MERCED SGMA

Merced Groundwater Subbasin

GROUNDWATER SUSTAINABILITY PLAN

Executive Summary

Image courtesy: Veronica Adrover/UC Merced

November 2019

EXECUTIVE SUMMARY

ES-1. INTRODUCTION AND PLAN AREA

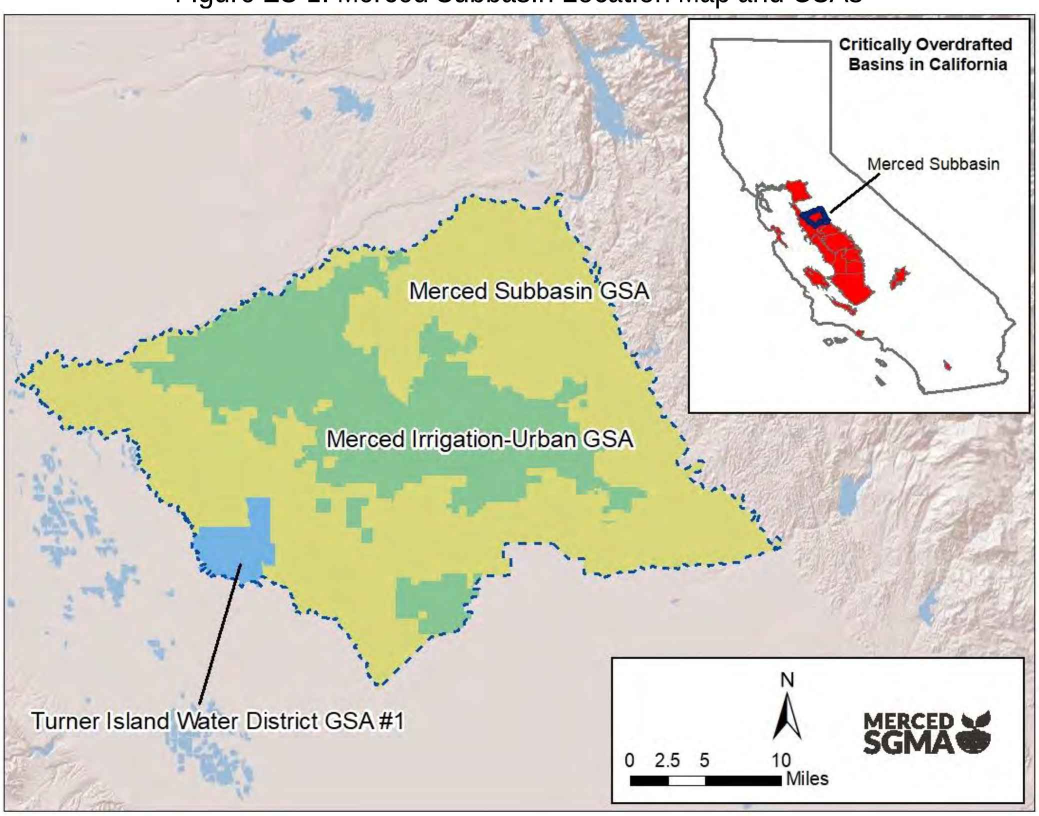
The Sustainable Groundwater Management Act (SGMA), passed in 2014, requires the formation of local Groundwater Sustainability Agencies (GSAs) to oversee the development and implementation of Groundwater Sustainability Plans (GSPs), with the ultimate goal of achieving sustainable management of California's groundwater basins. The purpose of this Groundwater Sustainability Plan is to bring the Merced Groundwater Basin (Merced Subbasin or Subbasin), a critically overdrafted basin located within the San Joaquin Valley (see Figure ES-1), into sustainable groundwater management by 2040. The Subbasin is heavily reliant on groundwater, and users recognize the basin has been in overdraft for a long period of time.

