Grassland Groundwater Sustainability Agency

DRAFT

Groundwater Sustainability Plan

In Cooperation with:
Merced County Delta-Mendota Groundwater Sustainability Agency

October 2019

LIMITATION

In preparation of this Groundwater Sustainability Plan (Plan), the professional services of Provost & Pritchard Consulting Group were consistent with generally accepted engineering principles and practices in California at the time the services were performed.

Judgments leading to conclusions and recommendations were made based on the best available information but are made without a complete knowledge of subsurface geological and hydrogeological conditions. This Plan is intended to provide information from readily available published or public sources. We understand that the interpretations and recommendations are for use by the Grassland Groundwater Sustainability Agency (GGSA) in cooperation with the Merced County Delta-Mendota Groundwater Sustainability Agency (MCDMGSA) in assisting the GSAs in making decisions related to potential water supplies and groundwater management activities in light of California’s new and evolving Sustainable Groundwater Management Act (SGMA) regulations. Subsurface conditions or variations cannot be known, or entirely accounted for, in spite of significant study and evaluation. Future surface water and groundwater quantity, quality, and availability cannot be known. Trends have been estimated and projected based upon past historical data and events and are used for planning purposes. It should be noted that historic trends may not be indicative of future outcomes. Historic hydrology has been used to identify averages and potential extremes that may be experienced in future years; however, it will be important for the GSAs to continually evaluate all the parameters that make up the water budget. Additionally, the rapidly changing regulatory environment surrounding the SGMA and State regulatory agencies may render any or all recommendations invalid in the future if not implemented and necessary approvals, permits, or rights obtained in a timely manner. Information contained in this GSP should not be regarded as a guarantee that only the conditions reported and discussed are present within the GGSA and MCDMGSA, or that other conditions may exist which could have a significant effect on groundwater availability.

In developing our methods, conclusions, and recommendations we have relied on information that was prepared or provided by others. We have assumed that this information is accurate and correct, unless noted. Changes in existing conditions due to time lapse, natural causes including climate change, operations in adjoining GSAs or subbasins, or future management actions taken by a GSA may deem the conclusions and recommendations inappropriate. No guarantee or warranty, expressed or implied, is made.

Plan prepared by:

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Abbreviations

AF .... Acre-Feet
AF/YR .... Acre-Feet Per Year
CASGEM .... California Statewide Groundwater Elevation Monitoring
CDEC .... California Data Exchange Center
CDFW .... California Department of Fish and Wildlife
CEQA .... California Environmental Quality Act
CGPS .... Continuous Global Positioning System
CVP .... Central Valley Project
DHS .... Department of Health Services
District .... Grassland Water District
DMB, Subbasin .... Delta-Mendota Groundwater Subbasin
DMS .... Data Management System
DMSDMS .... Delta-Mendota Subbasin Data Management System
DTSC .... Department of Toxic Substances Control
DWR .... Department of Water Resources
EC .... Electroconductivity
EPA .... U.S. Environmental Protection Agency
ET .... Evapotranspiration
FFB .... Freemont Ford Bridge Station
GAMA .... Groundwater Ambient Monitoring and Assessment
GC .... Groundwater Conditions
GDE .... Groundwater Dependent Ecosystem
GEA .... Grassland Ecological Area
GGSA .... Grassland Groundwater Sustainability Agency
GPS .... Global Positioning System
GPD .... Gallons Per Day

GRCD .... Grassland Resource Conservation District
GSA .... Groundwater Sustainability Agency
GSP .... Groundwater Sustainability Plan
GWD .... Grassland Water District
HCM .... Hydrogeological Conceptual Model
ILRP .... Irrigated Lands Regulatory Program
InSAR .... Interferometric Synthetic-Aperture Radar
IRWMP .... Integrated Regional Water Management Plan
KDSA .... Kenneth D. Schmidt & Associates
LiDAR .... Light Detection and Ranging
MCDMGSA .... Merced County Delta-Mendota Groundwater Sustainability Agency
NASA .... National Aeronautics and Space Administration
NAVSTAR .... Navigation Satellite Timing and Ranging
NGWCWQCP .... North Grassland Water Conservation and Water Quality Control Project
NRCS .... Natural Resource Conservation Service
PBO .... Plate Boundary Observatory
Plan Area .... Grassland Plan Area
QAPP .... Quality Assurance Program Plan
RTWQMP .... Real-Time Water Quality Monitoring Program
RWQCB, Regional Board .... Central Valley Regional Water Quality Control Board
SGMA .... Sustainable Groundwater Management Act
SJR .... San Joaquin River
SJRRP, Restoration Program .... San Joaquin River Restoration Program
SJS .... Stevenson Station
SLDMWA .... San Luis & Delta-Mendota Water Authority
SMC .... Sustainable Management Criteria
SOPAC .... Scripps Orbit and Permanent Array Center
SWRCB .... State of California Water Resources Control Board
TDS .... Total Dissolved Solids
UNAVCO .... University NAVSTAR Consortium
USACE .... US Army Corps of Engineers
USBR .... U.S. Bureau of Reclamation
USFWS .... United States Fish and Wildlife Service
USGS .... United States Geological Survey
WDR .... Waste Discharge Requirement

WHPA.. Wellhead Protection Area

WMA.. Wildlife Management Area

Executive Summary

The Grassland Groundwater Sustainability Agency (GGSA) and Merced County Delta-Mendota Groundwater Sustainability Agency (MCDMGSA) have prepared a Groundwater Sustainability Plan (GSP) to comply with the Sustainable Groundwater Management Act (SGMA). The GGSA and MCDMGSA are both located within the Delta-Mendota Groundwater Subbasin (DMB, Subbasin), which consists of six plan areas that encompass 23 GSAs. The following is a summary of the content and layout of the document.

Chapter 1 - Introduction

On September 16, 2014, Governor Jerry Brown signed into law a three-bill legislative package, composed of AB 1739 (Dickinson), SB 1168 (Pavley), and SB 1319 (Pavley), collectively known as the Sustainable Groundwater Management Act of 2014 (SGMA), which is codified in Section 10720 et seq. of the California Water Code. This legislation created a statutory framework for groundwater management in California that must be achieved during the planning and implementation horizon from 2020 to 2040 and sustained into the future without causing undesirable results. SGMA requires that the following six sustainability indicators must be considered:

- Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply
- Significant and unreasonable reduction of groundwater storage
- Significant and unreasonable seawater intrusion
- Significant and unreasonable degraded water quality
- Significant and unreasonable land subsidence
- Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water

The Grassland Plan Area (Plan Area) consists of the GGSA and portions of the MCDMGSA. Both GSAs are governed by their respective GSA boards, and engage in coordination for the development and implementation of the Grassland GSP. In addition to the Grassland GSP coordination, the DMB is overseen by a Coordination Committee that ensures the use of consistent data and methodologies, develops sustainable management criteria (SMC) that are approved by all members of the Subbasin, and manages data from a comprehensive monitoring network for the required sustainability indicators. Compliant with SGMA and the DMB Coordination Agreement, the Grassland GSP participants agree to submit the GSP to the Department of Water Resources (DWR) through the Coordination Committee and Plan Manager. The Grassland GSP is considered complete with the submittal of the Common Chapter (**Appendix A**).

The Grassland Plan Area will continue to be sustainable by maintaining the historically balanced groundwater system in order to avoid causing significant and unreasonable undesirable impacts to beneficial users of groundwater as they relate to the six sustainability indicators. The Plan Area participants are committed to continued coordination with neighboring GSP areas and neighboring subbasins in order to aid in the localized and statewide groundwater sustainability goals as defined by each GSP and Subbasin.

Chapter 2 - Plan Area

The Plan Area covers 104,417 acres located within Merced County and is comprised of portions of the MCDMGSA and the entirety of the Grassland Water District (GWD) and the Grassland Resource Conservation District (GRCD), the two of which together form the GGSA. The majority of the Plan Area is located within the 240,000-acre Grassland Ecological Area. The Grassland Plan Area, comprised of GGSA and MCDMGSA, is located in western Merced County (**Figure ES-1**). The Plan Area land use is predominantly managed wetlands, uplands, and riparian corridors (see **Table ES-1**). There are few permanent residents in the Plan Area and no cities or towns. There are no adjudicated areas within the Plan Area.

Table ES-1: DWR 2014 Plan Area Land Use

Land-Use Classification	Percent of Total Area
Managed Wetlands and Uplands	95.39
Agriculture	3.26
Urban/Developed	1.35
Total	100

The Plan Area is bounded by the following GSAs: San Joaquin River Exchange Contractors GSA, MCDMGSA, Central Delta-Mendota Region GSA, City of Los Banos GSA, City of Gustine GSA, Northwestern Delta-Mendota GSA, Merced Subbasin GSA, and Turner Island Water District GSA (**Figure ES-2**). Additionally, the Grassland Plan Area is adjacent to the San Joaquin River which is influenced by the San Joaquin River Restoration Program (SJRRP, Restoration Program).

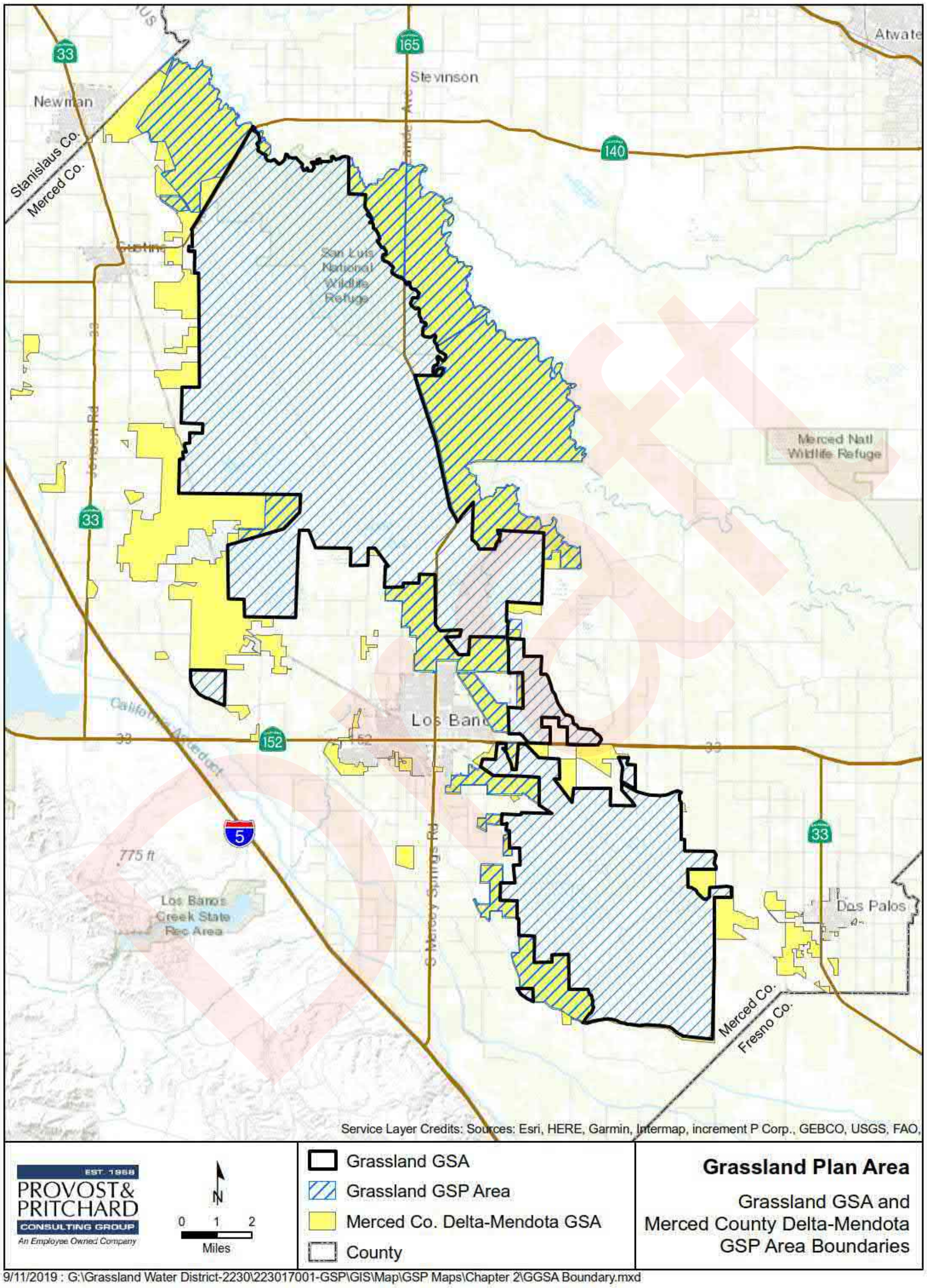

Figure ES-1: Grassland GSA and Extended GSP Area Boundaries

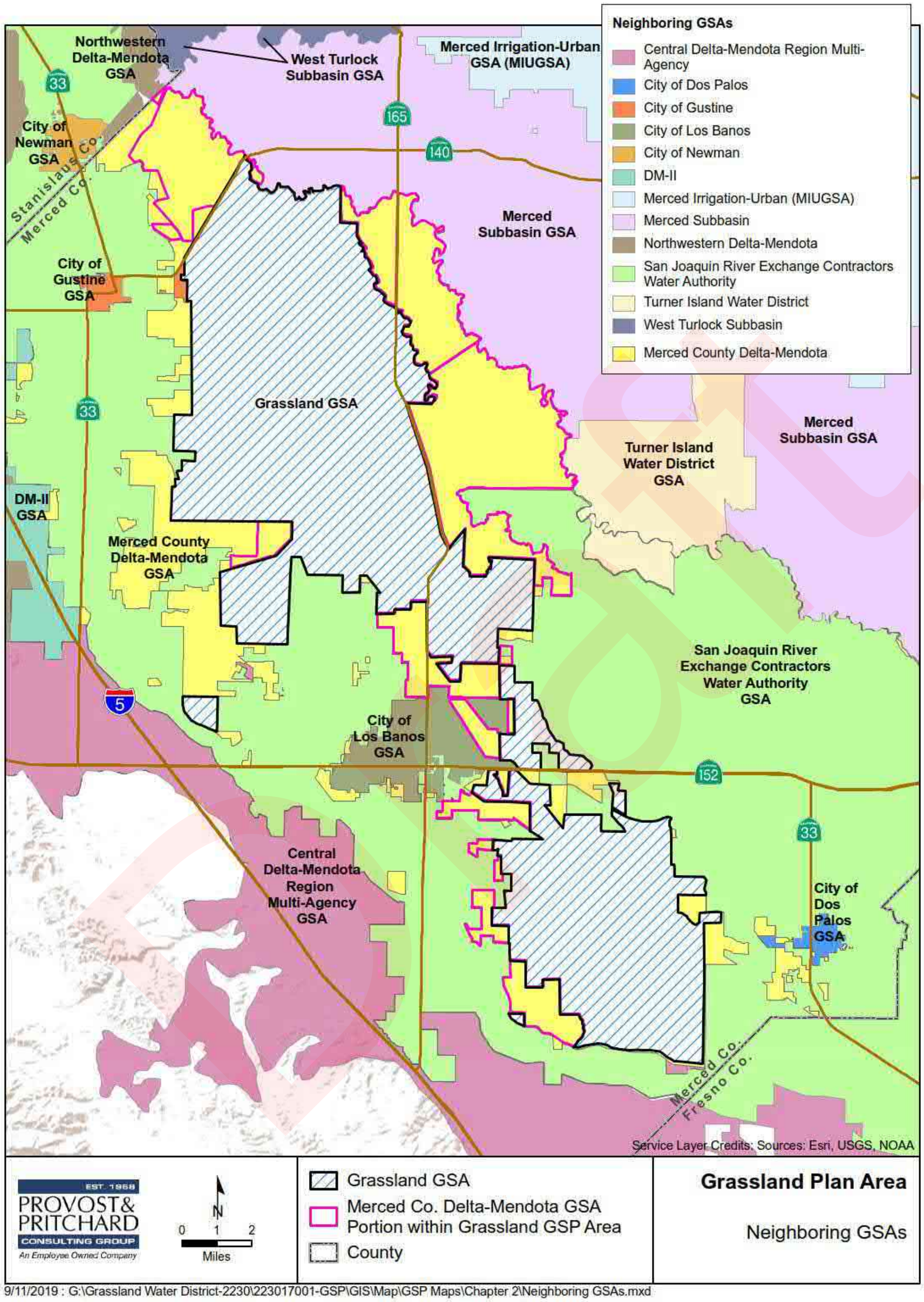

Figure ES-2: Grassland Plan Area - Neighboring GSAs

Chapter 3 - Basin Setting

Hydrogeologic Conceptual Model/Groundwater Conditions

The Hydrogeologic Conceptual Model (HCM) provides a description of the general physical characteristics of the regional hydrology, geology, geologic structure, water quality, principal aquifers, and principal aquitards in the Subbasin. The overview of Groundwater Conditions (GC) provides a historic, average, and current description of subsurface hydrology, water quality, and subsidence. The HCM/GC lays the foundation for development of water budgets, monitoring networks, and identification of data gaps. The narrative HCM/GC was developed by Kenneth D. Schmidt & Associates (KDSA) and is attached as **Appendix B**.

Water Budgets

A water budget is an account of all of the water that flows into and out of a specified area and describes the various components of the hydrologic cycle (**Figure ES-3**). A water budget includes all water supplies, demands, modes of groundwater recharge, and non-recoverable losses, making it possible to identify how much water is stored in a system and changes in groundwater storage during a given period.

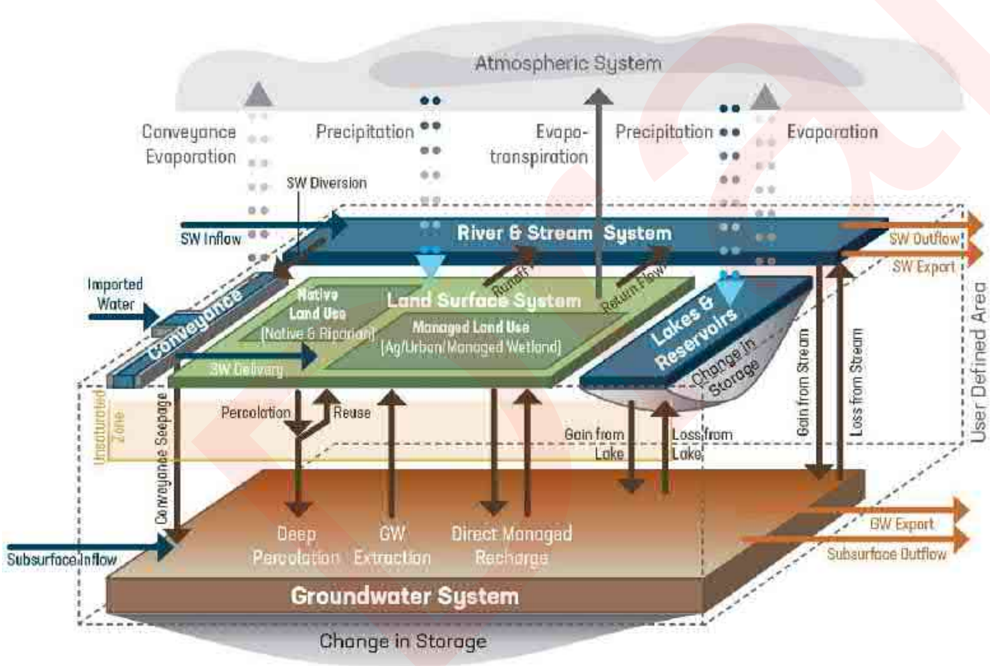

Figure ES-3: DWR Water Budget Graphic

Water budgets were prepared for a historical period (2003-2012, and based on 2013, 2015 and 2017), current period (2013), and future periods (2020-2070). The historical water budget covers a hydrologically average period based on San Joaquin River (SJR) full natural flow to assist in calibration of the water budget. The current water budget assesses the annual average change in storage in 2013 and uses supplemental data from periods of similar conditions to facilitate estimations in instances of missing data. The future water budget is based on numerous assumptions related to climate change, population growth, water use, and future project implementation. The estimated average annual change in groundwater storage for the aquifer underlying the Grassland Plan Area during the historic period was approximately +3,100 acre-feet.

Chapter 4 - Sustainable Management Criteria

SGMA defines sustainable groundwater management as the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results. The avoidance of undesirable results is important to assessing the success of the GSP and maintaining sustainability. Several requirements from GSP regulations have been grouped together under the heading of Sustainable Management Criteria, including a Sustainability Goal, Significant and Unreasonable Effects, Undesirable Results, Interim Milestones, Minimum Thresholds, and Measurable Objectives for the various indicators of groundwater conditions shown above. Development of these Sustainable Management Criteria is dependent on basin information developed and presented in the HCM/GC prepared by KDSA and the water budget.

The six GSP Groups within the Subbasin have been coordinating since 2017 on how to reach and maintain sustainability. Many of the GSAs within the Subbasin have federal Central Valley Project surface water contracts that reduce the reliance on groundwater that leads to subsidence and other undesirable results. The Plan Area encompasses wetland habitat areas identified in the Central Valley Project Improvement Act which receive reliable water allocations similar to the adjacent agricultural San Joaquin River Exchange Contractor Water Authority GSA. These areas collectively supply more than one million acre-feet of surface water to the DMB annually. Coordination efforts between the GSAs have contributed to the development of minimum thresholds and measurable objectives for each monitoring site included in the individual GSPs' representative monitoring networks as well as the DMB's collective representative monitoring networks in order to achieve sustainability. These values will continue to be monitored and evaluated as additional information is gathered.

<u>Sustainability Goal</u>
The goal of the DMB and Grassland Plan Area is to prevent groundwater management-induced impairments to the beneficial users of groundwater as they relate to the six sustainability indicators.

<u>Undesirable Results</u>
Undesirable Results were broadly defined by SGMA as outlined above. It is the intent of SGMA to allow subbasins and GSAs to define the conditions under which sustainability indicators become significant and unreasonable, thereby causing an undesirable result. As a result of the unique dynamics of the Delta-Mendota Subbasin, a broad definition of Undesirable Results was developed, expanding on DWR's definition while allowing flexibility for GSAs and GSP Groups to define them further on a local level. The DMB has defined Undesirable Results as (see Common Chapter – **Appendix A)**:

<u>Groundwater Levels</u>
> *Significant and unreasonable chronic decrease in water level, as defined by each GSP Group, that has an impact on the beneficial users of groundwater in the Subbasin through either intra- and/or inter-basin actions.*

<u>Groundwater Storage Volume</u>
> *Significant and unreasonable chronic decrease in groundwater storage, as defined by each GSP Group, that has an impact on the beneficial users of groundwater in the Subbasin through either intra- and/or inter-basin actions.*

<u>Sea Water Intrusion</u>
> *Not defined – Inapplicable.*

Water Quality

Significant and unreasonable degradation of groundwater quality, as defined by each GSP Group, that has an impact on the beneficial users of groundwater in the Subbasin through either intra- and/or inter-basin actions and/or activities.

Subsidence

Changes in ground surface elevation that cause damage to critical infrastructure that would cause significant and unreasonable reductions of conveyance capacity, damage to personal property, impacts to natural resources, or create conditions that threaten public health and safety.

Interconnected Surface Water

Significant and unreasonable depletion of surface water, as defined by each GSP Group, that has an impact on the beneficial users of surface water in the Subbasin through either intra- and/or inter-basin actions and/or activities.

Defining Sustainable Management Criteria

Significant and unreasonable effects were considered for each of the undesirable results defined in the previous section. Public workshops for the DMB were held to discuss SMCs and significant and unreasonable effects and to familiarize the public with these technical concepts. Considerations were taken for neighboring GSP Groups in regard to significant and unreasonable effects as they are experienced by others outside of the Plan Area. The Grassland Plan Area has historically remained sustainable. Although 2015 drought conditions did not result in significant and unreasonable results, data from the most recent severe drought period served as a useful metric for quantitatively defining the minimum thresholds, measurable objectives, and interim milestones.

Chapter 5 - Monitoring Network

Current monitoring programs and the proposed monitoring network developed by the Grassland Plan Area participants will collect sufficient data to determine short-term, seasonal, and long-term trends in groundwater and related surface conditions, ultimately providing information necessary to support the implementation of this GSP, evaluate the effectiveness of the GSP, and aid in decision-making by the GGSA and MCDMGSA.

The six GSPs within the Delta-Mendota Subbasin have established representative monitoring networks for groundwater level/groundwater storage/interconnected surface water, groundwater quality, and land subsidence. The objectives of the various monitoring programs include:

1. Establish a baseline for future monitoring
2. Provide warning of potential future problems
3. Use data gathered to generate information for water resources evaluation
4. Help to quantify annual changes in water budget components
5. Develop meaningful long-term trends in groundwater characteristics
6. Provide comparable data from various locales within the Plan Area and the Subbasin
7. Demonstrate progress toward achieving interim milestones and measurable objectives described in the GSP
8. Monitor changes in groundwater conditions relative to minimum thresholds
9. Monitor impacts to the beneficial uses or users of groundwater

Chapter 6 - Projects and Management Actions

It is the purpose of the GSP regulations to identify projects and management actions that would be implemented to avoid undesirable results and achieve groundwater sustainability goals by 2040. In the case of the Grassland Plan Area, the groundwater system has historically remained sustainable, rendering a unique focus on maintaining those conditions rather than implementing new projects or adaptive management actions. To be conservative, the GSP participants recognize that mitigation measures may be needed in the future due to climate change or neighboring management actions. Therefore, projects are identified and discussed in **Chapter 6**.

Chapter 7 - Plan Implementation

The adoption of the GSP will be the official start of the plan implementation. Both GGSA and MCDMGSA will continue their efforts to engage the public and secure necessary funding to successfully monitor and continue sustainable management of groundwater resources within the Plan Area. While the GSP is being reviewed by DWR, the GGSA and MCDMGSA will coordinate with various stakeholders and beneficial users to improve their monitoring and data collection. The Plan participants intend for the historical trend of groundwater sustainability to continue into the 2040 planning horizon and both GSAs will work with neighbors to encourage improved sustainability.

Costs to implement, monitor, and update the GSP were estimated conservatively at nearly $463,000 annually starting in 2020. Funding for the identified projects and management actions will be acquired through assessments, grant funds, and other public funds when available. As the GSP is implemented and projects are developed, costs will be refined. The schedules and estimates presented in the GSP are initial estimates and will likely change as the plan is periodically evaluated.

Successful implementation of this GSP over the planning and implementation horizon (2020-2040) will require ongoing efforts to engage stakeholders and the general public in the sustainability process; communicating the statutory requirement, the objectives of the GSP, and progress toward each identified interim milestone and measurable objective. The Plan participants will report the results of SMC monitoring including annual groundwater levels, extraction volume, surface water use, total water use, groundwater storage change, subsidence, and progress of GSP implementation to the public and DWR on an annual basis in cooperation with the other GSAs in the Subbasin. The Delta-Mendota Subbasin has developed a data management system to help store and evaluate groundwater-related data. In addition, the Plan participants will provide updated information and amend the GSP at least every five years. The update will include the results of Subbasin monitoring and progress toward achieving sustainability, including current groundwater conditions, status of projects and management actions, evaluations of undesirable results relating to measurable objectives and minimum thresholds, changes in monitoring networks, summaries of enforcement or legal actions, and agency coordination efforts.

1 Introduction

1.1 Purpose of Groundwater Sustainability Plan

On September 16, 2014, Governor Jerry Brown signed into law a three-bill legislative package, composed of AB 1739 (Dickinson), SB 1168 (Pavley), and SB 1319 (Pavley), collectively known as the Sustainable Groundwater Management Act of 2014 (SGMA), which is codified in Section 10720 et seq. of the California Water Code. This legislation created a statutory framework for groundwater management in California that must be achieved during the planning and implementation horizon and sustained into the future without causing undesirable results. SGMA requires that the following six sustainability indicators must be considered:

(1) Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply
(2) Significant and unreasonable reduction of groundwater storage
(3) Significant and unreasonable seawater intrusion
(4) Significant and unreasonable degraded water quality
(5) Significant and unreasonable land subsidence
(6) Depletions of interconnected surface water that have significant and unreasonable impacts on beneficial uses of surface water

SGMA requires governments and water agencies of high and medium priority basins to halt groundwater overdraft and bring groundwater basins into balanced levels of pumping and recharge without causing significant and unreasonable undesirable results related to the six sustainability indicators. Under SGMA, these basins should reach sustainability within 20 years of implementing their sustainability plans. For critically overdrafted high priority basins, including the Delta-Mendota Groundwater Subbasin (Delta-Mendota Subbasin, Subbasin, or DMB) that the Grassland Plan Area (Plan Area) area is part of, the deadline for achieving sustainability is 2040.

In his signing statement, Governor Brown emphasized that “groundwater management in California is best accomplished locally.” The Groundwater Sustainability Agencies (GSAs) within the DMB are working cooperatively together to achieve basin-wide sustainability. With local funding and ongoing financial and technical assistance from the Department of Water Resources (DWR), the Grassland Plan Area participants are collaborating with neighboring agencies to achieve groundwater sustainability for the DMB at the local level.

1.2 Sustainability Goal

The sustainability goal for the Delta-Mendota Subbasin was established to succinctly state the objectives and desired conditions of the Subbasin that will culminate in the absence of undesirable results by 2040. The sustainability goal of the Subbasin and by extension the Grassland Plan Area is as follows:

The Delta-Mendota Subbasin will manage groundwater resources for the benefit of all users of groundwater in a manner that allows for operational flexibility, ensures resource availability under drought conditions, and does not negatively impact surface water diversion and conveyance and delivery capabilities. This goal will be achieved through the implementation of the proposed projects *and management actions to reach identified measurable objectives and milestones through the implementation of the GSP(s), and through continued coordination with neighboring subbasins to ensure the absence of undesirable results by 2040.*

The following definitions of “undesirable results” were agreed upon by DMB Groundwater Sustainability Plan (GSP, Plan) participants for the following applicable sustainability indicators (undesirable results for seawater intrusion were not defined because this is not an applicable sustainability indicator for the DMB):

- **Chronic lowering of groundwater levels** - Significant and unreasonable chronic change in water levels, as defined by each GSP Group, that has an impact on the beneficial users of groundwater in the Subbasin through either intra- and/or inter-basin actions.
- **Reduction in groundwater storage** - Significant and unreasonable chronic decrease in groundwater storage, as defined by each GSP Group, that has an impact on the beneficial users of groundwater in the Subbasin through either intra- and/or inter-basin actions.
- **Degraded water quality** - Significant and unreasonable degradation of groundwater quality, as defined by each GSP Group, that has an impact on the beneficial users of groundwater in the Subbasin through either intra- and/or inter-basin actions and/or activities.
- **Land subsidence** - Changes in ground surface elevation that cause damage to critical infrastructure that would cause significant and unreasonable reductions of conveyance capacity, damage to personal property, impacts to natural resources, or create conditions that threaten public health and safety.
- **Depletions of interconnected surface water** - Depletions of interconnected surface water, as defined by each GSP Group, that have significant and unreasonable adverse impacts on the beneficial uses of surface water.
- ***Seawater intrusion** – The Grassland Plan Area is located approximately 55 miles from the Pacific Ocean and separated by the Coastal Range. Considering the distance separating the Plan Area from the Pacific Ocean, saltwater intrusion from the ocean into the freshwater aquifer is not a concern for the area and not applicable for analysis in the GSP.*

The sustainability goal will be met by balancing water demand with available water supply and stabilizing the long-term trend of declining groundwater levels in the DMB without significantly or unreasonably impacting groundwater storage, water quality, land subsidence, or interconnected surface water.

The Delta-Mendota Subbasin, identified by the DWR as groundwater Subbasin Number 5-022.07, is located within the San Joaquin River Hydrologic Region and the Tulare Lake Hydrologic Region, San Joaquin Valley Groundwater Basin. The Delta-Mendota Subbasin has been recognized as being in a state of groundwater overdraft prior to the adoption of SGMA and the State recently identified the DMB as a “high priority, critically overdrafted” subbasin. This designation is primarily attributed to considerable subsidence in parts of the Subbasin; however, the Grassland Plan Area has not historically experienced the rates of significant subsidence that other DMB GSP participants have (see Chapter 3 and Delta-Mendota Subbasin Common Chapter (**Appendix A**). Additionally, the Grassland

Plan Area historical change in groundwater storage has been sustainable. **Chapter 3** of this GSP discusses the sustainability and water budget for the Grassland Plan Area in greater depth. The Delta-Mendota Subbasin Common Chapter (**Appendix A**) further explores the variability in historic overdraft across the DMB GSP participants.

To that end, this GSP recognizes measures to continue sustainability trends and work with neighboring GSP groups and subbasins to support and encourage the reaching of the collective goals of SGMA and the respective subbasins.

As part of the process to accomplish this overarching goal, this GSP identifies undesirable results, which are outcomes that could be realized should the plan's strategies be ineffective or be ineffectively implemented. Undesirable results are marked by minimum thresholds: identified conditions which if not met will be interpreted as an indication that an undesirable result has occurred. Unlike GSP groups that have historically experienced undesirable results or are in a position of unsustainable overdraft trends, the positive outcomes defined in this GSP will require maintaining the system and improving neighbor coordination, rather than undergoing significant projects or management action implementation. The measurable objectives in this GSP are quantitative and are reflective of achieving the sustainability goal in 2040. The associated five-year interim milestones (interim goals) have been defined to gauge progress during the intervening years. The interim milestones help assure not only that the Grassland Plan Area is moving toward its sustainability goals, but that the rate of progress is as planned and is sufficient to meet the overall implementation schedule.

Significant and unreasonable undesirable results, minimum thresholds, and measurable objectives to meet the sustainability goal of the Grassland Plan Area are all defined and discussed in detail in **Chapter 4** of this GSP.

1.3 Coordination Agreements

This section includes a description of intra-basin coordination agreements, which are required in the circumstance that there is more than one GSP to be implemented in a groundwater basin, pursuant to the SGMA Regulations Article 8, Interagency Agreements, § 357.4.

Legal Requirements:

§ 357.4. Coordination Agreements
(a) Agencies intending to develop and implement multiple Plans pursuant to Water Code Section 10727(b)(3) shall enter into a coordination agreement to ensure that the Plans are developed and implemented utilizing the same data and methodologies, and that elements of the Plans necessary to achieve the sustainability goal for the basin are based upon consistent interpretations of the basin setting.
(b) Coordination agreements shall describe the following:
(1) A point of contact with the Department.
(2) The responsibilities of each Agency for meeting the terms of the agreement, the procedures for the timely exchange of information between Agencies, and procedures for resolving conflicts between Agencies.
(3) How the Agencies have used the same data and methodologies for assumptions described in Water Code Section 10727.6 to prepare coordinated Plans, including the following:
(A) Groundwater elevation data, supported by the quality, frequency, and spatial distribution of data in the monitoring network and the monitoring objectives as described in Subarticle 4 of Article 5.
(B) A coordinated water budget for the basin, as described in Section 354.18, including groundwater extraction data, surface water supply, total water use, and change in groundwater in storage.
(C) Sustainable yield for the basin, supported by a description of the undesirable results for the basin, and an explanation of how the minimum thresholds and measurable objectives defined by each Plan relate to those undesirable results, based on information described in the basin setting.
(c) The coordination agreement shall explain how the Plans, implemented together, satisfy the requirements of the Act and are in substantial compliance with this Subchapter.
(d) The coordination agreement shall describe a process for submitting all Plans, Plan amendments, supporting information, all monitoring data and other pertinent information, along with annual reports and periodic evaluations.
(e) The coordination agreement shall describe a coordinated data management system for the basin, as described in Section 352.6.
(f) Coordination agreements shall identify adjudicated areas within the basin, and any local agencies that have adopted an Alternative that has been accepted by the Department. If an Agency forms in a basin managed by an Alternative, the Agency shall evaluate the agreement with the Alternative prepared pursuant to Section 358.2 and determine whether it satisfies the requirements of this Section.
(g) The coordination agreement shall be submitted to the Department together with the Plans for the basin and, if approved, shall become part of the Plan for each participating Agency.
(h) The Department shall evaluate a coordination agreement for compliance with the procedural and technical requirements of this Section, to ensure that the agreement is binding on all parties, and that provisions of the agreement are sufficient to address any disputes between or among parties to the agreement.
(i) Coordination agreements shall be reviewed as part of the five-year assessment, revised as necessary, dated, and signed by all parties.

The Delta-Mendota Subbasin Coordination Agreement (Coordination Agreement), effective as of December 12, 2018, has been signed by all participating agencies in the Delta-Mendota Subbasin. The Coordination Agreement can be found as Appendix A of the Common Chapter (**Appendix A**). This Coordination Agreement defines how the coordination efforts will be achieved and documented and sets out the process for identifying the Plan Manager.

The Coordination Agreement for the Delta-Mendota Subbasin covers the following topics:

1. Purpose of the Agreement, including:
    a. Compliance with SGMA
    b. Description of Criteria and Function
2. General Guidelines, including:
    a. Responsibilities of the Parties
    b. Adjudicated or Alternative Plans in the Subbasin
3. Role of San Luis & Delta-Mendota Water Authority (SLDMWA), including:
    a. Agreement to Serve
    b. Reimbursement of SLDMWA
    c. Termination of SLDMWA's Services
4. Responsibilities for Key Functions, including:
    a. Coordination Committee
    b. Coordination Committee Officers
    c. Coordination Committee Authorized Action and Limitations
    d. Subcommittees and Workgroups
    e. Coordination Committee Meetings
    f. Voting by Coordination Committee
5. Approval by Individual Parties
6. Exchange of Data and Information, including:
    a. Exchange of Information
    b. Procedure for Exchange of Information
7. Methodologies and Assumptions, including:
    a. SGMA Coordination Agreements
    b. Pre-GSP Coordination
    c. Technical Memoranda Required
8. Monitoring Network
9. Coordinated Water Budget
10. Coordinated Data Management System
11. Adoption and Use of the Coordination Agreement, including:
    a. Coordination of GSPs
    b. GSP and Coordination Agreement Submission
12. Modification and Termination of the Coordination Agreement, including:
    a. Modification or Amendment of Exhibit "A" (Groundwater Sustainability Plan Groups including Participation Percentages)
    b. Modification or Amendment of Coordination Agreement
    c. Amendment for Compliance with Law
13. Withdrawal, Term, and Termination
14. Procedures for Resolving Conflicts
15. General Provisions, including:
    a. Authority of Signers
    b. Governing Law
    c. Severability
    d. Counterparts
    e. Good Faith
16. Signatories of all Parties

Department of Water Resources (DWR) Point of Contact
The point of contact for the Delta-Mendota Subbasin is:
Christopher Olvera
Department of Water Resources
Christopher.Olvera@water.ca.gov
(559) 230-3373

Agency Responsibility
In meeting the terms of the Coordination Agreement, all Delta-Mendota Subbasin GSAs agree to work collaboratively to meet the objectives of SGMA and the Coordination Agreement. Each Party to the Agreement is a GSA and acknowledges that it is bound by the terms of the Coordination Agreement as an individual party. More information regarding agency responsibility can be found in the Common Chapter (**Appendix A**).

Coordinated Data and Methodology
To ensure the Coordination Agreement requirements for coordinated data and methodology were achieved, the Delta Mendota Subbasin GSP participants formed a technical subcommittee of technical staff from all or some of the parties. Through this effort, items required or helpful for coordination were discussed, and coordinated data and methodologies were agreed upon. More information regarding common data and methodologies can be found in the Common Chapter and the accompanying Technical Memoranda (**Appendix A**).

Dispute Resolution
The Coordination Agreement outlines a path to dispute resolution, should it arise. The Common Chapter summarizes the method for resolution as follows:

> *The disputing Party or Parties are to provide written notice of the basis of the dispute to the other Parties within thirty (30) calendar days of the discovery of the events giving rise to the dispute. Within thirty (30) days after such written notice, all interested Parties are to meet and confer in good faith to informally resolve the dispute. All disputes that are not resolved informally shall be settled by arbitration. In such an event, within ten (10) days following the failed informal proceedings, each interested Party is to nominate and circulate to all other interested Parties the name of one arbitrator. Within ten (10) days following the nominations, the interested Parties are to rank their top three among all nominated arbitrators, awarding three points to the top choice, two points to the second choice, and one point to the third choice and zero points to all others. Each interested Party will then forward its tally to the Secretary, who tabulates the points and notifies the interested Parties of the arbitrator with the highest cumulative score, who shall be the selected arbitrator. The Secretary may also develop procedures for approval by the Parties for selection of an arbitrator in the case of tie votes or in order to replace the selected arbitrator in the event such arbitrator declines to act. The arbitration is be administered in accordance with the procedures set forth in the California Code of Civil Procedure, Section 1280, et seq., and of any state or local rules then in effect for arbitration pursuant to said section. Upon completion of arbitration, if the controversy has not been resolved, any Party may exercise all rights to bring legal action relating to the controversy.*

Plan Implementation and Submittal
Compliant with the SGMA and the Coordination Agreement, the Plan Area participants agree to submit the GSP to DWR through the Coordination Committee and Plan Manager. The Grassland GSP is considered complete with the incorporation of the Common Chapter and appended Technical Memoranda. GSPs implemented together satisfy the requirements of SGMA for the entire Subbasin.

The Coordination Agreement does not otherwise affect each Party's responsibility to implement the terms of its respective GSP in accordance with SGMA. Rather, the Coordination Agreement is the mechanism through which the participating GSAs will coordinate their respective GSPs to the extent necessary to ensure that such GSP coordination complies with SGMA. Each GSA and respective GSP group are responsible for ensuring that its own GSP complies with the statutory requirements of SGMA including but not limited to the filing deadline.

The Coordination Committee is responsible for assuring the submittal of annual reports and providing five-year assessments recommending any needed revisions to the Coordination Agreement. More information on GSP implementation and submittal can be found in the Common Chapter and Coordination Agreement (**Appendix A**).

Adjudicated Areas and Alternative Plans

There are no adjudicated areas within the Delta-Mendota Subbasin and no Alternative Plans have been submitted by the local agencies within the Subbasin.

1.4 Inter-basin Agreements

This section includes a description of inter-basin coordination agreements, which are optional agreements between neighboring groundwater subbasins, pursuant to the SGMA Regulations Article 8, Interbasin Agreements, § 357.2.

Legal Requirements:

§ 357.2. Interbasin Agreements

Two or more Agencies may enter into an agreement to establish compatible sustainability goals and understanding regarding fundamental elements of the Plans of each Agency as they relate to sustainable groundwater management. Interbasin agreements may be included in the Plan to support a finding that implementation of the Plan will not adversely affect an adjacent basin's ability to implement its Plan or impede the ability to achieve its sustainability goal. Interbasin agreements should facilitate the exchange of technical information between Agencies and include a process to resolve disputes concerning the interpretation of that information. Interbasin agreements may include any information the participating Agencies deem appropriate, such as the following:

(a) General information:

(1) Identity of each basin participating in and covered by the terms of the agreement.

(2) A list of the Agencies or other public agencies or other entities with groundwater management responsibilities in each basin.

(3) A list of the Plans, Alternatives, or adjudicated areas in each basin.

(b) Technical information:

(1) An estimate of groundwater flow across basin boundaries, including consistent and coordinated data, methods and assumptions.

(2) An estimate of stream-aquifer interactions at boundaries.

(3) A common understanding of the geology and hydrology of the basins and the hydraulic connectivity as it applies to the Agency's determination of groundwater flow across basin boundaries and description of the different assumptions utilized by different Plans and how the Agencies reconciled those differences.

(4) Sustainable management criteria and a monitoring network that would confirm that no adverse impacts result from the implementation of the Plans of any party to the agreement. If minimum thresholds or measurable objectives differ substantially between basins, the agreement should specify how the Agencies will reconcile those differences and manage the basins to avoid undesirable results. The Agreement should identify the differences that the parties consider significant and include a plan and schedule to reduce uncertainties to collectively resolve those uncertainties and differences.

(c) A description of the process for identifying and resolving conflicts between Agencies that are parties to the agreement.

(d) Interbasin agreements submitted to the Department shall be posted on the Department's website.

The sole interbasin agreement in the DMB is a data sharing agreement between SLDMWA and Westlands Water District. SLDMWA, on behalf of the Northern and Central Delta-Mendota Regions, executed an inter-basin data sharing agreement with Westlands Water District in April 2018. The purpose of the agreement is to establish a set of common assumptions regarding groundwater conditions on either side of the boundary between Westlands Water District's service area and the Delta-Mendota Subbasin to be used for the development of GSPs in support of SGMA implementation.

The Grassland Plan Area did not directly engage in an interbasin agreement with another subbasin; however, the data provided under the agreement allowed the Plan Area participants access to the shared information from Westlands Water District. Additional interbasin agreements may be developed during GSP implementation.

1.5 Agency Information

Legal Requirements:

§354.6(a) The name and mailing address of the Agency

This GSP covers the Grassland Groundwater Sustainability Agency (GGSA) and a portion of the Merced County Delta-Mendota Groundwater Sustainability Agency (MCDMGSA). The MCDMGSA area includes state and federal wildlife refuges and some private habitat and agricultural lands that lie adjacent to the GGSA. The aggregate of the areas covered by this GSP is referred to as the Grassland Plan Area. The mailing addresses for the GGSA and MCDMGSA are as follows:

Grassland GSA Grassland Water District 200 W. Willmott Avenue Los Banos, CA 93635	Merced County Delta-Mendota GSA County of Merced 2222 M Street Merced, CA 95340

1.5.1 Organization and Management Structure of the GSA

Legal Requirements:

§354.6(b) The organization and management structure of the Agency, identifying persons with management authority for implementation of the Plan. **§354.6(c)** The name and contact information, including the phone number, mailing address and electronic mail address, of the plan manager.

In accordance with the Coordination Agreement discussed in **Section 1.3**, the Delta-Mendota Subbasin Plan Manager is recognized as:

Andrew Garcia, PE
Senior Civil Engineer
San Luis & Delta-Mendota Water Authority
842 6th Street
Los Banos, CA 93635
(209) 826-1872
andrew.garcia@sldmwa.org

The Grassland GSP covers the GGSA and a portion of the MCDMGSA. The GGSA was formed by the Grassland Resource Conservation District (GRCD) and the Grassland Water District (GWD) pursuant to a 2016 Memorandum of Agreement (MOA), which established terms and conditions for the formation and administration of the multi-agency GGSA and the preparation and implementation of this GSP. Pursuant to the MOA, the GWD assumed principal responsibilities for administering the GGSA and developing and implementing the GSP. The governing body of the GRCD and the GWD each appointed two of their members to a GGSA Advisory Committee, and the General Manager of the GWD serves as the fifth member of that committee. Approval by both the GRCD and GWD is required for certain financial decisions, GSP adoption, enforcement actions, and other specified activities. Meetings of the GGSA and its Advisory Committee are noticed and open to the public in accordance with the Ralph M. Brown Act, California Government Code section 54950.

The MCDMGSA was formed by the County of Merced. The Merced County Board of Supervisors serves as the governing body for the MCDMGSA. Meetings of the MCDMGSA are noticed and open to the public in accordance with the Ralph M. Brown Act, California Government Code section 54950.

The GGSA and MCDMGSA executed a Memorandum of Understanding (MOU) in 2018 to coordinate the preparation of a GSP and SGMA implementation and enforcement. The MOU addresses data sharing, monitoring, the treatment of federal lands, GSP development and implementation, basin-wide coordination, and cost sharing.

Persons with management authority for implementation of this GSP include the following:

Ricardo Ortega, Coordinator Grassland GSA 200 W. Willmott Avenue Los Banos, CA 93635 (209) 826-5188 rortega@gwdwater.org	Lacey Kiriakou, Water Resources Coordinator Merced County Delta-Mendota GSA 2222 M Street Merced, CA 95340 (209) 385-7654 Lacey.Kiriakou@countyofmerced.com

1.5.2 Legal Authority of the GSA

Legal Requirements:

§354.6(d) The legal authority of the Agency, with specific reference to citations setting forth the duties, powers, and responsibilities of the Agency, demonstrating that the Agency has the legal authority to implement the plan.
§354.6(e) An estimate of the cost of implementing the Plan and a general description of how the Agency plans to meet those costs.

The GGSA is not a separate legal entity from its constituent agencies. Pursuant to the MOA between the GRCD and the GWD, the GGSA exercises the collective powers of its two member agencies, with the GWD assuming primary responsibility. The GWD is a California Water District formed pursuant to Division 13 of the California Water Code. The GRCD is a California Resource Conservation District formed pursuant to Division 9 of the Public Resources Code. The GWD oversees a groundwater program for managed wetland habitat within the GGSA. It also collects annual assessments and water delivery fees from landowners. It has the legal authority to manage water within its boundaries.

The MCDMGSA was formed by the Merced County Board of Supervisors and is not a separate legal entity. It exercises the powers of the County of Merced, which include the management and regulation of groundwater resources, and authorities granted to a GSA by SGMA. Merced County is a political subdivision of the State of California. Accordingly, both the GGSA and the MCDMGSA have been deemed the local agencies within the designated territory endowed with powers to comply with SGMA.

The SGMA legislation requires a GSA to develop and implement a GSP in order to achieve groundwater sustainability management within its territory in compliance with specific mandates and timelines. In the case of the Grassland Plan Area, both the GGSA and MCDMGSA coordinated to develop and implement a single GSP.

Pursuant to the existing powers of the GWD, GRCD, and Merced County and Chapter 8 of Part 2.74 of Division 6 of the Water Code, the GGSA and MCDMGSA may impose a variety of fees as they determine to be necessary, including, but not limited to, permit fees and fees on groundwater extraction or other regulated activities; fees to fund the costs of a groundwater sustainability program, including, but not limited to, preparation, adoption, and amendment of a GSP; and investigations, inspections, compliance assistance, enforcement, and program administration during implementation of the GSP, including a prudent reserve. An estimate of the cost of implementing the GSP and a general description of how the GGSA and MCDMGSA plan to meet those costs is provided in **Chapter 1**.

1.6 GSP Organization and Preparation Checklist

The Grassland GSP is organized in accordance with the Emergency SGMA Regulations in a format similar to the outline provide by DWR.

- **Executive Summary** provides a summary of what will be included in the GSP.
- **Chapter 1** describes the Introduction, including purpose of the GSP, sustainability goal, agency information, and GSP organization.
- **Chapter 2** describes the Plan area, including geographic setting, existing water resources planning and programs, relationship of the GSP to other general plan documents within the Agency boundary, and additional GSP components.
- **Chapter 3** describes the Basin setting. It includes a detailed discussion of the hydrogeologic conceptual model used to prepare the GSP, current and historical groundwater conditions, and a discussion of the area groundwater budget.
- **Chapter 4** sets forth the adopted sustainability goals, addresses the mandated Undesirable Results, defines Minimum Thresholds for each Undesirable Result, and sets Measurable Objectives for both intermediate plan years (Interim Milestones) and for the Plan's complete implementation.
- **Chapter 5** describes the network of monitoring wells and other facilities identified by the GGSA and MCDMGSA to measure Plan outcomes and assesses the need for improvements to the network in order to provide fully representative data. Monitoring protocols and data analysis techniques are also addressed.
- **Chapter 6** lists and describes each project and management action that will be evaluated and may be adopted by the GGSA and MCDMGSA in pursuit of sustainability. The section includes such project details as Measurable Objectives, required permits, anticipated benefits, project costs, project schedule, and required ongoing management operations, along with management actions that may be implemented.
- **Chapter 7** describes the Plan implementation process, including estimated costs, sources of funding, an overall preliminary schedule through full implementation, description of the required data management system, methodology for annual reporting, and how progress evaluations will be made over time.
- **Chapter 8** summarizes the references and sources used to prepare and document this Plan.

In December 2016, DWR published a Preparation Checklist for GSP Submittal. The checklist includes references to applicable GSP regulations and Water Code sections, as well as a brief description of the required GSP information. The checklist also contains a column for GSAs to record the page number or section of the GSP where the information for that particular requirement is found. The preparation checklist is presented below in **Table 1-1** and was used to develop a GSP consistent with the requirements of the GSP regulations and SGMA. *[The checklist is presented here in draft form and will be completed prior to adoption of this GSP.]*

Table 1-1: Preparation Checklist for GSP Submittal

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
352.2		Monitoring Protocols	• Monitoring protocols adopted by the GSA for data collection and management • Monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, inelastic surface subsidence for basins for which subsidence has been identified as a potential problem, and flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater extraction in the basin	(Example: Section 4.3.2, Figure 4-4, Appendix B)
354.4		General Information	• Executive Summary • List of references and technical studies	*[To be completed.]*
354.6		Agency Information	• GSA mailing address • Organization and management structure • Contact information of Plan Manager • Legal authority of GSA • Estimate of implementation costs	*[To be completed.]*
354.8(a)	10727.2(a)(4)	Map(s)	• Area covered by GSP • Adjudicated areas, other agencies within the basin, and areas covered by an Alternative • Jurisdictional boundaries of federal or State land • Existing land use designations • Density of wells per square mile	*[To be completed.]*
354.8(b)		Description of the Plan Area	• Summary of jurisdictional areas and other features	*[To be completed.]*
354.8(c) 354.8(d) 354.8(e)	10727.2(g)	Water Resource Monitoring and Management Programs	• Description of water resources monitoring and management Description of programs • Description of how the monitoring networks of those plans will be incorporated into the GSP	*[To be completed.]*
354.8(f)	10727.2(g)	Land Use Elements of Applicable General Plans	• Summary of general plans and other land use plans • Description of how implementation of the GSP may change water demands or affect achievement of sustainability and how the GSP addresses those effects • Description of how implementation of the GSP may affect the water supply	*[To be completed.]*

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
			assumptions of relevant land use plans • Summary of the process for permitting new or replacement wells in the basin • Information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management	
Article 5. Plan Contents, Subarticle 1. Administrative Information				
354.8(g)	10727.4	Additional GSP Contents	**Description of Actions related to:** • Control of saline water intrusion • Wellhead protection • Migration of contaminated groundwater • Well abandonment and well destruction program • Replenishment of groundwater extractions • Conjunctive use and underground storage • Well construction policies • Addressing groundwater contamination cleanup, recharge, diversions to storage, conservation, water recycling, conveyance, and extraction projects • Efficient water management practices • Relationships with State and federal regulatory agencies • Review of land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity • Impacts on groundwater dependent ecosystems	*[To be completed.]*
354.10		Notice and Communication	• Description of beneficial uses and users • List of public meetings • GSP comments and responses • Decision-making process • Public engagement • Encouraging active involvement • Informing the public on GSP implementation progress	*[To be completed.]*

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
Article 5. Plan Contents, Subarticle 2. Basin Setting				
354.14		Hydrogeologic Conceptual Model	• Description of the Hydrogeologic Conceptual Model • Two scaled cross-sections • Map(s) of physical characteristics: topographic information, surficial geology, soil characteristics, surface water bodies, source and point of delivery for imported water supplies	*[To be completed.]*
354.14(c)(4)	10727.2(a)(5)	Map of Recharge Areas	• Map delineating existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas	*[To be completed.]*
	10727.2(d)(4)	Recharge Areas	• Description of how recharge areas identified in the plan substantially contribute to the replenishment of the basin	*[To be completed.]*
354.16	10727.2(a)(1) 10727.2(a)(2)	Current and Historical Groundwater Conditions	• Groundwater elevation data • Estimate of groundwater storage • Seawater intrusion conditions • Groundwater quality issues • Land subsidence conditions • Identification of interconnected surface water systems • Identification of groundwater-dependent ecosystems	*[To be completed.]*
354.18	10727.2(a)(3)	Water Budget Information	• Description of inflows, outflows, and change in storage • Quantification of overdraft • Estimate of sustainable yield • Quantification of current, historical, and projected water budgets	*[To be completed.]*
	10727.2(d)(5)	Surface Water Supply	• Description of surface water supply used or available for use for groundwater recharge or in-lieu use	*[To be completed.]*
354.20		Management Areas	• Reason for creation of each management area • Minimum thresholds and measurable objectives for each management area • Level of monitoring and analysis • Explanation of how management of management areas will not cause undesirable results outside the management area • Description of management areas	*[To be completed.]*

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
Article 5. Plan Contents, Subarticle 3. Sustainable Management Criteria				
354.24		Sustainability Goal	• Description of the sustainability goal	*[To be completed.]*
354.26		Undesirable Results	• Description of undesirable results • Cause of groundwater conditions that would lead to undesirable results • Criteria used to define undesirable results for each sustainability indicator • Potential effects of undesirable results on beneficial uses and users of groundwater	*[To be completed.]*
354.28	10727.2(d)(1) 10727.2(d)(2)	Minimum Thresholds	• Description of each minimum threshold and how they were established for each sustainability indicator • Relationship for each sustainability indicator • Description of how selection of the minimum threshold may affect beneficial uses and users of groundwater • Standards related to sustainability indicators • How each minimum threshold will be quantitatively measured	*[To be completed.]*
354.30	10727.2(b)(1) 10727.2(b)(2) 10727.2(d)(1) 10727.2(d)(2)	Measurable Objectives	• Description of establishment of the measurable objectives for each sustainability indicator • Description of how a reasonable margin of safety was established for each measurable objective • Description of a reasonable path to achieve and maintain the sustainability goal, including a description of interim milestones	*[To be completed.]*

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
Article 5. Plan Contents, Subarticle 4. Monitoring Networks				
354.34	10727.2(d)(1) 10727.2(d)(2) 10727.2(e) 10727.2(f)	Monitoring Networks	• Description of monitoring network • Description of monitoring network objectives • Description of how the monitoring network is designed to: demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features; estimate the change in annual groundwater in storage; monitor seawater intrusion; determine groundwater quality trends; identify the rate and extent of land subsidence; and calculate depletions of surface water caused by groundwater extractions • Description of how the monitoring network provides adequate coverage of Sustainability Indicators • Density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends • Scientific rational (or reason) for site selection • Consistency with data and reporting standards • Corresponding sustainability indicator, minimum threshold, measurable objective, and interim milestone • Location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used • Description of technical standards, data collection methods, and other procedures or protocols to ensure comparable data and methodologies	*[To be completed.]*
354.36		Representative Monitoring	• Description of representative sites • Demonstration of adequacy of using groundwater elevations as proxy for other sustainability indicators • Adequate evidence demonstrating site reflects general conditions in the area	*[To be completed.]*
354.38		Assessment and Improvement of Monitoring Network	• Review and evaluation of the monitoring network • Identification and description of data gaps • Description of steps to fill data gaps • Description of monitoring frequency and density of sites	*[To be completed.]*

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
Article 5. Plan Contents, Subarticle 5. Projects and Management Actions				
354.44		Projects and Management Actions	• Description of projects and management actions that will help achieve the basin's sustainability goal • Measurable objective that is expected to benefit from each project and management action • Circumstances for implementation • Public noticing • Permitting and regulatory process • Timetable for initiation and completion, and the accrual of expected benefits • Expected benefits and how they will be evaluated • How the project or management action will be accomplished. If the projects or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included. • Legal authority required • Estimated costs and plans to meet those costs • Management of groundwater extractions and recharge	*[To be completed.]*
354.44(b)(2)	10727.2(d)(3)		• Overdraft mitigation projects and management actions	
Article 8. Interagency Agreements				
357.4	10727.6	Coordination Agreements - Shall be submitted to the Department together with the GSPs for the basin and, if approved, shall become part of the GSP for each participating Agency.	**Coordination Agreements shall describe the following:** • A point of contact • Responsibilities of each Agency • Procedures for the timely exchange of information between Agencies • Procedures for resolving conflicts between Agencies • How the Agencies have used the same data and methodologies to coordinate GSPs • How the GSPs implemented together satisfy the requirements of SGMA • Process for submitting all Plans, Plan amendments, supporting information, all monitoring data and other pertinent information, along with annual reports and periodic evaluations • A coordinated data management system for the basin • Coordination agreements shall identify adjudicated areas within the basin, and any local agencies that have adopted an Alternative that has been accepted by the Department	*[To be completed.]*

2 Plan Area

Legal Requirements:

§354.8 Each Plan shall include a description of the geographic areas covered, including the following information:
(a) One or more maps of the basin that depict the following, as applicable:
(1) The area covered by the Plan, delineating areas managed by the Agency as an exclusive Agency and any areas for which the Agency is not an exclusive Agency, and the name and location of any adjacent basins.
(2) Adjudicated areas, other Agencies within the basin, and areas covered by an Alternative.
(3) Jurisdictional boundaries of federal or state land (including the identity of the agency with jurisdiction over that land), tribal land, cities, counties, agencies with water management responsibilities, and areas covered by relevant general plans.
(4) Existing land use designations and the identification of water use sector and water source type.
(5) The density of wells per square mile, by dasymetric or similar mapping techniques, showing the general distribution of agricultural, industrial, and domestic water supply wells in the basin, including de minimis extractors, and the location and extent of communities dependent upon groundwater, utilizing data provided by the department, as specified in section 353.2, or best available information.

2.1 Plan Area Description

This Groundwater Sustainability Plan (GSP, Plan) covers the Grassland Groundwater Sustainability Agency (GGSA) and portions of the Merced County Delta-Mendota GSA (MCDMGSA). The MCDMGSA area includes adjacent state and federal wildlife refuges and some private habitat and agricultural lands that lie adjacent to the GGSA. Together the GGSA area and the MCDMGSA area are referred to as the Grassland Plan Area or Plan Area (See **Figure 2-1)**. The Plan Area is located within the Delta-Mendota Groundwater Subbasin (DMB, Subbasin). There are twenty-three GSAs in the DMB, drafting six individual GSPs. This GSP will address the basin-wide planning of the DMB coordinated effort and specific Plan Area efforts. GSP methodologies and data are coordinated and approved through the DMB technical committee and the DMB coordination committee respectively to ensure consistency among GSPs.

2.1.1 Groundwater Basin Boundary

The DMB is part of the San Joaquin Valley Groundwater Basin which lies within the San Joaquin River Hydrologic Region. The DMB is bounded on the west by the Coast Range. The northern, southern, and eastern boundaries about the Tracy, Modesto, Turlock, Merced, Chowchilla, Madera, Kings, and Westside Subbasins (See **Figure 2-2**).

The DMB boundary is defined in the Department of Water Resources (DWR) Bulletin 118 as DWR Subbasin No. 5-22.07. The Subbasin covers 1,170 square miles (747,000 acres). DWR estimated in 1995 that the groundwater storage for the DMB is about 26.6 million acre-feet (AF) to a depth of 300 feet (DWR Bulletin 118, 2003). Additional details on the DMB are included in **Appendix A -** Delta-Mendota Subbasin Coordinated Chapter developed by the Delta-Mendota Technical Committee and approved by the Delta-Mendota Coordination Committee.

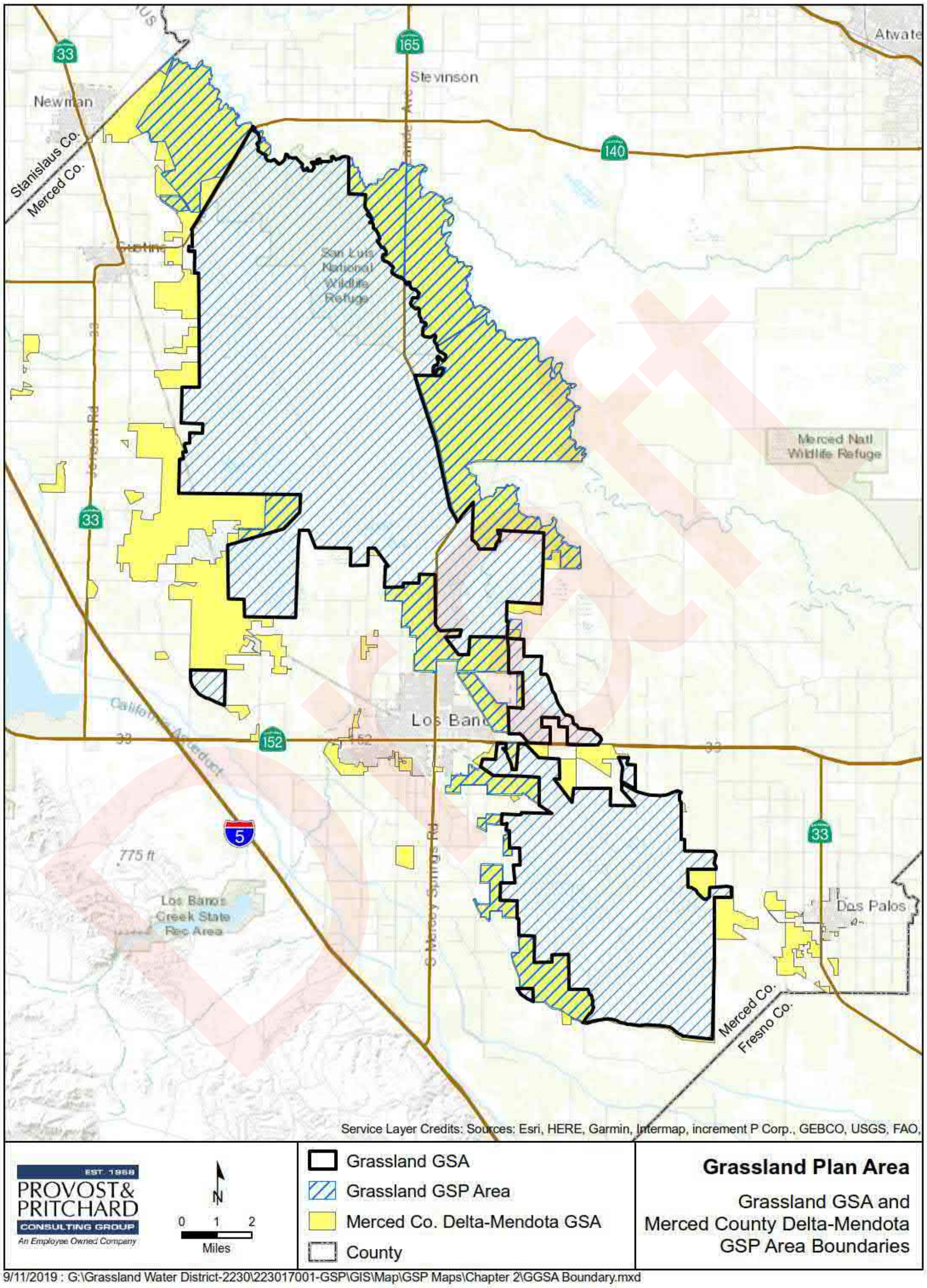

Figure 2-1: Grassland GSA and Extended GSP Area Boundaries

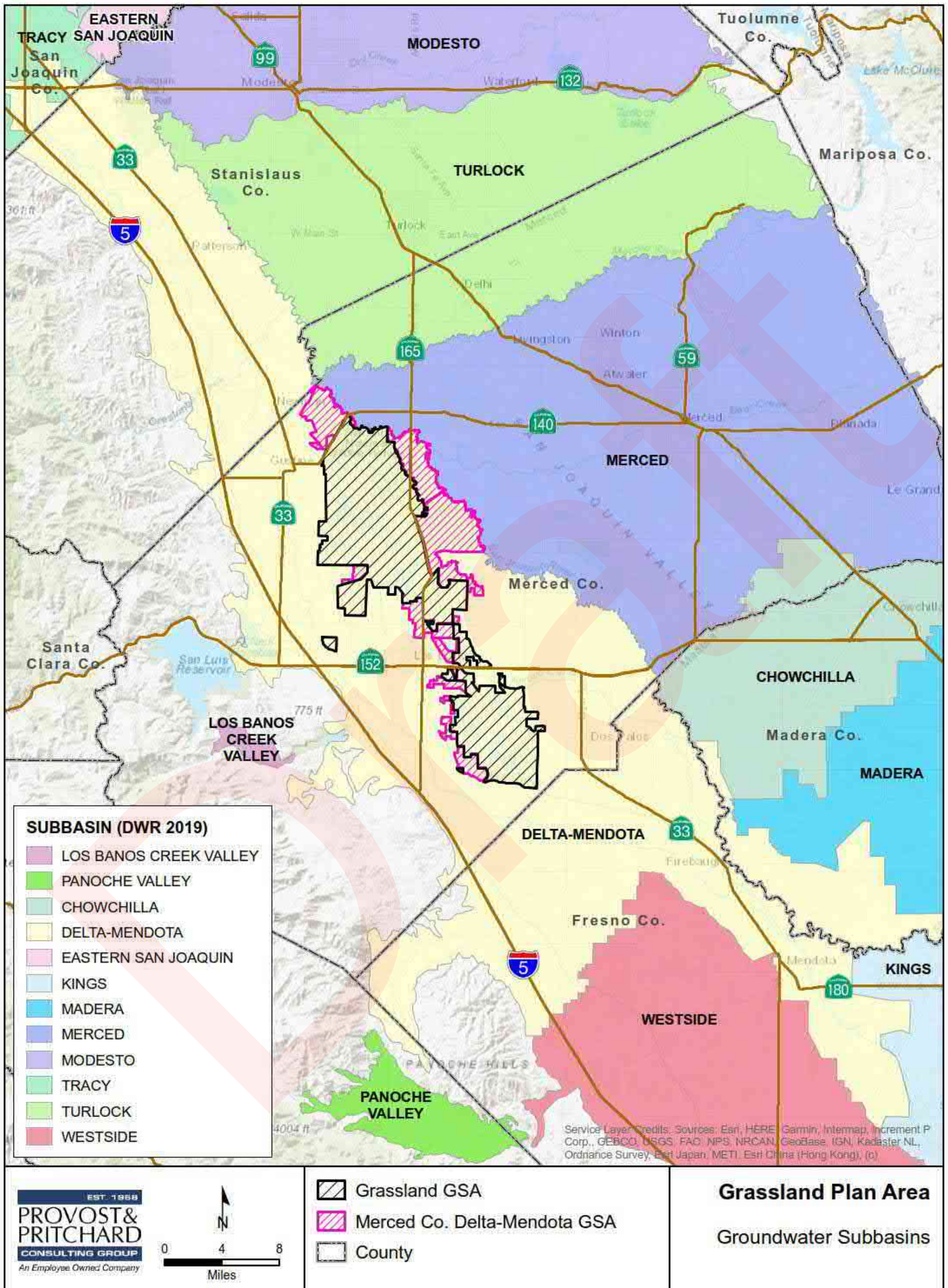

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Figure 2-2: Groundwater Subbasins

2.1.2 Groundwater Sustainability Plan Area

The Plan Area consists of the GGSA area and the MCDMGSA area (See **Figure 2-3**). The GGSA area is comprised of the Grassland Resource Conservation District (GRCD) and the Grassland Water District (GWD) service areas. The GRCD occupies approximately 75,000 acres and includes most of the GWD, which encompasses approximately 50,000 acres. GRCD and GWD have elected to jointly form the GGSA in order to sustainably manage groundwater in that portion of the DMB that lies within the districts' boundaries in the Plan Area. The GGSA is located in the Grassland Ecological Area (GEA), which is recognized internationally as a critical wetland ecosystem of hemispheric significance for migratory birds. GGSA lands are referred to as Subarea 1, which consists of a combination of privately managed wetland habitat, state wildlife areas, and national wildlife refuges, along with a small amount of agricultural lands.

The Plan Area also includes un-districted lands adjacent to the GGSA area (known as white areas), which are under Merced County's (County) jurisdiction. These white areas are part of the Merced County Delta-Mendota GSA. The GGSA has agreed to include the identified areas in the Plan in partnership with Merced County. Other white areas in the MCDMGSA have been included in the San Joaquin River Exchange Contractors Water Authority GSP. The Merced County white areas are referred to as Subarea 2 or the MCDMGSA area. The MCDMGSA area consists of approximately 30,000 acres of privately managed wetland habitat, state wildlife areas, and national wildlife refuges located in the GEA, along with a small amount of agricultural lands adjacent to GWD conveyance channels that participate in groundwater programs for delivery to habitats in the GGSA area. The GGSA and MCDMGSA Plan area have been separated into two respective subareas for ease of monitoring and calculating water budgets.

The GEA hosts more than 200 species of birds and significant numbers of mammals, reptiles, amphibians, fish, insects, and plants, some of which are threatened or endangered. Each year it serves as a major overwintering ground for millions of waterfowl, shorebirds, and other waterbirds. Migratory waterfowl include 19 duck species, including green-winged teal, northern shoveler, mallard, gadwall, wigeon, cinnamon teal, northern pintail, ring-necked duck, canvasback, and ruddy duck, and six goose species, such as snow, Ross's, white-fronted, and Aleutian cackling geese. The majority of waterfowl remain until late March before beginning their journey north to breeding areas. However, some species including mallard, gadwall, shorebirds, and raptors breed and raise young in the GEA.

More than 25 species of shorebirds have been documented at the GEA. It is estimated that a half million shorebirds, including sandpipers and plovers, migrate through the wetlands of the GEA in the fall and again in the spring. Large flocks of dunlin, dowitchers, and sandpipers can be seen feeding in these shallow seasonal wetlands, and flocks of long-billed curlews are found using the wetlands, uplands, and adjacent alfalfa and range lands. Other wildlife that can be found in the Plan Area include western pond turtles, raccoons, coyote, striped skunks, beaver, muskrats, tricolored blackbirds, and giant garter snakes.

The Plan Area has very few permanent residents and lies outside the boundaries of the City of Los Banos or any other incorporated communities. There are no adjudicated areas within the Plan Area. The Plan Area is bounded by the following GSAs: San Joaquin River Exchange Contractors GSA, MCDMGSA, Central Delta-Mendota Region GSA, City of Los Banos GSA, City of Gustine GSA, Northwestern Delta-Mendota GSA, Merced Subbasin GSA, and Turner Island Water District GSA (See **Figure 2-4**).

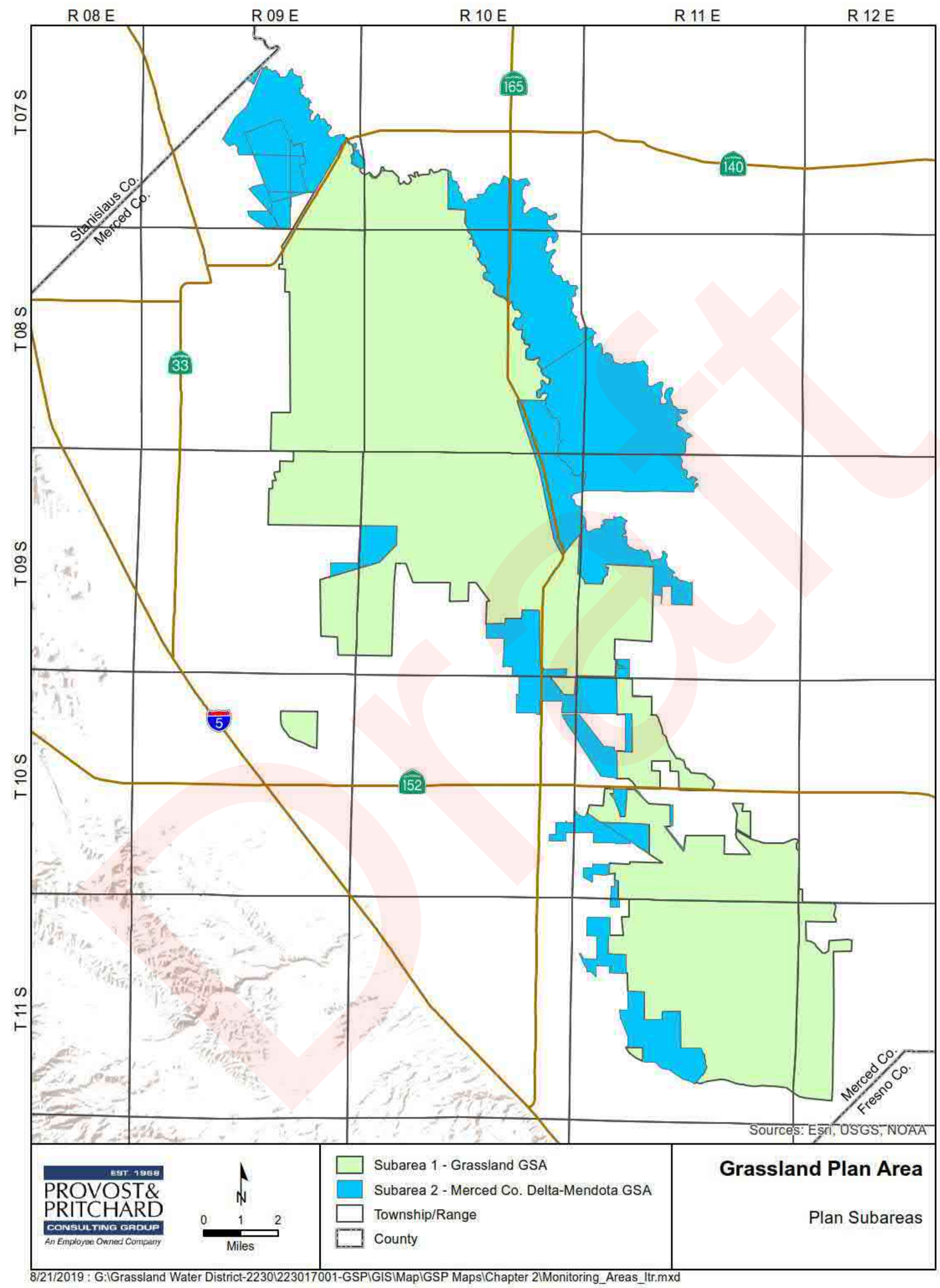


Figure 2-3: Plan Subareas

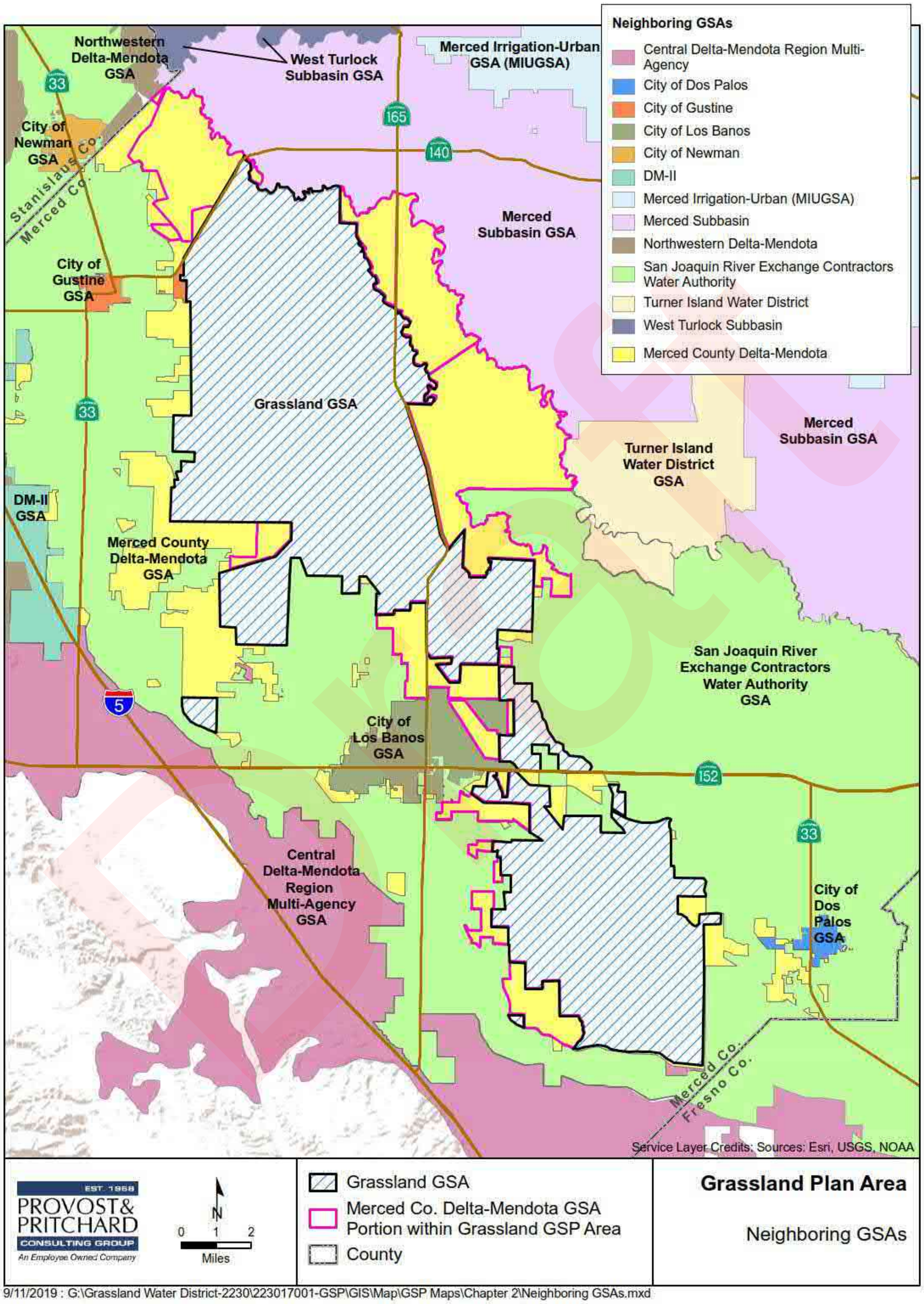


Figure 2-4: Neighboring GSAs

2.1.3 Land Use

DWR's land use survey for Merced County was last updated in 2014 and the general survey classifications can be seen in **Table 2-1.** However, due to the inaccuracy of the DWR land use survey, additional sources including the CropScape data layer, Ducks Unlimited land use and wetland data layers, aerial verification using Google Earth, and ground truthing were combined to develop a more refined and accurate catalogue of land uses in the Plan Area **(Table 2-2)**.

Table 2-1: DWR 2014 Plan Area Land Use

Land-Use Classification	Percent of Total Area
Managed Wetlands and Uplands	95.39
Agriculture	3.26
Urban/Developed	1.35
Total	100

Table 2-2: Verified Land Use

Land Use Classification	Subarea 1 (acre)	Subarea 2 (acre)	% of total
Field & Row Crops	2633	2102	5%
Vines & Nuts	0	836	1%
Urban/Developed	860	748	2%
Open Water	1123	269	1%
Idle	424	1029	1%
Managed Wetlands	60240	15118	72%
Grassland-Upland	8994	9574	18%

About 90% of the Plan Area consists of managed wetlands and grassland/upland areas. Agricultural and urban land uses together comprise less than 10% of the Plan Area. Farm operations within the Plan Area include mixed pasture, alfalfa, wheat, cotton, and almonds. **Figure 2-5** shows crop types and land uses from the United States Department of Agriculture's (USDA) online mapping data base known as CropScape. The land surrounding the Plan Area is also used for agricultural purposes (See Common Chapter Figure CC-17).

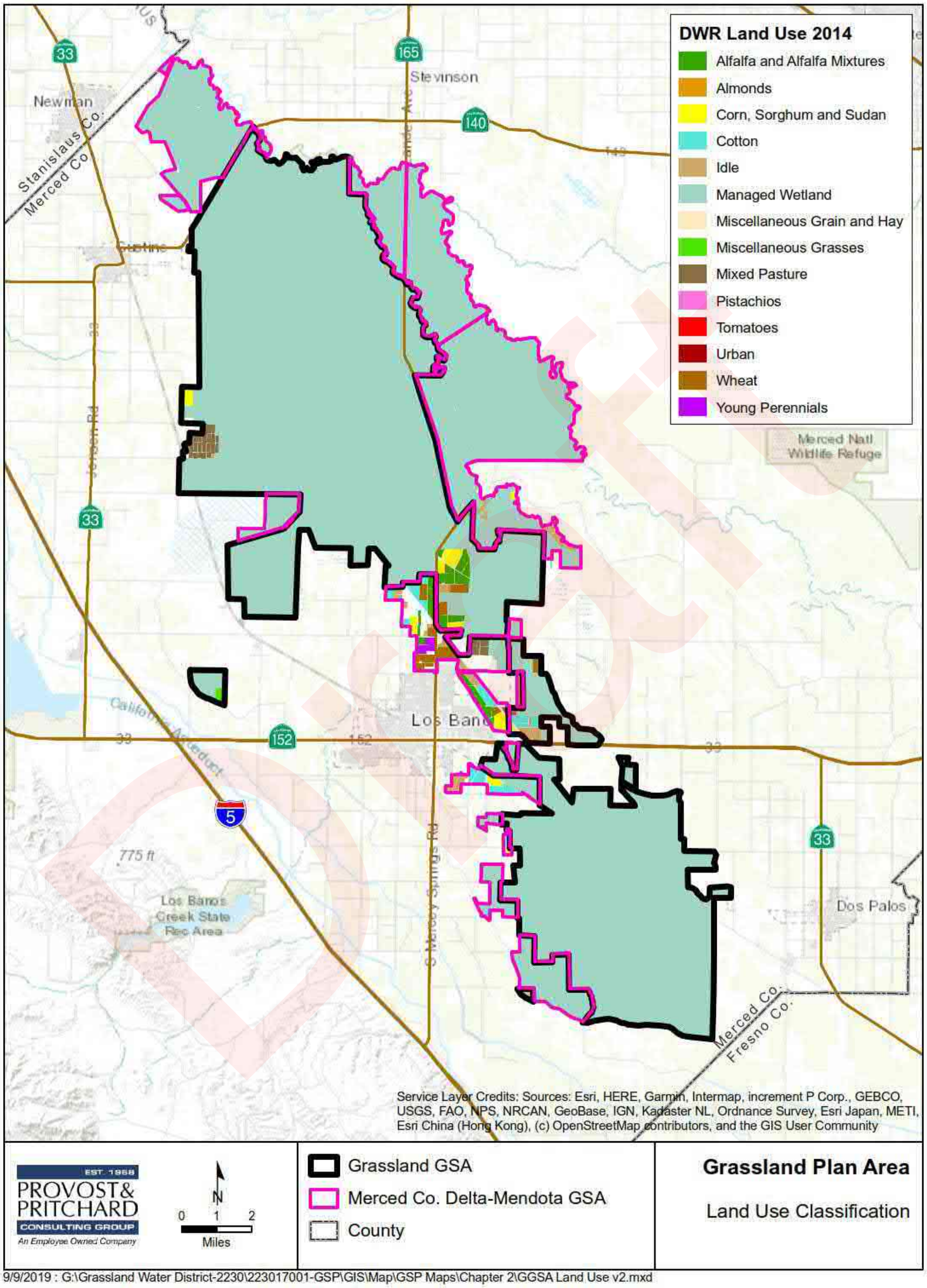


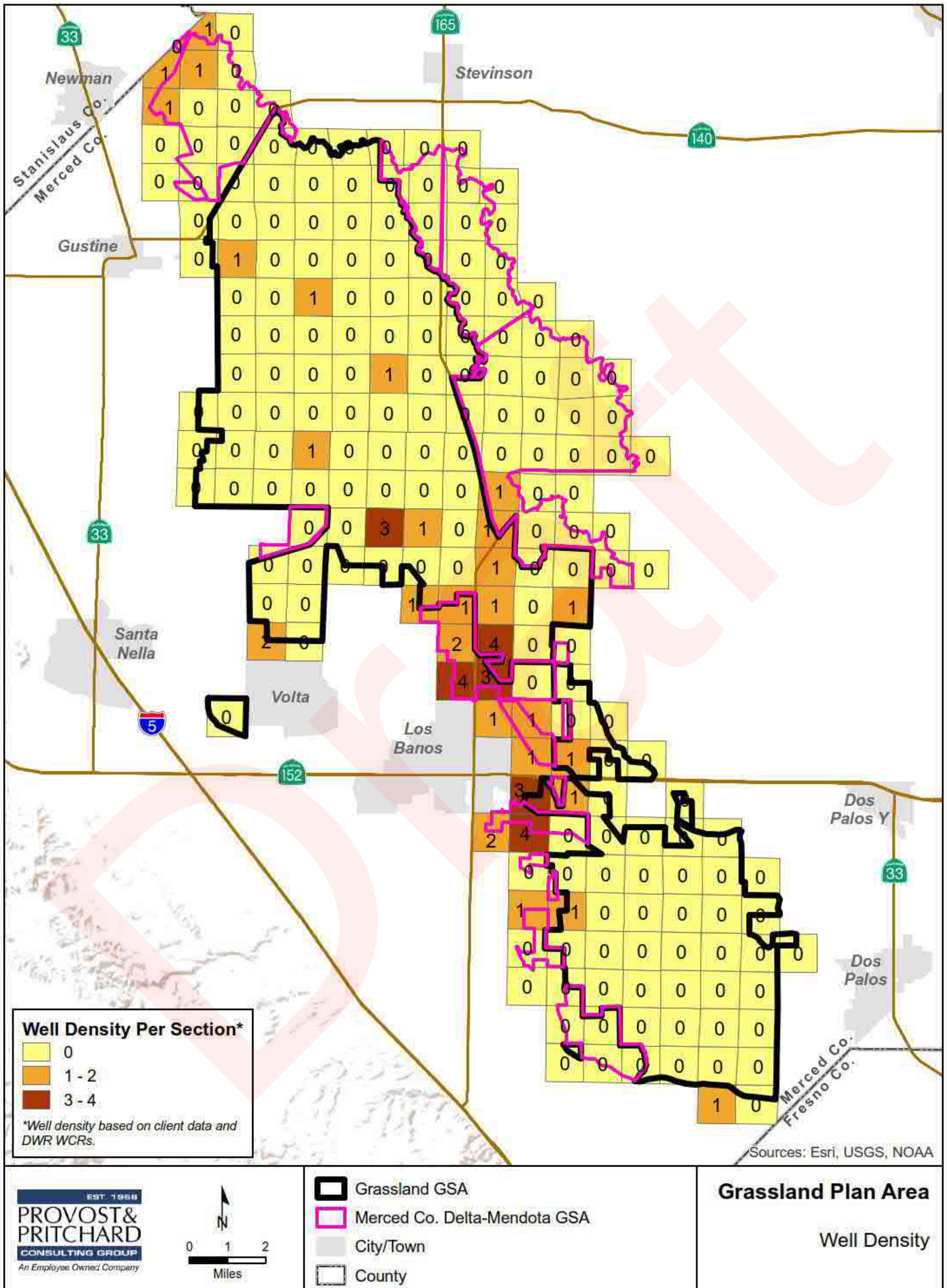
Figure 2-5: Land Use Classification

2.1.4 Water Sources and Use

Surface water for the GGSA and a large portion of the MCDMGSA area is obtained through federal contracts with the United States Bureau of Reclamation (USBR). USBR is required to deliver surface water from the Central Valley Project (referred to as Refuge Level 2 supply) as well as water acquired from voluntary sources (referred to as Refuge Incremental Level 4 supply) under the terms of the Central Valley Project Improvement Act (CVPIA). The full combined volume of Level 2 and Incremental Level 4 surface water supplies is referred to as Refuge Level 4 supply. The federal Delta-Mendota Canal conveys water southeast along the west side of the San Joaquin Valley (Westside) to the Mendota Pool to offset water supply that has been lost from the San Joaquin River due to the construction of Friant Dam. The Mendota Pool is located at the confluence of the San Joaquin River and the north fork of the Kings River and is the major delivery point and holding reservoir for agricultural and wetland irrigation supply on the Westside. Irrigation water can be diverted directly from the Delta-Mendota Canal, although water can also be delivered to the Plan Area from the Mendota Pool via canals that run north to agricultural water districts and wetland water supply contractors. Wetlands in the Plan Area are typically inundated with shallow ponded water starting in late August or September and retained through early spring. This cycle mimics historical hydrologic periods in order to provide foraging and loafing habitats for migratory waterfowl, shorebirds, and other resident wildlife.

Surface water is delivered to private, state, and federal wetlands within a large portion of the Plan Area through GWD's Agatha Canal, Camp 13 Ditch, Santa Fe Canal, San Luis Canal, and Almond Drive Ditch; Henry Miller Reclamation District's Arroyo and C Canals; Central California Irrigation District's Main Canal; USBR's Volta Wasteway; and Los Banos Creek, among others. The GGSA coordinates with USBR to source an Incremental Level 4 supply by using groundwater to supplement surface water in years when surface water deliveries are not adequate to meet full Level 4 wetland demand. The groundwater is pumped from privately-owned wells within the Plan Area and delivered to the GGSA area wetlands under groundwater acquisition and monitoring agreements. In addition to groundwater, GWD also receives operational spill and storm water from neighboring lands in order to meet demands within the Plan Area. The wetlands are drained in the spring (when soil temperatures are optimal for seed germination and subsequent wetland plant growth) to initiate the growing season. Waters drained from these wetlands are conveyed to Los Banos Creek and Mud and Salt Sloughs, which are tributaries to the lower San Joaquin River above the Merced River confluence.

State and federal lands within Subarea 2 also receive federally contracted surface water. This surface water is delivered by GWD and other neighboring districts. Private lands in Subarea 2 do not receive federally contracted surface water but may receive storm water, operational spill water from adjacent districts, and flooding from Los Banos and Garzas creeks. Private lands in Subarea 2 rely primarily on groundwater pumping to meet demands. As shown in **Figure 2-5** above, the vast majority of lands in the Plan Area are managed seasonal wetlands. Water is primarily used to provide overwintering wetland habitat for migratory waterfowl, shorebirds, and other species. In the spring, water is also used for irrigation purposes in order to grow grasses for migratory birds and to provide habitat for local breeding birds and other wildlife, including threatened and endangered species. Approximately half of the agricultural lands in the Plan Area are located in Subarea 2.



9/11/2019 : G:\Grassland Water District-2230\223017001-GSP\GIS\Map\GSP Maps\Chapter 2\Well Density.mxd

Figure 2-6: Well Density

2.1.5 Well Density

Well density was determined using known locations of Plan Area wells and verified using the online database of DWR well completion reports. Shown in **Figure 2-6** is the well density of all known production wells in the Plan Area, active or inactive. It is important to note that domestic wells may not be represented accurately in **Figure 2-6** due to gaps in well completion report data from DWR. Domestic wells qualify as “de minimis extractors” under SGMA and will be excluded from certain regulatory requirements of the GSP. There are no municipal wells and the only known publicly owned water systems are the wetland water delivery systems owned and operated by GWD, the California Department of Fish and Wildlife (CDFW), and the United States Fish and Wildlife Service (USFWS). These systems do not provide drinking water and therefore do not qualify as “public water systems” under state law. One publicly available groundwater connection serves drinking water to visitors at the San Luis National Wildlife Refuge visitor center.

2.2 Summary of Jurisdictional Areas and Other Features

Legal Requirements:

§354.8(b) A written description of the Plan Area, including a summary of the jurisdictional areas and other features depicted on the map.

The Plan Area is located within Merced County and covers 104,417 acres, including portions of the MCDMGSA. The majority of the Plan Area is located within the 240,000-acre GEA (**Figure 2-7**). This vast network of freshwater marshes (both permanent and seasonal), alkali grassland, and riparian thickets is the result of decades of wetland preservation, restoration, and collaborative conservation agreements between private duck clubs, California State Parks (Great Valley Grasslands), CDFW (Volta, Los Banos, and North Grasslands State Wildlife Areas), and USFWS (San Luis National Wildlife Refuge and the larger Grasslands Wildlife Management Area). **Figure 2-8** provides a map of the plan area and the various plan participants. Additionally, wildlife refuges and wetland habitat in the Plan Area and DMB are depicted in **Figure C-11** of the Common Chapter (**Appendix A**).

These land managers cooperate with several wetland-related conservation organizations that provide direct services to the wetlands, including the installation of water control structures, development of drainage swales, habitat improvements, and water management and efficiency improvements and techniques. Organizations that assist landowners include Ducks Unlimited, California Waterfowl Association, Natural Resource Conservation Service, Wildlife Conservation Board, USFWS, and CDFW. These agencies are instrumental in securing funding for wetland habitat improvements.

The GEA contains the largest remaining block of freshwater wetlands in the western United States. The area has received numerous designations and protections, including a Wildlife Management Area designation by Congress, a Wetland of International Importance designation under the Ramsar Convention, an Important Bird Area designation by the Audubon Society, and a Site of International Importance designation by the Western Hemispheric Shorebird Reserve Network.

2.2.1 Plan Participants and Jurisdictional Areas

The following is a summary of Plan participants and the jurisdictional areas within the Plan Area (See **Figure 2-8**).

Grassland Water District / Grassland Resource Conservation District
The GRCD occupies 75,000 acres and includes most of the GWD, which encompasses approximately 50,000 acres. Both the GRCD and GWD are located in the southwestern San Joaquin Valley within the GEA. GRCD and GWD have elected to jointly form the GGSA in order to sustainably manage groundwater for those portions of the Delta-Mendota Subbasin that lie within the combined service area of the Districts.

The GWD is a California Water District formed pursuant to California Water Code Section 34000 et seq. The GWD's primary function is to protect, secure, and deliver water to the critical wetland habitat within its boundaries and within the larger GRCD. The GWD also conveys water to adjacent state and federal wildlife refuges on behalf of the USBR. The GWD adopted its first Groundwater Management Plan in 2011 and manages a conjunctive use groundwater program for wetland habitats within the GWD and GRCD in cooperation with the USBR. A five-member GWD Board of Directors is elected by landowners within the GWD. The GWD collects annual assessments and water delivery fees from landowners.

The GRCD, which encompasses the GWD, is a California Resource Conservation District formed under Division 9 of the California Public Resources Code. The GRCD works closely with the CDFW and the USFWS to maximize food and habitat availability in order to meet the needs of the migratory birds utilizing the pacific flyway. Ninety percent of the GRCD is preserved under permanent wetland conservation easements. The GRCD was identified as one of the 19 refuges in the federal Central Valley Project Improvement Act, which directed the Secretary of the Interior and the State of California to provide adequate and reliable water supplies to these critical wetlands. A five-member GRCD Board of Directors is elected by residents within the GRCD. The GRCD does not collect annual assessments or fees from landowners and cooperates with the GWD regarding landowner outreach and groundwater management.

Almost all land within the GRCD and GWD is privately owned and maintained as wetland habitat, primarily within waterfowl hunting clubs. In the 1920s duck hunting began to become prevalent, and by the 1950s duck hunting became the predominant use of the land within the Plan Area. Clubs began to develop shallow open water in order to attract wintering waterfowl by mimicking historic wetlands and hydroperiods. Approximately 70% of managed wetlands in California are on private property and most of that land is owned and maintained by duck hunting clubs. Currently there are approximately 200 individual clubs in the Plan Area that rely on gravity flow water to operate and maintain year-round wetland habitat for wildlife. The majority of these clubs are located within the GRCD and GWD.

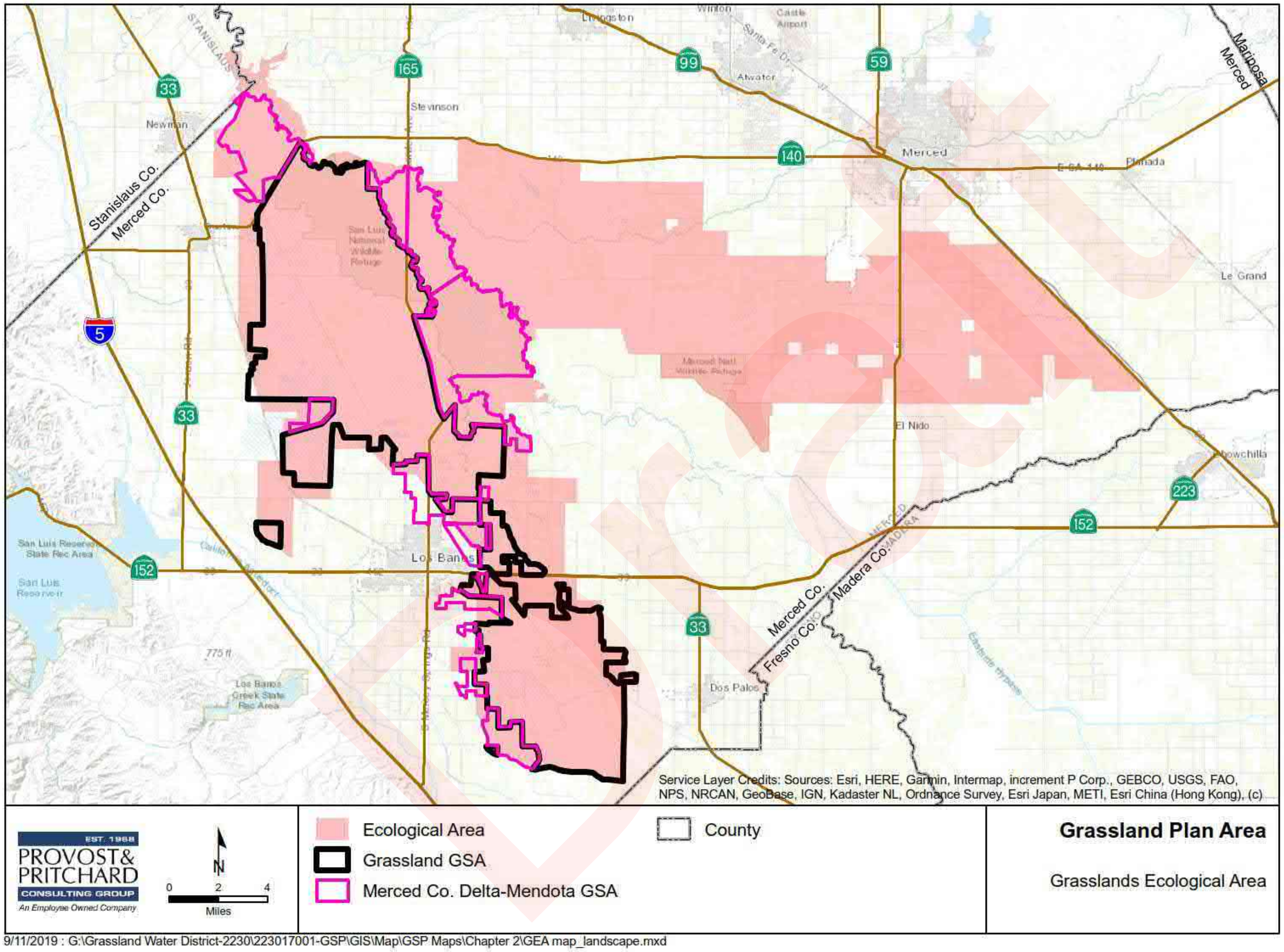


Figure 2-7: Grasslands Ecological Area

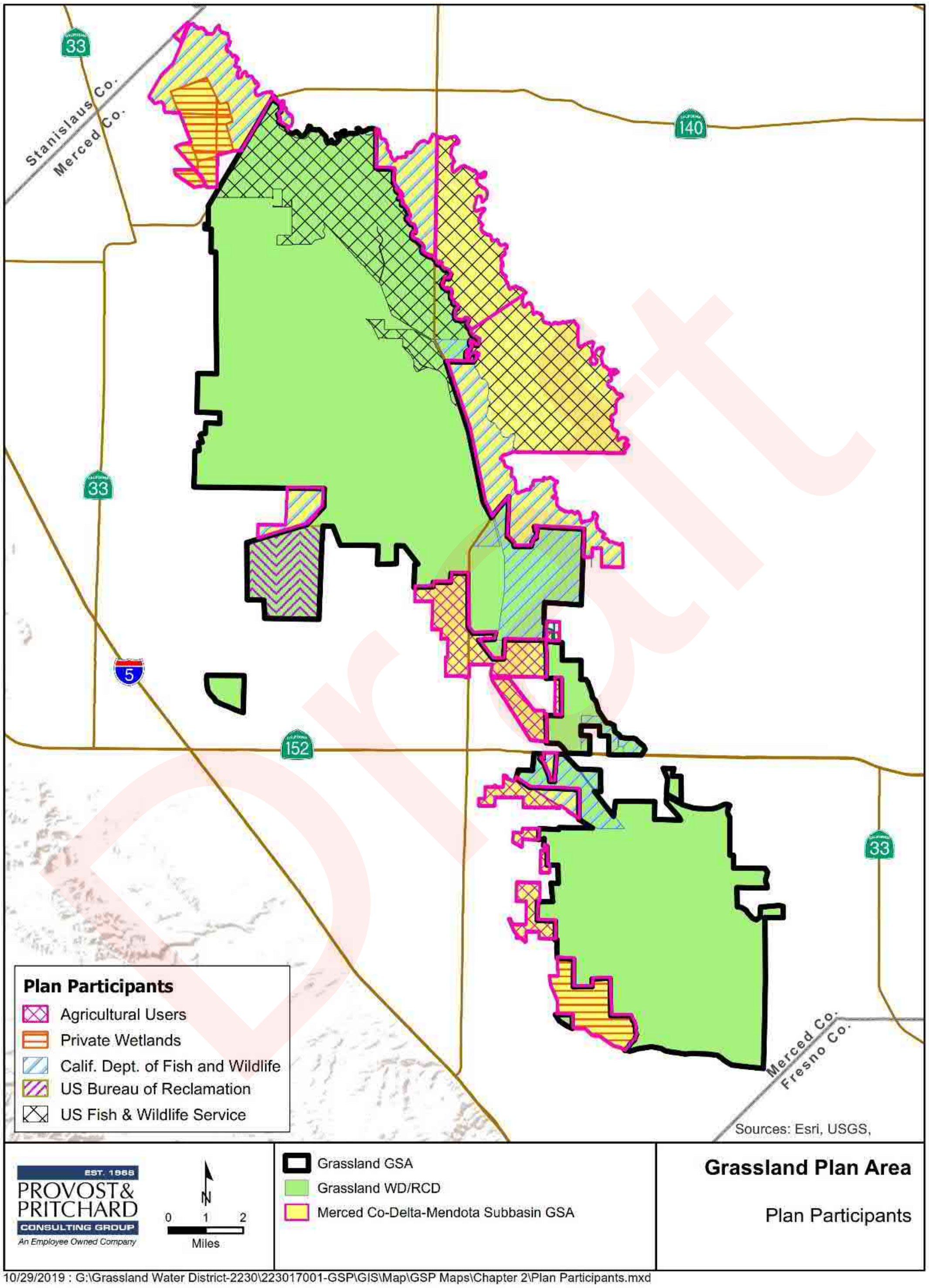


Figure 2-8: Plan Participants

Merced County

Merced County was formed in 1855 and includes the incorporated cities of Atwater, Dos Palos, Gustine, Livingston, Los Banos, and Merced. The County has a total area of 1,238,974 acres, or 1,935 square miles, of which 98.1% is unincorporated land according to the Merced County General Plan Background Report. Approximately 87,500 acres of grassland marsh in western Merced County provide unique wetland habitat for migratory waterfowl. This area represents 6.9% of the total area within the County. Approximately 87,000 acres of this grassland marsh is permanently protected by conservation agreements as part of the Grasslands Wildlife Management Area (approximately 7% of the County). In addition, more than 101,000 acres in Merced County (8% of the total land area) are protected as National Wildlife Refuges and state Wildlife Areas.

Merced County is located in the central portion of the San Joaquin River drainage basin with several major tributaries flowing from the west slope of the Sierra Nevada, including the Merced River, Bear Creek, Owens Creek, Mariposa Creek, Deadman Creek, and the Chowchilla River along the County's southern border. The San Joaquin River flows from southeast to northwest with approximately 9,520 square miles of upstream San Joaquin river drainage in Merced County. The Merced River carries runoff from the Sierra Nevada year-round with roughly 1,276 square miles of drainage area flowing east to west through the northern portion of the County. Major water supply and diversion dams, reservoirs, and hydroelectric power projects regulate and control flow along the San Joaquin and Merced Rivers. Agricultural consumers account for the highest percent of surface water use in the County. Additional uses of surface water include municipal, domestic, and industrial.

Merced County overlays four groundwater subbasins within the larger San Joaquin Valley Groundwater Basin. Groundwater flow in the County is generally towards the Central Valley trough, west of the Sierra Nevada and east of the Diablo Range towards the San Joaquin River. Private agricultural pumping represents more than 80% of total groundwater use. Additional uses of groundwater in Merced County include municipal and domestic supply, industrial service and process supply, and wetland habitat supply.

Within the Plan Area, about 29,781 acres (approximately 28.5% of the Plan Area) are located outside of the service areas of GWD and GRCD and constitute the County's MCDMGSA area. The Sustainable Groundwater Management Act at Water Code §10724(a) addresses unmanaged areas ("white spaces" or "white areas") within a groundwater basin through the presumption that the overlying county(s) will become responsible for these areas. The MCDMGSA and the GGSA entered into a Memorandum of Understanding (MOU) for the purposes of developing this Plan and implementing SGMA in portions of the MCDMGSA that are adjacent to the GGSA and within the Delta-Mendota Subbasin. Under the MOU, Merced County is partnering with the GGSA to coordinate Plan preparation, implementation, and enforcement, including but not limited to the establishment of monitoring protocols, data exchange, fee recovery, and enforcement mechanisms.

California Department of Fish and Wildlife (CDFW)

Prior to 1840, Native Americans known as the Yokut occupied most of the San Joaquin River basin. They lived as a hunting and gathering culture in the areas that are now managed as state Wildlife Areas by the CDFW as well as throughout the surrounding vicinity. Settlers used the area for commercial, subsistence, and recreational hunting from the time they first entered the area until new laws and a lack of wildlife curtailed the first two activities.

North Grasslands Wildlife Area
Most of this land was historically flooded, and as a result occupancy was limited to high spots and was seasonal at best. As waters of the San Joaquin were diverted, flooding was curtailed, thus making the cattle business practices of the past increasingly more dependent on artificially maintained surface water. The North Grasslands Wildlife Area was designated as a wildlife area by the Fish and Game Commission in 1992. It consists of approximately 7,400 acres in three distinct units: China Island, Gadwall, and Salt Slough.

China Island Unit
China Island has historically been used for cattle grazing and recreational waterfowl hunting. The northern portion was fenced and graded to support irrigated pasture. The southern portion remained predominantly as a San Joaquin River floodplain. The China Island Unit was acquired by the state in 1990 to implement the San Joaquin Basin Action Plan/Kesterson Mitigation Plan. In wet years the San Joaquin River breaches its banks and floods the majority of the China Island Unit, providing much needed food and nutrients back to the San Joaquin River and South Delta in addition to providing habitats for many species of fish and wildlife.

Gadwall Unit
The Gadwall Unit encompasses 1,600 acres of managed seasonal wetlands and is the southernmost unit of the North Grasslands Wildlife Area. The known historical uses on this unit were cattle grazing and duck hunting. The property was operated as a viable private duck club prior to its purchase by the California Department of Fish and Wildlife. The Gadwall Unit was expanded by 158 acres through the acquisition of the Ramacciotti Unit, which was restored in the summer of 2013 from rangeland into the Widell-Ramacciotti Marsh.

Salt Slough Unit
Prior to the 1930s, this land was altered to improve grazing by the Miller & Lux Corporation and was operated as a cattle ranch until it was acquired by the CDFW in 1990 to implement the San Joaquin Basin Action Plan/Kesterson Mitigation Plan. Since this area is adjacent to the Salt Slough, fishing and hunting also took place in or around this area.

Los Banos Wildlife Area
Purchased in 1929, the Los Banos Wildlife Area was the first of a series of state wildlife refuges established throughout California to manage habitat primarily for overwintering waterfowl. Expanded from its original 3,000 acres, there are now approximately 6,200 acres of wetland habitat that includes lakes, sloughs, and marsh. The wildlife area lies partially within a large Mexican land grant called Sanjon de Santa Rita that was granted by the Governor of Mexico in 1841. In 1863, Henry Miller purchased 8,000 acres, and by 1870, Miller had purchased the rest of the land grant for agricultural use.

In 1929, the Fish and Game Commission purchased 3,000 acres that had been used in a natural condition to graze livestock. The rest of the wildlife area was purchased from lands that were converted to farming by owners subsequent to Miller's purchase. The property was designated as a wildlife area by the Fish and Game Commission in 1954. The Los Banos Wildlife Area contains a 2.5-mile birding trail for wildlife viewing from late February through mid-June and houses the Grassland Environmental Education Center, which provides free-of-charge outdoor educational programming for children.

<u>Mud Slough Unit</u>
The Mud Slough Unit of the Los Banos Wildlife Area encompasses 455 acres of restored wetland habitat rehabilitated from cotton production in the early 1990s. Forty-two percent of the Mud Slough unit is managed for moist soil habitat, the majority of which is swamp timothy covering 77 acres.

Volta Wildlife Area
Volta Wildlife Area is approximately 3,800 acres and contains 1,300 acres of moist soil habitat. Beginning in 1949, a series of meetings were held throughout California to discuss the acquisition of wetlands for state-owned waterfowl management areas. Purposes for acquisition included an economic necessity to protect agricultural crops from waterfowl depredation, recognition of a need to protect waterfowl overwintering habitat, and a desire to accommodate public waterfowl hunting. The Volta Wildlife Area was approved in concept at these meetings.

The Volta Wildlife Area is owned by the USBR. In 1952, a lease agreement was initiated for CDFW to manage the property. This property is managed primarily as seasonally flooded wetland in order to provide for the habitat needs of migratory waterfowl and associated species. It was designated as a state Wildlife Area by the California Fish and Game Commission in 1973.

<u>California Department of Parks and Recreation</u>

Great Valley Grasslands State Park
This 2,826-acre park preserves one of the few intact examples of native grasslands on the floor of the Central Valley. Several rare and endangered plant and animal species inhabit the park. Springtime wildflower displays, fishing, and wildlife watching attract visitors to this undeveloped park, which also encompasses the former Fremont Ford State Recreation Area. In wet years the Great Valley Grasslands State Park can be flooded by the San Joaquin River, creating a vast shallow lake teaming with invertebrates; an ideal floodplain habitat for many species of fish and wildlife.

<u>U.S. Fish and Wildlife Service (USFWS)</u>
SGMA requires that federally reserved water rights to groundwater shall be respected in full and encourages voluntary participation by federal agencies in the SGMA planning and implementation process (Water Code § 10720.3.) The USFWS has participated in the GSP development by providing requested data for analysis and plan development.

San Luis National Wildlife Refuge
The San Luis National Wildlife Refuge (NWR) encompasses 26,878 acres of wetlands, riparian forests, native grasslands, and vernal pools. A thriving population of the endemic tule elk resides on the refuge. The USFWS purchased the first refuge parcel in 1966 using federal Duck Stamp funds to provide a sanctuary for migratory waterfowl and the refuge was officially established in 1967. The refuge has steadily grown in size and today is comprised of six contiguous units, five of which are within the Plan Area: the San Luis, West Bear Creek, Freitas, Blue Goose, and Kesterson units. The San Joaquin River bisects the eastern portion of the refuge outside of the Plan Area, where the East Bear Creek unit is located. The refuge is part of the larger San Luis NWR Complex, which includes the Merced NWR and San Joaquin River NWR, both of which are also located outside of the Plan Area.

San Luis Unit
The San Luis Unit contains the LEED Platinum-certified San Luis NWR Complex Visitor Center and Headquarters, which includes an exhibit hall and provides a launching point to explore the refuge complex. The unit contains two automobile tour routes and five nature trails for wildlife observation. This unit also offers public hunting and fishing opportunities.

West Bear Creek Unit
The West Bear Creek Unit contains an automobile tour route and two nature trails for wildlife observation and offers public waterfowl hunting opportunities.

Freitas Unit
The Freitas Unit offers boat-in waterfowl hunting along Salt Slough and upland pheasant hunting opportunities.

Blue Goose Unit
The “Blue Goose” is the symbol of the National Wildlife Refuge System and has been used on refuge boundary markers, entrance signs, brochures, and exhibits since 1936. The Blue Goose Unit provides public waterfowl hunting opportunities.

Kesterson Unit
The Kesterson Unit offers public waterfowl and pheasant hunting opportunities during the hunting season and “free-roam” nature hiking from February 15 through September 15 when the waterfowl hunting season is closed. This unit contains a portion of the historic San Joaquin River floodplain and is home to a unique community of plants and animals adapted to its alkaline soils. The Kesterson Unit was formerly called the Kesterson NWR and contained the Kesterson Reservoir, a series of evaporation ponds for agricultural drainage water that was closed in 1986 to protect wildlife.

Grasslands Wildlife Management Area
The Grasslands Wildlife Management Area (WMA) was approved by Congress and established by the USFWS in 1979 and is located in western Merced County within the San Joaquin River Basin. Nearly coextensive with the GEA, the Grasslands WMA has a 230,000-acre “acquisition boundary” for the USFWS to acquire conservation easements on privately-owned parcels that complement the two National Wildlife Refuges and four state Wildlife Areas within the WMA. These easements preserve wetland and grassland habitats as well as wildlife-beneficial agricultural lands. The preservation of these areas prevents conversion of the land to uses not compatible with migratory birds and other wildlife while still allowing daily management to remain under the landowners’ control.

The Grasslands WMA is divided into eastern and western divisions separated by the San Joaquin River. In the heart of the western division is the GRCD, an area of 75,000 acres of private wetlands and associated grasslands and over 30,000 acres of National Wildlife Refuges and state Wildlife Areas. These wetlands constitute 30% of the remaining wetlands in California's Central Valley and are extremely important to Pacific Flyway waterfowl populations and other bird species.

The Grasslands WMA contains diverse habitats including seasonally flooded wetlands, semi-permanent wetlands, riparian habitats, wet meadows, vernal pools, native uplands, pastures, and native grasslands. In addition to waterfowl, these habitats support shorebirds, wading birds, songbirds, raptors, and other wildlife species. Several federal and state-listed endangered and threatened plants and animals are present in the area and benefit from the habitat protection provided by the easement program. To date, the USFWS holds more than 190 conservation easements on private lands totaling approximately 87,000 acres within the Grasslands WMA. Habitat management assistance is available to all Grasslands WMA landowners who request it, whether they participate in the easement program or not.

In 1987, the USFWS initiated the Partners for Fish & Wildlife cost-share program, which pays landowners up to 50% of the funding necessary to accomplish wetland restoration and enhancement projects on their properties. This program provides landowners with the opportunity to perform wildlife habitat improvements they might not be able to afford without financial assistance. Typical projects that have been cost-shared in the past include the installation of new water control structures, the construction of swale drains that increase efficiency of habitat management practices, and the construction of levees and waterfowl loafing islands.

The Plan Area contains a small number of acres of privately-owned wetlands that are not within the GRCD/GWD or a state Wildlife Area or National Wildlife Refuge. These wetlands are within the Grasslands WMA and most are preserved through USFWS conservation easements.

Agricultural Users

There are agricultural lands in the Plan Area that are adjacent to GWD conveyance infrastructure and participate in refuge water supply groundwater pumping programs. The majority of these agricultural water users are in the MCDMGSA and rely primarily on operational spill, groundwater, and surface water transfers. There are approximately 4,700 acres of agricultural land in the Plan Area (See **Table 2-2**).

2.3 Water Resources Monitoring and Management Programs

Legal Requirements:

§354.8(c) Identification of existing water resource monitoring and management programs, and description of any such programs the Agency plans to incorporate in its monitoring network or in development of its Plan. The Agency may coordinate with existing water resource monitoring and management programs to incorporate and adopt that program as part of the Plan.
§354.8(d) A description of how existing water resource monitoring or management programs may limit operational flexibility in the basin, and how the Plan has been developed to adapt to those limits.

2.3.1 Monitoring and Management Programs

There are several existing monitoring and management programs that have provided the needed data for development of the GSP and will help the GGSA and MCDMGSA to comply with annual reporting requirements in the future. Existing programs were particularly useful in determining historic and current conditions for both surface and groundwater and for development of the historic and current water budgets. Existing monitoring and management activities will continue to be utilized within the Plan Area as a source of data for tracking progress in GSP implementation. Existing management activities will be coordinated between the Plan participants and stakeholders to ensure consistent and accurate data collection. The GGSA will continue to collaborate with MCDMGSA and landowners to avoid the duplication of efforts. Existing monitoring and management programs are described below. Monitoring for data collection and GSP reporting is described in further detail in **Chapter 5** – Monitoring Network.

2.3.1.1 Groundwater Level Monitoring

GWD maintains a groundwater level monitoring program that includes pre- and post-pumping seasonal water level measurements. Monitoring began in 2008 under a Monitoring Plan approved by USBR and data is reviewed annually. The monitoring program is intended to track depth to groundwater trends, help collaboration with other agencies, and identify and help avoid third-party impacts as a result of groundwater pumping for wetland habitat use. Depth to groundwater measurements are made at multiple wells above and below the Corcoran Clay approximately 4 times a year. Measurements (which include ambient, drawdown, and recovery levels) are made in the spring prior to spring-summer wetland irrigation pumping (ambient), again prior to the end of the spring-summer pumping period (drawdown), and at least 24 hours after well shutdown (recovery). Additionally, in the fall, levels are again taken prior to the beginning of the fall-winter pumping period (ambient), prior to the end of the pumping period (drawdown), and at least 24 hours after well shutdown (recovery). More information regarding GWD's monitoring program can be found in **Chapter 4**.

The majority of the pumping in the Plan Area is done in the fall and winter outside of the surrounding agricultural irrigation and groundwater pumping season. Water level measurements are taken using electronic well sounders and measured from an identified reference point at each well. CDFW also collects groundwater elevation data from observation wells on a weekly basis and has and will continue to provide that data to the GGSA.

GWD also works with the San Luis & Delta-Mendota Water Authority (SLDMWA) to monitor several wells for inclusion in the SLDMWA groundwater monitoring program. Data is entered into an electronic database and submitted to the SLDMWA for inclusion in the CASGEM program. Additionally, there are four DWR wells within the Plan Area that are monitored regularly by DWR. Data for these wells is available on the Water Data Library and the CASGEM websites. Annual summaries of groundwater level trends are reviewed by the District's Board of Directors and provided to the USBR, CDFW, SWRCB, and USFWS in annual and semi-annual reports.

2.3.1.2 Groundwater Extraction Monitoring

All wells in the Plan Area that are pumped for Refuge Incremental Level 4 water supply are equipped with flow meters. Meters within the GGSA are monitored and data recorded on a weekly basis, while meters on state and federal lands within Subareas 1 and 2 are monitored monthly. Groundwater pumped for the limited amount of agricultural production within the Plan Area is likely not metered and is not currently monitored by the GGSA. However, pursuant to the Merced County Groundwater Mining and Export Ordinance, all new wells constructed in Merced County must be metered with an approved water measuring device and report pumping amounts to the Merced County Department of Public Health, Environmental Health Division (MCDEH). Furthermore, all persons extracting groundwater within the County from wells permitted under the Groundwater Mining and Export Ordinance of Merced County, adopted in March 2015, must submit annual reports to MCDEH including water level and pumping data.

2.3.1.3 Groundwater Quality Monitoring

Water quality samples are collected from all wells being utilized for Incremental Level 4 refuge water supply and analyzed for electroconductivity (EC), total dissolved solids (TDS), selenium, and boron. Laboratory analysis provides specific correlation ratios to convert EC to TDS for each well. EC is measured weekly at each well site using hand-held multi-parametric sensors. Results are evaluated in relation to refuge water quality requirements and compared to historic data to identify and track trends. GWD has observed that wellhead water quality is stable, enabling the development of minimum flow requirements to maintain surface water objectives. Annual summaries of groundwater quality trends are reviewed by the GWD Board of Directors and submitted to the USBR, CDFW, SWRCB, and USFWS in annual and semi-annual reports.

Current groundwater monitoring plans also require GWD to monitor water in surface water channels where groundwater is introduced. The Central Valley Regional Water Quality Control Board (CVRWQCB) has established a maximum surface water concentration of 2 μg/L of selenium for Grassland wetlands and delivery channels. Although there is no adopted surface water quality objective for boron within the GRCD, the program will cease pumping if surface water exceeds the CVRWQCB's 4 mg/L boron objective for the San Joaquin River. Surface water quality sampling and analysis is conducted upstream and downstream of well discharges to help ensure compliance with surface water quality objectives set by the CVRWQCB. If a surface water quality objective is exceeded, groundwater pumping is curtailed until additional high-quality surface water is routed into the receiving conveyance channel and surface water quality objectives are again met.

Weekly monitoring of EC, pH, and temperature upstream and downstream of each well discharge is also conducted. The CDFW also conducts and shares weekly EC measurements from 19 supply and drainage locations to the Los Banos Wildlife Area and Volta Wildlife Area. These monitoring efforts help ensure that high-quality water is provided to the wetland habitat within the Plan Area in accordance with wetland water quality standards adopted by GWD and other wetland management agencies.

Surface water quality monitoring is also relevant to this GSP since groundwater is blended with surface water in the Plan Area. Since the mid-1980s GWD has collected and recorded water quality data on surface inflows, deliveries, and drainage leaving the district. These sites continue to be monitored monthly throughout each water year for TDS, EC, boron, and selenium. Grab sampling occurs on a monthly basis at major drainages and at delivery locations to state and federal refuges, coinciding with monthly Irrigated Lands Regulatory Program sampling efforts.

GWD's Real Time Water Quality Monitoring Network (RTWQMN) currently consists of approximately 30 real-time monitoring stations located at key inflow, delivery, and drainage points that continuously measure surface water flow, EC, temperature, and pH. Real-time surface water monitoring is required under the CVRWQCB's Salt and Boron Total Maximum Daily Load (TMDL) requirement for the lower San Joaquin River, which took effect in 2006. GWD cooperates with the USBR, the San Luis Drainage Authority, and the Grassland Basin Drainers group to implement the program. GWD is currently updating its RTWQMN stations with new sensors, modems, and loggers with funding from the USBR and DWR.

2.3.1.4 Land Surface Subsidence Monitoring

Land subsidence can result from compaction of underlying formations that are affected by water level decline. Although significant subsidence has been measured within the Delta-Mendota Subbasin, most of it has occurred outside of the Plan Area boundaries and has been associated with pumping from the lower aquifer, beneath the Corcoran Clay (See Section 4.2.6 of the Common Chapter, Land Subsidence). Water production wells within the Plan Area primarily pump from the upper zone, above the Corcoran Clay. Therefore, groundwater pumping activities within the Plan Area have not and are not expected to contribute to land subsidence.

The SLDMWA, USBR, and San Joaquin River Exchange Contractors Water Authority (SJRECWA) maintain land subsidence monitoring programs. GWD will continue to monitor the results of these established monitoring programs, collaborate with the aforementioned agencies to identify problems associated with land subsidence, and participate in the development of both intra-and inter-basin solutions.

The Plan Area has not been identified as a critical land subsidence area. GWD and several other water districts collaborated with the SLDMWA and the SJRECWA, which maintain local land subsidence monitoring programs, to help develop a Groundwater Level and Subsidence Monitoring Plan as a part of USBR's Environmental Assessment for Refuge Groundwater Acquisitions. The USBR annually reviews the results of these monitoring programs and works with the monitoring agencies to the extent practical to address any regional problems associated with land subsidence.

2.3.1.5 Grassland Bypass Project

Under an agricultural drainage improvement program by the USBR, sub-surface agricultural drainage from a large portion of the 370,000-acre Grasslands Watershed west of the San Joaquin River in Merced County has been shifted from discharging into wetland areas to discharging to the San Luis Drain and Mud Slough, a tributary to the San Joaquin River. The Grassland Bypass Project improves water quality in the Plan Area's wildlife refuges and wetlands, sustains the productivity of 97,000 acres of farmland to the south of the Plan Area, and fosters cooperation between area farmers and regulatory agencies in drainage management and the reduction of selenium and salt loading. The project is operated by the San Luis Drainage Authority, the Grassland Basin Drainers group, USBR, and the SLDMWA.

The project has gradually reduced discharges of agricultural drainage water, and there are no such discharges to the San Joaquin River currently. Beginning in January 2020, the CVRWQCB will require that discharges of agricultural drainage water permanently cease, and the Grassland Bypass Project is thereafter proposed for continued management as a storm water bypass project. Agricultural drainage water will continue to be reused to grow salt-tolerant crops as part of the San Joaquin River Improvement Project (SJRIP), located south of the Plan Area. The Drainage authority has agreed to install 5 monitoring wells along the common boundary between the GGSA and the SJRIP, also known as the drainage reuse area, to begin to monitor subsurface groundwater conditions. Monitoring results will be incorporated into future GSP updates.

2.3.1.6 Irrigated Lands Regulatory Program

The CVRWQCB's Irrigated Lands Regulatory Program (ILRP) addresses discharge of wastes (e.g., sediments, pesticides, nitrates) from irrigated lands. These wastes can harm aquatic life or make water unusable for drinking or agricultural uses. The goal of the ILRP is to protect surface water and groundwater and to reduce impacts of irrigated discharges to waters of the State. In 1999, the California Legislature passed Senate Bill 390, which eliminated a blanket waiver for agricultural waste discharges. The bill required the SWRCB to develop a program to regulate irrigated lands under the Porter-Cologne Water Quality Control Act. In 2003, the CVRWQCB adopted conditional Waiver of Waste Discharge Requirements (WDRs) to regulate agricultural and managed wetland discharges to surface waters. In December 2012, the CVRWQCB started adopting WDRs that addressed discharges to both surface water and groundwater, thus requiring ILRP enrollment for all irrigated agricultural and wetland operations. Surface water quality has been monitored for several years and, in the future, groundwater quality will be monitored.

Under the ILRP rules, growers may form “third party” coalitions to assist with required monitoring, reporting, and education requirements for irrigated lands. GWD is a participant in the Westside San Joaquin River Watershed Coalition’s (Westside Coalition) program to implement the requirements of the CVRWQCB’s Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands. GWD pays annual fees to cover the cost of compliance within the GGSA. The Westside Coalition was organized under the San Joaquin Valley Drainage Authority (Drainage Authority), a California joint powers authority, to administer the Irrigated Lands Regulatory Program. Governance, budgeting, and administration are implemented through an activity agreement between the Drainage Authority and public agency participants.

An updated Irrigated Lands Regulatory Program Waste Discharge Requirements General Order for Growers within the Western San Joaquin River Watershed was adopted on January 9, 2014, by the CVRWQCB. All owners of irrigated lands within the Plan Area, including managed wetlands, are required to enroll in the ILRP program and must submit annual reports to the CVRWQCB.

2.3.1.7 Central Valley Project Drought Contingency Plan

The Central Valley Project (CVP) Drought Contingency Plan (DCP) was developed by the USBR and DWR in 2016 to address mounting environmental and economic issues resulting from multiple years of drought conditions. The DCP considered the supply needs of all users and the best approaches for balancing all needs without creating undue hardships. The DCP defines allocations to CVP water users when faced with what is known as a Shasta Critical Year. Needs were ranked with municipal health and safety first, preservation of Sacramento-San Joaquin Delta water quality second, and finally the protection of threatened and endangered habitats. The remainder of water contractors, including agricultural users, were considered last. Under the CVP refuge water supply contracts that provide surface water to wetland habitat areas in the Plan Area, Level 2 surface water deliveries are cut back by up to 25% in a Shasta Critical Year. In practice, Incremental Level 4 supplies are also cut back significantly, as there is little water available for voluntary acquisitions or transfers in a critically dry year.

2.3.2 Impacts to Operational Flexibility

The presence of several different existing water monitoring and management programs constitute constraints that could impact operational flexibility and water operations within the Plan Area. These programs are illustrated in **Figure 2-9**: Impacts to Operational Flexibility, followed by a description of each program and possible adaptation measures.

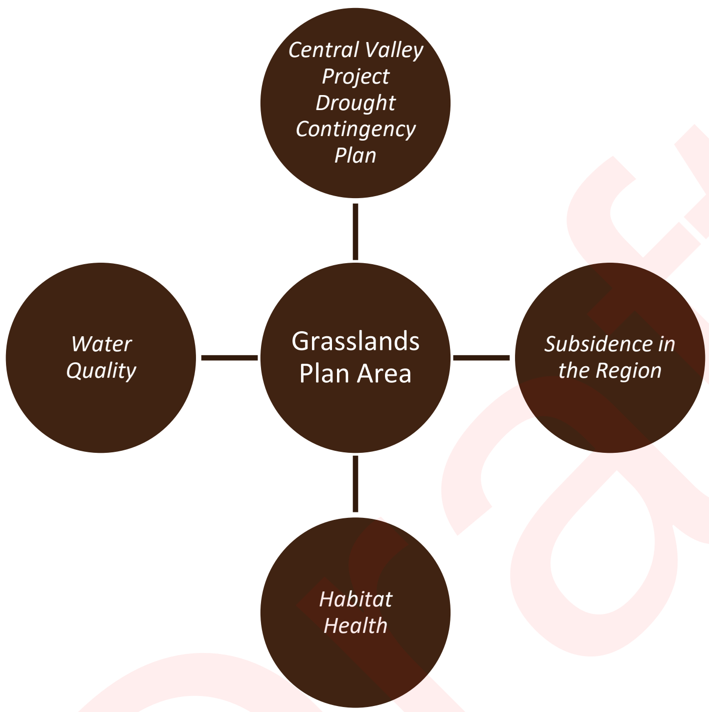


Figure 2-9: Impacts to Operational Flexibility

2.3.2.1 Central Valley Project Drought Contingency Plan

During Shasta Critical years, the GGSA and the MCDMGSA members with federal water contracts that supply water to wetland habitat are subject to water supply reductions. As a result, the Plan Area may rely more on groundwater to supplement their supply during these years. Historically, the Plan Area lands with federal water supply contracts have not experienced stresses to the groundwater system following years with surface water shortages. See Chapter 3.3 – Historic Water Budget.

The Plan Area has been in the process of implementing a conjunctive use groundwater program that allows refuge contractors to increase groundwater pumping when surface water supplies are reduced in critically dry years. See **Section 2.3.3** for details on conjunctive use programs within the Plan Area.

2.3.2.2 Water Quality Standards

Water Quality is a limiting factor in the Plan Area's operational flexibility. Both surface and groundwater quality have the potential to reduce the amount of water that can be used for application. Water quality is discussed in detail in **Section 2.3.1.3**. If groundwater exceeds limits on TDS or Selenium, it cannot be pumped into the distribution system. Surface water may also require additional dilution if water quality exceeds concentrations designated in the monitoring plan.

2.3.2.3 Subsidence in the Region

Subsidence is currently a critical concern in the DMB regarding SGMA implementation. Although subsidence in the Plan Area itself is minimal, it remains an issue for other GSAs in western Madera County, western Fresno County, and in southern Merced County. Land subsidence has been occurring in these counties for decades. Historically, subsidence has been centered near the Eastside/Chowchilla Bypasses and in the El Nido and Red Top areas, east of the Plan Area. However, in the past ten years, land subsidence has become more pronounced and the subsidence has extended west of the Eastside/Chowchilla Bypasses to at least the San Joaquin River. This increase in subsidence is considered to be a result of the development of hundreds of new wells which tap the lower aquifer. Increased pumping from the lower aquifer has increased the rate of subsidence, which in turn has affected the elevations of the San Joaquin River, water delivery infrastructure, and local canals. See Section 4.2.6 of the Common Chapter for more details on land subsidence.

Although water management practices in the Plan Area are unlikely to contribute to subsidence, the effects of subsidence directly affect the Plan Area. Actions taken to address this subsidence primarily entail measures to decrease lower aquifer pumpage in neighboring GSAs and subbasins. This can be done by reducing lower aquifer pumpage, relying more on upper aquifer pumpage in conjunction with increased intentional recharge, and by increasing in-lieu recharge.

2.3.2.4 Habitat Health

The primary purpose of the GGSA and many of the Plan Area lands is to protect the health of the wetland habitats that provide food and shelter for a variety of migratory waterfowl and other species. Should a decline in habitat health be evident, GGSA would take the necessary precautions to rectify the situation. No changes in habitat health due to local groundwater trends are anticipated, but groundwater extraction in the DMB could affect water supply and drainage conveyance and associated infrastructure.

2.3.3 Conjunctive Use Programs

Legal Requirements:

§354.8(e) A description of conjunctive use programs in the basin.

Conjunctive use of water is defined as the combined use of ground and surface water to minimize the undesirable effects of both water sources and to optimize water demand. Higher water reliability can be achieved by augmenting groundwater in wet years so that stored groundwater can function as a buffer for periods of water scarcity. The idea of this management approach is to use surface water when available in lieu of groundwater. Surface water should also be used for groundwater recharge in areas that allow surface water to be stored in the aquifer for use later. This would be especially important as a buffer function for mitigating impacts of groundwater overdraft.

The GWD pilot groundwater pumping project began in the fall of 2008 as a means of assessing whether utilizing existing wells to pump groundwater into the GWD conveyance system for the purpose of meeting unmet water needs would cause adverse impacts to water quality or groundwater levels. From the early 1990s up until this pilot project there had been no significant groundwater usage within the GWD. Wells drew from the upper zone above the Corcoran Clay at depths from 250 to 350 feet. The pilot project demonstrated that water levels remained consistent and pumping-related subsidence was not experienced in the area, indicating that no short-term or long-term adverse impacts were occurring from pumping up to 10,000 acre-feet per year (AFY) of groundwater under the program.

The pilot program is now a long-term groundwater acquisition program administered by GWD and USBR, which now includes more groundwater wells within the Plan Area that can produce up to 29,000 AFY to supplement inadequate Incremental Level 4 refuge water supplies. USBR analyzed the impacts including cumulative effects to local groundwater and geologic resources from pumping wells under the program. This aquifer impact analysis is included in USBR's existing NEPA Environmental Assessment for *the 5-Year Groundwater Acquisitions for South of Delta Central Valley Project Improvement Act Refuges Project* dated December 2015, and the associated Finding of No Significant Impact dated January 26, 2016.

The Volta Wildlife Area pilot project began developing groundwater in the fall of 2011. The Volta wells collectively can produce up to 6,600 AFY of groundwater of acceptable quality to be conveyed to wildlife refuges. USBR analyzed the impacts to local groundwater and geologic resources from pumping the Volta wells, including the cumulative effects when combined with the pumping of other local wells. This groundwater level and aquifer impact analysis is included in USBR's existing NEPA Environmental Assessment for the *Volta Wildlife Area Level 2 Diversification / Incremental Level 4 Development Pilot Project* dated May 2010, and associated Finding of No Significant Impact dated June 1, 2010.

Approximately 30,000 - 50,000 AFY of groundwater is pumped and used within the Plan Area. This pumping includes the pumping of state, federal, and private refuge lands as well as the limited agricultural lands in the Plan Area. Historically, GWD's refuge water supply pumping can be up to 28,262 AF in below normal or critical years. Pumping is reduced significantly during wet years when other sources of surface water are available for use in the Plan Area.

Table 2-3: Grassland Water District Total Groundwater Production

Grassland Water District Total Groundwater Production	
Groundwater Production (Acre-feet)	
Water Year 13 (Dry)	7,627.11
Water Year 14 (Critical)	18,898.76
Water Year 15 (Critical)	19,989.45
Water Year 16 (Below Normal)	28,262.14
Water Year 17 (Wet)	306.13
Total WY 13-17	**75,083.59**

In addition, the state and federal refuges in the Plan Area pump a limited amount of groundwater in order to supplement their surface water supplies. Groundwater pumping on the China Island Unit, San Luis National Wildlife Refuge, Los Banos Wildlife Area, and Salt Slough Unit is metered monthly. Total annual pumping ranges from approximately 1,100 AF to 7,600 AF annually depending on the water year type. An additional approximate amount of 30,000 AF is assumed to be extracted by MCDMGSA stakeholders without federal water contracts for private wetlands and agricultural and transfer purposes. Since limited historic pumping data is available for MCDMGSA stakeholders, uncertainty in groundwater pumping volumes for Subarea 2 is high. Greater detail on the breakdown of groundwater pumping is included in the Chapter 3.3 of the GSP.

2.4 Relation to General Plans

Legal Requirements:

§354.8(f) A plain language description of the land use elements or topic categories of applicable general plans that include the following: (1) A summary of general plans and other land use plans governing the basin.

2.4.1 Summary of General Plans/Other Land Use Plans

The California Government Code (§§ 65350-65362) requires that each county and city in the state develop and adopt a General Plan. The General Plan is a comprehensive, long-term framework for the protection of agricultural, natural, and cultural resources and for development in the county or city. Designed to meet the state requirements, it outlines policies, standards, and programs and sets out plan proposals to guide day-to-day decisions concerning a county or city's future. Each General Plan must include the vision, goals, and objectives of the city or county in terms of planning and development within eight different "elements" defined by the state: land use, housing, circulation, conservation, noise, safety, open space, and environmental justice. The General Plan may be adopted in any form deemed appropriate or convenient by the legislative body of the county or city, including the combining of elements.

Merced County is the only agency within the Plan Area that has a general plan: the 2030 Merced County General Plan. However, the Plan Area is adjacent to the City of Los Banos and it is important to consider its General Plan as well, as it is one of the fastest growing cities within the State of California. The Delta-Mendota Groundwater Subbasin as a whole encompasses several counties and cities. However, only those directly affecting the Plan Area necessitate further discussion.

Although outside of the GGSA Plan Area, as discussed in the prior paragraph, the City of Los Banos, which is entirely groundwater-dependent, extracts groundwater from the Delta-Mendota Subbasin to meet the City's water demand (City of Los Banos 2030 General Plan Update, 2009). The Land Use Element of The City of Los Banos 2030 General Plan Update provides insight into future areas of urban expansion that may affect water resources in the vicinity. The City of Los Banos 2030 General Plan Update was adopted in 2009, well before the enactment of SMGA (the City of Los Banos has now formed its own GSA). The Land Use Element contains the framework for land use planning in Los Banos to the year 2030, and the Public Facilities and Utilities Element addresses projected water demand and water quality issues for the same time period.

2.4.2 Impact of the General Plan on Water Demands

Legal Requirements:

§354.8(f) (2) A general description of how implementation of existing land use plans may change water demands within the basin or affect the ability of the Agency to achieve sustainable groundwater management over the planning and implementation horizon, and how the Plan addresses those potential effects.

Merced County General Plan

Merced County depends heavily on groundwater for water supply and the Water Element of the General Plan indicates that "the use of surface water supplied by the irrigation districts is decreasing during droughts, while the pumping of groundwater for irrigation has been increasing" (Note that the 2030 Merced County General Plan was adopted in 2013, prior to the enactment of SGMA and development of this GSP). According to the Merced County General Plan Background Report (2013), the County's population also increased from 178,919 to 240,925 between 1990 and 2005, which corresponds to a growth rate of approximately 2%. By 2030, the total population of Merced County is projected to be 390,167.

Based on these projections, 63% of this population growth is expected to be concentrated within existing incorporated cities; therefore, it is anticipated that incorporated cities will also absorb approximately 63% of the projected 54,600 new housing units to be added countywide by 2030. Job forecasts included in the Merced County General Plan Background Report (2013) anticipate growth in the service and retail industries and a significant decrease in farming and agricultural positions. According to these projections, which encompass the 25-year planning period from 2005 to 2030, "over half of new jobs will require additional acreage of retail and other uses." Projections include a 25-year demand of 74 acres for general office space, 262 acres for industrial uses, and 195 acres for retail establishments. Total commercial demand is estimated to be 530 acres over the 25-year planning period, an average of 21 acres per year. Institutional space demand is estimated at 64 acres over this same period, an average of 2.6 acres per year (Merced County General Plan Background Report, 2013).

Incorporated cities within the County will absorb a significant portion of this projected employment-related development. The UC Merced campus and the Mid-California International Trade District at Castle, both located within the County but outside of the Delta-Mendota Subbasin, are also projected to spur economic growth. The UC Merced campus has a projected buildout year of 2030 and is expected to generate approximately 42,000 new residents and a demand of 222 acres of commercially developed land in the County, aside from the campus. Plans for the 1,900-acre Mid-California International Trade District at Castle include 8 million square feet of industrial development.

The Merced County General Plan Background Report (2013) used community and urban development plans and an assumed buildout rate of 2,000 gallons per day per acre to calculate an estimated future urban water demand of 147,994 AFY by 2030. According to the 2030 Merced County General Plan Environmental Impact Report (2013), projected urban development is expected to require up to an additional 92,000 AFY under full buildout conditions, and the preservation and promotion of agricultural lands under the General Plan would also likely increase water demand.

The Merced County General Plan Background Report also recognizes the importance of the GEA and the benefits of protecting it from incompatible land uses: “Wise planning, which incorporates measures to buffer the GEA, the East Merced Vernal Pool Grasslands, the Merced River riparian corridor, and the San Joaquin River Corridor from incompatible land uses such as residential housing and commercial development, is key to ensuring the perpetuation of this irreplaceable and economically important resource for future generations.” (Merced County General Plan Background Report, 2013). The General Plan incorporates procedures by which the County must consult with GWD, CDFW, USFWS, and waterfowl organizations when a potentially incompatible land use is proposed within or near the GEA. The County’s commitment to maintaining habitat values and compatible land uses within the Plan Area means that water demands in the Plan Area are unlikely to significantly increase in the future.

<u>City of Los Banos General Plan</u>
The largest community adjacent to the Grassland Plan Area is the City of Los Banos located to the west. Portions of the Grassland Plan Area lie within the City of Los Banos sphere of influence and planning area. Los Banos is entirely dependent on groundwater, and the City’s water supply consists exclusively of extracted groundwater from the Delta-Mendota Subbasin. According to the City of Los Banos 2030 General Plan Update, projected water demand for the year 2030 is 20,787 AFY. Annual pumping currently exceeds 8,000 AFY. The City is also concerned with the quality of its potable water. The primary constituent of concern is arsenic, although other constituents of concern include TDS, boron, chloride, and organic compounds (City of Los Banos 2030 General Plan Update, 2009).

According to the Land Use Element of the City of Los Banos 2030 General Plan Update, total population for the City of Los Banos is projected to grow 4.1-4.2% to reach 90,400 residents and 27,470 households by the year 2030. Furthermore, buildout by the year 2030 is expected to include development up to 3.7 million square feet of office space, up to 8.9 square feet of retail and commercial space, and up to 10.4 million square feet of industrial and employment park space. Although the latest official U.S. Census data is from 2010, the U.S. Census Bureau provides an estimated population of 39,183 residents in the City of Los Banos for the year 2017, which comprises an 8.9% growth rate from 2010 to 2017.

<u>Other Nearby Communities</u>
The Cities of Newman and Gustine are within a few miles of the northwestern part of the Plan Area. The City of Dos Palos lies to the southeast.

2.4.3 Impact of GSP on Land Use Plan Assumptions

Legal Requirements:

§354.8(f) (3) A general description of how implementation of the Plan may affect the water supply assumptions of relevant land use plans over the planning and implementation horizon.

As mentioned above, there is only one General Plan within the Plan Area. The General Plan section that covers water supply is summarized in this section.

Merced County General Plan

Water is a critical resource for the Merced County economy and for the quality of life of its residents. Future growth and agricultural production are dependent upon surface and groundwater supplies. Like the majority of California, regions within Merced County have experienced problems with water supply and quality. The Water Element of the General Plan addresses water resource issues, such as water supply, water quality, and watershed management. Goals and policies within the Water Element are organized under the following headings: Water Supply, Water Quality, Water Reuse and Conservation, Watershed Management, and Interagency Coordination. The relevant policies are listed below:

- Policy W-1.1: Countywide Water Supply (MPSP/IGC) - Ensure that continued supplies of surface and groundwater are available to serve existing and future uses by supporting water districts and agencies in groundwater management and water supply planning; requiring that new development have demonstrated long-term water supply; and assisting both urban and agricultural water districts in efforts to use water efficiently.
- Policy W-1.3: Agricultural Water Study (MPSP/IGC) - In cooperation with local water agencies and districts, maintain the detailed General Plan study of countywide water use and needs for agriculture with periodic updates and with information that can be widely shared and publicized.
- Policy W-1.5: New Well Guidelines (RDR/IGC) - Coordinate with the cities and special districts in developing Countywide guidelines regarding the location and construction of new water wells.
- Policy W-1.6: Surface Water Storage (SO) - Support water agencies in the exploration of additional surface water storage opportunities.
- Policy W-1.8: Single User Well Consolidation (IGC) - Encourage consolidation of single user wells into local water districts (with management plans) where feasible.
- Policy W-3.1: Water Availability and Conservation (SO/PI) - Support efforts of water agencies and districts to prevent the depletion of groundwater resources and promote the conservation and reuse of water.
- Policy W-5.1: Countywide Water Supply Study (RDR/MPSP/PSR) - Prepare and regularly update a comprehensive water supply study that includes all four groundwater basins and three hydrologic zones and takes into consideration activities in neighboring counties and the region. The plan shall consider reductions in Federal and State water deliveries in the western part of the County and anticipated reductions in water supplies due to climate change.
- Policy W-5.2: Master Plan Development (IGC) - Coordinate with all agricultural and urban water districts to develop water supply master plans to guide future groundwater basin water supplies through regional solutions.
- Policy W-5.3: Water Forum (IGC/FB) - Support a countywide water forum to coordinate long-term water demand and supply programs that emphasize sustainability in the County consistent with approved Interagency Regional Water Management Plans.

Nothing in this Plan will adversely affect or alter the assumptions and policies in the County General Plan. Coordination between the GGSA and the County will be ongoing, especially in light of the Memorandum of Understanding between the MCDMGSA and GGSA to coordinate SGMA implementation and enforcement.

2.4.4 Permitting New or Replacement Wells

Legal Requirements:

§354.8(f) (4) A summary of the process for permitting new or replacement wells in the basin, including adopted standards in local well ordinances, zoning codes, and policies contained in adopted land use plans.

Within the boundaries of the GGSA, the Merced County Department of Public Health, Division of Environmental Health (MCDEH) manages well permitting programs pursuant to Sections 9.27 and 9.28 of the Merced County Code.

Section 9.27 of the Merced County Code contains the Groundwater Mining and Export Ordinance which prohibits the unpermitted construction of wells. The Ordinance recognizes that the export of groundwater from inside Merced County to outside of the groundwater basin in which it originates may yield adverse economic and physical impacts to beneficial users of groundwater, stemming from increased groundwater overdraft, land subsidence (if pumping from the lower aquifer), and uncontrolled movement of inferior quality groundwater. Any proposal for such groundwater “mining” and export requires a permit from the County. Furthermore, all new wells must be metered with an approved water measuring device and all persons extracting groundwater within the County from wells permitted under 2015’s Groundwater Mining and Export Ordinance of Merced County, including public water agencies, must submit water level and pumping data annually to MCDEH.

Section 9.28 of the Merced County Code contains the Well Ordinance which further describes the permitting process for water well construction, modification, or destruction. Specifically, a permit will not be issued unless all of the required information is provided, and the well design is in compliance with all of the adopted standards set forth in Section 9.27 and 9.28 of the Merced County Code. These standards are based on the DWR Bulletin 74-81, “Water Well Standards,” and State of California Bulletin 74-90, “Monitoring Well Standards and Cathodic Protection Well Standards.”

Well Construction and Destruction Permit Applications and instructions for completion are available on the MCDEH’s website (http://www.co.merced.ca.us/2247/Well-Systems). The well permit application is a 6-page document which requires attachment of a detailed, scaled plot plan. Completed applications are reviewed by MCDEH to determine the purpose of the well, the proposed pumping volume, and any potential environmental impacts. Permit review time varies by project complexity, and projects with potential for environmental impacts or projects requiring additional analysis may be subject to environmental review pursuant to the California Environmental Quality Act (CEQA).

2.4.5 Land Use Plans Outside the Basin

Legal Requirements:

§354.8(f) (5) To the extent known, the Agency may include information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management.

There are no general plans outside the Basin that would affect the Plan Area.

2.5 Additional GSP Components

Legal Requirements:

§354.8(g) A description of any of the additional Plan elements included in the Water Code Section 10727.4 that the Agency determines to be appropriate.

2.5.1 Saline Water Intrusion

Saltwater intrusion is the induced flow of seawater into freshwater aquifers primarily caused by groundwater development near the coast and is a major concern commonly found in coastal aquifers around the world. Where groundwater is being pumped from aquifers that are in hydraulic connection with the sea, induced gradients may cause the migration of saltwater from the sea toward a well, making the freshwater well unusable.

Given the distance separating the Plan Area from the Pacific Ocean, saltwater intrusion from the ocean into the freshwater aquifer is not a concern. However, groundwater with naturally occurring elevated concentrations of salts does exist in the local aquifers. As part of the Grassland Bypass Project, the GGSA and the Grassland Basin Drainers plan to install new groundwater monitoring wells along the common boundary between the Plan Area and the San Joaquin River Improvement Project to the south. The results of this monitoring will be incorporated into future GSP updates.

Another factor to consider is the interface between the freshwater zone and the saline water zone. This represents a flow divide and defines the bottom of the fresh groundwater system in the basin. The base of freshwater, or the depth at which elevated specific conductance is encountered, has been characterized as the boundary where the concentration of specific conductance is over 3,000 µS/cm (Page, 1973). The base of freshwater varies throughout the basin and is discussed in detail in Section 3.1 – Hydrogeologic Conceptual Model.

2.5.2 Wellhead Protection

A Wellhead Protection Area (WHPA) is defined by the federal Safe Drinking Water Act Amendments of 1986 as "the surface and subsurface area surrounding a water well or wellfield supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield." The WHPA may also be the recharge area that provides the water to a well or wellfield. Unlike surface watersheds, which can be easily determined from topography, WHPAs can vary in size and shape depending on subsurface geologic conditions, the direction of groundwater flow, pumping rates, and aquifer characteristics.

The Federal Wellhead Protection Program was established by Section 1428 of the Safe Drinking Water Act Amendments of 1986. The purpose of the program is to protect groundwater sources of public drinking water supplies from contamination, thereby eliminating the need for costly treatment to meet drinking water standards. The program is based on the concept that the development and application of land use controls, usually applied at the local level, and other preventative measures can protect groundwater.

The 1996 federal Safe Drinking Water Act Amendments require each state to develop and implement a Source Water Assessment Program. Section 11672.60 of the California Health and Safety Code requires the Department of Health Services (DHS, the precursor to the California Department of Public Health) to develop and implement a program to protect sources of drinking water, specifying that the program must include both a Source Water Assessment Program and a wellhead protection program. In response to both legal mandates, DHS developed the Drinking Water Source Assessment and Protection (DWSAP) Program. California's DWSAP Program addresses both groundwater and surface water sources. The groundwater portion of the DWSAP Program serves as the state's Wellhead Protection Program. DHS submitted the DWSAP Program to the U.S. Environmental Protection Agency (EPA) in January 1999. The EPA approved the DWSAP as California's Wellhead Protection Program in January 1999. In November 1999, the EPA gave final approval of the DWSAP Program as California's source water assessment and protection program. DHS was responsible for the completion of all assessments by May 2003. Wellhead Protection Programs are not regulatory in nature, nor do they address specific sources. They are designed to focus on the management of the resource rather than control a limited set of activities or contaminant sources.

Wellhead protection is performed primarily during design and can include requiring annular seals at the well surface, providing adequate drainage around wells, constructing wells at high locations, and avoiding well locations that may be subject to nearby contaminated flows. Wellhead protection is required for potable water supplies and is recommended but not generally required for agricultural wells.

Contaminants from the surface can enter an improperly designed or constructed well along the outside edge of the well casing or directly through openings in the wellhead. The well is the direct supply source to the water user, and as such, contaminants entering the well could be pumped out and discharged directly into the distribution system. Therefore, proper well design, construction, and site grading are essential to any wellhead protection program in order to prevent intrusion of contaminants into the well from surface sources.

Wells constructed in the Plan Area are designed and constructed in accordance with DWR Bulletin 74-81 and 74-90. A permit is needed from the County to construct a new well. DWR Bulletins 74-81 and 74-90 provide specifications pertaining to wellhead protection, including:

- Methods for sealing the well from intrusion of surface contaminants.
- Covering or protecting the boring at the end of each day from potential pollution sources or vandalism.
- Site grading to assure drainage is away from the wellhead.

2.5.3 Migration of Contaminated Groundwater

Groundwater can become contaminated from natural sources or numerous types of human activities. Residential, municipal, commercial, industrial, and agricultural activities can all affect groundwater quality. Contaminants may reach groundwater from activities on the surface, such as releases or spills from stored industrial wastes; from sources below the surface but above the water table, such as septic systems or leaking underground petroleum storage systems; from structures beneath the water table, such as wells; or from contaminated recharge water. Depending on its physical, chemical, and biological properties, a contaminant that has been released into the environment may move within an aquifer in the same manner that groundwater moves (Some contaminants, because of their physical or chemical properties, do not always follow groundwater flow). It is possible to predict, to some degree, the transport within an aquifer of those substances that move along with groundwater flow. For example, both groundwater and certain contaminants flow in the direction of the topography from recharge areas to discharge areas. Soils that are porous and permeable tend to transmit water and certain types of contaminants with relative ease to an aquifer below.

Just as groundwater generally moves slowly, so do contaminants in groundwater. As a result, contaminants tend to remain concentrated in the form of a plume that flows along the same path as the groundwater. The size and speed of the plume depends on the amount and type of contaminant, its solubility and density, and the velocity of the surrounding groundwater. Contaminants can also move into the groundwater system through macro-pores—root systems, animal burrows, abandoned wells, and other systems of holes and cracks that supply pathways for contaminants. In areas surrounding pumping wells, the potential for contamination increases because water from the zone of contribution, a land area larger than the original recharge area, is drawn into the well and the surrounding aquifer. Under certain conditions, pumping can also cause the groundwater (and associated contaminants) from another aquifer to enter the one being pumped. This phenomenon is called inter-aquifer leakage. Thus, properly identifying and protecting the areas affected by well pumping is crucial to maintaining groundwater quality.

Contamination of groundwater can result in poor drinking water quality, loss of water supply, degraded surface water systems, high cleanup costs, high costs for alternative water supplies, and/or potential health problems. Several federal laws help protect groundwater quality:

- The Safe Drinking Water Act (SDWA) establishes three drinking water source protection programs: the Wellhead Protection Program, the Sole Source Aquifer Program, and the Source Water Assessment Program, which also call for regulation of the use of underground injection wells for waste disposal and provide EPA and the states with the authority to ensure that drinking water supplied by public water systems meets minimum health standards.
- The Clean Water Act regulates groundwater that is shown to have a connection with surface water. It sets standards for allowable pollutant discharges to surface water.
- The Resource Conservation and Recovery Act (RCRA) regulates the treatment, storage, and disposal of hazardous and nonhazardous wastes.
- The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) authorizes the government to clean up contamination or sources of potential contamination from hazardous waste sites or chemical spills, including those that threaten drinking water supplies. CERCLA includes a “community right-to-know” provision.
- The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) regulates pesticide use.
- The Toxic Substances Control Act (TSCA) regulates manufactured chemicals.

In addition, several State of California online databases provide information and data on known groundwater contamination, planned and current corrective actions, investigations into groundwater contamination, and groundwater quality from select water supply and monitoring wells:

California Water Resources Control Board: The State of California Water Resources Control Board (SWRCB) maintains an online database that identifies known contamination cleanup sites, known leaky underground storage tanks, and permitted underground storage tanks. The online database contains records of investigation and actions related to site cleanup activities at http://geotracker.waterboards.ca.gov.

The Department of Toxic Substance Control: The State of California Department of Toxic Substances Control (DTSC) provides an online database with access to detailed information on permitted hazardous waste sites and corrective action facilities, as well as existing site cleanup information. Information available through the online database includes investigation, cleanup, permitting, and/or corrective actions that are planned, being conducted, or have been completed under DTSC's oversight. The online database can be accessed at http://www.envirostor.dtsc.ca.gov.

Groundwater Ambient Monitoring and Assessment Program: The State Water Resources Control Board GAMA (Groundwater Ambient Monitoring and Assessment) program collects data by testing untreated raw water for naturally occurring and man-made chemicals and compiles collected data into a publicly accessible online database. The online database can be accessed at http://geotracker.waterboards.ca.gov/gama/.

The Plan Area does not include any urban or industrial areas and the risk of groundwater contamination from chemical spills or leaks is not considered significant. Delivered water must meet specific quality requirements for managed wetlands. However, adjacent to and upgradient of the southern boundary of the Plan Area lies the 97,000-acre Grassland Basin Drainers (GBD). The GBD agricultural lands historically drained their subsurface drainage (tile) water to GWD for use in managing the wetlands in the District. This practice was terminated in 1986 with the discovery of bird deformities caused by elevated concentrations of selenium in the water. Since 1986 the GBD have disposed of their drainage water in the San Joaquin River through use of the San Luis Drain and Mud Slough (the Grassland Bypass Project). The agreement for use of the San Luis Drain for drainage water expires at the end of 2019, and because of this, the GBD have developed a project called the San Joaquin River Improvement Project (SJRIP).

The SJRIP includes the irrigation of salt-tolerant crops with drainage water on approximately 6,000 acres of land that is adjacent to and upgradient from the Plan Area. GWD has worked closely with the GBD to manage the use of drainage water in a manner that minimizes impacts to the habitat in the District. This cooperation includes the development of a series of monitoring wells that are to be installed in 2019. The wells will be used to monitor the quality and movement of groundwater along the southern border of the Plan Area and to identify and minimize any potential problems that could occur due to possible migration of groundwater containing elevated concentration of salt and selenium. There is a potential for contamination of usable groundwater supplies and impacts on the habitat, which if found to be occurring must be monitored and mitigated. As the monitoring wells are installed, they will be added to the monitoring well network of the GGSA.

2.5.4 Well Abandonment/Well Destruction Program

Well abandonment generally includes properly capping and locking a well that is no longer used or unusable. Well destruction includes completely filling in a well in accordance with standard procedures. Proper well abandonment and destruction are necessary to protect groundwater resources and public safety. Improperly abandoned or destroyed wells can provide a conduit for surface or near-surface contaminants to reach the groundwater. In addition, undesirable mixing of water with different chemical qualities from different strata can occur in improperly destroyed wells.

California Well Standards, published as DWR Bulletin 74, represent minimum standards for well construction, alteration, and destruction in order to protect groundwater. In California, cities, counties, and water agencies have regulatory authority over wells and can adopt local well ordinances that meet or exceed the statewide Well Standards. In Merced County, well construction and destruction programs are permitted and managed by the Merced County Department of Public Health pursuant to Section 9.28 of the Merced County Code, which requires that all abandoned wells be destroyed according to State standards documented in DWR Bulletins 74-81 and 74-90.

2.5.5 Replenishment of Groundwater Extractions

During the hydrologic cycle, replenishment occurs naturally when rain, stormwater, and the flow from rivers, streams, and creeks seep into an aquifer. Water also soaks into the ground as farmers irrigate fields and orchards and as wetland managers supply water to habitat. Replenishment within the context of groundwater management is accomplished through recharge at a rate that exceeds baseline conditions and maintains or improves groundwater elevation levels. Two recharge methods can be used: direct spreading and aquifer injection. There is also in-lieu recharge in which an alternative source is provided to users who would normally use groundwater, thereby leaving groundwater in place for later use and increasing the potential to improve groundwater levels.

Most of the Plan Area wetlands are managed to simulate historic wetland cycles. Prior to development in the Central Valley, wetlands were abundant and standing water was common in the valley floodplains. Unlike some other water users in the state, the GGSA does not need to engage in additional groundwater recharge projects to replenish the aquifer, given the current and historic low level of pumping. Management of the land in the Plan Area essentially acts as one large recharge system. The entire water conveyance system consists of unlined open canals which provide a mechanism for recharge. Water contained in duck ponds and other managed wetlands also contributes to groundwater replenishment. For specific information on recharge and replenishment of groundwater in the GGSA and MCDMGSA areas, refer to **Chapter 3** – Basin Setting.

The neighboring agencies with surface water infrastructure or access to surface water include the SJRECWA (Central California Irrigation District, Henry Miller Reclamation District, Firebaugh Canal Company, and Columbia Canal Company), and members of the SLDMWA including San Luis Water District, Del Puerto Water District, and Panoche Water District. It is significant that neighboring agencies have access to reliable surface water as this reduces overall dependence on groundwater in the region. Having a regional reliable surface water supply reduces the fringe effects of nearby groundwater use. Each neighboring district may implement and manage their own groundwater recharge projects to contribute to the overall replenishment of the aquifers.

2.5.6 Conjunctive Use

See **Section 2.3.3.**

2.5.7 Well Construction Policies

Proper well construction is important to ensure well reliability and longevity and the protection of groundwater resources from contamination. All of the Plan Area members follow Merced County's well construction standards (MCC 9.28.060) when constructing municipal and agricultural wells. Merced County has adopted a well construction permitting program consistent with State Well Standards (DWR Bulletins 74-81 and 74-90) with any differences intended to reflect the unique conditions and needs of Merced County in order to help assure proper construction of private wells. The County maintains records of all wells drilled in the Plan Area. Private domestic or agricultural wells can be drilled with a county permit. State well standards address annular seals, surface features, well development, water quality testing, and various other topics. Refer to DWR Bulletins 74-81 and 74-90 for more details. Well construction policies intended to ensure proper wellhead protection are discussed in **Section 2.5.2**.

2.5.8 Groundwater Projects

The two member agencies of the GGSA coordinate together to develop projects to meet wetland water demands and will develop future projects to meet and maintain sustainability goals. These agencies have a shared responsibility for development and operation of water sources, recharge, storage, conservation, recycling, and extraction projects within the Plan Area. Projects to develop and secure additional water storage and surface water supplies are key to ensuring wetland and irrigation water demands can be met without compromising groundwater sustainability. Chapter 6 provides descriptions, estimated costs, and estimated yield for numerous proposed projects. The GGSA will also support measures to identify funding and implement regional projects that help the Plan Area and the Subbasin, including adjacent state and federal wildlife refuges and private lands, achieve groundwater sustainability.

CDFW is working on projects that will improve infrastructure and monitoring efforts. CDFW is replacing and installing infrastructure (which includes radial gates) at the Volta Wildlife Area. Measurement flumes are being installed along Los Banos Creek and Salt Slough in four locations to assist with monitoring and reporting.

2.5.9 Efficient Water Management Practices

There are no urban communities or residential areas within the Plan Area, and there are very few agricultural water users. Merced County's Groundwater Ordinance requires all new wells to be metered and users to provide annual water-use reports. Furthermore, all wells that are pumped to provide water for wetland habitat in the GGSA are already metered and monitored. The refuge agencies in the GGSA strive to utilize water efficiently since they rarely receive their full entitlement under federal law, which is needed to optimally manage the habitat. Under their water supply contracts with the USBR, the three refuge water agencies are required to submit Water Management Plans (WMP) every five years and also to provide annual reports on water usage. The GWD WMP details the usage of water in the GRCD as well as provides information on the water conservation and efficiency efforts of the District. Water use efficiency projects include the replacement of aging water delivery infrastructure with modern facilities that enable the water operators to minimize spill from the conveyance system while improving the ability to meet demands. The GWD is also in the process of constructing a water recirculation project (North Grasslands Water Conservation and Water Quality Control Project) that will save the District approximately 14,000 AFY. The latest WMP is included in **Appendix C** and provides further detail on GWD's water management practices and its efforts to conserve and efficiently use its limited surface water supply.

CDFW land management within the Plan Area has included the implementation of water conservation and reuse projects dating back to the early 1980s. A summary of those efforts by Management Unit is included below.

Los Banos Wildlife Area (LBWA): The LBWA is located within both GWD and San Luis Canal Company (SLCC). Water supplies received from SLCC are made up of a combination of CVP contract water and operational spill into the Boundary Drain and Salt Slough. Projects to conserve and reuse available water include:

1. Underground pipeline distribution systems installed throughout the area to conserve conveyance and evaporative losses. These systems irrigate wetlands, upland grassland habitat, and grain crops grown for wildlife nesting habitat and wildlife food resources.
2. Recirculation and reuse at LBWA include four low-lift pumps that divert both contract water and operational spill from the Boundary Drain and Salt Slough. Recirculation and reuse are also accomplished by two low-lift pump stations in Button Willow Lake. These pumps allow the reuse of 10-15% of the total water used. The "field 9" low-lift pump allows for water to be moved into Ruth Lake and pumped into the San Luis Canal, benefiting both CDFW lands and Grassland wetlands.
3. Water measurement is being improved by the installation of 4 Replogle flumes being installed along the GWD San Luis Canal.

Mud Slough Unit:
The Mud Slough Unit was restored from agricultural production to managed wetlands in the early 1990s. Using the existing water infrastructure, it was designed to maximize water conservation, recirculation, and reuse of available water supplies. Three recirculation pump stations combined with pipelines allow for recirculation of 40% or more of the CVP contract water deliveries received from GWD and SLCC.

Volta Wildlife Area: Recirculation is accomplished at Volta by returning water from managed wetlands on the west side to "field 10." This water is then used to flood and maintain habitat in the Volta expansion unit to the north. The expansion unit also has a low-lift pump located at the northern boundary, which can recirculate or lift water delivered from the GWD Mosquito Ditch into the expansion lands. An estimated 40% of the water delivered to Volta can be reused.

North Grassland Wildlife Area (NGWA): The NGWA is comprised of three distinct units. The Salt Slough and Gadwall Units are located within the GRCD and the China Island Unit is located outside the GRCD.

Salt Slough Unit:
CVP contract surface water is delivered by GWD through the San Luis Canal. Water distribution in the unit includes one recirculation pump, 3 low-lift diversion pumps along Salt Slough, and pipelines for irrigation. A Replogle weir has been installed at the San Luis Canal turnout for improved water measurement and management. The three Salt Slough low-lift pumps allow for reuse of water discharged from upstream users including CDFW, USFW, and SLCC. An estimated 80% of this water can be reutilized by lifting it out of the Wolfsen Drain and redistributing it for irrigation on uplands. The low-lift pump located on Wolfsen Drain can

recirculate water from the west side of Salt Slough into pipelines that go to the north end which are used to irrigate an estimated 260 acres of seasonal wetlands and 320 acres of uplands.

China Island Unit:
Surface water supplies are delivered by the Central California Irrigation District to the J lateral canal for distribution. Water distribution includes three low-lift pumps, a holding reservoir, and a pump station. Water used on managed wetlands within the management area is pumped and returned to the main distribution ditch (J lateral) and reused. The pumping station is used to move water onto the San Joaquin River flood plain. Although China Island does not divert water from the San Joaquin River, it does flood periodically in wet years. Reuse accounts for 25% of the unit's water use.

Gadwall Unit:
Surface water is delivered to the Gadwall Unit by GWD via the San Luis Canal and the Gadwall Deep Channel for distribution. Three low-lift pumps recirculate water for use in the unit. Reuse accounts for 25% of the unit's water use. Planned future projects by CDFW to maximize water use are limited at this time to installing Repogle weirs to improve water measurement.

2.5.10 Relationships with State and Federal Agencies

A list of plan participants in **Section 2.2.1** outlines all of the state and federal entities that hold interests in the GGSA or MCDMGSA area described in this Plan. The Plan Area also has ties to other state and federal agencies not listed in **Section 2.2.1**. Those relationships that are common to all water agencies, such as regulation under SGMA by DWR, are not discussed here.

One other relationship that has unique ties to the Plan Area is the United States Bureau of Reclamation (USBR). USBR is the lead agency managing the Central Valley Project (CVP), a complex, multi-purpose network of dams, reservoirs, canals, hydroelectric power plants, and other facilities. The CVP both provides flood protection and supplies domestic and industrial water in the Central Valley. Private, state, and federal lands in the Plan Area have long-term contracts with USBR to receive CVP water for habitat management under the requirements of the CVPIA.

2.5.11 Land Use Planning

Apart from the land that is managed by state and federal wildlife agencies, Merced County is the only participating agency with direct land-use planning authority. However, all participating agencies have an interest in land-use planning policies and how they will impact continued water supplies. **Figure 2-5** is a map showing land uses in the Plan Area.

Land-use policies are documented in various reports such as General Plans, Specific Plans, and plans for proposed developments. Updating some of these plans is a multi-year process and not all of the plans could be fully updated concurrently with GSP development. These plans are expected to be modified gradually over time to be consistent with the goals and objectives of this GSP.

2.5.12 Impacts to Groundwater Dependent Ecosystems

GDEs are defined under SGMA as ecological communities of species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface (23 CCR § 351(m)). GDEs are characterized in two primary categories: Wetland GDEs and Vegetative GDEs. A Wetland GDE is characterized by the presence of hydric soils, independent of wetland vegetation being present. Vegetative GDEs indicate the presence of (1) obligate wetland species that are dependent on hydric soils, and in some instances, (2) facultative species occurring in wetlands. Facultative species occur in wetlands in 67 to 99 percent of cases but can sustain in upland environments. The Vegetative GDE characterization for facultative species is limited to only the facultative species that are dependent on groundwater to survive. A Ducks Unlimited (DU) wetland delineation dataset was used to develop a Wetland GDE map within the Plan Area and the Nature Conservancy's Natural Communities Dataset Viewer (NC Dataset Viewer) was used to evaluate Vegetative GDEs. (**Figure 2-10** and **Figure 2-11**). Many of the possible GDEs in **Figure 2-10** and **Figure 2-11** occur within habitat managed by GWD, GRCD, and state and federal entities within the Plan Area. The managed habitat relies on applied water to meet evapotranspiration (ET) demands and hydrology influencing the GDEs is anticipated to be better understood with future monitoring as outlined in Chapter 5.

The Vegetative GDE map conservatively estimates that all vegetation types identified by The Nature Conservancy (TNC) as natural communities commonly associated with groundwater (NCCAG) are possible GDEs. Not all Wetland NCCAGs identified by TNC were included on the Wetland GDE map because (1) ponded wetlands within the Plan Area are surface-water dependent and generally contain very shallow-rooted plan species that are unlikely to access groundwater and (2) wetland data for the Plan Area is out-of-date, inconsistent, and inaccurate. Wetland delineations produced by DU were used to better define the Wetland GDEs in the Plan Area. Wetland NCCAGs identified by TNC following sloughs in the northeastern portion of the Plan Area were also included as possible wetland GDEs, supplementing the DU wetland delineations. Historically, the shallow groundwater levels in the Plan Area are generally stable and are projected to continue a sustainable trend into the planning horizon; therefore, groundwater pumping is not anticipated to have a significant impact on GDEs. GDEs and their relationship to the groundwater conditions will continue to be evaluated, and revisions will be made in future GSP updates if appropriate.

Table 2-4: Groundwater-Dependent Ecosystem Acreage

Possible Groundwater Dependent Ecosystems – Acreage[1]		
Grassland Plan Area		
GGSA Area (Subarea 1)	Possible Wetland GDE Acreage	Possible Vegetative GDE Acreage
Managed Wetlands	38,047	9,057
San Luis National Wildlife Refuge Unites	1,657	1,074
CA State Wildlife Area Units	4,210	1,484
MCDMGSA GSP Area		
MCDMGSA Area (Subarea 2)	Possible Wetland GDE Acreage	Possible Vegetative GDE Acreage
Agricultural Land	338	213
San Luis National Wildlife Refuge Units	3,483	2,416
CA State Wildlife Area Units	2,687	510
Private Wetlands	1,494	849
[1]Many acres of possible wetland GDEs overlap with acres of possible vegetative GDEs.		

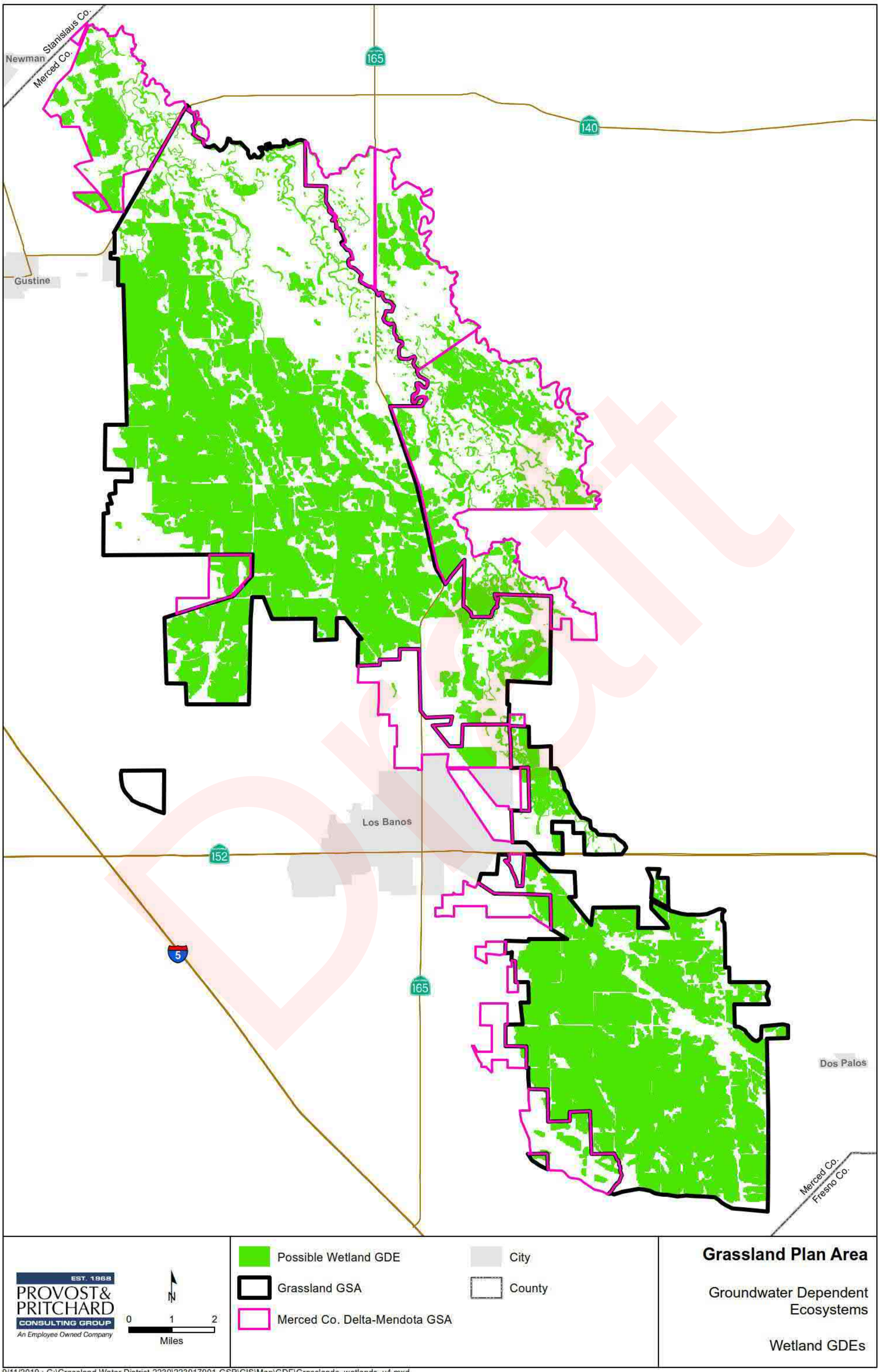


Figure 2-10: Wetland Groundwater Dependent Ecosystem Map

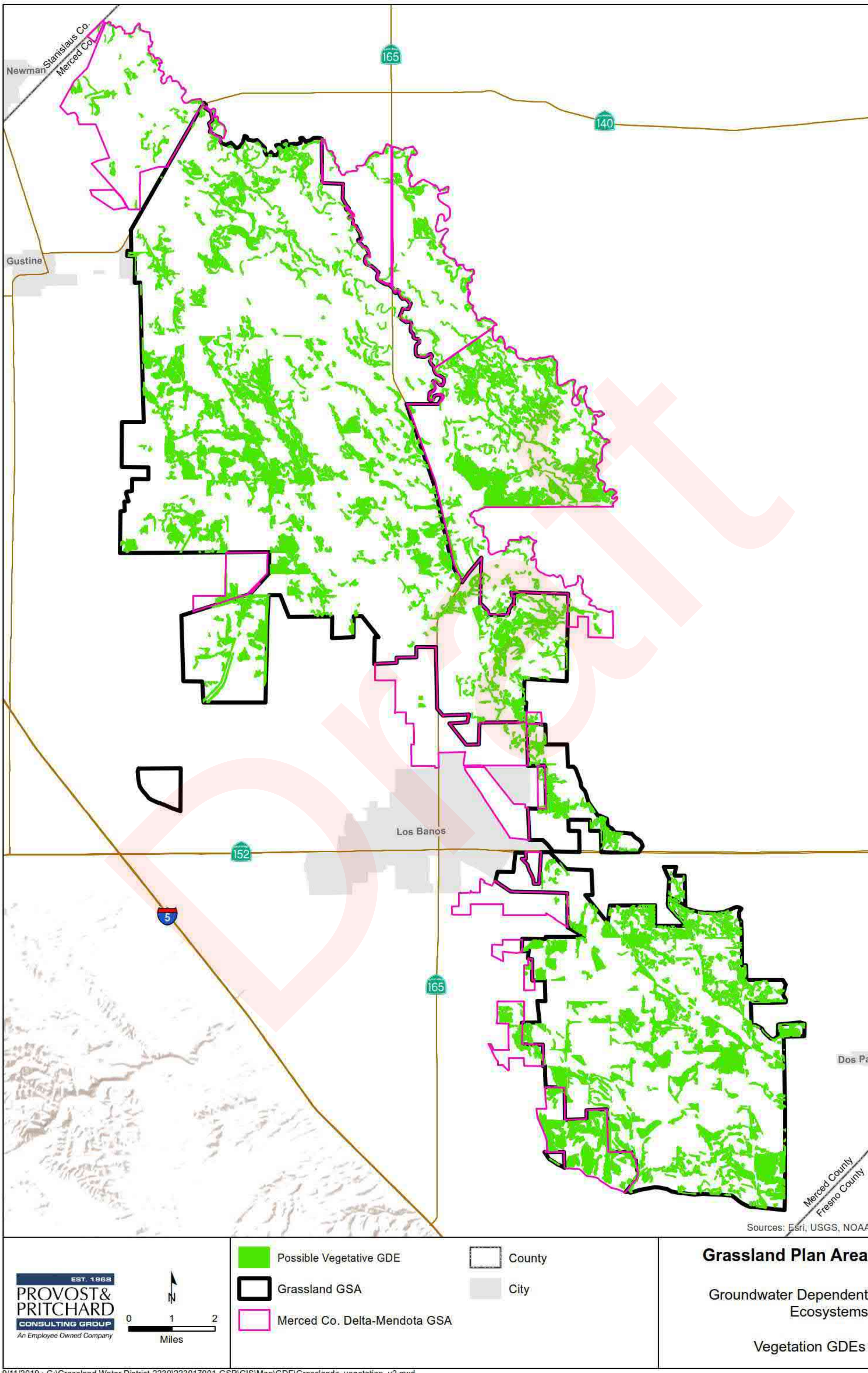


Figure 2-11: Vegetative Groundwater Dependent Ecosystem Map

2.6 Notice and Communication

2.6.1 Description of Beneficial Uses and Users

Legal Requirements:

§354.10 Each plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following: **(a) A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties.**

Pursuant to California Water Code Section 10723.2, each GSA shall consider the interests of all beneficial uses and users of groundwater as well as those responsible for implementing a GSP.

