Merced Integrated Regional Water Management
Merced Region Drought Grant Proposal

Attachment 3:
Project Justification

Attachment 3 consists of the following items:

- ✓ **Project Summary Table**
  Table showing for each project the applicable project element(s) from both the Drought Project Element and IRWM Project Element Sections of the table.

- ✓ **Project Description**
  Brief description of each project and discussion of how the project will help alleviate the drought impact(s) identified in Attachment 2 and how the project can be considered as one or more of the four eligible drought project types (Section C), and why expedited funding is needed.

- ✓ **Regional and Project Map**
  A regional map and project maps.

- ✓ **Project Physical Benefits**
  Discussion of physical benefits.

- ✓ **Technical Analysis of Physical Benefits Claimed**
  Narrative description of the primary and secondary expected physical benefits, which must address the following items:

  - Technical basis of the project.
  - Recent and historical conditions that provide background for benefits to be claimed.
  - Estimates of without-project conditions.
  - Description of methods used to estimate physical benefits.
  - Identification of all new facilities, policies, and actions required to obtain the physical benefits.
  - Description of any potential adverse physical effects.

  Technical analysis detail should be commensurate with the size of the project.

- ✓ **Cost Effective Analysis**
  Analysis that evaluates whether physical benefits provided by the project are provided at the least possible cost.

Project Summary Table

Table 3-1: 2014 Merced Region Drought Grant Proposal Summary Table

Table 4 – 2014 IRWM Drought Solicitation Project Summary				
		Highlands Groundwater Conservation Project	Cressey Recharge Basin Project	Water Meter Conservation Project
Drought Project Element				
D.1	Provide immediate regional drought preparedness?	X	X	X
D.2	Increase local water supply reliability and the delivery of safe drinking water?	X	X	X
D.3	Assist water suppliers and regions to implement conservation programs and measures that are not locally cost effective?			
D.4	Reduce water quality conflicts or ecosystem conflicts created by the drought?	X	X	X
IRWMP Project Element				
IR.1	Water supply reliability, water conservation, and water use efficiency	X	X	X
IR.2	Stormwater capture, storage, clean-up, treatment and management			
IR.3	Removal of invasive non-native species, the creation and enhancement of wetlands, and the acquisition, protection and restoration of open space and watershed lands			
IR.4	Non-point source pollution reduction, management and monitoring			
IR.5	Groundwater recharge and management projects	X	X	X
IR.6	Contaminant and salt removal through reclamation, desalting, and other treatment technologies and conveyance of reclaimed water for distribution to users			
IR.7	Water banking, exchange, reclamation and improvement of water quality	X	X	X
IR.8	Planning and implementation of multipurpose flood management programs			
IR.9	Watershed protection and management			
IR.10	Drinking water treatment and distribution			
IR.11	Ecosystem and fisheries restoration and protection			

Project Description

Highlands Groundwater Conservation Project

Brief Description: This project would deliver surface water to 717 acres in lieu of groundwater pumping in the Highlands area to meet immediate and critical water demands.

Expanded Description: The Highlands Groundwater Conservation Project, sponsored by MID, is an in-lieu groundwater recharge (conjunctive use) project that will allow water to be banked in the groundwater basin by providing surface water to be used instead of pumping groundwater. It will provide immediate relief and drought preparedness for the Highlands area by reducing over pumping that is occurring due to the drought, and limiting the associated impacts of over pumping such as lack of adequate supplies, water quality degradation, and subsidence. It is expected that during most years, sufficient surface water would be provided to meet all agricultural demands of existing customers in the Highlands area, avoiding pumping groundwater entirely. This will allow groundwater to remain in the basin for replenishment and use for potable purposes. During critically dry years when surface water supplies are limited, the existing wells that have been idled would be available for pumping to augment available surface water supplies. It is anticipated that even during critically dry years, 75 percent of the supply would be from surface water, with approximately 25 percent of the water coming from the groundwater basin. The project would directly alleviate the existing drought impacts identified in Attachment 2 by providing additional supply to meet existing demands while simultaneously improving quantity and quality of groundwater supplies. Specifically, once the proposed facilities (modified pump stations, replaced and new pipelines, inlet/outlet structures, tie-ins to existing wells, upgraded SCADA) have been constructed, the project will provide surface water to replace groundwater pumping.

MID has surface water supply that could be provided to its customers in this area, but infrastructure is currently not sufficient to convey supply to the entire area. Because the project would allow water to be left in the Merced Subbasin rather than extracted for use, the project would contribute to recovery of groundwater levels over the long-term, addressing the over draft condition of the entire basin and meeting drinking water needs of the Highlands area DAC as well as other DACs throughout the region. With increasing water levels in the basin, existing and potential impacts including drinking water MCL violations, loss of groundwater wells, and regional subsidence would be substantially reduced. Because in-lieu recharge essentially serves as a bank account for water, the stored water could be extracted under future dry conditions to minimize the effects of reduced agricultural and ecosystem water demands (potentially by limiting MID's cut back to growers and Merced National Wildlife Refuge (NWR) or by extending water supply during multiple dry years). Any reduction of impacts to growers and ecosystem needs would minimize associated economic impacts for agriculture and the community as a whole.

The project would also increase local water supply reliability by diversifying the water source to the Highlands area such that the groundwater levels could recover in the Merced Subbasin. Because all potable supply in the Merced Region is solely provided by groundwater, increasing groundwater levels would increase water supply reliability in the Region and the delivery of safe drinking water. Thus, this project would meet the following project types specified in Section C of the PSP: 1) Provide immediate regional drought preparedness; 2) Increase local water supply reliability and the delivery of safe drinking water; and 3) Reduce water quality conflicts or ecosystem conflicts created by the drought. Because the project would reduce overall pumping, this project would result in a net reduction in energy consumption and greenhouse gas emissions.

Expedited funding is needed as a result of the dire situation caused by the current drought and the anticipated worsening situation if the drought were to extend into 2015. These effects are identified in Attachment 2. MID also does not currently have funding to move forward with this project, because budget has been spent on immediate drought-related relief, including lowering/deepening wells and implementing mandatory conservation / rationing, which impacts revenues. With this project, MID is in a unique position to help not only its customers but the Merced Subbasin as a whole by increasing groundwater levels, which would reduce secondary impacts including water quality effects, loss of groundwater wells, subsidence, reduction in agricultural production, and other related economic impacts.

Cressey Recharge Basin Enlargement Project

Brief Description: This project will expand an existing recharge basin to provide immediate drought relief by increasing supplies in the Merced Subbasin.

Expanded Description: The Cressy Recharge Basin Enlargement Project, sponsored by MID, is the second phase of an ongoing recharge project. The project would enlarge the existing Cressey recharge basin, located at the southwest corner of Mercedes Avenue and Jones Road north of the town of Winton, from 8 acres to 13 acres. The existing recharge basin began operations in 2011[1] and is capable of recharging 2.74 acre feet per acre per day (AF/AC/day)[2]. Similar to the existing project, the expanded basin would be supplied by water from Lake McClure flood releases, precipitation from the watershed, and planned releases when water is available. Water would be delivered through the Cressey Lateral during the irrigation season, which typically occurs from March through October period, but varies depending on hydrologic year type.

The expanded project would help alleviate the drought impacts identified in Attachment 2. Specifically, the project would have the immediate benefit of increasing the quantity and quality of available groundwater. Because recharge activities would elevate groundwater levels within the entire Merced Subbasin, the project would address the risk of not meeting existing drinking and agricultural water demands once the basin has been expanded, both in the immediate and long term. Flood releases that otherwise would have ultimately been conveyed out of the Merced Region via the Merced River would instead be stored in the basin for later use, particularly during years of drought when insufficient supply is available. Recharge activities would contribute to the recovery of groundwater levels, which would address the over draft condition of the entire basin. With increasing water levels in the basin, existing and potential impacts such as drinking water MCL violations, the loss of groundwater wells, and potential for regional subsidence would be substantially reduced. Water recharged by this project and stored in the groundwater basin could be extracted under future dry conditions to minimize the impacts of reduced agricultural and ecosystem water demands (potentially by limiting MID's cutbacks to growers and Merced NWR or by extending the supply during multiple dry years). Any reduction of impacts to growers and ecosystem needs would minimize associated economic impacts for agriculture and the community as a whole. Thus, this project would not only provide immediate regional drought preparedness, but also reduce water quality or ecosystem conflicts created by the drought.

In addition, the project would enhance local water supply reliability by increasing groundwater levels and reducing over draft in the Merced Subbasin. Because all potable supply in the Merced Region is solely provided by groundwater, increasing groundwater levels would increase water supply reliability in the Merced Region and the delivery of safe drinking water.

Expedited funding is needed to address the dire situation caused by the current drought and the additional impacts expected if the drought were to extend into 2015. These effects are identified in Attachment 2. MID also does not currently have funding to move forward with this project, because budget has been spent on other immediate drought relief programs, including rehabilitating / deepening wells and implementing mandatory conservation / rationing, which impacts revenues. This project provides a unique opportunity to not only help MID meet its customers' demands, but to benefit the Merced Subbasin as a whole by increasing groundwater levels. This would in turn reduce secondary impacts including water quality effects, loss of groundwater wells, reduction in agricultural production, and other related economic impacts.

[1] MID. 2014. Groundwater Recharge. Accessed on July 2, 2014. Available at: http://www.mercedid.com/index.cfm/water/groundwater/
[2] This infiltration rate is based on monitoring data at the basin. See **Appendix 3-14**.

Water Meter Conservation Project

Brief Description: This project would install water meters for existing customers in Le Grand, to reduce water consumption and enable water usage to be monitored.

Expanded Description: The project would install 525 new water meters (500 connections to homes and 25 connections to businesses, schools, and the County park) and transmitter equipment in the LGCSD service area. Each meter would be housed in a box under the curb outside each site to allow for real-time water usage readings. The project is an emergency drought-preparedness project which would result in immediate demand reductions, This would alleviate the dire drought impacts identified in Attachment 2 for this DAC, particularly due to the precipitous drop (50 feet) in groundwater levels that has resulted in the need for LGCSD to redrill all of its municipal wells. The project would allow each customer to self-monitor water usage and modify usage to respond to the drought. It would also allow LGCSD to monitor water consumption by individual customers and proactively address over-consumption. The project would address both immediate and long-term drought preparedness by contributing to sustainable water supplies and supply reliability during water shortages by promoting water conservation, achieving water use reductions, and enabling proactive groundwater management. The project would also reduce net energy consumption, as long-term reduction in water consumption by customers and rising groundwater levels would decrease energy requirements for pumping. With reduced energy consumption, greenhouse gas emissions would also be reduced. Groundwater is disinfected using chlorination at the wellhead; a reduction in water usage would translate to a reduced requirement for water treatment chemicals. Arsenic and 123-TCP occur locally in Le Grand, in both the shallow and deep aquifers. Increases in groundwater levels would improve water quality in the short- and long-term.

The project would also increase local water supply reliability by conserving water. The water meters act as a management tool for tracking the consumption of water within the LGCSD service area. Currently, LGCSD has no way of monitoring individual customers. The installation of the meters would serve as an enforcement tool that would allow LGCSD to address over-consumption during critical periods.

Expedited funding is needed because LGCSD has no alternative source of potable supply and must implement this project to conserve water for the community on an emergency basis. Because of the precipitous drop in groundwater elevations (about 50 feet within a three month timespan), LGCSD has had to deepen its production wells to ensure drinking water supply is available to this DAC. There is no other alternative water supply source in this community, which is entirely reliant on groundwater. The situation is so dire that the Le Grand public schools did not have sufficient water pressure to flush toilets in May, causing an immediate public health and safety concern. Stage 3 water conservation measures have already been imposed, and it is anticipated that conservation levels will increase to Stage 4 by the end of the year. As such, this community will likely be unable to meet its drinking water demand and ensure Human Right to Water by late summer 2014. The funds that were originally set aside for this project have been redirected to other drought-related relieve actions such as deepening existing municipal wells, preventing LGCSD from proceeding with this project, even though final design was completed in 2011 and the project is shovel-ready.

Regional Map and Project Map

Regional Map

Figure 3-1 shows the regional map of the area, including the Merced IRWM Region boundary, and locations of the Highlands Groundwater Conservation Project, the Cressey Recharge Basin Project, and the Water Meter Conservation Project.