The County of Merced and water districts and cities within the Merced Subbasin formed three GSAs in accordance with SGMA: Merced Irrigation-Urban Groundwater Sustainability Agency (MIUGSA), Merced Subbasin Groundwater Sustainability Agency (MSGSA), and Turner Island Water District Groundwater Sustainability Agency #1 (TIWD GSA-1) (see Figure ES-1). The three GSAs coordinated efforts to develop this GSP for the Subbasin. With the adoption of this GSP, the GSAs will adopt the following sustainability goal for the Merced Subbasin:

> "Achieve sustainable groundwater management on a long-term average basis by increasing recharge and/or reducing groundwater pumping, while avoiding undesirable results."

This goal will be achieved by allocating a portion of the estimated Subbasin sustainable yield to each of the three GSAs and coordinating the implementation of programs and projects to increase both direct and in-lieu groundwater recharge, which will in turn increase the groundwater and / or surface water available in the Subbasin.

Figure ES-1: Merced Subbasin Location Map and GSAs



Development of the GSP was guided by a Coordinating Committee composed of members appointed by the GSA Boards to provide recommendations on technical and substantive basin-wide issues. The Coordinating Committee and GSA Boards were also informed by a Stakeholder Advisory Committee, which consisted of a broad group of groundwater beneficial users (also appointed by the GSA Boards) to review groundwater conditions, management issues and needs, and projects and management actions to improve sustainability in the basin. Extensive outreach was also conducted to seek input from additional beneficial users of groundwater through multiple venues including public workshops held in locations specifically selected to provide access to disadvantaged communities. Figure ES-2 illustrates the relationship among the groups described above.

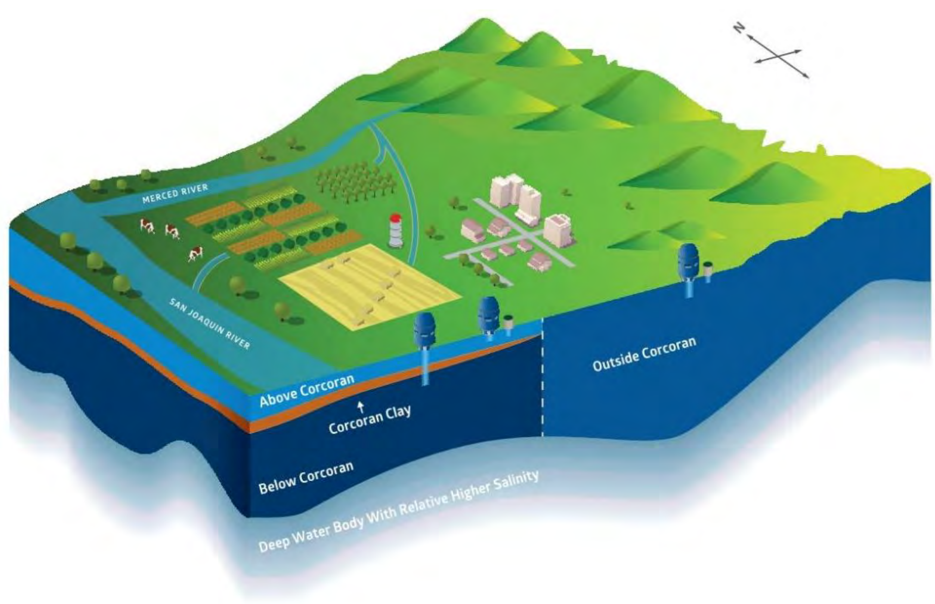
Figure ES-2: Diagram of Levels of Engagement and Decision-Making