Agricultural Users – There are a limited number of agricultural water users within the Grassland Plan Area. As described in **Table 2-2**, active agricultural land uses account for approximately 5,571 acres (6% of the Plan Area) while managed wetlands, uplands, and open water account for approximately 95,318 acres (91% of the Plan Area). Many of the agricultural users rely on groundwater to meet their irrigation demands, and all of them have preexisting relationships with the agencies developing this Plan.

Domestic Well Users – There are a limited number of domestic wells within the Plan Area; most of which supply nonpotable water to temporary residences on seasonal recreational properties that have access to alternate supplies of potable water. The small number of domestic wells qualify as “de minimis extractors” under SGMA and will be excluded from certain regulatory requirements of the GSP.

Municipal Well Operators – There are no municipal wells within the Plan Area. Nearby municipal well operators within the Subbasin include the Cities of Los Banos, Newman, Gustine, and Dos Palos; the South Dos Palos County Water District, North Dos Palos Water District, Volta Community Services District, and Santa Nella County Water District. The GGSA consulted with the closest of these municipal well operators, the adjacent City of Los Banos, when forming the GSA and preparing this GSP.

Public Water Systems – The USFWS San Luis NWR headquarters and visitor center provides the only known supply of groundwater for public use within the Plan Area. The wetland water delivery systems owned and operated by GWD, CDFW, and USFWS do not provide drinking water and therefore do not qualify as a “public water system” under state law.

Local Land-Use Planning Agencies – The Plan Area lies entirely within Merced County and is adjacent to the City of Los Banos. The Districts consulted with Merced County when forming the GSA and signed a MOU with the MCDMGSA for development of this Plan. Other counties within the Subbasin include the Counties of San Joaquin, Stanislaus, Madera, and Fresno.

Environmental Users of Groundwater – The primary use of groundwater within the Plan Area is the limited environmental use of groundwater on both public wildlife refuges managed by CDFW and USFWS and private wetlands owned by landowners. Environmental users of groundwater have preexisting relationships with the member agencies of the GGSA. The Boards of Directors of the GWD and GRCD are each comprised of five members representing environmental users of water within the

GGSA Area. The Districts and Merced County consulted with CDFW and USFWS, as well as with USBR when forming the GSA and preparing the GSP.

Surface Water Users– GWD, CDFW, and USFWS hold the surface water rights that are used within the Plan Area.

Federal Government – USFWS and USBR own federal lands within the Plan Area. The GGSA consulted with both agencies when forming the GSA and preparing the GSP. Both GWD and the state and federal lands within the Plan Area have a contractual relationship with USBR and will continue to work with the federal government to meet federal water supply delivery mandates.

California Native American Tribes – There are no Native American Tribes within or adjacent to the Plan Area.

Disadvantaged Communities – Nearby disadvantaged communities include the Cities of Newman, Gustine, Los Banos, and Dos Palos, and the Census Designated Places of Santa Nella, Volta, Dos Palos Y, and South Dos Palos.

Entities listed in Water Code section 10927 that are monitoring and reporting groundwater elevations in all or part of a groundwater basin to be managed by the GGSA – The SLDMWA monitors groundwater elevations within the Subbasin. The GGSA consulted with SLDMWA when forming the GSA and preparing the GSP.

2.6.2 GSP Planning Process

§354.10 (b) A list of public meetings at which the Plan was discussed or considered by the Agency.
(c) Comments regarding the Plan received by the Agency and a summary of any responses by the Agency.

Engagement with groundwater users occurs in the following phases of the development and implementation of the GSP:

Formation of the GSAs
GSA Formation and Coordination has been completed. The Plan Area includes all of the GGSA and portions of the MCDMGSA. They have agreed to draft a single GSP to help facilitate sustainable groundwater management in the area. More information on the GSAs can be found on the SGMA Portal: https://sgma.water.ca.gov/portal/#gsa.

Grassland Groundwater Sustainability Agency
This phase stretched from 2015 through 2016 and consisted of forming the GGSA and establishing and maintaining the List of Interested Parties. Stakeholder input was utilized during the GSA formation phase, as beneficial users and stakeholders with interests in groundwater usage within the GGSA boundary participated in the GGSA Formation Public Hearing and GWD Board Meetings. Public meetings were noticed in the Merced Sun-Star on November 8 and 15, 2016. The Public Hearing was held on Tuesday, November 22, 2016, at 3:00 p.m. at the GWD office.

Merced County Delta-Mendota Groundwater Sustainability Agency
The MCDMGSA resolution for formation was adopted by the County of Merced Board of Supervisors on March 21, 2017 and encompasses lands both within the Grassland Plan Area and the San Joaquin River Exchange Contractor GSA Plan Area. The County of Merced Board of Supervisors held a GSA formation public hearing on March 21, 2017, at 10:00 a.m. at the County Administration Building where beneficial users and stakeholders with interests were able to participate. The public hearing was noticed in the Merced Sun-Star on March 7 and 14, 2017.

Development of the Draft GSP
GSP development spanned from 2017 through 2020. With the objective of having the draft GSP by the third quarter of 2019, 2018 and 2019 consisted primarily of the technical development of the Plan, while simultaneously working with stakeholders for feedback and input. During this phase, the Communication & Engagement Plan was developed to outline communication efforts for the GSP development, public review, and implementation phases. During 2018 and 2019, direct interaction with stakeholder groups and other industry organizations and entities were held with the purpose of educating and informing stakeholders about SGMA and the GSP process during Delta-Mendota Subbasin Public Workshops while also soliciting feedback and input from these groups to mitigate as much as possible the negative impacts to beneficial users of groundwater. The Technical and Coordination Committees for the Delta Mendota Subbasin meet weekly at a minimum and meetings are open to the public.

Activities in the Plan Area are coordinated between the GGSA and the MCDMGSA as well as the other Basin GSAs. Coordination at the Basin level for GSP development is noted in the common chapter, which includes all decisions that have been voted on and agreed to by all Basin participants. The common chapter can be found in **Appendix A** with specific reference to coordination in **Section 8.5, Subbasin Decision Making Process**.

The GGSA and MCDMGSA public outreach efforts in which SGMA was discussed are identified in **Table 2-5** and **Table 2-6**. These efforts consisted of public GSA Board meetings, stakeholder meetings, informational fliers, and Delta-Mendota Subbasin Public Workshops.

Table 2-5: GSA Public Outreach

Grassland GSP Public Outreach		
GGSA Outreach		
November 22, 2016 Public Hearing to form GGSA Grassland Water District 200 W Willmott Ave, Los Banos, CA 93635	February 13, 2018 GGSA Board of Directors Meeting Grassland Water District 200 W Willmott Ave, Los Banos, CA 93635	May 19, 2018 GGSA Stakeholder Meeting Grassland Water District 200 W Willmott Ave, Los Banos, CA 93635
August 28, 2018 GGSA Board of Directors Meeting Grassland Water District 200 W Willmott Ave, Los Banos, CA 93635	September 8, 2018 CDFW Public Outreach Meeting Los Banos Wildlife Area 18110 Henry Miller Road Los Banos, CA 93635	May 17, 2019 GGSA Board of Directors Meeting Grassland Water District 200 W Willmott Ave, Los Banos, CA 93635
May 18, 2019 GGSA Stakeholder Meeting Grassland Water District 200 W Willmott Ave, Los Banos, CA 93635	October 1, 2019 GGSA Board of Directors Meeting Grassland Water District 200 W Willmott Ave, Los Banos, CA 93635	
MCDMGSA Public Outreach		
March 21, 2017 Public Hearing to form MCDMGSA Merced County Administration Building 2222 M Street Merced, CA 95340	August 29, 2017 MCDMGSA Board Meeting Merced County Administration Building 2222 M Street Merced, CA 95340	July 31, 2018 Merced County Board of Supervisor's Meeting Merced County Administration Building 2222 M Street Merced, CA 95340
September 18, 2018 MCDMGSA Board Meeting Merced County Administration Building 2222 M Street Merced, CA 95340	January 29, 2019 MCDMGSA Board Meeting Merced County Administration Building 2222 M Street Merced, CA 95340	Merced County Property Tax bills included an informational flyer regarding SGMA Implementation in 2017, 2018, and 2019.
May 8-10, 2019 Merced County SGMA informational and public workshop mailer to all landowners in the MCDMGSA, the Merced County portions of the Central Delta-Mendota Region GSA, and the Northwestern Delta-Mendota GSA.		

Finalization of the GSP

During mid-2019, GSP review and evaluation was the primary focus of communication and engagement efforts. After the GSP was completed in the third quarter of 2019, the public review process began. The GGSA held a public meeting to present the draft GSP on October 1, 2019. A 30-day comment period was held from October 30 to November 29, 2019, with the GSP draft posted on the GSAs' webpages for stakeholders to conveniently download and review.

Once the public review period was complete, public comments were taken into consideration and incorporated into the final version of the Grassland Plan Area GSP. [*Final Adoption Dates to be Inserted*]. The GSP was submitted to the DWR by the January 31, 2020 deadline. Following submittal, stakeholders will be given a second 60-day comment period through the DWR's SGMA portal at http://sgma.water.ca.gov/portal/. Comments will be posted to the DWR's website prior to the state agency's evaluation, assessment, and approval.

Implementation of the GSP

Implementation and reporting will begin once the plan is submitted in January 2020. Even while DWR is reviewing the GSP, implementation must proceed at the GSA level. During the implementation phase, communication and engagement efforts will be shifted to educating on and increasing awareness of the requirements and processes of reaching groundwater sustainability. Active involvement of all stakeholders is encouraged during this phase and public notices are required prior to imposing or increasing any fees.

Table 2-6: Delta-Mendota Subbasin Public Workshops

<table>
<tr><th colspan="12">Delta-Mendota Subbasin GSP Public Workshops</th></tr>
<tr><th colspan="12">Spring 2018 – Workshop #1</th></tr>
<tr><td colspan="4">Los Banos
Monday, May 14,
4:00 – 6:00 PM
SLDMWA Los Banos Administrative Office
842 6th Street, Los Banos</td><td colspan="4">Patterson
Wednesday, May 16,
4:00 – 6:00 PM
Hammon Senior Center
1033 W Las Palmas Ave, Patterson</td><td colspan="4">Mendota
Thursday, May 17,
4:00 – 6:00 PM
Mendota Public Library
1246 Belmont Ave, Mendota</td></tr>
<tr><th colspan="12">Fall 2018 – Workshop #2</th></tr>
<tr><td colspan="4">Firebaugh
Monday, October 22, 5:00 - 7:00 PM
Firebaugh Middle School MPR
1600 16th St, Firebaugh</td><td colspan="4">Los Banos
Wednesday, October 24, 4:00 - 6:00 PM
College Greens Building
1815 Scripps Drive, Los Banos</td><td colspan="4">Patterson
Thursday, October 25, 4:00 - 6:00 PM
Hammon Senior Center
1033 W Las Palmas Ave, Patterson</td></tr>
<tr><th colspan="12">Winter 2019 – Workshop #3</th></tr>
<tr><td colspan="4">Los Banos
Tuesday, February 19, 4:00 - 6:00 PM
College Greens Building
1815 Scripps Drive, Los Banos, 93635</td><td colspan="4">Patterson
Wednesday, February 20, 4:00 - 6:00 PM
Patterson City Hall
1 Plaza Circle, Patterson, CA 95363</td><td colspan="4">Santa Nella
Monday, March 4, 6:00 - 8:00 PM
Romero Elementary School MPR
13500 Luis Ave, Gustine, CA 95322</td></tr>
<tr><th colspan="12">Spring 2019 – Workshop #4</th></tr>
<tr><td colspan="3">Patterson
Monday, May 20, 4:00 - 6:00 PM
Patterson City Hall
1 Plaza Circle, Patterson, CA 95363</td><td colspan="3">Los Banos
Tues, May 21, 4:00 - 6:00 PM
College Greens Building
1815 Scripps Drive, Los Banos, 93635</td><td colspan="3">Santa Nella
Weds, May 22, 6:00 - 8:00 PM
Romero Elementary School MPR
13500 Luis Ave, Gustine, CA 95322</td><td colspan="3">Mendota
Thurs, May 23, 6:00 – 8:00 PM
Mendota Public Library
1246 Belmont Ave, Mendota 93640</td></tr>
</table>

Public Comment and Response Management:

A system for managing public comments and responses will be developed to help track all comments received and comment status. The system will outline issues by topic category to help track all feedback received. A tracking document will be maintained by GGSA staff to ensure all comments are recorded.

2.6.3 Decision-Making Process

Legal Requirements:

§354.10 (d) A communication section of the Plan that includes the following: **(1) An explanation of the Agency's decision-making process.**

The decision-making responsibility for the GSP lies with the GGSA Board of Directors at the guidance of the general manager and legal counsel. The MOA executed by GWD and GRCD on November 22, 2016, gives primary responsibility to GWD for administrating the GSA and developing and implementing this GSP. The MOA authorizes the formation of an Advisory Committee comprised of representatives from both agencies. Both GWD and GRCD approval is required for adoption of a GGSA budget, adoption of this GSP, SGMA implementation activities, enforcement actions, fees, and similar matters. The GSP was adopted during the [*date adopted*] public board meeting as Resolution XX-XXX.

The Merced County Board of Supervisors is responsible for the review, approval, and adoption of the GSP on behalf of the MCDMGSA. The GSP was adopted at the [*date adopted*] public hearing as Resolution XX-XXX.

2.6.4 Public Engagement/Public Outreach Plan

Legal Requirements:

§354.10 (d)(2) Identification of opportunities for public engagement and a discussion of how public input and response will be used.

The Grassland GSA Communication & Engagement (C&E) Plan addresses how stakeholders within the GSA's boundary will be engaged through stakeholder education and opportunities for input and public review during the development and implementation of the GSP. This plan will be updated throughout the phases. The C&E provides an overview of the Grassland GSA, its stakeholders, and decision-making processes; identifies opportunities for public engagement and discussion of how public input and responses will be used; describes how the Grassland GSA encourages the active involvement of diverse, social, cultural, and economic elements of the population within the GSA boundary; and the methods the GSA will use to inform the public stakeholders about the progress of GSP development, public review, and implementation.

The C&E is attached as **Appendix F**.

2.6.5 Encouraging Active Involvement

Legal Requirements:

§354.10 (d)
(3) A description of how the Agency encourages the active involvement of diverse social, cultural, and economic elements of population within the basin.
(4) The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions.

To promote diverse public involvement for the Delta-Mendota Subbasin GSPs, public workshops were held at various locations evenly distributed throughout the Basin. See

Table 2-6. The Delta Mendota Subbasin hosts an online website http://deltamendota.org/ and distributes a monthly progress newsletter that describes progress and decisions made at the Basin and Plan Area level. The GGSA also provides a link and information on its website http://gwdwater.org/sustainability-agency/sustainability-board-who-we-are/ about SGMA developments.

The GWD, GRCD, and GGSA Board of Directors' meetings provide opportunities for stakeholders and the public to comment on aspects of the GSP development. The GWD Board of Directors' meetings are held on the second Tuesday of each month at 3 p.m., and the GRCD Board of Directors' meetings are held on the fourth Tuesday of each month at 1:30 p.m. Both agencies' board meetings are held at the Grassland Water District office located at 200 W. Wilmott Avenue in Los Banos and are open to the public. GGSA meetings are also noticed in accordance with the Brown Act and are held at regular intervals.

The MCDMGSA meets when necessary at the County of Merced Administration Building at 2222 M Street in Merced, CA in conjunction with County of Merced Board of Supervisor Meetings. Board of Supervisor meetings are held approximately twice a month at 10:00 a.m. on Tuesdays in the Board Room.

Public outreach and meetings in which SGMA implementation within the Plan Area was actively discussed are listed in **Table 2-5**.

3 Basin Setting

3.1 Hydrogeologic Conceptual Model

3.1.1 Introduction

Legal Requirements:

§354.14(a) Each Plan shall include a descriptive hydrogeologic conceptual model of the basin based on technical studies and qualified maps that characterizes the physical components and interaction of the surface water and groundwater systems in the basin. **§354.16(g)** Identification of groundwater dependent ecosystems within the basin, utilizing data available from the Department, as specified in Section 353.2, or best available information **§354.16(c)** Seawater intrusion conditions in the basin, including maps and cross-sections of the seawater intrusion front for each principal aquifer.

The purpose of a Hydrogeologic Conceptual Model (HCM) is to provide an easy-to-understand description of the general physical characteristics of the regional hydrology, land use, geology, geologic structure, water quality, principal aquifers, and principle aquitards in the basin setting. Once developed, an HCM is useful in providing the context needed to develop water budgets and monitoring networks and to identify data gaps.

An HCM is not a numerical groundwater model or a water budget model; rather, an HCM is a written and graphical description of the hydrologic and hydrogeologic conditions that will lay the foundation for future water budget models. Refer to **Section 3.3** for information on the GSAs' water budgets. The narrative HCM description provided in this chapter is accompanied by graphical representations of the Grassland Plan Area portion of the Delta-Mendota Subbasin that portray the geographic setting, regional geology, basin geometry, and general water quality. This HCM has been prepared utilizing published studies and resources. It will be periodically updated as data gaps are addressed, and new information becomes available.

A scientific primer is offered in the HCM for the five applicable sustainability indicators in the Plan Area. Seawater intrusion is not applicable due to the Plan Area's physical distance and the geologic barriers from the Pacific Ocean. Groundwater dependent ecosystems are not addressed in the HCM, as they are identified and discussed in **Chapter 2, Section 2.5.12 Impacts to Groundwater Dependent Ecosystems**.

The following section was adapted from a report prepared by Kenneth D. Schmidt & Associates (KDSA) in December 2018 and incorporated into the GSP prepared by Provost & Pritchard Engineering Group (**Appendix B**).

This report is intended to satisfy Sections 354.14 (Hydrogeological Conceptual Model) and Section 354.16 (Groundwater Conditions) of a GSP for the GGSA and portions of the MCDMGSA. The Plan Area is split into two divisions. The North Division is north of Highway 152 and is generally bounded to the east by the San Luis Drain. Three federal wildlife refuges are located adjacent to the Northern Division and are included in the area evaluated. The South Division is located south of Highway 152 and east and north of the Central California Irrigation

District (CCID) Main Canal. The other areas include 1) private wetlands, 2) agricultural lands, 3) the San Luis National Wildlife Refuge (NWR), and 4) state refuges located in the MCDMGSA.

3.1.2 Surficial Characteristics of Basin

3.1.2.1 Topography

Legal Requirements:

§354.14(d)(1) Physical characteristics of the basin shall be represented on one or more maps that depict topographic information derived from the U.S. Geological Survey or another reliable source.

Figure 3-1 shows topographic conditions in the basin. The land generally slopes to the northeast towards the San Joaquin River. Major drainages that pass through the area are Los Banos Creek, San Luis Creek, Mud Slough, and Salt Slough. The San Joaquin River bounds the San Luis NWR to the north and Los Banos Creek joins the river north of Highway 140. Land surface elevations range from about 130 to 140 feet above mean sea level along the Main Canal south of the Southern Division to about 70 feet above mean sea level near the Highway 140 crossing of the San Joaquin River at Fremont Ford.

3.1.2.2 Surficial Geology

Legal Requirements:

§354.14(d)(2) Physical characteristics of the basin shall be represented on one or more maps that depict surficial geology derived from a qualified map including the locations of cross-sections required by this Section.

Hotchkiss and Balding (1971, Plate 1) mapped the surficial geology of the Tracy-Dos Palos Area, which includes the area evaluated. **Figure 3-2** shows the part of their map that covers the area evaluated. Except in the southwest edge of the Plan Area, surficial deposits are mapped as flood basin deposits. These are unconsolidated clay, silt, sand, and gravel deposits on the floodplain of the San Joaquin River. Alluvial deposits are present along the southwest edge of the Plan Area, primarily along the San Luis Creek and Los Banos Creek alluvial fans. These are also unconsolidated clay, silt, sand, and gravel.

3.1.2.3 Topsoils

Legal Requirements:

§354.14(d)(3) Physical characteristics of the basin shall be represented on one or more maps that depict soil characteristics as described by the appropriate Natural Resource Conservation Service soil survey or other applicable studies.

Figure 3-3 is taken from the U.S. Soils Conservation Service report on soil in the Los Banos area and shows the major types of topsoils in the area evaluated. The soils have been divided into coarse-grained, intermediate-textured, and clay and silty clay. Most of the coarse-grained soils are in the north part of the area. In the south part of the area the predominant soils are clay and silty clay, and few coarse-grained soils are present.

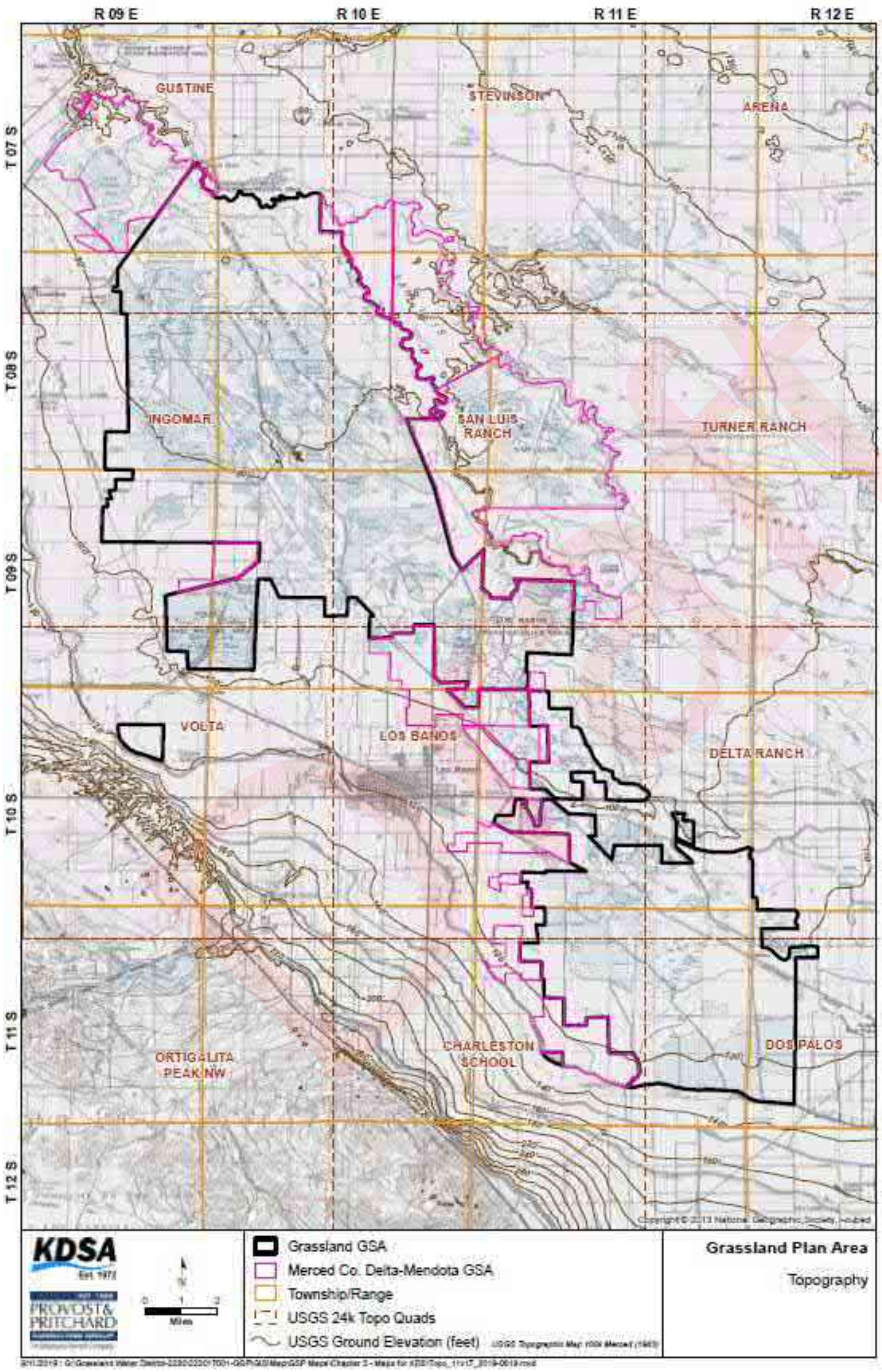


Figure 3-1: Topography

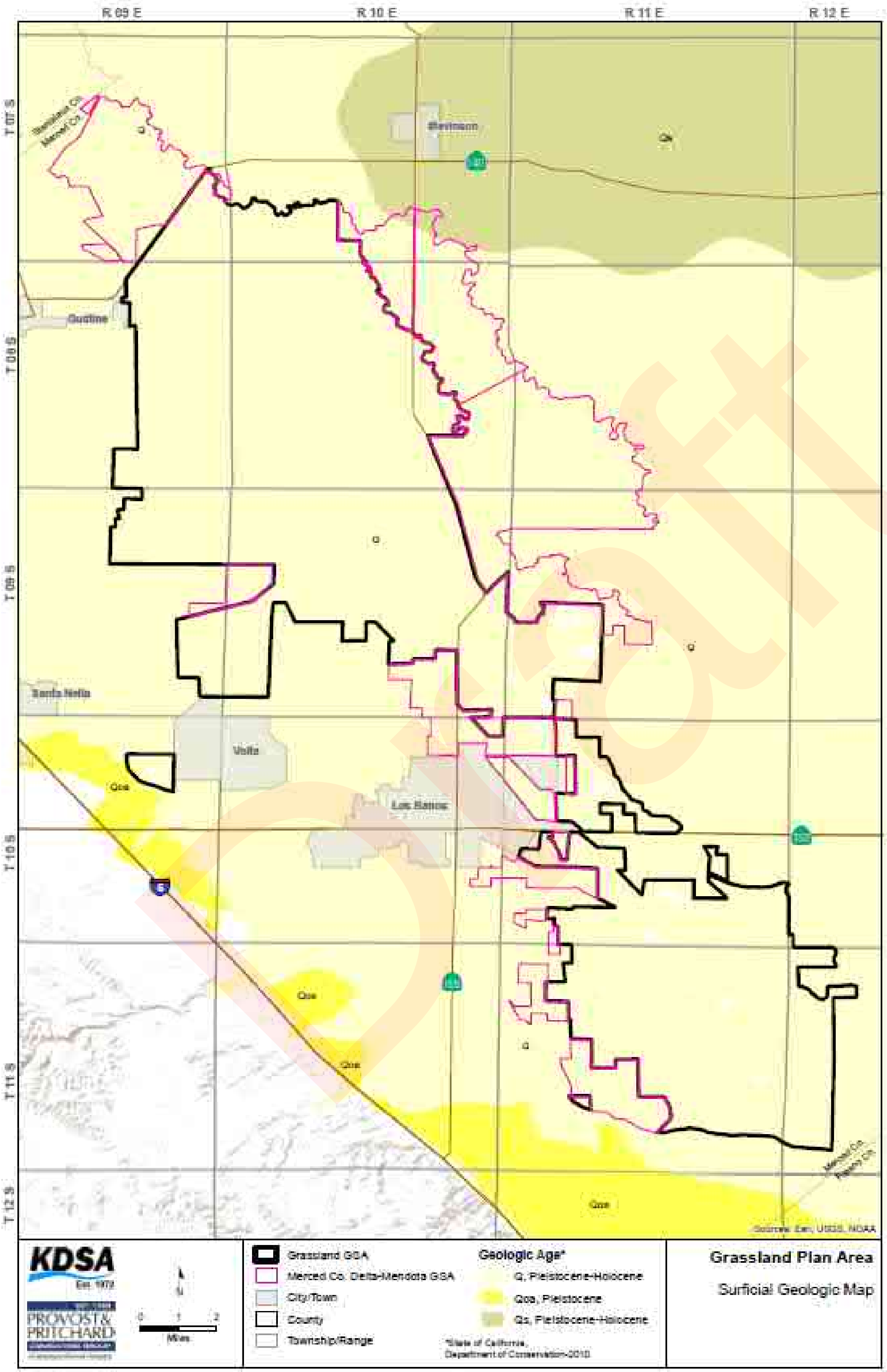


Figure 3-2: Surficial Geologic Map

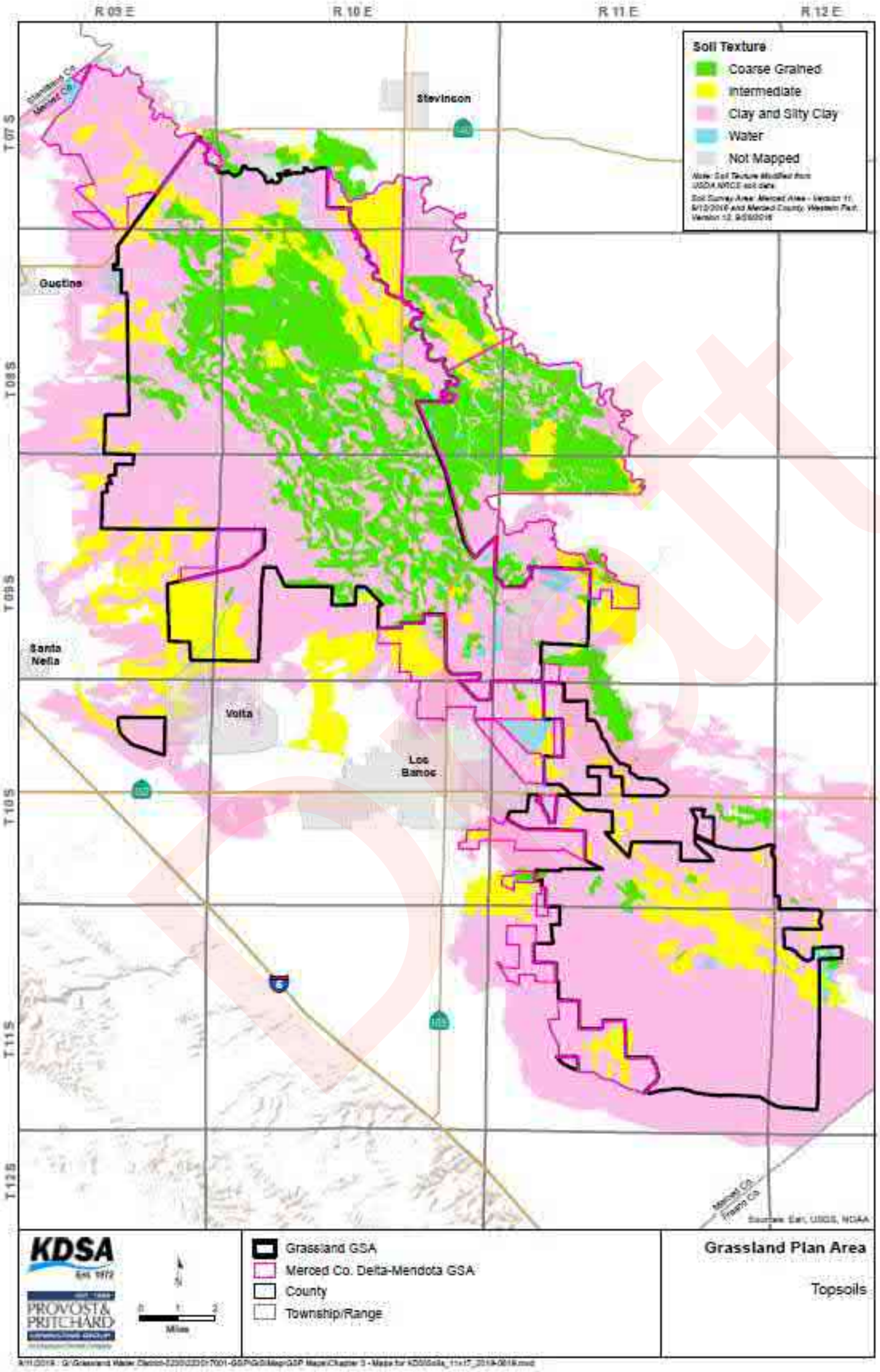


Figure 3-3: Topsoils

3.1.2.4 Surface Water Bodies

Legal Requirements:

§354.14(d)(5) Physical characteristics of the basin shall be represented on one or more maps that depict surface water bodies that are significant to the management of the basin.
§354.14(d)(6) Physical characteristics of the basin shall be represented on one or more maps that depict the source and point of delivery for imported water supplies.

Figure 3-4 shows the location of surface water bodies in the area evaluated. Streams on the west side are San Luis Creek and Los Banos Creek, both of which have been dammed, and Garzas Creek and Ortigalita Creek. Other drainages in the area are Mud Slough and Salt Slough. Los Banos Creek and Mud Slough join the San Joaquin River near or north of the north boundary of the San Luis NWR. Major canals in the area include the Delta-Mendota Canal (DMC) and the CCID's Main and Outside Canals, which are located upslope and to the southwest of the GRCD. Other important canals are the Santa Fe and San Luis Canals. The San Luis Drain was designed to carry storm water and surface and subsurface agricultural drainage flows, which formerly were discharged to Mud Slough, located just east of the northern part of the Northern Division. Lakes and reservoirs are shown as of April 5, 2001, from the California Department of Fish and Game (now CDFW). **Figure 3-5** represents the source and point of delivery for surface water supplies.

3.1.3 Subsurface Geologic Conditions

Hotchkiss and Balding (1971) described the geology, hydrology, and water quality of the Tracy-Dos Palos Area, which includes the area evaluated. In addition, Kenneth D. Schmidt & Associates (KDSA 1997a) provided a report for the CCID on groundwater conditions in the area between Mendota and Crows Landing. These reports provided significant information on subsurface geologic conditions.

3.1.3.1 Regional Geologic and Structural Setting

Legal Requirements:

§354.14(b)(1) The hydrogeologic conceptual model shall be summarized in a written description that includes the regional geologic and structural setting of the basin including the immediate surrounding area, as necessary for geologic consistency.

The area evaluated is within the San Joaquin Valley, which is a topographic and structural trough bounded on the east by the Sierra Nevada fault block and on the west by the folded and faulted Coast Ranges. Both mountain blocks have contributed to marine and continental deposits in the Valley. In the west-central part of the valley, more than 12,000 feet of sediments are present. Groundwater is present in alluvial deposits that dip slightly toward the trough of the valley (the San Joaquin River).

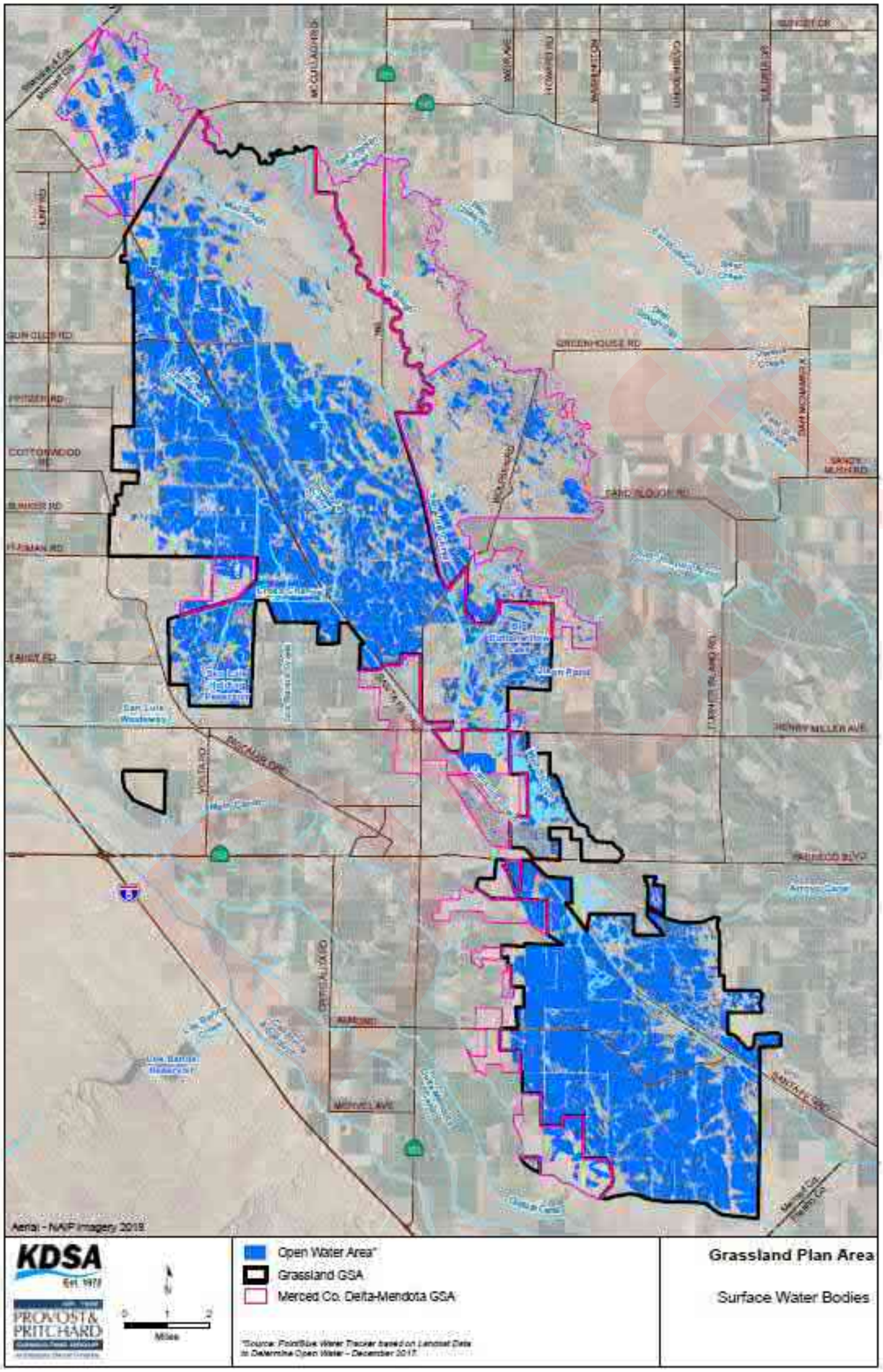


Figure 3-4: Surface Water Bodies

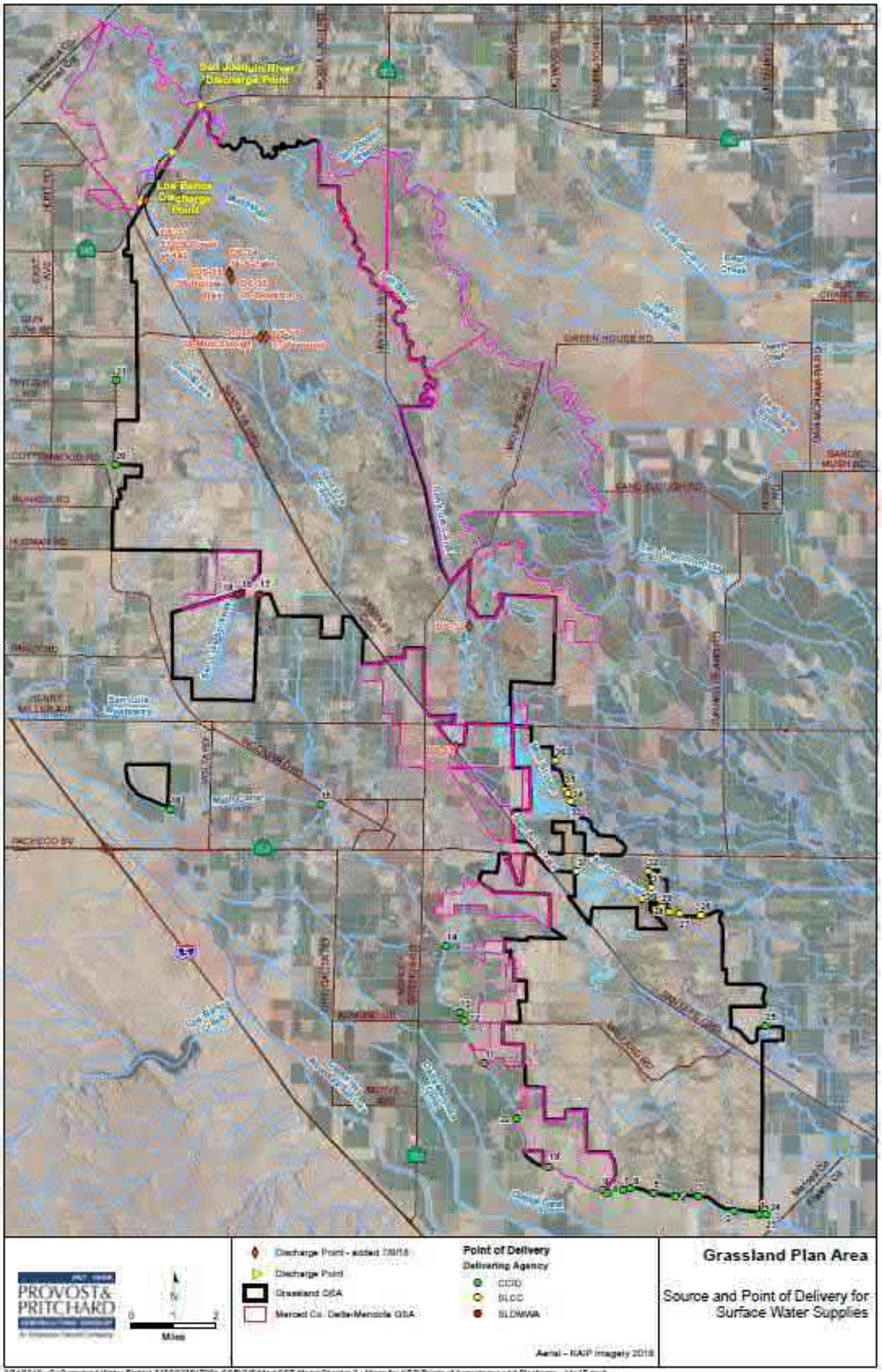


Figure 3-5: Source and Point of Delivery for Surface Water Supplies

3.1.3.2 Lateral Boundaries

Legal Requirements:

§354.14(b)(2) The hydrogeologic conceptual model shall be summarized in a written description that includes lateral basin boundaries, including major geologic features that significantly affect groundwater flow.

Figure 2-1 shows the boundaries of the Plan Area. The Plan Area boundaries include the San Joaquin River on the north end and the CCID Main Canal on the south end. The west boundary of most of the area evaluated is a political boundary with the CCID, whereas the east boundary of the part of the basin north of Highway 152 is the Salt Slough or the San Joaquin River. For the part farther south, the east boundary is the CCID or the San Luis Canal Co. The entirety of the Plan Area is in Merced County. Three national wildlife refuges and a number of State wildlife areas are also included in the area evaluated.

3.1.3.3 Definable Bottom of the Basin

Legal Requirements:

§354.14(b)(3) The hydrogeologic conceptual model shall be summarized in a written description that includes the definable bottom of the basin.

Figure 3-6 shows the definable bottom of the basin. Historically, the U.S. Geological Survey (Page, 1973) used an electrical conductivity of about 3,000 micromhos per centimeter at 25°C to delineate the regional base of the fresh groundwater in the San Joaquin Valley. The underlying groundwater is termed "connate water" and is of higher salinity. Page indicated that the base of the fresh groundwater ranged from about 800 to 1,000 feet deep in most of the area evaluated. As part of this evaluation, electric logs for a number of deep holes were obtained from the California Division of Oil & Gas. A review of these logs indicated depths to the base of the fresh groundwater ranging from about 860 to 1,160 feet. For most of the area, the base of the fresh groundwater was less than 1,070 feet deep. When considering depths of the deepest water supply wells in the area (about 800 to 900 feet), this range is reasonable. Deeper deposits are either primarily clay and/or contain brackish groundwater.

3.1.3.4 Formation Names

§354.14(b)(4)(a) Formation names, if defined.

Hutchkiss and Balding (1971) divided the unconsolidated deposits in the Tracy-Dos Palos area into flood basin deposits (normally less than 50 feet thick), Quaternary alluvium (usually less than 200 feet thick), and the Tulare Formation (up to almost 1,000 feet thick). The Tulare Formation has a thinner upper section above the Corcoran Clay, and a thicker lower section below the clay. The Corcoran Clay is a regional confining bed which divides the groundwater into an upper aquifer and lower aquifer. Deposits in the west part of the area evaluated are generally tan in color and are termed the Diablo Range deposits. Deposits to the east are brown, gray, or white in color and are termed the Sierra deposits. These deposits are shown on a number of subsurface geologic cross sections that are presented later in this report.

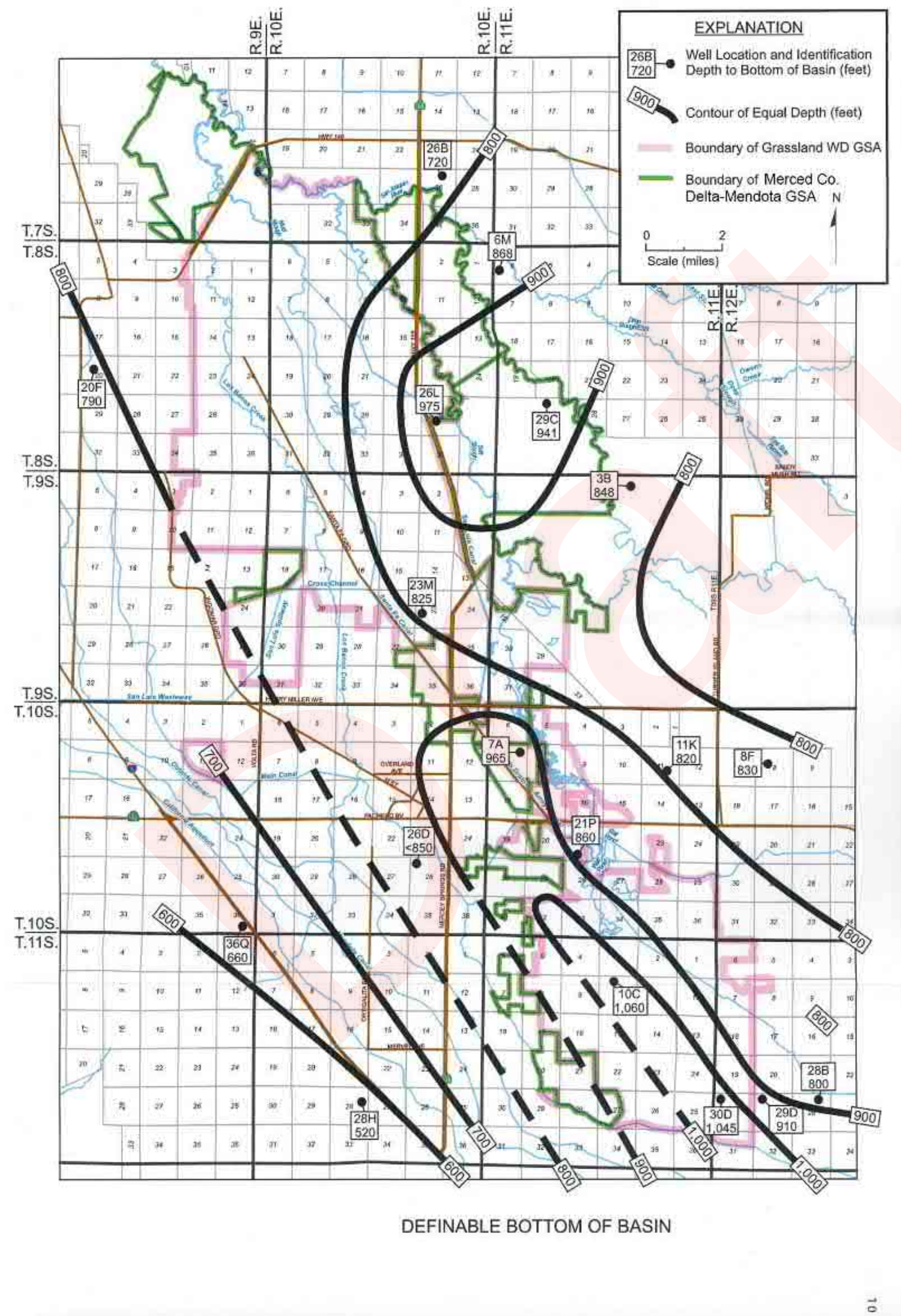


Figure 3-6: Definable Bottom of Basin

3.1.3.5 Confining Beds

Legal Requirements:

§354.14(b)(4)(c) Structural properties of the basin that restrict groundwater flow within the principal aquifers, including information regarding stratigraphic changes, truncation of units, or other features.

The Corcoran Clay is indicated as the most important confining bed in the area evaluated. **Figure 3-7** shows the depth to the top of the Corcoran Clay, which was mapped for this evaluation and primarily based on electric logs and geologic logs for test holes and wells. The depth to the top of this clay is generally the greatest in the central-southern part of the area evaluated. The shallowest depth (about 200 feet) is along the west and east edges of the area evaluated. The shallowest depth along the east edge is about 185 feet. North of Highway 152, the depths to the top of the Corcoran Clay in the central part of the area range from about 250 to 300 feet. South of Highway 152, the depths to the top of the clay range from about 200 to 350 feet. The depths to the top of the Corcoran Clay essentially define the base of the upper aquifer.

The thickness of the Corcoran Clay also tends to be less towards the west and east edges of the area evaluated (**Figure 3-8**). For the area north of Highway 152, the thinnest area of Clay (less than 40 feet thick) is beneath the northeast part. The Corcoran Clay ranges from about 35 to 50 feet thick along the east edge of the area evaluated, and from about 65 to 120 feet along the west edge. In the area south of Highway 152, the thinnest clay (about 80 feet thick) is along the east edge of the area evaluated, and along the west edge south of Almond Drive Ditch. The thickest area (greater than 120 feet) is west of South Dos Palos. There are no known geologic faults that restrict groundwater flow.

3.1.3.6 Principal Aquifers

Legal Requirements:

§354.14(b)(4) The hydrogeologic conceptual model shall be summarized in a written description that includes the principal aquifers and aquitards.

Based on subsurface geologic cross sections (presented in **Section 3.1.3.7**) and water well drillers' logs and completion reports, the upper aquifer is the principal aquifer in most of the area adjoining the Plan Area (i.e., in the CCID and San Luis Canal Co. service areas). However, in the Panoche Water District, the lower aquifer is the principal aquifer. There are two aquifers in the Plan Area, the upper unconfined aquifer which serves as the primary source aquifer and the lower confined aquifer.

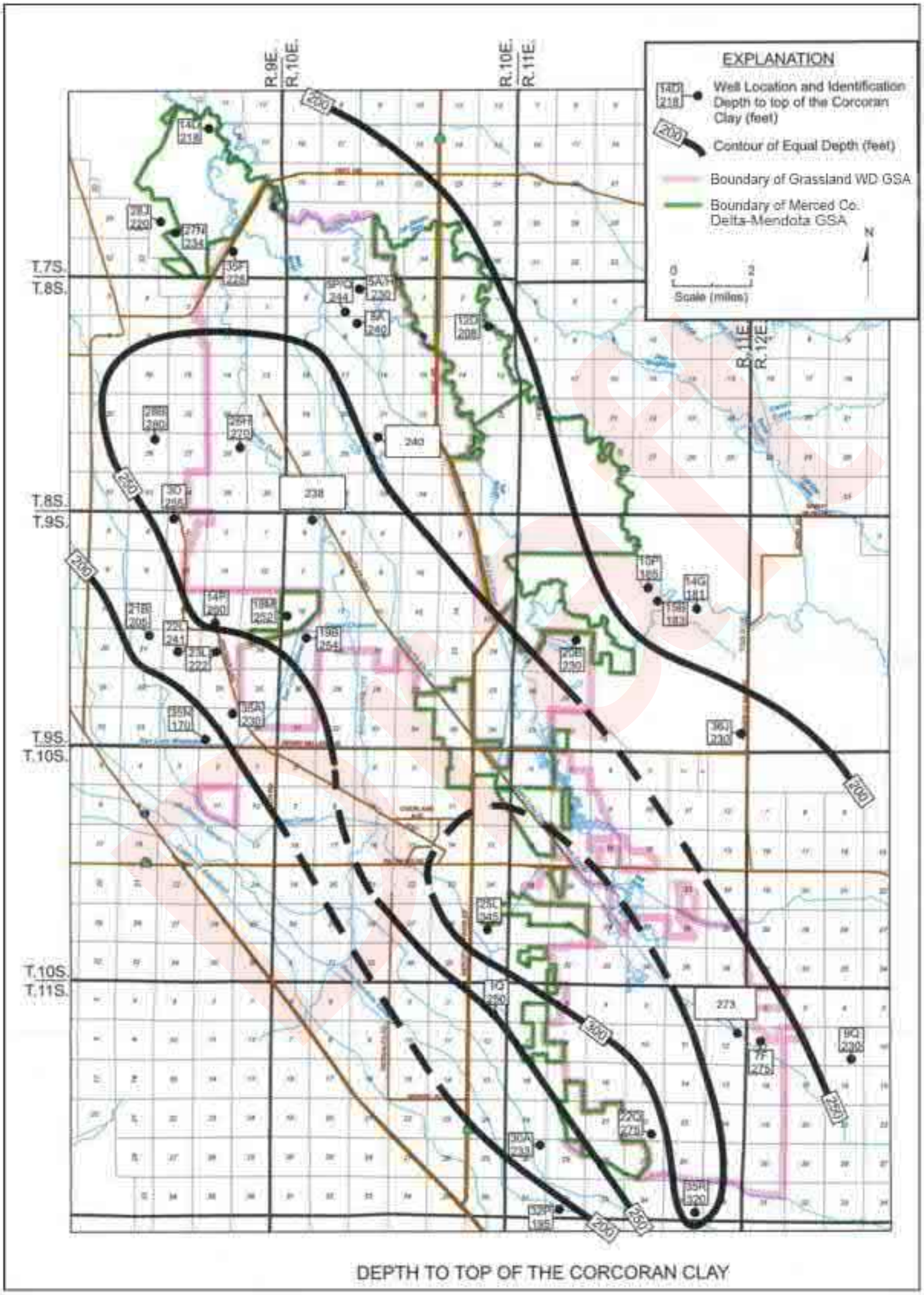


Figure 3-7: Depth to Top of the Corcoran Clay

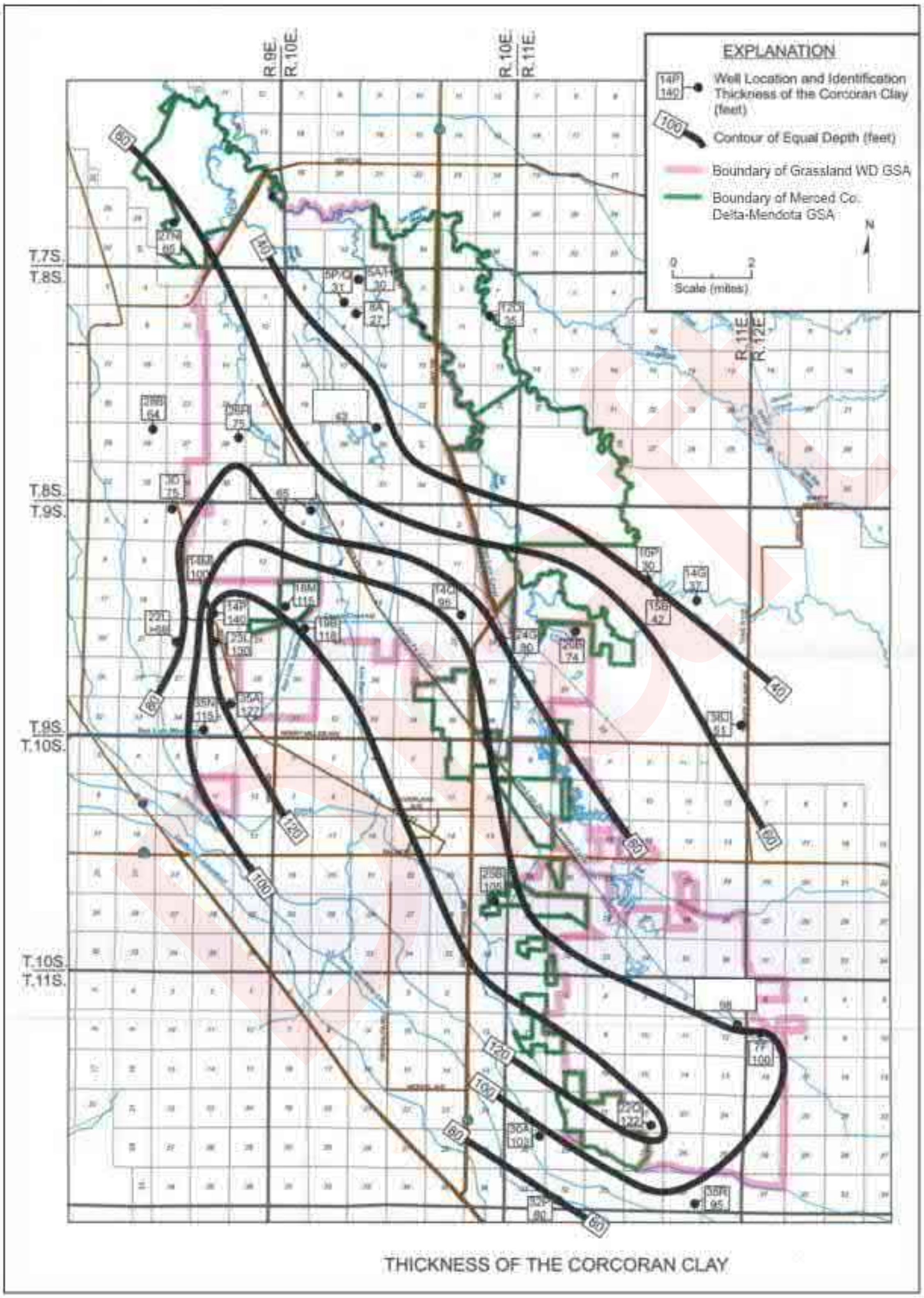


Figure 3-8: Thickness of the Corcoran Clay

3.1.3.7 Subsurface Geological Cross Sections

Legal Requirements:

§354.14(c) The hydrogeologic conceptual model shall be represented graphically by at least two scaled cross-sections that display the information required by this section and are sufficient to depict major stratigraphic and structural features in the basin.

The subsurface geologic cross sections presented in this report were either from Hotchkiss and Balding (1971) and modified by KDSA, or prepared by KDSA for the CCID and City of Los Banos (KDSA, 1997 and 2013). Locations of the cross sections are provided on **Figure 3-9**.

<u>Northern Area</u>

For the area north of Highway 152, three subsurface cross sections are provided. Cross Section A-A' extends from north of Highway 140 on the north end to the south and southeast, to near the Merced County-Fresno County line (**Figure 3-10**). This section is generally near the west edge of the area evaluated. The base of the unconsolidated deposits (base of the aquifer) ranges from about 800 to 1,000 feet along this section and Diablo Range deposits are predominant. The Corcoran Clay is at an average elevation of about 200 feet below sea level along the section. Along the west edge of the Northern Division north of Husman Road, Diablo Range deposits are predominant above the Corcoran Clay, whereas farther south, Sierra deposits are predominant along this section. Below the Corcoran Clay, Sierra deposits are only predominant above a depth of about 600 feet in the area north of Husman Road. Otherwise, Diablo Range deposits are predominant.

Cross Section B-B' (**Figure 3-11**) extends from near Husman Road and about half a mile east of the boundary between R9E and R10E to the northeast near the San Joaquin River. The former Kesterson Reservoir is located near the northeast edge of the section. This cross section illustrates well the predominance of the Sierra deposits both above and below the Corcoran Clay in most of the area within the Northern Division and the adjacent San Luis NWR. The Diablo Range deposits are only significant above the Corcoran Clay beneath the west part of the Northern Division along this section, and within the lower 100 to 200 feet of unconsolidated deposits beneath the Sierra deposits.

Cross Section C-C' (**Figure 3-12**) was modified from Cross Section A-A'. The part of this section northeast of the City of Los Banos Well No. 8 was used and the section was extended to the northeast past the San Joaquin River. The Corcoran Clay is shallower to the northeast along this section and sand strata above the Corcoran Clay are more extensive to the southwest. Sand strata are common above and below the clay along the southwest and northeast parts of the section.

<u>Southern Area</u>

Cross Section D-D' (**Figure 3-13**) was modified from Meade (1968). This cross section extends from southeast of Los Banos to the south to near Eagle Field. The top of the consolidated deposits deepens to the south along the section, and ranges from about 900 to 1,000 feet deep beneath the Southern Division. The Corcoran Clay averages about 200 feet deep along the part of the section in the Southern Division. Deposits above the Corcoran Clay are primarily Sierra floodplain deposits. Deposits below the clay along the north part of this section in the Southern

Division are primarily Sierra floodplain deposits, whereas beneath the south part, Diablo floodplain deposits are predominant.

Subsurface Geologic Cross Section E-E' (**Figure 3-14**), modified from Hotchkiss and Balding (1971), extends from the northeast near Copa De Oro Avenue and Brito Road to the southwest near Delta Road and the boundary of T11S and T12S, between the Outside Canal and the DMC. The Corcoran Clay dips to the northeast along the southwest part of the section, and to the southwest along the northeast part. Sierra deposits are predominant above the Corcoran Clay whereas Diablo Range deposits are predominant below the Corcoran Clay along this section. A thin wedge of Sierra deposits is present at a depth of about 600 feet along the east part of the Southern Division along this section.

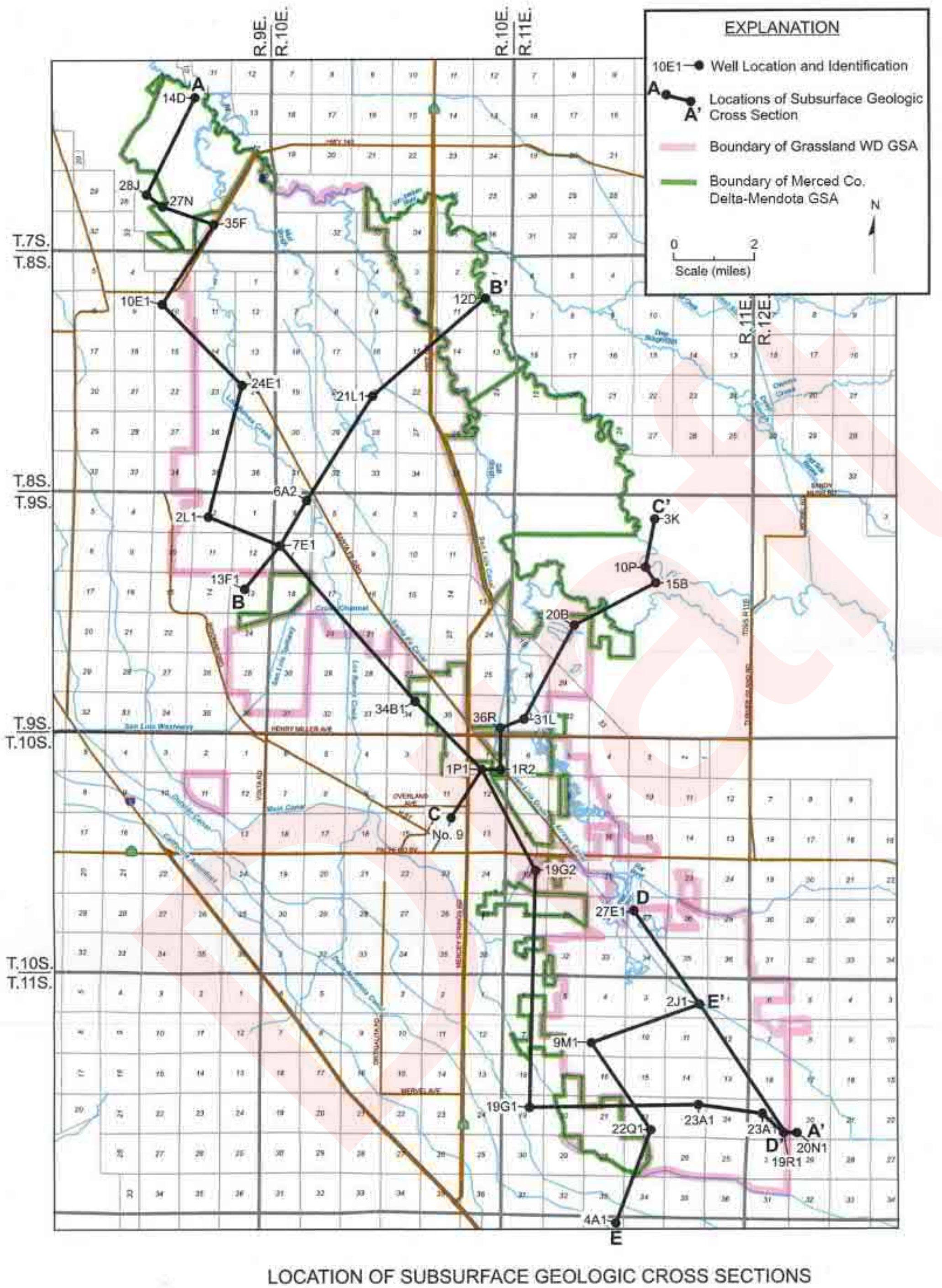


Figure 3-9: Location of Subsurface Geologic Cross Section

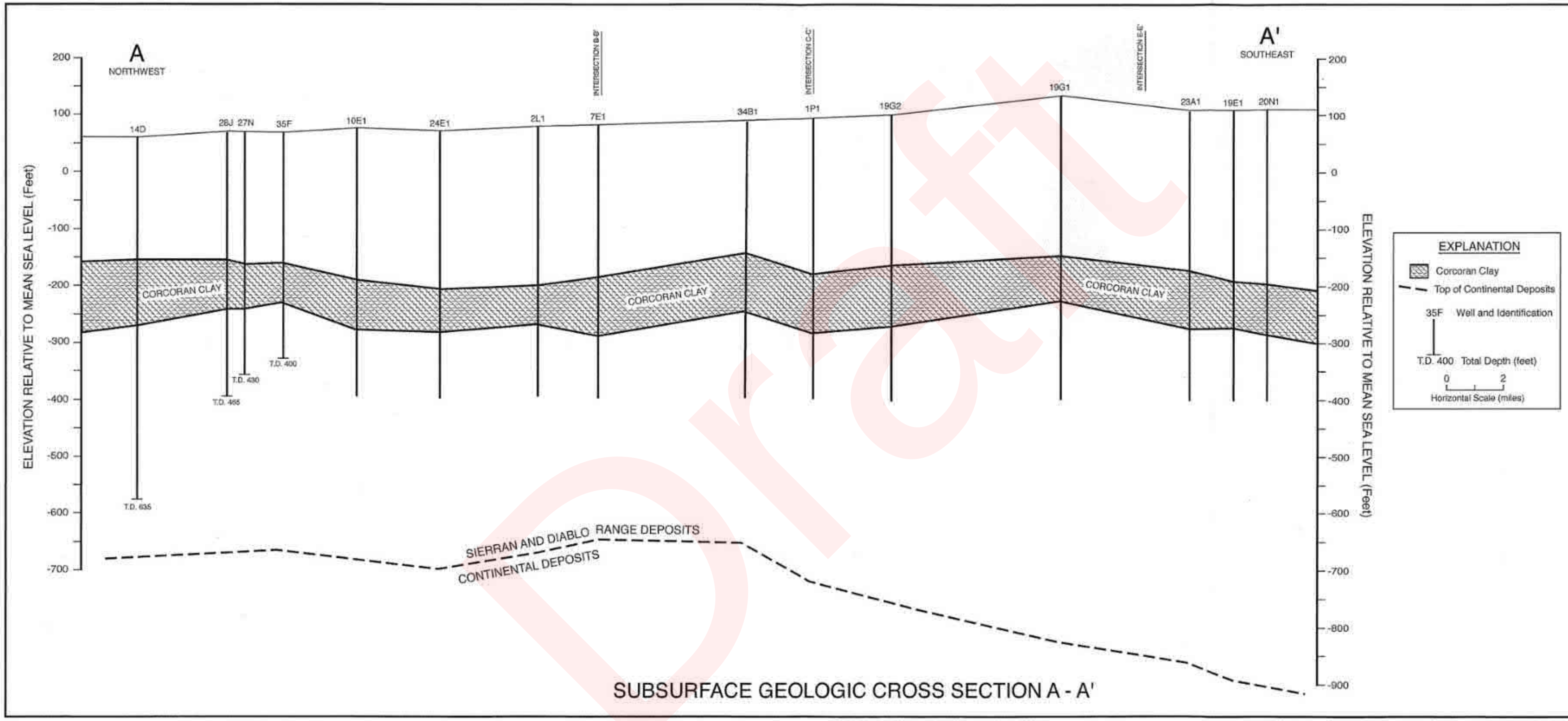


Figure 3-10: Subsurface Geologic Cross Section A-A'

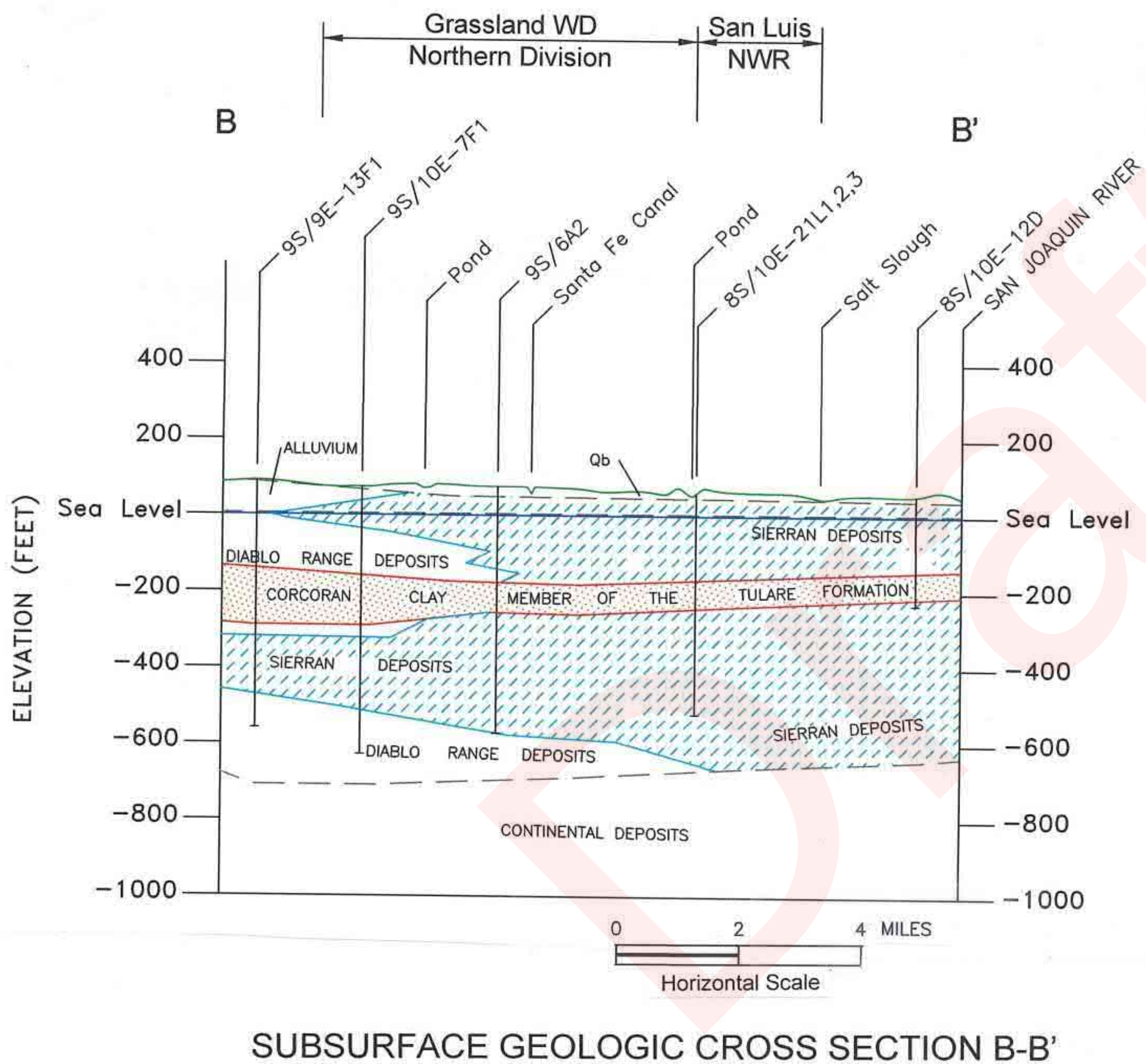


Figure 3-11: Subsurface Geologic Cross Section B-B'

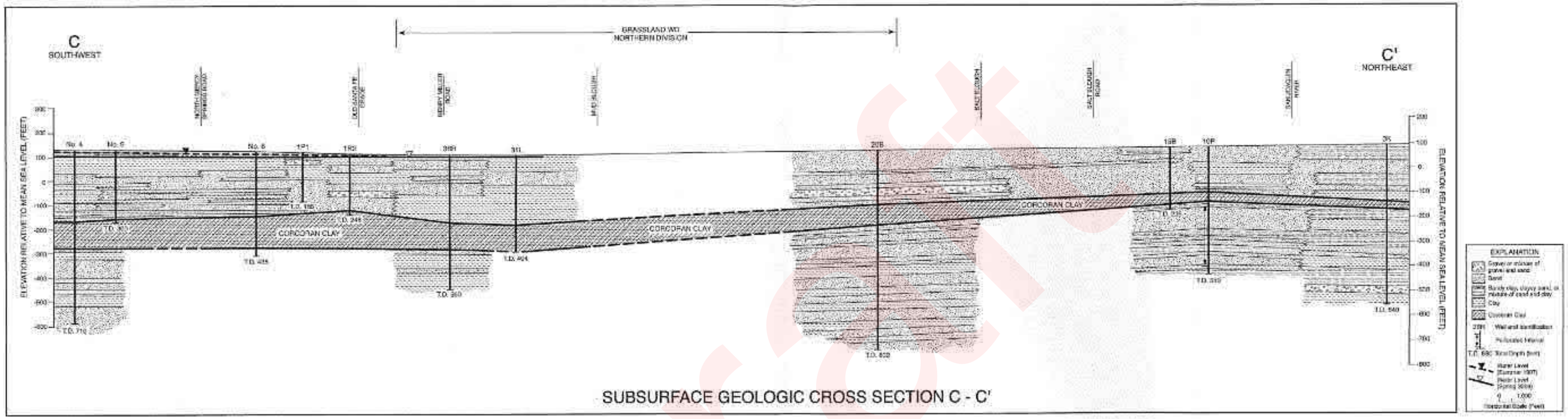


Figure 3-12: Subsurface Geologic Cross Section C-C'

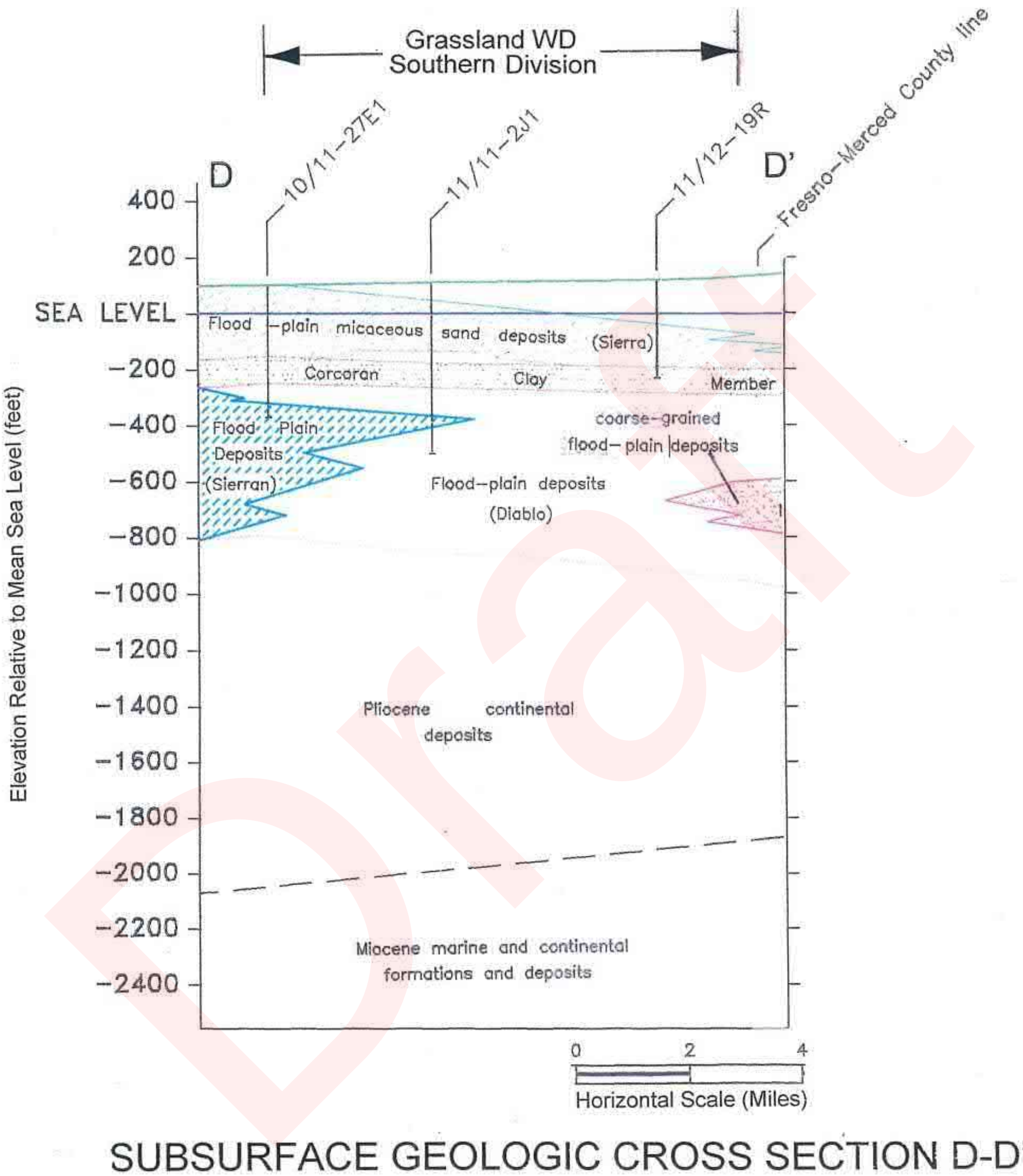


Figure 3-13: Subsurface Geologic Cross Section D-D'

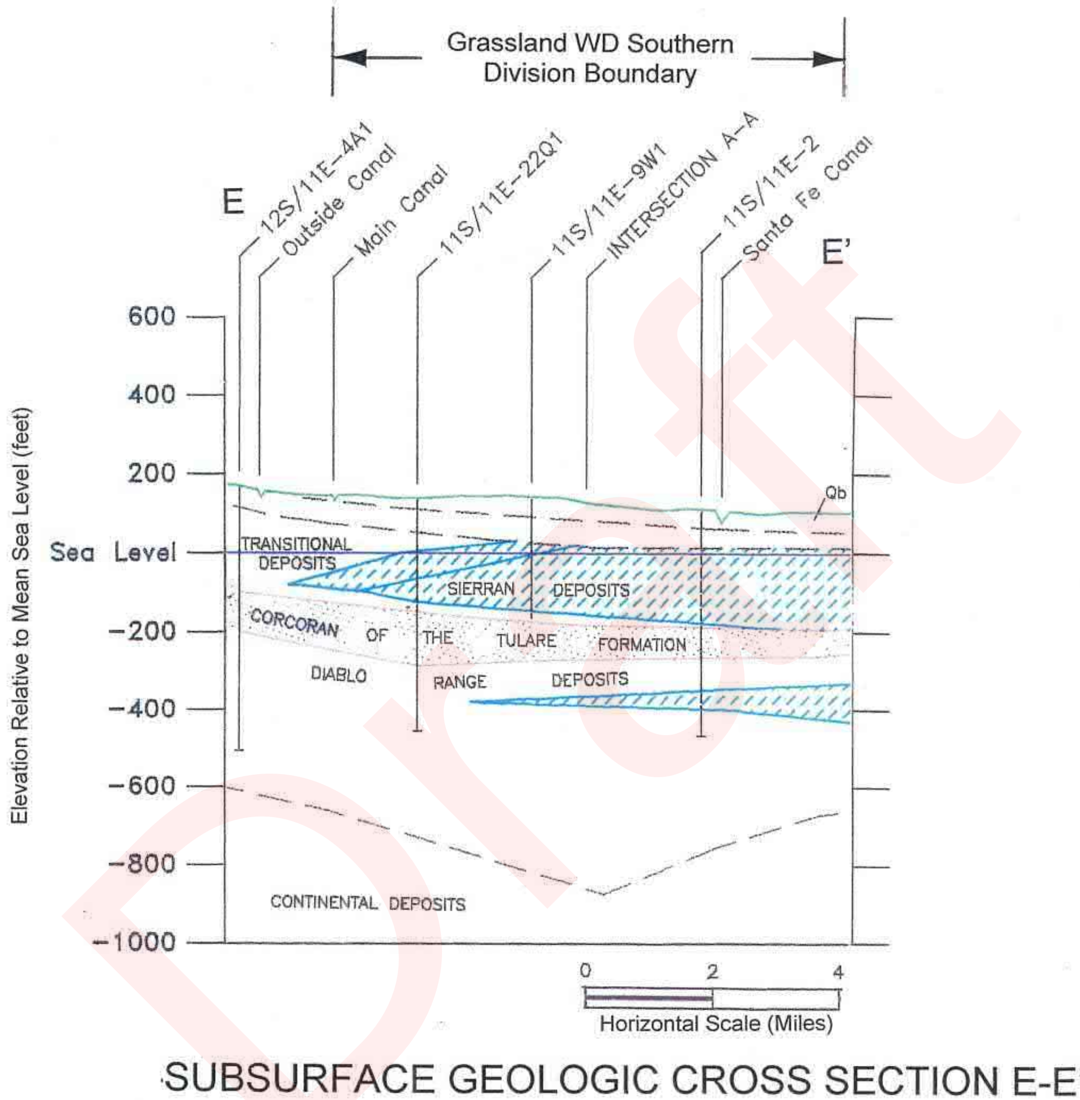


Figure 3-14: Subsurface Geologic Cross Section E-E'

3.2 Groundwater Conditions

3.2.1 Groundwater Use and Well Data

3.2.1.1 Primary Uses of Each Aquifer

Legal Requirements:

§354.14(b)(4)(e) Identification of the primary use or uses of each aquifer, such as domestic, irrigation, or municipal water supply.

The GGSA provided driller's logs and electric logs for test holes and water supply wells in and near the Plan Area. Logs for the federal wildlife refuges, state refuges, and other areas were obtained from the DWR. Most upper aquifer wells generally extend to near the top of the Corcoran Clay, and thus range from about 200 to 300 feet deep. The deepest water supply wells with records in the north part of the area are from about 780 to 870 feet deep. The deepest water supply wells with records in the south part of the area are about 600 to 700 feet deep. Most water supply wells either tap the upper aquifer or lower aquifer. Wells are primarily used for managed wetlands and crop irrigation. One publicly available groundwater connection serves drinking water to visitors at the San Luis National Wildlife Refuge visitor center. There are a limited number of domestic wells in the Plan Area ("de minimis extractors" under SGMA) that supply water to seasonal recreational properties.

3.2.2 Water Levels

Legal Requirements:

§354.16(a) Groundwater elevation data demonstrating flow directions, lateral and vertical gradients, and regional pumping patterns, including: (1) Groundwater elevation contour maps depicting the groundwater table or potentiometric surface associated with the current seasonal high and seasonal low for each principal aquifer within the basin. (2) Hydrographs depicting long-term groundwater elevations, historical highs and lows, and hydraulic gradients between principal aquifers.

Water-level records are available from three primary sources in the area evaluated. Included are records from DWR, GGSA, and the SJRECWA.

3.2.2.1 Depth to Water

In Spring 2018, the GGSA installed shallow monitor wells at ten sites to allow monitoring of shallow water levels. In early March 2018, the depth to water in these wells ranged from about one to five feet. Except for two of these wells, depth to water was 2.5 feet or less. In August-September 2018, depth to water in these wells ranged from 4.2 to 9 feet. Except for two wells, depth to water ranged from about 5.0 to 7.0 feet. These measurements indicate that the groundwater is shallow enough, particularly in the spring and early summer, to be directly evaporated. The GGSA provided a report on February 1, 2016 entitled Incremental Level 4 Groundwater Development Project Initial Study and Negative Declaration. This project allows the Grassland Water District to acquire up to 29,000 acre-feet per year of privately held groundwater supplies and/or exchange a portion of its surface water for such groundwater supplies. Data for 21 wells were provided in that report, most of which are along the Santa Fe Canal and tap the upper aquifer. Records for this project indicate that static water levels in most upper aquifer wells were from about 10 to 20 feet deep during 2012-14. On the other hand, static water levels in two lower aquifer wells ranged from about 80 to 100 feet deep.

In Fall 2015, nested monitor wells were installed at three sites in the GGSA. Two nested well sites are located in the North Division near the San Luis Drain and Taglio Road and the Santa Fe Canal and Cottonwood Road, respectively. An additional nested wells site is located in the South Division near Santa Fe Grade and north of Charleston Avenue. The static water level in one Northern Division upper aquifer monitor well was 16 feet deep in Fall 2015. The static water levels in two upper aquifer wells at the Southern Division site were about 26 feet deep at that time. The static level in three lower aquifer wells at a Northern Division site ranged from about 50 to 100 feet deep in Fall 2015. The static water levels in four lower aquifer wells at the other Northern Division site ranged from about 80 to 90 feet deep at that time.

3.2.2.2 Water Level Elevations and Direction of Flow

Water level elevation and direction of groundwater flow maps for both the upper aquifer and lower aquifer have been prepared by KDSA for the SJRECWA service areas, and these maps extend into part of the area evaluated. These maps were prepared to show both normal (Fall 1981) and drought conditions (Spring 1992).

Upper Aquifer

For the north part of the area, water level elevations in Fall 1981 ranged from about 60 to 90 feet above sea level and indicated a north to north-northeasterly direction of groundwater flow. Groundwater was moving from the CCID west of the North Division through the Northern Division toward the San Joaquin River. The water level elevations and direction of groundwater flow in Spring 1992 were essentially the same, indicating little variation in groundwater flow direction with climatic conditions. For the south part of the area, water level elevations in Fall 1981 ranged from about 90 to 120 feet above mean sea level. The direction of groundwater flow was primarily to the north or northwest. The groundwater in the upper aquifer was flowing toward the Northern Division. Groundwater inflow was coming from the CCID, Pacheco Water District, and Panoche Water District. The water level elevations and directions of groundwater flow in Spring 1992 were essentially the same, again indicating little variation with climatic conditions.

Figure 3-15 shows water level elevations and the direction of groundwater flow for the upper aquifer for Spring 2015. Essentially, the same water level elevations and direction of groundwater flow were present beneath the area north of Highway 152 and south of Highway 152 as in Fall 1981. Water level elevations exceeded 130 feet above mean sea level near the south boundary of the area evaluated (Merced Avenue) and were less than 70 feet near the north boundary. A cone of depression was located east and northeast of Los Banos, coincident with the locations of numerous wells which pump into the GWD water system.

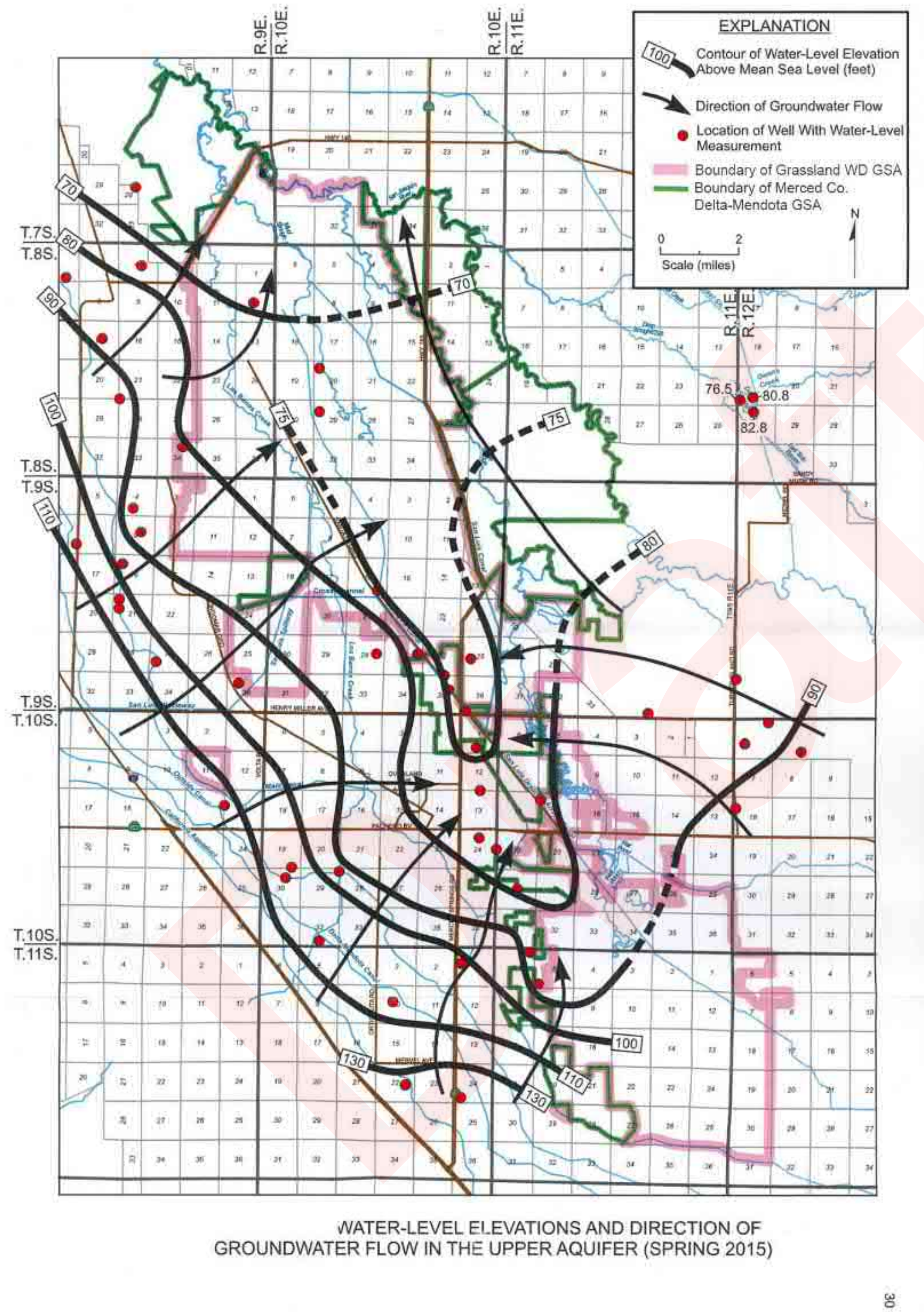


Figure 3-15: Water Level Elevation and Direction of Groundwater Flow in the Upper Aquifer (Spring 2015)

Groundwater in the Southern division of the Plan Area was primarily moving to the north towards this depression. In the Northern Division and south of the Cross Channel, groundwater was also moving toward the northwest. There was a groundwater divide north of Henry Miller road in the east part of the area evaluated. Northeast of this divide, groundwater moved towards the San Joaquin River.

Lower Aquifer

For the Northern Division, water level elevations ranged from less than 40 feet above mean sea level to about 60 feet in Fall 1981. There was a depression cone indicated beneath the Northern Division. Groundwater inflow was coming from the CCID on the west and northwest, the CCID and Plan Area Southern Division to the south, and the San Luis Canal Company, Turner Island W. D., and an undistricted area to the northeast.

For the Southern Division, water-level elevations in Fall 1981 ranged from about 60 feet above mean sea level east of Los Banos to 30 feet near the south end of the Plan Area. Groundwater was flowing into the Southern Division from the northeast and north-northeast, primarily from the San Luis Canal Company and CCID. Groundwater outflow was to the south and southwest toward the Pacheco Water District and Panoche Water District. Water level elevations in Spring 1992 ranged from about 65 feet above mean sea level east of Los Banos to about 10 feet near the south end of the Southern division. The lower water levels to the south compared to Fall 1981 were likely due to higher amounts of lower aquifer pumpage in the Panoche Water District and nearby areas during the drought.

Figure 3-16 shows water elevations and the direction of groundwater flow for the lower aquifer in Spring 2015. There was a groundwater divide near Henry Miller Avenue. North of the divide, groundwater flowed into a depression beneath the north part of the area. South of the divide, groundwater flowed to the south into the Panoche Water District and Westlands Water District. In the north part of the area, water levels in the lower aquifer were about 60 to 90 feet deeper than in the upper aquifer. In the south part of the area, water levels in the lower aquifer were about 50 to 110 feet deeper than in the upper aquifer.

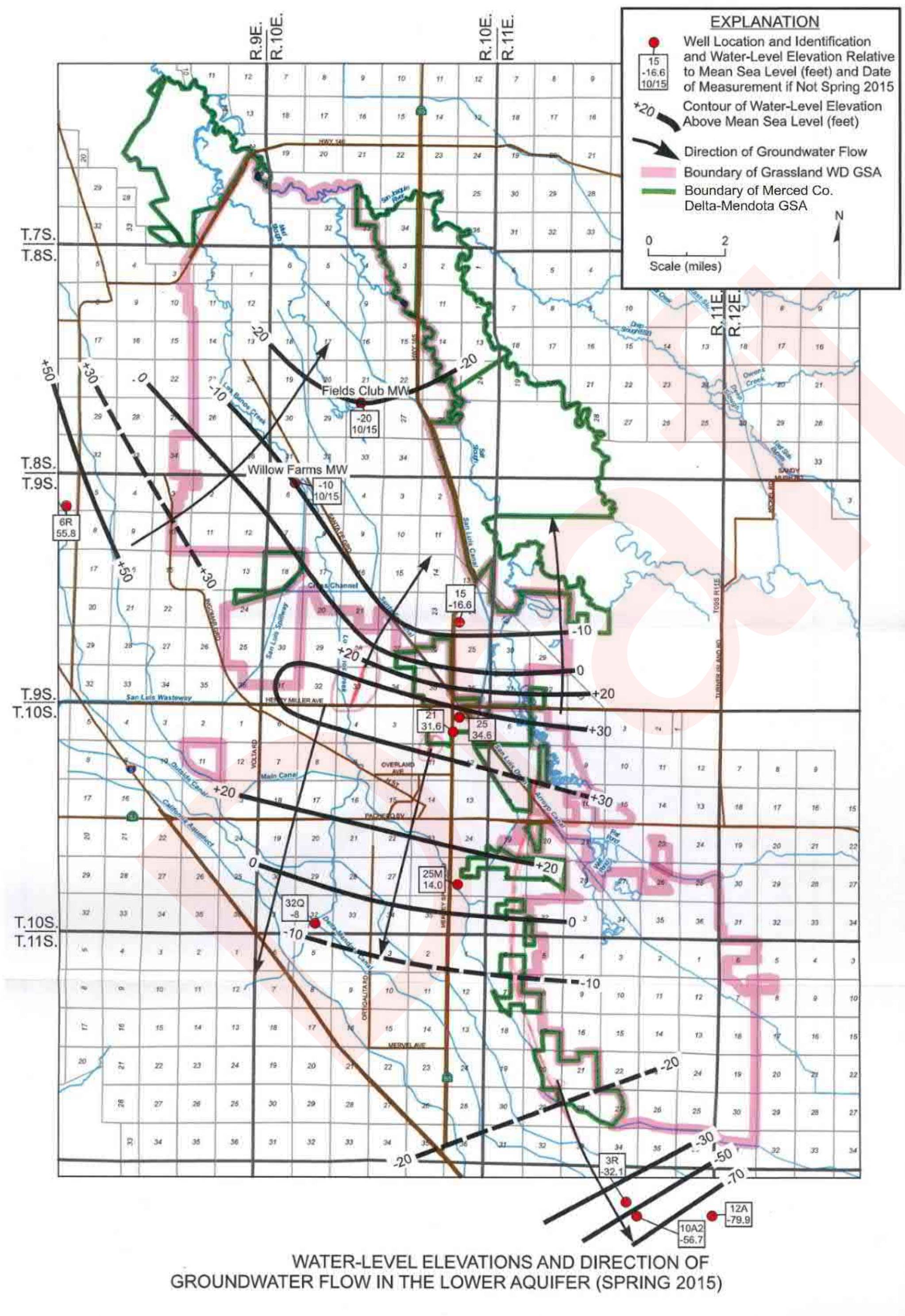


Figure 3-16: Water Level Elevations and Direction of Groundwater Flow in the Upper Aquifer (Spring 2015)

3.2.2.3 Water Level Fluctuations

Water level measurements and hydrographs for wells in and near the Plan Area were obtained from DWR websites and from the CCID. In addition, the GGSA provided water-level data for a number of wells for 2012-14.

Upper Aquifer

Long-term water level records are available for seven upper aquifer wells within or near the Northern Division:

T8S/R9E-10E1, 13E1, and 34G1
T8S/R10E-17N2 and 30E1
T9S/R9E-3C1 and 36P1

Water levels in five of these wells have risen over the long-term, extending back to the 1960s or 1970s. Water levels in two of these wells were relatively stable. **Figure 3-17** shows representative water level hydrographs for CASGEM wells in the Northern Division. Water levels in the wells have temporarily fallen during drought periods such as the early 1990s and then have recovered.

Long-term water level records are available for 13 upper aquifer wells in or near the Southern Division.

T1OS/R10E-1M1
T1OS/R11E-17E1, 32N1, and 36A1
T11S/R11E-4N1, 6B1, 12P1, 12P3, 17E1, and 17E2
T11S/R12E-8C1, 30H1, and 30H2

Figure 3-18 shows representative water level hydrographs for two CASGEM wells in or near the Southern Division. Water levels in these wells have either risen or been relatively stable during the past several decades. Levels appear to be recovering from slight declines during the recent severe drought, in particular 2014 and 2015.

Static water levels in a number of upper aquifer wells in the Plan Area were measured prior to pumping and about a day after pumping stopped for the wetlands during 2012-14. Water level differences between pre-pumping and post-pumping were generally only several feet. In a number of cases, the post-pumping water levels were shallower than those prior to pumping. The upper aquifer water level fluctuations are indicative of an unconfined aquifer. They indicate that there has been no groundwater overdraft in the Plan Area as a whole. This is consistent with conditions in the surrounding parts of the CCID and San Luis Canal Co. service areas.

Lower Aquifer

Depth to water in lower aquifer wells has been substantially deeper than in upper aquifer wells, commonly from 50 to 100 feet deep. Long term water level records aren't available for wells solely tapping the lower aquifer in the Plan Area. However, continuous records from 2011-2016 are available for two Volta area wells which tap both the upper and lower aquifers. Records for these wells indicate very quick water level recovery after pumping stops. In 2012, water levels were much shallower after pumping stopped than they were prior to pumping.

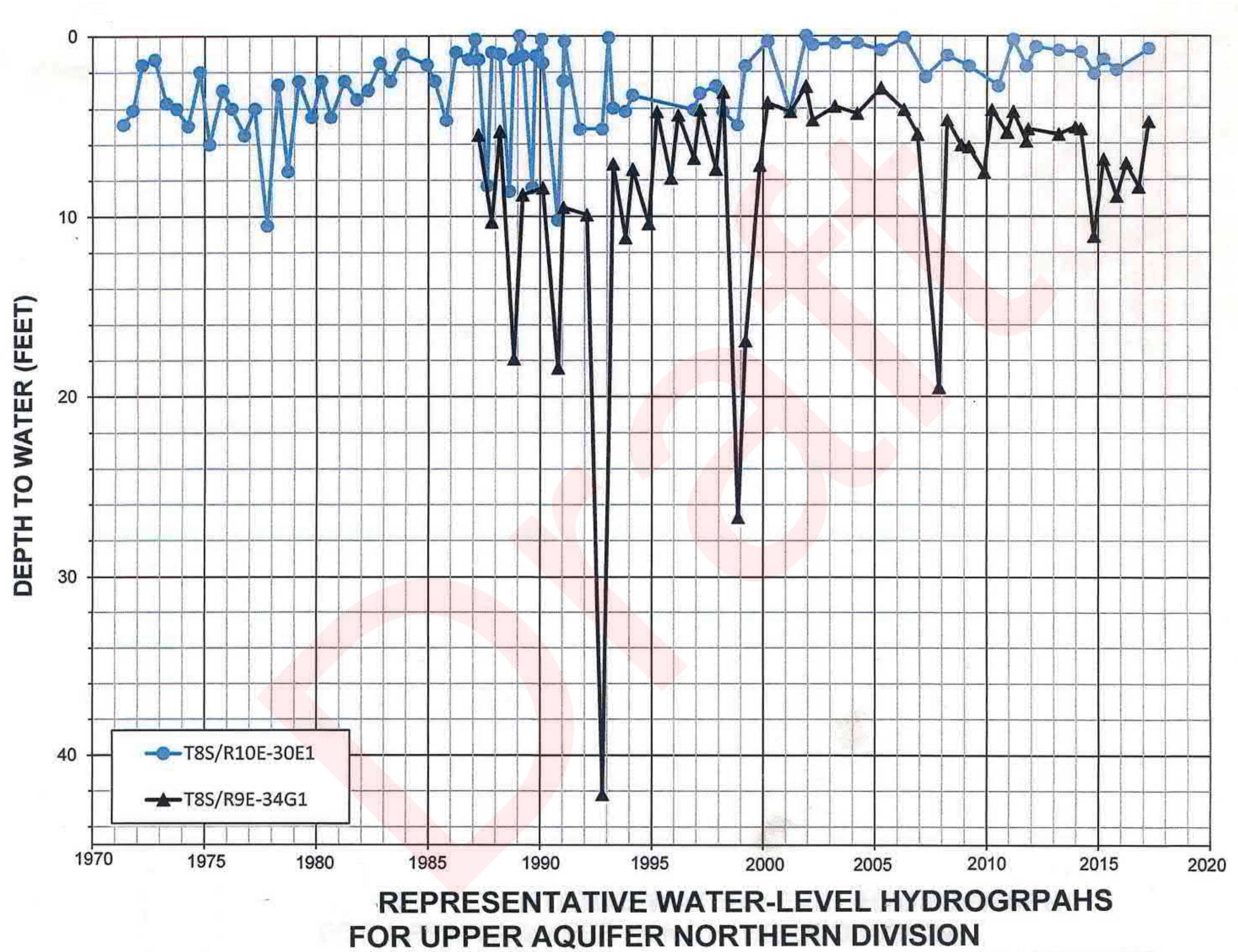


Figure 3-17: Water Level Hydrographs for Upper Aquifer Northern Division

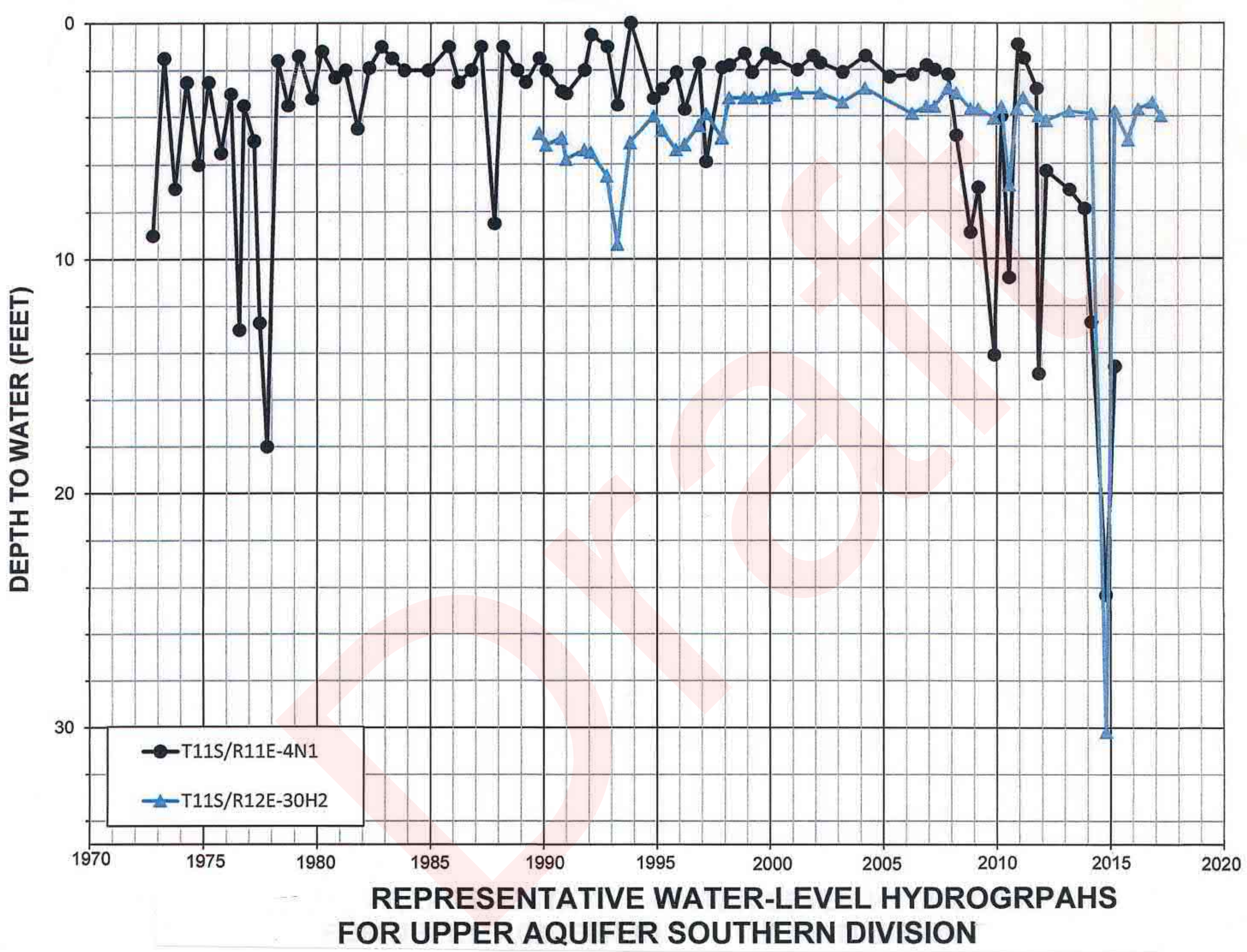


Figure 3-18: Water Level Hydrographs for Upper Aquifer Southern Division

3.2.3 Potential Sources of Groundwater Recharge

Legal Requirements:

§354.14(d)(4) Physical characteristics of the basin shall be represented on one or more maps that depict delineation of existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas, including significant active springs, seeps, and wetlands within or adjacent to the basin.

Figure 3-19 shows major potential sources of recharge to groundwater in the area evaluated, including wetlands and agricultural lands. The major sources of recharge are groundwater inflow, seepage from conveyance facilities, and deep percolation from the wetlands. The Plan Area has imported an average of 150,000 acre-feet per year of Central Valley Project refuge water supplies from the DMC (see **Figure 3-5)** for associated water delivery points). Summers Engineering estimated that an average of about 29,000 acre-feet per year have been recharged through unlined conveyance canals within the District. For the upper aquifer, groundwater inflow is primarily from the southwest and south. For the lower aquifer, groundwater in the Northern Division flows into the Plan Area from almost all directions. In the Southern Division, groundwater inflow was from the north-northwest and northeast. Also, because hydraulic heads are lower in wells tapping the lower aquifer than in those tapping the upper aquifer, there is a trend for downward flow of groundwater through the Corcoran Clay. Amounts of this downward flow in the SJREC service area were estimated by KDSA (1997b).

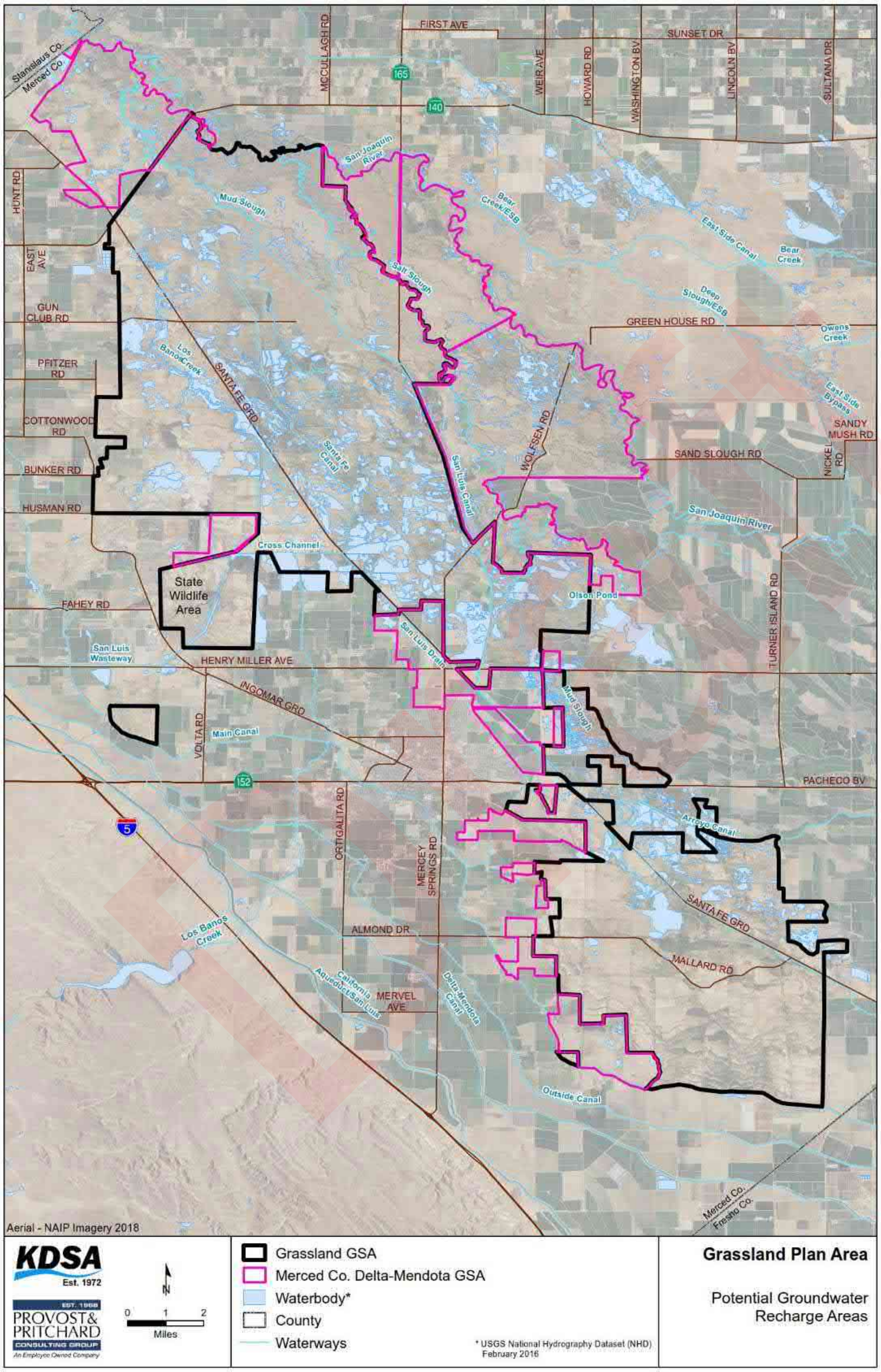


Figure 3-19: Potential Groundwater Recharge Areas

3.2.4 Potential Sources of Groundwater Discharge

Legal Requirements:

§354.14(d)(4) Physical characteristics of the basin shall be represented on one or more maps that depict delineation of existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas, including significant active springs, seeps, and wetlands within or adjacent to the basin.

Groundwater is discharged from the upper aquifer through pumping wells, groundwater outflow toward the San Joaquin River, downward flow of groundwater through the Corcoran Clay, and through evaporation or evapotranspiration of shallow groundwater. Groundwater discharge from the lower aquifer is primarily from pumping wells and groundwater outflow from the Southern Division.

3.2.5 Aquifer Characteristics

Legal Requirements:

§354.14(b)(4)(b) Physical properties of aquifers and aquitards, including the vertical and lateral extent, hydraulic conductivity, and storativity, which may be based on existing technical studies or other best available information.

The GGSA provided pumping rates for 23 wells in the GWD groundwater pilot program. Pumping rates ranged from about 500 to 3,700 gpm. Pumping rates for most of these wells ranged from about 1,350 to 2,300 gpm. Pump tests are available for some of these wells.

3.2.5.1 Transmissivities

Aquifer transmissivities were assembled based on aquifer tests on wells in or near the area evaluated. Specific capacities for upper aquifer wells can be multiplied by a factor of 1,500 to estimate the transmissivity for areas where aquifer tests aren't available. Similarly, specific capacities for lower aquifer wells can be multiplied by 2,000 to estimate the transmissivity[1]. In addition to these estimates, KDSA (2018) determined transmissivities for specific flow estimates along some of the boundaries within the Plan Area. For the upper aquifer, these included several inflow segments on the west side, segments near the south and east side of the Northern Division, and two inflow segments near the southwest side of the Southern Division. For the lower aquifer, transmissivity values were developed for segments northwest, west, south, and northeast of the Northern Division.

Outflow segments were developed for areas south and southeast of the Northern Division. KDSA (2018) determined aquifer transmissivities for the upper and lower aquifers from the results of aquifer tests and specific capacity values for wells in the SJRECWA service areas. KDSA (2018) indicated that transmissivities for the various segments for upper aquifer flow ranged from about 100,000 to 190,000 gallons per day (gpd) per foot. The highest values were generally along the area near the southwest boundary and along the east edge of the southern part of the area evaluated. For the lower aquifer, transmissivities ranged from about 60,000 to 160,000 gpd per foot.

[1] Thomasson et al. (1960) developed conversion factors between specific capacity and transmissivity in U.S. Geological Survey Water-Supply Paper 1464.

3.2.5.2 Vertical Hydraulic Conductivities

The vertical hydraulic conductivity of the Corcoran Clay at this location was determined to be less than 0.001 gpd per square foot. For the SJRECWA service areas, an average vertical hydraulic conductivity for the Corcoran Clay was estimated to be 0.0075 gpd per square foot. This higher value was indicated to be due to thinner Corcoran Clay in many areas compared to that at the leaky aquifer test site (110 feet) and to the presence of more well conduits compared to those near the leaky aquifer test site.

3.2.5.3 Storativity

Values for the specific yield from textural descriptions of deposits tapping the upper aquifer are the best way to estimate specific yields. The USGS has estimated specific yields in many parts of the San Joaquin Valley. Based on the subsurface geologic cross sections available, an average specific yield of 12 percent is used for the upper aquifer. Storage coefficients for strata confined by the Corcoran Clay are sparse in this area. However, a one-week long leaky aquifer test was conducted using wells located along the DMC near Russell Avenue in January 1997 (KDSA, 1997b). This best value for storage coefficient for the lower aquifer for the test was 0.001.

3.2.6 Changes in Groundwater Storage

Legal Requirements:

> **§354.16(b)** A graph depicting estimates of the change in groundwater in storage, based on data, demonstrating the annual and cumulative change in the volume of groundwater in storage between seasonal high groundwater conditions, including the annual groundwater use and water year type.

Changes in storage for coarse-grained deposits in the lower aquifer are shown to be insignificant, as the aquifer remains full of water despite water level declines. However, land subsidence has occurred due to compaction of clays and the volume of land subsidence can be used to estimate the decrease in storage for confining beds in the lower aquifer, including the Corcoran Clay. For the upper aquifer, long-term water level changes can be used to determine storage changes during periods when the water levels declined significantly. Due to the relatively small changes in storage, year-to-year changes are often insignificant (except during severe droughts). Water levels in upper aquifer wells have slightly risen over the long-term. Thus, two changes in storage for the upper aquifer were evaluated: 1) annual decreases in storage during droughts, and 2) long-term increases in storage.

<u>Northern Division</u>

Annual water level declines during the 1987-93 drought averaged 1.4 feet per year. For an acreage of about 72,000 acres and an average specific yield of about 12 percent, the annual loss in groundwater storage was about 12,000 acre-feet per year. As in most areas, water level hydrographs for wells showing these declines indicated full recovery within several years after the drought ended. Long term water level hydrographs for the area evaluated indicate an average water level rise of about 0.04 foot per year. This equates to an increase in groundwater storage averaging about 350 acre-feet per year. Over a 30-year period, this would total about 10,500 acre-feet.

<u>Southern Division</u>

Annual water level declines during the droughts of 1987-93 and 2008-14 indicate average annual water level declines of 1.7 feet per year. For an area of about 32,000 acres and an average specific yield of about 12 percent, this annual loss in groundwater storage was about

6,500 acre-feet per year. It should be noted that water-level hydrographs for the period following the first of these droughts generally indicate full recovery within a few years. Long-term hydrographs indicate an average water level rise of about 0.04 foot per year. The increase in groundwater storage would be about 150 acre-feet per year. Over a 30-year period, this would total about 4,500 acre-feet.

3.2.7 Land Subsidence

Legal Requirements:

§354.16(e) The extent, cumulative total, and annual rate of land subsidence, including maps depicting total subsidence, utilizing data available from the Department, as specified in Section 353.2, or best available information.

Historically, there was little subsidence monitoring throughout most of the Plan Area. However, land surface elevations were periodically measured along Highway 152 between Los Banos and Highway 99 (**Figure 3-20**). Near Los Banos, little subsidence was indicated, due to the paucity of pumpage from the lower aquifer in this area. Prior to about 2000, most of the land subsidence along Highway 152 was east of the Eastside Bypass, where numerous wells were present that pumped from the lower aquifer. Starting in about 2008, many more wells tapping the lower aquifer were constructed south of Red Top, both east and west of the Bypass. Pumping of these wells had caused significant land subsidence as of 2016. **Figure 3-21** shows land subsidence determined by the USBR for July 2012-December 2016.

Using this data, subsidence contours were developed by KDSA, and are shown for the area evaluated and to the east. Near the west edge of the north part of the area evaluated, subsidence was about 0.05 foot. Near the eastern edge of the north part of the area evaluated, subsidence was averaged to be about 0.5 foot. Near the west edge of the south part of the area evaluated, subsidence was about 0.3 foot and about 0.6 foot near the east edge. In both divisions, subsidence increased to the east-northeast. There is some pumpage from lower aquifer wells in the area evaluated and adjoining areas. To the east of the area evaluated, the subsidence increased to more than 2.0 feet for July 2012-December 2016. Land subsidence in part of that area decreased after December 2016 due to mitigating measures that were enacted.

3.2.8 Groundwater Quality

Legal Requirements:

§354.14(b)(4)(d) General water quality of the principal aquifers, which may be based on information derived from existing technical studies or regulatory programs.

Recent information on the chemical quality of groundwater in the area evaluated was derived primarily from the GWD report of February 1, 2016 on the Incremental Level 4 Groundwater Development Project and from the installation of the nested monitor wells at the three sites. Monitoring plans require that the GWD have samples from the District's surface water channels analyzed. The GWD's Board of Directors has adopted a surface water quality objective for TDS of 2,500 mg/l.

Figure 3-22 shows recent groundwater quality data for the area evaluated. The 22 supply wells with chemical analyses generally indicated the quality of groundwater acceptable for pumping into the GGSA system. Much worse quality groundwater is present at some locations; however, only in certain depth intervals that are not tapped by these wells.

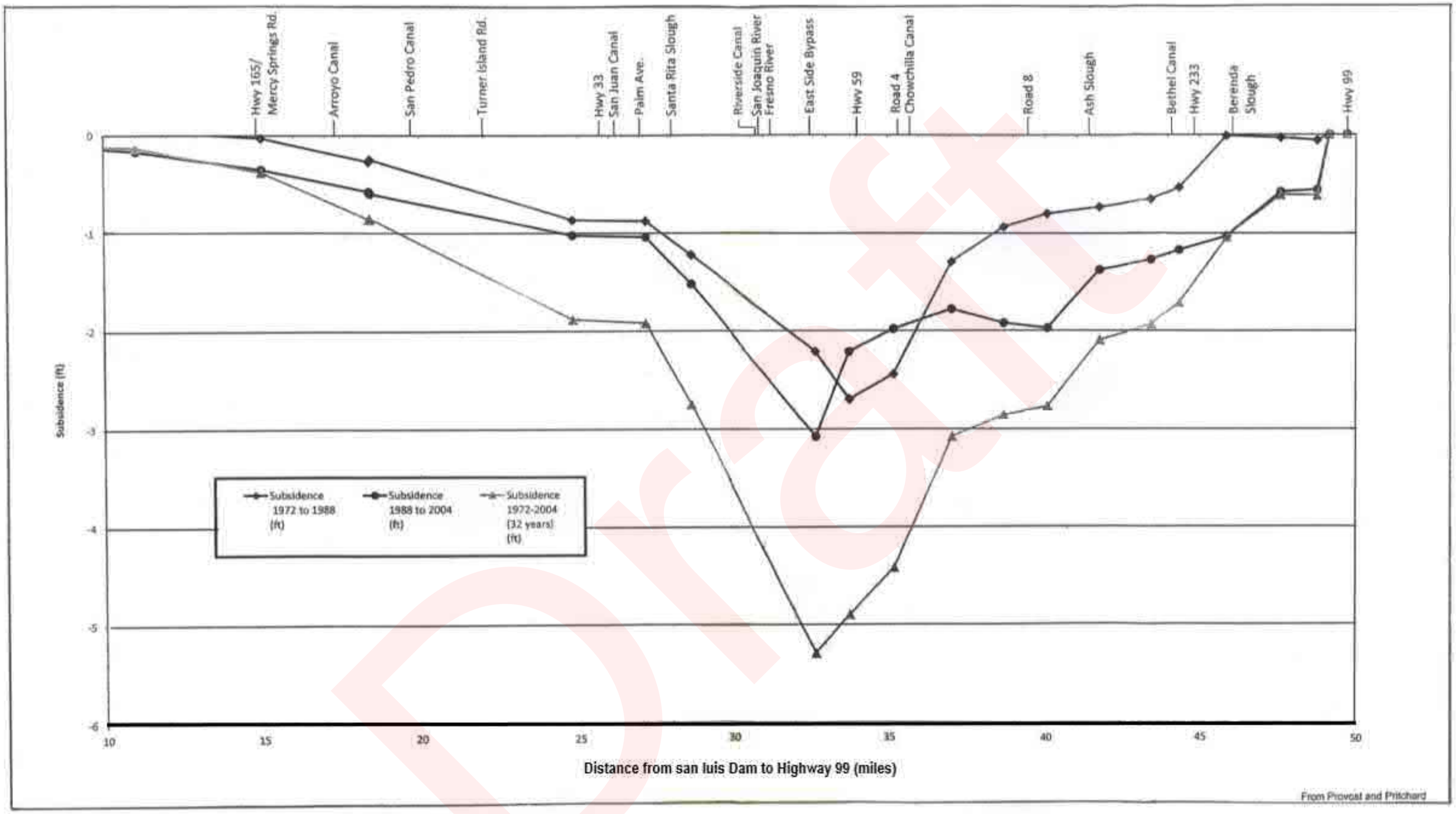


Figure 3-20: Historical Land Surface Elevations Along Highway 152 Transect

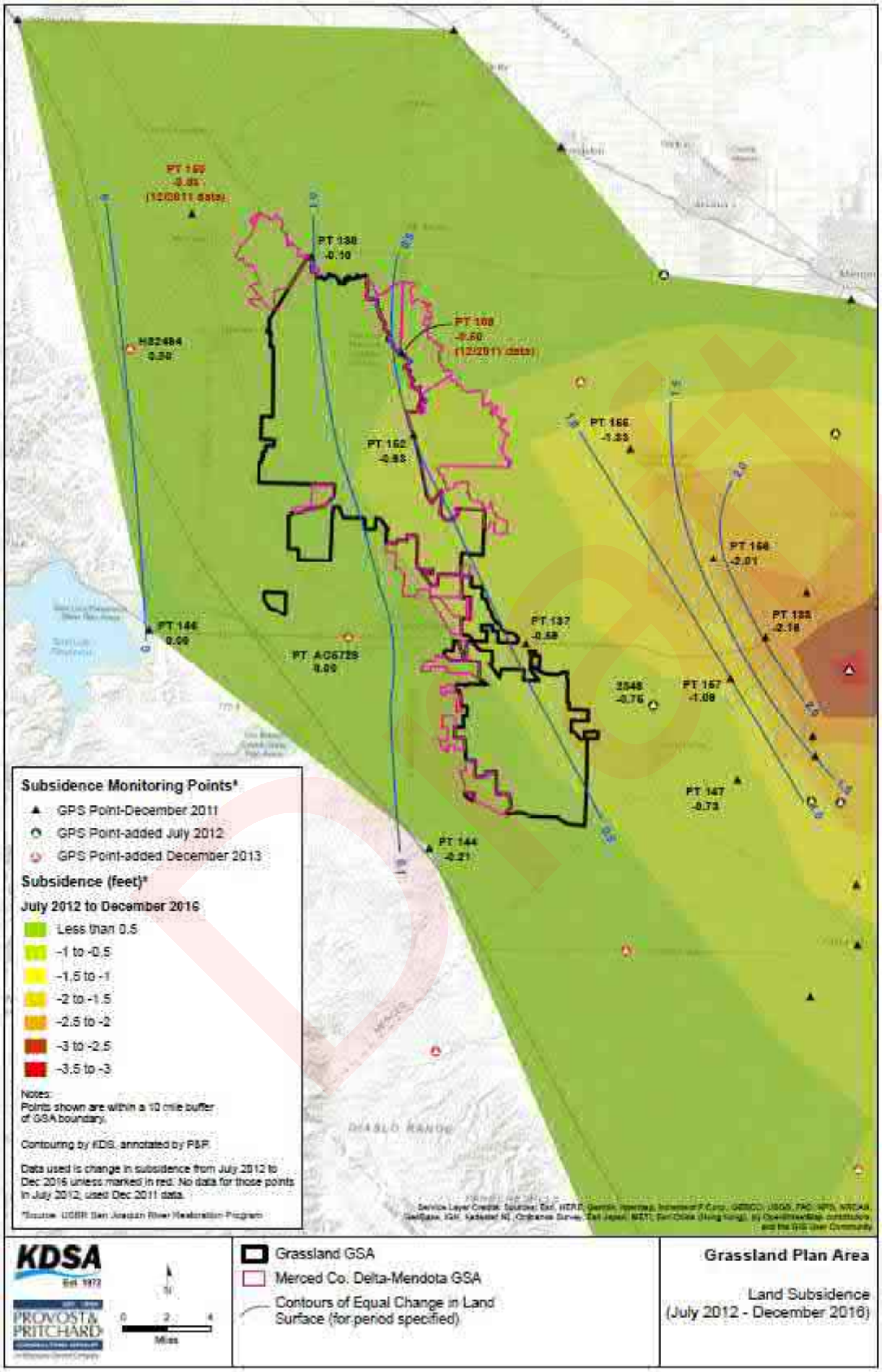


Figure 3-21: Land Subsidence

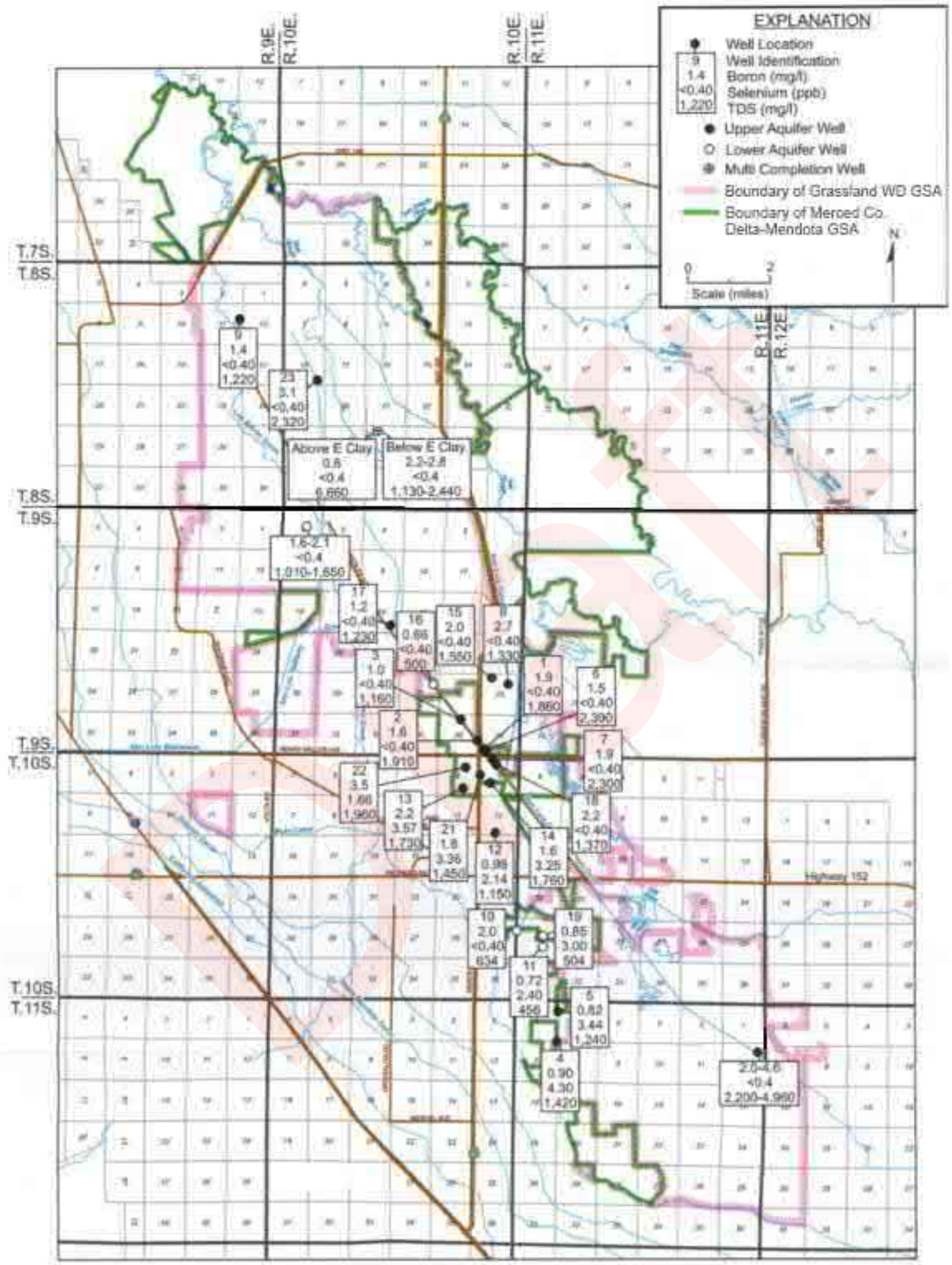


FIGURE 23 - GROUNDWATER QUALITY IN THE GWD

Figure 3-22: Groundwater Quality

Northern Division

Most of the chemical analyses for the Northern Division are of wells within about five miles of Los Banos. Data is also included from the two sites where nested monitor wells were installed. TDS concentrations in water from upper aquifer supply wells north of Highway 152 ranged from 1,160 to 2,390 mg/l. TDS concentrations exceeding 2,000 mg/1 were present in water from a well near Gun Club Road and two other wells near Henry Miller Road and the Santa Fe Canal. TDS concentrations of less than 1,500 mg/1 were present in water from a well near Carnation Road near the north edge of the Plan Area and from six other wells between Highway 152 and Husman Road.

Water from a lower aquifer well north of China Camp Road and near the Santa Fe Canal had a TDS concentration of 500 mg/1.

At one site, water samples were collected from both above and below the Corcoran Clay. The water sample from above the Corcoran Clay had a TDS concentration of 6,660 mg/1. For water samples collected from below the Corcoran Clay, TDS concentrations ranged from 1,130 to 2,440 mg/1.

At one site, water samples were collected only from below the Corcoran Clay as brackish groundwater was indicated above the clay. TDS concentrations ranged from 1,010 to 1,650 mg/1.

Southern Division

All five of the sampled supply wells in the Southern Division were located along the west side of the Plan Area between Pioneer and Almond Drive Road. Two of these wells were upper aquifer wells and three were lower aquifer wells. TDS concentrations in water from the upper aquifer wells ranged from 1,240 to 1,470 mg/l. Three wells that tapped the lower aquifer had TDS concentrations ranging from 456 to 634 mg/l.

At the sites, water samples were collected from two depth intervals above the Corcoran Clay. TDS concentrations ranged from 2,200 to 4,960 mg/1. The electric log for the test hole at the site indicated high salinity groundwater in the lower aquifer below the Corcoran Clay. A similar situation has been found in groundwater elsewhere in the Dos Palos area and to the southeast.

3.2.9 Interconnected Surface and Groundwater Systems

Legal Requirements:

§354.16(f) Identification of interconnected surface water systems within the basin and an estimate of the quantity and timing of depletions of those systems, utilizing data available from the Department, as specified in Section 353.2, or best available information.

The only locations in the area evaluated where groundwater is known to be in direct hydraulic communication with a stream is along a nine-mile-long reach of the San Joaquin River on the north edge of the San Luis NWR (**Figure 3-4**). A series of shallow monitoring wells have been installed by Reclamation as part of the SJRRP. Water level maps indicate that groundwater in the upper aquifer discharges to the river along this reach. The GGSA has installed a network of shallow (10 to 20 feet deep) observation wells in the District. Monitoring of these wells will provide more definitive information on the relationship between shallow groundwater and streamflow at these same locations.

3.2.10 Known Contamination Sites

Legal Requirements:

§354.16(d) Groundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and map of the location of known groundwater contamination sites and plumes.

Figure 3-23 shows known groundwater contamination sites within the vicinity of the area evaluated, as taken from the Central Valley Regional Water Quality Control Board Geotracker website. There are very few sites within the Plan Area, and they are listed as closed sites.

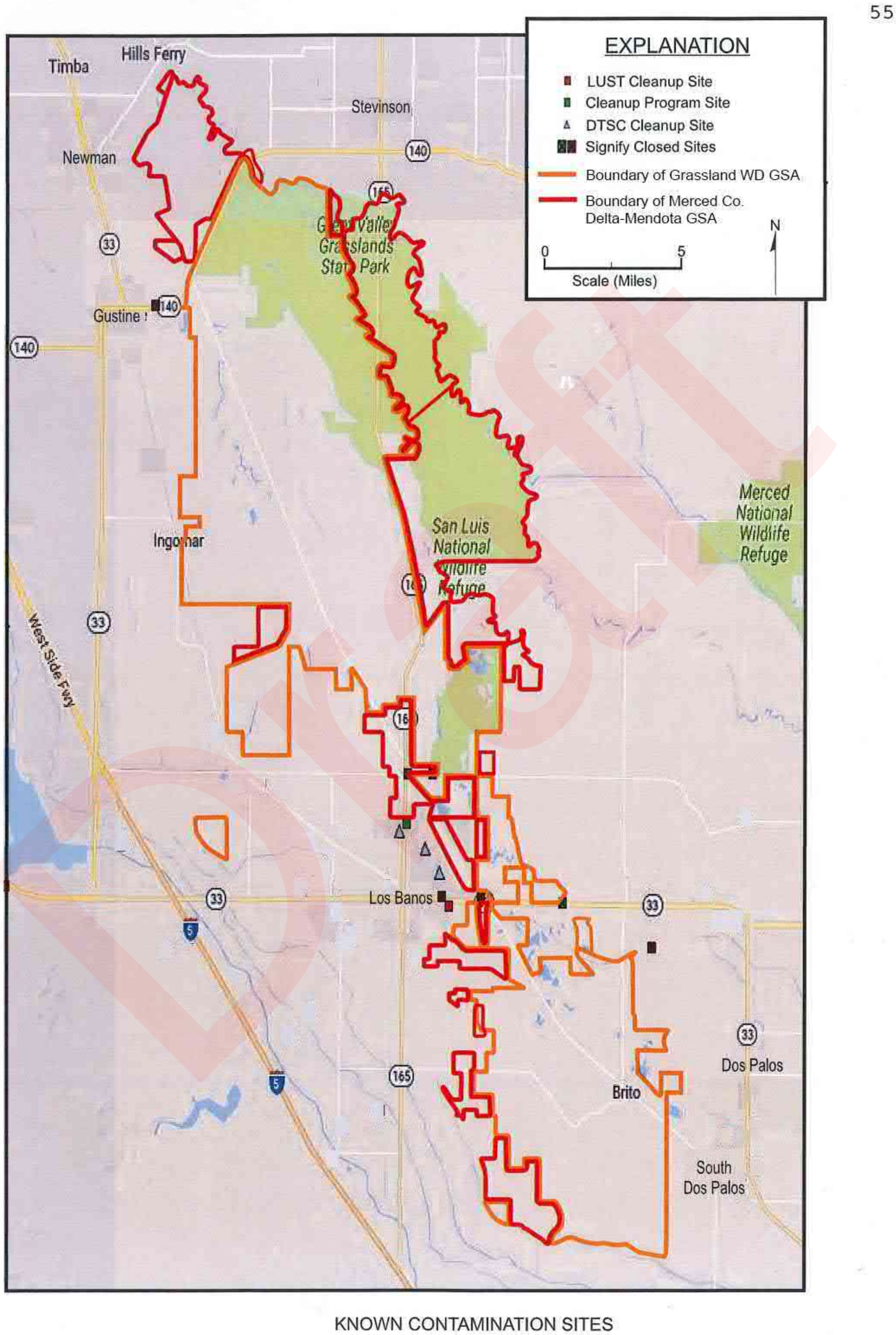


Figure 3-23: Known Contamination Sites

3.3 Water Budget Information

Legal Requirements:

> **§354.18**
> (a) Each Plan shall include a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored. Water budget information shall be reported in tabular and graphical form.

A water budget is crucial to sustainable groundwater management. Quantifying historic, current, and projected conditions and overdraft allows a deeper understanding of water use and, in turn, allows GSAs to set supply augmentation and demand mitigation objectives if necessary. The water budget for the Grassland Plan Area was developed using information gathered from various sources including the hydrogeologic conceptual model and groundwater conditions report, precipitation and evapotranspiration databases, measurements of inflows and outflows to the system, and other relevant data.

GSP regulations stipulate the need to use the best available information and the best available science to quantify the water budget for the basin. Best available information is common terminology that is not defined under SGMA or the GSP Regulations. Best available science, as defined in the GSP Regulations, refers to the use of sufficient and credible information and data, specific to the decision being made and the time frame available for making that decision, which is consistent with scientific and engineering professional standards of practice. The best available information at the time the GSP is developed may be limited spatially and temporally. It is the intention of the GSAs within the Plan Area to continue to evaluate data gaps, compile data, seek additional sources, and improve means and methods of analyzing data moving forward in order to provide a clear and accurate description of the annual Groundwater Conditions and development of future Water Budgets.

3.3.1 Description of Groundwater Model

Legal Requirements:

> **§354.18**
> **(**e) Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow. If a numerical groundwater and surface water model is not used to quantify and evaluate the projected water budget conditions and the potential impacts to beneficial uses and users of groundwater, the Plan shall identify and describe an equally effective method, tool, or analytical model to evaluate projected water budget conditions.
> (f) The Department shall provide the California Central Valley Groundwater-Surface Water Simulation Model (C2VSIM) and the Integrated Water Flow Model (IWFM) for use by Agencies in developing the water budget. Each Agency may choose to use a different groundwater and surface water model, pursuant to Section 352.4.

GSP Regulations do not require the use of a numerical computer model to quantify and evaluate water budget conditions and the potential impacts to beneficial uses and users of groundwater. However, if a model is not used, the GSA is required to describe in the GSP an equally effective method, tool, or analytical model to evaluate projected water budget conditions.

There is a lack of sufficient data regarding water use and cropping patterns in some parts of the Plan Area during the historically average period chosen by the Subbasin. In order to gain a greater understanding of operational and natural conditions in the Plan Area, the GSAs decided to use an analytical accounting tool to quantify the water budget conditions for specific year types where data was prevalent. This allowed the Plan Area to project historic trends into the future using actual data while incorporating factors that may alter these trends such as climate change and land use. The analytical accounting tool was also chosen to alleviate costs, to provide clarity in assumptions and data that were used, and to prevent the need to use unrealistic assumptions in order to calibrate a computer model. Such models can be very complicated and commonly produce results well outside of the expected range of error when limited data is available for analysis. This is especially true when dealing with systems like groundwater and land subsidence. The development of these complex groundwater models requires the results of local data, contour maps, trusted external data sets and equations, and physical observation and surveys.

Numerical groundwater models must be calibrated with actual data to determine their accuracy. The Central Valley Hydrologic Model Version 2 (CVHM2) numerical groundwater model was initially considered by other GSP Groups in the Subbasin to develop the required water budgets. However, it was determined that the model was not adequately calibrated within the Subbasin and did not provide an accurate estimate of actual conditions. The Plan Area participants chose instead to utilize available data and develop an analytical spreadsheet model for water budget accounting. Using actual data under these circumstances represents the best available information. Within the Subbasin this method is considered equally effective, if not more effective, than the numerical model. The GSAs will consider using an adequately calibrated groundwater model once their datasets are developed, if a model would be likely to produce more accurate results. It should be noted that existing models were referenced during the development of this water budget.

The complete water budget, including historic, current, and projected, for the Plan Area was developed using information from the hydrogeologic conceptual model and the groundwater conditions summary developed by Kenneth D. Schmidt & Associates and discussed earlier in this chapter along with data from sources such as the California Irrigation Management Information System (CIMIS), DWR, Irrigation Training & Research Center (ITRC), and California Data Exchange Center (CDEC), among others. Data from these sources as well as internal monitoring data and other publicly available information were utilized. The water budget methodology and data collection were coordinated with the other Delta-Mendota GSAs through the implementation of the Coordination Agreement and associated Coordination Committee and Technical Subcommittee.

3.3.1.1 Period of Record

The period of record chosen to analyze the historic data was water year (WY) 2003 to 2012, covering an average hydrologic period. In August 2018, the Delta-Mendota Subbasin Coordination Committee approved the coordinated historic period of WY 2003 to 2012 and the current year of 2013 for the Subbasin. The projected water budget was analyzed from 2014 – 2070. The hydrologically average period was developed using San Joaquin River – Full Natural Flow (SJR FNF) data, the DWR water year index, and precipitation data at nearby gaging stations. A 50-year average of SJR FNF runoff was evaluated from 1966 to 2015, which was approximately 1.83 million AF. An alternative period from 1990 – 2015 was considered for potential analysis. A series of analyses were done for periods ranging from 1990-2015, but the period between 2003 and 2012 was chosen because:

- The average represented nearly 100% of the 50-year average for hydrological conditions (**Table 3-4**).
- The period was recent and reflects recent land use and regulatory conditions.
- It met the minimum 10-year requirement.
- The period did not end in a severe drought.
- It had a balanced number of water-year types.
- The data for the period would be more readily available given it is relatively recent.

Additional detail on the development of the historic water budget and hydrological average period can be found in **section 3.3.4**.

3.3.1.2 Representative Water Years

Because of the limited data in the Plan Area, representative years were chosen for specific water year types: 2013 for the average/dry year, 2015 for the critical year, and 2017 for the wet year. Water year types were determined using the DWR water-year index. Data from these years were compiled to develop an annual water budget and then used as surrogates for the 2003-2012 water years. They were also used as surrogates for the projected water budget. Average and dry years were combined into a single category because surface water allocations and groundwater pumping tend to be unchanged during these year types. Changes in groundwater pumping only occur during wet years when there is surplus water available, reducing the need to pump supplemental groundwater, and during critical years when surface water allocations are reduced increasing the need for additional groundwater extraction.

3.3.1.3 Changes in Land Use

The extensive managed wetlands within the Grassland Plan Area form a landscape that changes from month to month. The Plan Area is made up of private managed wetlands, federal and state wildlife refuge, and a small amount of farmland. Unlike most geographical areas where agricultural and urban land uses remain fairly static, the Plan Area is dynamic, changing as wetlands are flooded, drained, and irrigated. Because of this, evapotranspiration and seepage were analyzed in greater detail on a monthly timescale. Shapefile data provided by Point Blue Conservation Science and Ducks Unlimited were used to develop monthly maps of the extent of the wetland ponding, in acres (see **Figure 3-24** and **Figure 3-25**). This helped to determine which types of wetland vegetation were present monthly, for accurate estimates of evapotranspiration of vegetation and water surfaces. Changes in the wetland area required seepage from wetland ponds to be also analyzed monthly.

3.3.1.4 Aquifer Significance

There are two principal aquifers in the Plan Area: the upper unconfined and the lower confined aquifer, separated by the Corcoran Clay, which are described in the aquifer characteristics portion of the HCM. Groundwater is pumped from both the upper and lower aquifer, with very little water pumped from the lower aquifer within the Plan Area. Only total pumping is calculated, and the water budgets do not differentiate between upper and lower aquifer contributions. Further investigations will be needed to separate upper aquifer pumping from lower aquifer pumping. This will require development of a Plan Area-wide database to log well completion, perforation locations, and the volume of water pumped. The database will require interpretation by an experienced hydrogeologist. Groundwater monitoring will help quantify each aquifer's total amounts of groundwater extracted and the recovery of the both aquifers over time. Hydrographs, contour maps, and subsidence trends were used to calculate change in storage and sustainable yield for each aquifer and these are provided in the corresponding sections of this GSP.

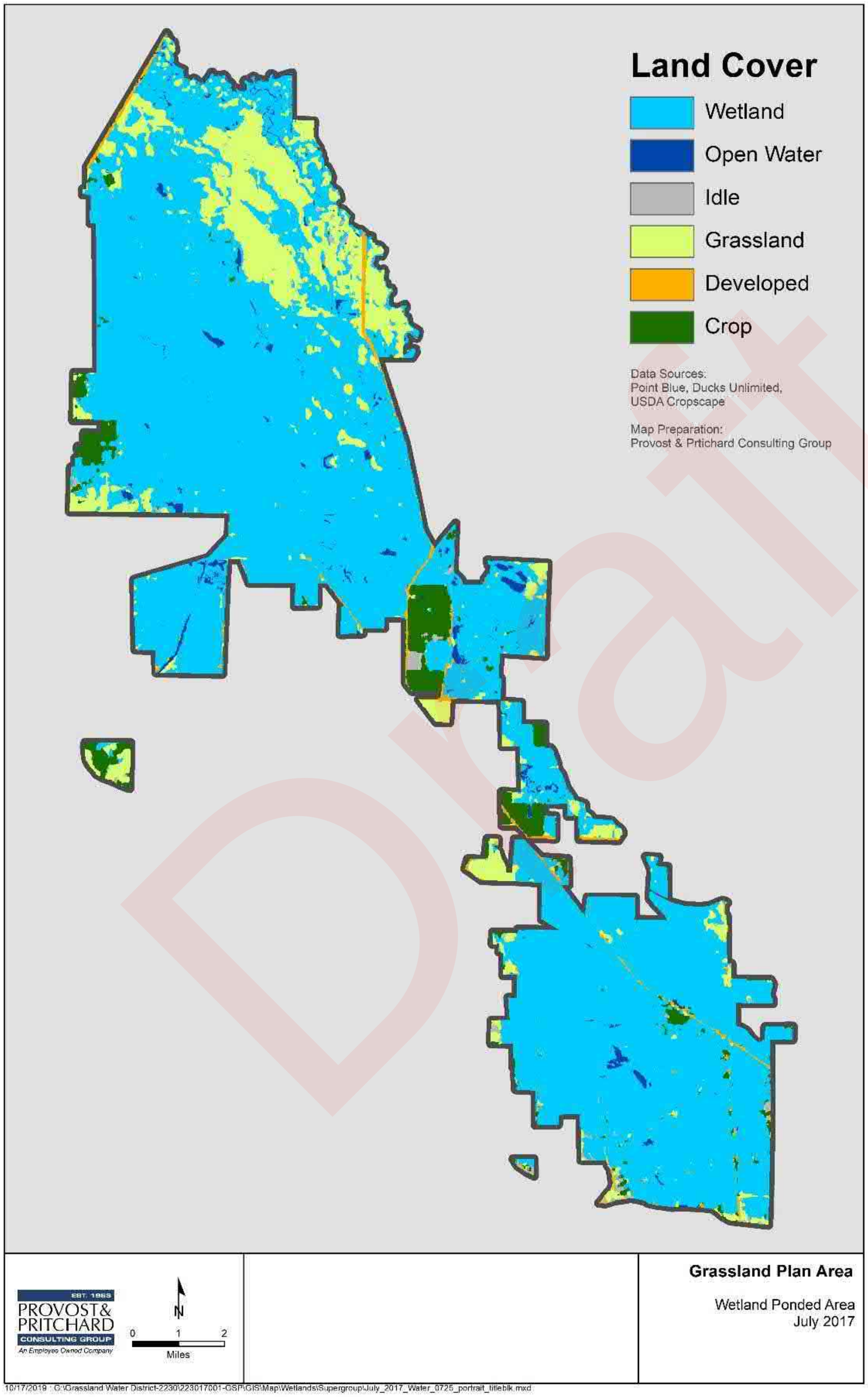


Figure 3-24: Wetland Ponded Area – July 2017

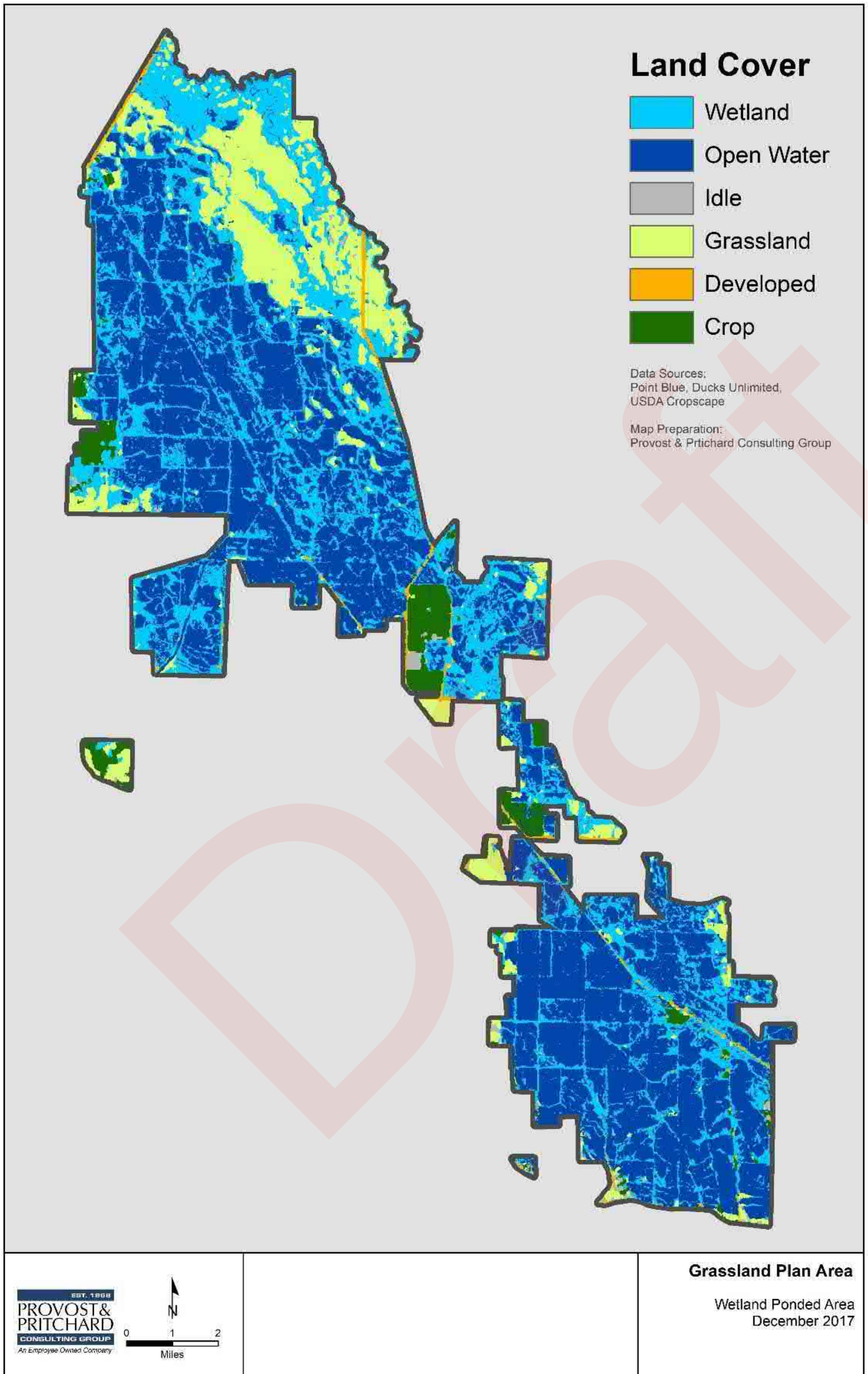


Figure 3-25: Wetland Ponded Area – December 2017

3.3.2 Method for Quantification of Inflows and Outflows

Legal Requirements:

> **§354.18(b) The water budget shall quantify the following, either through direct measurements or estimates based on data:**
> **(1) Total surface water entering and leaving a basin by water source type.**
> **(2) Inflow to the groundwater system by water source type, including subsurface groundwater inflow and infiltration of precipitation, applied water, and surface water systems, such as lakes, streams, rivers, canals, springs and conveyance systems.**
> **(3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.**

Quantification of inflows and outflows to the Plan Area were necessary to develop the historic, current, and projected water budgets. Some variables were estimated, using the best available science and methods, due to a lack of measured data. Inflows and outflows were broken down by water source and use. Each of the parameters described below is incorporated into the water budget spreadsheet tool. DWR's diagram displaying typical inflows and outflows for the atmospheric system, land surface system, and groundwater system is shown in **Figure 3-26**. For the purposes of the Grassland GSP's water budget, the analysis looks at the land surface system and the groundwater system, any losses to or gains from the atmospheric system are accounted for in the land surface system as evaporation or precipitation. Results of the historic, current, and projected water budget are provided in subsequent sections of this chapter.

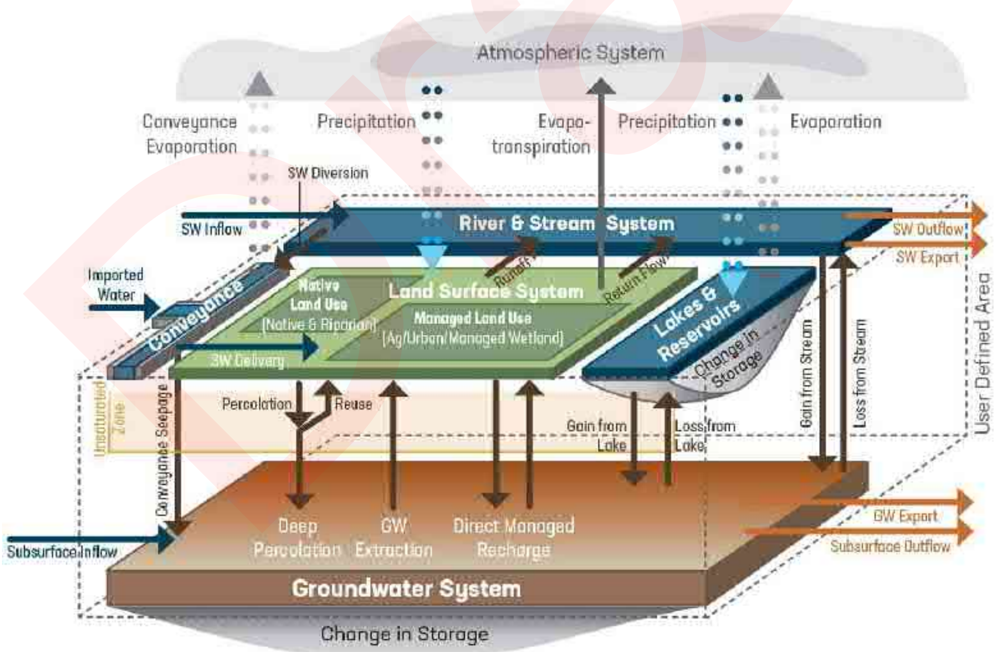


Figure 3-26: DWR Water Budget Graphic

3.3.2.1 Land Surface System Inflows

Surface Water

Both the GGSA and the MCDMGSA (Subareas 1 and 2, respectively, See **Figure 2-1**) have lands within their jurisdictions that receive federally contracted CVP surface water from USBR for private, state, and federal refuges. During wet water years, they also have the ability to receive Section 215 flood water from USBR. An additional source of surface water includes groundwater imported from outside of the GSA that is pumped into Subarea 2 and delivered to managed wetlands in Subarea 1 through the surface water delivery system (see Groundwater discussion below). Total values for delivered surface water for Subarea 1 can range from 125,000 AF during critically dry years to nearly 270,000 AF during wet years. In Subarea 2 surface water deliveries range from 31,000 AF during critically dry years to 52,000 AF during a wet year.

Surface Water Inflows

Non-CVP surface water inflows occur from surrounding agricultural districts and local waterways due to the low-lying elevation of the Plan Area. These inflows are accounted for in the surface water totals above. Typically, these inflows are unmetered but have been quantified using observed flow rates as they pass into the Plan Area, along with known watershed capacity characteristics. Surface water inflows have decreased over time with increased agricultural irrigation efficiencies. Non-CVP surface water inflows to Subarea 1 (GGSA area) are estimated at 30,600 AF under the current water budget and 33,800 AF under the average historic water budget. Some of these non-CVP surface water inflows may flow through into Subarea 2 (MCDMGSA area), but there are few independent sources of non-CVP surface water inflows to Subarea 2. Therefore, no additional value for non-CVP surface water inflows was assigned to Subarea 2 in the development of the Plan Area water budgets.

Precipitation

Monthly precipitation data was collected from the Los Banos CIMIS station for the surrogate water years. The same station was used to analyze data for the projected water budgets; however, data interpolated from the PRISM model was used in representative years prior to the installation of the CIMIS station (see **Section 3.3.4.4, Projected Water Budget**). The PRISM model calculates precipitation and evapotranspiration values in locations where monitoring stations do not exist and during years prior to the establishment of data collection. During the historically average period, rainfall ranged from slightly less than 4 inches in 2013 to 14 inches in 2005.

Precipitation either is utilized by plants as effective precipitation and evapo-transpired as an output from the surface water system, leaves the surface water system as precipitation runoff, or enters the groundwater system and becomes deep percolation as an input to the groundwater system and an output from the surface water system. These will be detailed further in their respective sections.

<u>Effective Precipitation</u>

Effective precipitation is the amount of rainfall that is beneficially used by vegetation. For managed wetlands, effective precipitation is considered to be any precipitation that has the potential to satisfy monthly evapotranspiration (ET) requirements. Precipitation that is in excess of ET requirements is considered runoff and contributes to surface water outflow.

For agricultural land, effective precipitation is calculated as 50% of total annual precipitation for the October-September water year. This 50% effective precipitation assumption is a commonly used method. Based on the Plan Area hydrology consultant's experience with calculating effective precipitation for other agricultural water balances, water transfers, and GSPs, the 50% assumption is known to produce results that are consistent with the more time-intensive Macgillivray method developed by DWR, which requires monthly time steps for precipitation data. The DWR method is based on the set of three equations seen below as **Equation 3-1** (1989 Macgillivray report for DWR).

Equation 3-1 Effective Precipitation

$$Nov - Feb = -0.54 + (0.94 * P)$$
$$Mar = -1.07 + (0.837 * P)$$
$$Oct = -0.06 + (0.635 * P)$$

Where P = Precipitation for the months listed in inches

Groundwater

Groundwater pumping is metered in the GGSA (Subarea 1 for Water Budget purposes) and much of the MCDMGSA (Subarea 2). Groundwater pumping for areas within Subarea 2 that are not metered was estimated using a consumptive use of applied water method (**Equation 3-2**). All consumptive use within the unmetered areas is assumed to be met with groundwater. Pumping was calculated as vegetation/crop demand with an irrigation efficiency factor of 80% applied to account for losses, primarily deep percolation into the aquifer. Groundwater pumping is an outflow to the groundwater system and an inflow to the land surface system.

Equation 3-2 Groundwater Pumping

$$GW = \left[\frac{(CD)}{IE}\right]$$

Where:
GW = Groundwater Pumped for Irrigation
CD = Crop Demand
IE = Irrigation Efficiency

Total groundwater extraction in Subarea 1 ranges from less than 3,000 AF during wet years to almost 20,000 AF during all other year types. Subarea 2 pumping ranges from nearly 30,000 AF in most year types to about 37,000 AF during critically dry years. Additional considerations were taken for groundwater pumped within Subarea 2 that is used within Subarea 1 for wetland habitat purposes. This groundwater pumping is metered and accounted for as groundwater outflow from Subarea 1 (labelled Groundwater Subarea 2 → Subarea 1).

Demand due to Irrigation Efficiency

Irrigation efficiencies were estimated for agricultural lands in the Plan Area. Efficiencies are estimated using the combination of actual irrigation practices and distribution system design. Irrigation methods were assigned to specific crop types based on known irrigation trends. Typical efficiencies of each irrigation method were used to estimate irrigation efficiency as it relates to irrigation practices, which was close to 80%. The irrigation efficiencies were used to estimate groundwater pumping for private agricultural lands in Subarea 2 as described in the groundwater description above.

Irrigation efficiencies are not a direct input or output from the surface water system. The volume of groundwater that is pumped to meet demands resulting from irrigation efficiency is assumed to percolate back into the groundwater system, essentially netting in no change to the water budget. Water returning to the groundwater system as a result of irrigation efficiencies is described in further detail in the section below titled Deep Percolation of Irrigation Water.

3.3.2.2 Surface System Outflows

Runoff of Precipitation

Runoff of precipitation is estimated as the amount of precipitation that cannot be effectively used on the landscape. Only during wet years is runoff of precipitation considered to be a large contributing factor to the water budget. It is assumed that a majority of the precipitation is either consumptively used by vegetation, percolated back into the ground, or evaporated. This analysis was conducted where data was available within the Plan Area, with the exception of some portions of Subarea 2 (including the West Bear Creek and San Luis Units of the San Joaquin National Wildlife Refuge, and the China Island Unit of the North Grasslands State Wildlife Area), where runoff data is not available. The Plan Area participants will work with landowners and agencies in those areas to obtain this information in order to refine the water budget in future GSP updates.

Evapotranspiration

Evapotranspiration values for vegetation (ET_v) in the Plan Area were developed using vegetation coefficients Howes, Fox, and Hutton (2015) al. This paper developed evapotranspiration coefficients (K_v) for wetland and upland vegetation and also published K values for other rainfed vegetation. K_v values were used with reference ET (ET_o) to calculate ET_v.

Vegetation categories included open water, large stand seasonal wetlands, moist soil vegetation, rainfed vegetation, and crops (grassland, idle land). Developed land was also considered, but it was assumed that water on this land use type would be precipitation only and be attributed to runoff. The vegetation coefficients (Kv/Kc) and ETo values for the land use types are shown in **Table 3-1.**

Table 3-1: Vegetation Coefficients and ET for Natural Vegetation Types

Vegetation Coefficients and ET For Natural Vegetation Types				
	Kv/Kc (annual average, inches)	Wet Year ET_o 59.53 annual, inches	Normal/Dry Year Total ETo 59.39 annual, inches	Critical Year Total ET_o 57.75 annual, inches
		Wet Year $ET_{kc/kv}$ (annual average, inches)	Normal/Dry Year $ET_{kc/kv}$ (annual average, inches)	Critical Year $ET_{kc/kv}$ (annual average, inches)
Moist Soil Veg Vegetation	0.37	0.10	0.10	0.10
Large Stand Seasonal Wetlands	0.89	0.40	0.41	0.39
Open Water	0.87	0.39	0.39	0.38
Grassland	0.37	0.10	0.10	0.10
Idle Land	0.37	0.10	0.10	0.10

Using acreages of each land use type, total acre-feet of ET per month was calculated for each Subarea for each year type and is summarized in **Table 3-2** below.

Table 3-2: Evapotranspiration (AFY) by Subarea

Evapotranspiration (AFY)		
	Subarea 1 (GGSA)	Subarea 2 (MCDMGSA)
Wet	204,800	96,200
Normal/Dry	210,100	99,500
Critical	170,600	89,200

Evaporation of Channels and Ponds

Evaporation from water delivery channels and wetland ponds was calculated for all surfaces of waterbodies in the Plan Area during the evapotranspiration calculation, using vegetation coefficients from Howes' document that included ET estimates for open water. The surface area of each water body was determined using surveyed areas and aerial images. Total ET for the open water irrigation channels and ponds was included in **Table 3-2.**

3.3.2.3 Groundwater System Inflows

Inflows to groundwater are any sources of water that contribute to the groundwater aquifer as a result of natural or managed inflow. Inflows may come from surface water or adjacent boundary groundwater flow. Inflows from surface water include recharge from natural bodies of water, losses from irrigation and conveyance systems, and managed or intentional recharge.

Deep Percolation of Irrigation Water

Deep percolation of agricultural irrigation water is an inflow from the land surface to the groundwater. Deep percolation of irrigation water is calculated using the assumption that all applied water in excess of the evapotranspiration (due to irrigation inefficiencies) infiltrates past the root zone and makes it back into the groundwater system (**Equation 3-3**). Deep percolation of irrigation water was only calculated for agricultural lands in Subarea 2. Any deep percolation of water used for irrigation of managed wetlands was accounted for in the analysis of pond seepage and is not considered in this calculation.

Equation 3-3 Deep Percolation of Irrigation

$$Deep\ Percolation\ of\ Irrigation\ Water = \left[\frac{(ET)}{IE}\right] - (ET)$$

Where:
ET = Evapotranspiration
IE = Irrigation Efficiency

Deep Percolation of Precipitation

Deep percolation of precipitation is an inflow from the land surface system to the groundwater system. Deep percolation of precipitation is estimated to be 10% of total annual precipitation based on previously made assumptions and known hydrogeologic characteristic of the area.

Deep Percolation of Rivers, Streams, Channels, and Ponds

Deep percolation of water from surface water bodies, natural or managed, is often called seepage or infiltration. Seepage of water in surface water bodies is typically affected by soil permeability, channel width, and water depth. Other factors that can affect seepage include sedimentation of silts in channels, decaying vegetative matter, groundwater levels, and hydraulic gradients. Several sources and existing studies were examined to develop seepage estimates. The seepage analysis evaluated the following sources of data:

- The Grassland Water District Groundwater Management Plan
- Studies from the San Joaquin River Restoration Program (SJRRP)
- Saturated hydraulic conductivity maps developed using NRCS mapping layers (See **Section 3.1, HCM**)
- Soil texture and hydrologic grouping maps
- Irrigation delivery data

Deep Percolation of Channels and Streams

Surface water delivery systems incidentally infiltrate water through the soil in unlined canals and storage and regulating reservoirs. According to the GWD Groundwater Management Plan, an estimated 18% of delivered water is lost due to seepage in the wetland water delivery canals. Therefore, 18% of total surface water deliveries was used to estimate seepage losses from channels within each Subarea for each water year type. Deep percolation from natural streams and channels that deliver spill water from neighbors or flood waters is also included in the estimated 18% of total surface water deliveries.

Local River Seepage

The portion of the San Joaquin River that runs along the eastern edge of the Plan Area is a gaining stream; therefore, there is no contribution from the river to the groundwater system. Streams that flow through the Plan Area are included in the estimates for deep percolation of channels. Losses to the SJR are accounted for in the Discharges & Consumptive Use/Lateral Flow of Groundwater in the Groundwater Outflow section below.

Pond Seepage

A mass balance method was used to calculate seepage from wetland habitat ponds. System gains and losses were quantified. Losses included evapotranspiration as described previously, surface water outflow from the Plan Area, and seepage of ponded water. Gains included effective precipitation and water deliveries. Seepage was quantified using **Equation 3-4** Total Seepage.

Equation 3-4 Total Seepage

$$Total\ Seepage = (ET + Outflow) - (EP + Water\ Deliveries)$$

Where:
ET = Evapotranspiration
EP = Effective Precipitation

Seepage rates for the flooded habitat were determined while ponded areas were full and receiving "maintenance" deliveries to compensate for losses. The volume of pond seepage was calculated using **Equation 3-4** Total Seepage for months where water deliveries for maintenance flow were provided. The monthly volume was converted to an average monthly loss rate over the ponded area. Using this method an average seepage rate of approximately 0.25 feet/month or 0.0082 feet/day was established. When a 0.25 foot/month loss rate was applied to the total acreage of open water for each month, total losses were approximately 67,000 AF. These losses also include losses from channels and streams, quantified as 18% of total surface water deliveries. By subtracting the seepage of the channels from the total seepage, it was determined that approximately 8.6% of the total applied surface water returns to the groundwater system.

Intentional Groundwater Recharge

There is no intentional groundwater recharge in the Plan Area; however, recharge from the ponded habitat results in gains to groundwater system, some of which is assumed to leave the groundwater system as described in **Section 3.3.2.4**.

Groundwater Inflow

Groundwater movement occurs due to hydraulic gradients. Calculations of groundwater movement use transmissivity values based on aquifer tests (see **Section 0**), groundwater level contours and cross- boundary flow directions (see **Section 3.2.2.2**). Transmissivity changes with depth due to variations in aquifer material. For the Plan Area, an average transmissivity value was used for each boundary line to estimate the thickness of the aquifer, based on available data. Therefore, the GGSA and MCDMGSA worked with the neighboring SJRECGSA, which had sufficient internal data to develop groundwater flow contours as groundwater contours were unavailable or inconsistent for some years in areas adjacent to and within the Plan Area. The SJRECGSA assisted KDSA in calculating the average-per-mile outflows from the SJRECGSA boundary adjacent to the Plan Area. These numbers were used to calculate Plan Area inflows.

Other Recharge

There are no other known recharge components.

3.3.2.4 Groundwater System Outflows

Groundwater Pumping

Groundwater is pumped from both the upper and lower aquifers in the Plan Area. Pumping is not separated by aquifer for the purposes of this water budget and was explained in detail previously in the surface water discussion.

Subsurface Groundwater Outflow

Groundwater outflow was calculated the same way as inflow. Limited data was available for areas adjacent to and within the Plan Area. All groundwater outflow from the Grassland Plan Area leaves the Delta-Mendota Subbasin boundary and enters the Merced Subbasin.

Groundwater Pumped in Subarea 1 and Delivered in Subarea 2

Groundwater is pumped from portions of Subarea 2 and delivered to Subarea 1 through the surface water delivery system, where it is applied to habitat. This groundwater is accounted for in Subarea 2 as pumped groundwater (labelled "Groundwater Subarea 2 → Subarea 1) and is accounted for in Subarea 1 as surface water inflow.

Discharges & Consumptive Use/Lateral Flow of Groundwater

Since the estimated inputs to the groundwater system are greater than the estimated outflows throughout most of the Plan Area, additional losses from the groundwater system were quantified as a "closing term" (in water accounting, where one part of a water budget is back-calculated using the other terms), to reflect other uses of groundwater as a result of the difference in physical change in storage. Additional losses from the groundwater system are assumed to be either passively discharged to surface water from the shallow groundwater table or consumptively used by GDE vegetation in the Plan Area, which may also be associated with localized lateral flow gradients. The total additional losses from this parameter range from 14,000 AFY to 58,000 AFY for the entire Plan Area. These outflows are included in the water budget under the category "Other Consumptive Use of Groundwater" and are labelled as "Discharge to Surface Water/Consumptive use by GDEs/Lateral Flow."

Discharges to Surface Water
Discharges to surface water occur when the groundwater table is at or above the elevation of adjacent surface water. Discharges from the groundwater system are known to enter the SJR adjacent to the Plan Area. Additional monitoring is needed to detect discharge locations and quantities. Discharges to some ditches, canals, and sloughs are also possible as groundwater elevation rises during the irrigation season and wet periods. Although discharges to surface water are not directly quantified, it has been determined based on water operator's experiences that during wet years, certain wetland units retain water in volumes that exceed precipitation, even without active surface or groundwater deliveries. In addition, water runoff from the Plan Area is sometimes greater than the volume of applied water and precipitation. In these wet years, it is estimated that passive discharges of shallow groundwater to surface water during wet years are greater than consumptive use of groundwater by vegetation. Pumping of groundwater is low in wet years due to wetland water needs being met by reliable deliveries of surface water and above average precipitation.

Consumptive Use/Lateral Flow of Shallow Groundwater
Consumptive use of groundwater is defined as the evapotranspiration of shallow groundwater by vegetation. During average/dry years and critically dry years, consumptive use is greater than applied water (both surface and groundwater), signifying that additional near-surface water sources are likely present for use in wetland habitats. This deficiency in available water for wetland consumptive use may also create a local gradient that allows groundwater to move laterally from ponded areas or areas with greater access to surface water to areas with less access to surface water. It should be noted that lateral flow may be induced in nearby areas where groundwater pumping is the main source of water.

3.3.3 Quantification of Overdraft and Sustainable Yield

Legal Requirements:

§354.18(b) The water budget shall quantify the following, either through direct measurements or estimates based on data:
(4) The change in the annual volume of groundwater in storage between seasonal high conditions.
(5) If overdraft conditions occur, as defined in Bulletin 118, the water budget shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions.
(6) The water year type associated with the annual supply, demand, and change in groundwater stored.
(7) An estimate of sustainable yield for the basin.

3.3.3.1 Overdraft/Change in Groundwater Storage

Overdraft happens when more water is flowing out of the aquifer than is being replenished. Overdraft is synonymous with a negative change in groundwater storage. This is also the change in available water within an aquifer or the change in available storage space in an aquifer. Change in storage is typically based on annual seasonal high groundwater level measurements. Seasonal high groundwater level measurement trends are plotted on water level hydrographs in order to observe long-term changes in water level for a single well. Seasonal high measurements are also used to create water level elevation contour maps. Hydrographs and contour maps are compared by location and from year to year, respectively, to calculate a change in groundwater storage. In highly regulated systems it is also possible to quantify change in storage using inflows and outflows; however, calculations of subsurface groundwater flows are still dependent on seasonal high contour maps to determine subsurface inflow and outflow gradients.

There are two primary aquifers in the Plan Area, the upper unconfined aquifer and the lower confined aquifer. Upper aquifer change in storage is calculated using changes in the amount of water available for use from year to year, and can be calculated using the Inflow/Outflow Method (**Equation 3-6**) or the Specific Yield Method (**Equation 3-5**). The lower aquifer change in storage is the loss of the system's ability to store water due to compaction of fine-grained deposits observed as land subsidence and is calculated in the Subsidence Mapping Method for the lower aquifer.

For the upper unconfined aquifer, change in storage was calculated using the Specific Yield Method for each year type. An annual change in storage for the hydraulic base period was calculated using the results of the Specific Yield Method for each year type in the annual water budget spreadsheet (**Table 3-3**), which averaged the change in storage over the 10-year period, based on year type. The Inflow/Outflow Method was not used to determine change in storage because of the limited amount of data available. However, the results of the Specific Yield method were used to inform the use of the Inflow/Outflow method for other water budget parameters.

Due to a current lack of water level data, lower aquifer change in storage is calculated by proxy as the loss of the system's ability to store water due to compaction of fine-grained deposits, observed as land subsidence and calculated using the Subsidence Mapping Method. See **Table 3-2** for a summary of changes in storage for the Plan Area.

Upper Aquifer Overdraft/Change in Storage

Specific Yield Method

Equation 3-5 was used to calculate annual change in groundwater storage based on average annual measured water level decline, developed using water level hydrographs and contour maps, and specific yield. As defined in the HCM, the average specific yield for the Plan Area is 0.12 feet, and average changes in water levels across the Plan Area for specific water year types range from +1.4 feet during wet years to -1.5 feet during critical years. When applied to the 10-year average hydrologic period there was an increase of approximately 0.2 feet per year. This Specific Yield Method for calculating annual change in groundwater storage is described in **Equation 3-5**:

Equation 3-5 Groundwater Storage Change (Specific Yield Method)

$$\Delta\, Storage = SY * \ \Delta WL * A$$

Where:
SY = Specific Yield (%)
ΔWL = Change in Water Level (feet/year)
A = Area of GSA (acres)

Inflow/Outflow Method

The Inflow/Outflow Method is based on the water budget difference between inflow to the area (supply sources) and outflow from the area (uses). **Equation 3-6** shows the method. Change in storage was not calculated using this method but may be used in the future as estimates of actual inflow and outflow parameters are obtained.

Equation 3-6 Groundwater Storage Change (Inflow/Outflow Method)

$$\Delta\, Storage = Inflows - Outflows$$

Where:
Inflows = Groundwater system inflows
Outflows = Groundwater system outflows

The water budgeting process generally used the Inflow/Outflow Method, and this method was used in the Coordinated Delta-Mendota Water Budget. The average change in storage calculated using the Specific Yield Method was used to help estimate some of the other water budget parameters, such as the closing term that includes consumptive use of groundwater by GDEs and groundwater discharges to the surface water system. This was achieved by setting the Inflow/Outflow parameter for change in groundwater storage as equal to the Specific Yield result for change in storage. Once values were developed for water budget parameters using the Inflow/Outflow method, individual water years during the hydrologic average base period were inserted as required for the Coordinated Delta-Mendota Water Budget.

Since some of the values for the Inflow/Outflow Method were calculated using the average period, values were unavailable for various year types. This created additional error when using the Inflow/Outflow Method to calculate change in storage for individual years. The specific yield method is the preferred method for determining average change in storage for the unconfined groundwater because of the error in the annual inflow/outflow method.

Subsidence Mapping Method

Long-term change in storage in the lower aquifer can be directly correlated to subsidence. Due to a lack of water level and specific yield data for the lower aquifer, subsidence mapping was used to calculate a change in lower aquifer storage (as described in **Chapter 5**) using the following formula:

Equation 3-7: Groundwater Storage Change (Subsidence Mapping)

$$\Delta\, Storage = Average\ \Delta GS * A$$

Where:
Average ΔGS = Average Change in Ground Surface Elevation (feet)
A = Area of GSA (acres)

The average change in ground surface elevation was calculated over the available period of record from local surveys and USBR and SJRRP monitoring data from 2011-2017. An average annual rate of subsidence from that period amounted to a 0.075-foot loss. The subsidence mapping method is the preferred method for determining average change in storage in the lower aquifer per year. As a result of limited groundwater elevation in the lower aquifer and limited understanding of the lower aquifer in the Plan Area, change in lower aquifer groundwater storage using subsidence mapping was performed for the entire Plan Area, it was not done by any individual GSA.

Table 3-3: Average Annual Change in Storage Summary

	Plan Area	Equation Used
Upper Aquifer **(based on rate of water level change)**	0.19 feet/year	$\Delta\ Storage = SY * \Delta WL * A$ Where: SY = Specific Yield (%) ΔWL = Change in Water Level (feet/year) A = Area of GSA (acres)
Lower Aquifer **(based on rate of land subsidence)**	-0.075 feet/year	$\Delta\ Storage = Average\ \Delta GS * A$ Where: Average ΔGS = Average Change in Ground Surface Elevation (feet) A = Area of GSA (acres)

3.3.3.2 Sustainable Yield

The Plan Area does minimal pumping on a per-acre basis, and undesirable results have not been observed. It is unknown whether increases in pumping will affect the groundwater storage volume or cause undesirable results. Because of the lack of understanding regarding how pumping affects the aquifer, calculating sustainable yield can be complicated. The Plan Area experiences a positive change in groundwater storage on average, and therefore a calculation of sustainable yield for the Plan Area may be underestimated. It is also unknown how other factors, such as shallow groundwater discharges to surface water, or consumptive use of groundwater by GDEs, affect sustainability.

The Delta-Mendota Coordination Committee developed a basinwide sustainable yield estimation for the upper aquifer, as required by SGMA (see Section 4.3.4 of the Common Chapter). The basinwide analysis resulted in an Upper Aquifer Sustainable Yield estimate ranging from 325,000 AF to 480,000 AF, demonstrating the Subbasin's estimated Upper Aquifer sustainable yield without implementing any projects and management actions (low end of range) and the Subbasin's estimated Upper Aquifer sustainable yield considering the implementation of projects and management actions (high end of range).

The basinwide estimates for the Lower Aquifer sustainable yield are approximately 250,000 AFY over the approximately 750,000-acre Subbasin. Sustainable yield is not uniform throughout the Subbasin, and it will be the responsibility of the GGSA and MCDMGSA to monitor groundwater conditions that may result from lower aquifer pumping. Additional information on the sustainable yield development for the upper and lower aquifer is available in **Appendix A – Common Chapter**.

3.3.4 Current, Historical, and Projected Water Budget

Legal Requirements:

§354.18 (c) Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:

3.3.4.1 Current Water Budget

Legal Requirements:

§354.18
(c) (1) Current water budget information shall quantify current inflows and outflows for the basin using the most recent hydrology, water supply, water demand, and land use information.
(d) The Agency shall utilize the following information provided, as available, by the Department pursuant to Section 353.2, or other data of comparable quality, to develop the water budget:
(2) Current water budget information for temperature, water year type, evapotranspiration, and land use.

The current water budget is just a snapshot, while the historic water budget more accurately portrays the cause and effect of different parameters in the Plan Area. The Delta-Mendota Subbasin chose 2013 as the current year. Since 2013 was also used as the surrogate year for the average/dry year water budget, data was readily available; however, annual data was not available for each individual parameter, so data was supplemented from other average/dry years to develop a value for some parameters. Data gaps include annual groundwater inflow and outflows and flow to the lower aquifer from the upper aquifer.