Project Maps

Figures 3-2 through **3-4** show the project maps for each of the three projects. Included in the maps are the projects' geographical locations, the surrounding work boundaries, facilities of the projects, water resources that will be affected, DACs within the project service areas, and proposed locations where claimed benefits would be monitored. For the Highlands Groundwater Conservation Project (**Figure 3-2**), the proposed locations where benefits would be

monitored include the seven existing groundwater wells located within the boundary of the Highlands area. For the Cressey Recharge Basin Enlargement Project (**Figure 3-3**), the proposed locations where benefits would be monitored include the four monitoring stations that were originally installed as part of the pilot project. The SCADA system would be upgraded to allow MID to track percolation/groundwater recharge rates in real time. It should be noted that **Figure 3-4** does not show the 525 water meters that are proposed for the project because the scale of the figure does not accommodate identification of the individual water meters. The proposed locations where claimed benefits would be monitored include the District office where household water usage information would be transmitted and analyzed, as well as at existing groundwater wells where levels are checked regularly.

Project Physical Benefits

Highlands Groundwater Conservation Project

The physical benefits of this project are shown in **Table 3-2**. The conjunctive use project would allow for in-lieu recharge of the groundwater basin through the provision of surface water supply to MID customers. Reduced groundwater pumping would result in an increase in groundwater elevations over the long term, and a reduction in net electricity consumption and greenhouse gas emissions. The increase in groundwater levels would also improve water quality and reduce subsidence potential. These benefits are gained from project construction and operation, including upgrades/modifications to the existing pump station and installation of about 10,500 feet of new and/or replacement pipelines.

Figure 3-1: Regional Map

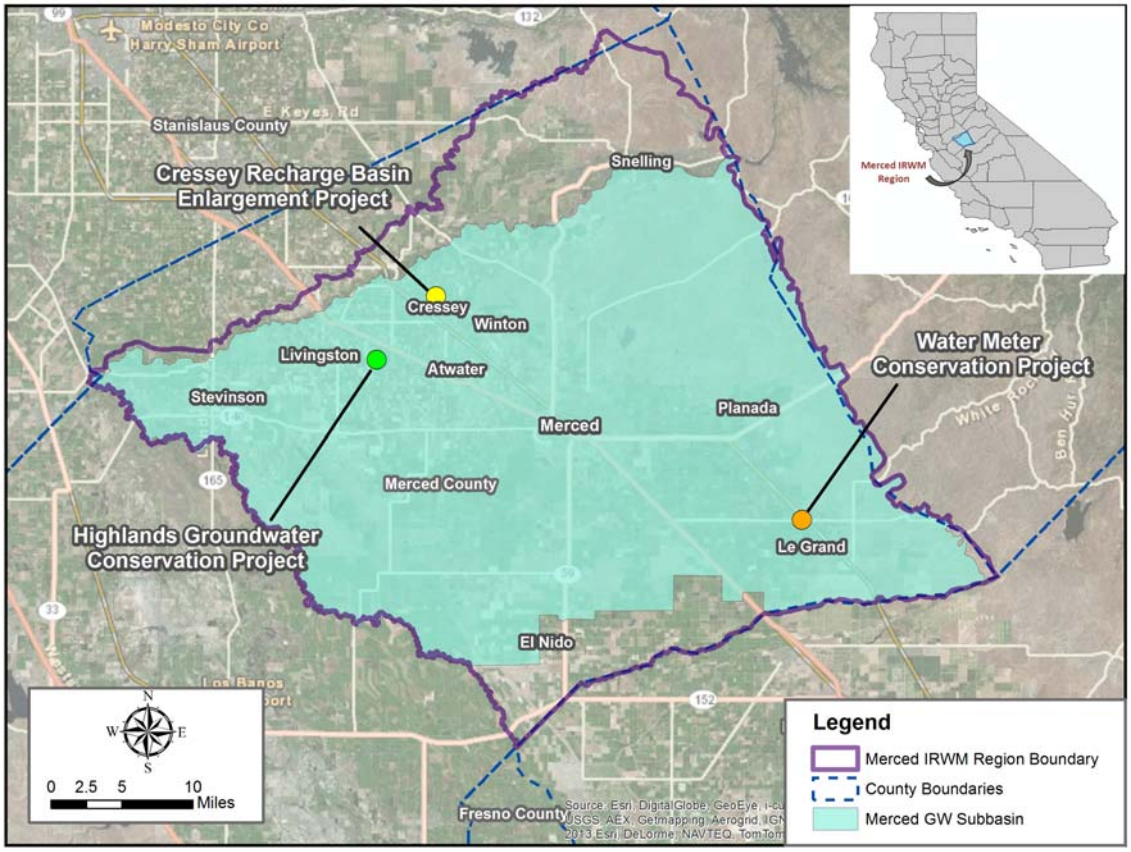


Figure 3-2: Highlands Groundwater Conservation Project

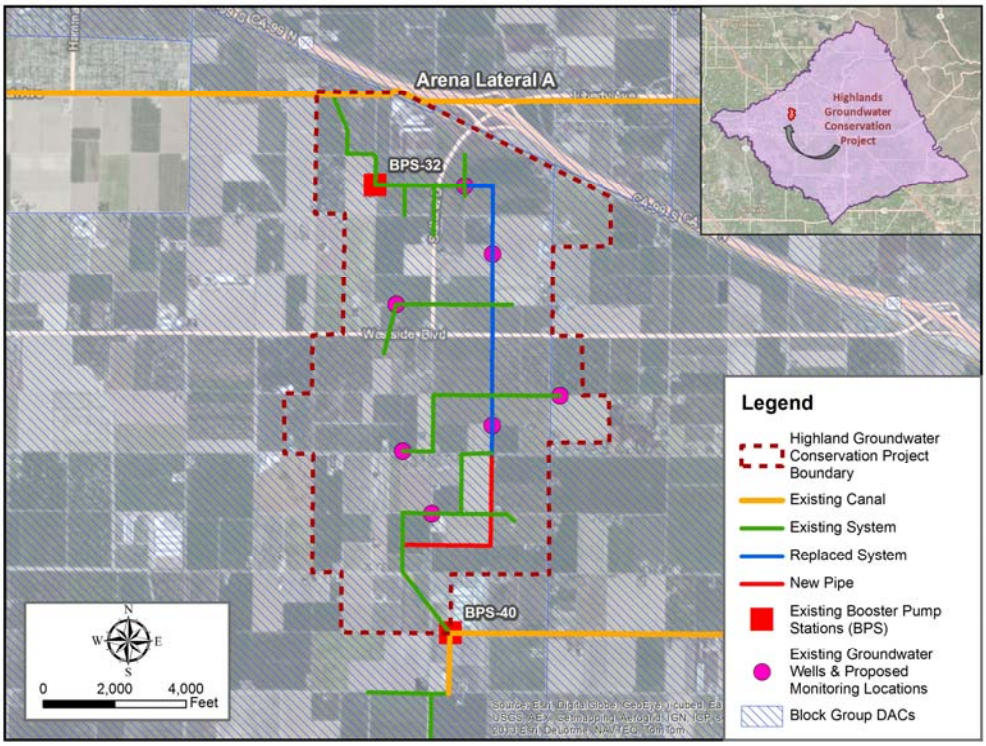


Figure 3-3: Cressey Recharge Basin Enlargement Project

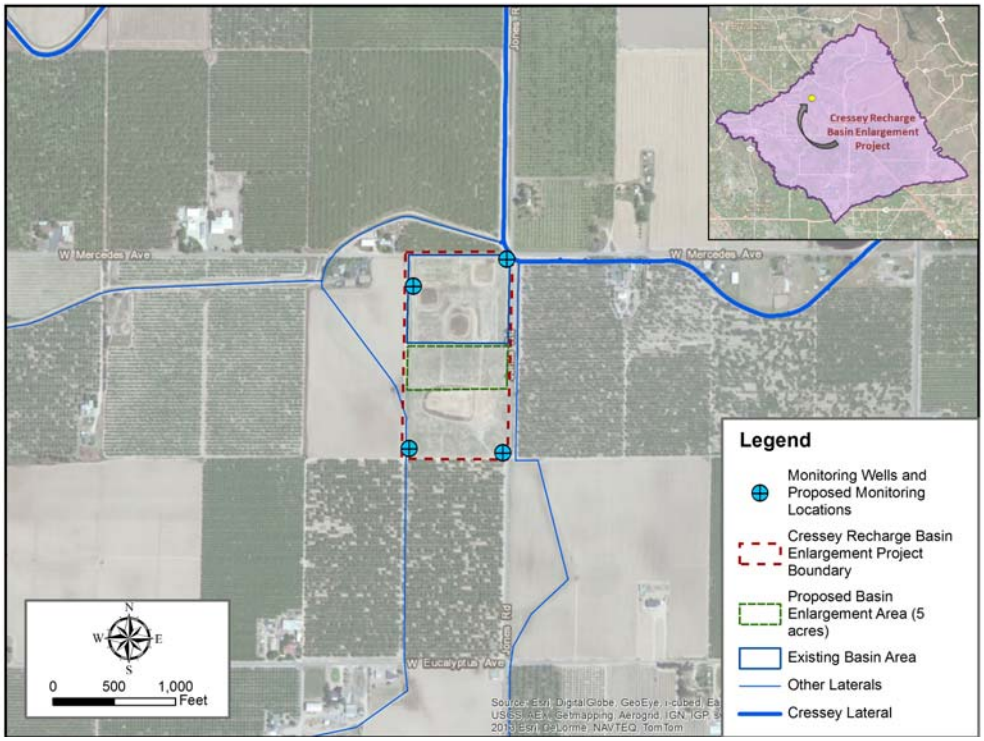
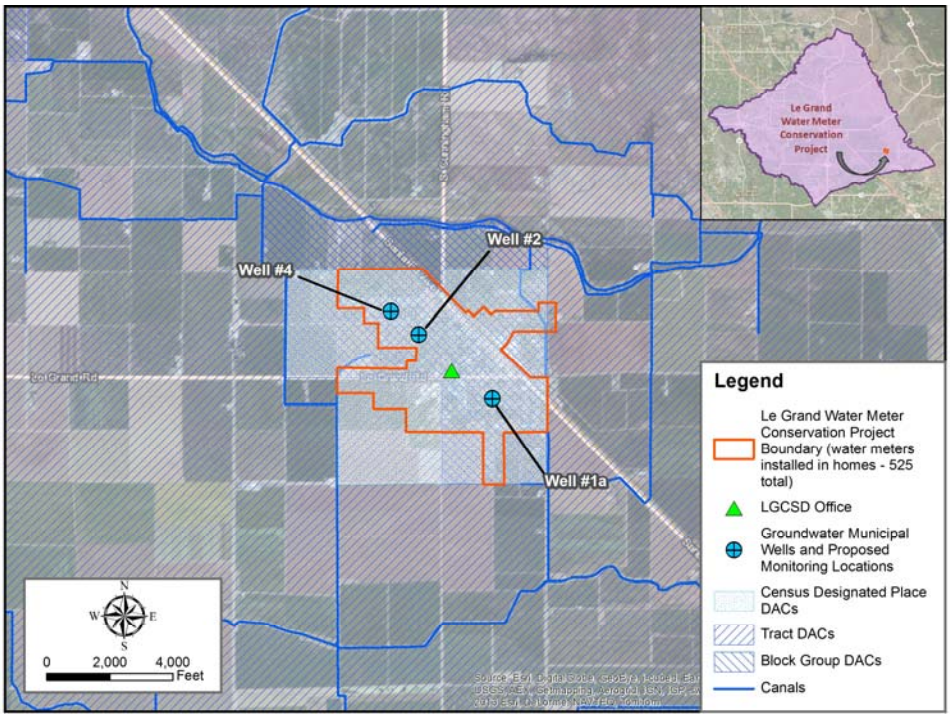


Figure 3-4: Water Meter Conservation Project



Benefits of the project are summarized in **Table 3-2**, and annual projected physical benefits are shown in **Tables 3-3** through **3-5**.

Table 3-2: Physical Benefits Summary
Highlands Groundwater Conservation Project

Physical Benefit	Type of Benefit	Quantification of Benefits
Conserved long-term water supply and associated reduction in groundwater basin over draft	Primary	Up to 2,216 AFY
Reduce Net Consumption of Electricity	Primary	Up to 9,751 kWh/yr
Reduce Net Production of Greenhouse Gases	Secondary	Up to 3 MT CO_2/yr
Improve Water Quality	Secondary	Not quantified
Reduction in Subsidence Potential	Secondary	Not quantified

Table 3-3 shows the water supply benefits for this project. Claimed water supply benefits are different depending on the hydrologic year type. Benefits are anticipated to be slightly reduced in critically dry years, when surface water supplies are reduced and only 75 percent of demands could be met with surface water alone. In all other year types, surface water would be sufficient to meet 100 percent of existing demands and groundwater pumping would be completely avoided. Projected hydrologic conditions for the next 31 years were based on a review of the DWR's San Joaquin River index for the past 31 years. The following table summarizes the projected benefit of the proposed project, assuming critical dry years occur at the same frequency in the next 31 years as they did in the past 31 years. Justification and explanation of the claimed benefits are presented in the Technical Analysis of Physical Benefits Claimed section below.