ES-2. BASIN SETTING

Hydrogeologic Conceptual Model

The Merced Subbasin contains three principal aquifers that are defined by their relationship to the Corcoran Clay aquitard, a laterally-extensive silt and clay layer that underlies approximately the western half of the Subbasin and acts as a significant confining layer. The Above Corcoran Principal Aquifer includes all aquifer units that exist above the Corcoran Clay Aquitard and generally contains moderate to large hydraulic conductivities and yields for domestic and irrigation uses. The Below Corcoran Principal Aquifer includes all aquifer units that exist below the Corcoran Clay Aquitard and contains hydraulic conductivities and yields ranging from small to large for irrigation as well as some domestic and municipal uses. The Outside Corcoran Principal Aquifer includes all aquifers that exist outside of the eastern lateral extent of the Corcoran Clay. The Outside Corcoran Principal Aquifer is connected laterally with the Above Corcoran Principal Aquifer at shallower depths and the Below Corcoran Principal Aquifer at deeper depths. Major uses of water in the Outside Corcoran Principal Aquifer include irrigation, domestic, and municipal uses. The Principal Aquifers are underlain by a deep aquifer with higher salinity relative to the principal aquifers. See Figure ES-3 for a 3D illustration demonstrating the relationship between the principal aquifers and Corcoran Clay aquitard

Figure ES-3: 3D Illustration of Merced Subbasin Principal Aquifers and Aquitard



Water Budget Information

Water budgets provide quantitative accounting of water entering and leaving the Merced Subbasin and can be used to help estimate the extent of overdraft occurring now and in the future. Consistent with SGMA requirements, water budgets for historical, current, projected, and sustainable conditions were developed for the Merced Subbasin. These water budgets were developed using the Merced Water Resources Model (MercedWRM), a fully integrated surface and groundwater flow model developed and calibrated specifically for the Subbasin. See Figure ES-4 for a conceptual diagram of the inputs and outputs quantified by the model. The historical conditions water budget (see Figure ES-5) shows an annual average rate of overdraft ("Change in Storage") of 192,000 acre-feet per year (AFY) over water years 2006 through 2015. In this Figure, the "Change in Storage" represents the average annual decline in storage resulting from the Subbasin outflows, principally groundwater pumping.

Figure ES-4: Generalized Water Budget Diagram

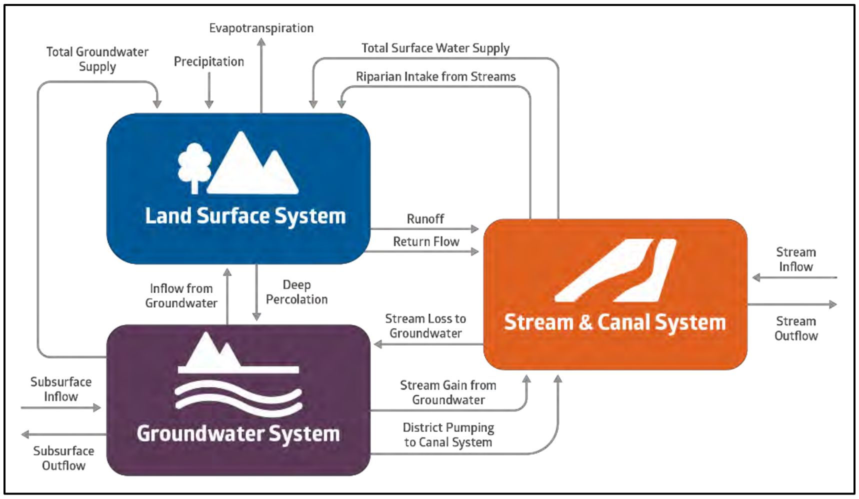
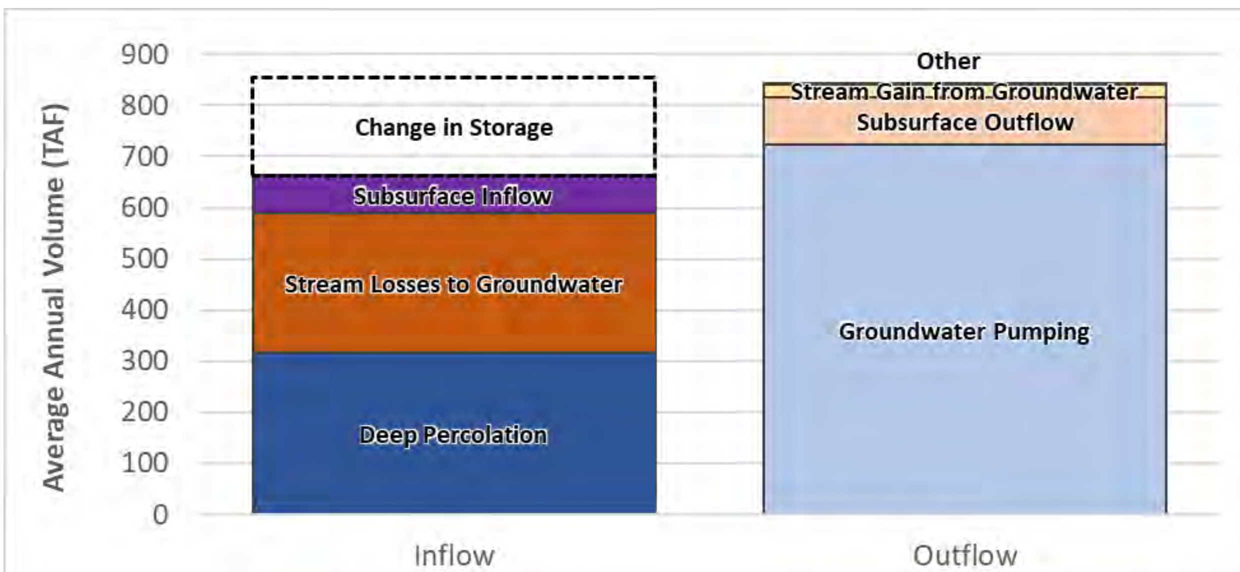


