

Table 4-2: Kern Groundwater Authority Projects and Management Actions

Project Name	Project Description
Subsidence Monitoring (basin-wide)	Improve the understanding of the causes and impacts of subsidence in the Subbasin. Implementation Period: 2020 to 2025
Groundwater Modeling (basin-wide)	Improve the understanding of groundwater reactions to the implementation of projects and management actions, relationship to minimum thresholds and measurable objectives, determination of the native yield of the Subbasin, and subsurface flow within and out of the Subbasin. Implementation Period: 2020 to 2025
Study of Native Yield of the Subbasin	Studies to refine the understanding and allocation of the available native groundwater yield within the Subbasin. Implementation Period: 2020 to 2025
Basin-wide Coordination	Continuation of the Kern Subbasin Managers Group to coordinate water management activities in the Subbasin, including technical analysis, project management and coordination, identification of joint management opportunities and coordination of SGMA reporting requirements to DWR. Implementation Period: 2020 to ongoing
Annual Reporting	Coordination and facilitation of annual SGMA reporting requirements. Implementation Period: 2020 to ongoing

The Subbasin includes a complex environment of various local and imported surface water supplies; variable access to groundwater supplies based on quantity and quality; water management authorities; extent and capacity of water management infrastructure; and fiscal relationship with local landowners for participation in water management programs. Each of the member agencies within the KGA has identified projects and management actions best suited to meet the conditions of sustainability within their respective management areas within the water management and authorities of its entity. Collectively these projects and management actions are designed to maintain or achieve sustainability and the avoidance of undesirable results, first within the management area and then collaboratively throughout the Subbasin. The KGA, the KGA/GSA Managers Group and the Kern SGMA Coordination Committee will monitor the progress of project and management action implementation against reported groundwater conditions and performance to measurable objectives and interim milestones. Through this coordination effort opportunities will be explored for collaboration in implementing projects and management actions, as has been historically accomplished in the Subbasin, for joint conveyance as well as recharge and banking projects, as an example.

Table 4-1 list more than 150 projects and management actions. This includes management projects ranging from expansion of local and regional conveyance and recharge facilities to take advantage of surplus supplies; new conveyance and recharge projects; and participation in the California Water Fix or other thru-Delta improvement projects. Management actions range from implementing district level fee structures to incentive reduced groundwater pumping; participation in local, regional, and state-wide water markets; and setting allocation for groundwater use by landowner, based on the sustainable yield of the management area.

Table 4-1 also demonstrates the tremendous capacity of the entities in the Subbasin to implement projects and management actions to manage the Subbasin sustainably. As the KGA and the other Subbasin GSAs progress to 2040, the implementation of projects and management actions will be adaptively managed to ensure that the proper mix of projects or management actions are developed to avoid undesirable results. Each management area plan as developed its own adaptive management strategy, which often entails some level of groundwater pumping reductions if proposed project or management action are not realized or are not as effective as anticipated.

4.2 Projected Future Water Budgets with SGMA Implementation

Projected water budgets with implementation of the projects and management actions described in the previous section were developed using the C2VSimFG-Kern to evaluate the performance with respect to achieving groundwater sustainability. Proposed projects and management actions were simulated under Baseline conditions, 2030 Climate Conditions and 2070 Climate Conditions using the C2VSimFG-Kern. Detailed description of proposed SGMA projects, and management actions are provided in *Attachment H: Historical and Projected Future Water Budget Development with C2VSimFG-Kern*.

4.2.1 Future Baseline Water Budget with SGMA Implementation

The Baseline Scenario with Projects simulates the implementation of proposed projects and management actions applied to the Baseline Scenario. No other changes were made except for the addition of the projects to provide a direct comparison of the relative benefits of the over 400,000 AFY of proposed SGMA projects and management actions. The change in groundwater storage for projected future baseline with SGMA Projects improves by about 409,904 AFY. This change results in a net gain in groundwater in aquifer storage over the WY2041 to WY2070 sustainability period of about 85,578 AFY.

Figure 4-1 shows the comparison of the average annual water budget components for the two different Baseline Scenarios. Over this period, the average groundwater pumping of 1,354,000 AFY for the Baseline Scenario with SGMA Projects (which includes agricultural pumping, urban pumping and exported water) is over 270,000 AFY less than the Baseline Scenario.

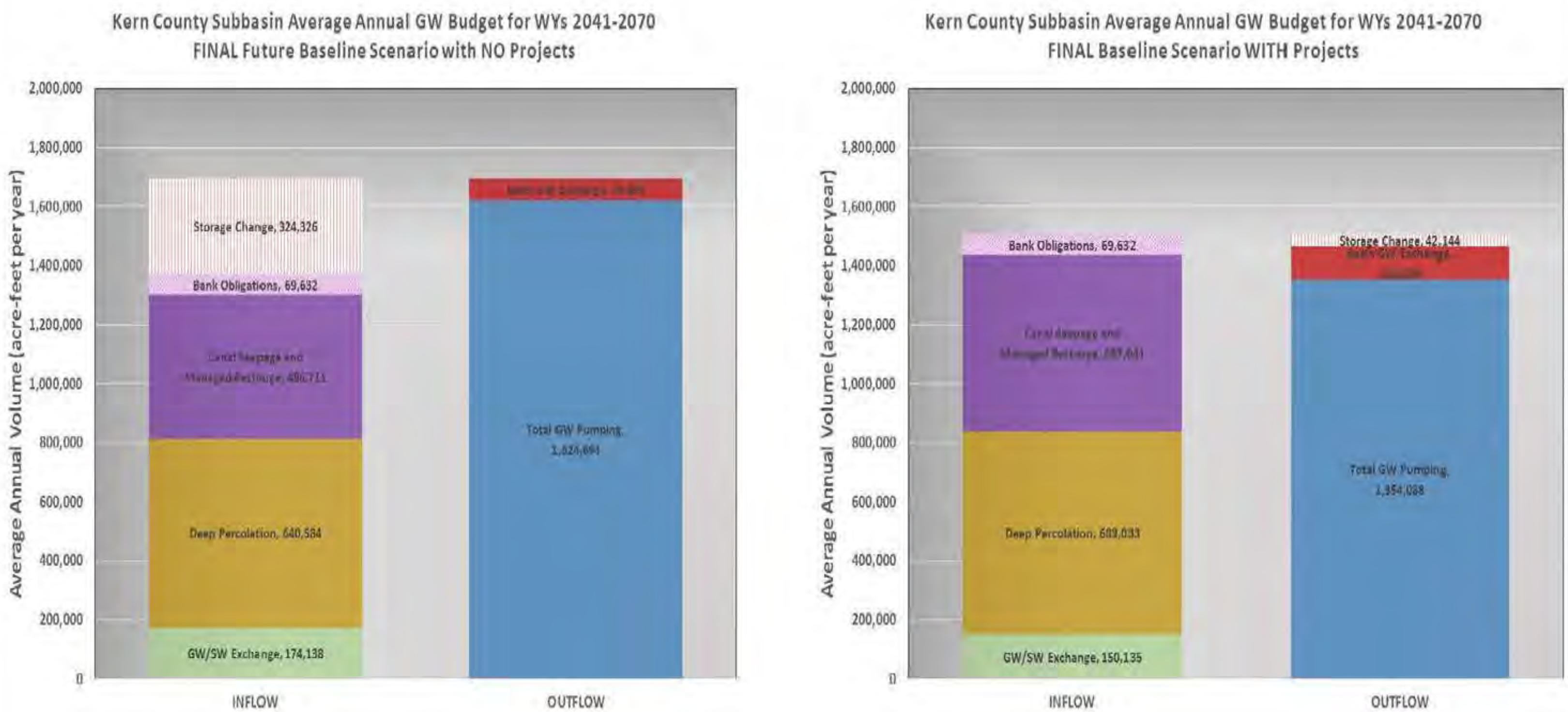
4.2.2 2030 Climate Change Water Budget with SGMA Implementation

The 2030 Climate Scenario with SGMA Projects simulates the implementation of proposed projects and management actions applied to the 2030 climate change conditions. No other changes were made to this scenario. A comparison of the average annual water budget components for the two 2030 Climate Scenarios is presented in Figure 4-2. The change in groundwater storage for projected 2030 Climate Scenarios condition with SGMA Projects improves by about 418,949 AFY. This change results in a net deficit in groundwater in aquifer storage over the WY2041 to WY2070 sustainability period of about 46,829 AFY. Over this period, the average groundwater pumping of 1,444,300 AFY for the 2030 Climate Scenario with SGMA Projects, which includes agricultural pumping, urban pumping and exported water, is over 290,000 AFY less than the 2030 Climate Scenario without SGMA Projects.

4.2.3 2070 Climate Change Water Budget with SGMA Implementation

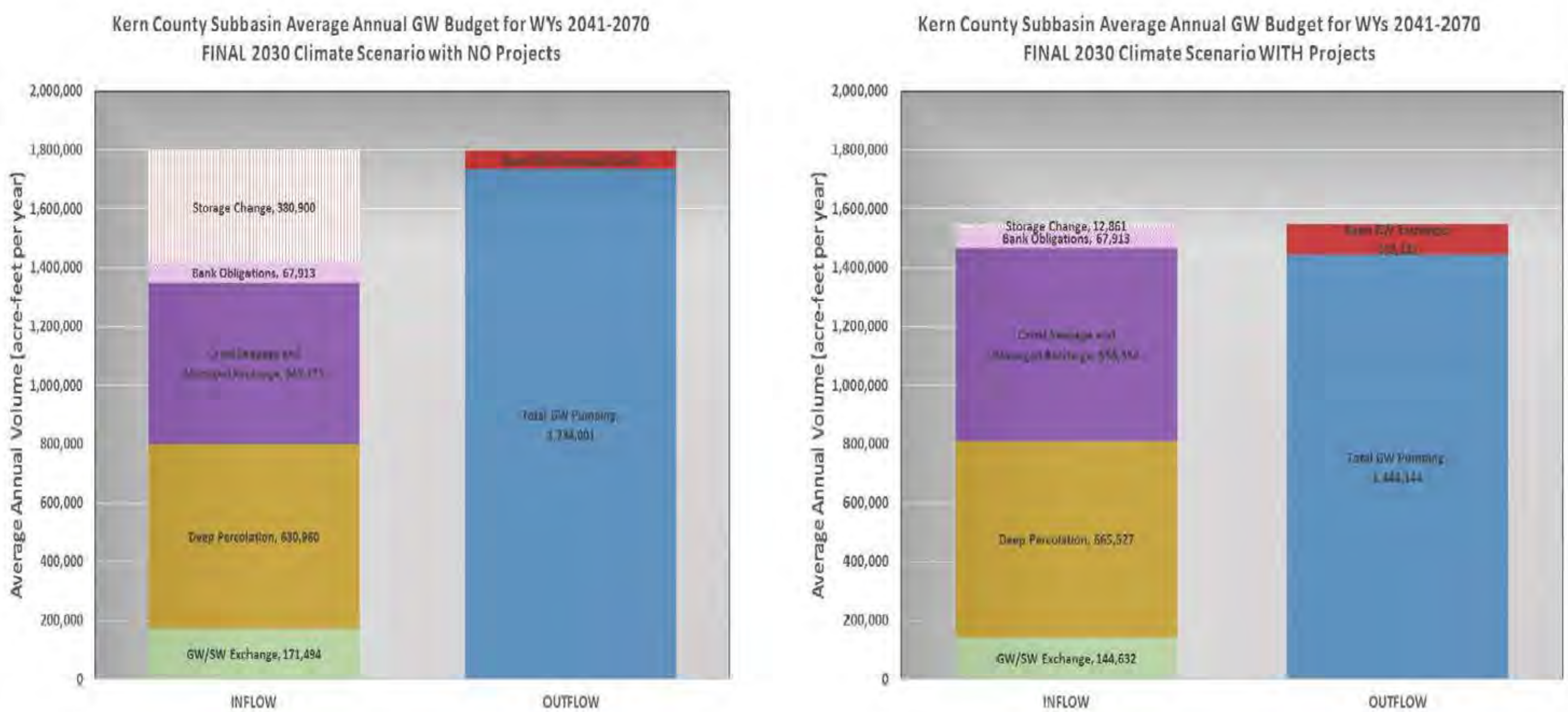
The 2070 Climate Scenario with SGMA Projects simulates the implementation of proposed projects and management actions applied to the 2070 climate change conditions. No other changes were made to this scenario. A comparison of the average annual water budget components for the two different 2070 Climate Scenarios is presented in Figure 4-3. The change in groundwater storage for projected 2070 Climate Scenarios condition with SGMA Projects improves by about 426,367 AFY. This change results in a net deficit in groundwater in aquifer storage over the WY2041 to WY2070 sustainability period of about 45,969 AFY. Over this period, the average groundwater pumping of 1,559,000 AFY for the 2070 Climate Scenario with SGMA Projects, which includes agricultural pumping, urban pumping and exported water, is over 307,000 AFY less than the 2070 Climate Scenario without SGMA Projects.

A comparison of the annual change in groundwater storage over the 50-year hydrologic period for the baseline conditions, 2030 and 2070 climate condition for with and without projects is presented in Figure 4-4. The time series shows that change in groundwater storage has stabilized to slightly increasing over the period from WY2041 to WY2070 for with Projects condition.



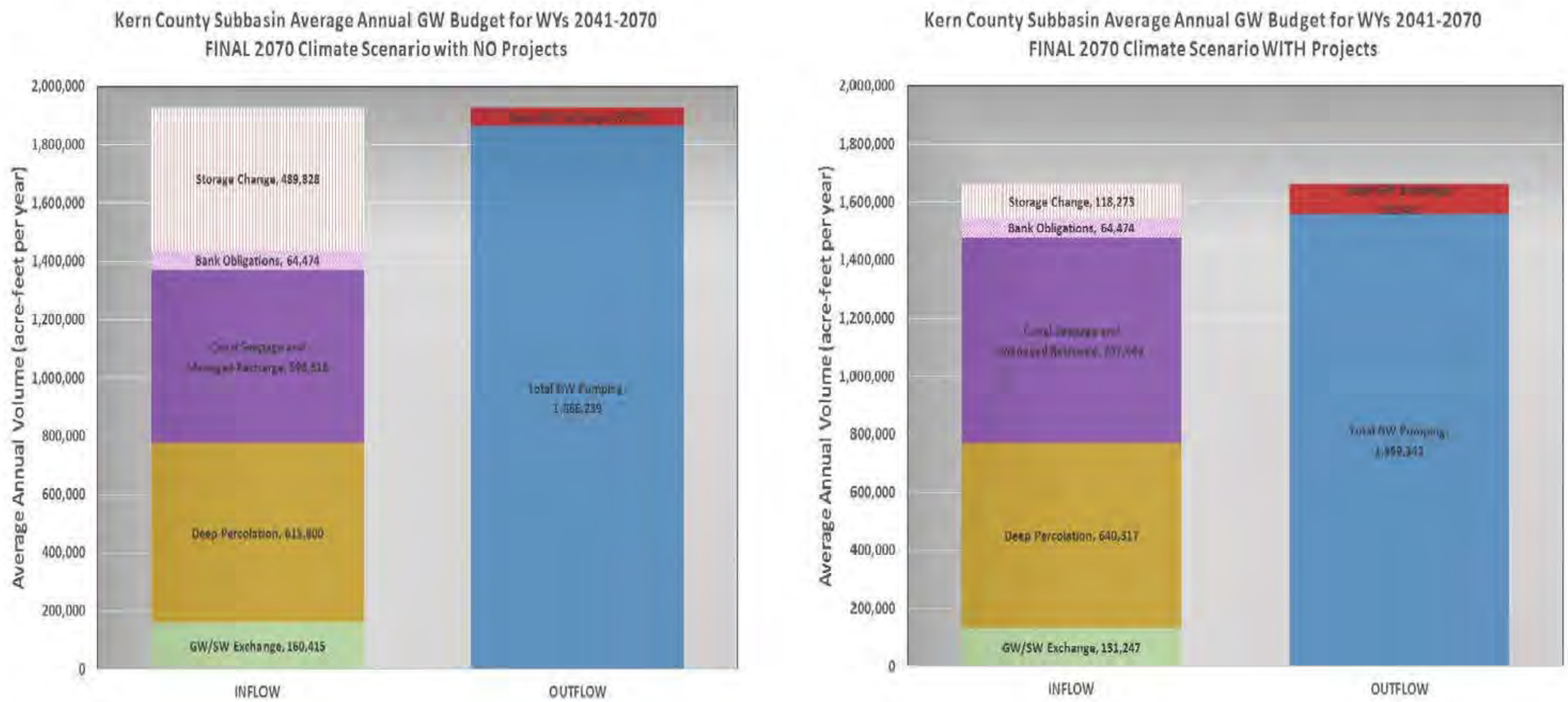
August 2019	Baseline Projected Future Average Annual Groundwater Budget for WY2041-2070
TODD GROUNDWATER	

Figure 4-1. Baseline Projected Future Average Annual Groundwater Budget for WY2041-2070



August 2019	2030 Climate Projected Future Average Annual Groundwater Budget for WY2041-2070
TODD GROUNDWATER	

Figure 4-2. 2030 Climate Projected Future Average Annual Groundwater Budget for WY2041-2070



August 2019

TODD GROUNDWATER

2070 Climate Projected Future Average Annual Groundwater Budget for WY2041-2070

Figure 4-3. 2070 Climate Projected Future Average Annual Groundwater Budget for WY2041-2070

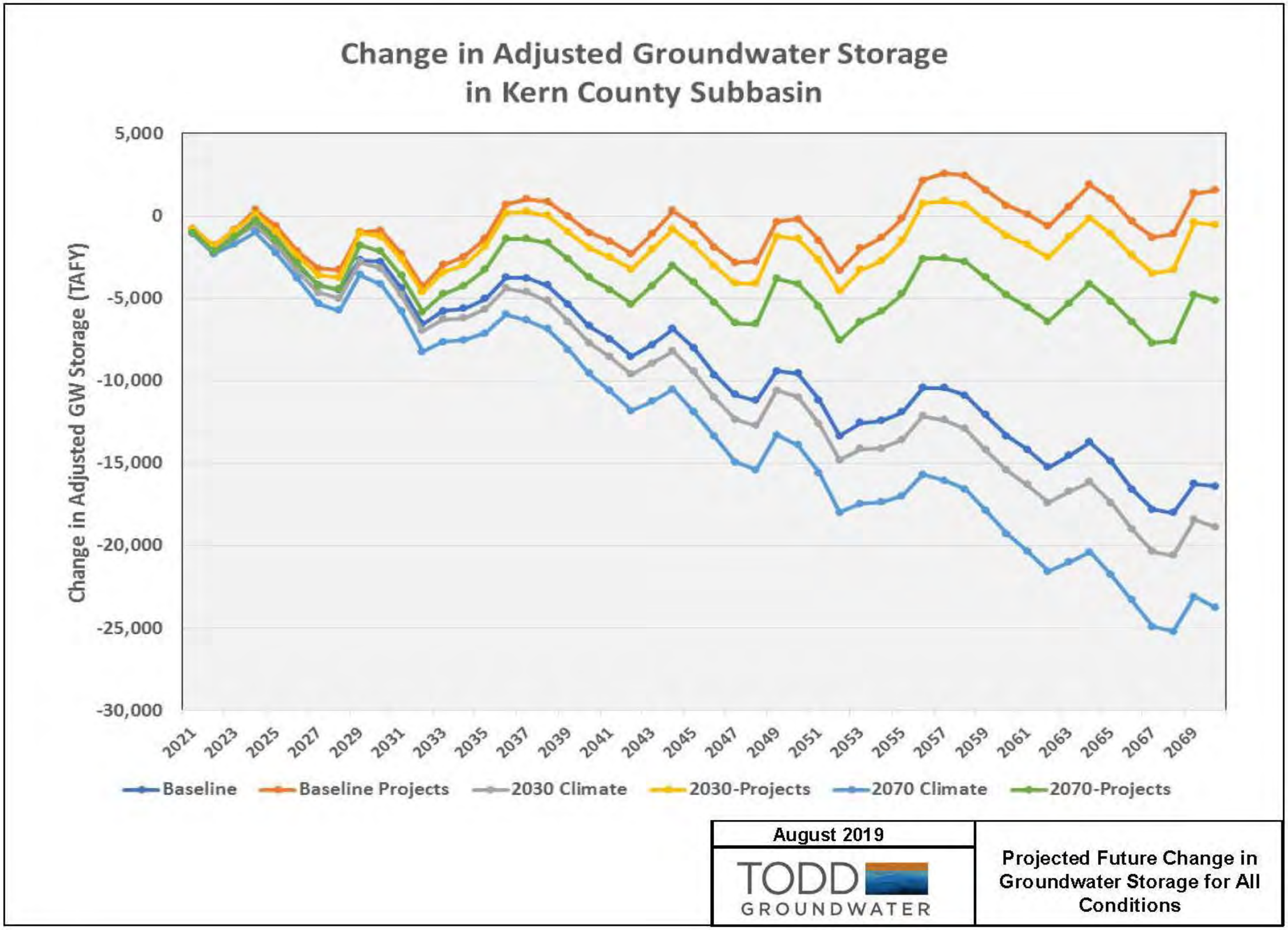


Figure 4-4. Projected Future Change in Groundwater Storage for all Conditions.