Table 3-3: Highlands Groundwater Conservation Project
Conserved Water Supply and Reduction in Groundwater Basin Over Draft

Table 5 – Annual Project Physical Benefits Project Name: *Highlands Groundwater Conservation Project* Type of Benefit Claimed: *Conserved Water Supply and Reduction in Groundwater Basin Over Draft* Units of Benefit Claimed: *Acre-feet per year (AFY)* Additional Information About this Benefit:			
(a)	(b)	(c)	(d)
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2016	0	1,108	1,108
2017-2019	0	2,216	2,216
2020-2025	0	1,662	1,662
2026	0	2,216	2,216
2027	0	1,662	1,662
2028-2039	0	2,216	2,216
2040-2041	0	1,662	1,662
2042-2044	0	2,216	2,216

Table 3-4 shows the benefits associated with reduction of energy consumption for this project. Similar to the water savings, claimed energy benefits differ based on hydrologic year type. Groundwater pumping would be completely offset in all but critical dry years. During critically dry years, groundwater pumping would be reduced by 75 percent compared to current conditions; as such, it was assumed that energy savings in critically dry years is equal to 75 percent of the energy usage. The projected occurrence of critically dry years was based on the San Joaquin River index for the past 31 years. Energy usage and savings were estimated based on energy usage data for the groundwater wells and booster pump station in the Highlands area from Pacific Gas and Electricity (PG&E). The justifications and explanations for the benefits claimed are presented in the Technical Analysis of Physical Benefits Claimed section below.

Table 3-4: Highlands Groundwater Conservation Project
Net Reduction in Energy Consumption

Table 5 – Annual Project Physical Benefits Project Name: *Highlands Groundwater Conservation Project* Type of Benefit Claimed: *Net Reduction in Energy Consumption* Units of Benefit Claimed: *kilowatt hour/yr (KWh/yr)* Additional Information About this Benefit:			
(a)	(b)	(c)	(d)
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2016	0	4,875	4,875
2017-2019	0	9,751	9,751
2020-2025	0	7,313	7,313

Table 5 – Annual Project Physical Benefits Project Name: *Highlands Groundwater Conservation Project* Type of Benefit Claimed: *Net Reduction in Energy Consumption* Units of Benefit Claimed: *kilowatt hour/yr (KWh/yr)* Additional Information About this Benefit:			
(a)	(b)	(c)	(d)
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2026	0	9,751	9,751
2027	0	7,313	7,313
2028-2039	0	9,751	9,751
2040-2041	0	7,313	7,313
2042-2044	0	9,751	9,751

Table 3-5 shows the benefits associated with reduction in greenhouse gas emissions produced for this project. Similar to the water and energy savings, claimed energy benefits differ depending on the type of hydrologic year, Greenhouse gas reduction was calculated using the energy consumption provided in **Table 3-4** above. The justification and explanation of the benefits claimed are presented in the Technical Analysis of Physical Benefits Claimed section below.

Table 3-5: Highlands Groundwater Conservation Project
Net Reduction in Greenhouse Gas Production

Table 5 – Annual Project Physical Benefits Project Name: *Highlands Groundwater Conservation Project* Type of Benefit Claimed: *Net Reduction in Greenhouse Gas Production* Units of Benefit Claimed: *Mega-ton of CO_2 per year (MT CO2e/yr)* Additional Information About this Benefit:			
(a)	(b)	(c)	(d)
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2016	0	1.5	1.5
2017-2019	0	3	3
2020-2025	0	2.5	2.5
2026	0	3	3
2027	0	2.5	2.5
2028-2039	0	3	3
2040-2041	0	2.5	2.5
2042-2044	0	3	3

Cressey Recharge Basin Enlargement Project

The physical benefits of this project are shown in **Table 3-6**. The Cressey Recharge Basin Enlargement Project would increase recharge to the Merced Subbasin, increasing groundwater quantity and quality. This would result in both immediate and long-term water supply savings and an associated reduction in groundwater basin over draft, improved water quality / reduced MCL violations, and reductions in subsidence potential. Project physical benefits are shown in **Tables 3-7**. Justification and explanation of claimed benefits claimed are presented in the section Technical Analysis of Physical Benefits Claimed below.

Table 3-6: Physical Benefits Summary
MID Cressey Recharge Basin Enlargement Project

Physical Benefit	Type of Benefit	Quantification of Benefits
Conserved long-term water supply and associated reduction in groundwater basin over draft	Primary	Up to 3,094 AFY
Improved Water Quality	Secondary	Not quantified
Reduction in Subsidence Potential	Secondary	Not quantified

Table 3-7 shows the water supply benefits for this project. Benefits vary by hydrologic year type; year types were determined using the DWR San Joaquin River index for the past 31 years. Justification and explanation of claimed benefits are presented in the Technical Analysis of Physical Benefits Claimed section below.

Table 3-7: Cressey Recharge Basin Enlargement Project
Conserved Water Supply and Reduction in Groundwater Basin Over Draft

Table 5 – Annual Project Physical Benefits

Project Name: Cressey Recharge Basin Enlargement Project

Type of Benefit Claimed: Conserved Water Supply and Reduction in Groundwater Basin Over draft

Units of Benefit Claimed: AFY

Additional Information About this Benefit:

(a)	(b)	(c)	(d)
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2016	0	1,547	1,547
2017-2019	0	3,094	3,094
2020-2025	0	0	0
2026	0	3,094	3,094
2027	0	0	0
2028-2039	0	3,094	3,094
2040-2041	0	0	0
2042-2044	0	3,094	3,094

Water Meter Conservation Project

The physical benefits of this project are a result of a single, measureable, benefit – water conserved due to meter installation and the associated reduction in groundwater basin over draft. Benefits are summarized in **Table 3-8**, and annual project physical benefits are shown in **Table 3-9** through **Table 3-12**. The justifications for the benefits claimed are presented in the section Technical Analysis of Physical Benefits Claimed below.

Table 3-8: Physical Benefits Summary
Water Meter Conservation Project

Physical Benefit	Type of Benefit	Quantification of Benefits
Conserved long-term water supply and associated reduction in groundwater basin over draft	Primary	119 AFY
Reduced Net Electricity Consumption	Secondary	65,052 kW/hr/yr
Reduced Net Greenhouse Gas Production	Secondary	22 MT CO_2/yr
Reduced Net Chemical Usage	Secondary	720 gallons/yr
Improved Water Quality	Secondary	Not quantified

Table 3-9 shows the benefits associated with reduction in water demands / consumption resulting from project implementation. Demand reductions are estimated based on reductions achieved by similar projects in this region. Justification and explanation of the benefits claimed are presented in the Technical Analysis of Physical Benefits Claimed section below.

Table 3-9: Water Meter Conservation Project
Conserved Water Supply and Reduction in Groundwater Basin Over Draft

Table 5 – Annual Project Physical Benefits Project Name: Water Meter Conservation Project Type of Benefit Claimed: Conserved Water Savings Units of Benefit Claimed: AFY Additional Information About this Benefit:			
(a)	(b)	(c)	(d)
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2015-2039	0	95	95

Table 3-10 shows the projected reduction in energy consumption resulting from project implementation. Energy usage was provided by LGCSD. Justification and explanation of the benefits claimed are presented in the Technical Analysis of Physical Benefits Claimed section below.

Table 3-10: Water Meter Conservation Project
Reduce Net Consumption of Electricity

Table 5 – Annual Project Physical Benefits Project Name: *Water Meter Conservation Project* Type of Benefit Claimed: *Net Reduction in Energy Consumption* Units of Benefit Claimed: *KWh/yr* Additional Information About this Benefit:			
(a)	(b)	(c)	(d)
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2015-2039	0	65,052	65,052

Table 3-11 shows the projected reduction in greenhouse gas emissions resulting from project implementation. Greenhouse gas reduction was calculated using the energy consumption provided in **Table 3-10** above. Justification and explanation of the benefits claimed are presented in the Technical Analysis of Physical Benefits Claimed section below.

Table 3-11: Water Meter Conservation Project
Reduce Net Production of Greenhouse Gas Emissions

Table 5 – Annual Project Physical Benefits Project Name: *Water Meter Conservation Project* Type of Benefit Claimed: *Net Reduction in Greenhouse Gas Production* Unit of Benefit Claimed: *MT CO2e/yr* Additional Information About this Benefit:			
(a)	(b)	(c)	(d)
Year	Without Project	With Project	Change Resulting from Project
2015-2039	0	22	22

Table 3-12 shows the projected reduction in water treatment chemicals resulting from project implementation. Projected savings in chemical use were provided by LGCSD. Justification and explanation of the benefits claimed are presented in the Technical Analysis of Physical Benefits Claimed section below.

Table 3-12: Water Meter Conservation Project
Reduce Net Use of Chemicals

Table 5 – Annual Project Physical Benefits			
Project Name: *LCGSD Water Meter Conservation Project* Type of Benefit Claimed: *Net Reduction in Chlorine Use* Units of Benefit Claimed: *gallons chlorine per year* Additional Information About this Benefit:			
(a)	(b)	(c)	(d)
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2015-2039	0	720	720

Technical Analysis of Physical Benefits Claimed

Highlands Groundwater Conservation Project

Summary of Benefits

The projected project benefits include:

- **Water Supply (primary benefit):** The project is estimated to conserve 2,216 AFY of groundwater during most years, when surface water would completely offset groundwater pumping, and 1,662 AFY during critically dry years when some groundwater pumping would be needed to supplement surface water supplies.
- **Energy and greenhouse gas emissions (primary benefit)**: The project would provide surface water to an area that has primarily relied on groundwater. Existing wells would be idled in most years and operating at an assumed 25 percent capacity during critically dry years. Thus, the reduction in pumping would result in net reductions in energy consumption and greenhouse gas emissions production of 9,751 kWh/yr and 3 MT CO2e/yr, respectively, during all hydrologic years but critically dry years. During critically dry years, the net reduction energy consumption and greenhouse gas production would be 7,313 kWh/yr and 2.5 MT CO2e/yr, respectively.
- **Improved Water Quality (secondary benefit, unquantified)**: Improved water quality is a secondary benefit that would result from increasing groundwater levels. Although unquantified, water quality is expected to improve substantially with respect to TDS and nitrate concentrations, as there are two areas immediately north and northeast of the Highlands with elevated concentrations of these constituents. Increases in groundwater levels would reverse exceedances of the MCL for nitrate and avoid damage to crops from high TDS levels.
- **Reduction in subsidence potential (secondary benefit, unquantified)**: Reduced subsidence potential is a secondary benefit that would result from increased groundwater levels. This is an unquantified benefit because the exact reduction in subsidence cannot be determined. However, it is expected that increases in groundwater levels could reduce subsidence by up to 0.2 feet/yr based on the losses that have occurred in the recent past.

Technical Basis of the Project

The following list provides the technical basis for the project. The methods used to determine the claimed benefits are further discussed in a separate subsection.

- MID conducted conceptual design for the proposed Project to determine facility sizing. The calculations to support the project are included in **Appendix 3-1** (As described on page 1 of **Appendix 3-1**, the project was designed for a flow rate of 18 cubic feet per second [cfs]. The spreadsheet on page 3 of this appendix provides facility sizing information from the conceptual design).
- The water supply benefits claimed for the project were calculated based on acreage of land anticipated to be converted from groundwater to surface water supply (**Appendix 3-2**), cropscape information (i.e., type of crops), evapotranspiration data for specific crops, and irrigation efficiency for the Highlands area presented in **Appendix 3-3** (page 1 [lower tables] show the calculations for the consumptive use and total water supply applied in AFY, based on the evapotranspiration data for individual crops by month presented on page 2 and the irrigation efficiency data for the various crops on page 3). The benefits in critically dry years also required the historical, average water allocations (curtailments), provided in **Appendix 2-2**.
- The energy benefits claimed for the project were calculated based on PG&E electricity usage information for the wells and booster pump station in the Highlands area, included in **Appendix 3-4**. Annual energy consumption by existing groundwater users (i.e., use of groundwater wells) is presented on page 13 of this appendix. Annual energy usage by surface water users (i.e., use of booster pump station) is presented on page 2 of this appendix. Raw data for the calculating the energy consumption are included on pages 7 - 12 (booster pump station) and pages 42 - 73 (groundwater wells). The reduction in energy consumption is summarized on page 1 of the appendix.
- Greenhouse gas benefits claimed for the project were calculated based on energy consumption information included in **Appendix 3-4** (see page 1).
- Water quality benefits were based on data included in the *Merced IRWM Plan Groundwater Recharge Feasibility Study*, presented in **Appendix 3-5** (maps of the groundwater elevation on page 28, generalized groundwater flow directions on page 29, TDS concentrations on page 34, and nitrate concentrations on page 36).
- Subsidence avoidance benefits were based on data included in the *Merced IRWM Plan Groundwater Recharge Feasibility Study*, presented in **Appendix 3-5** (maps of subsidence on pages 31 and 32)
- Ecosystem benefits are based on the license with Federal Power Commission (revised February 1, 1964) (pages 1 – 29 of **Appendix 3-6**), the United States of America Federal Energy Regulatory Commission Notice of Authorization for Continued Project Operation (March 5, 2014) (pages 30 – 32 of **Appendix 3-6**), and the 2013 USFWS letter identifying the preliminary schedule for the delivery of water in 2013 to Merced NWR (page 33 of **Appendix 3-6**).
- Groundwater production wells that were rendered inoperable are based on the list of wells that have been lost in the 2014 irrigation season as shown in **Appendix 3-7**.
- Groundwater level information for MID and El Nido is presented in **Appendix 3-8**. Page 1 of this appendix shows the MID well groundwater depth from 2009-2013 including the groundwater depth within the Highlands area ("7 well avg" as shown on the chart). Pages 2 – 5 of the appendix shows a summary of the groundwater levels at each wells for the same period. The raw data for the wells are presented on pages 6 – 11. The groundwater level depth for El Nido is presented on pages 12 – 14.