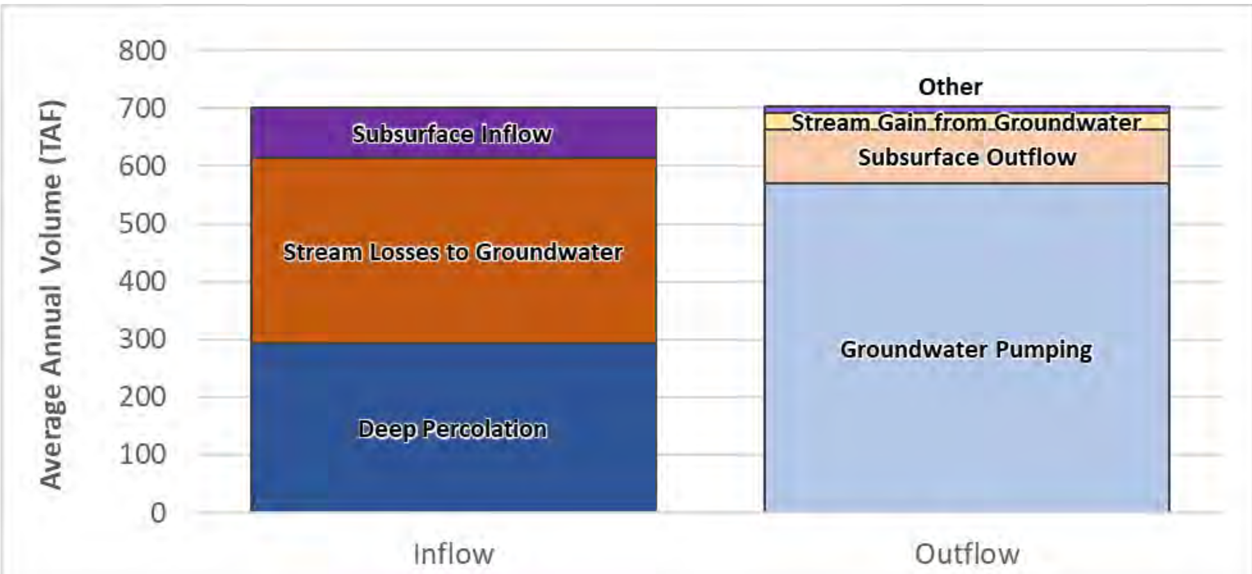
Figure ES-5: Historical Conditions Water Budget



SGMA defines sustainable yield as "the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result" (California Water Code §10721(w)).