Table 3-4: 2013 - Current Water Budget

			Plan Area
Inflows	Precipitation		30,400
	Surface Water Inflows		30,600
	Applied Water - Groundwater		52,100
	Applied Water - Imported Surface Water		239,400
	Other Direct Recharge		0
	Total Inflows		**352,500**
Outflows	Runoff		300
	Evapotranspiration		309,600
	Surface Water Outflows		26,800
	Deep Percolation		56,400
	Total Outflows		**393,100**
Inflows	Deep Percolation	*Precipitation Infiltration*	300
		Surface Water Infiltration	48,600
		Applied Water Infiltration	7,500
	Subsurface Groundwater Inflows	*Upper Aquifer*	25,600
		Lower Aquifer	NA
	Other Direct Recharge		20,100
	Total Inflows		**102,100**
Outflows	Groundwater Extraction from Upper Aquifer		52,100
	Groundwater Extraction from Lower Aquifer		0
	Subsurface Groundwater Outflows	*Upper Aquifer*	3,400
		Lower Aquifer	NA
	Other Consumptive Use of Groundwater	*Flow to Lower Aquifer*	19,600
		Discharge to Surface Water/Consumptive use by GDEs/Lateral Flow	14,400
		Groundwater Subarea 2 → Subarea 1	13,600
	Total Outflows		**103,100**
Change in Storage	Estimated Annual Change in Groundwater Storage	Inflows	102,100
		Outflows	103,100
		Change in Storage - Upper Aquifer	(1,000)
		Change in Storage - Lower Aquifer	See Table 3-2
		Change in Storage - Total	(1,000)

3.3.4.2 Historical Budget

Legal Requirements:

§354.18
(c) Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:
(2) Historical water budget information shall be used to evaluate availability or reliability of past surface water supply deliveries and aquifer response to water supply and demand trends relative to water year type. The historical water budget shall include the following:
(A) A quantitative evaluation of the availability or reliability of historical surface water supply deliveries as a function of the historical planned versus actual annual surface water deliveries, by surface water source and water year type, and based on the most recent ten years of surface water supply information.
(B) A quantitative assessment of the historical water budget, starting with the most recently available information and extending back a minimum of 10 years, or as is sufficient to calibrate and reduce the uncertainty of the tools and methods used to estimate and project future water budget information and future aquifer response to proposed sustainable groundwater management practices over the planning and implementation horizon.
(C) A description of how historical conditions concerning hydrology, water demand, and surface water supply availability or reliability have impacted the ability of the Agency to operate the basin within sustainable yield. Basin hydrology may be characterized and evaluated using water year type.
(d) The Agency shall utilize the following information provided, as available, by the Department pursuant to Section 353.2, or other data of comparable quality, to develop the water budget:
(1) Historical water budget information for mean annual temperature, mean annual precipitation, water year type, and land use.

In accordance with GSP regulations, a base period must be selected so that the analysis of sustainable yield is performed for a representative period with minimal bias that might result from the selection of an overly wet or dry period while recognizing changes in other conditions including land use and water demands. The base period should be selected considering the following criteria: long-term mean annual water supply; inclusion of both wet and dry periods; antecedent soil conditions; adequate data availability; and inclusion of current hydrologic, cultural, and water management conditions in the basin.

As previously mentioned, the historical water budget was prepared using data from water years 2003-2012, which represents a typical hydrologic base period for the Subbasin based on flow in the San Joaquin River. In building the water budget, full natural flow of the SJR was evaluated for the duration of the historic record going back to 1901 in order to establish a long-term average flow rate. The period of WY 2003-2012 was chosen because it represents a recent average period that lies outside the most recent drought. The full natural flow (also known as unimpaired flow) was also compared to precipitation records in the area and the SJR water year index. The percent water year is based on DWR's water year index for the San Joaquin River. For simplification purposes, above normal and below normal years were grouped into "normal years," and dry and critically dry years were grouped into "dry years," with the exception of Shasta Critical water years in which surface water allocations are reduces to 75%. **Table 3-5** shows the full natural flow and percent water year of the SJR for the average historical period chosen.

Table 3-5: Average Historical Period – SJR Full Natural Flows

Water Year	Water Year Type	Runoff (AF)	Percent Water Year
2003	Normal	1,450,000	81%
2004	Dry	1,131,000	63%
2005	Wet	2,830,000	158%
2006	Wet	3,181,000	177%
2007	Dry	684,000	38%
2008	Dry	1,117,000	62%
2009	Dry	1,455,000	81%
2010	Normal	2,029,000	113%
2011	Wet	3,305,000	184%
2012	Dry	832,000	46%
Average Percent Water Year			100.3%

All other parameters for factoring inflow and outflow have been described in **Section 3.3.2** and are summarized in **Table 3-6**. Surface water system outflows are reported as greater than inflows, which is likely explained by the outflow of shallow groundwater to the surface water system or through consumptive use by GDEs. In addition, because managed wetlands within the Plan Area routinely receive less than the full Level 4 water supply needed for optimal wetland management, some wetlands may experience lower-than-estimated outflows through evapotranspiration.

The historical water budget was prepared for an average 10-year period where each parameter was analyzed independently and averaged both over a 10-year period, and on a year-by-year basis, as required by DWR. On an average annual basis, the water budget for the Plan Area shows a positive average change in storage of approximately 3,200 AFY in the upper unconfined aquifer (see **Table 3-6**). As discussed previously the Plan Area has significant amounts of surface water and is minimally dependent on groundwater. Groundwater is replenished and likely flows out of the Plan Area as a result of the heavy application of surface water to the area.

Table 3-6: Historical Water Budget Summary

Grassland GSP Historic Water Budget		
Period of Record: 2003 - 2013		
Land Surface Budget		Annual Average (acre-feet/year)
	Description	
Inflows		
1)	Precipitation	34600
2)	Surface Water Inflows	33800
3)	Applied Water - Groundwater	46300
4)	Applied Water - Surface Water Diversions	251400
5)	Other Direct Recharge	0
	Total Inflows	*366100*

Grassland GSP Historic Water Budget		
Period of Record: 2003 - 2013		
Outflows		
1)	Runoff	2310
2)	Evapotranspiration	307000
3)	Surface Water Outflows	28000
4)	Deep Percolation	63000
	Total Outflows	***400300***
Groundwater Budget		**Annual Average (acre-feet/year)**
	Description	
Inflows		
1)	Deep Percolation	
	Precipitation Infiltration (included in SW infiltration)	*300*
	Surface Water Infiltration (losses from canals & conveyance)	*51330*
	Applied Water Infiltration (0 if ET is greater than surface water inflows - losses)	*11300*
2)	Subsurface Groundwater Inflows	
	Upper Aquifer	*25600*
	Lower Aquifer (not enough data to calculate)	*0*
3)	Other Direct Recharge (pond seepage)	*20970*
	Total Inflows	***109500***
Outflows		
1)	Groundwater Extraction from Upper Aquifer	*46300*
2)	Groundwater Extraction from Lower Aquifer	*0*
3)	Subsurface Groundwater Outflows	*3400*
4)	Other Consumptive Use of Groundwater	
	Flow to Lower Aquifer	*19600*
	Discharge to Surface Water/Consumptive use by GDEs	*27600*
	Exported Groundwater	*9500*
	Total Outflows	***106400***
Change in Storage	***Estimated Annual Change in Groundwater Storage***	
	Inflows	***109600***
	Outflows	***106400***
	Change in Storage	***3200***

3.3.4.3 Projected Water Budget

Legal Requirements:

§354.18
(c) Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:
(3) Projected water budgets shall be used to estimate future baseline conditions of supply, demand, and aquifer response to Plan implementation, and to identify the uncertainties of these projected water budget components. The projected water budget shall utilize the following methodologies and assumptions to estimate future baseline conditions concerning hydrology, water demand and surface water supply availability or reliability over the planning and implementation horizon:
(A) Projected hydrology shall utilize 50 years of historical precipitation, evapotranspiration, and streamflow information as the baseline condition for estimating future hydrology. The projected hydrology information shall also be applied as the baseline condition used to evaluate future scenarios of hydrologic uncertainty associated with projections of climate change and sea level rise.
(B) Projected water demand shall utilize the most recent land use, evapotranspiration, and crop coefficient information as the baseline condition for estimating future water demand. The projected water demand information shall also be applied as the baseline condition used to evaluate future scenarios of water demand uncertainty associated with projected changes in local land use planning, population growth, and climate.
(C) Projected surface water supply shall utilize the most recent water supply information as the baseline condition for estimating future surface water supply. The projected surface water supply shall also be applied as the baseline condition used to evaluate future scenarios of surface water supply availability and reliability as a function of the historical surface water supply identified in Section 354.18(c)(2)(A), and the projected changes in local land use planning, population growth, and climate.
(d) The Agency shall utilize the following information provided, as available, by the Department pursuant to Section 353.2, or other data of comparable quality, to develop the water budget:
(3) Projected water budget information for population, population growth, climate change, and sea level rise.

The goal of a projected water budget is to estimate future baseline conditions in response to GSP implementation. The projected water budget must use 50 years of historical precipitation, evapotranspiration, and streamflow while using the most recent land use and water supply information as the baseline condition. In formulating future baseline conditions, the effects of climate change on water availability and use must be considered.

A yearly sequence was chosen to line up historical data to projected years from 2018 to 2070. A similar historic period to the recent drought was identified from 1975-1977. The following year 1978 was used as the first projected year and corresponded to 2017. The historical sequence of years from 1978 through 2017 was used in the projected water budget to represent future water years 2017 through 2056. For the years 2012-2017, which would correspond to projected years 2052-2056, climate change factors were not available, so surrogate years were chosen based upon water year type. **Table 3-7** shows the matching surrogate years for this period. For the years 2057-2070 the historical water years of 1965-1978 were used in sequence.

Table 3-7: Surrogate Projected Years

Surrogate Years for 2012-2017	
Historical Year	Surrogate Year
2012	2001
2013	1992
2014	1976
2015	1977
2016	2002
2017	2011

A simplified model was used to calculate the projected water budget for 2020-2070. Precipitation and ET components were calculated based upon historical measurements. For projected land use, cropping was maintained at 2017 acreages for all future years. No communities are within the GSAs, so population growth was not considered. Cross-boundary groundwater flows had the greatest uncertainty and were set during the calibration of the model. Other components were formulated by selecting and applying conditions based on four different water year types. Three types were identified based upon historical indices of the San Joaquin River: Dry, Normal, Wet. The fourth water year type, Shasta Critical, was identified as a critically dry year when reductions to surface water allocations may be experienced. Water year types were kept the same for projected years and were not recalculated based upon climate change. For each year type water budget components had specified volumes which were applied to the projected year from which the climate was derived. Wet years were represented with values from 2017, average/dry years from 2013, and Shasta Critical years from 2015.

Historical precipitation, evapotranspiration, and streamflow were not continuously recorded within the Plan Area for any 50-year period which necessitated using modeled climate data to project future conditions. Surface water allocations were kept the same and the effects of climate change on streamflow were not quantified due to the high-priority water right that the GSAs have for habitat use. Precipitation and minimum and maximum temperature measurements were obtained from the Parameter-elevation Regressions on Independent Slopes Model (PRISM) historical datasets (http://www.prism.oregonstate.edu/, Daly et al.,1994). PRISM is a gridded monthly dataset that includes monthly temperature maximum and minimum and precipitation accumulation. All PRISM grid cells that are either fully or partially within the GSAs' boundaries were considered for the period of interest. The segmented maximum temperature, minimum temperature, and precipitation values were averaged for each parameter by month in the period.

Historical evapotranspiration measurements are not available for the GSAs before the mid-1980s implementation of the California Irrigation Management Information System (CIMIS). Thus, monthly evapotranspiration was calculated with PRISM temperature data using the Hargreaves-Samani equation (Hargreaves and Samani, 1982) from the DWR California Simulation of Evapotranspiration of Applied Water (Cal-SIMETAW) model (Orang et al., 2013). This equation (shown as **Equation 3-7)** provides a monthly reference ET estimate derived from mean temperature and long-term average radiation for a centroid of the Plan Area. This model was used to calculate monthly reference ET values.

Equation 3-7: Hargreaves-Samani Equation

$$ETo = 0.0023\,(T_{mean} + 17.8) * \sqrt{T_{max} - T_{min}} * R_a$$

where: *ETo* is reference monthly evapotranspiration
T is monthly temperature
Ra is the monthly average extraterrestrial radiation at the given latitude

Precipitation and derivation of ET from PRISM were used in the baseline calculations for the model. To consider the effects of climate change, DWR provided a dataset containing factors to apply to historical data. This method, known as climate period analysis, preserves the historical variability while dampening or amplifying the magnitude of events based upon projected changes in precipitation and temperature. The provided climate change factors for two future 30-year periods, centered on 2030 and 2070, were derived from statistical analysis of an ensemble of 20 global climate model projections.

Using the same method as was used with the PRISM grid, the monthly climate change factors provided by DWR were averaged over the spatial extent of the Plan Area. The monthly change factors were then applied to the PRISM-derived monthly precipitation and ET and then summed by water year. The 2030 climate change factors, which are applicable to the climate period of 2016-2045, were used for projected years through 2045. For the projected years of 2046-2070, the 2070 climate change factors were used.

In addition to the uncertainties of changes in climate, there were other factors that affected the projected change in storage calculations such as variability in subsurface flows and consumptive use of groundwater. The water budget was computed for each projected year individually, so inter-year trends and variability did not affect water budget components. The lack of inter-year variability may have led to compounding effects of wet or dry years. Since every dry year was 2015, a four-year drought would result in four consecutive projections of 2015 conditions. If this sequence of years were to occur, the years would be either slightly wetter or dryer, resulting in different availabilities of water and changes in management that would consume a different volume of water.

Projected changes in population were not made because there are no communities within the Plan Area, and the existing protected status of the majority of land in the Plan Area is not expected to support population growth. Effects of drought and water shortage beyond the conditions of the historical data were not considered. The most recently calculated vegetation coefficients were used to determine consumptive use, but it is unknown how the coefficients will change under future management and climate change. There are also limitations in the ability to predict future conditions for flows in the San Joaquin River. The SJRRP projects have increased flows from those that occurred during the 10-year average hydrologic period. These are not accounted for in the specific year types used to project current conditions due to uncertainty of implementation. In addition existing climate change projections expect increases in flood releases which will likely occur earlier in the year and at higher rates than they have historically resulting in more high-flow periods that would in turn increase seepage, associated groundwater flows, and availability of water in surface water systems. A summary of the projected water budget (with climate change) is summarized in **Table 3-8**, below, and the full projected water budget can be seen in **Appendix D – Projected Water Budget**.

Table 3-8: Projected Water Budget Summary

Parameter			Projected Period Average 2014-2070 (acre-feet/year)
Inflows	Precipitation		94,256
	Surface Water Inflows		41,953
	Applied Water - Groundwater		45,467
	Applied Water - Imported Surface Water		233,142
	Other Direct Recharge		0
	Total Inflows		**414,818**
Outflows	Runoff		26,721
	Evapotranspiration		298,380
	Surface Water Outflows		28,290
	Deep Percolation		72,135
	Total Outflows		**425,526**
Inflows	Deep Percolation	*Precipitation Infiltration*	789.4736842
		Surface Water Infiltration	47,212
		Applied Water Infiltration	15,415
	Subsurface Groundwater Inflows	*Upper Aquifer*	26,389
		Lower Aquifer	NA
	Other Direct Recharge		20,688
	Total Inflows		
Outflows	Groundwater Extraction from Upper Aquifer		44,488
	Groundwater Extraction from Lower Aquifer		0
	Subsurface Groundwater Outflows	Upper Aquifer	1,900
		Lower Aquifer	0
	Other Consumptive Use of Groundwater	*Flow to Lower Aquifer*	19,600
		Discharge to Surface Water/Consumptive use by GDEs/Lateral Flow	35,507
		Groundwater Subarea 2 → Subarea 1	7,549
	Total Outflows		**109,044**
Change in Storage	Estimated Annual Change in Groundwater Storage	Inflows	110,494
		Outflows	109,044
		Change in Storage - Upper Aquifer	1,450

3.4 Management Areas

Legal Requirements:

§354.20 (a) Each Agency may define one or more management areas within a basin if the Agency has determined that creation of management areas will facilitate implementation of the Plan. Management areas may define different minimum thresholds and be operated to different measurable objectives than the basin at large, provided that undesirable results are defined consistently throughout the basin. (b) A basin that includes one or more management areas shall describe the following in the Plan:

The GGSA and MCDMGSA will be managing the Plan Area as one unit.

4 Sustainable Management Criteria

Legal Requirements:

§354.22 This Subarticle describes criteria by which an Agency defines conditions in its Plan that constitute sustainable groundwater management for the basin, including the process by which the Agency shall characterize undesirable results, and establish minimum thresholds and measurable objectives for each applicable sustainability indicator.

SGMA defines sustainable groundwater management as the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results. The avoidance of undesirable results is important to the success of a GSP. Several requirements from GSP regulations have been grouped together under the heading of Sustainable Management Criteria (SMC), including a Sustainability Goal, Undesirable Results, Minimum Thresholds, and Measurable Objectives for various indicators of groundwater conditions. Development of these Sustainable Management Criteria is dependent on basin information developed and presented in the hydrogeologic conceptual model, groundwater conditions, and water budget chapters of the Grassland GSP (DWR, 2017).

Indicators for the sustainable management of groundwater were determined by SGMA based on factors that are important to the health and general well-being of the public. There are six indicators that must be monitored throughout the planning and implementation period of the GSP including groundwater levels, groundwater storage volume, land subsidence, water quality, interconnected surface water, and seawater intrusion. This chapter will describe the indicators and why they are significant and will define management thresholds for the Plan area.

The Sustainable Management Criteria described herein were prepared following the requirements set forth in the California Code of Regulations, Title 23, Division 2, Chapter 1.5, Subchapter 2, Article 5, Subarticle 3 (§354.22 through §354.30).

4.1 Sustainability Goal

Legal Requirements:

§354.24 Each Agency shall establish in its Plan a sustainability goal for the basin that culminates in the absence of undesirable results within 20 years of the applicable statutory deadline. The Plan shall include a description of the sustainability goal, including information from the basin setting used to establish the sustainability goal, a discussion of the measures that will be implemented to ensure that the basin will be operated within its sustainable yield, and an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation and is likely to be maintained through the planning and implementation horizon.

The Delta-Mendota Subbasin sustainability goal is a general description of the objectives of the GSP and for the Basin: *The Delta-Mendota Subbasin will manage groundwater resources for the benefit of all users of groundwater in a manner that allows for operational flexibility, ensures resource availability under drought conditions, and does not negatively impact surface water diversion and conveyance and delivery capabilities. This goal will be achieved through the implementation of the proposed projects and management actions to reach identified measurable objectives and milestones through the implementation of the GSP(s), and through continued coordination with neighboring subbasins to ensure the absence of undesirable results by 2040.*

The success of the GSP is reflected in the avoidance of undesirable results as described in section 4.3 Undesirable Results. This allows a significant amount of flexibility in defining and implementing Sustainable Management Criteria in the absence of undesirable results.

It is the intent of the Grassland Plan Area participants and the members of the Delta-Mendota Subbasin to work collaboratively to continue to better understand the basin characteristics by establishing a coordinated network of monitoring locations and reporting requirements. This will help to recognize existing hydrogeological patterns to better refine Sustainable Management Criteria in future GSP updates. It is the goal of the Grassland Plan Area and other Basin members to establish criteria and implement programs and projects to monitor and manage groundwater levels and storage, protect water quality, and reduce the effects of subsidence in a manner that is open to the public and stakeholders.

4.2 Sustainability Indicators

The Grassland GSP Area participants will monitor groundwater conditions that correspond to sustainability indicators established by DWR (**Figure 4-1**). These sustainability indicators are groundwater levels, change in storage, seawater intrusion, water quality, land subsidence, and depletions of interconnected surface water. SMCs (including measurable objectives and minimum thresholds) are developed for each applicable indicator by setting values in which undesirable results would be avoided and sustainability would be obtained. These values are intended to define the range in which groundwater is in a sustainable condition. For example, exceedance of a measurable objective would initiate additional investigations or monitoring to determine if significant and unreasonable effects are being experienced as a result of exceeding that SMC. Should an indicator exceed SMC values for any length of time without triggering significant and unreasonable effects, SMCs could be reconsidered and revised in future GSP updates. Conversely, should significant and unreasonable effects be experienced prior to a SMC exceedance, values may also be reconsidered and revised.

Figure 4-1: Sustainability Indicators

4.3 Undesirable Results

Undesirable results are defined by DWR. Definitions for specific sustainability indicators are provided in Section 10721 of the SGMA regulations:

<u>Groundwater Levels</u>

> *Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods*.

Groundwater Storage Volume

Significant and unreasonable reduction of groundwater storage.

Sea Water Intrusion

Significant and unreasonable seawater intrusion.

Water Quality

Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.

Subsidence

Significant and unreasonable land subsidence that substantially interferes with surface land uses.

Interconnected Surface Water

Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

It is incumbent of agencies to define potential significant and unreasonable effects within each basin or plan area. This is the basis for establishing the SMC and allows flexibility for Plan implementation. Undesirable Results will be discussed in greater detail for each sustainability indicator in the following sections.

4.3.1 Undesirable Result Development

Legal Requirements:

§354.26 (a) Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.

Delta-Mendota Subbasin

Undesirable Results were defined by DWR as described above. It is the intent of SGMA to allow basins and GSAs to determine how groundwater conditions could cause significant and unreasonable effects and how significant and unreasonable effects could cause an Undesirable Result. Because of the dynamics of the Delta-Mendota Subbasin, a broad definition of Undesirable Results was developed to expand on DWR's definition, while allowing flexibility for GSAs and plan areas to define them on a local level. The Delta-Mendota Subbasin Coordination Committee participants have defined Undesirable Results for the applicable sustainability indicators as:

Groundwater Levels

Significant and unreasonable chronic decrease in water level, as defined by each GSP Group, that has an impact on the beneficial users of groundwater in the Subbasin through either intra- and/or inter-basin actions.

Groundwater Storage Volume

Significant and unreasonable chronic decrease in groundwater storage, as defined by each GSP Group, that has an impact on the beneficial users of groundwater in the Subbasin through either intra- and/or inter-basin actions.

Sea Water Intrusion

Not defined – Inapplicable.

Water Quality

Significant and unreasonable degradation of groundwater quality, as defined by each GSP Group, that has an impact on the beneficial users of groundwater in the Subbasin through either intra- and/or inter-basin actions and/or activities.

Subsidence

Changes in ground surface elevation that cause damage to critical infrastructure that would cause significant and unreasonable reductions of conveyance capacity, damage to personal property, impacts to natural resources or create conditions that threaten public health and safety.

Interconnected Surface Water

Significant and unreasonable depletion of surface water, as defined by each GSP Group, that has an impact on the beneficial users of surface water in the Subbasin through either intra- and/or inter-basin actions and/or activities.

More detailed definitions for undesirable results were developed at the Plan Area level to consider localized groundwater conditions, known or potential issues, resiliency and risk tolerance of beneficial users, and potential mitigation actions. After development of undesirable result criteria, definitions and methodologies were shared among the Delta-Mendota Subbasin technical committee members to address any concerns or inconsistencies in development or understanding of problems within the Basin.

Grassland Plan Area

The Grassland GSP Technical Working Group, comprised of the Grassland Water District General Manager, District Engineer, Water Master, Science Programs Manager, General Counsel, and technical consultants, coordinated during numerous meetings to develop SMCs. The collaboration provided the opportunity to discuss at length the local understanding of undesirable results, beneficial users, and existing data from which to establish SMCs. Considerations were made regarding historic groundwater conditions, aquifer characteristics, groundwater quality, well construction, spatial distribution of groundwater production and monitoring wells, other existing infrastructure, adjacent agencies and basins, and previous experience.

The Grassland GSP Technical Working Group condensed their evaluation of potential impacts to the following topics:

- Impacts that could be experienced in the Grassland Plan Area due to changing groundwater conditions
- Resiliency of the aquifer to changes in groundwater conditions
- Resiliency of beneficial users
- Financial and environmental tolerance to impacts

The purpose was to analyze potential impacts, determine at which point the impacts become significant and unreasonable, and develop SMCs based on the most vulnerable beneficial users.

The discussion ultimately determined the most limiting beneficial user to all applicable sustainability indicators was habitat productivity. The SMC evaluation discussed in this chapter reflects the objective to maintain habitat productivity and avoid impacts from groundwater pumping on these systems. As a result, the less sensitive beneficial users, such as agriculture, are assumed to be protected under successful Plan implementation.

Significant and unreasonable undesirable results, as qualitatively defined by the Grassland Plan Area, are outlined below:

Groundwater Levels
Lowering of groundwater levels would lead to increased costs associated with higher total lift, lowering pumps, need to drill deeper wells, or costs securing alternative water sources. Impacts to habitat would require mitigation, including alternative water supplies and habitat restoration.

Groundwater Storage
Insufficient water storage necessary to maintain critical habitat. Reduction in storage would lead to increased costs associated with higher total lift, lowering pumps, and costs associated with the need to either drill deeper wells or secure alternative water sources. Impacts to habitat would require mitigation, including alternative water supplies and habitat restoration.

Sea Water Intrusion
Not applicable. The Pacific Coast and San Francisco Bay are both greater than 55 miles from the border of the Grassland Plan Area and geologically separated by the Coastal Range.

Water Quality
Degradation of groundwater quality resulting in reduced ability to develop and manage groundwater for habitat productivity.

Subsidence
Damage to infrastructure, permanent loss of conveyance capacity beyond mitigation, and potential inability to flood or drain by gravity and associated habitat impacts.

Interconnected Surface Water
Groundwater pumping in the Grassland Plan Area does not influence surface water depletion. Reduction of interconnected surface water bodies and associated groundwater dependent ecosystems (GDEs) that would require reduction in groundwater pumping (no management activities have depleted interconnected surface water in the Grassland Plan Area within the historical period). A significant and unreasonable undesirable result would impair any habitats directly associated with interconnected surface waters.

4.3.2 Causes of Groundwater Conditions Leading to Undesirable Results

Legal Requirements:

§354.26 (b) The description of undesirable results shall include the following:
(1) The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.

At present there are no conditions resulting in undesirable effects in the GSA. Going forward there are factors that have the potential to cause changes leading to undesirable effects such as the following:

1. **Climate Change**
   a. The State of California Department of Water Resources predicts that warmer conditions could lead to more intense rain events and less snowpack in the state. The Plan Area's surface water supply allocation is based on the Shasta Reservoir index and associated shortage provisions. The reliability of surface

water supplies may be influenced by both the increased precipitation and the reduction in snowmelt to the reservoir.

b. The same studies indicate that increased temperatures could result in higher evapotranspiration rates which would increase demand.
c. Some studies suggest more variability in water year types with dry years becoming more dry and wet years becoming more wet, which could lead to more flooding in wet years and more severe droughts in dry years.

2. **Changing Crop Patterns**. Agriculture makes up only six percent of the Grassland Plan Area. Agricultural land use may change in the 20-year planning horizon, affecting the evapotranspiration demand of the system. Historically, the Grassland Plan Area has sustainably met the evapotranspiration demands of crops and wetlands through imported surface water supplies and a small amount of supplemental groundwater pumping. The underlying aquifer is replenished via deep percolation generated from precipitation, a network of unlined earthen water conveyance facilities, seasonal and permanent wetland water management within the Plan Area, and from irrigation practices on agricultural lands. The trend is projected to continue into the future due to the surface water supply reliability from the federal Central Valley Project, protected wildlife refuges owned and operated by the State and Federal agencies, and conservation easements established on the vast majority of the Plan Area. More information regarding the water demands and deep percolation are outlined in **Chapter 3, Section 3**.

3. **Access to Surface Supply**. Wetlands that make up the majority of the Grassland Plan Area have historically received reliable surface water deliveries under the Central Valley Project Improvement Act, which are anticipated to continue in the future as they are mandated under law. The Level 2 wetland water supply allocation is based on the Shasta Reservoir Index, with reductions of no more than 25% in critically dry years.

4.3.3 Significant and Unreasonable Impacts & Threshold Exceedances Defining Undesirable Results

Legal Requirements:

§354.26 (b) The description of undesirable results shall include the following:
(2) The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.

Upper Aquifer Groundwater Levels and Groundwater Storage

There are no significant and unreasonable effects of groundwater level declines or changes in groundwater storage in the Grassland Plan Area, and the projected water budget in **Chapter 3.3** indicates future sustainability in the Grassland Plan Area. Recognizing that neighboring influences and the factors identified in **Section 4.3.2** may contribute to changes in the projected sustainability, the Grassland Plan Area participants developed groundwater level and groundwater storage thresholds that recognize the beneficial use most sensitive to significant and unreasonable lowering of groundwater levels, habitat productivity.

The qualitative definitions stated above for significant and unreasonable undesirable results note that the lowering of groundwater levels or decreased groundwater storage would lead to substantially increased costs associated with higher total lift, lowering pumps, need to drill deeper wells or costs of securing alternative water sources. Such effects would be considered significant and unreasonable if they resulted from substantial lowering of groundwater levels that led to substantially increased costs.

The qualitative definitions above also note that impacts to habitat would require mitigation, including alternative water supplies and habitat restoration. The impacts of declining groundwater levels or decreased storage on habitat would take the form of drier ground conditions, unhealthy or less productive wetland plant populations that provide food and cover for wildlife, and the need to deliver increased amounts of surface water in lieu of near-surface groundwater. These are examples of the conditions for which mitigation would be required within the Plan Area.

Observed groundwater level lows were identified across the Grassland Plan Area from 2000 to present. No significant and unreasonable impacts to habitat productivity (or other beneficial users) associated with lowered groundwater levels or changes in groundwater storage in the Grassland Plan Area were experienced within this period. The undesirable result was conservatively quantified as a twenty percent lowering of groundwater elevation from the representative groundwater level monitoring sites' recent historical (2000 to 2019) groundwater elevation low. In other words, an undesirable result would occur if the groundwater elevation at a monitoring site drops 20% below the previously measured low. For most monitoring sites the recent historical low was measured during the severe drought years in 2014, 2015, or 2016. The minimum threshold is described in more detail in **Section 4.4.1**.

Recognizing the shallow groundwater requirements for habitat conservation that cover a spatially influential area and the lack of historically experiencing undesirable results in the Grassland Plan Area, the criterion used to assess when effects of groundwater conditions cause undesirable results are defined qualitatively and quantitatively in **Table 4-1**:.

Table 4-1: Significant and Unreasonable Undesirable Results – Water Levels and Groundwater Storage

Significant and Unreasonable Undesirable Results		
	Groundwater Levels	**Groundwater Storage**
Qualitative Definition of Significant and Unreasonable Undesirable Results	Lowering of groundwater levels would lead to increased costs associated with higher total lift, lowering pumps, and need to drill deeper wells or secure alternative water sources. Impacts to habitat would require mitigation, including alternative water supplies and habitat restoration.	Insufficient water storage necessary to maintain critical habitat. Reduction in storage would lead to increased costs associated with higher total lift, lowering pumps, and costs associated with the need to either drill deeper wells or secure alternative water sources. Impacts to habitat would require mitigation, including alternative water supplies and habitat restoration.
Quantitative Definition of Significant and Unreasonable Undesirable Results	If a twenty percent or greater decrease from the recent historical (2000 to 2019) groundwater level lows are experienced or exceeded at more than fifty percent of the representative monitoring network wells for three consecutive years, then it can be assumed that significant and unreasonable undesirable results have occurred.	

Although not defined as quantification of an undesirable result, the Grassland Plan Area also recognizes that if a twenty percent or greater decrease from the recent historical (2000 to 2019) groundwater elevation low is experienced at a single representative upper-aquifer monitoring network well for three consecutive years, then the area may require further investigation and mitigation. This focus offers an opportunity to localize any necessary mitigation to the affected area.

The representative water elevation monitoring sites provide meaningful spatial coverage of the Grassland Plan Area and will provide insight into whether changes in water elevation conditions are localized or regionwide. If meaningful changes occur in greater than fifty percent of wells (as detailed in **Table 4-1**:) there is assumed to be a Plan Area-wide need for mitigation. Additionally, the temporal consideration of three consecutive years allows for the natural fluctuations in hydrology and rebound potential of the habitat.

<u>Lower Aquifer Groundwater Levels and Groundwater Storage</u>
Lower aquifer representative monitoring wells have been identified for the monitoring network. However, little historic data exists, as lower aquifer pumping is not prevalent in the Plan Area. The Grassland Plan Area participants will monitor the identified sites and with the gathered data, and intend to establish meaningful interim goals, measurable objectives, and minimum thresholds in future GSP Updates.

<u>Interconnected Surface Water</u>The Grassland Plan Area defined significant and unreasonable undesirable results of interconnected surface water as “reduction of interconnected surface waterbodies and associated GDEs that would require reduction in groundwater pumping.” Essentially, any noticeable reduction in the volume of groundwater flows reaching the SJR from the Plan Area could create an undesirable result, as it would signify an area-wide lowering of

the historically high water table in the Plan Area. This would adversely affect not only the existing riparian corridors along the SJR but also the groundwater-dependent plant communities throughout the Plan Area. However, there is no indication that historical groundwater pumping in the Plan Area has not influenced surface water depletion and no management activities have depleted interconnected surface waters in the Plan Area within the historic period.

The San Joaquin River (SJR) is the only major natural surface waterbody in the Grassland Plan Area. **Chapter 3.3** identifies the groundwater inflows and outflows. It is assumed based on this analysis, groundwater contours, and hydrogeologist input that there is a net inflow from the Grassland Plan Area to the SJR, designating it as interconnected and a gaining stream in this section.

The presumed causations of this are related to: (1) the protected status of the majority of managed wetlands within the Plan Area, through both public lands protection as state wildlife areas and national wildlife refuges and permanent conservation easements held on private wetlands; (2) existing state and federal "No Net Loss" policies[2] regarding wetland preservation which caution that wetlands in the Grassland Plan Area should retain their spatial extent; and (3) the presence of shallow clay layers that hold groundwater close to the surface. Therefore, the Grassland Plan Area has historically maintained shallow depth to water in much of the area in order to retain wetland habitat. The protected status of managed wetlands in the Plan Area in conjunction with the "No Net Loss" policy and existing hydrogeologic conditions are indications that the Plan Area will continue to sustain shallow groundwater in the wetland areas and produce a net positive flow to the SJR. It is projected that sustainability will continue and there will be no significant and unreasonable depletion of interconnected surface water.

In the event that the groundwater levels in areas within or outside of the wetlands were to significantly decline, the steepened gradient of the applied water for wetland habitat conservation to the areas of lowered groundwater would likely result in impairment to those habitats or increased costs to irrigate and maintain the wetland systems. Both of these scenarios can be assumed to produce an undesirable result, as the groundwater gradient flowing towards the SJR may be impeded.

Therefore, the Grassland GSP Technical Working Group and Plan Area participants have decided to use water elevation SMCs as a proxy for interconnected surface water (see **Section 5.3.2**). The definition of significant and unreasonable undesirable results is shown again in **Table 4-2.**

[2] *See* https://obamawhitehouse.archives.gov/the-press-office/2015/11/03/mitigating-impacts-natural-resources-development-and-encouraging-related, *and* https://www.waterboards.ca.gov/rwqcb5/board_decisions/tentative_orders/1504/2_5_wetlands/5_wet_policies_sum.pdf.

Table 4-2: Significant & Unreasonable Undesirable Results – Interconnected Surface Water

Significant and Unreasonable Undesirable Results	
	Interconnected Surface Water
Qualitative Definition of Significant and Unreasonable Undesirable Results	Grassland Plan Area groundwater pumping does not influence surface water depletion. Reduction of interconnected surface water bodies and associated GDEs would require reduction in groundwater pumping (no management activities have depleted interconnected surface water in the Grassland Plan Area within the historical period). A significant and unreasonable undesirable result would impair any habitat directly associated with interconnected surface waters.
Quantitative Definition of Significant and Unreasonable Undesirable Results	If a twenty percent or greater decrease from the recent historical (2000 to 2019) upper aquifer groundwater level lows are experienced or exceeded at more than fifty percent of the representative monitoring network wells for three consecutive years, then it can be assumed that significant and unreasonable undesirable results have occurred.

Although not defined as quantification of an undesirable result, the Grassland Plan Area also recognizes that if a twenty percent or greater decrease from the recent historical (2000 to 2019) groundwater elevation low is experienced at a single representative upper-aquifer monitoring network well for three consecutive years, then the area may require further investigation and mitigation. This focus offers an opportunity to localize any necessary mitigation to the affected area.

<u>Sea Water Intrusion</u>
Not defined – Inapplicable.

<u>Upper Aquifer Water Quality</u>
Although no degradation in groundwater quality has been observed historically, there is potential for water quality experience degradation due to activities outside the Plan Area, which may compromise habitat health. The Grassland Water District monitors salt and additional constituents, such as boron and selenium, under the GWD Surface and Groundwater Monitoring Program.

There are several potential causes of groundwater quality degradation that could lead to undesirable results. These include, but are not limited to:

- Fertilizers: Although fertilizers are not used in managed wetlands, the accumulated effects of fertilizer nutrient application and other land management practices on lands outside of the managed wetland complex could lead to accumulation of constituents of concern in groundwater
- Salinity: The accumulated effects of salinity from repeated source water recycling, irrigation and pumping patterns outside the wetland complex
- Waste Discharge: The accumulated effects of regulated and unregulated waste discharge streams from wastewater treatment facilities, septic systems, industry, and food processors outside the wetland complex
- Contaminant Plumes: Groundwater pumping mobilizing groundwater contaminant plumes, although there are no known contaminant plumes affecting the Plan Area

The Grassland Plan Area will continue to monitor for declining groundwater levels that could cause pumped groundwater to have higher concentrations of some naturally occurring constituents that may cause habitat productivity and health concerns or aesthetic concerns.

The Grassland Plan Area regularly experiences variations in salinity tolerance, even within the same beneficial uses. Agricultural areas are more sensitive to higher salt and boron concentrations. The Central Valley Regional Water Quality Control Board's Water Quality Control Plan (Basin Plan) for the Central Valley notes that certain waterways within the planning area, such as Mud Slough and wetland water supply channels, are of limited use for irrigated agriculture because "elevated natural salt and boron concentrations may limit this use to irrigation of salt and boron tolerant crops" (CRWQCBCVR, 2018). For similar reasons those same waterways, as well as Salt Slough, are not designated for municipal and domestic water supply.

The Grassland Plan Area will continue to monitor for declining groundwater levels that can cause pumped groundwater to have higher concentrations of some naturally occurring constituents that may cause habitat productivity and health concerns or aesthetic concerns (see **Section 5.1.2**). With consideration to the shallow groundwater requirements for habitat conservation that cover a spatially influential area and the lack of historical undesirable results in the Grassland Plan Area, the criteria used to assess when effects of groundwater quality cause undesirable results are defined in **Table 4-3.** Salinity is used as a key indicator for water quality because it affects all beneficial uses within the Plan Area and is the primary constituent of concern under existing regulatory programs (due to the rarity of fertilizer or pesticide applications within the Plan Area).

Table 4-3: Significant & Unreasonable Undesirable Results - Water Quality

Significant and Unreasonable Undesirable Results	
	Water Quality
Qualitative Definition of Significant and Unreasonable Undesirable Results	Degradation of groundwater quality that results in reduced ability to develop and manage groundwater for habitat productivity.
Quantitative Definition of Significant and Unreasonable Undesirable Results	If a TDS measurement of 2500 mg/L or greater is experienced at more than fifty percent of the representative monitoring network wells for three consecutive years, then it can be assumed that significant and unreasonable results may have occurred.

Although not defined as quantification of an undesirable result, the Grassland Plan Area also recognizes that if a TDS measurement of 2500 mg/L or more is observed at a single representative monitoring network well for three consecutive years, then the area may require further investigation and mitigation. This focus offers an opportunity to localize any necessary mitigation to the affected area.

As with the representative groundwater level monitoring network, the representative quality monitoring network provides meaningful spatial coverage of the Grassland Plan Area and will provide insight into whether changes in water quality conditions are localized or regionwide. To allow for the variety of salinity tolerance in the Plan Area, the threshold exceedances will be evaluated on a three-year basis. However, in accordance with GWD's longstanding groundwater quality policy, GWD does not accept groundwater for habitat use if the TDS concentration is 2,500 mg/L or above or causes an increase in surface water TDS concentration by more than 200 mg/L. These standards were set in the 1980s, have also been adopted by USBR for wetlands in the Plan Area, and have been successfully implemented to protect the health of wetlands and wildlife in the Plan Area for more than 30 years. Although the quality of water delivered within the Plan Area has a much lower TDS concentration than 2,500 mg/L due to blending with higher-quality CVP surface water supplies and the 200 mg/L maximum increase standard, the 2,500 TDS standard is a longstanding benchmark for significant and unreasonable results in the Plan Area.

Subsidence

The Grassland Plan Area has not experienced undesirable results related to subsidence, which is thought to be caused by the compaction of clays due to lower aquifer pumping. Lower aquifer pumping in the Plan Area has historically been negligible, rendering the Grassland Plan Area participant's contribution to subsidence-related impacts insignificant. However, subsidence caused by pumping outside of the Plan Area does pose a risk of creating undesirable results within the Plan Area. Significant and unreasonable undesirable results for subsidence are defined in **Table 4-4.**

Table 4-4: Significant & Unreasonable Undesirable Results - Subsidence

Significant and Unreasonable Undesirable Results	
	Subsidence
Qualitative Definition of Significant and Unreasonable Undesirable Results	Damage to infrastructure, permanent loss of conveyance capacity beyond mitigation, and potential inability to flood or drain by gravity and associated habitat impacts
Quantitative Definition of Significant and Unreasonable Undesirable Results	If a subsidence monitoring station experiences an increase in subsidence greater than the interim 5-year milestones in a three-year period

The interim milestones follow the historic subsidence rates at various monitoring locations and rates—none of which have historically experienced subsidence-related adverse impacts. In the event that an interim milestone is exceeded within three years, it can be assumed that a significant and unreasonable undesirable result has occurred.

Future Assessment of Undesirable Results

After Plan implementation, if it is determined that there were no adverse effects to habitat health, the definition of significant and unreasonable effects leading to undesirable results may be reevaluated in future updates of the GSP. The Grassland Plan Area participants also recognize the opportunity to assess impacts to other beneficial users and revise the criteria in the event that currently unknown and unintended undesirable results were to occur.

4.3.4 Effects on Beneficial Users

Legal Requirements:

§354.26 (b) The description of undesirable results shall include the following: (3) Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.

During the Grassland GSP Technical Working Group's SMC development process, there were several unanimously identified impacts that could become significant and unreasonable. These included impairments to habitat health, wells becoming unproductive, and water quality negatively impacted to the point of causing degradation of wetland habitat, crops, or productivity. However, the Grassland Plan Area is not currently experiencing undesirable impacts, nor has it experienced undesirable impacts in the past.

Negative effects to the SJRRP, domestic users, and adjacent agencies were also considered during the development of definitions of significant and unreasonable effects. There is no indication that other beneficial users have experienced any adverse effects due to current management practices in the Grassland Plan Area, which is unlikely to experience aquifer overdraft. There are actions in place to ensure the protection of conditions in, adjacent to, and downstream of the SJR in order to prevent impacts to beneficial users of both surface water and groundwater. These are discussed in greater detail in **Chapter 2 – Plan Area**.

There are a limited number of domestic wells within the Grassland Plan Area, most of which supply non-potable water to seasonal recreational properties that use bottled water or similar alternate supplies for drinking and cooking. Naturally occurring salinity in the upper water table has historically made these supplies unsuitable for potable use. The small number of private domestic wells qualify as "de minimis extractors" under SGMA and will be managed by landowners as necessary.

Adjacent agencies have been consulted, and it is agreed that groundwater conditions and practices in the Grassland Plan Area are unlikely to cause any significant and unreasonable impacts. However, neighboring agencies are experiencing undesirable results in their GSAs, the most significant being subsidence. Several agencies are experiencing loss of and damage to infrastructure as a result of subsidence. Therefore, significant and unreasonable effects were defined with consideration to subsidence as a limiting factor when possible. Grassland Plan Area participants will continue to work with neighboring agencies to monitor groundwater conditions and prevent undesirable results.

4.3.5 Evaluation of Multiple Minimum Thresholds

Legal Requirements:

§354.26 (c) The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.

Although minimum thresholds for the sustainability indicators are consistent across the Grassland Plan Area, the GSAs recognize the value in applying the minimum thresholds to multiple monitoring sites in order to best reflect the conditions of the localized baseline and the meaning of future measurements. Based on the hydrologic conditions in the Plan Area and the defined undesirable results, a combination of minimum thresholds is not required to assess whether an undesirable result is occurring in the Grassland Plan Area and Delta-Mendota Subbasin. Sustainability indicators and quantification of undesirable results can be assessed independently or collectively.

The assessment for groundwater levels, groundwater storage, and interconnected surface water requires an evaluation of the nine representative monitoring sites in the upper aquifer (for all three indicators) and six representative sites in the lower aquifer (for groundwater levels and groundwater storage), as well as their unique water surface elevation values. The water quality assessment will evaluate three representative monitoring sites in the upper aquifer, four representative sites in the lower aquifer, and their respective TDS measurements. The site-specific method of assessment provides the opportunity to assess whether any impacts are localized or regionwide. See **Chapter 5** for greater detail on the monitoring network.

The Delta-Mendota Subbasin's **Common Chapter** (**Appendix A**) addresses the considerations of the basin-wide SMC analysis as being a sum-of-the-parts method, with the position that each GSP group has the most informed understanding of their respective beneficial users, finances, infrastructure, hydrology, and other contributing parameters for SMC development.

Each GSP Group developed their sustainable management criteria consistent with the GSP Regulations, Article 5 Plan Contents, Subarticle 3 Sustainable Management Criteria (§ 354.2 through 354.30). DWR's Draft Best Management Practices for the Sustainable Management of Groundwater Sustainable Management Criteria BMP (2017) document was also used when and where applicable at the discretion of each GSP Group.

4.3.6 Sustainability Indicators Not Considered

Legal Requirements:

§354.26 (d) An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators.

<u>Seawater Intrusion</u>

The Grassland Plan Area is located 55 miles and several mountain ranges from the Pacific Ocean. Seawater intrusion is not applicable to the area.

More detail on decisions for omitting the development of this parameter can be found in **Chapter 2– Plan Area** and **Chapter 3 – Basin Setting**.

4.4 Minimum Thresholds

Legal Requirements:

§354.28 (a) Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.

Minimum Thresholds (MT) were developed for all sustainability indicators except for seawater intrusion. These MTs were developed to address the potential significant and unreasonable effects that could be caused by changes in groundwater conditions causing an Undesirable Result. In the case of water levels, groundwater storage, and interconnected surface water, the same MTs were established for all of the representative upper aquifer groundwater level monitoring sites. Three of the upper aquifer and all of the lower aquifer representative monitoring wells identified for the representative monitoring networks have no historical data. The Grassland Plan Area participants will monitor these representative sites and use the gathered data to establish meaningful interim goals, measurable objectives, and minimum thresholds in future GSP Updates.

Undesirable results were defined specifically for the Grassland Plan Area in **Section 4.3** for all sustainability indicators. The Minimum Thresholds use known Basin/Plan Area characteristics and available data to quantify rates, elevations, and concentrations at which an undesirable result may be experienced.

4.4.1 Description of Minimum Thresholds

Legal Requirements:

§354.28 (b) The description of minimum thresholds shall include the following: (1) The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by uncertainty in the understanding of the basin setting.

Table 4-5 identifies the MTs for each sustainability indicator and specific MT measurements for selected representative monitoring sites. Maps depicting the representative monitoring networks can be found in **Chapter 5**.

Table 4-5: Minimum Thresholds

Sustainability Indicator	Threshold Description	Monitoring Site ID	Minimum Threshold	Threshold Units
Upper Aquifer Water Levels, Upper Aquifer Groundwater Storage, & Interconnected Surface Water	The upper aquifer minimum threshold is set to not exceed a 20% lowered water elevation from the recent historical low set uniquely at each representative monitoring site. "Recent Historical" is defined as the period from 2000 to the present.	2PU-3	44	WSE (feet)
		1PU-1	58	WSE (feet)
		08S09E34G001M	52	WSE (feet)
		08S10E30E001M	56	WSE (feet)
		11S12E30H002M	91	WSE (feet)
		11S11E04N001M	77	WSE (feet)
		1MU-1	These three upper aquifer monitoring wells do not have historical data; however, the Grassland Plan Area participants will monitor the sites and intend to use the gathered data to establish meaningful interim goals, measurable objectives, and minimum thresholds.	
		1MU-2		
		1MU-3		
Lower Aquifer Water Levels & Lower Aquifer Groundwater Storage	Lower aquifer representative monitoring wells have been identified for the monitoring network. However, no historical data exists for these wells. The Grassland Plan Area participants will monitor the sites and intend to use the gathered data to establish meaningful interim goals, measurable objectives, and minimum thresholds in future GSP Updates.	1ML-1	See threshold description.	
		1ML-2		
		1ML-3		
		1ML-4		
		1ML-5		
		1ML-6		
Subsidence	The minimum threshold is set to not exceed the historical annual average rate of subsidence from December 2011 to December 2015.	108	-0.11	Annual Average Rate of Subsidence (feet per year, NAVD 1988)
		152	-0.15	Annual Average Rate of Subsidence (feet per year, NAVD 1988)
		137	-0.13	Annual Average Rate of Subsidence (feet per year, NAVD 1988)
Upper Aquifer Water Quality	The minimum threshold is set to a TDS measurement of 2500 mg/L for all representative water quality wells.	1PU-1	2,500	TDS (mg/L)
		2PU-1	2,500	TDS (mg/L)
		2PU-3	2,500	TDS (mg/L)
Lower Aquifer Water Quality	The minimum threshold is set to a TDS measurement of 2500 mg/L for all representative water quality wells.	1PL-1	2,500	TDS (mg/L)
		1PL-2	2,500	TDS (mg/L)
		1PL-3	2,500	TDS (mg/L)
		2PL-3	2,500	TDS (mg/L)
Sea Water Intrusion	Not Applicable	N/A	N/A	N/A

4.4.1.1 Upper Aquifer Groundwater Levels, Groundwater Storage, and Interconnected Surface Water Threshold Development

Legal Requirements:

§354.28 (c) Minimum thresholds for each sustainability indicator shall be defined as follows:
(1) Chronic Lowering of Groundwater Levels. The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results. Minimum thresholds for chronic lowering of groundwater levels shall be supported by the following:
(A) The rate of groundwater elevation decline based on historical trends, water year type, and projected water use in the basin.
(B) Potential effects on other sustainability indicators.
(2) Reduction of Groundwater Storage. The minimum threshold for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin.
(6) Depletions of Interconnected Surface Water. The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results. The minimum threshold established for depletions of interconnected surface water shall be supported by the following:
(A) The location, quantity, and timing of depletions of interconnected surface water.
(B) A description of the groundwater and surface model used to quantify surface water depletion. If a numerical groundwater and surface water model is not used to quantify surface water depletion, the Plan shall identify and describe an equally effective method, tool, or analytical model to accomplish the requirements of this Paragraph.

Minimum thresholds for groundwater levels, groundwater storage (using groundwater levels as a proxy), and interconnected surface water were developed considering the upper aquifer as the principal source aquifer for the Grassland Plan Area. Minimum thresholds were developed using the existing conditions of the basin within the Grassland Plan Area and with due consideration to the historically high-water level localized in the Plan Area.

Groundwater Levels

Chapter 5 describes the representative water level monitoring network in greater detail. The site selection was developed to provide enough spatial coverage to represent the variety of groundwater conditions that may occur across the Plan Area and sites were selected based on historical data available to establish SMCs.

The initial criteria for a representative monitoring network were based on wells that had at least three years' worth of data from 2000 to present. However, wells that did not meet the data requirements were also added to the monitoring network and will be used for contouring efforts as well as to supplement the understanding of the groundwater conditions associated with the five applicable sustainability indicators. There were multiple instances where representative monitoring sites were identified for the monitoring network even though no historical data existed for the site. The Grassland Plan Area participants will monitor the sites and intend to use the gathered data to further establish meaningful interim goals, measurable objectives, and minimum thresholds in future GSP Updates.

Interconnected Surface Water

It is understood that the Grassland Plan Area maintains wetland habitat in the Plan Area via a cycle of imported surface water deliveries rather than by groundwater pumping. The application of surface water results in a sustainable system as identified in **Chapter 3**. Historically, the SJR is interconnected to the stretch adjacent to the Grassland Plan Area for most of the year during most water years. The Grassland Plan Area's contribution to the interconnection can be quantitatively measured by the upper aquifer groundwater levels across the Plan Area, as the groundwater flow trends towards the SJR and contributes a net inflow to the river. Any disruptions to that contribution are best assessed on a regional basis rather than on a site-specific scale. The representative water level monitoring used for assessing upper aquifer groundwater levels will also serve as the monitoring and SMC evaluation method for interconnected surface water and will assess the location, quality, and timing of depletions of the SJR as a result of Grassland Plan Area management actions. Additionally, the Water Budget and ongoing upper aquifer groundwater level contouring effort described in **Chapter 3** and the **Appendix A – Common Chapter** will effectively serve as supplemental tools to assess the groundwater levels and flow direction in the Plan Area.

Groundwater Storage

Groundwater levels are directly related to upper aquifer and lower aquifer storage and will be used as a proxy for groundwater storage volume changes (see **Section 3.2.6**). To calculate the volume of groundwater storage, the water levels gathered from the representative water level monitoring sites will be plotted and contours will be developed to understand groundwater levels in the Grassland Plan Area. A volume of groundwater storage can be assessed using the specific yield, water levels, and acreage.

Most of the upper aquifer representative monitoring wells have only three years' worth of groundwater levels and have conflicting temporal measurement periods. None of the lower aquifer representative monitoring wells have adequate historical data to develop a meaningful volumetric minimum threshold, as groundwater contours are dependent on spatial coverage of data measured under similar temporal conditions such as a seasonal high or seasonal low. Therefore, the minimum thresholds for groundwater storage are defined as the same thresholds set for water levels. The Grassland Plan Area participants plan to reassess the minimum thresholds in future GSP updates and expect improved data quality and quantity after implementation of the representative monitoring program.

Additionally, in the event that significant and undesirable results to beneficial uses or users are realized prior to reaching a minimum threshold, the Plan Area participants recognize the need to mitigate and reassess SMC development for future GSP updates. If a threshold has been exceeded, yet no undesirable results occur, the same opportunity to reassess SMC development may be exercised.

4.4.1.2 Subsidence Threshold Development

Legal Requirements:

§354.28 (c) Minimum thresholds for each sustainability indicator shall be defined as follows:
(5) Land Subsidence. The minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results. Minimum thresholds for land subsidence shall be supported by the following:
(A) Identification of land uses and property interests that have been affected or are likely to be affected by land subsidence in the basin, including and explanation of how the Agency has determined and considered those uses and interests, and the Agency's rationale for establishing minimum thresholds in light of those effects.
(B) Maps and graphs showing the extent and rate of land subsidence in the basin that defines the minimum threshold and measurable objectives.

The Corcoran Clay that underlies the Plan Area is composed of inelastic clay minerals. Inelastic subsidence occurs when clay particles in the lower aquifer that are composed of certain minerals collapse when dewatered or subjected to rapid pressure reductions, resulting in the clay structure compacting and being unable to re-expand to its original thickness, despite replenishment causing rises in groundwater levels. Therefore, impacts related to subsidence in the Grassland Plan Area can be directly associated with pumping activities from wells perforated below the Corcoran Clay.

The Delta-Mendota Subbasin has experienced localized instances of severe subsidence and resulting infrastructural impacts. Although the Grassland Plan Area is within the Subbasin, it has not experienced the same rates of subsidence as the northern and southern areas of the Delta-Mendota Subbasin, and the Grassland Plan Area's influence on subsidence is insignificant considering that pumping from the lower aquifer is negligible in the Plan Area.

The Grassland Plan Area participants evaluated recent historical trends in subsidence in the Plan Area using USBR subsidence mapping and analysis from KSA as identified in **Chapter 3**. By using geographic information systems (GIS) to analyze the USBR ground surface file and incorporating the KSA calibration, the average subsidence rate was determined to be 0.075 ft/year during the period of 2011 to 2017.

Impacts to water available for habitat conservation serves as the limiting land use; however, impacts to agricultural irrigation were also considered when evaluating what the significant and unreasonable impacts would be in the Plan Area. The most likely impact is that subsidence would affect the critical infrastructure conveying water used for agricultural and habitat irrigation. Historically, the Plan Area has not experienced subsidence-induced disruptions to conveyance capacity. The current rate at which subsidence is occurring within the Grassland Plan Area is neither currently yielding nor projected to yield significant and unreasonable undesirable results. Therefore, the minimum threshold was set to not exceed the historical annual average rate of subsidence from December 2011 to December 2018, defined at each of the three representative monitoring sites: 108, 137, and 152 (**Table 4-5**).

See **Figure 3-21** in **Chapter 3** for a map depicting the extent and rate of land subsidence that had influence on development of the minimum threshold, interim goals, and measurable objective at 2040. The Delta-Mendota Subbasin's Common Chapter **(Appendix A)** further explains the extent of subsidence on a basin-wide scale.

4.4.1.3 Water Quality Threshold Development

Legal Requirements:

§354.28 (c) Minimum thresholds for each sustainability indicator shall be defined as follows:
(4) Degraded Water Quality. The minimum threshold for degraded water quality shall be the degradation of water quality, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the Agency that may lead to undesirable results. The minimum threshold shall be used on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin. In setting minimum thresholds for degraded water quality, the Agency shall consider local, state, and federal water quality standards applicable to the basin.

As described in prior sections, there are several potential causes of groundwater quality degradation that could lead to undesirable results, such as fertilizer application on adjacent lands, salt accumulation, chemical spills, wastewater discharges, naturally occurring elements, and the mobilization of groundwater plumes.

GWD has developed and has been maintaining a Groundwater Monitoring Plan designed to monitor the key groundwater quality constituents based on the beneficial uses and wetland habitat tolerances of the area. The Groundwater Monitoring Plan uses state and federal water quality standards applicable to the beneficial uses to define the local standards.

GWD's Groundwater Monitoring Plan was considered in conjunction with the groundwater quality assessment developed by KSA in **Chapter 3** in order to identify salinity in terms of TDS when establishing water quality sustainable management criteria. The minimum threshold is consistent with GWD's Groundwater Monitoring Plan threshold concentration of 2,500 mg/L TDS at each well head (**see Section 4.3.3**).

There are no known groundwater contaminant plumes in the Grassland Plan Area. As identified earlier in this chapter, the upper aquifer is the primary source aquifer in the Plan Area; however, water quality will be monitored, and SMCs will be analyzed in both the upper and lower aquifers. See **Chapter 5** for further details regarding the additional monitoring efforts that will be used to supplement the understanding of all five applicable sustainability indicators.

4.4.1.4 Relationship Between Thresholds

Legal Requirements:

§354.28 (b) The description of minimum thresholds shall include the following:
(2) The relationship between the minimum thresholds for each sustainability indictor, including and explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.

Thresholds were developed considering:

1. Who are the beneficial users of groundwater?
2. How are/could they be impacted?
3. To what level does the impact become significant and unreasonable?

These questions were developed independently of groundwater conditions and historical trends in order to determine what problems existed or were likely to develop and at which point mitigation would become too expensive or logistically infeasible. Considering that the Grassland Plan Area has not and is not expected to experience significant and unreasonable effects as a result of current groundwater conditions, land use practices, projected trends, or groundwater uses, it made sense to reach out to neighboring agencies to see what impacts they were experiencing.

The Grassland Plan Area considered both the Plan Area and Delta-Mendota Subbasin groundwater conditions in light of the five applicable sustainability indicators (and specifically the lack of undesirable results) as the driving influence when developing the minimum thresholds. The Plan Area participants recognize influences from neighboring agencies as the greatest hindrance to achieving their sustainability goals and are committed to communication with neighboring agencies as pivotal to GSP success.

Water Levels, Groundwater Storage, and Interconnected Surface Water
The minimum thresholds for water levels, groundwater storage, and interconnected surface water are consistent, based on their direct relationship to water levels and the sustainability goal of avoiding undesirable results. Groundwater storage is traditionally measured by evaluating groundwater levels and the safe yield of a defined area. Therefore, the water level thresholds were also appropriate to use for groundwater storage thresholds, as the significant and unreasonable undesirable results of both are recognized and water levels and groundwater storage are both identified by the depth to water.

The Grassland Plan Area's reliable imported surface water supply and management of wetland habitat has resulted in high groundwater levels and produces a net inflow to the SJR. Rather than measuring levels directly adjacent to the river, the water levels dispersed across the Plan Area will also be measured as they are also indicative of the groundwater level trends induced by applied irrigation for habitat conservation. The water level thresholds set for the representative monitoring network were deemed a conservative metric for assessing and maintaining interconnected surface water by the Grassland Plan Area participants.

Significant water level declines could negatively impact water quality. If water quality deteriorates to the level of the minimum threshold, wetland habitats may not be able to sustain productivity required for ecosystem functionality. Growers could also potentially experience a decrease in crop yield. The best way to mitigate an accumulated salt concentration is to leach the salt through the soil column. The water level threshold will be evaluated in the event that the TDS-based water quality threshold is exceeded or habitats are showing symptoms of impairment induced by poor water quality.

Subsidence
The recent historical rate of subsidence in the Plan Area is insignificant compared to other areas of the Subbasin, and there are no existing impacts or potential needs for infrastructure upgrades beyond the implementation horizon. Subsidence is unlikely to affect either water quality or water levels or groundwater storage in the upper aquifer. The upper aquifer serves as the primary source aquifer for the Plan Area. The minimum thresholds for subsidence are low and are intended to protect against the unreasonable lowering of groundwater levels or loss of groundwater storage in the lower aquifer.

Groundwater Quality
It is assumed that groundwater quality will remain appropriate for irrigation and wetland purposes with continued close monitoring and implementation of GWD's established Groundwater Monitoring Plan. GWD's efforts will continue into the GSP planning horizon. To comply with the requirements of SGMA, groundwater quality SMCs were set to address the potential for impairment to the most limiting beneficial use: habitat conservation. Should

groundwater quality become an issue, it may become necessary to extract water from one location within the Plan Area for use in another or to strategically deliver surface water for blending purposes. The District does not predict that water quality will impact the Plan Area by necessitating the deepening of wells or requiring the use of the lower aquifer due to water quality issues in the upper aquifer. Groundwater quality is unlikely to affect groundwater levels or subsidence rates.

4.4.1.5 Groundwater Level Proxy

Legal Requirements:

> **§354.28** (d) An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.

<u>Upper Aquifer Groundwater Storage</u>
Water level elevations in the upper aquifer will be used as a proxy for groundwater volume in storage in the upper aquifer. The volume of groundwater storage will be quantified on an annual basis using a large network of hydrographs and contour maps as described in **Chapter 3.3 – Water Budget** using changes in groundwater elevation, specific yield of the aquifer, and acreage of the Plan Area. Attempting to quantify the volume of groundwater storage at a single representative well using water level elevation should be avoided; however, it can be a good indicator of sustainability without having to quantify all uses and extractions. A more robust data set using water level should be employed for quantifications of volume when it becomes available through increased monitoring. This method of calculation is a widely used and acceptable substitution for determining changes in groundwater storage and considers all sources of groundwater.

<u>Interconnected Surface Water</u>
The Grassland Plan Area has historically maintained a shallow depth to water in much of the area, which supports wetland habitat. The protected status of most wetlands in the Plan Area, the "No Net Loss" policy, and the existence of shallow clay layers identified in **Section 4.3** results in the Plan Area sustaining shallow groundwater in the wetland areas and producing a net positive flow to the SJR. The gradient of groundwater flows produced by the management activities in the Plan Area is currently understood as the primary influencer to the SJR connection adjacent to the Plan Area and is not expected to change.

Therefore, the Grassland GSP Technical Working Group and Plan Area participants made the decision to use groundwater level SMCs across the Plan Area, representing a variety of land uses to evaluate gradient influences, as an appropriate proxy for interconnected surface water.

4.4.1.6 Effects on Adjacent Basins

Legal Requirements:

> **§354.28** (b) The description of minimum thresholds shall include the following:
> (3) How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.

The Grassland Plan Area participants have performed outreach internally with other members of the Delta-Mendota Groundwater Subbasin and have been supportive of inter-basin coordination efforts made by the Coordination Committee, such as a data sharing agreement with Westlands Water District in the Westlands Subbasin through the Northern and Central GSP group. After review of the Grassland Plan Area's historic and projected sustainable determinations regarding overdraft, and interbasin coordination performed by the Delta-Mendota Coordination Committee members with neighboring agencies, it is considered unlikely that implementation of the Plan and Minimum Thresholds will affect neighboring basins. Careful consideration was given to existing conditions outside the Plan Area and further coordination efforts will be ongoing. See the Delta-Mendota Subbasin **Common Chapter** (**Appendix A**) for more details on inter-basin coordination.

4.4.1.7 Affects to Beneficial Uses and Users

Legal Requirements:

§354.28 (b) The description of minimum thresholds shall include the following:
(4) How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.

Groundwater Levels, Groundwater Storage, and Interconnected Surface Water.
Implementation of these minimum thresholds is not likely to affect any beneficial uses and users of groundwater, except for potentially increasing costs to fund future projects and management actions. It is not the intention of the Grassland Plan Area participants to restrict access to groundwater unless undesirable results begin to occur and substantial evidence indicates specific wells are causing impacts. Thresholds may establish conditions that would require mitigation to continue accessing groundwater at specific locations.

The minimum thresholds are intended to prevent the necessity of lowering pumps or deepening wells in order to continue to access groundwater, treating groundwater of decreasing quality, losing habitat or crop productivity, or adversely affecting riparian habitat health due to impacts to the positive groundwater gradient towards the SJR.

Subsidence
Maintaining a rate of subsidence that is no greater than recent historical subsidence may eventually impact the conveyance capacity of critical water conveyance infrastructure. There is a potential for uneven ground surface movement to cause changes to the flow of gravity conveyance canals and damage to underground infrastructure that may require changes and updates to irrigation systems or other types of mitigation. In the event these types of impacts begin to occur prior to experiencing the minimum threshold, the Grassland Plan Area will reevaluate the SMCs' definitions.

Groundwater Quality
Adverse changes in groundwater quality may require additional sources of surface water to be imported into the Plan Area or relocation of wells to areas with better water quality. It is also possible that wells would require treatment of water prior to irrigation in order to prevent loss of habitat or crop production.

The Grassland Plan Area is anticipating continuing to operate consistent with the sustainability goals and GSP success will be measured by the avoidance of undesirable results. If minimum thresholds are exceeded yet undesirable results are not realized, the Grassland Plan Area participants may reevaluate SMC determinations and revise for the following GSP Update.

4.4.1.8 Relation to State or other Existing Standards

Legal Requirements:

§354.28 (b) The description of minimum thresholds shall include the following: (5) How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.

Groundwater Levels, Groundwater Storage, and Interconnected Surface Water

Groundwater levels have not been directly regulated federally, locally, or statewide prior to the adoption of SGMA and GSP implementation. However, wetlands that function based on shallow groundwater, including riparian wetlands along the SJR, are regulated under the federal Clean Water Act and recently adopted state wetland dredge and fill regulations and have been considered in the decision to establish conservative minimum thresholds and measurable objectives.

Subsidence

Subsidence has never been regulated under federal or state law or programs until SGMA.

Water Quality

State, federal, and local water quality regulations and programs applicable to the Grassland Plan Area are outlined in **Chapter 2**. All have been considered and have influenced the development of the water quality SMCs to match existing local thresholds.

4.4.1.9 Threshold Measurement Methods

Legal Requirements:

§354.28 (b) The description of minimum thresholds shall include the following: (6) How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.

Groundwater Levels, Groundwater Storage, Interconnected Surface Water

Groundwater levels, and groundwater storage thresholds by proxy, will be measured biannually to correlate with seasonal high and low groundwater levels and the monitoring schedule set forward by the Delta-Mendota Subbasin Coordination Committee. Groundwater levels will be taken as depth to water measurements in feet and converted to water surface elevations.

Subsidence

Subsidence will be surveyed at discrete reference points biannually in the summer and winter to correlate with monitoring efforts currently underway by USBR. Subsidence will be reported as a relative ground surface elevation for both thresholds and contouring efforts. Thresholds have been identified at each discrete location and summarized in **Table 4-5.** Additional monitoring information is outlined in the Delta-Mendota Subbasin **Common Chapter (Appendix A)** and **Chapter 5**.

Groundwater Quality

Groundwater quality will be measured in the summer. Thresholds have been identified for each constituent at each site in **Table 4-5** and results will be reported in the units provided. Water quality will be analyzed in a professional laboratory. Additional monitoring requirements and information are outlined in **Chapter 5,** Delta-Mendota Subbasin **Common Chapter** and **Common Monitoring Technical Memorandum**.

4.5 Measurable Objectives

Measurable objectives were developed to simulate a no-impact scenario based on historical trends or known levels at which impacts might occur. This is not to be confused with significant and unreasonable impacts, which for the purpose of this GSP show the level at which mitigation either becomes unaffordable or physically infeasible. For the purposes of this GSP, the term “measurable objective” serves as the quantitative point at which the sustainability goal has been realized at 2040 and the “interim goals” or “interim milestones” quantitatively reflect the sustainability goal being achieved within five-year increments corresponding with GSP Update submittal periods of 2025, 2030, and 2035.

Legal Requirements:

§354.30 (a) Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin with 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.

(b) Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.

(c) Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.

(d) An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.

(e) Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.

4.5.1 Groundwater Levels, Groundwater Storage, & Interconnected Surface Water

Unlike most GSPs within critically overdrafted basins, the Grassland Plan Area is not projected to significantly deviate from the sustained groundwater levels it has historically experienced. Therefore, the interim goals and measurable objectives are reflective of a sustained system. The measurable objective is conservatively quantified as the representative groundwater level monitoring sites’ recent historical (2000 to 2019) groundwater elevation low. In other words, an exceedance of the measurable objective would occur if the groundwater elevation at a monitoring site drops below the previously measured low. For most monitoring sites the recent historical low was measured during the severe drought years in 2014, 2015, or 2016.

The interim goals are defined as a water surface elevation greater than the measurable objective. The upper aquifer groundwater level interim goals and measurable objectives are listed below in **Table 4-6**, except for three upper aquifer representative water level monitoring wells that do not have historical data. The table outlines the site-specific measurable objective and interim goals for groundwater levels, groundwater storage, and interconnected surface water. The rationale for groundwater levels being used as a proxy for groundwater storage and interconnected surface water SMC development is identified in **Section 4.4.1.5**

Table 4-6: Water Level, Groundwater Storage, & Interconnected Surface Water SMCs

Sustainable Management Criteria					
Representative Monitoring Well	2025 Interim Goal	2030 Interim Goal	2035 Interim Goal	2040 Measurable Objective	Minimum Threshold
	WSE (ft)	*WSE (ft)*	*WSE (ft)*	*WSE (ft)*	*WSE (ft)*
Upper Aquifer Groundwater Levels, Groundwater Storage, & Interconnected Surface Water					
2PU-3	>56	>56	>56	56	44
1PU-1	>73	>73	>73	73	58
08S09E34G001M	>66	>66	>66	66	52
08S10E30E001M	>70	>70	>70	70	56
11S12E30H002M	>113	>113	>113	113	91
11S11E04N001M	>97	>97	>97	97	77
1MU-1	Three upper aquifer monitoring wells do not have historical data; however, the Grassland Plan Area participants will monitor the sites and intend to use the gathered data to establish meaningful interim goals, measurable objectives, and minimum thresholds.				
1MU-2					
1MU-3					
Lower Aquifer Groundwater Levels & Groundwater Storage					
1ML-1	Lower aquifer representative monitoring wells have been identified for the monitoring network. However, no historical data exists. The Grassland Plan Area participants will monitor the sites and intend to use the gathered data to establish meaningful interim goals, measurable objectives, and minimum thresholds in future GSP Updates.				
1ML-2					
1ML-3					
1ML-4					
1ML-5					
1ML-6					

The water level between the measurable objective and the minimum threshold is recognized as the operational flexibility, accounting for drought periods, land use changes, and allowance of opportunities to mitigate effects prior to experiencing a three-year sustained minimum threshold exceedance. To achieve sustainability and Plan success, the Grassland Plan Area participants will continue to manage the various land uses within the operational flexibility identified in **Table 4-7.** The projected water budget in **Chapter 3.3** anticipates a sustainable system based on historical data.

Table 4-7: Water Level, Groundwater Storage, & Interconnected Surface Water Upper Operational Flexibility

Water Surface Elevation – Upper Aquifer Measurable Objective and Interim Goals			
GSP Well ID	Measurable Objective at 2040 (WSE, ft)	Operational Flexibility (WSE, ft)	Minimum Threshold (WSE, ft)
3PU-1	56	12	44
1PU-1	73	15	58
08S09E34G001M	66	14	52
08S10E30E001M	70	14	56
11S12E30H002M	113	22	91
11S11E04N001M	97	20	77

4.5.2 Subsidence

The measurable objective is reflective of coordination with neighbors regarding lower aquifer impacts to regional subsidence considering the negligible volume of lower aquifer pumping occurring in the Grassland Plan Area. The measurable objective and respective interim goals are outlined in **Table 4-8**. The measurable objective is set to an average not to exceed the historical annual average rate of subsidence from December 2011 to December 2018 at each respective site. The Interim Goals are set to reflect any subsidence rate greater than the measurable objective or the historical annual average rate of subsidence from December 2011 to December 2018.

Table 4-8: Subsidence SMCs

Subsidence SMCs					
Monitoring Point	2025	2030	2035	2040	Minimum Threshold
	Interim Goal	Interim Goal	Interim Goal	Measurable Objective	
	Annual Average Rate of Subsidence (feet, NAVD 1988)				
108	Slower than -0.08	Slower than -0.08	Slower than -0.08	-0.08	-0.11
152	Slower than -0.1	Slower than -0.1	Slower than -0.1	-0.10	-0.15
137	Slower than -0.11	Slower than -0.11	Slower than -0.11	-0.11	-0.13

The pathway to achieving sustainability is strongly influenced by the Delta-Mendota Subbasin coordination, considering that the Grassland Plan Area's lower aquifer pumping is insignificant. The operational flexibility between the measurable objective and the minimum threshold is outlined in **Table 4-9**. The measurable objective to achieve sustainability is not to exceed the existing annual average subsidence rate seen from December 2011 to December 2018 and to encourage adjacent lower aquifer pumpers to improve upon lower aquifer groundwater reliance. This provides slightly more flexibility than the minimum threshold, which allows for the slightly higher subsidence rates seen from December 2011 to December 2015 and captures greater effects from sustained drought conditions.

Table 4-9: Subsidence Operational Flexibility

Subsidence Operational Flexibility			
GSP Well ID	Measurable Objective at 2040	Operational Flexibility	Minimum Threshold
	Annual Average Rate of Subsidence (feet, NAVD 1988)		
3PU-1	-0.08	-0.03	-0.11
1PU-1	-0.10	-0.05	-0.15
08S09E34G001M	-0.11	-0.02	-0.13

4.5.3 Water Quality

Water quality measurable objectives were established at each site uniquely, recognizing the historical electrical conductivity (EC) maximum values and applying a twenty-percent increase in concentration. EC was chosen for the measurable objectives because this is the salinity measurement method that is commonly used for groundwater quality monitoring programs within the Plan Area (see **Section 5.1.2**). Unlike TDS, EC is readily measurable and does not require lab analysis, which allows for better real-time water quality management. In contrast, TDS was chosen for the minimum threshold because it represents a longstanding threshold for acceptance of water for wetland use in the Plan Area. In addition to real-time EC measurements, both TDS and EC are reported in lab analyses for the existing water quality monitoring programs. Significant and unreasonable undesirable results were not experienced in instances in which the Grassland Plan Area reached the historic high EC concentration. **Table 4-10** outlines the measurable objective and interim goals set at each representative water quality monitoring site. Operational flexibility is the range between the measurable objective for salinity (measured in EC) and the minimum threshold of 2,500 mg/L (measured in TDS).

There is no gradual decline to these water quality levels, as the Grassland Plan Area participants anticipate maintaining their water system within existing water quality parameters and would require more data to meaningfully perform a groundwater quality trend analysis. As more information is obtained, interim goals may be refined to reflect the understanding of groundwater quality conditions in the Plan Area.

The plan to achieve water quality sustainability in the Grassland Plan Area lies in maintaining and managing the goals of other existing programs in the Plan Area. The understanding of groundwater quality is anticipated to improve with implementation of the representative water quality monitoring network.

Table 4-10: Water Quality SMCs

Water Quality Sustainable Management Criteria					
Representative Monitoring Well	2025	2030	2035	2040	Minimum Threshold
	Interim Goal	Interim Goal	Interim Goal	Measurable Objective	
	EC (µS/cm)	*EC (µS/cm)*	*EC (µS/cm)*	*EC (µS/cm)*	*TDS*
Upper Aquifer					
1PU-1	<2,028	<2,028	<2,028	2,028	2,500
2PU-1	<2,196	<2,196	<2,196	2,196	2,500
2PU-3	<1,080	<1,080	<1,080	1,080	2,500
Lower Aquifer					
1PL-1	Lower aquifer representative water quality monitoring sites have been identified; however, no historical data exists. The Grassland Plan Area participants will monitor the sites and intend to use the gathered data to establish meaningful interim goals and measurable objectives in future GSP Updates.				2,500
2PL-1					2,500
1PL-2					2,500
1PL-3					2,500

4.5.4 Additional Measurable Objective Elements

Legal Requirements:

§354.30 (f) Each Plan may include measurable objectives and interim milestones for additional Plan elements described in Water Code Section 10727.4 where the Agency determines such measures are appropriate for sustainable groundwater management in the basin.

(g) An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for finding of inadequacy of the Plan.

No additional objective elements were set for this GSP.

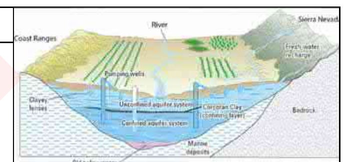
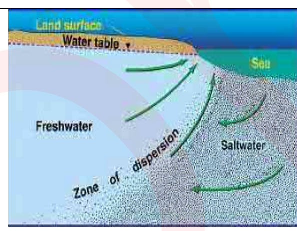
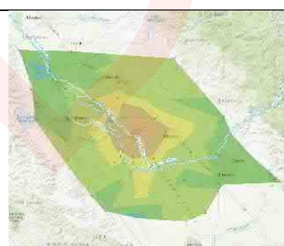
5 Monitoring Network

Legal Requirements:

> **§354.32** This Subarticle describes the monitoring network that shall be developed for each basin, including monitoring objectives, monitoring protocols, and data reporting requirements. The monitoring network shall promote the collection of data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the basin and evaluate changing conditions that occur through implementation of the Plan.

A comprehensive monitoring network is a fundamental component of groundwater management and is needed to measure progress toward groundwater sustainability. Below, **Table 5-1** includes the indicators necessary to monitor in order to comply with SGMA monitoring and reporting requirements. Monitoring programs for the five applicable sustainability indicators are described in this chapter, including the history of the monitoring programs, proposed monitoring to comply with SGMA, and the adequacy and scientific rationale for each monitoring network.

Table 5-1: Monitoring Requirements

Groundwater Levels: Monitoring of static groundwater levels each spring and fall		Groundwater Storage: Monitoring the annual change in groundwater storage	
Seawater Intrusion: Intrusion of seawater into local aquifers *(This is not applicable to the GGSA or MCDMGSA.)*		Water Quality: Monitoring for water quality degradation that could impact available groundwater supplies	
Land Subsidence: Monitoring surface land subsidence caused by groundwater withdrawals		Depletion of Interconnected Surface Water: Monitoring loss of permanent connections between surface water and groundwater	

5.1 Description of Monitoring Network

Legal Requirements:

§354.34(a) Each Agency shall develop a monitoring network capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and yield representative information about groundwater conditions as necessary to evaluate Plan Implementation.

This chapter describes the representative monitoring network and supplemental monitoring efforts currently being implemented by entities within the Plan Area, and the representative monitoring network that will be used by the GGSA and MCDMGSA for the Plan Area. The results and data from historical monitoring efforts can be found in **Chapter 3.2 – Current and Historical Groundwater Conditions**. These monitoring efforts will continue to collect data into the future to determine short-term, seasonal, and long-term trends in groundwater and related surface water conditions. Data from the internal representative monitoring network will be reported to the Delta-Mendota Subbasin for tracking existing conditions and threshold exceedances of any criteria or thresholds. This data will yield information necessary to support the implementation of this Plan, evaluation of the effectiveness of the Plan, and decision-making for the Plan Area.

Delta-Mendota Subbasin Representative Monitoring Networks
The Delta-Mendota Subbasin Common Chapter describes the coordination of each GSP's representative monitoring network:

As required by Subarticle 4. Monitoring Networks of the GSP regulations, the GSPs must include a monitoring network for each sustainability indicator, in addition to describing the monitoring protocols and data management to be followed in implementing the GSP monitoring program. Given the variability of conditions within the Delta-Mendota Subbasin, each GSP Group developed their individual monitoring networks, in coordination with their neighboring GSP Groups, such that the subbasin-wide monitoring programs is simply a compilation of those coordinated individual monitoring networks.

Grassland Plan Area Representative Monitoring Networks
The representative monitoring networks are sites specifically identified to monitor and evaluate sustainable management criteria (SMCs). These sites contribute to an understanding of hydrogeologic conditions and their relationship to groundwater pumping as well as the spatially dispersed data necessary to develop groundwater-level and subsidence contours and characterizations of changes in storage and water quality. Data obtained from these sites will be used for the evaluation and calculation of water budget updates, any future reconsideration of sustainable management criteria, and the refinement of groundwater level contours, water quality assessments, and subsidence analysis.

Supplemental Data
Data obtained via GWD's monitoring program (**Section 5.1.2, Density of Monitoring Sites and Frequency of Measurements**), state and federal monitoring, and additional publicly available monitoring programs will be used to supplement the representative monitoring network data. The Grassland Plan Area participants acknowledge the benefit of merging existing monitoring programs with GSP monitoring efforts.

Potential Future Monitoring Network
There are monitoring sites within or adjacent to the Grassland Plan Area that were not included in the representative monitoring network due to a lack of temporal data consistency. These sites will continue to be monitored under GWD's monitoring program and are included in the Grassland Plan Area's Potential Future Monitoring Network. The intention of this network is to recognize that the data obtained from additional monitoring efforts can be useful in the analyses required by SGMA and may be useful for inclusion in future GSP updates. These additional sites are considered supplemental to the Representative Monitoring Networks identified in **Section 5.4** and are not subject to SMC analyses unless otherwise decided upon by Plan participants in future GSP updates.

5.1.1 Monitoring Network Objectives

Legal Requirements:

§354.34(b) Each Plan shall include a description of the monitoring network objectives for the basin, including an explanation of how the network will be developed and implemented to monitor groundwater and related surface conditions, and the interconnection of surface water and groundwater, with sufficient temporal frequency and spatial density to evaluate the effects and effectiveness of Plan implementation. The monitoring network objectives shall be implemented to accomplish the following:

1. Demonstrate progress toward achieving measurable objectives described in the Plan.
2. Monitor impacts to the beneficial uses or users of groundwater
3. Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds.
4. Quantify annual changes in water budget components.

The objectives of the Grassland GSP monitoring network, consistent with the Delta-Mendota Subbasin Common Chapter, are as follows:

1. Establish a baseline for future monitoring.
2. Provide warning of potential future problems.
3. Generate information for water resources evaluation.
4. Quantify annual changes in water budget components.
5. Develop meaningful long-term trends in groundwater characteristics.
6. Provide comparable data from various locales within the Plan Area.
7. Demonstrate progress toward achieving measurable objectives and interim goals in the Plan.
8. Monitor changes in groundwater conditions relative to minimum thresholds, measurable objectives, and sustainable management criteria.
9. Monitor impacts to the beneficial uses or users of groundwater.

5.1.2 Implementation of Monitoring Network

Existing Monitoring – Water Quality, Water Levels, and Interconnected Surface Water

GWD has maintained a groundwater level monitoring program (GWMP) that includes pre- and post-pumping season water level measurements and is approved by USBR for the acquisition of refuge water supplies under the federal Refuge Water Supply Program. For the past several years, DWR has also asked local agencies to collect and report groundwater level data under the California Statewide Groundwater Elevation Monitoring (CASGEM) program. Data from these wells was recorded in an electronic database and submitted to the San Luis Delta Mendota Water Authority (SLDMWA) for inclusion in the CASGEM program.

The GWD also identified similar objectives in its Groundwater Management Plan:

- Measure water level fluctuations within wells in the District and evaluate the data for change in storage conditions.
- Measure water quality in wells and evaluate for potential water quality degradation.
- Submit water level data to the California Statewide Groundwater Elevation Monitoring (CASGEM) program.

GWD's groundwater quality monitoring program includes the collection of analytical grab samples at each wellhead least twice a year: at the beginning of the pumping season and just prior to the end of the pumping season. These samples are analyzed for selenium, EC, TDS, and boron. During the pumping season, wells are also tested for EC on a weekly basis, along with surface water upstream and downstream of each well. Annual summaries of groundwater quality trends are reviewed by the District's Board of Directors and submitted to the USBR in annual reports. This monitoring effort extends to all wells that provide groundwater for wetland habitat within the GGSA, including wells located adjacent to the GGSA and within the MCDMGSA. The CDFW maintains a similar groundwater monitoring and reporting program for groundwater wells that produce water for wetland habitat on state wildlife areas within the MCDMGSA.

GWD's Real Time Water Quality Monitoring Network (RTWQMN) currently consists of approximately 30 real-time monitoring stations located at key inflow, delivery, confluence, and drainage points that continuously measure surface water flow, EC, temperature, and pH. Additionally, current groundwater monitoring plans require GWD to monitor for TDS, selenium, and boron in surface water channels monthly in order to ensure continued compliance with the water quality objectives of the Central Valley Regional Water Quality Control Board (CVRWQCB).

The constituent with the greatest potential for negative impact in the Plan Area is salinity. Chapter 4 identifies the potential concerns of salinity and details a plan to assess SMCs for TDS and EC. Groundwater and surface water monitoring programs will continue and may expand as needed to comply with SGMA monitoring requirements. Monitoring for selenium and boron will continue independently of SGMA, compliant with the GWD's and CDFW's monitoring programs. In the event of a trend of groundwater or surface water quality deteriorating in such a way that would impact beneficial users of groundwater, the Plan Area participants recognize the necessity of updating the SMCs and water quality monitoring to reflect concern for potential impacts.

The San Joaquin River Improvement Project and Grassland Bypass Project improve water quality in the Plan Area's wildlife refuges and wetlands, sustain the productivity of 97,000 acres of farmland, and foster cooperation between area farmers and regulatory agencies in drainage management and the reduction of selenium and salt loading to surface water. The projects are located south of the Plan Area and are operated by the San Joaquin Valley Drainage Authority, the Grassland Basin Drainers group, USBR, and the SLDMWA. Under agricultural drainage improvements by the USBR, sub-surface agricultural drainage from a large portion of the 370,000-acre Grasslands Watershed west of the San Joaquin River in Merced County has been shifted from discharging into wetland areas to discharging to the San Luis Drain and Mud Slough, a tributary to the San Joaquin River. In 2019 the project will cease discharging agricultural drainage water and has been proposed to be managed as a storm water bypass project around the wetland complex going forward.

The San Joaquin Valley Drainage Authority has agreed to install 5 multi-completion monitoring wells along the common boundary between the GGSA and the San Joaquin River Improvement Project, also known as the drainage reuse area, to begin to monitor subsurface migration of salt. The results of this supplemental monitoring data will be considered during GSP updates.

<u>Irrigated Lands Regulatory Program</u>
The Irrigated Lands Regulatory Program (ILRP) was initiated in 2003 to address pollutant discharges to surface water and groundwater from commercially irrigated lands. The primary purpose of the ILRP is to address key pollutants of concern, including salinity, nitrates, and pesticides introduced through runoff or infiltration of irrigation water and stormwater. The program is administered by the Central Valley Regional Water Quality Control Board (RWQCB or Regional Board). The Westside San Joaquin River Watershed Coalition serves as the third-party group for the landowners within the Western San Joaquin River Watershed. The Waste Discharge Requirements (WDRs) under General Order R5-2014-0002, which apply to landowners within the Western San Joaquin River Watershed, were adopted by the RWQCB on January 9, 2014.

To date, the Coalition has monitored surface water quality, and groundwater quality is being monitored under the recent groundwater trend monitoring program and groundwater quality management plan released in March 2017. Fourteen wells are monitored annually at representative locations in high monitoring priority areas for constituents including nitrate, EC, pH, dissolved oxygen, temperature, and turbidity. Nitrate is the primary constituent of concern for the Coalition. However, the Plan Area is in the lowest monitoring priority area and is not within a high vulnerability area for nitrate. Nitrate management plans are not required by the RWQCB because managed wetlands within the Plan Area help play a role in improving groundwater quality and do not apply nitrogen fertilizer.

<u>Other Agencies</u>
Several other agencies play important roles in the monitoring of groundwater quality. These include the RWQCB, U.S. Environmental Protection Agency (EPA), Department of Toxic Substances Control (DTSC), U.S. Geological Survey (USGS), USBR, and State Water Resources Control Board (SWRCB). The GSP participants make efforts to collect and review pertinent water quality data published by these agencies. GWD also provides annual groundwater and surface water quality monitoring reports to USBR, CDFW, USFWS, and RWQCB.

Existing Monitoring – Subsidence

While some local agencies in the San Joaquin Valley monitor for land subsidence, the majority rely on monitoring performed by regional water agencies or the state and federal governments. Measurement and monitoring for land subsidence are performed by a variety of agencies including USGS, USBR, U.S. Army Corps of Engineers (USACE), University NAVSTAR (Navigation Satellite Timing and Ranging) Consortium (UNAVCO), and various private contractors. Interagency efforts between the USGS, USBR, the U.S. Coast and Geodetic Survey (now the National Geodetic Survey), and DWR have resulted in an intensive series of investigations that have identified and characterized subsidence in the San Joaquin Valley. NASA also measures subsidence in the Central Valley and has maps on its website that show the subsidence for a defined period. Several subsidence monitoring sites are located within and adjacent to the Plan Area and are actively monitored as part of the San Joaquin River Restoration Program. These sites are included in the representative monitoring network.

The SLDMWA and Central California Irrigation District maintain land subsidence monitoring programs. The Grassland Plan Area participants will continue to follow the results of these established monitoring programs, collaborate with the agencies to mitigate problems associated with land subsidence, and participate in the development of both intra- and inter-basin solutions.

Grassland Plan Area - Representative Monitoring Networks

Additionally, new monitoring networks have been developed (**Figure 5-1, Figure 5-2,** and **Figure 5-3**) for the purposes of GSP compliance and improvement of the hydrogeologic understanding of the Grassland Plan Area. Existing networks will be enhanced when necessary using the Data Quality Objective (DQO) process, which follows the U.S. EPA *Guidance on Systematic Planning Using the Data Quality Objective Process* (EPA, 2006). The DQO Process is also outlined in the DWR's Best Management Practices for monitoring networks (DWR, 2016a) and monitoring protocols (DWR, 2016b).

The DQO process includes the following:

1. State the problem.
2. Identify the goal.
3. Identify the inputs.
4. Define the boundaries of the area/issue being studied.
5. Develop an analytical approach.
6. Specify the performance or acceptance criteria.
7. Develop a plan for obtaining data.

The DQO process helps ensure a repeatable and robust approach to collecting data with a specific goal in mind.

5.1.3 Description of Monitoring Network

Legal Requirements:

§354.34(c) Each monitoring network shall be designed to accomplish the following for each sustainability indicator:

The Grassland Plan Area's monitoring efforts address the five applicable sustainability indicators and are organized into three representative monitoring networks:

(1) Representative water quality monitoring network
(2) Representative water level monitoring network
(3) Representative subsidence monitoring network

The wells identified in the representative water level and groundwater quality monitoring networks include wells perforated in the upper aquifer and wells perforated in the lower aquifer. The two distinct aquifers are substantially separated by the Corcoran Clay and are the two principle aquifers in the Plan Area. The lack of historical data from the wells that perforate down to the lower aquifer has prevented establishment of meaningful sustainable management criteria in the 2020 Grassland GSP for all sustainability indicators excepting water quality (for which the criteria are the same for the upper and lower aquifer). Lower aquifer wells are identified as representative monitoring sites and will undergo monitoring associated with GSP implementation. The data collected will be used for groundwater contouring and will facilitate further SMC development in future GSP updates for the lower aquifer. Thus, at this time SMC for water levels have been developed only for the upper aquifer.

Representative Groundwater Quality Monitoring Network
The groundwater quality monitoring network (**Table 5-2** and **Figure 5-1**) includes three upper aquifer wells. To achieve representative spatial coverage and characterize the conditions of both aquifers underlying the Grassland Plan Area, four lower aquifer representative water quality monitoring wells are also included in the network. Existing data indicates that groundwater quality is relatively consistent across broad expanses of the Plan Area. The monitoring sites were selected at representative locations in the south, central, and northern portions of the Plan Area. Other GSP groups in the Delta-Mendota Subbasin have identified water quality monitoring sites that are close to but outside of the Plan Area which will provide additional relevant data (see **Common Chapter (Appendix A) Figures CC-74 and CC-75**).

Table 5-2: Representative Groundwater Quality Monitoring Network Sites

Representative Groundwater Quality Monitoring Network	
Upper Aquifer	
1PU-1	Sufficient historical data available to establish SMCs.
2PU-1	
2PU-3	
Lower Aquifer	
1PL-1	Lower aquifer representative monitoring wells have been identified for the monitoring network. However, historical data is limited. The Grassland Plan Area participants will monitor the sites and establish meaningful interim goals and measurable objectives with the gathered data in future GSP Updates if feasible.
2PL-1	
1PL-2	
1PL-3	

Representative Water Level Monitoring Network

The groundwater level representative monitoring network (**Table 5-3** and **Figure 5-2**) is made up of nine upper aquifer wells, four of which have been and will continue to be monitored by DWR, and three of which are associated with two multicompletion well sites and do not have adequate historical data for SMC development. The lower aquifer representative water level monitoring network is comprised of six wells from three multicompletion well sites and also have limited historical data. After data is acquired during the implementation phase from the sites that do not have historical data, meaningful thresholds will be established and identified in GSP Updates. Existing data indicates that groundwater levels are relatively consistent across broad expanses of the Plan Area. The monitoring sites were selected at representative locations in the south, central, and northern portions of the Plan Area. Other GSP groups in the Delta-Mendota Subbasin have identified groundwater level monitoring sites that are close to but outside of the Plan Area, which will provide additional relevant data (see **Common Chapter (Appendix A) Figures CC-72 and CC-73**).

This network serves as the representative monitoring network for three of the sustainability indicators:

(1) Water levels
(2) Groundwater storage
(3) Interconnected surface water

Descriptions of their relationship to groundwater levels and spatial distribution are outlined in **Section 5.1.3.1**.

Table 5-3: Representative Water Level Monitoring Network Sites

<table>
<tr><th colspan="2">Representative Water Level Monitoring Network</th></tr>
<tr><th colspan="2">Upper Aquifer</th></tr>
<tr><td>2PU-3</td><td rowspan="6">Historical data available to establish SMCs.</td></tr>
<tr><td>1PU-1</td></tr>
<tr><td>08S09E34G001M</td></tr>
<tr><td>08S10E30E001M</td></tr>
<tr><td>11S12E30H002M</td></tr>
<tr><td>11S11E04N001M</td></tr>
<tr><td>1MU-1</td><td rowspan="3">Three upper aquifer monitoring wells have limited historical data; however, the Grassland Plan Area participants will monitor the sites and establish meaningful interim goals, measurable objectives, and minimum thresholds with the gathered data if feasible.</td></tr>
<tr><td>1MU-2</td></tr>
<tr><td>1MU-3</td></tr>
<tr><th colspan="2">Lower Aquifer</th></tr>
<tr><td>1ML-1</td><td rowspan="6">Lower aquifer representative monitoring wells have been identified for the monitoring network. However, historical data is limited. The Grassland Plan Area participants will monitor the site and establish meaningful interim goals, measurable objectives, and minimum thresholds with the gathered data in future GSP Updates if feasible.</td></tr>
<tr><td>1ML-2</td></tr>
<tr><td>1ML-3</td></tr>
<tr><td>1ML-4</td></tr>
<tr><td>1ML-5</td></tr>
<tr><td>1ML-6</td></tr>
</table>

Representative Subsidence Monitoring Network

The representative subsidence monitoring network (**Table 5-4** and **Figure 5-3**) is comprised of three USBR-monitored subsidence survey benchmarks (108, 137, and 152) located within and near the Plan Area. Although these three sites will specifically be examined for SMC analysis (**Chapter 4**), the understanding of subsidence in the Delta-Mendota Subbasin and Plan Area may require the examination of supplemental subsidence monitoring data from all publicly available sources due to the limited spatial extent of the monitoring network.

Table 5-4: Representative Subsidence Monitoring Network

Representative Subsidence Monitoring Network	
USBR Monitoring Sites	
108	Historical data available to establish SMCs.
152	
137	

Monitoring Networks Not Considered

The Grassland Plan Area is geographically distanced from the Pacific Coast in such a way that prevents any impacts related to seawater intrusion in the Plan Area. Therefore, a seawater intrusion monitoring network is not feasible, necessary, or required.

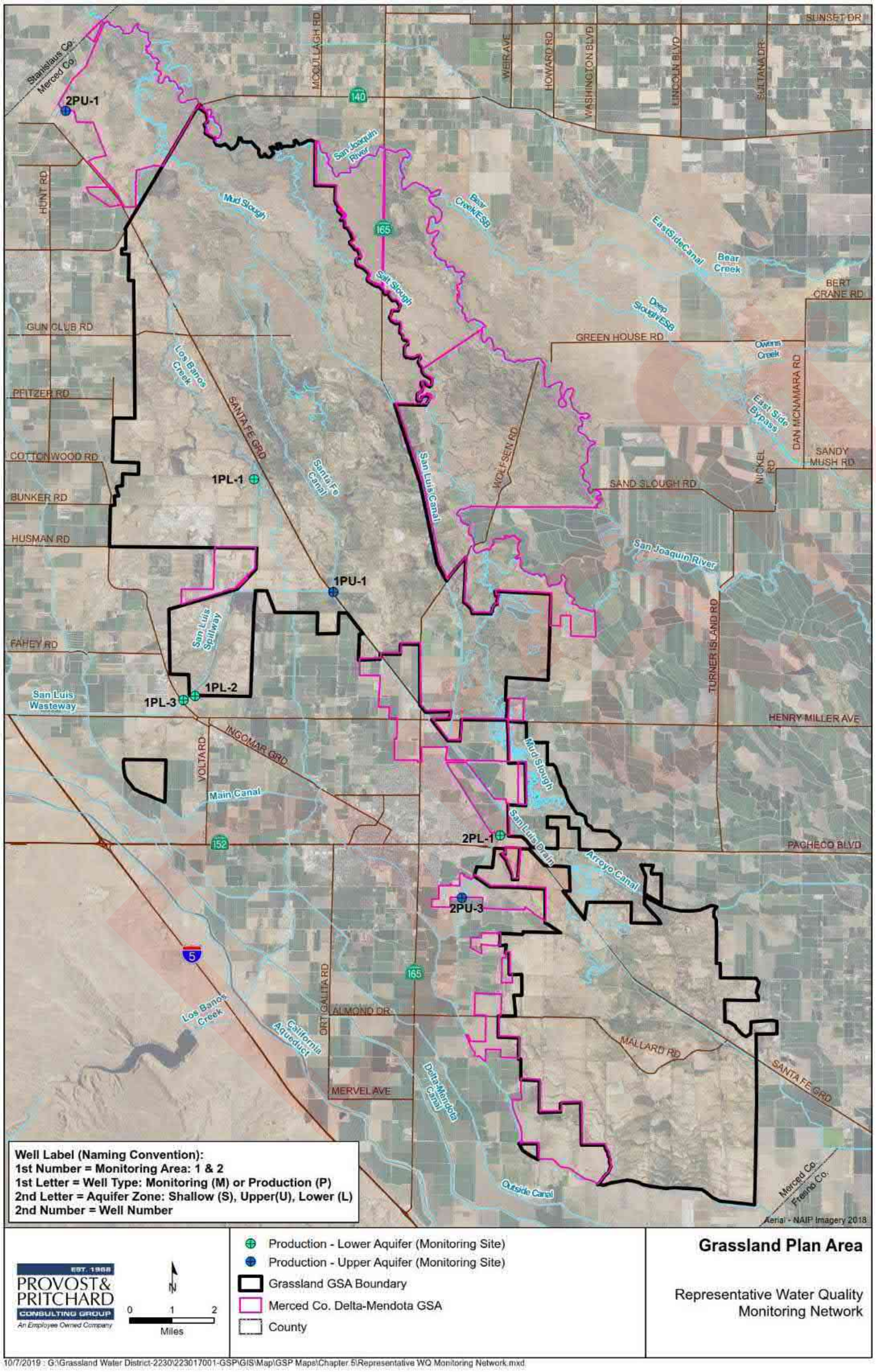


Figure 5-1: Representative Water Quality Monitoring Network

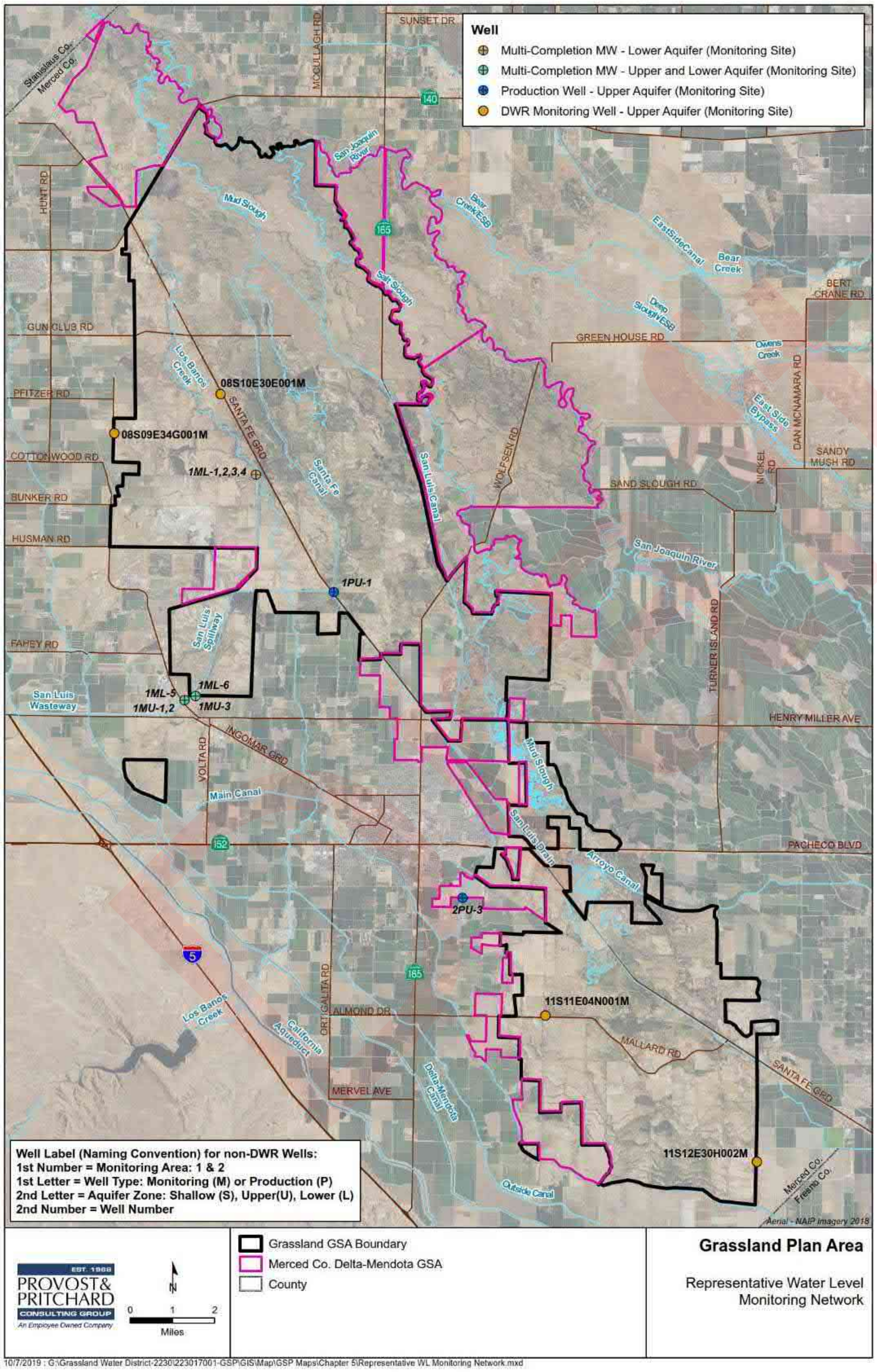


Figure 5-2: Representative Water Level Monitoring Network

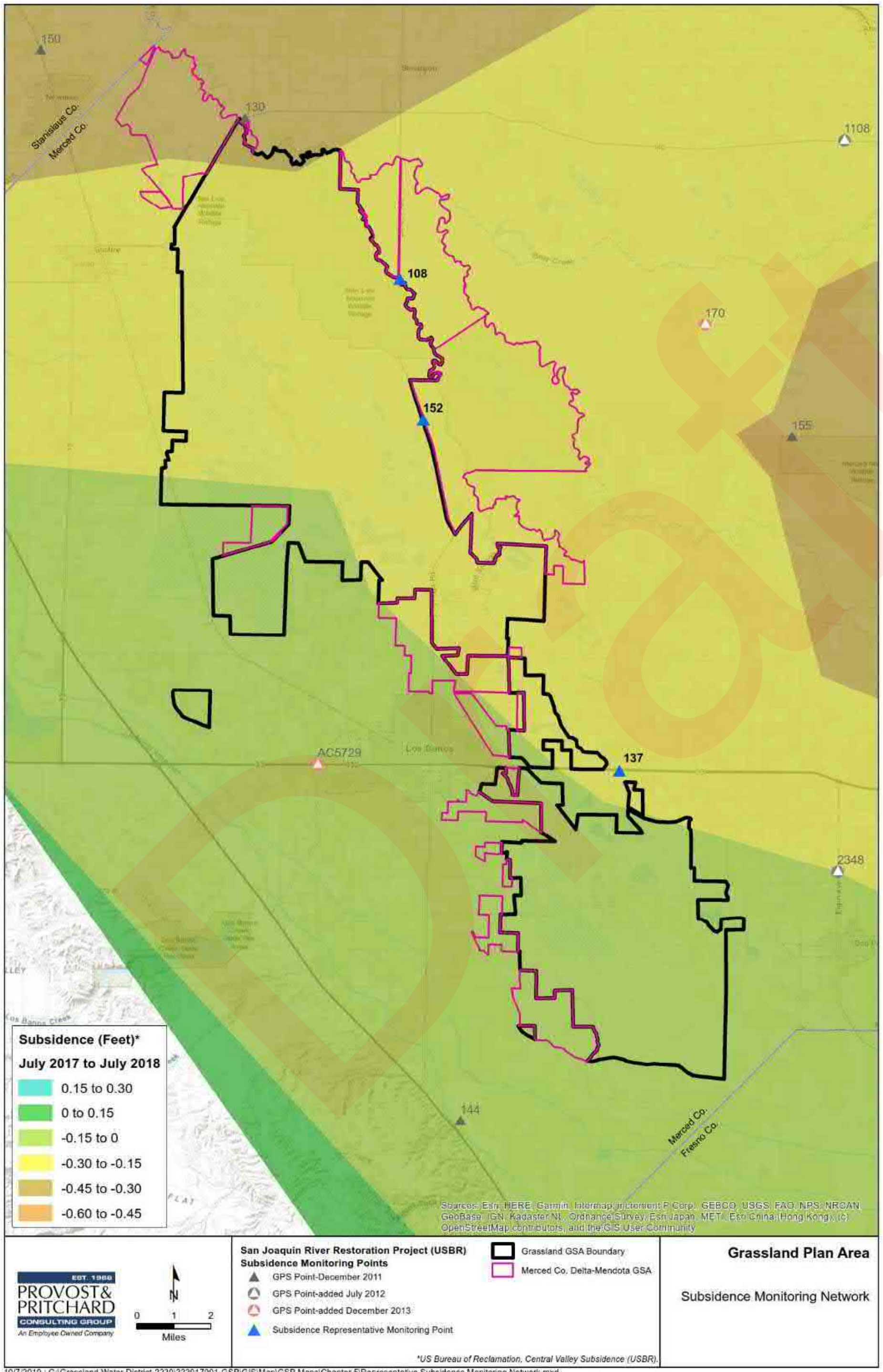


Figure 5-3: Representative Subsidence Monitoring Network

5.1.3.1 Groundwater Levels

Legal Requirements:

§354.34(c)(1) Chronic Lowering of Groundwater Levels. Demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features by the following methods:
(A) A sufficient density of monitor wells to collect representative measurements through depth-discrete perforated intervals to characterize the groundwater table or potentiometric surface for each principal aquifer.
(B) Static groundwater elevation measurements shall be collected at least two times per year, to represent seasonal low and seasonal high groundwater conditions.

The representative water level monitoring network was developed by identifying wells with adequate spatial and temporal coverage to develop meaningful SMCs. The following questions were the focus of the Grassland Plan Area Technical Working Group during the process for developing the representative water level monitoring network.

Temporal:
- Of the wells within the Grassland Plan Area, which have measurements from at least three years within the period of 2000 to present?
- If a public agency monitors the well, is the responsible agency anticipated to continue to monitor this site?
- Is the well accessible for monitoring?
- Is the well perforated in the primary source aquifer to better monitor Grassland Plan Area participants' impacts on the hydrogeology through the implementation period?

Spatial:
- Does the proposed network provide sufficient spatial coverage across the Plan Area?
- Does the proposed network recognize both the upper aquifer and the lower aquifer?

<u>Temporal Coverage</u>
Certain wells that did not meet the temporal criteria were nonetheless included in the representative monitoring network. These wells will be monitored to increase the hydrologic understanding of the Plan Area, refine SMCs, and facilitate groundwater contours.

<u>Spatial Coverage</u>
Hopkins and Anderson (2016) provide recommendations for groundwater-level monitor well densities. The recommended densities range from one well per 150 square miles to one well per 25 square miles based on the quantity of groundwater pumped. A density of one well per 75 square miles is recommended for areas that use between 10,000 and 100,000 AF of groundwater per year and experience little water-level fluctuation or less than a 20-foot decrease in groundwater levels per decade. The Grassland Plan Area meets these criteria and is approximately 163 square miles. The density of water level monitoring sites is one well per 18 square miles for the upper aquifer and one well per 27 square miles for the lower aquifer; therefore, the representative water level monitoring network will exceed the minimum monitoring density suggested above. (See **Figure 5-2**).

Monitoring Frequency

The groundwater levels will be monitored in January in order to be consistent with the Delta-Mendota Subbasin's spring measurement period as well as consistent with the seasonal high for the Plan Area. Groundwater levels will undergo their seasonal low measurement between September and October, consistent with the Delta-Mendota Subbasin coordinated effort. Spring measurements are typically designed to capture the recovery of the groundwater basin after demands have been met the previous year (seasonal high). Fall measurements typically capture a period prior to pond flood and after peak irrigation has ceased before any natural recovery has taken place (seasonal low). The two measurements together show the full effects of groundwater use in a given year. Due to the function of the managed wetlands, groundwater levels will be monitored at times that best reflect the seasonal high and low in the Plan Area.

5.1.3.2 Groundwater Storage

Legal Requirements:

§354.34(c)(2) Reduction of Groundwater Storage. Provide an estimate of the change in annual groundwater in storage.

Upper Aquifer Groundwater Storage Calculations

Table 3-2 and **Section 3.3.3.1** Identify and outline the calculated change in storage of the Plan Area. Upper aquifer groundwater storage change will be estimated by multiplying local specific yield values by the overall change in groundwater elevation levels in the upper aquifer as determined using multiple hydrographs and contour maps prepared by the hydrogeological consultant. Specific yield values were identified in the hydrogeological conceptual model (**Chapter 3.1**).

Refer to **Chapter 3** for figures depicting the well coverage used for contour development. All available and relevant water level data from wells in the Plan Area will be used for the calculations associated with groundwater storage reporting requirements.

The process for calculating storage for the upper aquifer is detailed in **Section 3.3.3.1**.

Lower Aquifer Groundwater Storage Calculations

Due to insufficient historical water level data for wells that perforate below the Corcoran Clay and the complexity of calculating lower aquifer groundwater storage using water levels, subsidence was used as an initial proxy to quantify change in lower aquifer storage. Excessive lower aquifer pumping can induce inelastic compaction, which occurs when the structure of the overlying clay is compromised such that it is unable to expand to its original thickness even when groundwater levels rise to pre-pumping conditions. See **Section 5.1.3.5** for more information regarding the Grassland Plan Area's subsidence monitoring.

The method for calculating groundwater storage for the lower aquifer includes the following steps:

1. Develop subsidence contours or evaluate publicly available subsidence contours.
2. Using GIS, determine the change in land surface elevation.
3. Multiply land surface elevation by acreage to determine volumetric change.

The Plan Area participants recognize that there is insufficient data to identify changes in groundwater storage that do not result in subsidence. New lower aquifer monitoring sites are included in the representative groundwater level monitoring network, and data collected during GSP implementation will be used in the future to help calculate volumetric changes in storage.

5.1.3.3 Seawater Intrusion

Legal Requirements:

§354.34(c)(3) Seawater Intrusion. Monitor seawater intrusion using chloride concentrations, or other measurements convertible to chloride concentrations, so that the current and projected rate and extent of seawater intrusion for each applicable principal aquifer may be calculated.

Given the distance separating the Plan Area from the Pacific Ocean, seawater intrusion from the ocean into the freshwater aquifer is not a concern. In addition, there are no saline water lakes in or near the GSA. As a result, seawater intrusion is not discussed hereafter in this chapter.

5.1.3.4 Water Quality

Legal Requirements:

§354.34(c)(4) Degraded Water Quality. Collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues.

Water quality monitoring is an important aspect of groundwater management in the area and serves the following purposes:

- Spatially characterize water quality according to soil types, soil salinity, geology, surface water quality, and land use
- Compare constituent levels at a specific well over time (i.e., years and decades)
- Assess the extent of groundwater quality problems in specific areas
- Identify groundwater quality protection and enhancement needs
- Assess water treatment needs
- Identify impacts of recharge and surface water use on water quality
- Monitor the migration of contaminant plumes

The questions guiding the Grassland Plan Area Technical Working Group's process for developing the representative water level monitoring network were repeated for the representative water quality network:

Temporal:

- Of the wells within the Grassland Plan Area, which have measurements from at least three years within the period of 2000 to present?
- If a public agency monitors the well, is the responsible agency anticipated to continue to monitor this site?
- Is the well accessible for monitoring?
- Is the well perforated in the primary source aquifer in order to better monitor Grassland Plan Area participants' impacts on the hydrogeology through the implementation period?

Spatial:

- Does the proposed network provide spatial coverage of 1 well per 75 square miles, as recommended in Hopkins and Anderson (2016)?
- Does the proposed network recognize both the upper aquifer and the lower aquifer?

Spatial Coverage

The water quality spatial coverage criteria mimics that of the water level network and exceeds the recommendation under Hopkins and Anderson (2016)*)* for a minimum density of one monitoring site per 75 square miles. **Figure 5-1** depicts the spatial coverage of the network, which is adequate considering that groundwater pumping within the Grassland Plan Area is significantly less than 100,000 AF and covers the spatial extent of approximately 163 square miles. Additionally, the groundwater level network includes coverage of both the upper and lower aquifer, which will improve data quality and quantity after monitoring of the new or previously unmonitored sites during GSP implementation. The water quality monitoring spatial coverage equals one well per 54 square miles in the upper aquifer and one well per 41 square miles in the lower aquifer.

Supplemental Monitoring

GWD, in cooperation with USBR, the Department of Fish and Wildlife (CDFW), and the United States Fish and Wildlife Service, has implemented a Real-Time Water Quality Monitoring Program (RTWQMP). The RTWQMP currently consists of 30 stations located at major points of acceptance, delivery, canal system confluences, and drainages of the Plan Area. The RTWQMP continuously monitors stage, flow, temperature, pH and salinity (EC). Real-time water quality monitoring data is proofed on a weekly basis through a Quality Assurance Program Plan (QAPP). The QAPP includes site visitations where technicians conduct sensor maintenance, calibration, and instantaneous and redundant flow and EC measurements to ensure that the data is representative and comprehensive. Surface water flow monitoring is evaluated at delivery points depicted in **Figure 5-5**.

5.1.3.5 Land Subsidence

Legal Requirements:

§354.34(c)(5) Land Subsidence. Identify the rate and extent of land subsidence, which may be measured by extensometers, surveying, remote sensing technology, or other appropriate method.

Although significant subsidence has been measured within the Delta-Mendota Subbasin, it has occurred outside of the Grassland Plan Area and has been associated with pumping from the lower aquifer beneath the Corcoran Clay (see this GSP **Section 3.3.3.1**). The upper aquifer serves as the primary source aquifer for the Grassland Plan Area with an insignificant amount of pumping from below the Corcoran Clay. Therefore, groundwater pumping activities within the Plan Area are not expected to contribute to land subsidence, although there is still a need to monitor subsidence that influences the Grassland Plan Area.

The USBR uses a variety of data described in detail in this section for its regional subsidence monitoring network in and around the Plan Area as well as conducts annual ground-truthing activities. USBR utilizes this information to develop subsidence contours. The USBR's subsidence survey benchmarks in the Plan Area and beyond are shown in **Figure 5-4.** Three of these USBR survey benchmarks that are within and adjacent to the Plan Area were identified for the representative monitoring network.

Supplemental Monitoring
See **Figure 5-4** for a compilation of subsidence monitoring locations that may provide supplemental data for the representative subsidence monitoring network identified in **Figure 5-3**. A more detailed discussion of the available subsidence data sources is outlined below.

Subsidence Monitoring Methods and Technology
Several methods for measuring subsidence are available and are discussed below:

Continuous Global Positioning System. Subsidence can be measured using continuous global positioning system (CGPS) data. Various USGS studies obtain CGPS data from the NAVSTAR UNAVCO Plate Boundary Observatory (PBO) network of continuously operating GPS stations. The PBO is the geodetic component of UNAVCO, a consortium of research institutions whose focus is measuring vertical and horizontal plate boundary deformation across the western United States using high-precision measurement techniques. CGPS data is measured to one hundredth of a millimeter with a relatively low standard deviation.

Extensometers. Extensometers measure compaction and expansion of the aquifer system. As the surrounding soils move, the distances between reference points change, which allow for continuous measurement of subsidence. Extensometers are costly to install and require frequent maintenance and calibration. In the 1950s and 1960s, the USGS, DWR, and other agencies installed several borehole extensometers in the San Joaquin Valley. There are presently no known extensometers within the Plan Area. Extensometers have a relative accuracy of approximately 1/100th of a foot.

InSAR. During the last decade, the USGS and other groups have been using data from radar-emitting satellites in a technique called InSAR (interferometric synthetic-aperture radar). This form of remote sensing compares radar images from each pass of an InSAR satellite over a study area to determine changes in the elevation of the land surface. InSAR has a relative accuracy within fractions of an inch.

LiDAR. DWR and USBR utilize Light Detection and Ranging (LiDAR) coupled with land elevation surveys to monitor subsidence. LiDAR utilizes a laser device that is flown above the earth's surface. LiDAR is known to be accurate down to less than a tenth of a foot as measured in root-mean-square deviation, an accuracy level very similar to that of surveying.

Surveying. In the past, subsidence measurement has relied upon optical (spirit level) surveying devices and laser and global positioning satellite (GPS) survey equipment. This type of measurement is still done today, usually along established highways and water conveyance facilities such as levees and canals. The relative accuracy of GPS surveying is approximately +/- 1 inch.

Subsidence Monitoring Programs

Measurement and monitoring for subsidence are performed by a variety of agencies including USGS, DWR, USBR, USACE, NAVSTAR UNAVCO, and various private contractors.

Continuous Global Positioning System Stations. There are two CGPS Stations near the Plan Area. The CGPS stations provide daily horizontal and vertical data at these locations with records starting as early as 2004. The CGPS stations also show subsidence or uplift at locations near the Plan Area. The PBO and the Scripps Orbit and Permanent Array Center (SOPAC) upload and process the data from the network of CGPS stations and produce graphs depicting the horizontal and vertical change in a point's location through time. The nearest CGPS stations are in Los Banos and Gustine with none within the Plan Area boundary. Information on CGPS stations can be found at the following website: https://www.unavco.org/instrumentation/networks/status/pbo/gps

NASA Monitoring Network. NASA obtains subsidence data by comparing satellite images of Earth's surface over time. For the last few years, InSAR observations from satellites and aircraft have been used to produce the subsidence maps. More information can be found on their website: https://www.nasa.gov/jpl/nasa-california-drought-causing-valley-land-to-sink

San Joaquin River Restoration Program. Currently, USBR in conjunction with DWR, USGS, and USACE obtains subsidence data twice yearly and has published maps of the results in July and December since 2012 as part of the San Joaquin River Restoration Program (SJRRP). The subsidence areas shown in these maps cover the entire Plan Area. The USBR has been monitoring subsidence along the river and bypass levees as part of the restoration effort. More information can be found on their website: http://www.restoresjr.net/monitoring-data/subsidence-monitoring/

USGS Monitoring Network. A subsidence monitoring network consisting of 31 extensometers was installed by the USGS in the 1950s to quantify the subsidence occurring in the San Joaquin Valley. By the 1980s, the land subsidence monitoring efforts had decreased. Since then, a new monitoring network has been developed. The new network includes refurbished extensometers from the old network, CGPS stations, and InSAR. More information can be found on the USGS website: https://ca.water.usgs.gov/land_subsidence/california-subsidence-measuring.html

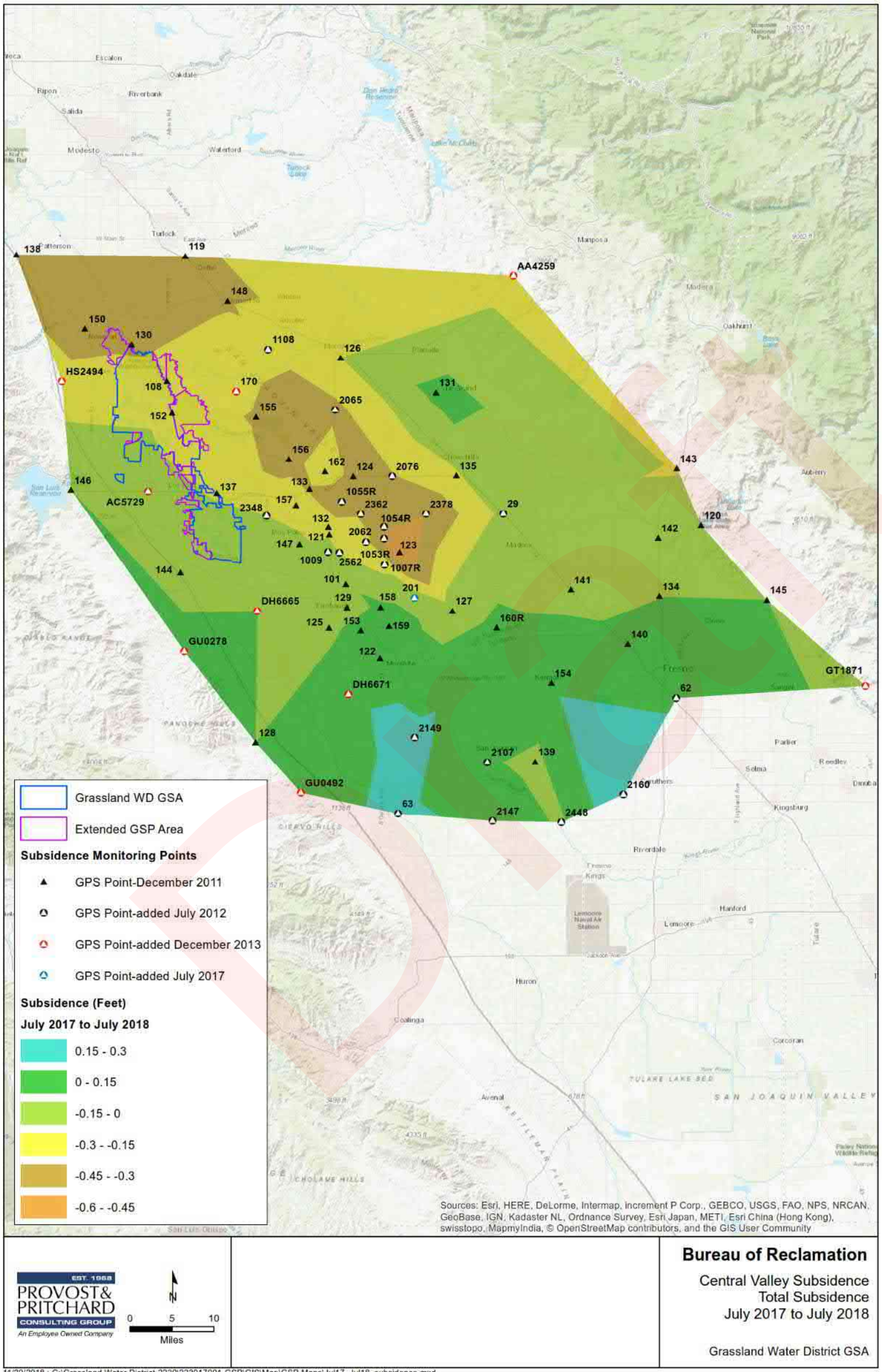


Figure 5-4: Supplemental Subsidence Monitoring Network

5.1.3.6 Depletion of Interconnected Surface Water

Legal Requirements:

§354.34(c)(6) Depletions of Interconnected Surface Water. Monitor surface water and groundwater, where interconnected surface water conditions exist, to characterize the spatial and temporal exchanges between surface water and groundwater, and to calibrate and apply the tools and methods necessary to calculate depletions of surface water caused by groundwater extractions. The monitoring network shall be able to characterize the following:

(A) Flow conditions including surface water discharge, surface water head, and baseflow contribution.

(B) Identifying the approximate date and location where ephemeral or intermittent flowing streams and rivers cease to flow, if applicable.

(C) Temporal change in conditions due to variations in stream discharge and regional groundwater extraction.

(D) Other factors that may be necessary to identify adverse impacts on beneficial uses of the surface water.

The Plan Area is adjacent to the San Joaquin River (SJR) along the northern edge of the San Luis National Wildlife Refuge, also referred to as Reach 5 of the SJR. Water level maps indicate the potential for groundwater to discharge to the San Joaquin River from the upper aquifer.

Water level maps indicate that the SJR has historically experienced a net inflow from the Grassland Plan Area. This can be attributed to historically high groundwater levels and requirements to sustain a large land area in wetland habitat conservation. The analysis of Grassland Plan Area impacts on interconnected surface water will be evaluated by assessing groundwater levels across the Plan Area in the representative water level monitoring network depicted in **Figure 5-2.** See **Chapter 4.8** for more information on assessing interconnected surface water SMCs.

The understanding of the flow conditions, period of flow, variations, and other factors in the SJR stretch adjacent to the Grassland Plan Area will further be evaluated using available supplemental data. The water budget analysis required for annual reporting in the Plan Area will be further understood by analyzing depth to water measurements and upper aquifer groundwater contours developed from the representative water level monitoring network, monitoring by other GSP groups in the Delta-Mendota Subbasin, and the Grassland GSP participants' supplemental monitoring efforts.

Supplemental Monitoring

San Joaquin River Restoration Program

The SJRRP has installed a network of shallow monitoring wells to monitor the relationship between groundwater and stream flow in this area. Most Plan Area participants are beneficial users of surface water; however, surface water is also delivered from sources other than the SJR as described in **Chapter 2**. Although surface and groundwater in the Plan Area flow toward the SJR, most surface water in the Plan Area is delivered within the GGSA and to state and federal wildlife areas in the MCDMGSA. Non-CVP water is also routinely delivered to adjacent agricultural and habitat areas. Due to the relatively minimal pumping and the depth and distance of wells from the river, there has been no observation that pumping has impacted surface water intended for other users along the SJR. The SJRRP monitoring network data will be reviewed to assess this assumption.

Surface water flow in the San Joaquin River adjacent to the Plan Area is monitored at the San Joaquin River near Stevenson (SJS) station and at the Freemont Ford Bridge (FFB) station. Surface water flow rates and stage levels are monitored by DWR and USGS respectively. Data is available on the California Data Exchange Center (CDEC) website. The Plan Area members are currently coordinating with the SJRRP and will continue to do so in order to monitor groundwater-surface water interactions and river flow losses in the adjacent reaches of the river to ensure that surface water is unimpaired by groundwater users.

Grassland Water District
All CVP contract water delivered to and by GWD is monitored and measured by USBR or its contractual wheeling agents. GWD's inflow, internal flow and outflow measurements, and recording procedures were established under the direction of GWD's General Manager and are currently being accounted for by GWD's Water Department and Watermaster. All water delivery is based on a water year beginning March 1 and ending on the last day of February of the following year.

GWD, in cooperation with USBR, the CDFW, and the USFWS, has implemented a Real-Time Water Quality Monitoring Program (RTWQMP). Surface water flow is evaluated at the water delivery points depicted in **Figure 5-5**. The QAPP includes site visitations where technicians conduct sensor maintenance, calibration, and measurements of EC and instantaneous and redundant flow to ensure that the data is representative and comprehensive.

MCDMGSA State and Federal Refuges
This vast network of freshwater marshes (permanent, semi-permanent, and seasonal wetlands), upland grasslands, and riparian corridors in the MCDMGSA's state and federal refuges is the result of decades of wetland preservation, restoration, and collaborative conservation agreements between private wetlands, California State Parks, CDFW, the Wildlife Conservation Board, the Natural Resources Conservation Service, and USFWS.

These land managers partner with several wetland-related conservation organizations that provide direct services, including the protection and enhancement of wetland water supply, construction and maintenance of wetland conveyance and facilities, and habitat restoration and improvements.

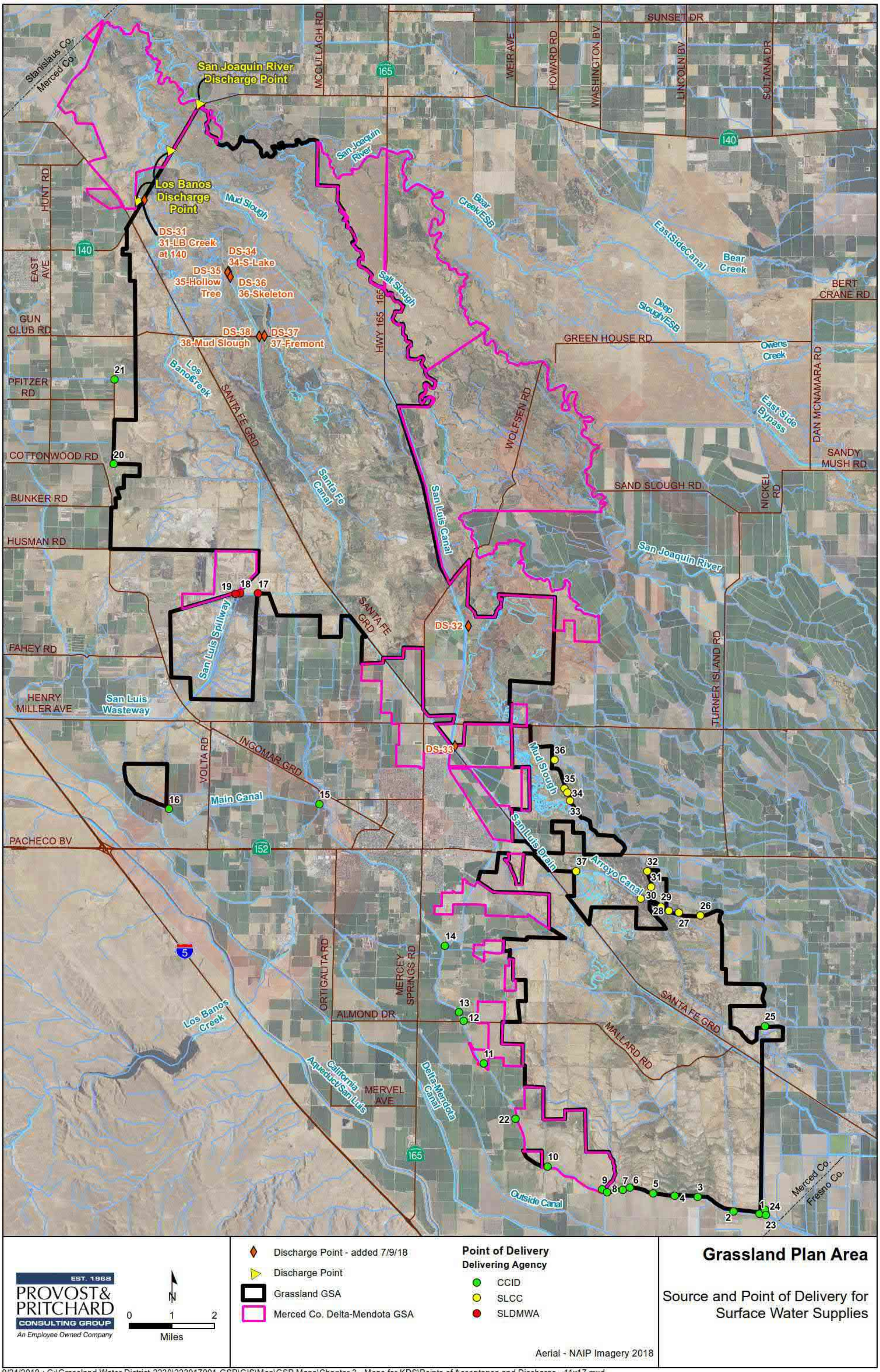


Figure 5-5: Supplemental Surface Water Monitoring Points

5.1.4 Adequacy of Monitoring Network

Legal Requirements:

§354.34(d) The monitoring network shall be designed to ensure adequate coverage of sustainability indicators. If management areas are established, the quantity and density of monitoring sites in those areas shall be sufficient to evaluate conditions of the basin setting and sustainable management criteria specific to that area.

The subbasin-level monitoring networks are a compilation of the representative monitoring networks developed by each GSP Group. The monitoring networks for each applicable sustainability indicator for each GSP Group were developed in accordance with the GSP Regulations Article 5 Plan Contents, Subarticle 4 Monitoring Networks (§ 354.21 – 354.40). DWR's Best Management Practices for the *Sustainable Management of Groundwater Monitoring Protocols, Standards, and Sites BMP* (2016b) and *Monitoring Networks and Identification of Data Gaps BMP* (2016a) documents were used when and where applicable at the discretion of each GSP group in developing monitoring networks and monitoring protocols. For more information on the subbasin-level monitoring networks, see the Delta-Mendota Subbasin **Common Chapter (Appendix A)**.

For additional information regarding the Grassland Plan Area's representative monitoring networks, see **Section 5.1.5**, **Section 5.1.6**, and **Section 5.4.**

5.1.5 Density of Monitoring Sites and Frequency of Measurements

Legal Requirements:

§354.34(f) The Agency shall determine the density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends based upon the following factors:
(1) Amount of current and projected groundwater use.
(2) Aquifer characteristics, including confined or unconfined aquifer conditions, or other physical characteristics that affect groundwater flow.
(3) Impacts to beneficial uses and users of groundwater and land uses and property interests affected by groundwater production, and adjacent basins that could affect the ability of that basin to meet the sustainability goal.
(4) Whether the Agency has adequate long-term existing monitoring results or other technical information to demonstrate an understanding of aquifer response.

The density or spatial coverage of monitoring sites is discussed above in **sections 5.1.3.1** and **5.1.3.4**. The density and frequency of monitoring was influenced by the determinations made below:

- The amount of current and projected groundwater use (**Chapter 3.3.4 Current, Historical, and Projected Water Budget**)
- Aquifer characteristics (**Chapter 3.2 Current and Historical Groundwater Conditions**)
- Potential impacts to beneficial users (**4.3.4. Effects on Beneficial Users**)
- Data coverage sufficient to demonstrate an understanding of aquifer response (**Section 5.5.2**)

Each GSP Group will utilize agreed-upon protocols, (i.e., industry standards and best management practices) to ensure the collection of comparable data using comparable methods. Additionally, the following minimum monitoring frequency for each applicable sustainability indicator was agreed upon by the Delta-Mendota Subbasin Coordination Committee and

Technical Working Group (see **Common Chapter Section 6.1.2**) at a meeting on June 18, 2019:

- <u>Chronic lowering of groundwater levels/reduction in groundwater storage -</u> Twice per year, with seasonal high groundwater elevation data collected between February and April and seasonal low groundwater elevation data collected between September and October.
- <u>Degraded groundwater quality</u> – Once per year between May and July.
- <u>Depletions of interconnected surface water</u> – Twice per year in conjunction with groundwater level monitoring
- <u>Subsidence</u> – Publicly available subsidence data will be used along with locally-collected data; three data points at minimum will be collected annually during the first five years of GSP implementation. The Grassland GSP participants have selected three USBR sites that historically have reported data annually.

The monitoring periods are summarized in **Table 5-5**: Delta-Mendota Subbasin Monitoring Frequency

It may be that more information will be needed to monitor specific areas in and near the Plan Area. If additional monitoring points or frequencies are necessary, they will be recognized in the 5-year Plan update. See the Delta-Mendota Subbasin **Common Chapter Section 6** for more information and a map of the Delta-Mendota Subbasin representative monitoring networks.

Table 5-5: Delta-Mendota Subbasin Monitoring Frequency

Delta-Mendota Subbasin Coordinated Monitoring Frequency		
Monitoring Parameter	**Frequency**	**Period of Measurement Notes**
Groundwater Levels	Bi-Annually (spring & fall)	Spring: February 1st and April 30th Fall: September 1st to October 31st
Water Quality	Annually	May 1st to July 31st

[1]The Delta-Mendota Subbasin GSP participants agree to coordinate collecting three data points within the first five years of GSP implementation, at a minimum. The Grassland GSP participants identified three USBR monitoring sites that historically report data annually.

5.1.6 Monitoring Network Information

Legal Requirements:

§354.34(g) Each Plan shall describe the following information about the monitoring network:

5.1.6.1 Rationale for Site Selection

Legal Requirements:

§354.34(g)(1) Scientific rationale for the monitoring site selection process.

Groundwater Levels and Quality
The scientific rationale for the groundwater level monitoring network includes the following:

- The network meets the minimum density goal of 1 well per 75 square miles
- Aquifer conditions are represented. Wells have been chosen to monitor various types of influences such as agricultural land uses, wetland areas, and boundary conditions
- Wells have known construction information
- Wells have quality long-term historical data

The following scientific rationale will be used to add new wells:

- Avoid wells perforated across multiple aquifers where feasible
- Select dedicated monitoring wells over production wells where feasible
- Select wells with available construction information (i.e., depth, perforated interval)

Land Subsidence
As stated previously, the USBR, DWR, USGS, USBR, USACE, UNAVCO, and various local entities including the SLDMWA and San Joaquin River Exchange Contractor Water Authority maintain land subsidence monitoring programs. The Plan Area participants will continue to follow the results of this established monitoring program and collaborate with the aforementioned agencies.

If additional monitoring locations are added, the following scientific rationale will be used:

- Add sites that are showing obvious signs of subsidence based on regional contour data
- Add sites that can be easily surveyed and tied back to a nearby monument
- Add sites where the ground surface is unlikely to be modified by future construction and will remain undisturbed
- Add sites in areas where the geology and soil types present the greatest potential for subsidence

Depletion of Interconnected Surface Water
The scientific rationale for the representative water level network applies to the analysis for depletion of interconnected surface water. Water level contour maps indicate the SJR has historically experienced a significant net inflow from the Grassland Plan Area, partially due to water supplies imported into the subbasin by the CVP. The historically high groundwater levels and requirements to sustain a large land area in wetland habitat conservation also facilitate the

significant net inflow to the SJR. The SMC analysis of Grassland Plan Area management impacts on interconnected surface water will be evaluated by assessing the groundwater levels across the Plan Area in the representative water level monitoring network depicted in **Figure 5-2.** See **Chapter 4.5** for more information on assessing interconnected surface water SMCs.

5.1.6.2 Consistency with Data and Reporting Standards

Legal Requirements:

§354.34(g)(2) Consistency with data and reporting standards described in Section 352.4. If a site is not consistent with those standards, the Plan shall explain the necessity of the site to the monitoring network, and how any variation from the standards will not affect the usefulness of the results obtained.

The data gathered through the monitoring networks is consistent with the standards identified in Section 352.4 of the California Code of Regulations related to Groundwater Sustainability Plans.

- Data reporting units (e.g., Water volumes shall be reported in acre-feet, etc.)
- Monitoring site information (e.g., Site identification number, description of site location, etc.)
- Well attribute reporting (e.g., CASGEM well identification number, casing perforations, etc.)
- Map standards (e.g., Data layers, shapefiles, geodatabases shall be submitted in accordance with the procedures described in Article 4, etc.)
- Hydrograph requirements (e.g., Hydrographs shall use the same datum and scaling to the greatest extent practical, etc.)

5.1.6.3 Corresponding Sustainability Indicator, Minimum Threshold, Measurable Objective, and Interim Goals

Legal Requirements:

§354.34(g)(3) For each sustainability indicator, the quantitative values for the minimum threshold, measurable objective, and interim goals that will be measured at each monitoring site or representative monitoring sites established pursuant to Section 354.36.

The quantitative values for minimum thresholds, measurable objectives, and interim goals that will be measured at the representative monitoring network sites associated with water levels, groundwater storage, and interconnected surface water are described in **Chapter 4, Table 4-6.** Those associated with the subsidence monitoring network are described in **Chapter 4, Table 4-8**, and those associated with the water quality monitoring network are described in **Chapter 4, Table 4-10.**

5.2 Monitoring Locations Map

Legal Requirements:

§354.34(h) The location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used.

The location of the representative monitoring network specific sites across the entire Delta-Mendota Subbasin are depicted in the **Common Chapter (Appendix A).** The location of representative monitoring sites for the Plan Area are depicted in **Figures 5-1, 5-2, and 5-3** above, and are described in **Tables 5-2, 5-3, and 5-4**. Measurement frequencies are shown in **Table 5-5**.

5.3 Monitoring Protocols

Legal Requirements:

§354.34(i) The monitoring protocols developed by each Agency shall include a description of technical standards, data collection methods, and other procedures or protocols pursuant to Water Code Section 10727.2(f) for monitoring sites or other data collection facilities to ensure that the monitoring network utilizes comparable data and methodologies.

Groundwater level, groundwater quality, and land subsidence monitoring will follow the protocols identified in the *Monitoring Protocols, Standards, and Sites BMP* (DWR, 2016b). Existing groundwater monitoring plans will also continue to be followed.

The following comments and exceptions to the BMP should be noted:

- SGMA regulations require that groundwater levels be measured to the nearest 0.1 feet. The BMP suggests measurements to the nearest 0.01 feet; however, this is not feasible for most measurement methodologies. In addition, this level of accuracy would have little value since groundwater contours maps typically have 10-or-more-foot intervals, and storage calculations are based on groundwater levels rounded to the nearest foot. The accuracy of groundwater level measurements will vary based on the well type and condition.
- If used in a well suspected of contamination or if there are obvious signs of contamination, well sounding equipment will be decontaminated after use.
- Wells will be surveyed to a horizontal accuracy of 0.1 feet.
- The BMP states that measurements each spring and fall should be taken “preferably within a 1- to 2-week period.” This is likely not feasible due to the large number of wells in the GSA. The monitoring periods defined in this Chapter identify a period in which the seasonal high and low will be reflected.
- If a vacuum or pressure release is observed, then water level measurements will be re-measured every 5 minutes until they have stabilized.
- In the field, water level measurements will be compared to previous records; if there is a significant difference, then the measurement will be verified.
- When monitoring for water quality, field parameters for pH, electrical conductivity, and temperature will also be monitored. A run time before sampling will be calculated to determine whether a well has been purged adequately to allow monitoring.

5.4 Representative Monitoring

Legal Requirements:

§354.36 Each Agency may designate a subset of monitoring sites as representative of conditions in the basin or an area of the basin, as follows:

See the figures in **Section 5.1.3** for the representative monitoring in the Grassland Plan Area (The Delta-Mendota Subbasin Common Chapter includes more information on the Subbasin-wide monitoring network, which is a compilation of the six Delta-Mendota GSP group's respective representative monitoring networks):

- **Figure 5-1** for the representative water quality monitoring network
- **Figure 5-2** for the representative water level monitoring network
- **Figure 5-3** for the representative subsidence Monitoring network

5.4.1 Description of Representative Sites

Legal Requirements:

§354.36(a) Representative monitoring sites may be designated by the Agency as the point at which sustainability indicators are monitored, and for which quantitative values for minimum thresholds, measurable objectives, and interim goals are defined.

DWR has referred to representative monitoring as utilizing a subset of wells or monitoring points in a management area. The representative monitoring sites identified are spatially dispersed to represent any variability in groundwater conditions across the Plan Area. See **Chapter 3** for more information on the spatial variety of groundwater conditions. Based on existing conditions, DWR's Monitoring Network BMP's, and Hopkins and Anderson (2016) the Plan Area well network is sufficient to monitor groundwater and will continue to use available water level data to assess groundwater conditions.

For water level, water quality, interconnected surface water, subsidence, and groundwater storage, the representative monitoring sites were identified based on the following criteria:

1. At least three years' worth of data to develop a meaningful minimum threshold or measurable objective
2. Of the available data, at least three of the measurements occurred within the historical period to present
3. There is enough spatial coverage within the Plan Area to represent the variability in groundwater conditions

Despite not meeting all the criteria identified above, additional sites were identified for inclusion in the representative monitoring networks with the intention of monitoring during GSP implementation. The data obtained during the implementation period will be used to develop meaningful SMCs and improve hydrologic understanding.

See **Section 5.1.3** for a description and maps of the representative monitoring networks. See **Chapter 4** for more information on defining minimum thresholds, measurable objectives, and interim goals.

5.4.2 Use of Groundwater Elevations as Proxy for Other Sustainability Indicators

Legal Requirements:

§354.36(b) Groundwater elevations may be used as a proxy for monitoring other sustainability indicators if the Agency demonstrates the following:
(1) Significant correlation exists between groundwater elevations and the sustainability indicators for which groundwater elevation measurements serve as a proxy.
(2) Measurable objectives established for groundwater elevation shall include a reasonable margin of operational flexibility taking into consideration the basin setting to avoid undesirable results for the sustainability indicators for which groundwater elevation measurements serve as a proxy.

The Grassland Plan Area is using groundwater elevation monitoring as a proxy in conjunction with subsidence data to evaluate groundwater storage and interconnected surface water.

Upper Aquifer & Lower Aquifer Groundwater Storage
Water elevations will be used as a proxy for groundwater storage volume in both the upper aquifer and the lower aquifer once sufficient data is collected from designated monitoring sites (until that time, subsidence data will be used to help determine groundwater storage for the lower aquifer). The volume of groundwater storage will be quantified on an annual basis using a larger network of hydrographs (where data exists) and contour maps as described in **Chapter 3.3– Water Budget** using changes in groundwater elevation, specific yield of the aquifer, and acreage of the Plan Area.

Interconnected Surface Water
The Grassland Plan Area has historically maintained shallow depth to water throughout the area. The Plan Area is the lowest-lying area in the Subbasin and all upper aquifer flow contours lead to and through the Plan Area and then on to the SJR. Additionally, the "No Net Loss" wetland legal mandate and other protections for wetlands identified in **Section 4.3** would result in the Grassland Plan Area continuing to sustain shallow groundwater in the wetland areas, producing a significant net positive flow to the SJR. The upper aquifer groundwater gradient in the Plan Area is currently understood as the primary influencer to the SJR connection adjacent to the Plan Area (see **Section 3.3**).

The Grassland GSP participants made the decision to use water level SMCs across the Plan Area and represent a variety of land uses to evaluate gradient influences as an appropriate proxy for interconnected surface water. There are few monitoring locations along the SJR and the high groundwater levels and direction of groundwater flow within the entire Plan Area produce a net outflow to the SJR (see **Section 3.2.2.2** and **Figure 3-15**).

5.5 Assessment and Improvement of Monitoring Network

5.5.1 Review and Evaluation of Monitoring Network

Legal Requirements:

§354.38(a) Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.

The monitoring network will continue to be developed and refined as data is gathered and analyzed. The GSAs will review the monitoring network annually to ensure that the monitoring points identified represent the regional conditions within the Plan Area. Any proposed changes will be noted in the annual report and implemented prior to the next measurement period to the extent feasible. It should be noted that the effectiveness of the monitoring network may not be apparent for several reporting periods.

5.5.2 Identification of Data Gaps

Legal Requirements:

§354.38(b) Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.

There are three general types of data gaps to consider for monitoring networks:

1. **Temporal**: Insufficient frequency of monitoring
2. **Spatial**: Insufficient number or density of monitoring sites in a specific area
3. **Insufficient quality of data**: Data may be available but of poor or questionable accuracy. Poor data could lead to incorrect assumptions or biases. The data may not appear consistent with other data in the area or with past readings at the monitoring site. The monitoring site may not meet all the desired criteria to provide reliable data. Past experiences have shown that well location information on well construction reports is often poor, making it difficult or impossible to match wells with their well logs

Following are discussions on data gaps in each existing monitoring network:

<u>Groundwater Levels and Groundwater Storage</u>
Temporal Data Gaps: Temporal data gaps caused the most inconsistency in monitoring historical trends in the Plan Area. Most groundwater monitoring in the Plan Area began within the past ten years. Another limitation to temporal data was a lack of regular monitoring during the transition from the Water Data Library to the CASGEM program.

Spatial Data Gaps: There is a historical lack of groundwater level monitoring in the lower aquifer, primarily due to the small number of lower aquifer wells in the Plan Area. Additional lower aquifer data will be acquired through the implementation phase. Representative well site spatial coverage meets recommended densities, includes both the upper and lower aquifer, and is representative of various locations within the Plan Area; therefore, it is not seen as a data gap going forward.

Quality of Data: Wells with historical data have no construction information for depth and perforated interval. When well construction information is available, it is often hard to match with specific wells, limiting the usefulness of historical data. These wells do not provide ideal data points, but the Plan Area participants will continue to collect well construction logs and other data, including conducting video surveys.

<u>Groundwater Quality</u>
Temporal Data Gaps: Entities in the Plan Area including the GWD and CDFW have collected a substantial amount of groundwater quality data from the upper aquifer and will continue to do so under ongoing monitoring programs and as part of SGMA implementation.

Spatial Data Gaps: There is a historical lack of groundwater quality monitoring in the lower aquifer, primarily due to the small number of lower aquifer wells in the Plan Area. Additional lower aquifer data will be acquired through the implementation phase. The Groundwater Quality Monitoring Network's spatial coverage meets recommended densities, includes both the upper and lower aquifer, and is representative of various locations within the Plan Area.

Quality of Data: The Plan participants use modern technology and laboratory analysis to collect and report water quality monitoring data, which will continue. This is not considered a data gap.

<u>Land Subsidence</u>
Temporal Data Gaps: The USBR and others have been collecting subsidence data from many monitoring points within the Central Valley for many years; however, the comprehensive data used for the USBR's study is limited to data from 2011 to present. Data prior to 2011 has been deemed unnecessary, as metadata is rare and summaries may not cover the area of interest or may contain large temporal gaps. There is limited historical subsidence data within the Plan Area boundaries to compare with current rates of subsidence at newly installed monitoring points.

Spatial Data Gaps: Although three representative subsidence monitoring points are identified in the Grassland Plan Area, the understanding of subsidence can be improved by assessing at a regional scale. The Plan Area participants will review subsidence data outside of the Plan Area in order to supplement this understanding.

Quality of Data: Although several subsidence monitoring points exist within and adjacent to the Plan Area, there are currently no extensometers or other devices that can physically measure aquifer compaction, because subsidence has not caused undesirable results in the Plan Area. If funding is made available, an extensometer could be installed to better monitor subsidence.

<u>Depletion of Interconnected Surface Water</u>
Temporal, Spatial, and Data Quality Gaps: There is limited historical groundwater level monitoring data available from directly along the SJR within the Grassland Plan Area, which is a temporal, spatial, and data quality gap. However, there are very few groundwater wells located in this part of the Plan Area. The influence of management activities on the interconnection of the SJR in this specific reach is best analyzed by assessing the greater Plan Area and adjacent Merced Subbasin. The representative water level monitoring network will also serve as the monitoring network for interconnected surface water.

5.5.3 Plans to Fill Data Gaps

Legal Requirements:

§354.38(c) If the monitoring network contains data gaps, the Plan shall include a description of the following: (1) The location and reason for data gaps in the monitoring network. (2) Local issues and circumstances that limit or prevent monitoring. (d) Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.

Historical collections of the data for groundwater levels, groundwater storage, groundwater quality, land subsidence monitoring networks, and depletion of interconnected surface water contain many temporal gaps. Efforts will be made to gain better access to any available historical data sets for incorporation into the data management system to assist in developing a greater understanding of changing groundwater conditions in order to more accurately generate projections of future trends. With the establishment of representative monitoring networks and adoption of monitoring frequencies under this GSP, future temporal data gaps are not anticipated.

To address spatial data gaps in the lower aquifer, multi-completion monitoring wells have been installed throughout the Plan Area, and a number of newly established lower aquifer monitoring sites will be monitored during the implementation period. The lower aquifer data gaps will be filled as data is acquired through the implementation phase associated with the representative monitoring sites.

5.5.4 Monitoring Frequency and Density

Legal Requirements:

§354.38(e) Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:
(1) Minimum threshold exceedances.
(2) Highly variable spatial or temporal conditions.
(3) Adverse impacts to beneficial uses and users of groundwater.
(4) The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin.

The frequency and density of the proposed monitoring programs are discussed in previous sections. The programs are considered adequate to provide sufficient monitoring data to satisfy SGMA requirements according to the provided criteria. The monitoring network may be modified or enhanced if deemed necessary when groundwater conditions are compared to sustainability goals.

5.6 Reporting Monitoring Data to the Department

Legal Requirements:

§354.40 Monitoring data shall be stored in the data management system developed pursuant to Section 352.6. A copy of the monitoring data shall be included in the Annual Report and submitted electronically on forms provided by the Department.

GGSA has an internal monitoring and reporting system that will serve as a supplemental data management system (DMS) to the Delta-Mendota Subbasin DMS (DMSDMS). The GGSA DMS and DMSDMS will facilitate annual reporting. GGSA will coordinate with MCDMGSA and other plan participants to coordinate monitoring efforts and gather necessary data as defined in this chapter. Data will be entered into the DMS by staff and consultants as measurements are recorded or received. Data necessary for coordination with the Delta-Mendota Subbasin will be submitted to the SLDMWA for entry in the DMSDMS. Data relative to the GSP development can be made available for review upon request.

6 Projects and Management Actions to Achieve Sustainability

As demonstrated in the Basin Setting Chapter, the Grassland Plan Area is currently sustainable and not experiencing any undesirable results. The following section is provided to demonstrate projects currently being implemented by GGSA to maintain sustainability and also to demonstrate GGSA's work to facilitate regional projects for the good of the Plan Area, agencies within the DM Subbasin, and other Basins.

Legal Requirements:

§ 354.44. Projects and Management Actions
(a) Each Plan shall include a description of the projects and management actions the Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.
(b) Each Plan shall include a description of the projects and management actions that include the following:
(1) A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent. The Plan shall include the following:
(A) A description of the circumstances under which projects or management actions shall be implemented, the criteria that would trigger implementation and termination of projects or management actions, and the process by which the Agency shall determine that conditions requiring the implementation of particular projects or management actions have occurred.
(B) The process by which the Agency shall provide notice to the public and other agencies that the implementation of projects or management actions is being considered or has been implemented, including a description of the actions to be taken.
(2) If overdraft conditions are identified through the analysis required by Section 354.18, the Plan shall describe projects or management actions, including a quantification of demand reduction or other methods, for the mitigation of overdraft.
(3) A summary of the permitting and regulatory process required for each project and management action.
(4) The status of each project and management action, including a time-table for expected initiation and completion, and the accrual of expected benefits.
(5) An explanation of the benefits that are expected to be realized from the project or management action, and how those benefits will be evaluated.
(6) An explanation of how the project or management action will be accomplished. If the projects or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included.
(7) A description of the legal authority required for each project and management action, and the basis for that authority within the Agency.
(8) A description of the estimated cost for each project and management action and a description of how the Agency plans to meet those costs.
(9) A description of the management of groundwater extractions and recharge to ensure that chronic lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater levels or storage during other periods.
(c) Projects and management actions shall be supported by best available information and best available science.
(d) An Agency shall take into account the level of uncertainty associated with the basin setting when developing projects or management actions.

6.1 Project 1 – North Grassland Water Conservation and Water Quality Control Project (NGWCWQCP)

6.1.1 Project Description

The North Grassland Water Conservation and Water Quality Control Project (NGWCWQCP or Project) aims to develop additional surface water to assist GWD in meeting its water demand within the GGSA. High-quality water from the District's water conveyance system and maintenance flows from managed wetlands in the northern portion of the District will be captured prior to leaving GWD during fall and early winter. Recovered water will be recirculated and returned to GWD's conveyance system to meet a portion of fall and winter demand. The amount of surface water available for recirculation through the NGWCWQCP facilities is expected to vary based on Level 2 CVP refuge water supply allocations, with an estimated 11,700 to 16,000 acre-feet per year available in years with 100% allocation (125,000 AF) and an estimated minimum of 5,200 acre-feet per year available in years with reduced Level 2 allocations (75% allocation: 93,750 AF). Based on the historical reliability of Level 2 water supplies, it is estimated that the average annual yield of the project will be approximately 14,000 acre-feet per year.

Implementation of the NGWCWQCP requires improvements to two existing District conveyances and the construction of two pipelines, three pump stations, and various water control structures to capture and recirculate water that would otherwise leave the District. Real-time monitoring stations will also be installed to allow the District to better control the quantity and quality of water entering and leaving the District's wetland complex. Annual project operation is expected to begin during the wetland flood-up in late September and continue through early February of the following year. Other benefits of the Project include improved District operational flexibility, improved aquifer sustainability, reduction in groundwater extractions, and better management of water resources, such as wetlands drawdown discharge into the San Joaquin River.

6.1.2 Measurable Objectives

The main objective of this project is to capture and recirculate an average of 14,000 acre-feet per year of high-quality water from District conveyance systems and maintenance flows from managed wetlands. The amount of recovered water will vary each year between an estimated 5,200 and 16,000 acre-feet based on Level 2 CVP refuge water supply allocations. Captured and recirculated flow rates, volumes, and quality will be measured at multiple Project real-time monitoring stations for monitoring and reporting purposes and to ensure water quality standards are continuously being met. The Project will allow for better water management within the District by improving the ability to manage wetland drawdown and discharges into the San Joaquin River while also improving basin sustainability.

6.1.3 Circumstances for Implementation

The NGWCWQCP is currently under construction by the District and is anticipated to become operational in the fall of 2019. The Project was initiated after drought resulted in reduced surface water supplies for the District in 2014 and 2015. The Project is being implemented to develop additional surface water supplies to assist GWD in meeting its water demands within the GSA while improving basin sustainability. The Project will help ensure that adequate water supplies are available to meet wetland habitat requirements, especially in the spring and summer.

6.1.4 Permitting and Regulatory Process

The Project is currently under construction, and thus all associated construction and environmental permits have been completed. No additional permits are needed for Project operation, but all recovered and recirculated water must meet all existing and any new water quality standards, including TDS, boron, and selenium concentration limits.

6.1.5 Project Schedule

The Project is currently under construction and is expected to be operational by fall of 2019.

6.1.6 Project Benefits

The NGWCWQCP will recover and recirculate up to 16,000 acre-feet per year of high-quality water from District conveyance systems and maintenance flows from managed wetlands. This amount will vary based on Level 2 CVP refuge water supply allocations from an estimated 5,200 acre-feet per year at 75% allocation up to 16,000 acre-feet per year at 100% allocation. Water that would otherwise flow out of the District will be recovered and recirculated under this project and will be used to meet fall and winter water demands within the District. Recirculated water could be used to supplement District water demands in years of insufficient Incremental Level 4 water allocations. There will be a small amount of groundwater recharge from conveyance system seepage losses, which could have a positive effect on groundwater levels and quality since the recovered water will typically be of higher quality than the groundwater. Additionally, the water supply generated from this project will extend the inundation period and provide additional spring irrigations on up to 16,000 acres of seasonal wetland, further improving recharge in GSP area CVPIA wetlands.

6.1.7 Project Implementation

This project will be implemented by GWD as an integral piece of the District's operations and overall effort to improve basin sustainability. It will be implemented, managed, and operated by GWD. Project implementation includes improvements to two existing District conveyances along with the construction of two pipelines, three pump stations, and various water control structures to capture and recirculate water that would otherwise leave the District. The Project also includes continuous monitoring of Project flow rates, volumes, and water quality.

6.1.8 Legal Authority

Grassland Water District will own, operate, and manage all Project facilities.

6.1.9 Project Cost Estimate/Acre-Foot of Yield

The cost of Project implementation is approximately $17.7 million. Assuming an average annual yield of 14,000 acre-feet and an additional $20,000 every 5 years for operations and maintenance, this equates to a cost of $65 per acre-foot of permanent water supply over a 20-year period.

6.1.10 Management of Groundwater Extractions and Recharge

There are no groundwater extractions as part of this Project. Groundwater extractions in the District could be reduced by meeting water demands with recirculated water instead of through groundwater pumping. Indirect groundwater recharge will occur in any unlined conveyance systems being constructed as part of the Project.

6.2 Project 2 – North Valley Regional Recycled Water Program (NVRRWP)

6.2.1 Project Description

The North Valley Regional Recycled Water Program (NVRRWP or Project) will ultimately convey tertiary treated municipal and industrial wastewater, or recycled water, from the Cities of Modesto, Ceres, and Turlock to the DMC using new pump stations and pipelines. The pump station and the 6.5-mile, 54-inch diameter pipeline from the City of Modesto's wastewater treatment plant to the DMC has already been constructed and is in operation. The 7-mile, 42-inch pipeline from the City of Turlock's wastewater treatment plant to the City of Modesto's wastewater treatment plant is currently under construction. Recycled Project water is metered at the DMC inlet facility and is delivered to DPWD and south-of-Delta public wildlife refuge areas within the GGSA and MCDMGSA. In 2018, the City of Modesto delivered approximately 14,700 acre-feet of recycled water through the Project facilities. CVPIA refuges within the GGSA and surrounding public wetlands within MCDMGSA took delivery of approximately 5,500 acre-feet of the available recycled water. The total Project yield, once the Turlock component is constructed, is estimated to be up to 26,000 AFY. Adjusted for urban growth projections, the future Project yield is estimated to be up to 59,000 AFY.

Long-term Water Service Agreements (WSAs) were executed between DPWD and the Cities of Modesto and Turlock in October 2015 and May 2016, respectively, that give DPWD exclusive rights to Project water through 2060 with a renewal option and acknowledgement of DPWD's right to deliver Project water to refuges. In addition, DPWD executed a Water Acquisition and Exchange Agreement with the USBR in 2016 that will last through 2060 with an option to renew. The agreement gives the USBR rights to acquire and deliver 20% of Project water from DPWD to CVPIA refuges. After adjusting for urban growth projections, the 20% of Project water available for refuges is estimated to be 11,800 acre-feet per year. The remaining 80% of DPWD's Project water will be exchanged with the USBR to cover DMC water wheeling costs. Of this 80%, 10% will be available to CVPIA refuges at no cost. Therefore, approximately 28% of Project water will be delivered to wetlands within GGSA and its MCDMGSA public wetlands. In 2018, GWD and DPWD secured a Proposition 1 grant from the California Natural Resources Agency (CNRA) to help cover the long-term costs of acquiring Project water for the refuges. DPWD also has the option of offering more Project water to the CVPIA refuges. In 2018, approximately 5,500 acre-feet was delivered to the refuges. Water costs for the refuges shall not exceed the cost of Project water paid by DPWD landowners, with a maximum cost of $225 per acre-foot plus conveyance costs.

6.2.2 Measurable Objectives

The current yield of the Project is 16,500 acre-feet per year and the amount is expected to increase with construction of the Turlock segment. The total yield of recycled water delivered to

DPWD for its members and the refuges is estimated to be 59,000 acre-feet per year under future urban growth projections. Under current operations, approximately 28% (4,620 acre-feet per year) will be delivered to the refuges through long-term acquisitions agreements and exchanges with DPWD and USBR. In the future, an estimated 11,800 acre-feet per year (after adjusting for urban grown projections) of recycled water will be diverted to refuges within GGSA and its surrounding area. Project water is metered at the DMC inlet facility.

6.2.3 Circumstances for Implementation

California's drought conditions and restrictions on San Joaquin-Bay Delta pumping have resulted in reduced surface water supplies for GWD and DPWD. The Project is being implemented to develop additional surface water supplies to assist both districts in meeting their water demands within their respective Plan Areas and to improve basin sustainability. The Project will help ensure that adequate water supplies are available to meet wetland habitat requirements while providing DPWD with a vital source of surface water for its landowners.

6.2.4 Permitting and Regulatory Process

Since part of the project is already constructed and the remaining portions are under construction, no additional permits or regulatory requirements will be required for construction. Project operations are governed by the already-executed WSAs between DPWD and the Cities of Turlock and Modesto, a Water Acquisition and Exchange Agreement between DPWD and the USBR, and a Grant Agreement between DPWD and the CNRA. Stringent water quality standards will need to be met for all Project water delivered and diverted.

6.2.5 Project Schedule

The pump station at the City of Modesto's wastewater treatment plant, the 54-inch diameter pipeline from the plant to the DMC, and the DMC inlet facility are constructed and operational. The 42-inch diameter pipeline conveyance system from the City of Turlock's wastewater treatment plant to the City of Modesto's wastewater treatment plant is currently under construction with an anticipated completion date of 2019.

6.2.6 Project Benefits

California's drought conditions and restrictions on Sacramento-San Joaquin Delta pumping have resulted in reduced surface water supplies for GWD and DPWD. The NVRRWP will provide a consistent and reliable surface water source to meet irrigation and refuge water demands and promote basin sustainability. The Project is already yielding up to 16,500 acre-feet per year with a minimum of 4,620 acre-feet per year for the refuges. In the long-term, the Project is expected to yield up to 59,000 acre-feet per year with an estimated 11,800 acre-feet per year for the refuges (based on urban growth projections). DPWD has the option to sell or exchange additional water to the USBR for use on the refuges.

In addition, the Project will reduce the region's reliance on other water supplies, both from south of the Delta and from the Delta itself while eliminating the discharge of treated wastewater into the San Joaquin River from the Cities of Modesto, Ceres, and Turlock.

6.2.7 Project Implementation

The Project will be a coordinated effort, implemented by the Cities of Modesto, Turlock, and Ceres; DPWD; Stanislaus County; USBR; and GWD.

6.2.8 Legal Authority

The facilities connecting the City of Modesto wastewater treatment plant to the DMC will be owned, operated, and maintained by the City of Modesto. The conveyance facilities connecting the City of Turlock's wastewater treatment plant to the City of Modesto's wastewater treatment plant will be owned, operated, and maintained by the City of Turlock. Deliveries to refuges will be managed by DPWD and governed by WSAs between DPWD and the Cities of Turlock and Modesto, a Water Acquisition and Exchange Agreement between DPWD and the USBR, and a Grant Agreement between DPWD and CNRA.

6.2.9 Project Cost Estimate/Acre-Foot of Yield

The first phase of the project, consisting of the pump station at the City of Modesto's wastewater treatment plant, the pipeline from the plant to the DMC, and the DMC inlet facilities, had a construction cost of $44 million. The next phase, which consists of conveyance facilities from the City of Turlock's wastewater treatment plants to the City of Modesto's wastewater treatment plants, has an estimated construction cost of $32 million. Environmental review, project design, and other planning costs are estimated at $10 to $12 million for a total estimated project cost of $86 to $88 million. Assuming operations and maintenance are included in existing annual operations for the DMC and treatment facilities, this Project would produce water for $30 per AF over a 50-year project life expectancy.

DPWD has secured several state and federal grants for a portion of the Project costs. Water costs for the refuges will not exceed the cost of Project water paid by DPWD landowners, with the cost capped at $225 per acre-foot plus conveyance costs. Both the USBR and the State of California have committed more than $25 million each for the Project, which should cover the delivery of water to CVPIA wetlands through 2060.

6.2.10 Management of Groundwater Extractions and Recharge

There are no explicit groundwater extractions or recharges as part of the Project. Groundwater extractions in GWD could be reduced by meeting refuge water demands with recycled or exchanged water instead of through groundwater pumping. Surface water exchanged with DPWD could be used by its users in-lieu of groundwater pumping or for recharge purposes, improving basin sustainability.

6.1 Project 3 – Flood Water Capture

6.1.1 Project Description

The GSAs may expand and improve conjunctive use of surface water and groundwater by adopting an integrated "Flood-MAR" resource management strategy that uses flood water from local rivers and streams for managed aquifer recharge (MAR) on agricultural lands, managed wetlands, riparian corridors, and floodplains. The GSAs will continue to utilize excess surface water flows from the San Joaquin River in accordance with procedures established by the Refuge Water Supply Program administered by USBR.

6.1.2 Measurable Objectives

The goal is to more beneficially use local flood water sources to strategically improve aquifer recharge. The measurable objective is the volume of managed aquifer recharge from floodwater applications, in acre-feet, and the measurement of any resulting groundwater extractions.

6.1.3 Circumstances for Implementation

The U.S. Bureau of Reclamation has historically delivered excess surface water flows from the San Joaquin River to the Plan Area for managed wetland use in wet years. Deliveries are measured and accounted for as Incremental Level 4 water to meet the demands of wetland habitat areas in compliance with the CVPIA. Under these circumstances, groundwater pumping is reduced in proportion to excess surface water deliveries.

6.1.4 Permitting and Regulatory Process

The GSAs receive approval from the USBR for diversion and recharge of excess flows from the San Joaquin River, under the Refuge Water Supply Program. If flood recharge projects are developed for the benefit of agricultural landowners within the Plan Area, they will be consulted. USBR in turn will apply for and receive any necessary permits from the State Water Resources Control Board, including but not limited to permit changes under Assembly Bill 658 (2019-2020).

6.1.5 Project Schedule

The project will take place in wet years on an ongoing basis, when water is available. In the meantime, the GSAs will consider adoption of a formal Flood-MAR resource management strategy, in coordination with USBR, before the 5-year GSP update for this Plan.

6.1.6 Project Benefits

When groundwater pumping is reduced in proportion to excess surface water deliveries, the upper aquifer is recharged to maintain sustainability, improve groundwater levels and groundwater quality, and benefit groundwater dependent ecosystems.

6.1.7 Project Implementation

The Project will be a coordinated effort, implemented by the GGSA, MCDMGSA, and USBR, in coordination with CDFW, USFWS, and agricultural landowners within the Plan Area.

6.1.8 Legal Authority

The USBR owns and manages water rights on the San Joaquin River.

6.1.9 Project Cost Estimate/Acre-Foot of Yield

Project implementation would be associated with the cost of water, wheeling, monitoring and analysis to recharge areas and is estimated to be less than $100 per acre foot.

6.1.10 Management of Groundwater Extractions and Recharge

Excess surface water from flood flows and storm events would expand the wetted footprint or maintain the extent for longer duration resulting in a net increase to recharge and diminish or fully augment the need to pump groundwater during those events.

6.2 Management Actions for Future Consideration

The Grassland Plan Area is currently sustainable as managed; however, in order to more efficiently gather data, share resources, and maintain existing sustainability, it may be necessary to implement additional management programs. Listed below are some potential management actions that could be implemented as necessary in the future. This list is not intended to act as a plan for implementation, rather as a plan for consideration and future development. Should it become necessary to implement one of the management actions listed below or consider other management actions for implementation, the GGSA will further define the required criteria as set forth in **Section 354.44** of the GSP regulations.

Table 6-1: Management Actions

#	Management Action	Description	Measurable Objective
1	**Require new developments (non-*de minimis* extractors) to prove sustainable water supplies**	The GSAs may adopt a policy to require new developments (non-*de minimis* extractors) to prove their usage of sustainable water supplies based upon current Sustainable Management Criteria. The GSAs may review and comment on environmental review documents for proposed development projects to ensure a sustainable water balance and the adoption of corresponding mitigation measures. Requires County support.	The goal is to ensure that new developments (non-*de minimis* extractors) do not cause the Plan Area to exceed the current GSP groundwater sustainable yield and groundwater supplies are consumed or retained within the Plan Area boundary. The measurable objective is proven new development water balance with the goal of 0.0 acre-feet groundwater overdraft /year.
2	**Registration of extraction facilities**	The GSAs may adopt a policy to require registration of groundwater extraction facilities within the Plan Area. Requires County support.	The goal is to improve the GSAs' database of groundwater extraction locations in order to support ongoing monitoring and other management actions. The measurable objective is the number of new registered facilities.
3	**Require self-reporting of groundwater extraction, water level, and water quality data**	The GSAs may adopt a policy to require groundwater users in the Plan Area (excluding *de minimis* extractors) to self-report groundwater extractions, static water levels, and water quality data twice per year.	The goal is to improve the GSAs' data collection for groundwater extractions, water levels, and the water quality monitoring network and to improve future water budget and sustainable yield development.

#	Management Action	Description	Measurable Objective
4	**Groundwater quantification methods**	The GSAs may adopt a policy to determine the method or methods to quantify groundwater extractions. The GGSA may consider a variety of methods including, but not limited to 1) aerial flyovers or remote sensing of irrigated areas, 2) annual crop surveys alongside aerial flyovers or remote sensing of irrigation areas including crop coefficients, 3) energy records and meter calibrations, 4) flow meter readings of pumped water, 5) remote sensing of evapotranspiration, and 6) other methods.	The goal is to accurately and efficiently quantify annual groundwater extractions. The measurable objective is the measured volume of groundwater extraction in acre-feet.
5	**Recycled water use**	The GSAs may explore further opportunities to utilize recycled water from nearby communities.	The goal is to maintain existing sustainability by securing affordable and reliable water supplies that are sourced locally or regionally. The measurable objective is the volume of additional recycled water delivered in acre-feet.
6	**Recharge estimation methods**	The GSAs may adopt a policy to better estimate recharge occurring from managed wetland uses within the Plan Area. The GSAs may consider a variety of methods, likely based on field measurements of inflows, outflows, pond levels, and groundwater elevations. The GSAs may conduct soil and percolation studies to better understand site-specific recharge.	The goal is to more accurately estimate recharge occurring from wetlands uses, which will improve both water budget estimates for the area and the representation of the area in groundwater models.
7	**Increasing access to surface water**	The GSAs may adopt a policy to define a method by which surface water can be conveyed to groundwater users within the Plan Area. The GSAs may consider a variety of structures that adhere to the limitations of available water supplies and allowable water uses.	The goal is to provide groundwater users in the Plan Area access to surface water to offset groundwater use. The measurable objective is the volume of surface water delivered to growers without previous access to surface water.
8	**Canal or basin infrastructure incentives**	The GSAs may adopt a policy to encourage groundwater extractors through incentives to develop infrastructure for surface water deliveries.	The goal is to incentivize the construction of new water conveyance and storage infrastructure to increase surface water access to growers in the Plan Area. The measurable objective is the capacity of any constructed conveyance canals or storage basins.

7 Plan Implementation

7.1 Estimate of GSP Implementation Costs

Implementation of the Plan will begin upon adoption. Funding is considered on a 5-year basis to coincide with Plan updates. The first annual report will be due April 2020. Costs for implementation include administrative costs, professional services, and monitoring and reporting. The administrative portion includes public outreach which covers time and materials for staff, consultants, and deliverables for GSA board meetings and other public events, along with insurance and other overhead costs of managing the GGSA and MCDMGSA. Professional services costs include time and materials for staff; consultants for technical, legal, and political issues that may arise during implementation; and basin-wide coordinated efforts outside of the Plan Area. Monitoring and reporting costs include management of the data management system and annual monitoring (sampling, lab analysis, data collection) and reporting (data analysis, mapping, and report development). Costs are preliminary and are not marked up for inflation. These costs also do not include project development, construction or rehabilitation of infrastructure, additional monitoring sites, supplemental Plan Area analyses, additional grant development or administration, changes due to future SGMA legislation, or added compliance requirements. Costing will be refined using actual costs as the Plan is implemented.

Table 7-1: Plan Implementation Costs

	2020-2024	2025-2029	2030-2034	2035-2039	2040
Administration Costs					
Public Outreach	40,000	40,000	40,000	40,000	8,000
Insurance	50,000	50,000	50,000	50,000	10,000
Other Overhead	25,000	25,000	25,000	25,000	5,000
Professional Services					
Agency Management	1,000,000	1,000,000	1,000,000	1,000,000	200,000
Technical Consultants	250,000	250,000	250,000	250,000	0
Legal Services	200,000	200,000	200,000	200,000	40,000
Governmental/Legislative	250,000	250,000	250,000	250,000	50,000
Coordinated Cost	250,000	250,000	250,000	250,000	50,000
Monitoring & Reporting					
DMS	50,000	50,000	50,000	50,000	10,000
Annual Monitoring	100,000	100,000	100,000	100,000	20,000
Annual Reporting	100,000	100,000	100,000	100,000	20,000
Total	2,315,000	2,315,000	2,315,000	2,315,000	413,000
Annual Average	463,000	463,000	463,000	463,000	413,000

Public Outreach - Includes $5,000 per year during years outside of GSP updates for approximately 2 GSA board meetings per year held to direct and approve expenditures for monitoring and annual report development and $20,000 for years in which the GSP is updated for up to 2 workshops, drafting of outreach materials, and printing, posting, and other document delivery costs.

Insurance – Includes $5,000 per year as a portion of previous insurance requirements.

Other Overhead – Includes $5,000 per year for other incidental costs that will likely be shared with overlapping agencies within Grassland GSA and Merced County Delta-Mendota GSA.

Agency Management – Includes salaries and benefits for day-to-day operation of GSAs and Plan implementation such as annual monitoring, Basin-wide coordination, and development of Plan updates. This includes $160,000 per year for the four years prior to GSP updates, which covers 10% of annual workload for four professional employees to perform monitoring and annual report development. This also includes $440,000 for GSP update years to cover 25% of annual workload for four professionals to develop GSP, coordinate with Basin-wide committees, and complete other SGMA related tasks.

Technical Consultants – Includes a one-time cost of $250,000 every 5-years for GSP development and implementation costs.

Legal Services – Includes $100,000 for legal consulting per year.

Government/Legislative Cost – Includes $50,000 per year for internal and consultant costs to participate in future SGMA or related groundwater legislation development.

Coordinated Cost – Includes payment for Basin-wide annual reporting and GSP development by an outside agency. Costs include a $20,000 annual cost for coordinated annual report development and $150,000 for GSP update development.

DMS – Includes $10,000 per year for routine maintenance and updating of data management system and data requests and gathering by Plan Area staff. This cost does not include the Coordinated DMS cost, which has been included in the total annual Coordinated Cost above.

Annual Monitoring – Includes $20,000 per year for annual monitoring of groundwater conditions for representative monitoring network and wells proposed for inclusion in future Plan updates.

Annual Reporting – Includes $20,000 per year for data analysis and materials development for annual reports.

Costs will be split between GGSA and MCDMGSA as appropriate, beginning in 2020 when GSP implementation begins. Some tasks may be performed independently by GSAs while others will require coordination and development of an appropriate cost share agreement. Considerations will be made for agency area, benefitting parties, and location of monitoring points. This estimate includes salaries and benefits for employees of GSAs working on GSP implementation and development as well as expenses for outside consulting and other incidental costs. Costs should be refined in future Plan updates to reflect annual report development and any incurred Plan implementation costs.

7.2 Identify Funding Alternatives

The annual operational costs have already begun, and recently approved rate increases for water deliveries are being used to fund GGSA operations and activities required by SGMA. These activities include retaining consulting firms and other professional services to provide GSP development oversight in order to lead the GGSA through the steps for initial GSP development and future SGMA compliance. Expenses consist of administrative support, agency management, and annual monitoring and reporting, which are assumed to be ongoing expenses. Other expenses include the development of 5-year updates. Possible additional expenses could include the development of management actions, SGMA-specific studies, and grant writing for additional funding.

GWD has adopted Resolution 18-001, which has increased water delivery rates for the first time since 2004 and secured funds to generate sufficient revenue to fund GSP development costs, annual GSA management costs, and expenses associated with the implementation of the GSP. Assessments for refuge water service will increase by $12 per acre (an area-based rate) between 2019 and 2022, and non-CVP agricultural water deliveries will increase by $9 per acre-foot per year (a volume-based rate) between 2019 and 2022. GWD has developed estimated budget projections that include SGMA regulatory compliance costs through Fiscal Year 2028.

Annual operating costs for MCDMGSA will be initially funded through the County of Merced. The MCDMGSA is considering mechanisms for funding the GSA through landowner fees within the MCDMGSA management area. Any funding through fees will be conducted according to the California Water Code, the California Government Code, or any other applicable legal requirements.

Several grants have been made available to both GGSA, its member agencies GWD and GRCD, and MCDMGSA. These include grants from DWR, CDFW, and the Department of Conservation. Additional grant funding will be sought to offset the costs of Plan implementation, monitoring, and updating, including but not limited to:

- Proposition 1 and Proposition 68 Grant Funding
- Federal Grant funding opportunities
- Data Management Grant
- Well videoing/inspection Grant

7.3 Schedule for Implementation

Implementation of the Plan has already begun. Data is being gathered at representative monitoring sites, coordination between Basin members is underway in anticipation of the first annual report, and projects to reduce potential impacts are being developed and constructed. However, it should be noted that the Plan Area is currently sustainable and is not experiencing undesirable results based on existing groundwater conditions and Sustainable Management Criteria. Pumping in the Plan Area is minimal; therefore, only existing projects that are currently under construction are considered in the implementation schedule, which include the North Grassland Water Conservation and Water Quality Control Project and the North Valley Regional Recycled Water Program (see Sections 6.1 and 6.2). Both of these projects have an anticipated completion date of 2019. If the need or funding arises, the GGSA and MCDMGSA may consider implementing additional programs or projects that will assist in strengthening the sustainable management of the Plan Area. Management of the GSA, annual monitoring, and GSP implementation will be ongoing processes. The data management system, annual reporting, and 5-year Plan updates are defined in the following sections.