Table 4-1. Kern Groundwater Authority List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
Arvin-Edison Water Storage District				
AEWSD	AEWSD Sunset Spreading Works	Land acquisitions has been completed. To be implemented upon adoptions of AEWSD GSP Chapter and grant funding acquisition.	The Sunset Spreading Works, approximately 150 acres, is located on the boundary between AEWSDand KDWD, adjacent to KDWD's Eastside Canal. The Project will take surface water (Federal CVP,State Water Project, or local supplies) diverted through KDWD's Eastside Canal and recharge thesurface supplies as part of AEWSD's and KDWD's joint water management programs. The Project will include the construction of exterior and interior dikes for a direct recharge facility, a new turnout and pump station from the KDWD Eastside Canal, and interbasin structures.	Project enhances recharge relevant to groundwater levels, storage, and quality. Primary benefits include water supply augmentation of 2,000-3,000 AFY of recharge and a water demand reduction of 410 AFY.
AEWSD	Private and Caltrans Basin Connections	Not yet initiated. Implementation upon receipt of grant funding.	This project involves the construction of pipelines to connect several on-farm private basins and Caltrans sumps near AEWSD to utilize for groundwater recharge.	Project enhances recharge relevant to groundwater levels and storage. Primary benefits include water supply augmentation of 50-500 AFY of recharge.
AEWSD	Sycamore Creek Detention & Sedimentation Basin	Not yet initiated. Implementation upon receipt of grant funding.	The proposed basin would serve to intercept sediment from Sycamore creek flows to prevent constriction where sediment deposits downstream, reduce the peak outflow, and prevent the likelihood of a canal and spreading basing breach. Detained water could be recirculated for irrigation demands or recharged for groundwater supply augmentation.	Project enhances recharge relevant to groundwater levels, storage, and quality. Primary benefits include water supply augmentation of 200-300 AFY of stormwater capture.
AEWSD	AEWSD South Canal Flood Study / Improvements	Study to be initiated upon GSP adoption and grant funding acquisition.	The South Canal Flood Study would review and possibly revise the FEMA floodplain in this area in order to increase the height of the canal bank to provide additional operational freeboard and accordingly reduce the potential for canal spills and subsequent flooding.The additional canal storage could allow for the caputure and use of additional floodwater in-lieu of groundwater pumping.	Project enhances recharge relevant to groundwater levels and storage. Primary benefits include water supply augmentation of 100-200 AF of increased storage capacity and stormwater capture.
AEWSD	Stormwater Management and Flood Control Improvements	To be decided upon available funding. Excessive flooding or further damages may expedite intiation.	Potential construction of new sedimentation/detention basins, flood ditch erosion protection, Spillway Basin expansion, lengthening the South Canal's siphon under David Road or extension of the South Canal liner through designated floodplain reaches.	Project enhances recharge relevant to groundwater levels, storage, and quality.
AEWSD	On-Farm Recharge	Underway	The program will encourage individual growers to perform on-farm recharge for individual and aggregated benefits. Water may be recharged on-farm in private basins and/or distributed through irrigation systems across irrigated acreage in excess of current crop ET.	Project enhances recharge relevant to groundwater levels and storage.
AEWSD	Caliente Creek Habitat Mitigation and Gorundwater Recharge	Not yet initiated. Implementation upon receipt of grant funding.	Restoration of agricultural lands to native vegetation to provide flood mitigation. Two alternatives are being considered, of which Alternative 1 is partial agricultural and 2 is non-agricultural.	Project provides immediate flood control benefits of local stormwwater.
AEWSD	AEWSD Intake Canal / KDWD Buena Vista Canal Intertie	Not yet initiated. Implementation to be decided.	Improvement of existing and/or construction of new interties between AEWSD Intake Canal and KDWD's Buena Vista Canal to facilitate water exchanges between the two districts and Kern County partners.	Project to increase surface storage capacity and delivery flexibility in relation to groundwater levels and storage. Primary benefits include water supply augmentation of 8,000 AFY increased transfer and exchange potential.
AEWSD	AEWSD Intake Canal / KDWD Farmer's Canal Intertie	Not yet initiated. Implementation to be decided.	Improvement of existing and/or construction of new interties between AEWSD Intake Canal and KDWD's Farmer's Canal to facilitate water exchanges between the two districts and Kern County partners.	Project to increase surface storage capacity and delivery flexibility. Primary benefits include water supply augmentation of 4,000 AFY increased transfer and exchange potential.
AEWSD	AEWSD Wasteway Basin Improvements	Project to be implemented upon FEMA grant approval.	The primary use of the existing AEWSD Wasteway Basin is to provide emergency water storage in the event of power failure. Additionally, it works as a detention facility for the City of Bakersfield stormwater. This project would include construction of a HDPE liner along the levees, installation of recirculation pumps, and basin grading. These improvements would allow the basin to serve as a location to divert and clarify sediment.	Project to increase surface storage capacity and delivery flexibility in relation to groundwater levels and storage. Primary benefits include water supply augmentation of 1,550 AFY of stormwater capture.

Table 4-1. Kern Groundwater Authority List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
AEWSD	Forrest Frick Pipeline / KDWD Eastside Canal Intertie	Not yet initiated. Implementation upon receipt of grant funding.	This project would connect the Forrest Frick Pipeline to the KDWD Eastside Canal to send AEWSD SW supplies through KDWD to serve portions of the AEWSD GWSA with temporary water contracts, utilizing existing infrastructure (turnouts, pipelines that are both District and landowner owned). With the District's new 9(d) contract, certain provisions of Reclamation law are no longer applicable and all lands within the service area can now be served with federal water supplies.	Primary benefits include water supply augmentation of 10 AFY of recharge, 3 AFY/ac of land served.
AEWSD	AEWSD North Canal Balancing Reservoir Expansion & Discharge Pipelines	To be initiated upon completion of feasibilty	The proposed project will consist of the installation of a pipeline system that will convey flows from the four (4) wells within the AEWSD Balancing Reservoir directly to the basin discharge structure and no longer through the basin low flow channels. Infiltration and evaporation losses on well discharge flows will be eliminated and power efficiency for the wells (kwh/af) will be significantly enhanced since all water pumped will be discharged into the North Canal.	Primary benefits include water supply augmentation of 16 AF of increased storage capacity and 100 AFY of recharge. In addition, water demand is expected to be reduced by 50 AFY in evaporative losses.
AEWSD	AEWSD Lateral Capacity Improvement Projects	Not yet initiated.	Increase delivery capacity of the AEWSD N-55 lateral system. Some examples of the actions considered for this project are: replacement of lateral system and landowner pipelines, renovation of storage tanks, construction of pump stations, etc.	Primary benefits include water supply augmentation of 2,000 AFY of of increased delivery capacity.
AEWSD	Conversion of Granite Quarry to Sycamore Reservoir	Study to be initiated upon GSP adoption and grant funding acquisition.	The Granite Co. quarry, located upstream of the Sycamore Spreading Basins, is approaching the end of its operational life and could be converted into a balancing / detention / spreading reservoir. Excess flows in the North Canal could be pumped into the quarry reservoir, so the detained water could be recirculated for irrigation demands in-lieu of groundwater pumping and/or recharged.	Primary benefits include water supply augmentation of 3,000-6,000 AFY of recharge and an additional 2,500 AF increased storage capacity.
AEWSD	AEWSD South Canal Balancing Reservoir	Not yet intiated.	Creation of a reservoir to allow water storage for flow mismatches in the AEWSD canal system during operation or emergencies. Depending on the location, this reservoir would increase storage capacity by ~500 AF.	Primary benefits include water supply augmentation of 500 AF increased storage capacity.
AEWSD	Frick Unit In-Lieu Project	Not yet intiated. To be implemented upon grant funding.	This project would increase the ability of the District to provide surface water supplies to the Groundwater Service Area (GWSA) to help meet crop irrigation requirements. With the Project, the District will supply surface water when available through new facilities to the GWSA to meet crop irrigation requirements with the intent of reducing District wide groundwater use.	Primary benefits include water supply augmentation of 3,500 AFY of increased surface water deliveries.
AEWSD	DiGiorgio Unit In-Lieu Project	Completed Phase I. Future phases intiated upon grant funding.	The District will supply SW when available through new facilities to the GWSA to meet its water requirements with the intent of reducing District-wide GW use. However, when SW is in short supply and under agreement, the landowners could recover and return GW from their own wells to the District canal system through new pipelines once they have satisfied their own water needs.	Primary benefits include water supply augmentation of 4,250 AFY in increased surface water deliveries.
AEWSD	General In-Lieu Banking Program	Not yet initiated. To be implemented upon grant funding.	The In-Lieu Banking Program consists of suppling surface water to landowners that previously relied only on groundwater (GWSA). New infrastructure would have to be built to facilitate the implementation of this program.	Primary benefits include water supply augmentation of 2.75 AFY/ac increased surface water deliveries every 2.5 years.
AEWSD	Reclamation of Oilfield Produced Water	To be implemented upon adoptions of AEWSD GSP Chapter and agreement with partnering oil field.	Reclaiming water from oil production facilities for irrigation purposes is currently an untapped water source in AEWSD. After treatment and cooling, produced water could be pumped into AEWSD facilities to serve irrigation demands in-lieu of groundwater pumping.	The primary expected benefit is water supply augmentation.
AEWSD	Wastewater Reclamation with City of Arvin & Bakersfield	To be implemented upon adoptions of AEWSD GSP Chapter and agreement with City of Arvin and City of Bakersfield.	Reclaiming water from Cities of Arvin and Bakersfield wastewater treatment facilities for irrigation purposes is currently an untapped water source in AEWSD. After wastewater treatment, the effluent could be pumped into AEWSD facilities to serve irrigation demands in-lieu of groundwater pumping.	The primary expected benefit is water supply augmentation of 10,000 AFY.
AEWSD	Incentives for Land Conversion	To be implemented upon adoptions of AEWSD GSP Chapter.	The District would provide subsidies to incentivize groundwater users to convert land to alternative land uses (e.g. solar farms) and reduce groundwater extractions. The District may consider a subsidy structure study to determine which subsidies would result in the greatest expected annual benefit in acre-feet per year.	The primary expected benefit is water demand reduction of 2.75 AFY/ac of land converted.

Table 4-1. Kern Groundwater Authority List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
AEWSD	On-farm Water Conservation	To be implemented upon stakeholder interest and acuisition of grant funding.	The NRCS is offering landowner incentive programs to assist in implementing various conservation activities, including but not limited to: irrigation system improvements, water/nutrient/pest management, and pump engine replacement. Interested landowners can call (661) 336-0967 or visit the website (www.ca.nrcs.usda.gov) for more information.	The primary expected benefit is water demand reduction of 50 - 500 AFY.
AEWSD	Groundwater Fee Increase	Contingent on the Frick Unit In-Lieu Project, Digorgio Unit In-Lieu Project, and General In-Lieu Banking Program.	Increase GWSA costs to incentivize groundwater users to reduce groundwater extractions and take surface water when available. The District may consider modifying its fee structure study to determine the best strategy for curbing groundwater overdraft without causing inequitable economic impact.	The primary expected benefit is water demand reduction.
AEWSD	Groundwater Extraction Quantification Method	To be implemented upon adoptions of AEWSD GSP Chapter.	Application of a new policy to specify an approved method to quantify the individual and aggregated groundwater extractions for the required SGMA annual reporting. Some methods to consider (or a combination of them) are the following: (1) Irrigated Acreage determined by aerial imagery; (2) Irrigated area hybrid determined by annual crop survey alongside aerial imagery; (3) Calibrated energy records; (4) Volumetric flow measurement; (5) Remote sensing of vapotranspiration; (6) Other.	This Project is expected to improve water management flexibility and efficiency as well as data gap filling and monitoring.
AEWSD	Groundwater Allocation per Acre	To be implemented upon adoptions of AEWSD GSP Chapter and initiated as needed to meet milestones if other new supplies are not developed as anticipated.	This program would provide a finite groundwater allocation on a per acre basis. The policy would identify and forecast the demands associated with existing water rights, domestic and environmental uses. The sustainable yield and ultimate groundwater allocation would take into consideration the applicable beneficial uses and users of groundwater. Once an individual groundwater allocation is determined, the District may adopt a policy which provides a gradual “ramp-down” wherein an allocation would decrease over time to arrive at the actual roundwater allocation to allow growers time to adjust to the concept of an allocation and, for some growers, a reduction in groundwater use. The policy would detail the number of years and amount of reduction each year.	The primary expected benefit is water demand reduction.
AEWSD	Groundwater Marketing & Trading	Contingent on Management Actions; Groundwater Extraction Quanitification Method and Groundwater Allocation per Acre.	Contingent on the GW extraction quantification and allocation programs, the District would pursue a groundwater market and trading program to provide uses and beneficial users more flexibility in utilizing a groundwater allocation. The District may adopt a policy to define a groundwater trading program, acknowledging that many complexities and considerations required to successfully initiate and manage a trading program may arise. Therefore the District should discuss any other water bank/credit systems in existence. The District may adopt a groundwater trading structure and consider a variety of structures including: (1) Bilateral contracts or "coffee shop" markets; (2) Brokerage; (3) Bulletin boards; (4) Auctions and reverse auctions; (5) Electronic clearing-houses or "smart markets" ; (6) Other trade structures.	This Project is expected to improve water management flexibility and efficiency.
AEWSD	Education of Groundwater Use per Acre	To be implemented upon adoptions of AEWSD GSP Chapter.	This program would provide groundwater users an expected groundwater volume, as an education tool, prior to enforcement actions on groundwater allocations, with the goal of providing awarness of overdraft conditions. This information would be provided in an annual letter, along with average crop demand, GSA average extraction, GW overdraft, and reminders of GSA powers and authorities.	The primary expected benefit is water demand reduction of 100 AFY.
AEWSD	ACSD Emergency 1,2,3-TCP Treatment at Well No. 13	Implementation is underway.	The project involves the installation of emergency 1,2,3-TCP treatment at the well head. The work will include installation of a skid mounted treatment system with two granular activated carbon media vessels for removal of 1,2,3-TCP, connection to the existing well discharge piping, installation of below ground and above ground influent and effluent piping and appurtenances, electrical and controls, and modifications to the existing well site PLC programming.	This Project is expected to imrpove water quality.
AEWSD	ACSD Arsenic Mitigation Project - Phase II	Implementation is underway.	The purpose of the project is to bring the ACSD water system into compliance for Arsenic. All five of the ACSD active wells exceed the maximum contaminant level (MCL) of 10 ppb for Arsenic. The project was separated into two phases. Phase II involves drilling three new wells, constructing a 1.0 MG storage tank and booster pumping plant, and connecting the facilities to the existing distribution system. The original five (5) water wells will then be abandoned and destroyed in accordance with Kern County Standards.	This Project is expected to imrpove water quality.
Cawelo Water Storage District				
CWD	Voluntary Land Conversion	2020 to 2040 Implementation	The Cawelo GSA will develop a program to incentivize landowners to reduce their total crop demand by converting farmed land to groundwater recharge areas. This would reduce demands and the increased recharge capability could increase supplies. It could also reduce the potential of currently fallow land being used for future crops. This Management Action could be implemented conjunctively with Project #2: Increase GW Recharge and Banking Capacity	Range of annual benefit is 2,000 AFY with an average annual benefit at 2040 of 2,000 AFY.

Table 4-1. Kern Groundwater Authority List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
CWD	Crop Conversion and Irrigation Efficiency	2020 to 2040 Implementation	The Cawelo GSA will evaluate potential programs to incentivize growers to convert from relatively high water demands crops to crops that require less water and to improve the efficiency of irrigation practices. The Cawelo GSA will partner with Federal, State and local organizations such as the California Department of Food and Agriculture, U.S. Department of Agriculture, and Natural Resources Conservation Service to provide landowners information and access to conservation programs. The programs would educate the landowners on the potential economic savings from conversion to lower water demand crops and increased irrigation efficiencies and incentivize them to seek improved economically viable agricultural operations.	Range of annual benefit is less than 2,000 AFY with an average annual benefit at 2040 of 3,8000 AFY.
CWD	Land Acquisition	2020 to 2040 Implementation	The Cawelo GSA will evaluate and potentially implement a program to acquire land that is actively farmed to reduce irrigated acreages within the Cawelo GSA. This would directly eliminate demands and free up the associated water supplies to meet other demands. This could be a very long-term program seeking to acquire appropriate land when available or to reduce the financial burden. Another method for pot ential conservation programs will be developed that could place certain easements on land that would minimize potential future increased water demands. These programs could also be implemented by contracts or other types of agreements.	Range of annual benefi is 2,500 AFY with an average annual benefit at 2040 of 2,400 AFY.
CWD	New Water Supply Purchases	Begin program in 2020.	The Cawelo GSA would implement programs that will acquire long term new water purchase contracts and/or establish a water purchase fund if contracts are difficult to secure because of high demand and competition and resulting high costs. The main goal would be to secure long term new water contracts but compliance with SGMA will impact future water management practices and could make the availability of new long term contracts scarce. If long term contracts can't be secured then a new water fund would be established to build funding reserves for water purchases. These purchases could occur during favorable times such as hydrologically wet years when water will be more readily available at lower costs. While the Cawelo GSA would likely not need this water in wet years, these types of purchases could be in the form of banked water that the Cawelo GSA could request at a future date. Alternatively, the funds could be used to make annual water purchases and the revenue for the fund would be consistent from year to year regardless of the hydrological conditions. Therefore, during wet or average hydrologic years the water would cost less and reserves would be built up for more costly water purchases during the drier years. It is estimated that an additional 5,000 AFY to 23,000 AFY of water could be imported into the Cawelo GSA area through new long term contracts or establishing a new water purchase fund or both.	- Securing new long term contracts or establishing a water purchase fund or both could result in an additional 5,000 AFY to 23,000 AFY of water that could be imported into the Cawelo GSA area. This additional water would increase the amount of water in the basin and decrease overdraft.
CWD	Increase Groundwater Recharge and Banking Capacity	Target 2030 Implementation	The Cawelo GSA will implement projects or programs to increase recharge capacity to capture and recharge additional wet year high flow waters to store for future use. The Cawelo GSA has limited groundwater recharge facilities and has not been able to capture and recharge all available water under wet hydrological conditions. This project would entail building additional Cawelo GSA owned recharge facilities and/or improve the distribution system to increase the capacity to capture more water, especially during wet hydrologic events. Some facilities could be strategically located to capture storm runoff that may otherwise leave the Cawelo GSA area. It is estimated that approximately 200 to 570 acres of new recharge and banking facilities could be developed. Additionally, the Cawelo GSA will consider implementing a program to incentivize landowners to use their land for recharge. This could provide an opportunity for landowners to bank their privately owned water for future recovery and possibly allow the Cawelo GSA access to their lands for additional recharge. This program would not only increase recharge capacities during wet years but could also reduce water demand by replacing crops with recharge facilities. The privately owned water could be purchased under Project #1, New Water Supply Purchases, described above.	There are significant regions within the Cawelo GSA with soil properties that could achieve percolation rates of up to 0.5 AF per day. Assuming an average percolation rate of 0.35 AF/day and approximately 200 to 570 acres of potential new recharge and banking land, about an average of 500 AFY to 1,500 AFY of new water could be recharged for future recovery. It is not clear what magnitude landowner owned recharge facilities would have on importing additional waters into the Cawelo GSA area. It could be anywhere between an average of 50 AFY to 500 AFY.
CWD	New Cawelo GSA Banking Partners	Begin program in 2020.	The Cawelo Water District benefits from a banking program partnership with the Zone 7 Water Agency. Located in the Livermore Amador Valley, which is outside of the Kern County Subbasin. The District stores water for Zone 7 and keeps half of the water that it stores. For example, for every 2 AF feet of water delivered to District recharge facilities, the District is obligated to only return 1 AF. The currently banking program with Zone 7 could be modified to increase the amount of water stored for Zone 7 and/or a new banking programs and partners could be considered to fund the construction of new facilities and/or to improve existing facilities. It is estimated this could increase the annual average water supply up to 500 AFY.	The expansion of the existing banking contract with Zone 7 and/or the development of additional banking partners would be a beneficial way the Cawelo GSA could increase its groundwater supply by the portion of water each partner agrees to essentially leave in the Cawelo GSA area. Zone 7 has agreed to leave 50 percent of all that is spread. It is estimated that this program would generate about 500 AFY.