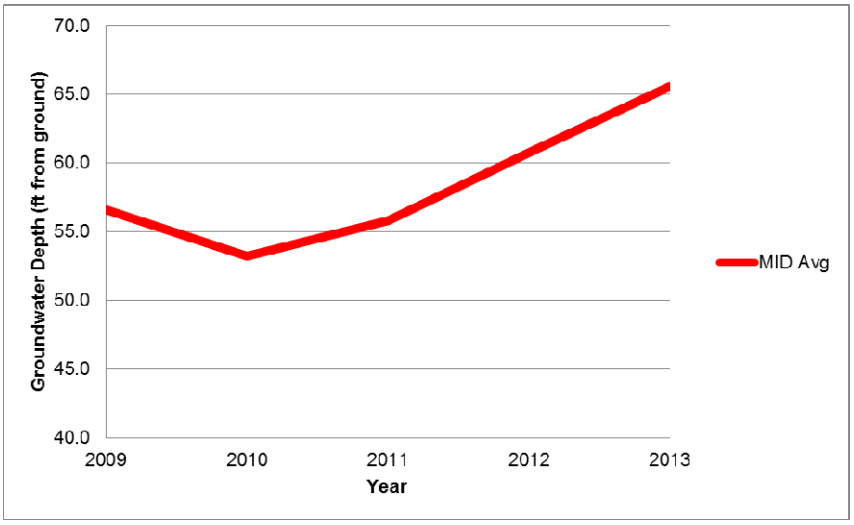
Background for Benefits Claimed

Precipitation is an important source of groundwater recharge in the Merced Subbasin. The Merced Subbasin has been in a state of mild groundwater level decline with a cumulative decrease in storage of approximately 720,000 AF from 1980 to 2007[3]. Lack of rain in recent years has caused a reduction in basin recharge. In addition, increased pumping activities needed to sustain agricultural crops during this drought have resulted in a significant decline in

[3] AMEC Geomatrix, Inc. 2008. Merced Groundwater Basin Groundwater Management Plan Update. Merced County. July 29. [pages 20 and 22)

groundwater levels. Between 2010 and 2013, the average groundwater level in the MID service area declined more than 10 feet (see **Figure 3-5**).

Figure 3-5: Average MID Groundwater Depth from 2009-2013



During the 2014 irrigation season, up to 27 of MID's production wells became inoperable as a result of the substantial drop in groundwater levels. These wells, shown in **Figure 3-6**, are identified in **Appendix 3-7**. The red dots in **Figure 3-6** denote groundwater wells that will require rehabilitation (existing pumps will have to be lowered within the existing well casing) and the purple dots denote groundwater wells where deepening (via redrilling) will be required. Within the Highlands area, two wells have been rendered inoperable because of this drought. Although the exact numbers are not known, many private wells have also been rendered inoperable because of the drought, resulting in the need for either rehabilitation or deepening. The loss of irrigation wells directly affects agricultural production, which has exacerbated the current difficulties faced by many residents and farmers in the Highlands area (a DAC) and overall within the Merced Subbasin. The loss of private domestic wells also affects directly access to safe drinking water supplies in the area.

Declining water levels affect groundwater quality. The Highlands area is located south of Highway 99, close to the community of Arena between the cities of Livingston and Atwater. As indicated in the *Merced IRWM Plan Groundwater Recharge Feasibility Study*, there is an area of depressed groundwater elevations (60-foot contour) to the north and northeast of the Highlands area (see page 28 of **Appendix 3-5**). This is in close proximity and down gradient of two areas of high TDS (with levels exceeding the 500 mg/L MCL) (see **Figure 3-7** and page 34 of **Appendix 3-5**) and high nitrate concentrations (ranging from 25 to 45 mg/L, compared to the 45 mg/L MCL) (see **Figure 3-8** and page 36 of **Appendix 3-5**). Water quality is expected to continue to deteriorate as groundwater declines without the project, thus affecting drinking water and irrigation supplies. If drinking water quality is further impacted, DACs in and around the Highlands area would face significant public health and safety issues, as there is no other alternative drinking water supply to meet basic human needs in this area.

Figure 3-6: MID Production Wells that Have become Inoperable in 2014

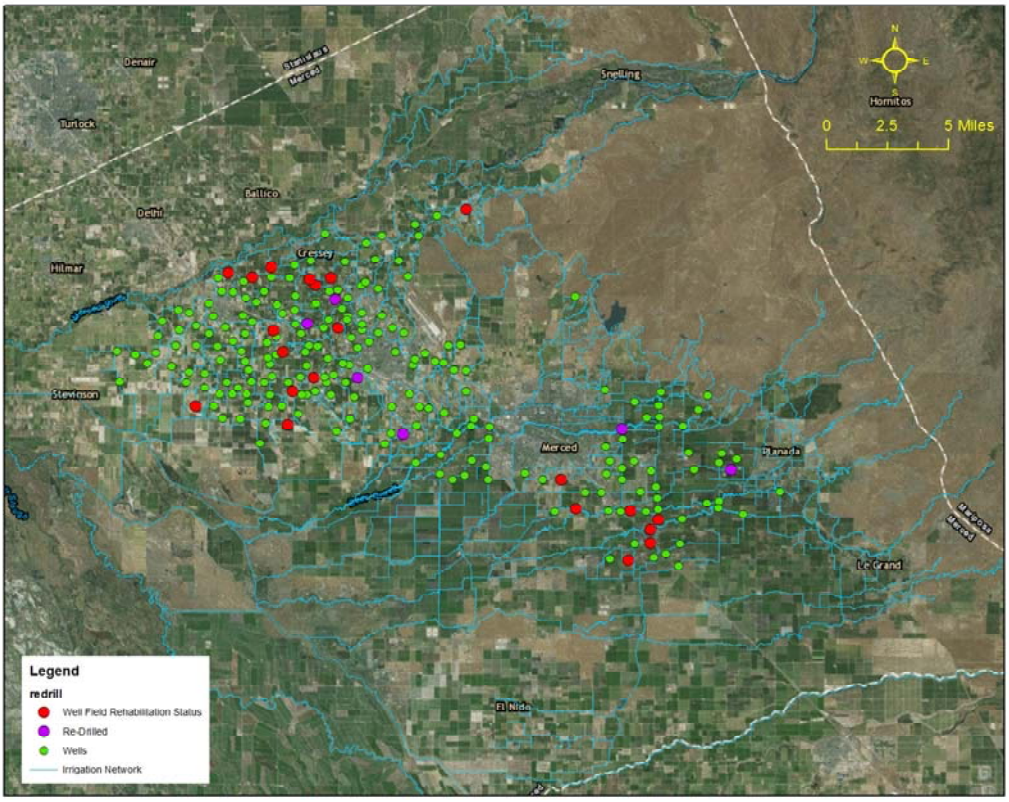


Figure 3-7: TDS Concentrations in the Merced IRWM Region

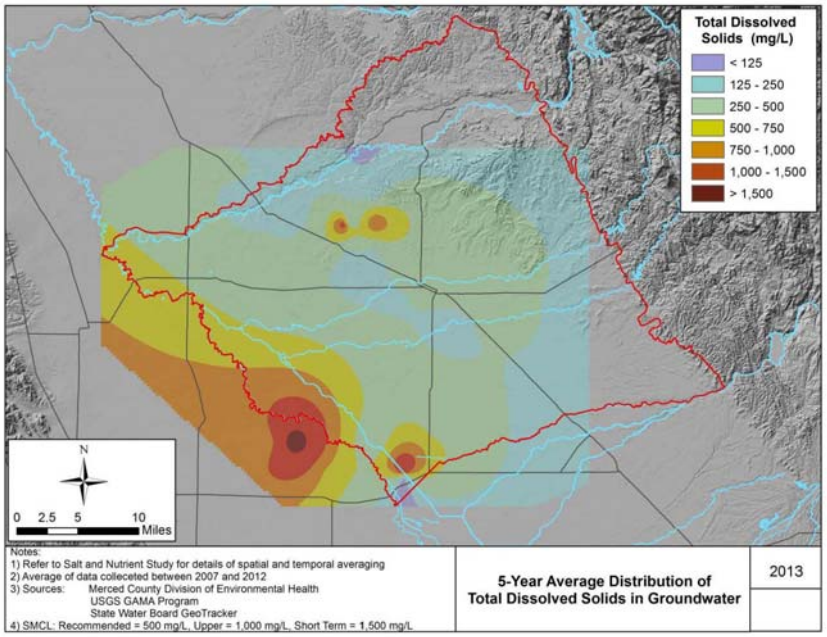
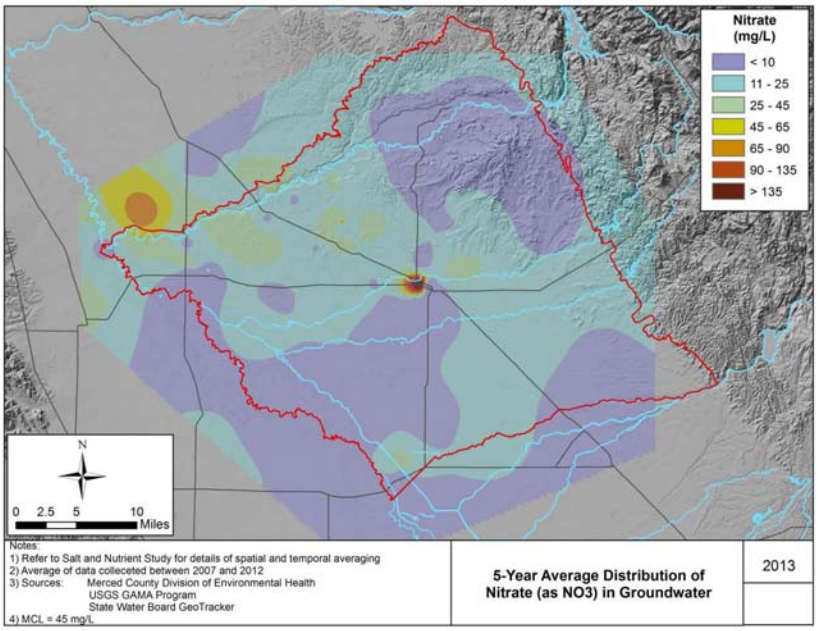


Figure 3-8: Nitrate Concentrations in the Merced IRWM Region

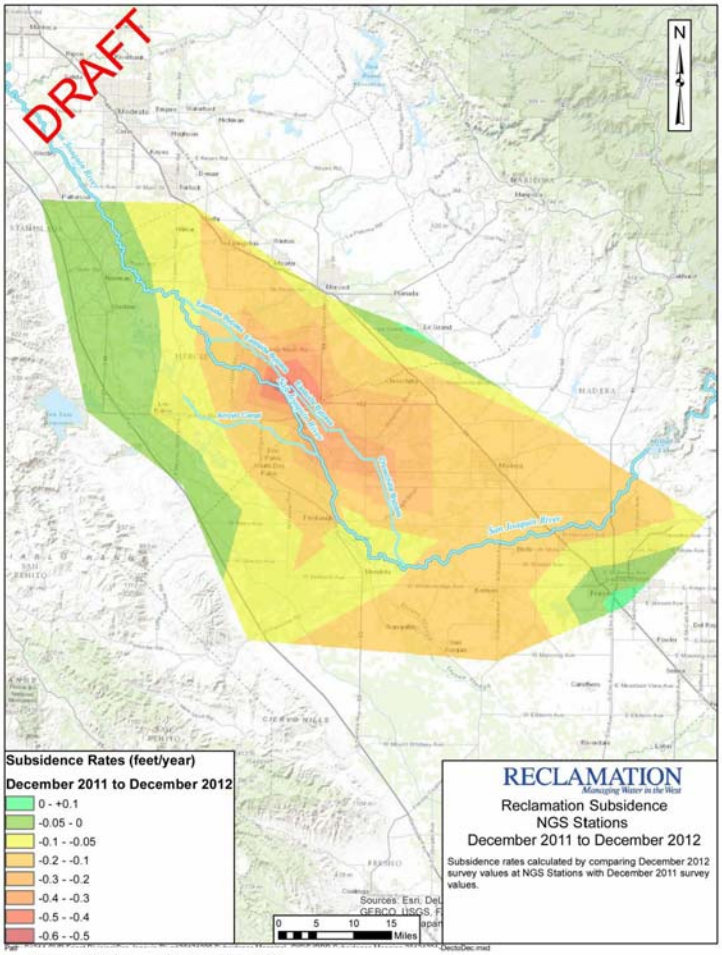


The Highlands area is located within an area defined by USBR as having subsided at a rate of -0.1 to -0.2 feet/yr between December 2011 and December 2012 (see **Figure 3-9** and **Appendix 3-5**, page 31).