For the Merced Subbasin, sustainable yield was estimated by modifying conditions in the groundwater model to balance out the change in stored water over time. In order to achieve a net-zero change in groundwater storage over a long-term average condition, current agricultural and urban groundwater demand in the Merced Subbasin would need to be reduced by approximately 10 percent, absent implementation of any new supply-side or recharge projects. Figure ES-6 illustrates the Subbasin water budget under long term sustainable conditions.

Figure ES-6: Groundwater Water Budget under Sustainable Groundwater Management Conditions Long-Term (50-Year) Average Annual



ES-3. SUSTAINABLE MANAGEMENT CRITERIA

SGMA requires consideration of six sustainability indicators. For each indicator, the GSP must define undesirable results for the basin ("significant and unreasonable" negative impacts) and determine if they could occur. For the indicators with the potential for undesirable results, the GSP must establish sustainable management criteria that are intended to prevent undesirable results from occurring and establish a monitoring network.

Sustainable management criteria were developed to be protective of beneficial uses in the Merced Subbasin and to support the Subbasin's sustainability goal. Demonstration by 2040 of stable groundwater elevations on a long-term average basis, combined with the absence of undesirable results, will support a determination that the basin is operating within its sustainable yield, and thus that the sustainability goal has been achieved.

A summary of the sustainable management criteria for the Merced Subbasin is shown in Table ES-1.

Table ES-1: Summary of Sustainable Management Criteria

Sustainability Indicator	Minimum Threshold (MT)	Measurable Objective	Undesirable Result
Groundwater Levels	Depth of shallowest well in a 2-mile radius of each representative well or minimum pre-January 1, 2015, elevation	Projected average future groundwater level under sustainable yield modeling simulation	Greater than 25% of representative wells fall below MT in 2 consecutive wet, above normal, or below normal years[1]
Groundwater Storage	Not applicable - not present and not likely to occur in the Subbasin due to the significant volumes of freshwater in storage		
Seawater Intrusion	Not applicable - not present and not likely to occur due to the distance between the Subbasin and the Pacific Ocean (and Sacramento-San Joaquin Delta)		
Degraded Water Quality	1,000 mg/L TDS	500 mg/L TDS	At least 25% representative wells exceed MT for 2 consecutive years
Land Subsidence	-0.75 ft/year	-0.25 ft/year	Exceedance of MT at 3 or more representative sites for 2 consecutive years
Depletions of Interconnected Surface Waters	Groundwater levels used as a proxy for this sustainability indicator		

There are two sustainability indicators deemed not applicable to the Merced Subbasin. Undesirable results related to significant and unreasonable depletions of groundwater storage are not present and not likely to occur in the Subbasin, since historical reductions have been insignificant relative to the total volume of freshwater water storage in the Subbasin. Seawater intrusion is not an applicable sustainability indicator because seawater intrusion is not present and is not likely to occur due to the distance between the Subbasin and the Pacific Ocean (and Sacramento-San Joaquin Delta).

For the remaining sustainability indicators, sustainable management criteria were established to be protective of Subbasin beneficial uses as described below.

Minimum thresholds for chronic declining groundwater levels were developed based on records of well depth for the shallowest domestic wells within a 2-mile radius of each representative monitoring well. This methodology is intended to be protective against significant and unreasonable dewatering of domestic wells. Since domestic wells are generally shallower than agricultural and municipal, this is also protective of these other well types. Sustainable management criteria for declining groundwater levels were developed with a dataset including historical groundwater levels, Merced County's well permitting database, and simulated groundwater levels from the MercedWRM. Groundwater levels are also being used as a proxy indicator for depletion of interconnected surface waters.