Table 4-1. Kern Groundwater Authority List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
CWD	Water Treatment Facilities	Begin program in 2020.	The Cawelo GSA is currently evaluating projects to install water treatment facilities that will allow the Cawelo GSA to acquire wastewater and treat it to a level that is safe for crop irrigation. Wastewater is exempt from SGMA regulation and the treated wastewater would be considered new water. There is a substantial volume of oilfield produced water (OPW), a byproduct of oil production, available in the vicinity of the Cawelo GSA. The salinity of OPW can range from moderate to high, although even the best quality still requires some level of blending with fresh water before it can be used on crops. Reverse osmosis or distillation would generally be needed to remove enough salts to make the OPW usable for irrigation. Near the Cawelo GSA, approximately 20,000 AFY of wastewater is injected into exempt groundwater aquifers well below the base of fresh water. The Cawelo GSA is evaluating potential projects to treat anywhere from 7,500 AFY to 20,000 AFY of OPW.	The treated OPW would be a new source of about 7,500 AFY to 20,000 AFY of water for irrigation.
CWD	Friant Pipeline Project	Construction in 2019.	The Cawelo GSA is currently developing the Friant Pipeline Project that would increase water importation capacity into the Cawelo GSA area. Currently, the amount of imported water that the Cawelo GSA can import into the area is limited by conveyance capacity, not by irrigation demand or recharge basin capacities. The Friant Pipeline Project would increase the total capacity by 100 cubic feet per second (cfs) and connect Cawelo's Famoso Recharge Basins directly to the Friant Kern Canal. The increased capacity would allow greater access to high flow water and support banking programs with Friant Contractors. The Friant Pipeline Project would result in an additional 1,500 AFY to 2,500 AFY of water brought into the Cawelo GSA area on an average annual basis.	The Friant Pipeline Project would increase the total capacity into the Cawelo GSA by 100 cfs and increase access to CVP high flow waters and allow for banking programs with Friant Contractors. It would result in an additional 1,500 AFY to 2,500 AFY of water brought into the Cawelo GSA area on an average annual basis.
CWD	Poso Creek Flood Water Capture	Target 2030 Implementation	The CWD has appropriative rights to divert water from Poso Creek, an ephemeral stream, when there are flows into the Cawelo GSA area. Additionally, there are downstream districts that also have subsequent appropriative rights and certain adjacent landowners that exercise their riparian rights. CWD also has additional diversion rights to divert supplementary water when high flows occur. The Poso Creek Flood Water Capture Project would consist of the construction of additional facilities to take advantage of those additional rights and divert supplementary water from the creek during times of high flow. In addition to making more water available to the Cawelo GSA, this capture of additional high flows could reduce potential downstream flooding impacts. Participation from downstream right holders would be needed due to potential water right impacts. The estimated net water gain is up to 150 AFY on average.	The Poso Creek Flood Water Capture Project would provide up to 150 AFY on average of additional water and could reduce potential downstream flooding impacts.
CWD	Surface Water Storage	Target 2030 Implementation	The Cawelo GSA has several existing reservoirs with a combined storage capacity of 800 AF. This project would consist of constructing a new 5,000 AF reservoir within the Cawelo GSA boundary. This would provide additional storage capacity to bring more water into the Cawelo GSA area during wet years. It is estimated that this new reservoir would provide approximately 500 AFY on average. This program would likely only be implemented conjunctively with other water management programs.	A new reservoir would provide approximately 500 AFY on average.
CWD	Out of Cawelo GSA Banking	Begin program in 2020.	The Cawelo GSA will evaluate groundwater banking projects that are outside the Cawelo GSA but within the Kern County Subbasin and also groundwater banking projects outside of the Kern County Subbasin. Potential banking projects outside of the Cawelo GSA are likely to have multiple participants and therefore offer a limited share of project benefits.	This Project could yield an average annual benefit of 500 AFY to 4,000 AFY through out of Cawelo GSA banking programs.
Eastside Water Management Area				
EWMA	Project-1	Not yet initiated; Timetable TBD.	Development of oilfield produced-water supplies to potentially reduce groundwater demand.	Potential additional external source of water for the basin (annual volume TBD).
EWMA	Project-2	Not yet initiated; Timetable TBD.	Investigation of groundwater quality by compilation and analysis of (a) available water quality data, and (b) borehole geophysical data.	Improved HCM and understanding of 3-D distribution of TDS in specific aquifers or regions.
EWMA	Project-3	Not yet initiated; Timetable TBD.	Improved estimation of local (EWMA) native yield by use of additional field-collected data and analysis.	Improved HCM and understanding of groundwater recharge in specific aquifers or regions.
EWMA	Project-4	Not yet initiated; Timetable TBD.	Construction of aquifer-specific monitoring wells in locations with data gaps, to better understand hydraulic heads and gradients.	Improved ability to monitor groundwater conditions in specific aquifers or areas.
EWMA	Project-5	Not yet initiated; Timetable TBD.	Installation of pressure transducers in selected wells of the monitoring network, to collect high-resolution cost-effective data.	Improved ability to monitor groundwater conditions in EWMA.
EWMA	Project-6	Not yet initiated; Timetable TBD.	Surface runoff capture and enhanced infiltration in impoundments.	Reduced groundwater pumping (annual volume TBD) to meet sustainability goals, as needed.
EWMA	Management Action-7	Not yet initiated; Timetable TBD.	Reduction of irrigated acreage, or modification of irrigation techniques or crop types to reduce water usage.	Reduced groundwater pumping (annual volume TBD) to meet sustainability goals, as needed.
EWMA	Management Action-8	Not yet initiated; Timetable TBD.	Assess fees for groundwater use to encourage reduced pumping or curtailment.	Reduced groundwater pumping (annual volume TBD) to meet sustainability goals, as needed.
EWMA	Management Action-9	Not yet initiated; Timetable TBD.	Establish a system of transferrable water credits.	Reduced groundwater pumping (annual volume TBD) to meet sustainability goals, as needed.

Table 4-1. Kern Groundwater Authority List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
EWMA	Management Action-10	Not yet initiated; Timetable TBD.	Legal and administrative review: effects of CEQA and water law on joint management of native yield.	Clarification of constraints on sustainable groundwater management in EWMA.
Kern Water Bank Authority				
KWB	Temporary Lowering of Groundwater Levels	Ongoing	KWB operations can cause a temporary lowering of groundwater levels in adjacent areas toward the end of extended droughts. In order to mitigate the potential impacts that might arise from those temporary changes, DWR has developed mitigation measures for the project, which have now been coordinated with other adjacent water banking projects and incorporated into a Joint Operations Plan. The Joint Operations Plan designates measures to prevent, eliminate or mitigate significant adverse impacts resulting from project recovery operations.	
KWB	Reduction of Groundwater Storage	Ongoing	KWBA cannot recover water beyond those volumes previously stored less appropriate losses. When storage accounts reach zero, recovery pumping will stop. Given due consideration to this mitigation measure, no other management actions are necessary	
KWB	Degraded Water Quality	Ongoing	Groundwater monitoring from 1994 through 2018 indicates groundwater quality is not being degraded by KWB water banking activities, and in fact the removal of salts is benefitting the aquifer. DWR developed mitigation measures to ensure that continued KWB operations do not degrade groundwater quality.	
KWB	Subsidence	Ongoing	Subsidence has not occurred in over twenty years of KWB operations. DWR has also concluded that subsidence is not likely to occur as the result of future operations. Monitoring will continue, and if subsidence begins to develop appropriate mitigation measures will be developed.	
KWB	Project	Not yet initiated.	KWBA intends to construct an additional 1,025 acres of recharge basins.	Project will allow KWBA capture more water in the future, furthering the conservation goals of SGMA.
Kern Tulare Water District				
KTWD	Action 1: Modify District Pricing Structure	ction 1 could be executed during the first 5 years of implementing the Plan (2020-2025).	The most affordable way to reduce groundwater pumping is to provide a pricing mechanism that causes groundwater to cost more than surface water. This could be accomplished by implementing a "groundwater charge" for every acre-foot pumped. Water Code §35533 provides the District the authority to collect groundwater charges. Revenue from the groundwater charge could be used to implement management actions or to reduce the cost to deliver surface water from the District.	5,580 AF/yr reduction in groundwater pumping.
KTWD	Action 2: CRC Pipeline Project - Produced Water Project	The District and CRC are in the process of acquiring permits, preparing an anti-degradation analysis and acquiring a WDR from the Regional Board. Project pipelines have been designed and plan and profile drawings have been prepared. The District is negotiating an agreement with CRC and obtaining rights-of-way. The pipeline construction is expected to be completed prior to 2025.	The District has historically accepted produced water to provide surface water to the District and is in the process of obtaining an additional source of produced water from California Resources Corporation (CRC). Produced water from CRC will be transported through 12 miles of 15-inch pipeline to the Guzman Reservoir. From the Guzman Reservoir, water will be transported through 1.8 miles of 30-inch pipeline to the District's existing Big 4 Reservoir, from which it will be blended with water from the Friant-Kern Canal and distributed in existing facilities to existing irrigated agriculture located within the District.	3,000 AF/yr of additional surface supplies (results in a reduction of 1,440 AF/yr in groundwater pumping).
KTWD	Action 3: In-District Surface Storage	The project is still in the preliminary design phase and will require additional steps before construction. The District has selected two potential reservoir sites, completed exploratory borings, and conducted a geotechnical evaluation of the two potential sites. The District has yet to acquire land and rights of way, permits, environmental documentation, or project financing. It is estimated that these facilities will be constructed between 2025 and 2030 if they are determined to be feasible and found to be necessary.	There are times when affordable water supplies are available, but the District has little to no irrigation demand and no available spreading capacity in its existing out-of-district banking programs. Construction of off-stream surface storage will allow the District to acquire water when it is available and store it to meet future irrigation demands. The District has selected two potential reservoir sites with a total capacity of 8,000 AF to capture wet year water. The sites are located to the east of the District in both the north and south portions. A location map of facilities and detailed description is not provided due to the confidential nature of the property and rights of way acquisition.	Based upon annual water supply modeling herein, the project yields only 530 AF/yr. However, a monthly analysis will need to be conducted to provide a better estimate of project yield, which could be as much as 2,000 AF/yr (assumes the reservoirs are used once every 4 years).
North Kern Water District & Shafter-Wasco Irrigation District				
NKWSD	Calloway Canal Improvements: Lining Snow Rd. to 7th Standard Rd.	Calloway Canal Lining is an ongoing project. NKWSD is in the process of acquiring adequate funding to complete the next one-mile lining of the project. The proposed project schedule includes a start date of October 2019 and completion within 36-months.	Calloway Canal Improvements is part of NKWSD's continued effort of the recently completed 1.1-mile long canal lining. The first phase of this project consists of concrete lining approximately 2,200 LF of currently unlined portion of the Calloway Canal to increase surface water reliability and prevent seepage.. Phase two of this project includes water delivery improvements (WDI) that consist of installing magnetic flowmeters (or magmeters) at a total of 50 of the District owned production wells. Each magmeter will include a totalizer capable of measuring the volume of groundwater pumped through the wells. Further, water level sensors will also be installed in each of the 50 production wells and four additional monitoring wells to quantify the depth-to-water data. Additionally, the District proposes to implement telemetry upgrades at each of the production well sites, each of the monitoring well sites, and 14 remote Terminal Unity (RTUs-used to measure canal levels) sites. The final part of the water delivery improvements integrating these sites with NKWSD's Supervisory Control and Data Acquisition (SCADA) setup.	Lining the canal will reduce the irrecoverable losses that result when high quality surface water seeps to poor quality groundwater, which cannot be recovered for later use without substantial treatment. Reducing these losses enhances NKWSD's capability to deliver increased volumes of water from the Kern River to irrigators for existing demand. The integration of the telemetry system with the SCADA setup will enable the District to control well operation and access their groundwater pumping data remotely. Water conserved by lining the canal and implementing WDI is estimated at 1,576 AFY.

Table 4-1. Kern Groundwater Authority List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
NKWSD	Expanded Water Banking Program	This program is an expansion of the District's ongoing groundwater banking program. Environmental documents are being prepared to carry out the program in a timely manner.	Due to historically low groundwater levels, requirements under SGMA, and potential reductions in its historical water supplies, NKWSD is proposing a new program to increase its existing conjunctive use (or water banking) facilities and subsequently expand these facilities. Phase I of this program would primarily rely on unused capacity in existing facilities which is available from time to time (with some additional conveyance) and would seek to increase the utilization of the District's proven recharge and recovery assets. Phase II would involve the construction of additional direct recharge and recovery facilities to further expand water banking in the District. Both the District and District landowners will receive water supply benefits from this program.	Implementation of this program would bring additional water supplies that would help offset potential losses of the District's historical supplies, support the District's mission of maintaining economic pumping lifts for its landowners, and maintain supplies to be used for municipal and industrial purposes by the city of Shafter. Quantitative benefits include 50,000 AFY (Phase I) and 72,000 AFY (Phase II) for a total of 122,000 AFY of water for the District.
NKWSD	Groundwater Banking Conveyance Improvements to NKWSD Recharge and Recovery	NKWSD is in the process of acquiring adequate funding to complete this project. The proposed project schedule includes a start date of October 2019 and completion by the end of 2021.	The proposed project involves the drilling and equipping of three replacement wells and connecting two other deeps wells (five total) to NKWSD's existing network to improve return capacity of recharged water for the District's neighbors. Proposed project is to construct the necessary pipelines to connect five deep wells to the District's recovery network system that improves the capacity to return water supplies multiple districts in the region during dry years.	Implementation of this project is anticipated to return previously stored water into the FKC and NKWSD's conveyance system at a rate of approximately 27 cfs. This equates to a total estimated average of 1,660 acre-feet per month, or an annual capacity of 9,961 acre-feet per year for the seasonal use of the wells (six months in a year) to improve the return capacity for the Poso Creek IRWM CVP Contractors to meet irrigation demands during a critically dry year. Two of the five wells will discharge into the District's canals and the remaining three will connect to the District's manifold pipeline, which ultimately discharges to the FKC.
NKWSD	Beneficial Reuse of Oilfield Produced Water	This is an ongoing project. NKWSD is interested in expanding the amount of oilfield produced water being brought into the district; however, no decision has been made at this time.	Since 2015, NKWSD has made beneficial reuse of oilfield produced water by blending produced water with other surface supplies for irrigation use. The California Resources Corporation (CRC) discharges 58 acre-feet per day of produced water from CRC's Kern Front Oil Field to NKWSD. The blended water is used directly for irrigation or is discharged to spreading basins in NKWSD for groundwater recharge.	Currently, this project has an important beneficial impact on water resources in the local area. One impact of the project is the annual recycling of up to 11,000 AF of oilfield produced water to the District. This flow is blended with other water sources and used for irrigation and groundwater recharge. Produced water increases the District's water supply and partially replaces groundwater that would otherwise be pumped. During the winter season, produced water is discharged to the Rosedale Spreading Basins along with any available Kern River water to recharge groundwater supplies. This has the added benefit of decreasing the rate of groundwater decline and lowering pumping costs.
NKWSD	SCADA Automation and Evapotranspiration Measurement Improvements	This is an ongoing project. The District is in the process of switching from SCADA to Wonderware Software and plans to implement upon approval from Reclamation.	The proposed project includes the installation of Supervisory Control and Data Acquisition (SCADA) Automation software along with Evapo-transpiration (ET) measurement stations. This project is divided into two components, the purpose of the first component is to remotely monitor and control the District owned and operated groundwater wells and Canal level transmitters. The second component of this project is to install evapo-transpiration (ET) stations in strategic locations within the District. The District anticipates that the crop specific ET measurements will help the District and its growers to correlate the ET and the applied water with the crop yield.	With these modernization efforts, the District can automatically record the instantaneous groundwater pumping rate, depth to groundwater, canal level, water quality parameters, and ET data.
NKWSD	Poso Creek Weir	Currently, this project is in preliminary stages. This project is part of the projects planned to meet the sustainability goal of the District by 2040. NKWSD may implement this at any time over the planning horizon to reach its sustainability goal.	NKWSD plans to construct a weir on the Poso Creek Flood channel to divert water into their facilities. The District currently has an earthen plug that works to divert water; however, the plug is not reliable and has proven to be inefficient for the District. Implementation of this project will provide a more reliable management of flows, allow water to be measured as it is diverted, and reduce the velocity and sediment loading prior to diversion. Diverted water will be used to increase groundwater banking activities in NKWSD to help prevent further lowering of groundwater levels.	Construction of a weir will provide the ability to drop out sediment prior to flood water entering the District's distribution system or direct spreading facility. By slowing the velocity and allowing sediment to drop out, higher water quality is diverted into the district.
NKWSD	Spreading Pond Facility	No Data	No Data	No Data
RRID	Expanded Recharge	Project is in the conceptual phase; however, the pre-existing conveyance pipeline allows for swift project implementation if needed.	RRID will expand their recharge to include on-farm spreading to maximize recharge capability. To ensure adequate delivery of supplies, water delivery infrastructure improvements will be included in this project. Improvements to the CRC pipeline will be made before on-farm recharge occurs.	An estimated 6,000 AFY would be added to the already 5,000 AFY provided by CRC for the purposes of beneficial reuse.
RRID	Allocation of Available NKWSD Supplies	This project is ongoing as NKWSD already allocates produced water to their facility; however, water spread in the Rosedale facility will now exclusively benefit RRID.	Oilfield produced water will be allocated to North Kern's Rosedale spreading facility for RRID's exclusive benefit.	
SWID	Diltz Intertie Lateral Piping and WMI	Design plan specifications have been completed for the proposed later improvements coinciding with the Diltz Intertie mainline design. Project is in its pre-construction phase and will be fully implemented in 2020.	The proposed project includes installing pressurized pipe laterals to connect the Diltz Intertie mainline to serve 380 acres of irrigated land. Project will consist of a 1.5-mile long, 30 cfs, 36- inch diameter, bi-directional, intertie pipeline, which will allow for the efficient conveyance of surface water supplies to spreading ground facilities located in SWID.	Component 1 is expected to decrease groundwater pumping in the SWID by providing growers with pressurized surface water deliveries at a greater capacity and frequency. Decreased groundwater pumping in SWID will all for the recovery of groundwater elevations. This project will save 1,927 AFY of water following project completion.
SWID	Bell Recharge Project	Project is currently in planning phase and still requires final pipeline alignment selection to begin other project components such as easement acquisition, final design, and bidding.	Implementation of this project includes the construction of a 12 cfs conveyance improvement along SWID's existing distribution system that will allow CVP-Friant supply to be delivered from the FKC to the Bell Recharge site. Bell project will allow for delivery of surface water to the new Bell Recharge facilities form the CVP, for increased water storage.	Proposed Bell Project pipeline connection is anticipated to convey CVP wet period water into SWSD at a rate of 12 CFS with estimated annual benefits of 1,728 AFY.