Without-Project Conditions

Without the proposed project, the groundwater basin will continue to be over drafted. During drought conditions, the decline would increase significantly and the region's supply of both surface water and groundwater would continue to be diminished as additional stress on the Merced Subbasin is incurred from increased groundwater pumping activity in the Merced Subbasin. Additional groundwater wells (both public and private) would be expected to be rendered inoperable as the drought worsens, requiring rehabilitation or deepening, which in turn results in further reduction in water production in this critical crisis.

Figure 3-9: Land Subsidence in the San Joaquin River Area, December 2011-December 2012



Source: (US Bureau of Reclamation, 2012)

Water quality impacts, which result from declining water levels, would be expected to worsen. In particular, TDS and nitrate levels could continue to increase in the vicinity of the Highlands area, potentially exceeding 500 mg/L for TDS and 45 mg/L for nitrate (above the MCLs). As the entire region relies solely on groundwater for its potable supply, the loss of this critical resource would have devastating effects. These effects could be just as dire for the agricultural economy if water quality of the groundwater were to worsen such that damages to agricultural crops were incurred due to increased salinity of the source water. The impact to the agricultural economy would be further magnified when considering the combined effect of MID water supply curtailments and dwindling surface and groundwater supplies.

Ecosystem water would also be reduced substantially. Although MID is required to provide up to 15,000 AFY of ecosystem water to Merced National Wildlife Refuge (NWR) per Article 45 of its license with the Federal Power Commission (revised February 1, 1964) (see page 26 of **Appendix 3-6**) and the United States of America Federal Energy Regulatory Commission (FERC) Notice of Authorization for Continued Project Operation (March 5, 2014) (pages 30 to 31 of **Appendix 3-6**), during droughts such requirements may not be met. Each year, USFWS submits a letter outlining the preliminary schedule for delivery of water prior to the irrigation season, and the MID Board of Directors determines the duration of the irrigation season. Typically, the irrigation season extends from March through October. However, for 2014, the season will be cut short by two months. Because the USFWS requested schedule for delivery of water differs each year, it is difficult to accurately predict the precise distribution of water deliveries by month. In 2013, for example, the allocations varied from 1,200 to 2,700 AF, with 1,200 AF in March

and 2,700 AF in October (see page 33 of **Appendix 3-6**). If the same schedule was provided in 2014, then the reductions in ecosystem water would be 3,900 AF for the year, a substantial decrease that could translate to reduced habitat for plants and wildlife. This could result in a reduction in numbers of plants and wildlife, which could cause indirect effects to the recreation and tourism industry (e.g., for birdwatching and hunting). Without the project and the additional supply stored in the groundwater basin over the long term, the NWR could face more severe cutbacks in the future.

Without the project, subsidence would be expected to worsen in the future, particularly due to the increased groundwater extraction and resulting dewatering of sensitive clay units. Thus, uniform and differential subsidence could occur. The latter type of subsidence could damage infrastructure.

Finally, without the proposed project, the risk of not meeting drinking water and agricultural supplies would continue with declining groundwater levels and groundwater quality could be compromised.

Methods used to Estimate Physical Benefits

Water Supply Benefits. Water supply benefits were calculated based on property information for the Highlands Area (see **Appendix 3-2** which shows the acreage of land that is currently using groundwater). The Highlands area consists of approximately 1,132 acres of agricultural land, of which approximately 463 acres are currently using surface water and limited well water, 67 acres are reliant on well water from MID wells, 583 acres are reliant on well water from private wells, and 67 acres are reliant on both MID well water and surface water, for a total of 717 acres of land that are currently supported by groundwater. Agricultural crops in this area use approximately 3.09 AF/AC on average (see page 1 of **Appendix 3-3**), based on a land use analysis that evaluated the type of crops in the Highlands area[4], the evapotranspiration (ET) rates[5] (see page 2 of **Appendix 3-3**) and irrigation efficiencies (IE)[6] (see page 3 of **Appendix 3-3**) associated with these crops. Consumptive use was calculated using crop type and ET, and the total water supply also considered the IE and total acreage. 2013 land use data was used to reflect changed land uses in the recent past from field crops to nut orchards. The ET and IE factors are based generally on the types of crops and thus are not associated with any particular year. Based on this information, calculated crop demand for 717 acres of land would be converted from groundwater to surface water use and a water demand of 3.09 AF/AC per year, or approximately 2,216 AFY of groundwater, would be conserved in the basin for future use.

Because of the conjunctive nature of this project, groundwater may be used during some years. To be conservative, the last 31 years of record from DWR's Chronological Reconstructed San Joaquin Valley Water Year Hydrologic Classification Index were reviewed to define the type of water years anticipated to occur over the life of the project (31 years)[7]. Critical dry years occurred in 10 of the last 31 years of record based on DWR data, as shown on **Figure 3-10** below. Construction of the project is anticipated to be complete in the spring of 2016. It is assumed that only half of the benefits (to be conservative) would be incurred on the first year because construction would not be completed until April 2016 (see Attachment 6 for the project schedule). Thereafter, during all years but critically dry hydrologic years, it is assumed that 100 percent of the benefit would accrue. During critically dry years, only 75 percent of the benefits would be realized, as it is assumed that surface water deliveries would be reduced by 25 percent and the remainder would be made up through groundwater pumping. This percentage was calculated based on historical water curtailment records (see **Appendix 2-2**). Water allocations were set in 1977, 1988-1992, 2008,

[4] USDA National Agricultural Statistics Service Cropland Data Layer. 2014. Published crop-specific data layer [Online]. Accessed May 22,2014 at http://nassgeodata.gmu.edu/CropScape/

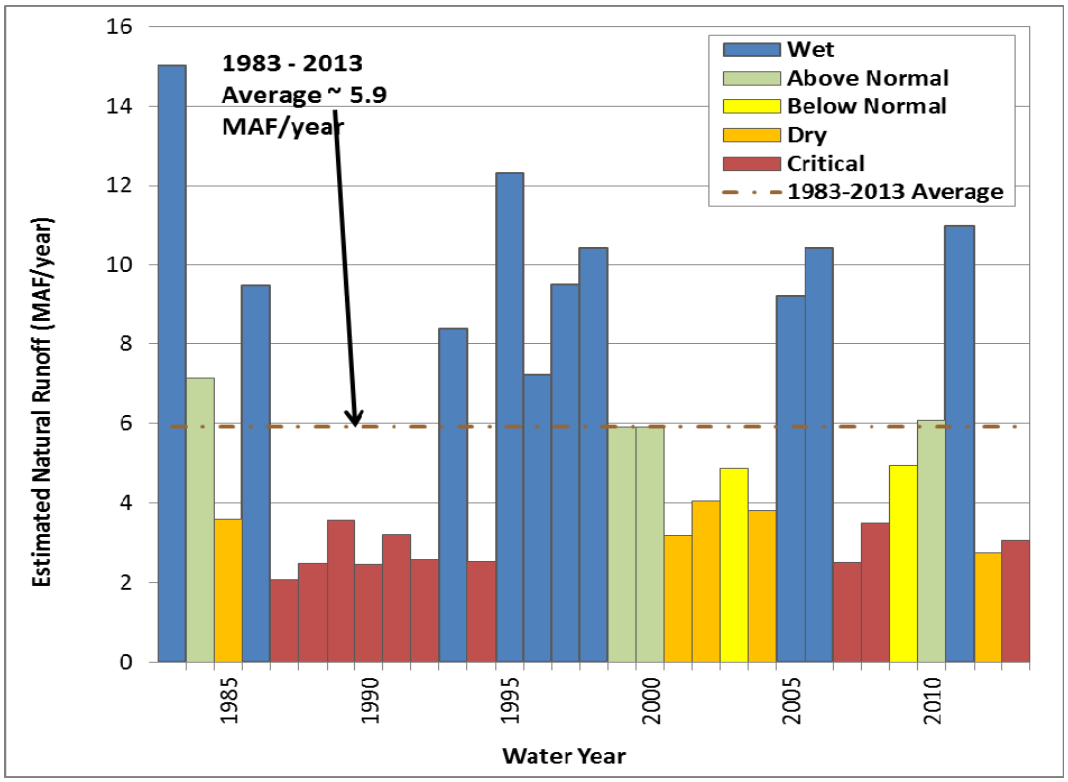
[5] Irrigation Training and Research Center (ITRC). California Evapotranspiration Data for Irrigation District Water Balances. Accessed online on July 3, 2014 at http://itrc.org/etdata/waterbal.htm

[6] Minimum soil moisture requirement and crop irrigation efficiency values were based on values used in the CVGSM model, which in turn were derived from the DWR Consumptive Use Model (James M. Montgomery Consulting Engineers. 1990A. Documentation and User's Manual for Integrated Groundwater and Surface Water Model. Sacramento, CA: James M. Montgomery Consulting Engineers, Inc.)

[7] Department of Water Resources (DWR). 2013. DWR California Data Exchange Center. Chronological Reconstructed Sacramento and San Joaquin Valley Water Year Hydrologic Classification Indices. December 19. Accessed on July 2, 2014. Available at: http://cdec.water.ca.gov/cgi-progs/iodir/WSIHIST

and 2012-2014. The average allocation for these years was 2.25 AFY/AC, which is equivalent to about 75 percent of the typical crop usage of 3.0 AFY/AC. Thus, it was assumed that during critically dry years, the water supply benefits associated with conserved water is 75 percent of 2,216 AFY or 1,662 AFY.

Figure 3-10: DWR San Joaquin Valley Water Year Hydrologic Classification Index



Energy Benefits. The net reduction in electricity was based on PG&E power consumption data obtained for the seven wells and booster pump station No. 32 within the Highlands area. Based on PG&E data, the average annual energy usage of seven wells was 78,143kWh between 2011 and 2013 (see page 13 of **Appendix 3-4**). The average annual energy usage of the booster pump station No. 23 was 44,173 kWh between 2008 and 2013 (see page 6 of **Appendix 3-4**). The unit energy use was then calculated to determine the energy usage per acre foot of water. As described under Water Supply Benefits above, 463 of the existing 1132 acres of land are currently using surface water (see p. 2 of **Appendix 3-4**). Using 3.09 AFY/AC as the demand for agricultural corps in the area (see page 1 of Appendix 3-3), the total production of surface water associated with the 463 AC of land is 1,431 AFY; the unit energy use would then be 44,173 kWh divided by 1,431 AFY, or 31 kWh/AFY. The total land area currently supported by groundwater is 717 AC. Multiplying by 3.09 AF/AC, the total groundwater production would be 2,216 AFY. The unit energy use for groundwater pumping is then 78,143 kWH divided by 2,216 AFY, or 35 kWh/AFY (see page 1 of **Appendix 3-4**).

To determine the energy savings from conversion of groundwater to surface water, the difference between pumping of the booster pump station and groundwater wells is calculated assuming 2,216 AFY (717 AC times 3.09 AFY/AC) of water production as this is the acreage that would be converted from groundwater to surface water in most water year types. As shown on page 1 of **Appendix 3-4**, the energy consumption of the booster pump station would be 68,392 kWh/yr (2,216 AFY times 31 kWh/AFY). . The groundwater wells would consume 78,143 kWh/yr to produce the same amount of water. Thus, the difference of the two pumping is 9,751 kWh/yr, or the energy savings associated the reduced consumption of energy. During critically-dry years, it is assumed that 25 percent of the water supply would come from groundwater wells. Thus, the savings would reduce to 7,313 kWh/yr.