[1] *Water year types based on San Joaquin Valley Water Year Index* (DWR, 2017c)

Degraded water quality is unique among the six sustainability indicators because it is already the subject of extensive federal, state, and local regulations carried out by numerous entities, and SGMA does not directly address the role of GSAs relative to these other entities (Moran & Belin, 2019). SGMA does not specify water quality constituents that must have minimum thresholds. Groundwater management is the mechanism available to GSAs to implement SGMA. Establishing minimum thresholds for constituents that cannot be managed by increasing or decreasing pumping was deemed inappropriate by the GSAs and basin stakeholders. The major water quality issue being addressed by sustainable groundwater management is the migration of relatively higher salinity water into the freshwater principal aquifers. The nexus between water quality and water supply management exists for the pumping-induced movement of low-quality water from the west and northwest to the east. Other water quality concerns are being addressed through various water quality programs and agencies that have the authority and responsibility to address them.

Within the Merced Subbasin, while land subsidence has been recognized by the GSAs as an area of concern, it is not considered to have caused a significant and unreasonable reduction in the viability of the use of infrastructure. However, it is noted that subsidence has caused a reduction in freeboard of the Middle Eastside Bypass over the last 50 years and has caused problems in neighboring subbasins, highlighting the need for ongoing monitoring and management in the Merced Subbasin. Thus, sustainable management criteria were established based on historical rates of subsidence in the Subbasin, and the GSAs will continue to coordinate efforts with surrounding subbasins to develop regional or local solutions to subsidence occurring in the Merced, Chowchilla, and Delta-Mendota Subbasins.

Depletions of interconnected surface waters will be managed using groundwater levels as a proxy due to the challenges associated with directly measuring streamflow depletions and because of the significant correlation between groundwater levels and depletions.

ES-4. MONITORING NETWORKS

Consistent with SGMA requirements, the GSAs plan to establish monitoring networks for each sustainability indicator to monitor trends in the Subbasin and evaluate GSP implementation against sustainable management criteria. The groundwater level monitoring network consists of wells from the California Statewide Groundwater Elevation Monitoring (CASGEM) Program that were selected to provide representative conditions for groundwater levels across the Subbasin. The groundwater quality monitoring network includes a combination of wells in the Subbasin that are part of the East San Joaquin Water Quality Coalition Groundwater Quality Trend Monitoring Program as well as public water system wells that report data to the Division of Drinking Water. The subsidence monitoring network relies on control points monitored by the United States Bureau of Reclamation as part of the San Joaquin River Restoration Program. While the monitoring networks reflect a robust history of monitoring Subbasin conditions, data gaps exist, and plans to fill these data gaps for each sustainability indicator are also described in this GSP.

ES-5. DATA MANAGEMENT SYSTEM

The Merced Subbasin Data Management System (DMS) was developed to serve as a data sharing portal to enable utilization of the same data and tools for visualization and analysis to support sustainable groundwater management and transparent reporting of data and results. Monitoring data can be manually input by users or batch uploaded via template and is expected to include groundwater level, groundwater quality, streamflow, and subsidence data. All monitoring locations can be viewed spatially (map or list format) and data records per site can be viewed temporally (chart or list format). Ad-hoc queries and standard reports will greatly assist in answering questions about basin characterization, providing input for decision-making, and developing reports to meet annual report submittal requirements.

ES-6. PROJECTS AND MANAGEMENT ACTIONS TO ACHIEVE SUSTAINABILITY GOAL

SGMA requires that GSPs describe the projects and management actions to be implemented as part of bringing the Subbasin into sustainability. The primary means for achieving sustainability in the basin will be reduction in groundwater pumping achieved through implementation of an allocation framework to allocate the sustainable yield of the basin to the GSAs. A water allocation framework has been the subject of much discussion during GSP development. The GSAs have agreed that they intend to allocate water to each GSA but have not yet reached agreement on allocations or how they will be implemented. Such an agreement will be developed during GSP implementation.