Table 4-1. Kern Groundwater Authority List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
SWID	Kimberlina Recharge Project	Already being implemented. To be completed by 2022.	Construction of a 285-acre recharge site for CVP surface water.	Water suuply augmentation of approximately 19,000 AFY
SWID	Leonard Avenue Conveyance Improvement Project	Project is currently in planning phase and still requires final pipeline alignment selection to begin other project components such as easement acquisition, final design, and bidding.	This project involves the construction of 1.5 miles of pipeline to connect SWID with Semitropic Water Storage District (SWSD). Implementation of a new pipeline will provide SWID with the operational flexibility to absorb surface water when it is available for delivery to SWSD's distribution system, connecting the supply to in-lieu and direct recharge facilities in SWSD, generally during wet periods, so that water delivered can later be recovered for irrigation in peak demand months, or dry periods.	When implemented, this project will provide added capacity to absorb surplus water from the CVP during wet periods. It is estimated that this project will capture 2,880 AFY of surface supply, predominately from the CVP surface floodwater conveyed via the FKC, through SWID and into SWSD. Additional water absorbed into the groundwater basin will be split 50/50 between SWID and SWSD. The total average annual water saving to SWID is 1,440 AFY. Captured water will directly offset SWID's reliance on San Joaquin River supplies to the Bay-Delta and help conserve local groundwater supplies.
SWID	Improved Water Level Measurement of District Recharge Facility	This project is in the planning phase. Implementation of this project may begin as soon as 2020.	Proposed project includes the construction of a 400 to 500-feet deep, 8-inch diameter PVC monitoring well and the conversion of an existing older well to an 800-feet deep, 6-inch diameter monitoring well both equipped with both water-level sensors and located within the District's recharge facility. Both monitoring wells will help manage and collection information on groundwater levels which can be used to document site performance as well as monitor the effects on the groundwater aquifer levels.	Implementation of this project will contribute to improving the district's drought resiliency and preserving groundwater levels by monitoring groundwater levels in the facility and improving efficiency of recharge operations.
NKWSD	Refinement of Water Budget Components	Ongoing	Improvement of monitoring and measurements to refine the accuracy of measurement or calculation of inflow and outflow components of district level water budget. Will also refine Subbasin Model and water budget.	This management action is conceptual; a volume of water associated with this management action has not been calculated.
NKWSD/SWID	"Surface Water First" Incentive Program	This Management Action is in the preliminary stages of consideration by the districts. It has not been formally adopted but is under consideration.	Both NKWSD and SWID have access to imported surface water to supply their respective jurisdictional areas. However, there instances in which growers have historically opted to pump groundwater, rather than receiving deliveries of surface water from the district which services their properties. When this occurs, the district must either use that water for groundwater recharge or enter into exchanges with other districts (either in the KCS or in another basin). While this may be an economic decision for the grower, it has the potential to cause local impacts to groundwater in the district over the long-term. To prevent local impacts to groundwater due to the use of groundwater over available surface water, the districts may explore a fee structure in which growers with access to surface water may be assessed for the use of groundwater when surface water is available for use. The fees collected for such activities would be applied to the expansion of existing recharge projects or the development of new recharge projects to accommodate the additional surface water that would be brought into the district to replace the additional groundwater pumped.	A reduction of groundwater extraction would result from the implementation of this incentive program. The fees collected in this incentive program have not been quantified but would also provide a source of funding for the expansion of existing recharge or the development of new recharge projects within the districts.
NKWSD/SWID	On-Farm Efficiency/Deficit Irrigation Practices Incentive Program	The provisions of the conservation laws are being complied with by both NKWSD and SWID. Ag water management plans, as required by SB 7, are being regularly updated by these districts for submittal to DWR. Plans will be updated to include the applicable requirements of AB 1668 and SB 606.	As agricultural water service providers, both NKWSD and SWID comply with all provisions of SB 7 (amending Division 6, Part 2.55 of the Water Code) passed into law in November 2009 regarding agricultural water conservation and management. Efficient management practices in the law, related to SGMA objectives, include volumetric water pricing, incentives for conjunctive use and increased groundwater recharge, and development of an overall water budget. AB 1668 and SB 606 passed in 2018 did not materially add to these objectives, save for those districts serving between 10,000 and 25,000 acres who must now prepare water management plans under the newer laws.	There are no direct benefits to be derived and quantified from compliance with the aforementioned agricultural conservation laws at the present time. The districts will continue to divert for beneficial use all local and imported water supplies to which it is entitled. Should agricultural demands for irrigation water diminish as a result of some of the conservation provisions, a larger portion of diverted supplies will be devoted to groundwater recharge in the future.
NKWSD/SWID	On-Farm Recharge Activities Incentive Program	This Management Action is in the preliminary stages of consideration by the districts. It has not been formally adopted but is under consideration.	In wet years, when the districts have utilized the full capacity of their respective recharge basins and spreading grounds, it may be necessary for the districts to seek other locations for the application of available surface water for groundwater recharge. The districts will develop an incentive program to encourage landowners to take delivery of available water that is in excess of customer demand and the districts' capacity for recharge projects for application to fallow land and/or over-irrigation of crops to facilitate further groundwater recharge. Landowners will receive a groundwater credit in exchange for participation in this program, for their use within the district which has provided the water for on-farm recharge activities.	A increase of groundwater recharge would result from theimplementation of this incentive program.
NKWSD/SWID	Subsurface Recharge Feasibility Study	This Management Action is in the preliminary stages of consideration by the districts. It has not been formally adopted but is under consideration.	Both NKWSD and SWID have been approached by landowners within their respective districts about the efficacy and use of subsurface recharge methods. While subsurface recharge is being tested in neighboring districts, neither NKWSD nor SWID have taken an official position on the use of such methods. Before the implementation of any program which would supply water to landowners for use in subsurface recharge practices, the districts will conduct a feasibility study to evaluate whether or not these practices are appropriate for the hydrogeologic conditions and/or land uses within their respective jurisdictions. The scope of the feasibility study is yet to be determined, but it will include an evaluation of subsurface recharge methods, the soil types located within each district, the effectiveness of subsurface recharge compared to other recharge methods, and its compatibility with existing land uses.	No benefits have been quantified for this Management Action at this time. Potential benefits gained through the use of subsurface recharge will be determined as a result of this Management Action.

Table 4-1. Kern Groundwater Authority List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
NKWSD/SWID	Land Conversion from Agricultural Use to Urban Use	The conversion of land use from agricultural to urban is an ongoing process, the pace of which is determined by external factors such as the demand for land based on each city's growth and need for additional housing and/or property to support business, industrial, or municipal use. The projected growth for each city is based upon the current General Plans and may be subject to change when the cities update their respective plans.	As described in the General Plans for the cities of Shafter and Wasco, anticipated population growth is expected to lead to changes in land use within the limits of each city and in the Sphere of Influence for each city. The conversion of land use from agricultural to urban use generally leads to an overall reduction in groundwater use due to the decreased demand, in terms of volume per unit area.	For NKWSD's jurisdiction, there is an anticipated reduction of water by 2030, based on the conversion of land use as the city of Shafter expands. In SWID's jurisdiction, the anticipated reduction of water by 2030 reflects the anticipated growth of both Shafter and Wasco.
NKWSD/SWID	Urban Water Conservation Program	The cities of Shafter and Wasco are currently evaluating their respective compliance measures for indoor use and are awaiting additional information and guidelines concerning regional outdoor and landscape compliance measures. The cities presently are complying with the 2020 mandates contained in SB 7X-7 and as embodied in their respective UWMPs. As the SWRCB establishes its compliance deadlines for both indoor and outdoor usage, anticipated to occur by 2025, the municipal KGA Members will have a clearer picture of an implementation schedule.	As referenced in the Umbrella Basin Setting (Chapter 2), urban water usage in the future is expected to comply with the conservation mandates contained in SB 606 and AB 1668, both bills signed into law in May 2018. Based on that legislation, indoor residential use is to be capped at 55 gpcd in 2019 and ramp down to 50 gpcd by 2030, and outdoor residential use is to be capped in the future based on local climate and size of landscaped areas. Standards for outdoor usage are to be defined in a SWRCB rule-making process to be completed by June 2022.	Given the early implementation stages of AB 1668 and SB 606, its benefits in terms of reduced groundwater pumping by Shafter and Wasco can only be roughly approximated. The Pacific Institute, in its 2014 report "Urban Water Conservation and Efficiency Potential in Calif." estimated that indoor usage could be reduced by 33-40 gpcd, and that outdoor/landscape usage could be reduced by 20-50 gpcd. These values are on a statewide basis and likely unrealistic in some regions; however, the report postulates that total urban water usage could be reduced by as much as 30-60%. Savings of this magnitude would represent a significant reduction in groundwater pumping by both cities. The Measurable Objectives to be partially met with additional urban conservation include groundwater level stabilization and, by proxy, groundwater storage stabilization.
SWID	Mitigation Program for Potential Impacts to Domestic Wells	Upon implementation of the law.	In coordination with other KGA members, develop a mitigation program to offer financial assistance for the replacement of domestic wells which are impacted by groundwater management to the proposed SMCs. Coordinate development of eligibility criteria for participation in mitigation program.	Since this management action is conceptual, a volume of water associated with this management action has not been calculated.
NKWSD/SWID	In-District Allocation Structure	This Management Action is in the conceptual stages, having been discussed with various stakeholder groups. However, an actual structures and fee schedules have yet to be devised for either district.	At the time of this draft of the GSP, neither NKWSD nor SWID have an established allocation structure and fee schedule for groundwater extraction. As SGMA is implemented throughout the KCS, the districts are required to manage to the Sustainable Management Criteria (SMCs). One of the ways to manage for the SMCs is to allocate the Sustainable Yield for their respective districts to the landowners within their districts. While the specifics of such an allocation structure may vary between the districts, a baseline groundwater extraction volume would be allocated to each parcel based on its size and the Sustainable Yield for the district. If a landowner were to extract more water than the baseline volume for that parcel or for the aggregate of all of their parcels within the district, they would be required to pay an extraction fee which would be applied toward projects and programs implemented by the district to reach and/or maintain sustainability.	The benefits to sustainable groundwater management have not been quantified at this time. However, the development and implementation of an allocation structure for each district would allow for the districts to utilize their Sustainable Yield as a management tool for reaching and maintaining their SMCs.
NKWSD/SWID	Voluntary Land Fallowing	At this time, this Management Action is conceptual. The districts will develop their respective fallowing programs during the SGMA implementation period.	In the event of a drought, the districts may not be able to entirely meet in-district demand by increasing the volume of imported water. The combination of decreased availability in surface water to supply to the district and decreased recharge from other sources in the subbasin has the potential to lead to violations of SMCs at the Representative Monitoring Sites, in the absence of decreased demand. To facilitate the districts' ability to maintain sustainability at their respective monitoring sites, the districts will develop and implement their own voluntary land fallowing programs for their jurisdictions.	The decrease in water demand will be dependent upon the land being fallowed and its existing land use at the time of fallowing. Agricultural demand for water is generally estimated to be 3 AF/acre. Fallowing or land retirement would reduce the demand to zero for the lands participating in the program.
NKWSD/SWID	Pumping Restrictions	At this time, this Management Action is conceptual. The districts will develop their respective processes to implement pumping restrictions within their jurisdictions.	In the event that the districts or the entire subbasin are nearing a condition where they are at risk of triggering an Undesirable Result, even with the implementation of the projects and management actions described in this Plan, it may be necessary for the districts to limit groundwater pumping. The volume of groundwater extraction permitted under this Management Action would be determined by the districts based on the Sustainable Yield for the district and the SMCs at the Representative Monitoring Sites.	Pumping restrictions based on the Sustainable Yield of the district, could decrease groundwater demand if applied to NKWSD. If applied to SWID, pumping restrictions could decrease groundwater demand.
Pioneer Groundwater Sustainability Agency				
Pioneer	Project 1: Participation in California WaterFix	Participation in California WaterFix is within the authority of KCWA as an SWP contractor and its decision to fully, partially or not participate would require coordination with its Member Units.	California WaterFix may be implemented by DWR in partnership with the Delta Conveyance Design and Construction Joint Powers Authority (JPA) to increase the amount of water that can safely be diverted from the Delta by constructing a diversion in the upper Delta and conveying it through a tunnel(s) to the existing SWP and CVP pump stations. Under current operations, the SWP and CVP are unable to consistently deliver full contract amounts of water because of environmental and water quality concerns. Diverting a portion of Delta supplies at a point further upstream and further from the ocean would reduce water quality issues because the source water is high quality, and is less likely to cause seawater intrusion in the lower Delta. It will also help reduce diversion-specific impacts on the environment by reducing direct impacts of pumping on aquatic species, such as reversal of Delta flow and entrapment in screens on the diversion pumps (CNRA, 2018).	The new monitoring well cluster will address an identified data gap in the Pioneer GSA Area. The monitoring well cluster will also help Pioneer GSA evaluate maintenance of its sustainability goals and monitor groundwater conditions in that portion of the Pioneer GSA Area.

Table 4-1. Kern Groundwater Authority List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
Pioneer	Project 2: Install Monitoring Well in North Pioneer	Implementation of this project entails planning, permitting, design and currently, construction of the monitoring well cluster. KCWA and/or its consultants will secure necessary permits and plan, design and construct the wells. KCWA will monitor the wells as part of normal Pioneer Project operations.	A data gap for groundwater monitoring north of the Kern River was identified during development of this Chapter GSP, and a monitoring well cluster is being constructed in the northwest triangle-shaped parcel of the Pioneer Project (i.e., the area of the GSA north of Kern River). The triangle shaped parcel is in the northwest portion of the North Pioneer Area, and does not include a recharge pond. This area is in the southeast quarter of section 6, T 30S/R26E. The monitoring well cluster will allow groundwater monitoring at multiple depths using three separate boreholes.	The new monitoring well cluster will address an identified data gap in the Pioneer GSA Area. The monitoring well cluster will also help Pioneer GSA evaluate maintenance of its sustainability goals and monitor groundwater conditions in that portion of the Pioneer GSA Area.
Pioneer	Management Action 1: Continued Balanced Pumping and Recharge	This management action would be accomplished through continuation of existing groundwater recharge and recovery operations. Surplus water would be banked either for overdraft recovery or future use. Banked groundwater would be used to supplement water supplies in dry years or during years of shortages	Continued balanced pumping and recharge is the standard operating procedure for the Pioneer GSA. Under this management action, long-term pumping would be balanced by long-term recharge activities in the Pioneer GSA Area. Pioneer GSA would continue to closely monitor water that is pumped from the Subbasin and water that recharges the Subbasin with the goal of a balanced groundwater budget over the long term.	The Pioneer Project is operated in a manner that results in more water being recharged than recovered from the Subbasin in the Pioneer GSA Area. Therefore, continuing operation of the Pioneer Project in the same manner would provide a net positive increase of groundwater volume in the Pioneer GSA Area. Full benefits of this management action would be evaluated through accounting of water recharge volumes compared to groundwater pumping.
Pioneer	Management Action 2: Continued Participation in Basin-Wide Coordination with other GSAs	This management action would be accomplished through continued attendance at KGA coordination meetings and by arranging periodic coordination meetings with the Kern River GSA, the Henry Miller GSA, the WKWD GSA and the Buena Vista GSA. Meetings would be attended by one or more representatives of Pioneer GSA and may include the GSA manager or their designated staff. Decisions made in coordination meetings would not be binding until approved by the appropriate authority, such as the Pioneer GSA manager or by KCWA's Board of Directors.	Pioneer GSA is one of 11 GSAs in the Subbasin. Sustainable management of the Subbasin as a whole requires coordination among GSAs and their respective GSPs. During development of the GSPs in the Subbasin, GSAs have been discussing sustainability thresholds, potential projects and management actions and specific issues and concerns. The KGA is a JPA composed of member agencies that was established in 2014 to develop and implement a groundwater management plan in the Subbasin and the neighboring Tulare Lake Groundwater Basin (KGA, 2017). This management action would involve attending monthly KGA manager and coordination meetings, as well as KGA stakeholder meetings, which are held as needed. Quarterly coordination meetings would be held with the Kern River GSA, and annual coordination meetings would be held with the Henry Miller GSA, the WKWD GSA and the Buena Vista GSA.	This management action would continue existing coordination activities between GSA managers, and help to build and maintain relationships with neighboring GSAs. Through coordination activities and ongoing communication, potential conflicts among GSAs regarding groundwater management would be mitigated because GSAs would better understand the challenges facing each other and how these challenges are being addressed. It will also provide an opportunity for GSAs to inform each other of potential issues that may require intra-Subbasin coordination, and to inform neighboring GSAs of management actions and projects under way that may affect decisions of other GSAs.
Pioneer	Adaptive Management Strategy: Increase Surface Spreading Losses from 6 to 10 Percent	Coordination would be initiated by KCWA with the Pioneer Project Participants.	Under the *Pioneer Project Participation Agreement* , all surface water diverted to the Pioneer Project for spreading is assessed a 6 percent loss factor. All losses assessed are non-recoverable. This provision was set up to "prevent, eliminate or mitigate significant adverse impacts" resulting from project recovery operations. The intent of losses assessed is to assist in mitigating impacts to adjoining entities. This adaptive management strategy would explore feasibility of increasing the fixed loss rate from 6 percent to a fixed loss rate of 10 percent.	This adaptive management strategy would provide KCWA and the Pioneer Project Participants an understanding of the feasibility of increasing lossess assessed to diverted surface water. If increasing losses is deemed feasible, it would provide the Pioneer Project and the opportunity to mitigate and avoid undersirable results and support the for sustainability indicators relevant to the Pioneer GSA as follows: chronic lowering of groundwater levels (direct), reduction of groundwater storage (proxy), degraded water quality (proxy), and subsidence (proxy).
Rosedale Rio Bravo Management Area				
RRBMA	West Basin Improvements	RRBWSD purchased the properties in 2009 2015. Project construction was completed in 2016	The improvement of existing recharge ponds and development of an additional 50 acre project west of Bakersfield designed to recharge, store and recover water to provide a cost effective and reliable water supply for landowners within the RRBWSD.	This project has the potential to recharge up to 5,000 AF of water in wet years. This could provide the RRBWSD with up to 1,000 AFY.
RRBMA	Stockdale East Groundwater Storage and Recovery Project	RRBWSD purchased the property in 2010. Project is 90% complete, it will be operational by 2020.	Project is a developed 200 acre project west of Bakersfield designed to recharge, store and recover water to provide a cost effective and reliable water supply for landowners within the RRBWSD.	This project has the potential to recharge up to 25,000 AF of water in wet years. This could provide the RRBWSD with up to 4,000 AF per year on average.
RRBMA	Pilot Projects	These continued GRAT projects could be on-line as early as 2025.	In 2017 the RRBWSD developed four pilot recharge projects under which it leased properties for temporary recharge activities. Since that time the District has invested in a Groundwater Recharge Assessment Tool (GRAT) in order to identify similar projet sites in the future.	Approximately 10,000 AF was recharged during that year of implementation in these four projects. The GRAT implementation could provide RRBWSD up to 2,000 AF per year.