Greenhouse Gas Benefits. The net reduction in greenhouse gas production was calculated based on the energy consumption data. The GHG emission factor associated with power production is derived from the California Energy Commission (CEC) and EPA's eGRID data. Per the CEC's Energy Almanac[8], , California produces 70 percent of its energy and imports 10 percent from the Pacific Northwest, and 20 percent from the Pacific Southwest. USEPA eGRID data provides information about the GHGs associated with each of the energy supplies (calculated as carbon dioxide equivalent units or CO2e) as 613.28 pounds of CO2e per MWH (lbs/MWh), 846.97 lbs/MWh, and 1,182 lbs/MWh, respectively[9]. Averaging each of these CO2e emissions factors shows that California energy supplies have a combined CO2e emissions factor of 750.57 lbs/MWh, or 0.34 metric tons (MT) of CO2e per MWh. Based on projected energy savings, the avoided greenhouse gas emissions benefit would be 3 MT CO2e/yr during critically dry years and 2.5 MT CO2e /yr during all other years.

Water Quality Benefits Because groundwater flows generally in the west and southwesterly direction in this area (see page 29 of **Appendix 3-5**), it is expected that increases in groundwater levels resulting from in-lieu recharge would generate substantial water quality benefits in the Highlands area. Elevated concentrations of TDS and nitrate would decrease overtime, reducing the potential for damage associated with irrigation of crops with elevated TDS and nitrate in excess of the MCLs.

Subsidence Benefits. The Highlands area is located within an area defined by USBR as having subsided at a rate of -0.1 to -0.2 ft/yr between December 2011 and December 2012 (see **Figure 3-9** above). Managing water levels reduces future subsidence, particularly with regard to dewatering of sensitive clay units. This project would therefore prevent impacts to infrastructure due to difference subsidence, though this benefit cannot be quantified.

New facilities, Policies, and Actions Required to Obtain Physical Benefits

The following new facilities are necessary to obtain physical benefits:

- Upgrade of Booster Pump Station No. 32 with a larger pump and variable frequency drive;
- Modification of Booster Pump Station 40 by removing the pump and installation of a spill structure;
- Upgrade of 6,500 feet of existing pipelines from 12- to 16-inches to 27-inch in diameter;
- Installation of 4,000 feet of new 27-inch in diameter pipelines;
- Installation of outlet structures; and
- Installation of pressure boxes.

No policies are required to obtain the physical benefits.

The actions necessary to obtain the physical benefits above are completion of design, environmental compliance, and construction of the project. MID will complete the environmental documentation and design for proposed facilities described above.

Potential Adverse Physical Effects of the Project

Proposed facilities would be constructed within existing disturbed areas (e.g., pump stations) or within road rights-of-ways, except for an approximately 600-foot segment where a new pipeline would cross an existing orchard. Implementation of the project would have primarily temporary, construction-related impacts as well as long-term impacts to agricultural uses associated with the removal of a small amount of farmland from production for placement and operation of the pipeline. MID will comply with CEQA and prepare an environmental document (anticipated to be an Initial Study / Mitigated Negative Declaration) to analyze the project and to reduce any potential impacts through appropriate mitigation measures. Thus, it is not anticipated that potential adverse physical effects would occur.

[8] CEC. 2013. California Electrical Energy Generation Total Production, by Resource Type (Gigawatt hours). Accessed 24 June 2014. Available: http://energyalmanac.ca.gov/electricity/electricity_generation.html
[9] U.S. Environmental Protection Agency (USEPA). 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/

Cressey Recharge Basin Enlargement Project

Summary of Benefits

The projected project benefits include:

- **Water Supply (primary benefit):** The project is estimated to conserve 3,094 AFY through the life of the project during all but critically dry years through artificial recharge. In critically dry years, this benefit is assumed to be 0 AFY.
- **Improved Water Quality (secondary benefit, unquantified)**: Improved water quality is a secondary benefit that would result from increasing groundwater levels. Although unquantified, water quality is expected to improve substantially with respect to TDS and nitrate concentrations, as the project is located upgradient of areas with elevated concentrations of these constituents. Increases in groundwater levels could correct exceedances of the nitrate MCL and avoid damage to crops from high TDS levels.
- **Reduction in subsidence potential (secondary benefit, unquantified)**: The reduction in subsidence potential is a secondary benefit that results from increasing groundwater levels. This is an unquantified benefit because the exact reduction in subsidence cannot be determined. However, it is expected that increases in groundwater levels could reduce subsidence by up to 0.2 feet/yr based on the losses that have occurred in the recent past.

Technical Basis of the Project

The following information provides the technical basis for the project:

- DWR prepared a Technical Memorandum on the Cressey Recharge Basin Assessment Project in August 2002. This document is the work plan for the pilot recharge project. Page 1 of **Appendix 3-9** shows that the original pilot project sites were determined by MAGPI members and DWR. Page 2 of this appendix specifies that following completion of a hydrogeological evaluation of the site, MAGPI members and DWR developed a work plan that identifies the physical, legal, institutional, engineering, and data collection and analysis considerations that may be required for the successful implementation of a pilot recharge project. This work plan provides the justification for the Enlargement Project because it establishes the location of the potential recharge basin and shows that physical, legal, institutional, and engineering considerations were already considered as part of the pilot project.
- DWR prepared the hydrogeological investigation of the Cressey site in 2002 (see **Appendix 3-10**). As indicated above, the results of this investigation allowed MAGPI and DWR to proceed with the pilot project. As discussed on pages 2 and 3 of this appendix, five exploratory drill holes were initially drilled to a maximum depth of 150 feet below ground surface (bgs) and three drill holes were converted into monitoring wells. Due to the lithologic variability encountered during drilling, three additional drill holes were drilled and one additional monitoring well was installed. Page 10 of this appendix shows the locations of the exploratory drill holes and the monitoring wells. Pages 5 through 8 of this appendix provide the findings, conclusions, and recommendations of the study. The geologic logs are provided on pages 17 through 58 of this appendix. Because the hydrogeologic investigation has been completed, these results will apply to the enlargement project and a separate hydrogeologic investigation will not be required. This investigation provides the basis for the feasibility of the enlarged basin location.
- MID prepared the Improvement Plans for Cressey Groundwater Recharge Basin in January 2011. Because the proposed site would be an expansion of the original recharge basin, it is expected that the design of the enlargement project would be similar to that of the original recharge basin. The same characteristics (i.e., height of berms, material used, etc.) would be expected for the enlarged basin. This document is included as **Appendix 3-11**.

- MID evaluated the original 8-acre recharge basin within the 18-acre site in the initial study / mitigated negative declaration (IS/MND) conducted in March 31, 2010 (see **Appendix 3-12**). This document, which evaluated construction of the original basin and the use of the remaining site for stockpiling, concluded that no significant environmental impacts would occur because revisions in the project were made to avoid impacts (see pages 15 and 16 of this appendix). Similar conclusions in a newly prepared environmental document are anticipated because site conditions are unlikely to have change substantially and MID would avoid adverse impacts to the environment through appropriate mitigation measures. This document provides documentation the viability of the site in terms of environmental factors and that physical adverse effects are not anticipated.
- MID's description of the proposed basin enlargement is provided in **Appendix 3-13**.
- The water supply benefits claimed for the project were calculated based on proposed acreage (5 acres), the infiltration rate calculated based on monitoring at the existing Cressey Recharge Basin (2.74 AF/AC/day) (see **Appendix 3-14**), and the average length of the irrigation season derived from historic record (1993 to 2012) **(**see **Appendix 3-15)**. The calculations of the water supply benefits are also included in **Appendix 3-15**.
- The benefits to water quality are based on information included in the *Merced IRWM Plan Groundwater Recharge Feasibility Study*, presented in **Appendix 3-5** (maps of the groundwater elevation on page 28, generalized groundwater flow directions on page 29, TDS on page 34, nitrate on page 36, and arsenic on page 37).
- The avoidance of subsidence effects is based on information included in the *Merced IRWM Plan Groundwater Recharge Feasibility Study*, presented in **Appendix 3-5** (maps of subsidence on pages 31 and 32 of this appendix)
- Ecosystem demands are based on the license with Federal Power Commission (revised February 1, 1964) (pages 1 – 29 of **Appendix 3-6**), the United States of America FERC Notice of Authorization for Continued Project Operation (March 5, 2014) (pages 30 – 32 of the same appendix), and the 2013 USFWS letter identifying the preliminary schedule for the delivery of water in 2013 to Merced NWR (page 33 of **Appendix 3-6**). The groundwater production wells that were rendered inoperable are based on the list of wells that have been lost in the 2014 irrigation season as shown in **Appendix 3-7**.
- Groundwater level information for MID and El Nido is presented in **Appendix 3-8**. Page 1 of this appendix shows the MID well groundwater depth from 2009-2013. Pages 2 – 5 of the appendix shows a summary of the groundwater levels at each wells for the same period. The raw data for the wells are presented on pages 6 – 11. The groundwater level depth for El Nido is presented on pages 12 – 14.

Background for Benefits Claimed

Precipitation is an important source of groundwater recharge in the Merced Subbasin. The Merced Subbasin has been in a state of mild groundwater level decline with a cumulative decrease in storage of approximately 720,000 AF from 1980 to 2007[10]. The lack of rain in recent years has resulted in reduced recharge to the basin. In addition, increased pumping activities necessary to sustain agricultural crops during this drought have resulted in further declining groundwater levels. Between 2010 and 2013, the average groundwater level in the MID service area declined more than 10 feet (see **Figure 3-5** above).

During the 2014 irrigation season, up to 27 of MID's production wells became inoperable as a result of the substantial drop in groundwater levels. These wells, shown in **Figure 3-6** above, are identified in **Appendix 3-7**. The red dots in **Figure 3-6** denote groundwater wells that will require rehabilitation (existing pumps will have to be lowered within the existing well casing) and the purple dots denote groundwater wells where deepening (via redrilling) will be required. Although the exact numbers are not known, many private wells have also been rendered

[10] AMEC Geomatrix, Inc. 2008. Merced Groundwater Basin Groundwater Management Plan Update. Merced County. July 29. [pages 20 and 22)

inoperable because of the drought, resulting in the need for either rehabilitation or deepening. The loss of wells also directly affects agricultural production.

Without the project, water quality impacts, which are linked to declining water levels, would be expected to worsen. The Cressey Recharge Basin is located upgradient of two areas of elevated concentrations of TDS and nitrate, where TDS concentrations exceed 750 mg/L and nitrate concentrations exceed 45 mg/L for nitrate (both of which are above the respective MCLs) (see **Figure 3-7** and **3-8** above). In general, water quality of the Merced Subbasin would deteriorate with declining groundwater levels. As the entire region relies solely on groundwater for its potable water supply, the loss of this critical resource would have a devastating effect on public health and safety. The agricultural economy would also be impacted if water quality of the groundwater were to worsen such that agricultural crops were damaged by increased salinity of the source water. The impacts to the agricultural economy would be further magnified when combined with MID water supply curtailments. Water quality would continue to deteriorate, affecting drinking water and irrigation supplies.

The project area is also located upgradient of an area defined by USBR as having subsided at a rate of -0.1 to -0.2 feet/yr of between December 2011 and December 2012 (see **Figure 3-9** above). Subsidence can worsen in the basin with decreasing groundwater levels.

Without-Project Conditions

Without the proposed project, the groundwater basin will continue to be over drafted. During drought conditions, the decline would increase significantly and the region's supply of both surface water and groundwater would continue to be diminished as groundwater pumping increases to meet potable and agricultural demands. Additional groundwater wells (both public and private) would be expected to be rendered inoperable as the drought worsens, requiring rehabilitation or deepening.

Water quality impacts, which are also linked to declining water levels, would be expected to become more severe. In particular, TDS and nitrate levels could continue to increase in and down gradient of the Cressey Recharge Basin area, potentially exceeding the TDS and nitrate MCLs of 500 mg/L and 45 mg/L, respectively. As the entire region relies solely on groundwater for its potable supply, the loss of this critical resource would have devastating effects on public health and safety. These effects could be just as dire for the agricultural economy if groundwater salinity were to increase to the point where agricultural crops were damaged. The impacts to the agricultural economy would be further magnified when combined with MID water supply curtailments.