The GSP identifies a shortlist of 12 priority projects that met a series of screening criteria for implementation (see Table ES-2) as well as a longer list of possible future projects that were identified during GSP development. Projects and management actions will either increase surface water supplies to augment the sustainable groundwater yield or will increase groundwater recharge, which will in turn increase the amount of groundwater that may be sustainably used.

Table ES-2: Projects Shortlist for Merced Subbasin Groundwater Sustainability Plan*

Project Name	Current Status	Expected Completion	Estimated Cost
Project 1: Planada Groundwater Recharge Basin Pilot Project	Planning, to be implemented with DWR Grant Funding	12/17/2023	$395,292
Project 2: El Nido Groundwater Monitoring Wells	Planning, to be implemented with DWR Grant Funding	12/31/2019	$400,000
Project 3: Meadowbrook Water System Intertie Feasibility Study	Planning	06/2020	$100,588
Project 4: Merquin County Water District Recharge Basin	Planning/Initial Study	12/15/2021	$1,400,000
Project 5: Merced Irrigation District to Lone Tree Mutual Water Company Conveyance Canal	Conceptual	11/2020	$3-6,000,000
Project 6: Merced IRWM Region Climate Change Modeling	Design	4/30/2021	$250,000
Project 7: Merced Region Water Use Efficiency Program	Design	12/31/2020	$500,000
Project 8: Merced Groundwater Subbasin LIDAR	Planning/Initial Study	12/2020	$150,000
Project 9: Study for Potential Water System Intertie Facilities from MID to LGAWD and CWD	Design Complete	06/01/2020	$100,000
Project 10: Vander Woude Dairy Offstream Temporary Storage	Planning/Initial Study & Conceptual Design	05/2020	$750,000
Project 11: Mini-Big Conveyance Project	Planning	06/2026	$ 6-8,000,000
Project 12: Streamlining Permitting for Replacing Sub-Corcoran Wells	Planning	1/31/2020	$75,000

*Information provided by project proponents.

ES-8. PLAN IMPLEMENTATION

Implementation of the GSP will be a substantial undertaking that will include implementation of the projects and management actions as well as GSAs administration, public outreach, implementation of the monitoring programs and filling data gaps, development of annual reports, and development of a 5-year update and report. The GSAs have developed an implementation schedule (see Table ES-3) and estimated costs for all activities, as well as potential funding mechanism options. Implementation of the GSP is projected to run between $1.2M and $1.6M per year. Costs for projects and management actions are estimated to be an additional $22.9M in total, with costs for individual projects or management actions ranging between $75,000 to $8M in total.

Table ES-3: GSP Implementation Schedule

2020 | 2025 | 2030 | 2035 | 2040

Monitoring and Reporting	Preparation for Allocations and Low Capital Outlay Projects	Prepare for Sustainability	Implement Sustainable Operations
• Establish monitoring network • Install new monitoring wells • Reduce/fill data gaps	• Conduct 5-year evaluation/update • Monitoring and reporting continue	• Conduct 5-year evaluation/update • Monitoring and reporting continue	• Conduct 5-year evaluation/update • Monitoring and reporting continue
• GSAs allocated initial allocations • GSAs establish their allocation procedures and demand reduction efforts • Develop metering program	• As-needed demand reduction to reach Sustainable Yield allocation • Metering program continues	• As-needed demand reduction to reach Sustainable Yield allocation	• Full implementation demand reduction as needed to reach Sustainable Yield allocation by 2040
• Funded and smaller projects implemented	• Planning/ design/ construction for small to medium sized projects	• Planning/ design/ construction for larger projects begins	• Project implementation completed
• Extensive public outreach regarding GSP and allocations	• Outreach regarding GSP and allocations continues	• Outreach continues	• Outreach continues