Table 4-1. Kern Groundwater Authority List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
RRBMA	Onyx Ranch	The project is currently undergoing a feasibility and environmental analysis. The project could be on line as early as 2025.	The RRBWSD owns several parcels of land and the associated water rights for the Onyx Ranch and the Smith Ranch. These parcels are located along the South Fork of the Kern River in the Kern River Valley, in and around the communities of Weldon and Onyx, in an unincorporated area of northeastern Kern County. These parcels together comprise the 4,109.18 acre project site. The RRBWSD is currently conducting an analysis of a proposed change in the point of diversion and place of use of the water rights associated with these parcels so that the water can be delivered in the RRBWSD service area on the San Joaquin Valley floor and used for irrigation and groundwater recharge. The project would reduce the diversion of water on the project site and convert the irrigated fields to lower water use crops, or allow the fields to return to their native vegetative state. With the proposed project, RRBWSD would allow the water that would have been diverted on the project site to remain in the South Fork of the Kern River and flow downstream. This could result in a net increase in flows within the South Fork of the Kern River, and the Isabella Reservoir where the water would be released through the Isabella Dam and flow downstream in the lower Kern River until the water is diverted at the RRBWSD diversion point. From there, the RRBWSD would deliver the water to recharge basins and channels within and near its service area west of the City of Bakersfield (City) in unincorporated Kern County within the San Joaquin Valley.	The net increase in water supplies to the RRBWSD's service area as a result of the proposed project would help mitigate the shortages in RRBWSD's contracted State Water Project (SWP) water supply from the State of California, which has steadily reduced due to environmental constraints in the Sacramento/San Joaquin Delta. The proposed project would provide the RRBWSD with approximately 6,500 AF per year.
RRBMA	James Groundwater Storage and Recovery Project	Rosedale and Buena Vista Water Storage District jointly purchase the property in 2011. Current project status is feasibility and environmental analysis. This project could be online as early as 2025.	The James Groundwater Storage and Recovery Project is a proposed 2,070 acre project in southwest Bakersfield designed to recharge, store and recover water to provide a cost effective and reliable water supply for landowners within the RRBWSD (and elsewhere).	This project has the potential to recharge up to 150,000 AF of water in wet years. This could provide the RRBWSD with up to 3,000 AF per year.
RRBMA	Kern Fan Groundwater Storage Project.	Project status is feasibility analysis. This project could be on line as early as 2030.	The District has evaluated a conceptual Kern Fan Groundwater Storage Project (Kern Fan Project). This project would serve to develop a regional water bank in the Kern Fan to capture and store Article 21 water via the State Water Project (SWP) during conditions when surface water is abundant. A twophased approach would be taken to the development of the Kern Fan Project. The first phase would be to develop a project site, including the purchase of approximately 640 acres of land in the Kern Fan area. The first phase would also include constructing conveyance facilities, recharge facilities, and recovery facilities as necessary to develop a fully functioning water banking project. The second phase of the Kern Fan project would involve acquiring an additional 640 acres of land for expansion of the water banking facilities and developing the associated recharge and recovery facilities.	This could provide the RRBWSD with up to 10,000 AFY.
RRBMA	Western Rosedale In Lieu Service Area	Project status is shovel ready; feasibility and environmental analysis is complete. This project could be on line as early as 2035.	The Western Rosedale Lands In Lieu Service Area Project (the Project) includes construction and operation of up to ten miles of water conveyance pipelines, including appurtenant facilities (such as pumps and valves), and a joint service area agreement between RRBWSD and BVWSD in order to provide surface water to agricultural water users within the portion of RRBWSDs service area located westerly of Interstate 5 in close proximity to Buena Vista Water Storage Districts East Side Canal.	This could provide the RRBWSD with up to 1,000 AFY.
RRBMA	Ten Section Water Recharge Project	No implementation date is known at this time.	The owners of Ten Section located within the South of the River Monitoring Zone are currently studying the feasibility of a 200+ acre groundwater recharge, storage and recovery project.	It is estimated that approximately 2,200 AF/month could be recharged into the aquifer.
RRBMA	Water Charge Demand Reduction	This management action could be on line as early as 2025.	The Water Charge would be expected to result in demand reduction in the RRBWSD. For market reasons it is probable that landowners will opt to fallow ground in order to trade water supplies to other District landowners, as well as fallow lands (or limit double cropping) to avoid the Water Charge all together.	With an agricultural water consumptive use demand of about 84,000 AF per year we conservatively expect a 5% demand reduction as a result of the water charge which results in about 4,000 AFY of reduced demand
RRBMA	RRBWL (White Land) Water Supplies and Demand Imbalance Reduction	This management action could be on line as early as 2020.	White Lands (non RRBWSD lands) within the RRBMA that are not used for groundwater banking will correct the water supply imbalance on a linear basis over the planning period of 2020 2040. Like RRBWSD lands, the white lands will start with the native yield of 0.15 AF/acre. The total annual demand for white lands in the RRBMA is about 10,307 AFY with a water supply imbalance (or deficit) of 3,618 AFY. The average agricultural demand is 2.6 AF/acre according to METRIC studies. While agricultural demands in the White Lands range from 1.4 4.9 AF/acre the initial allowable demand will be the average demand of 2.6 AF/acre. It is expected that white lands would seek to acquire water supplies for in lieu and direct groundwater recharge via banking agreements with RRBWSD or others to offset demands.	Demand reduction will occur as follows over the 2020 2040 period; the imbalance will be reduced by 1/20 of the current imbalance each year (5%). This approach will result in about 217 AF of imbalance reduction each year and 2,170 AFY by 2030 and a total of 4,335 AFY by the 2040 sustainability planning period.
RRBMA	RRBWD 3rd Party Recharge and Storage Program	This management action could be on line as early as 2020.	The RRBWSD will assist 3rd parties (white lands, districts, and private parties) in recharging water supplies for use in the RRBMA or other down gradient areas in the Kern Sub basin. RRBWSD would offer existing conveyance and recharge facilities in exchange for a portion of the imported water supply and payments of yet to be developed costs and/or fees.	It is expected that the RRBWSD would provide this service in exchange for 20 33% of the imported water supply and that an average amount of 5000 AFY would be imported. This management action could bring an additional supply of 1,250 AFY to RRBDL lands.
Southern San Joaquin Municipal Utility District				

Table 4-1. Kern Groundwater Authority List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
SSJMUD	In-District Spreading and Recovery Facility	SSJMUD is in the process of purchasing land and applying for construction funding. Once these steps are complete, the District will implement this project immediately.	This project will include construction of 80-acres of spreading ponds and the installation of two recovery wells within district boundaries. The proposed recharge ponds have an anticipated annual capacity of 3,240 AFY. Prior to this project, the district has not had any in-district direct recharge facilities. Implementation of this project will allow SSJMUD the opportunity to capitalize on wet period storage of CVP supplies and allow them to bypass less favorable out-of-district banking agreements to store water that would increase the District's and the subbasin's water reliability and drought resiliency.	The proposed recharge ponds have an anticipated annual capacity of 3,240 AFY. Estimated amount of water to deliver to recharge is at least 4,200 AFY. If the available surplus is delivered to an out-of-district facility, it is expected that North Kern will keep one-third of the water as part of banking agreements and SSJMUD will realize an average water benefit of 2,800 AFY. Captured water will directly offset the District's reliance on the San Joaquin River supplies to the Bay-Delta and help conserve local groundwater.
SSJMUD	SSJMUD and Semitropic Schuster Intertie	This project is in the conceptual stage of development and is included in the 2019 Poso Creek IRWM Plan Update.	The proposed project is to construct an intertie in coordination with SWSD. This pipeline will allow for SSJMUD to bank or return water to Semitropic previously delivered to Semitropic's groundwater banking program. SSJMUD could deliver wet period water from the FKC for groundwater banking to Semitropic or return water for irrigation purposes during dry years. This Project removes the need to involve a third-party in an agreement with Semitropic for banking since it establishes a direct connection to return water to SSJMUD from Semitropic, thereby increasing operational flexibility and reliability to deliver previously stored water from groundwater storage at times of drought.	Considering the frequency of surplus 'Other Water' in the Central Valley Project and the existing design limit of 50 cfs, the Project will allow for an expected average annual amount of 3,622 AF to be put into storage with 1,811 AF credited to SSJMUD for return. Given that recently the District became a member of the Poso Creek Integrated Regional Water Management Group (IRWM) in spring 2016, interties such as this pipeline were identified as the first step in the District's efforts towards banking water with their neighboring districts to add drought resiliency.
SSJMUD	SSJMUD and CWD Intertie Pipeline	This project is in the conceptual stage of development and is included in the 2019 Poso Creek IRWM Plan Update.	SSJMUD and CWD propose to construct a bidirectional intertie connecting their respective water conveyance systems. This pipeline is a regional opportunity to improve flexibility, reliability, and conjunctive use of water supplies.	The estimated annual yield of this project is approximately 50 to 500 AF, depending on the selected project size. Project size will be determined by greatest benefit yielded that is economically feasible and sustainable.
SSJMUD	SSJMUD and North Kern WSD 9-28 Intertie Pipeline	This project is in the planning stage of development, in conjunction with NKWSD, and is defined in the Poso Creek IRWM Plan.	Project proposal includes the construction of the 9-28 Intertie pipeline with NKWSD. This pipeline will allow for the return of CVP Class I, Class II, and surplus floodwater that was previously delivered to the District's groundwater banking partner (NKWSD) from the FKC for groundwater banking or irrigation purposes during wet years. The pipeline is the conveyance mechanism for return of previously stored water to the District during dry years. This project removes the need to involve a third-party in an agreement with North Kern for banking since it established a direct connection to return water to SSJMUD from NKWSD, thereby increasing operational flexibility and reliability to deliver previously stored water from groundwater storage during times of drought.	This project would allow for SSJMUD to better capture and utilize wet period supplies by increasing the District's capacity to return banked wet period water during dry periods. Considering the frequency of surplus Other Water in the Central Valley Project, the Project will allow for an expected annual amount of 10,000 AF to be put into storage with 6,667 AF credited to SSJMUD for return. The pipeline capacity to return water from North Kern to SSJMUD is 4,284 AFY, which will require roughly 1.5 years to return the water for each 10,000 AF of water banked and 6,667 AF credited.
SSJMUD	Southeast Delano Spreading Grounds	This project is in the planning stage of development. SSJMUD has already begun the process of developing a CEQA document to assess the potential impacts of the construction and operation of spreading grounds in the areas identified by the district.	SSJMUD proposes the purchasing of land holdings, with possible partnering agencies (to be identified later), in and around the eastern most portion of the District. The District is currently exploring the potential for capturing excess surface water deliveries in the FKC. Excess surface supply, or those flows beyond the quantity of water that satisfies immediate water demand, typically occur in wet years where precipitation in applicable watersheds is large enough to induce surface water available above Class I contract supplies. Potential captured flows consist of water which is currently discharged during wet year and flood conditions.	Implementation of this project has the potential for contributing water supplies to SSJMUD, the City of Delano (which qualifies as a DAC), and Poso Creek IRWM water users. Specifically, SSJMUD will use a portion of these captured flows to offset their groundwater use in dry years by moving the surplus water to this banking facility using either the Friant Kern Canal or other existing infrastructure. Wet year water supplies captured in the spreading grounds and storage locations will be utilized by SSJMUD, City of Delano, and potentially other Poso Creek stakeholders, during years where other water supplies are limited.
SSJMUD	City of Delano Spreading Grounds	This project is in the planning stage of development. SSJMUD has already begun the process of developing a CEQA document to assess the potential impacts of the construction and operation of spreading grounds in the areas identified by the district.	SSJMUD proposes identifying and evaluating potential land suitable for developing recharge basins, with possible purchase with private and/or public partnering agencies within the City of Delano. The purpose of this project is to capture surface water deliveries that are delivered through the FKC. Excess available surface supply, or those flows beyond the quantity of water that satisfies immediate water demand within a service area, typically occurs in wet years when precipitation in contributing watersheds is large enough to induce surface water available above Friant Class 1 contract supplies. Potential flows to capture consists of water which is currently discharged during wet years, during flood conditions and for water that needs to be delivered due to changes in timing to meet environmental water management goals for the San Joaquin River Restoration.	Implementation of this project has the potential for contributing water supplies to SSJMUD, the City of Delano (which is classified as DAC), and Poso Creek IRWM water users. Specifically, SSJMUD will use a portion of these captured flows to offset their groundwater use in dry years by moving the surplus surface water to this banking facility from the FKC or other existing infrastructure. Wet year water supplies captured in the spreading grounds and storage locations will be utilized by SSJMUD, City of Delano, and potentially other Poso Creek stakeholders, during years where other water supplies are limited.
SSJMUD	Pond Road Spreading Grounds	This project is in the planning stage of development. SSJMUD has already begun the process of developing a CEQA document to assess the potential impacts of the construction and operation of spreading grounds in the areas identified by the district.	SSJMUD proposes identifying and evaluating potential land holdings to be purchased, with possible private and/or public partnering agencies. The District is currently exploring the potential for capturing excess surface water deliveries in the Friant-Kern Canal. Excess surface supply, or those flows beyond the quantity of water that satisfies immediate water demand, typically occur in wet years where precipitation in applicable watersheds is large enough to induce surface water available above Class 1 contract supplies. Potential captured flows consist of water which is currently discharged during wet year and flood conditions.	Implementation of this project has the potential for contributing water supplies to SSJMUD, the City of Delano, and Poso Creek IRWM water users. Specifically, SSJMUD will use a portion of these captured flows to offset their groundwater use in dry years by moving the surplus water to this banking facility using either the California Aqueduct or other existing infrastructure. Wet year water supplies captured in the spreading grounds and storage locations will be utilized by SSJMUD, City of Delano, and potentially other Poso Creek stakeholders, during years where other water supplies are limited.

Table 4-1. Kern Groundwater Authority List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
SSJMUD	In District Spreading Grounds	This project is in the planning stage of development. SSJMUD has already begun the process of developing a CEQA document to assess the potential impacts of the construction and operation of spreading grounds in the areas identified by the district.	SSJMUD proposes identifying and evaluating potential land holdings to be purchased, with possible private and/or public partnering agencies. The District is currently exploring the potential for capturing excess surface water deliveries in the FKC. Excess surface supply, or those flows beyond the quantity of water that satisfies immediate water demand, typically occur in wet years where precipitation in applicable watersheds is large enough to induce surface water available above Class 1 contract supplies. Potential captured flows consist of water which is currently discharged during wet year and flood conditions.	Implementation of this project has the potential for contributing water supplies to SSJMUD, the City of Delano, and Poso Creek IRWM water users. Specifically, SSJMUD will use a portion of these captured flows to offset their groundwater use in dry years by moving the surplus water to this banking facility using either the California Aqueduct or other existing infrastructure. Wet year water supplies captured in the spreading grounds and storage locations will be utilized by SSJMUD, City of Delano, and potentially other Poso Creek stakeholders, during years where other water supplies are limited.
SSJMUD	Conversion of Dairy to Recharge Facility	This project is in the conceptual stage of development, with potential sites being evaluated based on data available through the RWQCB's GAMA Geotracker program, the district's recharge feasibility study, and other state and local agencies.	SSJMUD proposes identifying and evaluating potential purchase of a dairy, with possible private and/or public partnering agencies. The District is currently exploring the potential for capturing excess surface water deliveries in the FKC. Excess surface supply, or those flows beyond the quantity of water that satisfies immediate water demand, typically occur in wet years where precipitation in applicable watersheds is large enough to induce surface water available above Class 1 contract supplies. Potential captured flows consist of water which is currently discharged during wet year and flood conditions.	Implementation of this project has the potential for contributing water supplies to SSJMUD, the City of Delano, and Poso Creek IRWM water users. Specifically, SSJMUD will use a portion of these captured flows to offset their groundwater use in dry years by moving the surplus water to this banking facility using either the California Aqueduct or other existing infrastructure. Wet year water supplies captured in the spreading grounds and storage locations will be utilized by SSJMUD, City of Delano, and potentially other Poso Creek stakeholders, during years where other water supplies are limited.
SSJMUD	"Surface Water First" Incentive Program	This Management Action is in the preliminary stages of consideration by the districts. It has not been formally adopted but is under consideration.	SSJMUD has access to imported surface water to supply its jurisdictional area. However, there instances in which growers have historically opted to pump groundwater, rather than receiving deliveries of surface water from the district which services their properties. When this occurs, the district must either use that water for groundwater recharge or enter into exchanges with other districts (either in the KCS or in another basin).	An estimated reduction of 1,800 AFY of groundwater extraction would result from the implementation of this incentive program. The fees collected in this incentive program have not been quantified but would also provide a source of funding for the expansion of existing recharge or the development of new recharge projects within the districts.
SSJMUD	On-Farm Efficiency/Deficit Irrigation Practices Incentive Program	The provisions of the conservation laws are being complied with by both NKWSD and SWID. Ag water management plans, as required by SB 7, are being regularly updated by these districts for submittal to DWR. Plans will be updated to include the applicable requirements of AB 1668 and SB 606.	As an agricultural water service provider, SSJMUD complies with all provisions of SB 7 (amending Division 6, Part 2.55 of the Water Code) passed into law in November 2009 regarding agricultural water conservation and management. Efficient management practices in the law, related to SGMA objectives, include volumetric water pricing, incentives for conjunctive use and increased groundwater recharge, and development of an overall water budget. AB 1668 and SB 606 passed in 2018 did not materially add to these objectives, save for those districts serving between 10,000 and 25,000 acres who must now prepare water management plans under the newer laws.	There are no direct benefits to be derived and quantified from compliance with the aforementioned agricultural conservation laws at the present time. The districts will continue to divert for beneficial use all local and imported water supplies to which it is entitled. Should agricultural demands for irrigation water diminish as a result of some of the conservation provisions, a larger portion of diverted supplies will be devoted to groundwater recharge in the future.
SSJMUD	On-Farm Recharge Activities Incentive Program	This Management Action is in the preliminary stages of consideration by the districts. It has not been formally adopted but is under consideration.	In wet years, when the district has utilized the full capacity of their respective recharge basins and spreading grounds, it may be necessary for the districts to seek other locations for the application of available surface water for groundwater recharge. The district will develop an incentive program to encourage landowners to take delivery of available water that is in excess of customer demand and the district's capacity for recharge projects for application to fallow land and/or over-irrigation of crops to facilitate further groundwater recharge. Landowners will receive a groundwater credit in exchange for participation in this program, for their use within the district which has provided the water for on-farm recharge activities.	An estimated increase of 1,200 AFY of groundwater recharge would result from the implementation of this incentive program.
SSJMUD	Conversion of Agricultural Land to Urban Use	The conversion of land use from agricultural to urban is an ongoing process, the pace of which is determined by external factors such as the demand for land based on each city's growth and need for additional housing and/or property to support business, industrial, or municipal use. The projected growth for each city is based upon the current General Plans and may be subject to change when the cities update their respective plans.	As described in the General Plans for the cities of Delano and McFarland, anticipated population growth is expected to lead to changes in land use within the limits of each city and in the Sphere of Influence for each city. The conversion of land use from agricultural to urban use generally leads to an overall reduction in groundwater use due to the decreased demand, in terms of volume per unit area. The City of Delano and the surrounding areas have a projected increase of 2,100 acres in urban use; the City of McFarland and its surrounding areas have a projected increase of 1,100 acres.	For SSJMUD's jurisdiction, there is an anticipated reduction of 900 AF of water by 2030, based on the conversion of land use as the cities of Delano and McFarland expand. By 2040, the projected reduction is 1750 AF.
SSJMUD	Urban Water Conservation Program	The cities of Delano and McFarland are currently evaluating their respective compliance measures for indoor use and are awaiting additional information and guidelines concerning regional outdoor and landscape compliance measures. The cities presently are complying with the 2020 mandates contained in SB 7X-7 and as embodied in their respective UWMPs. As the SWRCB establishes its compliance deadlines for both indoor and outdoor usage, anticipated to occur by 2025, the municipal KGA Members will have a clearer picture of an implementation schedule.	As referenced in the Umbrella Basin Setting (Chapter 2), urban water usage in the future is expected to comply with the conservation mandates contained in SB 606 and AB 1668, both bills signed into law in May 2018. Based on that legislation, indoor residential use is to be capped at 55 gpcd in 2019 and ramp down to 50 gpcd by 2030, and outdoor residential use is to be capped in the future based on local climate and size of landscaped areas. Standards for outdoor usage are to be defined in a SWRCB rule-making process to be completed by June 2022.	Given the early implementation stages of AB 1668 and SB 606, its benefits in terms of reduced groundwater pumping by Delano and McFarland can only be roughly approximated. The Pacific Institute, in its 2014 report "Urban Water Conservation and Efficiency Potential in Calif." estimated that indoor usage could be reduced by 33-40 gpcd, and that outdoor/landscape usage could be reduced by 20-50 gpcd. These values are on a statewide basis and likely unrealistic in some regions; however, the report postulates that total urban water usage could be reduced by as much as 30-60%. Savings of this magnitude would represent a significant reduction in groundwater pumping by both cities. The Measurable Objectives to be partially met with additional urban conservation include groundwater level stabilization and, by proxy, groundwater storage stabilization.