Ecosystem water would also be reduced substantially. Although MID is required to provide up to 15,000 AFY of ecosystem water to Merced NWR per Article 45 of its license with the Federal Power Commission (revised February 1, 1964) (see page 26 of **Appendix 3-6**) and the United States of America FERC Notice of Authorization for Continued Project Operation (March 5, 2014) (pages 30 to 31 of **Appendix 3-6**), during droughts such requirements may not be met. Each year, USFWS submits a letter outlining the preliminary schedule for delivery of water prior to the irrigation season, and MID determines the duration of the irrigation season. Typically, the irrigation season extends from March through October. However, for 2014, the season will be cut short by two months. Because the USFWS requested schedule for delivery of water differs each year, it is difficult to accurately predict the precise distribution of water deliveries by month. In 2013, for example, the allocations varied from 1,200 to 2,700 AF, with 1,200 AF in March and 2,700 AF in October (see page 33 of **Appendix 3-6**). If the same schedule was provided in 2014, then the reductions in ecosystem water would be 3,900 AF for the year, a substantial decrease that could translate to reduced habitat for plants and wildlife. This could in turn result in a reduction in the number of plants and wildlife and could subsequently cause indirect effects to the recreation and tourism industry (e.g., for birdwatching and hunting). Without the project and the additional supply stored in the groundwater basin over the long term, the NWR could face more severe cutbacks in the future.

Without the project, subsidence would be expected to worsen in the future, particularly due to the increase groundwater extraction and resulting dewatering of sensitive clay units. This could cause uniform and differential subsidence and potentially damage infrastructure.

Without the proposed project, drinking water and agricultural demands may not be met and groundwater quality could be compromised. The Human Right to Water would not be achieved given such a scenario. Ecosystem supplies would also suffer, as there would be cutbacks to the water sent to the Merced NWR.

Methods used to Estimate Physical Benefits

Water Supply Benefits. The calculation of the water supply benefit is based on several factors:

- The expected percolation rate of 2.74 AF/AC/day is derived from observed percolation rates for the existing recharge basin (see **Appendix 3-14**). Specifically, the percolation rate for each day from July 21, 2011 through October 20, 2011 was calculated, and then averaged to determine the infiltration rate for the existing 8 acre basin (21.92 AF/day). The per acre value was then calculated (21.92 AF/day divided by 8 AC = 2.74 AF/AC/day). It should be noted that during the July 2011 through October 2011 period, there were periods of 0 inflow;
- The expansion area is 5 acres as proposed;
- The duration of recharge on any given year was based on the last 20 years (1993 to 2012) of irrigation season data (**Appendix 3-15**); .
- Total water savings for non-critical dry years were calculated based on the percolation rate (2.74 AF/AC/day) times the expanded basin area (5 AC) times the average number of days in the irrigation season for each year from 1993 through 2013. An average was then taken for that same period to derive the claimed water benefits for non-critically dry years (see **Appendix 3-15**). The water supply benefit was calculated to be 3,094 AFY. For critically dry years, it was assumed that the claimed benefits would be 0 because there would not be any available for artificial recharge. To determine the critically dry years, the last 30 years of record from DWR's Chronological Reconstructed San Joaquin Valley Water Year Hydrologic Classification Index was used to define the type of water year that are anticipated to occur over the life of the project (31 years). Critically dry years occurred in 10 of the last 31 years of record based on DWR data, as shown on **Figure 3-10** above. Construction of the project is anticipated to be complete in the spring of 2016. It is assumed that only half of the benefits (to be conservative) would be incurred in the first year because construction would not be completed until February 2016 (see Attachment 6 for the project schedule). Thereafter, during all years but critically dry hydrologic years, it is assumed that 100 percent of the benefit would accrue. During critically dry years, 0 percent of the benefits would be claimed

Water Quality Benefit. Although an unquantified benefit, artificial recharge would increase groundwater levels such that water quality in this area would be improved. TDS levels in the vicinity range from 500 mg/L to approximately 1,500 mg/L, in excess of the MCL, and nitrate concentrations range from 25 mg/L to 45 mg/L, near the MCL. With increased groundwater levels, elevated concentrations of TDS and nitrates are expected to decrease overtime, reducing MCL exceedances and the potential for crop damage due to elevated TDS. While this is an unquantified benefit, the improvement in water quality would be substantial.

Subsidence Benefit: The project area is located just north of an area defined by USBR as having subsided at a rate of -0.1 to -0.2 feet/yr of between December 2011 and December 2012 (see **Figure 3-9** above). Increasing recharge artificially in this area would allow for better management of water levels that could reduce future subsidence related to dewatering of sensitive clay units. Thus, this project would reduce subsidence, though this benefit cannot be quantified.

New facilities, Policies, and Actions Required to Obtain Physical Benefits

The following new facilities are necessary to obtain physical benefits:

- Enlarged basin (five acre expansion)
- Upgrade of the SCADA system to allow MID to track percolation/groundwater recharge rates in real time

No policies are required to obtain the physical benefits.

In order to achieve the benefits summarized above, the final design, environmental compliance, and construction of the project must be completed. MID will complete the environmental documentation and design for proposed facilities described above.

Potential Adverse Physical Effects of the Project

An IS/ND was prepared for the original Cressey Basin Project, which evaluated impacts over the entire 18-acre area for a 10+acre basin with the remaining area used for stockpiling (see **Appendix 3-12**). Expansion of the recharge basin within the existing 18-acre footprint is not expected to result in any adverse physical effects as all work would be confined within areas that are currently disturbed. MID will comply with CEQA and prepare an environmental document (anticipated to be an IS/MND) to analyze the project and to reduce any potential impacts through appropriate mitigation measures. Thus, potential adverse physical effects are not anticipated.

Water Meter Conservation Project

Summary of Benefits

The projected project benefits include:

- **Water Supply (primary benefit):** The project is estimated to conserve 119 AFY over the life of the project, based on an estimated 25 percent reduction in water consumption in Le Grand. These savings would result from a change in customer behavior due to water metering, which will enable usage to be monitored by customers and LGCSD.
- **Reduction in energy and greenhouse gas emissions (secondary benefit)**: The project would reduce energy consumption and greenhouse gas emissions commensurate with the water usage savings (25 percent). The anticipated reductions in energy usage and greenhouse gas emissions are 65,052 kWh/yr, and 22 MT CO2e/yr, respectively.
- **Reduction in Chemical Use (secondary benefit)**: A reduction in overall water usage will the reduce need for water treatment chemicals. It is anticipated that chlorine use would be reduced by 720 gallons/yr, in proportion to the reduction in water consumption.
- **Improved Water Quality (secondary benefit, unquantified)**: Improved water quality is a secondary benefit that would result from the reduction in water consumption and subsequent increase in groundwater elevations. Although unquantified, water quality is expected to improve substantially with respect to arsenic and 123-TCP concentrations, as Elevated levels of arsenic and 123-TCP have been detected in both the shallow and deep aquifers in Le Grand. Increases in groundwater levels could prevent exceedances of the arsenic MCL and contamination of the potable water supply.

Technical Basis of the Project

The following information provides the technical basis for the project:

- LGCSD completed final design for the project. The final design drawings are included in **Appendix 3-16**.
- Groundwater level changes in Le Grand are included in **Appendix 3-17**.
- The benefit to water quality as it relates to arsenic is based on information included in the *Merced IRWM Plan Groundwater Recharge Feasibility Study*, presented in **Appendix 3-5** (a map of arsenic concentrations is on page 37 of this appendix).
- The benefit to water quality as it relates to 123-TCP is based on information included in the *Merced Integrated Regional Water Management Plan Salt and Nutrient Study*, presented in **Appendix 3-18** (p. 4 of this appendix).

- The water supply benefits claimed are based on the existing groundwater pumping data, reduced by 25 percent to account for conservation associated with water meter operations. The existing pumping data is presented in **Appendix 3-19**. The 25 percent estimate was developed by the LGCSD Engineer, based on experience installing water meters throughout communities in eastern Merced County. In general, water meter installation in this area has resulted in a reduction in water use by between 25 and 30 percent.
- The energy benefits claimed for the project were calculated based on energy usage information for the wells, included in **Appendix 3-20.** A summary of the energy consumption between July 2013 and June 2014 is shown on page 1 of **Appendix 3-20**, followed by the raw data presented in the PG&E bills.
- The greenhouse gas benefits claimed for the project were calculated based on the energy consumption information included in **Appendix 3-20**.
- The reduction in chemical usage is based on the usage of chlorine in 2013, presented in **Appendix 3-21**.

Background for Benefits Claimed

Precipitation is an important source of groundwater recharge in the Merced Subbasin. The Merced Subbasin has been in a state of mild groundwater level decline with a cumulative decrease in storage of approximately 720,000 AF between 1980 and 2007[11]. Lack of rain in recent years has reduced recharge in the Merced Subbasin. This has caused water levels to decline precipitously – observed groundwater elevations in the LGCSD service area dropped by about 50 feet between March and June of 2014 (see **Appendix 3-17**). As a result, the LGCSD has to deepen all three of its production wells to continue to provide drinking water supply to this DAC. As there is no other available potable water supply, this community is entirely reliant on groundwater. Stage 3[12] water conservation measures have already been imposed, and it is expected that conservation levels will increase to Stage 4 by the end of the year. This community is not expected to be able to meet its drinking water demands by September 30 of this year. The money that was originally set aside for this project has been used to deepen the wells; as such, LGCSD would be unable to proceed with this project without grant funding.

Arsenic has been detected in Le Grand, both in the shallow and deep aquifers. As shown in **Figure 3-11** (see also **Appendix 3-5**, page 37), Le Grand is located in an area where arsenic levels range from 2.5 to 10 µg/L and adjacent to an area with concentrations ranging from 10 µg/L to 20 µg/L. The current California MCL for arsenic is 10 µg/L. Given the precipitous drop in groundwater levels that have already occurred in Le Grand (of approximately 50 feet between March and June 2014 as described above), it is expected that arsenic levels will continue to increase as the groundwater elevations decrease, impacting the sole drinking water supply for this DAC. 123-TCP is also a problem in the shallow and deep aquifers, as shown in **Figure 3-12** below. Concentrations of 123-TCP range from 0.005 to 1 µg/L (see page 4 of **Appendix 3-18**).[13]. The notification level for 123-TCP is 0.005 µg/L[14].

Without-Project Conditions

Without the proposed project, excess groundwater pumping will continue to cause a decline in groundwater elevations at unprecedented rates. This will, in turn, cause water quality to deteriorate further, and supplies will further violate the California MCLs and notification levels for arsenic and 123-TCP, respectively, making it unsafe for human consumption. Because groundwater is the sole source of drinking water for this community, it would leave the area – a designated DAC – with no source of drinking water.

[11] AMEC Geomatrix, Inc. 2008. Merced Groundwater Basin Groundwater Management Plan Update. Merced County. July 29. [pages 20 and 22)

[12] Stage 3 conservation consists of limiting the days and hours that residents can water. In addition, all vehicle washing would be done on a lawn, using buckets for washing and rinsing.

[13] AMEC, Inc Geomatrix in Association with RMC Water and Environment. 2013. Merced Integrated Regional Water Management Plan Salt and Nutrient Study. August.

[14] AMEC, Inc Geomatrix in Association with RMC Water and Environment. 2013. Merced Integrated Regional Water Management Plan Salt and Nutrient Study. August.