7.4 Data Management System

GGSA has an internal monitoring and reporting system, which has been described in detail in Chapters 2 and 5. GGSA will coordinate with MCDMGSA and other plan participants to coordinate monitoring efforts and gather necessary data as defined in **Chapter 5 – Monitoring Network**. Data will be entered into the Data Management System (DMS) by staff and consultants as measurements are recorded or received. Data necessary for coordination with the Subbasin will be submitted to the SLDMWA for entry in the Basin-wide DMS. Data relative to the GSP development can be made available for review upon request.

7.5 Annual Reporting

Legal Requirements:

§ 356.2. Annual Reports
Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:
(a) General information, including an executive summary and a location map depicting the basin covered by the report.
(b) A detailed description and graphical representation of the following conditions of the basin managed in the Plan:
(1) Groundwater elevation data from monitoring wells identified in the monitoring network shall be analyzed and displayed as follows:
(A) Groundwater elevation contour maps for each principal aquifer in the basin illustrating, at a minimum, the seasonal high and seasonal low groundwater conditions.
(B) Hydrographs of groundwater elevations and water year type using historical data to the greatest extent available, including from January 1, 2015, to current reporting year.
(2) Groundwater extraction for the preceding water year. Data shall be collected using the best available measurement methods and shall be presented in a table that summarizes groundwater extractions by water use sector, and identifies the method of measurement (direct or estimate) and accuracy of measurements, and a map that illustrates the general location and volume of groundwater extractions.
(3) Surface water supply used or available for use, for groundwater recharge or in-lieu use shall be reported based on quantitative data that describes the annual volume and sources for the preceding water year.
(4) Total water use shall be collected using the best available measurement methods and shall be reported in a table that summarizes total water use by water use sector, water source type, and identifies the method of measurement (direct or estimate) and accuracy of measurements. Existing water use data from the most recent Urban Water Management Plans or Agricultural Water Management Plans within the basin may be used, as long as the data are reported by water year.
(5) Change in groundwater in storage shall include the following:
(A) Change in groundwater in storage maps for each principal aquifer in the basin. (B) A graph depicting water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater in storage for the basin based on historical data to the greatest extent available, including from January 1, 2015, to the current reporting year.
(c) A description of progress towards implementing the Plan, including achieving interim milestones, and implementation of projects or management actions since the previous annual report.

An annual report will be developed each year that details Plan Area operations (extraction volume, surface water use, total water use, recharged surface water), groundwater conditions (groundwater levels, groundwater storage change), and progress of GSP implementation in accordance with SGMA regulation §356.2. – Annual Reports.

7.6 Periodic Evaluations

Legal Requirements:

§ 356.4. Periodic Evaluation by Agency
Each Agency shall evaluate its Plan at least every five years and whenever the Plan is amended, and provide a written assessment to the Department. The assessment shall describe whether the Plan implementation, including implementation of projects and management actions, are meeting the sustainability goal in the basin, and shall include the following:
(a) A description of current groundwater conditions for each applicable sustainability indicator relative to measurable objectives, interim milestones and minimum thresholds.
(b) A description of the implementation of any projects or management actions, and the effect on groundwater conditions resulting from those projects or management actions.
(c) Elements of the Plan, including the basin setting, management areas, or the identification of undesirable results and the setting of minimum thresholds and measurable objectives, shall be reconsidered and revisions proposed, if necessary.
(d) An evaluation of the basin setting in light of significant new information or changes in water use, and an explanation of any significant changes. If the Agency's evaluation shows that the basin is experiencing overdraft conditions, the Agency shall include an assessment of measures to mitigate that overdraft.
(e) A description of the monitoring network within the basin, including whether data gaps exist, or any areas within the basin are represented by data that does not satisfy the requirements of Sections 352.4 and 354.34(c). The description shall include the following:
(1) An assessment of monitoring network function with an analysis of data collected to date, identification of data gaps, and the actions necessary to improve the monitoring network, consistent with the requirements of Section 354.38.
(2) If the Agency identifies data gaps, the Plan shall describe a program for the acquisition of additional data sources, including an estimate of the timing of that acquisition, and for incorporation of newly obtained information into the Plan.
(3) The Plan shall prioritize the installation of new data collection facilities and analysis of new data based on the needs of the basin.
(f) A description of significant new information that has been made available since Plan adoption or amendment, or the last five-year assessment. The description shall also include whether new information warrants changes to any aspect of the Plan, including the evaluation of the basin setting, measurable objectives, minimum thresholds, or the criteria defining undesirable results.
(g) A description of relevant actions taken by the Agency, including a summary of regulations or ordinances related to the Plan.
(h) Information describing any enforcement or legal actions taken by the Agency in furtherance of the sustainability goal for the basin.
(i) A description of completed or proposed Plan amendments.
(j) Where appropriate, a summary of coordination that occurred between multiple Agencies in a single basin, Agencies in hydrologically connected basins, and land use agencies.
(k) Other information the Agency deems appropriate, along with any information required by the Department to conduct a periodic review as required by Water Code Section 10733.

The Plan will be evaluated at least every five years and whenever the GSP is amended. The evaluation will consider current groundwater conditions, status of projects or management actions, potential needs to update Sustainable Management Criteria or other Plan elements, changes in the monitoring network, new information or data available, existing or new data gaps or actions and monitoring implemented to close data gaps, applicable enforcement or legal actions implemented, and coordination efforts with other agencies in accordance with SGMA regulation §356.4. – Periodic Evaluation by Agency.

8 References and Technical Studies

California Data Exchange Center. (n.d.). Retrieved September 5, 2019, http://cdec.water.ca.gov/

California Department of Toxic Substances Control. (n.d.). *EnviroStor*. Retrieved September 27, 2019, https://www.envirostor.dtsc.ca.gov/public/

California Department of Water Resources (DWR). (1981). *California Water Well Standards. California's Groundwater Bulletin 74-81.* Department of Water Resources. http://wdl.water.ca.gov/well_standards/b74-81chap1a.html

California Department of Water Resources (DWR). (1991). *California Water Well Standards: Supplement to Bulletin 74-81. California's Groundwater Bulletin 74-90.* Department of Water Resources. http://wdl.water.ca.gov/well_standards/well_standards_content.html

California Department of Water Resources (DWR). (2006). *Bulletin 118.* Department of Water Resources. https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118#

California Department of Water Resources (DWR). (2010, December). *Groundwater Elevation Monitoring Guidelines.* https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/CASGEM/Files/CASGEM-DWR-GW-Guidelines-Final-121510.pdf

California Department of Water Resources (DWR). (2016a, December). *Monitoring Networks and Identification of Data Gaps BMP*. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-2-Monitoring-Networks-and-Identification-of-Data-Gaps.pdf

California Department of Water Resources (DWR). (2016b, December). *Monitoring Protocols, Standards, and Sites BMP*. https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Monitoring_Protocols_Final_2016-12-23.pdf

California Department of Water Resources (DWR). (2017, November). Draft *Best Management Practices for the Sustainable Management of Groundwater: Sustainable Management Criteria*. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-6-Sustainable-Management-Criteria-DRAFT.pdf

California Department of Water Resources (DWR). (2018a, April). *Water Available for Replenishment.* Department of Water Resources. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/WAFR/Final/Water-Available-for-Replenishment---Final-Report.pdf

California Department of Water Resources (DWR). (2018b, December). *Agricultural Land & Water Use Estimates.* Retrieved from California Department of Water Resources: https://water.ca.gov/Programs/Water-Use-And-Efficiency/Land-And-Water-Use/Agricultural-Land-And-Water-Use-Estimates

California Department of Water Resources (DWR). (2018c). *Guidance for Climate Change Data Use during Groundwater Sustainability Plan Development.* Retrieved from California Department of Water Resources: https://data.cnra.ca.gov/dataset/sgma-climate-change-resources

California Department of Water Resources (DWR). (n.d.). *SGMA Data Viewer for Land Subsidence*. Retrieved September 5, 2019, https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#landsub

California Division of Oil, Gas, and Geothermal Resources. (n.d.). *Well Search for Well Record Electric Logs*. https://secure.conservation.ca.gov/WellSearch

California Open Data Portal. (n.d.). *Estimated Subsidence in the San Joaquin Valley between 1949-2005.* Retrieved September 5, 2019, https://data.ca.gov/dataset/estimated-subsidence-in-the-san-joaquin-valley-between-1949-2005

California Open Data Portal. (n.d.). *NASA JPL InSAR Subsidence Data.* Retrieved September 5, 2019, https://data.ca.gov/dataset/nasa-jpl-insar-subsidence-data

California Regional Water Quality Control Board Central Valley Region (CRWQCBCVR). (2018, May). *The Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board Central Valley Region, Fifth Ed*. https://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/sacsjr_201805.pdf

California Water Boards. (n.d.). *GAMA Groundwater Information System*. Retrieved September 27, 2019, https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/

California Water Boards. (n.d.). *Wetland Policies*. Retrieved September 27, 2019, https://www.waterboards.ca.gov/rwqcb5/board_decisions/tentative_orders/1504/2_5_wetlands/5_wet_policies_sum.pdf

California Water Resources Control Board. (n.d.). GeoTracker. Retrieved September 27, 2019, http://geotracker.waterboards.ca.gov/

City of Los Banos 2030 General Plan Update. (2009). Retrieved September 27, 2019, http://losbanos.org/wp-content/uploads/2013/09/plan_gp_entire.pdf

Daly, C., Neilson, R. P., & Phillips, D. L. (1994). A statistical-topographic model for mapping climatological precipitation over mountainous terrain. *Journal of applied meteorology*, *33*(2), 140-158. https://journals.ametsoc.org/doi/abs/10.1175/1520-0450%281994%29033%3C0140%3AASTMFM%3E2.0.CO%3B2

Davis, G. H., Green, J. H., Olmsted, F. H., & Brown, D. W. (1959). *Ground-Water Conditions and Storage Capacity in the San Joaquin Valley California.* USGS. Water Supply Paper 1469. https://pubs.er.usgs.gov/publication/wsp1469

Environmental Defense Fund (EDF). (2017). *Groundwater Trading as a Tool for Implementing California's Sustainable Groundwater Management Act.* https://www.edf.org/sites/default/files/documents/water-markets.pdf

Grasslands Groundwater Sustainability Agency (GGSA). (2016, February 1). *Incremental Level 4 Groundwater Development Project Initial Study and Negative Declaration*.

Hargreaves, G. H. & Allen, R. (2003). *History and Evaluation of Hargreaves Evapotranspiration Equation*. Journal of Irrigation and Drainage Engineering. https://ascelibrary.org/doi/10.1061/%28ASCE%290733-9437%282003%29129%3A1%2853%29

Hargreaves, G. H., & Samani, Z. A. (1982). Estimating potential evapotranspiration. *Journal of Irrigation and Drainage*, *108*(3), 225-230. https://cedb.asce.org/CEDBsearch/record.jsp?dockey=0035047

Hopkins, J., & Anderson, B. (2016, September). *A Field Manual for Groundwater-Level Monitoring at the Texas Water Development Board.* User Manual 52. http://www.twdb.texas.gov/groundwater/docs/UMs/UM-52.pdf

Hotchkiss, W.R., and Balding, G.O. (1971). *Geology, Hydrology, and Water Quality of the Tracy-Dos Palos Area, San Joaquin Valley, California.* USGS. Open-File Report 72-169. https://pubs.er.usgs.gov/publication/ofr72169

Howes, D.J., Fox, P., and Hutton, P.H. (2015). *Evapotranspiration from Natural Vegetation in the Central Valley of California: Monthly Grass Reference-Based Vegetation Coefficients and the Dual Crop Coefficient Approach. http://www.itrc.org/papers/etnatural.htm*

Kenneth D. Schmidt & Associates (KDSA). (1997a). *CCID Groundwater Conditions in the Area between Mendota and Crows Landing.*

Kenneth D. Schmidt & Associates (KDSA). (1997b). *Amounts of Downward Flow in the SJREC Service Area.*

Kenneth D. Schmidt & Associates (KDSA). (1997 and 2013). *Subsurface Geologic Cross Sections.*

Kenneth D. Schmidt & Associates (KDSA). (2018). *Hydrogeologic Conceptual Model and Groundwater Conditions for the Grassland Water District Expanded GSP.*

MacGillivray, N. A., & Jones, M. D. (1989). *A Field Study to Assess Consumptive Use of Winter Rains by Spring and Summer Crops.* DWR.

Meade, R.H. (1967). *Petrology of Sediments Underlying Areas of Land Subsidence in Central California*. USGS. Professional Paper 497-C. https://pubs.er.usgs.gov/publication/pp497C

Merced County. (2013). *2030 Merced County General Plan Background Report.* Retrieved September 27, 2019, http://www.co.merced.ca.us/DocumentCenter/View/6768/GP-Background-Report?bidId=

Merced County Department of Public Health. (n.d.). *Well Systems*. Retrieved September 27, 2019, http://www.co.merced.ca.us/2247/Well-Systems

ObamaWhiteHouse. (2015, November 3). *Presidential Memorandum: Mitigating Impacts on Natural Resources from Development and Encouraging Related Private Investment*. Retrieved

September 27, 2019, https://obamawhitehouse.archives.gov/the-press-office/2015/11/03/mitigating-impacts-natural-resources-development-and-encouraging-related

Orang, M. N., Snyder, R. L., Shu, G., Hart, Q. J., Sarreshteh, S., Falk, M., & Eching, S. (2013). California simulation of evapotranspiration of applied water and agricultural energy use in California. *Journal of Integrative Agriculture*, *12*(8), 1371-1388. https://water.ca.gov/LegacyFiles/landwateruse/models/Cal-SIMETAW.pdf

Page, R. W. (1973). *Base of fresh ground water (approximately 3,000 micromhos) in the San Joaquin Valley, California.* USGS. Hydrologic Atlas 489. https://pubs.er.usgs.gov/publication/ha489

San Joaquin River Restoration Program. (n.d.). *Subsidence Monitoring.* Retrieved September 5, 2019, http://www.restoresjr.net/monitoring-data/subsidence-monitoring/

San Joaquin River Restoration Program. (n.d.). *Water Quality.* Retrieved September 5, 2019,*:* http://www.restoresjr.net/restoration-flows/water-quality/

Thomasson, H., Olmsted, F., & LeRoux, E.F. (1960). *Geology, Water Resources and Usable Ground-Water Storage Capacity of part of Solano County, California.* USGS. Water Supply Paper 1464. https://pubs.er.usgs.gov/publication/wsp1464

University NAVSTAR Consortium (UNAVCO). (n.d.). *PBO GPS Stations Network Monitoring*. Retrieved September 27, 2019, https://www.unavco.org/instrumentation/networks/status/pbo/gps

United States Bureau of Reclamation (USBR). (2018, July). *Agrimet Irrigation Guide.* Retrieved from United States Bureau of Reclamation: https://www.usbr.gov/pn/agrimet/irrigation.html#Efficiency

United States Geological Survery (USGS). (2017, March 20). *USGS Land Subsidence Resources*. Retrieved from California Water Science Center: https://ca.water.usgs.gov/land_subsidence/california-subsidence-resources.php

United States Geological Survey (USGS). (n.d.). *Land Subsidence in California.* Retrieved September 5, 2019, https://ca.water.usgs.gov/land_subsidence/

United States Environmental Protection Agency (EPA). (2006). *Guidance on Systematic Planning Using the Data Quality Objectives Process*. https://www.epa.gov/sites/production/files/documents/guidance_systematic_planning_dqo_process.pdf

Williamson, A.K., Prudic, D.E., & Swain, L.A. (1989). *Ground-Water Flow in the Central Valley, California.* USGS. Professional Paper 1401-D. https://pubs.er.usgs.gov/publication/pp1401D

Appendix A – Common Chapter

DELTA-MENDOTA SGMA

Common Chapter

For the Delta-Mendota Subbasin Groundwater Sustainability Plan

August 2019

PROP 1 WATER BOND 2014

DEPARTMENT OF WATER RESOURCES · STATE OF CALIFORNIA

San Joaquin River Exchange Contractors GSP Group

THE COUNTY OF FRESNO 1856

GRASSLAND WATER DISTRICT

NORTHERN & CENTRAL DELTA-MENDOTA

Aliso Water District Groundwater Sustainability Agency

FARMERS WATER DISTRICT

Delta-Mendota Groundwater Subbasin

Groundwater Sustainability Plan: Common Chapter

Prepared by:

August 2019

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San Luis & Delta-Mendota Water Authority
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Telephone (209) 832-6229
Email: andrew.garcia@sldmwa.org

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Acronyms

AB 3030	1992 California Assembly Bill 3030
AWMP	Agriculture Water Management Plan
BMP	Best Management Practice
CASGEM	California Statewide Groundwater Elevation Monitoring
CCC	Columbia Canal Company
CCF	Climate Change Factors
CCID	Central California Irrigation District
CDFW	California Department of Fish and Wildlife
cfs	cubic feet per second
CVP	Central Valley Project
CVRWQCB	Central Valley Regional Water Quality Control Board
DAC	Disadvantaged Community
DMC	Delta-Mendota Canal
DPWD	Del Puerto Water District
DWR	California Department of Water Resources
ET	Evapotranspiration
ET_c	Total Crop Evapotranspiration
ET_{iw}	Crop Evapotranspiration of Irrigation Water
ET_{misc}	Miscellaneous Evapotranspiration including; canal evaporation, consumptive use of phreatophytes, etc.
FCWD	Firebaugh Canal Water District
FNF	Full Natural Flow
GAMA	Groundwater Ambient Monitoring and Assessment
gpm	gallons per minute
GRCD	Grassland Resource Conservation District
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GWD	Grassland Water District
HCM	Hydrogeologic Conceptual Model
HMRD	Henry Miller Reclamation District

Acronyms

IRWM	Integrated Regional Water Management
JPA	Joint Powers Authority
KDSA	Kenneth D. Schmidt and Associates
MAF	million acre-feet
MSL	Mean Sea Level
NASA JPL	National Aeronautics and Space Administration Jet Propulsions Laboratory
P&P	Provost and Pritchard Consulting Group
RCD	Resource Conservation District
RWQCB	Regional Water Quality Control Board
SB 372	2017 California Senate Bill 372
SGMA	Sustainable Groundwater Management Act
SGWP	Sustainable Groundwater Planning
SJREC	San Joaquin River Exchange Contractors
SJRECWA	San Joaquin River Exchange Contractors Water Authority
SJRIP	San Joaquin River Improvement Program
SJRRP	San Joaquin River Restoration Program
SLDMWA	San Luis & Delta-Mendota Water Authority
SMC	Sustainable Management Criteria
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAF	thousand acre-feet
TDS	Total Dissolved Solids
TIWD	Turner Island Water District
TNC	The Nature Conservancy
UNAVCO	University NAVSTAR Consortium
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USF&WS	U.S. Fish & Wildlife Service
USGS	United States Geological Survey

Acronyms

UWMP	Urban Water Management Plan
WDL	Water Data Library
WMP	Water Management Plan
WSIP	Water Storage Investment Program
WWD	Westlands Water District

DISCLAIMER

The work products presented in this Common Chapter and associated Technical Memoranda (Appendix B) are a compilation of work completed by the six (6) individual Groundwater Sustainability Plan (GSP) regions under the direction of a Professional Geologist (PG) or Professional Engineer (PE) as indicated by the stamps on the respective GSP Executive Summaries. The signature here represents work completed in compiling the Common Chapter from these individual GSPs, and the signing Professional Engineer assumes no responsibility for any errors or misleading statements presented therein. Compilation of the Common Chapter, exclusive of work conducted for the individual GSPs, has been prepared under the oversight of Leslie Dumas, P.E. and the signature below is specifically for that compilation.

REGISTERED PROFESSIONAL ENGINEER
LESLIE S. DUMAS
C 43897
EXP 6/30/21
CIVIL
STATE OF CALIFORNIA

1. INTRODUCTION

1.1 Purpose of Common Chapter

The 23 Groundwater Sustainability Agencies (GSAs) overlying the Delta-Mendota Subbasin (Subbasin) have prepared six Groundwater Sustainability Plans (GSPs) that, together, encompass the entire Subbasin area (Error! Reference source not found.). These GSPs have been prepared in a coordinated manner under the oversight of the Delta-Mendota Subbasin Coordination Committee (Coordination Committee) and in accordance with the Delta-Mendota Subbasin Coordination Agreement (Coordination Agreement) for the Subbasin. This Common Chapter has been prepared as means of integrating key parts of the six GSPs to meet subbasin-level requirements per the Sustainable Groundwater Management Act (SGMA) and the Emergency GSP regulations (DWR, 2016).

This Common Chapter, along with the six Subbasin GSPs, Coordination Agreement (**Appendix A**) and Common Technical Memoranda (**Appendix B**), meets regulatory requirements established by the California Department of Water Resources (DWR) as shown in the completed *Preparation Checklist for GSP Submittal* (**Appendix C**). The Common Technical Memoranda summarize the common data sets, assumptions and methodologies used during preparation of the six Subbasin GSPs. The reader is referred to the individual GSP (and their associated Executive Summaries) for information, data, and GSP requirements specific to each GSP Plan Area.

1.2 Delta-Mendota Subbasin

The Delta-Mendota Subbasin (DWR Basin 5-022.07) is located in the San Joaquin Valley Groundwater Basin and adjoins nine (9) subbasins of the San Joaquin Valley Groundwater Basin. The Delta-Mendota Subbasin boundaries generally corresponds to DWR's California's Groundwater Bulletin 118 – Update 2003 (Bulletin 118) groundwater basin boundaries. Changes made to the Subbasin boundaries as part of the SGMA planning process include the following:

- A jurisdictional internal boundary modification made in 2016 to extend the boundary of the Delta-Mendota Subbasin eastward to include all of Aliso Water District.
- A jurisdictional internal boundary modification made in 2016 to bring areas that straddle the Delta-Mendota Subbasin and adjacent subbasins fully within the Delta-Mendota Subbasin. This modification adjusted areas from the southern boundary of the Delta-Mendota Subbasin and the Westside Subbasin in coordination with Westlands Water District, and moved the eastern boundary of the Delta-Mendota Subbasin from the Madera Subbasin into the Delta-Mendota Subbasin in coordination with Aliso Water District. The modification also moved areas from the Tracy Subbasin into the Delta-Mendota Subbasin so that Del Puerto Water District and West Stanislaus Irrigation District were fully within the Delta-Mendota Subbasin, and cleaned up boundaries between the Delta-Mendota Subbasin and the Kings Subbasin to conform with the boundaries of Tranquillity Irrigation District and the Traction Ranch property (bounded on the east by Mid-Valley Water District).
- A jurisdictional internal boundary modification made in 2018 to modify the boundary between the Delta-Mendota and the Chowchilla Subbasins to follow the western boundary of Triangle T

Water District and the southern boundary of Clayton Water District. This modification moved approximately 700 acres of land from the Chowchilla Subbasin into the Delta-Mendota Subbasin.

The western San Joaquin Valley is a highly agricultural region with an economy dependent on that industry. There are no large cities or industries in the Delta-Mendota Subbasin to provide an alternative economic base; hence the availability of Central Valley Project (CVP) imported supplies and surface water supplies (primarily from the San Joaquin and Kings River) are essential elements to the economic health of the region. Other uses of CVP and surface water in the Subbasin are for municipal and industrial (M&I) purposes and wildlife refuge water supply.

Groundwater is a key component of overall water supplies in the Delta-Mendota Subbasin. Agricultural and wildlife refuge needs may be supplemented by groundwater for areas with access to CVP water. Other landowners within the Subbasin may rely wholly on groundwater for irrigation and/or potable purposes. Municipal and industrial (M&I) water use, which is a small share of total water use in the Subbasin, occurs primarily within the cities and predominantly uses groundwater to meet those demands. The largest M&I use areas in the Delta-Mendota Subbasin, based on 2015 population estimates from the U.S. Census Bureau, are the cities of Patterson (population 21,498) and Los Banos (population 37,457) (U.S. Census Bureau, 2015).

As previously noted, most communities within the Delta-Mendota Subbasin have economies greatly dependent on agricultural production. These communities include Paterson, Grayson, Tranquillity, Mendota, Firebaugh, Dos Palos, Los Banos, Santa Nella, Newman, Gustine, Crows Landing, Westley, Volta and Vernalis.

1.3 Disadvantaged Communities within the Delta-Mendota Subbasin

A disadvantaged community (DAC) is defined as a community with a Median Household Income (MHI) less than 80% of the California statewide MHI. The California Department of Water Resources (DWR) compiled U.S. Census Bureau's American Community Survey (ACS) data from 2012 to 2016; these data were used in GIS to identify DACs within the Delta-Mendota Subbasin. California's average statewide MHI from 2012 to 2016 is $63,783; thus, a community with an MHI less than or equal to $51,026 is considered a DAC. Based on these criteria, 93% of the geographic area of the Subbasin is considered disadvantaged. Furthermore, a community with an MHI of less than 60% of the California statewide MHI, meaning an MHI of less than or equal to $38,270, is considered a severely disadvantaged community (SDAC). According the U.S. Census ACS 2012-2016 data, there are a number of SDACs throughout the Subbasin. See **Figure CC-2** for a map of the DACs and SDACs throughout the Delta-Mendota Subbasin.

As noted above, a significant portion of the Subbasin contains DACs. Of the total population of 117,120 within the Subbasin, 80% of the population lives within a DAC, with 93% of the Subbasin's total geographic area consisting of DACs. **Table CC-1** includes the proportion of DACs in the Subbasin based on population and geographic area.

Table CC-1: DACs as a Percentage of the Delta-Mendota Subbasin

Area	Geographic Area (Square Miles)	% Based on Geographic Area	Population	% Based on Population
DAC (including SDAC)	1,109	93%	93,786	80%
Delta-Mendota Subbasin	1,194		117,120	

Table CC-2 includes Census Designated Places that are DACs in the Delta-Mendota Subbasin, with their associated MHIs and percentage of the California MHI from the ACS 5-Year 2012-2016 average. Several DACs in the Subbasin have considerably lower MHI than 80% of the California Statewide MHI and are further designated as Severely Disadvantaged Communities (SDACs). In **Table CC-2**, SDACs are indicated in bold text. Note that according to the U.S. Department of the Interior Indian Affairs, as of January 2017, there are no listed federally recognized tribes within the Region (Mosley, 2017).

Table CC-2: DAC and SDAC Census Designated Places in Delta-Mendota Subbasin

Census Designated Place (CDP)	Median Household Income (MHI)	% of CA MHI
City of Dos Palos	**$36,509**	**57%**
City of Firebaugh	**$36,181**	**57%**
City of Gustine	**$37,770**	**59%**
City of Los Banos	$45,751	72%
City of Mendota	**$26,094**	**41%**
City of Newman	$52,783	83%
Crows Landing	**$26,786**	**42%**
Dos Palos Y (CDP)	**$16,656**	**26%**
Grayson	**$29,787**	**47%**
Madera County	$45,490	74%
Merced County	$43,066	70%
Fresno County	$45,963	72%
Santa Nella	**$27,778**	**44%**
South Dos Palos	$41,992	66%
Tranquillity	**$30,441**	**48%**
Volta	$48,250	76%
Westley	**$23,375**	**37%**

Data Sources:
1. U.S. Census ACS data from 2012 to 2016 provided by DWR Mapping Tool.
2. MHI data are from the 2016 Census, and percent of CA MHI is calculated based on the 2012-2016 Statewide MHI. Bold rows indicate severely disadvantaged communities (less than 60% of CA Statewide MHI).

1.4 Economically Disadvantaged Areas within the Delta-Mendota Subbasin

An economically distressed area (EDA) is defined by the State of California as a "municipality with a population of 20,000 persons or less, a rural county, or a reasonably isolated and divisible segment of a larger municipality where the segment of the population is 10,000 persons or less, with an annual median household income that is less than 85% of the statewide median household income, and with one or more of the following conditions as determined by the (sic) Department of Water Resources:

1. Financial hardship
2. Unemployment rate at least two percent higher than the statewide average
3. Low population density (CA Assembly, 2014)."

U.S. Census GIS data provided by DWR were used to identify EDAs in the Delta-Mendota Subbasin. **Figure CC-3** shows the location of EDAs within the Delta-Mendota Subbasin

A significant portion of the Subbasin contains EDAs. Of the total population of 117,120 within the Subbasin, 87% live in areas that meet EDA Criterion 2, 20% live in areas that meet EDA Criterion 3, and 87% live in areas that meet Criteria 2 or 3. In all, 93% of the geographic area within the Subbasin consists of areas considered to meet either EDA Criteria 2 or 3. **Table CC-3** includes the proportion of EDAs in Subbasin based on population and geographic area.

Table CC-3: EDAs as a Percentage of the Delta-Mendota Subbasin

Area	Geographic Area (Square Miles)	% Based on Geographic Area	Population	% Based on Population
EDA Criterion 2	1,112	93%	102,407	87%
EDA Criterion 3	1,004	84%	23,688	20%
EDA Criteria 2 or 3	1,112	93%	102,407	87%
Delta-Mendota Subbasin	1,194		117,120	

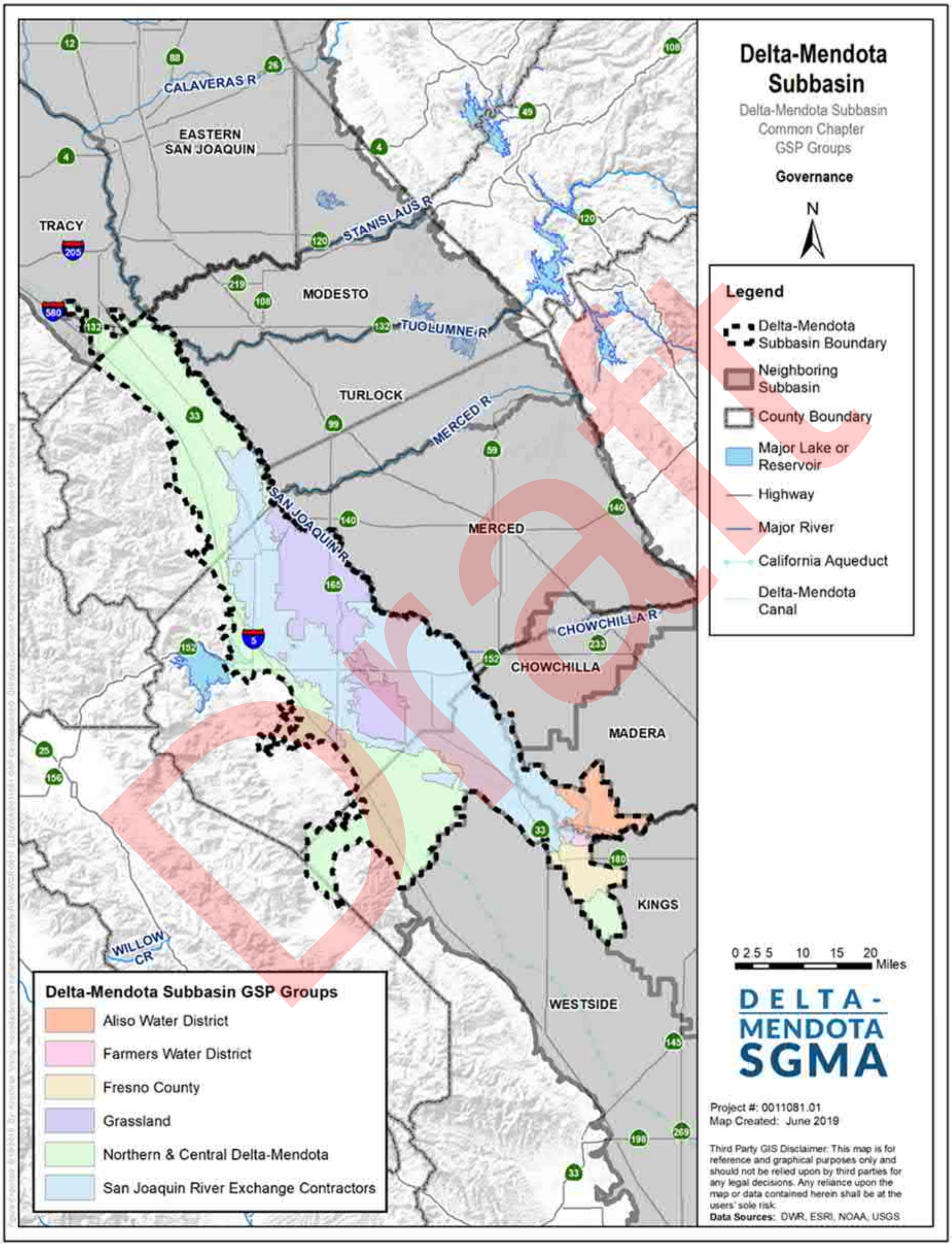


Figure CC-1: Delta-Mendota Subbasin and GSP Regions

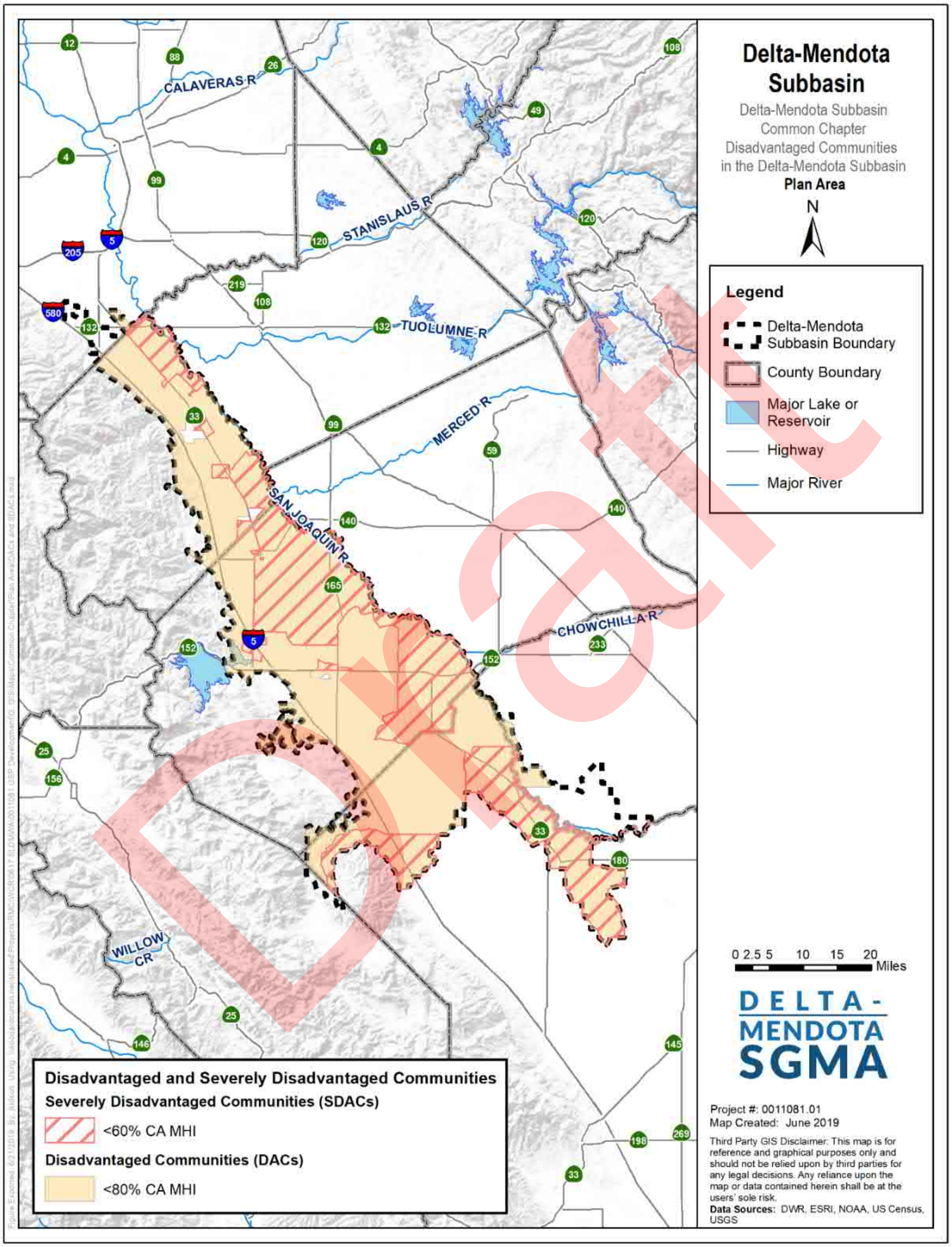


Figure CC-2: Disadvantaged and Severely Disadvantaged Communities in the Delta-Mendota Subbasin

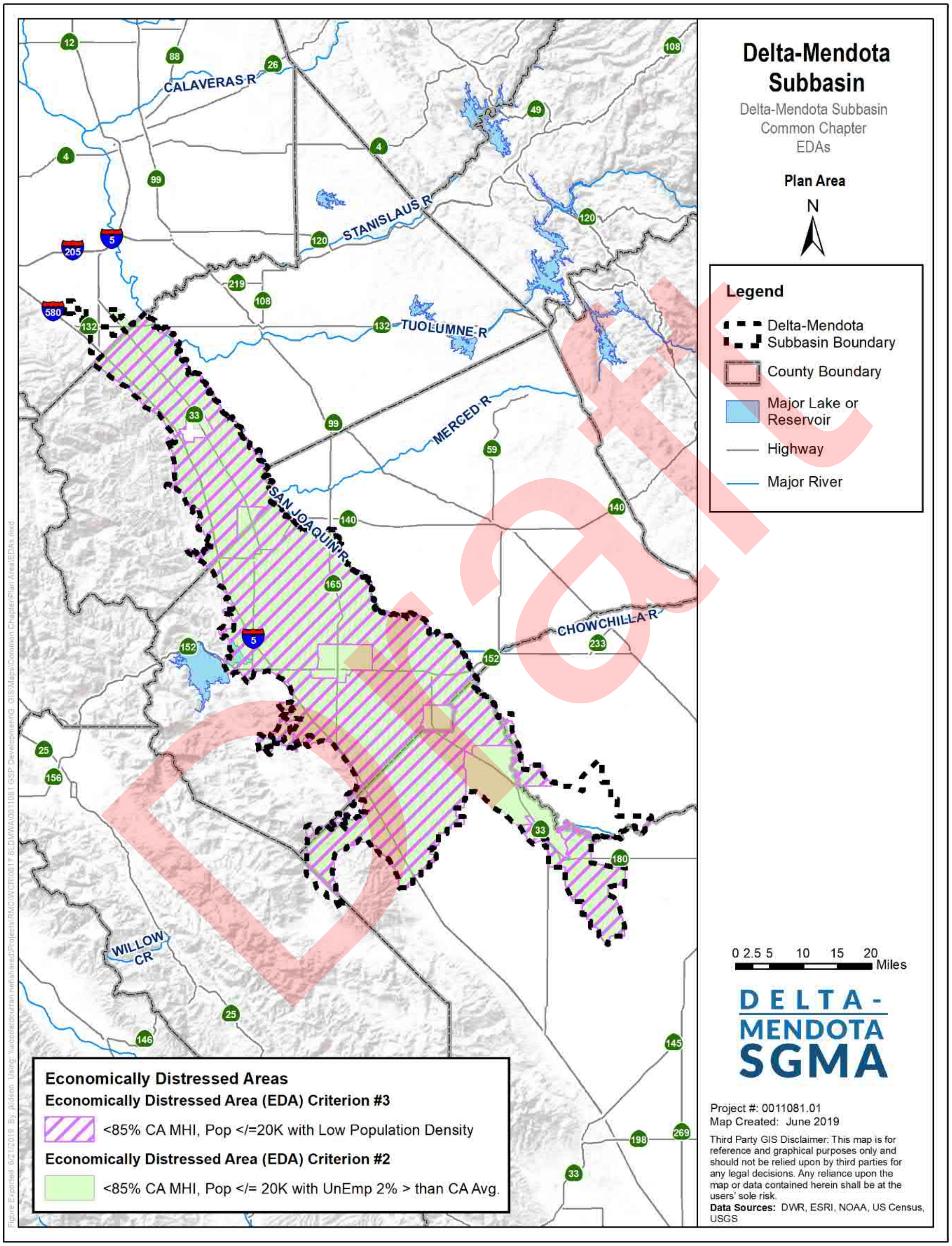


Figure CC-3: Economically Distressed Areas in the Delta-Mendota Subbasin

2. DELTA-MENDOTA SUBBASIN GOVERNANCE

This section includes information pursuant to Article 5. Plan Contents, Subarticle 1. Administrative Information, § 354.6 (Agency Information) as well as Subarticle 8. Interagency Agreements (§ 357.2 Interbasin Agreements and § 357.4 Coordination Agreements), as required by the Groundwater Sustainability Plan (GSP) Regulations. Agency Contact information for the Delta-Mendota Subbasin and the plan manager is included in this section. The organization and management structure, as well as the legal authority of each Groundwater Sustainability Agency (GSA) in the Delta-Mendota Subbasin, is detailed and accompanied by GSA boundary maps and a description of intra-basin and inter-basin coordination agreements in place for the development and implementation of the GSPs overlying the Delta-Mendota Subbasin.

Agency Contact Information

This Common Chapter to the six GSPs for the Delta-Mendota Subbasin has been prepared in a cooperative manner by the following GSAs in the Delta-Mendota Subbasin:

Northern & Central Delta-Mendota Region GSP

- Patterson Irrigation District GSA
- West Stanislaus Irrigation District GSA
- DM-II GSA
- City of Patterson GSA
- Northwestern Delta-Mendota GSA
- Central Delta-Mendota GSA
- Widren Water District GSA
- Oro Loma Water District GSA

San Joaquin River Exchange Contractors (SJREC) GSP

- San Joaquin River Exchange Contractors Water Authority GSA
- Turner Island Water District-2 GSA
- City of Mendota GSA
- City of Firebaugh GSA
- City of Los Banos GSA
- City of Dos Palos GSA
- City of Gustine GSA
- City of Newman GSA
- Madera County - 3 GSA
- Portion of Merced County – Delta-Mendota GSA
- Portion of Fresno County Management Area B GSA

Grassland GSP

- Grassland GSA
- Portion of Merced County – Delta-Mendota GSA

<u>Aliso Water District GSP</u>

- Aliso Water District GSA

<u>Farmers Water District GSP</u>

- Farmers Water District GSA

<u>Fresno County GSP</u>

- Fresno County Management Area A GSA
- Portion of Fresno County Management Area B GSA

The plan areas covered by each of the six Subbasin GSPs is show in **Figure CC-1**. **Figure CC-4** through **Figure CC-6** show the location of the GSAs comprising the six GSP regions. These GSAs are coordinating development and implementation of the six GSPs under the Coordination Agreement, as described below in Section 2.1.

The initial Plan Manager for the coordinated Delta-Mendota Subbasin GSPs is Andrew Garcia, Senior Civil Engineer for San Luis & Delta-Mendota Water Authority (SLDMWA). Mr. Garcia can be contacted as follows:

Mr. Andrew Garcia, Plan Manager
Delta-Mendota Subbasin
842 6th Street
Los Banos, CA 93635
Phone: (209)-832-6200 / Fax (209)-833-1034
andrew.garcia@sldmwa.org

Contact information for each GSP plan administrator can be found in the respective GSPs. The DWR Point of Contact is shown below.

<u>Department of Water Resources (DWR) Point of Contact</u>

The point of contact for the Delta-Mendota Subbasin is:

Christopher Olvera
Department of Water Resources
Christopher.Olvera@water.ca.gov
(559) 230-3373

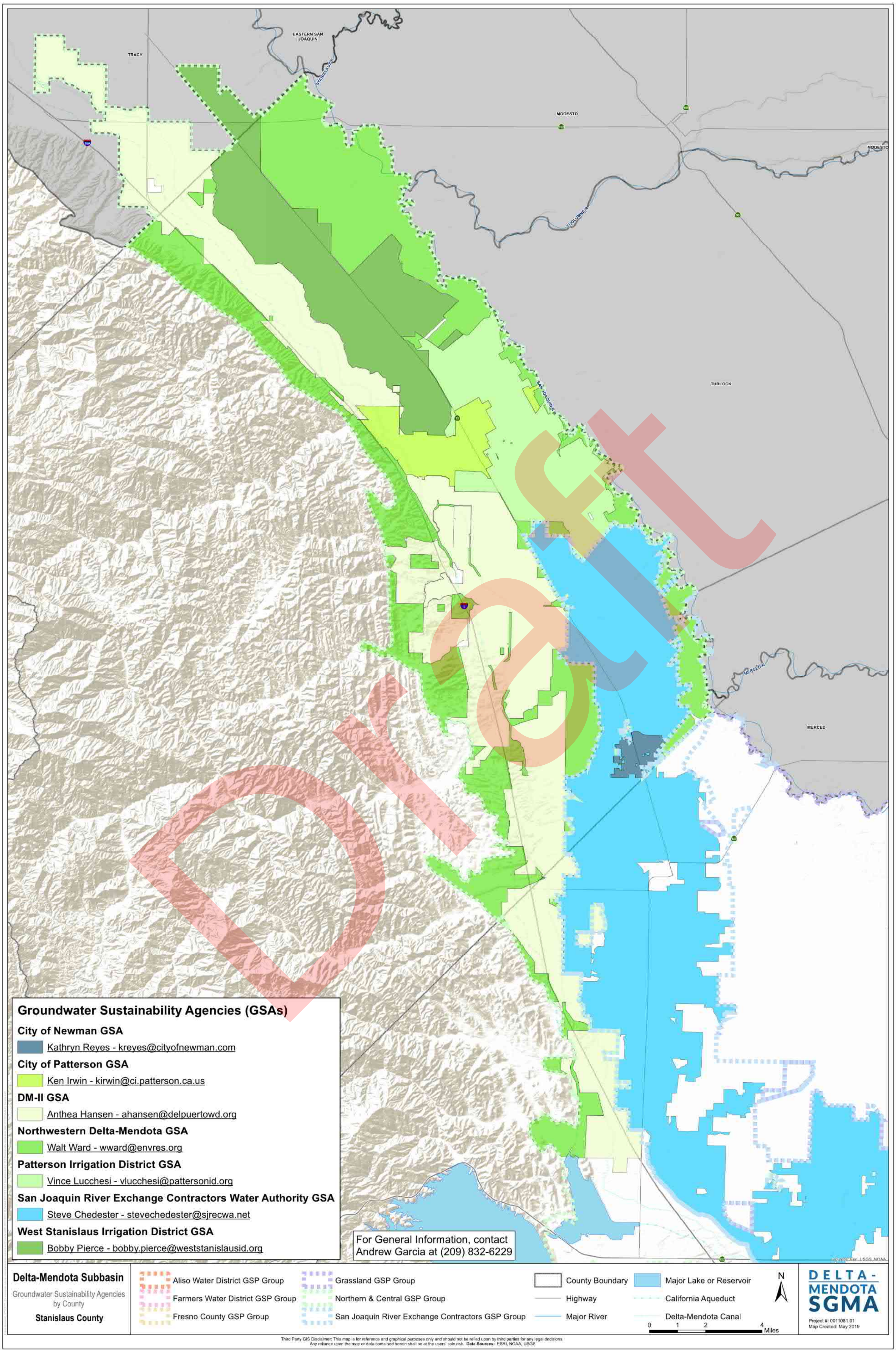


Figure CC-4: GSAs in the Delta-Mendota Subbasin – Stanislaus County

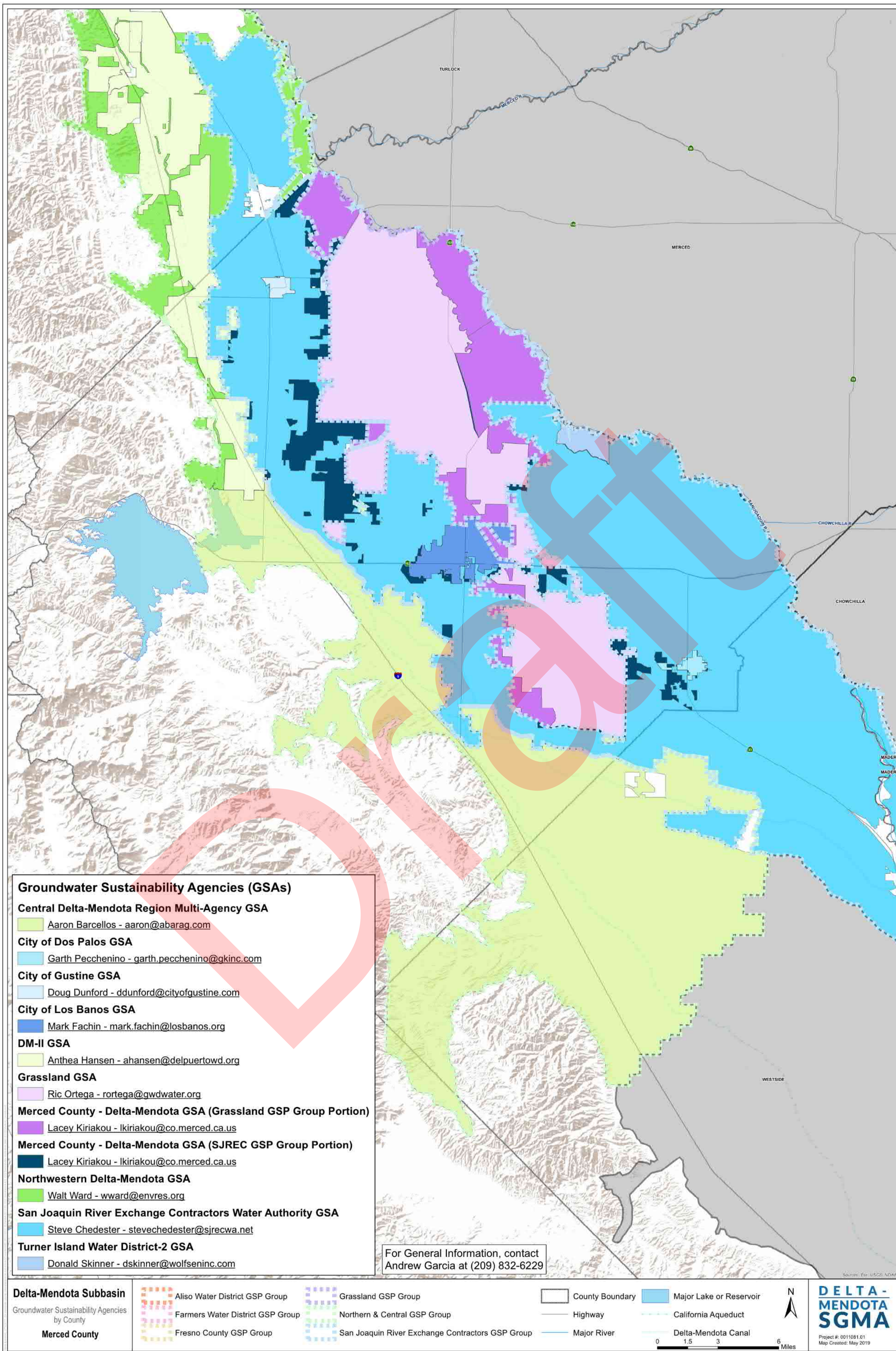


Figure CC-5: GSAs in the Delta-Mendota Subbasin – Merced County

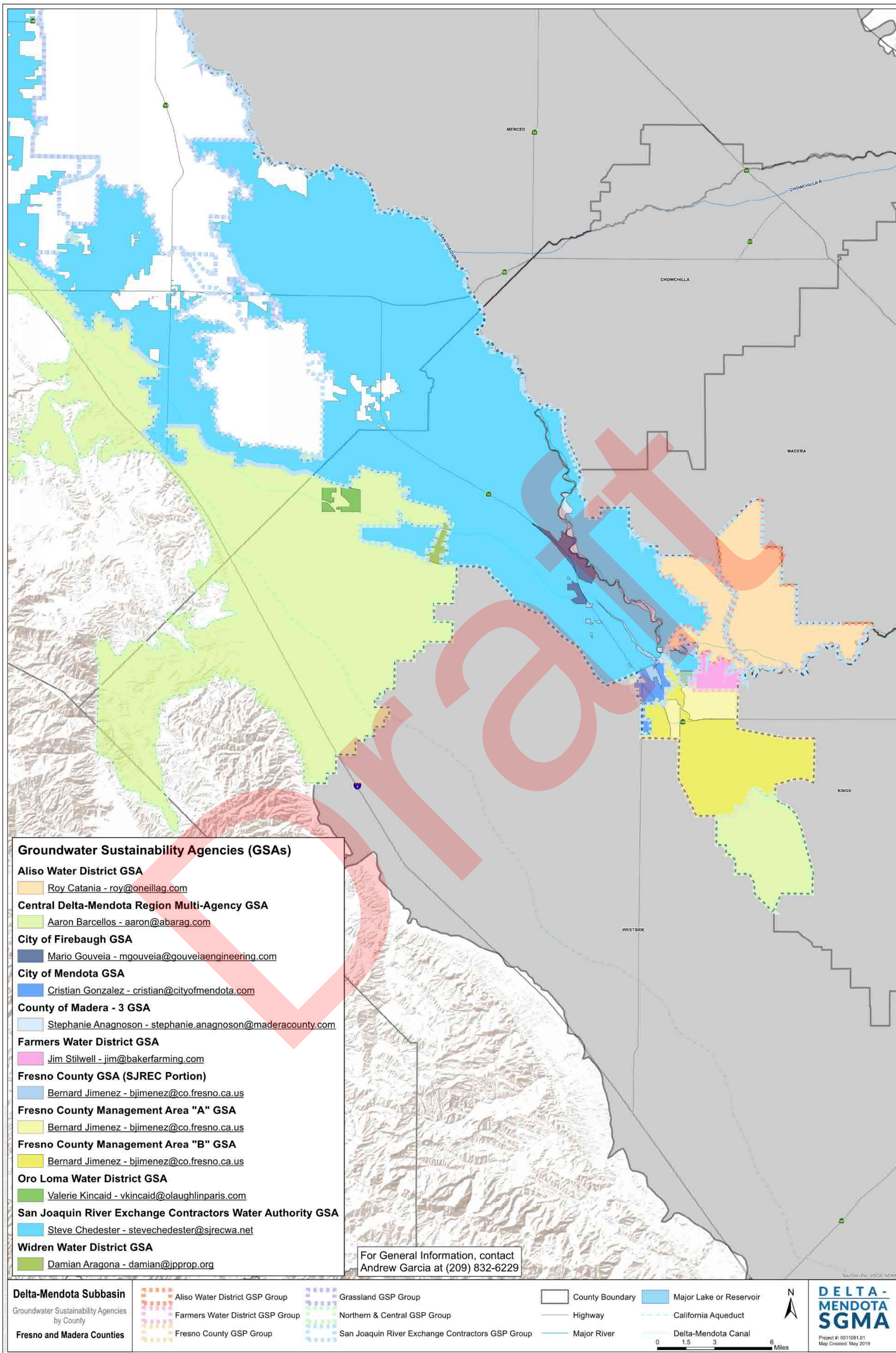


Figure CC-6: GSAs in the Delta-Mendota Subbasin – Fresno and Madera Counties

2.1 GSA and GSP Coordination and Governance

This section includes a description of intra-basin coordination agreements, which are required where there is more than one GSP prepared for a groundwater basin, and inter-basin coordination agreements, which are optional agreements between neighboring groundwater subbasins, pursuant to Article 8. Interagency Agreements, § 357.4. Coordination Agreements and § 357.2 Interbasin Agreements.

2.1.1 Delta-Mendota Subbasin SGMA Governance Structure

The GSAs within the Delta-Mendota Subbasin adopted and executed a Coordination Agreement on December 12, 2018 to comply with the SGMA requirement that multiple GSAs within a given subbasin must coordinate when developing and implementing their GSPs (see Intra-Agency Coordination subsection above for more information). Additionally, a Cost Sharing Agreement was signed and executed by the same parties on December 12, 2018. **Figure CC-5** shows the SGMA governance structure within the Delta-Mendota Subbasin. In addition to the two members appointed to represent each of the Northern & Central Delta-Mendota GSP Region and the San Joaquin River Exchange Contractors (SJREC) GSP Region on the Delta-Mendota Subbasin Coordination Committee as voting members, the Grassland GSP Region, Farmers Water District GSP Region, Fresno County Management Areas A & B GSP Region, and Aliso Water District GSP Region all have appointed one voting member each for a total of eight voting members.

Three working groups were formed under the auspices of the Delta-Mendota Subbasin Coordination Committee: the Technical Working Group, the Communications Working Group and the DMS Working Group. Representatives of each GSP region participate on each working group.

Table CC-4: Delta-Mendota Subbasin Coordination Committee Members

GSP		GSA	Agency	Coordination Committee Members	
				Primary	Alternate
Northern & Central Delta-Mendota Region GSP	Northern Delta Mendota Region Management Committee	Patterson Irrigation District GSA	Patterson Irrigation District	Vince Lucchesi	Walt Ward
			Twin Oaks Irrigation District		
		West Stanislaus Irrigation District GSA	West Stanislaus Irrigation District		
		DM-II GSA	Del Puerto Water District		
			Oak Flat Water District		
		City of Patterson GSA	City of Patterson		
		Northwestern Delta-Mendota GSA	Merced County		
			Fresno County		
	Central Delta-Mendota Region Management Committee	Central Delta-Mendota GSA	San Luis Water District	Ben Fenters	Lacey Kiriakou
			Panoche Water District		
			Tranquillity Irrigation District		
			Fresno Slough Water District		
			Eagle Field Water District		
			Pacheco Water District		
			Santa Nella County Water District		
			Mercy Springs Water District		
			Merced County		
			Fresno County		
		Widren Water District GSA	Widren Water District		
		Oro Loma Water District GSA	Oro Loma Water District		

GSP	GSA	Agency	Coordination Committee Members	
			Primary	Alternate
San Joaquin River Exchange Contractors GSP	San Joaquin River Exchange Contractors Water Authority GSA	Central California Irrigation District	Jarrett Martin, Alejandro Paolini	Chris White, John Wiersma
		Columbia Canal Company		
		Firebaugh Canal Water District		
		San Luis Canal Company		
	Turner Island Water District-2 GSA	Turner Island Water District		
	City of Mendota GSA	City of Mendota		
	City of Firebaugh GSA	City of Firebaugh		
	City of Los Banos GSA	City of Los Banos		
	City of Dos Palos GSA	City of Dos Palos		
	City of Gustine GSA	City of Gustine		
	City of Newman GSA	City of Newman		
	County of Madera - 3 GSA	County of Madera		
	Portion of Merced County – Delta-Mendota GSA	County of Merced		
	Portion of Fresno County Management Area B GSA	County of Fresno		
Grassland GSP	Grassland GSA	Grassland Water District	Ric Ortega	Ken Swanson
		Grassland Resource Conservation District		
		County of Merced		
Farmers Water District GSP	Farmers Water District GSA	Farmers Water District	Jim Stilwell	Don Peracchi
Fresno County GSP	Fresno County - Management Area A	County of Fresno	Buddy Mendes	Glenn Allen or Augustine Ramirez
	Fresno County - Management Area B	County of Fresno		

GSP	GSA	Agency	Coordination Committee Members	
			Primary	Alternate
Aliso Water District GSP	Aliso Water District GSA	Aliso Water District	Joe Hopkins	Board Secretary (Ross Franson)

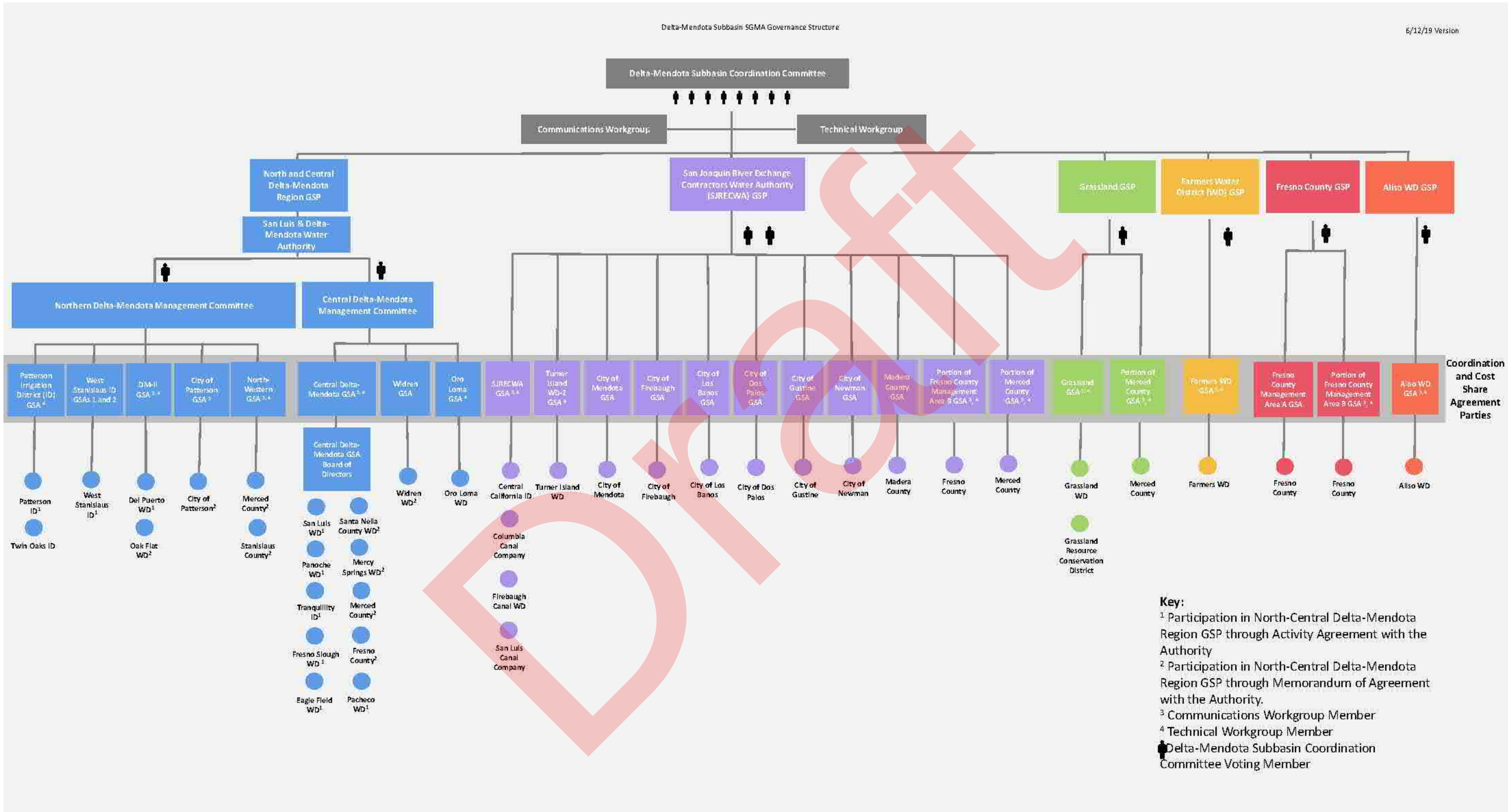


Figure CC-7: Governance Structure of the Delta-Mendota Subbasin

2.1.2 Intra-Basin Coordination

The Delta-Mendota Subbasin Coordination Agreement (Coordination Agreement), effective as of December 12, 2018, has been signed by all participating agencies in the Delta-Mendota Subbasin; a copy of this agreement is included in **Appendix A**. The purpose of the Agreement, including technical reports to be developed after the initial execution of this Agreement, is to comply with SGMA requirements and to ensure that the multiple GSPs within the Subbasin are developed and implemented utilizing the same datasets, methodologies and assumptions, that the elements of the GSPs are appropriately coordinated to support sustainable subbasin management of groundwater resources, and to ultimately set forth the information necessary to show how the multiple GSPs in the Subbasin will achieve the sustainability goal as determined for the Subbasin in compliance with SGMA and its associated regulations.

A key goal of basin-wide coordination is to ensure that the Subbasin GSPs utilize the same data and methodologies during their plan development and that elements of the Plans necessary to achieve the sustainability goal for the basin are based upon consistent interpretations of the basin setting, as required by SGMA and associated regulations. The Coordination Agreement defines how the coordinated efforts will be achieved and documented, and also sets out the process for identifying the Plan Manager. The Coordination Agreement is part of each individual GSP within the Delta-Mendota Subbasin.

The Coordination Agreement for the Delta-Mendota Subbasin covers the following topics:

1. Purpose of the Agreement, including:
    a. Compliance with SGMA and
    b. Description of Criteria and Function;
2. General Guidelines, including:
    a. Responsibilities of the Parties and
    b. Adjudicated or Alternative Plans in the Subbasin;
3. Role of San Luis & Delta-Mendota Water Authority (SLDMWA), including:
    a. Agreement to Serve,
    b. Reimbursement of SLDMWA, and
    c. Termination of SLDMWA's Services;
4. Responsibilities for Key Functions, including:
    a. Coordination Committee,
    b. Coordination Committee Officers,
    c. Coordination Committee Authorized Action and Limitations,
    d. Subcommittees and Workgroups,
    e. Coordination Committee Meetings, and
    f. Voting by Coordination Committee;
5. Approval by Individual Parties;
6. Exchange of Data and Information, including:
    a. Exchange of Information and
    b. Procedure for Exchange of Information;
7. Methodologies and Assumptions, including:
    a. SGMA Coordination Agreements,

   b. Pre-GSP Coordination, and
   c. Technical Memoranda Required;
8. Monitoring Network
9. Coordinated Water Budget
10. Coordinated Data Management System
11. Adoption and Use of the Coordination Agreement, including:
   a. Coordination of GSPs and
   b. GSP and Coordination Agreement Submission;
12. Modification and Termination of the Coordination Agreement, including:
   a. Modification or Amendment of Exhibit "A" (Groundwater Sustainability Plan Groups including Participation Percentages),
   b. Modification or Amendment of Coordination Agreement, and
   c. Amendment for Compliance with Law;
13. Withdrawal, Term, and Termination;
14. Procedures for Resolving Conflicts;
15. General Provisions, including:
   a. Authority of Signers,
   b. Governing Law,
   c. Severability,
   d. Counterparts, and
   e. Good Faith; and
16. Signatories of all Parties

<u>Coordination During GSP Implementation</u>

The Coordination Agreement ensures that the multiple GSAs are working cooperatively and collaboratively to ensure GSPs within the Subbasin are developed and implemented utilizing the same methodologies and assumptions and to ultimately establish the processes necessary to show how the multiple GSPs in the Subbasin will be sustainably managed to achieve the Delta-Mendota Subbasin's sustainability goal. The Coordination Committee intends to continue to meet and confer following the submittal of the Subbasin's GSPs and will develop guidelines for GSP implementation between the GSP Groups and update the Coordination Agreement as the Parties to the Agreement deem necessary.

The Coordination Committee will continue meeting regularly following submittal of the Subbasin GSPs in order to develop the guidelines for coordinated implementation of GSPs. The intent of the guidelines will be to outline processes that will ensure the GSAs are progressing toward the Subbasin sustainability goal, while meeting the Annual Reporting requirements or any other requirements agreed upon for purposes of coordination.

Agency Responsibilities

In meeting the terms of the Coordination Agreement, all Parties (meaning the Delta-Mendota Subbasin GSAs) agree to work collaboratively to meet the objectives of SGMA and the Coordination Agreement. Each Party to the Agreement is a GSA and acknowledges that it is bound by the terms of the Coordination Agreement as an individual party.

The Parties have established a Coordination Committee to provide a forum to accomplish the coordination obligations of SGMA. The Coordination Committee operates in full compliance with the Brown Act and is composed of a Chairperson and Vice Chairperson, Secretary, Plan Manager, and a GSP Group Representative and Alternate Representative for each of the six GSP groups. The Chairperson and Vice Chairperson are rotated annually among GSP Groups in alphabetical order. The Secretary assumes primary responsibility for Brown Act compliance. The GSP Group Representatives, who are identified in **Table CC-4**, are selected by each respective GSP Group at the discretion of the respective GSP Group, and such appointments are effective upon providing written notice to the Secretary and to each Group Contact. The Coordination Committee recognizes each GSP Group Representative and GSP Group Alternate Representative until the Group Contact provides written notice of removal and replacement to the Secretary and to every other Group Contact. Each GSP Group is required to promptly fill any vacancy created by the removal of its Representative or Alternate Representative so that each GSP Group has the number of validly designated representatives.

Each GSP Group Representative is entitled to one vote at the Coordination Committee, where the Alternate Representative is authorized to vote in the absence of the GSP Group Representative. The unanimous vote of the GSP Representatives from all GSP Groups is required on most items upon which the Coordination Committee is authorized to act, with the exception of certain ministerial and administrative items. Voting procedures to address a lack of unanimity take place upon a majority vote of a quorum of the Coordination Committee and include: straw polls, provisional voting, and delay of voting (see Section 5.6.3 – *Voting Procedures to Address Lack of Unanimity* of the Coordination Agreement). Where the law or the Coordination Agreement require separate written approval by each of the Parties, such approval is evidenced in writing by providing the resolution, Motion, or Minutes of their respective Board of Directors to the Secretary of the Coordination Committee. Minutes of the Coordinate Committee are kept and prepared by the Secretary's appointee and maintained by the Secretary as Coordination Agreement records and are available to the Parties and the public upon request. Meeting agenda and minutes are posted on the Delta-Mendota website (www.deltamendota.org).

The Coordination Committee may appoint subcommittees, working groups, and otherwise direct staff made available by the Parties. Subcommittees or working groups may include qualified individuals possessing the knowledge and expertise to advance the goals of the Coordination Agreement on the topics being addressed by the subcommittee or working group, whether or not such individuals are GSP Group Representatives or Alternate Representatives. Tasks assigned to subcommittees, working groups, or staff made available by the Parties may include developing technical data, supporting information, and/or recommendations on specialized matters to the Coordination Committee. One GSP Group Representative or Alternate Representative is required to vote on behalf of the GSP Group at the subcommittee level. If no GSP Group Representative or Alternate Representative is present, one individual working on a subcommittee on behalf of the Parties in a GSP Group votes on behalf of the GSP Group. Subcommittees report voting results and provide information to the Coordination Committee but are not entitled to make determinations or decisions that are binding on the Parties.

The Coordination Committee is authorized to act upon the following items:

1. The Coordination Committee reviews, and consistent with the requirements of SGMA, approves the Technical Memoranda that compose the Common Chapter (see *Coordinated Data and Methodology*);
2. The Coordination Committee is responsible for ongoing review and updating of the Technical Memoranda as needed; assuring submittal of annual reports; providing five-year assessments and recommending any needed revisions to the Coordination Agreement; and providing review and assistance with coordinated projects and programs, once the GSPs have been submitted to and approved by DWR;
3. The Coordination Committee reviews and approves work plans, and in accordance with the budgetary requirements of the respective Parties, approves annual budget estimates of Coordinated Plan Expenses presented by the Secretary and any updates to such estimates provided that such estimates or updates with supporting documentation are circulated to all Parties for comment at least thirty (30) days in advance of the meeting at which the Coordination Committee will consider approval of the annual estimate;
4. The Coordination Committee is authorized to approve changes to Exhibit "A" (Groundwater Sustainability Plan Groups including Participation Percentages) to the Agreement and to recommend amendments to terms of the Agreement;
5. The Coordination Committee may assign work to subcommittees and workgroups as needed, provide guidance and feedback and ensure that subcommittees and workgroups prepare work products in a timely manner;
6. The Coordination Committee directs the Plan Manager in the performance of its duties under SGMA; and
7. The Coordination Committee provides direction to its Officers concerning other administrative and ministerial issues necessary for the fulfillment of the above-enumerated tasks.

Additional information regarding the roles, responsibilities, and duties of the Coordination Committee can be found in Section 5 – *Responsibilities for Key Functions* of the Coordination Agreement.

Exchange of Information

Timely exchange of information is a critical aspect of GSP coordination. All parties to the Coordination Agreement have agreed to exchange public and non-privileged information through collaboration and/or informal requests made at the Coordination Committee level or through subcommittees designated by the Coordination Committee. To the extent it is necessary to make a written request for information to another Party, each Party designates a representative to respond to information requests and provides the name and contact information of the designee to the Coordination Committee. Requests may be communicated in writing and transmitted in person or by mail, facsimile machine, or other electronic means to the appropriate representative as named in the Coordination Agreement. The designated representative is required to respond in a reasonably timely manner. Nothing in the Agreement shall be construed to prohibit any Party from voluntarily exchanging information with any other Party by any other mechanism separate from the Coordination Committee.

The Parties agree that each GSP Group shall provide the data required to develop the Subbasin-wide coordinated water budget but, unless required by law, will not be required to provide individual well or parcel-level information in order to preserve confidentiality of individuals to the extent authorized by law, including but not limited to Water Code Section 10730.8, subdivision (b). To the extent that a court order, subpoena, or the California Public Records Act is applicable to a party, the Party in responding to a request made pursuant to that Act for release of information exchanged from another Party shall notify each other Party in writing of its proposed release of information in order to provide the other Parties with the opportunity to seek a court order preventing such release of information.

Dispute Resolution

Procedures for conflict resolution have been established within the Coordination Agreement. In the event that a dispute arises among Parties as it relates to the Coordination Agreement, the disputing Party or Parties are to provide written notice of the basis of the dispute to the other Parties within thirty (30) calendar days of the discovery of the events giving rise to the dispute. Within thirty (30) days after such written notice, all interested Parties are to meet and confer in good faith to informally resolve the dispute. All disputes that are not resolved informally shall be settled by arbitration. In such an event, within ten (10) days following the failed informal proceedings, each interested Party is to nominate and circulate to all other interested Parties the name of one arbitrator. Within ten (10) days following the nominations, the interested Parties are to rank their top three among all nominated arbitrators, awarding three points to the top choice, two points to the second choice, and one point to the third choice and zero points to all others. Each interested Party will then forward its tally to the Secretary, who tabulates the points and notifies the interested Parties of the arbitrator with the highest cumulative score, who shall be the selected arbitrator. The Secretary may also develop procedures for approval by the Parties for selection of an arbitrator in the case of tie votes or in order to replace the selected arbitrator in the event such arbitrator declines to act. The arbitration is to be administered in accordance with the procedures set forth in the California Code of Civil Procedure, Section 1280, *et seq.*, and of any state or local rules then in effect for arbitration pursuant to said section. Upon completion of arbitration, if the controversy has not been resolved, any Party may exercise all rights to bring legal action relating to the controversy.

Coordinated Data and Methodology

Pursuant to SGMA, the Coordination Agreement ensures that the individual GSPs utilize the same data and methodologies for developing assumptions used to determine: 1) groundwater elevation; 2) groundwater extraction data; 3) surface water supply; 4) total water use; 5) changes in groundwater storage; 6) water budgets; and 7) sustainable yield. The Parties have agreed to develop agreed-upon methodologies and assumptions for the aforementioned items prior to or concurrent with the individual development of GSPs. This development is facilitated through the Coordination Committee's delegation to a subcommittee or working group of the technical staff provided by some or all of the Parties. The basis upon which the methodologies and assumptions have been developed includes existing data/information, best management practices, and/or best modeled or projected data available and may include consultation with DWR as appropriate.

The data and methodologies for assumptions described in Water Code Section 10727.6 and Title 23, California Code of Regulations, Section 357.4 to prepare coordinated plans are set forth in Technical Memoranda prepared by the Coordination Committee for each of the following elements: Data and Assumptions; Hydrogeologic Conceptual Model; Coordinated Water Budgets; Sustainable Management Criteria; Coordinated Monitoring Network; Coordinated Data Management System, and Adoption and Use of the Coordination Agreement. The Technical Memoranda have been subject to the unanimous approval of the Coordination Committee and once approved, have been attached to and incorporated by reference into the Coordination Agreement without formal amendment of the Coordination Agreement being required. The Parties have agreed that they will not submit this Coordination Agreement to DWR until the Technical Memoranda described herein have been added to the Coordination Agreement. The Technical Memoranda created pursuant to the Coordination Agreement are to be utilized by the Parties during the development and implementation of their individual GSPs in order to assure coordination of the GSPs is in compliance with SGMA. The Technical Memoranda have been included as an appendix to this GSP as a part of the Common Chapter.

Plan Implementation and Submittal

Under the Coordination Agreement, the Parties have agreed to submit their respective GSPs to DWR through the Coordination Committee and Plan Manager, in accordance with all applicable requirements. Subject to the subsequent attachment of the Technical Memoranda as appendices to the Common Chapter, the Parties intend that the described Coordination Agreement fulfill the requirements of providing an explanation of how the GSPs implemented together satisfy the requirements of SGMA for the entire Subbasin. The Coordination Agreement does not otherwise affect each Party's responsibility to implement the terms of its respective GSP in accordance with SGMA. Rather, this Coordination Agreement is the mechanism through which the Parties will coordinate their respective GSPs to the extent necessary to ensure that such GSP coordination complies with SGMA.

Each Party is responsible for ensuring that its own GSP complies with the statutory requirements of SGMA, including but not limited to the filing deadline. The Parties to this Coordination Agreement intend that their individual GSPs be coordinated together in order to satisfy the requirements of SGMA and to be in substantial compliance with the California Code of Regulations. The collective GSPs will satisfy the requirements of Water Code Sections 10727.2 and 10727.4 by providing a description of the physical setting and characteristics of the separate aquifer systems within the Subbasin, the measurable objectives for each such GSP, interim milestones, and monitoring protocols that together provide a detailed description of how the Subbasin as a whole will be sustainably managed.

The Parties agree to submit their respective GSPs to DWR through the Coordination Committee and Plan Manager, in accordance with all applicable requirements. The Coordination Committee is responsible for assuring submittal of annual reports, five-year updates, and for providing assessments recommending any needed revisions to the Coordination Agreement.

Coordinated Data Management System

The Delta-Mendota Subbasin GSAs have developed and will maintain a coordinated Data Management System that is capable of storing and reporting information relevant to the reporting requirements and/or implementation of the GSPs and monitoring network of the Subbasin.

The Parties may also develop and maintain separate Data Management Systems. Each separate Data Management System developed for each GSP will store information related to implementation of each individual GSP, monitoring network data and monitoring sites requirements, and water budget data requirements. Each system will be capable of reporting all pertinent information to the Coordination Committee. After providing the Coordination Committee with data from the individual GSPs, the Coordination Committee will ensure the data are stored and managed in a coordinated manner throughout the Subbasin and reported to DWR on an annual basis.

Adjudicated Areas and Alternative Plans

There are no adjudicated areas within the Delta-Mendota Subbasin, and no Alternative Plans have been submitted by the local agencies within the Subbasin.

Legal Bindings of the Delta-Mendota Subbasin Coordination Agreement

The Coordination Agreement, as contained herein, is reflected in the same manner and form as in the six Subbasin GSPs. All parties understand that the Delta-Mendota Subbasin Coordination Agreement is part of the GSPs for participating Subbasin GSAs and will be a primary mechanism by which the six Subbasin GSPs will be implemented in a coordinated fashion. Further, all parties to the Coordination Agreement understand that DWR will evaluate the agreement for compliance with the procedural and technical requirements of GSP Regulations § 357.4 (Coordination Agreement) to ensure that the agreement is binding on all parties and that provisions of the agreement are sufficient to address any disputes between or among parties to the agreement.

The Coordination Agreement will continue to be the framework under which the six Delta-Mendota Subbasin GSPs will be implemented and will be reviewed as part of the five-year assessment and revised as necessary, dated, and signed by all parties.

2.1.3 Inter-basin Agreements

SLDMWA, on behalf of the Northern and Central Delta-Mendota Regions, and the SJREC GSA executed inter-basin data sharing agreements with Westlands Water District (the lead entity encompassing the adjoining Westside Subbasin). The purpose of the agreement is to establish a set of common assumptions on groundwater conditions on either side of the boundary between the Westside Subbasin and the Delta-Mendota Subbasin to be used for the development of GSPs in support of implementation of SGMA. In this agreement, the parties agree to provide each other with recorded, measured, estimated, and/or simulated modeling data located within five (5) miles of the boundary between the Westside Subbasin and the Delta-Mendota Subbasin. A list of data types to be shared between the parties to the agreement can be found in **Appendix D**.

Data provided under this agreement are understood to be shared with consultants and other stakeholders in the respective basins (Delta-Mendota Subbasin and Westside Subbasin), and that the information will be made public through the development of the respective Parties' (meaning SLDMWA/SJREC and Westlands Water District) GSPs and the supporting documentation of the GSPs. Other than publishing information for those purposes, neither Party will disclose the other Party's information to any third party, except if the other Party determines, at its sole discretion, the disclosure is required by law. Each Party may review preliminary results before publishing the information.

It is recognized that many of the sustainability indicators, notably groundwater quality, inelastic land subsidence and change in storage, are regional issues that may require future inter-basin discussions and coordination. Memorandum of Intent (MOI) are being discussed with the surrounding subbasins to demonstrate/confirm the subbasins' desires to coordinate during GSP implementation. These agreements, to be discussed further following submittal of GSPs, will allow for thoughtful consideration of the intent, structure, and need for future coordination with respect to data collection, reporting, regular meetings, and updates prior to annual reporting.

3. DELTA-MENDOTA SUBBASIN PLAN AREA

This section describes the Delta-Mendota Subbasin, including major streams and creeks, institutional entities, agricultural and urban land uses, locations of state lands (including wetlands), and geographic boundaries of surface water runoff areas. The reader is referred to the individual Subbasin GSPs for descriptions of existing surface water and groundwater monitoring programs, existing water management programs, and general plans in the individual GSP Plan Areas. The information contained in this section reflects information from publicly available sources and may not reflect all information that will be used for GSP technical analysis.

This section of the GSP satisfies Section 354.8 of the SGMA regulations.

3.1 Plan Area Definition

The Plan Area for the six coordinated GSPs is the Delta-Mendota Subbasin (DWR Basin 5-022.07). As previously noted, the Delta-Mendota Subbasin is one of nine subbasins that lie completely within the San Joaquin Valley Hydrologic Region and adjoins the following subbasins (**Figure CC-8**):

- Tracy
- Eastern San Joaquin
- Modesto
- Turlock
- Merced
- Chowchilla
- Madera
- Kings
- Westside

As described in *California's Groundwater*, DWR Bulletin 1188 (2016), the Delta-Mendota Subbasin is in the San Joaquin Valley Groundwater Basin, located along the western edge of the San Joaquin Valley and includes portions of San Joaquin, Stanislaus, Merced, Fresno, San Benito and Madera Counties. The northern boundary begins just south of Tracy in San Joaquin County, and the eastern boundary generally follows the San Joaquin River and Fresno Slough. The southern boundary is near the small town of San Joaquin, and the Subbasin is bounded on the west by the Coast Range. The Subbasin boundaries are further described in Section 4.1.5, Basin Boundaries, and is shown in relation to each of the six counties in **Figure CC-9**.

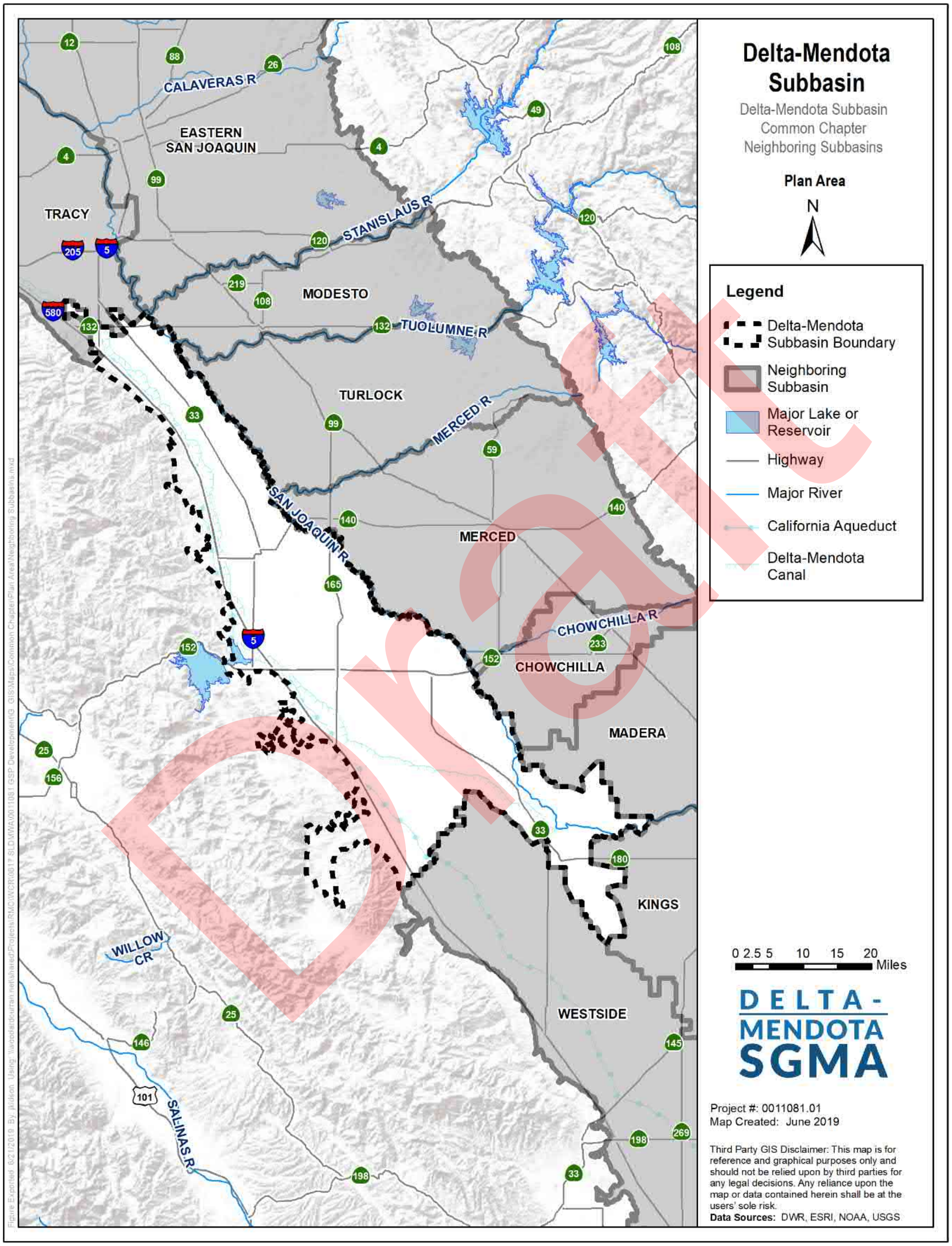


Figure CC-8: Neighboring Subbasins of the Delta-Mendota Subbasin

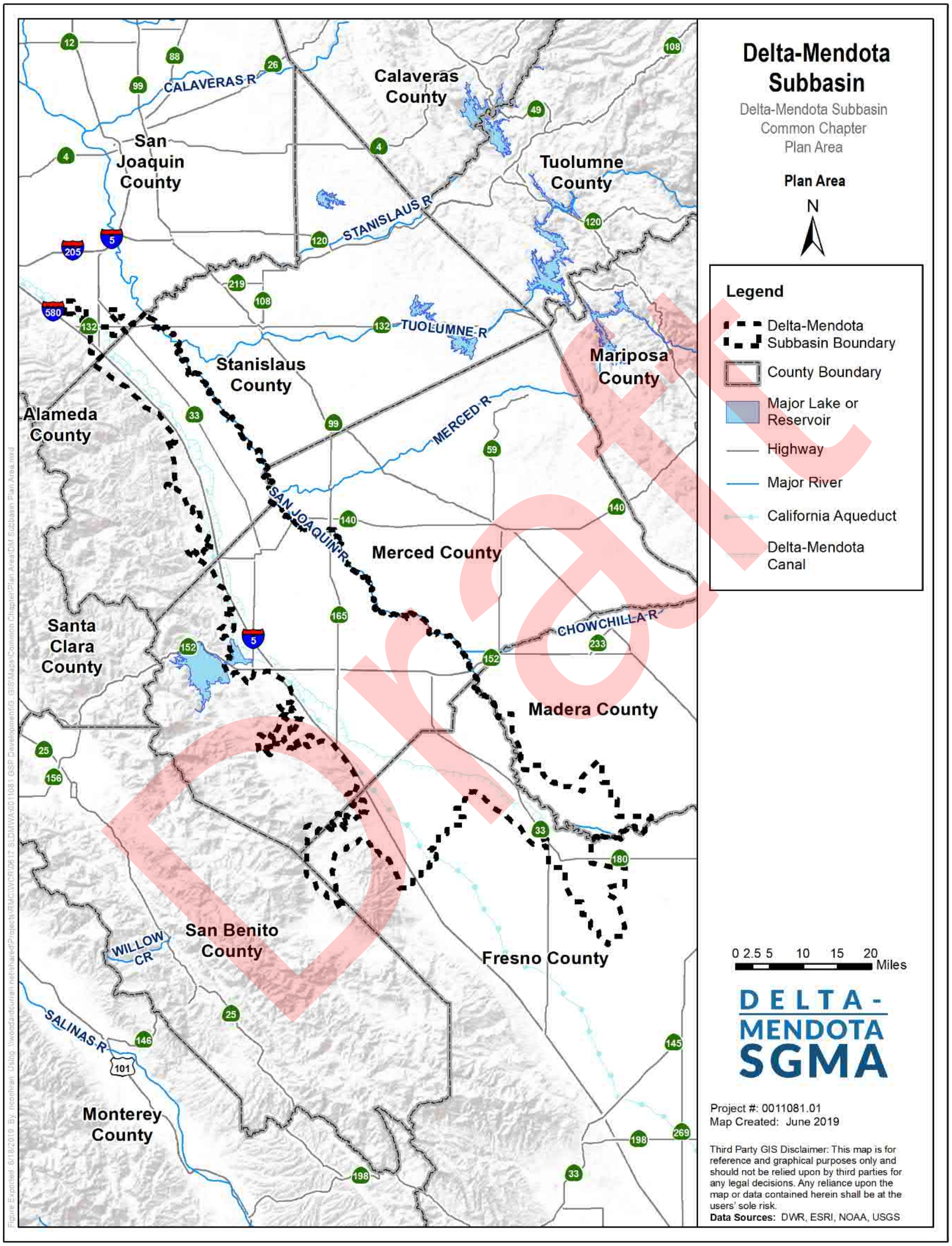


Figure CC-9: Delta-Mendota Groundwater Subbasin Plan Area

3.2 Plan Area Setting

As previously noted, the Delta-Mendota Subbasin lies along the western margin of the San Joaquin Valley. This valley is part of the large, northwest-to-southeast-trending asymmetric trough of the Central Valley, which has been filled with up to six vertical miles of sediment. This sediment includes both marine and continental deposits ranging in age from Jurassic to Holocene. The San Joaquin Valley lies between the Coast Range Mountains on the west and the Sierra Nevada on the east and extends northwestward from the San Emigdo and Tehachapi Mountains to the Sacramento-San Joaquin Delta (Delta) near the City of Stockton. The San Joaquin Valley is 250 miles long and 50 to 60 miles wide. The relatively flat alluvial floor is interrupted occasionally by low hills. Foothills adjacent on the west are composed of folded and faulted beds of mainly marine shale in the north and sandstone and shale in the south.

The San Joaquin Valley floor is divided into several geomorphic land types, including dissected uplands, low alluvial fans and plains, river floodplains and channels, and overflow lands and lake bottoms. Alluvial plains cover most of the valley floor and comprise some of the most intensely developed agricultural lands in the San Joaquin Valley. In general, alluvial sediments of the western and southern parts of the San Joaquin Valley tend to have lower permeability than east side deposits.

This section provides additional information relating to water resources in and around the Delta-Mendota Subbasin.

Watersheds

The Delta-Mendota Subbasin lies in the Middle San Joaquin-Lower Merced-Lower Stanislaus watershed and the Middle San Joaquin-Lower Chowchilla watershed (**Figure CC-10**). Historically, the San Joaquin Valley Basin was a large floodplain of the San Joaquin River that supported vast expanses of permanent and seasonal marshes, lakes, and riparian areas. Approximately 90 percent of the basin's wetlands have been lost, with approximately 58,000 flooded acres remaining on State, federal and private wildlife refuges. Approximately 100,000 acres of managed wetland, upland and riparian habitat is found within the Grassland Plan area, and together with the 12,000-acre Mendota Wildlife Area (found in the Fresno County Plan area), encompasses the vast majority of the remaining wetlands found in the basin (**Figure CC-11**).

The San Joaquin River Basin (Basin) includes the entire area drained by the San Joaquin River. The San Joaquin River Basin drains 13,513 square miles (mi^2) before it flows into the Sacramento-San Joaquin Delta near the town of Vernalis. The Merced, Tuolumne and Stanislaus Rivers are the three major tributaries that join the mainstream San Joaquin River from the east before it flows into the Delta.

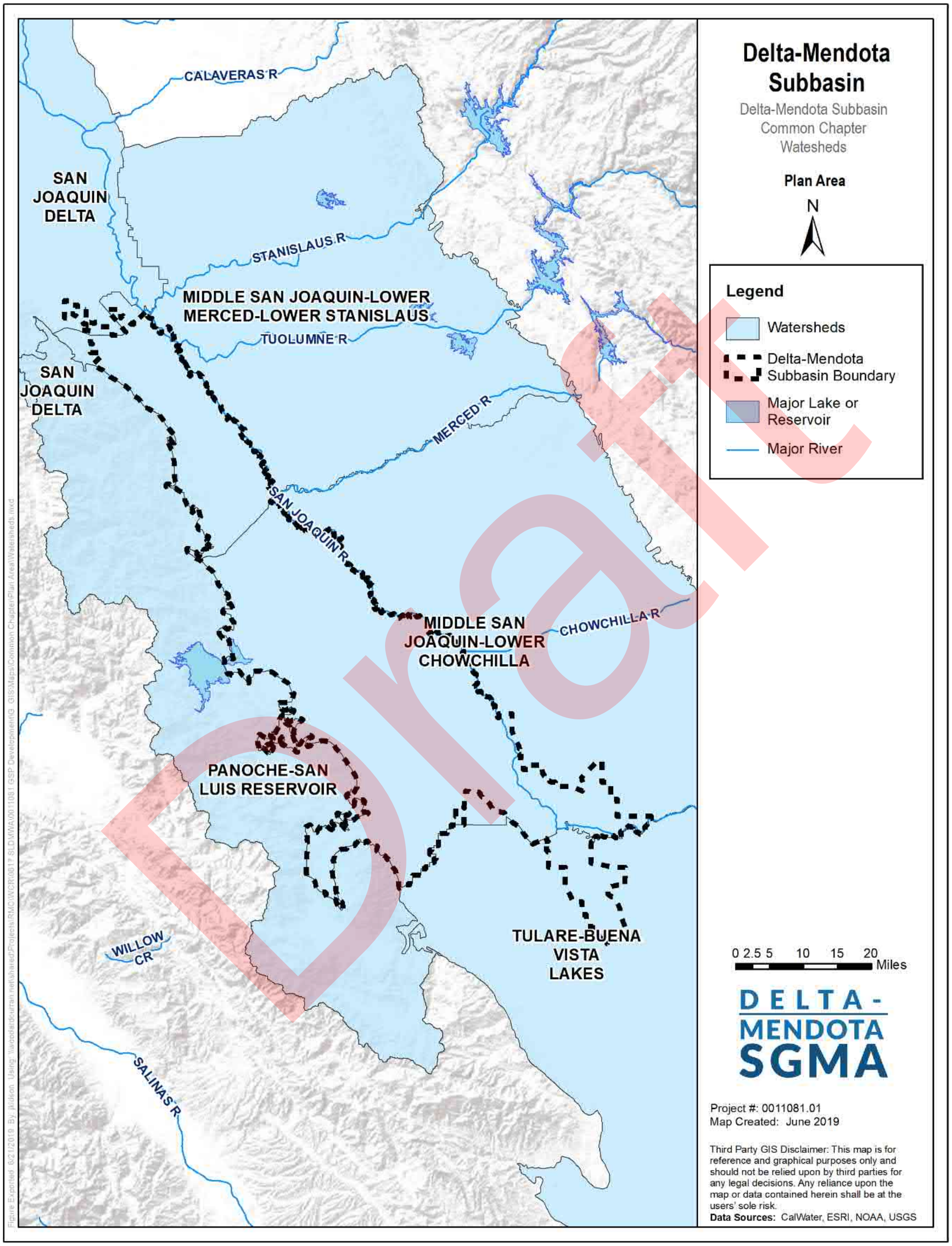


Figure CC-10: Local Watersheds

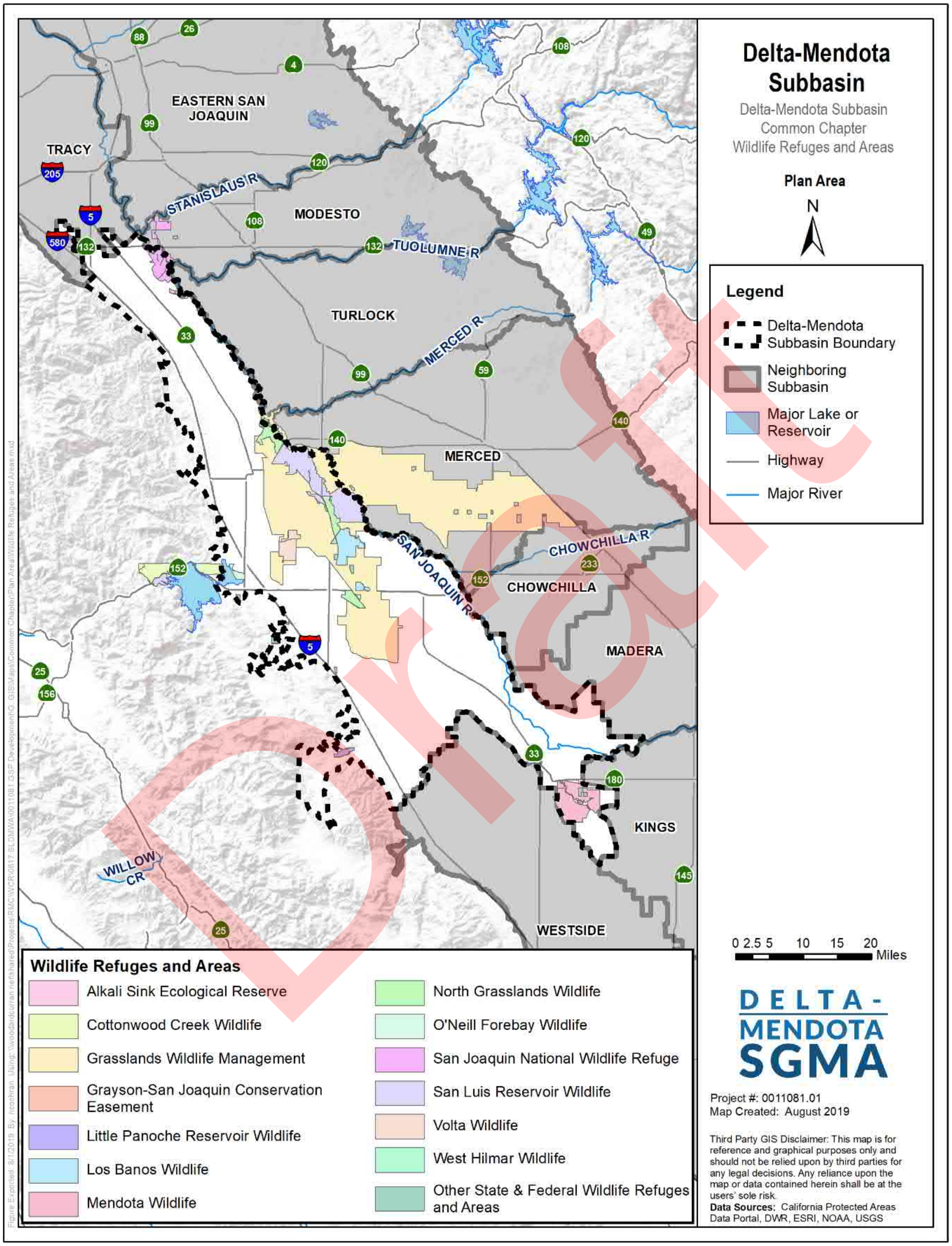


Figure CC-11: Wildlife Refuges and Wetland Habitat Areas in the Delta-Mendota Subbasin

Surface Water Use

Surface water is a primary water supply for agriculture within the Delta-Mendota Subbasin. Surface water supplies are brought into the Subbasin using an extensive series of water systems relied upon by multiple water agencies, cities, and private water users. Major water-related infrastructure in the Subbasin includes the facilities required to deliver Central Valley Project (CVP) supplies to CVP water supply contractors, in addition to key infrastructure of the State Water Project (SWP) utilized to deliver water to SWP water supply contractors and surface water diversions (e.g. intakes) to divert and distribute water from the San Joaquin and Kings Rivers.

The San Luis & Delta-Mendota Water Authority (SLDMWA) is a joint powers authority consisting of 28 member agencies that provide water to approximately 1.2 million acres of highly productive farmland, 2 million California residents, and millions of waterfowl dependent upon the nearly 200,000 acres of managed wetlands within this area of the Pacific Flyway. The SLDMWA operates and maintains portions of the CVP, including the Delta Cross Channel, the C.W. "Bill" Jones Pumping Plant, the Delta-Mendota Canal (DMC), O'Neill Pumping-Generating Plant, and the San Luis Drain, and provides emergency assistance when requested on the Delta Cross Channel and the Tracy Fish Collection Facility. The California Department of Water Resources (DWR) operates and maintains the SWP facilities, designed to deliver nearly 4.2 million acre-feet of water per year to 29 long-term SWP water supply contractors. Joint federal-state facilities include the California Aqueduct, Banks Pumping Plant, O'Neill Dam and Forebay, Sisk Dam and San Luis Reservoir, and Dos Amigos Pumping Plant. Surface water diversion facilities are owned and operated by individual water and irrigation districts and typically include some form of intake (e.g. fish screen, open water intake, flumes) plus facilities to convey the diverted surface water to a distribution system.

Groundwater Use

Groundwater is a key component of water supplies in the Delta-Mendota Subbasin. To protect the long-term sustainability of groundwater resources, pumping has significantly reduced in past years (2017-2019), allowing the groundwater levels in the Subbasin to recover to some extent. During the most recent drought period, groundwater was heavily relied upon throughout the Subbasin for irrigation as surface water deliveries were significantly severely reduced for many water users (especially those with junior surface water rights), resulting in increased groundwater pumping.

There are many communities within the Subbasin that are partially or completely reliant on groundwater for municipal and domestic water supplies, including the cities of Patterson, Newman, Gustine, Los Banos, Firebaugh, and Mendota and the communities of Grayson, Westley, Crows Landing, Santa Nella, Volta, Dos Palos Y, and Tranquillity (**Figure CC-12**). Other unincorporated areas of the Subbasin also rely on groundwater as the sole water supply source. There are several areas of *de minimis* groundwater extractors in the Subbasin, which are defined as well owners who extracts two acre-feet or less per year from a parcel for domestic purposes (SWRCB, n.d. (a)).

Figure CC-13, **Figure CC-14**, and **Figure CC-15** show the density per square mile (PLSS Section) of domestic, production, and public wells in the Delta-Mendota Subbasin as identified by DWR's Well Completion Report Map Application. Domestic wells are defined as individual domestic wells which supply water for the domestic needs of an individual residence or systems of four or less service connections (DWR, 1981). Within the Delta-Mendota Subbasin, the majority of PLSS Sections contain five or fewer domestic wells (**Figure CC-13**). Production well statistics include wells that are designated as irrigation, municipal, public, and industrial on well completion reports, generally indicating wells designed to obtain water from productive zones containing good-quality water (DWR, 1991). The majority of PLSS Sections in the Subbasin contain only zero, one, or two production wells (**Figure CC-14**). The highest concentration of production wells can be found in the south of the Subbasin, near Mendota. Public wells are defined as wells that provide water for human consumption to 15 or more connections or regularly serves 25 or more people daily for at least 60 days out of the year (SWRCB, n.d. (b)). Compared to domestic and production wells, public wells are less common in the Subbasin. The status of the wells (e.g. active, abandoned, destroyed) contained in the DWR Well Completion Report Map Application has not been independently confirmed. Additionally, the reader is referred to each of the six Subbasin GSPs for more information regarding wells in the Delta-Mendota Subbasin.

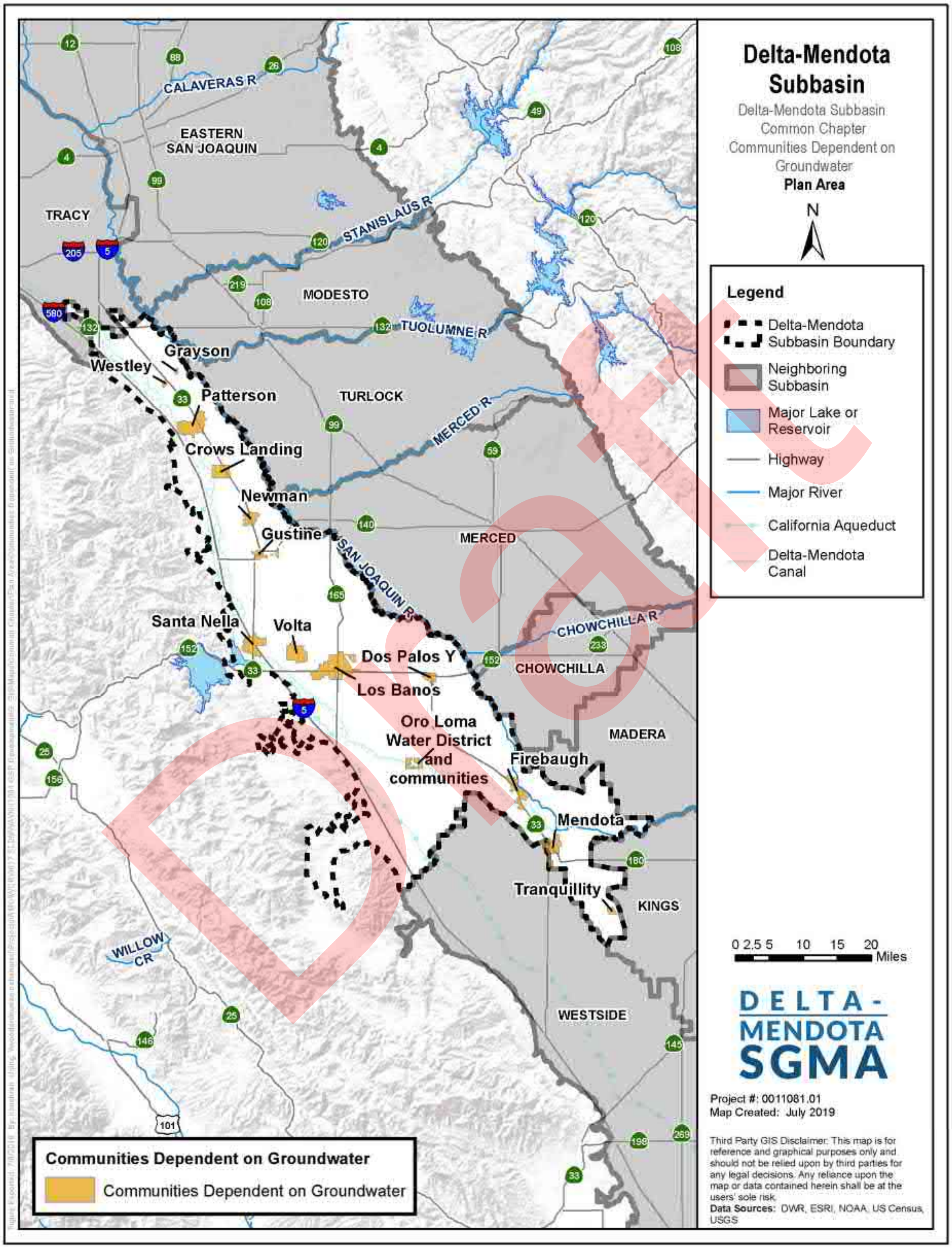


Figure CC-12: Communities Dependent on Groundwater

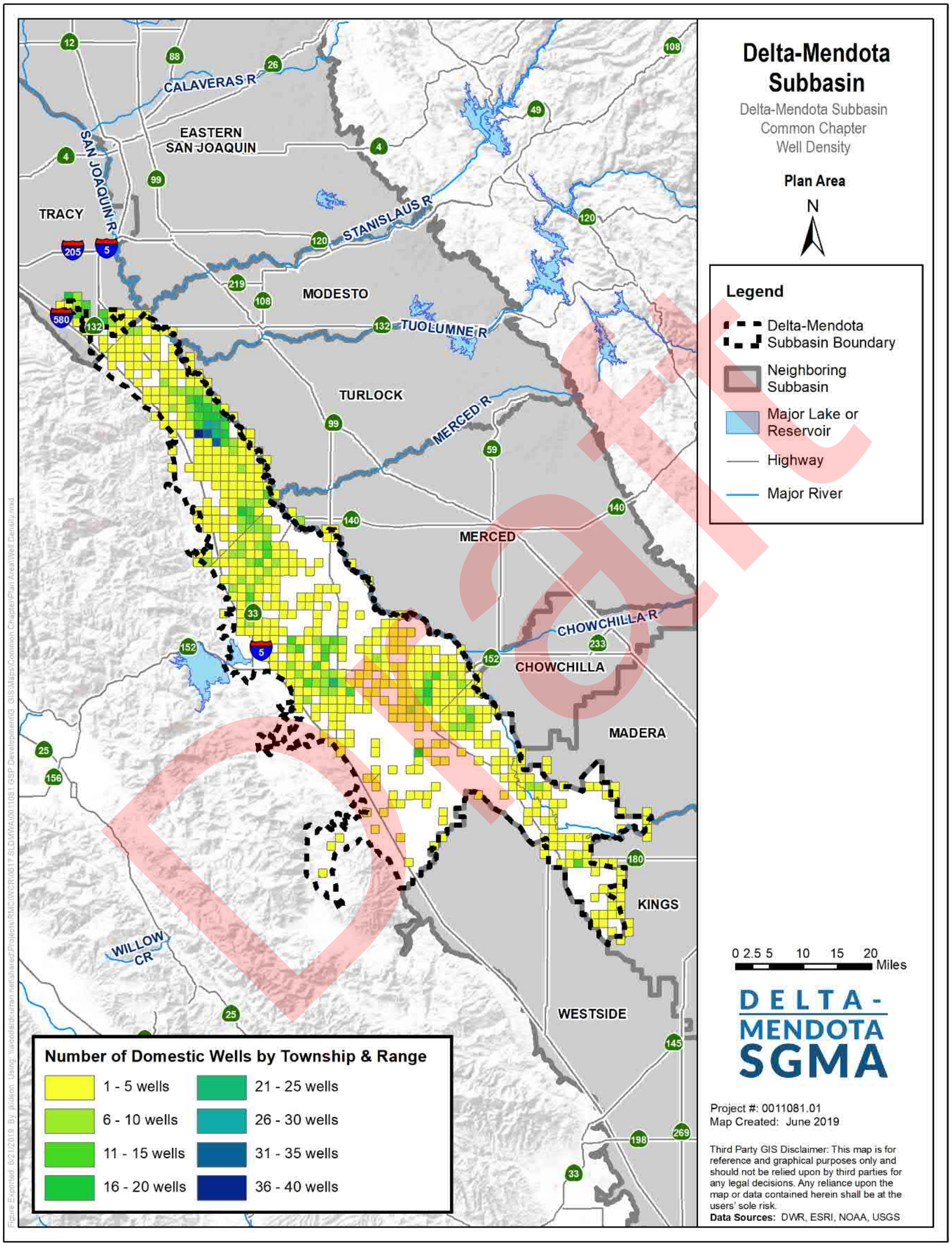


Figure CC-13: Domestic Well Density in the Delta-Mendota Subbasin

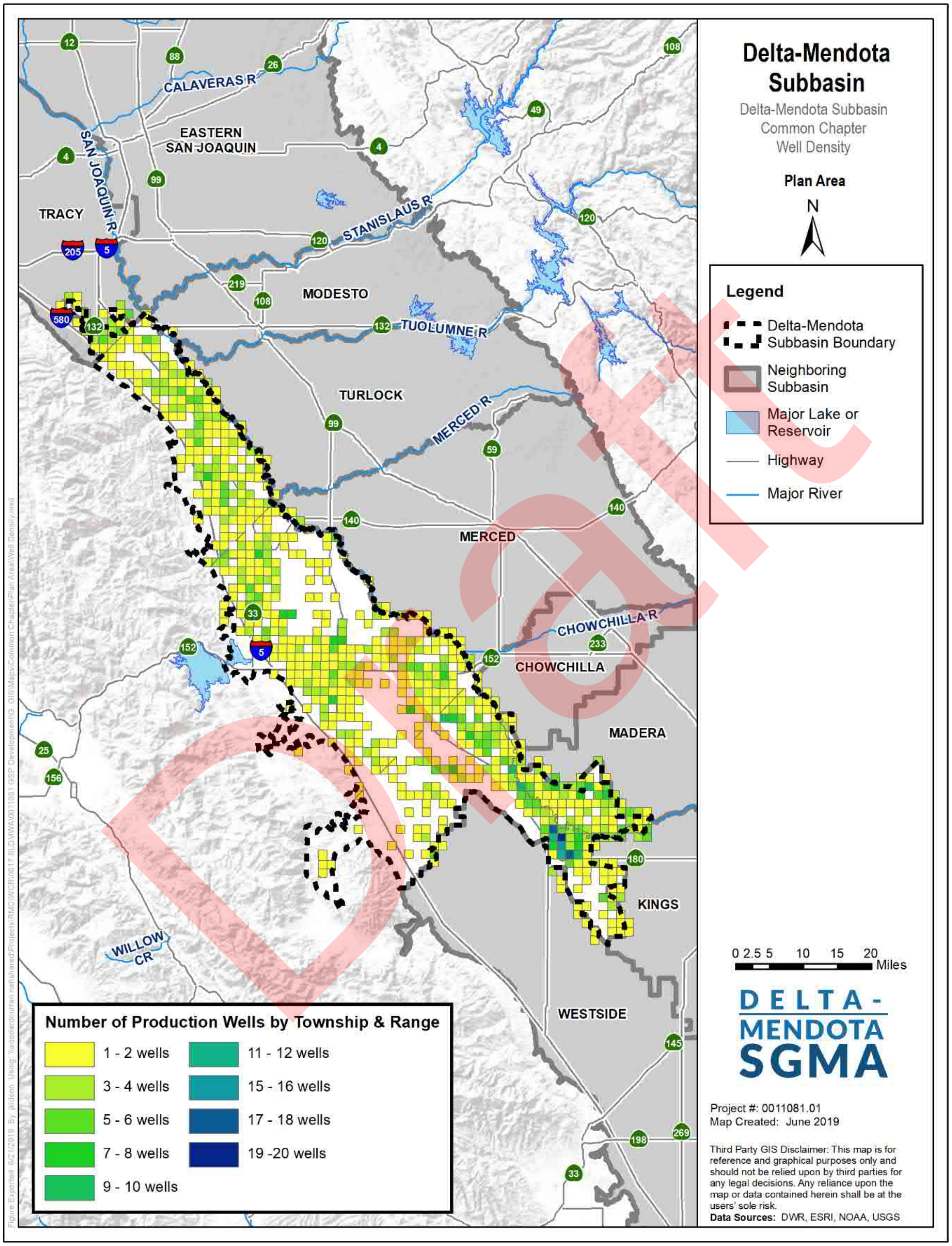


Figure CC-14: Production Well Density in the Delta-Mendota Subbasin

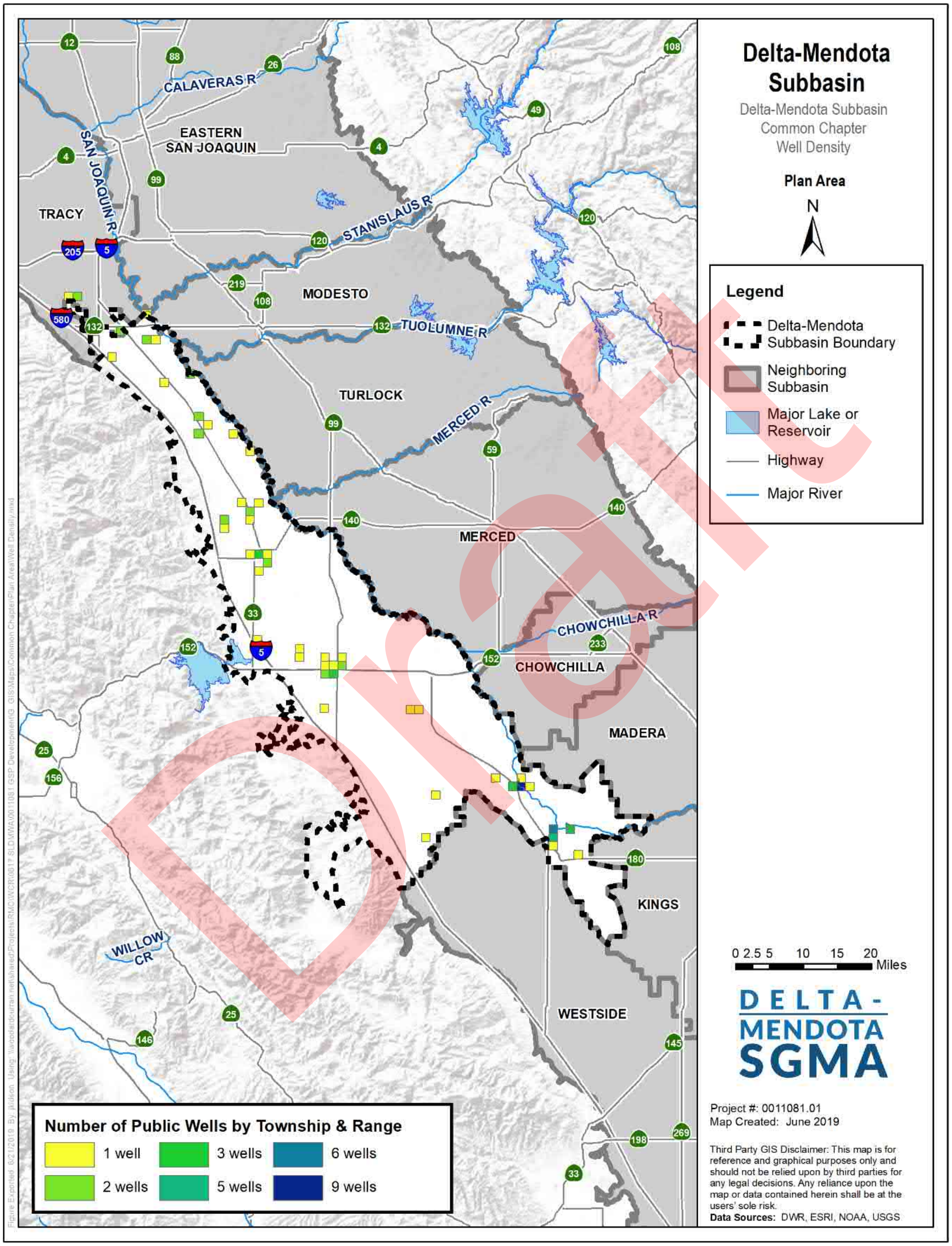


Figure CC-15: Public Well Density in the Delta-Mendota Subbasin

Flood Management

In general, the Delta-Mendota Subbasin slopes toward the San Joaquin River with steeper slopes along the western boundary (near the Coast Range), tapering off closer to the San Joaquin River. The flood management system in the San Joaquin Valley includes reservoirs to regulate snowmelt from elevations greater than 5,000 feet, bypasses at lower elevations, and levees that line major rivers.

Severe rain events in 1997/98, 2005/2006, 2011 and 2017 flooded communities, agricultural lands and refuges adjacent to the San Joaquin River in the Delta-Mendota Subbasin (specifically the communities of Firebaugh, Newman, Gustine and Mendota) and produced some localized flooding of farmland and refuges caused by runoff impoundment by elevated canal banks. Based on the recent historical events, the primary threat of flooding to urban areas will be for those along (and immediately adjacent to) the San Joaquin River. Areas within the 100-year floodplain within the Subbasin are shown in **Figure CC-16**.

Major Land Use Divisions

The Delta-Mendota Subbasin consists mostly of agricultural land use types (**Figure CC-17**). Typical land uses are described in the following sections and consist predominantly of the following:

- Pasture/Rangeland
- Agricultural Land (including rice, field crops and grains)
- Deciduous Forest
- Idle and Retired Farmland/Rangeland
- Riparian/Wetland
- Urban

The primary land use planning entities in the Delta-Mendota Subbasin include San Joaquin, Stanislaus, Merced, Fresno, and Madera Counties, as well as the cities of Patterson, Newman, Gustine, Los Banos, Dos Palos, Firebaugh, and Mendota, and Community of Santa Nella, as shown in **Figure CC-18**.

Pasture/Rangeland

Grasslands in the Central Valley were originally dominated by native perennial grasses such as needlegrass and alkali sacaton. Currently, grassland vegetation is characterized by a predominance of annual or perennial grasses in an area with few or no trees and shrubs. Annual grasses found in grassland vegetation include wild oats, soft chess, ripgut grass, medusa head, wild barley, red brome, and slender fescue. Perennial grasses found in grassland vegetation are purple needlegrass, Idaho fescue, and California oatgrass. Forbs commonly encountered in grassland vegetation include long-beaked filaree, redstem filaree, dove weed, clovers, Mariposa lilies, popcornflower, and California poppy. Vernal pools found in small depressions with an underlying impermeable layer are isolated wetlands within grassland vegetation. Pastures can consist of both irrigated and unirrigated lands dominated by perennial grasses used predominantly for grazing.

Rangeland communities are composed of similar grasses, grass-like plants, forbs, or shrubs which are grazed by livestock. Rangelands are classified into three basic types: shrub and brush rangeland, mixed rangeland, and herbaceous rangeland. The shrub and brush rangeland is dominated by woody vegetation and is typically found in arid and semiarid regions. Mixed rangelands are ecosystems where more than one-third of the land supports a mixture of herbaceous species and shrub or brush rangeland species. Herbaceous rangelands are dominated by naturally occurring grasses and forbs as well as some areas that have been modified to include grasses and forbs as their principal cover. Rangelands are, by definition, areas where a variety of commercial livestock are actively maintained.

Agricultural Land

General agricultural types occurring in the Delta-Mendota Subbasin include row crops, grains, orchards, and vineyards. Management of agricultural lands often includes intensive management, including soil preparation activities, crop rotation, grazing, and the use of chemicals.

Row Crops

Most row crops grown in the San Joaquin Valley and harvested for food are annual species and are managed with a crop rotation system. During the year, several different crops may be produced on a given parcel of land either concurrently or in succession. Typical crops grown in the Delta-Mendota Subbasin include tomatoes, melons, grain crops (such as barley, wheat, corn, and oats), rice, cotton, and beans.

Orchards and Vineyards

Orchard and vineyards consist of cultivated fruit or nut-bearing trees or grapevines. Orchards are typically open, single-species, tree-dominated habitats and are planted in a uniform pattern and intensively managed. Understory vegetation is usually sparse. Vineyards are typically managed in a similar manner for producing grapes for wine and/or direct consumption.

Deciduous Forest

Deciduous forests are composed of trees that lose their leaves in the winter. These include species such as the various California oaks, California buckeye, Fremont Cottonwoods, Goodding Willows, and California Sycamores. The interior live oak, which is not deciduous, is also found in deciduous forests. Valley oak woodlands are found in the Sacramento and San Joaquin Valleys and usually occur below elevations of 2,000 feet.

Idle or Retired Farmland/Rangeland

Lands of this category are similar to abandoned farmlands in ruderal (disturbed) areas. Plants on these parcels may consist of either native and/or non-native species.

Riparian/Wetland

Riparian and wetland communities are both natural and man-made. Managed wetlands are classified as riparian and are flooded for overwintering migratory bird habitat. In the spring the wetlands are drained to promote grasses such as swamp timothy and watergrass which are an important waterfowl food supply. Although some grazing continues on managed wetlands, historically, many of these lands were irrigated and used as rangeland throughout the summer months. Today, managed wetlands are irrigated in the spring to maximize wetland productivity and provide nesting and sensitive species habitat. Managed wetlands also contain emergent vegetation such as cattail and tule and are often adjacent to riparian corridors.

Urban

Urban land uses include cities and smaller communities, in addition to other lands used for industrial and/or commercial practices.

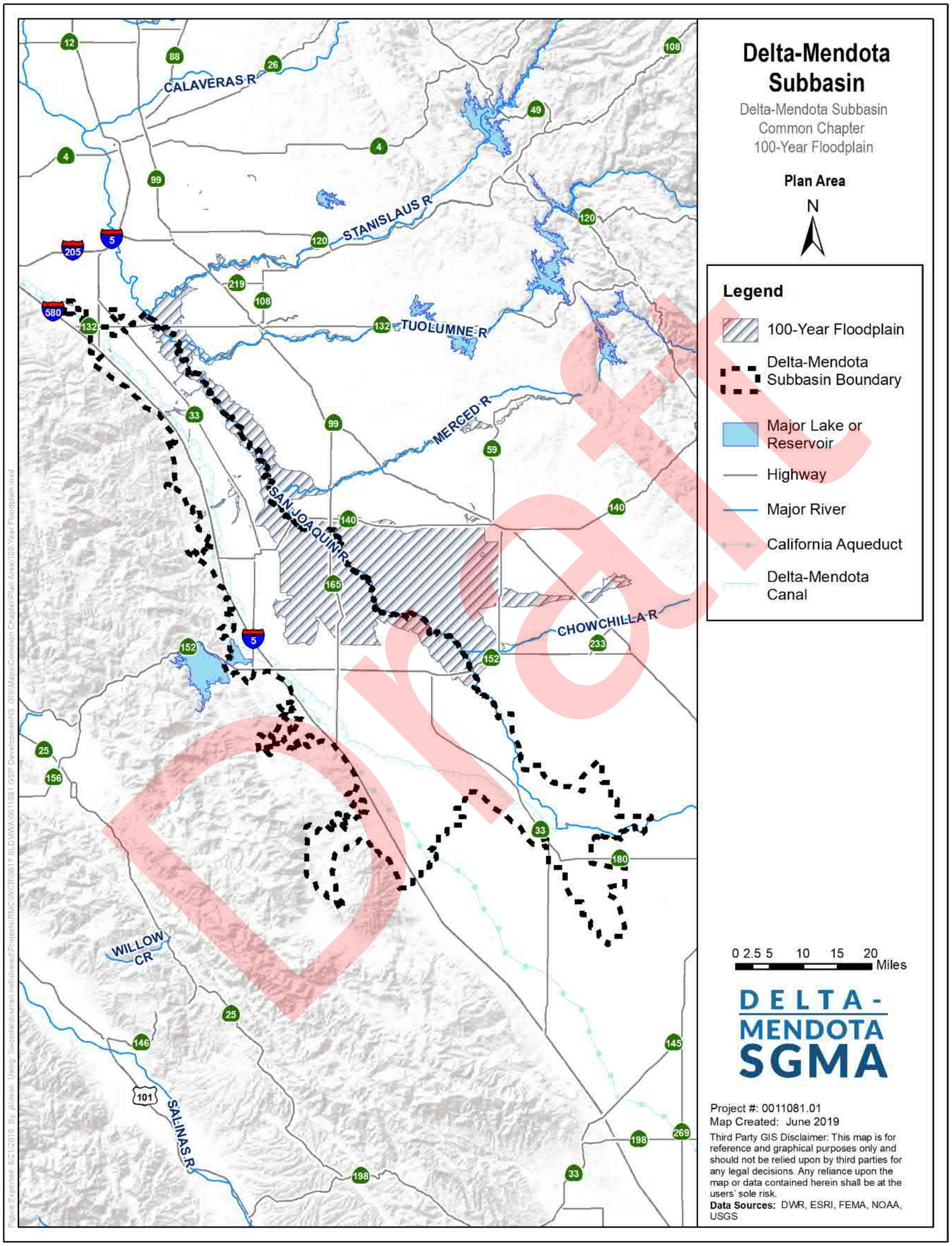


Figure CC-16: 100-Year Floodplain, Delta-Mendota Subbasin

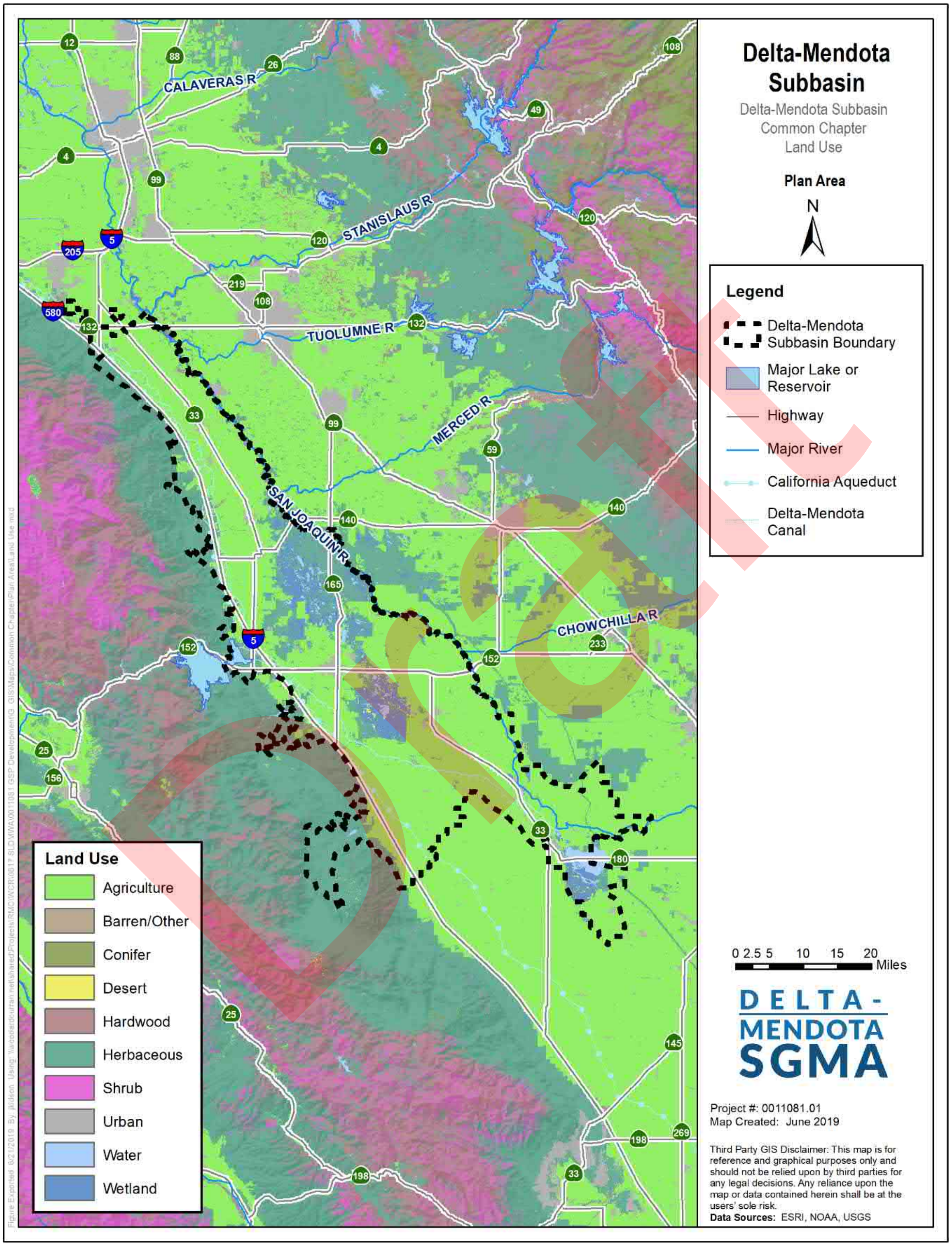


Figure CC-17: Typical Land Use

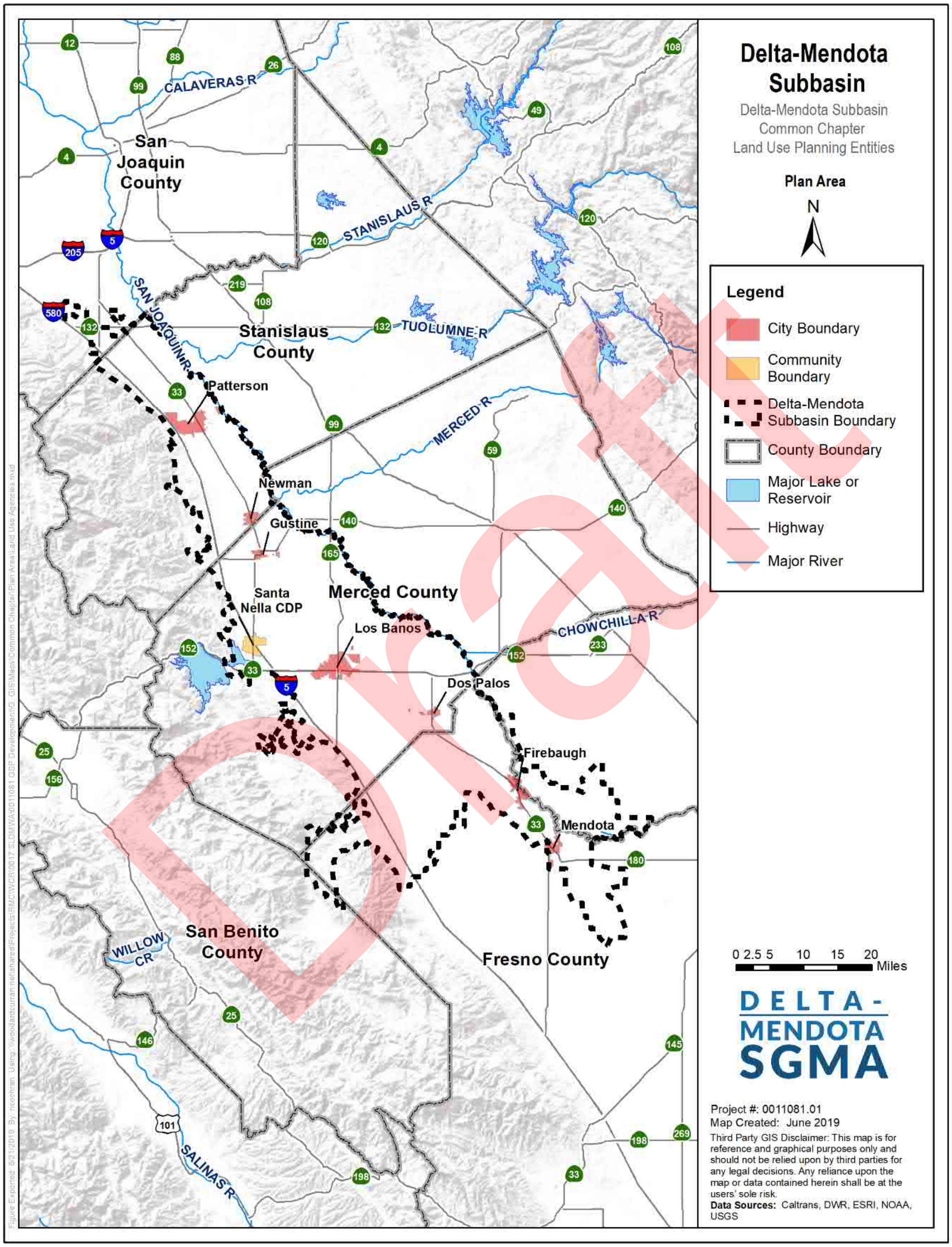


Figure CC-18: Land Use Planning Entities

Regional Economic Issues and Trends

The western San Joaquin Valley is a highly agricultural region. There are no large cities or industries in the Subbasin to provide an alternative economic base. The economy of this region is predominately driven by agricultural production and therefore, the availability of surface water supplies (predominantly in the form of CVP agricultural water and diversions from the San Joaquin and Kings Rivers) is an essential element to the economic health of the region. Other uses of surface water in the Subbasin are used for M&I purposes and wildlife refuge water supply.

Depending on water supply conditions, about 800,000 acres in the Delta-Mendota Subbasin are partially or solely irrigated with surface water. Other economic base industries include travel on the Interstate 5 (I-5) corridor, some petroleum extraction, and tourism. State, federal and private wildlife refuges benefit local economies by attracting hunters, anglers, outdoor recreationists to the region. Managed wetland water conveyance infrastructure is maintained and improved by many contractors and local agency staff. Large scale conveyance improvements and habitat restoration projects, including mitigation banks, are also common throughout the Subbasin. M&I water use, which is a small share of total water use in the Subbasin, occurs primarily within the cities and smaller communities. The largest M&I use areas in the Delta-Mendota Subbasin, based on 2018 population estimates from the U.S. Census Bureau, are the cities of Patterson (population 22,352) and Los Banos (population 30,074) (U.S. Census Bureau, 2017).

All communities within the Delta-Mendota Subbasin have economies greatly dependent on agricultural production. These communities include Patterson, Tranquillity, Grayson, Mendota, Firebaugh, Dos Palos, Los Banos, Santa Nella, Newman, Gustine, Crows Landing, and Westley. All of these communities are strongly affected by the reliability of agricultural water supplies. Some of them are dependent upon groundwater for M&I use.

Plan Area Jurisdictional Boundaries

Jurisdictional areas within the Delta-Mendota Subbasin include counties, cities, water districts, irrigation districts, mutual water companies, and federal and state agencies. There are no federal- or state-recognized tribal communities in the Subbasin. Federal and State Lands are shown in **Figure CC-19**. More detail on specific jurisdictional areas within each GSP area can be found in the respective GSP.

In general, all municipal, water/irrigation districts and counties within the Delta-Mendota Subbasin are participating in GSP development either as a separate GSA or as members of a GSA. The California Department of Fish and Wildlife boundaries and the U.S. Fish and Wildlife Service boundaries overlay the wildlife refuges and areas and state parks within the Subbasin. DWR manages the SWP and the California Aqueduct, and the U.S. Bureau of Reclamation (USBR), through the SLDMWA, manages the CVP and the Delta-Mendota Canal. The California Department of Transportation (Caltrans) is responsible for managing the State and Interstate highways in the Subbasin, including Interstate- (I-) 5, and State Highways 132, 33, 140, 152, and 165.

Figure CC-9 depicts the Subbasin's extent relative to the boundaries of the various counties that overlie the Subbasin. Merced County has jurisdiction over the largest portion of the Subbasin (525 square miles), in the central portion of the Subbasin. Stanislaus County has jurisdiction over most of the area on the northern end of the Subbasin (covering 223 square miles). Fresno and Madera Counties have jurisdiction over the southern extent of the Delta-Mendota Subbasin (400 square miles). Finally, San Benito County covers the smallest portion of the Subbasin (5 square miles) in the southwestern portion of the Subbasin near San Luis Reservoir.

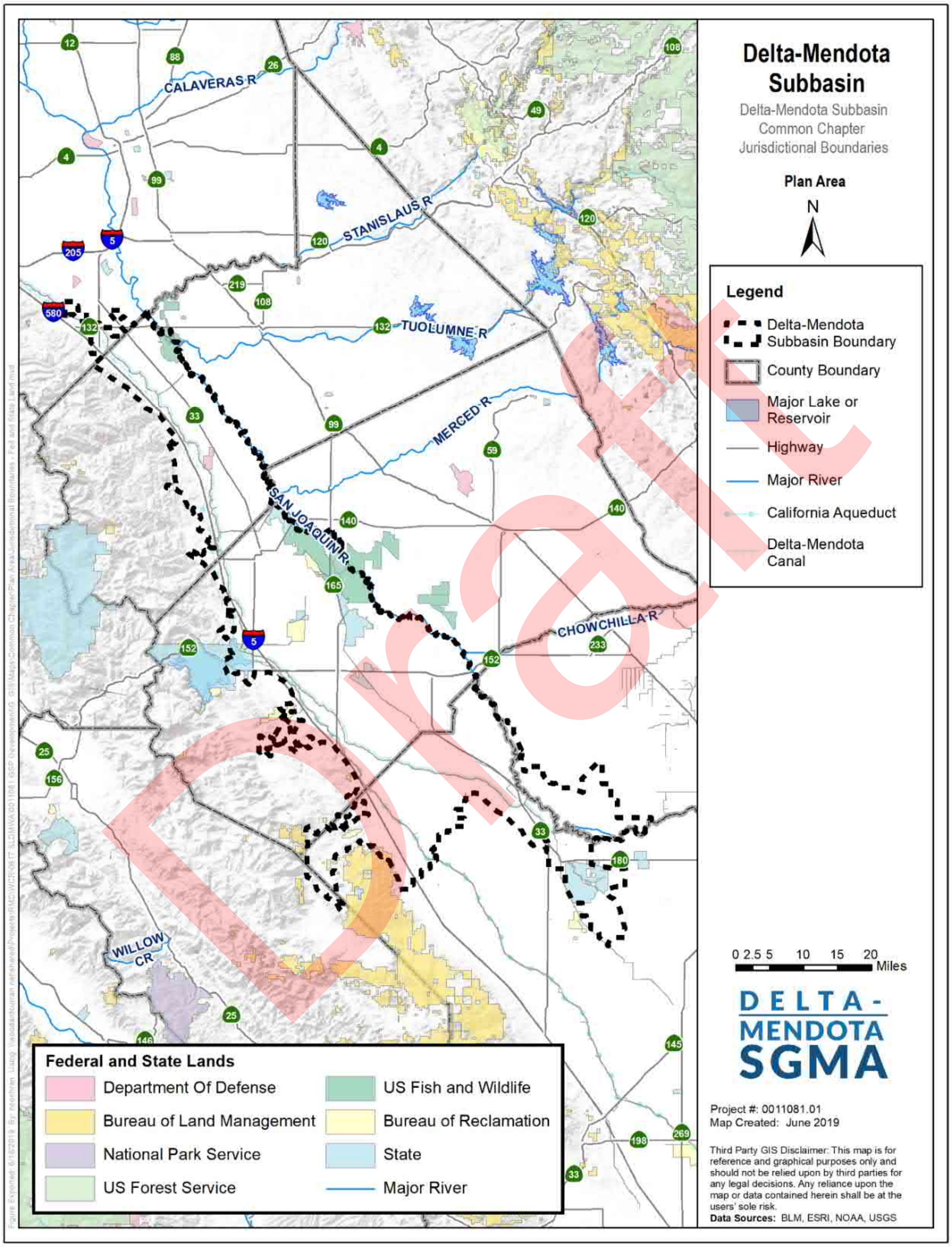


Figure CC-19: Federal and State Lands

Land Use Elements

Land use in the Delta-Mendota Subbasin is predominantly agricultural with wildlife habitat areas and areas of municipal, industrial and commercial use. Predominant crops grown in the region include grain and hay crops, nut and fruit trees, and row crops. **Figure CC-20** shows the distribution of different land use types across the Delta-Mendota Subbasin.

Conjunctive use of surface water and groundwater is practiced throughout much of the Delta-Mendota Subbasin. Urban centers, such as the City of Patterson, and most unincorporated county areas rely solely on groundwater for their water supplies. Several water and irrigation districts hold water rights to divert from the San Joaquin River and/or the Kings Rivers. Other water purveyors receive water from the CVP and use groundwater and non-CVP-acquired surface waters to supplement demand, while some water districts rely solely on groundwater for their supplies. Refer to each GSP for detailed discussions of the water sources used by each agricultural, wetland, and urban water supplier.

Agriculture is the predominant water use sector throughout the Delta-Mendota Subbasin (**Figure CC-20**). Urban water uses are mostly concentrated within and surrounding cities (such as Patterson and Los Banos). Non-irrigated land includes any idle or native riparian land classifications, which are scattered throughout the Regions.

3.3 General Plans in Plan Area

Within each GSP, General Plans and/or Community Specific Plans overlie the area. These include County general plans for Fresno, Merced, San Benito, San Joaquin, Stanislaus, and Madera Counties, and specific plans for cities and communities. Each GSP contains a detailed list of General Plan policies and objectives relevant to water resources management in the applicable GSP area. Refer to discussions in the individual GSPs which satisfy §354.8(f) of the GSP Emergency Regulations under SGMA.

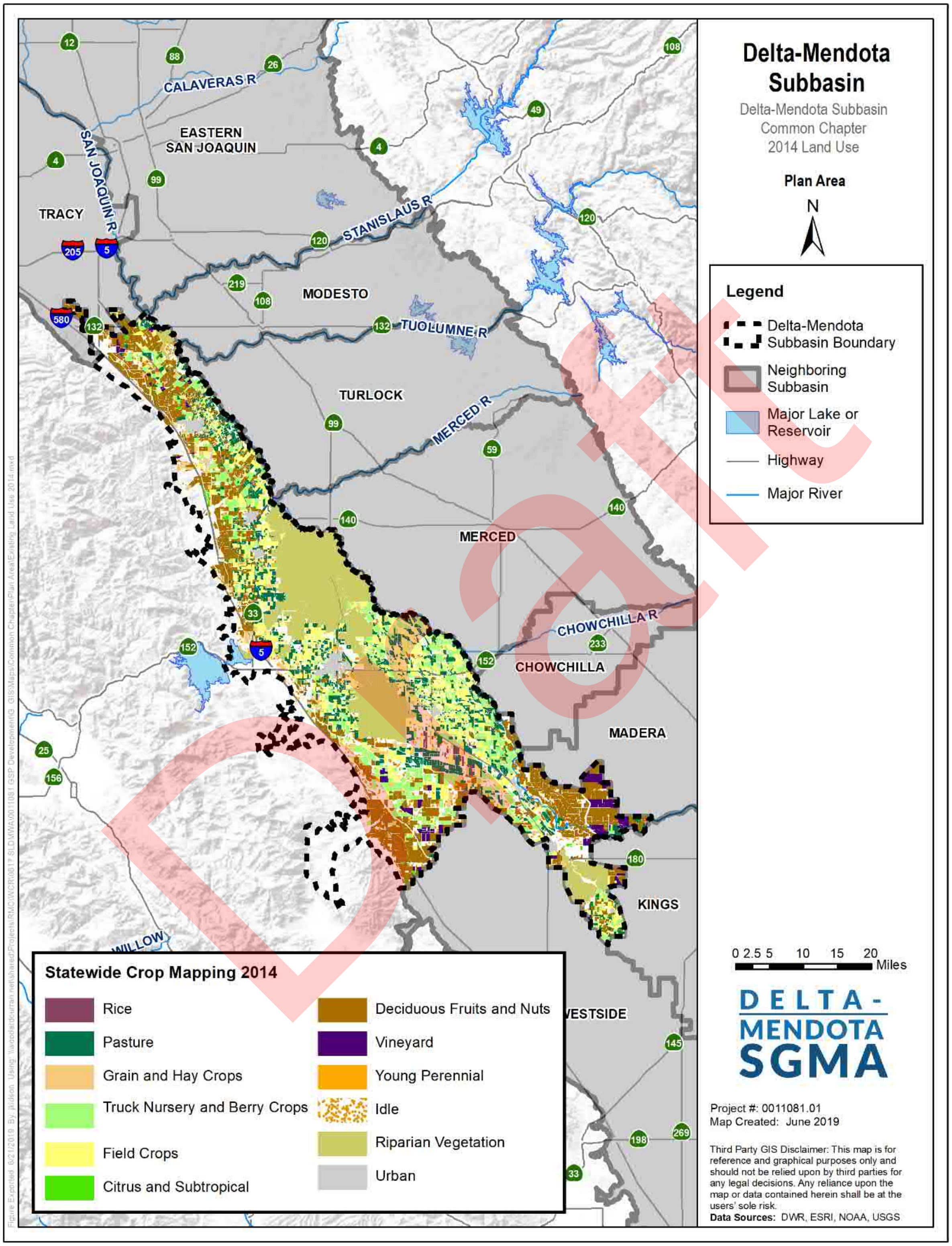


Figure CC-20: 2014 Land Use in the Delta-Mendota Subbasin

3.4 Existing Land Use Plans and Impacts to Sustainable Groundwater Management

Numerous policies in each County's and Community's General Plan compliment the GSPs' plans to conserve and sustainably manage groundwater resources. In general, the County and City General Plans guide future growth and development (and associated demands) within their respective jurisdictional areas. This additional growth may impact groundwater sustainability by placing additional demands on groundwater resources in an area where surface water resources are scarce or are otherwise unavailable. The General Plans also promote water conservation (in both the urban and agricultural sectors), which could potentially offset the additional demands associated with future urban development. In addition to conservation, some (though not all) General Plans promote groundwater recharge, the protection of recharge areas and wetlands, and the use of water transfers to further benefit groundwater sustainability.

Most General Plans within the Delta-Mendota Subbasin include goals focused on preserving agriculture, efficient use of existing and future water sources in both the urban and agricultural sectors, connecting smaller rural communities to larger water systems, and water quality protection. With respect to the protection of water quality and groundwater dependent ecosystems, the General Plans generally protect riparian and wetland habitats, encourage the protection of water quality (including through the remediation of contamination that may impact groundwater quality, requiring the use of septic systems in rural areas that are designed to be protective of groundwater quality and/or the use of community wastewater systems in urban areas), and promote flood control and management (including the associated impacts of erosion and sedimentation of surface water-courses).

The Fresno County General Plan, in particular, promotes sustainability by managing new wells in urban areas, supporting monitoring of water resources and associated habitats, and through the formation of a water resources document repository.

While the magnitude of impacts of these policies over the planning and implementation horizon are not known, such policies have been considered in this GSP, primarily through the use of the General Plans and associated zoning maps to identify future land use types and projected growth areas. These General Plans and mapping were used along with available water master plans, urban water management plans, agricultural water management plans, and other relevant planning documents to determine projected future land use and estimate future water demands by land use sector for use in the projected future water budgets.

Just as the General Plans complement the GSPs, the GSPs in the Delta-Mendota Subbasin may influence the General Plans' goals and policies. Sustainable management of groundwater resources through a GSP may change the pace, location and type of development and/or land use that will occur in the Subbasin. GSP implementation is anticipated to be consistent with the General Plans' goals to sustainably manage land development and water resources in the Subbasin.

3.5 Existing Water Resources Monitoring and Management Programs

As required by §354.8(c) and (d) of the GSP Emergency Regulations, the following section describes key existing water resources-related management and monitoring programs, and a discussion of how these programs will either impact GSP implementation and/or will be incorporated into the GSPs. The information shown below is a high-level summary of key existing programs; please see the individual GSPs for additional relevant management and monitoring programs.

Irrigated Lands Regulatory Program (ILRP)

In 1999, the California Legislature passed Senate Bill 390, which eliminated a blanket waiver of water quality regulations for agricultural waste discharges. The Bill required the Regional Water Quality Control Boards to develop a program to regulate agricultural lands under the Porter-Cologne Water Quality Control Act. In 2003, the Central Valley Regional Water Quality Control Board (CV-RWQCB) issued an order that sets Waste Discharge Requirements (WDRs) for irrigated lands to protect both surface and groundwater throughout the Central Valley, primarily to address nitrates, pesticides, and sediment discharge. The resulting Irrigated Lands Regulatory Program (ILRP) regulates wastes from commercial irrigated lands that discharge into surface and groundwater. The program is administered by the CV-RWQCB working directly with a regional or crop-based coalition as well as directly with irrigators. The goal of the ILRP is to protect surface water and groundwater and to reduce impacts of irrigated agricultural discharges to waters of the State. As a result of the ILRP, monitoring reports, assessment reports, management plans, surface water quality data, and groundwater quality data are made available to the public.

Implementation of the IRLP in the Delta-Mendota Subbasin is managed primarily by the Westside San Joaquin River Watershed Coalition and the Grassland Drainage Area Coalition under the San Joaquin Valley Drainage Authority, a California Joint Powers Authority (JPA). This region specifically emphasizes nitrogen, sediment, and erosion control.

CV-SALTS

The Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) is an initiative to reduce salt and nitrate impacts, restore groundwater quality, and provide safe drinking water supplies. Developed by a group of stakeholders (federal, state, and local agencies, dischargers and growers, and environmental groups) called the Central Valley Salinity Coalition, the Central Valley Salt and Nitrate Management Plan (SNMP) was released in 2017.

The Central Valley SNMP recommends revised and flexible regulations for existing Basin Plans and includes recommended interim solutions for salt and nutrient management in high priority basins in addition to long-term salt management strategies. Under the Central Valley SNMP, dischargers are provided two compliance pathways: (1) traditional permitting as an individual discharger or as a coalition (i.e. irrigated lands coalition), or (2) groundwater management zone permitting. Zone permitting allows dischargers to work as a collective in collaboration with the CV-RWQCB to provide safe drinking water with the option to extend time to achieve nitrogen balance. At this time, the Central Valley SNMP is not currently enforced.

Integrated Regional Water Management Program

Three Integrated Regional Water Management Plans (IRWMPs) overlie the Delta-Mendota Subbasin. The Westside-San Joaquin IRWMP covers most of the Subbasin, while smaller portions of the Subbasin are covered by the East Stanislaus and Madera IRWM Plans.

Integrated Regional Water Management (IRWM) is a collaborative effort to identify and implement water management solutions on a regional scale that increase regional self-reliance, reduce conflict, and manage water to concurrently achieve social, environmental, and economic objectives. Developed by Regional Water Management Groups, the IRWMPs seek to deliver higher value for investments in water resources and management by considering all interests, providing multiple benefits, and working across jurisdictional boundaries. Examples of multiple benefits include improved water quality, better flood management, restored and enhanced ecosystems, and more reliable surface and groundwater supplies. Please see the individual GSPs for additional details regarding the IRWM program in their GSP Plan areas.

California State Groundwater Elevation Monitoring Program (CASGEM)

Since 2009, the California Statewide Groundwater Elevation Monitoring (CASGEM) Program has tracked seasonal and long-term groundwater elevation trends in groundwater basins statewide. The program's mission is to establish a permanent, locally-managed program of regular and systematic monitoring in all of California's alluvial groundwater basins. This early attempt to monitor groundwater continues to exist as a tool to help achieve the goals set out under the Sustainable Groundwater Management Act (SGMA) with mandatory annual water elevation monitoring and reporting.

San Joaquin River Restoration Program (SJRR)

The San Joaquin River Restoration Program (SJRRP) is a comprehensive, long-term effort to restore flows to the San Joaquin River from Friant Dam to the confluence of Merced River and restore a self-sustaining Chinook salmon fishery in the river while reducing or avoiding adverse water supply impacts from Restoration Flows. The program has two general goals resulting from the San Joaquin River Restoration Settlement reached in 2006:

- **Restoration:** To restore and maintain fish populations in "good condition" in the main stem of the San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish.

- **Water Management:** To reduce or avoid adverse water supply impacts to all of the Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided for in the Settlement.

The program includes the implementation of projects, reintroduction activities and associated monitoring to assess progress towards achieving the Settlement goals.

USGS Land Subsidence Monitoring

The USGS maintains and monitors a large system of monitoring locations nationwide using interferometric synthetic aperture radar (InSAR), continuous GPS (CGPS) measurements, campaign global positioning system (GPS) surveying, and spirit-leveling surveying. Aquifer-system compaction is measured by using extensometers to aid in the understanding of the depths at which compaction is occurring. The USGS shares these results to support decision making relative to groundwater basin management with the goal of minimizing future inelastic land subsidence.

3.6 County Well Construction/Destruction Standards and Permitting

DWR has developed well standards for the state per California Water Code Sections 13700 to 13806. These standards have been adopted by the State Water Resources Control Board (SWRCB) into a statewide model well ordinance (Resolution No. 89-98) for use by the Regional Boards for enforcing well construction standards where no local well design ordinance exists that meets or exceeds the DWR standards. DWR's Well Standards are presented in Bulletin 74-81 and Bulletin 74-90.

Each GSP lists the counties within their GSP Plan areas and the respective permitting agencies and local ordinances for well construction and destruction standards. Discussion of these standards and the respective permitting process as well as well abandonment and destruction procedures can be found in the individual GSPs.

3.7 Existing and Planned Conjunctive Use Programs

Conjunctive use programs in the Subbasin are currently implemented and planned by single agencies as well as through multi-agency partnerships. Maximizing the beneficial use of surface water, groundwater, and recycled water resources is of critical concern to water managers throughout the Delta-Mendota Subbasin with the ultimate goal of using all of these water sources more efficiently to avoid overdraft and to sustainably manage groundwater resources. Each GSP describes efforts to utilize existing water resources conjunctively and demonstrate feasibility to continue to implement conjunctive use projects in the future. These may include projects such as groundwater recharge and conveyance facilities, new wells, improved monitoring systems, improved delivery efficiency, water recycling, and water quality improvements and treatment.

Underground recharge and storage occurs throughout the Delta-Mendota Subbasin through stormwater applied water and managed wetland recharge. Stormwater collects both naturally and artificially and eventually percolates through the ground and into aquifers for beneficial use for both urban and agriculture. Recharge from agricultural and wetland water conveyance and irrigation percolates into the ground and eventually into aquifers where it can be pumped again for use. This natural and unmanaged recharge creates future opportunities for conjunctive use programs; however, this recharge may decline as farmers move toward more precise and water efficient irrigation methods.

3.8 Plan Elements from California Water Code Section 10727.4

Each GSP may contain, as deemed appropriate, a detailed discussion of the additional plan elements as identified in California Water Code (CWC) Section 10727.4. These elements are:

- Control of saline water intrusion
- Wellhead protection areas and recharge areas
- Migration of contaminated groundwater
- Well abandonment and well destruction programs
- Activities implementing, opportunities for, and removing impediments to conjunctive use or underground storage
- Measures addressing groundwater contamination cleanup, groundwater recharge, in-lieu use, diversions to storage, conservation, water recycling, conveyance, and extraction projects
- Efficient Water Management Practices, as defined in Section 10902, for the delivery of water and water conservation methods to improve the efficiency of water use
- Efforts to develop relationships with state and federal regulatory agencies
- Processes to review land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risk to groundwater quality or quantity
- Impacts on Groundwater Dependent Ecosystems

4. SUBBASIN SETTING

This Delta-Mendota Subbasin Settings section contains three main subsections as follows:

- **Hydrogeologic Conceptual Model (HCM)** – The HCM section (Section 4.1) provides the geologic information needed to understand the framework that water moves through in the Subbasin. It focuses on geologic formations, aquifers, structural features, and topography.
- **Groundwater Conditions** – The Groundwater Conditions section (Section 4.2) describes and presents groundwater trends, levels, hydrographs and level contour maps, estimates changes in groundwater storage, identifies groundwater quality issues, addresses subsidence, and addresses surface water interconnection.
- **Water Budget** – The Water Budget section (Section 4.3) describes the data used to develop the water budget. Additionally, this section discusses how the budget was calculated, provides water budget estimates for historical conditions, and current conditions and projected conditions

4.1 Hydrogeologic Conceptual Model

This section describes the hydrogeologic conceptual model (HCM) for the Delta-Mendota Subbasin based on technical studies and qualified maps that characterize the physical components and interaction of the surface water and groundwater systems, pursuant to Article 5, Plan Contents, Subarticle 2, Basin Setting, § 354.14 Hydrogeologic Conceptual Model of the GSP Emergency Regulations. The physical description of the Delta-Mendota Subbasin is based on information originally published in the *Western San Joaquin River Watershed Groundwater Quality Assessment Report* (GAR) (LSCE, 2015), *Grassland Drainage Area Groundwater Quality Assessment Report* (LSCE, 2016), and *Groundwater Overdraft in the Delta-Mendota Subbasin* (KDSA, 2015).

4.1.1 Regional Geologic and Structural Setting

The Delta-Mendota Subbasin is located in the northwestern portion of the San Joaquin Valley Groundwater Basin within the southern portion of the Central Valley (**Figure CC-21**). The San Joaquin Valley is a structural trough up to 200 miles long and 70 miles wide filled with up to 32,000 feet of marine and continental sediments deposited during periodic inundation by the Pacific Ocean and by erosion of the surrounding Sierra Nevada and Coast Range mountains, respectively (DWR, 2006). Continental deposits shed from the surrounding mountains form an alluvial wedge that thickens from the valley margins toward the axis of the structural trough. This depositional axis is slightly west of the series of rivers, lakes, sloughs, and marshes which mark the current and historic axis of surface drainage in the San Joaquin Valley.

The Delta-Mendota Subbasin (DWR Basin No. 5-22.07) is bounded on the west by the tertiary and older marine sediments of the Coast Ranges, on the north generally by the San Joaquin-Stanislaus County line, on the east generally by the San Joaquin River and Fresno Slough, and on the south by the Tranquillity Irrigation District boundary near the community of San Joaquin. Surface waters converge from the Fresno, Merced, Tuolumne, and Stanislaus Rivers into the San Joaquin River, which drains to the north toward the Sacramento-San Joaquin Delta.

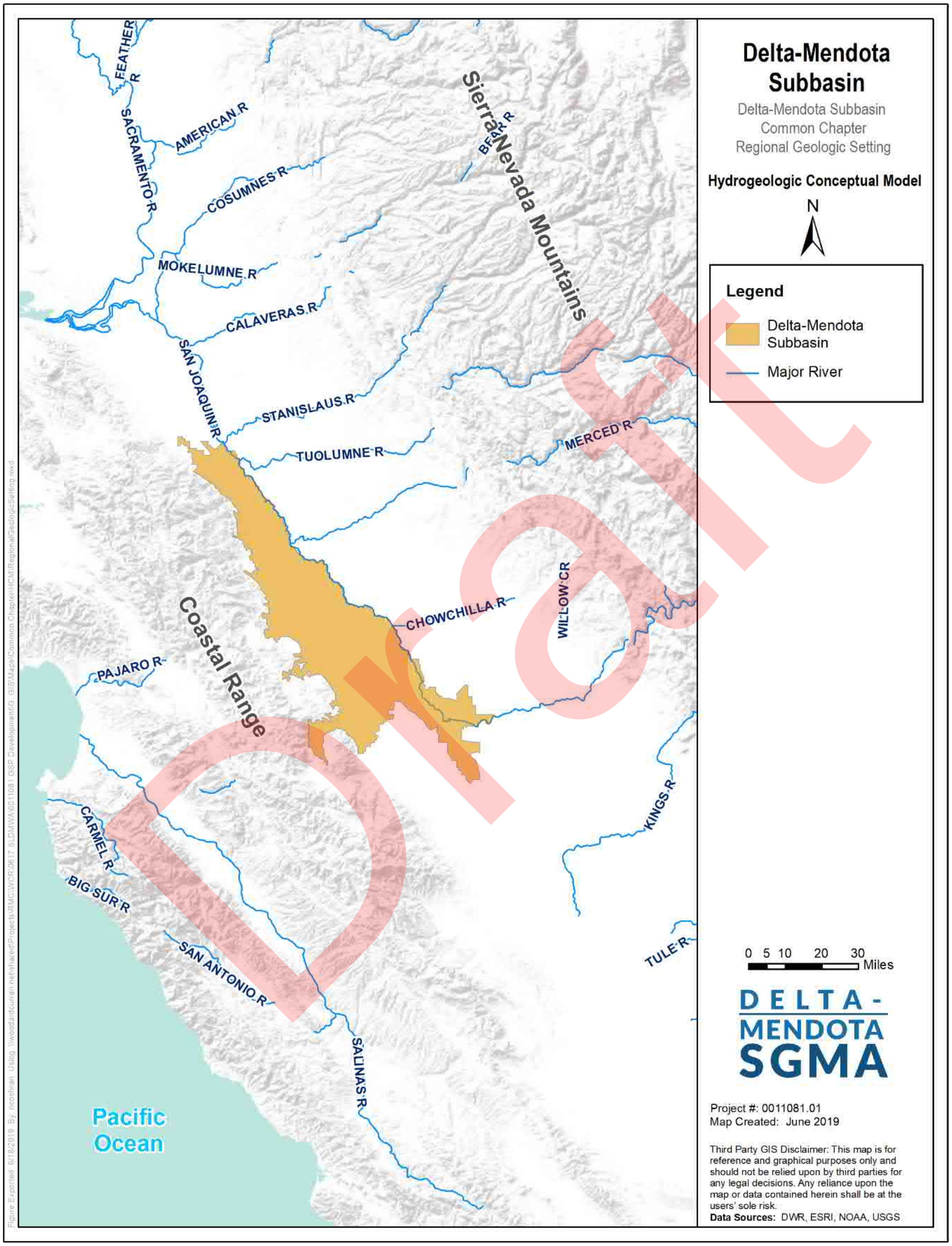


Figure CC-21: Regional Geologic Setting

4.1.2 Geologic History

Approximately three million years ago, tectonic movement of the Oceanic and Continental plates associated with the San Andreas Fault system resulted in the formation of the Coast Range which sealed off the Central Valley from the Pacific Ocean (LSCE, 2015). As this occurred, the floor of the San Joaquin Valley began to transition from a marine depositional environment to a freshwater system with ancestral rivers bringing alluvium to saltwater bodies (Mendenhall et al., 1916). The Coast Ranges on the western side of the San Joaquin Valley consist mostly of complexly folded and faulted consolidated marine and non-marine sedimentary and crystalline rocks ranging from Jurassic to Tertiary age, dipping eastward and overlying the basement complex in the region (Croft, 1972; Hotchkiss and Balding, 1971). The Central Valley Floor, in which the Delta-Mendota Subbasin lies, consists of Tertiary and Quaternary-aged alluvial and basin fill deposits (**Figure CC-22**). The fill deposits mapped throughout much of the valley extend vertically for thousands of feet, and the texture of sediments varies in the east-west direction across the valley. Coalescing alluvial fans have formed along the sides of the valley created by the continuous shifting of distributary stream channels over time. This process has led to the development of thick fans of generally coarse texture along the margins of the valley and a generally fining texture towards the axis of the valley (Faunt et al., 2009 and 2010).

Deposits of Coast Range and Sierra Nevada sources interfinger within the Delta-Mendota Subbasin. Steeper fan surfaces, with slopes as high as 80 feet per mile, exist proximal to the Coast Range, whereas more distal fan surfaces consist of more gentle slopes of 20 feet per mile (Hotchkiss and Balding, 1971). In contrast to the east side of the valley, the more irregular and ephemeral streams on the western side of the valley floor have less energy and transport smaller volumes of sediment resulting in less developed alluvial features, including alluvial fans which are less extensive, although steeper, than alluvial fan features on the east side of the valley (Bertoldi et al., 1991). Lacustrine and floodplain deposits also exist closer to the valley axis as thick silt and clay layers. Lakes present during the Pleistocene epoch in parts of the San Joaquin Valley deposited great thicknesses of clay sediments.

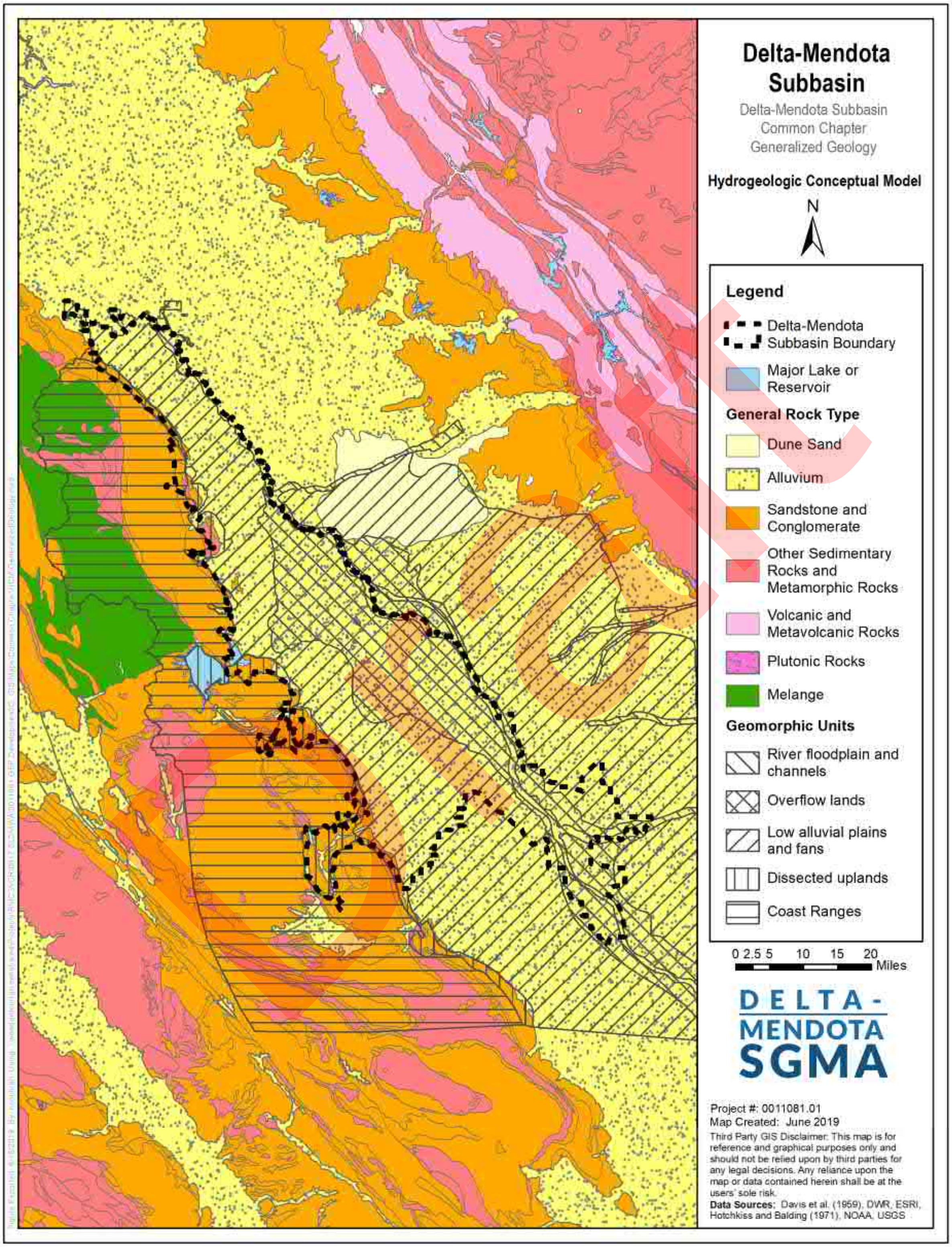


Figure CC-22: Generalized Geology

4.1.3 Geologic Formations and Stratigraphy

Distinct geomorphic units exist within the Delta-Mendota Subbasin defining areas of unique hydrogeologic environments. The geomorphic units are mapped and described by Hotchkiss and Balding (1971) and Davis et al. (1959) and are shown in **Figure CC-22**. The two primary geomorphic units within the Central Valley Floor area of the Delta-Mendota Subbasin include the overflow lands geomorphic unit and the alluvial fans and plains geomorphic unit. Overflow lands are defined as areas of relatively poorly draining soils with a shallow water table. The overflow lands geomorphic unit is located in the southeastern portion of the Subbasin and is dominated by finer-grained floodplain deposits that are the result of historical episodic flooding of this low-land area. This has formed poorly-draining soils with generally low hydraulic conductivity characteristics. In contrast, the alluvial fans and plains geomorphic unit is characterized by relatively better drainage conditions, with sediments comprised of coalescing and somewhat coarser-grained alluvial fan materials deposited by higher-energy streams flowing out of the Coast Range (Hotchkiss and Balding, 1971). The alluvial fans and plains geomorphic unit covers much of the Delta-Mendota Subbasin along the western margins of the Central Valley Floor at the base of the Coast Range.

The primary groundwater bearing units within the Delta-Mendota Subbasin consist of Tertiary and Quaternary-aged unconsolidated continental deposits and older alluvium of the Tulare Formation. Subsurface hydrogeologic materials covering the Central Valley Floor consist of lenticular and generally poorly sorted clay, silt, sand, and gravel that make up the alluvium and Tulare Formation. These deposits are thickest along the axis of the valley with thinning along the margins towards the Coast Range mountains (DWR, 2003; Hotchkiss and Balding, 1971). A zone of very shallow groundwater, generally within 25 feet of the ground surface, exists throughout large areas of the Subbasin, with considerable amounts (greater than 50 percent) of farmland in the area estimated to have very shallow depths to groundwater of less than 10 feet (Hotchkiss and Balding, 1971). Many of these areas are naturally swampy lands adjacent to the San Joaquin River.

The Tulare Formation extends to several thousand feet in depth and to the base of freshwater throughout most of the area and consists of interfingered sediments ranging in texture from clay to gravel of both Sierra Nevadan and Coast Range origin. The formation is composed of beds, lenses, and tongues of clay, sand, and gravel that have been alternatively deposited in oxidizing and reducing environments (Hotchkiss and Balding, 1971).

Terrace deposits of Pleistocene age lie up to several feet higher than present streambeds and are comprised of yellow, tan, and light-to-dark brown silt, sand, and gravel with a matrix that varies from sand to clay (Hotchkiss and Balding, 1971). The water table generally lies below the bottom of the terrace deposits; however, the relatively large grain size of the terrace deposits suggests their value as possible recharge sites. Alluvium is composed of interbedded, poorly to well-sorted clay, silt, sand, and gravel and is divided based on its degree of dissection and soil formation. The flood-basin deposits are generally composed of light-to-dark brown and gray clay, silt, sand, and organic material with locally high concentrations of salt and alkali. Stream channel deposits of coarse sand and gravel are also included.

The Tulare Formation also includes the Corcoran Clay (E-Clay) member, a diatomaceous clay or silty clay of lake bed origin which is a prominent aquitard in the San Joaquin Valley, separating the upper zone from the lower zone and distinguishing the semi-confined Upper Aquifer from the confined Lower Aquifer (Hotchkiss and Balding, 1971). The depth and thickness of the Corcoran Clay are variable within the Central Valley Floor, and it is not present in peripheral areas (outside the Central Valley Floor) of the Subbasin. Within the Upper Aquifer, additional clay layers exist and also provide varying degrees of confinement, including other clay members of the Tulare Formation and layers of white clay identified by

Hotchkiss and Balding (1971). These clays are variable in extent and thickness, but the white clay is noted to be as much as 60 feet thick in areas providing very effective confinement of underlying zones (Croft, 1972; Hotchkiss and Balding, 1971). The Tulare Formation is hydrologically the most important geologic formation in the Delta-Mendota Subbasin because it contains most of the fresh water-bearing deposits. Most of the natural recharge that occurs in the Subbasin is in the alluvial fan apex areas along Coast Range stream channels (Hotchkiss and Balding, 1971).

4.1.4 Faults and Structural Features

The valley floor portion of the Delta-Mendota Subbasin contains no known major faults and is fairly geologically inactive. There are few faults along the western boundary of the Subbasin within the Coast Range mountains, but they are not known to inhibit groundwater flow or impact water conveyance infrastructure (**Figure CC-23**).

4.1.5 Basin Boundaries

The Delta-Mendota Subbasin is defined by both geological and jurisdictional boundaries. The Delta-Mendota Subbasin borders all subbasins within the San Joaquin Valley Hydrologic Region with the exception of the Cosumnes Subbasin. The following subsections describe the lateral boundaries of the Subbasin, boundaries with neighboring subbasins, and the definable bottom of the Delta-Mendota Subbasin.

Lateral Boundaries

The Delta-Mendota Subbasin is geologically and topographically bounded to the west by the Tertiary and older marine sediments of the Coast Ranges, and to the east generally by the San Joaquin River. The northern, central, and southern portion of the eastern boundary are dictated by jurisdictional boundaries of water purveyors within the Delta-Mendota Subbasin.

As described in *California's Groundwater*, DWR Bulletin 118 (2016), the Delta-Mendota Subbasin is in the San Joaquin Valley Groundwater Basin, located along the western edge of the San Joaquin Valley. The northern boundary begins just south of Tracy in San Joaquin County. The eastern boundary generally follows the San Joaquin River and Fresno Slough. The southern boundary is near the small town of San Joaquin. The subbasin is bounded on the west by the coast range. The Subbasin boundary is defined by 20 segments detailed in the descriptions below. The Delta-Mendota Subbasin extends into six (6) counties: San Joaquin, Stanislaus, Merced, Fresno, San Benito, and Madera and is shown in relation to each of the six counties in **Figure CC-9**.

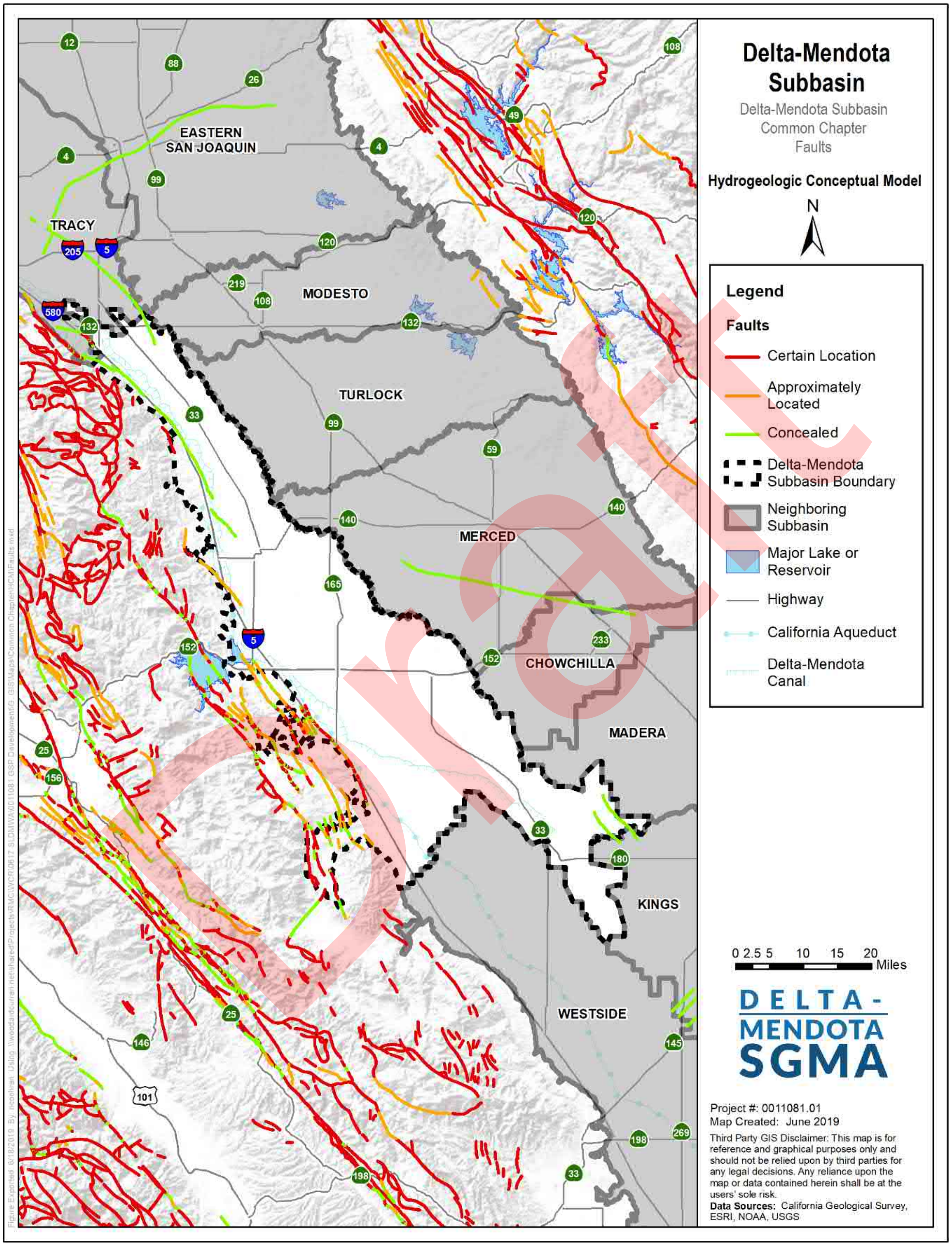


Figure CC-23: Subbasin Faults

4.1.6 Definable Bottom of Basin

In the San Joaquin Valley, the bottom of the Delta-Mendota Subbasin is defined as the interface of saline water of marine origin (base of fresh water) within the uppermost beds of the Tulare Formation. The Tulare Formation is characterized by blue and green fine-grained rocks and principally composed of fine-grained silty sands, silt, and clay (Foss and Blaisdell 1968). The Tulare Formation is predominantly marine in origin and is considered late Pliocene and possibly early Pleistocene in age. This formation is the upper shaley part of the Pliocene sequence. The top of the Tulare Formation is generally encountered around -2,000 feet mean sea level throughout the Delta-Mendota Subbasin. As agreed upon by the Delta-Mendota Subbasin GSP Groups, the base of freshwater is specifically defined by an electrical conductivity of 3,000 micromhos per centimeter at 25 °C, as presented by Page (1973). If and when significant use of water beyond the defined bottom takes place, the definition of the bottom will be revised appropriately.

4.1.7 Principal Aquifers and Aquitards

DWR's Groundwater Glossary defines an aquifer as "a body of rock or sediment that is sufficiently porous and permeable to store, transmit, and yield significant or economic quantities of groundwater to wells, and springs". There are two primary aquifers within the Delta-Mendota Subbasin: a semi-confined aquifer above the Corcoran Clay and a confined aquifer below the Corcoran Clay, with the Corcoran Clay acting as the principal aquitard within the Delta-Mendota Subbasin. **Figure CC-24** shows the locations of the representative cross-sections for the Delta-Mendota Subbasin, where **Figure CC-25** through **Figure CC-30** show the hydrostratigraphy of the representative cross-sections.

While the two-aquifer system described above is generally true across the Delta-Mendota Subbasin, there are portions of the Subbasin where the Corcoran Clay does not exist (predominantly along the western margin of the Subbasin) and hydrogeology is generally controlled by localized interfingering clays, and/or where local hydrostratigraphy results in shallow groundwater conditions that differ, to some extent, from that seen in the Subbasin as a whole. Additionally, in the southern portion of the Subbasin in the Mendota, Aliso and Tranquillity areas, there are A and C Clay layers in addition to the Corcoran Clay that inhibit vertical groundwater flow. However, while there are localized complexities throughout the Subbasin, the Corcoran Clay (or E Clay) extends through much of the Delta-Mendota Subbasin, generally creating a two-aquifer system.