Table 4-1. Kern Groundwater Authority List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
SSJMUD	In-District Allocation Structure	This Management Action is in the conceptual stages, having been discussed with various stakeholder groups. However, an actual structures and fee schedules have yet to be devised for either district.	At the time of this draft of the GSP, SSJMUD does not have an established allocation structure and fee schedule for groundwater extraction. As SGMA is implemented throughout the KCS, the districts are required to manage to the Sustainable Management Criteria (SMCs) established in Section 5 of this Chapter GSP. One of the ways to manage for the SMCs is to allocate the Sustainable Yield for their respective districts to the landowners within their districts. The allocation structure would allow for the transfer of groundwater pumping credits within each district's jurisdiction, provided that it does not lead to localized impacts to at the Representative Monitoring Sites defined in Sections 4 and 5 of this Chapter GSP.	The benefits to sustainable groundwater management have not been quantified at this time. However, the development and implementation of an allocation structure for each district would allow for the districts to utilize their Sustainable Yield as a management tool for reaching and maintaining their SMCs.
SSJMUD	Voluntary Land Fallowing	At this time, this Management Action is conceptual. The district will develop its fallowing program during the SGMA implementation period.	In the event of a drought, the district may not be able to entirely meet in-district demand by increasing the volume of imported water. The combination of decreased availability in surface water to supply to the district and decreased recharge from other sources in the subbasin has the potential to lead to violations of SMCs at the Representative Monitoring Sites, in the absence of decreased demand. To facilitate the district's ability to maintain sustainability at its monitoring sites, the district will develop and implement a voluntary land fallowing program.	The decrease in water demand will be dependent upon the land being fallowed and its existing land use at the time of fallowing. Agricultural demand for water is generally estimated to be 3 AF/acre. Fallowing or land retirement would reduce the demand to zero for the lands participating in the program.
SSJMUD	Pumping Restrictions	At this time, this Management Action is conceptual. The district will develop its process to implement pumping restrictions within the plan area.	In the event that the districts or the entire subbasin are nearing a condition where they are at risk of triggering an Undesirable Result, even with the implementation of the projects and management actions described in this Plan, it may be necessary for the district to limit groundwater pumping. The volume of groundwater extraction permitted under this Management Action would be determined by the district based on the Sustainable Yield for the district and the SMCs at the Representative Monitoring Sites.	The benefits of mandatory pumping restrictions have not yet been quantified, as the guidelines for such a management action have not been established.
Shafter-Wasco Irrigation District - 7th Standard				
SWID - 7th Standard	Evaluation of Potential to Utilize SWID Kimberlina Ponds for Recharge or other Facilities	Status: Conceptual, have begun initial discussions; Initiation: 2020-2024 Completion: Ongoing Accrual of Benefits: Annual-basis	SWID operates the Kimberlina Ponds groundwater recharge facility. The Annex Area will evaluate opportunities with SWID to utilize Kimberlina Pond storage capacity for recharge. The Annex Area will evaluate opportunities to purchase non-SWID water for recharge in the Kimberlina Ponds facilities, when the Ponds have unused capacity (i.e., likely in nonwet and non-drought years).	Up to 4,500 AFY of imported supply, in combination with other recharge projects. Increased groundwater levels.
SWID - 7th Standard	Evaluation of Potential to Partner in Kern Fan Groundwater Storage Project	Status: Conceptual, have begun initial discussions with RRBWSD; Initiation: 2030 Completion: 2035 Accrual of Benefits: 50 years after construction	The Kern Fan Groundwater Storage Project is under development by RRBWSD and would serve to develop a regional water bank in the Kern Fan to capture and store Article 21 water via the State Water Project (SWP) during conditions when surface water is abundant. The Annex Area could potentially become a funding partner in this project and have access to recharge and storage capacity in the Project.	Up to 4,500 AFY of imported supply, in combination with other recharge projects. Increased groundwater levels.
SWID - 7th Standard	7th Standard Annex Management Area Storage Pond Project	Status: Conceptual, have begun initial discussions with RRBWSD; Initiation: 2030 Completion: 2035 Accrual of Benefits: 50 years after construction	This project would improve water supply reliability and groundwater conditions in the Management Area. Benefits of developing a groundwater recharge facility within the Mangement Area include effective conveyance of surface water supplies when they are available, facilitation of water banking and exchange arrangements, and avoidance of direct water quality impacts. A conveyance mechanism, such as the Flat Rocks Canal would be necessary to bring such water to the Mangement Area.	Up to 1,463 AFY of recharge capacity for purchased surface water within the Management Area (assumes 320-acre basin). Increased groundwater levels.
SWID - 7th Standard	Identify Opportunities to Utilize Existing Infrastructure	Status: Conceptual, have begun initial discussions; Initiation: 2020-2024 Completion: ongoing Accrual of Benefits: annual	Several entities in the vicinity of the Annex Area have existing groundwater recharge infrastructure, which have unused capacity, particularly in nonwet years. The Annex Area will evaluate potential opportunities with these entities to utilize the unused capacity for recharge of purchased water.	Up to 4,500 AFY of imported supply, in combination with other recharge projects. Increased groundwater levels.
SWID - 7th Standard	On-Farm Groundwater Recharge	Status: Conceptual, have begun initial discussions; Initiation: 2020-2024 Completion: ongoing Accrual of Benefits: annual	In May 2019, the SWID Board adopted a new Buried Recharge policy that will allow for on-farm water banking, which will allow Annex Area landowners to purchase and recharge non-SWID water on their own properties, as well as those within the original SWID boundary.	Up to 4,500 AFY of imported supply, in combination with other recharge projects. Increased groundwater levels.
SWID - 7th Standard	Flat Rock Canal Extension	Status: Conceptual, have begun initial discussions; Initiation: 2030 Completion: 2035 Accrual of Benefits: 50 year period following construction	The Management Area will assess the feasibility of this project and seek partnership with other interest entities. This project would provide connection from the Annex Area to the Kern Water Bank Canal, Cross Valley Canal, and Goose Lake Slough. Phase 1 of this project is to distribute Kern River water to the north using gravity from Goose Lake Slough.	Improve ability to delivery surface water supplies to the District for irrigation or recharge. Benefits to neighboring entities, who would be key partners in this regional project.
SWID - 7th Standard	Develop New Interconnections Within SWID's Conveyance System (and Improve "Bottleneck" Issues)	Status: Conceptual, will require evaluation of options and benefits; Initiation: TBD Completion: TBD Accrual of Benefits: TBD	The Annex Area can work with SWID to increase the capacity and flexibility of SWID's current conveyance system, to allow access to additional supplies.	Improve operational flexibility within the SWID conveyance system to allow for increased capacity to accept surface water supplies when available.
SWID - 7th Standard	Increased Recycled Water Deliveries and Recharge	Status: In discussions for increased purchases; Initiation: In progress Completion: Anticipated 2019-2020 Accrual of Benefits: Annual	Secondary-treated municipal wastewater is from the North of the River Sanitary District is currently used for irrigation and infiltrated into groundwater within the Annex Area. The Annex Area is discussion options to increase recycled water deliveries and recharge of groundwater with secondary-treated wastewater within the Annex Area. Growth rate is projected at 2% and output expected to increase to 14,000 AFY.	Up to 8,180 AFY of treated effluent (based on project increased WWTP flows), to be used for irrigation to offset groundwater demand.

Table 4-1. Kern Groundwater Authority List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
SWID - 7th Standard	On-farm Water Conservation	Status: not yet initiated; Initiation: Upon stakeholder interest Completion: TBD Accrual of Benefits: 1-3 years after initiation	The NRCS is offering landowner incentive programs to assist in implementing various conservation activities, including but not limited to: irrigation system improvements, water/nutrient/pest management, and pump engine replacement. Interested landowners can call (661) 336-0967 or visit the website (www.ca.nrcs.usda.gov) for more information.	Reduce on-farm water demands.
SWID - 7th Standard	Voluntary Rotational Land Fallowing Program	Status: not yet initiated; Initiation: Upon approval of funding mechanism Completion: Anticipated 2020-2024 Accrual of Benefits: 1 years after initiation	In order to reduce demand within the Management Area, this project would incentivize landowners to fallow their previously farmed lands voluntarily on a rotational basis. This potential project would be implemented on a voluntary rotational basis. Incentives have not yet been established, but would be anticipated to be funded by the Annex Area landowners through the same funding mechanism used for other SGMA related activities.	Up to 1,443 AFY of reduced water demand (assumed 430 acres fallowed per year).
SWID - 7th Standard	Education of Groundwater Use per Acre	Status: not yet initiated; Initiation: Upon GSP implementation Completion: Until overdraft ends/other programs initiated Accrual of Benefits: 1 year after initiation	This program would provide groundwater users an expected groundwater volume, as an education tool, prior to enforcement actions on groundwater allocations, with the goal of providing awareness of overdraft conditions. This information would be provided in an annual letter, along with average crop demand, GSA average extraction, GW overdraft, and reminders of GSA powers and authorities.	Reduce on-farm water demands.
Semitropic Water Storage District				
SWSD	Landowner Water Budgets	Under Development; Initiation expected 2020.	Establish individual water budget for landowners by landowner classes	Water demand reduction of an estimated 60,000 af total (3,000 af/yr to 2040)
SWSD	Tiered Pricing for Groundwater Pumping	Not yet started; to be implemented in 2020 after implementation of MA 1	Develop pricing structure to incentize groundwater users to manage groundwater extractions to MA1 water Budgets	Water demand reduction consistent with MA1 (Landowner Water Budgets)
SWSD	District Fallowing Program	Not yet started; to be implemented in 2020 after implementation of MA 1	Support land fallowing as a District action and by individual landowners or groups of landowners.	Water demand reduction consistent with MA1 (Landowner Water Budgets)
SWSD	Enhanced Groundwater Recharge	Status is ongoing and expected to be initiated in 2020 upon adoption of Semitropic GSP.	Development of surface and subsurface recharge projects underlying developed agricultural lands to increase groundwater recharge capacity	Water supply augmentation up to 20,000 af average annual
SWSD	Evaluation and Assessment of GDEs within the Semitropic Area	Not yet started; Expected to be initiated in 2020 upon adoption of Semitropic GSP.	Conduct additional analysis to verify the prescence and extent of GDE's in the Semitropic and, if present, develop appropriate monitoring protocols.	
SWSD	Brackish Water Desalination	Initiated planning; expected to be initiated in 2022 upon completion of environmental and regualtory requirements.	Development of a braackish water treatment facility to treat locally sourced brackish water for District use.	Expected water supply augmentation of 1,800 af/year
SWSD	In-District Water Markets and Transfers	Not yet started; Expected to be initiated in 2022 upon adoption of Semitropic GSP.	District will allow for the development of market for in-district transfers	Water supply augmentation TBD.
SWSD	Poso Creek MAR	Upon completion of feasibility and permitting requirements; Expected initiation in 2020	Development of floodwater capture and recharge program ffrom Poso Creek flood flows	Water supply augmentation of 1,200 af average annual
SWSD	Tulare Lake Project	Under Development since 2018; Initiated upon completion of water rights determination	Development of conveyance facilities to divert Kings River flood flows for direct use and recharge in the SWSD	Water supply augmentation of 70,000 af average annual
SWSD	Water Market Acquititions	Status is ongoing and expected to be initiated in 2020 upon adoption of Semitropic GSP.	Increased participation in state-wide water markets for spot market and long-term water transfers	Water supply augmentation of 4,000 af average annual
SWSD	Stored Water Recovery Unit	Initiated; 2025 Upon approve by SWSD BOD and identification of funding	Development of water storage to expand in-lieu service areas	Increases capacity & flexibility of conveyance for recharge
SWSD	Pond-Poso Spreading Grounds, Phase II	Inititated; Upon adotion of Semitropic SWSD; 2020.	Development of spreading facilliteis to increase groundwater recharge capacity	Increases groundwater recharge capacity
SWSD	Pond-Poso Entrance Ponds	Initiated; 2025 upon approval by SWSD BOD and identification of funding.	Development of spreading facilliteis to increase groundwater recharge capacity	Increases capacity & flexibility of conveyance for recharge
SWSD	Multi-District Conveyance (CA to Friant-Kern Canal)	Ongoing; Implementation upon approval by SWSD BOD and identification of funding.	Development of a conveyance system to deliver surface water for groundwater recharge and irrigation	Increases capacity & flexibility of conveyance for recharge
SWSD	Schuster Spreading Grounds	Not yet started; Expected initiation 2030 upon approval by SWSD BOD and identification of funding	Development of spreading facilliteis to increase groundwater recharge capacity	Increases groundwater recharge capacity
SWSD	Leonard Avenue System	Inititated 2019; Upon adotion of Semitropic SWSD.	Development of an intertie system to provide east to west surface water conveyance to for supply in groundwater dependent areas	Increases capacity & flexibility of conveyance for recharge
SWSD	Diltz Intertie	Ongoing 2018; Upon adoption of Semitropic SWSD.	Connection of an intertie to provide surface water converyance for agricultural irrigation	Increases capacity & flexibility of conveyance for recharge
SWSD	Cox Canal	Ongoing 2018; Upon adoption of Semitropic SWSD.	Developed canal for the conveyance of surface water for groundwater recharge	Increases capacity & flexibility of conveyance for recharge
SWSD	Stored Water Recovery Unit- XYZ	Ongoing 2019; Upon adoption of Semitropic SWSD.		Increases capacity & flexibility of conveyance for recharge
Tejon-Castac Water District Management Area				

Table 4-1. Kern Groundwater Authority List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
TCWDMA	Conversion of Granite Quarry to Sycamore Reservoir	The timeframe for initiation and completion of this P/MA are not certain, but presumably would begin once the Granite Quarry facility ceases operations, which is anticipated in one to four years. Construction duration is to-be-determined.	This P/MA entails repurposing of the Granite Quarry excavation into a storage reservoir upon cessation of mining operations at the facility which is expected in the next one to four years. The P/MA is being considered and developed in conjunction with Arvin-Edison Water Storage District (AEWSD), and the source of water to fill the new reservoir would likely be surplus imported surface water, brought to the reservoir by AEWSD during wet years, with possible additional contribution from local stormflow runoff. In addition, TCWD may choose to store some of its State Water Project water supplies in the facility at times, supplies which would be wheeled through the AEWSD canal system. The facility is anticipated to serve as a storage basin for water added to it, as well as a location for recharge.	AEWSD has estimated the net benefit of this P/MA to be approximately 2,500 acre-feet (AF) of increased storage capacity (which aids in delivery flexibility for AEWSD), and between 3,000 and 6,000 acre-feet per year (AFY) of increased recharge. As a secondary benefit, recharge of imported surface water would likely have a positive effect on local groundwater quality.
TCWDMA	Recharge of Carrot Wash Water	The status of this P/MA currently underway, and the timeframe to accrual of benefits is likely on the order of one year.	Tejon Ranchcorp (TRC) recharges carrot wash water generated at a nearby carrot processing facility to a 75.5-acre parcel located just outside of the TCWD MA (Township 32S Range 30E Section 6). The site, which has been in operation since 2016, receives carrot wash water from a nearby carrot processing facility which is discharged to a set of recharge ponds. A total of over 1,000 AF has been recharged at these ponds between 2016 and early 2019. This project is anticipated to continue in the future, and results in a local recharge benefit. A production well may be installed in the future at the site to allow for recovery of recharged groundwater.	Based on the amount of water recharged since operations began in 2016, the annual benefit from this P/MA is estimated at approximately 300 AFY.
West Kern Water District				
WKWD	Project 1: Automatic Meter Reading Project	The circumstance of implementation for this project would be current conditions, once funding is secured or committed and the project approved by WKWD's Board of Directors, it could be implemented.	In 2015, WKWD began installing AMR systems for all industrial and outlying customers. To further achieve sustainability goals, WKWD would install AMR systems on the remainder of its primarily residential customer meters. The AMR system selected by WKWD for its industrial and outlying customers uploads data every 24 hours to a website where customers can access their accounts and view water use data, compare their current water use to their historical water use, and receive leak alerts.	AMR provides potential water savings through early leak detection and increased awareness of water use among customers. Upgrading meters also reduces unaccounted-for losses related to accuracy degradation in older meters. WKWD estimates that AMR will save an average 8 percent of water for each metered connection, based on savings experienced by nearby agencies. The City of Sacramento had an average 4 percent water savings based on a pilot AMR project, while the Golden Hills Community Services District realized 12 percent in average savings (WKWD, 2014). WKWD's 2015 UWMP shows residential water use ranges between 2,169 AF in 2015 to a projected high of 2,597 AF in 2040, and applying the projected 8 percent conservation, anticipated water savings from this project is estimated to be 173 to 208 AFY (WKWD, 2016). Conservation achieved by the AMR project would be measured by the reduction in water deliveries to customers with AMR meters.
WKWD	Project 2: Participation in California WaterFix	Long-term	California WaterFix is intended to address the challenges of pumping water from the Delta by diverting water upstream of the current diversion points and conveying it to existing pump stations for the SWP and the Central Valley Project (CVP). Under current operation, the SWP and CVP are unable to consistently deliver state and federal water contractors their full contract supplies. California WaterFix is intended to address some of the conditions that impact the ability to export water from the Delta.	The primary benefit of this project would be the increased reliability of imported water supplies and to expand groundwater banking opportunities to meet customer demands. Additional supplies could be 1) banked in WKWD's recharge facilities, 2) used for GWE protection if monitoring shows unexpected declines in elevation, or 3) transferred to neighboring agencies to help offset groundwater pumping in the Subbasin.
WKWD	Project 3: Buena Vista Recreation Area Water Supply Management Coordination	Implementation of this project is already underway and is likely to remain an ongoing project until such time as the BVARA no longer requires water from the GSA area.	BVARA is in and adjacent to the WKWD GSA area. The 1,585-acre BVARA is home to two manmade lakes, Lake Webb and Lake Evans, boating facilities, playgrounds and volleyball courts, camp sites, and picnic areas. The lakes lie outside of the GSA area but the park facilities such as picnic areas, restrooms, and parking areas are within the GSA area. When constructed, the lakes had a combined storage capacity of over 6,800 AF. Shoreline camping and picnic areas are landscaped with grass and are irrigated during the dry season (County of Kern Parks and Recreation Department, 2019). With no outlet, water from the lakes either evaporates or percolates into the groundwater basin. Kern County pumps groundwater from wells located within the GSA area to supplement losses at the lake. Supplemental water delivered to the lakes is not metered and is not included in WKWD GSA's water balance.	Managing water supply for the BVARA would include a focused effort on monitoring pumping in that portion of the GSA area, and identifying which projects or management actions are needed to eliminate undesirable results in the Subbasin. Securing additional supplemental supplies would reduce the potential impacts to groundwater levels, storage, and water quality for this portion of the GSA area. Improved management of the BVARA water supply would also support ongoing use of the BVARA, a popular recreation area. The project does not have a directly measurable benefit unless implementation actions arise from these meetings.
WKWD	Management Action 1: Continued Balanced Pumping and Recharge	The circumstance of project implementation would be current conditions and would remain unless conditions indicated a different management approach was needed to achieve sustainability indicators.	Continued balanced pumping of groundwater and recharge of imported supplies has and will continue to be the operational norm for WKWD. Under this management action, recharge and recovery activity will continue to be monitored closely by WKWD to maintain balanced conditions.	This management action would allow WKWD to continue operating groundwater recharge and recovery in balance, resulting in a long-term net-zero balance in the Subbasin for the areas under WKWD's control.
WKWD	Management Action 2: Implement Water Shortage Response Plan	The circumstance of implementation for this project would be times of water shortage, supply interruption, or drought, as declared by WKWD's Board of Directors. Implementation would cease when shortages are no longer being experienced, and as approved by the WKWD's Board of Directors.	WKWD's Water Shortage Response Plan (WSRP) is incorporated into the 2015 UWMP and includes triggers for when the WSRP would be implemented. The WSRP describes management actions and use restrictions that would be implemented if water shortages were declared. Because current operation of groundwater recharge and recovery in the GSA area has shown a long-term increase in banked groundwater, and normal water years are projected to have a surplus of supply that can be banked, it is not expected that the WSRP would go into effect during normal or wet years. During extended dry periods, groundwater pumping would increase, and WKWD would use banked supplies to meet demands in excess of available imported and surface water supplies.	The WSRP is designed to reduce customers' overall water use by implementing restrictions on when and how water may be used. As a result, implementation of this management action would reduce overall demand, which offsets demand for imported water and groundwater. Each Response Level is designed to help achieve a specific conservation target, and would reduce overall demands between 0 and 6,900 AF (i.e., 0- to 50 percent conservation) (Table 8-3). Conservation achieved by this management action would be measured by the reduction in metered water deliveries after this management action is implemented.