Figure 3-11: Arsenic Concentrations in the Merced IRWM Region

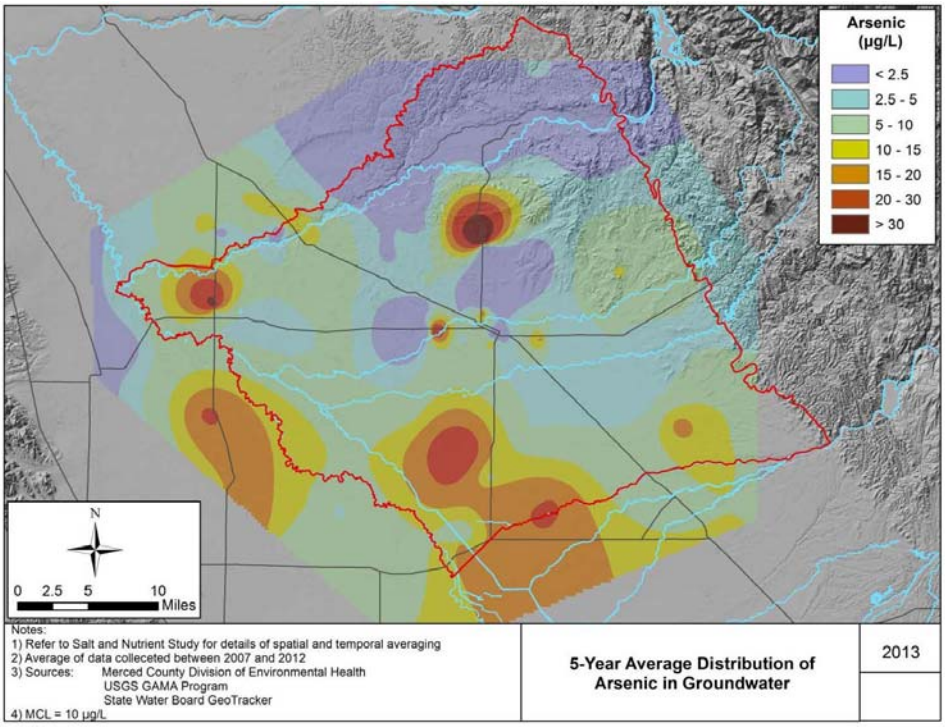
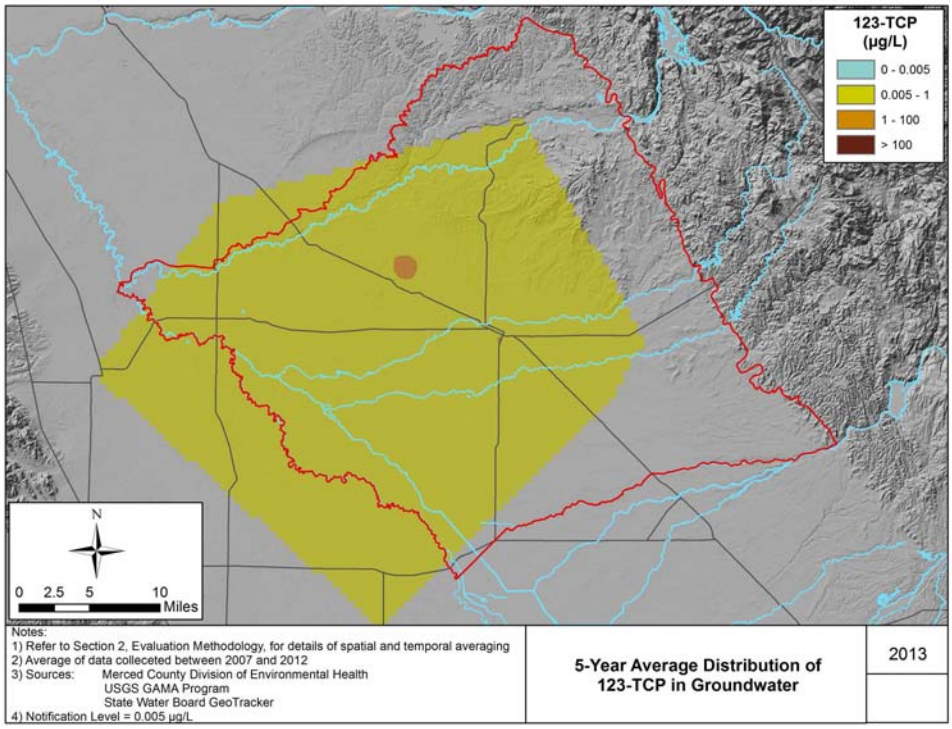


Figure 3-12: 123-TCP Concentrations in the Merced IRWM Region



As described in Attachment 2, the only industry in Le Grand is the Live Oak Farms, a tomato and pepper packing company, which employs the majority of Le Grand's residents. Closing of Live Oak Farms due to lack of water would have devastating financial consequences for the community, as the community is a DAC. Public health and safety is also a concern for Le Grand. The public schools, which are the third largest users of water in the community, did not have sufficient pressure to flush toilets in May. The schools are currently not in session, but are expected to be back in session in early August. As only one well is in operation at this time, there is concern that there would not be sufficient water to meet public health and safety needs. **Appendix 2-3** describes issues currently faced by LGCSD. The situation in Le Grand is so dire that LGCSD had sought assistance from the California Department of Public Health (CDPH).LGCSD secured grant funding through the CDPH Public Water System Drought Emergency Response Program to implement a two-phase emergency drought response program that included interim water hauling to the community, rehabilitation of three of the community's impacted wells (see **Appendix 2-1**, page 19). LGCSD is already unable to meet existing demands. If the drought were to continue into 2015, water supplies would continue to be insufficient to meet existing demands despite continuing conservation measures.

Methods used to Estimate Physical Benefits

Water Supply Benefits: Estimated water supply benefits are based on the expected water demand reduction – 25 percent – resulting from operation of the water meters (see **Appendix 3-19**). The total water pumpage from June 2013 through May 2014 was 154 million gallons (475 AF). With a 25 percent reduction, the total savings would be about 119 AF per year. The benefit is expected to remain the same throughout the life of the project.

Energy Benefits: The net reduction in electricity was based on PG&E power consumption data obtained for the three wells from July 2013 to June 2014. The benefits were calculated assuming a 25 percent reduction in pumping. The total annual electrical usage required to operate the three wells was 260,210 kWh. Assuming a 25 percent reduction in energy consumption, the savings would be 65,052 kWh/yr. The claimed energy savings are assumed to be conservative because the energy usage during this period was lower than previous years because some groundwater wells were offline for repairs and because additional energy would be required for pumping as groundwater elevations drop (see **Appendix 3-20**). A summary of the energy consumption during the July 2013 to June 2014 period is shown on page 1 of **Appendix 3-20**, followed by the raw data presented in the PG&E bills. The benefit is expected to remain the same throughout the life of the project.

Greenhouse Gas Benefits: The net reduction in greenhouse gas production was calculated based on the projected energy savings described above. The GHG emission factor associated with power production is derived from the California Energy Commission (CEC) and EPA's eGRID data. Per the CEC's Energy Almanac[15], California produces 70 percent of its energy and imports 10 percent from the Pacific Northwest, and 20 percent from the Pacific Southwest. USEPA eGRID data provides information about the GHGs associated with each of the energy supplies (calculated as carbon dioxide equivalent units or CO2e) as 613.28 pounds of CO2e per MWH (lbs/MWh), 846.97 lbs/MWh, and 1,182 lbs/MWh, respectively[16]. Averaging each of these CO2e emissions factors shows that California energy supplies have a combined CO2e emissions factor of 750.57 lbs/MWh, or 0.34 metric tons (MT) of CO2e per MWh. By reducing groundwater pumping by 25 percent, the project would reduce energy usage by 25 percent, or 65,052 kWh/yr. Using the statewide emissions factor of 0.34 MT CO2e / MWh, this equates to a reduction in GHG emissions of 22 MT/yr (65,052 kWh/yr times x 0.001 MWh/kwh x 0.34 MT CO2e/MWh =22.11 MT CO2e/year). The benefit is expected to remain the same throughout the life of the project.

Chemical Use Benefits: The net reduction in chemical usage was calculated using the amount of chlorine usage in 2013 at the three wells and the anticipated water demand reduction (25 percent). The total chlorine usage in 2013 was 2,880 gallons. Assuming 25 percent reduction in chlorine usage in proportion to the water savings, the reduction in chlorine usage would be 720 gallons per year. (see **Appendix 3-21**).

[15] CEC. 2013. California Electrical Energy Generation Total Production, by Resource Type (Gigawatt hours). Accessed 24 June 2014. Available: http://energyalmanac.ca.gov/electricity/electricity_generation.html
[16] U.S. Environmental Protection Agency (USEPA). 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/

Water Quality Benefits: Elevated levels of arsenic and 123-TCP have been detected in both the shallow and deep aquifers in Le Grand. Although this is an unquantified benefit, groundwater quality is expected to improve as groundwater levels increase commensurate with the decrease in water consumption. Improvement in water quality would reduce the potential for exceedances of drinking water standards.

New facilities, Policies, and Actions Required to Obtain Physical Benefits

In order to achieve these physical benefits, 525 water meters would need to be installed throughout the District, located beneath the curb in front of each site

No policies are required to obtain the physical benefits. All policies are already in place, including meter rates.

Construction and operation of the project is required to obtain physical benefits. Final design of the project is complete. LGCSD expects to prepare a CEQA Notice of Exemption in July 2014. Because of the nature of the project, it is expected that the project would qualify for exemption under the Class I Categorical Exemption, According to the 2014 CEQA Guidelines, a Class 1 categorical exemption consists of the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, involving negligible or no expansion of use beyond that existing at the time of the lead agency. Installation of meters would be considered a minor alteration of existing facilities that involve negligible expansion of use.

Potential Adverse Physical Effects of the Project

The water meters would be located under the curb outside of each site. Installation and operation of the facilities are not expected to result in any adverse physical impacts to the environment. LGCSD expects to file a CEQA categorical exemption for the project as described above.

Cost Effectiveness Analysis

Tables 3-13 through **3-15** provide a cost effective analysis for the three projects, in accordance with Table 6 of the PSP.

Table 3-13: *Highlands Groundwater Conservation Project*

Table 6 – Cost Effective Analysis Project Name: Highlands Groundwater Conservation Project	
Question 1: Types of benefits provided as shown in Table 5.	The types of benefits achieved by this project include immediate and long-term conserved water supplies and an associated reduction in groundwater basin over draft, reduction in net consumption of electricity and net production of greenhouse gases, water quality improvements, and reductions in subsidence potential.
Question 2: Have alternative method been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?	Another project was considered to recharge the groundwater basin, but not specifically for the Highlands area, and not specifically to achieve the same types and amounts of physical benefits. The Cressey Recharge Basin Enlargement Project, also included in this application, would provide long-term water supply benefits to the groundwater basin, water quality improvements, and reductions in subsidence; however, that project is an artificial recharge project and not an in-lieu recharge project. Thus, the Cressey Recharge Basin Enlargement Project would not achieve any reduction in net consumption of electricity and greenhouse gases. More importantly, the Cressey Recharge Basin Enlargement Project would not address the District's long-term goal of delivering surface water to the Highlands area. Thus, there are no alternatives that would achieve the same objectives as the Highlands Groundwater Conservation Project.
Question 3: If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.	As shown in Attachment 5, the Highlands Groundwater Conservation Project is more expensive than the Cressey Recharge Basin Enlargement Project. The Highlands Groundwater Conservation Project is the preferred alternative because it addresses a critical need in an area where no alternatives are available. There are no other alternatives that would achieve the objective of providing surface water to the Highlands area or the claimed benefits associated with the reduction in electricity and greenhouse gas emissions.

Table 3-14: *Cressey Recharge Basin Enlargement Project*

Table 6 – Cost Effective Analysis Project Name: Cressey Recharge Basin Enlargement Project	
Result of Physical Benefit	Quantification of Benefits
Question 1: Types of benefits provided as shown in Table 5.	The types of benefits achieved by this project include immediate and long-term conservation of water supply and associated reduction in groundwater basin over draft, water quality improvements, and a reduction in subsidence potential.
Question 2: Have alternative method been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?	The Highlands Groundwater Conservation Project, included in this application, would achieve similar types and degree of physical benefits. The Highlands Groundwater Conservation Project would also provide long-term water supply benefits to the groundwater basin, through in-lieu rather than direct recharge. A groundwater recharge feasibility was completed for the Merced Region in August 2013,[17]which identified opportunity areas for artificial recharge in the basin but did not evaluate site-specific locations. The study acknowledged that "development of recharge facilities will require additional site-specific investigations and/or pilot projects". Because such site-specific investigations (geotechnical borings and pilot studies) have already been completed at the site as part of the pilot project and the original Cressey Recharge Basin, and because the existing recharge basin is already operating successfully at this location, it would be more cost-effective to expand this site then to develop a new recharge basin at an alternate location. Thus, no other alternatives to this project were considered.
Question 3: If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.	The Cressey Recharge Basin Enlargement Project is the least cost alternative compared to the Highlands Groundwater Conservation Project. As described above under the response to Question 2, the Cressey Recharge Basin Enlargement Project is an artificial recharge project that would expand upon an existing, successful recharge operation.

[17] RMC. 2013. Merced Integrated Regional Water Management Plan. Groundwater Recharge Feasibility Study. August.

Table 3-15: *Water Meter Conservation Project*

Table 6 – Cost Effective Analysis Project Name: Water Meter Conservation Project	
Result of Physical Benefit	Quantification of Benefits
Question 1: Types of benefits provided as shown in Table 5.	The types of benefits achieved by this project include immediate and long-term reduction in water demands; conservation of water supply; reductions in electricity consumption, greenhouse gas production, and water treatment chemical usage; and improvement in groundwater water quality.
Question 2: Have alternative method been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?	No other alternative methods were considered, because no other alternatives are available that could achieve the same type and amounts of physical benefits as the proposed project. Given the small size of the community, the most effective form of water conservation is demand reduction using water meters. Water meters would yield the greatest savings compared to other demand reduction measures (e.g., appliance rebates, conversion of lawns to native plants, etc.), and thus are the preferred option for LGCSD. In addition, water meters are the only mechanism for LGCSD to monitor and manage water use at the individual customer scale and impose penalties in the event that households exceed their allocated amounts during mandatory rationing.
Question 3: If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.	As no other alternatives were considered, this question is not applicable.