Principal Aquifers

In the Delta-Mendota Subbasin, there are two primary aquifers composed of alluvial deposits separated by the Corcoran Clay (KDSA, 2015): a semi-confined Upper Aquifer (generally the ground surface to the top of the Corcoran Clay), and a confined Lower Aquifer starting at the bottom of the Corcoran Clay to the base of fresh water. However, as previously described, the localized presence of the A and C Clay layers in the southern portion of the Subbasin, the absence of the Corcoran Clay at the western margin of the Subbasin, and/or local hydrostratigraphy result in differing shallow groundwater conditions and/or perched groundwater conditions in some portions of the Subbasin. See the individual GSPs for more detailed descriptions of hydrostratigraphy in the respective Plan areas.

Upper Aquifer

The Upper Aquifer is represented by materials extending from the upper groundwater table to the top of the Corcoran Clay. The Upper Aquifer includes shallow geologic units of younger and older alluvium and upper parts of the Tulare Formation. Sediments within the upper Tulare Formation have variable sources, and subdivision of units can be distinguished between eastern and western sourced materials. Alluvial fan materials above the Corcoran Clay in the Delta-Mendota Subbasin are generally more extensive than older alluvial fan deposits within the Tulare Formation below the Corcoran Clay. As shown in Figure CC-31 by the depth to the top of the Corcoran Clay, the Upper Aquifer extends to depths ranging between approximately 150 feet and greater than 350 feet. Other notable mapped clay units also exist within the upper part of the Tulare Formation in the Delta-Mendota Subbasin, including the A and C Clay members of the Tulare Formation and a white clay mapped by Hotchkiss and Balding (1971).

Lower Aquifer

The Lower Aquifer is the portion of the Tulare Formation that is confined beneath the Corcoran Clay, extending downward to the underlying San Joaquin Formation and the interface of saline water of marine origin within its uppermost beds. The Lower Aquifer is generally characterized by groundwater that tends to be dominantly sodium-sulfate type, which is often of better quality than the Upper Aquifer (Davis et al., 1957; Hotchkiss and Balding, 1971). Exceptions to this quality do exist in the Subbasin, particularly in the southwestern portion of the Subbasin. Because of its relatively shallow depth within the Delta-Mendota Subbasin and lower salinity in areas when compared to other groundwater resources, the Lower Aquifer is heavily utilized as a source of groundwater for agricultural and drinking water uses within the Subbasin.

The base of the Lower Aquifer generally decreases from south to north, changing in depth from about 1,100 to 1,200 feet deep in the south to about 600 feet to the north. Depth to the top of the Corcoran Clay ranges from less than 100 feet on the west near Interstate 5 (I-5) to more than 500 feet in the area near Tranquillity. The Corcoran Clay pinches out or is above the water level near the California Aqueduct in the western part of the Subbasin, where the Upper and Lower Aquifers merge into interfingered layers of sand, gravel, and clay.

Corcoran Clay

The Corcoran Clay, as a regional aquitard, is a notable hydrogeologic feature throughout most of the Delta-Mendota Subbasin, impeding vertical flow between the Upper and Lower Aquifers. The Corcoran Clay is present at varying depths across most of the Central Valley floor (**Figure CC-31** and **Figure CC-33**). The depths to the top of the Corcoran Clay ranges between approximately 100 and 500 feet below the ground surface throughout most of the Subbasin, with a general spatial pattern of deepening to the south and east. In the far southeastern area of the Subbasin, in the vicinity of Mendota and Tranquillity, the top of the Corcoran Clay is at depths of greater than 350 feet (**Figure CC-31**). The thickness of the Corcoran Clay, which likely influences the degree of hydraulic separation between the Upper and Lower Aquifers, is greater than 50 feet across most of the Delta-Mendota Subbasin with thicknesses of more than 75 feet in central Subbasin areas in the vicinity of Los Banos and Dos Palos, and 140 feet in the eastern portions of the Subbasin. The Corcoran Clay appears thinner in areas north of Patterson, between Patterson and Gustine, and also in the vicinity of Tranquillity to the south (**Figure CC-33**). Along the westernmost portions of the Delta-Mendota Subbasin, the Corcoran Clay layer is generally non-existent or it exists as Corcoran-equivalent clays (clays existing at the same approximate depth but not part of the mapped aquitard).

Aquifer Properties

The following subsections include discussion of generalized aquifer properties within the Delta-Mendota Subbasin. These include hydraulic conductivity, transmissivity, specific yield and specific storage.

DWR defines hydraulic conductivity as the "measure of a rock or sediment's ability to transmit water" and transmissivity as the "aquifer's ability to transmit groundwater through its entire saturated thickness" (DWR, 2003). High hydraulic conductivity values correlate with areas of transmissive groundwater conditions with transmissivity generally equaling hydraulic conductivity times the saturated thickness of the formation. Storage of water within the aquifer system can be quantified in terms of the specific yield for unconfined groundwater flow and the storage coefficient for confined flow, respectively (Faunt et al., 2009). Specific yield represents gravity-driven dewatering of shallow, unconfined sediments at a declining water table, but also accommodates a rising water table. The specific yield is dimensionless and represents the volume of water released from or taken into storage per unit head change per unit area of the water table. Specific yield is a function of porosity and specific retention of the sediments in the zone of water-table fluctuation.

Where the aquifer system is confined, storage change is governed by the storage coefficient, which is the product of the thickness of the confined-flow system and its specific storage. The specific storage is the sum of two component specific storages – the fluid (water) specific storage and the matrix (skeletal) specific storage, which are governed by the compressibility of the water and skeleton, respectively (Jacob, 1940). Specific storage has units of 1 over length and represents the volume of water released from or taken into storage in a confined flow system per unit change in head per unit volume of the confined flow system (Faunt et al., 2009). Therefore, the storage coefficient of a confined flow system is dimensionless and, similar to specific yield, represents the volume of water released from or taken into storage per unit head change.

Hydraulic Conductivity

Figure CC-34 shows the saturated C-horizon hydraulic conductivity of surficial soils within the Delta-Mendota Subbasin based on the National Resource Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO). Soil survey data for counties within the Subbasin were combined using the weighted harmonic mean of these representative layers to depict the saturated hydraulic conductivity of the C-horizon for each soil map unit. The soil profile represented by these data is variable but commonly extends to a depth of six or more feet.

Floodplain deposits are evident as soils with relatively low hydraulic conductivity (less than 0.5 feet per day [ft/day]) blanket much of the Central Valley Floor, although localized areas of soils with higher hydraulic conductivity are present in association with modern and ancient surface waterways and alluvial fan features (**Figure CC-34**). Coarse soils of distributary alluvial fan sediments deposited by Del Puerto Creek, Orestimba Creek, Los Banos Creek, Ortigalita Creek, and Little Panoche Creek, in addition to other ephemeral northeasterly creek flows off the Coast Ranges, are notably apparent as areas of soils of high hydraulic conductivity located along active and inactive stream channels extending eastward from the fan apex areas along the Valley Floor margins to the current alignment of the San Joaquin River in the valley axis. Additionally, soils in areas adjacent to the active channel of the San Joaquin River also exhibit high hydraulic conductivities, including values of greater than 4 ft/day which are particularly apparent in an area north of Mendota. Soils of similarly high hydraulic conductivity trending as linear features in a general northwest-southeast alignment to the north of Dos Palos and Los Banos are likely the result of historical depositional processes and paleochannels associated with the San Joaquin River (**Figure CC-34**). In areas peripheral to the Central Valley floor, soils tend to be characterized by relatively low hydraulic conductivity, although soils of somewhat higher hydraulic conductivity associated with distinct geologic units are mapped across much of the peripheral area to the west of Patterson and Gustine and also in localized bands associated with surface water courses.

Transmissivity

Transmissivity varies greatly above the Corcoran Clay, within the Corcoran Clay, and below the Corcoran Clay within the Delta-Mendota Subbasin, with transmissivities in the confined Lower Aquifer generally being larger than those in the semi-confined Upper Aquifer. Based on testing conducted at multiple locations within both the Upper and Lower Aquifers of the Delta-Mendota Subbasin, average transmissivities in the Subbasin are approximately 109,000 gallons per day per square foot (gpd/ft^2) (KDSA, 1997b).

Specific Yield

DWR defines specific yield as the "amount of water that would drain freely from rocks or sediments due to gravity and describes the proportion of groundwater that could actually be available for extraction" (DWR, 2003). Specific yield is a measurement specific to unconfined aquifers.

The estimated specific yield of the Delta-Mendota Subbasin is 0.118 (DWR, 2006). Within the southern portion of the Delta-Mendota Subbasin, specific yield ranges from 0.2 to 0.3 (Belitz et al., 1993). Specific yield estimates for the Delta-Mendota Subbasin are fairly limited in literature since the Upper Aquifer above the Corcoran Clay is semi-confined and the Lower Aquifer below the Corcoran Clay is confined. Therefore, specific yield values only characterize the shallow, unconfined groundwater within the Subbasin.

Specific Storage

Values for specific storage were extracted from the Central Valley Hydrologic Model 2 (CVHM2), which is currently under development by the United States Geological Survey (USGS) and includes refinements for the Delta-Mendota Subbasin. Specific storage varies above, within, and below the Corcoran Clay with CVMH2. Above the Corcoran Clay, specific storage ranges from 1.34×10^{-6} to 6.46×10^{-2} meters^{-1} (m^{-1}) with average values ranging from 6.16×10^{-3} to 1.97×10^{-2} m^{-1}. Specific storage within the Corcoran Clay is considerably smaller than above the Corcoran Clay, ranging between 1.41×10^{-6} and 2.35×10^{-6} m^{-1} and average values between 1.96×10^{-6} and 2.02×10^{-6} m^{-1}. Below the Corcoran Clay, specific storage is comparable to within the Corcoran Clay with overall ranges the same as within the Corcoran Clay and average values ranging from 1.86×10^{-6} to 2.01×10^{-6} m^{-1}. Therefore, specific storage is greatest within the semi-confined aquifer overlying the Corcoran Clay layer, with considerably smaller specific storage values within the low permeability Corcoran Clay and confined aquifer underlying the Corcoran Clay layer.

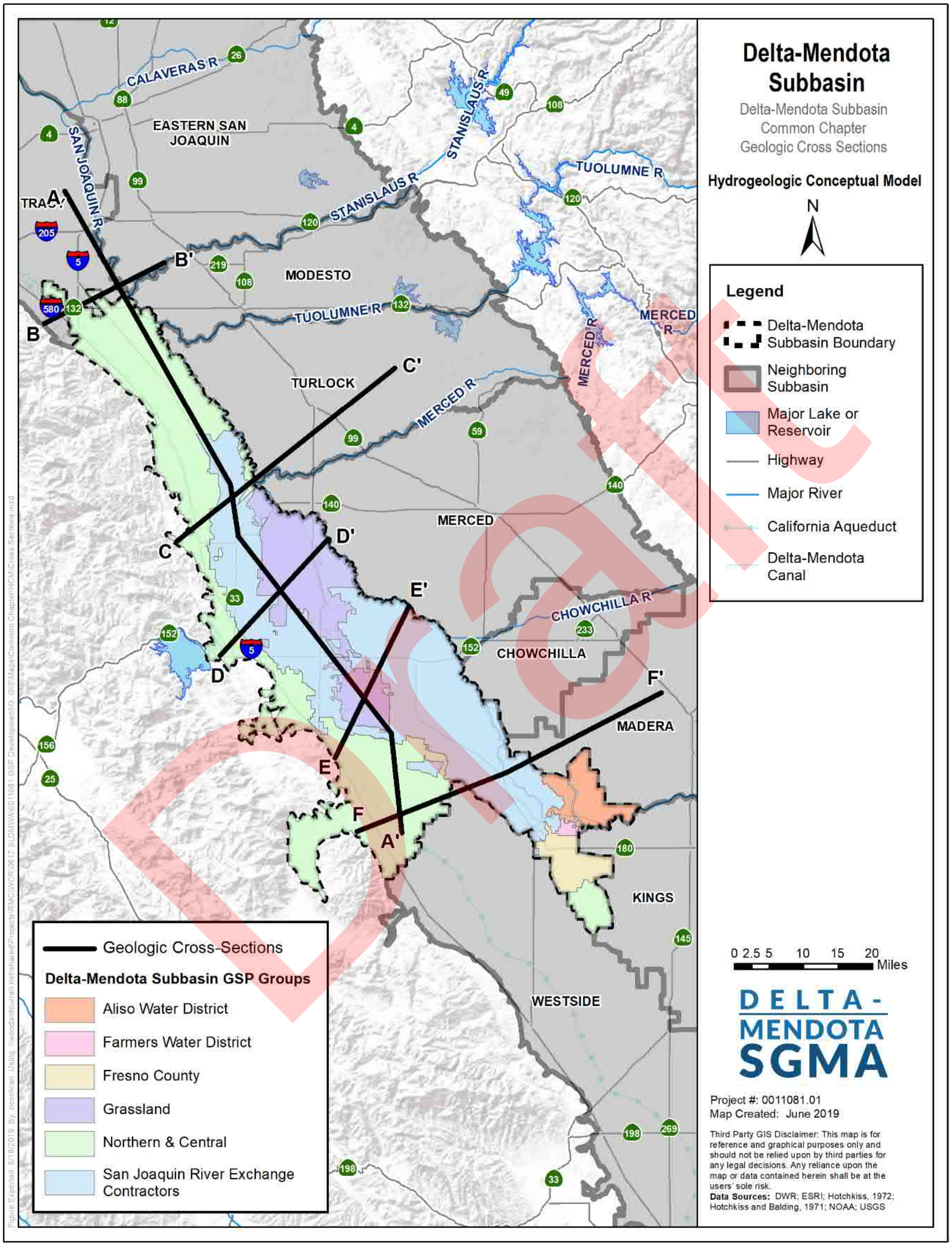


Figure CC-24: Representative Cross-Sections

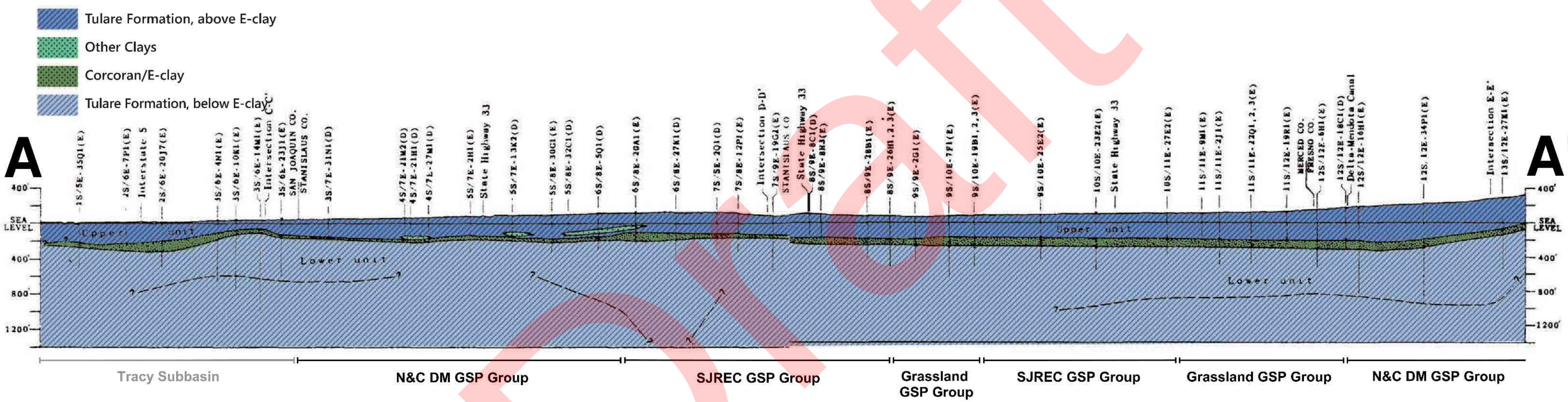


Figure CC-25: Cross-Section A-A' (Hotchkiss, 1972)

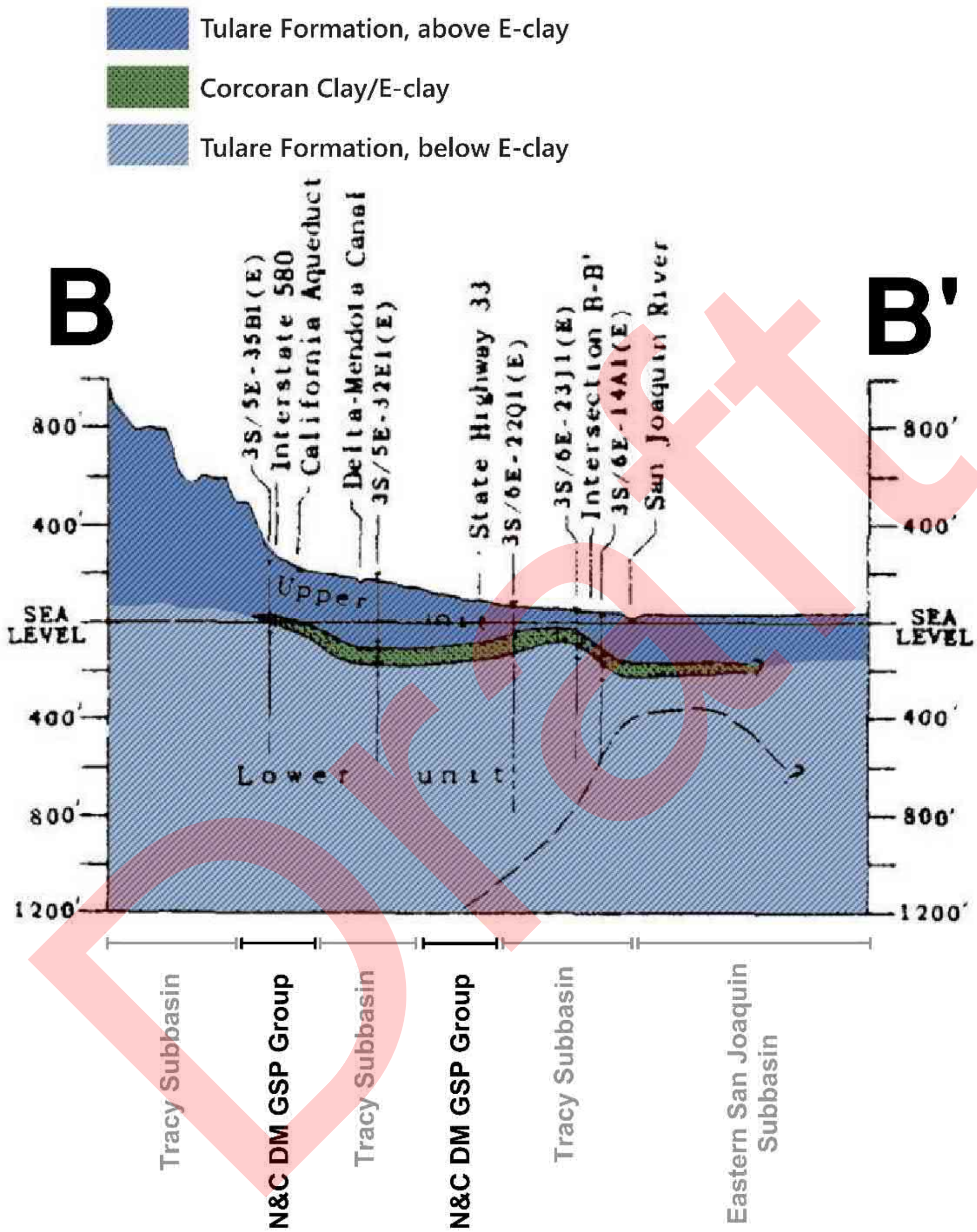


Figure CC-26: Cross-Section B-B' (Hotchkiss, 1972)

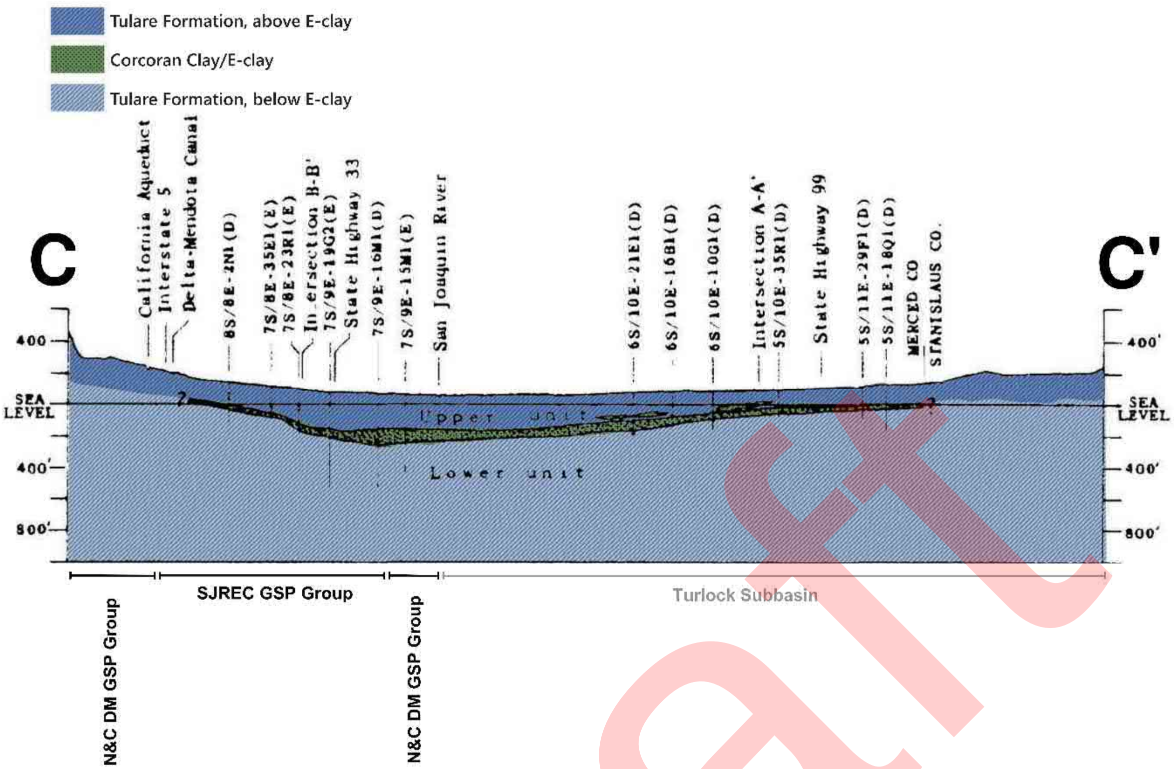


Figure CC-27: Cross-Section C-C' (Hotchkiss, 1972)

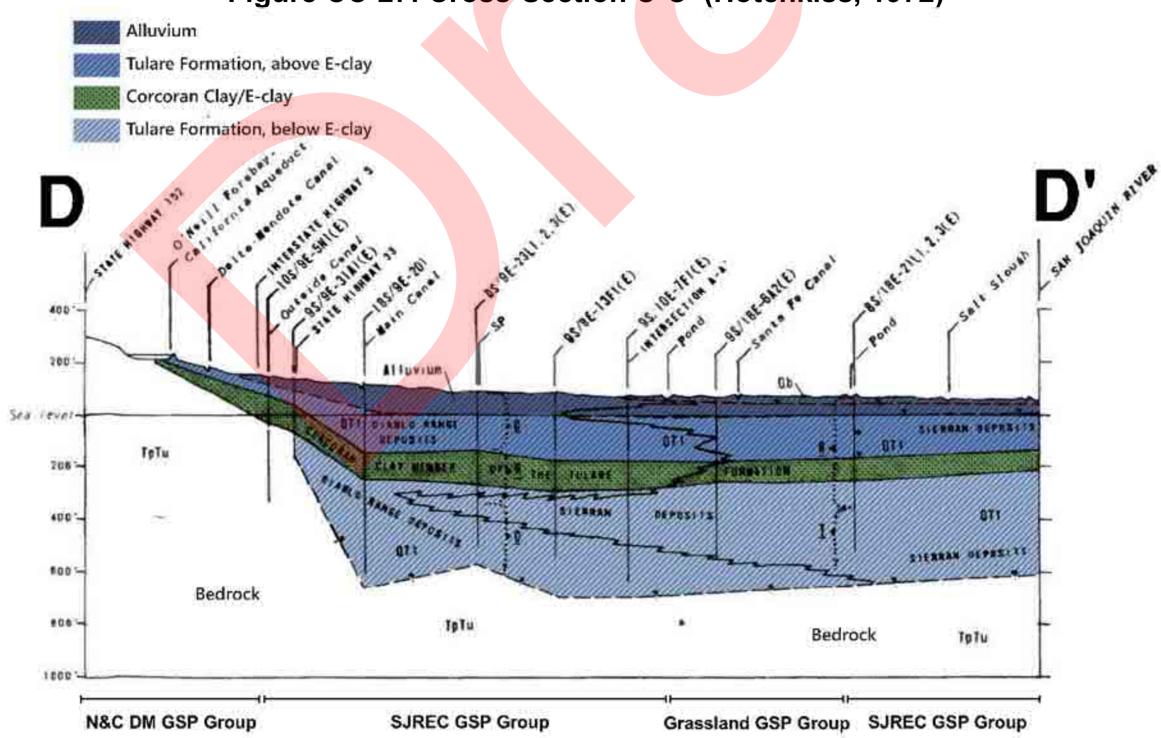


Figure CC-28: Cross-Section D-D' (Hotchkiss & Balding, 1971)

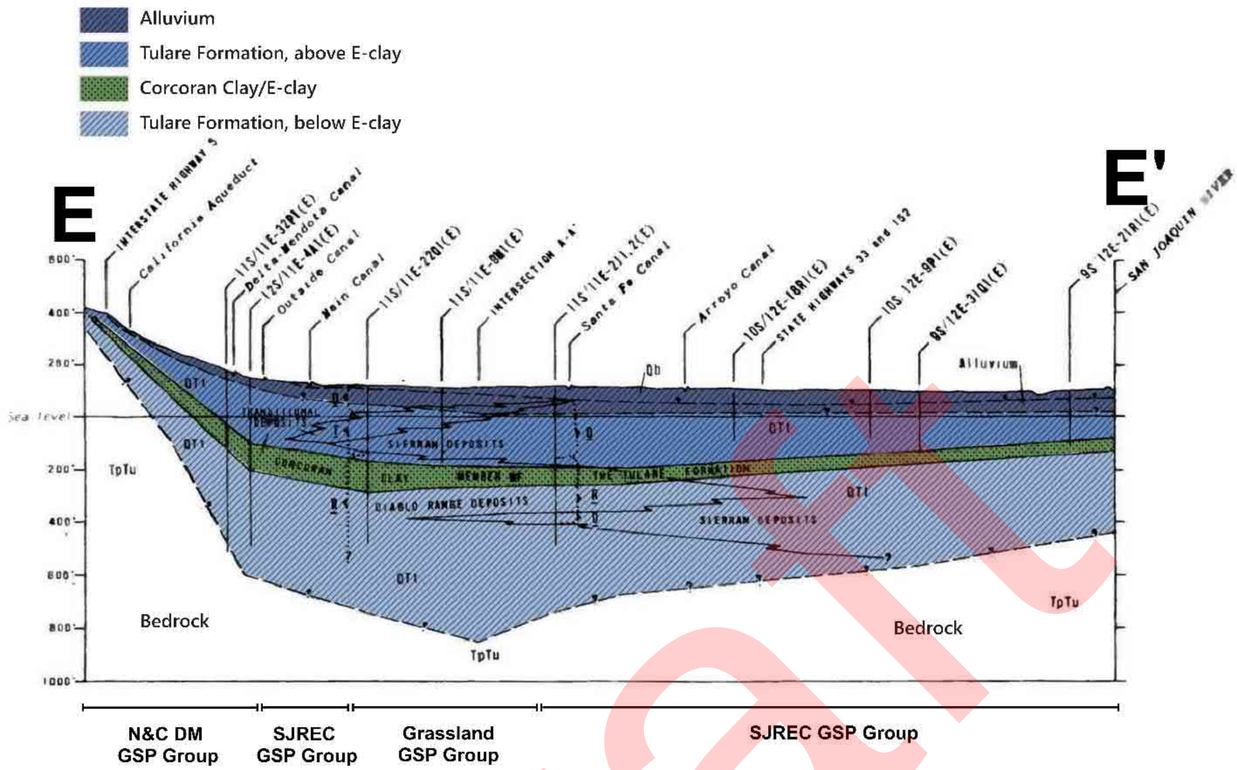


Figure CC-29: Cross-Section E-E' (Hotchkiss & Balding, 1971)

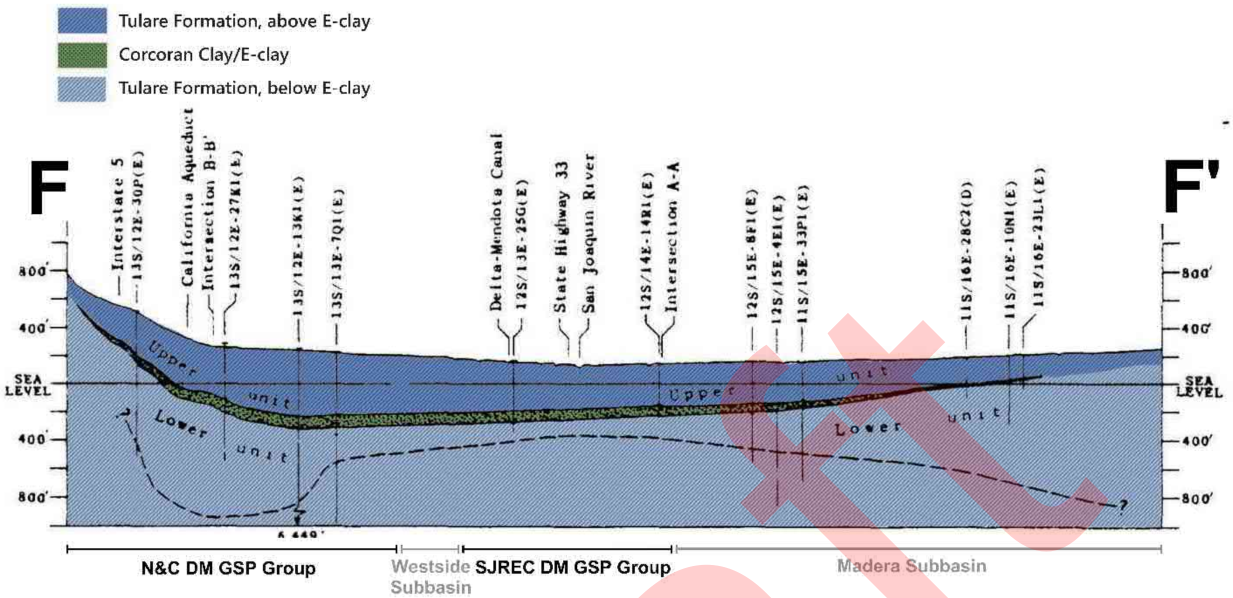


Figure CC-30: Cross-Section F-F' (Hotchkiss, 1972)

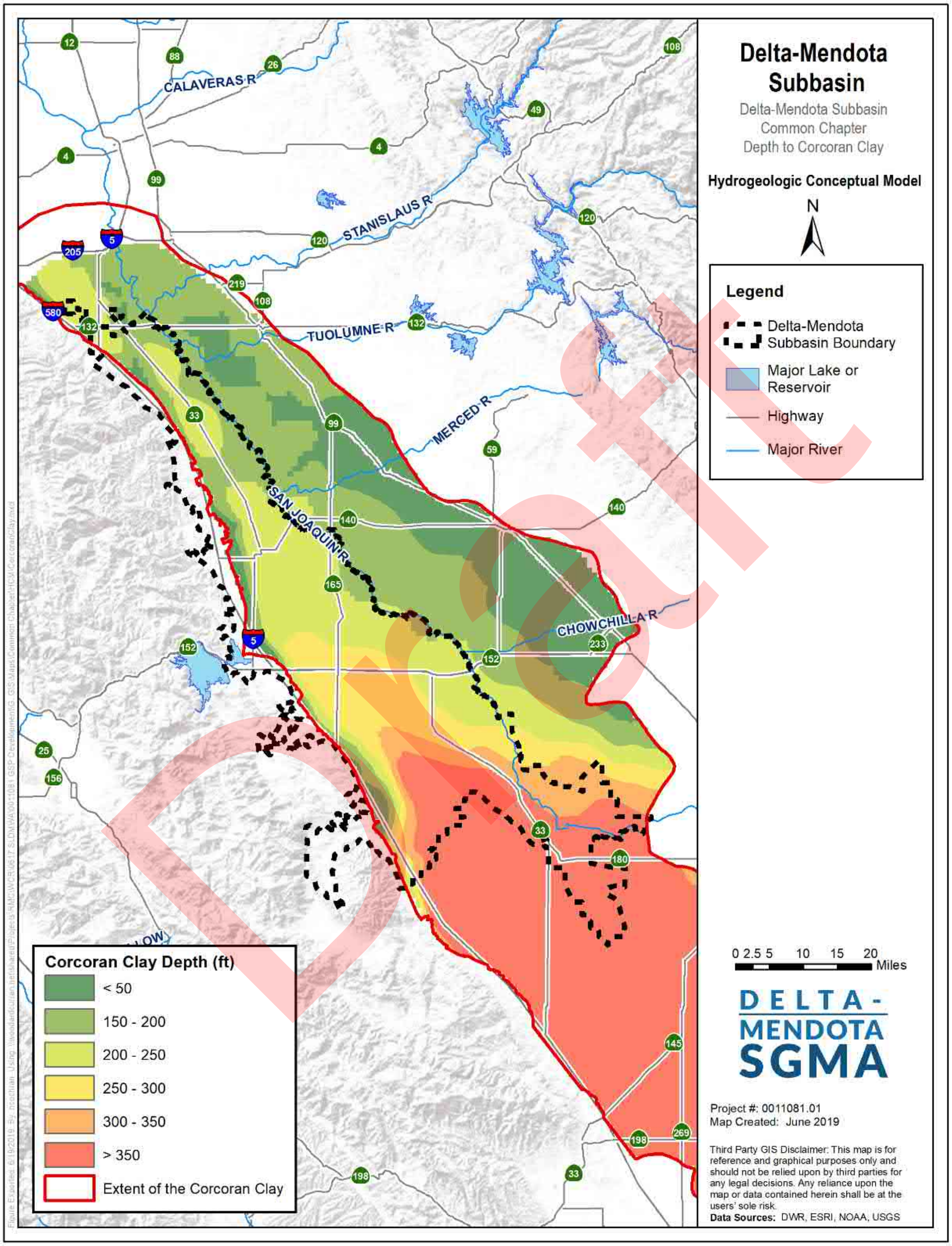


Figure CC-31: Depth to Corcoran Clay

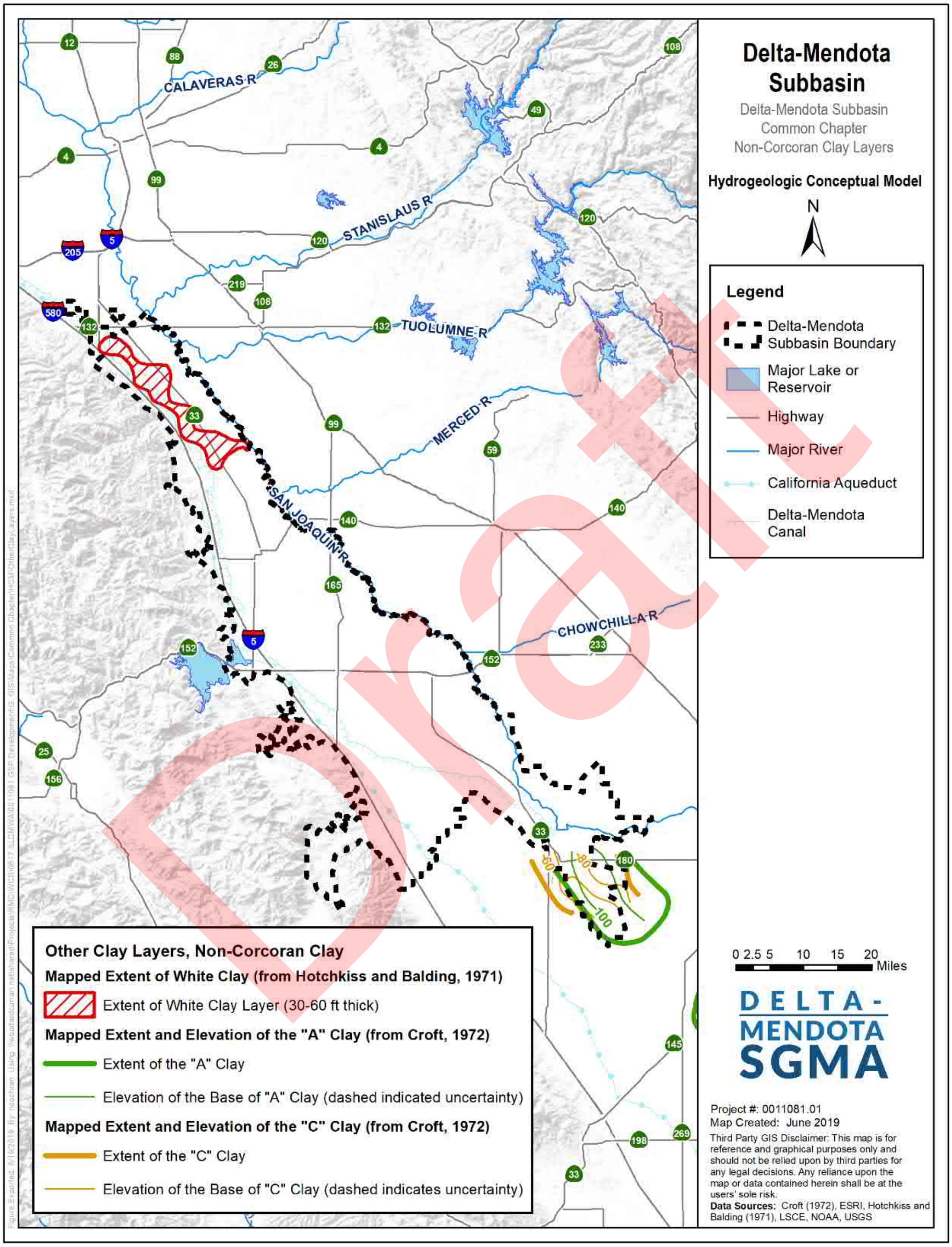


Figure CC-32: Non-Corcoran Clay Layers

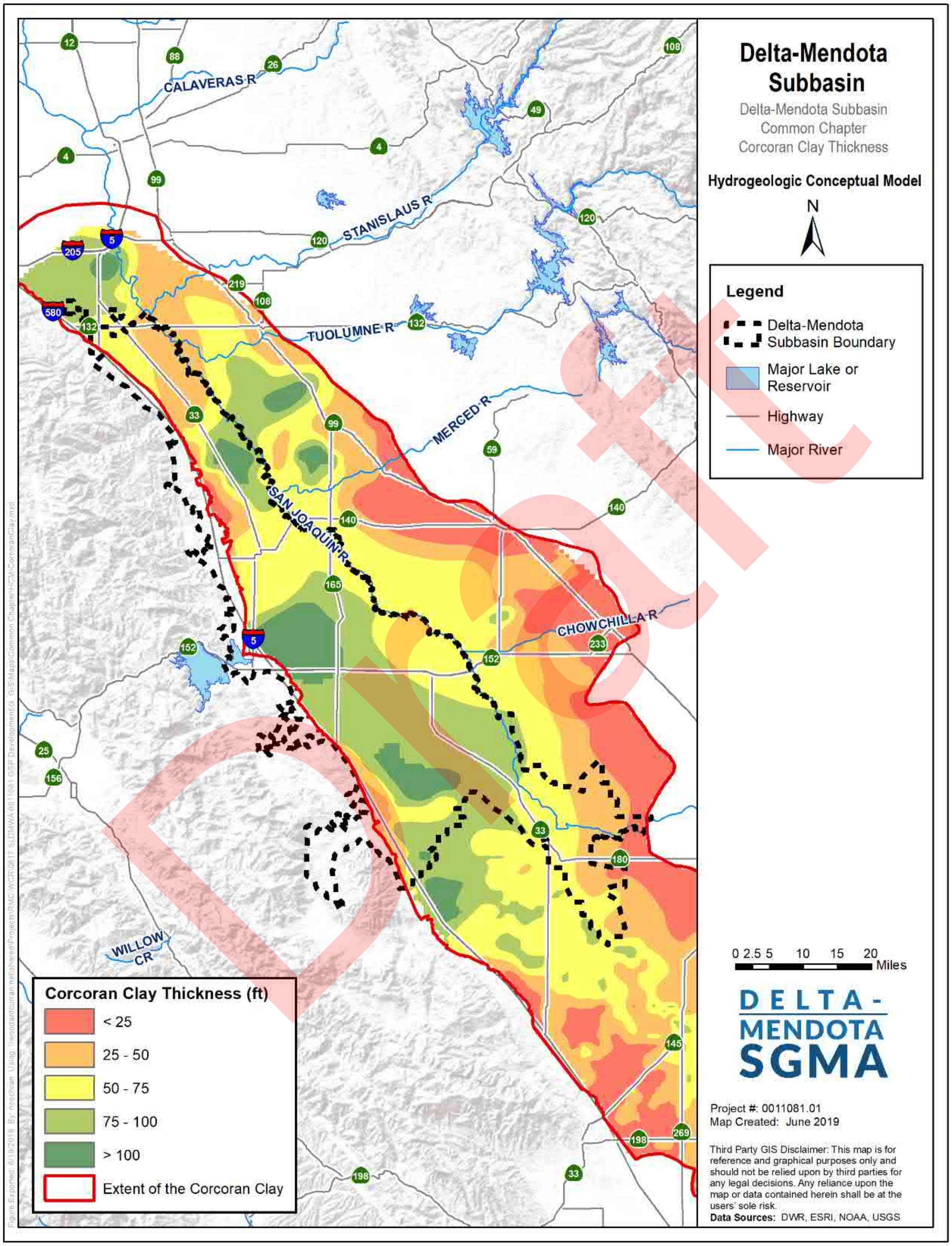


Figure CC-33: Thickness of Corcoran Clay

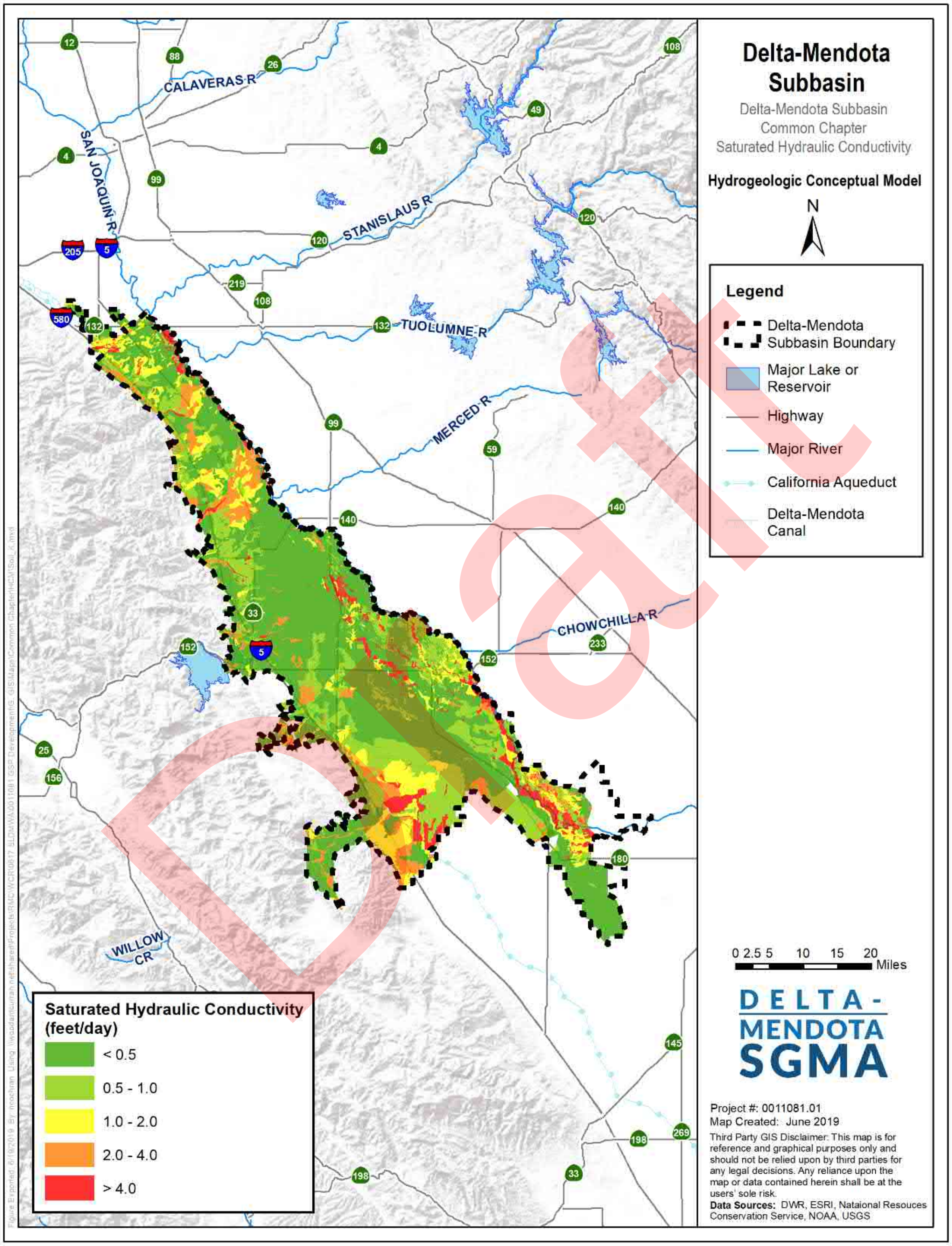


Figure CC-34: Soil Hydraulic Conductivity

4.1.8 Structural Properties and Restricted Groundwater Flow

Under natural (pre-development) conditions, the prevailing groundwater flow within the Upper and Lower Aquifer systems of the western San Joaquin Valley was predominantly in a generally northeasterly direction from the Coast Range towards and parallel to the San Joaquin River and the Sacramento-San Joaquin Delta (LSCE, 2015; Hotchkiss and Balding, 1971; KDSA, 2015). Historically, numerous flowing artesian wells within the Lower Aquifer existed throughout the Delta-Mendota Subbasin (Mendenhall et al., 1916) and the pressure gradient for groundwater flow was upward from the Lower Aquifer to the Upper Aquifer. These flowing artesian conditions have disappeared in many areas as a result of increased development of groundwater resources within the Tulare Formation (Hotchkiss and Balding, 1971). Additionally, the Delta-Mendota Subbasin has experienced periods of considerable decline in groundwater levels during which hydraulic heads in the Lower Aquifer decreased considerably in some areas due to heavy pumping (Bertoldi et al., 1991).

Despite the presence of local pumping depressions within parts of the Subbasin, the prevailing northeastward flow direction for groundwater in the Upper Aquifer within the region has remained (AECOM, 2011; DWR, 2010; Hotchkiss and Balding, 1971). Groundwater generally flows outward from the Delta-Mendota Subbasin, except along the southern and western margins where there is some recharge from local streams and canal seepage (KDSA, 2015), in addition to northward subbasin boundary flows. Within the Upper Aquifer, there are similar groundwater flow directions in most of the Subbasin with groundwater outflow to the northeast or towards the San Joaquin River in much of the Subbasin during wet and normal periods. One exception is in the Orestimba Creek area west of Newman where groundwater flows to the west during drought conditions and east during wet periods. Calculations based on aquifer transmissivity indicate the net groundwater outflow in the Upper Aquifer has been about three times greater during drought periods than during normal periods (KDSA, 1997a and 1997b).

Within the Lower Aquifer, there is a groundwater divide generally in the area between Mendota and the point near the San Joaquin River in the Turner Island area, northeast of Los Banos. Groundwater southwest of this divide generally flows southwest toward Panoche Water District and Westlands Water District. Groundwater northeast of this divide flows to the northeast into Madera and Merced Counties. Net groundwater outflow in the Lower Aquifer under drought conditions has been about two and a half times greater than for normal conditions (KDSA, 1997a and 1997b). Based on current and historical groundwater elevation maps, groundwater barriers do not appear to exist in the Delta-Mendota Subbasin (DWR, 2006).

The combined effect of pumping below the Corcoran Clay and increased leakage from the Upper Aquifer to the Lower Aquifer where the Corcoran Clay does not exist or has been perforated has developed a generally downward flow gradient in the Tulare Formation which changes with variable pumping and irrigation over time (Bertoldi et al., 1991). Periods of great groundwater level declines have also resulted in inelastic compaction of fine-grained materials in some locations, particularly between Los Banos and Mendota, potentially resulting in considerable decreases (between 1.5 and 6 times) in permeability of clay members within the Tulare Formation, including the Corcoran Clay (Bertoldi et al., 1991). However, the number of wells penetrating the Corcoran Clay may be enabling vertical hydraulic communication across the Corcoran Clay aquitard and other clay layers (Davis et al., 1959; Davis et al., 1964).

4.1.9 Water Quality

Groundwater in the Delta-Mendota Subbasin is characterized by mixed sulfate to bicarbonate water types in the northern and central portion of the Subbasin, with areas of sodium chloride and sodium sulfate waters in the central and southern portions (DWR, 2003). Total Dissolved Solids (TDS) values range from 400 to 1,600 mg/L in the northern portion, and 730 to 6,000 mg/L in the southern portion of the Delta-Mendota Subbasin (Hotchkiss and Balding, 1971). The Department of Health Services (currently the Division of Drinking Water), which monitors Title 22 water quality standards, reports TDS values in 44 public supply wells in the Subbasin ranging in value from 210 to 1,750 mg/L, with an average value of 770 mg/L. Shallow, saline groundwater also occurs within about 10 feet of the ground surface over a large portion of the Delta-Mendota Subbasin. There are also localized areas of high iron, fluoride, nitrate, selenium, and boron in the Delta-Mendota Subbasin (Hotchkiss and Balding, 1971).

Alluvial sediments derived from west-side streams are composed of material from serpentine, shale, and sandstone parent rock, which results in soil and groundwater types entirely different from those on the east side of the San Joaquin Valley (LSCE, 2015). In contrast with the siliceous mineralogy of the alluvial sands and gravels on the eastern side of the Central Valley that are derived from the Sierra granitic rocks (which are coarser and more resistant to chemical dissolution), the sulfate and carbonate shales and sandstones of Coast Range sediments on the western side are more susceptible to dissolution processes. Some soils and sediments within the western San Joaquin Valley that are derived from marine rocks of the Coast Range have notably high concentrations of naturally-occurring nitrogen, with particularly higher nitrate concentrations in younger alluvial sediments (Strathouse and Sposito, 1980; Sullivan et al., 1979). These naturally-occurring nitrogen sources may contribute to nitrate concentrations in groundwater within the Delta-Mendota Subbasin, although it is not well known where this may occur and to what degree. Naturally-high concentrations of TDS in groundwater are known to have existed historically within parts of the Subbasin due to the geochemistry of the Coast Range rocks and the marine depositional environment, the resulting naturally-high TDS of recharge derived from Coast Range streams, the dissolvable materials within the alluvial fan complexes, and the naturally-poor draining conditions which tend to concentrate salts in the system. The chemical quality of waters in the Coast Range streams can be closely correlated with the geologic units within their respective catchments. Groundwater flows discharging from these marine and non-marine rocks into streams introduce a variety of dissolved constituents resulting in variable groundwater types. The water quality and chemical makeup in westside streams can be highly saline, especially in more northern streams, including Corral Hollow, Panoche and Del Puerto Creeks, where historical baseflow TDS concentrations have typically exceeded 1,000 mg/L with measured concentrations as high as 1,790 mg/L (Hotchkiss and Balding, 1971). This is in contrast with TDS concentrations typically below 175 mg/L in streams draining from the Sierras. The contribution of water associated with these Coast Range sediments has resulted in naturally-high salinity in groundwater within and around the Delta-Mendota Subbasin, which has been recognized as early as the 1900s (Mendenhall et al., 1916). Groundwater in some areas within the immediate vicinity of the San Joaquin River is influenced by lower-salinity surface water discharging from the east side of the San Joaquin Valley Groundwater Basin (Davis et al., 1957).

Areas of historical high saline groundwater documented by Mendenhall *et al*. (1916) indicate somewhat high TDS concentrations approaching or greater than 1,000 mg/L in wells sampled throughout many parts of the Delta-Mendota Subbasin. Areas of locally higher TDS concentrations (1,500-2,400 mg/L) have existed between Mendota and Los Banos; whereas the trend in deeper groundwater (average well depth of 450 feet) south of Mendota near Tranquillity indicates slightly lower historical salinity conditions, but still somewhat high with an average TDS concentration of greater than 1,000 mg/L. In the northern part of the Subbasin, north of Gustine, the average historical TDS concentration of wells was also relatively high (930 mg/L). Historically low TDS concentrations (<500 mg/L) existed in groundwater from wells with an average depth of 209 feet in the central Subbasin area between Los Banos and Gustine.

The general chemical composition of groundwater in the Subbasin is variable based on location and depth. Groundwater within the Upper Aquifer is largely characterized as transitional type with less area characterized as predominantly of chloride, bicarbonate, and sulfate water types. Transitional water types, in which no single anion represents more than 50 percent of the reactive anions, occurs in many different combinations with greatly ranging TDS concentrations. Chloride-type waters occur generally in grassland areas east of Gustine and around Dos Palos, with sodium chloride water present in northern areas near Tracy and also extending south from Dos Palos. These waters also exhibit greatly varying salinity with typical TDS concentrations, ranging from less than 500 mg/L to greater than 10,000 mg/L and of high sodium makeup (50-75 percent of cations present) (Hotchkiss and Balding, 1971). Areas of bicarbonate groundwater within the Upper Aquifer of relatively lower TDS concentrations are directly associated with intermittent streams of the Coast Range near Del Puerto, Orestimba, San Luis, and Los Banos Creeks. Sulfate water in the central and southern Subbasin areas has TDS concentrations decreasing from west (1,200 mg/L) to east (700 mg/L) towards the San Joaquin River, similar to the bicarbonate water areas, although areas of sulfate water south of Dos Palos have much higher TDS concentrations (1,900 to 86,500 mg/L) (Hotchkiss and Balding, 1971).

Groundwater in the Lower Aquifer below the Corcoran Clay is also spatially variable, consisting of mostly transitional sulfate waters in the northern part of the Delta-Mendota Subbasin to more sodium-rich water further south in the grassland areas. In the northern part of the Delta-Mendota Subbasin, the Lower Aquifer exhibits relatively lower TDS concentrations, ranging from 400 to 1,600 mg/L, with a sulfate-chloride type makeup near the valley margin trending to sulfate-bicarbonate type near the valley axis. Farther south, TDS concentrations in the Lower Aquifer increase (Hotchkiss and Balding, 1971).

Natural conditions of groundwater salinity exist throughout the Upper and Lower Aquifers as a result of the contribution of salts from recharge off the Coast Range mountains. Surface water and groundwater flowing over and through Coast Range sediments of marine origin have dissolved naturally-occurring salts, contributing to the historical and current presence of salinity in groundwater within the Delta-Mendota Subbasin. In addition to natural salinity contributed from the Coast Range sediments, a number of other mechanisms are believed to further contribute to increased salinity in the groundwater in the region. Poorly draining soil conditions are extensive within some of the southern and eastern areas of the Subbasin, extending from the vicinity of Tranquillity to near Gustine, and these types of soil, combined with a shallow water table, contribute to a build-up of soil salinity.

4.1.10 Topography, Surface Water, Recharge, and Imported Supplies

This section describes the topography, surface water, soils, and groundwater recharge potential in the Delta-Mendota Subbasin.

Topography

As previously described, the Delta-Mendota Subbasin lies on the western side of the Central Valley and extends from the San Joaquin River on the east, along the axis of the Valley, to the Coast Range on the west side (LSCE, 2015). The Subbasin has ground surface elevations ranging from less than 100 feet above mean sea level (msl) along parts of the eastern edge to greater than 1,600 feet msl in the Coast Range mountains (**Figure CC-35**). Most of the lower elevation areas occur east of Interstate 5, in the eastern parts of the Delta-Mendota Subbasin; although some lower elevation areas also extend westward into the Coast Range, such as in Los Banos Creek Valley. Low elevation areas generally coincide with the extent of the Central Valley floor. Topography within the Delta-Mendota Subbasin consists largely of flat areas across the Central Valley floor, where slopes are generally less than 2 percent, with steepening slopes to the west. The topography outside of the Central Valley floor in the Coast Range mountains is characterized by steeper slopes, generally greater than 6 percent.

Surface Water Bodies

The San Joaquin River and its tributaries is the primary natural surface water feature within the Delta-Mendota Subbasin, flowing from south to north along the eastern edge of the Subbasin (LSCE, 2015). During the 1960s, the San Joaquin River exhibited gaining flow conditions through much of the Subbasin (Hotchkiss and Balding, 1971). Numerous intermittent streams from the Coast Range enter the Delta-Mendota Subbasin from the west; however, none of these maintain perennial flow and only Orestimba Creek, Los Banos Creek and Del Puerto Creek have channels that extend eastward to a junction with the San Joaquin River. Most of the flow in other notable west-side creeks, including Quinto Creek, San Luis Creek, Little Panoche Creek, and Ortigalita Creek, is lost to infiltration (Hotchkiss and Balding, 1971). Flow from Los Banos and San Luis Creeks are impounded by dams on their respective systems. When flood releases are made from Los Banos Creek Reservoir, the vast majority of flows pass through Grassland Water District to the San Joaquin River as they tend to occur during times when agricultural and wetland demand is low. San Luis Reservoir on San Luis Creek, which is located along the western boundary of the Delta-Mendota Subbasin, is an artificial water storage facility for the Central Valley Project and California State Water Project and has no notable natural surface water inflows. Outflows from the reservoir go into the system of federal- and state-operated canals and aqueducts comprising the Central Valley and State Water Projects. Surface water use within the Delta-Mendota Subbasin is derived largely from water deliveries provided by these projects, including from the California Aqueduct (referred to as San Luis Canal in the joint-use area of the California Aqueduct) and Delta-Mendota Canal, and also from the San Joaquin River (**Figure CC-36**).

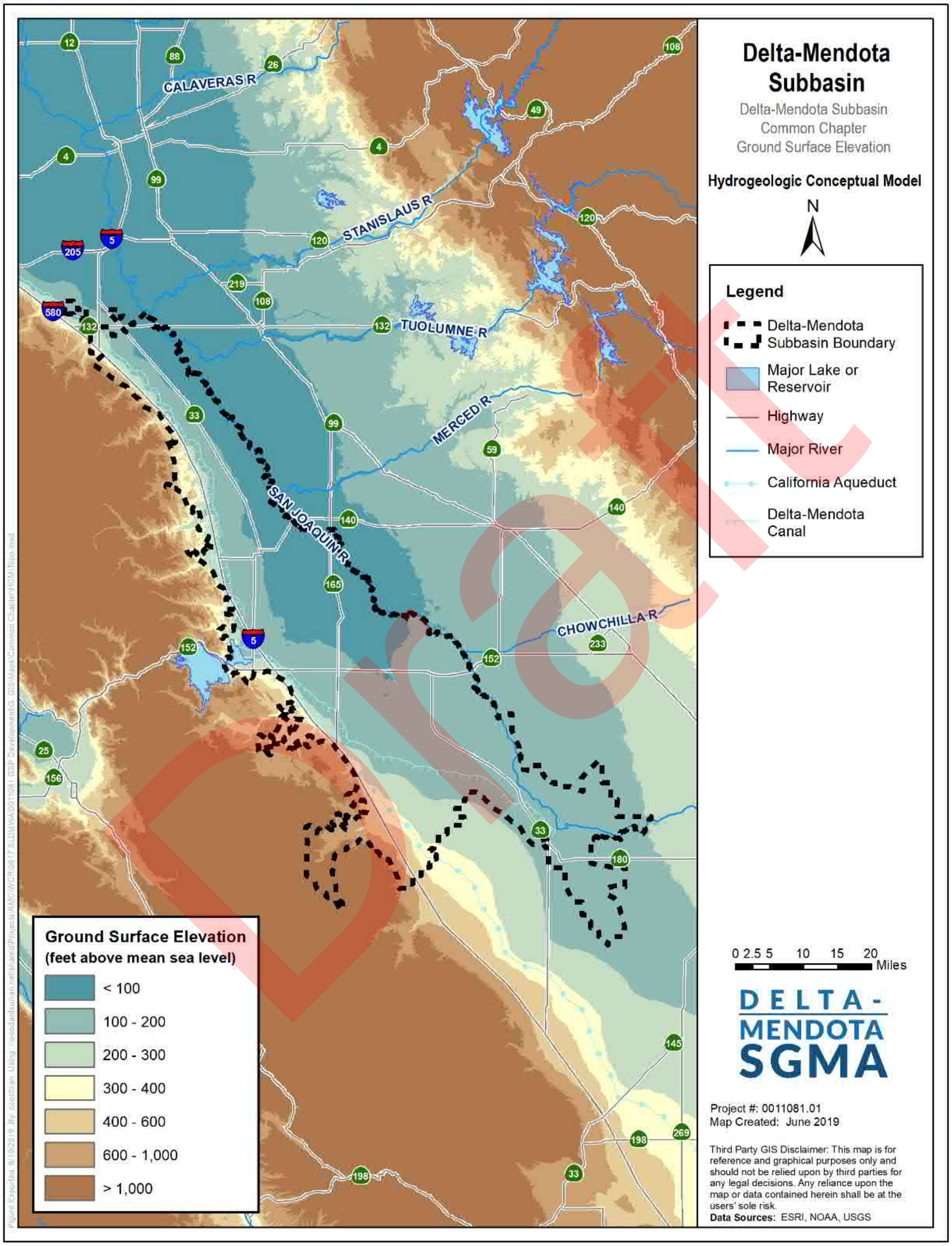


Figure CC-35: Ground Surface Elevation

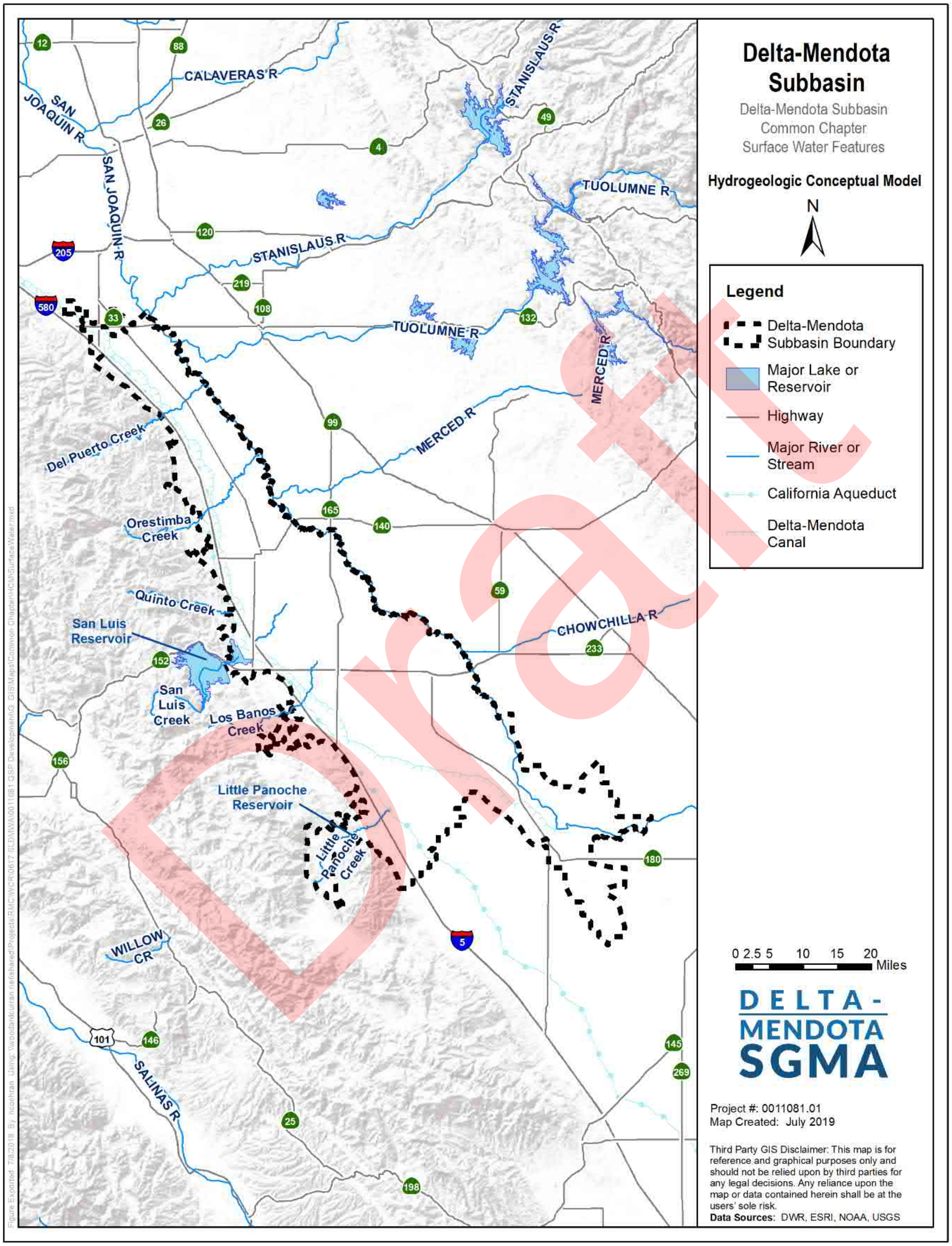


Figure CC-36: Surface Water Features

Soils

The NRCS provides soil mapping in the region. One of the combining soil groupings mapped includes hydrologic groups. The predominant soil hydrologic groups within the Delta-Mendota Subbasin are soil types C and D (**Figure CC-37**). Group C soils have moderately high runoff potential when thoroughly wet (NRCS, 2009) with water transmission through the soil somewhat restricted. Group C soils typically have between 20 percent and 40 percent clay and less than 50 percent sand and have loam, silt loam, sandy clay loam, clay loam, and silty clay loam textures. Group D soils have a high runoff potential when thoroughly wet and water movement through the soil is restricted or very restricted. Group D soils typically have greater than 40 percent clay, less than 50 percent sand, and have clayey textures. In some areas, they also have high shrink-swell potential.

Soil hydraulic conductivity groups are closely related to soil drainage characteristics and hydraulic conductivity. The fine-grained floodplain deposits present across much of the southeastern area of the Subbasin are evidenced as soils with lower hydraulic conductivity in **Figure CC-37** and accordingly, these characteristics also make these areas poorly drained. Poorly draining soil conditions are extensive within the southern and eastern areas of the Subbasin, extending from the vicinity of Tranquillity to near Gustine (Fio, 1994; Hotchkiss and Balding, 1971). Soils in the northern and western parts of the Delta-Mendota Subbasin exhibit better drainage characteristics, although areas of poorly drained soils are also present in the north and west in proximity to surface water courses, including most notably directly adjacent to portions of the San Joaquin River and Los Banos Creek channels. Many of the upland soils, which are of generally coarser texture and located proximal to sediment sources derived from the Coast Range hill slopes, are characterized as moderately well drained.

In areas with low hydraulic conductivity, corresponding to areas without adequate natural drainage, tile drains are present to remove shallow groundwater from the rooting zone. Known tile drain locations are shown in **Figure CC-38,** which are primarily located along the eastern boundary of the Delta-Mendota Subbasin as well as the southern portion of the Subbasin in the Grassland Drainage Area. The Grassland Drainage Area contains a tile drainage system connected to the San Joaquin River Improvement Project, which uses tile drainage water for irrigated agriculture with a high salinity tolerance.

Areas of Recharge, Potential Recharge, and Groundwater Discharge Areas

The primary process for groundwater recharge within the Central Valley floor area is from percolation of applied irrigation water and seepage from canals and stream beds, although some groundwater recharge does occur in the Delta-Mendota Subbasin along the western boundary of the Subbasin due to mountain front recharge. In sandier areas, recharge ponds have been constructed within certain districts (CCC, Aliso Water District, CCID and Del Puerto Water District) to promote managed aquifer recharge.

Groundwater recharge potential on agricultural land based on the Soil Agricultural Groundwater Banking Index (SAGBI) is shown in **Figure CC-39**. The SAGBI is based on five major factors: deep percolation, root zone residence time, topography, chemical limitations, and soil surface conditions. Within the Delta-Mendota Subbasin, SAGBI data categorizes 160,248 acres out of 744,237 acres (21%) of agricultural and grazing land within the regions as having Excellent, Good, and Moderately Good (**Figure CC-39**) recharge properties, and 571,573 acres out of 744,237 acres (or 77%) of agricultural and grazing land as having Moderately Poor, Poor, or Very Poor recharge properties. "Modified" SAGBI data shows higher potential for recharge than unmodified SAGBI data because the modified data assumes that soils have been or will be ripped to a depth of six feet, which can break up fine grained materials at the surface to improve percolation. The modified data set was determined to more accurately represent the Delta-Mendota Subbasin due to the heavy presence of agriculture. In almost all cases, recharge from applied water on irrigated lands recharges the Upper Aquifer of the Subbasin. However, the use of percolation ponds and other managed aquifer recharge techniques must consider existing water quality in addition to soil composition and may be limited in areas where poor water quality currently exists.

The Corcoran Clay is a known barrier restricting vertical flow between the Upper and Lower Aquifers; therefore, natural recharge of the Lower Aquifer from downward percolating water is most likely restricted where the Corcoran Clay is present, including across most of the Central Valley floor. Primary recharge areas to the Lower Aquifer are most likely in western parts of the Central Valley floor where percolating water can enter formations feeding the Lower Aquifer, particularly in the vicinity and west of Los Banos, Orestimba, and Del Puerto Creeks, along the western margin of the Subbasin.

Groundwater discharge areas are identified as springs located within the Delta-Mendota Subbasin and the San Joaquin River. **Figure CC-39** shows the location of historic springs identified by USGS. There are only six springs/seeps identified by USGS in their National Hydrograph Dataset, which are located in the southwestern corner of the Subbasin. The springs shown represent a dataset collected by USGS and are not a comprehensive map of springs in the Subbasin.

Imported Supplies

Both the California Aqueduct and Delta-Mendota Canal run the length of the Delta-Mendota Subbasin, primarily following the Interstate 5 corridor (**Figure CC-40**). The following water purveyors in the Delta-Mendota Subbasin are SLDMWA Member Agencies and thus receive water from the Central Valley Project via the Delta-Mendota Canal: California Department of Fish and Wildlife, Central California Irrigation District, Columbia Canal Company, Del Puerto Water District, Eagle Field Water District, Firebaugh Canal Water District, Fresno Slough Water District, Grassland Water District, Laguna Water District, Mercy Springs Water District, Oro Loma Water District, Pacheco Water District, Panoche Water District, Patterson Irrigation District, San Luis Canal Company, San Luis Water District, Tranquillity Irrigation District, Turner Island Water District, U.S. Fish and Wildlife Service, and West Stanislaus Irrigation District. Oak Flat Water District is the only recipient of State Water Project (SWP) water in the Delta-Mendota Subbasin; Oak Flat Water District initially bought into the SWP in 1968.

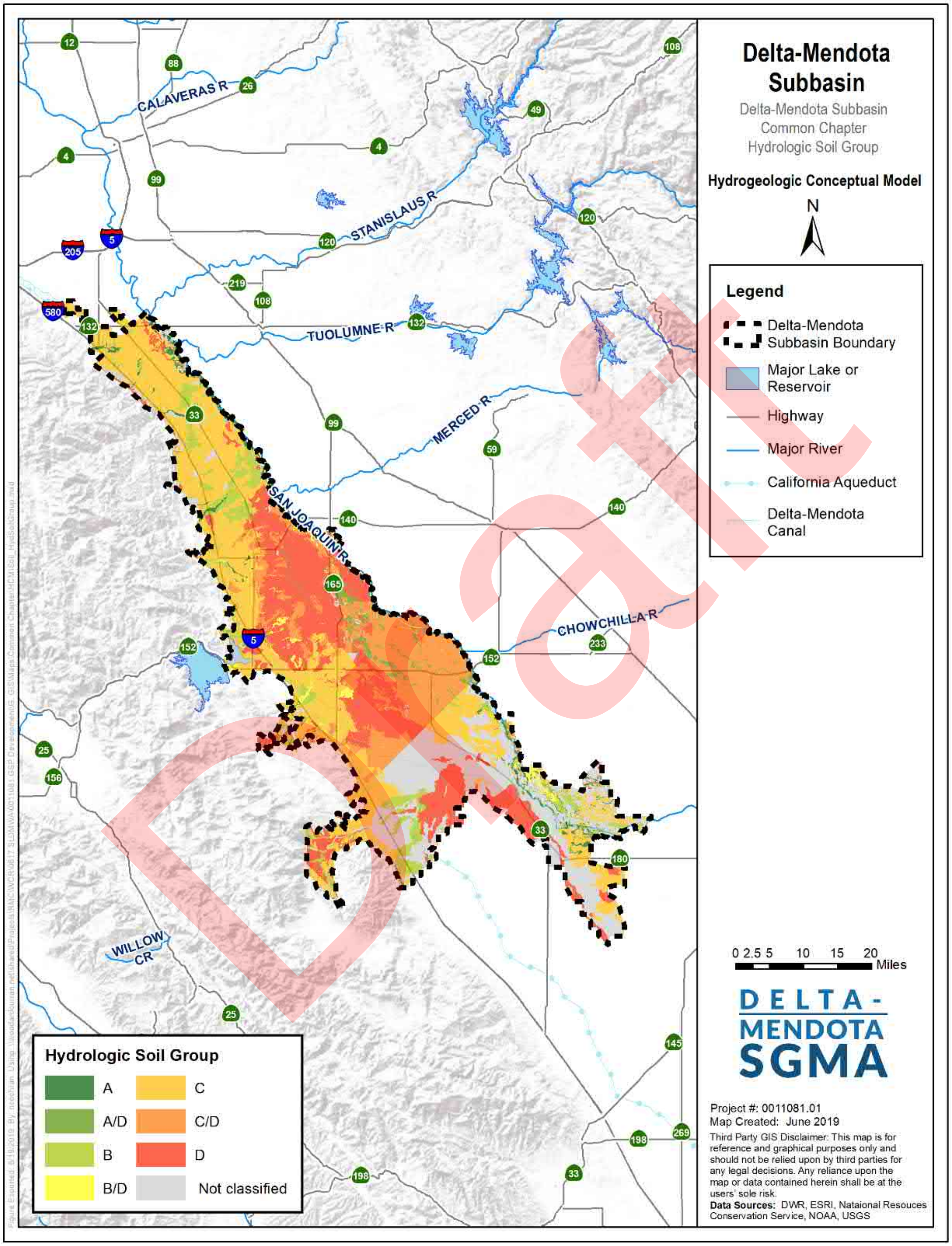


Figure CC-37: SAGBI Soils Map

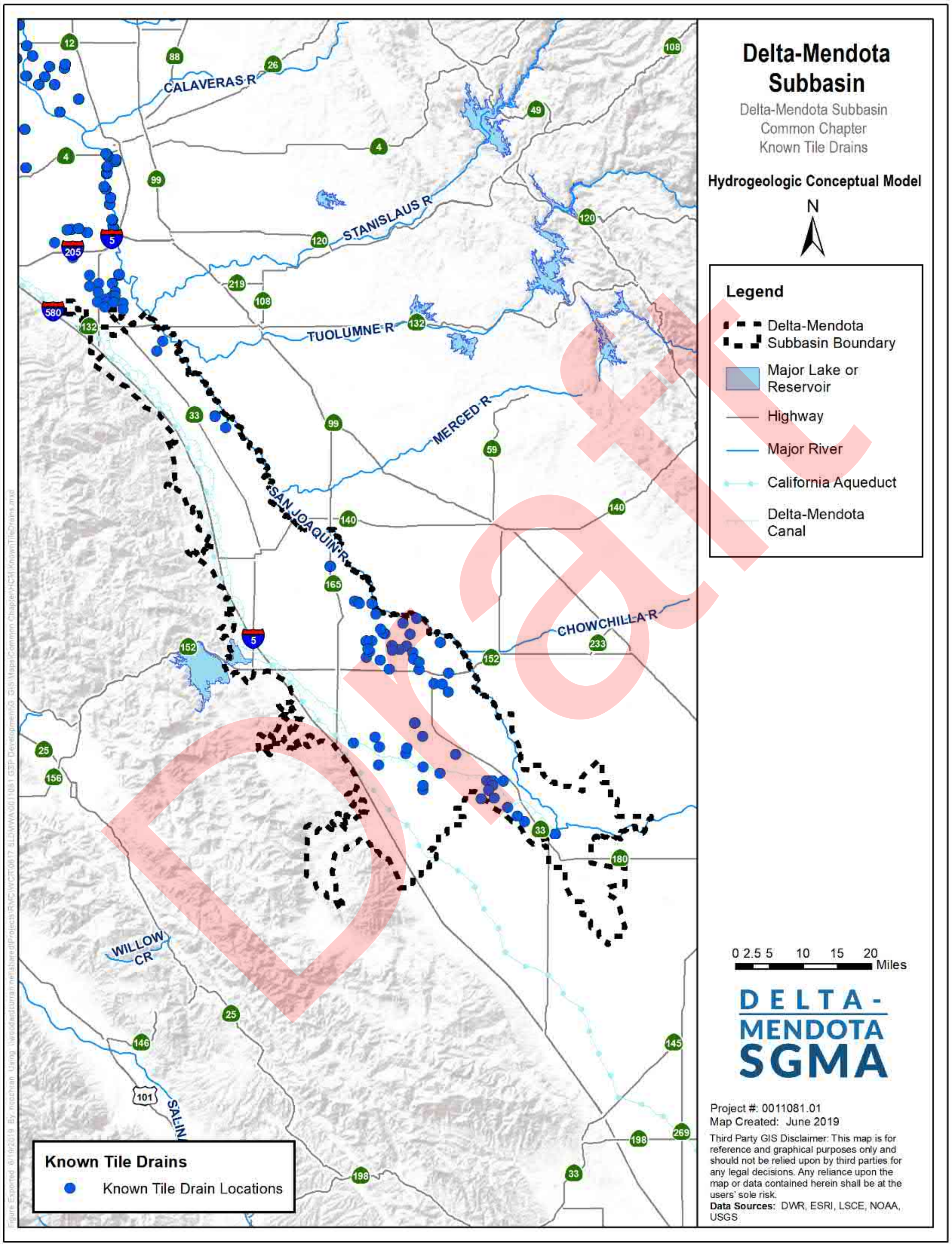


Figure CC-38: Tile Drains

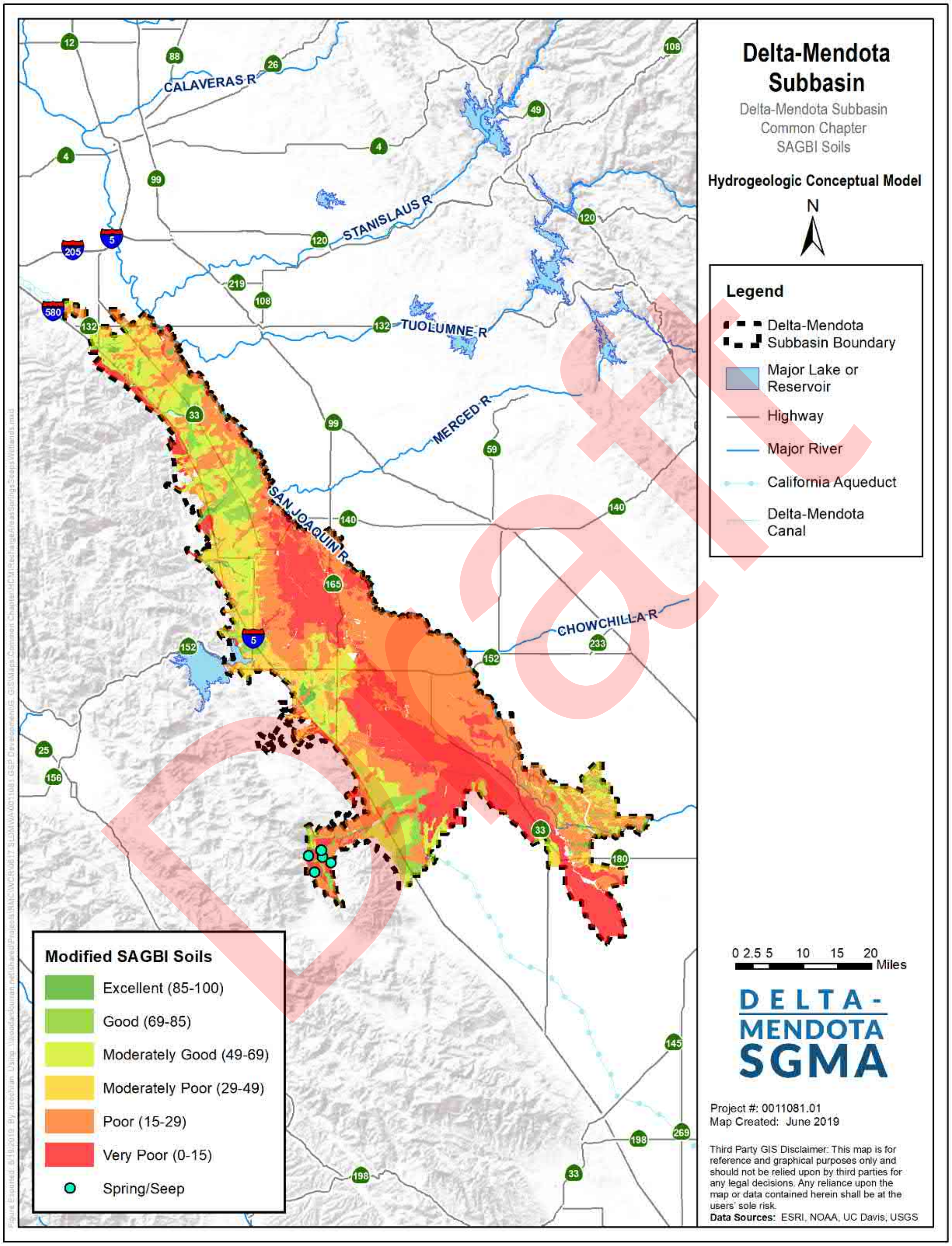


Figure CC-39: Recharge Areas, Seeps and Springs

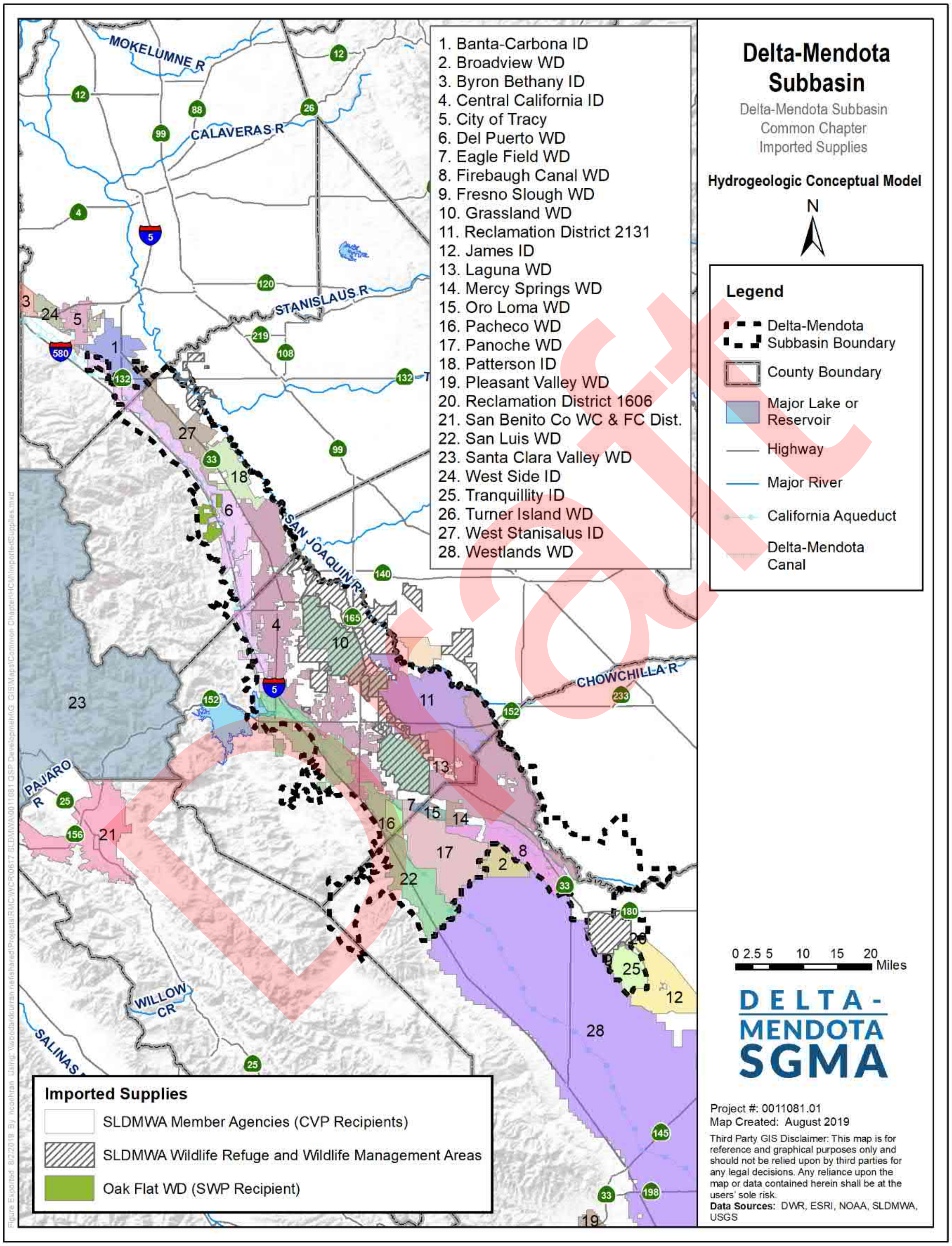


Figure CC-40: Imported Supplies

4.2 Delta-Mendota Subbasin Groundwater Conditions

This section describes the current and historic groundwater conditions in the Delta-Mendota Subbasin, including data from January 1, 2015 to recent conditions for the following parameters: groundwater elevations, groundwater storage, groundwater quality, land subsidence, interconnected surface water systems, and groundwater dependent ecosystems (GDEs) (pursuant to Article 5 Plan Contents, Subarticle 2 Basin Setting, § 354.16 Groundwater Conditions of the GSP Emergency Regulations). Seawater intrusion is not discussed herein as the Delta-Mendota Subbasin is inland and is not impacted by seawater intrusion. For the purposes of this GSP, "current conditions" is represented by Water Year (WY) 2013 conditions, which is consistent with the year representing the Current Conditions Water Budget (see Section 4.3 for more information about Water Budgets). Data post-WY 2013 through present day are presented when available.

The purpose of describing groundwater conditions, as contained in this section and described in the individual GSPs, is to establish baseline conditions that will be used to monitor changes relative to measurable objectives and minimum thresholds. Therefore, these established baseline conditions will help support monitoring to demonstrate measurable efforts in achieving the sustainability goal for the Delta-Mendota Subbasin.

4.2.1 Useful Terminology

This groundwater conditions section includes descriptions of the amounts, quality, and movement of groundwater, among other related components. A list of technical terms and a description of the terms are listed below. The terms and their descriptions are identified here to guide readers through the section and are not a definitive definition of each term:

- **Depth to Groundwater** – The distance from the ground surface to first-detected non-perched groundwater, typically reported at a well.
- **Upper Aquifer** – The alluvial aquifer above the Corcoran Clay (or E-clay) layer.
- **Lower Aquifer** – The alluvial aquifer below the Corcoran Clay (or E-clay) layer.
- **Horizontal gradient** – The slope of the groundwater surface from one location to another when one location is higher or lower than the other. The gradient is shown on maps with an arrow showing the direction of groundwater flow in a horizontal direction.
- **Vertical gradient** – Describes the movement of groundwater perpendicular to the ground surface. Vertical gradient is measured by comparing the elevations of groundwater in wells that are of different depths. A downward gradient is one where groundwater is moving down into the ground towards deeper aquifers and an upward gradient is one where groundwater is upwelling towards the ground surface.
- **Contour Map** – A contour map shows changes in groundwater elevations by interpolating groundwater elevations between monitoring sites. The elevations are shown on the map with the use of a contour line, which represents groundwater being at the indicated elevation along the contour line. Contour maps can be presented in two ways:
  - Elevation of groundwater above mean sea level (msl), which can be used to identify the horizontal gradients of groundwater, and
  - Depth to water (i.e. the distance from the ground surface to groundwater), which can be used to identify areas of shallow or deep groundwater.

- **Hydrograph** – A graph that shows the changes in groundwater elevation or depth to groundwater over time at a specific location. Hydrographs show how groundwater elevations change over the years and indicate whether groundwater is rising or descending over time.
- **Maximum Contaminant Level (MCL)** – MCLs are standards that are set by the State of California and the U.S. Environmental Protection Agency for drinking water quality. MCLs are legal threshold limits on the amount of an identified constituent that is allowed in public drinking water systems. At both the State and Federal levels, there are Primary MCLs, set to be protective of human health, and Secondary MCLs for constituents that do not pose a human health hazard but do pose a nuisance through either smell, odor, taste, and/or color. MCLs are different for different constituents and have not been established for all constituents potentially found in groundwater.
- **Elastic Land Subsidence** – Reversible and temporary fluctuations in the elevation of the earth's surface in response to seasonal periods of groundwater extraction and recharge.
- **Inelastic Land Subsidence** – Irreversible and permanent decline in the elevation of the earth's surface resulting from the collapse or compaction of the pore structure within the fine-grained portions of an aquifer system. This form of subsidence is what is required by SGMA to be monitored and reported.
- **Gaining Stream** – A stream in which groundwater flows into a streambed and contributes to a net increase in surface water flows across an identified reach.
- **Losing Stream** – A stream in which surface water is lost through the streambed to the groundwater, resulting in a net decrease in surface water flows across an identified reach.
- **Conjunctive Use** – The combined use of surface water and groundwater supplies, typically with more surface water use in wet years and more groundwater use in dry years.

4.2.2 Groundwater Elevations

This section describes groundwater elevation data utilized and elevation trends in the Delta-Mendota Subbasin. Groundwater conditions vary widely across the Subbasin. Historic groundwater conditions through present day conditions, the role of imported surface water in the Subbasin, and how conjunctive use has impacted groundwater trends temporally and spatially are discussed. Groundwater elevation contour maps associated with current seasonal high and seasonal low for each principal aquifer, as well as hydrographs depicting long-term groundwater elevations, historical highs and lows, and hydraulic gradients (both horizontal and vertical), are also described.

Available Data

Groundwater elevation data, and accompanying well construction information, within the Delta-Mendota Subbasin from the following sources and associated programs were utilized in the development of the Delta-Mendota Subbasin GSPs:

- California Department of Water Resources (DWR)
    - California Statewide Groundwater Elevation Monitoring Program (CASGEM)
    - Water Data Library (WDL)
- Water level data from local monitoring programs

Data provided by these sources included well information (such as location, well construction, owner, ground surface elevation and other related components), as well as groundwater elevation data (including information such as date measured, depth to water, groundwater surface elevation, questionable measurement code, and comments). At the time that these analyses were performed, groundwater elevation data were available for the time period from 1930 through 2018. There are many wells with monitoring data from some time in the past but no recent data, while a small number of wells have monitoring data recorded for periods of greater than 50 years.

Not all groundwater elevation data received were used in preparing the groundwater elevation contour maps for both principal aquifers (defined in this Common Chapter as the Upper and Lower Aquifers which are divided by the Corcoran Clay or E-clay layer). Some groundwater elevation data were associated with wells with unknown screened depths and/or composite well screens constructed across the Corcoran Clay. Groundwater elevation data associated with wells with composite screens and/or unknown screened depths were removed from the data set in most instances, along with any data point that appears to be an outlier when compared with surrounding data from the same period. Select wells with unknown construction were evaluated for inclusion in contour mapping efforts in areas of limited data. Duplicate well measurements were also removed prior to contouring and only one observation for a given well was used for the identified season, rather than averaging all measurements at a given well during the same season.

Figure CC-41 shows the locations of wells with known screened depths within the Delta-Mendota Subbasin as well as known spatial gaps where no well information is currently available. These wells include those monitored under CASGEM, the Delta-Mendota Canal Well Pump-in Program, and by local owners or agencies. Monitoring data available for these wells varies by local owner and agency. Well locations were provided by local agencies to the best of their knowledge at the time of writing and may include wells that have been destroyed or are no longer in service.

Historic Conditions

Historic groundwater trends changed significantly with the first deliveries of imported water deliveries to the Delta-Mendota Subbasin. Construction of the Delta-Mendota Canal and the California Aqueduct heralded the introduction of significant surface water supplies into the Subbasin and reduced dependence on groundwater as the primary water supply. These conveyance systems have resulted in significant increases in the conjunctive use of surface water and groundwater throughout the Subbasin. Various drought periods and regulations reducing delivery of supplies from the Sacramento-San Joaquin Delta also punctuate critical understandings of groundwater use patterns throughout the Subbasin, as well as what is known regarding response and recovery of groundwater levels following notable droughts.

<u>Prior to Imported Water Deliveries (1850-1950s)</u>

Prior to 1850, the majority of agriculture and development in the San Joaquin Valley consisted of rain-fed grain and cattle production, with irrigated development beginning sporadically during this time via river (primarily San Joaquin River) and perennial stream diversions (SWRCB, 2011). Construction of the railroad through the San Joaquin Valley from 1869 through 1875 increased demand for more extensive agriculture, making markets in larger coastal cities more accessible to valley farmers. Significant irrigation sourced from surface water and resulting production began in the western side of the San Joaquin Valley in 1872 when the San Joaquin River was diverted through the Miller and Lux canal system west of Fresno (DWR, 1965). By the 1890s and early 1900s, sizable areas of the southern San Joaquin Valley were being forced out of production by salt accumulation and shallow water tables. Much of this land lay idle until the 1920s when development of reliable electric pumps and the energy to power them accelerated the expansion of irrigated agriculture with the availability of vast groundwater resources. The resultant groundwater pumping lowered the water table in many areas (SWRCB, 1977 and Ogden, 1988) and allowed the leaching of salts, particularly near the valley trough and western side of the valley. Groundwater pumping for irrigation from around 1920 to 1950 drew the water table down as much as 200 feet in areas along the westside of the San Joaquin River (Belitz and Heimes, 1990). Declining water tables were causing higher pumping costs and land subsidence, and farmers were finding poorer quality water as water tables continued to decline. These issues created a desire for new surface water supplies, which would be fulfilled by the Central Valley Project.

Post-Imported Water Deliveries (1950s-2012)

Surface water deliveries from the Central Valley Project via the DMC began in the early 1950s, and from the State Water Project via the California Aqueduct in the early 1970s (Sneed et al., 2013). The CVP is the primary source of imported surface water in the Delta-Mendota Subbasin, where only Oak Flat Water District receives deliveries from the SWP. Introduction of imported water supplies to the Delta-Mendota Subbasin resulted in a decrease in groundwater pumping from some parts of the Subbasin and the greater Central Valley, which was accompanied by a steady recovery of water levels. During the droughts of 1976-1977 and 1987-1992, diminished deliveries of imported surface water prompted increased pumping of groundwater to meet irrigation demands, bringing water levels to near-historic lows. Following periods of drought, recovery of pre-drought water levels has been rapid, especially in the Upper Aquifer. This trend has been observed in historic hydrographs for wells across the Subbasin.

Current Conditions

Trends similar to historic drought and subsequent recovery conditions were observed during the 2012 to 2016 drought and the 2016 to present recovery period.

Recent Drought (2012-2016)

During the most recent drought, from 2012 through 2016, similar groundwater trends were observed as during the 1976-1977 and 1987-1992 droughts. With diminished imported surface water deliveries, groundwater pumping increased throughout the Subbasin to meet irrigation needs. This resulted in historic or near-historic low groundwater levels during the height of the drought in 2014 and 2015, when CVP and SWP allocations for agricultural water service contractors were 0%, Exchange Contractors and refuge deliveries were less than 75%, and post-1914 surface water rights in the San Joaquin River watershed were curtailed. In June 2015, senior water rights holders with a priority date of 1903 or later in the San Joaquin and Sacramento watersheds and the Delta were ordered by the State Water Resources Control Board to curtail diversions (State of California, 2015). This marked the first time in recent history that pre-1914 water rights holders were curtailed.

Post-Drought (2016-present)

With wetter conditions following the 2012-2016 drought, groundwater levels began to recover. This was largely a result of increased surface water availability with CVP allocations reaching 100% and full water rights supplies available for diversion from the San Joaquin River in 2017. Additionally, inelastic land subsidence rates also drastically decreased in 2017 as imported water supplies were once again available, resulting in decreased groundwater pumping particularly from the Lower Aquifer. This pattern of increased drought-driven groundwater pumping, accompanied by declining groundwater elevations, followed by recovery is a predominant factor to be considered in the sustainable management of the Delta-Mendota Subbasin. Furthermore, subsidence mitigation projects were developed which drastically reduced the observed subsidence rate on the eastern and southern boundaries of the Subbasin.

Groundwater Trends

Groundwater levels can fluctuate greatly throughout time due to various natural and anthropogenic factors, including long-term climatic conditions, adjacent well pumping, nearby surface water flows, and seasonal groundwater recharge or depletion (LSCE, 2015). As discussed in the Hydrogeologic Conceptual Model section of this Common Chapter (Section 4.1), the Delta-Mendota Subbasin is generally a two-aquifer system consisting of an Upper and Lower Aquifer that are subdivided by the Corcoran Clay layer, a regional aquitard. The Corcoran Clay layer, or E-Clay equivalent, restricts flow between the upper semi-confined aquifer and lower confined aquifer. The presence of a tile drain network along the Grassland Drainage Area and the Subbasin's eastern boundary affects the lateral and vertical water movement in the shallow groundwater zone (LSCE, 2016).

The Delta-Mendota Subbasin has a general flow direction to the east in the Upper Aquifer, where it loses groundwater to the San Joaquin River and its neighboring subbasins. Most recharge throughout the Subbasin is attributed to applied irrigation water, where other sources of recharge include local streams, canal seepage, and infiltration along the western margin of the Subbasin from the Coast Range. The figures that follow were developed for inclusion in the Western San Joaquin River Watershed Groundwater Quality Assessment Report (LSCE, 2015) and the Grassland Drainage Area Groundwater Quality Assessment Report (LSCE, 2016) and are included herein with the intent of demonstrating general trends in groundwater elevations around the Delta-Mendota Subbasin. These figures are not to scale.

Please see the individual GSPs for more specific information relating to similar trends in those respective GSP Plan areas. Additionally, it is important to note that groundwater trends, such as these, are dependent on climatic conditions and are not necessarily representative of the historic and current water budgets for those respective GSP Plan areas.

Upper Aquifer

For the Upper Aquifer, **Figure CC-42** presents select hydrographs illustrating temporal groundwater level trends in the Upper Aquifer wells within the Subbasin. Hydrographs shown on **Figure CC-42** are displayed with different ranges of elevation values on the vertical axes. Wells in the Upper Aquifer exhibit decreasing trends to somewhat stable water levels until the mid-1980s, and increasing or stable water levels thereafter.

Similarly, **Figure CC-43** presents select hydrographs illustrating temporal groundwater level trends in the areas covered by the Central Delta-Mendota, Oro Loma Water District, and Widren Water District GSAs in the Northern & Central Delta-Mendota Region GSP Group at various depths. The three select hydrographs representing wells in the Upper Aquifer each show less than 10 years of available data with two wells showing slight declines of about 10 feet or less from about 2003 through 2013, and one well showing a more drastic elevation change, ranging from 100 feet above mean sea level (ft msl) to -20 ft msl over a 5-year period from 2010 to 2016.

Lower Aquifer

Figure CC-44 presents select hydrographs illustrating temporal groundwater level trends in Lower Aquifer wells within the Subbasin. Note, hydrographs shown on **Figure CC-44** displayed different ranges of elevation on the vertical axes. In the Lower Aquifer, piezometric head typically increased or remained relatively stable during the period from the 1980s through the early 2000s.

Again, similarly, **Figure CC-43** presents select hydrographs illustrating temporal groundwater level trends in the Central Delta-Mendota, Oro Loma Water District, and Widren Water District GSA areas of the Northern & Central Delta-Mendota Region GSP Group at various depths. The two select hydrographs representing wells in the Lower Aquifer each show similar elevation patterns post-2010 with a total elevation change of 50 ft msl or more. USGS1000489 shows stable and increasing groundwater elevation trends from the late 1950s through the mid-1980s with a data gap from the mid-1980s through 2010, whereafter 2010 groundwater levels have a steep decline through 2016.

Vertical Gradients

Throughout most of the Delta-Mendota Subbasin, the Corcoran Clay layer acts as a regional aquitard, limiting the vertical migration of groundwater. In areas outside the Corcoran Clay layer (along the western margin of the Subbasin), localized interfingered clays minimize the downward migration of groundwater; although in areas where the clay layers are not competent or non-existent, groundwater migrates from shallower to deeper groundwater zones. Similarly, in areas where the Corcoran Clay has been compromised (due to well construction across the clay), groundwater generally flows from the Upper Aquifer to the Lower Aquifer, especially in areas where the Lower Aquifer is actively used as a water supply (lowering the potentiometric head in that zone).

Groundwater Contours

The Subbasin-wide groundwater contours reflected in **Figure CC-45** and **Figure CC-46** evaluate the seasonal high (Spring 2013) and seasonal low (Fall 2013) conditions of the current year (defined as WY2013 for the GSP analyses) for the Upper Aquifer. Spring is defined as groundwater surface elevation measurements collected between January 1 and April 8; where Fall is defined as groundwater surface elevation measurements collected between September 1 and October 31. For wells where multiple Spring 2013 or Fall 2013 measurements were available, the highest elevation for each season was used for contouring. Gaps in data and contours can be attributed to a lack of wells present, level measurements, or requirements to report level readings groundwater level data. Consistent with traditional contouring efforts, the quality of outlier water level data was investigated. In instances of poor quality data, the associated data was eliminated for the groundwater contouring effort. Furthermore, implementation of the CASGEM program in 2014 has reduced temporal and spatial gaps in groundwater level datasets, and implementation of the Delta-Mendota Subbasin GSPs' monitoring programs will add to the improved data quantity and quality.

In the Upper Aquifer, during Spring 2013, the general flow of groundwater in the Delta-Mendota Subbasin was from the Coast Range along the western boundary of the Subbasin toward the San Joaquin River along the eastern boundary. Groundwater elevations tend to increase moving south throughout the Subbasin. Within Stanislaus County, groundwater elevations are the lowest, ranging between 40 and 80 feet above msl, becoming increasingly higher in Madera County, ranging between 80 and 100 feet above msl, and in Merced and Fresno counties, ranging between 80 and 140 feet above msl (**Figure CC-45**). Similar flow directions (west to east and northeast) are observed in the Fall 2013. Within Stanislaus County, groundwater elevations are the lowest ranging between 40 and 80 feet above msl, showing little difference compared to Spring 2013; become increasingly higher in Madera County ranging between 60 and 100 feet above msl; in Merced County ranging between 60 and 140 feet above msl; and in Fresno County ranging from 60 and 120 feet above msl (**Figure CC-46**). Both maps indicate a prevailing southwest to northeast flow gradient above the Corcoran Clay. In general, little variation is apparent in groundwater elevation between seasonal high and low periods in 2013.

Due to insufficient data, groundwater elevation contour maps for the Lower Aquifer for the seasonal high and low (Spring 2013 and Fall 2013, respectively) could not be accurately prepared. **Figure CC-47** and

Figure CC-48 show the available groundwater elevation measurements for Spring 2013 and Fall 2013. Available Spring 2013 measurements range from -127 to 12 feet above msl in Stanislaus County, -65 to 124 feet above msl in Merced County, and -5 to 88 feet above msl in Fresno County (**Figure CC-47**), where no measurements are available for this time period in Madera County. Available Fall 2013 measurements range from -138 to 156 feet above msl in Stanislaus County, -94 to 19 feet above msl in Merced County, and -72 to -4 feet above msl in Fresno County (**Figure CC-48**), where no measurements are available for this time period in Madera County. The Lower Aquifer exhibits less seasonal difference in groundwater elevations than the Upper Aquifer. Throughout most of the Subbasin, the Lower Aquifer shows lower piezometric heads than the Upper Aquifer suggesting that potential exists for downward vertical gradient.

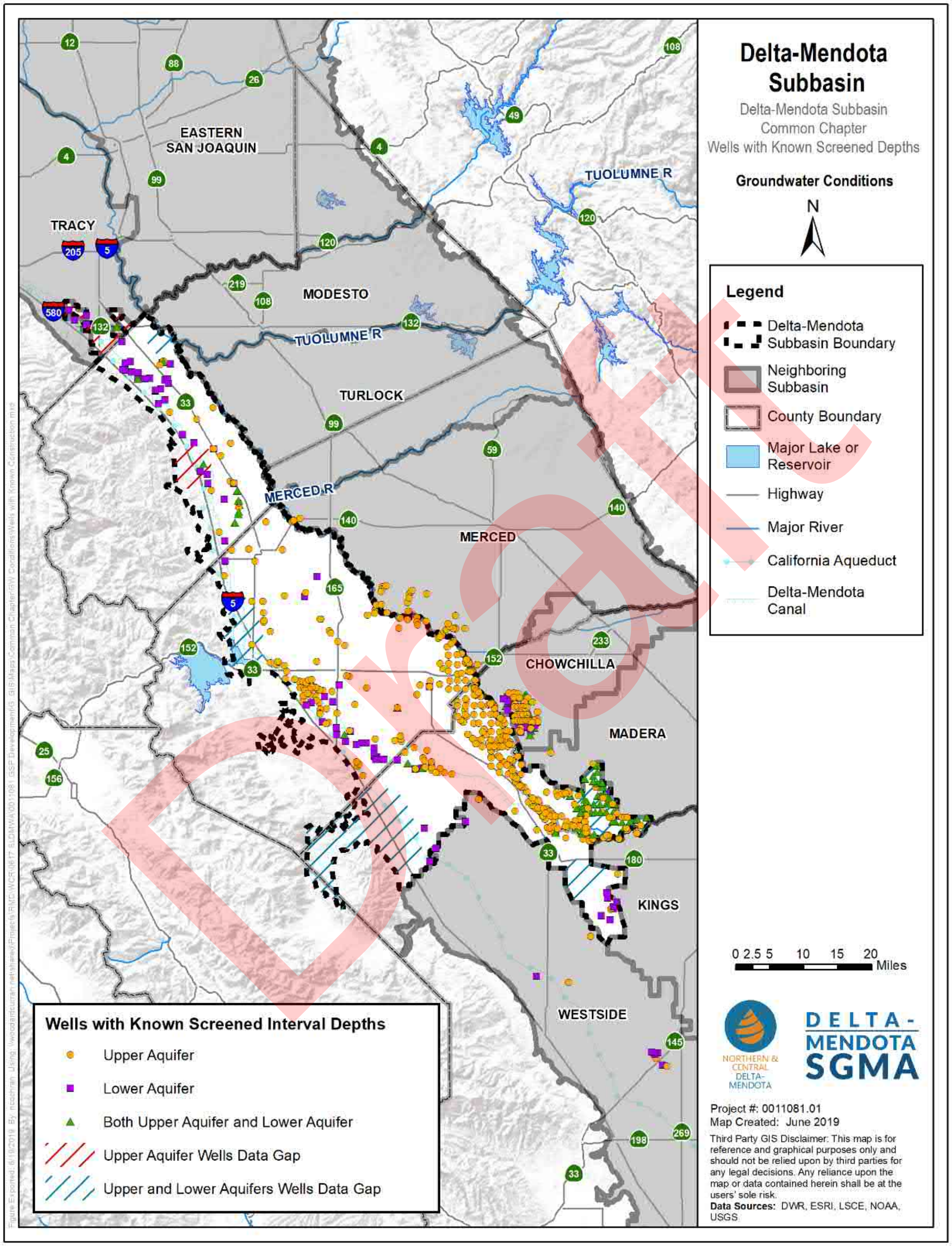
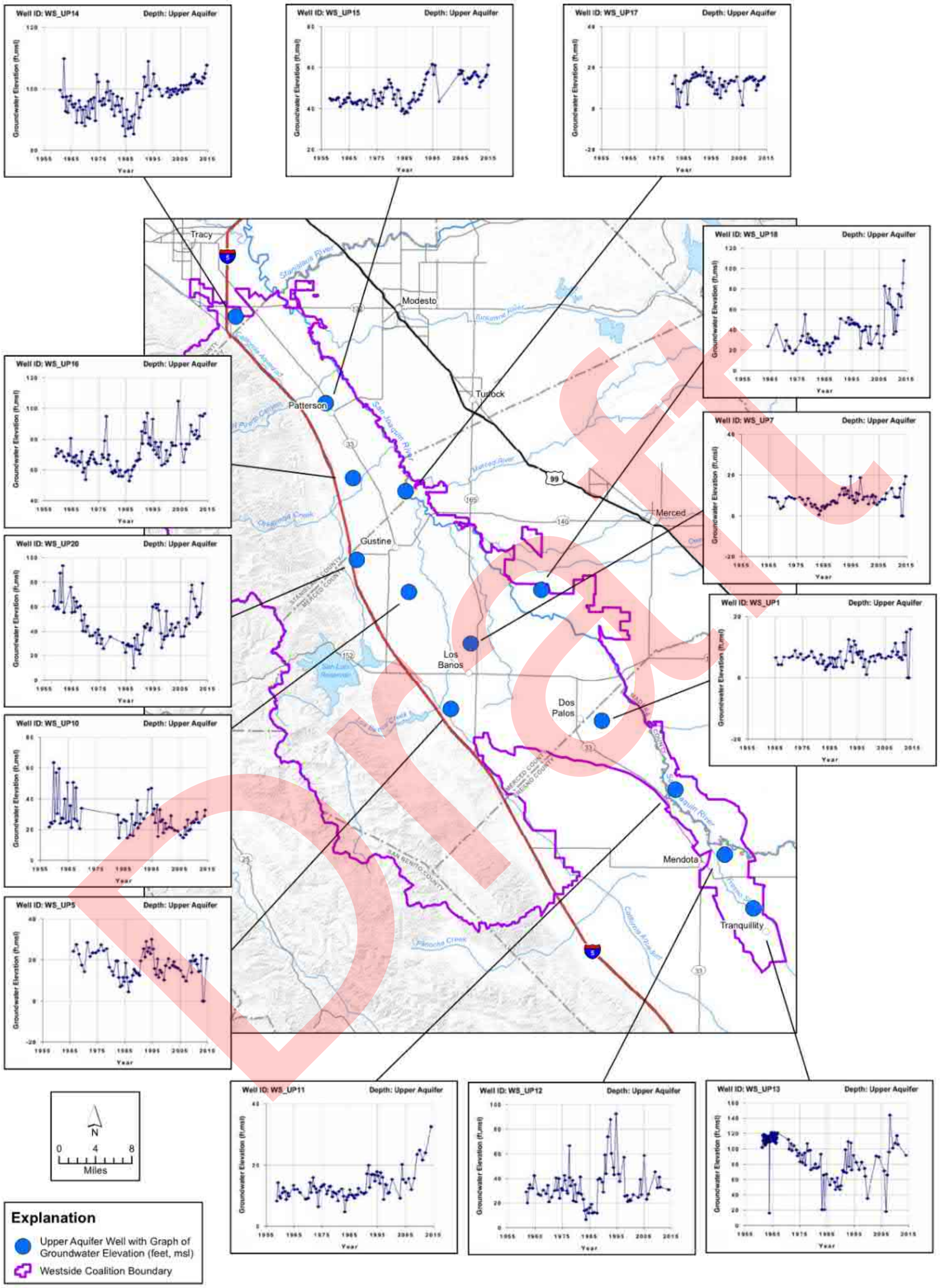
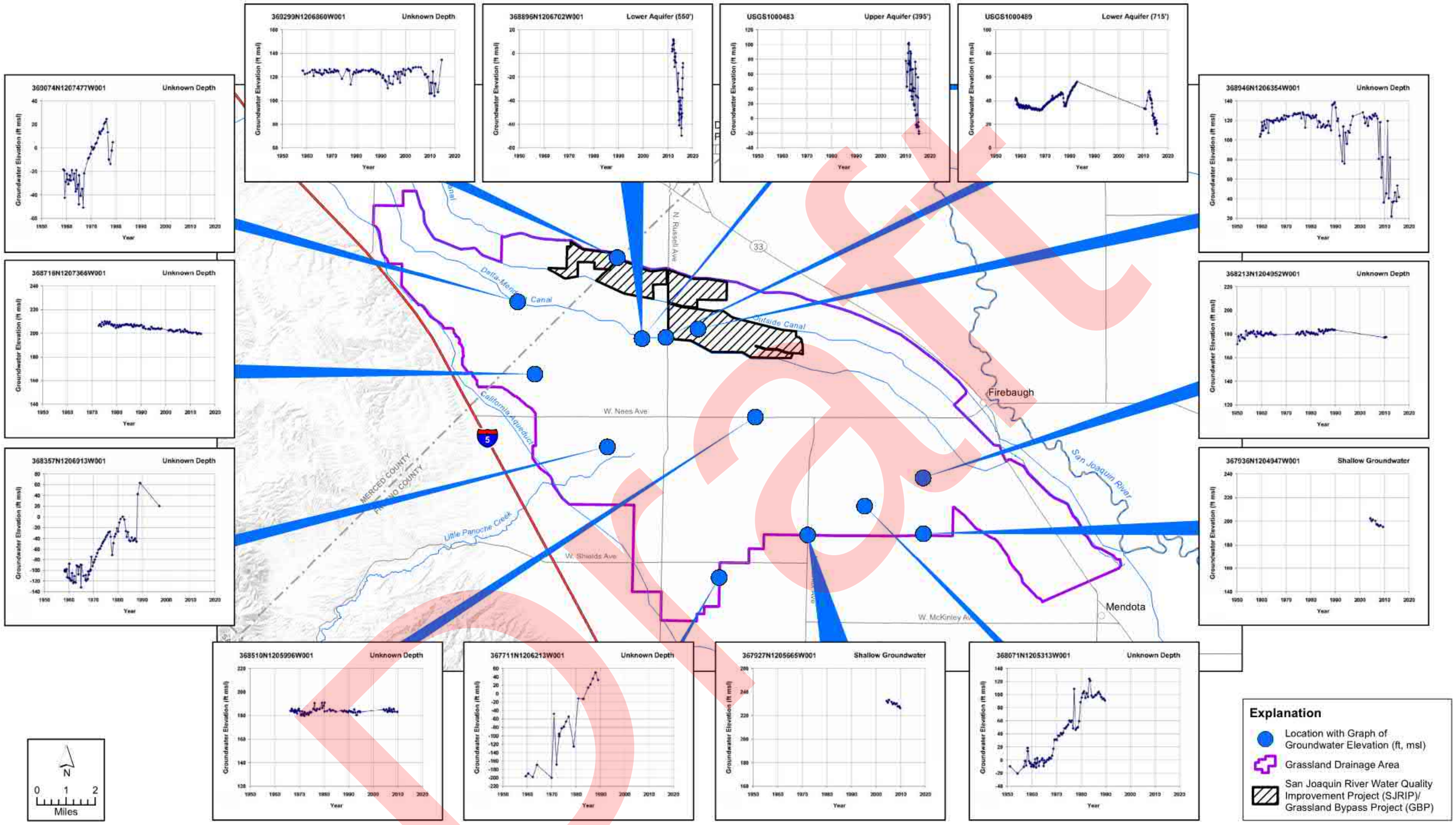


Figure CC-41: Wells with Known Screened Interval Depths



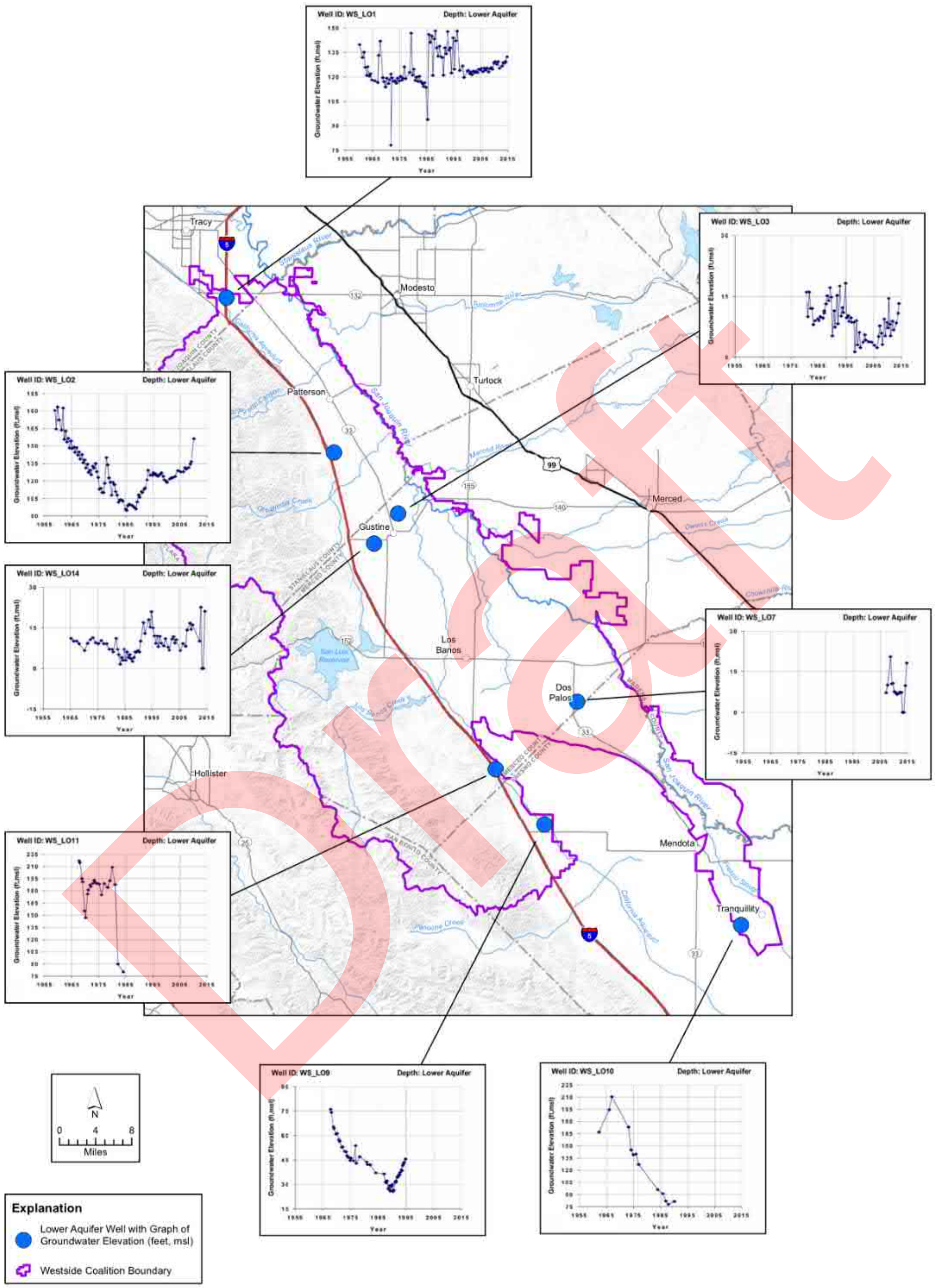
Note: Figure not to scale.
Source: *Western San Joaquin River Watershed Groundwater Quality Assessment Report*, 2016

Figure CC-42: Select Graphs of Groundwater Elevations, Upper Aquifer



Note: Figure not to scale.
Source: *Western San Joaquin River Watershed Groundwater Quality Assessment Report*, 2016.

Figure CC-43: Select Graphs of Groundwater Elevations, Various Depths



Note: Figure not to scale.
Source: *Western San Joaquin River Watershed Groundwater Quality Assessment Report*, 2016.

Figure CC-44: Select Graphs of Groundwater Elevations, Lower Aquifer

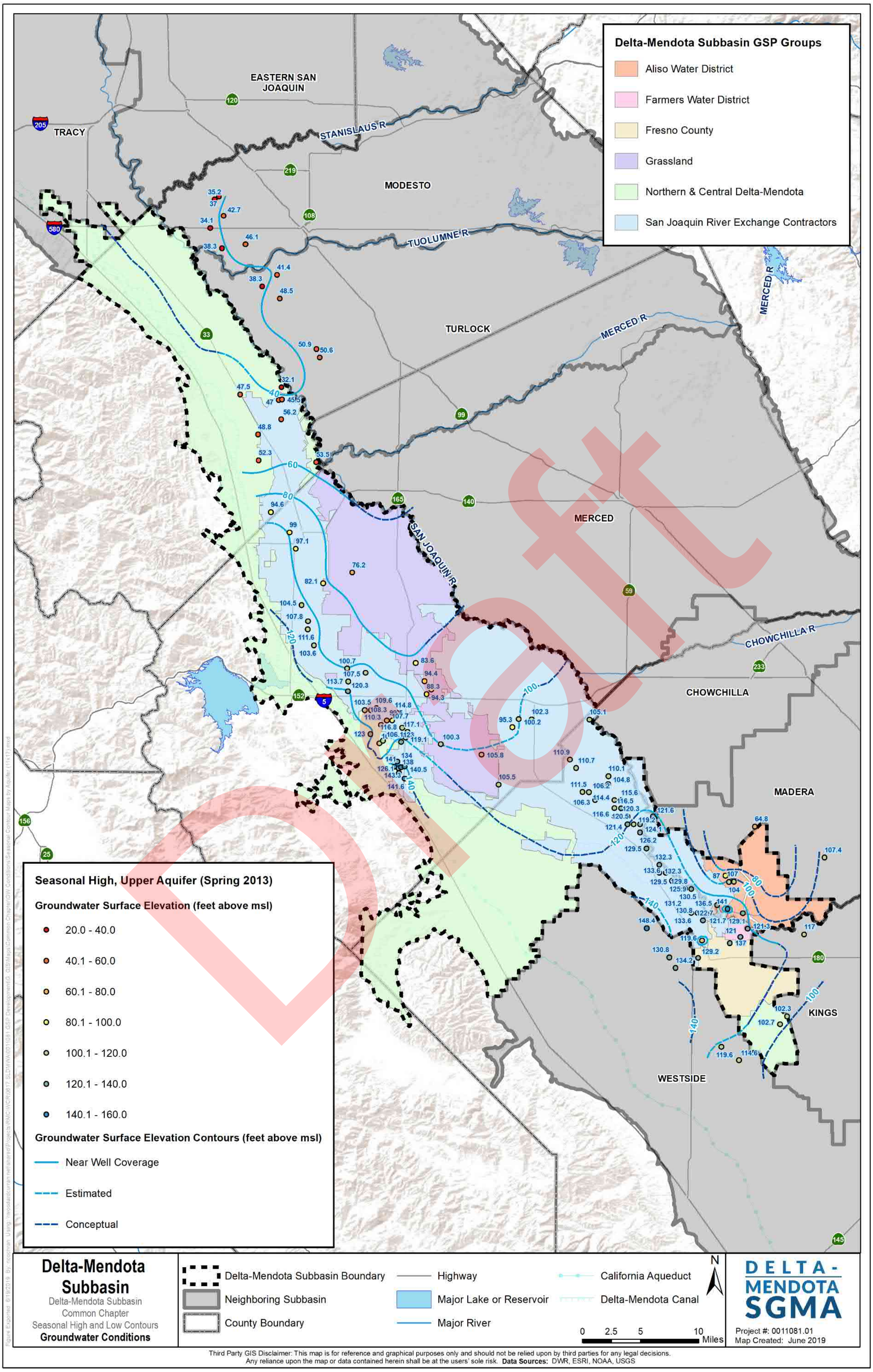


Figure CC-45: Spring 2013 Upper Aquifer Groundwater Contour Map

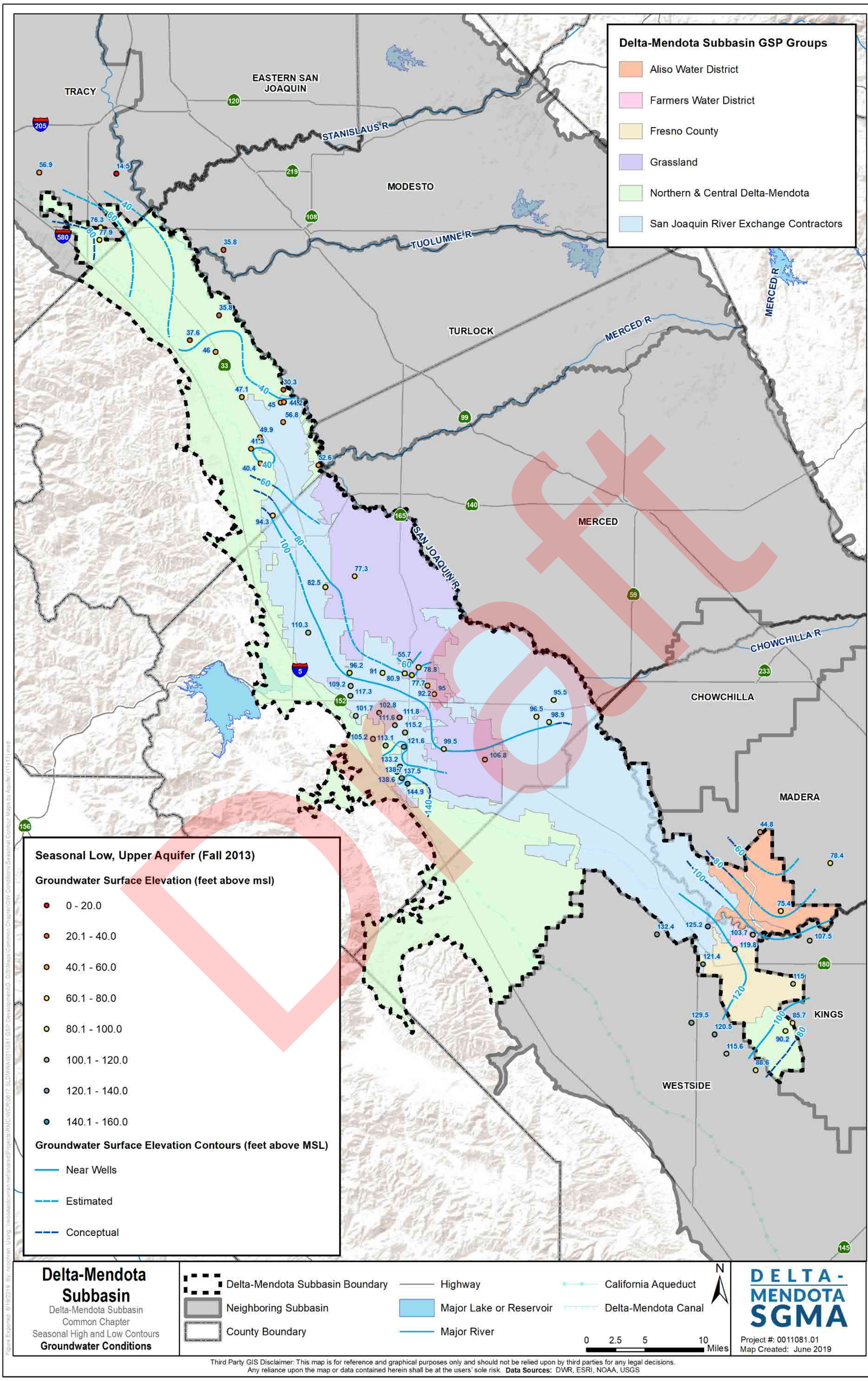


Figure CC-46: Fall 2013 Upper Aquifer Groundwater Contour Map

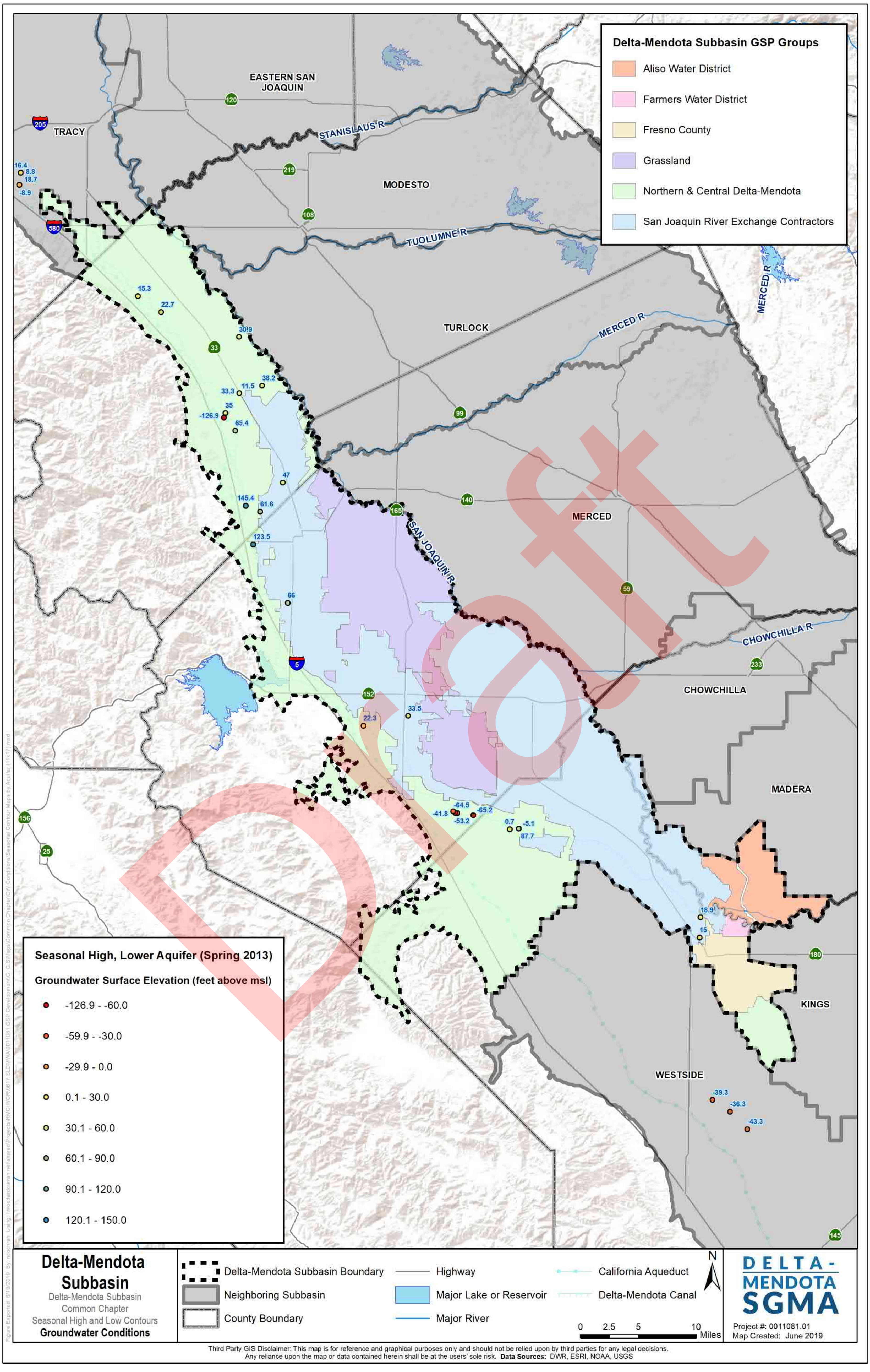


Figure CC-47: Spring 2013 Lower Aquifer Groundwater Elevation Measurements

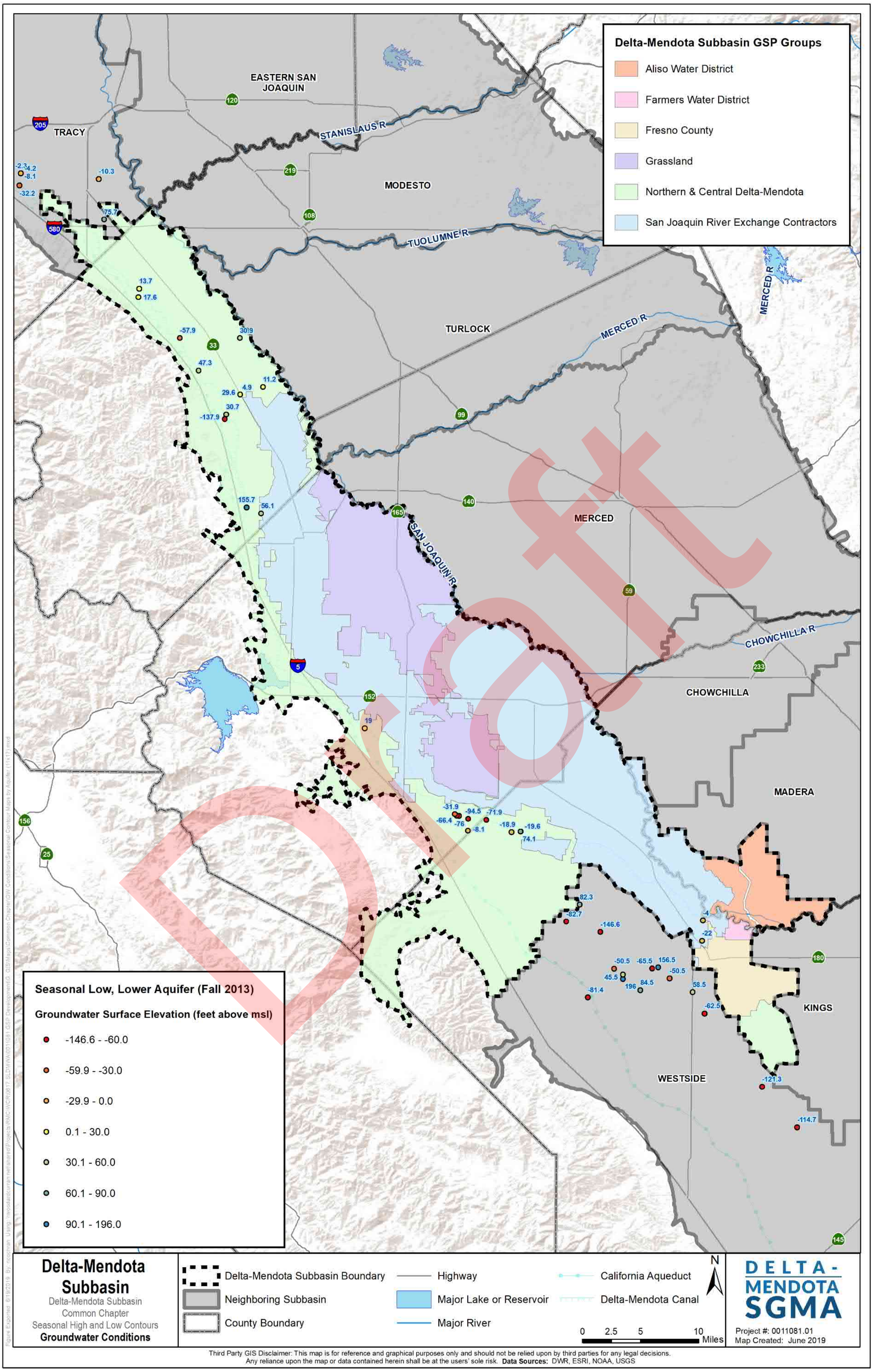


Figure CC-48: Fall 2013 Lower Aquifer Groundwater Elevation Measurements

4.2.3 Groundwater Storage

Annual changes in groundwater storage for both the Upper and Lower Aquifers in the Delta-Mendota Subbasin were estimated as part of the development of the Historic (WY2003-2012), Current (WY2013) and Projected Water Budgets (WY2014-2070). For information on how change in storage was calculated, refer to Section 4.3.2 – Water Budgets of this Common Chapter. **Figure CC-49** and **Figure CC-50** show annual change in storage, cumulative change in storage, and water year type for the Upper Aquifer and Lower Aquifer, respectively, from WY 2003 through 2013 for the Delta-Mendota Subbasin. For the purposes of the water budget four water year types were utilized, wet, average (corresponding to above and below normal water years), dry (corresponding to dry and critical water years) and Shasta critical.

Change in storage is negative for 6 out of the 11-year historic and current water budget period for the Upper Aquifer, and 9 out of 11 years for the Lower Aquifer. Despite periods of wet conditions with recharge outpacing extractions, an overall declining trend in groundwater storage can be observed in both the Upper Aquifer and Lower Aquifer. Cumulative change in storage declined more rapidly in the Upper Aquifer compared to the Lower Aquifer, declining by about 1,300,0000 AF in the Upper Aquifer and 678,000 AF in the Lower Aquifer between WY2003 to 2013.

Figure CC-49: Calculated Upper Aquifer Change in Storage, Annual and Cumulative

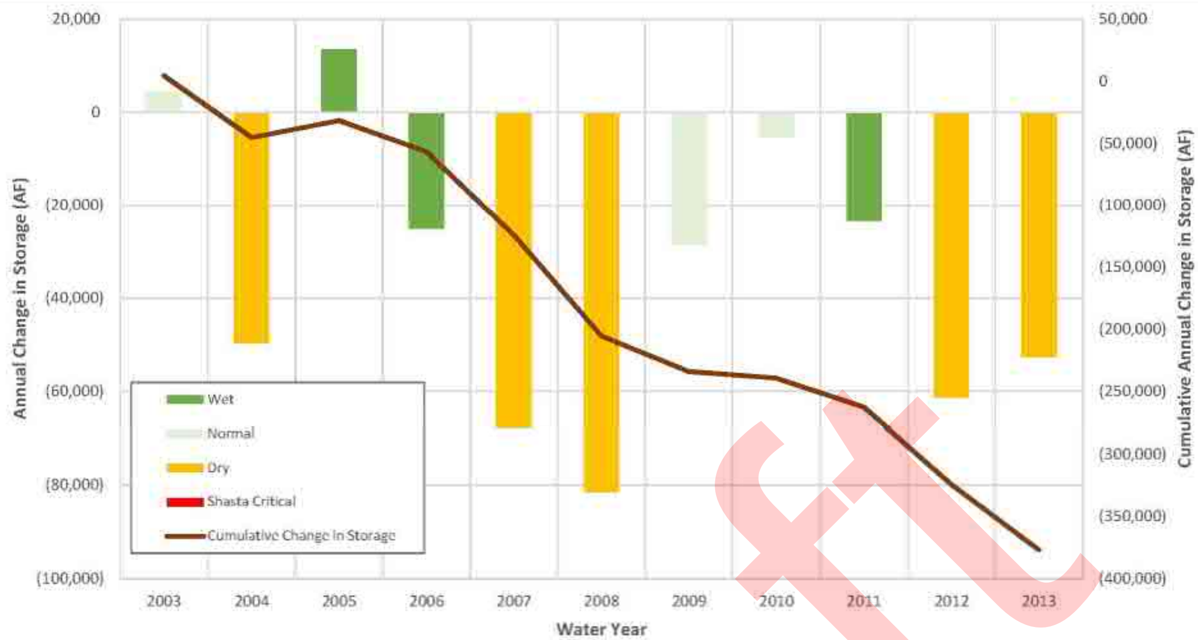


Figure CC-50: Calculated Lower Aquifer Change in Storage, Annual and Cumulative

4.2.4 Seawater Intrusion

Seawater intrusion is not an applicable sustainability indicator for the Delta-Mendota Subbasin. The Subbasin is located inland from the Pacific Ocean; thus, groundwater conditions related to seawater intrusion are not applicable to the Delta-Mendota Subbasin.

4.2.5 Groundwater Quality

Groundwater quality varies considerably from west to east and north to south throughout the Delta-Mendota Subbasin. In general, Upper Aquifer water quality has historically been impacted by overlying land uses with some areas showing increasing concentrations of nitrate and TDS. Areas of elevated salt concentrations can be found in the Subbasin, generally along the southern portion of the San Joaquin River and in the southern portion of the Subbasin. Lower Aquifer groundwater has, and remains in most cases, to be of generally good quality. For more information about historic and current conditions relative to groundwater quality in each GSP Group area, refer to the individual GSPs.

4.2.6 Land Subsidence

Long-term groundwater level declines can result in a one-time release of "water of compaction" from compacting silt and clay layers (aquitards) resulting in inelastic land subsidence (Galloway et al., 1999). There are several other types of subsidence in the San Joaquin Valley, including subsidence related to hydrocompaction of moisture-deficient deposits above the water table, subsidence related to fluid withdrawal from oil and gas fields, subsidence caused by deep-seated tectonic movements, and subsidence caused by oxidation of peat soils that is a major factor in the Sacramento-San Joaquin Delta (Sneed et al., 2013). However, aquifer-system compaction caused by groundwater pumping causes the largest magnitude and areal extent of land subsidence in the San Joaquin Valley (Poland et al., 1975; Ireland et al., 1984; Farrar and Bertoldi, 1988; Bertoldi et al., 1991; Galloway and Riley, 1999).

Land subsidence is a prevalent issue in the Delta-Mendota Subbasin as it has impacted prominent infrastructure of statewide importance, namely the DMC and the California Aqueduct, as well as local canals, causing serious operational, maintenance, and construction-design issues (Sneed et al., 2013). Reduced freeboard and flow capacity for the DMC and California Aqueduct have rippling effects on imported water availability throughout the State. Even small amounts of subsidence in critical locations, especially where canal gradients are small, can impact canal operations (Sneed and Brandt, 2015). While some subsidence is reversible (referred to as elastic subsidence), inelastic or irreversible subsidence is caused mainly by pumping groundwater from below the Corcoran Clay, thus causing compaction and reducing storage in the fine-grained materials in the lower confined aquifer as well as damaging well infrastructure. As a result, important and extensive damages and repairs have resulted in the loss of conveyance capacity in canals that deliver water or remove floodwaters, the realignment of canals as their constant gradient becomes variable, the raising of infrastructure such as canal check stations, and the releveling of furrowed fields.

Available Data

There are six UNAVCO Continuous GPS (CGPS) locations that monitor subsidence within the Delta-Mendota Subbasin (**Figure CC-51**). Changes in land surface elevation have also been measured at DMC Check Structures. **Figure CC-52** through **Figure CC-57** show the vertical change in land surface elevation from a given time point (specified on charts) for the UNAVCO CGPS stations within the Delta-Mendota Subbasin, along with annual CVP allocations. **Table CC-5** summarizes the greatest monthly land subsidence rate and corresponding year(s) of that change at each UNAVCO CGPS station. Overall, the greatest monthly subsidence rates occurring after January 1, 2015 occurred during the Spring of 2016 to the Spring of 2017. Land subsidence rates (in feet per year), as measured by USBR from December 2011 to December 2014, are shown in **Figure CC-58**. Based on these data, within the majority of the Delta-Mendota Subbasin, annual subsidence rates were between -0.15 and -0.3 feet/year during this period (or between -0.45 and -0.9 feet of total subsidence over this three-year period).

**Table CC-5: Subsidence Monitoring Trends
UNAVCO CGPS Stations**

Station ID	Greatest Monthly Land Subsidence Rate as of January 1, 2015 (feet)	Year(s) of Greatest Monthly Subsidence Rate
P255	-0.0292	Spring 2016 to 2017
P259	-0.0183	Spring 2016 to 2017
P252	-0.033	Spring 2016 to 2017
P303	-0.2190	Spring 2016 to 2017
P301	-0.0029	Spring 2016 to 2017
P304	-0.0003	Spring 2013 to 2017

Historic Conditions

Along the DMC, in the northern portion of the San Joaquin Valley, extensive groundwater extraction from unconsolidated deposits caused subsidence exceeding 8.5 meters (or about 28 feet) between 1926 and 1970 (Poland et al., 1975), reaching 9 meters (or about 30 feet) in 1980 (Ireland, 1986). Land subsidence from groundwater pumping began in the San Joaquin Valley in the mid-1920s (Poland et al., 1975; Bertoldi et al., 1991; Galloway and Riley, 1999), and by 1970, about half of the San Joaquin Valley had land subsidence of more than 0.3 meters (or about 1 foot) (Poland et al., 1975). When groundwater pumping decreased in the Delta-Mendota Subbasin following imported water deliveries from the CVP via the DMC in the early 1950s, compaction rates were reduced in certain areas and water levels recovered. Notable droughts of 1976-1977 and 1987-1992 saw renewed compaction during these periods, with increased groundwater pumping as imported supplies were reduced or unavailable. However, following these droughts, compaction virtually ceased and groundwater levels rose to near pre-drought levels quite rapidly (Swanson, 1998; Galloway et al., 1999).

Subsidence contours for 1926-1970 (Poland et al., 1975) show the area of maximum active subsidence was southwest of the community of Mendota. Historical subsidence rates in the Mendota area exceeded 500 millimeters/year (or about 20 inches/year) during the mid-1950s and early 1960s (Ireland et al., 1984). The area southwest of Mendota has experienced some of the highest levels of subsidence in California, where from 1925 to 1977, this area sustained over 29 feet of subsidence (USGS, 2017). Historical subsidence rates along Highway 152 calculated from leveling-survey data from 1972, 1988, and 2004 show that for the two 16-year periods (1972-1988 and 1988-2004), maximum subsidence rates of about 50 millimeters/year (or about 2 inches/year) were found just south of El Nido (Sneed et al., 2013). Geodetic surveys completed along the DMC in 1935, 1953, 1957, 1984, and annually from 1996-2001 indicated that subsidence rates were greatest between 1953 and 1957 surveys, and that the maximum subsidence along the DMC (about 3 meters, or about 10 feet) was just east of DMC Check Structure Number 18.

After 1974, land subsidence was demonstrated to have slowed or largely stopped (DWR, June 2017); however, land subsidence remained poised to resume under certain conditions. Such an example includes the severe droughts that occurred between 1976 and 1977 and between 1987 and 1991. Those droughts, along with other corroborating factors, led to diminished deliveries of imported water which prompted some water agencies and farmers (especially in the western Valley) to refurbish old pumps, drill new water wells, and begin pumping groundwater to make up for cutbacks in the imported water supply. The decisions to renew groundwater pumping were encouraged by the fact that groundwater levels had recovered to near-predevelopment levels. CGPS data collected between 2007 to 2014 show seasonally variable subsidence and compaction rates, including uplift as elastic rebound occurs during the fall and winter (Sneed and Brandt, 2015). Vertical displacement at P303, near Los Banos, indicates subsidence at fairly consistent rates during and between drought periods (Sneed and Brandt, 2015). Vertical displacement at P304, near Mendota, indicates that most subsidence occurred during drought periods with very little occurring between drought periods. Finally, data from extensometers 12S/12E-16H2, located on the DMC west of Los Banos, and 14S/13E-11D6, located between the DMC and California Aqueduct west of Mendota, showed subsidence rate increases during 2014, the third year of the most recent drought (Sneed and Brandt, 2015).

Subsidence impacts to the California Aqueduct, which runs parallel and in close proximity to the Delta-Mendota Canal across the Subbasin, is of statewide importance. During the construction of the California Aqueduct, it was thought that subsidence within the San Joaquin Valley would cease with the delivery of water from the Central Valley Project, though additional freeboard was incorporated into the design and construction of the Aqueduct in an attempt to mitigate for future subsidence (DWR, June 2017). After water deliveries from the Aqueduct began, subsidence rates decreased to an average of less than 0.1 inches/year during normal to wet hydrologic years. During dry to critical hydrologic years, subsidence increased to an average of 1.1 inches per year. The 2012-2015 drought produced subsidence similar to those seen before the Aqueduct began delivering water, with some areas experiencing nearly 1.25 inches of sinking per month (based on NASA UAVSAR flight measurements). Dry and critically dry water years since Aqueduct deliveries began have resulted in extensive groundwater withdrawals, causing some areas near the Aqueduct to subside nearly 6 feet.

Current Conditions

Based on subsidence rates observed over the last decade, it is anticipated that without mitigation, subsidence will continue to impact operations of the DMC and California Aqueduct. For example, recently, Reach 4A of the San Joaquin River near Dos Palos experienced between 0.38 and 0.42 feet/year in subsidence between 2008 and 2016. As a result of subsidence, freeboard in Reach 4A is projected to be reduced by 0.5 foot by 2026 as compared to 2016, resulting in a 50 percent reduction in designed flow capacity (DWR, May 2018). Reduced flow capacities in the California Aqueduct will impact deliveries and transfers throughout the State and result in the need to pump more groundwater, thus contributing to further subsidence.

More recent subsidence measuring indicates subsidence hot spots within the Subbasin include the area east of Los Banos and the Tranquillity Irrigation District (TRID) area. USGS began periodic measurements of the land surface in parts of the San Joaquin Valley over the last decade. Between December 2011 and December 2014, total subsidence in the area east of Los Banos, located within the Merced Subbasin (also referred to as the El Nido-Red Top area), over the three-year period ranged from 0.15 to 0.75 feet, or 1.8 to 9 inches respectively (KDSA, 2015). The Jet Propulsion Laboratory (JPL) at the California Institute of Technology has also been monitoring subsidence in California using interferometric synthetic aperture radar (or InSAR), and a recent progress report documenting data for the period from May of 2015 to September of 2016 indicates that the two previously-identified primary subsidence areas near the community of Corcoran and centered on El Nido was joined by a third area of significant subsidence near TRID. For the study period (as shown in **Figure CC-59**), maximum total subsidence of 22 inches was measured near Corcoran, while the El Nido area subsided 15 inches and the TRID area subsided around 20 inches. Analyses at two particular stations near El Nido show interesting trends. At Station P303, between 2007 and 2014, 50 mm (or nearly 2 inches) of subsidence occurred at this location. Vertical displacement at P303 (**Figure CC-55**) show subsidence at fairly consistent rates during and between drought periods, indicating that these areas continued to pump groundwater despite climatic variations (possibly due to a lack of surface water availability) (Sneed and Brandt, 2015). Residual compaction may also be a factor. Vertical displacement at Station P304 indicated that most subsidence in this particular area occurred during drought periods and very little occurred between drought periods (**Figure CC-57**). This suggests that this area received other sources of water (most likely surface water available between drought periods) and that residual compaction was not very important in this area. These two areas demonstrate a close link between the availability of surface water, groundwater pumping, and inelastic land subsidence.

Total land subsidence from April 2015 to April 2016 in the San Joaquin Valley is shown in

Figure CC-60: Vertical Displacement, April 2015 to April 2016 . Subsidence monitoring in the Delta-Mendota Subbasin, and in the San Joaquin Valley as a whole, demonstrated significant inelastic land subsidence as a result of the last drought, with effects continuing to the present time (as evidenced by continued subsidence between 2016 and 2018 through surveys of the DMC). While the impacts appeared to have slowed, the temporal and spatial impacts of continued subsidence have not yet been evaluated.

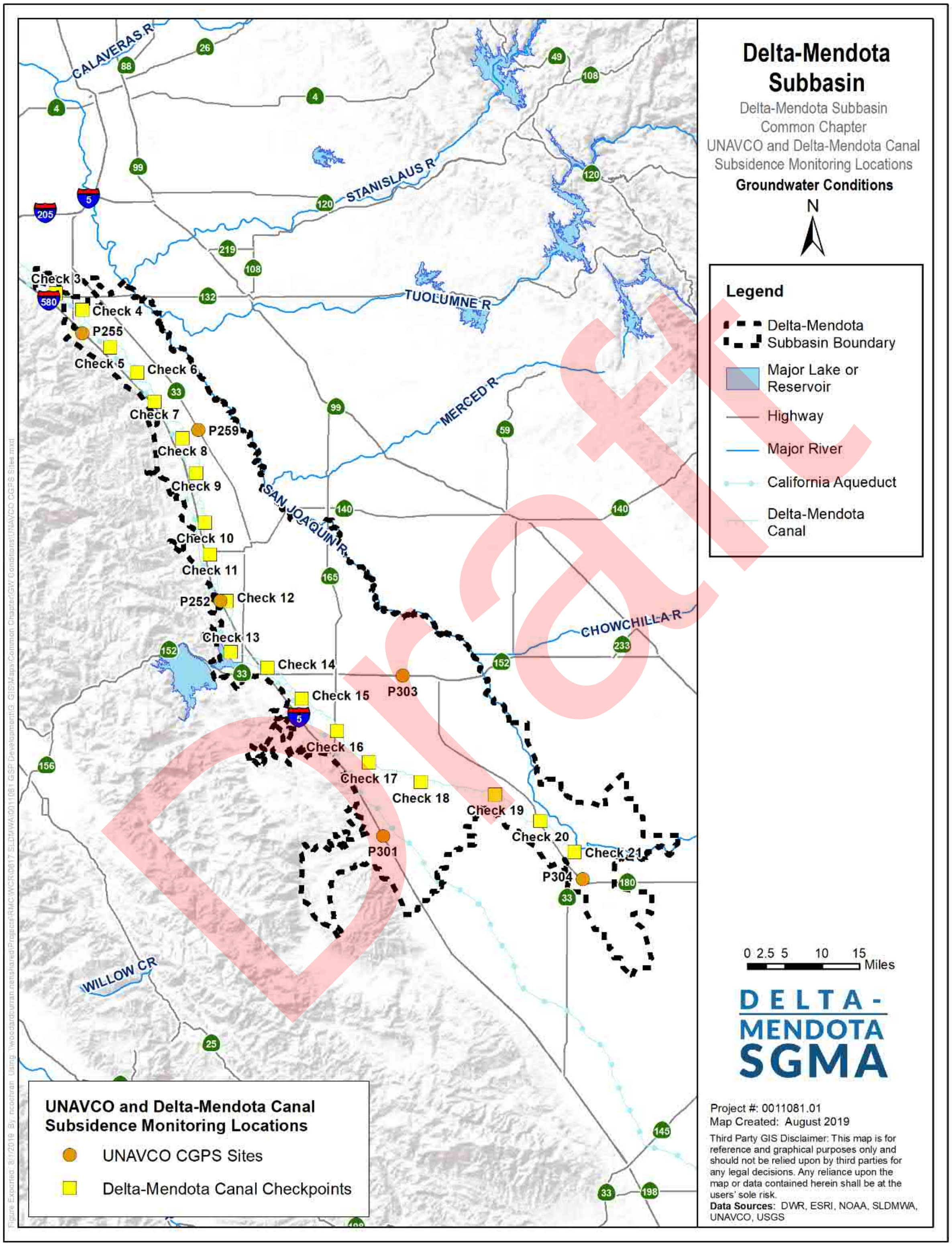


Figure CC-51: UNAVCO and Delta-Mendota Canal Subsidence Monitoring Locations

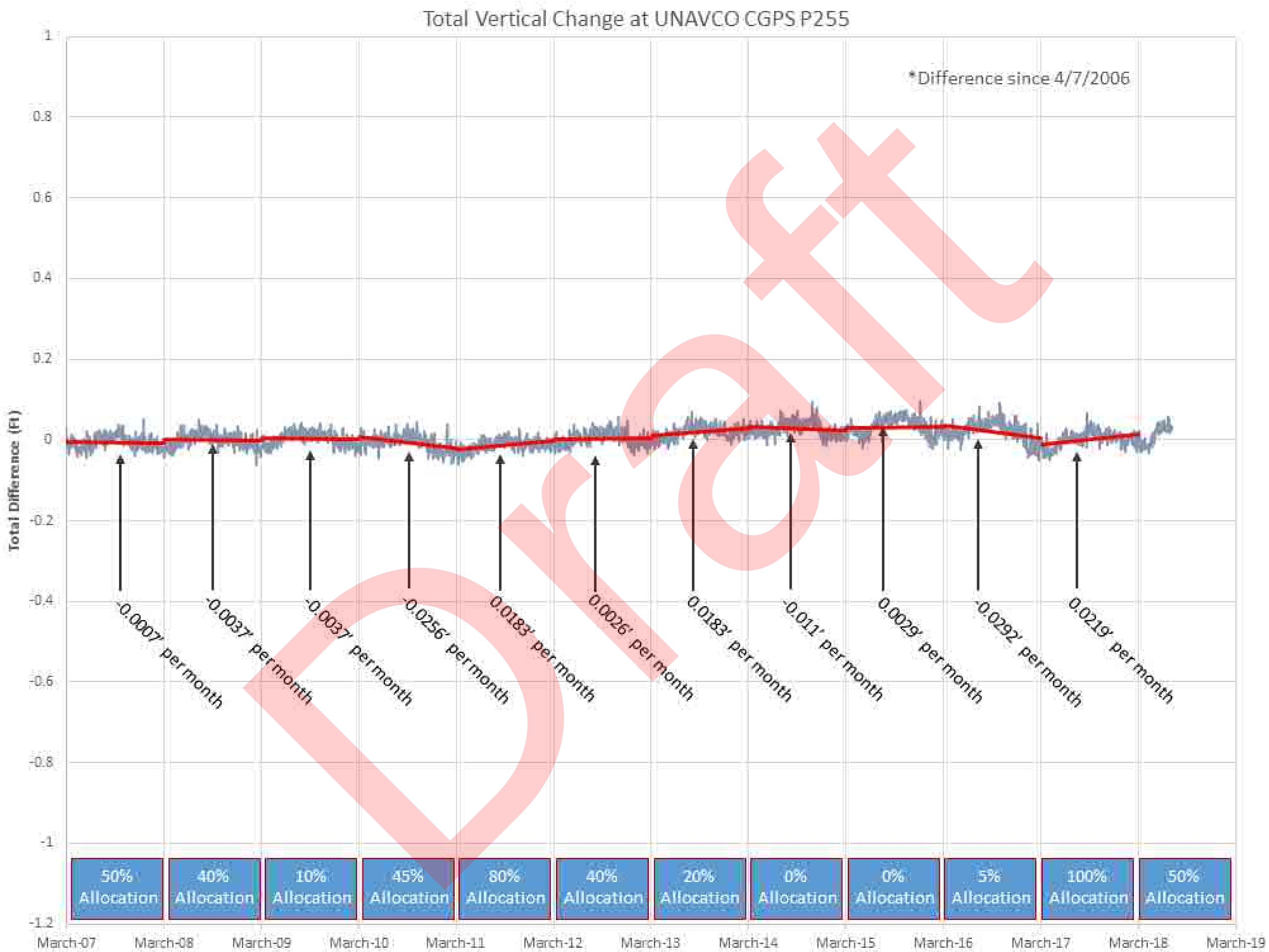


Figure CC-52: Vertical Elevation Change at UNAVCO CGPS P255, Spring 2007 to 2018

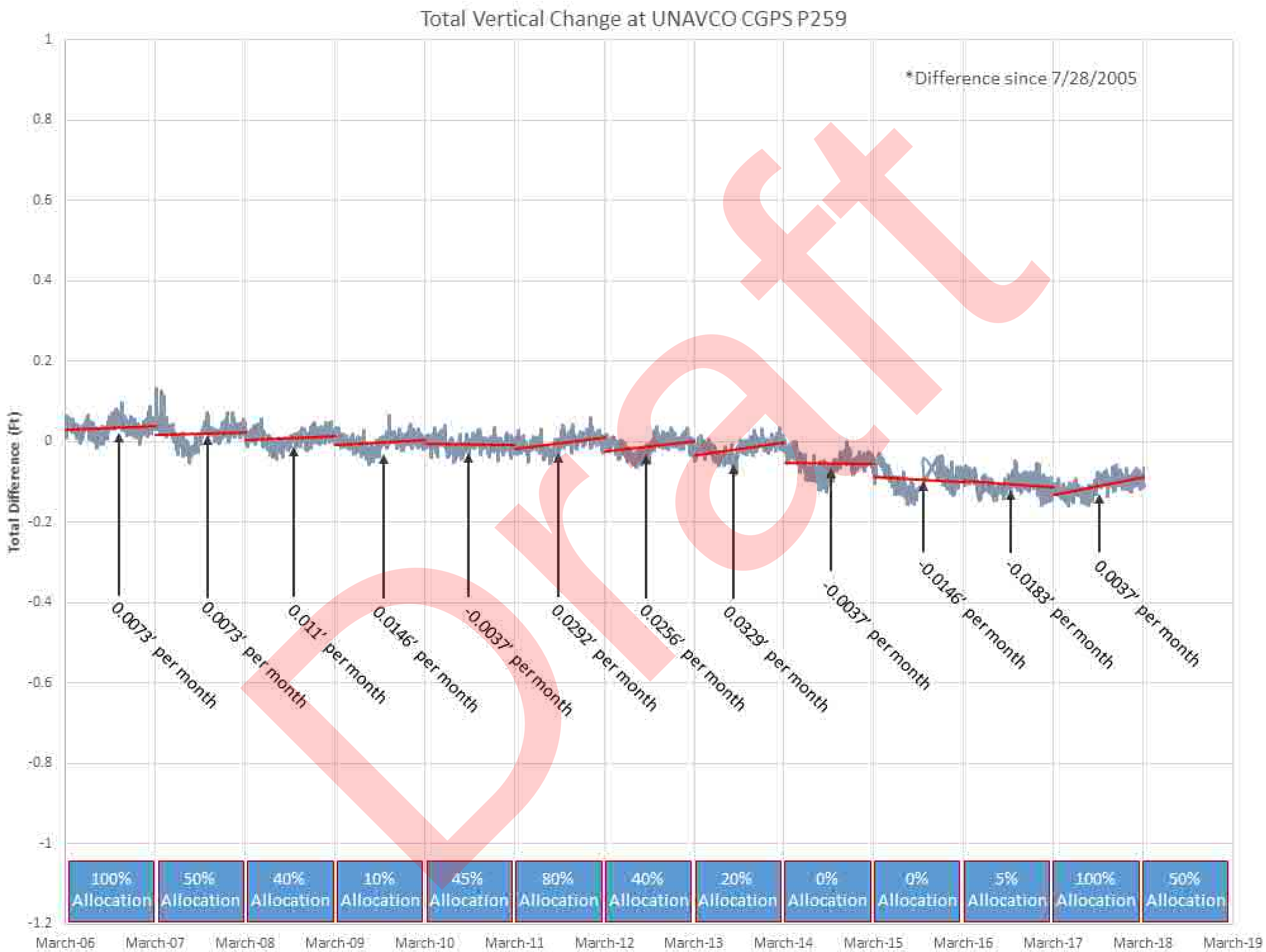


Figure CC-53: Vertical Elevation Change at UNAVCO CGPS P259, Spring 2006 to 2018

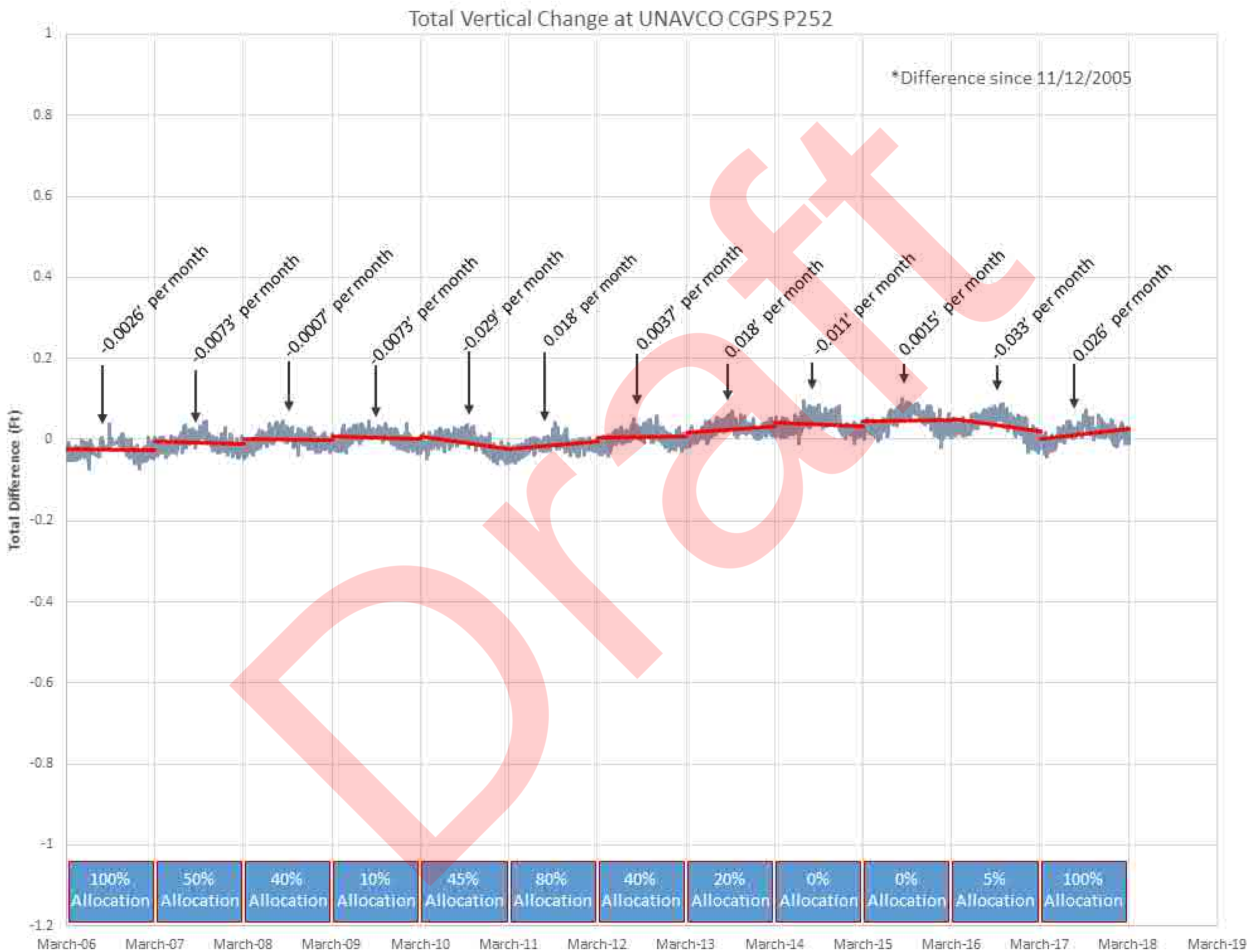


Figure CC-54: Vertical Elevation Change at UNAVCO CGPS P252, Spring 2006 to 2018

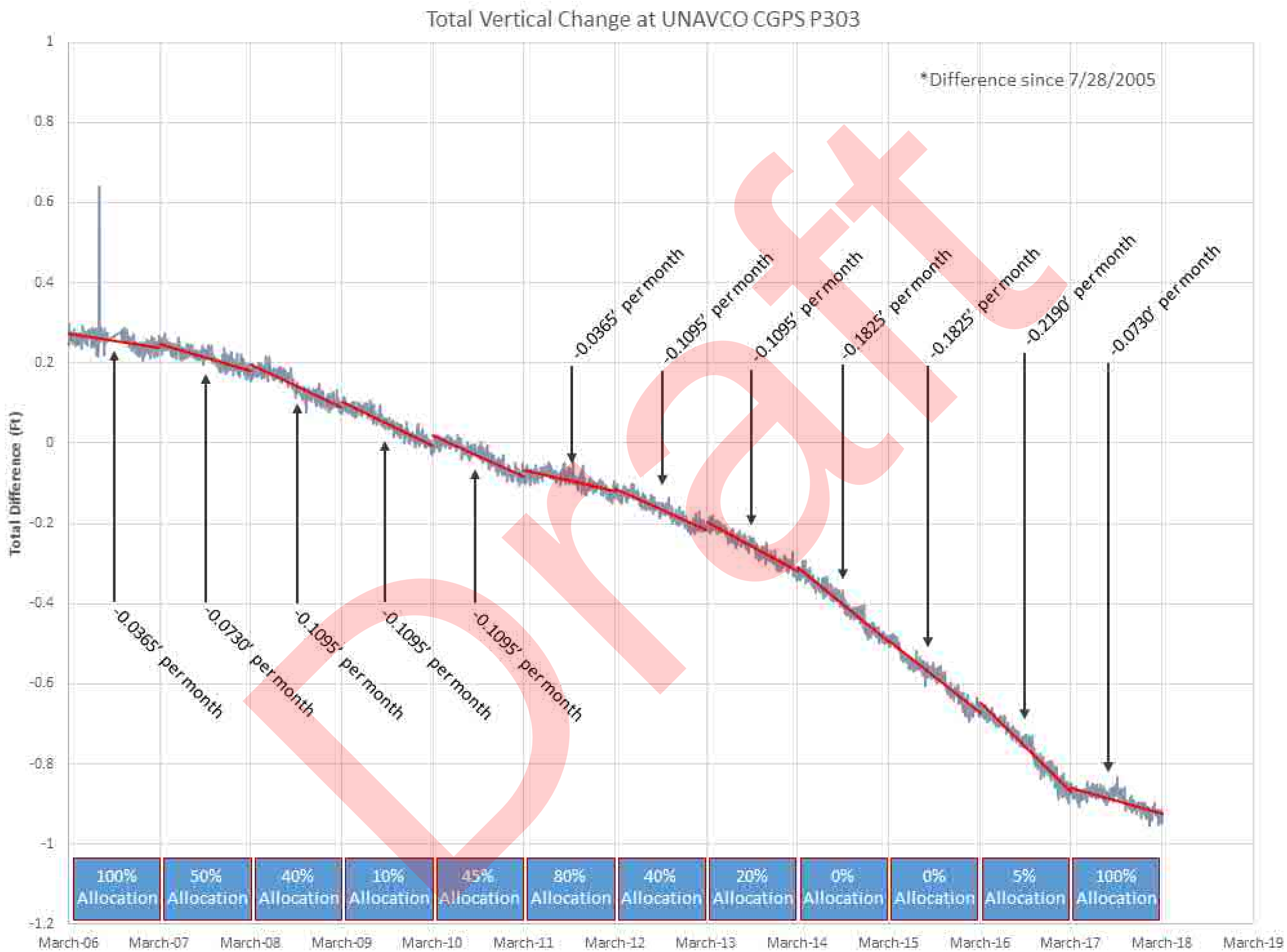


Figure CC-55: Vertical Elevation Change at UNAVCO CGPS P303, Spring 2006 to 2018

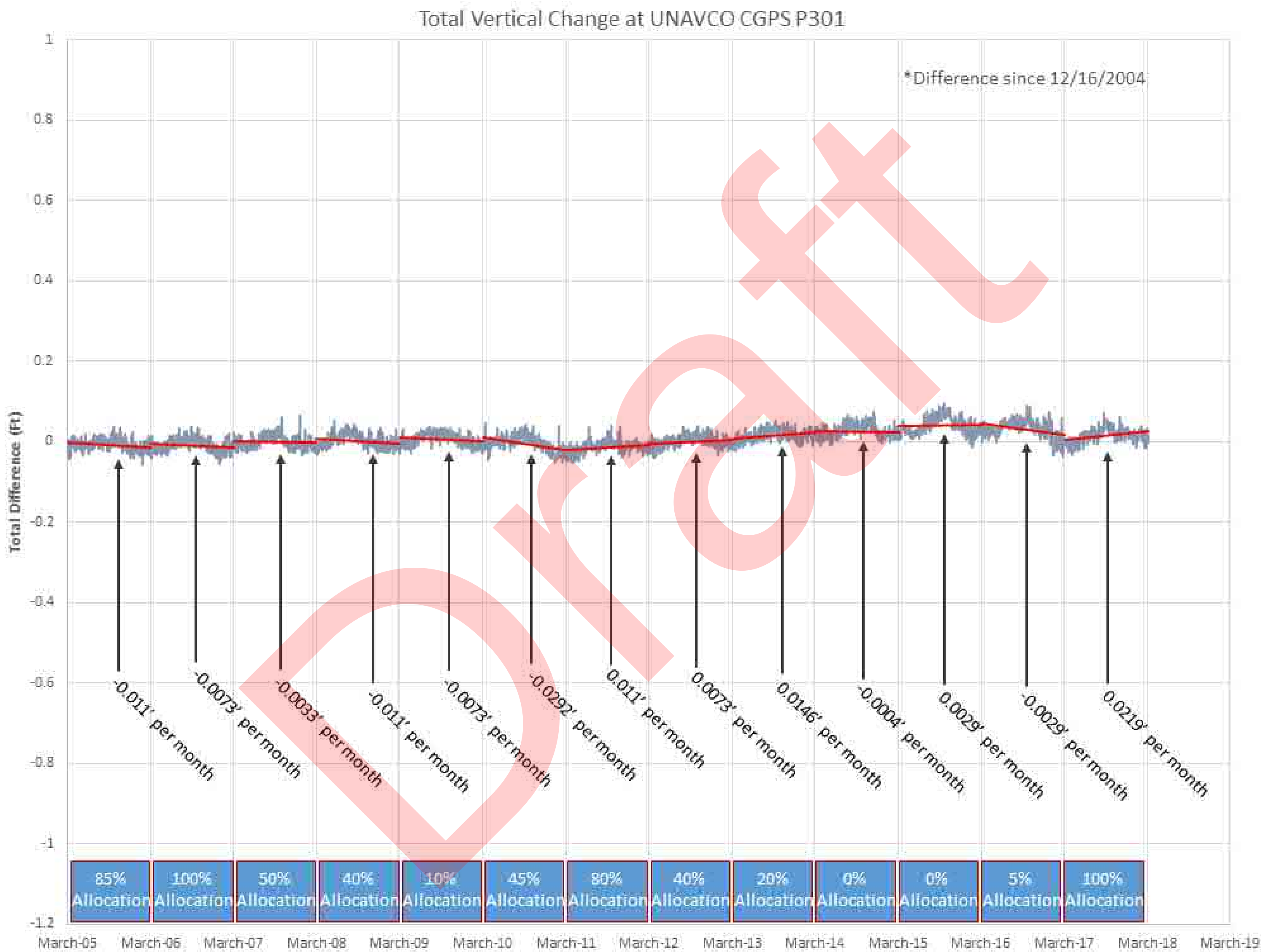


Figure CC-56: Vertical Elevation Change at UNAVCO CGPS P301, Spring 2005 to 2018

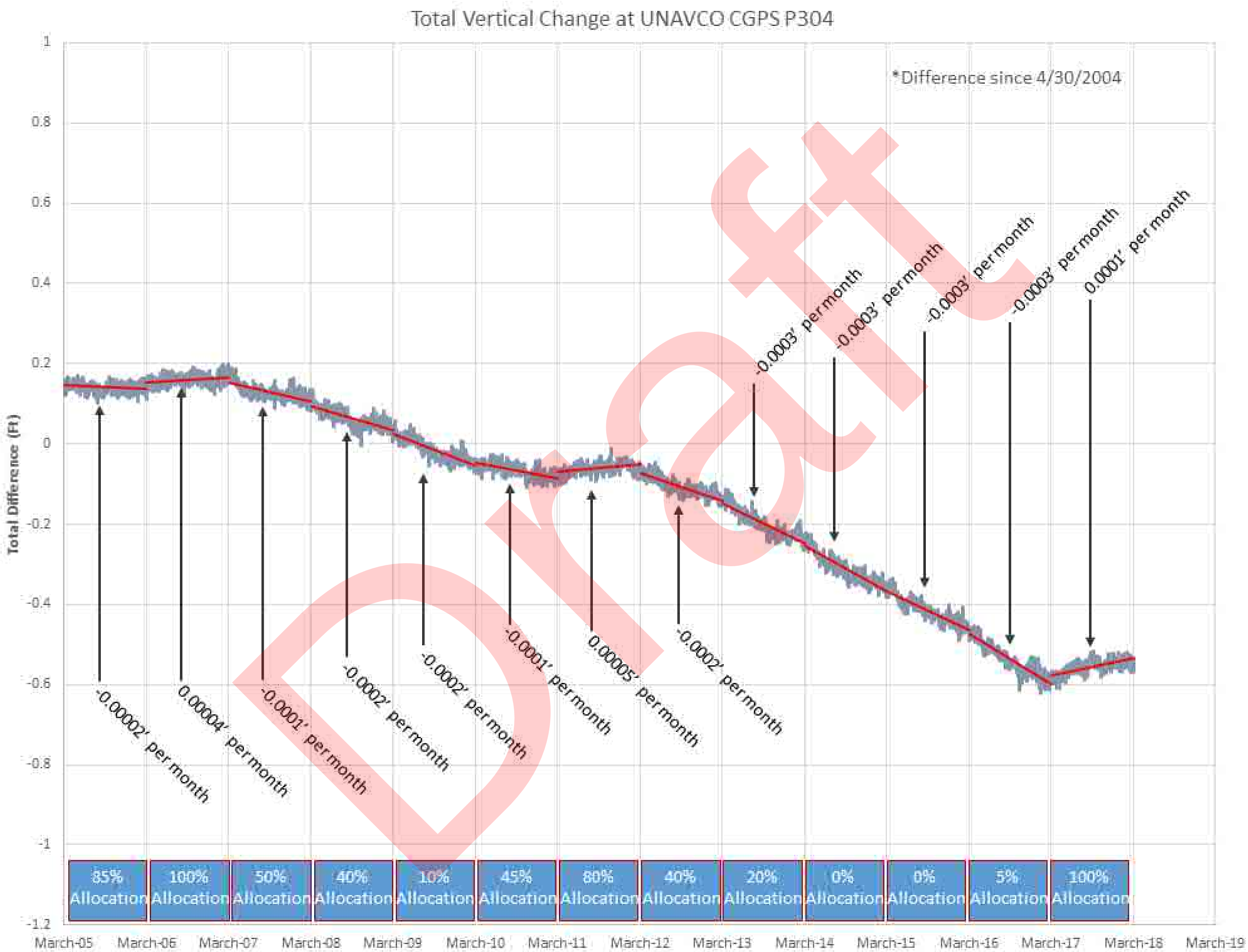


Figure CC-57: Vertical Elevation Change at UNAVCO CGPS P304, Spring 2005 to 2018

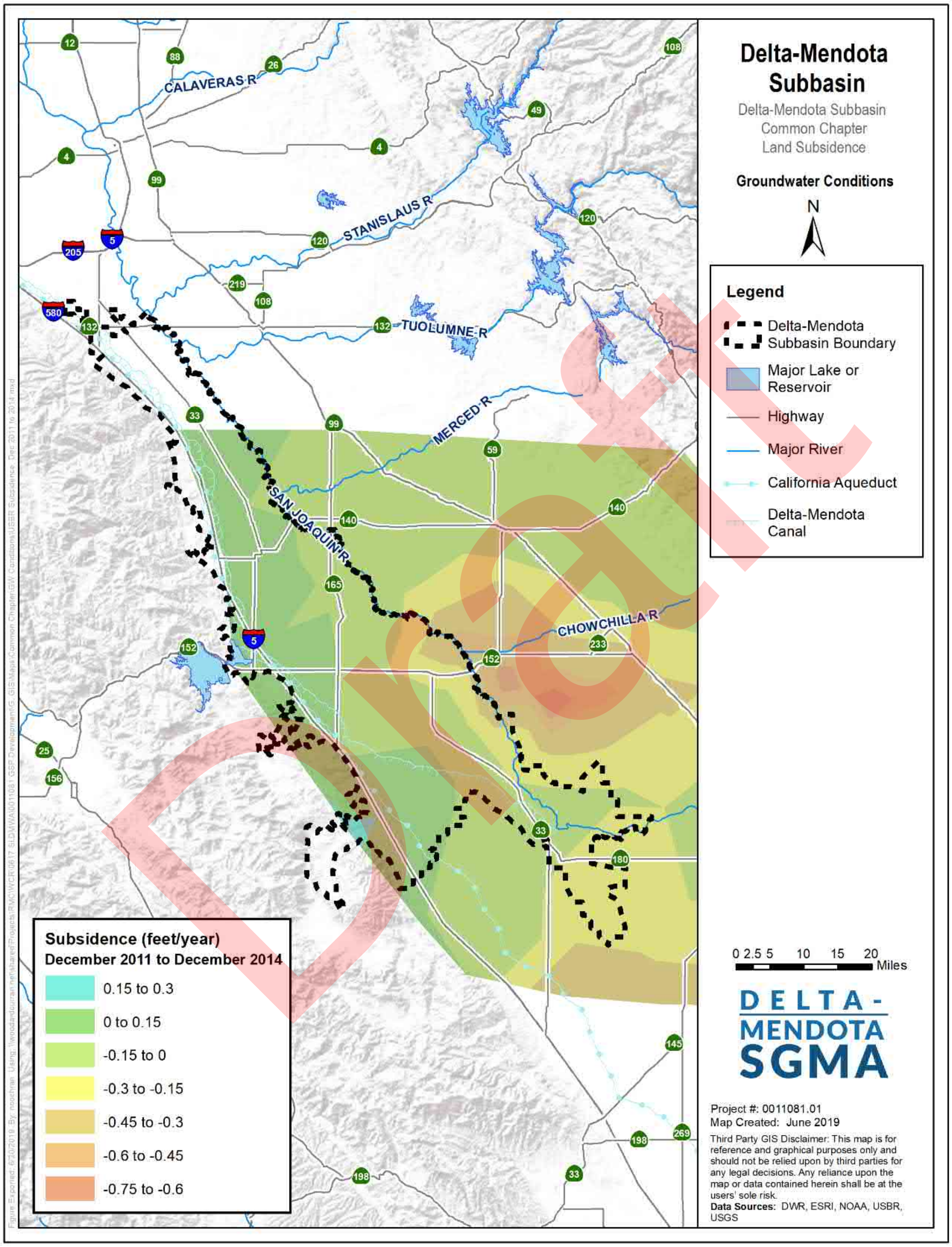
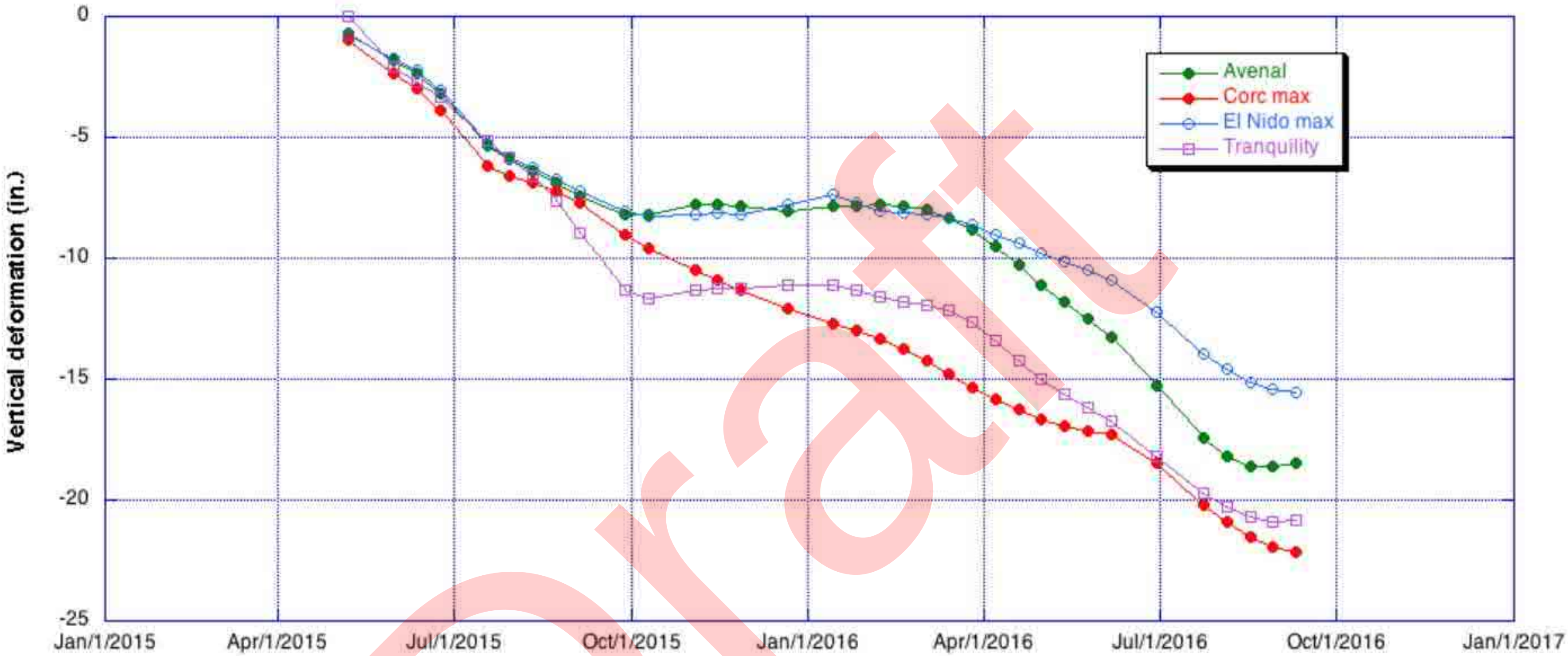


Figure CC-58: Land Subsidence, December 2011 to December 2014



Source: Progress Report: Subsidence in California, March 2015 – September 2016, Farr et. Al. JPL, 2017

Figure CC-59: Recent Land Subsidence at Key San Joaquin Valley Locations

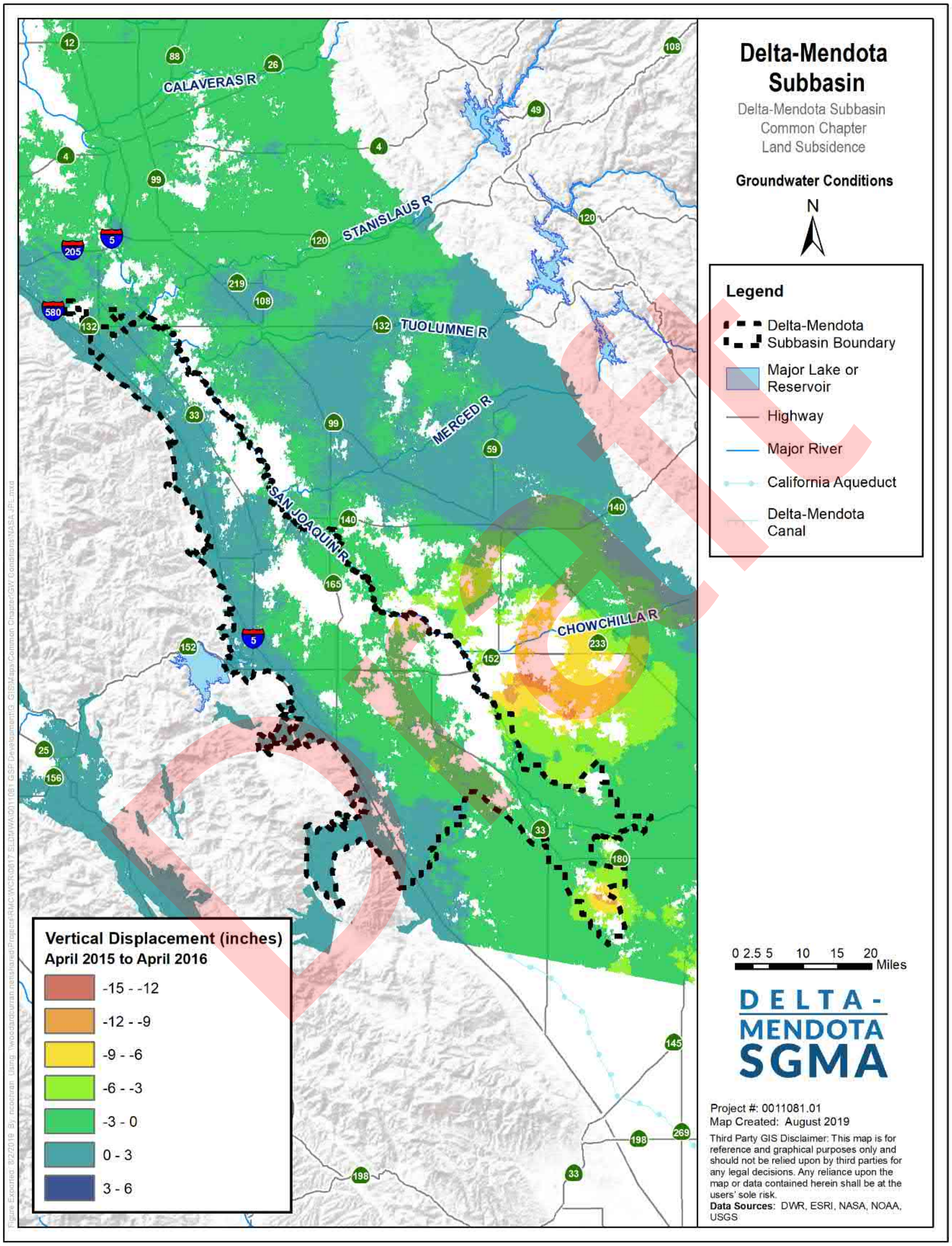


Figure CC-60: Vertical Displacement, April 2015 to April 2016

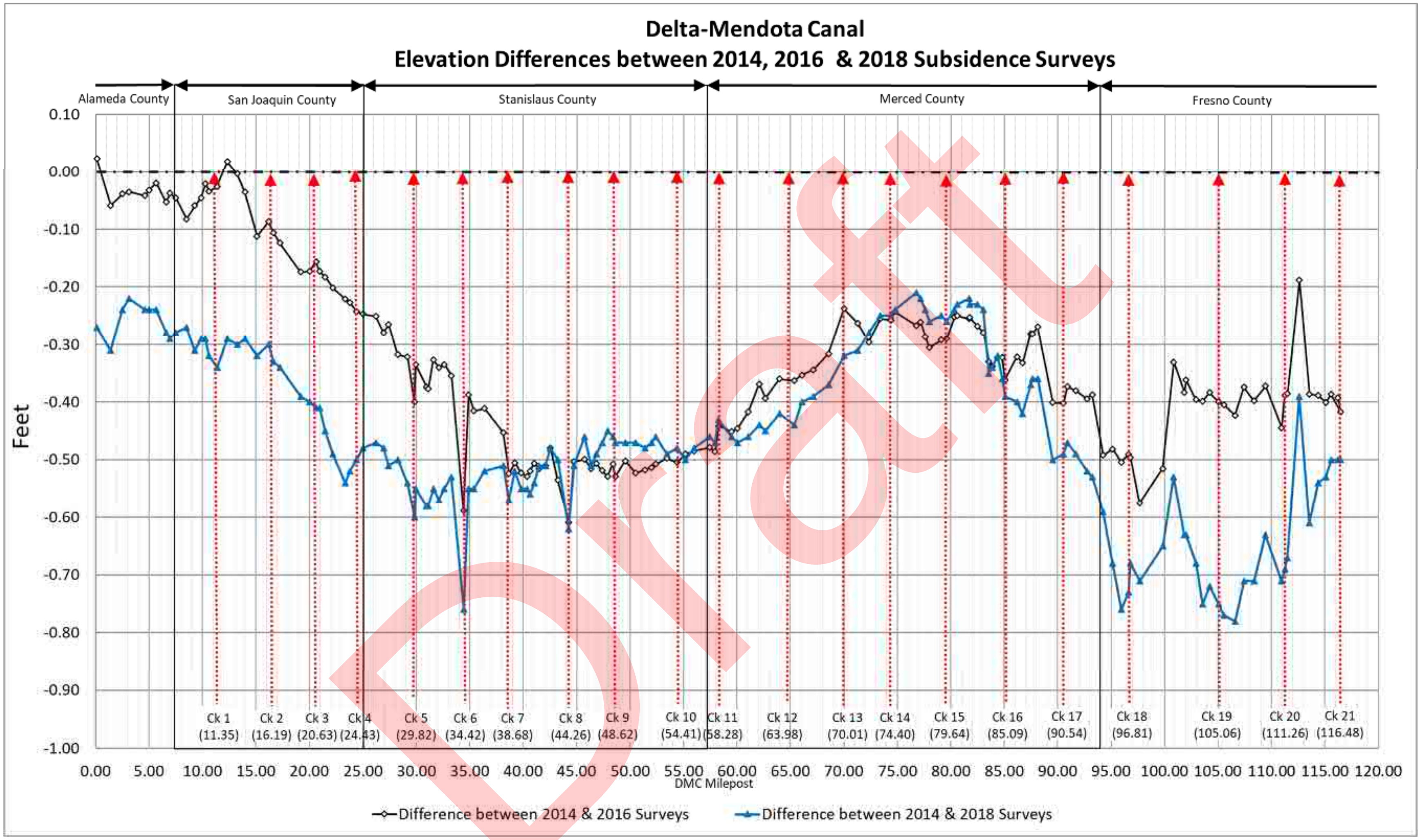


Figure CC-61: Elevation Change along the Delta-Mendota Canal, 2014 through 2018

4.2.7 Interconnected Surface Water Systems

Understanding the location, timing and magnitude of groundwater pumping impacts on interconnected surface water systems is important for the proper management of groundwater resources in order to minimize impacts on interconnected surface waters and the biological communities and permitted surface water diverters that rely on those resources. Historically, throughout the San Joaquin Valley, many interconnected stream reaches have transitioned from net-gaining to net-losing streams (TNC, 2014). Gaining streams occur when streamflows increase as a result of groundwater contribution and losing streams occur when streamflows decrease due to infiltration into the bed of the stream (McBain & Trush, Inc., 2002). Increased groundwater pumping has the ability to contribute to the depletion of interconnected waters with the nature, rate, and location of increased pumping being a function of distance to the river, as well as depth, timing, and rate of groundwater pumping.