Table 4-1. Kern Groundwater Authority List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
WKWD	Management Action 3: Continued Participation in Basin-Wide Coordination	The circumstance of implementation for this project is ongoing.	The WKWD GSA is one of 11 GSAs in the Subbasin. Coordination among these GSAs is necessary for sustainable management of the Subbasin as a whole and has been ongoing during development of their respective GSPs. Coordination during GSP development has included regular in-person meetings and calls to discuss sustainability thresholds, potential projects and management actions, and to discuss specific issues and concerns. As described in this Chapter GSP, the KGA is developing an Umbrella GSP for the Subbasin, while the other GSAs in Kern County are developing Chapter GSPs.	This management action would continue existing coordination activities among GSA managers, helping to build and maintain relationships with neighboring GSAs. Potential conflicts between GSAs regarding groundwater management would be reduced because GSAs would better understand the challenges experienced in each GSA area, and how these challenges are being addressed. Coordination meetings will also provide an opportunity for GSAs to inform each other of potential issues that may require intra-Subbasin coordination to address, and to notify neighboring GSAs of management actions or projects that might affect a decision made by another GSA.
WKWD	Adaptive Management Strategy 1: Taft Recycled Water Program	This project would be implemented through an agreement between WKWD, the City of Taft, and FCTHSD.	The Taft Recycled Water Program would create up to 423 AFY of tertiary recycled water suitable for Title 22-approved applications for recycled water. This project would be implemented in partnership between WKWD, the City of Taft, and the Ford City-Taft Heights Sanitation District (FCTHSD). WKWD provides water within the WKWD GSA area, but sanitation services are provided by the City of Taft and FCTHSD, which jointly own the Taft Wastewater Treatment Facility (WWTF). The Taft WWTF currently produces undisinfected secondary effluent that is suitable for and applied to feed crops, specifically alfalfa. This effluent is not suitable for wider recycled water use, but through upgrade to tertiary treatment, it could be used more widely for non-potable applications, such as landscape irrigation, which currently use potable water to meet demands (WKWD, 2018).	The project would create up to 423 AFY of tertiary recycled water, offsetting an equal volume of potable water (WKWD, 2018). Available and unused potable water is currently banked for future use during imported and surface water supply shortages. This project would both reduce demand for groundwater pumping during dry years and allow for additional water to be banked during wet years. Tertiary recycled water would be a local supply with high supply reliability, even during drought years. The volume of water offset by this project would be measured by quantifying the amount of tertiary recycled water both produced and delivered.
WKWD	Adaptive Management Strategy 2: Shift Balance of Pumping between North and South Wellfields	Implementation would require easy-to-implement operational changes and could be implemented quickly once triggered.	In 2010, WKWD's North Wellfield (wells within the North Project Management Area) was constructed in response to falling groundwater levels at the South Wellfield (wells within the South Project Management Area). Despite a surplus of banked groundwater, local levels at the South Wellfield showed a trending decline associated with groundwater recovery activities. A single wellfield for recovery activities also limited WKWD's operational flexibility. To combat these two management challenges, the North Wellfield was constructed along with additional recharge basins. Under current operation of the two wellfields, 11,300 AFY are pumped from the South Wellfield and 12,700 AFY are pumped from the North Wellfield. The North Wellfield has an annual pumping capacity of 24,000 AFY (WKWD, 2010).	This adaptive management strategy would reduce groundwater pumping in a localized area, allowing water levels in that area to recover or to decline less sharply during times of drought. Minimizing groundwater level declines reduces the potential for localized subsidence and long-term decrease in groundwater storage capacity. It also helps to maintain well efficiency, allowing for improved wellfield longevity. Local recovery of GWEs would be determined by standard monitoring activities that are part of regular wellfield management. Local groundwater level recovery from this strategy would be measured by monitoring of groundwater levels in the vicinity of the two wellfields.
WKWD	Adaptive Management Strategy 3: Implement Permanent Demand Management Measures	As needed	According to the 2016 WSRP, Response Level 1 is ongoing, and all water use restrictions are strictly voluntary. These actions only become mandatory if a Response Level 2 is declared, which requires a declaration by the WKWD's Board of Directors. This adaptive management strategy would convert the Response Level 1 actions in the WSRP from voluntary to mandatory. These water restrictions would require a 25 percent reduction in large landscape watering from 2007 levels, prohibit water waste, and reduce non-contracted industrial water use by 15 percent from 2007 levels. WKWD may choose to implement these or a different set of permanent demand management measures as appropriate at the time this adaptive management strategy is approved.	Project benefits are expected to be like those achieved under Management Action 2 (Implement WSRP), though they will have long-term benefits because they are permanent measures rather than temporary ones under the WSRP. Conservation achieved by this management action would be measured by the reduction in metered water deliveries after this management action is implemented.
Westside District Water Authority				
WDWA	Collect Representative Hydrogeologic Data	The PMA No.1 will be implemented beginning with acceptance of the MNP, and directly support WDWA MT/MOs by providing foundational data to monitor and manage adaptive management projects that are designed and implemented to ameliorate the potential for significant reduction of ground water elevations and groundwater in storage	Historically, because of the brackish and naturally degraded quality of groundwater in the WDWA, growers have relied almost exclusively on surface water from the SWP for their irrigation needs. Groundwater is used primarily for blending when annual SWP deliveries are less than expected. As a result, there is currently little representative hydrogeologic data in the WDWA. This lack of data represents a significant data gap that must be addressed in order to refine the current understanding of the WDWA Conceptual Hydrogeologic Model, including key elements such as groundwater elevations, pumping and changes to groundwater in storage and the overall water budget.	The ability to generate representative data for use in updating water budget elements; Improved numerical groundwater modeling results; and Better forecasting and planning of adaptive management projects and management actions.
WDWA	Water Resource Coordination	The implementation of the disparate Water Resource Coordination Programs vary, some as described above are already in place and ongoing. Others, like a KCS wide coordination program would likely begin with planning during the first five year reassessment period after KCS Plan implementation. Coordination between the WDWA and its immediately adjacent GMAs would likely be structured to begin with meetings shortly after Plan approval.	The member growers in the WDWA have historically made significant investment in efficient irrigation technologies and methods that promote water conservation and sustainable management. They have also coordinated amongst themselves as individuals or via the various Water Districts to implement focused reduction demand measures, trade or purchase surplus water when deliveries from the SWP have been reduced. It is assumed that these effective ad hoc arrangements will continue after Plan implementation. In addition, the WDWA will work cooperatively and in close consultation with its members, the KGA and adjacent GMAs to coordinate water resource monitoring, testing and future water trading as part of its overall strategy for the sustainable management of all its available water resources.	More reliability and flexibility in water availability; Drought resiliency; and Sustainable water strategies for both short and long term planning horizons.
WDWA	Conjunctive Reuse of Naturally Degraded Brackish Groundwater	Preliminary planning for a Project Engineering FS for the first phase of the project has already begun. It is expected there will be at a minimum two phases of distributed treatment facility construction.	To further enhance the sustainable and adaptive management strategies for the Westside, the WDWA is evaluating the feasibility of an innovative phased project that will integrate the treatment and conjunctive reuse of naturally degraded brackish groundwater and oilfield produced water for multiple beneficial uses.	When operational, the Project will result in multiple potential beneficial uses, including many of the "One Water" concepts enumerated in the State's California Water Action Plan.
Wheeler Ridge-Maricopa Water Storage District				

Table 4-1. Kern Groundwater Authority List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
WRMWSD	On Farm Recharge	Not yet initiated; To be implemented upon adoption of WRMWSD GSP Chapter - 2020	Study and implement on farm recharge where viable.	approx. 2,000 AFY (10,000 AF every five years)
WRMWSD	In District Banking Facilities	Not yet initiated; To be implemented upon adoption of WRMWSD GSP Chapter - 2020	Program to promote private and/or District owned banking facilities within the District.	approx. 2,000 AFY (10,000 AF every five years) approx. 2.75 AFY per acre of land converted to basins
WRMWSD	Increase Out of District Banking Operations	Not yet initiated; To be implemented upon adoption of WRMWSD GSP Chapter - 2020	Increase size/participation in out of District banking facilities (i.e., Kern Water Bank and Pioneer Project). Increased banking of wet year supplies outside of the District would support deliveries of imported water into the District in normal/dry years.	TBD; depends on recharge basin area
WRMWSD	Expand District Distribution System	Not yet initiated; TBD	Project to expand District distribution system into area currently using only private groundwater.	approx. 2,000 AFY
WRMWSD	Purchase Additional Supplies	Ongoing	Continue purchase of additional supplies, as available, for banking outside of the District or direct delivery within the District.	Increase purchases by 5,000 AFY
WRMWSD	Desalination Facilities	Not yet initiated; TBD	Desalination facilities to allow for use of additional poor quality groundwater for agricultural use, easing demand on principal aquifer.	No net supply augmentation, but minimizes local GW pumping impacts
WRMWSD	"Thru Delta" Facility	State-led effort underway	Particpation of some sort of "Thru Delta" Facility to increase access to contracted (SWP) supplies.	up to 25,000 AFY
WRMWSD	Acreage Assessment	Not yet initiated; To be implemented upon adoption of WRMWSD GSP Chapter - 2020	Set policy to implement an acreage assessment to fund purchase of additional supplies, purchase of land for fallowing, and other investments to support SGMA compliance.	
WRMWSD	Groundwater Allocation and Market	Not yet initiated; To be implemented upon adoption of WRMWSD GSP Chapter - 2020	Develop a groundwater pumping allocation methodology, including a market system for trading and/or transfering of allocations.	
WRMWSD	Voluntary Pumping Limitations	Not yet initiated; To be implemented upon adoption of WRMWSD GSP Chapter - 2020	Set non binding pumping limitations in conjunction with a fee for pumping above limits.	up to 21,000 AFY
WRMWSD	Mandatory Pumping Limitations	Not yet initiated; 2030	Set binding pumping limitations in conjunction with a fee for pumping above limits.	up to 21,000 AFY
WRMWSD	Land Retirement	Not yet initiated; 2035	Purchase and permanently fallow previously irrigated acreage within District to reduce overall water demand and groundwater extractions.	up to 21,000 AFY

KERN RIVER GSA

Groundwater Sustainability Plan

SGMA Project and Management Actions

January 2020

7 PROJECTS AND MANAGEMENT ACTIONS TO ACHIEVE SUSTAINABILITY GOAL

Multiple projects and management actions have been identified for planning and implementation to support the KRGSA sustainability goal. In particular, the projects and actions center around conjunctive use, a cornerstone of the sustainability goal of the KRGSA. The projects and actions also have been defined in the context of the sustainability goal of the Kern County Subbasin, which is to:

- Achieve sustainable groundwater management in the Kern County Subbasin through the implementation of projects and management actions at the member agency level of each GSA
- Maintain its groundwater use within the sustainable yield of the basin through as demonstrated by monitoring and reporting groundwater conditions
- Operate within the established sustainable management criteria, which are established based on the collective technical information presented in the GSPs in the Subbasin.
- Collectively bring the Subbasin into sustainability and to maintain sustainability over the implementation and planning horizon.

Projects involve substantial efforts that provide either an increase in water supply or a reduction in demand for the KRGSA. *Actions* provide a framework for groundwater management including establishing GSP policies and filling data gaps.

Projects and actions are categorized as Phase One or Phase Two, depending on the timing and circumstances of implementation. Phase One projects and actions will begin implementation during the first five years of the GSP. Some Phase One project benefits should be evident by the five-year update of this GSP, scheduled for 2025. Implementation of some project elements will extend into the second or third five-year periods (to 2035). Phase Two projects and actions involve additional activities that could be considered, as needed, for future sustainable management. These projects and actions will begin implementation after the 2030 five-year update, as needed. Additional project and actions may be identified at that time as needed to achieve the KRGSA and Subbasin sustainability goals.

7.1 Phase One Projects

The KRGSA already has under its control sufficient Kern River and imported SWP water to achieve sustainability under a variety of future demand scenarios. By using all of its Kern River entitlement (less obligations) conjunctively with imported water and recycled water supplies, the KRGSA intends to implement six Phase One projects that collectively provide:

- Increases in recharge and banking to offset potential future deficits and avoid overdraft
- Decreases in municipal and agricultural pumping
- Optimal conjunctive management of surface water and groundwater resources
- Improvements in drinking water quality for disadvantaged communities
- Mitigation for the potential of land subsidence in disadvantaged communities.

Three water supply projects have been identified to meet potential future deficits in the historical and projected water budgets, thereby reducing the potential for future overdraft conditions while providing adequate supply to support projected demands. One project provides for demand reduction with increased urbanization of former agricultural lands. Two water quality projects provide improvements to drinking water quality for disadvantaged communities (DACs) in the KRGSA.

A summary of the six water supply projects is provided in **Table 7-1** and described in the following sections.

Table 7-1: Phase One Project Summary for KRGSA GSP

Project	Description	New KRGSA Water Supply
Water Allocation Plan	KDWD plans to use its full Kern River entitlement as prioritized in its Water Allocation Plan (WAP) for the Agricultural MA. The WAP total average supply has been corrected for planned sales to NKWSD.	20,797 AFY
Kern River Optimized Conjunctive Use	The City plans to use its full Kern River entitlement, less current obligations, to mitigate undesirable results for water levels and water quality in the Urban MA.	89,619 AFY
Expand Recycled Water Use in the KRGSA	The City will increase recycled water use inside of the KRGSA from its WWTP No. 3 in 2026 when a contract for use outside of the KRGSA expires (about 72% is currently used outside of the KRGSA).	11,556 to 13,407 AFY
Conversion of Agricultural Lands to Urban Use	Approximately 10,000 acres of current KRGSA agricultural lands is expected to be urbanized; this future urban demand is already included in the projected water budget, so 100% of this agricultural water use represents a demand reduction.	27,000 AFY
ENCSD North Weedpatch Highway Water System Consolidation	Up to six small water systems in the northeast KRGSA will be consolidated into the ENCSD system for benefits to drinking water quality, including to disadvantaged communities (DACs).	No new supply; improved water quality to DACs
Possible Water Exchange	KRGSA member agencies can perform exchanges of surface water and groundwater for benefits to water quality, including to DACs	No new supply; improved water quality to DACs

As indicated in **Table 7-1**, Phase One projects provide about 148,972 AFY to 150,823 AFY of additional water supply to the KRGSA. As discussed in **Section 4.7.2** and summarized in **Table 4-14**, projected future deficits could range between -67,640 AFY (Baseline Conditions) and -165,135 AFY (2070 Climate

Change Conditions) using a conservative checkbook method approach. Accordingly, projects on **Table 7-1** have been selected to address deficits in this estimated range. At this time, Phase One projects fully address projected deficits for both baseline and 2030 climate change conditions. In addition, projects are within about 15,000 AFY of the projected 2070 deficits. Phase Two projects provide additional measures in the event that the more severe climate change conditions of the 2070 scenario are realized.

Each of these six projects will begin implementation during the first five years of the GSP. However, several projects will require adjustment and possible re-direction over time to optimize project performance and avoid undesirable results. Incorporating this concept of adaptive management will be key to achieving the KRGSA sustainability goal.

7.1.1 Water Allocation Plan (WAP) – Kern Delta Water District

For more than 130 years, canal systems on the Kern River have delivered a cost-effective, high quality water supply to support the agricultural economy in the KRGSA Plan Area. These systems were first developed as separate canal companies, each with its own Kern River water right and defined service area; separate canal companies were later consolidated. Until recently, KDWD had managed water supply according to each canal's separately-defined water right, which resulted in increased reliance on groundwater for some portions of KDWD. In 2011, KDWD developed its Water Allocation Plan (WAP) to optimize its Kern River entitlement,[35] increasing overall supply across the Agricultural MA. Project implementation was delayed due to litigation regarding compliance with the California Environmental Quality Act (CEQA). In 2018, the litigation was resolved, a Supplemental Environmental Impact Report (SEIR) was certified (ESA, 2017), and the WAP was adopted by the KDWD Board (Resolution 2018-03).

The WAP (Todd Engineers, 2011) consists of a series of prioritized management actions to allow KDWD to use its full Preserved Entitlement of 201,943 AFY from the Kern River to meet both agricultural and municipal demands in its service area. By revising internal operations for full use of the Preserved Entitlement, the WAP provides a supplemental supply of about 33,048[36] AFY on average to offset groundwater demands for both agricultural and municipal beneficial uses. The additional supply will be delivered directly to meet irrigation demands. Recharge will occur in unlined conveyance canals and will also be focused locally to benefit water levels and water quality near municipal wells, including the disadvantaged communities of Greenfield and Lamont (**Figure 2-15**). This beneficial recharge is documented as a specific management action in the WAP.

To estimate an average amount for this new supply to the KRGSA in **Table 7-1**, the historical Study Period (WY 1994 – WY 2015) is used to estimate the increase in supply if the WAP had been in place

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[35] Pre-1914 water right as modified by recent court decisions; also referred to as the *Preserved Entitlement*.
[36] As explained in the SEIR (ESA, 2017), the average of 33,048 AFY from the WAP was developed from a strict accounting of unused water from 1997 through 2007, representing average hydrologic conditions on the Kern River. As noted in the SEIR, the average varies slightly depending on the time period selected for average hydrologic conditions.

during that time period. During this time period, the average annual supply associated with the WAP was 30,472 AFY. In a 2017 Settlement Agreement with NKWSD, KDWD committed a certain portion of the WAP water for sale to NKWSD, with an approximate total of 9,675 AFY occurring for conditions during the historical Study Period. Accordingly, a new supply of 20,797 AFY is provided in **Table 7-1**.

GSP regulations require the inclusion of specific details associated with projects and management actions in the GSP (§354.44). These requirements are also listed in the GSP Preparation Checklist develop by DWR for GSP submittal (**Appendix E**). These required items have been categorized into project benefits and the project implementation process, as described below.

7.1.1.1 Project Benefits

Specific benefits of the WAP are summarized below:

- Provides an additional 33,048 AFY[31] to the Agricultural MA to reduce groundwater demands
- Maintains water levels through both increased recharge and decreased groundwater pumping to support measurable objectives for all of the sustainability indicators applicable to the KRGSA
- Provides operational flexibility through the network of conveyance canals and recharge basins to focus recharge and manage water levels for subsidence and municipal well water quality in the Agricultural MA (see **Sections 5.7.4** and **5.8.4**)
- Mitigates overdraft conditions as estimated by the adjusted checkbook water budget method described in **Section 4.4.2**. Sufficient to meet the estimate of 29,000 AFY of overdraft discussed in **Section 4.5.4** and shown in **Table 4-10**)
- Addresses numerous GSP elements described in Water Code §10727.4 and listed in **Section 2.6.6** of this GSP, most notably the replenishment of groundwater extractions, activities for implementing conjunctive use or underground storage, and measures addressing groundwater recharge, in-lieu use, diversions to storage, and conveyance projects.

7.1.1.2 Implementation Process:

The WAP was approved and adopted in 2018, and implementation has already begun. Public notice, permitting, regulatory, and procedural requirements were addressed through applicable provisions of the California Water Code (WC 35525 et seq.), the CEQA process, and the certified KDWD SEIR (ESA, 2017). Legal authority is provided through the California Water Code, various contractual agreements, and court decrees, decisions, and judgments. No additional legal authority is required for implementation. Costs have already been accounted for in KDWD operational budgets; no added costs are anticipated for full implementation. The implementation process will occur over time to optimize operations for the additional water supply in KDWD; as such, the project is expected to be fully implemented over the next five years. However, operations will be adapted on an ongoing basis to best support the sustainability goal while meeting beneficial uses of the water supply.

7.1.2 Kern River Conjunctive Use Optimization – City of Bakersfield

In order to increase flows in the Kern River channel to support municipal wellfields and other beneficial uses, and to avoid undesirable results, the City intends to optimize conjunctive use of its full entitlement of Kern River water that is now available due to the expiration of the “basic term” of City contracts with several parties outside of the KRGSA. Specifically, the City executed three long-term contracts for sale of certain amounts of Kern River water after its acquisition of the Kern River water right in 1976. At that time, funds were needed for infrastructure improvements relating to the City’s River management responsibilities. The initial 35-year basic term of the contracts expired in 2012, making about 70,000 AFY of Kern River water available to the City to supplement current supplies. It is recognized that the City may still have an obligation to supply some amount of water to certain parties under the “Extension Term” of the agreements, limited to years when there are substantial surface water supplies available to the City, and only after the City’s needs and demands have been satisfied.

In addition to the expired contract water, other discretionary historical diversions by the City were tabulated to better identify additional amounts of water that might be available to meet future urban demand increases. The tabulation of historical discretionary diversions and expired contract water resulted in an average amount of about 89,619 AFY (**Table 7-1**), indicating a significant additional future water supply for the KRGSA. This water is supplemental to the average amount of 59,770 AFY used by the City during the historical Study Period (**Table 4-11**). The total amount of 149,389 AFY accounts for the City’s full Kern River entitlement less future obligations and represents the City’s Kern River surface water supply to serve beneficial uses in the KRGSA and to avoid undesirable results (see **Section 5.4.4**). Accordingly, the net new supply of 89,619 AFY (**Table 7-1**), is incorporated as a Phase One project in the projected future water budgets. This project alone is sufficient to mitigate future water budget deficits estimated for baseline (-67,640 AFY) and 2030 Climate Change (-75,953 AFY) conditions (see **Table 4-14**).

The City has developed priority uses for allocating the GSP project water. The first will be to meet municipal demands by conveyance of water to the three water treatment plants in the KRGSA. Additional water will be targeted for recharge in the Kern River channel below the Calloway weir where the channel is dry most of the time. For planning purposes, three segments of the channel are prioritized for recharge, but locations and amounts will vary depending on available water, other obligations, and activities by others in the River. Finally, water will continue to be recharged in the COB 2800 facility, which has excess capacity in most years. As such, recharge of GSP project water would occur in addition to routine ongoing banking in the COB 2800 facility by the City. Priorities for use of GSP project water are summarized in **Table 7-2** below along with maximum monthly amounts.

Table 7-2: Kern River Conjunctive Use Optimization Project

Priority	Location	Maximum Monthly Amounts
1	Henry C. Garnett Water Purification Plant (WPP)	Up to 542 AF/month
2	Cal Water North East Treatment Plant (WTP)	Up to 5,604 AF/month
3	Cal Water North West Treatment Plant (WTP)	Up to 747 AF/month
4	Kern River Channel (below Calloway Weir)	Up to 12,000 AF/month
5	Kern River Channel (below the River Canal)	Up to 2,000 AF/month
6	Kern River Channel (below Rocky Point)	Up to 2,800 AF/month
7	COB 2800 Facility	Up to 20,000 AF/month

As indicated in **Table 7-2**, the City recognizes the potential for water budget deficits related to decreases in SWP supply, especially when considering the DWR climate change factors applied to Table A allocations. Therefore, the City has determined that the first priority for this GSP project will involve deliveries of Kern River water to the Henry C. Garnett Water Purification Plant operated by ID4 and the Northeast and Northwest water treatment plants operated by Cal Water. Treated surface water will be limited by plant capacity and demand; as such, plant deliveries will vary over time. In its UWMP, Cal Water documents plans for future expansion of its Northeast WTP that increase capacity to 43 MGD by 2030 (Cal Water, 2016a). Build-out for the plant is 60 MGD, with a peaking capacity of 69 MGD (Cal Water, 2016a). Although the final expansion is not currently scheduled before 2035, plans are in place for implementing the expansion earlier, as needed, depending on growth and urban demand.