Available Data

Two communities in the Delta-Mendota Subbasin are likely most vulnerable to the loss of interconnected surface water as a result of groundwater pumping: San Joaquin River surface water diverters and groundwater dependent ecosystems (GDEs). These communities represent the primary beneficial users of interconnected surface water and groundwater. Streams stemming from the west side of the Delta-Mendota Subbasin are ephemeral in nature, and only two of these creeks reach the San Joaquin River (Del Puerto Creek and Orestimba Creek). These creeks lose their flows to the underlying vadose zone (net-losing streams) and therefore do not represent areas of potential GDEs.

Groundwater dependent ecosystems are defined under Article 2 Definitions, § 351 Definitions of the GSP Emergency Regulations as “ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface.” The Natural Communities Commonly Associated with Groundwater (NCCAG) dataset (2018) provided by DWR in conjunction with The Nature Conservancy (TNC) was initially used to identify GDEs within the Delta-Mendota Subbasin, following the associated guidance document provided by TNC (Rohde et al., 2018). Local verification efforts were conducted in the Delta-Mendota Subbasin by different GSA representatives to ground-truth GDEs based on local knowledge. Specifically, areas where natural communities have been urbanized or otherwise modified prior to 2015 were eliminated from the data set used to identify GDEs.

Identification of Interconnected Surface Water Systems

The San Joaquin River and Fresno Slough are the primary surface water bodies interconnected with Delta-Mendota Subbasin groundwater. For information about the sources used to determine the interconnected segments of the San Joaquin River and Fresno Slough within the Delta-Mendota Subbasin, refer to the individual GSPs.

Historic Conditions

The San Joaquin River and its tributaries drain approximately 13,500 mi^2 (measured at the USGS gaging station at Vernalis) along the western flank of the Sierra Nevada and eastern flank of the Coast Range, and flows northward into the Sacramento-San Joaquin Delta where it is joined by the Calaveras and Mokelumne Rivers before combining with the Sacramento River. Typical of Mediterranean climate catchments, river flows vary widely seasonally and from year to year. Three major tributaries join the San Joaquin from the east: the Merced, Tuolumne, and Stanislaus Rivers. Smaller tributaries include the Fresno River, Chowchilla River, Bear Creek, and Fresno Slough (from the Kings River). Precipitation is predominantly snow above about 5,500 to 6,000 feet in the Sierra Nevada, with rain in the middle and lower elevations of the Sierra foothills and in the Coast Range. As a result, the natural hydrology historically reflected a mixed runoff regime dominated by winter-spring rainfall runoff and spring-summer snowmelt runoff. Most flow is derived from snowmelt from the Sierra Nevada, with relatively little runoff contributed from the western side of the drainage basin in the rain shadow of the Coast Range. The unimpaired average annual water yield (WY1906-2002) of the San Joaquin River, as measured immediately above Millerton Reservoir, is 1,801,000 acre-feet (USBR, 2002); the post-Friant Dam average annual water yield (WY 1950-2000) to the lower San Joaquin River is 695,500 acre-feet (USGS, 2000). As average precipitation decreases from north to south, the San Joaquin River basin (including the Stanislaus, Tuolumne, and Merced Rivers) contributes about 22% of the total runoff to the Delta (DWR, 1998).

Current Conditions

Historically, most of the San Joaquin River, which forms the great majority of the Delta-Mendota Subbasin's eastern border, was a gaining reach. Snowmelt runoff during the spring and early summer resulted in these conditions through a good portion of the year. However, significant decreases in groundwater elevations due to a myriad of factors, including pumping, tile drains, the channelizing of flood flows, and upstream diversions on the river, have reversed this condition so most reaches are now losing reaches. Some localized gaining reaches still remain on the lower river, such as between the Stanislaus and Merced Rivers; however, many reaches along these rivers (and along localized streams) may transition from gaining to losing depending on hydrology.

Estimates of Timing and Quantity of Depletions

Using available data and where feasible, each Delta-Mendota Subbasin GSP Group quantified the gains and/or losses from the groundwater at each interconnected reach of the San Joaquin River adjoining the Delta-Mendota Subbasin. **Table CC-6** summarizes these estimates. For more information about the sources or methods used to estimate the timing and quantity of depletions, refer to the individual GSPs.

Table CC-6: Estimated Quantity of Gains/Depletions for Interconnected Stream Reaches, San Joaquin River

	Landmark	River Mile	GSP Group	Interconnected?	Gaining or Losing?	Quantity Gained/Loss (cfs)	Notes
REACH 1		*267.5 to 229.0*	Located outside the Delta-Mendota Subbasin				
A	Friant Dam	267.5					
	North Fork Road Bridge	266.8					
	Cobb Island Bridge	259.0					
	State Route 41 (Lanes Bridge)	255.2					
	Scout Island Bend	250.0					
	ATSF Railroad Bridge	245.0					
B	State Route 99	243.2					
	Southern Pacific Railroad	243.2					
	State Route 145 Bridge (Skaggs Bridge)	234.1					
	Gravelly Ford	229.0					
REACH 2		*229.0 to 204.8*					
A	Gravelly Ford	229.0		Yes	Losing when flowing		
	Upstream Limit of Right Bank Levee	227.0					
	Upstream Limit of Left Bank Levee	225.0					
B	Chowchilla Bypass Control Structure	216.1	Farmers Water District	Yes	Losing when flowing	-4	2003 to 2013 average. High in 2010 (-8 cfs), low in 2004 and 2009 (-1 cfs)
	Mendota Dam	204.8					
	Mendota Pool			Yes	Losing	-40	-29,000 AFY
REACH 3		*204.8 to 182.0*		Yes	Losing	-25	-18.000 AFY
	Mendota Dam	204.8					
	Avenue 7.5 Bridge (Firebaugh)	195.2					
	Sack Dam	182.0					
REACH 4		*182.0 to 135.8*				-50 - 0	Losses when wet; gaining in some areas (but unquantifiable)
A	Sack Dam	182.0		Yes - first 2 miles No - next 1.5 miles Yes - remaining miles	Losing		
	State Route 152 Bridge	173.9		Yes	Gaining		
B	Sand Slough Control Structure	168.5					
	Mariposa Slough Control Structure	168.4					
	Turner Island Road Bridge	157.2					
	Mariposa Bypass confluence	147.2					
	Bear Creek/Eastside Bypass confluence	135.8					

Landmark	River Mile	GSP Group	Interconnected?	Gaining or Losing?	Quantity Gained/Loss (cfs)	Notes
REACH 5	*135.8 to 118.0*		Yes	Gaining	unquantifiable	Likely gaining from ag/refuge draining but unquantifiable
Bear Creek/Eastside Bypass confluence	135.8					
State Route 165 Bridge (Lander Avenue)	132.9					
Salt Slough con fluence	127.7					
State Route 140 Bridge (Fremont Ford)	125.1					
Mud Slough confluence	121.2					
Merced River confluence (Hills Ferry Bridge)	118.0					
Newman to Crows Landing		Northern & Central Delta-Mendota	Yes	Gaining	50	50
Crows Landing to Patterson		Northern & Central Delta-Mendota Region	Yes	Gaining	-50 to 200	-50 to 200
Patterson to Vernalis		Northern & Central Delta-Mendota Region	Yes	Gaining	190	6.1 cfs/mi for 30.8 miles. Based on Cooley, W. 2001. *Groundwater flow net analysis for lower San Joaquin River Basin.* Memo to CRWQCB, August 8, 2001

Groundwater Dependent Ecosystems

A groundwater dependent ecosystem (GDE) is defined under the GSP Emergency Regulations as referring "to ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" (§351(m)). Under §354.16(g) of the GSP Emergency Regulations, each Plan is required to identify GDEs within the subbasin utilizing data provided by DWR or the best available information. The following section describes the process for verifying GDEs within the Delta-Mendota Subbasin and the location of verified and potential GDEs.

The Natural Communities Commonly Associated with Groundwater (NCCAG) dataset (2018c) provided by DWR was used in conjunction with information provided by The Nature Conservancy (TNC) to identify GDEs within the Delta-Mendota Subbasin. To further screen available information regarding GDEs, each GSP Group developed individualized criteria. Additional details regarding the screening process implemented by each GSP can be found in the individual GSPs.

Based on the screening process implemented by each individual GSP Group, GDE polygons determined not to be GDEs were removed from the mapping. **Figure CC-62** and **Figure CC-63** summarize the results of the GDE analysis for the Subbasin. Results are compiled into two habitat classes: wetlands (**Figure CC-62**) and vegetation (**Figure CC-63**). Wetland features are commonly associated with surface expression of groundwater under natural, unmodified conditions. Vegetation feature types are commonly associated with the sub-surface presence of groundwater (phreatophytes – deep rooted plants). Confirmed GDEs have been grouped into larger polygons based on proximity and aquifer connection.

In general, identified Possible GDEs are primarily located along the San Joaquin River corridor, within the northern portion of the Northern & Central Delta-Mendota Region GSP, the SJREC GSP, the Grassland GSP, and the Fresno GSP Plan Areas, where some possible GDEs have been identified along ephemeral streams that originate from the Coast Range. Table CC-7 includes all freshwater species within the Delta-Mendota Subbasin as identified by TNC (2018). Per TNC data, these species (listed in Table CC-7) have either been observed or have the potential to exist within the Delta-Mendota Subbasin; however, the actual presence of these species have not been verified. As a result of the identification of Possible GDEs for the purpose of SGMA, no land use protections for GDEs are conveyed unless otherwise required. Additionally, the Delta Mendota Subbasin recognizes the opportunity to present further-refined GDE delineations in the subsequent GSP Updates.

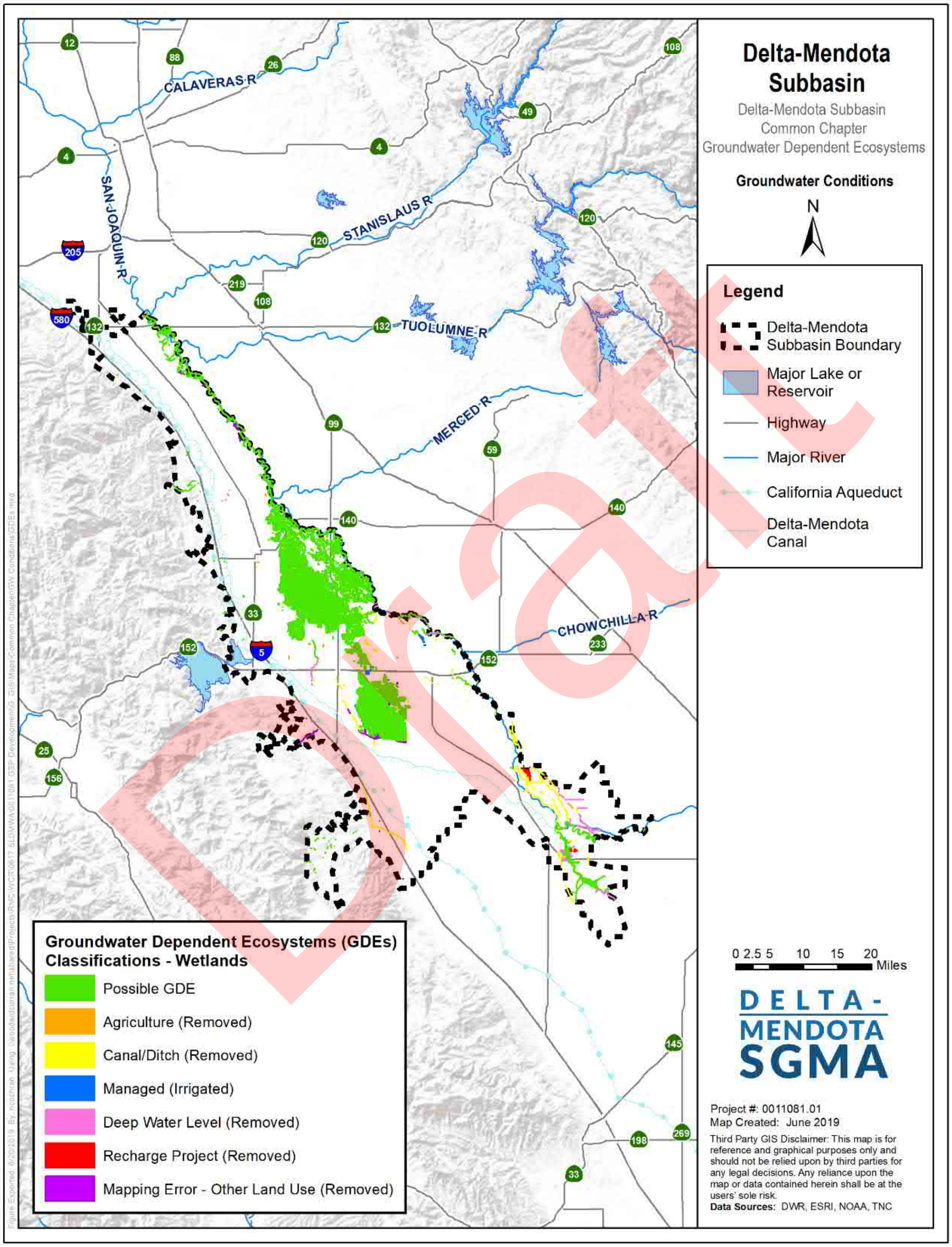


Figure CC-62: Groundwater Dependent Ecosystems, Wetlands

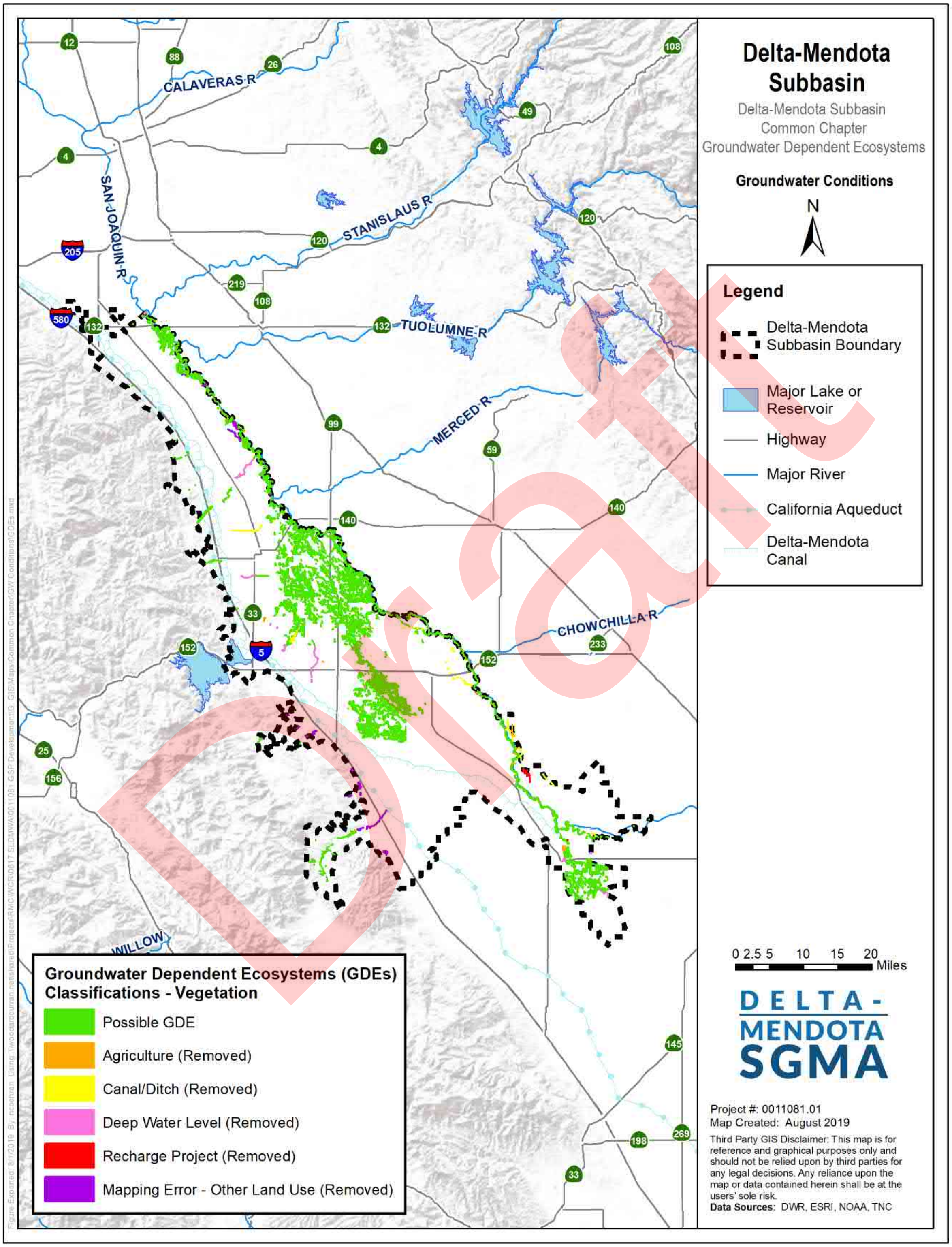


Figure CC-63: Groundwater Dependent Ecosystems, Vegetation

Table CC-7: List of Potential Freshwater Species

Scientific Name	Common Name	Group	Federal Protection Status	State Protection Status
Actitis macularius	Spotted Sandpiper	Birds		
Aechmophorus clarkii	Clark's Grebe	Birds		
Aechmophorus occidentalis	Western Grebe	Birds		
Agelaius tricolor	Tricolored Blackbird	Birds	Bird of Conservation Concern	Special Concern
Aix sponsa	Wood Duck	Birds		
Anas acuta	Northern Pintail	Birds		
Anas americana	American Wigeon	Birds		
Anas clypeata	Northern Shoveler	Birds		
Anas crecca	Green-winged Teal	Birds		
Anas cyanoptera	Cinnamon Teal	Birds		
Anas discors	Blue-winged Teal	Birds		
Anas platyrhynchos	Mallard	Birds		
Anas strepera	Gadwall	Birds		
Anser albifrons	Greater White-fronted Goose	Birds		
Ardea alba	Great Egret	Birds		
Ardea herodias	Great Blue Heron	Birds		
Aythya affinis	Lesser Scaup	Birds		
Aythya americana	Redhead	Birds		Special Concern
Aythya collaris	Ring-necked Duck	Birds		
Aythya marila	Greater Scaup	Birds		
Aythya valisineria	Canvasback	Birds		Special
Botaurus lentiginosus	American Bittern	Birds		
Bucephala albeola	Bufflehead	Birds		
Bucephala clangula	Common Goldeneye	Birds		
Butorides virescens	Green Heron	Birds		
Calidris alpina	Dunlin	Birds		
Calidris mauri	Western Sandpiper	Birds		
Calidris minutilla	Least Sandpiper	Birds		
Chen caerulescens	Snow Goose	Birds		

Scientific Name	Common Name	Group	Federal Protection Status	State Protection Status
Chen rossii	Ross's Goose	Birds		
Chlidonias niger	Black Tern	Birds		Special Concern
Chroicocephalus philadelphia	Bonaparte's Gull	Birds		
Cistothorus palustris	Marsh Wren	Birds		
Cygnus columbianus	Tundra Swan	Birds		
Cypseloides niger	Black Swift	Birds	Bird of Conservation Concern	Special Concern
Dendrocygna bicolor	Fulvous Whistling-Duck	Birds		Special Concern
Egretta thula	Snowy Egret	Birds		
Empidonax traillii	Willow Flycatcher	Birds	Bird of Conservation Concern	Endangered
Fulica americana	American Coot	Birds		
Gallinago delicata	Wilson's Snipe	Birds		
Gallinula chloropus	Common Moorhen	Birds		
Geothlypis trichas	Common Yellowthroat	Birds		
Grus canadensis	Sandhill Crane	Birds		
Haliaeetus leucocephalus	Bald Eagle	Birds	Bird of Conservation Concern	Endangered
Himantopus mexicanus	Black-necked Stilt	Birds		
Icteria virens	Yellow-breasted Chat	Birds		Special Concern
Limnodromus scolopaceus	Long-billed Dowitcher	Birds		
Lophodytes cucullatus	Hooded Merganser	Birds		
Megaceryle alcyon	Belted Kingfisher	Birds		
Mergus merganser	Common Merganser	Birds		
Mergus serrator	Red-breasted Merganser	Birds		
Numenius americanus	Long-billed Curlew	Birds		
Numenius phaeopus	Whimbrel	Birds		
Nycticorax nycticorax	Black-crowned Night-Heron	Birds		
Oxyura jamaicensis	Ruddy Duck	Birds		
Pandion haliaetus	Osprey	Birds		Watch list
Pelecanus erythrorhynchos	American White Pelican	Birds		Special Concern

Scientific Name	Common Name	Group	Federal Protection Status	State Protection Status
Phalacrocorax auritus	Double-crested Cormorant	Birds		
Phalaropus tricolor	Wilson's Phalarope	Birds		
Plegadis chihi	White-faced Ibis	Birds		Watch list
Pluvialis squatarola	Black-bellied Plover	Birds		
Podiceps nigricollis	Eared Grebe	Birds		
Podilymbus podiceps	Pied-billed Grebe	Birds		
Porzana carolina	Sora	Birds		
Rallus limicola	Virginia Rail	Birds		
Recurvirostra americana	American Avocet	Birds		
Riparia riparia	Bank Swallow	Birds		Threatened
Setophaga petechia	Yellow Warbler	Birds		
Tachycineta bicolor	Tree Swallow	Birds		
Tringa melanoleuca	Greater Yellowlegs	Birds		
Tringa semipalmata	Willet	Birds		
Tringa solitaria	Solitary Sandpiper	Birds		
Vireo bellii	Bell's Vireo	Birds		
Vireo bellii pusillus	Least Bell's Vireo	Birds	Endangered	Endangered
Xanthocephalus xanthocephalus	Yellow-headed Blackbird	Birds		Special Concern
Artemia franciscana	San Francisco Brine Shrimp	Crustaceans		
Branchinecta conservatio	Conservancy Fairy Shrimp	Crustaceans	Endangered	Special
Branchinecta lindahli	Versatile Fairy Shrimp	Crustaceans		
Branchinecta longiantenna	Longhorn Fairy Shrimp	Crustaceans	Endangered	Special
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Crustaceans	Threatened	Special
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Crustaceans	Endangered	Special
Linderiella occidentalis	California Fairy Shrimp	Crustaceans		Special
Oncorhynchus mykiss - CV	Central Valley steelhead	Fishes	Threatened	Special
Oncorhynchus mykiss irideus	Coastal rainbow trout	Fishes		

Scientific Name	Common Name	Group	Federal Protection Status	State Protection Status
Pogonichthys macrolepidotus	Sacramento splittail	Fishes		Special Concern
Actinemys marmorata	Western Pond Turtle	Herps		Special Concern
Ambystoma californiense	California Tiger Salamander	Herps	Threatened	Threatened
Anaxyrus boreas	Boreal Toad	Herps		
Pseudacris regilla	Northern Pacific Chorus Frog	Herps		
Rana boylii	Foothill Yellow-legged Frog	Herps	Under Review in the Candidate or Petition Process	Special Concern
Rana draytonii	California Red-legged Frog	Herps	Threatened	Special Concern
Spea hammondii	Western Spadefoot	Herps	Under Review in the Candidate or Petition Process	Special Concern
Thamnophis atratus	Santa Cruz Gartersnake	Herps		
Thamnophis elegans	Mountain Gartersnake	Herps		
Thamnophis gigas	Giant Gartersnake	Herps	Threatened	Threatened
Thamnophis hammondii	Two-striped Gartersnake	Herps		Special Concern
Thamnophis sirtalis	Common Gartersnake	Herps		
Aeshnidae fam.	Aeshnidae fam.	Insects & other inverts		
Anax junius	Common Green Darner	Insects & other inverts		
Brillia spp.	Brillia spp.	Insects & other inverts		
Callicorixa spp.	Callicorixa spp.	Insects & other inverts		
Capnia hitchcocki	Arroyo Snowfly	Insects & other inverts		
Chironomus spp.	Chironomus spp.	Insects & other inverts		
Coenagrionidae fam.	Coenagrionidae fam.	Insects & other inverts		
Corisella spp.	Corisella spp.	Insects & other inverts		
Cricotopus spp.	Cricotopus spp.	Insects & other inverts		
Ischnura cervula	Pacific Forktail	Insects & other inverts		
Ischnura denticollis	Black-fronted Forktail	Insects & other inverts		
Mesocapnia bulbosa	Bulbous Snowfly	Insects & other inverts		
Paraleptophlebia associata	A Mayfly	Insects & other inverts		

Scientific Name	Common Name	Group	Federal Protection Status	State Protection Status
Paratanytarsus spp.	Paratanytarsus spp.	Insects & other inverts		
Phaenopsectra spp.	Phaenopsectra spp.	Insects & other inverts		
Procladius spp.	Procladius spp.	Insects & other inverts		
Psectrocladius spp.	Psectrocladius spp.	Insects & other inverts		
Tanypus spp.	Tanypus spp.	Insects & other inverts		
Tipulidae fam.	Tipulidae fam.	Insects & other inverts		
Trichocorixa spp.	Trichocorixa spp.	Insects & other inverts		
Castor canadensis	American Beaver	Mammals		
Lontra canadensis	North American River Otter	Mammals		
Neovison vison	American Mink	Mammals		
Ondatra zibethicus	Common Muskrat	Mammals		
Anodonta californiensis	California Floater	Mollusks		Special
Margaritifera falcata	Western Pearlshell	Mollusks		Special
Pyrgulopsis diablensis	Diablo Range Pyrg	Mollusks		Special
Alopecurus saccatus	Pacific Foxtail	Plants		
Ammannia coccinea	Scarlet Ammannia	Plants		
Anemopsis californica	Yerba Mansa	Plants		
Arundo donax	NA	Plants		
Azolla filiculoides	NA	Plants		
Azolla microphylla	Mexican mosquito fern	Plants		Special
Baccharis salicina		Plants		
Bacopa eisenii	Gila River Water-hyssop	Plants		
Bidens laevis	Smooth Bur-marigold	Plants		
Bolboschoenus glaucus	NA	Plants		
Bolboschoenus maritimus paludosus	NA	Plants		
Callitriche marginata	Winged Water-starwort	Plants		
Ceratophyllum demersum	Common Hornwort	Plants		
Chloropyron molle hispidum		Plants		Special
Chloropyron palmatum	NA	Plants	Endangered	Special
Cotula coronopifolia	NA	Plants		
Crassula aquatica	Water Pygmyweed	Plants		

Scientific Name	Common Name	Group	Federal Protection Status	State Protection Status
Crypsis vaginiflora	NA	Plants		
Cyperus erythrorhizos	Red-root Flatsedge	Plants		
Cyperus squarrosus	Awned Cyperus	Plants		
Downingia bella	Hoover's Downingia	Plants		
Downingia pulchella	Flat-face Downingia	Plants		
Echinodorus berteroi	Upright Burhead	Plants		
Elatine brachysperma	Shortseed Waterwort	Plants		
Elatine californica	California Waterwort	Plants		
Eleocharis acicularis	Least Spikerush	Plants		
Eleocharis atropurpurea	Purple Spikerush	Plants		
Eleocharis coloradoensis		Plants		
Eleocharis macrostachya	Creeping Spikerush	Plants		
Eleocharis montevidensis	Sand Spikerush	Plants		
Eleocharis quadrangulata	NA	Plants		
Elodea canadensis	Broad Waterweed	Plants		
Epilobium cleistogamum	Cleistogamous Spike-primrose	Plants		
Eragrostis hypnoides	Teal Lovegrass	Plants		
Eryngium castrense	Great Valley Eryngo	Plants		
Eryngium racemosum	Delta Coyote-thistle	Plants		Endangered
Eryngium spinosepalum	Spiny Sepaled Coyote-thistle	Plants		Special
Eryngium vaseyi vallicola		Plants		
Eryngium vaseyi	Vasey's Coyote-thistle	Plants		
Euthamia occidentalis	Western Fragrant Goldenrod	Plants		
Hydrocotyle verticillata	Whorled Marsh-pennywort	Plants		
Juncus acuminatus	Sharp-fruit Rush	Plants		
Juncus xiphioides	Iris-leaf Rush	Plants		
Lasthenia ferrisiae	Ferris' Goldfields	Plants		Special
Lasthenia fremontii	Fremont's Goldfields	Plants		
Lemna aequinoctialis	Lesser Duckweed	Plants		

Scientific Name	Common Name	Group	Federal Protection Status	State Protection Status
Lemna gibba	Inflated Duckweed	Plants		
Lemna minor	Lesser Duckweed	Plants		
Lepidium jaredii	Jared's Pepper-grass	Plants		Special
Lepidium oxycarpum	Sharp-pod Pepper-grass	Plants		
Limnanthes douglasii	Douglas' Meadowfoam	Plants		
Limosella acaulis	Southern Mudwort	Plants		
Lipocarpha micrantha	Dwarf Bulrush	Plants		
Ludwigia peploides	NA	Plants		
Ludwigia repens	Creeping Seedbox	Plants		
Lythrum californicum	California Loosestrife	Plants		
Marsilea vestita	NA	Plants		
Mimulus cardinalis	Scarlet Monkeyflower	Plants		
Mimulus guttatus	Common Large Monkeyflower	Plants		
Montia fontana	Fountain Miner's-lettuce	Plants		
Myosurus minimus	NA	Plants		
Myosurus sessilis	Sessile Mousetail	Plants		
Myriophyllum aquaticum	NA	Plants		
Najas guadalupensis	Southern Naiad	Plants		
Navarretia heterandra	Tehama Navarretia	Plants		
Navarretia leucocephala	White-flower Navarretia	Plants		
Navarretia prostrata	Prostrate Navarretia	Plants		Special
Neostapfia colusana	Colusa Grass	Plants	Threatened	Endangered
Panicum dichotomiflorum	NA	Plants		
Paspalum distichum	Joint Paspalum	Plants		
Persicaria hydropiperoides		Plants		
Persicaria lapathifolia		Plants		
Persicaria maculosa	NA	Plants		
Persicaria pensylvanica	NA	Plants		
Phacelia distans	NA	Plants		
Phyla lanceolata	Fog-fruit	Plants		
Phyla nodiflora	Common Frog-fruit	Plants		

Scientific Name	Common Name	Group	Federal Protection Status	State Protection Status
Pilularia americana	NA	Plants		
Plagiobothrys acanthocarpus	Adobe Popcorn-flower	Plants		
Plagiobothrys greenei	Greene's Popcorn-flower	Plants		
Plagiobothrys humistratus	Dwarf Popcorn-flower	Plants		
Plagiobothrys leptocladus	Alkali Popcorn-flower	Plants		
Plantago elongata	Slender Plantain	Plants		
Pluchea odorata	Scented Conyza	Plants		
Pogogyne douglasii	NA	Plants		
Pogogyne zizyphoroides		Plants		
Potamogeton diversifolius	Water-thread Pondweed	Plants		
Potamogeton foliosus	Leafy Pondweed	Plants		
Potamogeton nodosus	Longleaf Pondweed	Plants		
Potamogeton pusillus	Slender Pondweed	Plants		
Psilocarphus brevissimus	Dwarf Woolly-heads	Plants		
Psilocarphus oregonus	Oregon Woolly-heads	Plants		
Psilocarphus tenellus	NA	Plants		
Puccinellia simplex	Little Alkali Grass	Plants		
Ranunculus sceleratus	NA	Plants		
Rorippa curvisiliqua	Curve-pod Yellowcress	Plants		
Rorippa palustris	Bog Yellowcress	Plants		
Rotala ramosior	Toothcup	Plants		
Ruppia cirrhosa	Widgeon-grass	Plants		
Ruppia maritima	Ditch-grass	Plants		
Sagittaria longiloba	Longbarb Arrowhead	Plants		
Sagittaria montevidensis calycina		Plants		
Salix exigua	Narrowleaf Willow	Plants		
Salix gooddingii	Goodding's Willow	Plants		
Schoenoplectus acutus occidentalis	Hardstem Bulrush	Plants		
Schoenoplectus americanus	Three-square Bulrush	Plants		
Sinapis alba	NA	Plants		

Scientific Name	Common Name	Group	Federal Protection Status	State Protection Status
Sparganium eurycarpum		Plants		
Stuckenia pectinata		Plants		
Typha domingensis	Southern Cattail	Plants		
Typha latifolia	Broadleaf Cattail	Plants		
Veronica americana	American Speedwell	Plants		
Wolffiella lingulata	Tongue Bogmat	Plants		
Zannichellia palustris	Horned Pondweed	Plants		

Source: The Nature Conservancy (TNC). 2018. Identifying Environmental Surface Water Users - Freshwater Species List for Each Groundwater Basin dataset. https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

4.2.8 Data Gaps

The Delta-Mendota Subbasin is an extensive subbasin covering a large area extending along the northwestern end of the San Joaquin Valley. While there is a significant amount of data available regarding various groundwater-related aspects of the Subbasin, much is still not known in multiple locations around the Subbasin To this end, the following data gaps have been identified and will be addressed as part of the interim period between adoption of this GSP and its first 5-year update.

- Information regarding subsidence varies in extent around the region. While there is a large amount of land elevation survey data available in association with the DMC and the San Joaquin River Restoration Program, other areas in the Delta-Mendota Subbasin require additional data collection to both further establish and monitor future land subsidence rates.
- Only three shallow groundwater wells exist proximate to the northern end of the San Joaquin River (outside of the area being addressed by the San Joaquin River Restoration Program). Additional nested or clustered monitoring wells are required adjacent to the river on the northern end of the Subbasin to evaluate horizontal and vertical groundwater gradients, and in connection with river stage monitoring, to assess the interconnection between the San Joaquin River and the northeastern end of the Delta-Mendota Subbasin.
- There are a large number of wells in the Delta-Mendota Subbasin where no well construction information exists or is readily available. Video surveys and other surveys should be conducted on selected wells that may potentially be added to the Subbasin monitoring network to (1) identify where the wells are screened, and (2) determine if the well(s) are appropriate as additions to the GSP Groups' groundwater monitoring programs.
- Mapping of GDEs in the Delta-Mendota Subbasin, as contained in this Common Chapter, is an initial assessment of their location. This mapping may be refined using most recent groundwater elevation/depth to water contour mapping.
- Monitoring networks contained herein are preliminary and were formulated based on existing well information. As additional wells are installed in the Subbasin and additional well construction information is obtained for existing wells, these networks may need to be refined to improve on the spatial (areal and vertical) distribution of monitoring points and the data collected for evaluation of conditions of the groundwater basin.
- The sustainable yield estimates and water budgets contained in this Common Chapter for both the Upper and Lower Aquifers were developed using limited data. As additional data are collected over the first five years, improved sustainable yield estimates and estimates of water in storage in both principle aquifers should be prepared utilizing the new data.

In addition to these Subbasin-level data gaps, additional data gaps have been identified for each GSP Plan Area. Please see the individual GSPs for additional identified data gaps.

4.3 Delta-Mendota Subbasin Water Budgets

This section describes the common coordinated assumptions agreed upon and utilized by each GSP Group in the Delta-Mendota Subbasin in developing the historical, current, and projected water budgets for their respective GSP Plan Areas. These coordinated historical, current, and projected water budgets were then compiled to prepare the subbasin-level water budgets required under the GSP Regulations § 357.4(b)(3)(B), presented below. The sustainable yield for the Upper Aquifer and Lower Aquifer developed at the Subbasin-level and agreed upon by all GSP Groups in the Delta-Mendota Subbasin is also presented along with a description as to how the sustainable yield for each primary aquifer was calculated.

4.3.1 Coordinated Assumptions

All common coordinated assumptions agreed upon and utilized by each GSP Group in preparing their respective historical, current, and projected water budgets are presented in Technical Memoranda 3 (*Assumptions for the Historical, Current, and Projected Water Budgets of the Delta-Mendota Subbasin*), which is included in **Appendix B** of this Common Chapter.

4.3.2 GSP-Level Water Budgets

Individual historical, current, and projected water budgets were developed by each GSP Group for their respective Plan Area. For more information on the development of those water budgets, as well as tabular and graphical representation of the results, refer to the respective sections of the individual GSPs.

All historical, current, and projected water budgets developed within the Delta-Mendota Subbasin are consistent with GSP Regulations § 354.18 Water Budget, and DWR's *Best Management Practices for the Sustainable Management of Groundwater Water Budget BMP* (2016c) document was used when and where applicable at the discretion of each GSP Group.

4.3.3 Coordinated Water Budgets

The land surface budget, groundwater budget, and annual change in storage for the historical water budget, current water budget, and projected water budget with climate change factors (CCFs) and projects and management actions for the Delta-Mendota Subbasin were developed by compiling the water budgets prepared by each of GSP Group. The land surface budget is an accounting of water flows into and out of the land surface above an aquifer within with Delta-Mendota Subbasin, where inflows and outflows include flow between GSP Groups and neighboring subbasins, the atmosphere, and the groundwater aquifer below. The groundwater budget is an accounting of groundwater flows into and out of the two principal groundwater aquifers (Upper Aquifer and Lower Aquifer) within the Delta-Mendota Subbasin, where inflows and outflows include flow between GSP Groups and neighboring subbasins as well as the above land surface.

The land surface budget and groundwater budget are presented respectively for the historical water budget in **Table CC-8** and **Table CC-9,** for the current water budget in **Table CC-10** and **Table CC-11**, and for the projected water budget with climate change factors and projects and management actions in **Table CC-12** and **Table CC-13**. All categories presented in the land surface budget and groundwater budget tables were agreed upon by all Delta-Mendota GSP Groups, with representatives from each GSP group tasked with filling out these budget tables as appropriate to account for the unique hydrology, land use, and water use within their respective GSP regions. The tables below are simply compilations of the individual GSP water budget data as provided by their respective plan preparers. **Figure CC-64** shows the average annual and cumulative change in storage in both principal aquifers under the Subbasin projected water budget (including application of climate change factors and the addition of projects and management actions).

Individual GSAs and agencies in the Delta-Mendota Subbasin understand that the historical, current and projected water budgets were completed using best available science and data. Where data gaps exist, the individual GSAs and agencies intend to conduct the work necessary to substantiate or improve the estimates and assumptions developed for determining their water budgets. Nothing in this part, or in any groundwater sustainability plan adopted pursuant to this part, determines or alters surface water rights or groundwater rights under common law or any provision of law that determines or grants surface water rights.

Table CC-8: Delta-Mendota Subbasin Historical Water Budget, Land Surface Budget

Land Surface Budget												
Water Year	Water Year Type	Inflows						Outflows				
		Precipitation	Surface Water Inflows	Applied Water - Groundwater	Applied Water - Imported Surface Water	Other Direct Recharge	**Total Inflows**	Runoff	Evapotranspiration	Surface Water Outflows	Deep Percolation	**Total Outflows**
2003	Normal	451,000	31,000	382,000	1,485,000	15,000	**2,364,000**	310,000	1,771,000	31,000	291,000	**2,403,000**
2004	Dry	412,000	31,000	398,000	1,486,000	14,000	**2,341,000**	263,000	1,764,000	31,000	304,000	**2,362,000**
2005	Wet	739,000	41,000	285,000	1,483,000	19,000	**2,567,000**	357,000	1,811,000	35,000	338,000	**2,541,000**
2006	Wet	572,000	41,000	270,000	1,499,000	17,000	**2,399,000**	318,000	1,795,000	34,000	289,000	**2,436,000**
2007	Dry	259,000	31,000	471,000	1,499,000	15,000	**2,275,000**	240,000	1,724,000	31,000	307,000	**2,302,000**
2008	Dry	329,000	31,000	529,000	1,382,000	17,000	**2,288,000**	224,000	1,797,000	30,000	327,000	**2,378,000**
2009	Normal	304,000	31,000	517,000	1,360,000	15,000	**2,227,000**	191,000	1,843,000	30,000	321,000	**2,385,000**
2010	Normal	538,000	31,000	371,000	1,392,000	22,000	**2,354,000**	283,000	1,669,000	30,000	394,000	**2,376,000**
2011	Wet	626,000	41,000	259,000	1,556,000	36,000	**2,518,000**	321,000	1,794,000	34,000	402,000	**2,551,000**
2012	Dry	276,000	31,000	471,000	1,505,000	20,000	**2,303,000**	223,000	1,709,000	30,000	353,000	**2,315,000**

Table CC-9: Delta-Mendota Subbasin Historical Water Budget, Groundwater Budget

Groundwater Budget																				
Water Year	Water Year Type	Inflows								Outflows					Change in Storage					
		Deep Percolation			Subsurface Groundwater Inflows		Seepage through Corcoran Clay	Other Direct Recharge	**Total Inflows**	Groundwater Extraction from Upper Aquifer	Groundwater Extraction from Lower Aquifer	Subsurface Groundwater Outflows		**Total Outflows**	**Estimated Annual Change in Groundwater Storage**				
		Precipitation Infiltration	*Surface Water Infiltration*	*Applied Water Infiltration*	*Upper Aquifer*	*Lower Aquifer*						*Upper Aquifer*	*Lower Aquifer*		Inflows	Outflows	Change in Storage - Upper Aquifer	Change in Storage - Lower Aquifer	Change in Storage - Total
2003	Normal	51,000	66,000	174,000	206,000	68,000	45,000	32,000	**642,000**	350,000	49,000	210,000	105,000	**759,000**	641,000	759,000	20,000	5,000	24,000
2004	Dry	36,000	65,000	204,000	184,000	64,000	45,000	30,000	**628,000**	365,000	49,000	233,000	131,000	**823,000**	628,000	822,000	(183,000)	(50,000)	(232,000)
2005	Wet	78,000	79,000	181,000	229,000	78,000	45,000	72,000	**762,000**	252,000	47,000	223,000	78,000	**645,000**	762,000	645,000	212,000	14,000	225,000
2006	Wet	59,000	78,000	152,000	208,000	70,000	45,000	98,000	**710,000**	238,000	46,000	221,000	78,000	**628,000**	710,000	628,000	14,000	(25,000)	(11,000)
2007	Dry	23,000	66,000	218,000	171,000	50,000	45,000	48,000	**621,000**	431,000	57,000	217,000	127,000	**877,000**	621,000	876,000	(272,000)	(68,000)	(339,000)
2008	Dry	26,000	69,000	233,000	186,000	57,000	45,000	40,000	**656,000**	475,000	70,000	234,000	131,000	**955,000**	655,000	954,000	(321,000)	(81,000)	(403,000)
2009	Normal	21,000	66,000	235,000	207,000	62,000	45,000	33,000	**669,000**	469,000	66,000	210,000	104,000	**894,000**	669,000	893,000	(123,000)	(28,000)	(151,000)
2010	Normal	53,000	73,000	267,000	230,000	74,000	45,000	65,000	**807,000**	335,000	52,000	215,000	112,000	**759,000**	808,000	759,000	190,000	(5,000)	184,000
2011	Wet	67,000	96,000	239,000	217,000	74,000	45,000	101,000	**839,000**	234,000	40,000	229,000	86,000	**634,000**	840,000	633,000	124,000	(23,000)	100,000
2012	Dry	26,000	71,000	257,000	180,000	57,000	45,000	62,000	**698,000**	432,000	56,000	230,000	136,000	**899,000**	698,000	898,000	(162,000)	(61,000)	(224,000)

Table CC-10: Delta-Mendota Subbasin Current Water Budget, Land Surface Budget

Land Surface Budget												
Water Year	Water Year Type	Inflows						Outflows				
		Precipitation	Surface Water Inflows	Applied Water - Groundwater	Applied Water - Imported Surface Water	Other Direct Recharge	**Total Inflows**	Runoff	Evapotranspiration	Surface Water Outflows	Deep Percolation	**Total Outflows**
2013	Dry	318,000	31,000	514,000	1,428,000	17,000	**2,308,000**	228,000	1,685,000	30,000	385,000	**2,328,000**

Table CC-11: Delta-Mendota Subbasin Current Water Budget, Groundwater System

Groundwater Budget																			
Water Year	Water Year Type	Inflows								Outflows					Change in Storage				
		Deep Percolation			Subsurface Groundwater Inflows		Seepage through Corcoran Clay	Other Direct Recharge	**Total Inflows**	Groundwater Extraction from Upper Aquifer	Groundwater Extraction from Lower Aquifer	Subsurface Groundwater Outflows		**Total Outflows**	Estimated Annual Change in Groundwater Storage				
		Precipitation Infiltration	*Surface Water Infiltration*	*Applied Water Infiltration*	*Upper Aquifer*	*Lower Aquifer*						*Upper Aquifer*	*Lower Aquifer*		Inflows	Outflows	Change in Storage - Upper Aquifer	Change in Storage - Lower Aquifer	Change in Storage - Total
2013	Dry	28,000	68,000	289,000	177,000	67,000	45,000	65,000	**739,000**	447,000	65,000	220,000	140,000	**917,000**	738,000	917,000	(123,000)	(53,000)	(176,000)

Table CC-12: Delta-Mendota Subbasin Projected Water Budget, Land Surface Budget (containing climate change factors and projects and management actions)

Land Surface Budget														
Water Year	Water Year Type	Inflows							Outflows					
		Precipitation	Surface Water Inflows	Applied Water - Groundwater	Applied Water - Imported Surface Water	Project Effects	Other Direct Recharge	**Total Inflows**	Runoff	Evapotranspiration	Surface Water Outflows	Deep Percolation	Project Effects	**Total Outflows**
2014	Shasta Critical	283,000	26,000	556,000	1,025,000	0	7,000	**1,897,000**	189,000	1,605,000	5,000	200,000	0	**1,999,000**
2015	Shasta Critical	363,000	26,000	607,000	907,000	0	8,000	**1,911,000**	169,000	1,519,000	4,000	261,000	0	**1,953,000**
2016	Dry	712,000	39,000	355,000	1,219,000	0	9,000	**2,334,000**	280,000	1,598,000	32,000	367,000	0	**2,277,000**
2017	Wet	686,000	53,000	282,000	1,442,000	16,000	8,000	**2,487,000**	330,000	1,755,000	39,000	405,000	0	**2,529,000**
2018	Normal	527,000	39,000	356,000	1,376,000	0	6,000	**2,304,000**	279,000	1,625,000	33,000	363,000	(1,000)	**2,300,000**
2019	Wet	712,000	53,000	234,000	1,501,000	11,000	8,000	**2,519,000**	331,000	1,780,000	39,000	338,000	(1,000)	**2,488,000**
2020	Dry	434,000	39,000	353,000	1,463,000	9,000	7,000	**2,305,000**	236,000	1,693,000	32,000	314,000	3,000	**2,275,000**
2021	Wet	808,000	53,000	227,000	1,499,000	6,000	8,000	**2,601,000**	383,000	1,787,000	39,000	352,000	10,000	**2,561,000**
2022	Wet	1,021,000	53,000	216,000	1,502,000	16,000	8,000	**2,816,000**	440,000	1,803,000	39,000	412,000	10,000	**2,694,000**
2023	Normal	580,000	39,000	355,000	1,443,000	4,000	6,000	**2,427,000**	257,000	1,683,000	33,000	371,000	2,000	**2,344,000**
2024	Dry	573,000	39,000	344,000	1,466,000	8,000	7,000	**2,437,000**	260,000	1,695,000	32,000	347,000	3,000	**2,334,000**
2025	Wet	884,000	53,000	227,000	1,501,000	16,000	8,000	**2,689,000**	355,000	1,815,000	39,000	384,000	10,000	**2,593,000**
2026	Dry	575,000	39,000	440,000	1,423,000	15,000	8,000	**2,500,000**	248,000	1,751,000	32,000	377,000	7,000	**2,408,000**
2027	Dry	653,000	39,000	438,000	1,423,000	14,000	8,000	**2,575,000**	280,000	1,732,000	32,000	380,000	9,000	**2,424,000**
2028	Dry	534,000	39,000	442,000	1,424,000	14,000	8,000	**2,461,000**	275,000	1,758,000	32,000	312,000	9,000	**2,377,000**
2029	Dry	462,000	39,000	441,000	1,422,000	15,000	8,000	**2,387,000**	257,000	1,709,000	32,000	312,000	10,000	**2,310,000**
2030	Shasta Critical	417,000	26,000	531,000	1,136,000	3,000	8,000	**2,121,000**	209,000	1,591,000	5,000	318,000	9,000	**2,123,000**
2031	Shasta Critical	492,000	26,000	531,000	1,136,000	3,000	8,000	**2,196,000**	211,000	1,606,000	5,000	360,000	9,000	**2,182,000**
2032	Wet	832,000	53,000	234,000	1,503,000	21,000	8,000	**2,651,000**	335,000	1,802,000	39,000	420,000	23,000	**2,596,000**
2033	Dry	466,000	26,000	445,000	1,350,000	20,000	8,000	**2,315,000**	245,000	1,706,000	5,000	316,000	11,000	**2,272,000**
2034	Wet	851,000	53,000	215,000	1,500,000	34,000	8,000	**2,661,000**	365,000	1,756,000	39,000	405,000	23,000	**2,565,000**
2035	Wet	731,000	53,000	243,000	1,502,000	22,000	8,000	**2,559,000**	324,000	1,815,000	39,000	356,000	23,000	**2,534,000**
2036	Wet	774,000	53,000	278,000	1,508,000	35,000	8,000	**2,656,000**	301,000	1,842,000	39,000	441,000	23,000	**2,623,000**
2037	Wet	1,194,000	53,000	211,000	1,497,000	37,000	8,000	**3,000,000**	494,000	1,741,000	39,000	554,000	24,000	**2,828,000**
2038	Normal	448,000	39,000	390,000	1,440,000	12,000	6,000	**2,335,000**	273,000	1,626,000	33,000	335,000	15,000	**2,267,000**
2039	Normal	488,000	39,000	404,000	1,439,000	11,000	6,000	**2,387,000**	265,000	1,664,000	33,000	362,000	15,000	**2,324,000**
2040	Dry	534,000	39,000	373,000	1,466,000	26,000	7,000	**2,445,000**	263,000	1,675,000	32,000	376,000	11,000	**2,346,000**
2041	Dry	384,000	39,000	388,000	1,468,000	16,000	7,000	**2,302,000**	214,000	1,671,000	32,000	335,000	10,000	**2,252,000**
2042	Normal	530,000	39,000	427,000	1,484,000	12,000	6,000	**2,498,000**	282,000	1,759,000	34,000	344,000	15,000	**2,419,000**
2043	Dry	488,000	39,000	386,000	1,449,000	26,000	7,000	**2,395,000**	238,000	1,766,000	33,000	285,000	11,000	**2,322,000**
2044	Wet	875,000	53,000	244,000	1,483,000	50,000	7,000	**2,712,000**	400,000	1,799,000	40,000	380,000	24,000	**2,619,000**
2045	Wet	622,000	53,000	270,000	1,512,000	42,000	6,000	**2,505,000**	328,000	1,809,000	39,000	318,000	23,000	**2,494,000**
2046	Dry	268,000	39,000	516,000	1,477,000	17,000	7,000	**2,324,000**	225,000	1,765,000	33,000	301,000	11,000	**2,324,000**

Land Surface Budget														
		Inflows							Outflows					
Water Year	Water Year Type	Precipitation	Surface Water Inflows	Applied Water - Groundwater	Applied Water - Imported Surface Water	Project Effects	Other Direct Recharge	Total Inflows	Runoff	Evapotranspiration	Surface Water Outflows	Deep Percolation	Project Effects	Total Outflows
2047	Dry	402,000	39,000	522,000	1,427,000	15,000	8,000	**2,413,000**	202,000	1,795,000	32,000	333,000	10,000	**2,362,000**
2048	Normal	331,000	39,000	548,000	1,455,000	6,000	5,000	**2,384,000**	212,000	1,858,000	33,000	298,000	14,000	**2,401,000**
2049	Normal	658,000	39,000	359,000	1,438,000	39,000	6,000	**2,539,000**	280,000	1,667,000	33,000	409,000	18,000	**2,389,000**
2050	Wet	708,000	53,000	267,000	1,505,000	48,000	7,000	**2,588,000**	343,000	1,840,000	39,000	336,000	23,000	**2,558,000**
2051	Dry	350,000	39,000	390,000	1,465,000	24,000	7,000	**2,275,000**	222,000	1,704,000	32,000	254,000	11,000	**2,212,000**
2052	Dry	390,000	39,000	496,000	1,421,000	28,000	8,000	**2,382,000**	210,000	1,693,000	32,000	363,000	11,000	**2,298,000**
2053	Shasta Critical	306,000	26,000	576,000	1,109,000	3,000	7,000	**2,027,000**	180,000	1,661,000	5,000	250,000	9,000	**2,096,000**
2054	Shasta Critical	340,000	26,000	575,000	1,045,000	5,000	8,000	**1,999,000**	154,000	1,627,000	4,000	300,000	8,000	**2,085,000**
2055	Dry	630,000	39,000	394,000	1,205,000	16,000	9,000	**2,293,000**	253,000	1,701,000	32,000	317,000	10,000	**2,303,000**
2056	Wet	745,000	53,000	300,000	1,432,000	35,000	8,000	**2,573,000**	311,000	1,857,000	39,000	395,000	22,000	**2,602,000**
2057	Wet	693,000	53,000	261,000	1,505,000	28,000	8,000	**2,548,000**	302,000	1,855,000	39,000	322,000	24,000	**2,518,000**
2058	Normal	478,000	39,000	494,000	1,459,000	11,000	5,000	**2,486,000**	208,000	1,836,000	33,000	380,000	15,000	**2,457,000**
2059	Wet	739,000	53,000	252,000	1,501,000	55,000	8,000	**2,608,000**	306,000	1,844,000	39,000	372,000	24,000	**2,561,000**
2060	Dry	405,000	39,000	377,000	1,466,000	23,000	7,000	**2,317,000**	200,000	1,743,000	32,000	305,000	11,000	**2,280,000**
2061	Wet	910,000	53,000	244,000	1,502,000	56,000	8,000	**2,773,000**	348,000	1,851,000	39,000	459,000	24,000	**2,697,000**
2062	Normal	466,000	39,000	400,000	1,441,000	14,000	6,000	**2,366,000**	230,000	1,716,000	33,000	352,000	15,000	**2,331,000**
2063	Normal	477,000	39,000	483,000	1,453,000	11,000	5,000	**2,468,000**	236,000	1,816,000	33,000	332,000	15,000	**2,417,000**
2064	Dry	338,000	39,000	379,000	1,469,000	26,000	7,000	**2,258,000**	168,000	1,739,000	32,000	287,000	11,000	**2,226,000**
2065	Normal	725,000	39,000	382,000	1,438,000	17,000	6,000	**2,607,000**	249,000	1,693,000	33,000	499,000	16,000	**2,474,000**
2066	Wet	668,000	53,000	261,000	1,503,000	28,000	8,000	**2,521,000**	293,000	1,853,000	39,000	300,000	24,000	**2,485,000**
2067	Wet	690,000	53,000	257,000	1,502,000	28,000	8,000	**2,538,000**	296,000	1,851,000	39,000	313,000	24,000	**2,499,000**
2068	Dry	448,000	26,000	484,000	1,188,000	17,000	8,000	**2,171,000**	222,000	1,650,000	5,000	267,000	11,000	**2,144,000**
2069	Dry	382,000	26,000	490,000	1,191,000	15,000	8,000	**2,112,000**	186,000	1,652,000	5,000	262,000	11,000	**2,105,000**
2070	Wet	962,000	53,000	236,000	1,498,000	55,000	8,000	**2,812,000**	360,000	1,838,000	39,000	490,000	24,000	**2,727,000**

Table CC-13: Delta-Mendota Subbasin Projected Water Budget, Groundwater Budget (containing climate change factors and projects and management actions)

Groundwater Budget																				
Water Year	Water Year Type	Inflows									Outflows					Change in Storage				
		Deep Percolation			Subsurface Groundwater Inflows		Seepage through Corcoran Clay	Other Direct Recharge	Project Effects	Total Inflows	Groundwater Extraction from Upper Aquifer	Groundwater Extraction from Lower Aquifer	Subsurface Groundwater Outflows		Total Outflows	Estimated Annual Change in Groundwater Storage				
		Precipitation Infiltration	*Surface Water Infiltration*	*Applied Water Infiltration*	*Upper Aquifer*	*Lower Aquifer*							*Upper Aquifer*	*Lower Aquifer*		Inflows	Outflows	Change in Storage - Upper Aquifer	Change in Storage - Lower Aquifer	Change in Storage - Total
2014	Shasta Critical	51,000	58,000	96,000	162,000	70,000	45,000	58,000	0	**540,000**	500,000	97,000	281,000	186,000	**1,109,000**	540,000	1,110,000	(433,000)	(123,000)	(556,000)
2015	Shasta Critical	39,000	57,000	167,000	157,000	68,000	45,000	60,000	0	**593,000**	546,000	98,000	282,000	197,000	**1,168,000**	593,000	1,168,000	(405,000)	(132,000)	(537,000)
2016	Dry	98,000	75,000	235,000	154,000	67,000	45,000	70,000	0	**744,000**	338,000	57,000	280,000	151,000	**871,000**	743,000	871,000	(92,000)	(49,000)	(141,000)
2017	Wet	93,000	93,000	212,000	198,000	82,000	45,000	109,000	16,000	**848,000**	245,000	50,000	260,000	87,000	**687,000**	843,000	688,000	142,000	(14,000)	128,000
2018	Normal	70,000	84,000	228,000	190,000	70,000	45,000	77,000	5,000	**769,000**	328,000	57,000	233,000	100,000	**763,000**	763,000	762,000	105,000	18,000	122,000
2019	Wet	106,000	92,000	145,000	215,000	79,000	45,000	105,000	15,000	**802,000**	226,000	37,000	233,000	73,000	**614,000**	798,000	614,000	116,000	13,000	128,000
2020	Dry	58,000	78,000	179,000	152,000	62,000	45,000	68,000	9,000	**651,000**	336,000	52,000	266,000	134,000	**833,000**	645,000	833,000	(184,000)	(43,000)	(227,000)
2021	Wet	108,000	93,000	166,000	218,000	80,000	45,000	85,000	16,000	**811,000**	219,000	37,000	235,000	71,000	**607,000**	805,000	608,000	128,000	15,000	144,000
2022	Wet	126,000	88,000	221,000	216,000	80,000	45,000	107,000	26,000	**909,000**	209,000	35,000	231,000	75,000	**595,000**	904,000	596,000	246,000	21,000	267,000
2023	Normal	81,000	78,000	212,000	188,000	72,000	45,000	75,000	9,000	**760,000**	329,000	52,000	234,000	108,000	**768,000**	753,000	768,000	91,000	28,000	119,000
2024	Dry	75,000	74,000	194,000	153,000	62,000	45,000	70,000	9,000	**682,000**	331,000	51,000	270,000	132,000	**829,000**	676,000	829,000	(152,000)	(13,000)	(164,000)
2025	Wet	111,000	91,000	173,000	214,000	81,000	45,000	107,000	26,000	**848,000**	220,000	36,000	234,000	71,000	**606,000**	841,000	606,000	170,000	27,000	197,000
2026	Dry	75,000	76,000	223,000	153,000	62,000	45,000	70,000	13,000	**717,000**	391,000	46,000	269,000	135,000	**886,000**	711,000	885,000	(165,000)	(7,000)	(172,000)
2027	Dry	82,000	80,000	233,000	153,000	60,000	45,000	68,000	15,000	**736,000**	390,000	47,000	270,000	128,000	**880,000**	731,000	879,000	(144,000)	0	(144,000)
2028	Dry	72,000	81,000	161,000	156,000	59,000	45,000	68,000	15,000	**657,000**	391,000	47,000	269,000	127,000	**879,000**	651,000	879,000	(216,000)	(5,000)	(222,000)
2029	Dry	60,000	84,000	175,000	155,000	58,000	45,000	68,000	16,000	**661,000**	387,000	46,000	269,000	127,000	**874,000**	654,000	875,000	(208,000)	(13,000)	(221,000)
2030	Shasta Critical	59,000	65,000	204,000	162,000	57,000	40,000	65,000	9,000	**661,000**	440,000	78,000	277,000	125,000	**960,000**	660,000	960,000	(225,000)	(33,000)	(257,000)
2031	Shasta Critical	66,000	66,000	240,000	162,000	57,000	40,000	65,000	9,000	**705,000**	439,000	77,000	276,000	116,000	**948,000**	703,000	947,000	(180,000)	(22,000)	(201,000)
2032	Wet	112,000	97,000	236,000	222,000	75,000	40,000	86,000	29,000	**897,000**	205,000	32,000	240,000	68,000	**585,000**	891,000	584,000	253,000	17,000	271,000
2033	Dry	61,000	69,000	195,000	161,000	57,000	40,000	65,000	17,000	**665,000**	386,000	45,000	273,000	130,000	**874,000**	659,000	874,000	(195,000)	(18,000)	(213,000)
2034	Wet	114,000	96,000	214,000	219,000	77,000	40,000	107,000	39,000	**906,000**	194,000	26,000	233,000	69,000	**562,000**	901,000	562,000	269,000	15,000	285,000
2035	Wet	100,000	93,000	165,000	220,000	78,000	40,000	86,000	29,000	**811,000**	215,000	30,000	237,000	74,000	**596,000**	806,000	596,000	157,000	14,000	171,000
2036	Wet	105,000	89,000	236,000	219,000	78,000	40,000	105,000	39,000	**911,000**	234,000	48,000	236,000	74,000	**632,000**	905,000	633,000	266,000	19,000	285,000
2037	Wet	149,000	86,000	359,000	214,000	83,000	40,000	107,000	40,000	**1,078,000**	192,000	27,000	230,000	77,000	**566,000**	1,072,000	566,000	431,000	14,000	445,000
2038	Normal	80,000	75,000	175,000	187,000	74,000	40,000	75,000	21,000	**727,000**	323,000	54,000	232,000	107,000	**756,000**	722,000	756,000	95,000	20,000	115,000
2039	Normal	72,000	75,000	219,000	195,000	76,000	40,000	77,000	21,000	**775,000**	332,000	60,000	236,000	105,000	**773,000**	769,000	773,000	143,000	20,000	163,000
2040	Dry	76,000	70,000	232,000	154,000	63,000	40,000	70,000	18,000	**723,000**	324,000	46,000	271,000	133,000	**814,000**	717,000	814,000	(75,000)	(11,000)	(87,000)
2041	Dry	61,000	75,000	197,000	153,000	60,000	40,000	68,000	16,000	**670,000**	328,000	49,000	269,000	128,000	**814,000**	665,000	814,000	(115,000)	(12,000)	(127,000)
2042	Normal	80,000	82,000	198,000	197,000	72,000	40,000	75,000	21,000	**765,000**	357,000	58,000	238,000	99,000	**792,000**	758,000	791,000	98,000	27,000	125,000
2043	Dry	72,000	77,000	136,000	152,000	60,000	40,000	70,000	18,000	**625,000**	329,000	49,000	271,000	106,000	**795,000**	617,000	796,000	(171,000)	(10,000)	(180,000)

Groundwater Budget																				
Water Year	Water Year Type	Inflows									Outflows					Change in Storage				
		Deep Percolation			Subsurface Groundwater Inflows		Seepage through Corcoran Clay	Other Direct Recharge	Project Effects	**Total Inflows**	Groundwater Extraction from Upper Aquifer	Groundwater Extraction from Lower Aquifer	Subsurface Groundwater Outflows		**Total Outflows**	**Estimated Annual Change in Groundwater Storage**				
		Precipitation Infiltration	*Surface Water Infiltration*	*Applied Water Infiltration*	*Upper Aquifer*	*Lower Aquifer*							*Upper Aquifer*	*Lower Aquifer*		Inflows	Outflows	Change in Storage - Upper Aquifer	Change in Storage - Lower Aquifer	Change in Storage - Total
2044	Wet	117,000	91,000	172,000	209,000	80,000	40,000	107,000	57,000	**873,000**	203,000	35,000	242,000	70,000	**590,000**	867,000	590,000	230,000	17,000	247,000
2045	Wet	89,000	87,000	113,000	215,000	81,000	40,000	107,000	56,000	**788,000**	217,000	40,000	230,000	75,000	**602,000**	782,000	603,000	143,000	9,000	151,000
2046	Dry	44,000	75,000	179,000	154,000	61,000	40,000	68,000	17,000	**638,000**	439,000	62,000	268,000	109,000	**918,000**	632,000	919,000	(259,000)	(19,000)	(278,000)
2047	Dry	52,000	80,000	206,000	152,000	59,000	40,000	68,000	16,000	**673,000**	440,000	65,000	270,000	103,000	**918,000**	667,000	919,000	(210,000)	(10,000)	(220,000)
2048	Normal	52,000	84,000	168,000	188,000	68,000	40,000	75,000	20,000	**695,000**	446,000	85,000	237,000	98,000	**906,000**	690,000	907,000	(26,000)	19,000	(7,000)
2049	Normal	94,000	84,000	271,000	188,000	70,000	40,000	77,000	24,000	**848,000**	312,000	51,000	238,000	101,000	**742,000**	842,000	742,000	210,000	24,000	234,000
2050	Wet	87,000	90,000	133,000	216,000	80,000	40,000	107,000	57,000	**810,000**	219,000	41,000	235,000	72,000	**607,000**	803,000	608,000	172,000	11,000	183,000
2051	Dry	48,000	76,000	134,000	152,000	61,000	40,000	68,000	17,000	**596,000**	329,000	51,000	269,000	133,000	**822,000**	591,000	822,000	(192,000)	(20,000)	(212,000)
2052	Dry	49,000	81,000	249,000	154,000	58,000	40,000	68,000	17,000	**716,000**	430,000	60,000	268,000	103,000	**901,000**	711,000	901,000	(175,000)	(14,000)	(189,000)
2053	Shasta Critical	49,000	63,000	148,000	160,000	57,000	40,000	63,000	9,000	**589,000**	474,000	91,000	276,000	101,000	**982,000**	588,000	982,000	(316,000)	(14,000)	(330,000)
2054	Shasta Critical	37,000	65,000	208,000	161,000	55,000	40,000	63,000	8,000	**637,000**	488,000	91,000	277,000	101,000	**997,000**	638,000	996,000	(262,000)	(18,000)	(280,000)
2055	Dry	85,000	86,000	152,000	156,000	55,000	40,000	70,000	16,000	**660,000**	340,000	54,000	268,000	100,000	**802,000**	654,000	801,000	(139,000)	(6,000)	(145,000)
2056	Wet	95,000	97,000	185,000	220,000	75,000	40,000	107,000	55,000	**874,000**	237,000	52,000	238,000	66,000	**633,000**	869,000	633,000	236,000	17,000	253,000
2057	Wet	97,000	95,000	133,000	223,000	76,000	40,000	85,000	30,000	**779,000**	228,000	34,000	240,000	72,000	**614,000**	772,000	613,000	105,000	14,000	119,000
2058	Normal	66,000	82,000	236,000	205,000	68,000	40,000	75,000	21,000	**793,000**	416,000	61,000	239,000	103,000	**859,000**	786,000	860,000	65,000	20,000	85,000
2059	Wet	101,000	92,000	152,000	222,000	79,000	40,000	107,000	58,000	**851,000**	222,000	33,000	235,000	72,000	**602,000**	845,000	602,000	187,000	18,000	205,000
2060	Dry	59,000	76,000	168,000	151,000	61,000	40,000	70,000	17,000	**642,000**	325,000	42,000	265,000	133,000	**805,000**	635,000	805,000	(155,000)	(13,000)	(167,000)
2061	Wet	108,000	91,000	243,000	217,000	80,000	40,000	107,000	58,000	**944,000**	214,000	33,000	235,000	70,000	**592,000**	938,000	592,000	289,000	20,000	309,000
2062	Normal	73,000	79,000	199,000	199,000	73,000	40,000	77,000	22,000	**762,000**	330,000	53,000	236,000	106,000	**765,000**	756,000	765,000	119,000	21,000	140,000
2063	Normal	71,000	77,000	183,000	201,000	73,000	40,000	75,000	21,000	**741,000**	408,000	61,000	237,000	104,000	**850,000**	735,000	850,000	20,000	25,000	45,000
2064	Dry	50,000	74,000	159,000	153,000	61,000	40,000	68,000	18,000	**623,000**	328,000	42,000	271,000	131,000	**812,000**	616,000	813,000	(180,000)	(9,000)	(190,000)
2065	Normal	81,000	82,000	388,000	187,000	71,000	40,000	77,000	22,000	**948,000**	315,000	53,000	238,000	100,000	**746,000**	941,000	745,000	323,000	26,000	349,000
2066	Wet	94,000	90,000	114,000	219,000	80,000	40,000	85,000	30,000	**752,000**	229,000	34,000	240,000	72,000	**615,000**	745,000	615,000	74,000	17,000	91,000
2067	Wet	97,000	89,000	126,000	216,000	80,000	40,000	85,000	30,000	**763,000**	227,000	33,000	236,000	75,000	**611,000**	756,000	611,000	92,000	16,000	108,000
2068	Dry	65,000	58,000	146,000	157,000	62,000	40,000	63,000	11,000	**602,000**	415,000	53,000	274,000	110,000	**892,000**	603,000	892,000	(284,000)	(12,000)	(296,000)
2069	Dry	57,000	64,000	150,000	156,000	58,000	40,000	63,000	11,000	**599,000**	421,000	53,000	274,000	103,000	**891,000**	598,000	890,000	(290,000)	(8,000)	(298,000)
2070	Wet	119,000	100,000	274,000	211,000	77,000	40,000	107,000	57,000	**985,000**	204,000	33,000	227,000	69,000	**573,000**	980,000	573,000	350,000	19,000	369,000

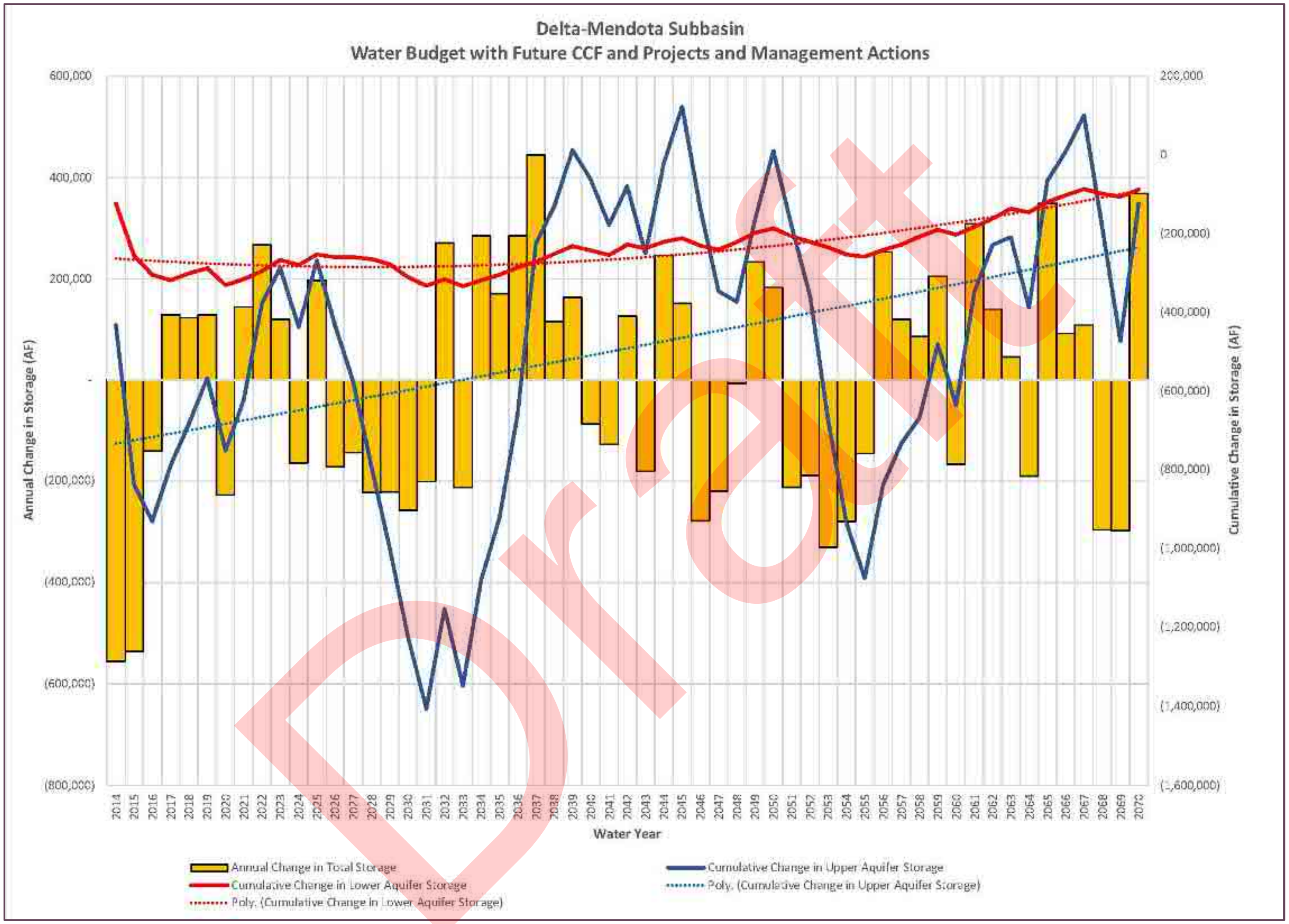


Figure CC-64: Change in Storage, Delta-Mendota Subbasin Projected Water Budget

4.3.4 Sustainable Yield

Under SGMA, sustainable yield is defined 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." (CWC 10721(w)). Sustainable yield estimates for the Upper Aquifer and Lower Aquifer have been developed in a coordinated fashion for the Delta-Mendota Subbasin by the Delta-Mendota Technical Working Group and approved by the Delta-Mendota Coordination Committee.

Upper Aquifer Sustainable Yield Estimate

Methodologies for calculating Upper Aquifer sustainable yield were discussed by both the Delta-Mendota Coordination Committee and an ad-hoc Technical Working Group of the Coordination Committee. During a workshop dedicated to this effort, several basic concepts and principles were discussed to calculate the Upper Aquifer sustainable yield estimate. Consideration was given to several potential options with increasing detail, including a combination of the following: total Subbasin Upper Aquifer pumping volumes, total Subbasin Upper Aquifer change in storage, and Subbasin Upper Aquifer subsurface inflows and outflows. Inflow from certain neighboring subbasins, based on groundwater flow direction, as well as subsurface inflow from the Coast Range at existing gradients (as part of the inflow to the Northern & Central Delta-Mendota Region GSP area) was considered. Outflow to neighboring subbasins at existing gradients was also considered in certain applicable areas along the Delta-Mendota Subbasin boundary based on groundwater flow characteristics.

Based on these considerations, the following formula was selected for estimating Upper Aquifer sustainable yield:

Upper Aquifer Sustainable Yield = (Pumping + Change in Storage) + (Outflow – Inflow)

Given existing Subbasin data gaps and uncertainties associated with the data used to develop the water budgets and this estimate, it was also decided that a +/- 10% factor should be applied to determine a range for the Upper Aquifer sustainable yield value. The +/- 10% factor is applied based on the percentage difference between the values from change in storage Subbasin contour mapping for the historic water budget period and the reported changes in storage from the Subbasin consolidated historic water budgets (WY2003-2012) for the Upper Aquifer.

The formula for determining Upper Aquifer sustainable yield was applied to the following compiled Delta-Mendota Subbasin projected water budgets (WY2014-2070):

Projected Baseline values with Climate Change Factors

Projected Baseline values with Climate Change Factors and Projects and Management Actions

This analysis resulted in an Upper Aquifer Sustainable Yield estimate ranging from 325,000 acre-feet to 480,000 acre-feet, demonstrating the Subbasin's Upper Aquifer sustainable yield estimated without implementing any projects and management actions (low end of range) and how the Subbasin's Upper Aquifer sustainable yield will be impacted by implementing planned projects and management actions (high end of range).

The Upper Aquifer sustainable yield values, derived from calculations using the best available but limited data, are considered to be preliminary estimations only and will be updated to an anticipated higher level of accuracy in future GSP updates. The intention of the Delta-Mendota Subbasin GSAs, following GSP submission in 2020, is to increase subbasin-wide data collection efforts. Improved data, modeling results, and understanding of subsurface flows will allow the GSAs and each GSP Group to improve estimated sustainable yield values for future GSP updates. The GSP Groups are in the process of developing GSP implementation guidelines that will address future data collection efforts and other GSP implementation activities.

The Upper Aquifer sustainable yield calculated range reflects the principle that the GSAs within the Delta-Mendota Subbasin reserve the right to claim or retain some portion of subbasin outflow generated by the lowering of groundwater levels from neighboring subbasins and the equitable portion of sources of recharge shared between two subbasins, by physical or non-physical means, in the future if the Delta-Mendota Subbasin GSAs determine that doing so will improve Subbasin sustainability or will prevent undesirable results due to chronic lowering of groundwater levels. Furthermore, intrabasin coordination during GSP development, followed by continuing interbasin coordination discussions and data collection after GSP adoption, will allow the GSAs to further refine these determinations.

Lower Aquifer Sustainable Yield Estimate

Currently, within the Delta-Mendota Subbasin, the distribution of known Lower Aquifer water level data and extraction volume data are not sufficient to allow for an accurate calculation of Lower Aquifer sustainable yield utilizing the same methodology as for the Upper Aquifer. Following discussions by both the Coordination Committee and the ad-hoc Technical Working Group of the Coordination Committee, a consensus was reached to establish a Lower Aquifer sustainable yield estimate for the Subbasin by evaluating studies previously conducted in adjoining subbasins.

The Westlands Water District GSA recently conducted a study using groundwater modeling, in conjunction with the Westside GSP development, to estimate sustainable yield for the Westside Subbasin. Based on an analysis of available data and an initial assumption of Lower Aquifer sustainable yield equivalent to approximately 0.35 acre-feet per acre within the Westside Subbasin (Westlands Water District GSA, Groundwater Management Strategy Concepts presentation to the WWD Board on October 16, 2018), the GSA estimates a sustainable yield of 230,000 to 250,000 acre-feet, with historic conditions suggesting a range from 250,000 to 300,000 acre-feet (Westlands Water District GSA, Westside Subbasin's Groundwater Model Forecast and Augmentation Strategies presentation to the WWD Board on April 3, 2019). Using Westlands Water District GSA's analysis, the Delta-Mendota Coordination Committee recommended a slightly more conservative sustainable yield value of one-third (0.33) an acre-foot per acre for the Delta-Mendota Subbasin. Using this more conservative value, the estimated Lower Aquifer sustainable yield is approximately 250,000 acre-feet per year over the approximately 750,000-acre subbasin. It should be noted that sustainable management of the Lower Aquifer is governed by significant and unreasonable subsidence rather than sustainable yield. The distribution of sustainable yield is not uniform throughout the Subbasin, and it will be the responsibility of each GSA in the Subbasin to manage Lower Aquifer pumping to prevent significant and unreasonable subsidence.

Since DWR classified the Delta-Mendota Subbasin as a critically-overdraft subbasin due to subsidence issues, the more conservative acre-foot per acre value for a Lower Aquifer sustainable yield estimation is considered valid as a starting point for the Subbasin. Lower Aquifer groundwater extractions may be managed to a stricter criterion in some areas in order to reduce or eliminate the potential for future inelastic land subsidence on critical infrastructure.

The Lower Aquifer sustainable yield estimate will be refined in the future based on data collected and compiled for the Subbasin. This current sustainable yield approximation highlights the importance of an accepted Subbasin-level subsidence monitoring program concurrent with improved estimates of sub-Corcoran Clay groundwater extractions.

5. SUSTAINABLE MANAGEMENT CRITERIA

As required by Subarticle 3. Sustainable Management Criteria of the GSP regulations, the GSPs must include a sustainability goal and definitions of undesirable results, in addition to defining what is considered to be significant and unreasonable and establishing minimum thresholds, measurable objectives and 5-year interim goals. Given the variability of conditions within the Delta-Mendota Subbasin, a subbasin-wide sustainability goal and definitions of undesirable results were developed at the subbasin-level, while the definitions of significant and unreasonable, minimum thresholds, measurable objectives and 5-year interim goals were established at the GSP Plan area-level.

This section describes the coordinated sustainability goal and definition of undesirable results at a subbasin-level and the sustainable management criteria at a GSP-level. Sustainable management criteria developed by each GSP Group were further compared and coordinated between neighboring GSP Groups to avoid conflicts, particularly in setting numeric minimum thresholds, measurable objectives, and interim milestones at boundary locations. The sustainable management criteria for each GSP Group for each applicable sustainability indicator are presented herein.

5.1 Coordinated Assumptions and Data

All common coordinated assumptions and data agreed upon and implemented by each GSP Group in developing their respective sustainable management criteria for each applicable sustainability indicator are presented in Technical Memoranda 4 (*Assumptions for Delta-Mendota Subbasin Management Areas, Sustainability Indicators, and GSP Documentation*), which is included in **Appendix B** of this Common Chapter.

Once each GSP Group drafted their respective sustainable management criteria for each applicable sustainability indicator, the Delta-Mendota Subbasin Technical Working Group requested that all GSP Groups meet with their neighboring GSP Groups to coordinate minimum thresholds and measurable objectives to avoid conflicts and ensure each GSP Group would not negatively impact their neighboring GSP Groups from achieving sustainability. These coordination meetings took place between April and August of 2019.

5.2 Coordinated Sustainability Goal and Undesirable Results

The sustainability goal for the Delta-Mendota Subbasin was established to succinctly state the objectives and desired conditions of the Subbasin that culminates in the absence of undesirable results by 2040. The sustainability goal for the Delta-Mendota Subbasin is as follows and was approved by the Delta-Mendota Subbasin Coordination Committee during the June 10, 2019 meeting:

> *The Delta-Mendota Subbasin will manage groundwater resources for the benefit of all users of groundwater in a manner that allows for operational flexibility, ensures resource availability under drought conditions, and does not negatively impact surface water diversion and conveyance and delivery capabilities. This goal will be achieved through the implementation of the proposed projects and management actions to reach identified measurable objectives and milestones through the implementation of the GSP(s), and through continued coordination with neighboring subbasins to ensure the absence of undesirable results by 2040.*

The following definitions of "undesirable results" were agreed upon for the following applicable sustainability indicators:

- **Chronic lowering of groundwater levels** - Significant and unreasonable chronic change in in water levels, as defined by each GSP Group, that has an impact on the beneficial users of groundwater in the Subbasin through either intra- and/or inter-basin actions.

- **Reduction in groundwater storage** - Significant and unreasonable chronic decrease in groundwater storage, as defined by each GSP Group, that has an impact on the beneficial users of groundwater in the Subbasin through either intra- and/or inter-basin actions.

- **Degraded water quality** - Significant and unreasonable degradation of groundwater quality, as defined by each GSP Group, that has an impact on the beneficial users of groundwater in the Subbasin through either intra- and/or inter-basin actions and/or activities.

- **Land subsidence** - Changes in ground surface elevation that cause damage to critical infrastructure that would cause significant and unreasonable reductions of conveyance capacity, damage to personal property, impacts to natural resources or create conditions that threaten public health and safety.

- **Depletions of interconnected surface water** - Depletions of interconnected surface water, as defined by each GSP Group, that have significant and unreasonable adverse impacts on the beneficial uses of surface water.

5.3 GSP-Level Sustainable Management Criteria

For more information on the development of the sustainable management criteria and information used to support the established sustainable management criteria for the individual GSP Groups, refer to the individual GSPs. Each GSP Group defined what is considered significant and unreasonable in their Plan Area for each applicable sustainability indicators, in addition to establishing minimum thresholds, measurable objectives and 5-year interim goals for their Plan Area.

Each GSP Group developed their sustainable management criteria consistent with GSP Regulations Article 5. Plan Contents, Subarticle 3. Sustainable Management Criteria (§ 354.2 through 354.30). DWR's *Draft Best Management Practices for the Sustainable Management of Groundwater Sustainable Management Criteria BMP* (2017) document was also used when and where applicable at the discretion of each GSP Group.

5.4 Delta-Mendota Subbasin Sustainable Management Criteria

The sustainable management criteria for each sustainability indicator contains the following components: the subbasin-wide definition of an undesirable result, GSP-level definition of significant and unreasonable, sustainability goals, 5-year interim goals, minimum threshold, and measurable objective. Separate tables show the sustainable management criteria for chronic lowering of groundwater levels (**Table CC-14**), reduction in groundwater storage (**Table CC-15)**, degraded water quality (**Table CC-16)**, land subsidence (**Table CC-17**), and depletions of interconnected surface water (**Table CC-18**) with details corresponding to the individual GSP Groups. The established sustainable management criteria were developed through detailed analysis and consideration of conditions unique to each GSP Group, where more detail may be necessary to support the decisions made by each GSP Group. For greater detail regarding the development of the sustainable management criteria for each GSP Group, refer to the sustainable management criteria section or chapter contained in each individual GSP.

Table CC-14: Delta-Mendota Subbasin SMC for Chronic Lowering of Groundwater Levels

GSP Group	Aliso Water District	Farmers Water District	Fresno County	Grassland	Northern & Central Delta-Mendota	San Joaquin River Exchange Contractors
Definition of Undesirable Results	Significant and unreasonable chronic change in in water levels, as defined by each GSP Group, that has an impact on the beneficial users of groundwater in the Subbasin through either intra- and/or inter-basin actions					
Definition of Significant and Unreasonable	Aliso is not currently experiencing significant and unreasonable effects of reduction in water levels or aquifer storage in the Upper Aquifer. Significant and unreasonable effects would be accelerated rates of subsidence as productive layers in the Upper Aquifer above the Corcoran Clay are depleted, especially in areas with deep or composite wells. Accelerated rates of subsidence may occur If 30% of the wells in the monitoring zone exceed the minimum threshold value on a 4-year consecutive average under normal or average year conditions.	Groundwater elevations dropping below historic lows (2015-2016)	Groundwater elevations dropping below historic lows (2015-2016)	Lowering of groundwater levels would lead to increased costs associated with higher total lift, lowering pumps, need to drill deeper wells or costs securing alternative water sources. Impacts to habitat would require mitigation, including alternative water supplies and habitat restoration.	Groundwater elevations dropping below the Minimum Threshold criteria at 40% of representative monitoring locations concurrently over a given water year resulting in shallow domestic wells going dry in the same subregion as the representative monitoring points in violation, higher pumping costs, and/or the need to modify wells to obtain groundwater.	The San Joaquin River Exchange Contractors (SJREC) GSP Group has a positive impact on the aquifer and is unlikely to cause Significant and/or Unreasonable lowering of groundwater levels. Triggers have been established to recover aquifer water levels before nearing an Undesirable Result. Currently, an approximation of 25% below historic low for each management area is used to indicate an Undesirable Result which will be refined based on annual updates and integration with other GSP Groups.
Sustainability Goal for Sustainability Criterion	To maintain the historic hydrological cycle and expand access to surface water during flood years for replenishment of the Upper Aquifer.	Maintain seasonal highs and lows. Prevent trend of decreasing groundwater levels.	Maintain seasonal highs and lows. Prevent trend of decreasing groundwater levels.	Maintain water levels and storage sufficient to meet operational storage in each the Upper Aquifer and Lower Aquifer.	Maintain water levels sufficient to meet operational storage as well as 3-year drought buffer storage.	Maintain historic water levels to meet demand of the beneficial users.
5-Year Interim Goals	**Year 5:** Maintain groundwater elevations comparable to historic hydrologic highs and lows **Year 10:** Maintain groundwater elevations comparable to historic hydrologic highs and lows **Year 15:** Maintain groundwater elevations comparable to historic hydrologic highs and lows	**Year 5:** < Minimum Threshold **Year 10**: < Minimum Threshold **Year 15:** < Minimum Threshold	**Year 5:** < Minimum Threshold **Year 10:** < Minimum Threshold **Year 15:** < Minimum Threshold	**Year 5:** WSE > Measurable Objective **Year 10:** WSE > Measurable Objective **Year 15:** WSE > Measurable Objective	**Year 5:** Maintain groundwater elevations comparable to 2012 through 2017 hydrologic highs and lows **Year 10:** Maintain groundwater elevations comparable to 2012 through 2017 hydrologic highs and lows **Year 15:** Maintain groundwater elevations comparable to 2012 through 2017 hydrologic highs and lows	**Year 5**: Maintain current water levels, SJREC GSP Group is sustainable. **Year 10:** Maintain current water levels, SJREC GSP Group is sustainable. **Year 15:** Maintain current water levels, SJREC GSP Group is sustainable.
Minimum Threshold	The minimum threshold is to provide a 100-foot of buffer from the top of the Corcoran Clay to the top of the water table	**Upper Aquifer** Season Low > 126 feet below ground surface (ft bgs) Season High > 57 ft bgs **Lower Aquifer** Season Low >213 ft bgs Season High > 185 ft bgs	**Upper Aquifer** Season Low > 63 feet below ground surface (ft bgs) Season High > 55 ft bgs **Lower Aquifer** Season Low >213 ft bgs Season High > 185 ft bgs	**Upper Aquifer:** 20% lowered water elevation from recent historic low (set at each monitoring site). **Lower Aquifer:** Lower aquifer representative monitoring wells have been identified for the monitoring network. However, no historic data exists. The Grassland Plan Area participants will monitor the site and with the gathered data, intend to establish meaningful interim goals, measurable objectives, and minimum thresholds in future GSP Updates.	**Upper Aquifer:** Hydrologic low **Lower Aquifer:** 95% of historic low	The SJREC GSP Group is sustainable. The SJREC GSP Group is unlikely to cause groundwater overdraft. As a result of this and historical groundwater management, trigger levels have been established for a representative site in each management area. If water levels drop below the established trigger level, no transfers of groundwater outside the area are allowed. This management has been in place for parts of the Subbasin for years and has proven effective to preserve a healthy aquifer.

GSP Group	Aliso Water District	Farmers Water District	Fresno County	Grassland	Northern & Central Delta-Mendota	San Joaquin River Exchange Contractors
Measurable Objective	The measurable objective is site specific and tied to water levels in long term hydrographs. The average rate in decline in each well was projected out until 2040 when water levels should begin to stabilize over the long term.	Maintain seasonal highs and lows above minimum thresholds.	Maintain seasonal highs and lows above minimum thresholds.	**Upper Aquifer:** Recent historic low (set at each monitoring site **Lower Aquifer:** Lower aquifer representative monitoring wells have been identified for the monitoring network. However, no historic data exists. The Grassland Plan Area participants will monitor the site and with the gathered data, intend to establish meaningful interim goals, measurable objectives, and minimum thresholds in future GSP Updates.	**Both Aquifers:** Seasonal historic high average, Spring 2012 or Spring 2017, whichever elevation is lowest or where data exists.	Operate groundwater levels between the effective root zone and the Minimum Threshold.

Table CC-15: Delta-Mendota Subbasin SMC for Reduction in Groundwater Storage

GSP Group	Aliso Water District	Farmers Water District	Fresno County	Grassland	Northern & Central Delta-Mendota	San Joaquin River Exchange Contractors
Definition of Undesirable Results	Significant and unreasonable chronic decrease in groundwater storage, as defined by each GSP Group, that has an impact on the beneficial users of groundwater in the Subbasin through either intra- and/or inter-basin actions					
Definition of Significant and Unreasonable	Aliso is not currently experiencing significant and unreasonable effects of reduction in water levels or aquifer storage in the Upper Aquifer. Significant and unreasonable effects would be accelerated rates of subsidence as productive layers in the Upper Aquifer above the Corcoran Clay are depleted, especially in areas with deep or composite wells. Accelerated rates of subsidence may occur if 30% of the wells in the monitoring zone exceed the minimum threshold value on a 4-year consecutive average under normal or average year conditions.	Depletion of storage greater than the 2012-2016 period.	Depletion of storage greater than the 2012-2016.	Insufficient water storage to develop necessary water to maintain critical habitat. Reduction in storage would lead to increased costs associated with higher total lift, lowering pumps, need to drill deeper wells or costs securing alternative water sources. Impacts to habitat would require mitigation, including alternative water supplies and habitat restoration.	If water levels are managed to meet the Minimum Thresholds, the Northern & Central Delta-Mendota Region GSP Group does not anticipate long-term reductions in storage. And, through coordination with other GSP Groups in the Subbasin, additional projects and/or management actions will be implemented to prevent the long-term decline in storage.	The San Joaquin River Exchange Contractors (SJREC) GSP Group has a positive impact on the aquifer and is unlikely to cause Significant and/or Unreasonable reduction of groundwater storage. Triggers have been established to recover aquifer water levels before nearing an Undesirable Result. Currently, an approximation of 25% below historic low water levels for each management area coupled with a determined storage coefficient, is used to indicate an Undesirable Result which will be refined based on annual updates and integration with other GSP Groups.
Sustainability Goal for Sustainability Criterion	To expand access to surface water during flood years for replenishment of the Upper Aquifer by working with neighbors in both Delta-Mendota and Madera subbasins where overdraft is occurring.	Minimize storage change during extended dry periods.	Minimize storage change during extended dry periods.	Maintain water levels and storage sufficient to meet operational demand.	Maintain water levels sufficient to meet operational storage as well as 3-year drought buffer storage.	Maintain historic water storage to meet demand of the beneficial users.
5-Year Interim Goals	**Year 5:** Maintain groundwater elevations comparable to historic hydrologic highs and lows **Year 10:** Maintain groundwater elevations comparable to historic hydrologic highs and lows **Year 15:** Maintain groundwater elevations comparable to historic hydrologic highs and lows	**Year 5:** < Minimum Threshold **Year 10:** < Minimum Threshold **Year 15:** < Minimum Threshold	**Year 5:** < Minimum Threshold **Year 10:** < Minimum Threshold **Year 15:** < Minimum Threshold	**Year 5:** WSE > Measurable Objective **Year 10:** WSE > Measurable Objective **Year 15:** WSE > Measurable Objective	**Year 5:** Maintain groundwater elevations comparable to 2012 through 2017 hydrologic highs and lows **Year 10:** Maintain groundwater elevations comparable to 2012 through 2017 hydrologic highs and lows **Year 15:** Maintain groundwater elevations comparable to 2012 through 2017 hydrologic highs and lows	**Year 5:** Maintain current water levels, SJREC GSP Group is sustainable **Year 10:** Maintain current water levels, SJREC GSP Group is sustainable **Year 15:** Maintain current water levels, SJREC GSP Group is sustainable
Minimum Threshold	The minimum threshold is to provide a 100-foot of buffer from the top of the Corcoran Clay to the top of the water table.	**Upper Aquifer** Storage Loss of >12,000 acre-feet (AF) from over extended dry period **Lower Aquifer** Storage Loss of >4600 AF over extended dry period	**Upper Aquifer** Storage Loss of >90,000 acre-feet (AF) over extended dry period **Lower Aquifer** Storage Loss of >55,000 AF over extended dry period	**Upper Aquifer:** 20% lowered water elevation from recent historic low (set at each monitoring site). **Lower Aquifer:** Lower aquifer representative monitoring wells have been identified for the monitoring network. However, no historic data exists. The Grassland Plan Area participants will monitor the site and with the gathered data, intend to establish meaningful interim goals, measurable objectives, and minimum thresholds in future GSP Updates.	**Upper Aquifer:** Hydrologic low **Lower Aquifer:** 95% of historic low	The SJREC GSP Group is sustainable. The SJREC GSP Group is unlikely to cause groundwater overdraft. As a result of this and historical groundwater management, trigger levels have been established for a representative site in each management area. If water levels drop below the established trigger level, no transfers of groundwater outside the area are allowed. This management has been in place for parts of the Subbasin for years and has proven effective to preserve a healthy aquifer.

GSP Group	Aliso Water District	Farmers Water District	Fresno County	Grassland	Northern & Central Delta-Mendota	San Joaquin River Exchange Contractors
Measurable Objective	The measurable objective is site specific and tied to water levels in long term hydrographs. The average rate in decline in each well was projected out until 2040 when water levels should begin to stabilize over the long term.	Long term average change of 0 AF/year	Long term average change of 0 AF/year	**Upper Aquifer:** Recent historic low (set at each monitoring site). **Lower Aquifer:** Four lower aquifer representative monitoring sites have been identified at a multi-completion well. However, no historic data exists. The Grassland Plan Area participants will monitor the site and with the gathered data, intend to establish meaningful interim goals, measurable objectives, and minimum thresholds in future GSP Updates.	**Both Aquifers:** Seasonal historic high average, Spring 2012 or Spring 2017, whichever elevation is lowest or where data exists.	Operate groundwater levels between the effective root zone and the Minimum Threshold which will maintain groundwater storage.

Table CC-16: Delta-Mendota Subbasin SMC for Degraded Water Quality

GSP Group	Aliso Water District	Farmers Water District	Fresno County	Grassland	Northern & Central Delta-Mendota	San Joaquin River Exchange Contractors
Definition of Undesirable Results	Significant and unreasonable degradation of groundwater quality, as defined by each GSP Group, that has an impact on the beneficial users of groundwater in the Subbasin through either intra- and/or inter-basin actions and/or activities					
Definition of Significant and Unreasonable	Aliso is not experiencing any significant and unreasonable impacts of water quality. Significant and unreasonable is defined as a reduction in crop production due to water quality issues and if 30% of the wells exceed the minimum threshold value on a 4-year consecutive average without treatment.	(1) Continued migration of the Steffens plume (elevated Total dissolved solids [TDS]) in Upper Aquifer both within Management Area A and towards Farmers Water District. (2) Unreasonable rates of migration of groundwater in the Upper Aquifer with naturally-occurring elevated concentrations of total dissolved solids in Management Area B. (3) Potential effects on the beneficial uses of groundwater include agricultural and domestic uses. (4) Degraded water quality in the Fresno Slough effect beneficial users of surface water	(1) Impairment of groundwater quality from the migration of the Steffens Plume from Fresno County's Management Area A. Impacts from the Steffens plume impacts Farmers Water District's ability to utilize groundwater for adjacent use and discharge into the Mendota Pool. (2) Potential effects on the beneficial users of groundwater include water quality levels that impact crops and drinking water standards for domestic uses. (3) Degraded water quality in the Fresno Slough effecting beneficial users of surface water.	Degradation of groundwater quality resulting in reduced ability to develop and manage groundwater for habitat productivity.	(1) Exceedance of maximum contaminant levels (MCLs) or water quality objectives (WQOs) for irrigation in public water systems for three (3) consecutive sampling events in non-drought years or the additional degradation of current groundwater quality where current groundwater quality exceeds the MCLs or WQOs for irrigation. (2) Water quality degradation due to recharge projects that exceeds 20% of the aquifer's assimilative capacity for one or more constituents without justification of a greater public benefit achieved	Migration of contamination plume that makes the water unusable for beneficial use
Sustainability Goal for Sustainability Criterion	Maintain Current Water Quality	Contain the Spreckels Plume and maintain historical rates of saline front migration	Prevent further degradation of groundwater quality from the Steffens Plume migrating from Fresno County Management Area A	Maintain groundwater quality suitable for habitat	Maintain existing water quality in all aquifers	Monitor existing groundwater contamination sites and engage to ensure cleanup and abatement orders are consistent with the San Joaquin River Exchange Contractors (SJREC) GSP Group. Work with upslope drainage area to reduce the migration of saline water into the SJREC GSP Group
5-Year Interim Goals	**Year 5:** Maintain groundwater elevations comparable to historic hydrologic highs and lows **Year 10:** Maintain groundwater elevations comparable to historic hydrologic highs and lows **Year 15:** Maintain groundwater elevations comparable to historic hydrologic highs and lows	**Year 5:** Average annual rate of degradation of 30 milligrams per liter (mg/L) TDS for saline front **Year 10:** Average annual rate of degradation of 30 mg/L TDS for saline front **Year 15:** Average annual rate of degradation of 30 mg/L TDS for saline front Spreckels Steffens plume dependent on Central Valley Regional Water Quality Control Board (CV-RWQCB) Cleanup and Abatement Order (CAO) actions.	**Year 5:** 1000 milligrams per liter (mg/L) total dissolved solids (TDS) **Year 10:** 800 mg/L TDS **Year 15:** 700 mg/L TDS	**Year 5:** < Measurable Objective **Year 10:** < Measurable Objective **Year 15:** < Measurable Objective	**Year 5:** Maintain 2003-2017 groundwater quality range **Year 10:** Maintain 2003-2017 groundwater quality range **Year 15:** Maintain 2003-2017 groundwater quality range	Continue mitigation efforts on the migration of saline water from upslope drainage.
Minimum Threshold	Electrical Conductivity (EC) - 4.5 deciSiemens per meter (dS/m)* Chlorine (Cl) - 13.3 milliequivalents per liter (meq/L)* NO_3-N - 30 milligrams per liter (mg/L)**	Average annual rate of degradation of 60 mg/L TDS for saline front. Threshold for Steffens plume determined by CV-RWQCB.	TDS concentration of 1100 mg/L	Production Wellhead thresholds: Total dissolved solids (TDS) 2,500 milligrams per liter (mg/L) in both aquifers	NO3 – 10 mg/L as N (Primary MCL) TDS – 1,000 mg/L (Secondary MCL) Boron – 0.7 mg/L (WQO for irrigation) or current groundwater quality where it exceeds MCLs or WQOs for irrigation as of December 2018	The minimum threshold is defined as the amount of poor-quality groundwater that is greater than what can be successfully managed through the management actions

GSP Group	Aliso Water District	Farmers Water District	Fresno County	Grassland	Northern & Central Delta-Mendota	San Joaquin River Exchange Contractors
Measurable Objective	EC - 0.75-1.0 dS/m, based on JM Lord and FAO 100% yield for grapes and almonds. Cl - 3.0 meq/L, based on JM Lord minimum recommendations NO_3-N - >5 mg/L, based on FAO Section 5.1, sensitive crop tolerance	Average annual rate of degradation of 20 mg/L TDS for saline front. Measurable objective for Steffens plume will be determined by CV-RWQCB as part of a CAO.	TDS concentration equivalent to background concentrations (approximately 500 mg/L, depending on Cleanup and Abatement Order [CAO] from Central Valley Regional Water Quality Control Board [CV-RWQCB] for Steffens Plume).	Upper Aquifer: Production Wellhead thresholds: 20% increase from max historic electrical conductivity (EC) concentration Lower Aquifer: Lower aquifer representative water quality monitoring sites have been identified; however, no historic data exists. The Grassland Plan Area participants will monitor the site and with the gathered data, intend to establish meaningful interim goals and measurable objectives in future GSP Updates.	2003-2017 groundwater quality range conditions by GSP sub-region	Mitigate impacts of the migration of saline groundwater from lands upslope of the SJREC GSP

* Based on Food and Agriculture Organization (FAO) 50% yield for grapes
** Based on FAO Section 5.1 typical crop tolerance

Table CC-17: Delta-Mendota Subbasin SMC for Land Subsidence

GSP Group	Aliso Water District	Farmers Water District	Fresno County	Grassland	Northern & Central Delta-Mendota: West Stanislaus Irrigation District-Patterson Irrigation District Management Area	Northern & Central Delta-Mendota: Tranquillity Irrigation District Management Area	Northern & Central Delta-Mendota: Remaining Plan Area	San Joaquin River Exchange Contractors
Definition of Undesirable Results	Changes in ground surface elevation that cause damage to critical infrastructure that would cause significant and unreasonable reductions of conveyance capacity, damage to personal property, impacts to natural resources or create conditions that threaten public health and safety							
Definition of Significant and Unreasonable	Aliso is not currently experiencing any significant and unreasonable effects of subsidence. Significant and unreasonable impacts are assumed to occur when the levees within the District have subsided to an elevation causing impacts to the water carrying capacity of the San Joaquin River and Chowchilla Bypass beyond their design flow rates, causing significant and unreasonable flooding or crop damage.	Damage to infrastructure and loss of conveyance capacity in neighboring Groundwater Sustainability Agencies (GSAs).	Damage to infrastructure, loss of conveyance capacity, and potential inability to flood or drain by gravity and associated habitat impacts.	Damage to infrastructure, permanent loss of conveyance capacity beyond mitigation, and potential inability to flood or drain by gravity and associated habitat impacts.	Impacts to laterals from differential settlement that reduces the ability to deliver surface water supplies.	Inadequate freeboard on levee system in wet years as a result of significant additional land subsidence resulting from groundwater extractions.	Increases in 2014-2016 subsidence rates due to groundwater pumping in two or more subregions that results in 50% loss of standup capacity and/or 75% overtopping of lining in the Delta-Mendota Canal as a result of inelastic land subsidence.	Reduction in the conveyance capacity for water distribution and/or damage to critical infrastructure
Sustainability Goal for Sustainability Criterion	Expand access to surface water during flood years for replenishment of the Upper Aquifer by working with neighbors in both the Delta-Mendota and Madera subbasins where subsidence is occurring.	No contribution to lower aquifer compaction.	No contribution to lower aquifer compaction.	No permanent reduction in conveyance and ability to manage habitat.	No additional subsidence as a result of future groundwater extraction	No additional subsidence as a result of future groundwater extraction.	Minimal additional subsidence (0.005 ft/yr) as a result of future groundwater extraction in the Delta-Mendota Subbasin beyond December 2019 surface elevations	The San Joaquin River Exchange Contractors (SJREC) are experiencing subsidence originating outside of the SJREC GSP Group area. The SJREC GSP Group will work with neighbors to mitigate subsidence impacts on SJREC's facilities.
5-Year Interim Goals	Interim goals established at 0.5-feet of additional subsidence per 5-year interim goal period.	**Year 5:** -0.0088 ft **Year 10:** -0.0065 ft **Year 15:** -0.0043 ft	**Year 5:** at Fordel-Ext: -0.015 ft P304-PBO: -0.084 ft **Year 10:** at Fordel-Ext: -0.013 ft P304-PBO: -0.068 ft **Year 15:** at Fordel-Ext: -0.011 ft P304-PBO: -0.0065 ft	The Grassland Plan area is not causing subsidence and will work with neighbors to achieve Subbasin-wide sustainability. **Year 5:** > Measurable Objective **Year 10:** > Measurable Objective **Year 15:** > Measurable Objective	**Year 5:** Establish Minimum Threshold and Measurable Objective for this parameter **Year 10:** To be determined (TBD) in 2025 GSP update based on additional data analysis **Year 15:** TBD in 2025 GSP update based on additional data analysis	**Year 5:** -0.15 ft/yr **Year 10:** -0.11 ft/yr **Year 15:** -0.08 ft/yr	**Year 5:** - North: -0.12 ft/yr - North-Central: -0.18 ft/yr - Central: -0.15 ft/yr - South-Central: -0.10 ft/yr - South: -0.15 ft/yr **Year 10:** - North: -0.12 ft/yr - North-Central: -0.09 ft/yr - Central: -0.09 ft/yr - South-Central: -0.06 ft/yr - South: -0.11 ft/yr **Year 15:** - North: -0.11 ft/yr - North-Central: -0.01 ft/yr - Central: -0.03 ft/yr - South-Central: -0.01 ft/yr - South: -0.08 ft/yr	N/A – SJREC is not causing subsidence and will work with neighbors to achieve the subbasin-wide sustainability goal by 2040.

GSP Group	Aliso Water District	Farmers Water District	Fresno County	Grassland	Northern & Central Delta-Mendota			San Joaquin River Exchange Contractors
					West Stanislaus Irrigation District-Patterson Irrigation District Management Area	Tranquillity Irrigation District Management Area	Remaining Plan Area	
Minimum Threshold	The minimum threshold is set to not exceed the current rate of subsidence of 0.2 feet/year or 4.0 feet total by 2040	-0.011 ft	Target additional subsidence at two subsidence monitoring points: - Fordel-Ext: -0.017 ft - P304-PBO: -0.1 ft	The minimum threshold is not to exceed, on average, the historic annual average rate of subsidence from December 2011 to December 2015 as defined at each representative subsidence monitoring site: - Point 108: -0.11 ft/yr - Point 152: -0.15 ft/yr - Point 137: -0.13 ft/yr	Acceptable loss in distribution capacity as a result of subsidence resulting from groundwater pumping as based on a future capacity study *Numerical value for this criterion to be determined based on data collection between 2020 and 2025	4 feet of additional subsidence (compared to 2019 levee elevation)	Target rate/goal by sub-region (average 2014-2016 elevation change from Delta-Mendota Canal survey): - North: -0.13 ft/yr - North-Central: -0.26 ft/yr - Central: -0.21 ft/yr - South-Central: -0.15 ft/yr - South: -0.18 ft/yr	SJREC has lost capacity in several conveyance facilities and is spending millions of dollars rehabilitating some of those facilities. The Minimum Threshold is that which doesn't reduce SJREC's conveyance capacity without appropriate mitigation. In other words, zero subsidence without mitigation.
Measurable Objective	The Measurable Objective is set to be the more restrictive of the two Significant and Unreasonable scenarios. It is assumed that significant impacts will cause flooding and crop damage will be 1/2 of the current design minimum freeboard of 4 feet (therefore 2 feet).	-0.002 ft	Target additional subsidence at two subsidence monitoring points: - Fordel-Ext: -0.0086 ft - P304-PBO: -0.036 ft	The measurable objective is not to exceed, on average, the historic annual average rate of subsidence from December 2011 to December 2018, defined at each respective site: - Point 108: -0.08 ft/yr - Point 152: -0.1 ft/yr - Point 137: -0.11 ft/yr	No loss in distribution capacity as a result of subsidence resulting from groundwater pumping *Numerical value for this criterion to be determined based on data collection between 2020 and 2025	2 feet of additional subsidence (compared to 2019 levee)	Target rate/goal by subregion (average 2016-2018 elevation change from Delta-Mendota Canal survey): - North: -0.11 ft/yr - North-Central: -0.01 ft/yr - Central: -0.03 ft/yr - South-Central: -0.01 ft/yr - South: -0.08 ft/yr	The measurable objective for land subsidence is to significantly reduce inelastic land subsidence to less than 0.005 ft/year

Table CC-18: Delta-Mendota Subbasin SMC for Depletions of Interconnected Surface Water

GSP Group	Aliso Water District	Farmers Water District	Fresno County	Grassland	Northern & Central Delta-Mendota	San Joaquin River Exchange Contractors
Definition of Undesirable Results	Depletions of interconnected surface water, as defined by each GSP Group, that have significant and unreasonable adverse impacts on the beneficial uses of surface water					
Definition of Significant and Unreasonable	Aliso Water District groundwater pumping does not influence surface water depletion. Landowners within the District are limited by the Herminghaus Agreement and similar pumping restrictions along the San Joaquin River that prevent pumping from above the A-Clay. Additionally, the primary aquifer, where groundwater pumping occurs, is disconnected from surface water source. A significant and unreasonable result would be a reduction in water availability to downstream beneficial users beyond what was experienced in similar water years in recent history as a result of groundwater extractions.	(1) San Joaquin River Restoration Project (SJRRP) operations and groundwater extractions from the Upper Aquifer that will influence stream depletion along San Joaquin River (2) Water level measurements along the San Joaquin River in the shallow zone of the Upper Aquifer to determine degree of vertical gradient (3) Potential degradation to groundwater dependent ecosystems (GDEs) along San Joaquin River primarily dependent on SJRRP operations of San Joaquin River flows since groundwater pumping expected to remain stable and consistent with historical (pre-SJRRP) levels	Decrease in surface water stage in Mendota Pool from Bureau of Reclamation and Central California Irrigation District (CCID) operations that impact groundwater dependent ecosystems (GDEs) and operations in Mendota Wildlife Area.	The Grassland Plan Area groundwater pumping does not influence surface water depletion. Reduction of interconnected surface water bodies and associated groundwater dependent ecosystems (GDEs), requiring reduction in groundwater pumping (no management activities have depleted interconnected surface water in the Grassland Plan Area within the Historic Period). A significant and unreasonable undesirable result would regard impaired habitat directly associated with interconnected surface waters.	Where interconnected stretches of surface water are identified, an X%* increase in depletions of surface water as a result of groundwater pumping. *The percent increase in depletions is to be determined from monitoring data collected between 2020 and 2025 and associated analyses of these data.	When groundwater extraction directly decreases streamflow in losing stretch of the San Joaquin River.
Sustainability Goal for Sustainability Criterion	Similar reductions in water availability to downstream beneficial users as was experienced in similar water years in recent history as a result of groundwater extractions.	Minimize downward gradient in the San Joaquin River	Maintain stage in Mendota Pool between 12.75 and 13 feet.	No reduction in interconnected surface water bodies or associated GDEs due to GGSA pumping.	No loss of productive agriculture due to an inability to pump groundwater.	Mitigate observed reductions of interconnected surface and groundwater due to pumping in the San Joaquin River Exchange Contractors (SJREC) GSP Group area.
5-Year Interim Goals	Not Applicable	**Year 5:** gradient of -1.1 **Year 10:** gradient of -0.99 **Year 15:** gradient of -0.83 All gradients measured at monitoring site SJRRP-09-55, 55b	**Year 5:** Mendota Pool staff gage reading of 7.4 ft **Year 10:** Mendota Pool staff gage reading of 9.1 ft **Year 15:** Mendota Pool staff gage reading of 11.3 ft	**Year 5:** WSE > Measurable Objective (Upper Aquifer) **Year 10:** WSE > Measurable Objective (Upper Aquifer) **Year 15:** WSE > Measurable Objective (Upper Aquifer)	**Year 5:** Establish Minimum Threshold and Measurable Objective for this parameter **Year 10:** To be determined (TBD) in 2025 GSP update based on additional data analysis **Year 15:** TBD in 2025 GSP update based on additional data analysis	**Year 5:** Mitigate depleted interconnected surface water in the San Joaquin River **Year 10:** Mitigate depleted interconnected surface water in the San Joaquin River **Year 15:** Mitigate depleted interconnected surface water in the San Joaquin River
Minimum Threshold	Not Applicable Similar reductions in water availability to downstream beneficial users as was experienced in similar water years in recent history as a result of groundwater extractions.	Gradient of -1.3 at monitoring site SJRRP-09-55, 55b	Mendota Pool staff gage reading of 5.4 ft	20% lowered water elevation from recent historic low (set at each monitoring site).	An X%* increase in surface water depletions along interconnected stretches of surface water as a result of groundwater pumping. *The percent increase in depletions is to be determined from monitoring data collected between 2020 and 2025 and associated analyses of these data.	Observed increase in seepage from the San Joaquin River due to groundwater extractions in the SJREC GSP Group area. The SJREC plan to work with the counties to restrict perforating wells above the first encountered restrictive clay layer (near the San Joaquin River) to prevent induced seepage similar to the established operations defined in the Herminghaus Agreement on Reach 2 of the San Joaquin River.

GSP Group	Aliso Water District	Farmers Water District	Fresno County	Grassland	Northern & Central Delta-Mendota	San Joaquin River Exchange Contractors
Measurable Objective	Not Applicable. Similar reductions in water availability to downstream beneficial users as was experienced in similar water years in recent history as a result of groundwater extractions.	Gradient of -0.67 at monitoring site SJRRP-09-55, 55b	Mendota Pool staff gage reading of 13.5 ft	Recent historic low (set at each monitoring site).	No increased depletions of surface water as a result of groundwater pumping.	Same as Minimum Threshold

6. SUBBASIN MONITORING PROGRAM

As required by Subarticle 4. Monitoring Networks of the GSP regulations, the GSPs must include a monitoring network for each sustainability indicator, in addition to describing the monitoring protocols and data management to be followed in implementing the GSP monitoring program. Given the variability of conditions within the Delta-Mendota Subbasin, each GSP Group developed their individual monitoring networks, in coordination with their neighboring GSP Groups, such that the subbasin-wide monitoring program is simply a compilation of those coordinated individual monitoring networks. Please see the individual GSPs for further discussion as to how the monitoring networks were developed.

The subbasin-wide monitoring networks presented herein are the representative monitoring networks for each of the applicable sustainability indicators, as defined according to the GSP Regulations § 354.36, *Representative Monitoring*. It is at the representative monitoring sites where each GSP Group has defined minimum thresholds, measurable objectives, and interim milestones to evaluate progress in achieving the Subbasin's sustainability goal by 2040. Data collected at the representative monitoring locations may be augmented with additional data, as available and appropriate, from other locations and/or publicly-available datasets, in evaluating Subbasin conditions on an annual basis.

6.1.1 Coordinated Assumptions and Data

As previously noted, the required monitoring networks were developed at the GSP-level in order to appropriately capture the variability of hydrogeologic and water quality conditions in the Delta-Mendota Subbasin. All common coordinated assumptions agreed upon and implemented by each GSP Group in developing their respective monitoring networks are presented in Technical Memorandum 5 (*Assumptions for Delta-Mendota Subbasin Monitoring Network*) which is included in **Appendix B** of this Common Chapter.

6.1.2 Coordinated Monitoring Activities

All Delta-Mendota Subbasin GSP Groups have agreed to utilize the following monitoring protocols, data management, and roles and responsibilities for implementing and reporting from their respective monitoring plans under SGMA to ensure consistency in data collection, analysis and management allowing for subbasin-wide evaluation of groundwater conditions relative to the Subbasin sustainability goal, as defined and agreed upon by all GSP Groups.

Monitoring Protocols

Each GSP Group will utilize agreed-upon protocols, which may be the same as, or equal to, data collection protocols (i.e. industry standards and best management practices) to ensure the collection of comparable data using comparable methods. Additionally, the following minimum monitoring frequency for each applicable sustainability indicator was agreed upon by each GSP Group during the joint Delta-Mendota Subbasin Coordination Committee and Technical Working Group meeting on June 18, 2019:

- **Chronic lowering of groundwater levels/reduction in groundwater storage** - Twice per year, with seasonal high groundwater elevation data collected between February and April, and seasonal low groundwater elevation data collected between September and October
- **Degraded water quality** – Once per year during irrigation season, typically between May and July

- **Depletions of interconnected surface water** – Twice per year in conjunction with groundwater level monitoring
- **Subsidence** – Publicly available subsidence data will be used along with locally-collected data. At a minimum, three data points will be collected within the first five years of GSP implementation, with a baseline value from 2019 or a date prior to that.

For non-monitored data to be reported as part of the annual reports (e.g. groundwater extractions, surface water deliveries), actual metered data will be used where such data exists, and when direct data do not exist, estimated quantities will be calculated based on existing indirect data (e.g. electrical usage, crop demand, ET) and/or other industry best practices.

Data Management

Each GSP Group will be responsible for conducting quality control reviews of data collected from the monitoring networks. As described in the Coordination Agreement, each GSP Group will exchange and share collected data in order to facilitate analysis and reporting at the Subbasin level. The Coordinated Data Management System (DMS) will be the primary vehicle by which data are shared amongst the GSP Groups, and it will be the responsibility of each GSP Group to conduct a quality control review of data entered into the DMS.

Roles and Responsibilities

It will be the responsibility of each GSP Group, and the GSAs included in that group, to conduct the monitoring program as agreed upon at the Subbasin level, for reviewing the data collected, and for ensuring that these data are available at the Subbasin level. **Figure CC-65** shows the general flow of data collected from the Delta-Mendota monitoring programs.

Figure CC-66 shows the roles and responsibilities of each GSA and GSP Group in the collecting, processing and reporting of data from the GSP monitoring networks. Additionally, it is the responsibility of each GSP Group, including their respective GSAs, to maintain the monitoring network and, as appropriate, revise and/or expand the monitoring networks to fill identified data gaps. Please see the individual GSPs for further information regarding data gaps and the GSAs plans for addressing those gaps.

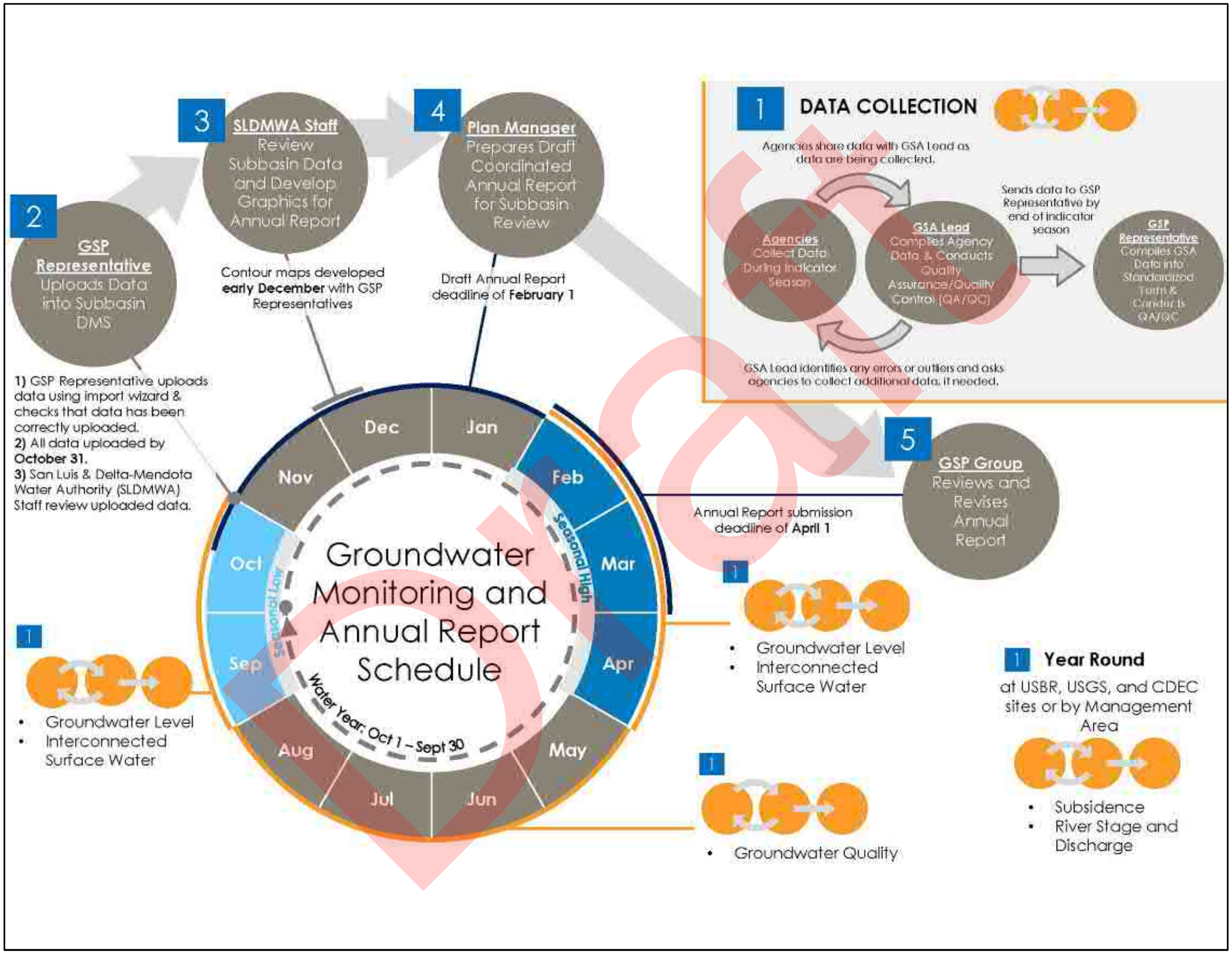


Figure CC-65: Data Flow in Delta-Mendota Subbasin

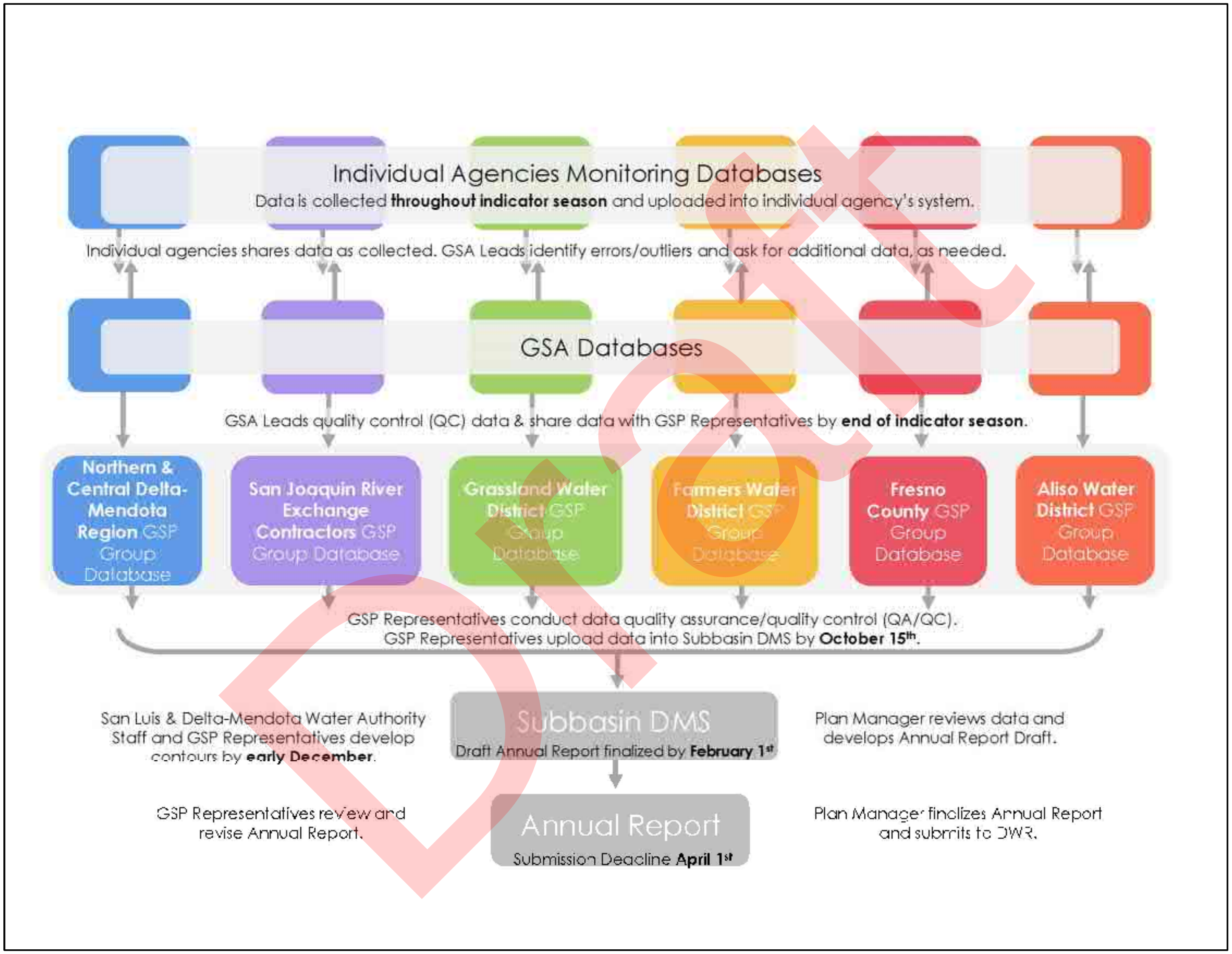


Figure CC-66: Delta-Mendota Monitoring and Data Management Roles and Responsibilities

6.1.3 GSP-Level Monitoring Networks

For more information on the individual GSP monitoring networks for each applicable sustainability indicator, including how the networks were developed, please refer to the individual GSPs. The monitoring networks for each applicable sustainability indicator for each GSP Group were developed in accordance with the GSP Regulations Article 5. Plan Contents, Subarticle 4. Monitoring Networks (§ 354.21 – 354.40). DWR's Best Management Practices for the *Sustainable Management of Groundwater Monitoring Protocols, Standards, and Sites BMP* (2016b) and *Monitoring Networks and Identification of Data Gaps BMP* (2016a) documents were used when and where applicable at the discretion of each GSP group in developing monitoring networks and monitoring protocols.

6.1.4 Delta-Mendota Subbasin Monitoring Networks

The subbasin-level monitoring networks are a compilation of the representative monitoring networks developed by each individual GSP Group. The monitoring network for the chronic lowering of groundwater sustainability indicator is comprised of two parts, the Upper Aquifer (**Figure CC-67**) and Lower Aquifer (**Figure CC-68**). The monitoring networks for the reduction in groundwater storage for the Upper Aquifer and Lower Aquifer are the same as those utilized for the chronic lowering of groundwater levels. The monitoring network for the degraded water quality sustainability indicator is also comprised of two parts, the Upper Aquifer (**Figure CC-69**) and Lower Aquifer (**Figure CC-70**). Data gaps (areas without wells of known construction) are shown for the Upper Aquifer and Lower Aquifer for the chronic lowering of groundwater and degraded water quality sustainability indicator. The interconnected surface water monitoring network for the Delta-Mendota Subbasin is shown in **Figure CC-71**, and the monitoring network for land subsidence for the Delta-Mendota Subbasin is shown in **Figure CC-72**.

The Delta-Mendota Subbasin representative monitoring networks will be periodically reviewed and revised, as appropriate, by the GSP Groups responsible for maintaining them and coordinated at the Subbasin level. Revised monitoring networks will be included in the five-year updates to the GSPs.

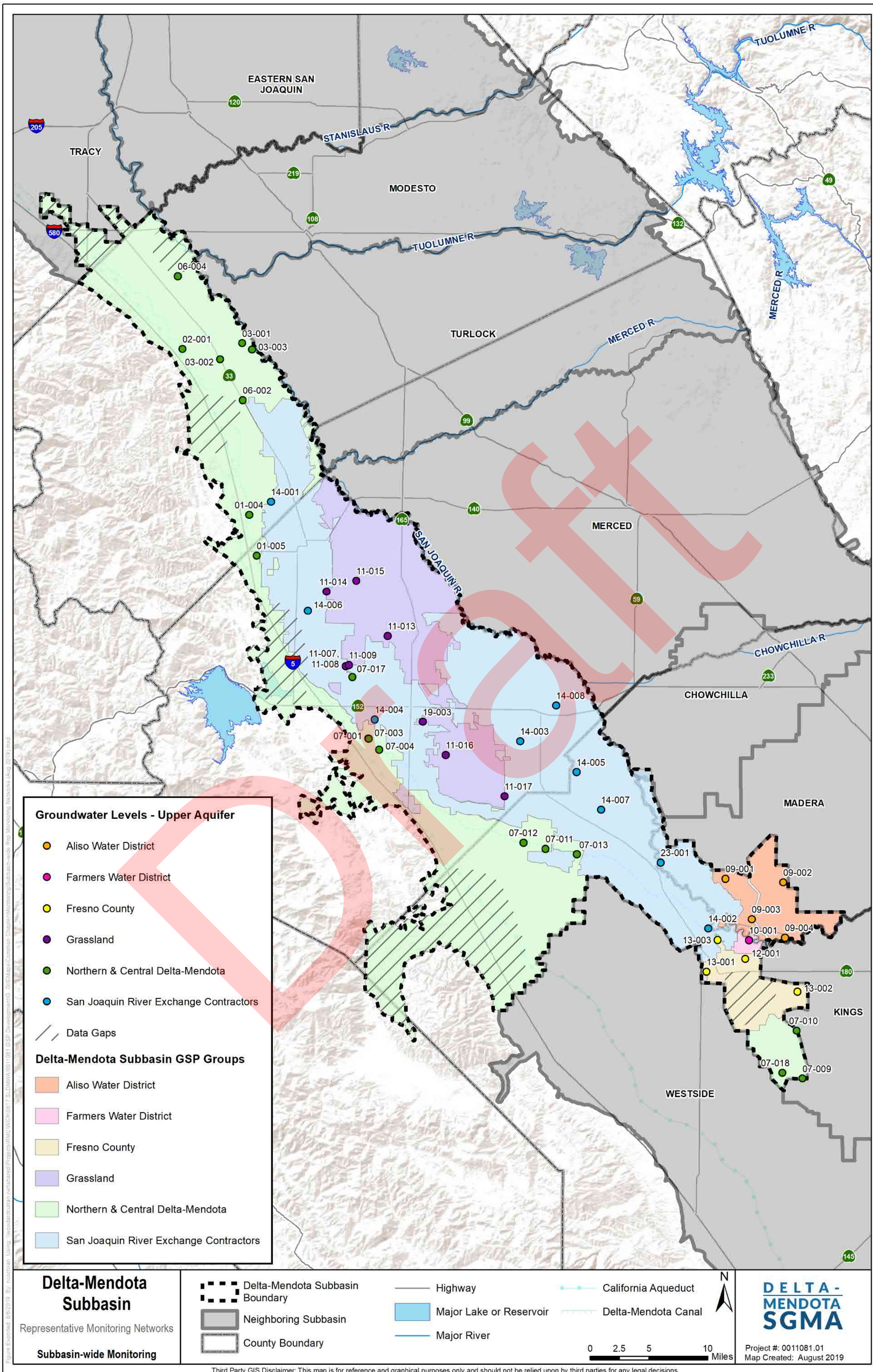


Figure CC-67: Upper Aquifer Groundwater Level Monitoring Network

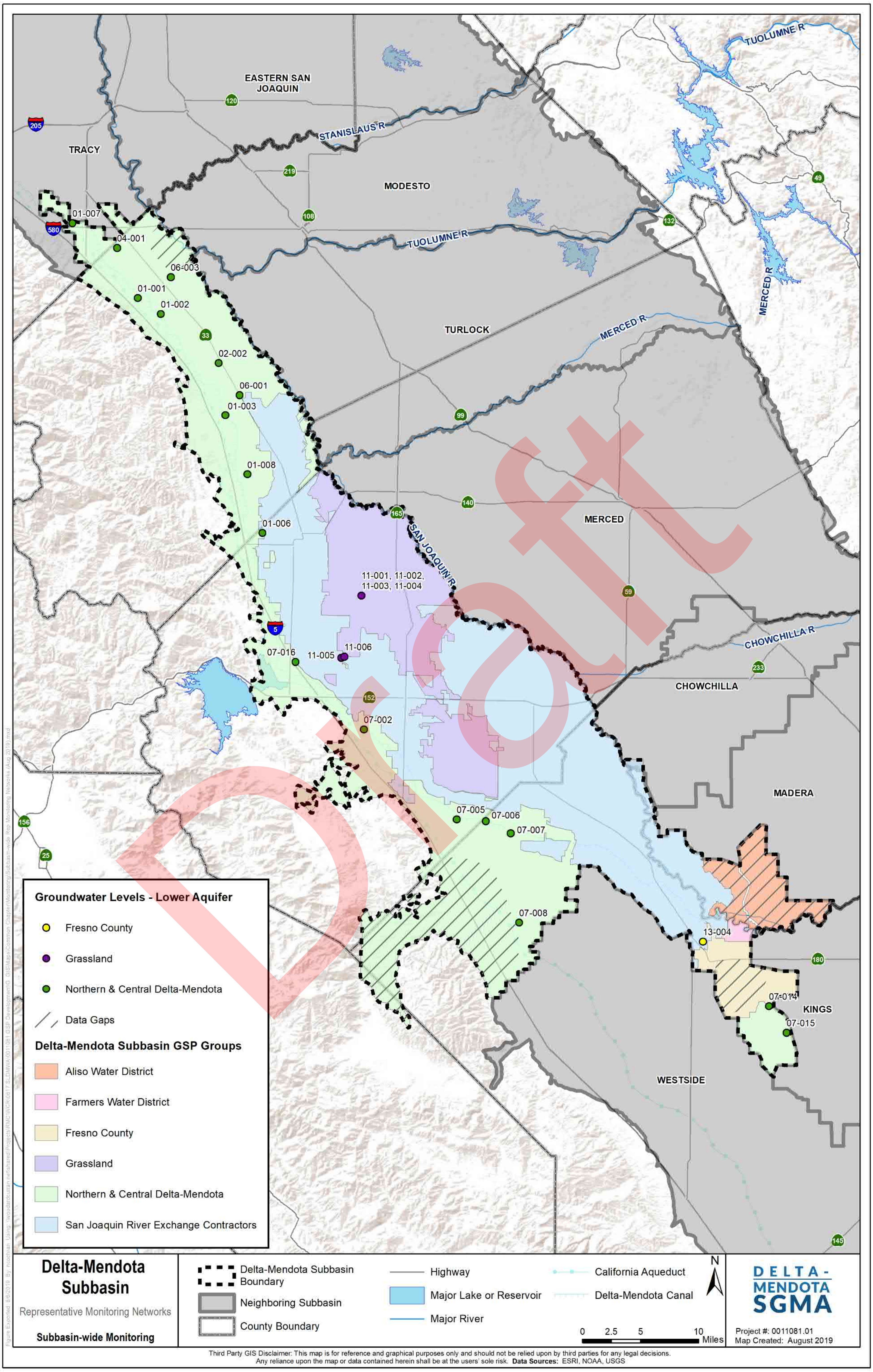


Figure CC-68: Lower Aquifer Groundwater Level Monitoring Network

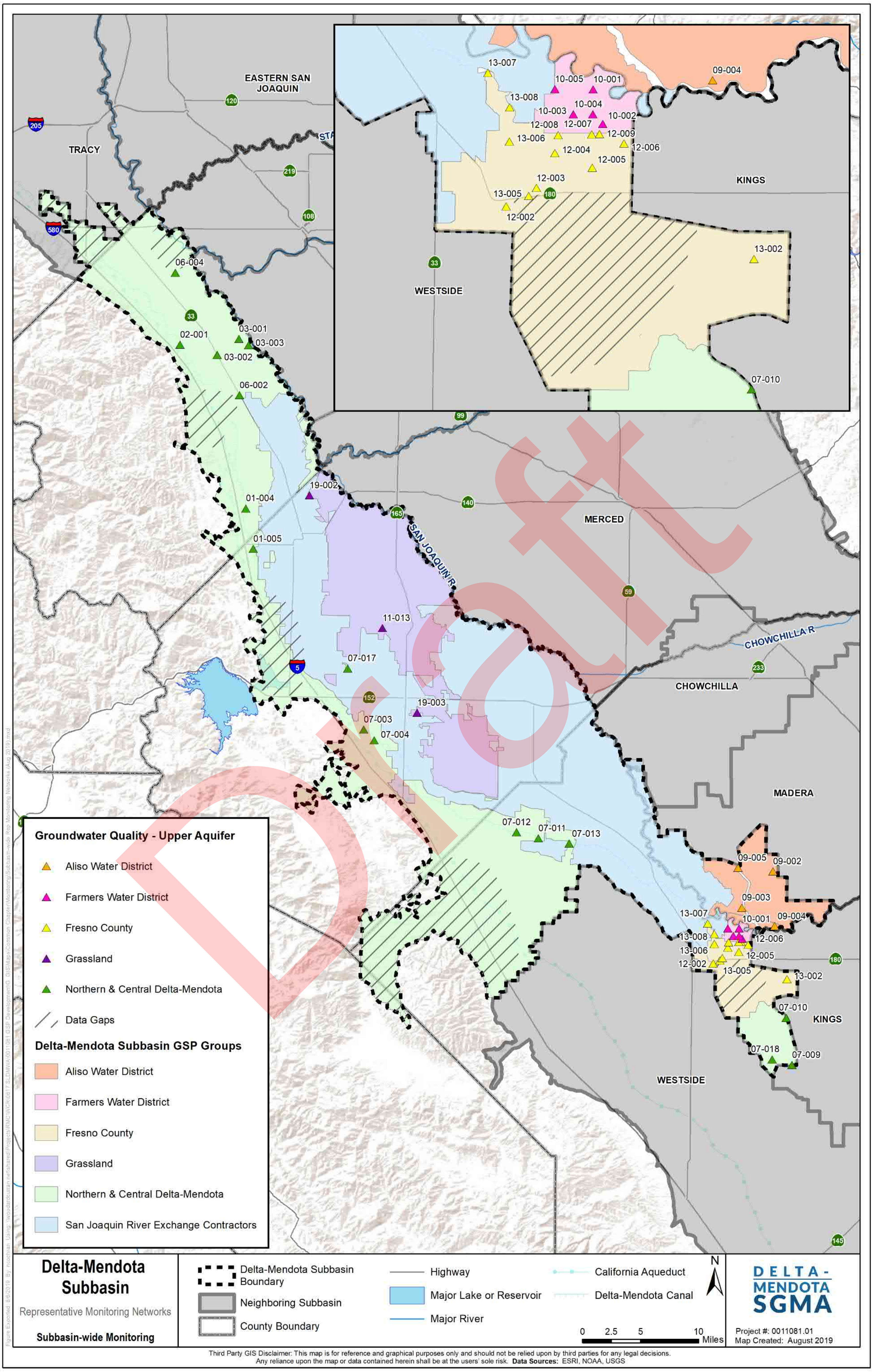


Figure CC-69: Upper Aquifer Groundwater Quality Monitoring Network

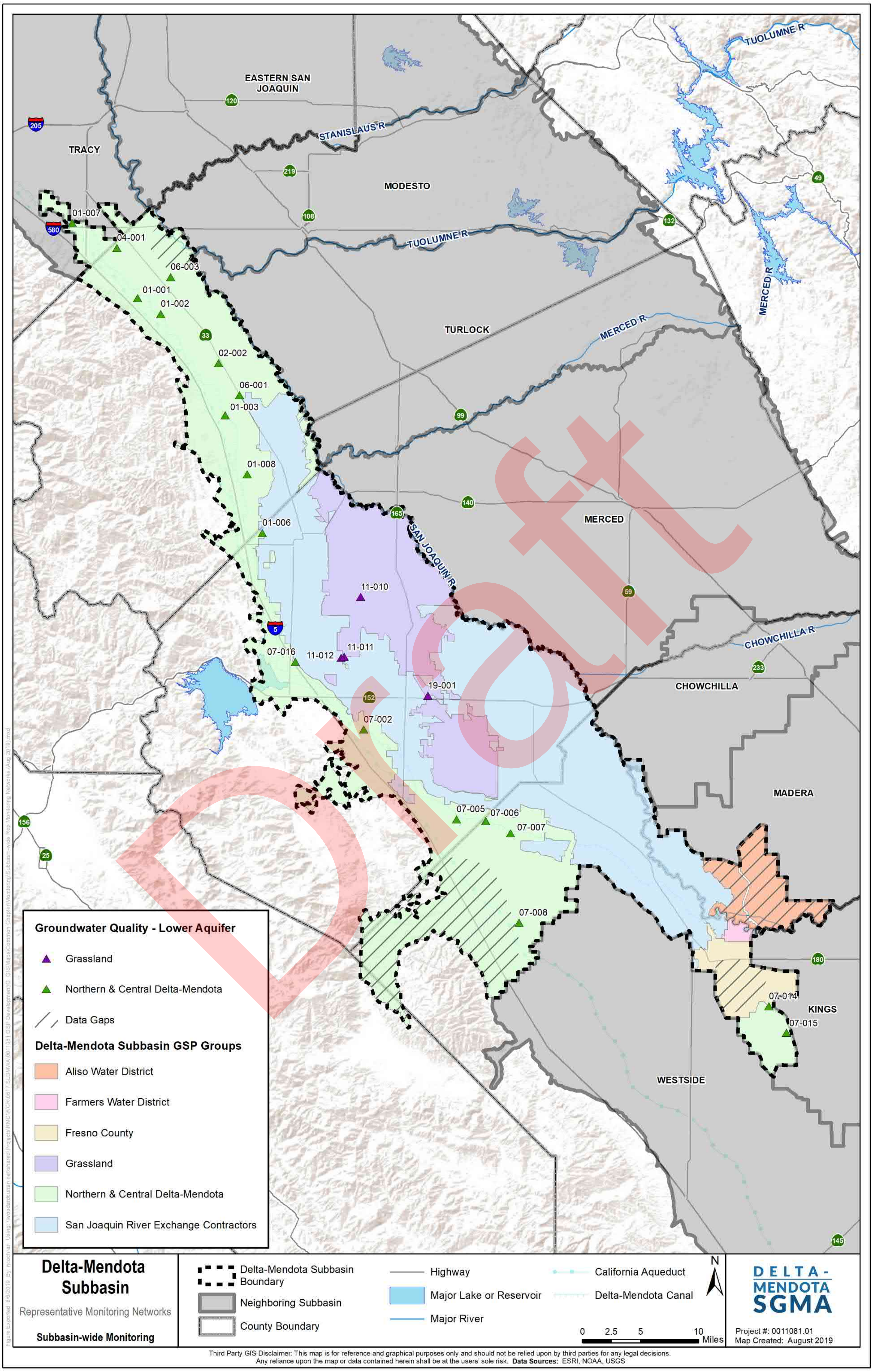


Figure CC-70: Lower Aquifer Groundwater Quality Monitoring Network

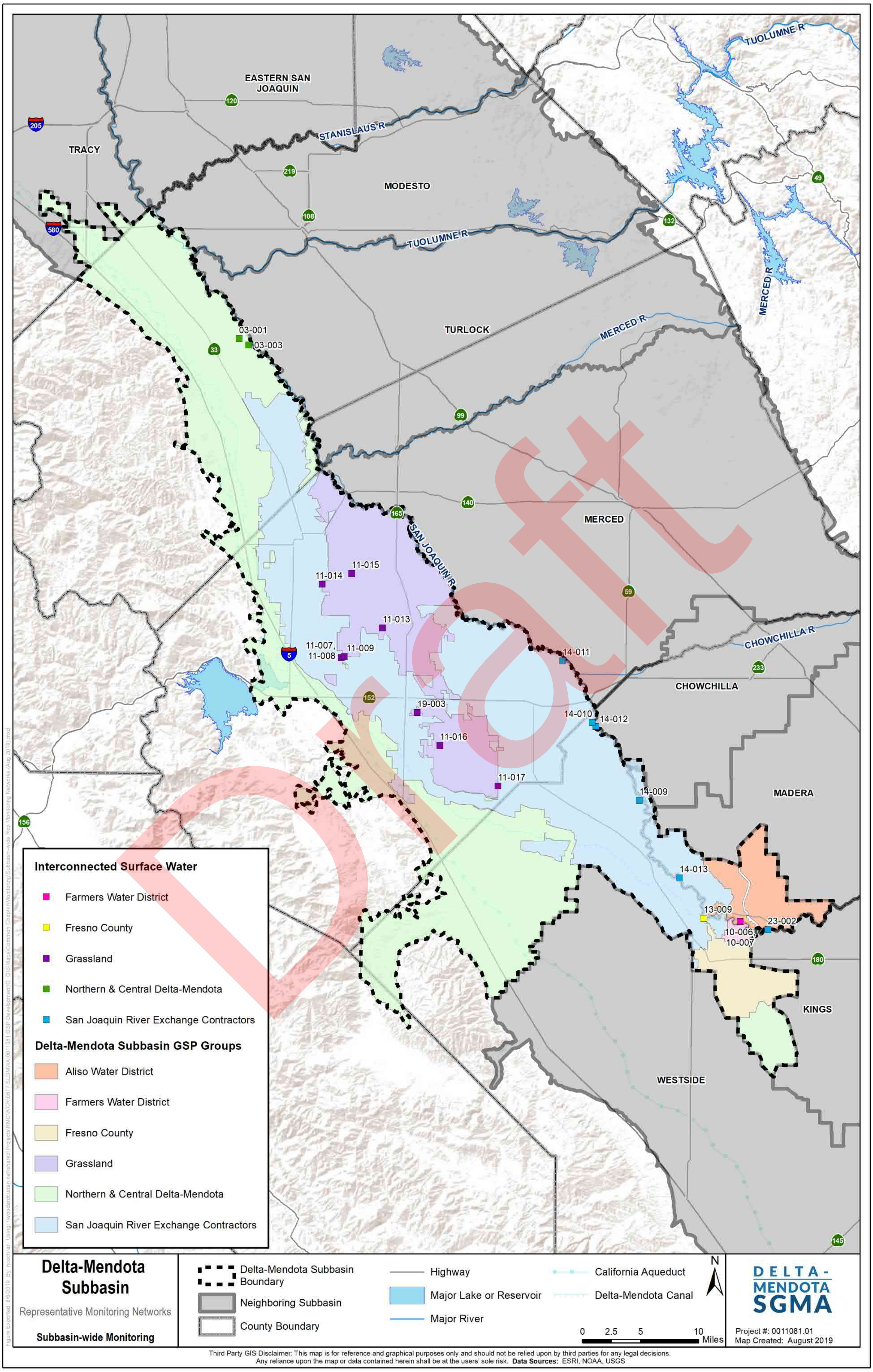


Figure CC-71: Interconnected Surface Water Monitoring Network

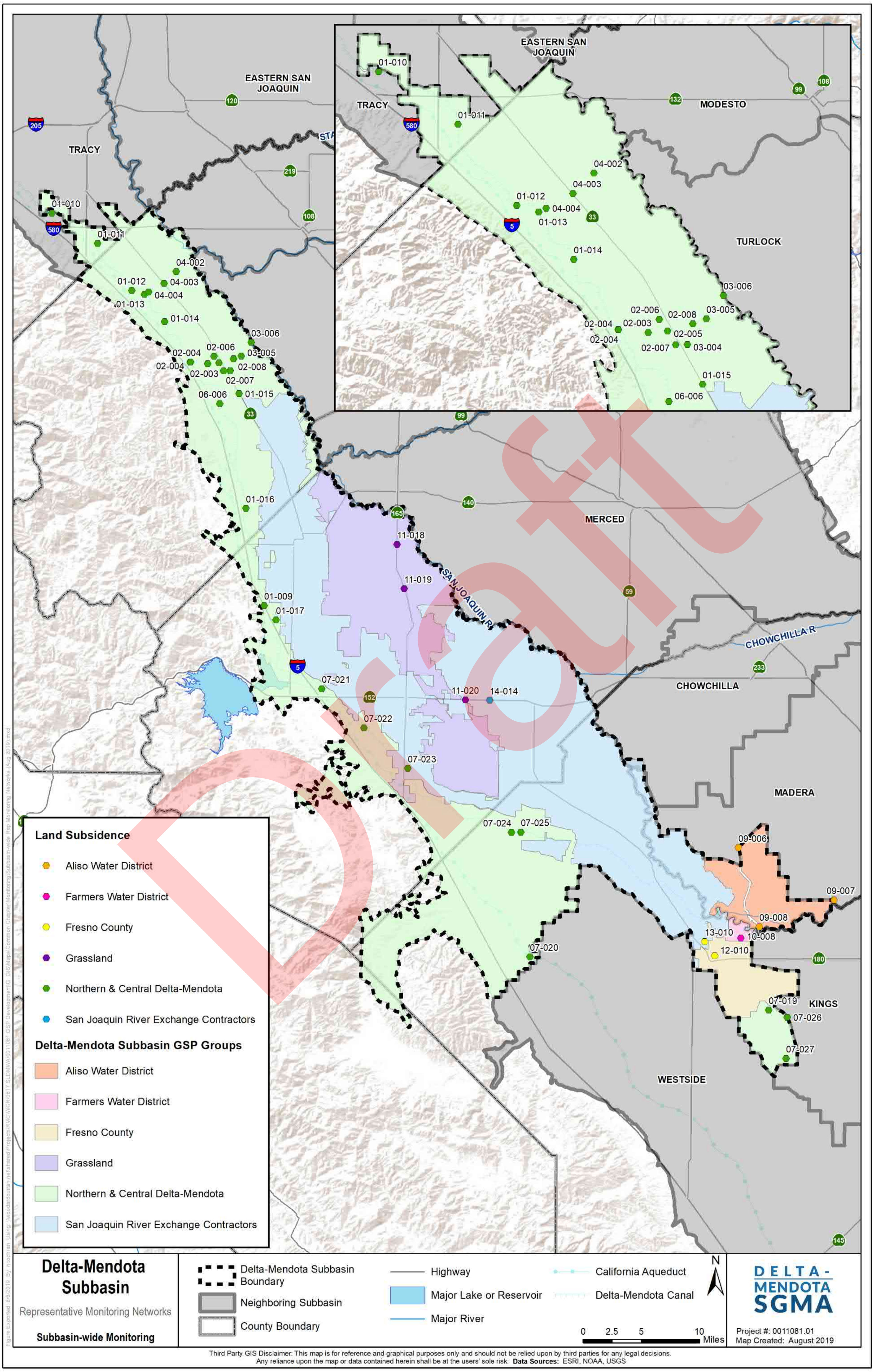


Figure CC-72: Land Surface Elevation Monitoring Network

7. SUBBASIN DATA COLLECTION AND MANAGEMENT

As required in §352.6, Data Management System of the GSP regulations, each GSA is required to develop and maintain a data management system (DMS) that is capable of storing and reporting information relevant to the development or implementation of the GSP(s). Additionally, per §354.4, Reporting Monitoring Data to the Department, all monitoring data is to be stored in a DMS with copies of the monitoring data included in the annual report and submitted electronically on forms provided by DWR. Recognizing that GSP implementation, including annual reporting, will require some efforts at the subbasin level, the 23 GSAs overlying the Delta-Mendota Subbasin have chosen to develop a coordinated DMS that can be utilized by each GSP Group for management of their data but which will allow for the required compendium of data sets for preparation of Subbasin annual reports. The coordinated DMS will also provide a generic framework that can be used by any GSP Group or GSA in the Subbasin for individual data management while allowing for consistent formatting and the simplified uploading of compiled datasets into the Subbasin-wide coordinated DMS.

The individual GSP Groups have also developed and will maintain separate data storage processes or DMSs. Each separate DMS developed for each GSP will store information related to implementation of each individual GSP, monitoring network data and monitoring sites requirements, and water budget data requirements. Each system will be capable of reporting all pertinent information to the respective GSA and/or GSP Group, and ultimately to the Coordination Committee. After providing the Coordination Committee with data from the individual GSPs, the Subbasin Plan Manager and Coordination Committee will ensure the data are stored and managed in a coordinated manner throughout the Subbasin and reported to DWR on an annual basis.

The DMS constructed for the Delta-Mendota Subbasin is a secured web-based application hosted on Amazon Web Services (AWS). The DMS focuses on five core business requirements including: centralized data warehouse, security of data, permissioned based access, data visualization and reporting. Other goals of the DMS focus around improving data collection/aggregation processes, creating data standards, gaining efficiencies in reporting and improving data sharing with stakeholders. The DMS is designed to aggregate data through import processes by GSP to support data visualization and annual report generation.

Underlying the web application is a relationship database used to store the information aggregated from GSPs across primary data types identified to support monitoring and Annual Report development. Those data types include groundwater extractions, surface water deliveries, groundwater storage, groundwater elevations, groundwater quality, interconnected surface water and land subsidence. The web application functionality includes an embedded GIS viewer, screens to view tables of time series data, and charting capabilities for hydrographs. The embedded GIS viewer contains functionality to store map layers such as reference data, GSA/GSP boundaries and derived information such as water level contours.

Section 6.1.2 describes the process by which monitoring data are collected by each GSP Group and processed for inclusion in the Coordinated DMS. In order to be able to track data by location in the Subbasin, each monitoring locations in the Delta-Mendota Subbasin is assigned a unique identifier in the DMS. The number system is in a format of ##-####, where the first two digits indicates which GSA the monitoring location is associated with, the subsequent four digits indicate which specific monitoring location in that GSA area. As shown in **Figure CC-66**, the general methodology agreed upon for data import and management is as follows:

- Each GSA collects their respective data per agreed-upon monitoring protocols and transmits it to the GSA Representative.
- Each GSA Representative then compiles the data and conducts a quality control check.
- The GSA Representative then transmits the compiled data set to the GSP Lead or Representative, who then aggregates the data from all GSAs and conducts a second quality control check.
- The GSP Lead or Representative then uploads the data set into the DMS using import wizards designed specifically for this process.
- The Subbasin Plan Manager then uses the data in the DMS to compile information as required for the annual report.

Compiled data sets from the DMS are then augmented with required maps generated externally to produce the required annual report. Mapping prepared outside the DMS are subsequently imported into the DMS as GIS files to ensure all data are kept in one place and to allow for access by GSAs and other Subbasin stakeholders.

The DMS will be maintained by the San Luis & Delta-Mendota Water Authority, while acting as the Plan Manager, with a contract with the software vendor for hosting, maintenance and future maintenance. Each GSP will pay a maintenance fee for the continued hosting and support of the Subbasin coordinated DMS.

The Coordinated DMS as described herein may be supplemented by additional DMS developed and maintained by each GSP Group in the Subbasin. The reader is referred to each of the six Subbasin GSPs for specific information relative to data collection and management in each GSP Plan area.

8. STAKEHOLDER OUTREACH

California Code of Regulations, Title 23, §354.10 identifies the requirements for notice and communication information presented in a GSP, which includes:

- A summary of information relating to notification and communication by the GSAs with other agencies and interested parties;
- A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties;
- A list of public meetings at which the GSP was discussed or considered by the GSAs;
- Comments regarding the GSP received by the GSAs and a summary of any responses by the GSAs;
- A communication section of the GSP that includes an explanation of the GSAs' decision-making process, identification of opportunities for public engagement, a discussion of how public input and response was used, a description of how the GSAs encouraged the active involvement of diverse social, cultural and economic elements of the population within the basin, and the methods used by the GSAs to inform the public about progress implementing the GSP, including the status of projects and actions.

In meeting these requirements, outreach and educational activities were conducted at the Subbasin, GSP and GSA level throughout the GSP development process. This section describes the noticing and outreach conducted at the Delta-Mendota Subbasin level for GSP development. Please refer to each individual Subbasin GSP for specific details regarding noticing and communication, and descriptions of the beneficial uses and users of groundwater at the GSP and GSA level. Information regarding Subbasin coordination and committees can be found in Section 2, Delta-Mendota Subbasin Governance, of this document.

8.1 Situation Assessment and Communications Plan

To assist in GSA formation and GSP development, agencies in the Delta-Mendota Subbasin sought and received Facilitation Support Services funding from DWR in August 2016. Under this funding, a neutral, third-party facilitation team conducted a situation assessment on behalf of the Subbasin GSAs. The purpose of the assessment was to understand how stakeholders perceived the status of the Subbasin's groundwater resources and identify potential barriers to the successful development of the GSPs.

The facilitation team, with input from local agencies, identified 30 stakeholders representing diverse interests and beneficial users in the Subbasin, together with disadvantaged communities, agricultural well owners, government and land use agencies, and environmental and ecosystem interests. From February 2017 to May 2017, the facilitators conducted over 30 phone and in-person interviews with stakeholders. The facilitators recorded the interview responses and summarized the results in a presentation made to the GSA representatives.

The assessment results were used to inform the development of the Delta-Mendota Subbasin Sustainable Groundwater Management Act Communications Plan (Communications Plan), which is provided with this document as **Appendix E**. The Communications Plan identifies near- and long-term outreach and engagement strategies, tactics, and tools for stakeholder engagement in GSP development and implementation. The Subbasin GSAs used the Communications Plan as a framework for conducting the stakeholder outreach and engagement activities described in this document.

The Delta-Mendota Subbasin is home to a large Hispanic or Latino population with many using Spanish as their primary language. As such, public noticing, educational materials and other outreach efforts were developed and presented in both English and Spanish throughout the GSP development process.

8.2 Public Noticing and Information

The Delta-Mendota Subbasin GSAs developed and used several coordinated tools, in addition to their own resources to inform members of the public about GSP development activities and promote opportunities for public engagement. These tools are described below.

- **Website:** The Subbasin website – www.deltamendota.org – is the primary location for information related to SGMA implementation in the Subbasin. Information provided on the website includes: an overview of SGMA, a description of each of the GSP groups, contact information for each of the GSAs, and upcoming workshops and public meetings. The website also serves as a repository for outreach collateral, workshop materials, and meeting packets and minutes for the Delta-Mendota Subbasin Coordination Committee, Technical Working Group, and Communications Working Group (described below), and provides links to the individual GSP websites maintained by each GSP Group.
- **Delta-Mendota Subbasin Newsletter:** The Delta-Mendota Subbasin Newsletter is distributed on a monthly basis and serves as an informational tool to keep interested parties, beneficial users, and members of the general public informed about the development and status of the GSPs. Newsletter topics include Subbasin-wide activities, general announcements, upcoming meetings and workshops, and past and upcoming GSP development activities. Copies of the newsletters are archived on the Subbasin website.
- **Informational Materials**: GSAs in the Subbasin developed a suite of materials in English and Spanish to educate and inform members of the public about SGMA and topics covered in the GSP. These materials include bilingual presentations, fact sheets, handouts, frequently asked questions, and videos. Copies of the materials are available on the Subbasin website. GSA representatives distributed these materials before and during meetings, workshops, and other outreach activities.

8.3 List of Public Meetings Where the GSPs were Discussed

Each GSP Group for the Delta-Mendota Subbasin has conducted individual outreach efforts relative to their own GSP Plan area in addition to those same efforts at the subbasin-level. Please refer to each of the individual GSPs for this information. Below is a list of the coordinated public workshops and meetings where the GSPs were discussed. These include meetings of the Delta-Mendota Subbasin Coordination Committee, the two Subbasin Working Groups and coordinated public workshops. All meetings were publicly noticed and held from June 2017 through July 2019. Meeting agenda, minutes and handouts are available on the Delta-Mendota Subbasin website at www.deltamendota.org.

Delta-Mendota Coordination Committee Meetings

The Delta-Mendota Subbasin Coordination Committee meets on the second Monday of each month at 9:30 am at the SLDMWA Administration Offices located at 842 6th Street, Los Banos, California. These meetings are noticed as required under the Brown Act and are open to the public.

In addition to the monthly meetings, a special meeting of the Coordination Committee was held on March 8, 2019 to discuss sustainable yield estimation methodologies.

Delta-Mendota Technical Working Group Meetings

The Delta-Mendota Technical Working Group meets on the third Tuesday of each month at 10:00 am at the SLDMWA Administration Offices located at 842 6th Street, Los Banos, California. These meetings are noticed as required under the Brown Act and are open to the public.

In addition to the monthly meetings, several special meetings of the Technical Working Group were held to discuss specific topics. These additional meetings were as follows:

- August 24, 2018 and September 19, 2018 meetings to discuss Groundwater Dependent Ecosystems
- August 8, 2018, October 30, 2018 and December 19, 2018 meetings to discuss water budgets

Delta-Mendota Communication Working Group Meetings

The Delta-Mendota Communications Working Group meets on the fourth Tuesday of each month at 1:00 pm. These meetings typically conducted via conference call. Meeting information for this working group is available on the Delta-Mendota Subbasin website.

Coordinated Public Workshops

Coordinated public workshops were held for the Delta-Mendota Subbasin shown in the table below. All workshops were advertised and conducted in both English and Spanish.

Table CC-19: Coordinated Public Workshops

Date	Location, Venue	Topic
Spring 2018 Workshops		
May 14, 2018	Los Banos, San Luis & Delta Mendota Water Authority	• Sustainable Groundwater Management Act overview • Delta-Mendota Subbasin overview • Opportunities for engagement
May 16, 2018	Patterson, Hammon Senior Center	
May 17, 2018	Mendota, Mendota Library	
Fall 2018 Workshops		
October 22, 2018	Firebaugh, Firebaugh Middle School	• GSP development and implementation process • Data collection • Hydrogeologic Conceptual Model • Numerical and analytical models • Water budgets
October 24, 2018	Los Banos, College Greens Building	
October 25, 2018	Patterson, Hammon Senior Center	
Winter 2019 Workshops		
February 19, 2019	Los Banos, College Greens Building	

Date	Location, Venue	Topic
February 20, 2019	Patterson, Patterson City Hall	• Historic and current water budgets • Sustainability criteria • Undesirable results • Projects and management actions
March 4, 2019	Santa Nella, Romero Elementary School	
Spring 2019 Workshops		
May 20, 2019	Patterson, Patterson City Hall	• Projected water budgets • Sustainable yield • Groundwater monitoring networks • Projects and management actions
May 21, 2019	Los Banos, College Greens Building	
May 22, 2019	Santa Nella, Romero Elementary School	
May 23, 2019	Mendota, Mendota Library	

Please see **Appendix F** for summaries of the coordinated public workshops, and **Appendix G** for example promotional materials for the public workshops.

8.4 Comments Regarding the GSPs

Key components of the six Subbasin GSPs were presented at the public workshops conducted throughout the GSP development process. **Appendix F** contains summaries of the coordinated public workshops, including comments received from and feedback provided to workshop participants. Additionally, each of the GSP Groups in the Delta-Mendota Subbasin are individually responsible for the public review of their plans and for addressing any public comments received. Please see the individual GSPs for additional information regarding plan review.

8.5 Subbasin Decision Making Process

The Delta-Mendota Subbasin Coordination Agreement outlines the responsibilities of all Subbasin parties, including decision making protocols and voting structure. These are further discussed in Chapter 2 of this document.

During the GSP development process, the Technical Working Group was charged with coordinating implementation of the required technical elements of the GSP (e.g. water budgets, monitoring networks), and to provide recommendations to the Delta-Mendota Subbasin Coordination Committee. Similarly, the Communications Working Group was charged with implementing the Subbasin Communications Plan and with providing recommendations for workshops and other outreach activities to the Coordination Committee. The Coordination Committee took actions and approved recommendations and work products and provided direction to both working groups and other ad hoc committees.

In general, the coordinated decision-making process included developing agendas for each meeting of the Delta-Mendota Subbasin Coordination Committee and for each Working Group meeting. The agendas were developed in concert with the Technical and Communications Working Groups, and the respective representatives of each GSP Group. Agenda items were either educational, informational, or required direction or decision. Meeting agendas, meetings minutes and handouts have been posted on the Delta-Mendota Subbasin website for public access.

8.6 Opportunities for Public Engagement and How Public Input was Used

Community input was encouraged and received at all meetings of the Coordination Committee, Technical Working Group, Communications Working Group meetings and at the public workshops. The Subbasin

GSPs (and therefore, this Common Chapter) was shaped by community input, Working Group input, and Coordination Committee direction and decisions.

8.6.1 Opportunities for Public Engagement

Regular opportunities for public engagement were available throughout GSP development. The Coordination Committee, Technical and Communications Working Groups, and individual GSA staff encouraged public input throughout the development of the GSPs as described below. A list of stakeholder and community organizations contacted as part of the Subbasin coordinated outreach efforts is included in **Appendix H**.

Meetings and Direct Engagement

Open meetings and public workshops were held as described in Section 8.1. In addition, GSA staff made direct contact with community representatives to encourage their participation in the GSP development process. GSA representatives provided their contact information by phone, email, or mail both online (on the Subbasin website) and at workshops for stakeholder questions and comments.

Targeted Stakeholder Engagement

The Subbasin GSAs also conducted targeted outreach and engagement to hard-to-reach communities, interested parties, and stakeholders that were previously underrepresented in other engagement activities. This included outreach to the following stakeholder types:

- **Agricultural Interests:** Agricultural stakeholders in the Subbasin include agricultural well operators, growers, ranchers, farmworkers, and agricultural landowners. Strong agricultural representation exists within the leadership of the GSAs. To augment direct outreach being conducted by individuals GSAs, Subbasin representatives also coordinated closely with local county farm bureaus to disseminate information related to GSP development and public workshops.
- **School Districts:** Schools districts are considered for both beneficial users of groundwater (for drinking water), as well communication channels to disseminate information about SGMA and GSP development. GSA representatives directly contacted local school districts to notify them of the public workshops. Some schools also help distributed informational materials and workshop flyers to their students and parents.
- **Industrial Interests:** There are many industrial interested in the Subbasin, including packaging and processing plants, mining industries, and other similar facilities that use groundwater in some fashion. The GSP Groups have identified these interests within their respective Plan areas and have disseminated information related to GSP development during individual outreach efforts.
- **Environmental/Conservation Interests:** Environmental and conservation interests in the Subbasin have been contacted and communicated with during GSP development. Specific related interest groups contacted during GSP development include The Nature Conservancy, the California Department of Fish and Wildlife, Audubon, and various sportsman clubs and wetland managers.

- **Disadvantaged Communities:** The GSAs followed best practices identified in Collaborating for Success: Stakeholder Engagement for Sustainable Groundwater Management Act Implementation (Community Water Center, 2015) and other guidance documents to engage disadvantaged and severely disadvantaged communities. This included holding meetings in disadvantaged communities; holding meetings in the evening at known local venues, such as schools, civic centers, and community centers; translating fact sheets, meeting materials, and presentations into other languages; and providing interpreting services at all public workshops.
- **Other Interests:** Other potential groundwater users in the Subbasin (or those with groundwater-related interests) contacted during GSP development included the various counties in which the Delta-Mendota Subbasin lie and/or are adjoining (including San Joaquin County and San Benito County), Caltrans, the DWR State Water Project Division of Operations and Maintenance, the U.S. Bureau of Reclamation, the U.S. Geological Survey and the San Joaquin River Restoration Program.

The Reader should refer to each individual GSP for a more complete description of GSP-specific meetings and direct engagement.

GSP Section Review and Comment Periods

Each GSP Group was responsible for coordinating the individual review of their GSP. Please see each GSP for additional information as to their specific public review process. This Common Chapter to the six Delta-Mendota Subbasin GSPs was posted on the Subbasin's website (www.deltamendota.org) following submittal of the Subbasin GSPs.

8.6.2 How Public Input and Response was Used in the Development of the GSP

Each GSP Group was responsible for coordinating the individual review of their GSP and for determining how to incorporate public input and responses into their respective plans. Public input to the GSPs was solicited through the GSP development process through a number of means, including coordinated public workshops, Board of Directors presentations, City Council presentations, and growers' meetings. Please see the individual GSPs for more information regarding GSP-specific outreach efforts and how stakeholder and public input was received and factored into the GSPs.

9. REFERENCES

AECOM. 2011. *Groundwater Management Plan for the Northern Agencies in the Delta-Mendota Canal Service Area*. https://water.ca.gov/LegacyFiles/lgagrant/docs/applications/City%20of%20Patterson%20(201209870076)/Att03_LGA12_CityofPatterson_GWMP_2of2.pdf. Accessed on July 25, 2018.

Belitz, K. and F.J. Heimes. 1990. *Character and Evolution of Ground-Water flow System in the Central Part of the Western San Joaquin Valley, California*. USGS WaterSupply Paper 2348.

Bertoldi, G.L., R.H. Johnston, and K. D. Evenson. 1991. *Ground water in the Central Valley, California – A Summary Report*. U.S. Geological Survey Professional Paper 1401-A.

Borchers, J.W. and M. Carpenter. April 2014. *Land Subsidence from Groundwater Use in California*. https://water.ca.gov/LegacyFiles/waterplan/docs/cwpu2013/Final/vol4/groundwater/13Land_Subsidence_Groundwater_Use.pdf. Accessed on October 1, 2018.

California Assembly. 2014. *Assembly Bill No. 1471. Water Quality, Supply, and Infrastructure Improvements Act of 2014*. Approved by Governor, filed with Secretary of State in August 2014.

California Department of Conservation, California Geologic Survey. Various dates. Faults shapefiles. https://maps.conservation.ca.gov/cgs/#datalist. Accessed on June 19, 2018.

California Department of Fish and Wildlife. 2013. California Lakes shapefile. https://www.wildlife.ca.gov/Data/GIS/Clearinghouse. Accessed on August 2, 2018.

California Department of Fish and Wildlife. 2016. California Streams shapefile. https://www.wildlife.ca.gov/Data/GIS/Clearinghouse. Accessed on August 2, 2018.

California Department of Water Resources (DWR). 1965. *San Joaquin Valley Drainage Investigation – San Joaquin Master Drain*. Department of Water Resources Bulletin No.127.

California Department of Water Resources (DWR). 1981. *Water Well Standards: State of California, Bulletin 74-81*. https://www.water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Wells/Files/Bulletin-74-81-Water-Well-Standards-State-of-California-December-1981.pdf?la=en&hash=7B64FA212D189E07BE9B1FA909B5C8FECDA20D68. Accessed on August 2, 2018.

California Department of Water Resources (DWR). 1991. *California Well Standards, Bulletin 74-90*. https://www.water.ca.gov/LegacyFiles/pubs/groundwater/water_well_standards__bulletin_74-90_/ca_well_standards_bulletin74-90_1991.pdf. Accessed on August 2, 2018.

California Department of Water Resources (DWR). 1998. *The California Water Plan Update, Volumes 1 and 2*. Sacramento, CA.

California Department of Water Resources (DWR). 2003. *California's Groundwater Bulletin 118 – Update 2003*. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Bulletin-118/Files/Statewide-Reports/Bulletin_118_Update_2003.pdf. Accessed on July 9, 2018.

California Department of Water Resources (DWR). 2006. *San Joaquin Valley Groundwater Basin Delta-Mendota Subbasin, DWR Bulletin 118*. http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/5-22.07.pdf. Accessed on July 9, 2018.

California Department of Water Resources (DWR). 2010. *Lines of Equal Elevation of Water in Wells, Unconfined Aquifer, San Joaquin Valley, Spring 2010*. https://water.ca.gov/LegacyFiles/pubs/groundwater/lines_of_equal_elevation_of_water_in_wells_unconfined_aquifer_san_joaquin_valley_spring_2008/sjv2008spr_unc_elev_color.pdf. Accessed on August 29, 2018.

California Department of Water Resources (DWR). 2009. California Statewide Groundwater Elevation Monitoring (CASGEM) database. https://www.casgem.water.ca.gov. Accessed on various dates.

California Department of Water Resources (DWR). 2016a. *Best Management Practices for the Sustainable Management of Groundwater: Monitoring Networks and Identification of Data Gaps*. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-2-Monitoring-Networks-and-Identification-of-Data-Gaps.pdf. Accessed on June 21, 2019.

California Department of Water Resources (DWR). 2016b. *Best Management Practices for the Sustainable Management of Groundwater: Monitoring Protocols, Standards, and Sites*. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-1-Monitoring-Protocols-Standards-and-Sites.pdf. Accessed on June 21, 2019.

California Department of Water Resources (DWR). 2016c. *Best Management Practices for the Sustainable Management of Groundwater: Water Budget BMP*. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-4-Water-Budget.pdf. Accessed on June 21, 2019.

California Department of Water Resources (DWR). 2016. Water Districts shapefile. https://data.cnra.ca.gov/dataset/water-districts. Accessed on March 31, 2016.

California Department of Water Resources (DWR). June 2017. *California Aqueduct Subsidence Study*. https://water.ca.gov/LegacyFiles/groundwater/docs/Aqueduct_Subsidence_Study-FINAL-2017.pdf. Accessed on October 1, 2018.

California Department of Water Resources (DWR). 2017. *DRAFT Best Management Practices for the Sustainable Management of Groundwater: Sustainable Management Criteria BMP*. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-6-Sustainable-Management-Criteria-DRAFT.pdf. Accessed on June 21, 2019.

California Department of Water Resources (DWR). May 2018. *Evaluation of the Effect of Subsidence on Flow Capacity in the Chowchilla and Eastside Bypasses, and Reach 4A of the San Joaquin River*. Received via personal communication with Alexis R. Phillips-Dowell (DWR) on September 11, 2018.

California Department of Water Resources (DWR). July 2018. Water Data Library database. http://wdl.water.ca.gov/waterdatalibrary/. Accessed on various dates.

California Department of Water Resources (DWR). 2018a. Disadvantaged Communities Mapping Tool. https://gis.water.ca.gov/app/dacs/. Accessed on July 17, 2017.

California Department of Water Resources (DWR). 2018b. Economically Distressed Areas Mapping Tool. https://gis.water.ca.gov/app/edas/. Accessed on July 17, 2017.

California Department of Water Resources (DWR). 2018c. Natural Communities Commonly Associated with Groundwater (NCCAG) dataset. https://gis.water.ca.gov/app/NCDatasetViewer/#. Accessed on August 13, 2018.

California Department of Water Resources (DWR). 2019. CA Bulletin 118 Groundwater Basins shapefile. https://data.cnra.ca.gov/dataset/ca-bulletin-118-groundwater-basins. Accessed on May 10, 2019.

California Natural Resources Agency. June 2018. NASA JPL InSAR Subsidence Data. https://data.cnra.ca.gov/dataset/nasa-jpl-insar-subsidence. Accessed on August 2, 2019.

California State Water Resources Control Board (SWRCB). 1977. *San Joaquin Valley Interagency Drainage Program Environmental Assessment – Phase I*. Prepared for the California State Water Resources Control Board by Environmental Impact Planning Corporation.

California State Water Resources Control Board (SWRCB). 2011. CV-SALTS Lower San Joaquin River Committee, April 28, 2011 Meeting Materials, Agenda Item 4 – Problem Statement. https://www.waterboards.ca.gov/centralvalley/water_issues/salinity/lower_sanjoaquin_river_committee/administrative_materials/#contracts. Accessed on September 28, 2018.

California State Water Resources Control Board (SWRCB). n.d (a). *State Intervention – The State Back Stop, Sustainable Groundwater Management Act (SGMA)*. https://www.waterboards.ca.gov/water_issues/programs/gmp/docs/intervention/intervention_fs.pdf. Accessed on August 3, 2018.

California State Water Resources Control Board (SWRCB). n.d (b). *What is a Public Water System?*. https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/waterpartnerships/what_is_a_public_water_sys.pdf. Accessed in August 3, 2018.

Caltrans. 2017. Caltrans Adjusted County Boundaries shapefile. http://www.dot.ca.gov/hq/tsip/gis/datalibrary/Metadata/Counties.html. Accessed on August 2, 2018.

Caltrans. 2018. California National Highway System shapefile. http://www.dot.ca.gov/hq/tsip/gis/datalibrary/Metadata/NHS.html. Accessed on May 20, 2019.

Corwin, D.L. 2012. Field-scale monitoring of the long-term impact and sustainability of drainage water reuse on the west side of California's San Joaquin Valley. Journal of Environmental Monitoring, Vol. 14, 1576.

Croft, M. G. 1972. Subsurface geology of the Late Tertiary and Quarternary water-bearing deposits of the southern part of the San Joaquin Valley, California: U.S. Geological Survey Water-Supply Paper 1999-H.

Davis, G.H. and J. F. Poland. 1957. *Ground-water conditions in the Mendota- Huron Area Fresno and Kings Counties, California*. U.S. Geological Survey Water Supply Paper No. 1360-G.

Davis, G. H., J.H. Green, S.H. Olmstead, and D.W. Brown. 1959. *Ground water conditions and storage capacity in the San Joaquin Valley, California*. U.S. Geological Survey Water Supply Paper No. 1469, 287 p.

Davis, G.H., B.E. Lofgren, S. Mack. 1964. Use of ground-water reservoirs for storage of surface water in the San Joaquin Valley California. U.S. Geological Survey Water-Supply Paper 1618.

East Stanislaus Regional Water Management Group. 2017. *East Stanislaus Region Integrated Regional Water Management Plan Update – Public Draft*. http://www.eaststanirwm.org/documents/2017-esirwmp-publicdraft.pdf. Accessed on July 26, 2018.

Farr, Tom G., Cathleen E. Jones, and Zhen Lieu. 2017. *Progress Report: Subsidence in California, March 2015 – September* 2016. Jet Propulsion Laboratory, California Institute of Technology. https://water.ca.gov/LegacyFiles/waterconditions/docs/2017/JPL%20subsidence%20report%20final%20for%20public%20dec%202016.pdf. Accessed on November 29, 2018.

Farrar, C.D., and G.L. Bertoldi. 1988. Region 4, Central Valley and Pacific Coast Ranges, in Back, William, Rosenshein, J.S., and Seaber, P.R., eds., Hydrogeology: Boulder, Colorado, Geological Society of America, Geology of North America, v. O-2, p. 59–67.

Faunt, C., R.T. Hanson, K. Belitz, W. Schmid, S. Predmore, D. L. Rewis, and K. McPherson. 2009. *Groundwater availability of the Central Valley Aquifer, California*. U.S. Geological Survey Professional Paper 1766. http://pubs.usgs.gov/pp/1766/. Accessed on August 29, 2018.

Faunt, C.C., K. Belitz., and R.T. Hanson. 2010. Development of a three-dimensional model of sedimentary texture in valley-fill deposits of Central Valley, California, USA: U.S. Geological Survey, Hydrogeology Journal, Vol. 18, 625.

Faunt, C.C., M. Sneed, J. Traum, and J.T. Brandt. 2015. *Water availability and land subsidence in the Central Valley, California, USA*. https://link.springer.com/content/pdf/10.1007%2Fs10040-015-1339-x.pdf. Accessed on October 10, 2018.

Fio, J.L. 1994. Calculation of a water budget and delineation of contributing sources to drainflows in the Western San Joaquin Valley, California. U.S. Geological Survey, Open-File Report 94-45.

Foss, F.D., and R. Blaisdell. 1968. *Stratigraphy of the West Side Southern San Joaquin Valley*. http://www.sanjoaquingeologicalsociety.org/wp-content/abstracts/1968_Foss_Blaisdell.pdf. Accessed on July 9, 2018.

Galloway, D.L., and F.S. Riley. 1999. *San Joaquin Valley, California—Largest human alteration of the Earth's surface*: in Galloway, D.L., Jones, D.R., and Ingebritsen, S.E., eds., *Land Subsidence in the United States*: U.S. Geological Survey Circular 1182, p. 23–34.

Galloway, D.L., D.R. Jones, and S.E. Ingebritsen. 1999. *Land subsidence in the United States*. U.S. Geological Survey Circular 1182, 175 p.

Hotchkiss, W.R. 1972. *Generalized subsurface geology of water-bearing deposits, northern San Joaquin Valley, California*. https://doi.org/10.3133/ofr73119. Accessed on October 24, 2018.

Hotchkiss, W.R. and G.O. Balding. 1971.Geology, hydrology, and water quality of the Tracy-Dos Palo area, San Joaquin Valley, California. U.S. Geological Survey Open-File Report 72-169. 107 p.

Ireland, R.L. 1986. *Land subsidence in the San Joaquin Valley, California, as of 1983*. U.S. Geological Survey Water Resources Investigations Report 85–4196, 50 p.

Ireland R.L., J.F. Poland, and F.S. Riley. 1984. *Land subsidence in the San Joaquin Valley, California, as of 1980*. U.S. Geological Survey Professional Paper 437-I, 93 p.

Jacob, C.E. 1940. *On the flow of water in an elastic artesian aquifer*. American Geophysical Union Trans., pt. 2, p. 574-586.

Jennings, C.W. and R.G. Strand. 1958. Geological Atlas of California – Santa Cruz Quadrangle. California Geological Survey, Geologic Atlas of California Map No. 020, 1:250,000 scale.

Mendenhall, W.C., R.B. Dole, and H. Stabler. 1916. *Ground water in the San Joaquin Valley, California*. U.S. Geological Survey Water-Supply Paper 398, 310 p.

Luhdorff & Scalmanini Consulting Engineers (LSCE). 2011. State of California Well Completion Report, Well No. E0132267. Received via personal communication on October 12, 2018.

Luhdorff & Scalmanini Consulting Engineers (LSCE), Davids Engineering, and Larry Walker Associates. March 2015. *Western San Joaquin River Watershed Groundwater Quality Assessment Report*. https://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/water_quality/coalitions_submittals/westside_sjr/ground_water/2015_0316_westside_gar.pdf. Accessed on July 9, 2018.

Luhdorff & Scalmanini Consulting Engineers (LSCE). July 2016. *Grassland Drainage Area Groundwater Quality Assessment Report*. https://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/water_quality/coalitions_submittals/grass and/ground_water/2016_0728_gda_gar.pdf. Accessed on July 9, 2018.

Madera Regional Water Management Group. 2014. *Madera Integrated Regional Water Management Plan – Final Draft*. https://water.ca.gov/LegacyFiles/irwm/grants/docs/PlanReviewProcess/Madera_IRWMP/Madera%20IRWMP.pdf. Accessed on July 26, 2018.

McBain & Trush, Inc. 2002. *San Joaquin River Restoration Study Background Report*, prepared for Friant Water Users Authority, Lindsay, CA, and Natural Resources Defense Council. https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/docs/sjrf_spprtinfo/mcbainandtrush_2002.pdf. Accessed on October 1, 2018.

Mosley, J. Natural Resources Specialist/GIS Coordinator, Bureau of Indian Affairs Pacific Region. Personal Communication on January 26, 2017.

National Resources Conservation Service (NRCS). 2009. *Part 630 Hydrology National Engineering Handbook, Chapter 7 Hydrologic Soil Groups*. http://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.shtml. Accessed on August 13, 2018.

Natural Resources Conservation Service (NRCS). 2015. *Soil Survey Manual*. http://www.nrcs.usda.gov/wps/portal/nrcs/detail//?cid=nrcs142p2_054253. Accessed on August 13, 2018.

Ogden, G. R. 1988. *Agricultural Land Use and Wildlife in the San Joaquin Valley, 1769-1930: An Overview*. SOLO Heritage Research. San Joaquin Valley Drainage Program, U.S. Department of Interior. Sacramento, California.

Page, R.W. 1973. Base of fresh groundwater (approximately 2,000 micromhos) in the San Joaquin Valley, California: U.S. Geological Survey Hydrologic Investigations Atlas HA-489, 1 sheet, scale 1:500,000. https://pubs.usgs.gov/of/1971/0223/plate-1.pdf. Accessed on October 25, 2018.

Poland, J.F., B.E Lofgren, R.L. Ireland, and A.G. Pugh. 1975. *Land subsidence in the San Joaquin Valley, California, as of 1972*: U.S. Geological Survey Professional Paper 437-H, 78 p.

Rohde, M.M., S. Matsumoto, J. Howard, S. Liu, L. Riege, and E.J. Remson (The Nature Conservancy). 2018. *Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans*. https://www.scienceforconservation.org/assets/downloads/GDEsUnderSGMA.pdf. Accessed on October 1, 2018.

San Joaquin River Restoration Program. Subsidence monitoring database. http://www.restoresjr.net/science/subsidence-monitoring/. Accessed on September 13, 2018.

San Luis & Delta-Mendota Water Authority. 2019. *Westside-San Joaquin Integrated Regional Water Management Plan*. https://www.ci.patterson.ca.us/DocumentCenter/View/4868/WSJ_IRWMP_2019_Final_w_appendices?bidId=. Accessed on June 21, 2019.

San Luis & Delta-Mendota Water Authority (SLDMWA). n.d (a). SLDMWA Member Agencies shapefile. Received via personal communication on August 7, 2018.

San Luis & Delta-Mendota Water Authority (SLDMWA). n.d (b). Delta-Mendota Canal Check Points coordinates. Received via personal communication on August 7, 2018.

Schmidt, K.D. & Associates (KDSA). 1997a. Groundwater Flows in the San Joaquin River Exchange Contractors Service Area. Prepared for SJREC, Los Banos, California, 46p.

Schmidt, K.D. & Associates (KDSA). 1997b. Groundwater Conditions in and near the Central California Irrigation District. Los Banos, California. 89 p.

Schmidt, K.D. & Associates (KDSA). September 2015. *Groundwater Overdraft in the Delta-Mendota Subbasin*. Fresno, California.

Sneed, M., J. Brandt, and M. Solt. 2013. *Land subsidence along the Delta-Mendota Canal in the northern part of the San Joaquin Valley, California, 2003-10*: U.S. Geological Survey Scientific Investigations Report 2013-5142, 87 p., http://dx.doi.org/10.3133/sir20135142. Accessed on September 28, 2018.

Sneed, M. and J.T. Brandt. 2015. *Land subsidence in the San Joaquin Valley, California, USA, 2007-2014*. https://www.proc-iahs.net/372/23/2015/piahs-372-23-2015.pdf. Accessed on October 10, 2018.

State of California. 2015. *Senior Water Rights Curtailed in Delta, San Joaquin & Sacramento Watersheds*. http://www.drought.ca.gov/topstory/top-story-37.html. Accessed on April 2, 2019.

Strathouse, S. M. and Sposito, G. 1980. *Geologic nitrogen may pose hazard*. California Agriculture, August-September 1980.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. *Web Soil Survey*. https://websoilsurvey.nrcs.usda.gov/. Accessed on June 19, 2018.

Sullivan, P.J., G. Sposito, S.M. Strathouse, and C.L. Hansen. 1979. *Geologic nitrogen and the occurrence of high nitrate soils in western San Joaquin Valley, California*. Hilgardia, Vol. 47, No. 2, 15-49 p.

Swanson, A.A.. 1998. *Land subsidence in the San Joaquin Valley, updated to 1995*, in Borchers, J.W., ed., Land subsidence case studies and current research: Proceedings of the Dr. Joseph F. Poland Symposium on Land Subsidence, Sacramento, Calif., October 4–5, 1995, Association of Engineering Geologists, Special Publication no. 8, p. 75–79.

The Nature Conservancy (TNC). 2014. *Groundwater and Stream Interaction in California's Central Valley: Insights for Sustainable Groundwater Management*. https://www.scienceforconservation.org/assets/downloads/GroundwaterStreamInteraction_2016.pdf. Accessed on October 1, 2018.

The Nature Conservancy (TNC). 2018. Identifying Environmental Surface Water Users - Freshwater Species List for Each Groundwater Basin dataset. https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/. Accessed on June 20, 2019.

UNAVCO. 2019. UNAVCO's Monitoring Network Map database. https://www.unavco.org/instrumentation/networks/map/map.html#/. Accessed on August 10, 2018.

United State Bureau of Reclamation (USBR). 2002. USBR computed full natural flows from 1906-2002.

United States Bureau of Reclamation (USBR). 2018. *Delta-Mendota Canal Non-Project Water Pump-in Program Monitoring Plan*. https://www.usbr.gov/mp/nepa/includes/documentShow.php?Doc_ID=32784. Accessed on October 25, 2018.

United States Census Bureau. 2017. *Population Estimates Program*. www.census.gov/quickfacts. Accessed on November 16, 2018.

United States Geological Survey (USGS). 2000. Water resources data for California, 1910-2000 for various gaging stations within the San Joaquin Valley.

United States Geological Survey (USGS). 2012. Central Valley Spatial Database, Corcoran Clay Depth, Extent, and Thickness shapefiles. https://ca.water.usgs.gov/projects/central-valley/central-valley-spatial-database.html. Accessed on August 13, 2018.

United States Geological Survey (USGS), California Water Science Center (CWSC). March 20, 2017. *Delta-Mendota Canal: Evaluation of Groundwater Conditions & Land Subsidence*. https://ca.water.usgs.gov/projects/central-valley/delta-mendota-canal.html. Accessed on October 1, 2018.

United States Geological Survey (USGS). 2018. National Elevation Dataset, Ground Surface Elevation shapefile. https://viewer.nationalmap.gov/advanced-viewer/. Accessed on June 19, 2018.

United States Geological Survey (USGS). n.d. National Hydrograph Dataset. https://viewer.nationalmap.gov/basic/?basemap=b1&category=nhd&title=NHD%20View. Accessed on August 13, 2018.

University of California, Davis (UCD) Department of Agriculture and Natural Resources. n.d. Soil Resource Lab. Soil Agricultural Groundwater Banking Index (SAGBI). https://casoilresource.lawr.ucdavis.edu/sagbi/. Accessed on April 20, 2018.

Wagner, D.L., Bortugno, E.J., and Mc Junkin, R.D. 1991. Geologic Map of the San Francisco – San Jose Quadrangle. California Geological Survey, Regional Geologic Map No. 5A, 1:250,000 scale.

Appendix A - Coordination Agreement

DELTA-MENDOTA SUBBASIN COORDINATION AGREEMENT

THIS DELTA-MENDOTA SUBBASIN COORDINATION AGREEMENT is made effective as of December 12, 2018 by and among the groundwater sustainability agencies within the Delta-Mendota Subbasin (each a "**Party**" and collectively the "**Parties**") and is made with reference to the following facts:

WHEREAS, On September 16, 2014, Governor Jerry Brown signed into law Senate Bills 1168 and 1319 and Assembly Bill 1739, known collectively as the Sustainable Groundwater Management Act ("**SGMA**");

WHEREAS, SGMA requires all groundwater subbasins designated as high or medium priority by the California Department of Water Resources ("**DWR**") to manage groundwater in a sustainable manner;

WHEREAS, the Delta-Mendota Subbasin (Basin Number 5-22.07, DWR Bulletin 118) within the San Joaquin Valley Groundwater Basin ("**Subbasin**"), has been designated as a high-priority basin by DWR;

WHEREAS, the Delta-Mendota Subbasin includes multiple groundwater sustainability agencies that intend to manage the Subbasin through the development and implementation of multiple different groundwater sustainability plans ("**GSP**");

WHEREAS, SGMA allows local agencies to engage in the sustainable management of groundwater, but requires groundwater sustainability agencies in all basins that are managed by more than one groundwater sustainability plan to enter into a coordination agreement to coordinate the multiple groundwater sustainability plans to sustainably manage the Subbasin pursuant to SGMA;

WHEREAS, pursuant to the requirements of SGMA, and the California Code of Regulations, and in recognition of the need to sustainably manage the groundwater within the Delta-Mendota Subbasin, the Parties desire to enter into this Agreement between their individual groundwater sustainability agencies;

WHEREAS, in order to efficiently coordinate among the large number of groundwater sustainability agencies ("**GSA**") in the Subbasin, the Parties intend to organize themselves into "**GSP Groups**" and to be represented by the "**GSP Group Representatives**," on terms to be developed and implemented by separate Agreements between each GSP Group and the Parties within such GSP Group; and

WHEREAS, this Coordination Agreement is being executed before the respective GSPs have been prepared, and the Parties anticipate attaching and incorporating technical reports covering such additional required information before submittal of this Agreement to DWR with the Parties' respective GSPs without separate amendment being required.

THEREFORE, in consideration of the facts recited above and of the covenants, terms and conditions set forth herein, the Parties agree as follows:

SECTION 1 – PURPOSE

1.1 <u>Compliance with SGMA</u>

In subbasins with multiple GSPs, SGMA requires the GSPs to be coordinated through a coordination agreement. The purpose of this Coordination Agreement including the anticipated attachment and incorporation of technical reports to be developed after the initial execution of this Agreement, is to comply with that SGMA requirement and ensure that the multiple GSPs within the Subbasin are developed and implemented utilizing the same methodologies and assumptions, that the elements of the GSPs are appropriately coordinated to support sustainable management, and to ultimately set forth the information necessary to show how the multiple GSPs in the Subbasin will achieve the sustainability goal, as determined for the Subbasin in compliance with SGMA and its associated regulations.

1.2 <u>Description of Criteria & Function</u>

An additional purpose of this Coordination Agreement is to describe the criteria for establishing the responsibilities of each Party for meeting the terms of this Coordination Agreement, the procedure for the exchange of information between the Parties, and procedures for resolving conflicts between the Parties. The goal of the coordination is to ensure that the Subbasin GSPs utilize the same data and methodologies, including but not limited to, groundwater elevation data, groundwater extraction data, surface water supply, total water use, changes in groundwater storage, water budgets, and sustainable yield during their development as required by SGMA and associated regulations. Additionally, this Coordination Agreement sets out the process for identifying a Plan Manager.

SECTION 2 – DEFINITIONS

2.1 "Coordinated Plan Expenses" shall mean any expenses incurred by the Secretary and the Plan Manager for purposes of developing and implementing the Coordination Agreement.

2.2 "**Coordination Agreement**" shall mean this Coordination Agreement.

2.3 "**Coordination Committee**" shall mean the committee of GSP Group Representatives established pursuant to this Coordination Agreement.

2.4 "**Group Contact"** shall mean one Party designated on Exhibit "A" attached hereto and by reference incorporated herein as responsible to supply notices and to circulate information and invoices for its respective Exhibit "A" GSP Group, as said Exhibit may be updated from time to time.

2.5 "**GSA**" shall mean a groundwater sustainability agency established in accordance with SGMA and its associated regulations, and "GSAs" shall mean more than one such groundwater sustainability agency. Each Party is a GSA.

2.6 "**GSP"** shall mean a groundwater sustainability plan as defined by SGMA and its regulations, and "GSPs" shall mean more than one such plan.

2.7 "**GSP Group**" shall mean a grouping of Parties, stakeholders, and interested parties developing an individual GSP within the Subbasin, as shown in Exhibit "A," who are combined for purposes of representation and voting on the Coordination Committee and for purposes of sharing Coordinated Plan Expenses as set forth in this Coordination Agreement.

2.8 "**GSP Group Alternate Representative," "Alternate Representative,"** or **"Alternate"** and their plural forms shall mean an alternate member of the Coordination Committee selected to represent the GSP Groups in accordance with Exhibit "A" and Section 5.1.2-5.1.4 of this Coordination Agreement who shall serve in the absence of the respective GSP Group Representative and shall be entitled to cast the vote for the absent GSP Representative.

2.9 "**GSP Group Representative"** or **"Representative"** and their plural forms as appropriate shall mean a member or members of the Coordination Committee selected to represent the GSP Groups in accordance with Exhibit "A" and Section 5.1.2 – 5.1.4 this Coordination Agreement.

2.10 "**Participation Percentages"** shall mean that percentage of Coordinated Plan Expenses allocated to each GSP Group as described on Exhibit "A" to this Coordination Agreement, which is attached and incorporated by reference herein, as updated from time to time.

2.11 “**Party**” or “**Parties**” shall mean a Groundwater Sustainability Agency or in the plural, two or more Groundwater Sustainability Agencies within the Delta-Mendota Subbasin.

2.12 “**Plan Manager**” shall mean an entity or individual, appointed at the pleasure of the Coordination Committee, or as provided in section 4.1.2 of this Coordination Agreement, to perform the role of the Plan Manager to serve as the point of contact to DWR as set forth in Section 5.2.3 of this Coordination Agreement.

2.13 “**Seasonal High**” shall mean the highest annual static groundwater elevation associated with stable aquifer conditions following a period of lowest annual groundwater demand.

2.14 “**Seasonal Low**” shall mean the lowest annual static groundwater elevation associated with a period of stable aquifer conditions following a period of highest annual groundwater demand.

2.15 “**San Luis & Delta-Mendota Water Authority”** or “**SLDMWA”** shall mean the San Luis & Delta-Mendota Water Authority, a California joint powers agency.

2.16 “**SGMA**” shall mean the Sustainable Groundwater Management Act, as amended from time to time, commencing at Water Code section 10720, together with its implementing regulations applicable to Groundwater Sustainability Plans, set forth at California Code of Regulations, Title 23, Division 2, Chapter 1.5, Subchapter 2.

2.17 “**SGMA Definitions**” shall mean those SGMA-specific definitions provided by statute or regulation and attached in the Appendix to this Coordination Agreement; in the event of any inconsistency between a term defined in this Section and a SGMA-specific definition, the definition contained in this Coordination Agreement shall prevail.

2.18 “**Subbasin**” shall mean the Delta-Mendota Subbasin (Basin Number 5-22.07, DWR Bulletin 118) within the San Joaquin Valley Groundwater Basin.

2.19 “**Technical Memoranda**” shall mean the memoranda prepared by the Coordination Committee that include the data and methodologies for assumptions described in Water Code section 10727.6 to prepare coordinated plans. Individually, the memoranda shall be referred to as a “**Technical Memorandum**.”

2.20 “**Water Year**” shall mean the period from October 1 through the following September 30 as defined by SGMA.

2.21 “**Water Year Type**” shall mean the classification provided by DWR to assess the amount of annual precipitation in a basin and as defined by SGMA.

SECTION 3 – GENERAL GUIDELINES

3.1 <u>Responsibilities of the Parties</u>

3.1.1 Obligation to Coordinate

The Parties to this Coordination Agreement agree to work collaboratively to meet the objectives of SGMA and this Coordination Agreement. Each Party to this Coordination Agreement is a GSA and acknowledges that it is bound by the terms of this Coordination Agreement as an individual Party.

3.1.2 Obligations Outside of Coordination Agreement Regarding GSP Groups

a) Representation and Voting. Each Party understands its participation, as more fully set forth in Section 5 of this Coordination Agreement, is based on representation through and by its GSP Group Representative(s). It is the responsibility and obligation of each Party under this Coordination Agreement to develop its own arrangements for how its respective GSP Group Representative and Alternate Representative are selected and how required actions of GSAs within the GSP Group under its respective GSP are identified and implemented.

b) The Coordination Committee and its members shall have no requirement to recognize a voting status or other decisional authority of any Party to this Coordination Agreement other than through the designated GSP Group Representative(s). For purposes of this Coordination Agreement, it is assumed that GSP Group Representatives have been authorized by the Parties in their GSP Groups to participate as described herein.

c) By signing this Coordination Agreement, each Party commits to provide documentation to the Secretary and the Coordination Committee of the authorization of its GSP Group Representative(s). Provided, that the Secretary shall not be obligated to evaluate or provide an opinion on the legal sufficiency of the documentation.

d) It is the responsibility and obligation of each Party under this Coordination Agreement that is included on Exhibit "A" as part of a multi-party GSP Group to provide documentation to the Secretary and to the Coordination Committee establishing that such GSP Group has a binding agreement or mechanism assuring that the GSP Group will pay its Participation Percentage set forth on Exhibit "A," as said Exhibit "A" may be modified from time to time. Provided, that the Secretary shall not be obligated to evaluate or provide an opinion on the legal sufficiency of the documentation.

3.1.3 Non-Entity Status

The Parties acknowledge and agree that this Coordination Agreement does not create a legal entity with power to sue or be sued, to enter into contract, or to enjoy the benefits or accept the obligations of a legal entity.

3.1.4 Implementation of Individual GSPs

This Coordination Agreement does not otherwise affect each Party's responsibility to implement the terms of its respective GSP in accordance with SGMA. Rather, this Coordination Agreement is the mechanism through which the Parties will coordinate their respective GSPs to the extent necessary to ensure that such GSP coordination complies with SGMA.

3.2 Adjudicated or Alternate Plans in the Subbasin

As of the date of this Coordination Agreement, there are no portions of the Subbasin that have been adjudicated or approved to submit an alternative plan as defined by SGMA.

SECTION 4 – ROLE OF SAN LUIS & DELTA-MENDOTA WATER AUTHORITY

4.1 Agreement to Serve

By executing this Agreement, and not as a Party, the San Luis & Delta-Mendota Water Authority agrees to carry out the functions described in this Section 4 and its subparts consistent with the terms of this Section and under the direction and supervision of the Coordination Committee, subject to the reimbursement and the termination provisions contained in this Section.

4.1.1 Secretary

The SLDMWA agrees to perform the obligations of the Secretary described in this Coordination Agreement, by delegation to one or more of its employees or to a consultant under contract to the SLDMWA.

4.1.2 Plan Manager

The SLDMWA agrees to perform the obligations of the Plan Manager described in this Coordination Agreement, by delegation to one or more of its employees or to a consultant under contract to the SLDMWA.

4.2 Reimbursement of SLDMWA

The commitment of the SLDMWA to perform the designated functions under this Section is contingent upon the execution and performance of a separate cost sharing agreement between the SLDMWA and the Parties.

4.3 Termination of SLDMWA's Services

Either the Parties acting through the Coordination Committee or the SLDMWA at any time may terminate the services being provided by the SLDMWA under this Coordination Agreement upon thirty (30) days' written notice, if from the SLDMWA, to the Coordination Committee and each GSP Group Representative; and if from the Coordination Committee, to the SLDMWA and each GSP Group Representative.

SECTION 5 – RESPONSIBILITIES FOR KEY FUNCTIONS

5.1 Coordination Committee

5.1.1 The Parties agree to establish a Coordination Committee to provide the forum for the Parties to accomplish the coordination obligation of SGMA pursuant to this Coordination Agreement.

5.1.2 The Coordination Committee will consist of the GSP Group Representatives identified on Exhibit "A" attached hereto and incorporated herein by this reference, as said Exhibit "A" may be modified from time to time pursuant to Section 13 of this Agreement. Each GSP Group Representative shall have one Alternate Representative authorized to vote in the absence of the GSP Group Representative.

5.1.3 Individuals serving as GSP Group Representatives and Alternate Representatives shall be selected by each respective GSP Group in the discretion of the respective GSP Group, and such appointments shall be effective upon providing written notice to the Secretary and to each Group Contact listed on Exhibit "A".

5.1.4 The Coordination Committee will recognize each GSP Group Representative and GSP Group Alternate Representative until such time as the Group Contact provides written notice of removal and replacement to the Secretary and to every other Group Contact designated on Exhibit "A." Each GSP Group or GSP Subgroup shall promptly fill any vacancy created by the removal of such Representative or Alternate Representative so that each GSP

Group shall have the number of validly designated Representatives and Alternate Representatives specified on Exhibit "A".

5.1.5. Minutes of the Coordination Committee will be prepared and maintained as set forth in Section 5.5.4.

5.2 Coordination Committee Officers

The Officers of the Coordination Committee will include a Chairperson, Vice Chairperson, Secretary, and Plan Manager. Except where the Parties have named such Officers pursuant to Section 4 of this Coordination Agreement, Officers shall be selected at the initial meeting of the Committee or as soon thereafter as reasonably can be accomplished.

5.2.1 Chairperson and Vice Chairperson

a) A GSP Group Representative shall serve as Chairperson. The Vice Chairperson, who shall also be a GSP Group Representative, shall serve in the absence of the Chairperson. In the absence of both the Chairperson and Vice Chairperson, a meeting may be led by an Acting Chairperson selected on an ad hoc basis.

b) The positions of Chairperson and Vice Chairperson shall rotate among the GSP Groups on an annual basis according to alphabetical order, with the first rotation beginning on the date the first Chairperson is selected. The schedule for rotation among the GSP Groups will be set at the first meeting after the Chairperson is appointed and reviewed and adjusted annually. A GSP Group Representative may waive designation as Chairperson. In such a case the Chairperson office would rotate to the next designated entity.

5.2.2 Secretary

The Coordination Committee shall select a Secretary to carry out the functions described in this subsection, to serve at the pleasure of the Coordination Committee. The Secretary shall be a public agency who may be, but need not be a Party to this Coordination Agreement. The San Luis & Delta-Mendota Water Authority is hereby designated as the initial Secretary, to serve at the pleasure of the Coordination Committee.

a) The Secretary shall select an appointee to implement the Secretary's responsibilities under this Coordination Agreement, for example, to coordinate meetings; prepare agendas; circulate notices and agendas; provide written notice to all Parties that the Coordination Committee has made a recommendation requiring approval by the Parties; prepare and maintain minutes of meetings of the Coordination Committee; receive notices on behalf of the Coordination Committee and call to the Coordination Committee's attention the need for responding; and provide such other assistance in coordination as may be appropriate.

b) The Secretary shall assume primary responsibility for Brown Act compliance, including without limitation, the responsibility to: prepare an agenda and notice, publicly post, and distribute agendas to all GSP Group or Subgroup Representatives, the Parties, and any other interested persons who requests, in writing, such notices. The Agenda shall be of adequate detail to inform the public and the parties of the meeting and the matters to be transacted or discussed, and shall be posted in a public location and distributed to each of the parties to this Coordination Agreement at least seventy-two (72) hours prior to every regular meeting and at least twenty-four (24) hours prior to every special meeting.

5.2.3 Plan Manager

If the SLDMWA ceases to serve as Plan Manager as agreed under Section 4.1.2 of this coordination Agreement, then the Coordination Committee shall name a successor Plan Manager, who may be a consultant hired by the Secretary pursuant to the Coordination Agreement, the representative of an entity that has been selected as Secretary, or a public agency serving as or participating in a GSA that is a Party to this Coordination Agreement, and who shall serve as the point of contact for DWR as specified by SGMA. The San Luis & Delta-Mendota Water Authority is hereby designated as the initial Plan Manager, to serve at the pleasure of the Coordination Committee.

a) The Plan Manager shall carry out the duties of a "plan manager" as provided in Title 23, division 2, Chapter 1.5, Subchapter 2, California Code of Regulations.

b) The Plan Manager has no authority to make policy decisions or represent the Coordination Committee without the specific direction of the Coordination Committee. The Plan Manager is obligated to disclose all substantive communications he/she transmits and receives in his/her capacity as Plan Manager to the Coordination Committee.

5.3 Coordination Committee Authorized Actions and Limitations

5.3.1 Authorized Actions

The Coordination Committee is authorized to act upon the following enumerated items:

a) The Coordination Committee shall review, and consistent with the requirements of SGMA, approve the Technical Memoranda described in Sections 8-12 of this Coordination Agreement.

b) Once GSP Plans have been submitted to and approved by DWR, the Coordination Committee shall be responsible for ongoing review and updating of the Technical Memoranda as needed; assuring submittal of annual reports; providing five-year assessments and recommending any needed revisions to the Coordination Agreement; and providing review and assistance with coordinated projects and programs.

c) The Coordination Committee shall review and approve work plans, and in accordance with the budgetary requirements of the respective Parties, approve annual estimates of Coordinated Plan Expenses presented by the Secretary and any updates to such estimates; provided, that such estimates or updates with supporting documentation shall be circulated to all Parties for comment at least thirty (30) days in advance of the meeting at which the Coordination Committee will consider approval of the annual estimate.

d) Pursuant to Section 13, the Coordination Committee is authorized to approve changes to Exhibit "A" to this Coordination Agreement and to recommend amendments to terms of this Coordination Agreement.

e) The Coordination Committee shall assign work to subcommittees and workgroups as needed, provide guidance and feedback and ensure that subcommittees and workgroups prepare work products in a timely manner.

f) The Coordination Committee shall direct the Plan Manager in the performance of its duties under SGMA.

g) The Coordination Committee shall provide direction to its Officers concerning other administrative and ministerial issues necessary for the fulfillment of the above-enumerated tasks.

5.3.2 <u>Limitations</u>

When the terms of this Coordination Agreement or applicable law require the approval of a Party, that approval shall be required and evidenced as indicated in Section 6 of this Agreement.

5.4 <u>Subcommittees and Workgroups</u>

The Coordination Committee may appoint subcommittees, workgroups, or otherwise direct staff made available by the Parties. Such subcommittees or workgroups may include qualified individuals possessing the knowledge and expertise to advance the goals of the Coordination

Agreement on the topics being addressed by the subcommittee, whether or not such individuals are GSP Group Representatives or Alternate Representatives.

5.4.1 Work of Subcommittees and Workgroups

Tasks assigned to subcommittees, workgroups, or staff made available by the Parties may include developing technical data, supporting information, and/or recommendations on matters including, but not limited to:

a) Developing a process to update the Coordination Committee on the activities of the respective Parties, including the development, planning, financing, environmental review, permitting, implementation, and long-term monitoring of the multiple GSPs in the Subbasin;

b) Subject to the oversight of the Coordination Committee, scheduling meetings of the subcommittee or workgroup as necessary to coordinate development and implementation of the Technical Memoranda and Coordination Agreement. Attendance at these meetings may be augmented to include staff or consultants of all Parties to ensure that the appropriate expertise is available;

c) Determining common methodologies for GSP development;

d) Developing a Subbasin-wide monitoring network;

e) Preparing a coordinated water budget;

f) Developing a coordinated data management system;

g) Providing an explanation of how the respective GSPs implemented together satisfy the requirements of SGMA and are in substantial compliance with SGMA; and

h) Such other tasks as may be referred by the Coordination Committee from time to time.

5.4.2 Subcommittee Voting

One GSP Group Representative or Alternate Representative shall vote on behalf of the GSP Group at the subcommittee level; if no GSP Group Representative or Alternate Representative is present, one individual working on a subcommittee on behalf of the Parties in a GSP Group shall vote on behalf of the GSP Group. Subcommittees shall report voting results and provide information to the Coordination Committee but shall not be entitled to make determinations or determinations that are binding on the Parties.

5.5 Coordination Committee Meetings

5.5.1 Timing and Notice

The Chairperson of the Coordination Committee, any two GSP Group Representatives, or the Secretary may call meetings of the Coordination Committee as needed to carry out the activities described in this Coordination Agreement. The Coordination Committee may, but is not required to, set a date for regular meetings for the purposes described in this Coordination Agreement. All Coordination Committee Meetings shall be held in compliance with the Ralph M. Brown Act (Government Code Section 54950 *et seq*.).

5.5.2 Quorum

A majority of the GSP Group Representative(s) from every GSP Group listed on Exhibit "A" shall constitute a quorum of the Coordination Committee for purposes of holding a Coordination Committee meeting; provided, that the GSP Group Representative(s) from every GSP Group listed on Exhibit "A" must be present at a meeting for any Coordination Committee vote on a matter described in section 5.3.1 a) through 5.3 d) and 5.3.1 f) to take place. The GSP Group Alternate Representative(s) of each GSP Group shall be counted towards a quorum and as the voting representative(s) in the absence of the GSP Group Representative for which the GSP Group Alternate has been appointed. If less than a quorum is present, the GSP Group Representatives and Alternate Representatives may hear reports and discuss items on the agenda, but no action may be taken.

5.5.3 Open Attendance

Members of the public, stakeholders, and representatives of the Parties who are not appointed as GSP Group Representatives may attend all meetings and shall be provided with an opportunity to comment on matters on the meeting agenda, but shall have no vote.

5.5.4 Minutes

The Secretary's appointee shall keep and prepare minutes of all Coordination Committee meetings. Notes of subcommittee and workgroup meetings shall be kept by the Secretary's appointee or an assistant to the appointee. All minutes and subcommittee and workgroup meeting notes shall be maintained by the Secretary as Coordination Agreement records and shall be available to the Parties and the public upon request.

5.6 <u>Voting by Coordination Committee</u>

5.6.1. Each GSP Group Representative shall be entitled to one vote at the Coordination Committee. It shall be up to the Parties in each GSP Group to determine how the GSP Group vote(s) will be cast.

5.6.2 Except as set forth in Section 5.6.3, the unanimous vote of the GSP Representatives from all GSP Groups is required on all items upon which the Coordination Committee is authorized to act as identified in Section 5.3.1 a) through 5.3.1 d) and 5.3.1 f); the vote of a majority of a quorum shall be required for all other matters on which the Coordination Committee is authorized to act.

5.6.3 <u>Voting Procedures to Address Lack of Unanimity</u>

When it appears likely that the Coordination Committee will not be able to come to unanimous decision on any matter upon for which a unanimous decision is required, upon a majority vote of a quorum of the Coordination Committee, the matter may be subjected to the following additional procedures.

a) Straw Polls

Straw poll votes may be taken for the purpose of refining ideas and providing guidance to the Coordination Committee, subcommittees, or both.

b) Provisional Voting

Provisional votes may occur prior to final votes. This will be done when an initial vote is needed to refine a proposal but the GSP Group Representatives wish to consult with their respective GSP Group(s) before making a final vote.

c) A vote shall be delayed if any GSP Group Representative declares its intention to propose an alternative or modified recommended action, to be proposed at the next meeting, or as soon thereafter as the GSP Group Representative can obtain any further information or clarifying direction from its GSP Group or governing body, or both, as needed to proposed its alternative or modified recommended action.

d) If the process outlined in subsection 5.6.3(c) fails to result in a unanimous vote, any GSP Group Representative not voting in favor of the recommended action may request that the vote be delayed so that the Coordination Committee can obtain further information on the recommended action (for example, by directing a subcommittee established under this

Coordination Agreement), so the GSP Group Representative can obtain clarifying direction from its GSP Group or governing body, or both, as needed.

e) Each of the Parties acknowledges the limited time provided by SGMA to complete the GSP preparation process, and agrees to make its best efforts to cooperate through the Coordinating Committee in coming to require a unanimous vote.

SECTION 6 – APPROVAL BY INDIVIDUAL PARTIES

6.1 Where law or this Coordination Agreement require separate written approval by each of the Parties, such approval shall be evidenced in writing by providing the resolution, Motion, or Minutes of their respective Boards of Directors to the Secretary of the Coordination Committee.

SECTION 7 – EXCHANGE OF DATA AND INFORMATION

7.1 Exchange of Information

The Parties acknowledge and recognize pursuant to this Coordination Agreement that the Parties may need to exchange information amongst and between the Parties.

7.2 Procedure for Exchange of Information

7.2.1 The Parties shall exchange public and non-privileged information through collaboration and/or informal requests made at the Coordination Committee level or through subcommittees designated by the Coordination Committee. However, to the extent it is necessary to make a written request for information to another Party, each Party shall designate a representative to respond to information requests and provide the name and contact information of the designee to the Coordination Committee. Requests may be communicated in writing and transmitted in person or by mail, facsimile machine, or other electronic means to the appropriate representative as named in this Coordination Agreement. The designated representative shall respond in a reasonably timely manner.

7.2.2 Nothing in this Coordination Agreement shall be construed to prohibit any Party from voluntarily exchanging information with any other Party by any other mechanism separate from the Coordination Committee.

7.2.3 The Parties agree that each GSP Group shall provide the data required to develop the Subbasin-wide coordinated water budget but unless required by law, will not be required to provide individual well or parcel-level information in order to preserve confidentiality of individuals to the extent authorized by law, including but not limited to Water Code Section 10730.8, subdivision (b).

7.2.4 To the extent that a court order, subpoena, or the California Public Records Act is applicable to a Party, such Party in responding to a request made pursuant to that Act for release of information exchanged from another Party shall notify each other Party in writing of its proposed release of information in order to provide the other Parties with the opportunity to seek a court order preventing such release of information.

SECTION 8 – METHODOLOGIES AND ASSUMPTIONS

8.1 SGMA Coordination Requirements

Pursuant to SGMA, this Coordination Agreement must ensure that the individual GSPs utilize the same data and methodologies for developing assumptions used to determine: 1) groundwater elevation; 2) groundwater extraction data; 3) surface water supply; 4) total water use; 5) changes in groundwater storage; 6) water budgets; and 7) sustainable yield.

8.2 Pre-GSP Coordination

Prior to the individual development of GSPs, the Parties agree to develop agreed-upon methodologies and assumptions for 1) groundwater elevation; 2) groundwater extraction data; 3) surface water supply; 4) total water use; 5) changes in groundwater storage; 6) water budgets; and 7) sustainable yield. This development may be facilitated through the Coordination Committee's delegation to a sub-committee or workgroup of the technical staff provided by some or all of the Parties. The basis upon which the methodologies and assumptions will be developed includes existing data/information, best management practices, and/or best modeled or projected data available and may include consultation with the DWR as appropriate.

8.3 Technical Memoranda Required

The data and methodologies for assumptions described in Water Code section 10727.6 and title 23, California Code of Regulations, section 357.4 to prepare coordinated plans shall be set forth in Technical Memoranda prepared by the Coordination Committee for each of the elements discussed in Sections 9, 10, 11, and 12 of this Coordination Agreement. The Technical Memoranda shall be subject to the unanimous approval of the Coordination Committee and once approved, shall be attached to and incorporated by reference into this Coordination Agreement without formal amendment of the Coordination Agreement being required. The Parties agree that they shall not submit this Coordination Agreement to DWR until the Technical Memoranda described herein have been added to the Coordination Agreement. The Technical Memoranda created pursuant to this Agreement shall be utilized by the Parties during the development and implementation of their GSPs in order to assure coordination of the GSPs in compliance with SGMA.

SECTION 9 – MONITORING NETWORK

9.1 In accordance with SGMA, the Parties hereby agree to coordinate the development and maintenance of a monitoring network at a Subbasin level through the coordination of the respective monitoring networks established pursuant to the GSPs in which each of the Parties hereto are participating. The Subbasin monitoring network description shall include monitoring objectives, protocols, and data reporting requirements specific to enumerated sustainability indicators. Each GSP Group's network shall facilitate the collection of data in order to characterize groundwater and related surface water conditions in the Subbasin and evaluate changing conditions that occur from implementation of the individual GSPs. Each Party's GSP will describe the monitoring network's objectives for the Subbasin, including an explanation of network development and implementation to monitor groundwater and related surface conditions, and the interconnection of surface water and groundwater.

9.2 Each GSP Group shall provide the Coordination Committee all relevant data and information for their respective representative monitoring sites established in accordance with Title 23, California Code of Regulations, section 354.36, as amended from time to time.

SECTION 10 – COORDINATED WATER BUDGET

10.1 In accordance with SGMA, the Parties hereby agree to prepare a single coordinated water budget for the Subbasin as described in this subsection for use in the respective GSP in which each of the Parties hereto are participating. The water budget will provide an estimate of the total annual volume of groundwater and surface water entering and leaving the Subbasin, including historical, current and projected water budget conditions, and the change in the volume of water stored and the safe yield for differing aquifers.

10.2 To the extent feasible, the Parties will consider the best available information and best available science to quantify the water budget for the Subbasin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow.

SECTION 11 – COORDINATED DATA MANAGEMENT SYSTEM

11.1 The Parties will develop and maintain a coordinated data management system that is capable of storing and reporting information relevant to the reporting requirements and/or implementation of the GSPs and monitoring network of the Subbasin.

11.2 The Parties also will develop and maintain separate data management systems. Each separate data management system developed for each GSP will store information related to implementation of each individual GSP, monitoring network data and monitoring sites requirements, and water budget data requirements. Each system will be capable of reporting all pertinent information to the Coordination Committee. After providing the Coordination Committee with data from the individual GSPs, the Coordination Committee will ensure the data is stored and managed in a coordinated manner throughout the Subbasin and reported to DWR annually as required.

SECTION 12 – ADOPTION AND USE OF THE COORDINATION AGREEMENT

12.1 Coordination of GSPs

Each Party is responsible to ensure that its own GSP complies with the statutory requirements of SGMA, including but not limited to the filing deadline. The Parties to this Coordination Agreement intend that their individual GSPs be coordinated together in order to satisfy the requirements of SGMA and to be in substantial compliance with the California Code of Regulations. The collective GSPs will satisfy the requirements of sections 10727.2 and 10727.4 of the Water Code by providing a description of the physical setting and characteristics of the separate aquifer systems within the Subbasin, the measurable objectives for each such GSP, interim milestones, and monitoring protocols that together provide a detailed description of how the Basin as a whole will be sustainably managed.

12.2 GSP and Coordination Agreement Submission

The Parties agree to submit their respective GSPs to DWR through the Coordination Committee and Plan Manager, in accordance with all applicable requirements. Subject to the subsequent attachment of the Technical Memoranda described in Sections 8-12, the Parties intend that this Coordination Agreement fulfill the requirements of providing an explanation of how the GSPs implemented together satisfy the requirements SGMA for the entire Subbasin.

SECTION 13 – MODIFICATION AND TERMINATION OF THE COORDINATION AGREEMENT

13.1 Modification or Amendment of Exhibit "A"

The Parties agree that Exhibit "A," except for the withdrawal or addition of Parties to this Agreement, may be updated by unanimous vote of the Coordination Committee from time to time. Upon such modification, the updated Exhibit "A" shall be attached to this Agreement as a replacement to the previously existing Exhibit "A." Upon such attachment, the updated "Exhibit "A" shall become a part of this Coordination Agreement without further Amendment of the Coordination Agreement being required. The Secretary shall provide notice of such change to all Group Contacts.

13.1.1 Addition of a Party

A Party may be added to this Coordination Agreement only upon its execution of a counterpart of this Agreement and its provision of any additional documentation required by Sections 3.1.2 a) through 3.1.2 d) of this Coordination Agreement. No Party may be added that is not within the Delta-Mendota Subbasin or that fails to execute an agreement to share in Coordinated Plan Expenses, unless such payment is waived by consent of all Parties.

13.2 Modification or Amendment of Coordination Agreement

Except as provided in Sections 13.1 and 13.3, the Parties hereby agree that this Coordination Agreement may be supplemented, amended, or modified only by a writing signed by all Parties.

13.3 Amendment for Compliance with Law

Should any provision of this Coordination Agreement be determined to be not in compliance with legal requirements under circumstances where amendment of the Agreement to include a provision addressing the legal requirement will cure the non-compliance, the Parties agree to promptly prepare and approve such amendment.

SECTION 14 – WITHDRAWAL, TERM, AND TERMINATION

14.1 <u>Withdrawal</u>

Subject to the requirements identified in SGMA and the any coordination guidelines or regulations issued by DWR, a Party may unilaterally withdraw from this Coordination Agreement without causing or requiring termination of this Coordination Agreement, effective upon thirty (30) days written notice to the Secretary and all other Parties. The Plan Coordinator shall report any such withdrawal to DWR within five (5) days of receipt of the written notice.

14.1.1 Any Party who withdraws shall remain obligated for Coordinated Plan Expenses as provided in a separate Cost Sharing Agreement. If no separate Cost Sharing Agreement is then in effect or enforceable against the withdrawing Party, the Party is obligated to pay its share of all debts, liabilities, and obligations the Party incurred or accrued under the Coordination Agreement prior to the effective date of such withdrawal, as established under its separate GSP Group agreement concerning such share of obligations.

14.1.2 Upon withdrawal, a Party agrees that it has a continuing obligation to comply with SGMA and any coordination guidelines or regulations issued by DWR, which require a coordination agreement if there are multiple GSPs in the Subbasin. This obligation shall survive the withdrawal from this Coordination Agreement and is for the express benefit of the remaining Parties.

14.1.3 In the event any GSP Group Representative(s) prevents/prevent a required unanimous vote of the Coordination Committee after following all procedures described in 5.3.1 or Section 15 of this Agreement, the Parties in such GSP Group agree to provide notice that such GSP Group has unilaterally withdrawn from this Agreement in accordance with this Section.

14.2 <u>Term</u>

As modified pursuant to Section 13 and unless terminated in accordance with Section 14.2.3, this Coordination Agreement shall continue for a term that is coterminous with the requirements of SGMA for the existence of a Coordination Agreement.

14.3 <u>Termination</u>

This Coordination Agreement may be terminated or rescinded and the coordinated implementation of GSPs terminated by unanimous written consent of all the Parties. Nothing in this Coordination Agreement shall prevent the Parties from entering into another coordination agreement for coordination with any other subbasin.

SECTION 15 – PROCEDURES FOR RESOLVING CONFLICTS

In the event of any dispute arising from or relating to this Agreement, the disputing Party shall, within thirty (30) calendar days of discovery of the events giving rise to the dispute, notify all Parties to this Agreement in writing of the basis for the dispute. Within thirty (30) calendar days of receipt of said notice, all interested Parties shall meet and confer in a good-faith attempt to informally resolve the dispute. All disputes that are not resolved informally shall be settled by arbitration. Within ten (10) days following the failed informal proceedings, each interested Party shall nominate and circulate to all other interested Parties the name of one arbitrator. Within ten (10) days following the nominations, the interested Parties shall rank their top three among all nominated arbitrators, awarding three points to the top choice, two points to the second choice, one point to the third choice and zero points to all others. Each interested Party shall forward its tally to the Secretary, who shall tabulate the points and notify the interested Parties of the arbitrator with the highest cumulative score, who shall be the selected arbitrator. The Secretary may also develop procedures for approval by the Parties, for selection in the case of tie votes or in order to replace the selected arbitrator in the event such arbitrator declines to act. The arbitration shall be administered in accordance with the procedures set forth in the California Code of Civil Procedure, section 1280, et seq., and of any state or local rules then in effect for arbitration pursuant to said section. Upon completion of arbitration, if the controversy has not been resolved, any Party may exercise all rights to bring a legal action relating to the controversy.

SECTION 16 – GENERAL PROVISIONS

16.1 Authority of Signers

The individuals executing this Coordination Agreement represent and warrant that they have the authority to enter into this Coordination Agreement and to legally bind the Party for whom they are signing to the terms and conditions of this Coordination Agreement.

16.2 Governing Law

The validity and interpretation of this Coordination Agreement will be governed by the laws of the State of California without giving effect to the principles of conflict of laws, with venue for all purposes to be proper only in the County of Merced, State of California.

16.3 Severability

Except as provided for cure by amendment in Section 13.3, if any term, provision, covenant, or condition of this Coordination Agreement is determined to be unenforceable by a court of competent jurisdiction, it is the Parties' intent that the remaining provisions of this Coordination Agreement will remain in full force and effect and will not be affected, impaired, or invalidated by such a determination.

16.4 Counterparts

This Coordination Agreement may be executed in any number of counterparts, each of which will be an original, but all of which will constitute one and the same agreement.

16.5 Good Faith

The Parties agree to exercise their best efforts and utmost good faith to effectuate all the terms and conditions of this Coordination Agreement and to execute such further instruments and documents as are reasonably necessary, appropriate, expedient, or proper to carry out the intent and purposes of this Coordination Agreement.

SECTION 17 – SIGNATORIES

PARTIES:

PATTERSON IRRIGATION DISTRICT GSA			
Patterson Irrigation District	**Date:** 05/22/2018		
Signature			
Name of Representative: Vince Lucchesi			
WEST STANISLAUS IRRIGATION DISTRICT GSA 1			
West Stanislaus Irrigation District	**Date:**		
Signature			
Name of Representative:			
DM II GSA			
Del Puerto Water District	**Date:**	**Oak Flat Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
CITY OF PATTERSON GSA			
City of Patterson	**Date:**		
Signature			
Name of Representative:			

16.3 Severability

Except as provided for cure by amendment in Section 13.3, if any term, provision, covenant, or condition of this Coordination Agreement is determined to be unenforceable by a court of competent jurisdiction, it is the Parties' intent that the remaining provisions of this Coordination Agreement will remain in full force and effect and will not be affected, impaired, or invalidated by such a determination.

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SECTION 17 – SIGNATORIES

PARTIES:

PATTERSON IRRIGATION DISTRICT GSA			
Patterson Irrigation District	**Date:**		
Signature			
Name of Representative:			
WEST STANISLAUS IRRIGATION DISTRICT GSA 1			
West Stanislaus Irrigation District	**Date:** 5/16/18		
Signature Robert Pierce			
Name of Representative: Robert Pierce, General Manager			
DM II GSA			
Del Puerto Water District	**Date:**	**Oak Flat Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
CITY OF PATTERSON GSA			
City of Patterson	**Date:**		
Signature			
Name of Representative:			

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Except as provided for cure by amendment in Section 13.3, if any term, provision, covenant, or condition of this Coordination Agreement is determined to be unenforceable by a court of competent jurisdiction, it is the Parties' intent that the remaining provisions of this Coordination Agreement will remain in full force and effect and will not be affected, impaired, or invalidated by such a determination.

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SECTION 17 – SIGNATORIES

PARTIES:

PATTERSON IRRIGATION DISTRICT GSA			
Patterson Irrigation District	**Date:**	**Twin Oaks Irrigation Company**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
WEST STANISLAUS IRRIGATION DISTRICT GSA 1			
West Stanislaus Irrigation District	**Date:**		
Signature			
Name of Representative:			
WEST STANISLAUS IRRIGATION DISTRICT GSA 2			
West Stanislaus Irrigation District	**Date:**		
Signature			
Name of Representative:			
DM II GSA			
Del Puerto Water District	**Date:** 8/28/18	**Oak Flat Water District**	**Date:** 8/28/18
Signature Anthea C Hansen		**Signature** Anthea C Hansen	
Name of Representative: Anthea C Hansen		**Name of Representative:** Anthea C Hansen	

16.3 Severability

Except as provided for cure by amendment in Section 13.3, if any term, provision, covenant, or condition of this Coordination Agreement is determined to be unenforceable by a court of competent jurisdiction, it is the Parties' intent that the remaining provisions of this Coordination Agreement will remain in full force and effect and will not be affected, impaired, or invalidated by such a determination.

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SECTION 17 – SIGNATORIES

PARTIES:

PATTERSON IRRIGATION DISTRICT GSA			
Patterson Irrigation District	**Date:**		
Signature			
Name of Representative:			
WEST STANISLAUS IRRIGATION DISTRICT GSA 1			
West Stanislaus Irrigation District	**Date:**		
Signature			
Name of Representative:			
DM II GSA			
Del Puerto Water District	**Date:**	**Oak Flat Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
CITY OF PATTERSON GSA			
City of Patterson	**Date:** 9/20/18		
Signature			
Name of Representative: Ken Irwin			

CITY OF PATTERSON GSA	
City of Patterson	**Date:**
Signature	
Name of Representative:	

NORTHWESTERN DELTA-MENDOTA GSA			
County of Merced	**Date:** 7/31/18	**County of Stanislaus**	**Date:**
Signature		**Signature**	
Name of Representative: Jerald R. O'Banion		**Name of Representative:**	
CENTRAL DELTA-MENDOTA REGION MULTI-AGENCY GSA			
San Luis Water District	**Date:**	**Panoche Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Tranquillity Irrigation District	**Date:**	**Fresno Slough Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Eagle Field Water District	**Date:**	**Pacheco Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Santa Nella County Water District	**Date:**	**Mercy Springs Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
County of Merced	**Date:** 7/31/18	**County of Fresno**	**Date:**
Signature		**Signature**	
Name of Representative: Jerald R. O'Banion		**Name of Representative:**	

ORO LOMA WATER DISTRICT GSA	
Oro Loma Water District	**Date:**
Signature	
Name of Representative:	
WIDREN WATER DISTRICT GSA	
Widren Water District	**Date:**
Signature	
Name of Representative:	

SAN JOAQUIN RIVER EXCHANGE CONTRACTORS GSA			
Central California Irrigation District	**Date:**	**Columbia Canal Company**	**Date:**
Signature		**Signature**	

CITY OF PATTERSON GSA			
City of Patterson	**Date:**		
Signature			
Name of Representative:			
NORTHWESTERN DELTA-MENDOTA GSA			
County of Merced	**Date:**	**County of Stanislaus**	**Date:** 10/9/18
Signature		**Signature** [illegible signature]	
Name of Representative:		**Jim DeMartini, Chariman:**	
APPROVED AS TO FORM John P. Doering County Counsel Stanislaus County		**BY:** [illegible signature] Asst County Counsel	**Date:** 10/3/18
CENTRAL DELTA-MENDOTA REGION MULTI-AGENCY GSA			
San Luis Water District	**Date:**	**Panoche Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Tranquillity Irrigation District	**Date:**	**Fresno Slough Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Eagle Field Water District	**Date:**	**Pacheco Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Santa Nella County Water District	**Date:**	**Mercy Springs Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
County of Merced	**Date:**	**County of Fresno**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
ORO LOMA WATER DISTRICT GSA			
Oro Loma Water District	**Date:**		
Signature			
Name of Representative:			
WIDREN WATER DISTRICT GSA			
Widren Water District	**Date:**		
Signature			
Name of Representative:			
SAN JOAQUIN RIVER EXCHANGE CONTRACTORS GSA			
Central California Irrigation District	**Date:**	**Columbia Canal Company**	**Date:**
Signature		**Signature**	

NORTHWESTERN DELTA-MENDOTA GSA			
County of Merced	**Date:**	**County of Stanislaus**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
CENTRAL DELTA-MENDOTA REGION MULTI-AGENCY GSA			
San Luis Water District	**Date:** 8/13/18	**Panoche Water District**	**Date:**
Signature		**Signature**	
Name of Representative: Lon Martin		**Name of Representative:**	
Tranquillity Irrigation District	**Date:**	**Fresno Slough Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Eagle Field Water District	**Date:**	**Pacheco Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Santa Nella County Water District	**Date:**	**Mercy Springs Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
County of Merced	**Date:**	**County of Fresno**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
ORO LOMA WATER DISTRICT GSA			
Oro Loma Water District	**Date:**		
Signature			
Name of Representative:			
WIDREN WATER DISTRICT GSA			
Widren Water District	**Date:**		
Signature			
Name of Representative:			
SAN JOAQUIN RIVER EXCHANGE CONTRACTORS GSA			
Central California Irrigation District	**Date:**	**Columbia Canal Company**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Firebaugh Canal Company	**Date:**	**San Luis Canal Company**	**Date:**
Signature		**Signature**	

CITY OF PATTERSON GSA			
City of Patterson	**Date:**		
Signature			
Name of Representative:			
NORTHWESTERN DELTA-MENDOTA GSA			
County of Merced	**Date:**	**County of Stanislaus**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
CENTRAL DELTA-MENDOTA REGION MULTI-AGENCY GSA			
San Luis Water District	**Date:**	**Panoche Water District**	**Date:**
Signature		**Signature** 07/31/18	
Name of Representative:		**Name of Representative:** John Bennett	
Tranquillity Irrigation District	**Date:**	**Fresno Slough Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Eagle Field Water District	**Date:**	**Pacheco Water District**	**Date:**
Signature		**Signature** 8/2/18	
Name of Representative:		**Name of Representative:** Aaron Barcellos	
Santa Nella County Water District	**Date:**	**Mercy Springs Water District**	**Date:** 7/31/18
Signature		**Signature**	
Name of Representative:		**Name of Representative:** Michael Linneman	
County of Merced	**Date:**	**County of Fresno**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
ORO LOMA WATER DISTRICT GSA			
Oro Loma Water District	**Date:**		
Signature			
Name of Representative:			
WIDREN WATER DISTRICT GSA			
Widren Water District	**Date:**		
Signature			
Name of Representative:			
SAN JOAQUIN RIVER EXCHANGE CONTRACTORS GSA			
Central California Irrigation District	**Date:**	**Columbia Canal Company**	**Date:**
Signature		**Signature**	

CITY OF PATTERSON GSA			
City of Patterson	**Date:**		
Signature			
Name of Representative:			
NORTHWESTERN DELTA-MENDOTA GSA			
County of Merced	**Date:**	**County of Stanislaus**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
CENTRAL DELTA-MENDOTA REGION MULTI-AGENCY GSA			
San Luis Water District	**Date:**	**Panoche Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Tranquillity Irrigation District	**Date:** 6/20/18	**Fresno Slough Water District**	**Date:**
Signature		**Signature**	
Name of Representative: Jerry Salvador		**Name of Representative:**	
Eagle Field Water District	**Date:**	**Pacheco Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Santa Nella County Water District	**Date:**	**Mercy Springs Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
County of Merced	**Date:**	**County of Fresno**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
ORO LOMA WATER DISTRICT GSA			
Oro Loma Water District	**Date:**		
Signature			
Name of Representative:			
WIDREN WATER DISTRICT GSA			
Widren Water District	**Date:**		
Signature			
Name of Representative:			
SAN JOAQUIN RIVER EXCHANGE CONTRACTORS GSA			
Central California Irrigation District	**Date:**	**Columbia Canal Company**	**Date:**
Signature		**Signature**	

NORTHWESTERN DELTA-MENDOTA GSA			
County of Merced	Date:	County of Stanislaus	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
CENTRAL DELTA-MENDOTA REGION MULTI-AGENCY GSA			
San Luis Water District	Date:	Panoche Water District	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
Tranquillity Irrigation District	Date:	Fresno Slough Water District	Date: 8-6-18
Signature		Signature [illegible]	
Name of Representative:		Name of Representative: Elizabeth Reeves	
Eagle Field Water District	Date:	Pacheco Water District	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
Santa Nella County Water District	Date:	Mercy Springs Water District	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
County of Merced	Date:	County of Fresno	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
ORO LOMA WATER DISTRICT GSA			
Oro Loma Water District	Date:		
Signature			
Name of Representative:			
WIDREN WATER DISTRICT GSA			
Widren Water District	Date:		
Signature			
Name of Representative:			
SAN JOAQUIN RIVER EXCHANGE CONTRACTORS GSA			
Central California Irrigation District	Date:	Columbia Canal Company	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
Firebaugh Canal Company	Date:	San Luis Canal Company	Date:
Signature		Signature	

NORTHWESTERN DELTA-MENDOTA GSA			
County of Merced	**Date:**	**County of Stanislaus**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
CENTRAL DELTA-MENDOTA REGION MULTI-AGENCY GSA			
San Luis Water District	**Date:**	**Panoche Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Tranquillity Irrigation District	**Date:**	**Fresno Slough Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Eagle Field Water District	**Date:**	**Pacheco Water District**	**Date:**
Signature Randall S Miles 6-27-18		**Signature**	
Name of Representative: Randall Miles		**Name of Representative:**	
Santa Nella County Water District	**Date:**	**Mercy Springs Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
County of Merced	**Date:**	**County of Fresno**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
ORO LOMA WATER DISTRICT GSA			
Oro Loma Water District	**Date:**		
Signature			
Name of Representative:			
WIDREN WATER DISTRICT GSA			
Widren Water District	**Date:**		
Signature			
Name of Representative:			
SAN JOAQUIN RIVER EXCHANGE CONTRACTORS GSA			
Central California Irrigation District	**Date:**	**Columbia Canal Company**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Firebaugh Canal Company	**Date:**	**San Luis Canal Company**	**Date:**
Signature		**Signature**	

NORTHWESTERN DELTA-MENDOTA GSA			
County of Merced	**Date:**	**County of Stanislaus**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
CENTRAL DELTA-MENDOTA REGION MULTI-AGENCY GSA			
San Luis Water District	**Date:**	**Panoche Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Tranquillity Irrigation District	**Date:**	**Fresno Slough Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Eagle Field Water District	**Date:**	**Pacheco Water District**	**Date:**
Signature		**Signature**	
Name of Representative: Amy Montgomery		**Name of Representative:**	
Santa Nella County Water District	**Date:** 9/14/18	**Mercy Springs Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
County of Merced	**Date:**	**County of Fresno**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
ORO LOMA WATER DISTRICT GSA			
Oro Loma Water District	**Date:**		
Signature			
Name of Representative:			
WIDREN WATER DISTRICT GSA			
Widren Water District	**Date:**		
Signature			
Name of Representative:			
SAN JOAQUIN RIVER EXCHANGE CONTRACTORS GSA			
Central California Irrigation District	**Date:**	**Columbia Canal Company**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Firebaugh Canal Company	**Date:**	**San Luis Canal Company**	**Date:**
Signature		**Signature**	

NORTHWESTERN DELTA-MENDOTA GSA			
County of Merced	Date:	County of Stanislaus	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
CENTRAL DELTA-MENDOTA REGION MULTI-AGENCY GSA			
San Luis Water District	Date:	Panoche Water District	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
Tranquillity Irrigation District	Date:	Fresno Slough Water District	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
Eagle Field Water District	Date:	Pacheco Water District	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
Santa Nella County Water District	Date:	Mercy Springs Water District	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
County of Merced	Date:	County of Fresno	Date: 8/21/18
Signature		Signature Sal Quintero	
Name of Representative:		Name of Representative: Sal Quintero	
ORO LOMA WATER DISTRICT GSA			
Oro Loma Water District	Date:		
Signature			
Name of Representative:			
WIDREN WATER DISTRICT GSA			
Widren Water District	Date:		
Signature			
Name of Representative:			
SAN JOAQUIN RIVER EXCHANGE CONTRACTORS GSA			
Central California Irrigation District	Date:	Columbia Canal Company	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
Firebaugh Canal Company	Date:	San Luis Canal Company	Date:
Signature		Signature	

ATTEST:
BERNICE E. SEIDEL
Clerk of the Board of Supervisors
County of Fresno, State of California
By ____ Deputy

NORTHWESTERN DELTA-MENDOTA GSA			
County of Merced	Date:	County of Stanislaus	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
CENTRAL DELTA-MENDOTA REGION MULTI-AGENCY GSA			
San Luis Water District	Date:	Panoche Water District	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
Tranquillity Irrigation District	Date:	Fresno Slough Water District	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
Eagle Field Water District	Date:	Pacheco Water District	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
Santa Nella County Water District	Date:	Mercy Springs Water District	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
County of Merced	Date:	County of Fresno	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
ORO LOMA WATER DISTRICT GSA			
Oro Loma Water District	Date:		
Signature			
Name of Representative: Steve Sloan			
WIDREN WATER DISTRICT GSA			
Widren Water District	Date:		
Signature			
Name of Representative:			
SAN JOAQUIN RIVER EXCHANGE CONTRACTORS GSA			
Central California Irrigation District	Date:	Columbia Canal Company	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
Firebaugh Canal Company	Date:	San Luis Canal Company	Date:
Signature		Signature	

NORTHWESTERN DELTA-MENDOTA GSA			
County of Merced	**Date:**	**County of Stanislaus**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
CENTRAL DELTA-MENDOTA REGION MULTI-AGENCY GSA			
San Luis Water District	**Date:**	**Panoche Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Tranquillity Irrigation District	**Date:**	**Fresno Slough Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Eagle Field Water District	**Date:**	**Pacheco Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Santa Nella County Water District	**Date:**	**Mercy Springs Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
County of Merced	**Date:**	**County of Fresno**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
ORO LOMA WATER DISTRICT GSA			
Oro Loma Water District	**Date:**		
Signature			
Name of Representative:			
WIDREN WATER DISTRICT GSA			
Widren Water District	**Date:**		
Signature			
Name of Representative: Jean Sagouspe			
SAN JOAQUIN RIVER EXCHANGE CONTRACTORS GSA			
Central California Irrigation District	**Date:**	**Columbia Canal Company**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Firebaugh Canal Company	**Date:**	**San Luis Canal Company**	**Date:**
Signature		**Signature**	

NORTHWESTERN DELTA-MENDOTA GSA			
County of Merced	**Date:**	**County of Stanislaus**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
CENTRAL DELTA-MENDOTA REGION MULTI-AGENCY GSA			
San Luis Water District	**Date:**	**Panoche Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Tranquillity Irrigation District	**Date:**	**Fresno Slough Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Eagle Field Water District	**Date:**	**Pacheco Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Santa Nella County Water District	**Date:**	**Mercy Springs Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
County of Merced	**Date:**	**County of Fresno**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
ORO LOMA WATER DISTRICT GSA			
Oro Loma Water District	**Date:**		
Signature			
Name of Representative:			
WIDREN WATER DISTRICT GSA			
Widren Water District	**Date:**		
Signature			
Name of Representative:			
SAN JOAQUIN RIVER EXCHANGE CONTRACTORS GSA			
Central California Irrigation District	**Date:** 9-7-2016	**Columbia Canal Company**	**Date:**
Signature		**Signature**	
Name of Representative: James O'Banion		**Name of Representative:**	
Firebaugh Canal Company	**Date:**	**San Luis Canal Company**	**Date:**
Signature		**Signature**	

Mike Stearns

Jim Nickel

NORTHWESTERN DELTA-MENDOTA GSA			
County of Merced	**Date:**	**County of Stanislaus**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
CENTRAL DELTA-MENDOTA REGION MULTI-AGENCY GSA			
San Luis Water District	**Date:**	**Panoche Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Tranquillity Irrigation District	**Date:**	**Fresno Slough Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Eagle Field Water District	**Date:**	**Pacheco Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
Santa Nella County Water District	**Date:**	**Mercy Springs Water District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
County of Merced	**Date:**	**County of Fresno**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	
ORO LOMA WATER DISTRICT GSA			
Oro Loma Water District	**Date:**		
Signature			
Name of Representative:			
WIDREN WATER DISTRICT GSA			
Widren Water District	**Date:**		
Signature			
Name of Representative:			
SAN JOAQUIN RIVER EXCHANGE CONTRACTORS GSA			
Central California Irrigation District	**Date:**	**Columbia Canal Company**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:** Kimberly Brown	
Firebaugh Canal Company	**Date:**	**San Luis Canal Company**	**Date:**
Signature		**Signature**	

Name of Representative:	Name of Representative:
TURNER ISLAND WATER DISTRICT -2 GSA	
Turner Island Water District	Date: 8/6/2018
Signature President	
Name of Representative: DONALD SKINNER, President	
CITY OF MENDOTA GSA	
City of Mendota	Date:
Signature	
Name of Representative:	
CITY OF FIREBAUGH GSA	
City of Firebaugh	Date:
Signature	
Name of Representative:	
CITY OF LOS BANOS GSA	
City of Los Banos	Date:
Signature	
Name of Representative:	
CITY OF DOS PALOS GSA	
City of Dos Palos	Date:
Signature	
Name of Representative:	
CITY OF GUSTINE GSA	
City of Gustine	Date:
Signature	
Name of Representative:	
CITY OF NEWMAN GSA	
City of Newman	Date:
Signature	
Name of Representative:	
COUNTY OF MADERA-3 GSA	
County of Madera	Date:
Signature	
Name of Representative:	
COUNTY OF MERCED DELTA-MENDOTA GSA	
County of Merced	Date:
Signature	
Name of Representative:	

Name of Representative:	**Name of Representative:**
TURNER ISLAND WATER DISTRICT -2 GSA	
Turner Island Water District	**Date:**
Signature	
Name of Representative:	
CITY OF MENDOTA GSA	
City of Mendota	**Date:** 12/12/18
Signature	
Name of Representative: Cristian Gonzalez	
CITY OF FIREBAUGH GSA	
City of Firebaugh	**Date:**
Signature	
Name of Representative:	
CITY OF LOS BANOS GSA	
City of Los Banos	**Date:**
Signature	
Name of Representative:	
CITY OF DOS PALOS GSA	
City of Dos Palos	**Date:**
Signature	
Name of Representative:	
CITY OF GUSTINE GSA	
City of Gustine	**Date:**
Signature	
Name of Representative:	
CITY OF NEWMAN GSA	
City of Newman	**Date:**
Signature	
Name of Representative:	
COUNTY OF MADERA-3 GSA	
County of Madera	**Date:**
Signature	
Name of Representative:	
COUNTY OF MERCED DELTA-MENDOTA GSA	
County of Merced	**Date:**
Signature	
Name of Representative:	

Name of Representative:	**Name of Representative:**
TURNER ISLAND WATER DISTRICT -2 GSA	
Turner Island Water District	**Date:**
Signature	
Name of Representative:	
CITY OF MENDOTA GSA	
City of Mendota	**Date:**
Signature	
Name of Representative:	
CITY OF FIREBAUGH GSA	
City of Firebaugh	**Date:** 9-25-18
Signature	
Name of Representative: Ben Gallegos	
CITY OF LOS BANOS GSA	
City of Los Banos	**Date:**
Signature	
Name of Representative:	
CITY OF DOS PALOS GSA	
City of Dos Palos	**Date:**
Signature	
Name of Representative:	
CITY OF GUSTINE GSA	
City of Gustine	**Date:**
Signature	
Name of Representative:	
CITY OF NEWMAN GSA	
City of Newman	**Date:**
Signature	
Name of Representative:	
COUNTY OF MADERA-3 GSA	
County of Madera	**Date:**
Signature	
Name of Representative:	
COUNTY OF MERCED DELTA-MENDOTA GSA	
County of Merced	**Date:**
Signature	
Name of Representative:	

Name of Representative:	Name of Representative:
TURNER ISLAND WATER DISTRICT -2 GSA	
Turner Island Water District	Date:
Signature	
Name of Representative:	
CITY OF MENDOTA GSA	
City of Mendota	Date:
Signature	
Name of Representative:	
CITY OF FIREBAUGH GSA	
City of Firebaugh	Date:
Signature	
Name of Representative:	
CITY OF LOS BANOS GSA	
City of Los Banos	Date: November 14, 2018
Signature	
Name of Representative: Alex Terrazas, City Manager	
CITY OF DOS PALOS GSA	
City of Dos Palos	Date:
Signature	
Name of Representative:	
CITY OF GUSTINE GSA	
City of Gustine	Date:
Signature	
Name of Representative:	
CITY OF NEWMAN GSA	
City of Newman	Date:
Signature	
Name of Representative:	
COUNTY OF MADERA-3 GSA	
County of Madera	Date:
Signature	
Name of Representative:	
COUNTY OF MERCED DELTA-MENDOTA GSA	
County of Merced	Date:
Signature	
Name of Representative:	

Name of Representative:	Name of Representative:
TURNER ISLAND WATER DISTRICT -2 GSA	
Turner Island Water District	Date:
Signature	
Name of Representative:	
CITY OF MENDOTA GSA	
City of Mendota	Date:
Signature	
Name of Representative:	
CITY OF FIREBAUGH GSA	
City of Firebaugh	Date:
Signature	
Name of Representative:	
CITY OF LOS BANOS GSA	
City of Los Banos	Date:
Signature	
Name of Representative:	
CITY OF DOS PALOS GSA	
City of Dos Palos	Date:
Signature	7/9/2018
Name of Representative: April Hogue	
CITY OF GUSTINE GSA	
City of Gustine	Date:
Signature	
Name of Representative:	
CITY OF NEWMAN GSA	
City of Newman	Date:
Signature	
Name of Representative:	
COUNTY OF MADERA-3 GSA	
County of Madera	Date:
Signature	
Name of Representative:	
COUNTY OF MERCED DELTA-MENDOTA GSA	
County of Merced	Date:
Signature	
Name of Representative:	

Name of Representative:	**Name of Representative:**
TURNER ISLAND WATER DISTRICT -2 GSA	
Turner Island Water District	**Date:**
Signature	
Name of Representative:	
CITY OF MENDOTA GSA	
City of Mendota	**Date:**
Signature	
Name of Representative:	
CITY OF FIREBAUGH GSA	
City of Firebaugh	**Date:**
Signature	
Name of Representative:	
CITY OF LOS BANOS GSA	
City of Los Banos	**Date:**
Signature	
Name of Representative:	
CITY OF DOS PALOS GSA	
City of Dos Palos	**Date:**
Signature	
Name of Representative:	
CITY OF GUSTINE GSA	
City of Gustine	**Date:** September 18, 2018
Signature	
Name of Representative: Doug Dunford	
CITY OF NEWMAN GSA	
City of Newman	**Date:**
Signature	
Name of Representative:	
COUNTY OF MADERA-3 GSA	
County of Madera	**Date:**
Signature	
Name of Representative:	
COUNTY OF MERCED DELTA-MENDOTA GSA	
County of Merced	**Date:**
Signature	
Name of Representative:	

Name of Representative:	Name of Representative:
TURNER ISLAND WATER DISTRICT -2 GSA	
Turner Island Water District	Date:
Signature	
Name of Representative:	
CITY OF MENDOTA GSA	
City of Mendota	Date:
Signature	
Name of Representative:	
CITY OF FIREBAUGH GSA	
City of Firebaugh	Date:
Signature	
Name of Representative:	
CITY OF LOS BANOS GSA	
City of Los Banos	Date:
Signature	
Name of Representative:	
CITY OF DOS PALOS GSA	
City of Dos Palos	Date:
Signature	
Name of Representative:	
CITY OF GUSTINE GSA	
City of Gustine	Date:
Signature	
Name of Representative:	
CITY OF NEWMAN GSA	
City of Newman	Date: 15 AUG 18
Signature	
Name of Representative: Michael E. Holland	
COUNTY OF MADERA-3 GSA	
County of Madera	Date:
Signature	
Name of Representative:	
COUNTY OF MERCED DELTA-MENDOTA GSA	
County of Merced	Date:

Name of Representative:	Name of Representative:
TURNER ISLAND WATER DISTRICT -2 GSA	
Turner Island Water District	Date:
Signature	
Name of Representative:	
CITY OF MENDOTA GSA	
City of Mendota	Date:
Signature	
Name of Representative:	
CITY OF FIREBAUGH GSA	
City of Firebaugh	Date:
Signature	
Name of Representative:	
CITY OF LOS BANOS GSA	
City of Los Banos	Date:
Signature	
Name of Representative:	
CITY OF DOS PALOS GSA	
City of Dos Palos	Date:
Signature	
Name of Representative:	
CITY OF GUSTINE GSA	
City of Gustine	Date:
Signature	
Name of Representative:	
CITY OF NEWMAN GSA	
City of Newman	Date:
Signature	
Name of Representative:	
COUNTY OF MADERA-3 GSA	
County of Madera	Date: 10-02-2018
Signature	
Name of Representative: Tom Wheeler	
COUNTY OF MERCED DELTA-MENDOTA GSA	
County of Merced	Date:
Signature	
Name of Representative:	

9-11-18

MICHAEL LINDEN, PER COUNTY COUNSEL

COUNTY OF MERCED DELTA-MENDOTA GSA			
County of Merced	Date: 7/31/18		
Signature Jerald R. O'Banion			
Name of Representative: Jerald R. O'Banion			
GRASSLAND WATER DISTRICT GSA			
Grassland Water District	Date:	Grassland Resource Conservation District	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	
FARMERS WATER DISTRICT GSA			
Farmers Water District	Date:		
Signature			
Name of Representative:			
FRESNO COUNTY GSA			
County of Fresno	Date:		
Signature			
Name of Representative:			
ALISO WATER DISTRICT GSA			
Aliso Water District	Date:		
Signature			
Name of Representative:			

EXECUTING NOT AS A PARTY:

SAN LUIS & DELTA-MENDOTA WATER AUTHORITY	
San Luis & Delta-Mendota Water Authority	Date:
Signature	
Name of Representative:	

GRASSLAND WATER DISTRICT GSA			
Grassland Water District	Date: 7-10-2018	Grassland Resource Conservation District	Date: 7-10-2018
Signature		Signature	
Name of Representative: Pepper Snyder		Name of Representative: Dennis Campini	

FARMERS WATER DISTRICT GSA	
Farmers Water District	Date:
Signature	
Name of Representative:	

FRESNO COUNTY MANAGEMENT AREA A and B GSAs	
County of Fresno	Date:
Signature	
Name of Representative:	

ALISO WATER DISTRICT GSA	
Aliso Water District	Date:
Signature	
Name of Representative:	

Draft

EXECUTING NOT AS A PARTY:

SAN LUIS & DELTA-MENDOTA WATER AUTHORITY	
San Luis & Delta-Mendota Water Authority	Date:
Signature	
Name of Representative:	

GRASSLAND WATER DISTRICT GSA			
Grassland Water District	**Date:**	**Grassland Resource Conservation District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	

FARMERS WATER DISTRICT GSA	
Farmers Water District	**Date:** 9-14-18
Signature	
Name of Representative: JIM STILWELL	

FRESNO COUNTY MANAGEMENT AREA A and B GSAs	
County of Fresno	**Date:**
Signature	
Name of Representative:	

ALISO WATER DISTRICT GSA	
Aliso Water District	**Date:**
Signature	
Name of Representative:	

Draft

EXECUTING NOT AS A PARTY:

SAN LUIS & DELTA-MENDOTA WATER AUTHORITY	
San Luis & Delta-Mendota Water Authority	**Date:**
Signature	
Name of Representative:	

GRASSLAND WATER DISTRICT GSA			
Grassland Water District	Date:	Grassland Resource Conservation District	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	

FARMERS WATER DISTRICT GSA	
Farmers Water District	Date:
Signature	
Name of Representative:	

FRESNO COUNTY MANAGEMENT AREA A and B GSAs	
County of Fresno	Date: August 21, 2018
Signature Sal Quintero	
Name of Representative: Sal Quintero	

ATTEST:
BERNICE E. SEIDEL
Clerk of the Board of Supervisors
County of Fresno, State of California
By [signature] Deputy

ALISO WATER DISTRICT GSA	
Aliso Water District	Date:
Signature	
Name of Representative:	

Draft

EXECUTING NOT AS A PARTY:

SAN LUIS & DELTA-MENDOTA WATER AUTHORITY	
San Luis & Delta-Mendota Water Authority	Date:
Signature	
Name of Representative:	

GRASSLAND WATER DISTRICT GSA			
Grassland Water District	Date:	Grassland Resource Conservation District	Date:
Signature		Signature	
Name of Representative:		Name of Representative:	

FARMERS WATER DISTRICT GSA	
Farmers Water District	Date:
Signature	
Name of Representative:	

FRESNO COUNTY GSA	
County of Fresno	Date:
Signature	
Name of Representative:	

ALISO WATER DISTRICT GSA	
Aliso Water District	Date: 10-23-18
Signature Roy [illegible]	
Name of Representative: ROY COTANDA, BOARD PRESIDENT	

EXECUTING NOT AS A PARTY:

SAN LUIS & DELTA-MENDOTA WATER AUTHORITY	
San Luis & Delta-Mendota Water Authority	Date:
Signature	
Name of Representative:	

GRASSLAND WATER DISTRICT GSA			
Grassland Water District	**Date:**	**Grassland Resource Conservation District**	**Date:**
Signature		**Signature**	
Name of Representative:		**Name of Representative:**	

FARMERS WATER DISTRICT GSA	
Farmers Water District	**Date:**
Signature	
Name of Representative:	

FRESNO COUNTY MANAGEMENT AREA A and B GSAs	
County of Fresno	**Date:**
Signature	
Name of Representative:	

ALISO WATER DISTRICT GSA	
Aliso Water District	**Date:**
Signature	
Name of Representative:	

Draft

EXECUTING NOT AS A PARTY:

SAN LUIS & DELTA-MENDOTA WATER AUTHORITY	
San Luis & Delta-Mendota Water Authority	**Date:** 8/6/18
Signature Frances Mizuno	
Name of Representative: Frances Mizuno	

EXHIBIT "A" – Groundwater Sustainability Plan (GSP) Groups

	Groundwater Sustainability Plan Group & Representation on Coordination Committee	Group Contact Agency	Participation Percentage
1	**Northern / Central Delta-Mendota Region – 2 Representatives** Central DM Subgroup – 1 Member representing the following: Central Delta-Mendota Multi-Agency GSA Oro Loma Water District GSA Widren Water District GSA Northern DM Subgroup – 1 Member representing the following: City of Patterson GSA DM-II GSA Northwestern Delta-Mendota GSA Oak Flat Water District GSA Patterson Irrigation District GSA West Stanislaus Irrigation District GSA	West Stanislaus Irrigation District	16.7%
2	**San Joaquin River Exchange Contractors – 2 Representatives** City of Dos Palos GSA City of Firebaugh GSA City of Gustine GSA City of Los Banos GSA City of Mendota GSA City of Newman GSA Madera County GSA Merced County Delta-Mendota GSA San Joaquin River Exchange Contractors GSA Turner Island Water District-2 GSA	San Joaquin River Exchange Contractors	16.7%
3	**Farmers Water District – 1 Representative** Farmers Water District GSA	Farmers Water District	16.7%

4	**Aliso Water District – 1 Representative** Aliso Water District GSA	Aliso Water District	16.7%
5	**Grassland Water District – 1 Representative** Grassland Water District GSA Grassland WD and Grassland Resource Conservation District Merced County Delta-Mendota GSA	Grassland Water District	16.7%
6	**Fresno County Management Area A & B – -1 Representatives** Fresno County Management Area A GSA Fresno County Management Area B GSA	Fresno County	16.7%

APPENDIX – SGMA DEFINITIONS

1. "**Agency**" or "**GSA**" shall mean a groundwater sustainability agency as defined in SGMA.

2. "**Coordination Agreement**" shall mean this Coordination Agreement, unless indicated otherwise.

3. "**Annual Report**" shall mean the report required by Water Code Section 10728 and SGMA Regulations Section 356.2.

4. "**Basin**" shall mean the Delta-Mendota subbasin and defined in Bulletin 118 as Basin 5- 22.07; for purposes of the Coordination Agreement, "Basin" and "Subbasin shall have the same meaning.

5. "**Basin Setting**" shall mean the information about the physical setting, characteristics, and current conditions of the basin as described by the Agency in the hydrogeologic conceptual model, the groundwater conditions, and the water budget, pursuant to California Code of Regulations, title 23, sections 354.12-354.20.

6. "**CASGEM**" shall mean the California Statewide Groundwater Elevation Monitoring Program developed by the DWR.

7. "**DWR**" shall mean the Department of Water Resources.

8. "**Groundwater**" shall mean the water beneath the surface of the earth within the zone below the water table in which the soil is completely saturated with water, but does not include water that flows in known and definite channels.

9. "**Groundwater flow**" shall mean the volume and direction of groundwater movement into, out of, or throughout a basin.

10. "**Interconnected surface water**" shall mean the surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted.

11. "**Measureable objectives**" shall mean specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions that have been included in an adopted GSP to achieve the sustainability goal for the basin.

12. "**Principal Aquifers**" shall mean aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems.

13. "**Representative Monitoring**" shall mean a monitoring site within a broader network of sites that typifies one or more conditions within the basin or an area of the basin.

14. "**Sustainability Indicator**" shall mean any of the effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results.

15. "**Water Source Type**" shall mean the source from which water is derived to meet the applied beneficial uses, including groundwater, precipitation, recycled water, reused water, and surface water sources.

16. "**Water Use Sector**" shall mean categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation.

Appendix B - Common Technical Memoranda

Common Chapter for the Delta-Mendota Subbasin Groundwater Sustainability Plan

Appendix B

TECHNICAL MEMORANDUM #1

RE: Common Datasets and Assumptions used in the Delta-Mendota Subbasin GSPs

PREPARED BY: Woodard & Curran

DATE: July 25, 2019

During development of the six coordinated Groundwater Sustainability Plans (GSPs) for the Delta-Mendota Subbasin (Subbasin), the twenty-three Groundwater Sustainability Agencies (GSAs) in the Subbasin agreed upon methodologies and assumptions for water budgets, change in storage, and sustainable yield. The common data and methodologies required in Water Code Section 10727.6 and Title 23, California Code of Regulations, Section 357.4 to prepare coordinated plans and utilized in preparation of the Delta-Mendota Subbasin GSPs are set forth in Technical Memoranda. Each of the individual Memoranda satisfies a requirement agreed upon in the Coordination Agreement and, collectively when combined with the Coordination Agreement, provides an explanation of how the six Subbasin GSPs implemented together satisfy the requirements of the Sustainable Groundwater Management Act (SGMA) for the entire Subbasin.

The Technical Memoranda will be utilized by the Coordination Agreement Parties (representing the twenty-three GSAs in the Subbasin) during the implementation of their GSPs in order to ensure coordination of the GSPs. The Coordination Committee is responsible for ongoing review and updating of the Technical Memoranda, as needed, during GSP implementation.

The following datasets and assumptions were used in a coordinated fashion by those preparing the six GSP for the Delta-Mendota Subbasin. These data sets and assumptions were agreed upon by the Delta-Mendota Subbasin Technical Working Group and approved by the Delta-Mendota Coordination Committee over the period extending from December 2017 through June 2019.

1. DATASETS

The technical development for the six GSPs in the Subbasin relied on the best available data for their respective Plan areas. The following outlines common datasets and instances of localized data use during the development of the GSPs.

<u>Groundwater Level Data and Contour Mapping</u>

1. Subbasin-wide groundwater level contour maps for the upper aquifer were developed for the selected historic water budget period (Spring 2003 and 2012) and current water budget period (Spring 2013 and Fall 2013). Contours were developed for the upper aquifer for the years identified. Thirty-foot contour intervals were used; individual GSAs compromised on this contour spacing following initial attempts at smaller contours due to variability in data. The lower aquifer's historic water surface elevation (WSE) data inventory was too limited to develop groundwater level contours for the entire Subbasin and is anticipated to be addressed in future GSPs and annual reports as these data gaps are addressed. Water level contour maps were composed from the following data sources:
    i. California Department of Water Resources (DWR):
        1. California Statewide Groundwater Elevation Monitoring (CASGEM) Program
        2. Water Data Library (WDL)

    ii. Water level data from local monitoring programs.

2. Subbasin-wide change in storage was evaluated for the upper aquifer using annual groundwater contour maps from Spring 2003 to Spring 2013 developed from the same datasets identified above and compared to each GSP's change in groundwater storage as calculated from historic and current water budgets for consistency. Change in storage for the lower aquifer was evaluated using specific yield and historic land subsidence provided by each GSP Group along with change in groundwater levels and storativity where lower aquifer groundwater level data were available. Datasets used to assess subsidence are discussed below.

Subsidence

3. Each GSP Group determined the historic rate of subsidence in their respective Plan area using the following data sources and period of record. The subsidence rates were combined using a 'sum-of-the-parts' methodology to develop an understanding of subsidence in the Subbasin.
    a. Aliso Water District GSP: United States Bureau of Reclamation (USBR) San Joaquin River Restoration Program (SJRRP) 2011-2017.
    b. Farmers Water District GSP: United States Geological Survey (USGS) and University-NAVSTAR Consortium (UNAVCO) 2004-2017.
    c. Fresno Management Areas A & B GSP: USGS and UNAVCO 2004-2017.
    d. Grassland GSP: USBR 2011-2017 with Ken D. Schmidt & Associates (KDSA) edits.
    e. Northern & Central Delta-Mendota GSP (without Tranquillity Irrigation District): USBR's Delta-Mendota Canal subsidence surveys interpolated from 1984 to 2014 (Pools 3 through 18) as well as the Department of Water Resources 2017 CA Aqueduct Subsidence Study.
    f. Northern & Central Delta-Mendota GSP (Tranquillity Irrigation District): Tranquillity Irrigation District's (TRID) local subsidence data from 2014 to 2018.
    g. San Joaquin River Exchange Contractors GSP: USBR's SJRRP subsidence monitoring network, USBR's Delta-Mendota Canal subsidence survey data, USGS continuous monitoring sites (including extensometers and CPGS sites), and local surveying data for years 2003-2012, 2013, and 2014-2018.

Water Budgets

4. Each GSP group developed Historic, Current, and Projected Water Budgets using the best available local and publicly available data for their respective Plan area. The six individually-developed water budgets were compared and combined for the Delta-Mendota Subbasin water budgets. Instances in which common data sources were used are as follows:
    a. The Historic, Current, and Projected Water Budgets relied on a common data source for water year type; the California Data Exchange Center (CDEC): San Joaquin River Index was used. The San Joaquin River Exchange Contractors water year type behavior is influenced by inflow to Shasta Reservoir, as does the managed wetlands in the Grassland GSP area that have federal contracts for refuge water supplies. Therefore, the Full Natural Flow (FNF) into Shasta Reservoir was considered to refine the water year type to distinguish between a critically dry year under the San Joaquin River Index and a critically dry year with reduced surface water deliveries to the San Joaquin River Exchange Contractors and the refuges due to a critical year under the Exchange Contract and refuge contracts (reduced inflows to Shasta Reservoir).
    b. The six GSP Groups also coordinated the use of DWR's 2030 and 2070 Climate Change Factors (CCF or CCFs) for the Projected Water Budget.

Groundwater Dependent Ecosystems

5. Groundwater Dependent Ecosystems (GDEs) were evaluated by each GSP Group. The Natural Communities (NC) Dataset Viewer's GDE delineations, produced by The Nature Conservancy (TNC) in partnership with the Department of Fish and Wildlife and DWR, was reviewed and vetted using the following data sources:

a. Aliso Water District GSP, Farmers Water District GSP, Fresno Management Areas A & B GSP, Northern & Central Delta-Mendota Regions GSP, and the San Joaquin River Exchange Contractors GSP used 2015 groundwater contours comprised of local and DWR's WDL depth to water data.

b. Grassland GSP used current Ducks Unlimited Wetland Inventory data for the Wetland GDE map, because the NC Dataset for wetland GDEs in this unique wetland habitat area is not accurate. The Wetland GDE map assumes that all wetlands identified by Ducks Unlimited are possible GDEs, and the Vegetative GDE map assumes that all TNC-delineated Vegetative GDEs are possible GDEs. The GSP Groups reserve the opportunity to gather more local data to refine the GDE maps in future updates.

c. Northern & Central Delta-Mendota Regions GSP used aerial satellite photos and field verification at locations with infrastructure, farms, ditches and canals, etc. to ground-truth the GDE data produced by TNC.

2. ASSUMPTIONS

Coordination and limited data required assumptions to be made to meet GSP requirements. Assumptions that affected the Delta-Mendota Subbasin's coordinated effort are outlined below along with the data and methodologies applied. The basis upon which the methodologies and assumptions were developed includes data and information provided by local agencies, State and federal data, best management practices, and/or best modeled or projected data available.

Mapping

1. Historic WSE Mapping – Assumed accurate and best available locally provided data

a. Upper Aquifer

i. Spring 2003 and Spring 2013 WSE contours were developed for the upper aquifer using datasets identified in item 1.1 above. Spring data was defined as being measured from January 1 through April 8.

ii. The groundwater levels at individual wells were plotted for both Spring 2003 and Spring 2013. Contours were refined by Luhdorff & Scalmanini, Consulting Engineers (LSCE) in the southern portion of the Subbasin and by KDSA for the entire Delta-Mendota Subbasin.

iii. The Spring 2003 and 2013 surfaces were overlaid to produce a change in groundwater level map for the historic period.

iv. The contour maps for the upper aquifer were developed on the following dates:
1. UPPER Change Spring 2003 vs. 2013 – Last edited February 7, 2019
2. UPPER Spring 2003 – Last edited February 6, 2019
3. UPPER Spring 2013 – Last edited February 6, 2019

a. Lower Aquifer

i. All available wells from the inventory identified in the datasets section above that had lower aquifer WSE readings in Spring 2013 and Fall 2013 were used to generate two maps showing lower aquifer 2003 and 2013 water levels (WSE values at individual wells). The spatial coverage was insufficient for contouring due to the distribution aligning linearly along the Delta-Mendota Canal and the limited well count. This effort was ultimately determined to be a data gap by the Technical Working Group on January 15, 2019.

1. Spring 2013: 37 water elevation measurements
2. Fall 2013: 48 water elevation measurements
3. Final maps for depiction of the lack of coverage and to meet GSP regulations were developed on February 6, 2019. Contours were unable to be developed for reasons noted above. Data will be collected in the future allowing for the development of lower aquifer contour maps as required in future annual reports.

2. Current WSE Mapping – Assumed accurate and best available locally provided data

a. Upper Aquifer

i. The upper aquifer Spring 2013 contour map developed on February 6, 2019 was also used to meet the requirements of the Current WSE contour maps. An additional upper aquifer Fall 2013 contour map was developed on March 1, 2019 using similar methodology and data from September 1 to October 31.

b. Lower Aquifer

i. As with the determination for the historic period, the spatial coverage was insufficient, and this effort has been determined to be a data gap by the Technical Working Group on January 15, 2019.

3. Groundwater Extraction Data

Extraction data were estimated or measured by local GSAs for use in the development of individual GSPs. Groundwater extraction volumes used for the Delta-Mendota Subbasin water budgets were compiled from the six individual GSP water budgets.

4. Surface Water Supply

Surface Water Supply allocations, deliveries, imports, and projected supplies were provided or estimated by local GSAs for use in the development of individual GSPs. Applied surface water volumes used for the Delta-Mendota Subbasin water budgets were compiled from the six individual GSP water budgets.

5. Total Water Use

Total Water Use was estimated or measured by local GSAs for use in the development of individual GSPs. Total water use included in the Delta-Mendota Subbasin water budgets was compiled from the individual GSP water budgets.

6. Change in Groundwater Storage

a. Upper Aquifer

i. Upper aquifer change in groundwater storage was evaluated using annual groundwater level contours from Spring 2003 to Spring 2013 developed using the same datasets identified above and applying specific yield (defined as the volume of water released from storage by an unconfined aquifer per unit surface area of aquifer per unit decline of the water table) provided by each individual GSP Group. The Delta-Mendota Subbasin upper aquifer change in groundwater storage assessment considered a 'sum-of-the-parts' methodology, combining the change in groundwater storage for each GSP to determine the overall change in groundwater storage for the Subbasin.

b. Lower Aquifer

i. On January 15, 2019, the Technical Working Group discussed addressing the historic period change in groundwater storage in the lower aquifer. Instead of using scarce data, the change was compared against loss of storage from inelastic land subsidence as calculated using change in land surface elevation multiplied by the area and supplemented by change in groundwater levels and storativity in areas of the Subbasin where those data were available.

7. GDEs

The Natural Communities Dataset Viewer's (NC Dataset Viewer) GDE delineations, produced by The Nature Conservancy (TNC) in partnership with the Department of Fish and Wildlife and DWR, were reviewed and vetted by each GSP Group. The primary reasons for not fully utilizing the NC Dataset Viewer GDE delineations were as follows: (1) A mapping error was identified, noting the land use is incompatible with the presence of GDEs; (2) for wetlands within the Grassland GSP, a more accurate and comprehensive wetland data set was available; and (3) The depth to groundwater exceeds 30 feet. The 30-foot criterion was used with the understanding that the deepest rooting depth of a vegetative GDE identified in NC Dataset Viewer is 30 feet, and further refined using effective rooting depths published by TNC. The GDE determinations and Spring 2015 depth to groundwater contours were compiled into a Wetland GDE map and Vegetative GDE map on May 29, 2019 and approved by the Subbasin Coordination Committee

The methods for GDE determinations are as follows.

a. Aliso Water District GSP:

   i. Spring 2013 and 2015 groundwater contours were assessed in Aliso Water District to evaluate areas in which the depth to water exceeded 30 feet, demonstrating unsuitable hydrologic conditions for vegetative or wetland GDEs. Aliso WD GSP's GDE determinations remained constant when using either Spring 2013 or Spring 2015 water levels for consideration.

   ii. GDEs identified within a 100-foot buffer from the San Joaquin River remained "Possible GDEs," as consistent with a typical wetland setback standard used by CalTrans. (See the Aliso Water District GSP for detailed references relating to this standard.)

b. Farmers Water District GSP:

   i. Using GIS, Spring 2015 groundwater elevation contours were overlain on the TNC GDE delineations identified in Farmers Water District to evaluate areas in which the depth to water exceeded 30 feet, demonstrating unsuitable hydrologic conditions for vegetative or wetland GDEs.

   ii. Local understanding of recent land use was also considered when vetting the TNC GDE delineations.

c. Fresno Management Areas A & B GSP:

   i. Spring 2015 groundwater contours were overlain on the TNC GDE delineations used for Fresno Management Areas A & B to evaluate areas in which the depth to water exceeded 30 feet, demonstrating unsuitable hydrologic conditions for vegetative or wetland GDEs.

   ii. Local understanding of recent land use was also considered when vetting the TNC GDE delineations.

d. Grassland GSP:

   i. The Ducks Unlimited Wetland Inventory data were used in place of TNC GDE delineations for the identification of possible Wetland GDEs, with the understanding that the TNC GDE delineations for wetlands did not cover the full extent of wetlands in the Grassland Plan area. The Ducks Unlimited wetland delineations were more comprehensive and were developed with ground-truthing surveys which improved accuracy. This deviation in the use of a common dataset for the Subbasin was necessary as this GSP Plan area contains extensive acres of heavily vegetated, shallow seasonal wetlands and therefore required a supplemental approach to GDE delineation beyond the TNC GDE delineation.

   ii. All TNC Vegetative GDEs were also considered "Possible GDEs" and the Grassland GSP Group recognizes the opportunity to gather more local data to refine this position in future GSP updates, if applicable.

e. Northern & Central Delta-Mendota Regions GSP:

   i. Spring 2015 groundwater elevation contours were overlain on the TNC GDE delineations to identify areas in which the depth to water exceeded 30 feet, demonstrating unsuitable hydrologic conditions for vegetative or wetland GDEs.

   ii. GDEs identified within a 100-foot buffer from the San Joaquin River remained "Possible GDEs," as consistent with a typical wetland setback standard in California.[1,2]

   iii. Local understanding of recent land use was also considered when vetting the TNC GDEs.

f. San Joaquin River Exchange Contractors GSP:

   i. Aerial imagery was reviewed for possible mapping errors based on land use and infrastructure. Remaining potential GDE's used Spring 2015 groundwater contours to identify areas in which the groundwater level exceeded the effective rooting depth published by TNC.

8. Subsidence

a. NASA JPL and USBR subsidence maps were provided to the Technical Working Group on October 16th, 2018.

   i. These maps were used for discussion purposes.

b. Subsidence values were produced by each GSP Group, using the most temporally and spatially representative data for their respective GSP on February 7, 2019. The GSP-specific subsidence values are listed in the table below. See the individual GSPs for more detailed information as to how the GSP-specific subsidence values were derived.

GSP Region	Subsidence Rate	Units	Rate	Period of Record	Source	Additional Notes
Aliso	0.15	ft/year	Annual	2011-2017	USBR	Local Surveys and SJRRP monitoring data
Farmers	0.689	ft	Cumulative	2004-2017	USGS and UNAVCO	USGS Fordel-upper aquifer Compaction, Total = 0.031 ft P304-Total Subsidence = 0.72 ft Lower aquifer Compaction, Total = 0.689 ft
Fresno	0.689	ft	Cumulative	2004-2017	USGS and UNAVCO	USGS Fordel-upper aquifer Compaction, Total = 0.031 ft P304-Total Subsidence = 0.72 ft Lower aquifer Compaction, Total = 0.689 ft
Grassland	0.075	ft/year	Annual	2011-2017	USBR and KDSA	The estimated rate of subsidence is based on monitoring points outside of the GSA and therefore has not been verified; Initial data came from USBR, KDSA provided edits to that data.
Northern & Central	Varies by DMC Pool, ranges from 0.7 to -0.88	ft	Cumulative	2003-2013	SLDMWA	Interpolated from 1984 and 2014 Subsidence Surveys for Pools 3-18
Northern & Central	0.53	ft/year	Annual	2014-2018	TRID	Survey data
San Joaquin River Exchange Contractors	0.35	ft	Cumulative	2003-2012	Various datasets	Local surveys, CGPS/CORS/Extensometer data, SJRRP monitoring data, DMC surveys

HCM/Groundwater Conditions

1. Four distinct hydrogeologic layers were initially identified for the Hydrogeological Conceptual Model: shallow layer (0-30 ft), medium layer (30 ft – top of Corcoran Clay), Corcoran Clay, and below Corcoran Clay. However, given that some areas in the Subbasin have more complex hydrogeology than others, these layers were consolidated to three regionally-recognized hydrogeologic features with management areas used further define localized hydrogeologic complexities as needed for SGMA compliance. At the Subbasin level, the three regionally-recognized hydrogeologic features are two principle aquifers – an upper aquifer (unconfined to semi-confined above the Corcoran Clay) and a lower aquifer (confined below the Corcoran Clay), and the intervening regional aquitard known as the Corcoran Clay. This hydrogeologic conceptual model was recommended by the Technical Working Group and approved by the Coordination Committee.
2. SGMA requires a description of the definable bottom of the basin (§354.14 of the GSP Emergency Regulations). The agreed-upon definable bottom of the basin for the Delta-Mendota Subbasin is the base of fresh water consistent with the published definition of the Base of Fresh Water found in R. W. Paige (USGS, Hydrologic Investigations Atlas HA-489, 1973), defined as >3,000 micromhos/cm [µmhos/cm] at 25°C.
3. The current year (2013) seasonal high (spring) ranges from January to April, and seasonal low (fall) ranges from August to October. Data collected during these periods were used for WSE mapping.
4. Data collected during the aforementioned period (as noted in #3, above) were used to prepare water surface contour maps for the upper aquifer. No water surface elevation contour maps were prepared for the lower aquifer for 2013 Fall and Spring (as required by the GSP regulations) due to a lack of aquifer-specific data in most areas of the Subbasin. However, lower aquifer data collected during the aforementioned period were plotted on maps in lieu of the required contour maps. Woodard & Curran / Provost & Pritchard prepared 2013 Fall and Spring WSE contouring for the upper aquifer.

5. Timeframe for upper aquifer WSE mapping defined spring as January 1st to April 8th and fall as September 1st to October 31st.
6. The water year types for water year (WY) 2011 (wet water year), WY2012 (dry water year), and WY2015 (Shasta dry/critical water year) were used to compare WSE maps between GSP Plan areas.
7. Kenneth D. Schmidt & Associate's (KDSA) mapping of interconnected reaches of the San Joaquin River (SJR) based on the SJRRP was used for areas within the SJREC and Grassland GSP Plan areas. A table is included in the Common Chapter showing which SJR reaches are within each GSP Plan area and whether those reaches are gaining or losing. For other GSP Plan areas adjacent to the San Joaquin River, determinations of interconnectedness were provided by those preparing individual GSPs.

Water Budget

1. **Historic Water Budget**

   The historic period was defined as WY2003 through WY2012 by the Technical Working Group on August 8, 2018 and confirmed by the Coordination Committee on August 13, 2018. The historic water budget period was ratified by the Coordination Committee on January 14, 2019 following the Coordination Agreement and Cost Share Agreement being finalized on December 12, 2018.

   Each GSP Group determined the surface and groundwater inputs and outputs using the best available public and local data for each respective GSP Plan area. The historic water budget was split into 1) a land interactions water budget and 2) a groundwater budget. The parameters that each GSP Group evaluated were coordinated and summed to develop the Subbasin-wide water budget used to assess the change in storage in the upper aquifer for each GSP Group on February 15, 2019. For details regarding the approach to developing the Subbasin water budgets using numerical and non-numerical tools and the associated discussions with DWR staff, see Technical Memorandum #3 – Assumptions for the Historic, Current and Projected Water Budgets of the Delta-Mendota Subbasin, Change in Storage Cross-Check, and Sustainable Yield.

   The change in lower aquifer groundwater storage considered the best available subsidence data per GSP Group and the respective specific yield. The lower aquifer change in storage for the Subbasin total was compiled on February 15, 2019.

2. **Current Water Budget**

   The current Water Budget follows similar methodology to the historic water budgets for both upper and lower aquifer change in groundwater storage. The current period was defined as WY2013 by the Technical Working Group on August 8, 2018 and confirmed by the Coordination Committee on August 13, 2018. The current water budget period was formally ratified by the Coordination Committee on January 14, 2019 following the Coordination Agreement and Cost Share Agreement being finalized on December 12, 2018.

3. **Projected Water Budget**

   Each GSP Group developed their own projected water budgets, using a similar comparison strategy to the historic and coordinated water budgets. The Subbasin-wide projected water budget was presented to the Technical Working Group and Coordination Committees on April 1, 2019. For more details regarding determinations of the projected water budget period and associated representative water years, see Technical Memorandum #3 – Assumptions for the Historic, Current and Projected Water Budgets of the Delta-Mendota Subbasin, Change in Storage Cross-Check, and Sustainable Yield.

The representative period, functioning as surrogate years, for a 50(+)-year historic period (WY2014-2070) was proposed by the Technical Working Group on January 15, 2019. Use of DWR's CCF modeling was also coordinated for changes in precipitation, evapotranspiration and streamflows.

For years 1 through 4 of the projected water budgets (WY2014 through WY2017), actual data were used and no CCF's were applied. Water year types are based on the SJR index except for Shasta Critical years. The following water year types will therefore be used: Shasta Critical, Critical, Dry, Below Normal, Above Normal, and Wet, with all designations based on the San Joaquin River Index except Shasta Critical, which is defined by Shasta indices under the Exchange Contract and refuge water supply contracts. For the projected simulation, four water year types were used for representative water years: Average (above or below normal), Dry (dry or critical), Wet and Shasta Critical.

Climate Change Factors for precipitation and evapotranspiration (ET) were applied considering representative historical water years surrogating for the future year until 2070. Fifty-three years of historical data (1965-2017) were used to model the projected water budget. However, to better match the existing hydrologic cycle, the six GSP Groups decided to begin the projected period with the representative year of 1979 for WY2018 (versus 1965 for WY2018). The coordinated representative year pattern is as follows:

- 1979 data represents WY2018
- 1980 data represents WY2019 (and so on until WY2056)
  and
- 1965 data represents WY2057
- 1966 data represents WY2058 (and so on until WY2070)

For years 38-43 (repeated WY2012-2017), the DWR model did not establish precipitation or ET CCF. The following CCFs for ET and precipitation were used:

- WY 2012 used 2001's 2070 CCF
- WY 2013 used 1992's 2070 CCF
- WY 2014 used 1976's 2070 CCF
- WY 2015 used 1977's 2070 CCF
- WY 2016 used 2002's 2070 CCF
- WY 2017 used 2011's 2070 CCF

For years 30 – 43 (repeated WY 2004-2017), the DWR modeling did not establish streamflow CCFs. For this reason, DWR suggested to use surrogate years' CCFs for the projection. The following CCFs were selected for streamflows:

- WY2004 used 2002's 2030 CCF
- WY2005 used 2002's 2030 CCF
- WY2006 used 1998's 2030 CCF
- WY2007 used 1992's 2070 CCF
- WY2008 used 1992's 2070 CCF
- WY2009 used 2002's 2070 CCF
- WY2010 used 2003's 2070 CCF
- WY2011 used 1997's 2070 CCF
- WY2012 used 1992's 2070 CCF
- WY2013 used 1992's 2070 CCF
- WY2014 used 1976's 2070 CCF
- WY2015 used 1977's 2070 CCF
- WY2016 used 2002's 2070 CCF
- WY2017 used 1998's 2070 CCF

9. Sustainable Yield

Methodologies for calculating upper aquifer sustainable yield were discussed by both the Coordination Committee and the Technical Working Group. After reviewing several options for this calculation, the Coordination Committee requested that the Technical Working Group further discuss potential options and provide a recommendation back to the Coordination Committee for adoption. On April 16, 2019, a joint workshop of the Coordination Committee and the Technical Working Group was held to discuss options for upper aquifer sustainable yield estimation and to identify a recommendation.

During the April workshop, several basic concepts and principles were discussed to calculate the upper aquifer sustainable yield value. Consideration was given to several potential options with increasing detail, including some combination of the following: total Subbasin upper aquifer pumping volumes, total Subbasin upper aquifer change in storage (which includes the effects of precipitation, evapotranspiration, and deep percolation), and Subbasin upper aquifer subsurface inflows and outflows. Inflow from certain neighboring subbasins, based on groundwater flow direction, as well as subsurface inflow from the Coast Range at existing gradients (as part of the inflow to the Northern & Central Delta-Mendota GSP area) was considered. Outflow to neighboring subbasins at existing gradients was also considered in certain applicable areas along the Delta-Mendota Subbasin boundary based on groundwater flow characteristics. Outflow from the Aliso GSP area, which lies east of the San Joaquin River, was not considered as outflow for purposes of developing these principles.

The formula for determining upper aquifer sustainable yield was applied to rolled-up Delta-Mendota Subbasin projected water budgets (WY2014-2070) in two categories:

- *Projected Baseline values with Climate Change Factors*
- *Projected Baseline values with Climate Change Factors and Projects and Management Actions*

If the projected baseline values for the Subbasin are expected to have undesirable results, the GSAs are required to implement projects or management actions that will offset the overdraft and result in a sustainable condition. The Technical Working Group recommended calculation of both a projected baseline for sustainable yield with applied climate change factors and a projected baseline for sustainable yield with climate change factors plus planned projects and management actions. Staff completed preliminary calculations for both baselines using average annual values from the Subbasin projected water budgets and following the formula below:

Upper Aquifer Sustainable Yield = Pumping + Change in Storage + (Outflow– Inflow)

The Technical Working Group determined that a +/- 10% factor should be applied to determine a range for the upper aquifer sustainable yield value. The +/- 10% factor is applied based on the percentage difference between the values from change in storage contour mapping (prepared by Provost & Pritchard) and reported changes in storage from the Subbasin consolidated historic water budgets (WY2003-2012) for the upper aquifer.

In summary, the most detailed range for the upper aquifer sustainable yield is calculated using the above formula for both categories of water budgets: projected baseline with climate change factors and projected baseline with climate change factors plus projects and management actions. The 10% factor is applied to the results for both categories. This range aims to demonstrate the Subbasin's upper aquifer sustainable yield without implementing any projects and management actions (low end of range) and how the Subbasin's upper aquifer sustainable yield will be impacted by implementing planned projects and management actions (high end of range).

Within the Delta-Mendota Subbasin, the distribution of known lower aquifer water level data and extraction volume data are limited and not sufficient to allow for a calculation of lower aquifer sustainable yield. The Technical Working Group therefore look to studies and/or analysis conducted in adjoining subbasins with similar hydrogeologic conditions for consideration in developing a preliminary sustainable yield estimate. A recent study conducted in the adjoining Westside Subbasin was identified and selected for use in developing this preliminary estimate.

The Westlands Water District GSA completed a recent study using groundwater modeling, in conjunction with the Westside Subbasin GSP development, to estimate sustainable yield for that subbasin. An analysis of their data reflected an initial assumption of lower aquifer sustainable yield equivalent to approximately 0.35 acre-feet per acre within the Westside Subbasin (Westlands Water District GSA, *Groundwater Management Strategy Concepts* presentation to the WWD Board on October 16, 2018). Using this analysis, a slightly lower (and therefore more conservative) sustainable yield value for the lower aquifer was selected (0.33 acre-feet per acre), amounting to approximately 250,000 acre-feet per year over the approximately 750,000-acre Delta-Mendota Subbasin.

The lower criteria for a lower aquifer sustainable yield estimation compared to that considered by Westlands Water District reflects DWR's classification of the Delta-Mendota Subbasin as critically overdrafted due to the subsidence issues and was therefore considered to be more protective against the potential for future inelastic land subsidence. After more data are obtained in future years, the lower aquifer sustainable yield value may undergo revisions.

For both the upper and lower aquifer sustainable yield, the Delta-Mendota Coordination Committee acknowledges that sustainable management criteria will be the primary indicator for managing lower aquifer extractions.

10. Boundary Flows

Boundary flows were evaluated by comparing inflows and outflows assessed by each GSP Group's water budget analyses and associated data, as well as groundwater flow trends from groundwater contours and hydrogeologist input. Each set of neighboring GSP Groups had independent meetings to coordinate and compare their respective contributions to inflows and outflows, and the results were provided and discussed by the Delta-Mendota Subbasin's Technical Working Group and Coordination Committee. More details on the applicable datasets can be found in the water budgets and groundwater contours sections of this Technical Memo.

TECHNICAL MEMORANDUM #2

RE: Assumptions for Hydrogeological Conceptual Model of the Delta-Mendota Subbasin

PREPARED BY: Woodard & Curran

DATE: July 25, 2019

During development of the six coordinated Groundwater Sustainability Plans (GSPs) for the Delta-Mendota Subbasin (Subbasin), the twenty-three Groundwater Sustainability Agencies (GSAs) in the Subbasin agreed upon methodologies and assumptions for water budgets, change in storage, and sustainable yield. The common data and methodologies required in Water Code Section 10727.6 and Title 23, California Code of Regulations, Section 357.4 to prepare coordinated plans and utilized in preparation of the Delta-Mendota Subbasin GSPs are set forth in Technical Memoranda. Each of the individual Memoranda satisfies a requirement agreed upon in the Coordination Agreement and, collectively when combined with the Coordination Agreement, provides an explanation of how the six Subbasin GSPs implemented together satisfy the requirements of the Sustainable Groundwater Management Act (SGMA) for the entire Subbasin.

The Technical Memoranda will be utilized by the Coordination Agreement Parties (representing the twenty-three GSAs in the Subbasin) during the implementation of their GSPs in order to ensure coordination of the GSPs. The Coordination Committee is responsible for ongoing review and updating of the Technical Memoranda, as needed, during GSP implementation.

The following common assumptions for the Delta-Mendota Hydrogeological Conceptual Model were agreed upon by the Delta-Mendota Subbasin Technical Working Group and approved by the Delta-Mendota Coordination Committee over the period extending from December 2017 through April 2019.

1. Four distinct hydrogeologic layers were initially identified for the Hydrogeological Conceptual Model: shallow layer (0-30 ft), medium layer (30 ft – top of Corcoran Clay), Corcoran Clay, and below Corcoran Clay. However, given that some areas in the Subbasin have more complex hydrogeology than others, these layers were consolidated to three regionally-recognized hydrogeologic features with management areas used further define localized hydrogeologic complexities as needed for SGMA compliance. At the Subbasin level, the three regionally-recognized hydrogeologic features are two principle aquifers – an upper aquifer (unconfined to semi-confined above the Corcoran Clay) and a lower aquifer (confined below the Corcoran Clay), and the intervening regional aquitard known as the Corcoran Clay. This hydrogeologic conceptual model was recommended by the Technical Working Group and approved by the Coordination Committee.
2. SGMA requires a description of the definable bottom of the basin (§354.14 of the GSP Emergency Regulations). The agreed-upon definable bottom of the basin for the Delta-Mendota Subbasin is the base of fresh water consistent with the published definition of the Base of Fresh Water found in R. W. Paige (USGS, Hydrologic Investigations Atlas HA-489, 1973), defined as >3,000 micromhos/cm [µmhos/cm] at 25°C.
3. For the required water surface elevation mapping for the defined current year (WY2013), data from January to April were used for the seasonal high (spring) mapping, and data from August to October were used for the seasonal low (fall) mapping to provide sufficient spatial distribution of data for mapping (recommended by the Technical Working Group during the period from March 2018 through August 2018).
4. Data collected during the aforementioned period (as noted in #3, above) were used to prepare water surface contour maps for the upper aquifer. No water surface elevation contour maps were prepared for the lower aquifer for 2013 Fall and Spring (as required by the GSP regulations) due to a lack of aquifer-specific data in most areas of the Subbasin. However, lower aquifer data collected during the aforementioned period were plotted on maps in lieu of the required contour maps.

5. The Technical Working Group used WY2011 (wet water year), WY2012 (dry water year), and WY2015 (Shasta critical water year) to compare groundwater elevation mapping prepared by the various GSP Groups for their respective GSP Plan areas.
6. Kenneth D. Schmidt & Associates mapping of interconnected reaches of the San Joaquin River based on the San Joaquin River Restoration Program was used for areas within the SJREC and Grassland GSP Plan areas. For other GSP Plan areas adjacent to the San Joaquin River, determinations of interconnectedness were provided by those preparing individual GSPs. A table will be provided showing which San Joaquin River reaches are within each GSP Plan area and whether those reaches are interconnected. If necessary to implement the sustainability goal of the Subbasin, the GSAs will coordinate estimating volumes of gains and losses at these reaches of the San Joaquin River.

TECHNICAL MEMORANDUM #3

RE: Assumptions for the Historic, Current and Projected Water Budgets of the Delta-Mendota Subbasin, Change in Storage Cross-Check and Sustainable Yield

PREPARED BY: Woodard & Curran

DATE: July 25, 2019

During development of the six coordinated Groundwater Sustainability Plans (GSPs) for the Delta-Mendota Subbasin (Subbasin), the twenty-three Groundwater Sustainability Agencies (GSAs) in the Subbasin agreed upon methodologies and assumptions for water budgets, change in storage, and sustainable yield. The common data and methodologies required in Water Code Section 10727.6 and Title 23, California Code of Regulations, Section 357.4 to prepare coordinated plans and utilized in preparation of the Delta-Mendota Subbasin GSPs are set forth in Technical Memoranda. Each of the individual Memoranda satisfies a requirement agreed upon in the Coordination Agreement and, collectively when combined with the Coordination Agreement, provides an explanation of how the six Subbasin GSPs implemented together satisfy the requirements of the Sustainable Groundwater Management Act (SGMA) for the entire Subbasin.

The Technical Memoranda will be utilized by the Coordination Agreement Parties (representing the twenty-three GSAs in the Subbasin) during the implementation of their GSPs in order to ensure coordination of the GSPs. The Coordination Committee is responsible for ongoing review and updating of the Technical Memoranda, as needed, during GSP implementation.

The following common assumptions were utilized by each GSP Group in the Subbasin in developing the historic and projected water budgets for their respective GSP Plan areas. These GSP-specific water budgets were then compiled (rolled-up) to the Subbasin level for inclusion in the Common Chapter. Also included herein are the assumptions used in developing Subbasin-level sustainable yield estimates for each principal aquifer. These assumptions were recommended by the Delta-Mendota Subbasin Technical Working Group and approved by the Delta-Mendota Coordination Committee.

1. Water Budgets

On September 25, 2017, the Delta-Mendota Subbasin Technical Working Group met with Trevor Joseph (Senior Engineering Geologist) and Mark Nordberg (Senior Engineering Geologist) from the California Department of Water Resources (DWR) to discuss how the development of six GSPs for the Subbasin will be coordinated to implement the best available science while also coordinating to use the same data and methodologies. DWR expressed concerns regarding coordination between those GSPs using a numerical model and those using a non-numerical (spreadsheet) model. Mr. Joseph advised that SGMA requires sustainability for the entire subbasin and was concerned about coordinating a subbasin water budget. The SJREC have experience sustainably managing groundwater using a non-numerical model. A follow-up meeting took place on November 17, 2017 with DWR representatives Trevor Joseph, Tyler Hatch (Senior Engineer) and Amanda Peisch-Derby (Regional SGMA Coordinator) to showcase how this spreadsheet model has been used. It was further discussed that the hydrogeologic principles and equations used for both types of modeling in the Delta-Mendota Subbasin are the same. DWR agreed that coordination amongst the GSP Groups, ensuring use of the same data and methodologies, can be achieved for SGMA modeling purposes in the Subbasin.

Historic Water Budget

The historic period adopted by the Subbasin Coordination Committee was defined as Water Year (WY) 2003 through WY2012. A water year is the period beginning October 1st and ending on September 30th of the subsequent year. The historic water budget period was ratified by the Coordination Committee on January 14, 2019.

Each GSP Group in the Delta-Mendota Subbasin developed land surface water budgets and groundwater budgets for the historic period using the best available public and local data for each respective GSP Plan area. The parameters (specific inputs and outputs) that each GSP Group evaluated were coordinated and summed to develop the Subbasin-wide water budget and to estimate the change in groundwater storage in the upper aquifer in each GSP Plan area. Parameters included pumping/tile drainage, subsurface inflows/outflows, and deep percolation of precipitation and applied surface water. Estimates of changes in groundwater levels in the upper aquifer over the historic water budget period were also utilized to estimate change in groundwater storage. The estimated change in groundwater storage for the upper aquifer from the compiled water budgets was compared to that estimated from changes in groundwater level. For purposes of developing a change in groundwater storage in the upper aquifer over the historic water budget period, the estimates developed from the water budget methodology were used for the Subbasin.

Development of the change in lower aquifer storage value was limited as a result of a lack of available aquifer-specific groundwater level data in most areas of the Subbasin. As a result, a methodology for estimating change in lower aquifer storage from subsidence, along with changes in potentiometric head (where groundwater level data were available), was used. For GSP Plan areas where groundwater level data were not available to support calculations of change in lower aquifer storage, change in land surface elevations was used as a proxy for estimates of change in lower aquifer storage. The best available subsidence data by GSP Group and representative specific yield values (defined as the volume of water released from storage by an unconfined aquifer per unit surface area of aquifer per unit decline of the water table) were used to estimate change in lower aquifer storage from subsidence.

Change in Storage Cross-Check

Groundwater elevation contour maps were developed for the upper aquifer for Spring 2003 and Spring 2013 to assess changes in groundwater storage during the historic and current water budget periods. The contour maps were used to estimate upper aquifer change in storage during the historic and current period by subtracting the Spring 2013 contours from the Spring 2003 contours and multiplying the change in groundwater elevations by GSP Plan area and specific yield of the aquifer. Estimates were made for each GSP Plan area and compared to the overall change in storage estimated in the individual GSP historic and current groundwater budgets. The results of the two methodologies were comparable (within 20%).

Change in land surface elevation is used as a proxy for lower aquifer change in storage using a similar methodology, multiplying the change in land surface elevation between 2003 and 2013 by the area covered by individual GSP Plan areas to estimate the change in lower aquifer storage.

Current Water Budget

The current year for the associated water budget was set as WY2013 by the Delta-Mendota Technical Working Group on August 8, 2018 and confirmed by the Delta-Mendota Coordination Committee on August 13, 2018. The current water budget and associated changes in storage (by principal aquifer) were calculated in the same manner as the historic water budgets. The current water budget period was ratified by the Coordination Committee.

Projected Water Budget

Each GSP Group developed their own GSP-specific projected water budgets using a similar methodology to the historic and current water budgets. GSP-specific water budgets were compiled at the Subbasin level, and the Subbasin projected water budget was recommended and approved at a joint meeting of the Delta-Mendota Technical Working Group and Coordination Committee.

Per SGMA and the GSP regulations, the projected water budget period begins with the year subsequent to the current water budget year and extends for a projection period of at least 50 years to WY2070 for application of the required climate change factors. For the Delta-Mendota Subbasin, the current water budget is WY2013, and the projected water budget period is WY2014 through WY2070.

As future hydrology (e.g. precipitation totals) is not known, historic hydrology is used to simulate projected future hydrology. As a result, each year in the projected water budget is assigned a representative water year from the historic period. For example, WY2018 is assumed to have hydrology similar to that of WY1979; WY2019 is assumed to have hydrology similar to that of WY1980; and so forth. The pattern of historic hydrology used to simulate future hydrology is established based on actual hydrology from WY2014 - WY2017 (known water year types at the start of the projected water budget period). This resulted in the following projected hydrologic pattern.

For the first four years of the projected water budget (WY2014 through WY2017), actual data are used and no climate change factor is applied. For WY2018 through WY2070, the following representative water year sequencing is used:

- WY2018 is equivalent to WY1979.
- Each subsequent projected water year (WY2019 through WY2056) will follow the equivalent subsequent historic water year (e.g. WY2019 is equivalent to WY1980; WY2020 is equivalent to WY1981, and so forth, with WY2056 being equivalent to WY2017).
- WY2057 is equivalent to WY1965 with each subsequent water year (WY2058 through WY2070) equivalent to the subsequent historic water year (with WY2070 being equivalent to WY1978).

Representative water years used the associated historic water year types for assumptions relative to projected hydrology (precipitation, stream flows, and evapotranspiration [ET]). Water year types were based on the San Joaquin River Index except for Shasta Critical Years, which required simulation of the SJREC and wildlife refuge surface water deliveries. Therefore, in summary, the following water year types were assigned to projected water years based on the associated representative water year type: Shasta Critical, Critical, Dry, Below Normal, Above Normal, and Wet, with all designations based on the San Joaquin River Index, except Shasta Critical defined by Shasta index (as recommended by the Technical Working Group). For projected simulations, water year types were 'lumped' into four categories as follows: wet, average (above and below normal), dry (dry and critical) and Shasta critical (as recommended by the Technical Working Group).

As agreed, upon, Climate Change Factors (CCFs) for precipitation and ET were applied considering representative historical year types surrogating for future years through WY2070. For projected years WY2038 through WY2043 (repeated WY2012 through WY2017), DWR did not establish precipitation or ET CCFs. Based on conversations with DWR, the following CCFs for precipitation and ET were used for this intervening period:

- WY 2012 used the 2001 2070 CCF
- WY 2013 used the 1992 2070 CCF
- WY 2014 used the 1976 2070 CCF
- WY 2015 used the 1977 2070 CCF
- WY 2016 used the 2002 2070 CCF
- WY 2017 used the 2011 2070 CCF

For projected years WY2030 - WY2043 (repeated WY2004 - WY2017), DWR did not establish streamflow CCFs. For this reason, DWR suggested to use surrogate years' CCFs for the projected period. The following CCFs were selected for streamflows:

- WY 2004 used the 2002 2030 CCF
- WY 2005 used the 2002 2030 CCF
- WY 2006 used the 1998 2030 CCF
- WY 2007 used the 1992 2070 CCF
- WY 2008 used the 1992 2070 CCF
- WY 2009 used the 2002 2070 CCF
- WY 2010 used the 2003 2070 CCF
- WY 2011 used the 1997 2070 CCF
- WY 2012 used the 1992 2070 CCF
- WY 2013 used the 1992 2070 CCF
- WY 2014 used the 1976 2070 CCF
- WY 2015 used the 1977 2070 CCF
- WY 2016 used the 2002 2070 CCF
- WY 2017 used the 1998 2070 CCF

The projected water budget period and associated representative water years were recommended by the Technical Working Group. Use of DWR's CCFs was also coordinated, and it was agreed that CCFs will only be applied to hydrology.

2. Sustainable Yield

The following methodologies were recommended by the Delta-Mendota Technical Working Group and approved by the Coordination Committee for establishing the required sustainable yield estimate for each principal aquifer:

Upper Aquifer Sustainable Yield

The following formula was agreed upon for the calculation of the sustainable yield of the upper aquifer:

Sustainable Yield = (Pumping + Change in Storage) + (Outflow – Inflow)

Data used in the calculation are from the Delta-Mendota Subbasin compiled projected water budget with Climate Change Factors and Projects/Management Actions, as well as Baseline Projected Water Budget with Climate Change Factors. A ± 10% factor was applied to the resulting sustainable yield estimate; this factor was estimated based on the percent difference in the WY2003-2012 upper aquifer change in storage calculations between the compiled historic water budget and the estimate of change in storage utilizing change in groundwater level contours cross-check analysis (see above). Data incorporated into the equation are the average annual values from the indicated projected water budgets (WY2014 - WY2070) using only upper aquifer values.

Sustainable management criteria (Minimum Thresholds and Measurable Objectives) will be the primary indicator governing upper aquifer extractions. The sustainable yield estimates will be updated as part of the five-year GSP review.

Lower Aquifer Sustainable Yield

Within the Delta-Mendota Subbasin, the distribution of known lower aquifer water level data and extraction volume data are limited and not sufficient to allow for a calculation of lower aquifer sustainable yield. A Northern & Central Delta-Mendota Region Management Committee memo dated April 10, 2019 outlined the alternative method used to estimate sustainable yield method for the lower aquifer and is summarized below.

The Westlands Water District GSA has completed a recent study using groundwater modeling, in conjunction with the Westside Subbasin GSP development, to estimate sustainable yield for that subbasin. Based on an analysis of their data and reflected an initial assumption of lower aquifer sustainable yield equivalent to approximately 0.35 acre-feet per acre within the Westside Subbasin (Westlands Water District GSA, Groundwater Management Strategy Concepts presentation to the WWD Board on October 16, 2018). Using this analysis, a slightly lower sustainable yield value for the lower aquifer was selected (0.33 acre-feet per acre), amounting to approximately 250,000 acre-feet per year over the approximately 750,000-acre Delta-Mendota Subbasin.

The lower criteria for a lower aquifer sustainable yield estimation compared to that considered by Westlands Water District reflects DWR's classification of the Delta-Mendota Subbasin as critically-overdrafted due to the subsidence issues. After more data are obtained in future years, the lower aquifer sustainable yield value may undergo revisions.

3. Other

The Technical Working Group of the Subbasin Coordination Committee discussed that not-yet implemented plans or programs (e.g. Delta conveyance, Updates to the Bay-Delta Water Quality Control Plan/SED, proposed large storage projects, etc.) would not be incorporated into the current GSPs. However, projects or programs may be qualitatively incorporated or described in individual GSPs, and such programs will be monitored during the next five years and incorporated into the GSPs in future updates as appropriate.

TECHNICAL MEMORANDUM #4

RE: Assumptions for Delta-Mendota Subbasin Management Areas, Sustainability Management Criteria

PREPARED BY: Woodard & Curran

DATE: July 25, 2019

During development of the six coordinated Groundwater Sustainability Plans (GSPs) for the Delta-Mendota Subbasin (Subbasin), the twenty-three Groundwater Sustainability Agencies (GSAs) in the Subbasin agreed upon methodologies and assumptions for water budgets, change in storage, and sustainable yield. The common data and methodologies required in Water Code Section 10727.6 and Title 23, California Code of Regulations, Section 357.4 to prepare coordinated plans and utilized in preparation of the Delta-Mendota Subbasin GSPs are set forth in Technical Memoranda. Each of the individual Memoranda satisfies a requirement agreed upon in the Coordination Agreement and, collectively when combined with the Coordination Agreement, provides an explanation of how the six Subbasin GSPs implemented together satisfy the requirements of the Sustainable Groundwater Management Act (SGMA) for the entire Subbasin.

The Technical Memoranda will be utilized by the Coordination Agreement Parties (representing the twenty-three GSAs in the Subbasin) during the implementation of their GSPs in order to ensure coordination of the GSPs. The Coordination Committee is responsible for ongoing review and updating of the Technical Memoranda, as needed, during GSP implementation.

The following common assumptions were utilized by each GSP Group in the Subbasin for preparing a subbasin-level description of management areas and sustainable management criteria.

1. Management Areas

The Coordination Committee left management areas and management of their respective GSPs to the six GSP Groups. Management areas were determined individually by each GSP Group with Woodard & Curran preparing a map showing all management areas ('sum of the parts' approach).

2. Sustainable Management Criteria

Per the GSP Regulations, definitions of undesirable results must be provided at the Subbasin level. The Technical Working Group defined these as follows:

- Chronic Lowering of Groundwater Levels: Significant and unreasonable chronic change in water levels, as defined by each GSP Group, that has an impact on the beneficial users of groundwater in the Subbasin through either intra- and/or inter-basin actions.
- Long-term Reduction of Groundwater Storage: Significant and unreasonable chronic decrease in groundwater storage, as defined by each GSP Group, that has an impact on the beneficial users of groundwater in the Subbasin through either intra- and/or inter-basin actions.
- Degraded Water Quality: Significant and unreasonable degradation of groundwater quality, as defined by each GSP Group, that has an impact on the beneficial users of groundwater in the Subbasin through either intra- and/or inter-basin actions and/or activities.
- Depletions of Interconnected Surface Water: Depletions of interconnected surface water, as defined by each GSP Group, that have significant and unreasonable adverse impacts on the beneficial uses of surface water

- Land Subsidence: Changes in ground surface elevation that cause damage to critical infrastructure that would cause significant and unreasonable reductions of conveyance capacity, damage to personal property, impacts to natural resources or create conditions that threaten public health and safety.
- Seawater Intrusion: The Coordination Committee recognized that the Subbasin is not in a coastal location and therefore seawater intrusion is unable to occur and therefore a definition of an undesirable result is not necessary.

Each GSP Group individually defined significant and unreasonable for each sustainability indicator, as well as established sustainability goals, interim milestones, minimum thresholds and measurable objectives. This process was discussed during the February 2019 meetings of the Technical Working Group, and ultimately recommended and approved by the Coordination Committee.

TECHNICAL MEMORANDUM #5

RE: Assumptions for Delta-Mendota Subbasin Monitoring Network

PREPARED BY: Woodard & Curran

DATE: July 25, 2019

During development of the six coordinated Groundwater Sustainability Plans (GSPs) for the Delta-Mendota Subbasin (Subbasin), the twenty-three Groundwater Sustainability Agencies (GSAs) in the Subbasin agreed upon methodologies and assumptions for water budgets, change in storage, and sustainable yield. The common data and methodologies required in Water Code Section 10727.6 and Title 23, California Code of Regulations, Section 357.4 to prepare coordinated plans and utilized in preparation of the Delta-Mendota Subbasin GSPs are set forth in Technical Memoranda. Each of the individual Memoranda satisfies a requirement agreed upon in the Coordination Agreement and, collectively when combined with the Coordination Agreement, provides an explanation of how the six Subbasin GSPs implemented together satisfy the requirements of the Sustainable Groundwater Management Act (SGMA) for the entire Subbasin.

The Technical Memoranda will be utilized by the Coordination Agreement Parties (representing the twenty-three GSAs in the Subbasin) during the implementation of their GSPs in order to ensure coordination of the GSPs. The Coordination Committee is responsible for ongoing review and updating of the Technical Memoranda, as needed, during GSP implementation.

The following common assumptions and approaches were utilized in developing the required Subbasin monitoring network for sustainability indicators:

- The required Subbasin-level monitoring networks will be a compilation of networks developed by each individual GSP Group.
- The compilation of the individual GSP monitoring networks will provide sufficient data in order to develop required water surface elevation contouring for each principal aquifer in the Subbasin, if applicable.
- The GSP groups will use CASGEM monitoring network data for 2018 and 2019 data collection and will supplement with locally collected data where available.
- Each monitoring location or point within the GSP network will be monitored, at a minimum, at the agreed upon frequency for each of the data types.
- Field Collection will follow agreed-upon protocols which may be the same as, or equal to, data collection protocols (i.e. industry standards and best management practices).
- For non-monitored data to be reported as part of the annual reports (e.g. groundwater extractions, surface water deliveries), actual metered data will be used where such data exists, and when direct data do not exist, estimated quantities will be calculated based on existing indirect data (e.g. electrical usage, crop demand, ET) and/or other industry best practices.
- Seasonal high groundwater elevation data will be collected between February and April, and seasonal low groundwater elevation data will be collected between September and October.
- Each GSP Group may use supplemental data in addition to the SGMA-required monitoring network documented in their GSP in order to comply with these requirements and those set forth in the Coordination Agreement.

- Individual data gaps in the monitoring networks and monitoring data identified in the GSPs will progressively be addressed by the applicable GSA or GSP Group during the 20-year GSP implementation timeframe (2020 to 2040).

TECHNICAL MEMORANDUM #6

RE: Coordination of the Delta-Mendota Subbasin Data Management System

PREPARED BY: Woodard & Curran

DATE: July 25, 2019

During development of the six coordinated Groundwater Sustainability Plans (GSPs) for the Delta-Mendota Subbasin (Subbasin), the twenty-three Groundwater Sustainability Agencies (GSAs) in the Subbasin agreed upon methodologies and assumptions for water budgets, change in storage, and sustainable yield. The common data and methodologies required in Water Code Section 10727.6 and Title 23, California Code of Regulations, Section 357.4 to prepare coordinated plans and utilized in preparation of the Delta-Mendota Subbasin GSPs are set forth in Technical Memoranda. Each of the individual Memoranda satisfies a requirement agreed upon in the Coordination Agreement and, collectively when combined with the Coordination Agreement, provides an explanation of how the six Subbasin GSPs implemented together satisfy the requirements of the Sustainable Groundwater Management Act (SGMA) for the entire Subbasin.

The Technical Memoranda will be utilized by the Coordination Agreement Parties (representing the twenty-three GSAs in the Subbasin) during the implementation of their GSPs in order to ensure coordination of the GSPs. The Coordination Committee is responsible for ongoing review and updating of the Technical Memoranda, as needed, during GSP implementation. This Technical Memorandum describes the development and anticipated use of the coordinated Subbasin Data Management System (DMS) for GSP implementation.

<u>Coordinated Data Management System</u>

As required in Section 352.6, Data Management System, of the GSP regulations, the Delta-Mendota Subbasin GSAs will develop and maintain a data management system that is capable of storing and reporting information relevant to the reporting requirements, implementation of the GSPs, and the monitoring networks of the Subbasin. Additionally, per Section 354.4, Reporting Monitoring Data to the California Department of Water Resources (DWR), all monitoring data are to be stored in a DMS with copies of the monitoring data included in the annual report and submitted electronically on forms provided by DWR. Recognizing that GSP implementation, including annual reporting, will require some efforts at the subbasin level, the 23 GSAs overlying the Delta-Mendota Subbasin have chosen to develop a coordinated DMS that can be utilized by each GSP Group for management of their data but which will allow for the required compilation of data sets for preparation of Subbasin annual reports. The coordinated DMS, once developed, will provide a generic framework that can be used by any GSP Group or GSA in the Subbasin for individual data management while allowing for consistent formatting and the simplified uploading of compiled datasets into the Subbasin-wide coordinated DMS.

The Parties have also developed and will maintain separate data storage processes or Data Management Systems. Each separate DMS developed for each GSP will store information related to implementation of each individual GSP, monitoring network data and monitoring sites requirements, and water budget data requirements. Each system will be capable of reporting all pertinent information to the respective GSA and/or GSP Group, and ultimately to the Coordination Committee. After providing the Coordination Committee with data from the individual GSPs, the Subbasin Plan Manager and Coordination Committee will ensure the data are stored and managed in a coordinated manner throughout the Subbasin and reported to DWR on an annual basis.

Leading up to the development of the DMS, the Subbasin used an *ad hoc* DMS working group and survey to develop a conceptual design for the software requirements. This was followed by the software vendor creating wireframes to communicate the functionality of the DMS. This *ad hoc* working group developed data standards for each data type to make the aggregation feasible at a subbasin level and established weekly calls to develop import wizards, attribute tables, interpretations of reporting requirements, and an annual report format. Data provided by Santa Nella County Water District were used to beta-test the completed DMS prior to release as a generic system for Subbasin-wide use.

The DMS includes permissions and business rules so each GSP can only upload data for their GSP based upon usernames and roles. GSP Groups, or GSAs within a GSP Group, are also not allowed to see other GSP Groups' data until all annual reporting has been completed and accepted by the Plan Manager. DMS development is ongoing, with development concurrent with final GSP development, and has been designed to support the needs of the severely disadvantaged communities, disadvantaged communities, and GSAs within the Subbasin. The DMS is scheduled to be completed for use in developing annual reports by January 2020.

The DMS constructed for the Delta-Mendota Subbasin is a secured web-based application hosted on Amazon Web Services (AWS). The DMS focuses on five core business requirements including: centralized data warehouse, security of data, permissioned based access, data visualization and reporting. Other goals of the DMS focus around improving data collection/aggregation processes, creating data standards, gaining efficiencies in reporting and improving data sharing with stakeholders. The DMS is designed to aggregate data through import processes by GSP to support data visualization and annual report generation.

Underlying the web application is a relationship database used to store the information aggregated from GSPs across primary data types identified to support monitoring and Annual Report development. Those data types include groundwater extractions, surface water deliveries, groundwater storage, groundwater elevations, groundwater quality, interconnected surface water and land subsidence. The web application functionality includes an embedded GIS viewer, screens to view tables of time series data, and charting capabilities for hydrographs. The embedded GIS viewer contains functionality to store map layers such as reference data, GSA/GSP boundaries and derived information such as water level contours.

In order to facilitate data synthesis, the GSP Groups agreed on the following frequencies for monitoring data collection:

- Groundwater elevations – twice a year (seasonal high and seasonal low)
- Interconnected surface water – twice a year (seasonal high and seasonal low)
- Groundwater quality – once a year
- Land subsidence – continuous monitoring sites or by Management Area

These datasets will be augmented with other data collection required for annual report preparation, including estimates of groundwater extractions and surface water diversions.

Additionally, the GSP Groups agreed to utilize the same general monitoring protocols or similar industry standards to ensure that the data were collected in a consistent and coordinated fashion. All monitoring locations in the Delta-Mendota Subbasin were assigned a unique identifier in the DMS. The number system is in a format of ##-####, where the first two digits indicates which GSA the monitoring location is associated with, and the subsequent four digits indicate the specific monitoring location in that GSA area. The general methodology agreed upon for data import and management is as follows:

- Each GSA collects their respective data per agreed-upon protocols and transmits it to the GSA representative.
- Each GSA representative then compiles the data and conducts a quality control check.
- The GSA representative transmits the compiled data set to the GSP Lead or Representative, who then aggregates the data from all GSAs and conducts a second quality control check.
- The GSP Lead or Representative uploads the data set into the DMS using import wizards designed specifically for this process.

- The Subbasin Plan Manager then uses the data in the DMS to compile information as required for the annual report.

Compiled data sets from the DMS will be augmented with required maps generated externally to produce the required annual report. Mapping prepared outside the DMS will be subsequently imported into the DMS as GIS files to ensure all data are kept in one place.

The DMS will be maintained by the San Luis & Delta-Mendota Water Authority, while acting as the Plan Manager, with a contract with the software vendor for hosting, maintenance and future updates. Each GSP will pay a maintenance fee for the continued hosting and support of the Subbasin coordinated DMS.

The Subbasin-level DMS, as described herein, may be supplemented by additional DMSs developed and maintained by each GSP Group or GSA in the Subbasin. The reader is referred to each of the six Subbasin GSPs for specific information relative to data collection and management in each GSP Plan area.

DELTA-MENDOTA SGMA

TECHNICAL MEMORANDUM #7

RE: Adoption and Use of the Subbasin Coordination Agreement

PREPARED BY: Woodard & Curran

DATE: July 25, 2019

During development of the six coordinated Groundwater Sustainability Plans (GSPs) for the Delta-Mendota Subbasin (Subbasin), the twenty-three Groundwater Sustainability Agencies (GSAs) in the Subbasin agreed upon methodologies and assumptions for water budgets, change in storage, and sustainable yield. The common data and methodologies required in Water Code Section 10727.6 and Title 23, California Code of Regulations, Section 357.4 to prepare coordinated plans and utilized in preparation of the Delta-Mendota Subbasin GSPs are set forth in Technical Memoranda. Each of the individual Memoranda satisfies a requirement agreed upon in the Coordination Agreement and, collectively when combined with the Coordination Agreement, provides an explanation of how the six Subbasin GSPs implemented together satisfy the requirements of the Sustainable Groundwater Management Act (SGMA) for the entire Subbasin.

This Technical Memorandum describes the Delta-Mendota Subbasin governance structure, participating parties, the Delta-Mendota Subbasin Coordination Agreement (Coordination Agreement), and details of this Coordination Agreement. Each GSA in the Subbasin is included in this memorandum. Additional details of the organization, management structure, and legal authority of each GSA and their associated GSPs, and accompanying GSA boundary maps, are described in the Delta-Mendota Subbasin Common Chapter (Common Chapter). Descriptions of intrabasin and interbasin coordination agreements in place for the development and implementation of the GSPs overlying the Subbasin are also referenced.

1. GSP and Coordination Agreement Submission

A Delta-Mendota Subbasin Common Chapter has been developed to "knit" the six Delta-Mendota GSPs together for cohesive implementation. The Common Chapter includes a separate signature page that contains a disclosure statement and professional stamp for the consultant charged with compiling the chapter (Woodard & Curran), as agreed upon by the Technical Working Group on April 17, 2018 and January 15, 2019. Each Subbasin GSP is stamped and signed by the professional overseeing their preparation. The Common Chapter was developed as part of a collaborative process, with input from the various GSAs, technical consultants, and stakeholders. The Coordination Agreement, Common Chapter, and Technical Memoranda collectively serve as the mechanism through which the GSAs and individual GSPs are coordinated during implementation.

The GSAs have agreed to submit their respective GSPs to the California Department of Water Resources (DWR) through the Delta-Mendota Subbasin Coordination Committee (Coordination Committee) and the Plan Manager, along with all developed Common Chapter and Technical Memoranda, by January 31, 2020. When submitted to DWR, the collective documents will be available for public review and comment as part of the 60-day public comment period per SGMA regulations.

2. GSP Groups and GSAs in the Delta-Mendota Subbasin

Below is a summary of the six GSP Groups and twenty-three GSAs (and their respective signatories) to the Coordination Agreement. Some signatories (also referred to as parties) are participating in multiple GSAs and/or GSPs.

Northern & Central Delta-Mendota Region GSP

- Patterson Irrigation District GSA
    - Patterson Irrigation District, Twin Oaks Irrigation District
- West Stanislaus Irrigation District GSA
    - West Stanislaus Irrigation District
- DM-II GSA
    - Del Puerto Water District, Oak Flat Water District
- City of Patterson GSA
    - City of Patterson
- Northwestern Delta-Mendota GSA
    - Merced County, Stanislaus County
- Central Delta-Mendota GSA
    - San Luis Water District, Santa Nella County Water District, Panoche Water District, Mercy Springs Water District, Tranquillity Irrigation District, Merced County, Fresno Slough Water District, Fresno County, Eagle Field Water District, Pacheco Water District
- Widren Water District GSA
    - Widren Water District
- Oro Loma Water District GSA
    - Oro Loma Water District

San Joaquin River Exchange Contractors (SJREC) GSP

- San Joaquin River Exchange Contractors Water Authority GSA
    - Central California Irrigation District, Columbia Canal Company, Firebaugh Canal Water District, San Luis Canal Company
- Turner Island Water District-2 GSA
    - Turner Island Water District
- City of Mendota GSA
    - City of Mendota
- City of Firebaugh GSA
    - City of Firebaugh
- City of Los Banos GSA
    - City of Los Banos
- City of Dos Palos GSA
    - City of Dos Palos
- City of Gustine GSA
    - City of Gustine
- City of Newman GSA
    - City of Newman
- Madera County GSA
    - Madera County
- Portion of Fresno County Management Area B GSA
    - Fresno County
- Portion of Merced County – Delta-Mendota GSA
    - Merced County

Grassland GSP

- Grassland GSA
    - Grassland Water District, Grassland Resource Conservation District
- Portion of Merced County GSA
    - Merced County

Farmers Water District GSP

- Farmers Water District GSA
    - Farmers Water District

Fresno County GSP

- Fresno County Management Area A GSA
    - Fresno County
- Fresno County Management Area B GSA
    - Fresno County

Aliso Water District GSP

- Aliso Water District GSA
    - Aliso Water District

With respect to the San Benito County portion of the Delta-Mendota Subbasin, this area will be included in the Central Delta-Mendota GSA of the Northern & Central Delta-Mendota Region GSP. In 2017, the San Benito County Water District Groundwater Sustainability Agency indicated its intent to act as the GSA for certain areas within its jurisdiction, but not for the unmanaged *de minimis* area in the most southwest portion of the Delta-Mendota Subbasin. For purposes of assuring that all land within the Subbasin is part of a GSP as required by DWR regulations, the Central Delta-Mendota GSA entered into a Memorandum of Understanding with San Benito County to include the unmanaged *de minimis* area in the Northern & Central Delta-Mendota Region GSP.

3. Delta-Mendota Subbasin Intrabasin Coordination Agreement

The aforementioned GSAs are coordinating development and implementation of the six GSPs under the Delta-Mendota Subbasin Coordination Agreement. All GSAs within the Subbasin agree to work collaboratively to meet the objectives of SGMA and the Coordination Agreement. Each GSA acknowledges that it is bound by the terms of this Coordination Agreement.

The Coordination Agreement for the Delta-Mendota Subbasin covers the following topics:

1. Purpose of the Agreement, including:
    a. Compliance with SGMA and
    b. Description of Criteria and Function;
2. Definitions
3. General Guidelines, including:
    a. Responsibilities of the Parties and
    b. Adjudicated or Alternative Plans in the Subbasin;
4. Role of San Luis & Delta-Mendota Water Authority (SLDMWA), including:
    a. Agreement to Serve,
    b. Reimbursement of SLDMWA, and
    c. Termination of SLDMWA's Services;

5. Responsibilities for Key Functions, including:
    a. Coordination Committee,
    b. Coordination Committee Officers,
    c. Coordination Committee Authorized Action and Limitations,
    d. Subcommittees and Workgroups,
    e. Coordination Committee Meetings, and
    f. Voting by Coordination Committee;
6. Approval by Individual Parties;
7. Exchange of Data and Information, including:
    a. Exchange of Information and
    b. Procedure for Exchange of Information;
8. Methodologies and Assumptions, including:
    a. SGMA Coordination Agreements,
    b. Pre-GSP Coordination, and
    c. Technical Memoranda Required;
9. Monitoring Network
10. Coordinated Water Budget
11. Coordinated Data Management System
12. Adoption and Use of the Coordination Agreement, including:
    a. Coordination of GSPs and
    b. GSP and Coordination Agreement Submission;
13. Modification and Termination of the Coordination Agreement, including:
    a. Modification or Amendment of Exhibit "A" (Groundwater Sustainability Plan Groups including Participation Percentages),
    b. Modification or Amendment of Coordination Agreement, and
    c. Amendment for Compliance with Law;
14. Withdrawal, Term, and Termination;
15. Procedures for Resolving Conflicts;
16. General Provisions, including:
    a. Authority of Signers,
    b. Governing Law,
    c. Severability,
    d. Counterparts, and
    e. Good Faith; and
17. Signatories of all Parties

The Coordination Agreement, effective as of December 12, 2018, has been signed by all thirty-six parties in the Delta-Mendota Subbasin. These signatories to the Coordination Agreement have formed a total of 23 GSAs in the Subbasin. A key goal of basin-wide coordination is to ensure that the Subbasin GSPs utilize the same data and methodologies during their plan development and that the elements of the Plans necessary to achieve the sustainability goal for the Subbasin are based upon consistent interpretations of the basin setting, as required by SGMA and associated regulations. It is the intent that the Coordination Agreement become part of each individual GSP within the Delta-Mendota Subbasin.

Delta-Mendota Subbasin Coordination Committee

The Delta-Mendota Subbasin Coordination Agreement establishes the Delta-Mendota Subbasin Coordination Committee (Coordination Committee), which provides representation from each of the six GSP groups. The Coordination Committee complies with requirements of the Brown Act. The Coordination Agreement describes the Coordination Committee's requirements for meeting noticing, attendance, voting, data sharing, governance of subcommittees and working groups, and approval of Subbasin documents.

The Coordination Agreement allows for development of individual subcommittees or working groups to support the development of the Technical Memorandums and to coordinated data, methodologies, and assumptions. For this purpose, the Coordination Committee recommended formation of an ad hoc Technical Working Group, Communications Working Group, and Data Management System Working Group.

The Coordination Committee provides specific direction to the Plan Manager. The initial Plan Manager for the six coordinated GSPs is Andrew Garcia, Senior Civil Engineer for San Luis & Delta-Mendota Water Authority (SLDMWA); however, the Coordination Committee and Coordination Agreement allow for a consultant of the SLDMWA to act as Plan Manager, if necessary. If the SLDMWA ceases to serve as Plan Manager, the Coordination Committee can name a successor per the Coordination Agreement. In the meantime, Mr. Garcia's contact information is included below:

Mr. Andrew Garcia, Plan Manager
San Luis & Delta-Mendota Water Authority
842 6th Street
Los Banos, CA 93635
Phone: (209)-832-6200 / Fax (209)-833-1034
andrew.garcia@sldmwa.org

Contact information for each GSP plan administrator is included in the respective GSPs.

Technical Memoranda

The Coordination Agreement describes the development of Technical Memoranda. These memoranda collectively explain the data, methodologies, and assumptions approved and used by the six GSP Groups within the Subbasin. The Coordination Agreement specifically referenced four Technical Memoranda; the Technical Working Group of the Coordination Committee subsequently recommended development of additional Technical Memoranda during the GSP development efforts. The Technical Memoranda are subject to the Coordination Committee's review and unanimous approval and will be submitted along with the Coordination Agreement to DWR. The Technical Memoranda will be used throughout GSP implementation to ensure continued coordination and compliance with SGMA.

The Technical Memoranda include:

1. Common Datasets Used in the Delta-Mendota Subbasin GSPs
2. Assumptions for Hydrogeological Conceptual Model of the Delta-Mendota Subbasin
3. Assumptions for the Historic, Current and Projected Water Budgets of the Delta-Mendota Subbasin, Change in Storage Cross-Check and Sustainable Yield
4. Assumptions for Delta-Mendota Subbasin Management Areas, Sustainability Management Criteria
5. Assumptions for Delta-Mendota Subbasin Monitoring Network
6. Coordination of the Delta-Mendota Subbasin Data Management System
7. Adoption and Use of the Subbasin Coordination Agreement
8. Coordinated Noticing, Communication, and Outreach Activities in the Delta-Mendota Subbasin

Interbasin Coordination

The Delta-Mendota Subbasin adjoins nine neighboring subbasins. These subbasins range in basin condition as determined by DWR, so some subbasins are also on the January 31, 2020 GSP submission deadline, while others have a 2022 deadline. With this multitude of neighbors and variety of timelines, the Delta-Mendota Subbasin has initiated interbasin coordination efforts with all of the adjoining subbasins. The SLDMWA, on behalf of the Northern and Central Delta-Mendota Regions, executed an interbasin data sharing agreement with Westlands Water District, the coordinating agency for the Westside Subbasin. The agreement establishes common assumptions for groundwater conditions as well as a process for continued data sharing for data located within five miles of the boundary between Westside Subbasin and the Delta-Mendota Subbasin.

Additional interbasin coordination efforts have been initiated with other adjoining subbasins. No other agreements have been formalized at the time of the Delta-Mendota Subbasin's GSP submissions, but may be developed later. The Delta-Mendota Subbasin intends to coordinate with neighboring subbasins to develop shared understandings of data and technical approaches.

TECHNICAL MEMORANDUM #8

RE: Coordinated Noticing, Communication, and Outreach Activities in the Delta-Mendota Subbasin

PREPARED BY: Stantec

DATE: July 25, 2019

---

1. Introduction

The Sustainable Groundwater Management Act of 2014 (SGMA) and subsequent Emergency Regulations developed by the California Department of Water Resources (DWR) in May 2016 identified a number of requirements for public notice and communication related to Groundwater Sustainability Agency (GSA) formation and Groundwater Sustainability Plan (GSP) development. California Code of Regulations §354.10 identifies the requirements for notice and communication information in a GSP:

> "Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:
>
> (a) A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties.
>
> (b) A list of public meetings at which the Plan was discussed or considered by the Agency.
>
> (c) Comments regarding the Plan received by the Agency and a summary of any responses by the Agency.
>
> (d) A communication section of the Plan that includes the following:
>
> (1) An explanation of the Agency's decision-making process.
>
> (2) Identification of opportunities for public engagement and a discussion of how public input and response will be used.
>
> (3) A description of how the Agency encourages the active involvement of diverse social, cultural and economic elements of the population within the basin.
>
> (4) The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions."

Pursuant to these requirements, GSAs in the Delta-Mendota Subbasin (Subbasin) conducted a number of activities to engage beneficial users of groundwater, interested parties, and the general public in the development of the six Subbasin GSPs. Each GSA was responsible for conducting outreach and engagement related to SGMA within its service area; however, recognizing efficiencies in pooling resources and the importance of consistent messaging, the GSAs also conducted a series of coordinated activities aimed at engaging stakeholders across the Subbasin. This document describes the coordinated tools, methods, and activities the GSAs used to inform and engage stakeholders in development of the Subbasin GSPs.

2. Situation Assessment and Communications Plan

To assist in GSA formation and GSP development, agencies in the Subbasin sought and received Facilitation Support Services funding from DWR in August 2016. Under this funding, a neutral, third-party facilitation team conducted a situation assessment on behalf of the Subbasin GSAs. The purpose of the assessment was to understand how stakeholders perceived the status of the Subbasin's groundwater resources and identify potential barriers to the successful development of the GSPs.

The facilitation team, with input from local agencies, identified 30 stakeholders representing diverse interests and beneficial users in the Subbasin, together with disadvantaged communities, agricultural well owners, government and land use agencies, and environmental and ecosystem interests. From February 2017 to May 2017, the facilitators conducted over 30 phone and in-person interviews with stakeholders. The facilitators recorded the interview responses and summarized the results in a presentation made to the GSA representatives.

The assessment results were used to inform the development of the Delta-Mendota Subbasin Sustainable Groundwater Management Act Communications Plan (Communications Plan), which is provided with this document as **Attachment A**. The Communications Plan identifies near- and long-term outreach and engagement strategies, tactics, and tools for stakeholder engagement in GSP development and implementation. The Subbasin GSAs used the Communications Plan as a framework for conducting the stakeholder outreach and engagement activities described in this document.

3. Public Noticing and Information

Legal Requirements:

> **§354.10 (d):** A communication section of the Plan that includes the following:
> (3) A description of how the Agency encourages the active involvement of diverse social, cultural, and economic elements of population within the basin.

The Subbasin GSAs developed and used several tools to inform members of the public about GSP development activities and promote opportunities for public engagement. These tools are described below.

- Website: The Subbasin website – www.deltamendota.org – is the primary location for information related to SGMA implementation in the Subbasin. Information provided on the website includes: an overview of SGMA, a description of each of the GSP groups, contact information for each of the GSAs, and upcoming workshops and public meetings. The website also serves as a repository for outreach collateral, workshop materials, and meeting packets and minutes for the Delta-Mendota Subbasin Coordination Committee, Technical Working Group, and Communications Working Group (described below).

- Delta-Mendota Subbasin Newsletter: The Delta-Mendota Subbasin Newsletter is distributed on a monthly basis and serves as an informational tool to keep interested parties, beneficial users, and members of the general public informed about the development and status of the GSPs. Newsletter topics include Subbasin-wide activities, general announcements, upcoming meetings and workshops, and past and upcoming GSP development activities. Copies of the newsletters are archived on the Subbasin website.

- Informational Materials: GSAs in the Subbasin developed a suite of materials in English and Spanish to educate and inform members of the public about SGMA and topics covered in the GSP. These materials include bilingual presentations, fact sheets, handouts, frequently asked questions, and videos. Copies of the materials are available on the Subbasin website. GSA representatives distributed these materials during meetings, workshops, and other outreach activities.

4. Public Engagement in GSP Development

Legal Requirements:

§354.10(b): A list of public meetings at which the Plan was discussed or considered by the Agency;

§354.10 (d): A communication section of the Plan that includes the following:
(2) Identification of opportunities for public engagement and a discussion of how public input and response will be used.
(3) A description of how the Agency encourages the active involvement of diverse social, cultural, and economic elements of population within the basin.

This section describes outreach activities coordinated among the Subbasin GSAs to inform, engage, and consult stakeholders in GSP development. Coordinated outreach activities fell into two main categories: general public outreach and targeted outreach. General public outreach activities primarily consisted of committee and working group meetings, and coordinated workshops aimed at informing and receiving public input on the content of the GSPs. The GSAs also conducted outreach activities targeted at hard-to-reach communities and beneficial users, including agricultural interests, school districts, and disadvantaged communities.

General Public Engagement Activities

There were two primary opportunities for members of the public to engage in development of the Subbasin GSPs: Coordination Committee and working group meetings and coordinated public workshops. These activities are further described below. In addition, the GSAs also informed and engaged members of the public by posting information on the Subbasin and member-agency websites, distributing the monthly newsletter, disseminating bilingual informational materials, and tabling at public events.

Committee Meetings

Comprised of members representing the entities preparing the Subbasin GSPs, the Coordination Committee was formed to provide overall guidance and resolve conflicts among the GSAs to ensure that the GSPs were coordinated as required by SGMA. The Technical Working Group and Communications Working Group were formed under the Coordination Committee to specifically coordinate technical and communication activities, respectively. Public meetings of the Coordination Committee and working groups served as key opportunities for stakeholders to engage and consult in development of the GSPs. Public comments were recorded in the meeting minutes, posted on the Subbasin website, and considered during development of the GSPs.

Coordinated Public Workshops

The Subbasin GSAs planned and held a series of public workshops from May 2018 – May 2019 aimed at educating and soliciting input from the public about topics covered in the GSPs. Table 1 identifies the workshop dates, locations, and topics. At these workshops, GSA representatives and their technical consultants presented information on each GSP development phase. Presentations were followed by an open house period to allow participants to talk directly with their GSA representatives. Bilingual interpreters were present at all workshops to provide interpretation services. All workshop materials, in both English and Spanish, are available on the Subbasin website.

Questions, comments, and input from workshop participants were recorded by facilitation staff and summarized the workshop summaries, provided with this document as **Attachment B**. All public comments were taken in consideration by GSAs and technical consultants during development of the GSPs.

The GSAs used a variety of methods to promote the workshops. These methods included distribution of bilingual flyers and utility bill inserts, email notifications, social media posts, website posts, newspaper notices, and press releases. **Attachment C** includes example workshop promotion activities. GSA representatives also directly contacted local organizations throughout the Subbasin. A list of organizations contacted is provided with this document as **Attachment D**.

Table 1. Coordinated Public Workshops

Date	Location, Venue	Topic
Spring 2018 Workshop		
May 14, 2018	Los Baños, San Luis & Delta-Mendota Water Authority	• Sustainable Groundwater Management Act overview • Delta-Mendota Subbasin overview • Opportunities for engagement
May 16, 2018	Patterson, Hammon Senior Center	
May 17, 2018	Mendota, Mendota Library	
Fall 2018 Workshops		
October 22, 2018	Firebaugh, Firebaugh Middle School	• GSP development and implementation process • Data collection • Hydrogeologic Conceptual Model • Numerical & Analytical Models • Water budgets
October 24, 2018	Los Baños, College Greens Building	
October 25, 2018	Patterson, Patterson Senior Center	
Winter 2019 Workshops		
February 19, 2019	Los Baños, College Greens Building	• Historic and current water budgets • Sustainability criteria • Undesirable results • Projects and management actions
February 20, 2019	Patterson, Patterson City Hall	
March 4, 2019	Santa Nella, Romero Elementary School	
Spring 2019 Workshops		
May 20, 2019	Patterson, Patterson City Hall	• Projected water budgets • Sustainable yield • Groundwater monitoring networks • Projects and management actions
May 21, 2019	Los Baños, College Greens Building	
May 22, 2019	Santa Nella, Romero Elementary School	
May 23, 2019	Mendota, Mendota Library	

Targeted Stakeholder Engagement

The Subbasin GSAs also conducted targeted outreach and engagement to hard-to-reach communities, interested parties, and stakeholders that were previously underrepresented in other engagement activities. This included outreach to the following stakeholder types:

- *Agricultural Interests:* Agricultural stakeholders in the Subbasin include agricultural well operators, growers, ranchers, farmworkers, and agricultural landowners. Strong agricultural representation exists within the leadership of the GSAs. To augment direct outreach being conducted by individuals GSAs, Subbasin representatives also coordinated closely with local county farm bureaus to disseminate information related to GSP development and public workshops.

- *School Districts:* Schools districts are considered for both beneficial users of groundwater (for drinking water), as well communication channels to disseminate information about SGMA and GSP development. GSA representatives directly contacted local school districts to notify them of the public workshops. Some schools also help distributed informational materials and workshop flyers to their students and parents.

- *Disadvantaged Communities:* The GSAs followed best practices identified in Collaborating for Success: Stakeholder Engagement for Sustainable Groundwater Management Act Implementation (Community Water Center, 2015) and other guidance documents to engage disadvantaged and severely disadvantaged communities. This included holding meetings in disadvantaged communities; holding meetings in the evening at known local venues, such as schools, civic centers, and community centers; translating fact sheets, meeting materials, and presentations into other languages; and providing interpreting services at all public workshops.

5. GSP Implementation

Legal Requirements:

> **§ 354.10(b)(4): The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions.**

Each GSA will utilize its own methods to inform the public about progress implementing its GSP and the status of any projects and management actions. The Subbasin website will continue to be the main source of information for Subbasin- wide announcements, public meetings, workshops, and informational materials. In addition, the GSAs will continue to coordinate public outreach and stakeholder engagement activities related to GSP implementation as-needed.

Attachments: Attachment A - Delta-Mendota Subbasin Sustainable Groundwater Management Act Communications Plan Attachment B – Coordinated Public Workshop Summaries
Attachment C – Example Public Workshop Promotion Materials
Attachment D – Stakeholder and Community Organizations Contacted Regarding Coordinated SGMA Workshops

ATTACHMENT A. DELTA-MENDOTA SUBBASIN SUSTAINABLE GROUNDWATER MANAGEMENT ACT COMMUNICATIONS PLAN

Delta Mendota Subbasin Groundwater Management

Sustainable Groundwater Management Act Communications Plan

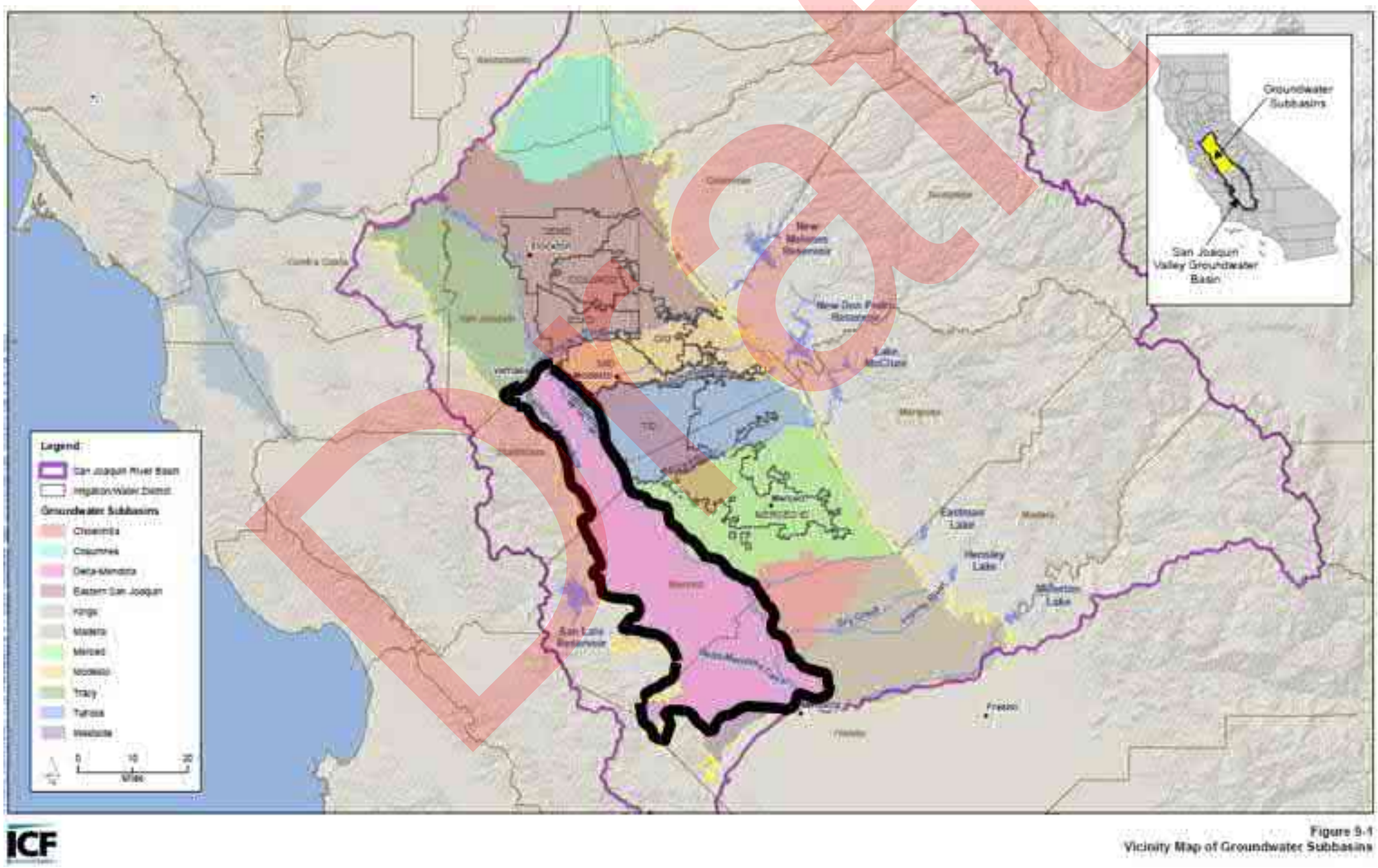

Figure 9-1
Vicinity Map of Groundwater Subbasins

Prepared by:
Lisa Beutler, MWH/Stantec,
Via CA Dept. of Water Resources,
Facilitation Services Technical Assistance

June 2017

MWH Stantec

Forward: How to use this Plan

This Communication Plan provides a high-level overview of near and long-term outreach and engagement strategies, tactics and tools. Its purpose is to assist the Groundwater Sustainability Agencies (GSAs) of the Delta Mendota Subbasin with stakeholder outreach and other related actions as required by the Sustainable Groundwater Management Act (SGMA) of 2014. It is presented as a working public draft, and should be considered a living document that is continuously refined and updated as circumstances suggest.

Chapter 1*: Introduction and Background* provides text and information about SGMA and the Delta Mendota Subbasin that can be repurposed directly into websites or printed materials by agencies and/or entities with an interest in SGMA and how it will affect the subbasin. This section also describes the communications activities mandated by SGMA.

Chapter 2: *Communications Plan Overview* provides communications planning goals and objectives as well as the scope. This section can be used in support of project management activities.

Chapter 3: *Situation Assessment* provides some of the context for communications activities. This section can be used in developing required assessments of stakeholder issues and interests. It also informs project management activities.

Chapter 4: *Audiences and Messages* identifies key subbasin audiences and message points for specific audience segments. The goal of this chapter is to provide information that can be used by the subbasin GSAs in preparing to work with key stakeholders.

Chapter 5: *Risk Management* is the summary of a communications risk assessment that considers subbasin communications strengths and weakness and proposes on-going adjustments based on best communication management practices. This section informs project management activities and provides a context for some of the recommended communications tactics.

Chapter 6: *Tactical Approaches* offers a communications to do list with specific communications activities relevant for project phases and subbasin audiences.

Chapter 7: *Measurements and Evaluation* outlines methods to determine the effectiveness of outreach and engagement.

Chapter 8: *Roles and Responsibilities* provides a sample list of tasks and illustrates the types of communications roles and responsibilities which might be assigned. This section should be incorporated into project management plans.

Subbasin GSAs should feel free to repurpose any or all parts of the document that will assist them in meeting SGMA requirements.

This document was developed with technical support provided by the California Department of Water Resources' (DWR) SGMA Facilitation Support Services Program and completed by the Communication and Engagement Group of MWH/Stantec.

Delta Mendota Subbasin
Sustainable Groundwater Management Act
Communications Plan
Working Draft

Contents

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List of Acronyms and Abbreviations

Item	Description
Basin	Groundwater Basin or Subbasin
Coms Plan	Delta Mendota Subbasin, Sustainable Groundwater Management Act, Working Draft Communications Plan
CSD	Community Service District(s):
CV-SALTS	Central Valley Salinity Alternatives for Long-Term Sustainability
DAC	Disadvantaged Communities
DMC	Delta-Mendota Canal
DWR	California Department of Water Resources
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
IRWMP	Integrated Resource Water Management Plan
PDF	Portable Document Format
RCD	Resource Conservation District(s)
SGMA	Sustainable Groundwater Management Act
SLDMWA	San Luis Delta- Mendota Water Authority
State Board	State Water Resources Control Board

Item	Description
SA	Situation Assessment
USGS	United States Geological Survey

Revision History

Table 1. Revision History

Revision History			
Revision/Dock Title #	Date of Release	Author	Summary of Changes

INTRODUCTION AND BACKGROUND

The purpose of this Communication Plan is to assist the Groundwater Sustainability Agencies (GSAs) of the Delta Mendota Subbasin with stakeholder outreach and other related actions as required by the Sustainable Groundwater Management Act (SGMA) of 2014. Its chapters identify key stakeholders and provide a high-level overview of near and long-term outreach and engagement strategies, tactics and tools. The plan was developed with technical support provided by the California Department of Water Resources' (DWR) SGMA Facilitation Support Services Program.

1.1. SGMA Basics[1]

After decades of debate, in 2014 California lawmakers adopted SGMA. This far-reaching law seeks to bring the State's critically important groundwater basins into a sustainable regime of pumping and recharge. The change in water management laws has created new obligations for residents and water managers in the Delta-Mendota Groundwater Subbasin. The San Luis Delta- Mendota Water Authority (SLDMWA) is assisting its members in implementation of this law.

SGMA requires, **by June 30, 2017**, the formation of locally-controlled GSAs in many of the State's groundwater basins and subbasins (basins). A GSA is responsible for developing and implementing a **groundwater sustainability plan** (GSP). These plans assist the basins in meeting sustainability goals. The primary goal is to maintain sustainable yields without causing undesirable results.

1.1.1. GSAs & GSPs

Any local public agency that has water supply, water management, or land use responsibilities in a basin can decide to become a GSA. A single local agency can decide to become a GSA, or a combination of local agencies can decide to form a GSA by using either a Joint Power Authority (JPA), a memorandum of agreement (MOA), or other legal agreement. If no agency assumes this role the GSA responsibility defaults to the County; however, the County may decline.

A GSP may be any of the following *(Water Code § 10727(b)):*

- A single plan covering the entire basin developed and implemented by one GSA.
- A single plan covering the entire basin developed and implemented by multiple GSAs.

[1] Sections on SGMA are largely drawn, in whole or in part, from publicly available materials from the Department of Water Resources. For more see: http://www.water.ca.gov/groundwater/sgm

- Subject to Water Code Section 10727.6, multiple plans implemented by multiple GSAs and coordinated pursuant to a single coordination agreement that covers the entire basin.

If local agencies are unable to form an approved GSA and/or prepare an approved GSP in the required timeframe, then the basin or subbasin would be considered unmanaged. Unmanaged groundwater basins and subbasins are subject to State Water Resources Control Board (State Board) oversight. This is true even if the vast majority of the subbasin is covered by a plan. Should intervention occur, the State Board is authorized to recover its costs from the GSAs.