7.1.2.1 Project Benefits

Project benefits of the Kern River Conjunctive Use Optimization Project are summarized as follows:

- Additional banking of water in the Kern River channel will benefit water levels in municipal wellfields and assist in meeting measurable objectives for chronic lowering of water levels, degraded water quality, and mitigation of potential future land subsidence.
- Aquifer replenishment raises water levels locally in the Urban MA for all beneficial uses and avoidance of undesirable results.
- Municipal wellfields will have excess capacity allowing a reduction in groundwater pumping of certain wells at certain times. This will provide operational flexibility for managing local water levels to avoid undesirable results.
- The Project provides sufficient water to meet the checkbook deficits estimated for the 2070 climate change scenario in **Table 4-14**. When combined with other projects, the amount fully mitigates the potential for future overdraft conditions, based on projected demands.
- The Project addresses numerous GSP elements described in Water Code §10727.4 and listed in **Section 2.6.6** of this GSP, most notably the replenishment of groundwater extractions, activities for implementing conjunctive use or underground storage, and measures addressing groundwater recharge, in-lieu use, diversions to storage, and conveyance projects.

- Use of the River channel as a primary groundwater recharge source restores more natural hydrologic functions of recharge beneath the River.

7.1.2.2 Implementation Process:

The City intends to implement this project incrementally over time and to continue project adaptation to changing conditions, adjusting the direct use of the additional Kern River water based on plant capacity and demand. Increased recharge associated with the project will be implemented in Year 1 (2020). Depending on the availability of Kern River water, the project will begin by testing the recharge capacity and aquifer response in certain areas of the channel to better develop management strategies for avoiding undesirable results. In particular, the location and amount of groundwater level increases will be evaluated over time, based on an analysis of scenarios involving resting wells and channel recharge.

Implementation of the project can begin without impediments because the GSP project water supply is part of the City's Kern River entitlement based on its pre-1914 appropriative rights. This provides the City with the legal authority to use the water for multiple reasonable beneficial uses. The City developed an EIR to describe how current water supplies and potential additional water supplies would be incorporated into a new proposed program referred to as the Kern River Flow and Municipal Water Program; that program involved a potential new supply and associated rights on the Kern River, which is on hold pending the outcome of a SWRCB application. However, this GSP project includes only the current Kern River entitlement that belongs to the City and remains available to the City. Additionally, the use of the water is not subject to new permits or regulatory requirements beyond current obligations regarding Kern River management and use.

Public notice of the City's intent to increase conjunctive use in the Kern River was provided during the CEQA process for numerous projects, including, but not limited to, the EIR for the Kern River Parkway project, the EIR for the 2800 Acres project, the EIR for the Kern River Flow and Municipal Water Program, and in a number of City planning and policy documents including the land use planning efforts described above and documented in **Sections 2.6.1** and **2.6.2** of this GSP (although this GSP does not involve all water sources included in those projects and documents). Additional public notice will be accomplished through the GSP outreach process, which includes public hearings and an open house occurring over the next several months.

Because this project simply increases the volume of water retained in the KRGSA, the City will manage a similar total of water that is managed now but will be directing it to increased recharge and/or water purification facilities. Accordingly, project costs are anticipated to be managed within the City's current operational budget for Kern River management. If additional facilities for recharge are required, those costs will be developed as a new KRGSA GSP project.

The timing for full implementation of this project is related, in part, to the planned expansion of the North East treatment plant (and other treatment plants), which in turn is tied closely to growth and future demands. Expansion of the Northeast WTP to 43 MGD is scheduled to occur by 2030 and full buildout will likely occur in the GSP Planning horizon. Scheduling of project details will be developed for the five-year update to the GSP, based on then-current projections.

Two additional treatment plants – Southwest Bakersfield WTP and Rosedale Ranch/Seventh Standard Corridor WTP – are also proposed to increase capacity for direct deliveries of Kern River water (Cal Water, 2016a). These plants are on hold due to economic conditions, but ultimately would serve to decrease reliance on groundwater.

7.1.3 Expand Recycled Water Use in the KRGSA Plan Area

For more than 30 years, the City of Bakersfield has been providing treated wastewater from its WWTP No. 3 to a 4,700-acre farm for irrigation, known as Green Acres. The farm is owned by the City of Los Angeles and located on the western edge of the KRGSA with most of the land outside of the KRGSA boundary (about 72 percent). Currently the City provides an average of about 18,000 AFY to Green Acres in accordance with its contract.

On July 17, 2019, the Bakersfield City Council voted not to renew the contract when it expires in 2026. This action allows all of the recycled water to be used in the KRGSA as needed. The City is currently exploring options for use including replacement of potable water for irrigation or for groundwater recharge. Although the water will not be available until after 2026, planning has begun for identification of needs in the Plan Area.

The average amount of water provided to Green Acres during the historical Study Period of WY 1995 – 2015 was about 11,321 AFY, but this average has increased over time with increasing inflows to WWTP No. 3. In addition, current amounts are expected to increase over time with population growth in the City. For analysis in the C2VSim-FG Kern local model, wastewater flows from WWTP No. 3 were increased proportional to the increase in urban water demand over time with a similar proportional increase in available recycled water. As a simplifying and conservative assumption, the amount of new water supply was limited to the percent of supply that had been used outside of the KRGSA (72 percent of the total amount). This calculation indicates a new average annual water supply to the KRGSA of about 11,556 to 13,407 AFY for the 20-year implementation period and the entire 50-year planning horizon, respectively.

<u>Benefits and Implementation</u>: This project will increase the availability of recycled water in the KRGSA for beneficial use. This water supply will support measurable objectives for all sustainability indicators with a net positive impact on the KRGSA Plan Area water budget to mitigate the potential for future overdraft. If used to replace potable water, the net benefit would be even greater by preserving a high-quality potable supply for other beneficial uses. This project supports a key GSP element by providing measures to address water recycling, as listed in Water Code §10727.4 and re-stated in **Section 2.6.6** (see item (h)). Depending on the selected water use, this project supports additional GSP elements including replenishment of groundwater extractions, opportunities for conjunctive use or underground storage.

The City owns the wastewater and no additional legal authority is needed to retain the water for local use. A permitting and regulatory process may be required depending on the type of use. At this time, the project is simply to retain the recycled water for use within the KRGSA; implementation will occur with the expiration of the contract in 2026. A more defined project and other implementation considerations will be developed between 2020 and 2026; updated project components will be provided in annual reports as they are developed. Costs have not yet been estimated for this project. The public was notified of this project at the City Council meeting on July 17, 2019. Numerous newspaper articles documented the discussion and vote of the City Council (Bakersfield Californian, 2019). Additional public notice will be provided through the public review period of this GSP. Additional public outreach will occur as specific uses are identified for the increase in available recycled water.

7.1.4 Land Use Conversion - Urbanization of Agricultural Lands

As indicated by the increase in urban demand over time (**Table 4-14**), growth in Metropolitan Bakersfield is anticipated. According to the UWMPs in the northern Plan Area, urbanization is expected to occur through increased density in urban lands, expansion onto undeveloped lands, and conversion of agricultural lands. Although the exact location of urban growth has not been defined specifically, much of the growth has been expanding to the south into the central and southern Plan Area, as indicated by the delineation of the KRGSA Urban MA (see **Figure 5-1**). Much of this land is either currently or historically used for irrigated agriculture and some of that land will likely be converted within the 20-year GSP implementation phase.

For the purposes of this project, it is assumed that about 10,000 acres of agricultural lands in the KRGSA Plan Area (about 10 percent of the total agricultural lands) will be urbanized. Most of this area is located in the Agricultural MA, but agricultural lands also occur in the Urban MA. Although the acreage and locations are uncertain, the City indicates that this is a reasonable assumption based on current urbanization areas. Project acreage would already be embedded in the analysis of future urban demand in the projected water budget, which is based simply on population growth. Accordingly, the total agricultural demand for the project acreage is decreased to prevent double counting of water use on these 10,000 acres. Using the average crop ET demand in the southern KRGSA Plan Area of 2.7 AF/acre, approximately 27,000 AFY is eliminated from the agricultural demand, representing an overall net demand reduction in the KRGSA as a result of this project.

Project benefits of this urbanization of former agricultural lands are summarized as follows:

- Decreases overall water demand, which supports measurable objectives of all sustainability indicators applicable to the KRGSA including chronic lowering of water levels, reduction of groundwater in storage, degraded water quality, and the potential for land subsidence
- Mitigates potential for future overdraft conditions by decreasing demand; this allows for surface water to meet a larger portion of the demand, thereby reducing groundwater pumping
- Allows for decreased pumping in areas of potential land subsidence

- Addresses several GSP elements described in Water Code §10727.4 and listed in **Section 2.6.6** of this GSP, most notably processes to review land use plans and efforts to coordinate with land use planning agencies and measures addressing in-lieu use.

7.1.4.1 Implementation Process:

There are no impediments to implementation of this project. Although the GSA does not specifically control the location of future growth, the City will assist in tracking and coordinating the conversion of agricultural lands through time as opportunities arise. Given previous patterns of growth and projections of population increase, this project is expected to be fully implemented within the 20-year GSP implementation period. Legal authority, permitting, and regulations for locations of population growth within the City limits reside with the land use planning, water resources, and other City departments and with the City Council. Outside city limits, land use planning resides with Kern County. Funding is not needed for implementation of this project.

Water use for urbanization of agricultural lands in KDWD is covered under an agreement between KDWD and the City of Bakersfield. That agreement obligates KDWD to make water available for those newly-urbanized lands, provided that those lands have been served historically by the water rights obtained by KDWD. Some of the recently urbanized lands in KDWD were not historically served by KDWD water rights and, as such, are not currently served by KDWD. KDWD has the responsibility to support the new urban demand at a rate of about 1.0 – 1.5 AF/acre. This agreement will provide sufficient water to serve urban demand and will prevent the need for additional groundwater pumping to support new growth in this area.

7.1.5 ENCSD North Weedpatch Highway Water System Consolidation Project

Six small water systems in the vicinity of Highway 184 (Weedpatch Highway) and Muller Road have had to cope with water quality issues including elevated nitrate, TCP, and arsenic concentrations detected in water supply wells. These disadvantaged communities (DACs) have limited resources and provide drinking water supply to more than 1,400 persons along the eastern KRGSA boundary. Three of these systems are located within the KRGSA Plan Area as noted below; the remaining three are just outside the KRGSA Plan Area in AEWSD.

- Oasis Property Owners Association (Oasis POA) – in KRGSA
- East Wilson Road Water Company (East Wilson Rd) – in KRGSA
- Wilson Road Water Community (Wilson Road WC) – east of KRGSA
- San Joaquin Estates Mutual Water Company (SJE MWC) – east of KRGSA
- Del Oro Water Company Country Estates District (Del Oro WC) – east of KRGSA
- Victory Mutual Water Company (Victory MWC) – in KRGSA.

Service areas of these small water systems are adjacent to, and in some areas surrounded by, the ENCSD service area (see **Figure 2-4**). In response to water quality violations, the SWRCB DDW ordered corrective actions to meet drinking water standards. Consolidation with ENCSD was evaluated as a possible corrective action for each of the water systems. ENCSD prepared an initial Engineering Report in 2016 evaluating the consolidation of four of the water systems (AECOM, 2019, see Attachment T-1). At the request of the SWRCB-DDW, an amendment to the Engineering Report was prepared in April 2019 to add Del Oro WC and Victory MWC to the consolidation evaluation (AECOM, 2019).

The project includes new water distribution systems, a new well (1,400 gpm capacity) with arsenic treatment, a storage tank, hydropneumatics tank, and a booster pump station. If TCP is detected in the new well, the grant will also fund a TCP treatment system. All wells with water quality violations will be properly abandoned according to Kern County Environmental Health regulations. Grant funding through the Drinking Water State Revolving Fund (DWRSF) program has been secured for construction costs. The small water systems have also received assistance from Self-Help Enterprises, a community development organization that assists rural communities identify clean drinking water sources in eight counties of the San Joaquin Valley.

Although this consolidation project was conceived prior to the preparation of this GSP, ENCSD is documenting this project in the GSP as a member agency in the KRGSA.

7.1.5.1 Project Benefits

Project benefits of the North Weedpatch Consolidation Project are summarized as follows:

- Supports measurable objectives for degraded water quality by managing local arsenic concentrations with construction of an arsenic wellhead treatment facility, thereby avoiding an undesirable result
- Controls projected urban demand through conservation efforts implemented by ENCSD
- Abandons wells with poor water quality
- Provides DACs with a reliable, clean drinking water supply
- Supports numerous GSP elements described in Water Code §10727.4 and listed in **Section 2.6.6** of this GSP, including wellhead protection areas (for the new project well), migration of contaminated groundwater (elevated nitrate from a nearby septic system as suggested in one DDW Water Quality Violation Order), adherence to well abandonment and well construction policies, measures addressing groundwater contamination, and efficient water management practices.

7.1.5.2 Implementation Process:

Numerous activities are required prior to project construction. ENCSD has adopted standards and policies that control this annexation process and requires legal Consolidation Agreements with the water systems for adherence to ENCSD requirements. Annexation proceedings will be completed through the Local Agency Formation Commission (LAFCO); approval is anticipated. CEQA compliance will include preparation of a CEQA Plus mitigated Negative Declaration, with a Notice of Determination filed with Kern County and the State Clearinghouse. ENCSD will need to acquire about 1.5 acres of undeveloped land from the Fairfax School District for the new well site. Construction design documents are approximately 90 percent complete (Ruiz, personal communication, 7/31/2019).

The project is scheduled for implementation once all of the agreements and CEQA compliance have been completed. To date, ENCSD has signed agreements to annex and consolidate service areas into ENCSD for SJE MWC, Oasis POA, and Wilson Road WC. Once annexed, ENCSD will have the legal authority to serve water throughout its expanded service area. Construction permits, including well drilling, are required for the project. The ENCSD permit with DDW for the provision of drinking water will be amended to include system improvements.

Construction of the consolidation project is being funded by a DWRSF grant. Funding includes new infrastructure, including pipelines, pump station, storage, and a new well. Costs for an arsenic treatment facility and TCP treatment, if needed, are included in the grant. Project costs are estimated at approximately $20 million. More detailed costs, including O&M are provided in the Engineering reports (AECOM, 2019).

The Project schedule is summarized below and expected to take approximately 62 months.

- Project design and CEQA Plus Document – 6 months
- DWRSF construction application process – 24 months
- Annexation proceedings, property acquisition, permitting and well drilling – 8 months
- Well equipping, booster pump station, treatment processes, facilities construction – 24 months.

Once permitted, ENCSD will have the authority to deliver drinking water to all customers and no additional legal authority is needed for project implementation. Public notice will occur through the CEQA process as well as in planned public hearings on this GSP. As mentioned previously, project design activities are proceeding, and agreements have been executed with three of the six systems (as of July 31, 2019).

7.1.6 Possible Water Exchange for Improved Drinking Water Quality in Disadvantaged Communities

The GSA recognizes the challenges of the DACs within the KRGSA to obtain sufficient high-quality drinking water with limited resources. Given the large infrastructure network in the KRGSA, the potential for numerous exchanges of various source waters provides management flexibility for controlling water levels, water quality, and avoiding undesirable results.

One possible exchange is envisioned between ENCSD, which serves water to DACs, and KDWD, who operates the Eastside Canal located through the ENCSD service area. In the event that ENCSD has an immediate need to mitigate elevated nitrate concentrations, KDWD could deliver Kern River water to the ID4 treatment plant on behalf of ENCSD. Then ENCSD could provide groundwater with elevated nitrate or arsenic into the Eastside Canal, where it would be blended and provided for agricultural irrigation (recognizing that nitrate and arsenic are not constituents of concern for agricultural use).

A similar exchange to assist DACs in Oildale MWC could be developed. For this exchange, surface water would be provided for treatment from an additional agency who could receive returned groundwater from Oildale MWC in the Beardsley Canal.

7.1.6.1 Project Benefits

Project benefits of water exchanges to improve drinking water quality for DACs are summarized as follows:

- Support measurable objectives for degraded water quality.
- Assists with improvement of water quality to DACs within the KRGSA and supports the KRGSA sustainability goal to meet municipal demands.
- Supports GSP elements described in Water Code §10727.4 and listed in **Section 2.6.6** of this GSP measures addressing groundwater contamination and efficient water management practices.

7.1.6.2 Implementation Process:

For implementation of this type of project, KRGSA Plan Managers would need to coordinate and consider institutional, legal, or permitting barriers prior to the exchange. For these types of exchanges, additional agreements may be required. For example, ID4 cannot deliver treated surface water from its purification plant outside of ID4 boundaries without amending or developing new contracts. Public notice will be accomplished as part of the public review of this GSP. Implementation of this type of water exchange is considered discretionary and will be considered and implemented only on an as-needed basis. Nonetheless, it remains a viable option for assisting DACs with a high-quality drinking water supply.

7.2 PHASE ONE MANAGEMENT ACTIONS

Phase One *management actions* differ from Phase One *projects* in that they typically do not represent new water supply or reductions in demand. Rather, these actions provide a framework for overall groundwater management including establishing GSP policies and filling data gaps. Ten management actions have been identified for implementation in Phase One.

As provided by SGMA and re-sated in the MOU forming the GSA, the KRGSA may perform the following functions:

1. Adopt standards for measuring and reporting water use.
2. Develop and implement policies designed to reduce or eliminate overdraft within the boundaries of the GSA.
3. Develop and implement conservation best management practices.
4. Develop and implement metering, monitoring, and reporting related to groundwater pumping.

The management actions included in this section rely on SGMA authority and no additional legal authority is required. In addition, the MOU states that the City and ID4 are jointly responsible for GSP implementation in the City limits and ID4 boundaries. KDWD is responsible for GSP implementation in its boundaries. In addition, Greenfield CWD is responsible for GSP implementation in its service area as per

HENRY MILLER GSA

Groundwater Sustainability Plan

SGMA Project and Management Actions

December 2019

4 PROJECTS AND MANAGEMENT ACTIONS (REG. § 354.44)

4.1 Project #1: Optimizing the recovery of Pioneer Project banked supplies in dry years

HMWD is a Recharge Participant in the Pioneer Project. Therefore, the District has a second priority right to recover banked water supplies from the Project. Since its inception in 1995, the District has banked SWP, Kern River, CVP, and other water in the Pioneer Project (or related Kern Fan facilities) for future recovery or flexibility with exchanges/transfers. In efforts to supplement supplies to the District in years when other surface supplies are sparse, the District could recover its banked supplies and deliver said water to lands within the District.

4.1.1 Measurable Objective that is Expected to Benefit from the Project or Management Action

Recovering banked supplies is expected to offset a decline in local water levels and a negative change in groundwater storage.

4.1.2 Circumstances for Implementation

The project may be implemented in a circumstance where HMWD's supplies are below their average quantities and the District would otherwise pump groundwater beyond its sustainable yield. The project would require the ability to recover and deliver the water; this may be difficult in certain years, when the Recovery Participants maximize their first priority to recover and preclude Participants, such as HMWD, from recovering their banked supplies.

4.1.3 Overdraft Mitigation Projects and Management Actions

The purpose of this project is to avoid overdraft in HMWD.

4.1.4 Time-Table for Initiation and Completion

In the event of a banked water recovery, HWMD will coordinate with Pioneer Project participants and stakeholders as needed.

4.1.5 Expected Benefits and how they will be Evaluated

The purpose of recovering banked water supplies is to prevent the decline of conditions below MT levels and prevent future MT exceedances for each of the applicable sustainability indicators.

4.1.6 How the Project will be Accomplished

HMWD will coordinate with the Pioneer Project as necessary to recover needed supplies.

4.1.7 Estimated Cost of Project

HMWD bears a portion of the recharge facility operations, maintenance, and facility costs through the contractual agreement already established with the Pioneer Project. Since this agreement is already in place, no additional costs will be incurred to implement this Project.

Other descriptive items outlined by SGMA were reviewed and deemed inapplicable to the implementation of this project including: public noticing, permitting and regulatory process, legal authority required, management of groundwater extractions and recharge, and additional GSP elements in Water Code § 10727.4.