1.2. SGMA Communications and Engagement Requirements

SGMA includes specific requirements for communications and engagement by each planning phase. **Figure 1** (next page) illustrates the requirements and provides water code references. The GSP submittal guidelines also describe the outreach and engagement documentation to be submitted with the plan. **Table 2** describes the submittal requirements. A full list of codes and requirements is also provided in **Appendix 1**.

Table 2. GSP Submittal Requirements[2]

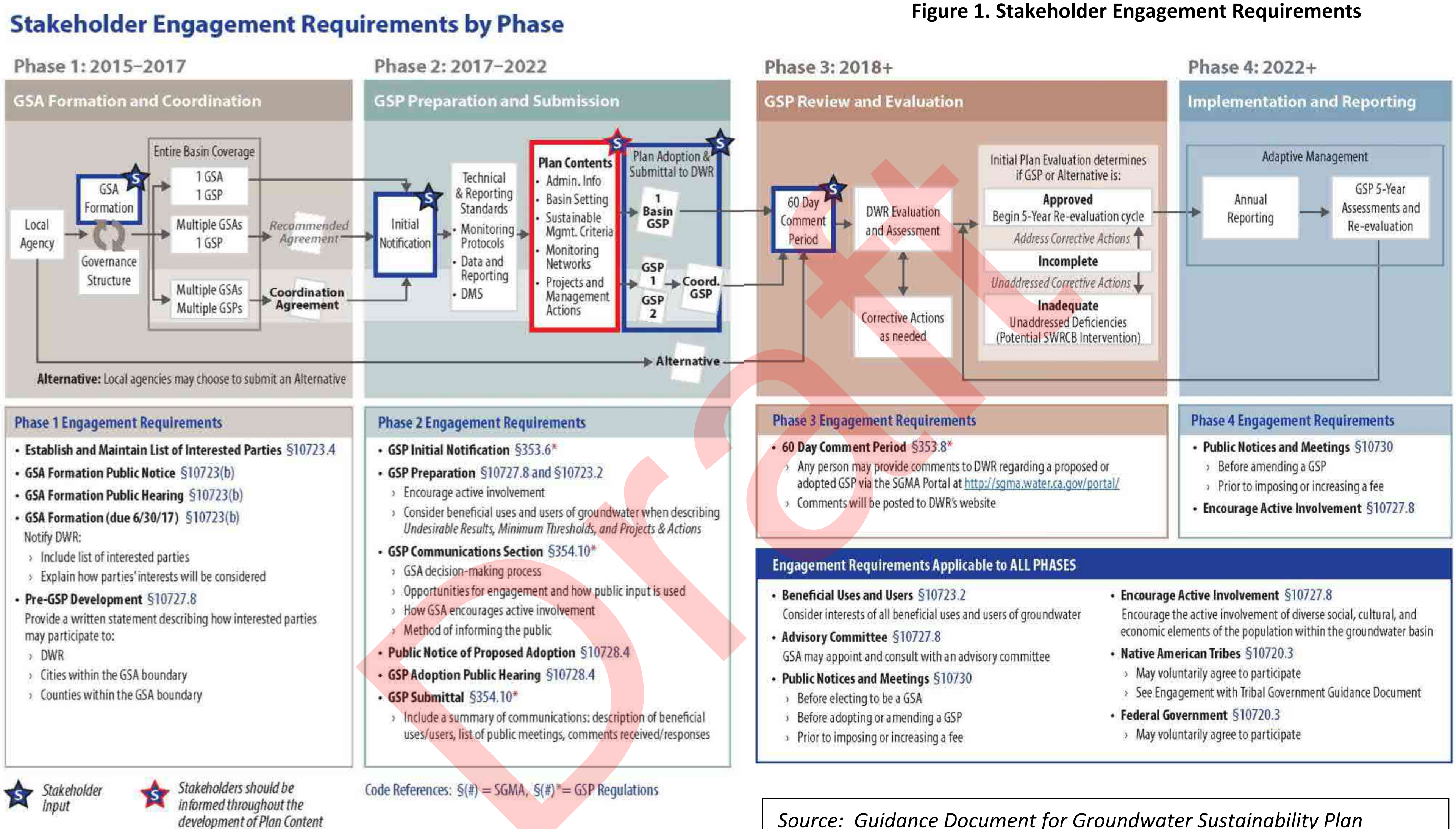
GSP Regulations Section	Requirement	Description
Article 5. Plan Contents, Sub-article 1. Administrative Information		
354.10	Notice and Communication	• Description of beneficial uses and users • List of public meetings with dates • GSP comments and responses • Decision-making process • Public engagement process • Method(s) to encouraging active involvement • Steps to inform the public on GSP implementation progress

1.3. Planning Approach

While the SLDMWA is assisting with the coordination of GSP(s) development, this Communications Plan (Coms Plan) is offered for the voluntary use of all of the GSAs of the Delta-Mendota Subbasin. A full Coms Plan schedule should be developed in conjunction with the overall GSP(s) development schedule. One additional option is for the Coordination Committee of GSAs to provide overall communications guidance. This could potentially be included in a section of the Coordination Agreement.

[2] Guidance Document for the Sustainable Management of Groundwater, Preparation Checklist for GSP Submittal, Department of Water Resources, December 2016

Figure 1. Stakeholder Engagement Requirements



Source: Guidance Document for Groundwater Sustainability Plan Stakeholder Communication and Engagement Department of Water Resources, June 2017

An important additional step will be establishing, in conjunction with the multiple GSAs, the roles and responsibilities for implementing the Coms Plan.

1.4. SGMA and the Delta Mendota Subbasin[3]

The Delta-Mendota Subbasin of the San Joaquin Valley Groundwater Basin is a long, relatively narrow groundwater basin that covers portions of five counties, from north to south, San Joaquin, Stanislaus, Merced, Madera and Fresno Counties (see **Figure 2**). The Delta-Mendota sub-basin is bounded on the west by the Tertiary and older marine sediments of the Coast Ranges. The northern boundary (from west to east) begins on the west by following the Stanislaus/San Joaquin County line, then deviates to the north to encapsulate all of the Del Puerto Water District before returning back to the Stanislaus/San Joaquin County line. The boundary continues east then deviates north again to encapsulate all of the West Stanislaus Irrigation District before returning back to the Stanislaus/San Joaquin County line. The boundary continues to follow the Stanislaus/San Joaquin County line east until it intersects with the San Joaquin River.

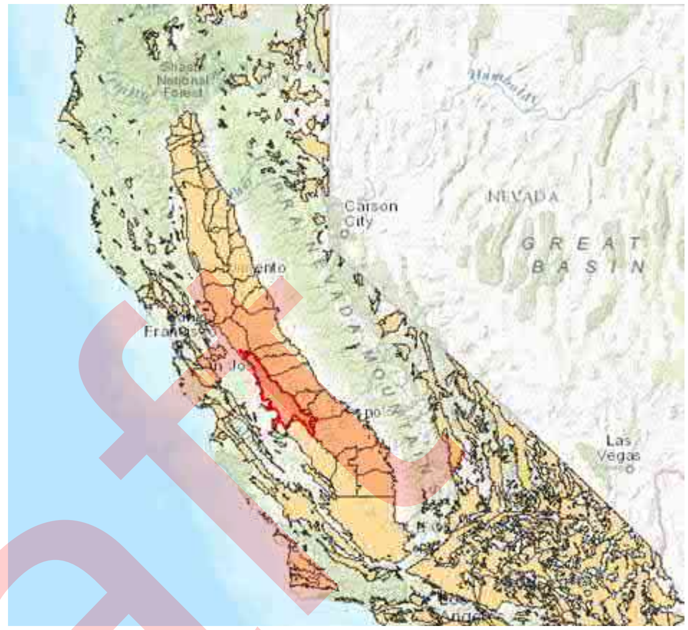


Figure 2. Delta Mendota Subbasin

The eastern boundary (from north to south) follows the San Joaquin River to within Township 11S, where it jogs eastward along the northern boundary of Columbia Canal Company and then follows the eastern boundary of Columbia Canal company until intersecting the northern boundary of the Aliso Water District. The boundary then heads east following the northern and then eastern boundary of the Aliso Water District until intersecting the Madera/Fresno County line. The boundary then heads westerly following the Madera/Fresno County line to the eastern boundary of the Farmers Water District. The boundary then heads southerly along the eastern boundary of the Farmers Water District, and continues southerly along the section line to the intersection with the northern right-of-way of the railroad. The boundary then heads east along the northern right-of-way of the railroad until intersecting with the western boundary of the Mid-Valley Water District. The boundary then heads south along the western boundary of the Mid-Valley Water District to the intersection with the northern boundary of Reclamation District 1606. The boundary then heads west and then south following the boundary of Reclamation District 1606 and James Irrigation District until its intersection with the Westlands Water District boundary.

The southern boundary (from east to west) matches the northerly boundaries of Westlands Water District legal jurisdictional boundary last revised in 2006. The boundary then

[3] Information related to the Delta Mendota subbasin is drawn directly from http://sgma.water.ca.gov/basinmod/basinrequest/preview/23.

proceeds west along the southernmost boundary of the San Luis Water District. The boundary then projects westward from this alignment until intersecting the Delta-Mendota sub-basin Western boundary described above.

1.5. Delta-Mendota Subbasin GSP Planning

The GSAs of the Delta-Mendota Subbasin intend to work together to meet Sustainable Groundwater Management Act (SGMA) requirements and prepare a Groundwater Sustainability Plan (GSP) or coordinated Sustainability Plans by June 31, 2020. The San Luis Delta- Mendota Water Authority (SLDMWA) is assisting its members and non-members in planning and implementation of this law and has been directly assisting a subset of the local GSA eligible agencies in organizing to accomplish required SGMA tasks. The SLDMWA has also hosted informal, information meetings with all of the subbasin GSAs.

While SLDMWA coordinated GSAs are confident in their ability to prepare a GSP for the areas under their jurisdiction, SGMA requires that an approved GSP or multiple coordinated GSPs are in place to provide sustainable management for the entire subbasin. The identified GSAs have been asked to determine how they wish to proceed in individual GSP development or a coordinated single GSP by July 2017 and whether or not they wish to participate in the Prop 1 Sustainable Groundwater Planning Grant as a joint request.

1.6. Delta Mendota Subbasin GSAs

Following are the DWR identified agencies (as of June 15, 2017).[4]

1. Aliso Water District
2. Central Delta-Mendota Region Multi-Agency GSA
3. City of Dos Palos
4. City of Firebaugh
5. City of Gustine
6. City of Los Baños
7. City of Mendota
8. City of Newman
9. City of Patterson
10. County of Madera—3
11. DM-II
12. Farmers Water District
13. Fresno County—Management Area ‘A’
14. Fresno County—Management Area ‘B’
15. Grasslands Groundwater Sustainability Agency
16. Merced County—Delta-Mendota

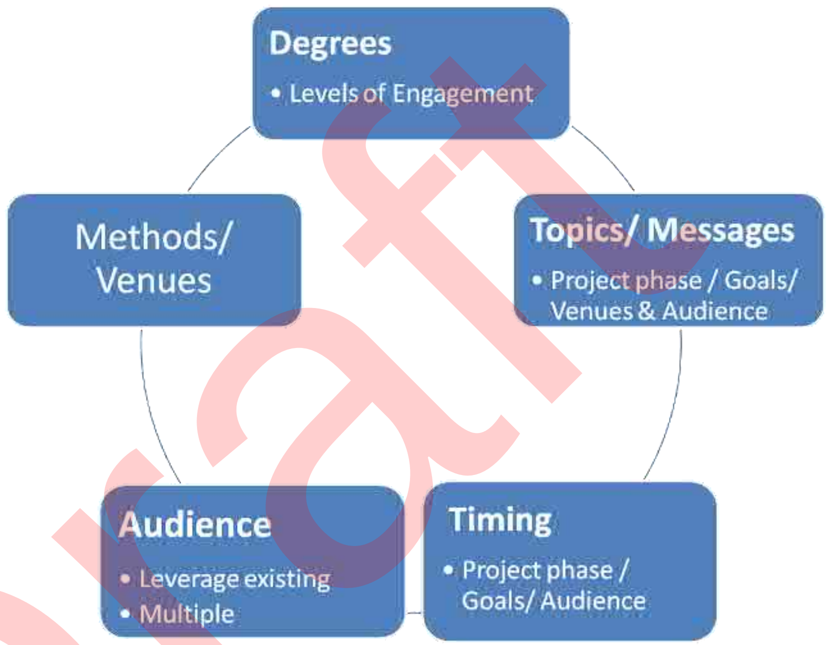
[4] See: http://sgma.water.ca.gov/portal/

17. Northwestern Delta-Mendota GSA
18. Ora Loma Water District
19. Patterson Irrigation District
20. San Joaquin River Exchange Contractors Water Authority
21. Turner Island Water District-2
22. West Stanislaus Irrigation District GSA
23. Widren Water District GSA

COMMUNICATIONS PLAN OVERVIEW

Communication is the process of transmitting ideas and information. According to the Project Management Institute, 75%-90% of a project manager's time is spent communicating. A Coms Plan provides the purpose, method, messages, timing, intensity, and audience of the communication, then describes who will do the communicating, and the frequency of the communication (see **Figure 3**.)

Figure 3. Elements of a Communications Plan



2.1. Purpose

The purpose of the Delta-Mendota Subbasin, Sustainable Groundwater Management Act, Coms Plan is to outline the information and communications needs of the project stakeholders and provide a roadmap to meet them. The Coms Plan then identifies how communications activities, processes, and procedures will be managed throughout the project life cycle.

2.2. Importance

While communications are important in every project, a well-executed communications strategy will be essential to the success of the GSP(s) development and adoption process. The financial and regulatory stakes are high and communication missteps can create project risks. Further, development of a viable GSP(s) will require an on-going collaboration among all the stakeholders, both organizational and external. The plan will be comprehensive and consider multiple variables, a range of system elements and project costs and benefits. Stakeholder input will be needed to refine GSP requirements and fully define the water management system, and potential impacts, costs and benefits that may result in managing for sustainability.

2.3. Scope

The plan focuses on formal communication elements. Other communication channels exist on informal levels and enhance those discussed within this plan. This plan is not intended to limit, but to enhance communication practices. Open, ongoing communication between stakeholders is critical to the success of the project.

2.4. Communications Goal

Development, adoption and implementation of the GSP(s) will require basin external stakeholders, other agencies, staff, managers, and the multiple GSA Boards to evaluate choices, make decisions and commit resources.

The core communications goal is to plan for and efficiently deliver clear and succinct information:

- At the right time
- To the right people
- With a resonating message

This is done to facilitate quality decision making and build accompanying public support

2.5. Communications Objectives

The Coms Plan Objectives are to present strategies and actions that are:

- Realistic and action-oriented
- Specific and measurable
- Minimal in number (a few well delivered are better than many mediocre efforts)
- Audience relevant

2.6. Strategic Approach

Three primary communications strategies have been identified for the GSP(s) development.

1) Fully leverage the activities of existing groups. This practical approach is cost effective and respectful of the limited time that stakeholders have to participate in collaborative processes.
2) Provide targeted, communications and outreach to opinion leaders in key stakeholder segments.
3) Provide user friendly information and intermittent opportunities through existing communication channels and open houses or workshops to allow interested stakeholders (internal and external) to engage commensurate with their degree of interest.

2.7. Communications Governance, Communications Team

Given the relatively large number of stakeholders, a recommendation for coordinated efforts, and the legal requirements for outreach[5], some form of communications governance is recommended. Several governance options for consideration are offered in Appendix 2. The actual form of the governance is less important than a clear understanding of the roles and responsibilities of those responsible for ensuring required communication. For the purpose of this document, an assumption is made that some form of governance will be identified and a communications team (which may be an individual or multiple individuals, and/or include the project consultants) is designated.

A driving consideration for this recommendation is the level of effort associated with required activities and the fact that communications are highly time dependent. That means that communications activities should be occurring that may happen outside of regularly scheduled GSA meetings. In this case delegation with guidance is efficient and effective.

2.8. Constraints

All projects are subject to limitations and constraints as they must be within scope and adhere to budget, scheduling, and resource requirements. These constraints can be even more challenging in projects with multiple agencies as will be the case with the development and coordination of multiple GSPs.

There are also legislative, regulatory, technology, and other organizational policy requirements which must be followed as part of communications management. These limitations must be clearly understood and communicated where appropriate. While communications management is arguably one of the most important aspects of project management, it must be done in an effective and strategic manner recognizing and balancing the multiple constraints.

All project communication activities should occur within the project's approved budget, schedule, and resource allocations. The GSP(s) project managers and the leadership of the participating GSAs should have identified roles in ensuring that communication activities are performed.

To the extent possible, to support collaboration and reduce costs, GSP(s) partners should utilize standardized formats and templates as well as project file management and collaboration tools.

[5] See Appendix 1

SITUATION ASSESSMENT

3.1. *Introduction*

The challenges of asking a community to make changes in how things are done, or forging an agreement among multiple parties are often large. Prior to preparing a Coms Plan, a neutral, 3rd party facilitator conducted a stakeholder Situation Assessment (SA).

The facilitator's role was to provide an independent evaluation of potential stakeholder's interest in coordination and governance for GSA formation and GSP development and identify any barriers or concerns that would need to be addressed for the GSA formation process and GSP(s) development to be successful.

3.2. *Situation Assessments*

An SA is an information-gathering process that informs outreach, engagement and collaboration. As part of preparing the basin communication's process, it was important to know more about:

- Stakeholder Categories
- Opinion leaders
- Regulatory and political context
- Advocates and detractors
- Attitudes and knowledge
- Other elements useful to the crafting of decisions

An assessment is also a low risk approach to education and signaling a future relationship. It facilitates the community's appraisal of its needs, wants and values. A well-crafted assessment sets the stage for the parties to better understand and interpret their situation so that they can make informed decisions for actions, in the short term and for the future.

The Delta-Mendota subbasin SA included background research and interviews. Interviews were usually with individuals but in a few cases a very small group was convened. To encourage candor, the results of the input process were bundled so those interviewed were not individually identified unless they explicitly indicated they wished to share their individual response.

3.3. *Background Research*

The facilitator worked closely with the SLDMWA and DWR to identify useful documents, plans and activities that might inform the overall communications planning process.

3.4. *Interviews and Consultations*

Using information gathered during the background research and similar GSA formation efforts throughout the state, the facilitator worked with the SLDMWA to craft interview questions. The facilitator also provided some selection criteria to the SLDWMA to help identify a representative group of interview candidates. Once selected, the SLDMWA staff and facilitation team invited the interviewees to participate. In addition to full interviews, additional calls and in person communications were conducted to acquire amplifying information. **Figure 4** provides a quick overview.

Figure 4. Interview and Consultation Quick Facts

Number of Contacts: 30

Dates of Calls and Interviews Conducted:
February to May 2017

Average Length: 1 hr.
(Shortest = 20 mins., Longest = 1.5 hrs)

Selected participants were all engaged or otherwise stakeholders in some aspect of the basin GSA development process.

A project background sheet was provided in advance of each formal interview and used again during the interviewee discussions with the facilitator. Each interview followed the same format and included 16-18 questions (depending on whether or not a follow-up question was needed).

The questions covered the following topics pertaining to the GSA formations and GSP(s) development:

1. Overarching perspectives from each key stakeholder on general groundwater conditions, GSA governance; subbasin management and associated SGMA compliance
2. Preferred methods to achieve groundwater sustainability consistent with SGMA requirements
3. The level of agreement/conflict around groundwater governance across the range of stakeholder perspectives
4. Experience with facilitated processes, outreach and engagement, and the goals for such support
5. Potential configurations of governance and formations of GSAs and GSP development

3.5. *Summary of key findings*

Interview results indicate an overall positive environment for the project and project communications; however, the effort will require interactions of a large number of parties and planning for an extremely complex system. Following are the reflections, ideas and suggestions of those contacted.

3.5.1. Related to Groundwater Sources and Trends

- *Significant observed impacts associated with Weather, Water Project Deliveries and Cropping Patterns* – Participants observed a declining groundwater situation and were able to attribute it to drought and weather (particularly timing of seasonal rainfall and periods of prolonged, higher temperatures), conversion to permanent crops, and significant changes in access to surface water.

- *Surface & Groundwater Nexus* – As noted in comments related to access to surface water, there was a clear understanding of the surface/groundwater nexus. Many believed that any realistic solution would have to include a full assessment of the region's surface water future.

- *Extremely Complex Systems* – Many of those interviewed reported that parts of the subbasin were doing fine and could, with good management, be sustainable. They described problems as being primarily in pockets of the subbasin. They also characterized some parts of the subbasin as not being managed sustainably and indicated that they believe this would have continued had SGMA not passed. While it was generally agreed that it would have been better if SGMA was not driving the change, they felt change would not occur without something like SGMA. Several of the participants were able to describe specific locations and situations that illustrated this.

  Issues related to operations of the Bureau of Reclamation, the Delta-Mendota Canal (DMC), the Mendota Pool and restoration activities are of keen interest to all the stakeholders. Everyone was familiar with issues of subsidence and with the facts and figures represented in graphics like those in **Figure 5**, prepared by the United States Geological Survey (USGS).[6]

  Many perceived that groundwater supplies for municipal uses in some parts of the basin were at risk.

- *Historic Rights and Arrangements* – Access to surface water is based on numerous historic rights and agreements as well as more contemporary agreements. As such there is no **single** description of the status of surface water availability among the many subbasin GSAs,[7] although there is a strong understanding of the rights and arrangements that do exist.[8]

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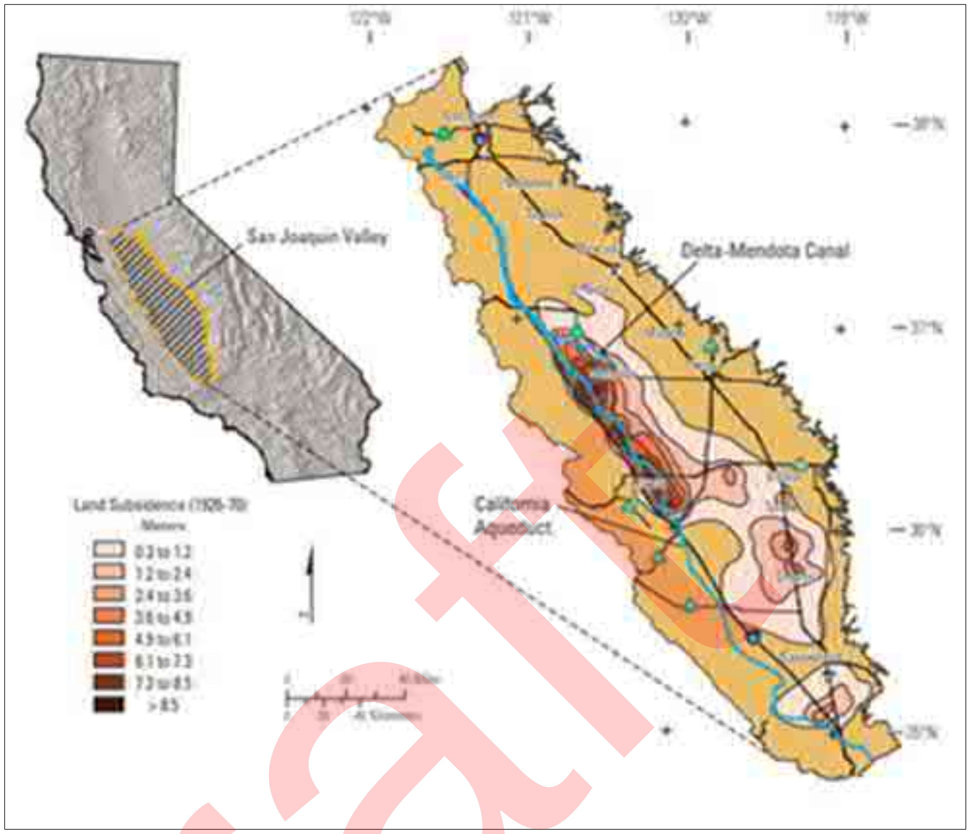
[6] U.S. Department of the Interior | U.S. Geological Survey: https://ca.water.usgs.gov/projects/central-valley/delta-mendota-canal.html, Page Last Modified: Monday, 20-Mar-2017 22:39:47 EDT

[7] A full inventory of water rights and arrangements for the subbasin GSAs is recommended to be prepared as part of the GSP planning process.

[8] In 2010 there were 1,403 water rights claimed in the San Joaquin Delta watershed, the largest number of any watershed in the State. [Source: Associated Press: Original data source is State Water Resources Control Board eWRIMS, Database

Figure 5. USGS Illustration of the DMC and Subsidence



The hierarchy of water rights as well as laws related to groundwater rights will be a significant factor in GSP negotiations.

Another historical factor related to sustainability is the character of land ownership. There was a perceived difference in the values placed on sustainability by multi-generational family farms versus investor driven agriculture and/or water development.

3.5.2. Related to GSA Governance; Subbasin Management and SGMA Compliance

- *Numbers* - The subbasin includes numerous Water Agencies (35) and other potential GSA eligible agencies including Cities and Counties (such as Dos Palos, Firebaugh, Gustine, Los Baños, Mendota, Newman, Patterson, Fresno, Madera, Merced, San Joaquin, and Stanislaus) and Community Service Districts (CSDs) including among others Grayson, Westley, and Volta, as well as multiple Resource Conservation Districts (RCDs) that for the most part were within the general boundaries of other GSA eligible authorities (Panoche, Poso and Grasslands as an example).

  By the June 30, 2017 filing deadline, 23 eligible entities had formally filed GSA formations and met SGMA requirements for subbasin coverage.

Even with this large number of GSA entities, during the SA interviews and in a follow-up survey, most agencies indicated a preference for a reduced number of GSPs and potentially just one or two.

At the time of this assessment there was not a full understanding of all of the potential requirements of being a GSA and ultimately what might be required to prepare a compliant GSP.

Table 3. Number of Subbasin Public Water Agencies

Number of Public Water Agencies

- Merced County
- Fresno County
- Broadview WD
- Centinella WD
- Central California ID,
- Davis WD
- Del Puerto WD
- Eagle Field WD
- El Solyo WD
- Farmers WD
- Firebaugh Canal WD
- Foothill WD
- Fresno Slough WD
- Grasslands WD
- Hospital WD
- Kern Canon WD
- Laguna WD
- Mercy Springs WD
- Mustang WD
- Oak Flat WD
- Orestimba WD
- Oro Loma WD
- Pacheco WD
- Panoche WD
- Patterson WD
- Romero WD
- Salado WD
- San Luis Canal Company
- San Luis WD
- Santa Nella C.WD
- Sunflower WD
- Tranquility ID
- West Stanislaus ID
- Widren WD
- Quinto WD

At the time of this assessment participants did not fully recognize the potential number of stakeholders and/or the requirements to conduct outreach.

- *Subbasin Governance Structures* – Many individuals and entities within the subbasin have experience working in cooperative governance and related structures. For example, the SLDMWA provides leadership for an Integrated Resource Water Management Plan (IRWMP) illustrated in **Figure 6**[9] on the following page. Many of the stakeholders are also involved with Irrigated Lands Coalitions (see **Figure 7**).[10]

  Likewise, many are also involved in efforts related to the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) initiative (see **Figure 8**).

[9] Source : San Luis & Delta-Mendota Water Authority, Westside-San Joaquin Integrated Water Resources Plan, July 2014

[10] Source: Central Valley Regional Water Resources Control Board

Existing Cooperative / Collaborative Governance Structures with Delta Mendota Subbasin Stakeholders

Figure 6. Integrated Regional Water Management Groups

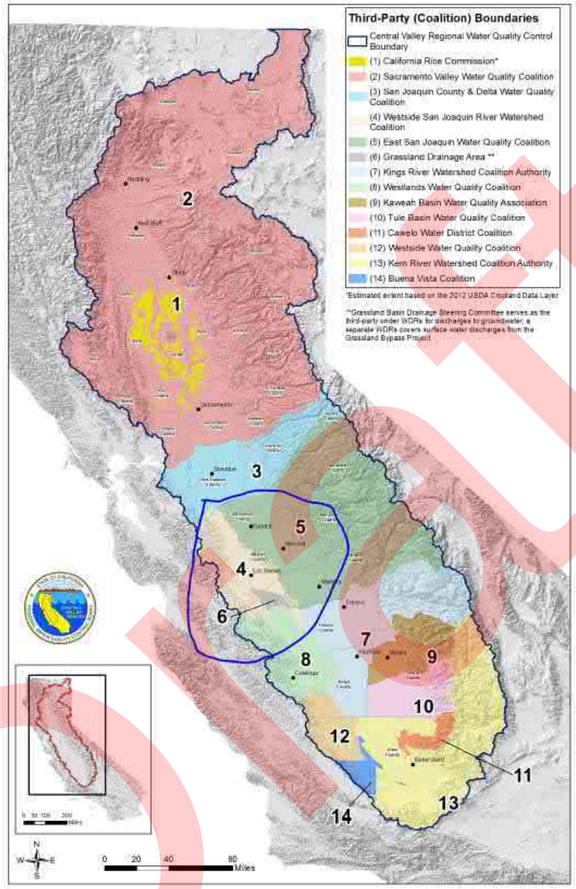


Figure 7. Irrigated Lands Coalitions

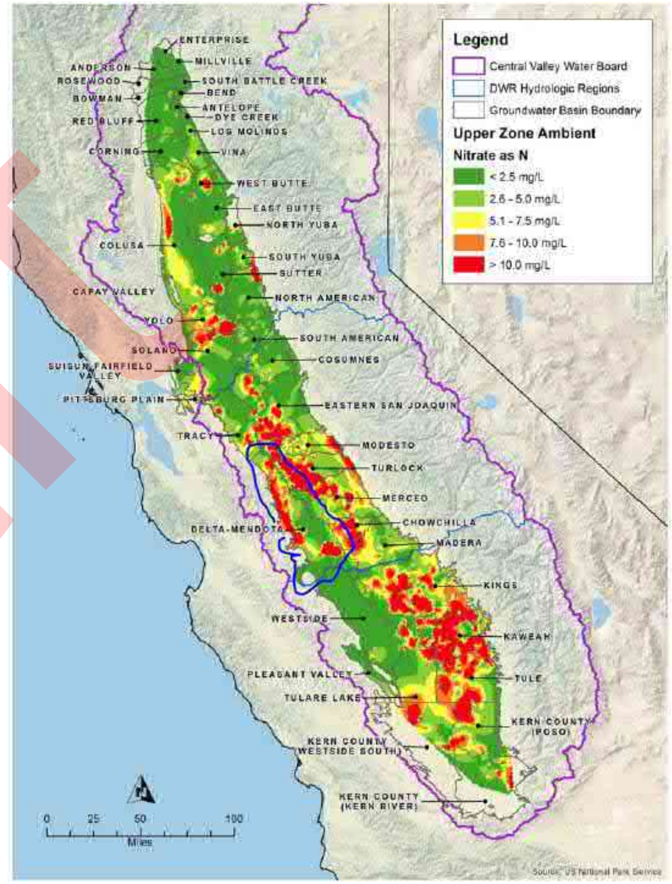


Figure 8. CV-Salts Initiative

CV-Salts was launched to develop sustainable salinity and nitrate management planning for the Central Valley. (See **Figure 8**.[11])

Finally, there are multiple arrangements in place related to surface water transfers and other previous groundwater management planning efforts.

Experience with these programs has created a capacity for collaborative planning that will be essential for GSP development. It also creates opportunities to access and leverage existing stakeholder meetings and events rather than needing to convene multiple new stakeholder processes.

3.5.3. Issues to be Addressed in Creating a Sustainability Plan

Some of the participants indicated they had an extremely good understanding of their section of the subbasin, with exact and extensive records to support their perspective. They found that making projections using historical data had been more reliable than some of the groundwater models that were in use.

In thinking about development of a GSP they felt there could be some difficulty in developing water balances due to lack of quality data for some locations. Another mild concern was the potential for disagreements about the selection of a groundwater model(s) or reconciling differences among methods.

Still another concern was the capacity of the GSAs and/or GSA members to fully participate. Some of these agencies are very lightly staffed and have varying levels of knowledge related to groundwater management. All of the participants had significant other duties prior to the passage of SGMA.

One concern, expressed after completion of the assessment, was the potential for some agencies to simply opt out of participating in the development of a GSP but still receive the benefits of the region having an approved plan without having contributed to the larger good of the subbasin.

3.5.4. Representation

The State Board lists the following as Required Interested Parties for the purpose of SGMA outreach:

- All Groundwater Users
- Holders of Overlying Rights (agriculture and domestic)
- Municipal Well Operators and Public Water Systems
- Tribes
- Counties
- Planning Departments /Land Use
- Local Landowners
- Disadvantaged communities
- Business

[11] Ibid

- Federal Government
- Environmental Uses
- Surface Water Users (if connection between surface and ground water)

All of these stakeholder categories were contacted in the interview process excepting tribes. In the case of tribes, there are no classified tribal lands in the Delta-Mendota subbasin, therefore no planning, outreach or communication needs are currently anticipated for tribes.

Due to subbasin characteristics, a primary focus of the assessment was on agricultural, disadvantaged communities (DACs) and municipal groundwater users.

- *Related to Agricultural Representation* - most respondents believed that the elected leadership of the GSA agencies would do a good job in representing agriculture and noted that many of them were growers themselves. It was also noted that farmers were busy and would be far more interested in any specifics of a GSP that would impact operations or the degree of certainty about water availability than the particulars of GSA governance.

- *Regarding DACs* - Much of the subbasin and its counties (San Joaquin, Stanislaus, Merced, and Fresno) have communities that meet the DAC definition and the region is generally considered disadvantaged. The ability of DACs to participate in GSP development was considered limited and it was thought that there would be a need for specific and direct outreach to DACs through elected leadership and via use of trusted community advocates. As part of the SA, several of those interviewed identified themselves as being able to represent a DAC perspective and one in particular was particularly concerned about the availability of Spanish language materials. As a result, Spanish language materials were included in the meeting materials of the public GSA adoption meetings and the SLDMWA provided a fluent Spanish speaker to assist with meetings.

In the past, to promote DAC identification and involvement, the Westside-San Joaquin IRWM previously conducted an extensive survey of private and public community representatives to educate and encourage understanding of the IRWM process, to help understand the issues confronted by DACs, and to better address the needs of minority and/or low-income communities. This effort resulted in identification of DACs in the Region and an initial list of 22 projects that would benefit DACs and low-income communities. Given known constraints on this community it is recommended that more focused DAC outreach should be coordinated with the IRWM. This effort is now in progress.

- *Regarding Municipals* - The SA outreach also included interviewing Municipal Stakeholders. A significant number of the Cities are fully dependent on wells for water supply and issues related groundwater management are of grave concern. These representatives all felt that even while it would be difficult to make time to participate in GSAs and GSP development, that they must make the time. Many had also determined that they wished to form their own GSA to reflect their specific interests in any kind of broader GSP negotiation.

- *Regarding Environmental Interests* - There appeared to be a less defined stakeholder segment representing traditional, environmentally focused issues. Outreach was made to subbasin government agencies that often serve as a surrogate for these interests and an informal consultation occurred with a representative of the Planning and Conservation League to identify any known, active stakeholders. However, no specific entity or individual was identified by those contacted. A general perception was that this community would desire engagement and would designate representatives if the GSP development was thought to potentially impact existing restoration or other environmental concerns but the formation of GSAs per-se, was of less interest. The next phase of communications should include outreach to organizations such as Audubon, the Nature Conservancy and Ducks Unlimited just to ensure due diligence. These connections will be important going forward, particularly if environmental issues are identified.

- *Regarding Industrial Users* – The region includes some industrial water users. This sector has a relatively lower percent of water use compared to other subbasins users; however, representatives of the sector pointed out how essential access to water was to their industry. The interviewees also emphasized how important these industries were to the local economies. There was a stated concern about representation since there didn't appear to be a direct way to engage, particularly with multiple GSAs being formed.

- *Regarding Counties & Planning Agencies* – All of the subbasin counties have designated representatives and all are assisting with GSA coverage for areas not otherwise covered by a GSA. All of the city and county representatives had direct engagement with the planning arms of their jurisdictions, or were staff to the planning departments. These representatives, like the municipal representatives, viewed this as critical issue even as it creates new workload for the already busy entities.

3.5.5. Communications and Facilitation Preferences

Participants were asked to describe their communications preferences. Several offered specific suggestions on written materials. Most did not believe there would be a need for a high frequency of communications directly with non-GSA stakeholders.

Several suggested using regularly scheduled activities of existing groups and gatherings to share information rather than creating stand-alone events. They listed annual meetings of the water agencies as one good venue as well as meetings related to the IRWM and Irrigated Lands. Several also thought that it would be good to go to places like Farmers Markets, particularly for the disadvantaged communities, and County Fairs.

Farm Bureau representatives also indicated a willingness to support outreach efforts. The Merced Farm Bureau, in particular, has already helped to advertise public meetings related to GSA formations.

Related to facilitation there was not a broad exposure to professional facilitators among many of the stakeholders. Even so, participants consistently listed qualities such as fairness and transparency, a good understanding of the issues, and confidence as helpful facilitator strengths. There was a sense that the GSAs would not need hand holding but that facilitation could be useful for helping the stakeholders forge decisions and making what many believed would need to be compromises.

3.5.6. Success Factors, Barriers to Success

The participants were asked to describe their view on the odds for success as well as any barriers that would prevent successful completion of a GSP.

Overall, most participants expressed a medium to high likelihood for success. They noted that the carrot (grants and technical support) and stick (significant regulatory intervention) by the State creates a dynamic that is supportive to success.

Participants stated barriers related to the capacity of the GSAs to participate and ultimately agree to, and implement changes. The much diffused governance structure of multiple GSAs amplifies this dilemma as do actions beyond the control of the subbasin entities (such as climate and water deliveries).

In addition to perceived barriers, participants outlined their thoughts on opportunities and success strategies.

- *Drought* – While the drought was unwelcome it increased awareness of the need for changes. Many felt it would be easier to move forward while the topic is prominent in everyone's minds.
- *Short and Long Game* – Several suggested it will be important to have a plan that includes long and short term strategies and activities.
- *Integrated Planning* – Many of the participants emphasized the importance of integrated planning.

3.5.7. Other Comments and Advice

Many participants expressed appreciation for being contacted and invited the facilitator to contact them again if there were questions.

3.6. *Promising messages and methods*

Three primary communications strategies have already been identified for the GSP(s) development:

- Leveraging the activities of existing groups
- Providing targeted, communications and outreach to opinion leaders in key stakeholder segments
- Providing user friendly information and intermittent opportunities for a broader range of stakeholders

The same strategies aligned with the recommendations of the SA participants. These methods will allow stakeholders to engage commensurate with their degree of interest while providing sufficient information to ensure long-term success for plan development and implementation.

AUDIENCES AND MESSAGES

GSA formation and GSP(s) development, like most large planning efforts, consists of a broad range of stakeholders with differing interests and influence.

4.1. Two Core Audience Segments

This Coms Plan Anticipates two core audience segments. First is the subbasin GSA Boards and the communications among and between themselves. This audience segment is significant in size given that 23 GSAs will be working to develop a GSP(s) and each GSA has its own Board and audiences.

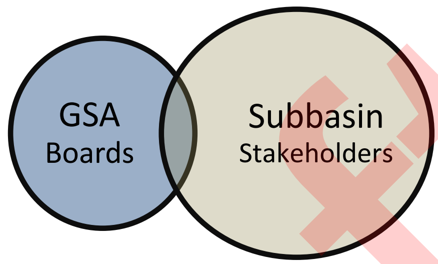


Figure 9. Two Core Audience Segments

The second audience is the subbasin stakeholders as identified in SGMA. This audience is also large. Many of the stakeholders are shared by the GSA Boards and some of the larger stakeholder segments are also represented on the GSA Boards (see **Figure 9**).

Nearly all of the communications strategies apply to both segments; however, some strategies apply to one or the other specifically and are so identified.

4.2. Communications and Change Management

The process of adopting and implementing a GSP will require significant change management. Communications planning should encompass basic change management approaches. Messages should also evolve over time and be tied to the planning process and key decision points. Then, for each audience and each major planning step, communications must do the following:

1. Describe what the actual proposed plan (change) is
2. Articulate how the change will directly impact the category of stakeholder involved
3. Outline the methods that will be used to implement the plan (change)
4. Define the costs and benefits of changing and not changing, and what future conditions will be if change does not occur
5. Consider unintended consequences and others that may also be impacted by the same change then develop a strategy to engage them
6. Offer opportunities for input and for stakeholders and others to improve the approach

The communications requirements for large changes are often underestimated. Some experts indicate that messages may need to be delivered up to 8 different times to be fully absorbed. Communications needs will also evolve as the GSP planning progresses. **Table 4** provides a sample of early communications that focus on SGMA and groundwater basics.

Table 4. Sample – Early Phase Message Elements for Subbasin Stakeholders

Element	What the Change Is	How it will affect the Stakeholder	How the change will be Implemented	Why it is a good idea
Early Phase GSP Development	• Locally governed GSAs will work together to sustainably manage ground water. • The Subbasin /Basin is required to ensure Sustainable Groundwater Management by submitting a sustainability plan by 2020. • The plan must be implemented and found to result in sustainable management by 2040.	(Unique to audience type) • Changes in the current methods of acquiring and utilizing groundwater may occur. • May affect future decisions related to crop types and decisions related to conjunctively using surface water. • May provide additional project resources to the DAC communities.	A collaborative approach is being undertaken to prepare the plan with multiple GSAs coordinating with the SLDMWA as the planning organizer.	• Sustainable and wise use of groundwater allows for the success of future generations and creates greater certainty for today's beneficial users. • Failure to act may result in negative regulatory consequences.

As part of the GSP planning process, the next phase of communications will also need to communicate the requirements for sustainability and how they are achieved in the context of the Delta-Mendota subbasin. Then, communications related to GSP specifics and adoption will require additional outreach, targeted to specific audiences.

4.3. Tied to Decision Making

Communications should also be tightly linked to decision making. For each anticipated decision, stakeholders for that decision should be identified and the following addressed.

1. Who (Is the stakeholder)
    a. An impacted party?
    b. A potential planning partner?
    c. A potential provider of services or resources?
    d. A regulator of the activity?
    (Note: Maybe more than one category.)

2. What (What is the interest of the stakeholder? How will the stakeholder be affected? What are the stakeholders' needs?)
3. Who (Who is the right messenger for the information)
4. How (How should the information be delivered? What are the best methods?)
5. When (What is the appropriate timing for the messages?)
6. Engagement and Knowledge Transfer (How do we create two-way communications?))

Table 5 illustrates some of these ideas.

Table 5. Communications Planning Questions

Who	Interest	Messenger	Delivery	Timing	Knowledge Transfer
• Impacted • Partner • Provider • Regulator	• How will decision affect? • What will stakeholder need?	• Who is a trusted information Source? • How do we ID and Partner	• What are the best delivery methods?	• When should we conduct outreach?	• What do the stakeholders know that we need to know?

4.4. GSA Boards

Due to the multiple subbasin GSAs, specific focus is needed on communications to keep them informed, provide consistent updates and information that the Boards can use in their own outreach, and support their decision making. Primary objectives for communications with the subbasin GSA Boards are to ensure:

- Consistent understanding of the requirements for a GSP and/or GSP coordination
- On-going access to current information
- Timely notice of any significant developments or decision points that may require changes to policies and/or require some other board action
- Confidence that the GSP(s) will be accepted by the GSA's stakeholders

Key communications activities involving the Board include;

1. Providing short and digestible pieces of information to ensure each Board member can quickly articulate to his/her constituents on key matters and remain sufficiently informed so that no decision points are surprises.
2. Provide user-friendly informational materials to be used with public audiences, and will support the Board with their own constituent outreach.
3. Utilize regular Board communications for routine updates and reserve specific Board agenda items for highly significant discussion items.

4.5. Primary Audiences

There are several core stakeholder groups that will require ongoing communications and tailored messaging throughout the planning process. They are:

- Agriculture
- Disadvantaged Communities
- Municipals

Other stakeholders requiring special consideration include:

- Industrial Users/ Business
- Regulators (State and Federal)
- Potential Partners
- Environmental Organizations
- Federal Agencies

While all of the stakeholder types are important to engage for development of a GSP, the first three will be most affected by any changes that might be proposed as a result of the *GSP(s)*.

The following provides an outline of key messages and activities in support of each of the audience types.

4.2.1. <u>Agricultural</u>

Messages about the GSP(s) development should feature the overall desirability of a sustainable management approach how the plan will contribute to management certainty and protect against regulatory oversight.

In thinking about irrigation users it is also important to remember that one size does not fit all.

4.2.2. <u>Disadvantaged Communities</u>

Messages developed for this sector should be tailored and specific to the community. This type of outreach is often best served by use of surrogates and trusted messengers. As identified in the SA, these messages should be aligned with activities of the IRWM, especially given the high, current dependence of many on unsustainable water sources. Messages about ways to access the increased availability of resources due to grant incentives should also be considered.

A specific outreach method to consider relates to the predominance of cells phones within the communities. According to the Pew Research Center, “over 50 percent of low-income households own a smartphone. Smartphone penetration in this demographic creates substantial opportunities for utilities to reach disadvantaged communities with software solutions like customer self-service platforms and targeted digital communications.”[12]

4.2.3. <u>Municipals</u>

[12] Secondary Source: Water Smart. https://www.watersmart.com/rethinking-disadvantaged-community-engagement/ (accessed June 1, 2017)

Some care will be needed to address tensions related to the relative percentages of use by Municipal agencies and what constitutes highest and best beneficial uses within an agricultural region. A promising interaction with this community would involve collaboration on messaging to achieve mutually beneficial goals.

Some thought it might be possible for the municipal agencies to provide in-kind support to the GSP development process through support for project websites and mailing lists, production of meeting notices, assistance to the planning process from in-house public information professionals and offering access to physical meeting spaces.

Municipals may need assistance in making the case for the need to think at a Basin scale rather than more local terms.

4.2.4. Business and Industry Interests

Business and industry interests seek assurances about the availability of water for operations and the viability of the farming industry in the region. Messages for these audiences should focus on how the GSP(s) development will contribute to sustainability and how these audiences can participate in discussion specific to their interests.

4.2.5. Regional/Statewide Interests and Regulators

Some degree of uncertainty remains in the overall legal, legislative and regulatory environment as it relates to SGMA implementation.

It is in the interest of the subbasin stakeholders to engage state and federal agencies and regulators throughout the process. These parties may have resources to assist the subbasin and a cooperative attitude will build good will in the event that adjustments are needed to achieve SGMA compliance.

4.2.6. Potential Agency Partners

A variety of collaborations to achieve GSP(s) development goals may be possible. The GSAs should consider the potential for collaboration with non-GSA members and inter-basin (adjacent subbasin) partners, as part of plan deliberations.

4.2.7. GSP Coordinators Planning Forum

A planning forum for subbasin GSP coordinators should be established to further inform a coordination strategy. This forum would include agency representatives as well as the consultant teams and be used for the sole purpose of coordination and mutual support. It is anticipated that this body might meet on a quarterly or as needed basis. This forum would also provide a central point of contact for adjacent subbasin coordinators.

4.2.8. Environmental Community

As noted in the SA, this community will be interested in a GSP features. The focus of messaging for this group being on how the GSP(s) development will contribute to a sustainable regional water portfolio. Special effort should be made to identify specific topics of interest. For example, as part of GSP development, a list of groundwater dependent species may be created, or impacts to wetlands may be identified. These types of lists would highlight where input from the environmental community might be needed.

4.2.9. Federal Government

Federal representatives interviewed for the assessment asked to be kept informed of subbasin SGMA activities. These agencies have a direct interest in surface water integration as well as SGMA activities that could impact wetlands restoration efforts or groundwater dependent ecosystems and species.

RISK MANAGEMENT

Risk management is the identification, assessment, and prioritization of risks (defined as *the effect of uncertainty on achieving objectives*) followed by coordinated, efficient and economical strategies and actions to minimize, monitor, and control the probability and/or impact of negative events. Strategies and actions may also be used to avert risk by leveraging strengths and opportunities.

Risks can come from uncertainty in economic factors, threats from project failures (at any phase), regulatory and legal uncertainties, natural causes and disasters (drought, flood, etc.), as well as dissention from adversaries, or events of uncertain or unpredictable circumstances. Several risk management standards have been developed. This analysis utilizes those from the Project Management Institute.

Table 6 outlines standardized risk categories and translates them to outreach risks.

Table 6. Risk Factors

RISK CATEGORY	Outreach RISK FACTORS
Technical, quality, or performance	• Realistic performance goals, scope and objectives
Project management	• Quality of outreach design • Outreach deployment and change management • Appropriate allocation of time and resources • Adequate support for Outreach in project management plans
Organizational / Internal	• Executive Sponsorship • Proper prioritization of efforts • Conflicts with other functions • Distribution of workload between organizational and consultant teams
Historical	• Past experiences with similar projects • Organizational relations with stakeholders • Policy and data adequacy • Media and stakeholder fatigue*
External	• Legal and regulatory environment • Changing priorities • Risks related to political dynamics

5.1. Technical, quality, or performance

The subbasin is fortunate to have a high level of water knowledge and skilled personnel available to assist with GSP planning. In general, stakeholder expectations for outreach and performance goals, scope and objectives are attainable. The larger concern in this category is properly communicating the scope of the GSP(s) development and the need for extensive coordination and outreach among a number of parties. Communication of SGMA requirements for outreach as a planning requirement should be an ongoing consideration and appears to be underestimated in emphasis.

5.2. Project management

A number of positive project management factors are present for the GSP(s) development outreach. Project managers view outreach as an important planning element. The outreach design is based on best management practices and industry standards. It is not overly complicated and with technical services support from DWR and other sources, sufficient resources should be available to properly execute it. Procedures and practices are already in place that can be leveraged to achieve communication goals.

The primary concern in this category relates to GSP coordination. This type of outreach will require additional assessment as the individual GSAs will determine their own protocols for representation.

5.3. Organizational / Internal

Conflicts with other GSA member functions and/or conflicts with outreach activities by efforts that include the same stakeholders (e.g. Irrigated Lands, IRWM, and CV-Salts) should be monitored.

One additional consideration will be the distribution of workload between GSA, organizational and consultant teams. Clear roles and responsibilities must be defined and continuous interaction in place to ensure successful execution.

The GSP(s) development process will also need identified, high level spokespersons or champions. These individuals should be able to discuss subbasin planning with the media, in discussions with regulators and potentially at professional conferences.

5.4. External

The legal and regulatory environment of the GSP(s) development process is complex and evolving. Ongoing issues with surface water deliveries and changing agricultural market conditions are outside of the control of the parties. It will be important for mechanisms to be in place that allow for relatively rapid responses to changing conditions.

5.5. Historical

The primary stakeholders in this process generally view interactions and meetings as productive. There is a history of cooperation and a willingness to work together to save costs and achieve better outcomes.

TACTICAL APPROACHES

Following are specific tactical approaches that may be utilized to deliver the activities, messages, and recommendations of the previous chapters. These approaches are based on best communication practices and grounded in the public participation philosophy of the International Association for Public Participation, Public Participation Spectrum as illustrated in **Table 7**.

The Spectrum represents a philosophy that outreach should match the desired level of input from both the stakeholder and the organizational entity.

Table 7. IAP2 Public Participation Spectrum

IAP2 Public Participation Spectrum

Developed by the International Association for Public Participation

INCREASING LEVEL OF PUBLIC IMPACT

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
Public Participation Goal:	To provide the public with balanced and objective information to assist them in understanding the problems, alternatives and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public issues and concerns are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision-making in the hands of the public.
Promise to the Public:	We will keep You informed.	We will keep you informed, listen to and acknowledge concerns and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and issues are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for direct advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.
Example Tools:	• Fact sheets • Web Sites • Open houses	• Public comment • Focus groups • Surveys • Public meetings	• Workshops • Deliberate polling	• Citizen Advisory Committees • Consensus-building • Participatory decision-making	• Citizen juries • Ballots • Delegated decisions

Based on the assessment findings for the GSP(s) development, most stakeholders would simply like to be <u>INFORMED</u> unless there is a potential for significant changes that may include that stakeholder. Tactics for this group will include fact sheets, websites, open houses, briefings, and informational items placed in publications they already read.

The next largest group of stakeholders, primarily groundwater pumpers and disadvantaged communities, wish to be <u>CONSULTED</u>. This group will have access to all the materials prepared as part of the informational phase. In addition they should be invited to provide comments on written materials and planning concepts and participate in focused workshops and/or briefings. They should also be invited to attend larger public meetings.

The development of some GSP features may require a higher degree of INVOLVEMENT. This would focus on engagement of a subset of stakeholders that may experience significant impacts associated with SGMA.

COLLABORATION opportunities have also been identified; however, they are of a different character than defined in the Spectrum. Collaboration in this GSP(s) development process will focus on working with partners that have mutual goals to achieve those goals together. This will more resemble a partnership than a public engagement activity.

6.1. Communications Coordination.

Each GSA is required to perform legally mandated outreach activities and the GSP submission guidelines require a minimum level of engagement.

The subbasin GSAs should coordinate outreach activities even if there is a decision to move forward with multiple GSPs. In addition to efficiency and cost savings (the GSAs can share resources) this strategy will allow for consistency in messaging and reduce confusion for stakeholders that may not know what GSA jurisdiction they are in, and/or are in multiple GSA jurisdictions. Following are suggested options for communications coordination.

1. Website
2. Meeting calendar
3. Branded informational Flyers, Templates, PowerPoint Presentations, etc.
4. Periodic newsletter
5. GSP related mailing lists
6. Descriptions of interested parties
7. Issues and interest statements for legally mandatory interested parties
8. Public workshops
9. Message calendar
10. Press releases and guest editorials
11. Speakers Bureau
12. Existing group venues
13. Outreach documentation

6.2. Tactics

6.2.1. Website

As part of the communications plan development, a list of website concepts and draft website content was prepared. The following describes the proposed approach:

a. Centralized – Establish a centralized website for the entire subbasin.

b. Individual GSAs – Posting of material to a website is part of the SGMA requirements. Those GSAs with their own webpages can link to and from the centralized site if they wish to provide their own customized information. For those GSAs without their own website, courtesy pages would be provided as an added feature of the main site. The courtesy pages would all use a single template with the same information to facilitate easy management and updates. Individual GSAs choosing to take advantage of the courtesy pages would be responsible for ensuring that information is current. The page should include a “Last Updated” box to indicate the timeliness of the information.

c. **Basic features** – A basic website framework has already been developed along with introductory information that has prepopulated each page. **Figure 10** illustrates the basic content of the site and includes:

    1. Background information
    2. Information about getting involved, including meeting information
    3. A separate link for Spanish Language materials
    4. Frequently asked questions
    5. Links to GSAs
    6. Contact information

   Should a GSA decide to not participate in the Central website, a similar structure could be utilized.

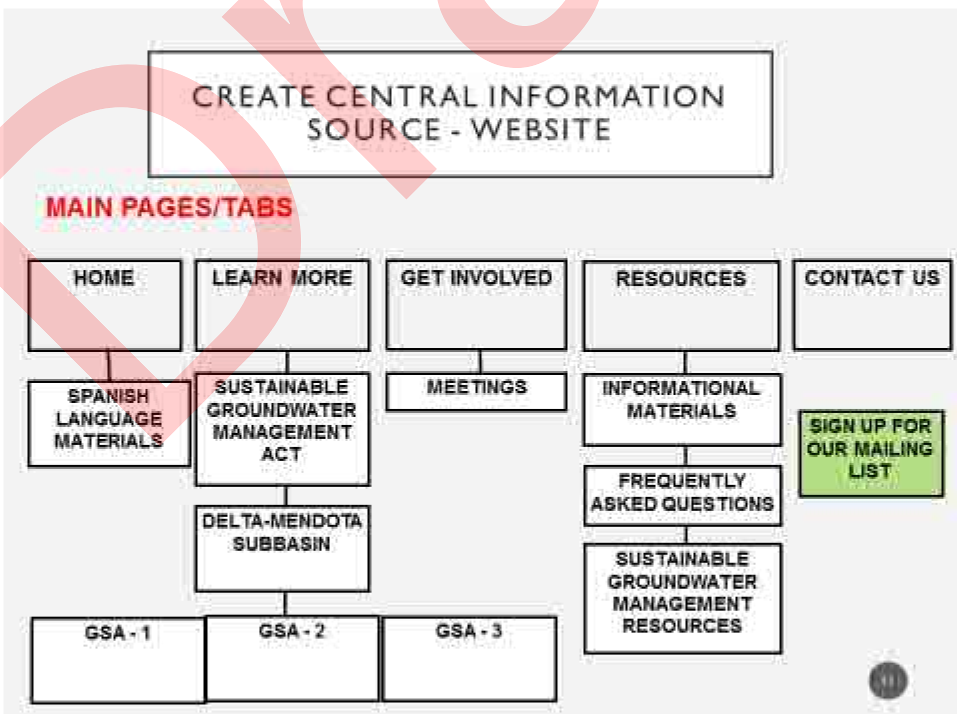


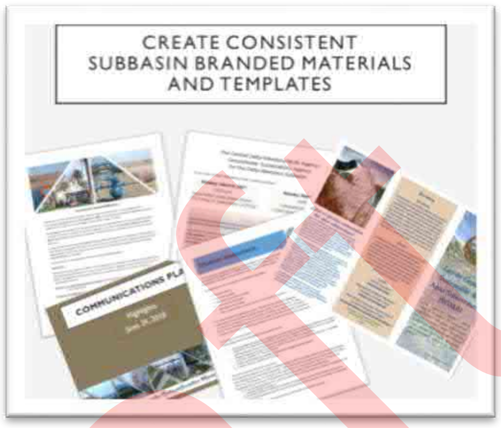
Figure 10. Website Structure

6.2.2. Meeting Calendar

A shared meeting calendar will provide a one-stop shop for stakeholders and assist in preventing meeting conflicts while creating more potential for shared activities. This calendar should include current and scheduled meetings and workshops as well as serve as the repository for agendas and meeting notes, along with copies of meeting materials and presentation.

An integrated project calendar should also be developed that links planning project milestones with communications milestones.

6.2.3. Branded Informational Flyers, Templates, PowerPoint Presentations, etc.



Subbasin level materials should have a single look and feel to create on-going consistency and visual recognition by stakeholders. Use of templates, shared presentations and flyers will create efficiencies and reinforce messaging. This communications plan incorporates some of this type of branding.

6.2.4. Periodic Newsletter

The need for regular communications cannot be overstated. One option is production of a periodic newsletter. Given the relatively short GSP(s) development process timeframe and the GSP development requirements for periodic outreach to identified stakeholders, a quarterly schedule would be realistic and achieve compliance with SGMA requirements for periodic updates to stakeholders. The newsletter should be designed so that individual GSAs can add tailored information if they choose to. For Portable Document Format (PDF) versions of the newsletter, a GSA could add a simple one or two page insert and the edition could be used as a handout or mailer. For a professional looking, email version of the newsletter, we recommend free or low cost services such as Mail Chimp or Constant Comment, which can be integrated with mailing lists.

Adding GSA specific information to an email newsletter can be done with web-links in the email to the very same PDF page prepared for the hardcopy mailer. An alternative is emailing the entire newsletter PDF as an attachment (although this format is less likely to be read than the mailer services).

6.2.5. GSP related mailing lists

Each GSA is required to develop notification lists. A central list may be utilized for GSP(s) related notifications.

6.2.6. Descriptions of Interested Parties

Each GSA is required to develop descriptions of interested parties. These lists should be updated and merged for use in the GSP(s) submittal(s). These can also be provided as background information on the website as part of constructing an administrative record. The SA in Chapter 4 provides an initial start for this documentation.

6.2.7. <u>Issues and Interest Statements for Legally Mandatory Interested Parties</u>

A GSP submission must include a statement of interests for listed stakeholders. As suggested earlier, this can also be included on the website.

6.2.8. <u>Coordinated Public Workshops</u>

SGMA requires a series of public hearings and some public workshops. Such workshops should be coordinated with other subbasin entities.

During the GSA formation process the County of Merced and a forming GSA body conducted a joint workshop to explain more about SGMA and the proposed GSA formation. Distribution of meeting flyers and notices was done concurrently, and DWR attended the event to answer questions. The GSP development process will offer similar opportunities, not only within the subbasin, but with adjacent subbasins.

6.2.9. <u>Message Calendar</u>

Basic messages should be associated with the planning schedule and each stage of GSP(s) development and serve as the theme for the communications materials being generated. For example, during the GSA formation period there was a need to communicate the basics of SGMA and groundwater management. During the GSP(s) initiation phase messages should focus on the basics of groundwater sustainability and the current state of the subbasin. As the GSP(s) begins to take form the specifics of the GSP(s) and what it means for each stakeholder would be the focus.

6.2.10. <u>Press Releases and Guest Editorials</u>

At some point in the GSP development and implementation process, it is likely that stakeholders will be asked to make changes and/or financially support a sustainability effort. It will be more productive for the GSAs and their GSP collaboration partners to frame discussions about these changes than to have others, perhaps with less knowledge, do so on their behalf. For that reason there is a need for press releases and/or guest editorials to offer the media and stakeholders accurate information offered in the context of SGMA. This type of outreach should be closely coordinated as consistency in messages is critical to stakeholder acceptance.

6.2.11. Speakers Bureau

Efforts should be made to conduct outreach at events and meetings that already occur (e.g. Farm Bureau meetings, Rotary Club, etc.). A list of knowledgeable presenters should be developed in the event an organization or other entity would like a presentation. Speakers Bureau engagements should be recorded on the planning project meeting calendar.

6.2.12. Existing Group Venues

Fully leverage the activities of existing groups.

- Maintain a roster of existing groups and typical meeting schedules with a nexus to GSP(s) development. Add the dates to the messaging calendar.
- The list of audiences, messages and existing groups should be referenced when there is a need to deploy information.
- Conduct informal outreach with the leaders of such groups to determine the best way to interact.
- Determine what communications channels these groups are using and equally leverage these, for example by placement of articles in newsletters.

6.2.13. Outreach Documentation

A central point of contact should be identified on the website and an outreach statistics inventory should be established that identifies dates, times, audiences and attendance. This information will be also be useful in conducting follow up with stakeholders as well as documenting outreach as part of GSP submittal guidelines.

6.3. Procedural and Legally Mandated Outreach

A discussion of SGMA outreach requirements was provided in Chapter 1 and a full list of requirements is contained in Appendix 1. One major feature of the requirements is a submission to DWR of the opportunities that interested parties will be given to participate in the GSP deliberations. The Situation Assessment provides an initial description that can be added to with additional outreach.

Following are the Required Interested Parties for the purpose of mandated outreach:

Table 9 provides a list of the mandated outreach and the timeframe in which is required.

Table 8. Mandated Outreach

Timeframe	Item
Prior to initiating plan development	1. Statement of how interested parties may contact the Agency and participate in development and implementation of the plan submitted to DWR.

Timeframe	Item
	2. Web posting of same information.
Prior to plan development	1. Must establish and maintain an interested persons list. 2. Must prepare a written statement describing the manner in which interested parties may participate in GSP development and implementation. Statement must be provided to: a. Legislative body of any city and/or county within the geographic area of the plan b. Public Utilities Commission if the geographic area includes a regulated public water system regulated by that Commission c. DWR d. Interested parties (see Section 10927) e. The public
Prior to and with GSP submission	1. Statements of issues and interests of beneficial users of basin groundwater, including types of parties representing the interests and consultation process 2. Lists of public meetings 3. Inventory of comments and summary of responses 4. Communication section in plan that includes: • Agency decision making process • ID of public engagement opportunities and response process • Description of process for inclusion • Method for public information related to progress in implementing the plan (status, projects, actions)
90 days prior to GSP Adoption Hearing	1. Prior to Public Hearing for adoption or amendment of the GSP, the GSP entities must notify cities and/or counties of geographic area 90 days in advance.
90 days or less prior to GSP Adoption Hearing	2. Prior to Public Hearing for adoption or amendment of the GSP, the GSP entities must: a. Consider and review comments b. Conduct consultation within 30 days of receipt with cities or counties so requesting
GSP Adoption or Amendment	1. GSP must be adopted or amended at Public Hearing.
60 days after plan submission	1. 60-day comment period for plans under submission to DWR. Comments will be used to evaluate the submission.
Prior to adoption of fees	1. Public meeting required prior to adoption of, or increase to fees. Oral or written presentations may be made as part of the meeting. 2. Public notice shall include: a. Time and place of meeting b. General explanation of matter to be considered

Timeframe	Item
	c. Statement of availability for data required to initiate or amend such fees d. Public posting on Agency Website and provision by mail to interested parties of supporting data (at least 20 days in advance) 3. Mailing lists for interested parties are valid for 1 year from date of request and may be renewed by written request of the parties on or before April 1 of each year. 4. Includes procedural requirements per Government Code, Section 6066.
Prior to conducting a fee adoption hearing.	1. Must publish notices in a newspaper of general circulation as prescribed. 2. Publication shall be once a week for two successive weeks. Two publications in a newspaper published once a week or oftener, with at least five days intervening between the respective publication dates not counting such publication dates, are sufficient. 3. The period of notice begins the first day of publication and terminates at the end of the fourteenth day, (which includes the first day.)

6.4. Items for Future Consideration

This GSP(s) Coms Plan outlines an outreach effort based on project and stakeholder needs and preferences. This document has been prepared as a working draft living document and should be updated as new information and the GSP(s) development process needs are developed.

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MEASUREMENTS & EVALUATION

A guiding principle for evaluation and measurement of the Coms Plan's success is to provide regular, unbiased reporting of progress toward achieving goals. Success may be evaluated in several ways, including process measures, outcome measures, and an annual evaluation of accomplishments. Optional evaluation measures are described below.

As part of each outreach effort debrief the following process and outcome measures will be discussed and recorded in a check sheet. The check sheets will be prepared with the goal of continuous improvement rather than criticisms.

7.2. Process Measures

Process measures track progress toward meeting the goals of the Coms Plan. These include:

- Level of attendance at outreach meetings
- Shared understanding of the overarching aims, activities, and opportunities presented by different planning approaches and project activities
- Productive dialogue among participants at meetings and events
- Sense of authentic engagement; people understand why they have been asked to participate, and feel that they can contribute meaningfully
- Timely and accurate public reporting of planning milestones
- Feedback from Coordinating Body and GSA members, regulators, stakeholders, and interested parties about the quality and availability of information materials
- Level of stakeholder interest in the GSP(s) development process information

7.3. Outcome Measures

Outcome measures track the level of success of the Coms Plan in meeting its overall goals. Some outcome measures considered for the GSP(s) development process include the following:

- Consistent participation by key stakeholders and interested parties in essential activities. Participants should have no difficulty locating the meetings, and should be informed as to when and where they will be held.
- Response from meeting participants that the engagement methods provided for a fair and balanced exchange of information.
- Feedback from interested parties that they understand how their input is used, where to track data, and what results to expect.
- The project receives quality media coverage that is accurate, complete and fair.

7.4. Mid-cycle Evaluation of Accomplishments

A mid-cycle evaluation provides an opportunity to examine the current effectiveness of the Coms Plan and provides a chance to reevaluate strategies to meet the GSP(s) development process objectives. The evaluation tasks may include:

- Preparation of an executive-level summary detailing high-level initiatives and accomplishments of the previous cycle. This evaluation should also include positive news, best practices, goals and objectives, notable changes, timelines, and priorities.
- Identifying gaps and areas for improvement.
- Highlighting how gaps and areas for improvement in the cycle has been addressed.
- Outlining process and outcome measures and their current results.

ROLES AND RESPONSIBILITIES

The GSP(s) development Coms Plan outlines numerous strategies, activities and tactics. While none are highly complex, there is a requirement for coordination and clarity regarding who will be responsible for executing the tasks.

After the planning team evaluates the timelines and priorities for each of the communications activities a recommended next step is completion of a Responsible, Accountable, Consulted, and Informed (RACI) Chart. This Chart, as displayed in **Table 10**, outlines key tasks and the assignment of roles and responsibilities for accomplishing them.

Table 9. Sample RACI Chart

Activity TYPE	SPECIFIC PRODUCT	RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
Internal Staff Communications, information materials for/briefings	Draft	Person A	Person E	Person I	
	Final Draft	Person A	Person E	Person I	Project Team
List Serves, mailing lists	Customer Contacts	Person B - Person A	Person E	Person I	Project Team
	Concurrent jurisdictions	Lisa Beutler/MWH	Person G	Person I	Project Team
	Other - identified stakeholders	Person A	Person G	Person I	Project Team
Web Content and Maintenance	Draft Content and Content Refresh	Lisa Beutler/MWH/	Person G	Person H	Project Team
	Site Administration	Person A	Person G	Person H	
General public Intro Packets, Fact Sheets and Brochures	Draft	Person D	Person E	Person I- Subject Matter Experts	Person J
	Revised Draft	Person D	Person E	Person I- Subject Matter Experts	Person J
	Final Draft	Person D	Person E	Person I- Subject Matter Experts	Project Team
Newsletter Content	Draft	Lisa Beutler/MWH	Person E	Person I- Subject Matter Experts	Person J
	Revised Draft	Person D	Person E	Person I- Subject Matter Experts	Person J
	Final Draft	Person D	Person E	Person I- Subject Matter Experts	Project Team

Responsible
Those who do the work to achieve the task. There is at least one person with a role of *responsible*, although others can be delegated to assist in the work required.

Accountable (also approver or final approving authority)
This is the person ultimately answerable for the correct and thorough completion of the deliverable or task, and the one who delegates the work to those responsible. <u>There **may only** be only one *accountable*</u> specified for each task or deliverable.

Consulted
Those whose opinions are sought, typically subject matter experts were people that are impacted by the activity; and with whom there is two-way communication.

Informed
Those who are kept up-to-date on progress, typically on the launch and completion of the task or deliverable. This is one way communication.

Role distinction
There is a distinction between a role and the individual assigned the task. Role is a descriptor of an associated set of tasks that could be performed by just one or many people.

In the case of the RACI Chart, the team may list as many people as is logical except for the Accountable role.

Scope of Work
Completion of the RACI Chart will also support development of any future scopes of work for consultant provided communication and outreach services.

LIST OF APPENDICES

Appendix 1-Public Outreach Requirements under SGMA

Appendix 2-Communications Governance

Appendix 1. Public Outreach Requirements under SGMA

GSP Regulations

CODE	PUBLIC OUTREACH REQUIREMENT
§ 353.6. Initial Notification (a) Each Agency shall notify the Department, in writing, prior to initiating development of a Plan. The notification shall provide general information about the Agency's process for developing the Plan, including the manner in which interested parties may contact the Agency and participate in the development and implementation of the Plan. The Agency shall make the information publicly available by posting relevant information on the Agency's website.	1. Statement of how interested parties may contact the Agency and participate in development and implementation of the plan submitted to DWR. 2. Web posting of same information. **Timing**: *Prior to initiating development of a plan.*
§ 353.8. Comments (a) Any person may provide comments to the Department regarding a proposed or adopted Plan. (b) Pursuant to Water Code Section 10733.4, the Department shall establish a comment period of no less than 60 days for an adopted Plan that has been accepted by the Department for evaluation pursuant to Section 355.2. (c) In addition to the comment period required by Water Code Section 10733.4, the Department shall accept comments on an Agency's decision to develop a Plan as described in Section 353.6, including comments on elements of a proposed Plan under consideration by the Agency.	1. 60-day comment period for plans under submission to DWR. Comments will be used to evaluate the submission. 2. Parties may also comment on a GSA's (or GSAs') statements submitted under section 353.6 **Timing**: For GSP Submittal - *60 days after submission to DWR*
§ 354.10. Notice and Communication Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following: (a) A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties. (b) A list of public meetings at which the Plan was discussed or considered by the Agency. (c) Comments regarding the Plan received by the Agency and a summary of any responses by the Agency. (d) A communication section of the Plan that includes the following: (1) An explanation of the Agency's decision-making process. (2) Identification of opportunities for public engagement and a discussion of how public input and response will be used.	5. Statements of issues and interests of beneficial users of basin groundwater, including types of parties representing the interests and consultation process 6. Lists of public meetings 7. Inventory of comments and summary of responses 8. Communication section in plan that includes: • Agency decision making process • ID of public engagement opportunities and response process • Description of process for inclusion • Method for public information related to progress in implementing the plan (status, projects, actions) **Timing**: For GSP Submittal – *with plan* For GSP Development – *continuous.* *[Note: activities should be included*

CODE	PUBLIC OUTREACH REQUIREMENT
(3) A description of how the Agency encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin. (4) The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions.	*in the project schedule and information posted on web.]*
§ 355.2. (c) Department Review of Adopted Plan (c) The Department (DWR) shall establish a period of no less than 60 days to receive public comments on the adopted Plan, as described in Section 353.8.	1. 60 day public review period for public comment on submitted plan. **Timing**: After GSP Submittal to DWR – *60 days*
§ 355.4. & 355.10 Criteria for Plan Evaluation The basin shall be sustainably managed within 20 years of the applicable statutory deadline consistent with the objectives of the Act. The Department shall evaluate an adopted Plan for compliance with this requirement as follows: (b) (4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered. … (10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.	1. Required public outreach and stakeholder information is submitted, including statement of issues and interests of beneficial users. 2. Public and stakeholder comments and questions adequately addressed during planning process. **Timing**: For GSP Submittal – *with plan* For resubmittal related to corrective action – *with submittal*

California Water Code

CODE	PUBLIC OUTREACH REQUIREMENT
10720. This part shall be known, and may be cited, as the "Sustainable Groundwater Management Act." **10720.3** (a) This part applies to all groundwater basins in the state. … (c) The federal government or any federally recognized Indian tribe, appreciating the shared interest in assuring the sustainability of groundwater resources, may voluntarily agree to participate in the preparation or administration of a groundwater sustainability plan or groundwater management plan under this part through a joint powers authority or other agreement with local agencies in the basin. A participating tribe shall be eligible to participate fully in planning, financing, and management under this part, including eligibility for grants and technical assistance, if any exercise of regulatory authority, enforcement, or imposition and collection of fees is pursuant to	1. Tribes and the federal government may voluntarily participate in GSA governance and GSP development. **Timing**: *Prior to initiating development of a plan.*

CODE	PUBLIC OUTREACH REQUIREMENT
the tribe's independent authority and not pursuant to authority granted to a groundwater sustainability agency under this part.	
CHAPTER 4. Establishing Groundwater Sustainability Agencies [10723 - 10724]	
10723. a) Except as provided in subdivision (c), any local agency or combination of local agencies overlying a groundwater basin may decide to become a groundwater sustainability agency for that basin. (b) Before deciding to become a groundwater sustainability agency, and after publication of notice pursuant to Section 6066 of the Government Code, the local agency or agencies shall hold a public hearing in the county or counties overlying the basin.	1. Must hold public hearing in the county or counties overlying the basin, prior to becoming a GSA **Timing**: *Prior to becoming a GSA.*
10723.2 The groundwater sustainability agency shall consider the interests of all beneficial uses and users of groundwater, as well as those responsible for implementing groundwater sustainability plans. These interests include, but are not limited to, all of the following: (a) Holders of overlying groundwater rights, including: (1) Agricultural users. (2) Domestic well owners. (b) Municipal well operators. (c) Public water systems. (d) Local land use planning agencies. (e) Environmental users of groundwater. (f) Surface water users, if there is a hydrologic connection between surface and groundwater bodies. (g) The federal government, including, but not limited to, the military and managers of federal lands. (h) California Native American tribes. (i) Disadvantaged communities, including, but not limited to, those served by private domestic wells or small community water systems. (j) Entities listed in Section 10927 that are monitoring and reporting groundwater elevations in all or a part of a groundwater basin managed by the groundwater sustainability agency.	1. Must consider interest of all beneficial uses and users of groundwater. 2. Includes specific stakeholders as listed. **Timing**: *During development of a GSP.*
10723.4. The groundwater sustainability agency shall establish and maintain a list of persons interested in receiving notices regarding plan preparation, meeting announcements, and availability of draft plans, maps, and other relevant documents. Any person may request, in writing, to be placed on the list of interested persons.	3. Must establish and maintain an interested persons list. 4. Any person may ask to be added to the list **Timing**: *On forming a GSA.*
10723.8. (a) Within 30 days of deciding to become or form a groundwater sustainability agency, the local agency or combination of local agencies shall inform the department of its decision and its intent to undertake sustainable groundwater management. The	1. Creates notification requirements that include: a. A list of interested parties b. An explanation of how interests will be considered

CODE	PUBLIC OUTREACH REQUIREMENT
notification shall include the following information, as applicable: … (4) A list of interested parties developed pursuant to Section 10723.2 and an explanation of how their interests will be considered in the development and operation of the groundwater sustainability agency and the development and implementation of the agency's sustainability plan.	**Timing**: *On forming a GSA & with submittal of GSP*
10727.8 (a) Prior to initiating the development of a groundwater sustainability plan, the groundwater sustainability agency shall make available to the public and the department a written statement describing the manner in which interested parties may participate in the development and implementation of the groundwater sustainability plan. The groundwater sustainability agency shall provide the written statement to the legislative body of any city, county, or city and county located within the geographic area to be covered by the plan. The groundwater sustainability agency may appoint and consult with an advisory committee consisting of interested parties for the purposes of developing and implementing a groundwater sustainability plan. The groundwater sustainability agency shall encourage the active involvement of diverse social, cultural, and economic elements of the population within the groundwater basin prior to and during the development and implementation of the groundwater sustainability plan. If the geographic area to be covered by the plan includes a public water system regulated by the Public Utilities Commission, the groundwater sustainability agency shall provide the written statement to the commission. (b) For purposes of this section, interested parties include entities listed in Section 10927 that are monitoring and reporting groundwater elevations in all or a part of a groundwater basin managed by the groundwater sustainability agency.	2. Agencies preparing a GSP must prepare a written statement describing the manner in which interested parties may participate in its development and implementation. 3. Statement must be provided to: a. Legislative body of any city and/or county within the geographic area of the plan b. Public Utilities Commission if the geographic area includes a regulated public water system regulated by that Commission c. DWR d. Interested parties (see Section 10927) e. The public 4. GSP entities may form an advisory committee for the GSP preparation and implementation. 5. The GSP entities are to encourage active involvement of diverse social, cultural and economic elements of the affected populations. **Timing**: *On initiating GSP*
10728.4 Public Notice of Proposed Adoption, GSP Adoption Pubic Hearing A groundwater sustainability agency may adopt or amend a groundwater sustainability plan after a public hearing, held at least 90 days after providing notice to a city or county within the area of the proposed plan or amendment. The groundwater sustainability agency shall review and consider comments from any city or county that receives notice pursuant to this section and shall consult with a city or county that requests consultation within 30 days of receipt of the notice. Nothing in this section is intended to	3. GSP must be adopted or amended at Public Hearing. 4. Prior to Public Hearing for adoption or amendment of the GSP, the GSP entities must: a. Notify cities and/or counties of geographic area 90 days in advance. b. Consider and review comments

<table>
<tr><th>CODE</th><th>PUBLIC OUTREACH REQUIREMENT</th></tr>
<tr><td>preclude an agency and a city or county from otherwise consulting or commenting regarding the adoption or amendment of a plan.</td><td>c. Conduct consultation within 30 days of receipt with cities or counties so requesting</td></tr>
<tr><td>10730 Fees.
(a) A groundwater sustainability agency may impose fees, including, but not limited to, permit fees and fees on groundwater extraction or other regulated activity, to fund the costs of a groundwater sustainability program, including, but not limited to, preparation, adoption, and amendment of a groundwater sustainability plan, and investigations, inspections, compliance assistance, enforcement, and program administration, including a prudent reserve. A groundwater sustainability agency shall not impose a fee pursuant to this subdivision on a de minimis extractor unless the agency has regulated the users pursuant to this part.
(b) (1) Prior to imposing or increasing a fee, a groundwater sustainability agency shall hold at least one public meeting, at which oral or written presentations may be made as part of the meeting.
(2) Notice of the time and place of the meeting shall include a general explanation of the matter to be considered and a statement that the data required by this section is available. The notice shall be provided by publication pursuant to Section 6066 of the Government Code, by posting notice on the Internet Web site of the groundwater sustainability agency, and by mail to any interested party who files a written request with the agency for mailed notice of the meeting on new or increased fees. A written request for mailed notices shall be valid for one year from the date that the request is made and may be renewed by making a written request on or before April 1 of each year.
(3) At least 20 days prior to the meeting, the groundwater sustainability agency shall make available to the public data upon which the proposed fee is based.
(c) Any action by a groundwater sustainability agency to impose or increase a fee shall be taken only by ordinance or resolution.
(d) (1) As an alternative method for the collection of fees imposed pursuant to this section, a groundwater sustainability agency may adopt a resolution requesting collection of the fees in the same manner as ordinary municipal ad valorem taxes.
(2) A resolution described in paragraph (1) shall be adopted and furnished to the county auditor-controller and board of supervisors on or before August 1 of each year that the alternative collection of the fees is being requested. The resolution shall include a list of parcels and the amount to be collected for each parcel.
(e) The power granted by this section is in addition to any powers a groundwater sustainability agency has under any other law.</td><td>Related to GSAs
5. Public meeting required prior to adoption of, or increase to fees. Oral or written presentations may be made as part of the meeting.
6. Public notice shall include:
a. Time and place of meeting
b. General explanation of matter to be considered
c. Statement of availability for data required to initiate or amend such fees
d. Public posting on Agency Website and provision by mail to interested parties of supporting data (at least 20 days in advance)
7. Mailing lists for interested parties are valid for 1 year from date of request and may be renewed by written request of the parties on or before April 1 of each year.
8. Includes procedural requirements per Government Code, Section 6066.

Timing: Prior to adopting fees.</td></tr>
</table>

California Government Code

CODE	PUBLIC OUTREACH REQUIREMENT
6060 Whenever any law provides that publication of notice shall be made pursuant to a designated section of this article, such notice shall be published in a newspaper of general circulation for the period prescribed, the number of times, and in the manner provided in that section. As used in this article, “notice” includes official advertising, resolutions, orders, or other matter of any nature whatsoever that are required by law to be published in a newspaper of general circulation. **6066** Publication of notice pursuant to this section shall be once a week for two successive weeks. Two publications in a newspaper published once a week or oftener, with at least five days intervening between the respective publication dates not counting such publication dates, are sufficient. The period of notice commences upon the first day of publication and terminates at the end of the fourteenth day, including therein the first day.	4. Must publish notices in a newspaper of general circulation as prescribed. 5. Publication shall be once a week for two successive weeks. Two publications in a newspaper published once a week or oftener, with at least five days intervening between the respective publication dates not counting such publication dates, are sufficient. 6. The period of notice begins the first day of publication and terminates at the end of the fourteenth day, (which includes the first day.) **Timing**: *Prior to adopting fees*

Appendix 2. Communications Governance

Given the relatively large number of stakeholders, a recommendation for coordinated efforts, and the legal requirements for outreach[13] some form of communications governance is recommended.

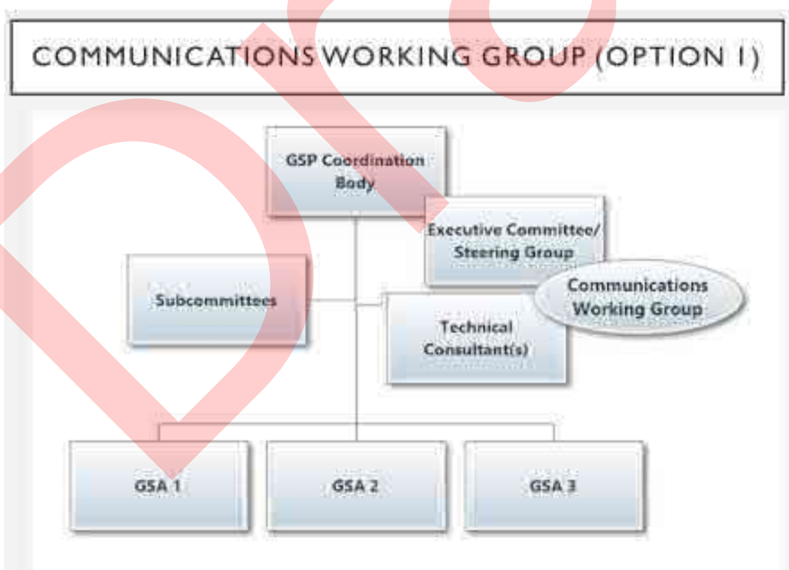
Execution of communications activities can be accomplished by an individual or multiple individuals, and/or include or be solely managed by project consultants. The actual form of the governance is less important than a clear understanding of the roles and responsibilities of those responsible for ensuring required communication. Also essential is a clear chain of command that ensures the elected representatives of GSAs are able to retain communications leadership and guidance.

A driving consideration for establishing a communications governance structure is the level of effort associated with required activities and the fact that communications are highly time dependent. That means that communications activities should be occurring that may happen outside of regularly scheduled GSA meetings. In this case delegation with guidance to a communications team is efficient and effective.

Several governance options for consideration are offered below.

Communications Option 1

Communications Option 1 is based on an overall GSP(s) development structure that includes a GSA member based leadership function that is guiding the Technical Consultants. A communications working group which might include staff, consultants and GSA elected officials, or some combination of those roles could be formed to serve as a communications working group that would ultimately report to the larger GSP coordinating body.



Communications Governance Option 1

Communications Option 2

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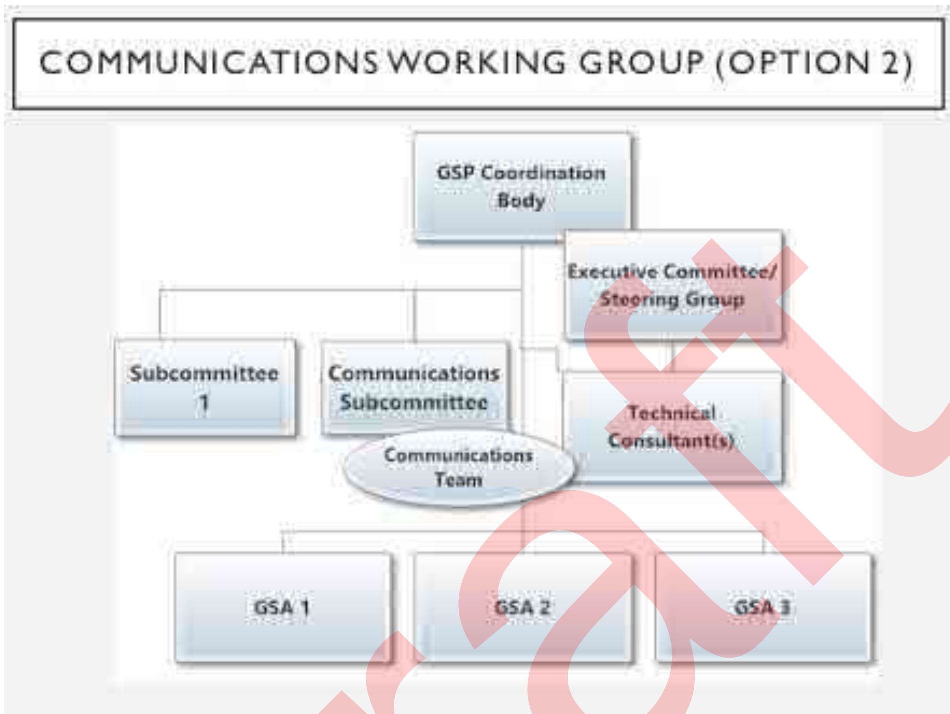
[13] See Appendix 1

Appendix 1

Communications Option 1 is based on an overall GSP(s) development structure that includes a GSA member based subcommittee guiding the Technical Consultants. A communications working group which might include staff, consultants and GSA elected officials, or some combination of those roles could be formed to serve as a communications team that is affiliated with a subcommittee and would ultimately report to the larger GSP coordinating body



Communications Governance Option 2

ATTACHMENT B. COORDINATED PUBLIC WORKSHOP SUMMARIES

DELTA-
MENDOTA
SGMA

DELTA-MENDOTA SUBBASIN
SUSTAINABLE GROUNDATER MANAGEMENT ACT
SPRING 2018 COORDINATED WORKSHOPS

Monday, May 14, 2018, Los Banos
Wednesday, May 16, 2018, Patterson
Thursday, May 17, 2018, Mendota

WORKSHOP SUMMARY

- Three workshops were held in the northern, central, and southern parts of the Delta-Mendota Subbasin. The purpose of the workshops was to educate stakeholders and members about the public about the Sustainable Groundwater Management Act (SGMA) and introduce participants to their local Groundwater Sustainability Agency representatives. Topics covered during the workshop included what is SGMA, the Delta-Mendota Subbasin, and opportunities for public engagement.
- Workshop participants' questions and feedback are summarized as follows:
  - Are the local groundwater regulations going to be re-set on an annual basis based on the water year, snowpack, etc.?
  - Who is the governing board that will make these decisions?
  - If this is a state-wide initiative, who is the decision-making body?
  - Will the California Department of Fish and Wildlife be involved?
  - Has the State provided criteria to what is considered a "chronic loss" of groundwater?
  - Are natural springs included under SGMA?
  - What criteria will you use to measure whether or not springs are overused?
  - What is the ultimate goal of SGMA? What does it mean to us?
  - How is the water budget going to be developed?
  - The Irrigated Lands Program already has a lot of requirements for growers. Is this going to be the same level of detail and effort?
  - What is the goal SGMA is trying to achieve? How are we going to get to sustainability?
  - What will happen when the State and districts do not receive their full surface water allocation and cities keep expanding?
  - It seems to me that the biggest problem is that the State wants to export water to Southern California. How can we come up with a solution if there are factors out of our control?

- How will you know how much I am pumping?

DELTA-MENDOTA SUBBASIN
SUSTAINABLE GROUNDATER MANAGEMENT ACT
FALL 2018 COORDINATED WORKSHOPS

Monday, October 22, Firebaugh
5:00 – 7:00 PM
Firebaugh Middle School MPR

Wednesday, October 24, Los Banos
4:00 – 6:00 PM
College Greens Building

Thursday, October 25, Patterson
4:00 – 6:00 PM
Patterson Senior Center

WORKSHOP SUMMARY

- Three workshops were held in the northern, central, and southern parts of the Delta-Mendota Subbasin. The purpose of the workshops was to educate stakeholders and members about the public about key Sustainable Groundwater Management Act (SGMA) topics in preparation for Groundwater Sustainability Plan (GSP) development workshops in 2019.
- The format and content of each workshop was the same. The workshops began with a 45-minute presentation, followed by an open house period for participants to talk with their Groundwater Sustainability Agency (GSA) representative. Spanish interpretation was provided at each workshop.
- In total, approximately 45 individuals (not including GSA representatives and supporting staff) participated in the workshops. Attendance by location was as follows: Firebaugh – 5 participants; Los Banos – 23 participants; Patterson – 17 participants. Three participants requested Spanish interpretation.
- Most participants heard about the workshops through emails from their local water or irrigation district, or direct flyers and bill inserts sent to them by their water/irrigation district or municipality.
- Presentation topics included: Overview of SGMA, GSP development and implementation process, data management, hydrogeologic conceptual model, numerical and analytical models, and the water budget.
- Workshop participants' questions and feedback are summarized as follows:

  Data

    - How much historical data are the GSAs using to make their assumptions?
    - Will data from counties be used?

- Is the numerical data available on the Delta-Mendota website?
- How big will the GSAs' monitoring network be? Do the GSAs anticipate drilling new monitoring wells?
- How will the GSAs monitor water quality and subsidence? Do the GSAs already have subsidence monitoring wells and data?
- How much data have the GSAs gathered? When will the GSAs stop gathering data?
- How much data will the GSAs be collecting from individual landowners?

Models

- Will the models take into account availability of surface water supplies?
- Will the models take into account changing crops?
- Will the models take into account agricultural areas that are being converted to commercial or urban areas?

Water Budget and Sustainable Yield

- What is the sustainable yield for the Delta-Mendota Subbasin?
- It sounds like the sustainable yield will be a number that oscillates around a baseline. What is this baseline?
- How will the GSAs determine the minimum threshold for the subbasin?
- How will the water budgets account for existing and new wells?
- What are the years for the historic water budget? How was this period set?

Projects and Management Actions

- Based on what is currently known, will the GSAs be able to limit groundwater pumping in the future?
- When the GSAs come up with groundwater management policies, will the policies impact groundwater pumping on an individual level, regional level, or basin-wide level?
- Will the California Department of Water Resources (DWR) or the GSAs be the ones to limit pumping?
- Could a potential management action be limiting pumping?
- Will the GSAs be the agencies to determine if new wells can or cannot be drilled?

Integration with Other Programs/Organizations

- How much are the GSAs integrating with the Irrigated Lands Program?
- How closely do GSAs work with local farm bureaus?

Other

- Will there be an administrative fee for the GSAs to oversee GSP implementation?
- How will the costs for GSP development and implementation be covered?
- Do the GSAs know what DWR's GSP review and certification process will consist of?

- Will the GSAs in the region have influence over how surface water resources are managed on a state-wide level?
- How many GSAs were formed after SGMA passed in 2014?

DELTA-MENDOTA SUBBASIN
SUSTAINABLE GROUNDATER MANAGEMENT ACT
WINTER 2019 COORDINATED WORKSHOPS

Tuesday, February 19, 2019, Los Banos
4:00 – 6:00 PM
College Greens Building

Wednesday, February 20, 2019, Patterson
4:00 – 6:00 pm
City of Patterson City Hall

Monday, March 4, 2019, Santa Nella
6:00 – 8:00 PM
Romero Elementary School

WORKSHOP SUMMARY

- Three workshops were held in the northern, central, and southern parts of the Delta-Mendota Subbasin during February and March 2019. The purpose of the workshops was to educate stakeholders and members about the public about topics covered in the draft Groundwater Sustainability Plans (GSP) being developed for the subbasin. Topics covered during the workshop included historic and current water budgets, sustainability criteria, undesirable results, and projects and management actions.
- Workshops were promoted via emails sent to each GSA's interested parties database, flyers and utility bill inserts, and social media posts.
- The format and content of each workshop was the same. The workshops began with a short presentation, followed by an open house period for participants to talk with their Groundwater Sustainability Agency (GSA) representative. Spanish interpretation was provided at each workshop.
- In total, approximately 30 individuals (not including GSA representatives and supporting staff) participated in the workshops. Attendance by location was as follows: Patterson – 14, Los Banos – 4, and Santa Nella – 12. Participants represented a range of beneficial users in the subbasin, including domestic well owners, agricultural water users, public water systems, and disadvantaged communities.

- Workshop participants' questions and feedback are summarized as follows:

  Water Budgets

    - Does the land surface budget include inflows from precipitation and applied water to crops?
    - Who provides the information about the inflows and outflows of the aquifer?
    - How is the aquifer recharged?
    - Do reservoirs lose water?
    - What happened between 1985 – now [regarding the historic water budget]?
    - What affect does precipitation have on the aquifer?

  Projects and Management Actions

    - Who will make the decision on who can drill wells and how much can well owners can pump?
    - Will GSAs in the subbasin be able to restrict selling of groundwater outside of the subbasin?
    - Projects and management actions should emphasize flood and stormwater capture and increased stormwater storage.
    - Will use of recycled water in new developments be considered a source of water to balance the water budget?
    - Are there percolation ponds by golf course?

  Sustainability Criteria and Undesirable Results

    - Is it the GSAs' responsibility to set the sustainability criteria for the subbasin?
    - Could this region experience seawater intrusion?
    - What's going to happen in areas like Dos Palos that have poor groundwater quality?

  Other

  - Does the GSP only cover of agricultural uses of groundwater or does it also cover residential and commercial uses of groundwater?
  - Who is doing the work to prepare the GSP?
  - How much does it cost to prepare a GSP?
  - Are there any agencies currently monitoring groundwater pumping and levels?
  - How is groundwater currently being removed from the groundwater basin?
  - How many monitoring stations have been identified? Have GSAs already identified where these monitoring pumps are?
  - Does the California Aqueduct affect the water table in the subbasin?
  - What is the rationale for the North-Central GSP group's boundaries? The north and south areas of the North-Central GSP group are very different.
  - Do water agencies in the subbasin send water to the Santa Clara Valley Water District?
  - Where are the coordinated meetings are held? What time are these meetings?
  - Will this raise our water rates?
  - The community of Tranquillity is currently experiencing land subsidence.

DELTA-MENDOTA SUBBASIN
SUSTAINABLE GROUNDATER MANAGEMENT ACT
SPRING 2019 COORDINATED WORKSHOPS

Monday, May 20, 2019, Patterson
4:00 – 6:00 pm
City of Patterson City Hall

Tuesday, May 21, 2019, Los Banos
4:00 – 6:00 PM
College Greens Building

Wednesday, May 22, 2019, Santa Nella
6:30 – 8:30 PM
Romero Elementary School

Thursday, May 23, 2019, Mendota
6:00 – 8:00 PM
Mendota Library

WORKSHOP SUMMARY

- Four workshops were held in the northern, central, and southern parts of the Delta-Mendota Subbasin. The purpose of the workshops was to educate stakeholders and members about the public about topics covered in the draft Groundwater Sustainability Plans (GSP) being developed for the subbasin. Topics covered during the workshop included water budgets, sustainable yield, projects and management actions, and groundwater monitoring networks.
- Workshops were promoted via emails sent to each GSA's interested parties database, flyers and utility bill inserts, social media posts, and direct outreach to community stakeholders.
- The format and content of each workshop was the same. The workshops began with a short presentation, followed by an open house period for participants to talk with their Groundwater Sustainability Agency (GSA) representative. Spanish interpretation was provided at each workshop.
- In total, approximately 30 individuals participated in the workshops. Attendance by location was as follows: Patterson – 7, Los Banos – 10, Santa Nella – 4, and Mendota – 9. Participants represented a range of beneficial users in the subbasin, including domestic well owners, agricultural water users, public water systems, and disadvantaged communities.

- Workshop participants' questions and feedback are summarized as follows:

  Water Budgets

  - Why is there a difference between the water budgets for the upper and lower aquifers?
  - Why is the change in storage negative?
  - Is there a water budget for each aquifer?
  - When the projected water budgets are finalized, will they include specific projects and management actions?
  - How was the data for the climate change factors developed?
  - Historically, California goes through periodic droughts. Do the projected water budgets account for future droughts?
  - Do the projected water budgets account for future population growth and new developments?
  - Do the water budgets account for percolation from water applied to crops?

  Projects and Management Actions

  - Will management actions include a charge for water pumping?
  - Will pumping restrictions be implemented during dry periods or drought?
  - Will the GSPs identify specific projects and management actions?
  - Will GSAs in the subbasin form a water bank?
  - If pumping restrictions are enacted, GSPs should include a provision that allows private well owners to demonstrate that they aren't overpumping or causing undesirable results.
  - The region needs more surface water storage to supplement groundwater pumping.
  - There should be restrictions on development in the region.

  Sustainable Yield

  - Does increases in groundwater demand relate to the cost of surface water supplies?

  Groundwater Monitoring

  - When local agencies monitor for groundwater, how far down do they monitor?

  GSP Adoption, Implementation and Enforcement

  - What agency approves the GSPs?
  - Will the California Department of Water Resources be the lead agency for providing oversight after the GSP is submitted?
  - Could the State Water Resources Control Board mandate pumping restrictions?
  - Will the state be looking at the drawdown of individual, private wells?
  - Where does the funding to implement GSPs come from?
  - How much will GSP implementation cost?
  - Who has to submit the annual report?

  Other

  - GSAs should be divided into even smaller units to manage projects and management actions locally.

ATTACHMENT C. EXAMPLE PUBLIC WORKSHOP PROMOTION MATERIALS

Groundwater management in our community is changing.

Learn more about how this may impact you.

Collaborating local agencies are hosting a series of public workshops about the Sustainable Groundwater Management Act. Come learn how this landmark legislation may impact our community, what we are doing about it, and how you can get involved. Representatives from local groundwater sustainability agencies will be available to answer questions. You have three opportunities to attend:

Los Banos
Monday, May 14
4:00 - 6:00 PM
San Luis & Delta-Mendota
Water Authority Office
842 6th St, Los Banos

Patterson
Wednesday, May 16
4:00 - 6:00 PM
Hammon Senior Center
1033 W Las Palmas Ave, Patterson

Mendota
Thursday, May 17
4:00 - 6:00 PM
Mendota Branch Library
Mendota Meeting Room
1246 Belmont Ave, Mendota

The content of each workshop will be the same. The first thirty minutes of each workshop will consist of an informational presentation, followed by an open house until 6:00 PM. For more information, please visit our website at: www.deltamendota.org.

We look forward to seeing you there!

El manejo del agua subterránea en nuestra comunidad está cambiando.

Obtenga más información sobre como esto puede afectarlo.

Las agencias locales colaboradoras están organizando una serie de talleres públicos sobre la Ley de gestión sostenible del agua subterránea. Venga y aprenda como esta histórica legislación puede afectar a nuestra comunidad, que estamos haciendo al respecto y como puede participar. Los representantes de las agencias locales de sostenibilidad del agua subterránea estarán disponibles para responder preguntas. Tienes tres oportunidades para asistir:

Los Baños
Martes, 14 de Mayo
4:00 - 6:00 PM
San Luis & Delta-Mendota
Water Authority Office
842 6th St, Los Baños

Patterson
Miércoles, 16 de Mayo
4:00 - 6:00 PM
Hammon Senior Center
1033 W Las Palmas Ave, Patterson

Mendota
Jueves, 17 de Mayo
4:00 - 6:00 PM
Mendota Branch Library
Mendota Meeting Room
1246 Belmont Ave, Mendota

El contenido de cada taller será el mismo. Los primeros treinta minutos de cada taller serán consisten de una presentación informativa, seguida de una jornada de puertas abiertas hasta las 6:00 P.M. Para obtener más información, visite nuestro sitio web en: www.deltamendota.org.

Public Notice

Public Groundwater Meeting

Santa Nella County Water District and other local water agencies are developing plans for the future of our groundwater resources. We want to hear from you! Come to an upcoming public workshop to learn more:

Santa Nella
Monday, March 4, 6:000 - 8:00 PM
Romero Elementary School MPR
13500 Luis Ave, Gustine, CA 95322

The first forty minutes of the workshop will consist of a bilingual informational presentation. The presentation will be followed by an interactive discussion on the region's groundwater "budget" and how to define "sustainability" for our groundwater resources. This workshop is open to people with all level of knowledge about water.

Spanish-language interpreters and materials will be available.

For more information, please visit our website at www.deltamendota.org and www.sncwd.com.

For questions or comments, email DMSGMA@sldmwa.org or contact Amy Montgomery, Santa Nella County Water District, at amontgomery@sncwd.com.

We look forward to seeing you there!

Engage in the Future of Our Water Resources!

Week of May 20th

Delta-Mendota SGMA invite you to learn why your local agencies are developing groundwater sustainability plans for the future of our groundwater. Please come to one

- **Patterson**: Mon., May 20, 4:00 – 6:00pm Patterson City Hall 1 Plaza Circle
- **Los Banos**: Tue., May 21, 4:00 – 6:00pm College Greens Building 1815 Scripps Drive
- **Santa Nella**: Wed., May 22, 6:30 – 8:30pm Romero Elem. School 13500 Luis Ave.
- **Mendota**: Thu., May 23, 6:00 – 8:00pm Mendota Library 1246 Belmont Ave.

For more information please visit www.deltamendota.org, To register visit: tinyurl.com/y3bxw3yv

PROP 1

#DeltaMendotaSGMA | #SLDMWA | #SGMA2020

DELTA-MENDOTA SGMA

Su Opinión es Importante!

Participe en una serie de talleres sobre el futuro de sus recursos hídricos!

<u>Semana del 20 de mayo</u>

Agencias locales están desarrollando planes de sostenibilidad para el futuro de los recursos hídricos del agua subterránea en la región y necesitan su opinión.

Acompáñenos en uno de los siguientes talleres:

- **Patterson**: Lun.,20 de Mayo , 4–6pm Ayuntamiento de Patterson 1 Plaza Circle
- **Los Banos**: Mar., 21 de May, 4–6pm College Greens Building 1815 Scripps Dr.
- **Santa Nella**: Mie., 22 de Mayo, 6:30–8:30pm Escuela Pri. Romero 13500 Luis Ave.
- **Mendota**: Jue., 23 de Mayo, 6–8pm Biblioteca de Mendota 1246 Belmont Ave.

Para más información visite:

www.deltamendota.org

Tel: 916-418-8288

#DeltaMendotaSGMA | #SLDMWA

Contact: Kirsten Pringle, Delta-Mendota Subbasin, Stantec
(916) 418-8243, Kirsten.Pringle@stantec.com

FOR IMMEDIATE RELEASE
October 19, 2018

MEDIA ADVISORY

Sustainable Groundwater Management Act Public Workshops

What: Collaborating local agencies are hosting a series of public workshops about the Sustainable Groundwater Management Act. Learn how this landmark legislation may impact our communities, the planning process, and how people can get involved. Spanish translation will be provided.

Format: There are three workshop opportunities to attend; the content of each workshop will be the same. The first 45 minutes of each workshop will consist of an informational presentation, followed by an open house.

When:

Firebaugh – Monday, October 22, 2018
5:00 - 7:00 PM
Firebaugh Middle School MPR
1600 16th Street, Firebaugh, CA

Los Banos – Wednesday, October 24, 2018
4:00 – 6:00 PM
College Greens Building
1815 Scripps Drive, Los Banos, CA

Patterson – Thursday, October 25, 2018
4:00 – 6:00 PM
Hammon Senior Center
1033 W. Las Palmas Avenue, Patterson, CA

Who: Representatives from local groundwater sustainability agencies will be available to answer questions.

Additional Resources: The Sustainable Groundwater Management Act, www.deltamendota.org/,

Background: *The Sustainable Groundwater Management Act (SGMA) is a package of three bills (AB 1739, SB 1168, and SB 1319) that provides local agencies with a framework for managing groundwater basins in a sustainable manner. Recognizing that groundwater is most effectively managed at the local level, the SGMA empowers local agencies to achieve sustainability within 20 years.*

ATTACHMENT D. STAKEHOLDER AND COMMUNITY ORGANIZATIONS CONTACTED REGARDING COORDINATED PUBLIC WORKSHOPS

Stakeholder and Community Organizations Contacted Regarding Coordinated SGMA Workshops

Organization Name	Organization Type
Fresno County Farm Bureau	Agriculture
Merced County Farm Bureau	Agriculture
North Grassland Wildlife Foundation	Agriculture
Patterson Apricot Fiesta	Agriculture
Stanislaus County Farm Bureau	Agriculture
Asociación de Charros La Internacional del Valle de Patterson	Business
Adobe Valley Ranch	Business
Gustine Chamber of Commerce	Business
Los Banos Chamber of Commerce	Business
Patterson-Westley Chamber of Commerce	Business
Santa Nella Chamber of Commerce	Business
American Association of University Women	Civic
Gustine Rotary Club	Civic
International Association of Lions Clubs - Patterson	Civic
League of United Latin American Citizens	Civic
Los Banos Lions Club	Civic
Los Banos Rotary Club	Civic
Mendota Community Corporation	Civic
Newman Lions Club	Civic
Newman Rotary Club	Civic
Newman Women's Club	Civic
Patterson Lions Club	Civic
International Association of Lions Clubs - Mendota	Civic
International Association of the Lions Clubs - Los Banos	Civic
Italian Catholic Federation of CA Inc.	Civic
Kiwanis International	Civic
Rotary International - Los Banos	Civic
Rotary International - Patterson	Civic
Firebaugh Rotary Club Inc.	Community General Public
Casa Mobile Home Park	Community/General Public
Center for Environmental Science Accuracy & Reliability	Community/General Public
Firebaugh Senior Center	Community/General Public
Friends of Green Valley Charter	Community/General Public
Friends of the Public Library	Community/General Public
Habitat for Humanity International	Community/General Public
Los Banos Senior Center	Community/General Public
Mendota Community Center	Community/General Public
Mendota Senior Center	Community/General Public
Merced County Library - Dos Palos	Community/General Public
Merced County Library - Gustine	Community/General Public
Merced County Library - Los Banos	Community/General Public
Merced County Library - Santa Nella	Community/General Public
San Joaquin River Resource Mgmt. Coalition	Community/General Public

Santa Nella RV Park	Community/General Public
Stanislaus County Library - Newman	Community/General Public
Stanislaus County Library - Patterson	Community/General Public
Dos Palos Oro Loma Joint Unified School District	Education
Firebaugh-Las Deltas Unified School District	Education
Gustine Unified School District	Education
Los Banos Unified School District	Education
Mendota Unified School District	Education
Merced College	Education
Creekside Parent Club	Education
Academy West Insurance	Other
Academy West Insurance Firebaugh	Other
Amaral & Associates Realty	Other
American Legion	Other
American Legion Auxiliary Elijah B Hayes	Other
Andrea Brandt State Farm Insurance	Other
Benevolent & Protective Order of Elks	Other
Borelli Real Estate Services	Other
California Garden Clubs Inc.	Other
Century 21 M&M & Assoc - Los Banos	Other
Century 21 M&M & Assoc - Patterson	Other
Coldwell Banker Kaljian & Assoc	Other
Eric Rodriguez - Patterson	Other
Farmers Insurance Antonio Gonzales	Other
First Prioirty of the Central Valley	Other
Greg Nunes Real Estate	Other
Joe G. Gutierez State Farm Insurance	Other
Mendota Land Co	Other
Noah's Ark Foundation of Tracy Inc.	Other
PMZ Real Estate - Patterson	Other
PMZ Real Estate - Los Banos	Other
Rafael Ruiz - Patterson	Other
Shane P. Donion Ranch Broker	Other
The Boyd Company	Other
Valley West Properties	Other
Adventure Christian Church of Patterson	Religious
Agape Baptist Church	Religious
Bethel Community Church	Religious
Church of Christ of Patterson	Religious
Church of God of Prophecy	Religious
Connections Christian Church	Religious
Evangelical Church of Los Banos	Religious
Family Christian Center	Religious
First Baptist Church	Religious
Full Gospel Businessmen's Fellowship International	Religious
Harvest Samoan Assembly of God	Religious

Mountain House Foursquare Church	Religious
Movimiento Familiar Cristiano Catolico	Religious
Patterson Covenant Church	Religious
Patterson Christian Fellowship	Religious
Patterson Seventh Day Adventist Church	Religious

Appendix C - Checklist for GSP Submittal

Checklist for Submittal of Delta-Mendota Subbasin Coordinated GSPs

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
Article 3. Technical and Reporting Standards				
352.2		Monitoring Protocols	• Monitoring protocols adopted by the GSA for data collection and management • Monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, inelastic surface subsidence for basins for which subsidence has been identified as a potential problem, and flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater extraction in the basin	• Section 6 – Subbasin Monitoring Program; Section 7 – Subbasin Data Collection and Management • Appendix B, Technical Memorandum (TM) #5 (Assumptions for Delta-Mendota Subbasin Monitoring Network), TM #6 (Coordination of the Delta-Mendota Subbasin Data Management System)
Article 5. Plan Contents, Subarticle 1. Administrative Information				
354.4		General Information	• Executive Summary • List of references and technical studies	• See individual GSPs • Section 9 – References and individual GSPs
354.6		Agency Information	• GSA mailing address • Organization and management structure • Contact information of Plan Manager • Legal authority of GSA • Estimate of implementation costs	• Section 2 – Delta-Mendota Subbasin Governance; Section 2.1 GSA and GSP Coordination and Governance • See individual GSPs for estimate of implementation costs
354.8(a)	10727.2(a)(4)	Map(s)	• Area covered by GSP • Adjudicated areas, other agencies within the basin, and areas covered by an Alternative • Jurisdictional boundaries of federal or State land • Existing land use designations • Density of wells per square mile	• Figure CC-1: Delta-Mendota Subbasin and GSP Regions • Figure CC-18: Land Use Planning Entities • Figure CC-19: Federal and State Lands • Figure CC-20: 2014 Land Use in the Delta-Mendota Subbasin • Figures CC-13 through CC-15: Domestic, Production, and Public Well Density in the Delta-Mendota Subbasin
354.8(b)		Description of the Plan Area	• Summary of jurisdictional areas and other features	Section 3 – Delta-Mendota Subbasin Plan Area

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
Article 5. Plan Contents, Subarticle 1. Administrative Information (Continued)				
354.8(f)	10727.2(g)	Land Use Elements or Topic Categories of Applicable General Plans	• Summary of general plans and other land use plans • Description of how implementation of the GSP may change water demands or affect achievement of sustainability and how the GSP addresses those effects • Description of how implementation of the GSP may affect the water supply assumptions of relevant land use plans • Summary of the process for permitting new or replacement wells in the basin • Information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management	• Section 3.3 – General Plans in Plan Area • See individual GSPs for description of implementation impacts on water demands and sustainability • Section 3.4 – Existing Land Use Plans and Impacts to Sustainable Groundwater Management • Section 3.6 – County Well Construction/Destruction Standards & Permitting • Section 3.3 – General Plans in Plan Area
354.8(c) 354.8(d) 354.8(e)	10727.2(g)	Water Resource Monitoring and Management Programs	• Description of water resources monitoring and management programs • Description of how the monitoring networks of those plans will be incorporated into the GSP • Description of how those plans may limit operational flexibility in the basin • Description of conjunctive use programs	Section 3.5 – Existing Water Resources Monitoring and Management Plans; Section 3.7 – Existing and Planned Conjunctive Use Programs

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
Article 5. Plan Contents, Subarticle 1. Administrative Information (Continued)				
354.8(g)	10727.4	Additional GSP Contents	Description of Actions related to: • Control of saline water intrusion • Wellhead protection • Migration of contaminated groundwater • Well abandonment and well destruction program • Replenishment of groundwater extractions • Conjunctive use and underground storage • Well construction policies • Addressing groundwater contamination cleanup, recharge, diversions to storage, conservation, water recycling, conveyance, and extraction projects • Efficient water management practices • Relationships with State and federal regulatory agencies • Review of land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity • Impacts on groundwater dependent ecosystems	Section 3.8 – Plan Elements from California Water Code Section 10727.4
354.10		Notice and Communication	• Description of beneficial uses and users • List of public meetings • GSP comments and responses • Decision-making process • Public engagement • Encouraging active involvement • Informing the public on GSP implementation progress	• Section 8 – Stakeholder Outreach • Appendix B, TM #8 (Coordinated Noticing, Communication, and Outreach Activities in the Delta-Mendota Subbasin)
Article 5. Plan Contents, Subarticle 2. Basin Setting				
354.14		Hydrogeologic Conceptual Model	• Description of the Hydrogeologic Conceptual Model • Two scaled cross-sections • Map(s) of physical characteristics: topographic information, surficial geology, soil characteristics, surface water bodies, source and point of delivery for imported water supplies	• Section 4.1 – Hydrogeologic Conceptual Model • Appendix B, TM #2 (Assumptions for Hydrogeologic Conceptual Model of the Delta-Mendota Subbasin)

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
Article 5. Plan Contents, Subarticle 2. Basin Setting (Continued)				
354.14(d)(4)	10727.2(a)(5)	Map of Recharge Areas	• Map delineating existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas	Figure CC-39: Recharge Areas, Seeps and Springs
	10727.2(d)(4)	Recharge Areas	• Description of how recharge areas identified in the plan substantially contribute to the replenishment of the basin	Section 4.1.10 – Topography, Surface Water, Recharge, and Imported Supplies
354.16	10727.2(a)(1) 10727.2(a)(2)	Current and Historical Groundwater Conditions	• Groundwater elevation data • Estimate of groundwater storage • Seawater intrusion conditions • Groundwater quality issues • Land subsidence conditions • Identification of interconnected surface water systems • Identification of groundwater-dependent ecosystems	Section 4.2 – Delta-Mendota Subbasin Groundwater Conditions
354.18	10727.2(a)(3)	Water Budget Information	• Description of inflows, outflows, and change in storage • Quantification of overdraft • Estimate of sustainable yield • Quantification of current, historical, and projected water budgets	• Section 4.3 – Delta-Mendota Subbasin Water Budgets • Appendix B, TM #3 (Assumptions for the Historic, Current and Projected Water Budgets of the Delta-Mendota Subbasin, Change in Storage Cross-Check and Sustainable Yield)
	10727.2(d)(5)	Surface Water Supply	• Description of surface water supply used or available for use for groundwater recharge or in-lieu use	Section 4.3 – Delta-Mendota Subbasin Water Budgets
354.20		Management Areas	• Reason for creation of each management area • Minimum thresholds and measurable objectives for each management area • Level of monitoring and analysis • Explanation of how management of management areas will not cause undesirable results outside the management area • Description of management areas	• Appendix B, TM #4 (Assumptions for Delta-Mendota Subbasin Management Areas, Sustainability Management Criteria) • See individual GSPs

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
Article 5. Plan Contents, Subarticle 3. Sustainable Management Criteria				
354.24		Sustainability Goal	• Description of the sustainability goal	Section 5.2 – Coordinated Sustainability Goal and Undesirable Results
354.26		Undesirable Results	• Description of undesirable results • Cause of groundwater conditions that would lead to undesirable results • Criteria used to define undesirable results for each sustainability indicator • Potential effects of undesirable results on beneficial uses and users of groundwater	• Section 5.2 – Coordinated Sustainability Goal and Undesirable Results • Section 5.4 – Delta-Mendota Subbasin Sustainable Management Criteria (Tables CC-14 through CC-18) • Appendix B, TM #4 (Assumptions for Delta-Mendota Subbasin Management Areas, Sustainability Management Criteria)
Article 5. Plan Contents, Subarticle 3. Sustainable Management Criteria (Continued)				
354.28	10727.2(d)(1) 10727.2(d)(2)	Minimum Thresholds	• Description of each minimum threshold and how they were established for each sustainability indicator • Relationship for each sustainability indicator • Description of how selection of the minimum threshold may affect beneficial uses and users of groundwater • Standards related to sustainability indicators • How each minimum threshold will be quantitatively measured	• Section 5.4 – Delta-Mendota Subbasin Sustainable Management Criteria (Tables CC-14 through CC-18) • Appendix B, TM #4 (Assumptions for Delta-Mendota Subbasin Management Areas, Sustainability Management Criteria)
354.30	10727.2(b)(1) 10727.2(b)(2) 10727.2(d)(1) 10727.2(d)(2)	Measurable Objectives	• Description of establishment of the measurable objectives for each sustainability indicator • Description of how a reasonable margin of safety was established for each measurable objective • Description of a reasonable path to achieve and maintain the sustainability goal, including a description of interim milestones	• Section 5.4 – Delta-Mendota Subbasin Sustainable Management Criteria (Tables CC-14 through CC-18) • Appendix B, TM #4 (Assumptions for Delta-Mendota Subbasin Management Areas, Sustainability Management Criteria)

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
Article 5. Plan Contents, Subarticle 4. Monitoring Networks				
354.34	10727.2(d)(1) 10727.2(d)(2) 10727.2(e) 10727.2(f)	Monitoring Networks	• Description of monitoring network • Description of monitoring network objectives • Description of how the monitoring network is designed to: demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features; estimate the change in annual groundwater in storage; monitor seawater intrusion; determine groundwater quality trends; identify the rate and extent of land subsidence; and calculate depletions of surface water caused by groundwater extractions • Description of how the monitoring network provides adequate coverage of Sustainability Indicators • Density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends • Scientific rational (or reason) for site selection • Consistency with data and reporting standards • Corresponding sustainability indicator, minimum threshold, measurable objective, and interim milestone • Location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used • Description of technical standards, data collection methods, and other procedures or protocols to ensure comparable data and methodologies	• Section 6 – Subbasin Monitoring Program • Appendix B, TM #5 (Assumptions for Delta-Mendota Subbasin Monitoring Network) • Section 7 – Subbasin Data Collection and Management

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
354.36		Representative Monitoring	• Description of representative sites • Demonstration of adequacy of using groundwater elevations as proxy for other sustainability indicators • Adequate evidence demonstrating site reflects general conditions in the area	• Section 6 – Subbasin Monitoring Program • Appendix B, TM #5 (Assumptions for Delta-Mendota Subbasin Monitoring Network)
Article 5. Plan Contents, Subarticle 4. Monitoring Networks (Continued)				
354.38		Assessment and Improvement of Monitoring Network	• Review and evaluation of the monitoring network • Identification and description of data gaps • Description of steps to fill data gaps • Description of monitoring frequency and density of sites	• Section 6 – Subbasin Monitoring Program • Appendix B, TM #5 (Assumptions for Delta-Mendota Subbasin Monitoring Network)
Article 5. Plan Contents, Subarticle 5. Projects and Management Actions				
354.44		Projects and Management Actions	• Description of projects and management actions that will help achieve the basin's sustainability goal • Measurable objective that is expected to benefit from each project and management action • Circumstances for implementation • Public noticing • Permitting and regulatory process • Timetable for initiation and completion, and the accrual of expected benefits • Expected benefits and how they will be evaluated • How the project or management action will be accomplished. If the projects or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included. • Legal authority required • Estimated costs and plans to meet those costs • Management of groundwater extractions and recharge	See individual GSPs
354.44(b)(2)	10727.2(d)(3)		• Overdraft mitigation projects and management actions	See individual GSPs

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in the GSP
Article 8. Interagency Agreements				
357.4	10727.6	Coordination Agreements - Shall be submitted to the Department together with the GSPs for the basin and, if approved, shall become part of the GSP for each participating Agency.	Coordination Agreements shall describe the following: • A point of contact • Responsibilities of each Agency • Procedures for the timely exchange of information between Agencies • Procedures for resolving conflicts between Agencies • How the Agencies have used the same data and methodologies to coordinate GSPs • How the GSPs implemented together satisfy the requirements of SGMA • Process for submitting all Plans, Plan amendments, supporting information, all monitoring data and other pertinent information, along with annual reports and periodic evaluation • A coordinated data management system for the basin • Coordination agreements shall identify adjudicated areas within the basin, and any local agencies that have adopted an Alternative that has been accepted by the Department	• Section 2.1.2 – Intra-Basin Coordination; Section 2.1.3 – Inter-basin Agreements • Appendix B, TM #1 (Common Datasets and Assumptions used in the Delta-Mendota Subbasin GSPs), TM #6 (Coordination of the Delta-Mendota Subbasin Data Management System), TM #7 (Adoption and Use of the Subbasin Coordination Agreement)

Appendix D - Interbasin Agreements

Inter-Basin Agreement Between Northern & Central Delta-Mendota GSP Region and Westlands Water District

DATA SHARING AGREEMENT

Westlands Water District (Westlands) and the San Luis & Delta-Mendota Water Authority, on behalf of the Northern Delta-Mendota Region GSAs and the Central Delta-Mendota Region Multi-Agency GSA (GSAs), (collectively the Parties) desire to establish a set of common assumptions on groundwater conditions on either side of the boundary between Westlands' service area and the Delta-Mendota Subbasin to be used for development of Groundwater Sustainability Plans (GSPs) related to the implementation of the Sustainable Groundwater Management Act (SGMA). To further that effort to develop a set of common assumptions, the Parties agree to provide each other with the following recorded, measured, estimated and/or simulated modeling data located within five (5) miles of the boundary between Westlands' service area and the Delta-Mendota Subbasin:

- Well location (latitude and longitude, preferably in a GIS shapefile)
- Ground surface elevation at well location, including elevation datum
- Depth to groundwater readings from 1960s to present as available per well (preferably in excel or electronic tabular format)
- Water surface elevation (if already in tabular format, otherwise it will be calculated from elevation less depth measured)
- Well driller's log (if available)
- Well information (perforated intervals, seal depth, pumping capacity, water quality, etc., if available)
- Agricultural practices (crop type, irrigation method (flood or drip), surface or groundwater application, etc., if available)
- Canal and irrigation ditch Information (location, dimension, flow direction, etc., if available)
- Tile drain (location, depth, discharge, flow direction, etc., if available)
- Subsidence data (if available)
- Historical reports and associated data, including but not limited to the Grasslands Groundwater Quality Assessment Report

The Parties understand that the requested data will be shared with their consultants, to other stakeholders in their respective basins, and that the information may be made public through the development of Westlands' and the Northern and Central Delta-Mendota Region GSA's respective GSPs and the supporting documentation for those GSPs. Other than publishing information for such purposes, neither Party will disclose the other Party's information to any third party, except if that other Party determines, at its sole discretion, the disclosure is required by law. Each Party may review preliminary results before publishing the information; provided that if a review of preliminary results is desired, the Party seeking to review will make that request in writing to the other party.

The Parties and their authorized representatives, by signatures below, agree to the Data Sharing Agreement.

Note: Return one signature copy to WWD

Westlands Water District:
By:
Title: CHIEF OPERATING OFFICER
Date: 4/23/18

SLDMWA on behalf of the Parties:
By:
Title: Assistant Executive Director
Date: 4/12/18

Note: Return one signature copy to WWD

Inter-Basin Agreement Between San Joaquin River Exchange Contractors GSP Region and Westlands Water District

DATA SHARING AGREEMENT

Westlands Water District (Westlands) and Central California Irrigation District (CCID), (collectively the Parties) desire to establish a set of common assumptions on groundwater conditions on either side of the boundary between Westlands' service area and the Delta-Mendota Subbasin to be used for development of Groundwater Sustainability Plans (GSPs) related to the implementation of the Sustainable Groundwater Management Act (SGMA). To further that effort to develop a set of common assumptions, the Parties agree to provide each other with the following recorded, measured, estimated and/or simulated modeling data located within five (5) miles of the boundary between Westlands' service area and the Delta-Mendota Subbasin:

- Well location (latitude and longitude, preferably in a GIS shapefile)
- Ground surface elevation at well location, including elevation datum
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- Water surface elevation (if already in tabular format, otherwise it will be calculated from elevation less depth measured)
- Well driller's log (if available)
- Well information (perforated intervals, seal depth, pumping capacity, water quality, etc., if available)
- Agricultural practices (crop type, irrigation method (flood or drip), surface or groundwater application, etc., if available)
- Canal and irrigation ditch Information (location, dimension, flow direction, etc., if available)
- Tile drain (location, depth, discharge, flow direction, etc., if available)
- Subsidence data (if available)
- Historical reports and associated data, including but not limited to the Grasslands Groundwater Quality Assessment Report

The Parties understand that the information will be shared with their consultants, to other stakeholders in their respective basins, and that the information will be made public through the development of Westlands' and CCID's GSA's respective GSPs and the supporting documentation for those GSPs. Other than publishing information for such purposes, neither Party will disclose the other Party's information to any third party, except if that other Party determines, at its sole discretion, the disclosure is required by law. Each Party may review preliminary results before publishing the information, provided that if a review of preliminary results is desired, the Party seeking to review will make that request in writing to the other party.

The Parties and their authorized representatives, by signatures below, agree to the Data Sharing Agreement.

Westlands Water District:
By: ______________________
Title: CHIEF OPERATING OFFICER
Date: May 16, 2018

Central California Irrigation District:
By: ______________________
Title: General Manager
Date: 5-14-18

Note: Return one signature copy to WWD

Appendix E - Delta-Mendota Subbasin Communications Plan

Delta Mendota Subbasin Groundwater Management

Sustainable Groundwater Management Act Communications Plan

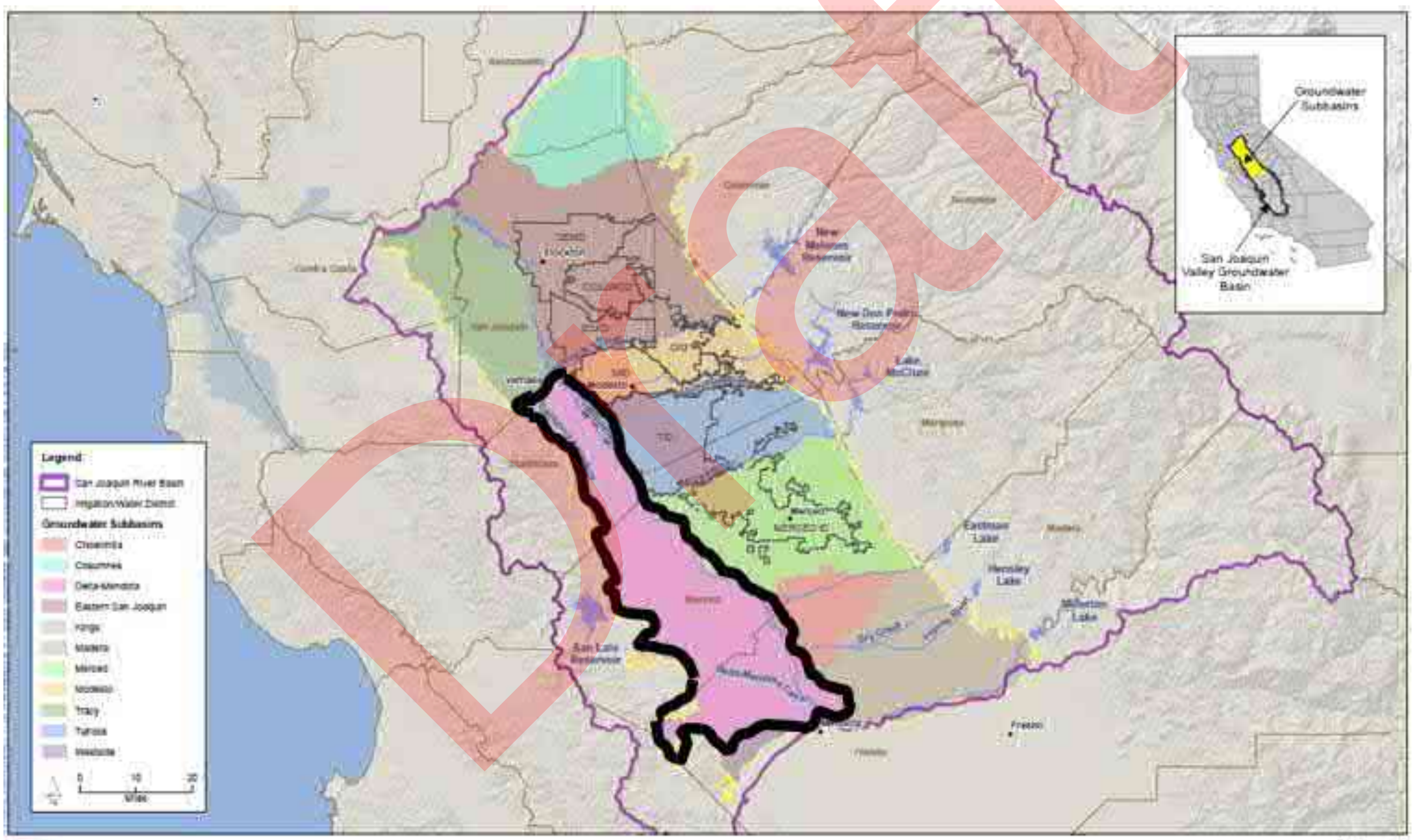


Figure 9-1
Vicinity Map of Groundwater Subbasins

Prepared by:
Lisa Beutler, MWH/Stantec,
Via CA Dept. of Water Resources,
Facilitation Services Technical Assistance

June 2017

Forward: How to use this Plan

This Communication Plan provides a high-level overview of near and long-term outreach and engagement strategies, tactics and tools. Its purpose is to assist the Groundwater Sustainability Agencies (GSAs) of the Delta Mendota Subbasin with stakeholder outreach and other related actions as required by the Sustainable Groundwater Management Act (SGMA) of 2014. It is presented as a working public draft, and should be considered a living document that is continuously refined and updated as circumstances suggest.

Chapter 1*: Introduction and Background* provides text and information about SGMA and the Delta Mendota Subbasin that can be repurposed directly into websites or printed materials by agencies and/or entities with an interest in SGMA and how it will affect the subbasin. This section also describes the communications activities mandated by SGMA.

Chapter 2: *Communications Plan Overview* provides communications planning goals and objectives as well as the scope. This section can be used in support of project management activities.

Chapter 3: *Situation Assessment* provides some of the context for communications activities. This section can be used in developing required assessments of stakeholder issues and interests. It also informs project management activities.

Chapter 4: *Audiences and Messages* identifies key subbasin audiences and message points for specific audience segments. The goal of this chapter is to provide information that can be used by the subbasin GSAs in preparing to work with key stakeholders.

Chapter 5: *Risk Management* is the summary of a communications risk assessment that considers subbasin communications strengths and weakness and proposes on-going adjustments based on best communication management practices. This section informs project management activities and provides a context for some of the recommended communications tactics.

Chapter 6: *Tactical Approaches* offers a communications to do list with specific communications activities relevant for project phases and subbasin audiences.

Chapter 7: *Measurements and Evaluation* outlines methods to determine the effectiveness of outreach and engagement.

Chapter 8: *Roles and Responsibilities* provides a sample list of tasks and illustrates the types of communications roles and responsibilities which might be assigned. This section should be incorporated into project management plans.

Subbasin GSAs should feel free to repurpose any or all parts of the document that will assist them in meeting SGMA requirements.

This document was developed with technical support provided by the California Department of Water Resources' (DWR) SGMA Facilitation Support Services Program and completed by the Communication and Engagement Group of MWH/Stantec.

Delta Mendota Subbasin
Sustainable Groundwater Management Act
Communications Plan
Working Draft

Contents

List of Figures

List of Tables

List of Acronyms and Abbreviations

Item	Description
Basin	Groundwater Basin or Subbasin
Coms Plan	Delta Mendota Subbasin, Sustainable Groundwater Management Act, Working Draft Communications Plan
CSD	Community Service District(s):
CV-SALTS	Central Valley Salinity Alternatives for Long-Term Sustainability
DAC	Disadvantaged Communities
DMC	Delta-Mendota Canal
DWR	California Department of Water Resources
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
IRWMP	Integrated Resource Water Management Plan
PDF	Portable Document Format
RCD	Resource Conservation District(s)
SGMA	Sustainable Groundwater Management Act
SLDMWA	San Luis Delta- Mendota Water Authority
State Board	State Water Resources Control Board

Item	Description
SA	Situation Assessment
USGS	United States Geological Survey

Revision History

Table 1. Revision History

Revision History			
Revision/Dock Title #	Date of Release	Author	Summary of Changes

INTRODUCTION AND BACKGROUND

The purpose of this Communication Plan is to assist the Groundwater Sustainability Agencies (GSAs) of the Delta Mendota Subbasin with stakeholder outreach and other related actions as required by the Sustainable Groundwater Management Act (SGMA) of 2014. Its chapters identify key stakeholders and provide a high-level overview of near and long-term outreach and engagement strategies, tactics and tools. The plan was developed with technical support provided by the California Department of Water Resources' (DWR) SGMA Facilitation Support Services Program.

1.1. SGMA Basics[1]

After decades of debate, in 2014 California lawmakers adopted SGMA. This far-reaching law seeks to bring the State's critically important groundwater basins into a sustainable regime of pumping and recharge. The change in water management laws has created new obligations for residents and water managers in the Delta-Mendota Groundwater Subbasin. The San Luis Delta- Mendota Water Authority (SLDMWA) is assisting its members in implementation of this law.

SGMA requires, **by June 30, 2017**, the formation of locally-controlled GSAs in many of the State's groundwater basins and subbasins (basins). A GSA is responsible for developing and implementing a **groundwater sustainability plan** (GSP). These plans assist the basins in meeting sustainability goals. The primary goal is to maintain sustainable yields without causing undesirable results.

1.1.1. <u>GSAs & GSPs</u>

Any local public agency that has water supply, water management, or land use responsibilities in a basin can decide to become a GSA. A single local agency can decide to become a GSA, or a combination of local agencies can decide to form a GSA by using either a Joint Power Authority (JPA), a memorandum of agreement (MOA), or other legal agreement. If no agency assumes this role the GSA responsibility defaults to the County; however, the County may decline.

A GSP may be any of the following *(Water Code § 10727(b)):*

- A <u>single plan</u> covering the entire basin developed and implemented by <u>one GSA</u>.
- A <u>single plan</u> covering the entire basin developed and implemented by <u>multiple GSAs</u>.

[1] Sections on SGMA are largely drawn, in whole or in part, from publicly available materials from the Department of Water Resources. For more see: http://www.water.ca.gov/groundwater/sgm

- Subject to Water Code Section 10727.6, multiple plans implemented by multiple GSAs and coordinated pursuant to a single coordination agreement that covers the entire basin.

If local agencies are unable to form an approved GSA and/or prepare an approved GSP in the required timeframe, then the basin or subbasin would be considered unmanaged. Unmanaged groundwater basins and subbasins are subject to State Water Resources Control Board (State Board) oversight. This is true even if the vast majority of the subbasin is covered by a plan. Should intervention occur, the State Board is authorized to recover its costs from the GSAs.

1.2. SGMA Communications and Engagement Requirements

SGMA includes specific requirements for communications and engagement by each planning phase. **Figure 1** (next page) illustrates the requirements and provides water code references. The GSP submittal guidelines also describe the outreach and engagement documentation to be submitted with the plan. **Table 2** describes the submittal requirements. A full list of codes and requirements is also provided in **Appendix 1**.

Table 2. GSP Submittal Requirements[2]

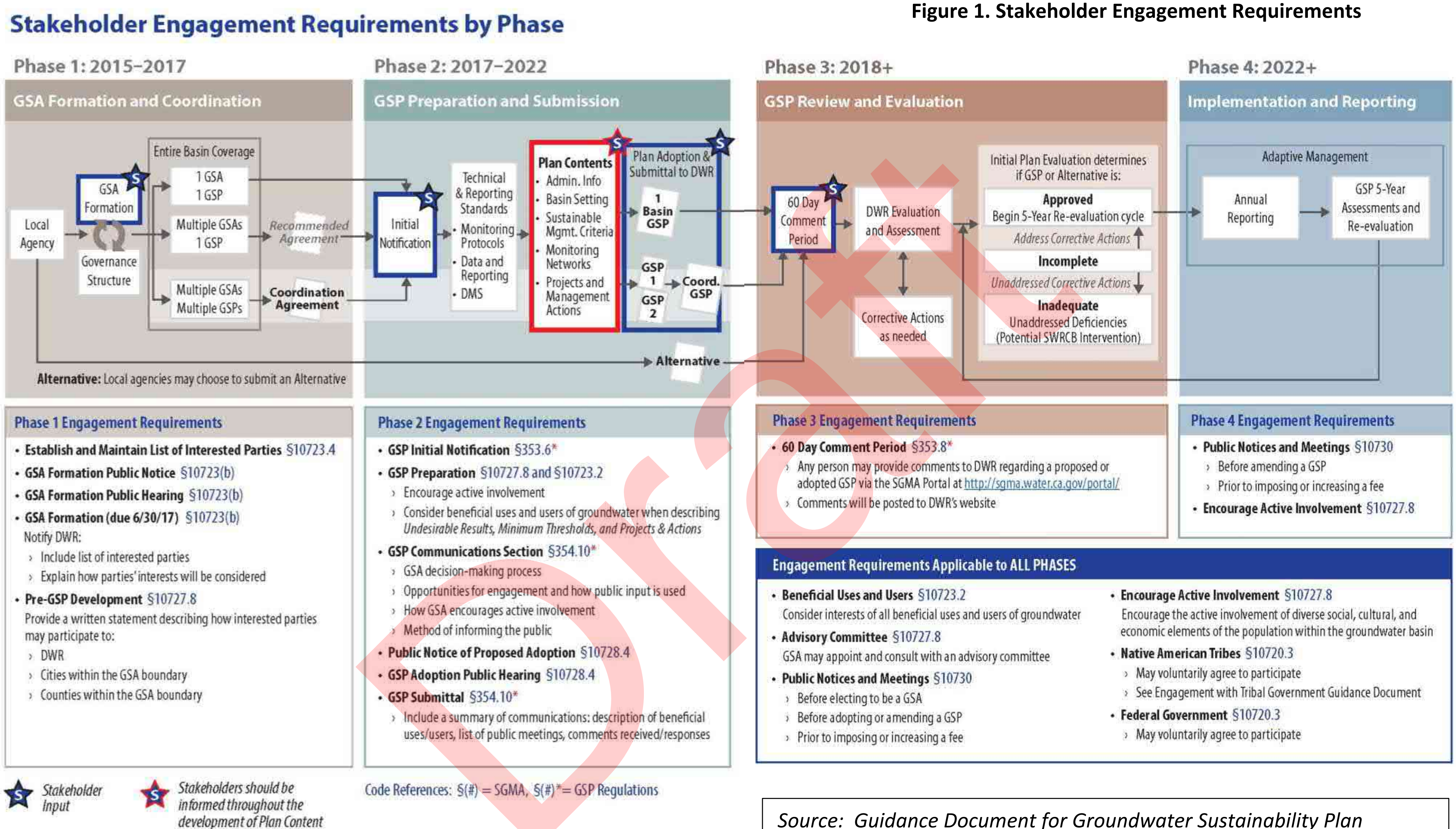
GSP Regulations Section	Requirement	Description
Article 5. Plan Contents, Sub-article 1. Administrative Information		
354.10	Notice and Communication	• Description of beneficial uses and users • List of public meetings with dates • GSP comments and responses • Decision-making process • Public engagement process • Method(s) to encouraging active involvement • Steps to inform the public on GSP implementation progress

1.3. Planning Approach

While the SLDMWA is assisting with the coordination of GSP(s) development, this Communications Plan (Coms Plan) is offered for the voluntary use of all of the GSAs of the Delta-Mendota Subbasin. A full Coms Plan schedule should be developed in conjunction with the overall GSP(s) development schedule. One additional option is for the Coordination Committee of GSAs to provide overall communications guidance. This could potentially be included in a section of the Coordination Agreement.

[2] Guidance Document for the Sustainable Management of Groundwater, Preparation Checklist for GSP Submittal, Department of Water Resources, December 2016

Figure 1. Stakeholder Engagement Requirements



Source: Guidance Document for Groundwater Sustainability Plan Stakeholder Communication and Engagement Department of Water Resources, June 2017

An important additional step will be establishing, in conjunction with the multiple GSAs, the roles and responsibilities for implementing the Coms Plan.

1.4. SGMA and the Delta Mendota Subbasin[3]

The Delta-Mendota Subbasin of the San Joaquin Valley Groundwater Basin is a long, relatively narrow groundwater basin that covers portions of five counties, from north to south, San Joaquin, Stanislaus, Merced, Madera and Fresno Counties (see **Figure 2**). The Delta-Mendota sub-basin is bounded on the west by the Tertiary and older marine sediments of the Coast Ranges. The northern boundary (from west to east) begins on the west by following the Stanislaus/San Joaquin County line, then deviates to the north to encapsulate all of the Del Puerto Water District before returning back to the Stanislaus/San Joaquin County line. The boundary continues east then deviates north again to encapsulate all of the West Stanislaus Irrigation District before returning back to the Stanislaus/San Joaquin County line. The boundary continues to follow the Stanislaus/San Joaquin County line east until it intersects with the San Joaquin River.

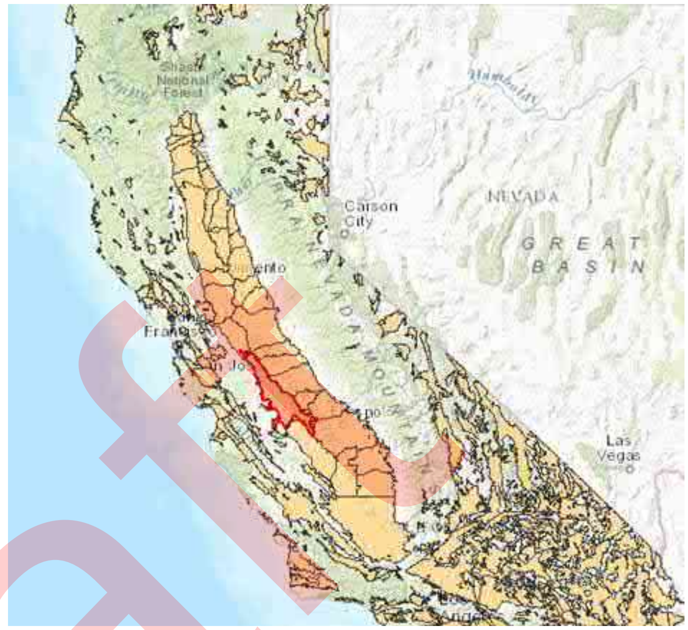


Figure 2. Delta Mendota Subbasin

The eastern boundary (from north to south) follows the San Joaquin River to within Township 11S, where it jogs eastward along the northern boundary of Columbia Canal Company and then follows the eastern boundary of Columbia Canal company until intersecting the northern boundary of the Aliso Water District. The boundary then heads east following the northern and then eastern boundary of the Aliso Water District until intersecting the Madera/Fresno County line. The boundary then heads westerly following the Madera/Fresno County line to the eastern boundary of the Farmers Water District. The boundary then heads southerly along the eastern boundary of the Farmers Water District, and continues southerly along the section line to the intersection with the northern right-of-way of the railroad. The boundary then heads east along the northern right-of-way of the railroad until intersecting with the western boundary of the Mid-Valley Water District. The boundary then heads south along the western boundary of the Mid-Valley Water District to the intersection with the northern boundary of Reclamation District 1606. The boundary then heads west and then south following the boundary of Reclamation District 1606 and James Irrigation District until its intersection with the Westlands Water District boundary.

The southern boundary (from east to west) matches the northerly boundaries of Westlands Water District legal jurisdictional boundary last revised in 2006. The boundary then

[3] Information related to the Delta Mendota subbasin is drawn directly from http://sgma.water.ca.gov/basinmod/basinrequest/preview/23.

proceeds west along the southernmost boundary of the San Luis Water District. The boundary then projects westward from this alignment until intersecting the Delta-Mendota sub-basin Western boundary described above.

1.5. Delta-Mendota Subbasin GSP Planning

The GSAs of the Delta-Mendota Subbasin intend to work together to meet Sustainable Groundwater Management Act (SGMA) requirements and prepare a Groundwater Sustainability Plan (GSP) or coordinated Sustainability Plans by June 31, 2020. The San Luis Delta- Mendota Water Authority (SLDMWA) is assisting its members and non-members in planning and implementation of this law and has been directly assisting a subset of the local GSA eligible agencies in organizing to accomplish required SGMA tasks. The SLDMWA has also hosted informal, information meetings with all of the subbasin GSAs.

While SLDMWA coordinated GSAs are confident in their ability to prepare a GSP for the areas under their jurisdiction, SGMA requires that an approved GSP or multiple coordinated GSPs are in place to provide sustainable management for the entire subbasin. The identified GSAs have been asked to determine how they wish to proceed in individual GSP development or a coordinated single GSP by July 2017 and whether or not they wish to participate in the Prop 1 Sustainable Groundwater Planning Grant as a joint request.

1.6. Delta Mendota Subbasin GSAs

Following are the DWR identified agencies (as of June 15, 2017).[4]

1. Aliso Water District
2. Central Delta-Mendota Region Multi-Agency GSA
3. City of Dos Palos
4. City of Firebaugh
5. City of Gustine
6. City of Los Baños
7. City of Mendota
8. City of Newman
9. City of Patterson
10. County of Madera—3
11. DM-II
12. Farmers Water District
13. Fresno County—Management Area ‘A’
14. Fresno County—Management Area ‘B’
15. Grasslands Groundwater Sustainability Agency
16. Merced County—Delta-Mendota

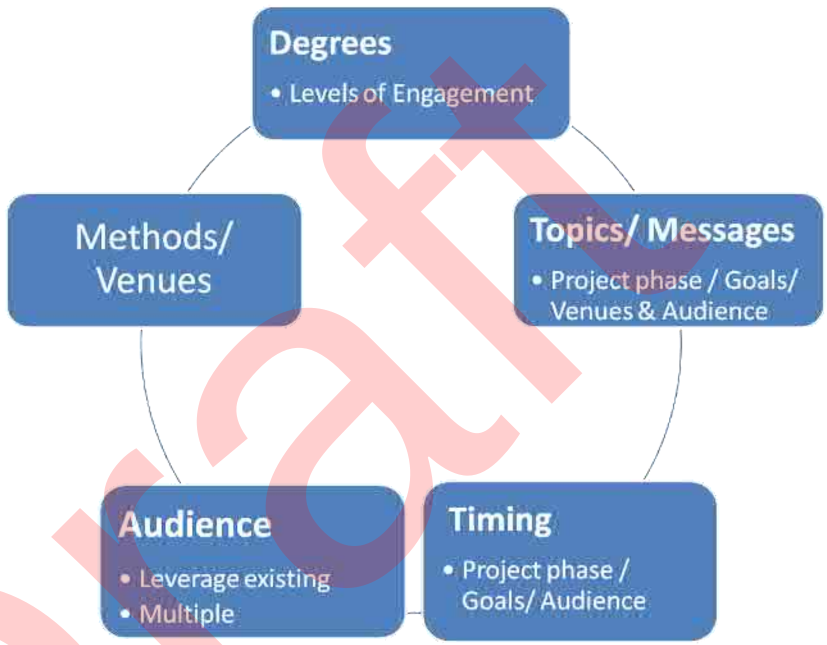
[4] See: http://sgma.water.ca.gov/portal/

17. Northwestern Delta-Mendota GSA
18. Ora Loma Water District
19. Patterson Irrigation District
20. San Joaquin River Exchange Contractors Water Authority
21. Turner Island Water District-2
22. West Stanislaus Irrigation District GSA
23. Widren Water District GSA

COMMUNICATIONS PLAN OVERVIEW

Communication is the process of transmitting ideas and information. According to the Project Management Institute, 75%-90% of a project manager's time is spent communicating. A Coms Plan provides the purpose, method, messages, timing, intensity, and audience of the communication, then describes who will do the communicating, and the frequency of the communication (see **Figure 3**.)

Figure 3. Elements of a Communications Plan



2.1. Purpose

The purpose of the Delta-Mendota Subbasin, Sustainable Groundwater Management Act, Coms Plan is to outline the information and communications needs of the project stakeholders and provide a roadmap to meet them. The Coms Plan then identifies how communications activities, processes, and procedures will be managed throughout the project life cycle.

2.2. Importance

While communications are important in every project, a well-executed communications strategy will be essential to the success of the GSP(s) development and adoption process. The financial and regulatory stakes are high and communication missteps can create project risks. Further, development of a viable GSP(s) will require an on-going collaboration among all the stakeholders, both organizational and external. The plan will be comprehensive and consider multiple variables, a range of system elements and project costs and benefits. Stakeholder input will be needed to refine GSP requirements and fully define the water management system, and potential impacts, costs and benefits that may result in managing for sustainability.

2.3. Scope

The plan focuses on formal communication elements. Other communication channels exist on informal levels and enhance those discussed within this plan. This plan is not intended to limit, but to enhance communication practices. Open, ongoing communication between stakeholders is critical to the success of the project.

2.4. Communications Goal

Development, adoption and implementation of the GSP(s) will require basin external stakeholders, other agencies, staff, managers, and the multiple GSA Boards to evaluate choices, make decisions and commit resources.

The core communications goal is to plan for and efficiently deliver clear and succinct information:

- At the right time
- To the right people
- With a resonating message

This is done to facilitate quality decision making and build accompanying public support

2.5. Communications Objectives

The Coms Plan Objectives are to present strategies and actions that are:

- Realistic and action-oriented
- Specific and measurable
- Minimal in number (a few well delivered are better than many mediocre efforts)
- Audience relevant

2.6. Strategic Approach

Three primary communications strategies have been identified for the GSP(s) development.

1) Fully leverage the activities of existing groups. This practical approach is cost effective and respectful of the limited time that stakeholders have to participate in collaborative processes.
2) Provide targeted, communications and outreach to opinion leaders in key stakeholder segments.
3) Provide user friendly information and intermittent opportunities through existing communication channels and open houses or workshops to allow interested stakeholders (internal and external) to engage commensurate with their degree of interest.

2.7. Communications Governance, Communications Team

Given the relatively large number of stakeholders, a recommendation for coordinated efforts, and the legal requirements for outreach[5], some form of communications governance is recommended. Several governance options for consideration are offered in Appendix 2. The actual form of the governance is less important than a clear understanding of the roles and responsibilities of those responsible for ensuring required communication. For the purpose of this document, an assumption is made that some form of governance will be identified and a communications team (which may be an individual or multiple individuals, and/or include the project consultants) is designated.

A driving consideration for this recommendation is the level of effort associated with required activities and the fact that communications are highly time dependent. That means that communications activities should be occurring that may happen outside of regularly scheduled GSA meetings. In this case delegation with guidance is efficient and effective.

2.8. Constraints

All projects are subject to limitations and constraints as they must be within scope and adhere to budget, scheduling, and resource requirements. These constraints can be even more challenging in projects with multiple agencies as will be the case with the development and coordination of multiple GSPs.

There are also legislative, regulatory, technology, and other organizational policy requirements which must be followed as part of communications management. These limitations must be clearly understood and communicated where appropriate. While communications management is arguably one of the most important aspects of project management, it must be done in an effective and strategic manner recognizing and balancing the multiple constraints.

All project communication activities should occur within the project's approved budget, schedule, and resource allocations. The GSP(s) project managers and the leadership of the participating GSAs should have identified roles in ensuring that communication activities are performed.

To the extent possible, to support collaboration and reduce costs, GSP(s) partners should utilize standardized formats and templates as well as project file management and collaboration tools.

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[5] See Appendix 1

SITUATION ASSESSMENT

3.1. *Introduction*

The challenges of asking a community to make changes in how things are done, or forging an agreement among multiple parties are often large. Prior to preparing a Coms Plan, a neutral, 3rd party facilitator conducted a stakeholder Situation Assessment (SA).

The facilitator's role was to provide an independent evaluation of potential stakeholder's interest in coordination and governance for GSA formation and GSP development and identify any barriers or concerns that would need to be addressed for the GSA formation process and GSP(s) development to be successful.

3.2. *Situation Assessments*

An SA is an information-gathering process that informs outreach, engagement and collaboration. As part of preparing the basin communication's process, it was important to know more about:

- Stakeholder Categories
- Opinion leaders
- Regulatory and political context
- Advocates and detractors
- Attitudes and knowledge
- Other elements useful to the crafting of decisions

An assessment is also a low risk approach to education and signaling a future relationship. It facilitates the community's appraisal of its needs, wants and values. A well-crafted assessment sets the stage for the parties to better understand and interpret their situation so that they can make informed decisions for actions, in the short term and for the future.

The Delta-Mendota subbasin SA included background research and interviews. Interviews were usually with individuals but in a few cases a very small group was convened. To encourage candor, the results of the input process were bundled so those interviewed were not individually identified unless they explicitly indicated they wished to share their individual response.

3.3. *Background Research*

The facilitator worked closely with the SLDMWA and DWR to identify useful documents, plans and activities that might inform the overall communications planning process.

3.4. *Interviews and Consultations*

Using information gathered during the background research and similar GSA formation efforts throughout the state, the facilitator worked with the SLDMWA to craft interview questions. The facilitator also provided some selection criteria to the SLDWMA to help identify a representative group of interview candidates. Once selected, the SLDMWA staff and facilitation team invited the interviewees to participate. In addition to full interviews, additional calls and in person communications were conducted to acquire amplifying information. **Figure 4** provides a quick overview.

Figure 4. Interview and Consultation Quick Facts

Number of Contacts: 30

Dates of Calls and Interviews Conducted:
February to May 2017

Average Length: 1 hr.
(Shortest = 20 mins., Longest = 1.5 hrs)

Selected participants were all engaged or otherwise stakeholders in some aspect of the basin GSA development process.

A project background sheet was provided in advance of each formal interview and used again during the interviewee discussions with the facilitator. Each interview followed the same format and included 16-18 questions (depending on whether or not a follow-up question was needed).

The questions covered the following topics pertaining to the GSA formations and GSP(s) development:

1. Overarching perspectives from each key stakeholder on general groundwater conditions, GSA governance; subbasin management and associated SGMA compliance
2. Preferred methods to achieve groundwater sustainability consistent with SGMA requirements
3. The level of agreement/conflict around groundwater governance across the range of stakeholder perspectives
4. Experience with facilitated processes, outreach and engagement, and the goals for such support
5. Potential configurations of governance and formations of GSAs and GSP development

3.5. *Summary of key findings*

Interview results indicate an overall positive environment for the project and project communications; however, the effort will require interactions of a large number of parties and planning for an extremely complex system. Following are the reflections, ideas and suggestions of those contacted.

3.5.1. Related to Groundwater Sources and Trends

- *Significant observed impacts associated with Weather, Water Project Deliveries and Cropping Patterns* – Participants observed a declining groundwater situation and were able to attribute it to drought and weather (particularly timing of seasonal rainfall and periods of prolonged, higher temperatures), conversion to permanent crops, and significant changes in access to surface water.

- *Surface & Groundwater Nexus* – As noted in comments related to access to surface water, there was a clear understanding of the surface/groundwater nexus. Many believed that any realistic solution would have to include a full assessment of the region's surface water future.

- *Extremely Complex Systems* – Many of those interviewed reported that parts of the subbasin were doing fine and could, with good management, be sustainable. They described problems as being primarily in pockets of the subbasin. They also characterized some parts of the subbasin as not being managed sustainably and indicated that they believe this would have continued had SGMA not passed. While it was generally agreed that it would have been better if SGMA was not driving the change, they felt change would not occur without something like SGMA. Several of the participants were able to describe specific locations and situations that illustrated this.

  Issues related to operations of the Bureau of Reclamation, the Delta-Mendota Canal (DMC), the Mendota Pool and restoration activities are of keen interest to all the stakeholders. Everyone was familiar with issues of subsidence and with the facts and figures represented in graphics like those in **Figure 5**, prepared by the United States Geological Survey (USGS).[6]

  Many perceived that groundwater supplies for municipal uses in some parts of the basin were at risk.

- *Historic Rights and Arrangements* – Access to surface water is based on numerous historic rights and agreements as well as more contemporary agreements. As such there is no **single** description of the status of surface water availability among the many subbasin GSAs,[7] although there is a strong understanding of the rights and arrangements that do exist.[8]

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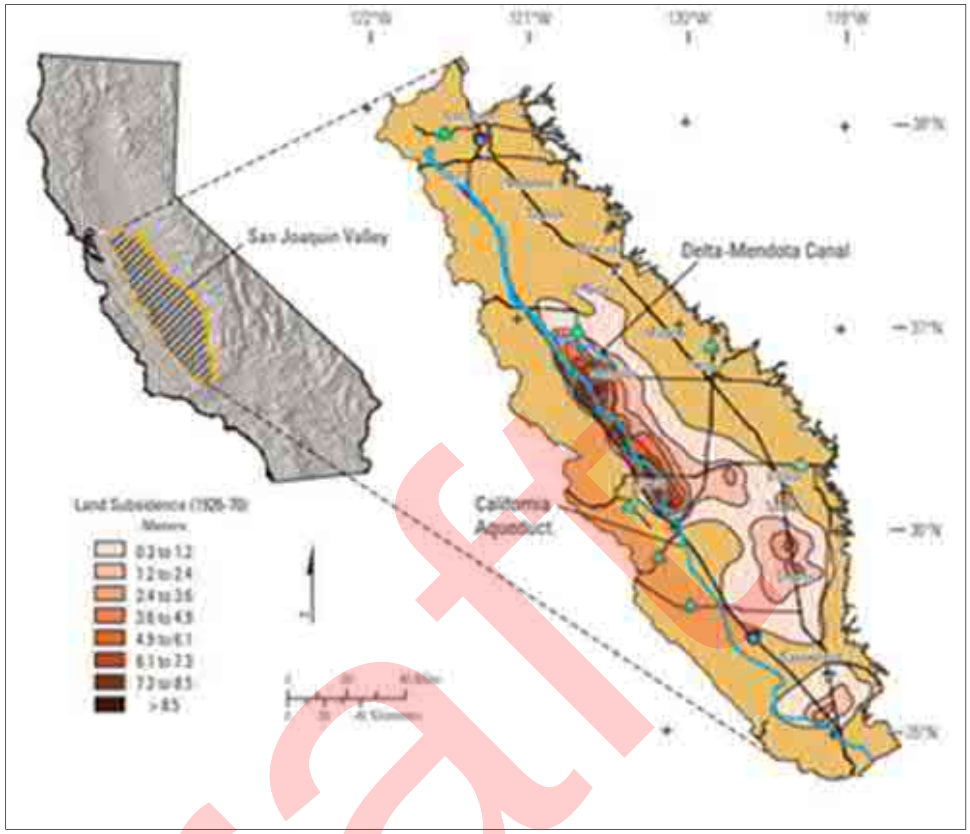
[6] U.S. Department of the Interior | U.S. Geological Survey: https://ca.water.usgs.gov/projects/central-valley/delta-mendota-canal.html, Page Last Modified: Monday, 20-Mar-2017 22:39:47 EDT

[7] A full inventory of water rights and arrangements for the subbasin GSAs is recommended to be prepared as part of the GSP planning process.

[8] In 2010 there were 1,403 water rights claimed in the San Joaquin Delta watershed, the largest number of any watershed in the State. [Source: Associated Press: Original data source is State Water Resources Control Board eWRIMS, Database

Figure 5. USGS Illustration of the DMC and Subsidence



The hierarchy of water rights as well as laws related to groundwater rights will be a significant factor in GSP negotiations.

Another historical factor related to sustainability is the character of land ownership. There was a perceived difference in the values placed on sustainability by multi-generational family farms versus investor driven agriculture and/or water development.

3.5.2. Related to GSA Governance; Subbasin Management and SGMA Compliance

- *Numbers* - The subbasin includes numerous Water Agencies (35) and other potential GSA eligible agencies including Cities and Counties (such as Dos Palos, Firebaugh, Gustine, Los Baños, Mendota, Newman, Patterson, Fresno, Madera, Merced, San Joaquin, and Stanislaus) and Community Service Districts (CSDs) including among others Grayson, Westley, and Volta, as well as multiple Resource Conservation Districts (RCDs) that for the most part were within the general boundaries of other GSA eligible authorities (Panoche, Poso and Grasslands as an example).

  By the June 30, 2017 filing deadline, 23 eligible entities had formally filed GSA formations and met SGMA requirements for subbasin coverage.

Even with this large number of GSA entities, during the SA interviews and in a follow-up survey, most agencies indicated a preference for a reduced number of GSPs and potentially just one or two.

At the time of this assessment there was not a full understanding of all of the potential requirements of being a GSA and ultimately what might be required to prepare a compliant GSP.

Table 3. Number of Subbasin Public Water Agencies

Number of Public Water Agencies

- Merced County
- Fresno County
- Broadview WD
- Centinella WD
- Central California ID,
- Davis WD
- Del Puerto WD
- Eagle Field WD
- El Solyo WD
- Farmers WD
- Firebaugh Canal WD
- Foothill WD
- Fresno Slough WD
- Grasslands WD
- Hospital WD
- Kern Canon WD
- Laguna WD
- Mercy Springs WD
- Mustang WD
- Oak Flat WD
- Orestimba WD
- Oro Loma WD
- Pacheco WD
- Panoche WD
- Patterson WD
- Romero WD
- Salado WD
- San Luis Canal Company
- San Luis WD
- Santa Nella C.WD
- Sunflower WD
- Tranquility ID
- West Stanislaus ID
- Widren WD
- Quinto WD

At the time of this assessment participants did not fully recognize the potential number of stakeholders and/or the requirements to conduct outreach.

- *Subbasin Governance Structures* – Many individuals and entities within the subbasin have experience working in cooperative governance and related structures. For example, the SLDMWA provides leadership for an Integrated Resource Water Management Plan (IRWMP) illustrated in **Figure 6**[9] on the following page. Many of the stakeholders are also involved with Irrigated Lands Coalitions (see **Figure 7**).[10]

  Likewise, many are also involved in efforts related to the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) initiative (see **Figure 8**).

[9] Source : San Luis & Delta-Mendota Water Authority, Westside-San Joaquin Integrated Water Resources Plan, July 2014

[10] Source: Central Valley Regional Water Resources Control Board

Existing Cooperative / Collaborative Governance Structures with Delta Mendota Subbasin Stakeholders

Figure 6. Integrated Regional Water Management Groups

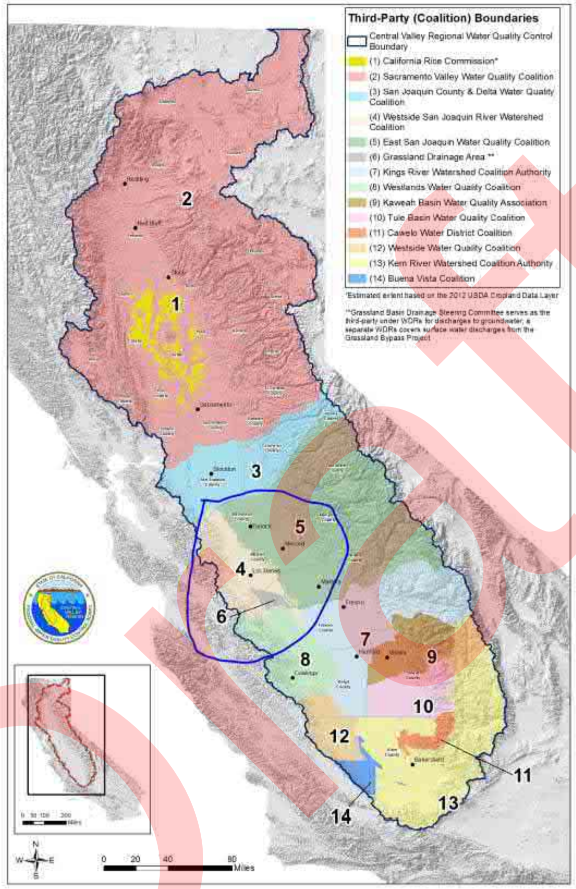


Figure 7. Irrigated Lands Coalitions

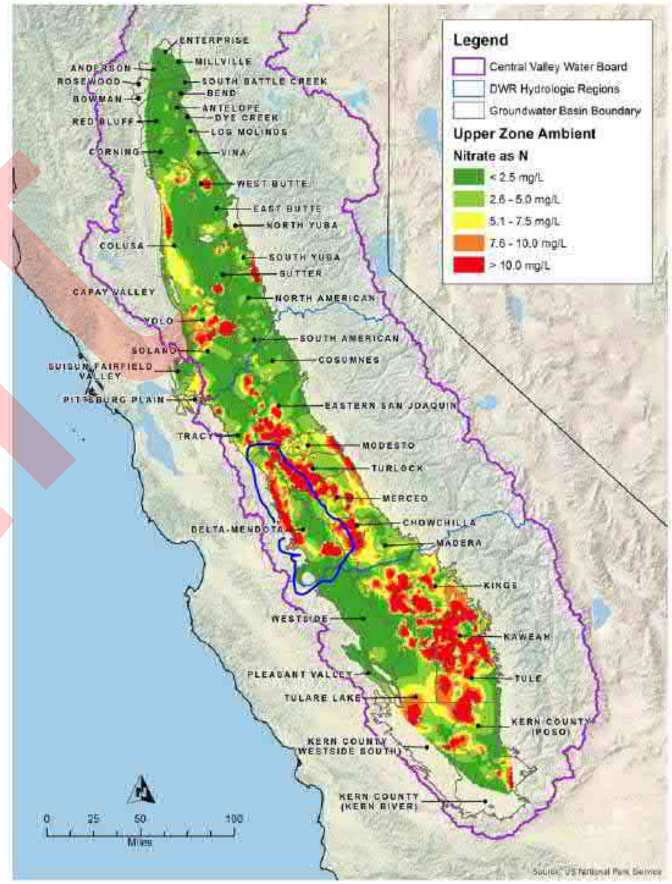


Figure 8. CV-Salts Initiative

CV-Salts was launched to develop sustainable salinity and nitrate management planning for the Central Valley. (See **Figure 8**.[11])

Finally, there are multiple arrangements in place related to surface water transfers and other previous groundwater management planning efforts.

Experience with these programs has created a capacity for collaborative planning that will be essential for GSP development. It also creates opportunities to access and leverage existing stakeholder meetings and events rather than needing to convene multiple new stakeholder processes.

3.5.3. Issues to be Addressed in Creating a Sustainability Plan

Some of the participants indicated they had an extremely good understanding of their section of the subbasin, with exact and extensive records to support their perspective. They found that making projections using historical data had been more reliable than some of the groundwater models that were in use.

In thinking about development of a GSP they felt there could be some difficulty in developing water balances due to lack of quality data for some locations. Another mild concern was the potential for disagreements about the selection of a groundwater model(s) or reconciling differences among methods.

Still another concern was the capacity of the GSAs and/or GSA members to fully participate. Some of these agencies are very lightly staffed and have varying levels of knowledge related to groundwater management. All of the participants had significant other duties prior to the passage of SGMA.

One concern, expressed after completion of the assessment, was the potential for some agencies to simply opt out of participating in the development of a GSP but still receive the benefits of the region having an approved plan without having contributed to the larger good of the subbasin.

3.5.4. Representation

The State Board lists the following as Required Interested Parties for the purpose of SGMA outreach:

- All Groundwater Users
- Holders of Overlying Rights (agriculture and domestic)
- Municipal Well Operators and Public Water Systems
- Tribes
- Counties
- Planning Departments /Land Use
- Local Landowners
- Disadvantaged communities
- Business

[11] Ibid

- Federal Government
- Environmental Uses
- Surface Water Users (if connection between surface and ground water)

All of these stakeholder categories were contacted in the interview process excepting tribes. In the case of tribes, there are no classified tribal lands in the Delta-Mendota subbasin, therefore no planning, outreach or communication needs are currently anticipated for tribes.

Due to subbasin characteristics, a primary focus of the assessment was on agricultural, disadvantaged communities (DACs) and municipal groundwater users.

- *Related to Agricultural Representation* - most respondents believed that the elected leadership of the GSA agencies would do a good job in representing agriculture and noted that many of them were growers themselves. It was also noted that farmers were busy and would be far more interested in any specifics of a GSP that would impact operations or the degree of certainty about water availability than the particulars of GSA governance.

- *Regarding DACs* - Much of the subbasin and its counties (San Joaquin, Stanislaus, Merced, and Fresno) have communities that meet the DAC definition and the region is generally considered disadvantaged. The ability of DACs to participate in GSP development was considered limited and it was thought that there would be a need for specific and direct outreach to DACs through elected leadership and via use of trusted community advocates. As part of the SA, several of those interviewed identified themselves as being able to represent a DAC perspective and one in particular was particularly concerned about the availability of Spanish language materials. As a result, Spanish language materials were included in the meeting materials of the public GSA adoption meetings and the SLDMWA provided a fluent Spanish speaker to assist with meetings.

In the past, to promote DAC identification and involvement, the Westside-San Joaquin IRWM previously conducted an extensive survey of private and public community representatives to educate and encourage understanding of the IRWM process, to help understand the issues confronted by DACs, and to better address the needs of minority and/or low-income communities. This effort resulted in identification of DACs in the Region and an initial list of 22 projects that would benefit DACs and low-income communities. Given known constraints on this community it is recommended that more focused DAC outreach should be coordinated with the IRWM. This effort is now in progress.

- *Regarding Municipals* - The SA outreach also included interviewing Municipal Stakeholders. A significant number of the Cities are fully dependent on wells for water supply and issues related groundwater management are of grave concern. These representatives all felt that even while it would be difficult to make time to participate in GSAs and GSP development, that they must make the time. Many had also determined that they wished to form their own GSA to reflect their specific interests in any kind of broader GSP negotiation.

- *Regarding Environmental Interests* - There appeared to be a less defined stakeholder segment representing traditional, environmentally focused issues. Outreach was made to subbasin government agencies that often serve as a surrogate for these interests and an informal consultation occurred with a representative of the Planning and Conservation League to identify any known, active stakeholders. However, no specific entity or individual was identified by those contacted. A general perception was that this community would desire engagement and would designate representatives if the GSP development was thought to potentially impact existing restoration or other environmental concerns but the formation of GSAs per-se, was of less interest. The next phase of communications should include outreach to organizations such as Audubon, the Nature Conservancy and Ducks Unlimited just to ensure due diligence. These connections will be important going forward, particularly if environmental issues are identified.

- *Regarding Industrial Users* – The region includes some industrial water users. This sector has a relatively lower percent of water use compared to other subbasins users; however, representatives of the sector pointed out how essential access to water was to their industry. The interviewees also emphasized how important these industries were to the local economies. There was a stated concern about representation since there didn't appear to be a direct way to engage, particularly with multiple GSAs being formed.

- *Regarding Counties & Planning Agencies* – All of the subbasin counties have designated representatives and all are assisting with GSA coverage for areas not otherwise covered by a GSA. All of the city and county representatives had direct engagement with the planning arms of their jurisdictions, or were staff to the planning departments. These representatives, like the municipal representatives, viewed this as critical issue even as it creates new workload for the already busy entities.

3.5.5. Communications and Facilitation Preferences

Participants were asked to describe their communications preferences. Several offered specific suggestions on written materials. Most did not believe there would be a need for a high frequency of communications directly with non-GSA stakeholders.

Several suggested using regularly scheduled activities of existing groups and gatherings to share information rather than creating stand-alone events. They listed annual meetings of the water agencies as one good venue as well as meetings related to the IRWM and Irrigated Lands. Several also thought that it would be good to go to places like Farmers Markets, particularly for the disadvantaged communities, and County Fairs.

Farm Bureau representatives also indicated a willingness to support outreach efforts. The Merced Farm Bureau, in particular, has already helped to advertise public meetings related to GSA formations.

Related to facilitation there was not a broad exposure to professional facilitators among many of the stakeholders. Even so, participants consistently listed qualities such as fairness and transparency, a good understanding of the issues, and confidence as helpful facilitator strengths. There was a sense that the GSAs would not need hand holding but that facilitation could be useful for helping the stakeholders forge decisions and making what many believed would need to be compromises.

3.5.6. Success Factors, Barriers to Success

The participants were asked to describe their view on the odds for success as well as any barriers that would prevent successful completion of a GSP.

Overall, most participants expressed a medium to high likelihood for success. They noted that the carrot (grants and technical support) and stick (significant regulatory intervention) by the State creates a dynamic that is supportive to success.

Participants stated barriers related to the capacity of the GSAs to participate and ultimately agree to, and implement changes. The much diffused governance structure of multiple GSAs amplifies this dilemma as do actions beyond the control of the subbasin entities (such as climate and water deliveries).

In addition to perceived barriers, participants outlined their thoughts on opportunities and success strategies.

- *Drought* – While the drought was unwelcome it increased awareness of the need for changes. Many felt it would be easier to move forward while the topic is prominent in everyone's minds.
- *Short and Long Game* – Several suggested it will be important to have a plan that includes long and short term strategies and activities.
- *Integrated Planning* – Many of the participants emphasized the importance of integrated planning.

3.5.7. Other Comments and Advice

Many participants expressed appreciation for being contacted and invited the facilitator to contact them again if there were questions.

3.6. *Promising messages and methods*

Three primary communications strategies have already been identified for the GSP(s) development:

- Leveraging the activities of existing groups
- Providing targeted, communications and outreach to opinion leaders in key stakeholder segments
- Providing user friendly information and intermittent opportunities for a broader range of stakeholders

The same strategies aligned with the recommendations of the SA participants. These methods will allow stakeholders to engage commensurate with their degree of interest while providing sufficient information to ensure long-term success for plan development and implementation.

AUDIENCES AND MESSAGES

GSA formation and GSP(s) development, like most large planning efforts, consists of a broad range of stakeholders with differing interests and influence.

4.1. Two Core Audience Segments

This Coms Plan Anticipates two core audience segments. First is the subbasin GSA Boards and the communications among and between themselves. This audience segment is significant in size given that 23 GSAs will be working to develop a GSP(s) and each GSA has its own Board and audiences.

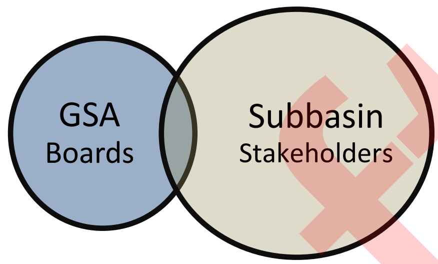


Figure 9. Two Core Audience Segments

The second audience is the subbasin stakeholders as identified in SGMA. This audience is also large. Many of the stakeholders are shared by the GSA Boards and some of the larger stakeholder segments are also represented on the GSA Boards (see **Figure 9**).

Nearly all of the communications strategies apply to both segments; however, some strategies apply to one or the other specifically and are so identified.

4.2. Communications and Change Management

The process of adopting and implementing a GSP will require significant change management. Communications planning should encompass basic change management approaches. Messages should also evolve over time and be tied to the planning process and key decision points. Then, for each audience and each major planning step, communications must do the following:

1. Describe what the actual proposed plan (change) is
2. Articulate how the change will directly impact the category of stakeholder involved
3. Outline the methods that will be used to implement the plan (change)
4. Define the costs and benefits of changing and not changing, and what future conditions will be if change does not occur
5. Consider unintended consequences and others that may also be impacted by the same change then develop a strategy to engage them
6. Offer opportunities for input and for stakeholders and others to improve the approach

The communications requirements for large changes are often underestimated. Some experts indicate that messages may need to be delivered up to 8 different times to be fully absorbed. Communications needs will also evolve as the GSP planning progresses. **Table 4** provides a sample of early communications that focus on SGMA and groundwater basics.

Table 4. Sample – Early Phase Message Elements for Subbasin Stakeholders

Element	What the Change Is	How it will affect the Stakeholder	How the change will be Implemented	Why it is a good idea
Early Phase GSP Development	• Locally governed GSAs will work together to sustainably manage ground water. • The Subbasin /Basin is required to ensure Sustainable Groundwater Management by submitting a sustainability plan by 2020. • The plan must be implemented and found to result in sustainable management by 2040.	(Unique to audience type) • Changes in the current methods of acquiring and utilizing groundwater may occur. • May affect future decisions related to crop types and decisions related to conjunctively using surface water. • May provide additional project resources to the DAC communities.	A collaborative approach is being undertaken to prepare the plan with multiple GSAs coordinating with the SLDMWA as the planning organizer.	• Sustainable and wise use of groundwater allows for the success of future generations and creates greater certainty for today's beneficial users. • Failure to act may result in negative regulatory consequences.

As part of the GSP planning process, the next phase of communications will also need to communicate the requirements for sustainability and how they are achieved in the context of the Delta-Mendota subbasin. Then, communications related to GSP specifics and adoption will require additional outreach, targeted to specific audiences.

4.3. Tied to Decision Making

Communications should also be tightly linked to decision making. For each anticipated decision, stakeholders for that decision should be identified and the following addressed.

1. Who (Is the stakeholder)
    a. An impacted party?
    b. A potential planning partner?
    c. A potential provider of services or resources?
    d. A regulator of the activity?
    (Note: Maybe more than one category.)

2. What (What is the interest of the stakeholder? How will the stakeholder be affected? What are the stakeholders' needs?)
3. Who (Who is the right messenger for the information)
4. How (How should the information be delivered? What are the best methods?)
5. When (What is the appropriate timing for the messages?)
6. Engagement and Knowledge Transfer (How do we create two-way communications?))

Table 5 illustrates some of these ideas.

Table 5. Communications Planning Questions

Who	Interest	Messenger	Delivery	Timing	Knowledge Transfer
• Impacted • Partner • Provider • Regulator	• How will decision affect? • What will stakeholder need?	• Who is a trusted information Source? • How do we ID and Partner	• What are the best delivery methods?	• When should we conduct outreach?	• What do the stakeholders know that we need to know?

4.4. *GSA Boards*

Due to the multiple subbasin GSAs, specific focus is needed on communications to keep them informed, provide consistent updates and information that the Boards can use in their own outreach, and support their decision making. Primary objectives for communications with the subbasin GSA Boards are to ensure:

- Consistent understanding of the requirements for a GSP and/or GSP coordination
- On-going access to current information
- Timely notice of any significant developments or decision points that may require changes to policies and/or require some other board action
- Confidence that the GSP(s) will be accepted by the GSA's stakeholders

Key communications activities involving the Board include;

1. Providing short and digestible pieces of information to ensure each Board member can quickly articulate to his/her constituents on key matters and remain sufficiently informed so that no decision points are surprises.
2. Provide user-friendly informational materials to be used with public audiences, and will support the Board with their own constituent outreach.
3. Utilize regular Board communications for routine updates and reserve specific Board agenda items for highly significant discussion items.

4.5. *Primary Audiences*

There are several core stakeholder groups that will require ongoing communications and tailored messaging throughout the planning process. They are:

- Agriculture
- Disadvantaged Communities
- Municipals

Other stakeholders requiring special consideration include:

- Industrial Users/ Business
- Regulators (State and Federal)
- Potential Partners
- Environmental Organizations
- Federal Agencies

While all of the stakeholder types are important to engage for development of a GSP, the first three will be most affected by any changes that might be proposed as a result of the *GSP(s)*.

The following provides an outline of key messages and activities in support of each of the audience types.

4.2.1. Agricultural

Messages about the GSP(s) development should feature the overall desirability of a sustainable management approach how the plan will contribute to management certainty and protect against regulatory oversight.

In thinking about irrigation users it is also important to remember that one size does not fit all.

4.2.2. Disadvantaged Communities

Messages developed for this sector should be tailored and specific to the community. This type of outreach is often best served by use of surrogates and trusted messengers. As identified in the SA, these messages should be aligned with activities of the IRWM, especially given the high, current dependence of many on unsustainable water sources. Messages about ways to access the increased availability of resources due to grant incentives should also be considered.

A specific outreach method to consider relates to the predominance of cells phones within the communities. According to the Pew Research Center, "over 50 percent of low-income households own a smartphone. Smartphone penetration in this demographic creates substantial opportunities for utilities to reach disadvantaged communities with software solutions like customer self-service platforms and targeted digital communications."[12]

4.2.3. Municipals

[12] Secondary Source: Water Smart. https://www.watersmart.com/rethinking-disadvantaged-community-engagement/ (accessed June 1, 2017)

Some care will be needed to address tensions related to the relative percentages of use by Municipal agencies and what constitutes highest and best beneficial uses within an agricultural region. A promising interaction with this community would involve collaboration on messaging to achieve mutually beneficial goals.

Some thought it might be possible for the municipal agencies to provide in-kind support to the GSP development process through support for project websites and mailing lists, production of meeting notices, assistance to the planning process from in-house public information professionals and offering access to physical meeting spaces.

Municipals may need assistance in making the case for the need to think at a Basin scale rather than more local terms.

4.2.4. Business and Industry Interests

Business and industry interests seek assurances about the availability of water for operations and the viability of the farming industry in the region. Messages for these audiences should focus on how the GSP(s) development will contribute to sustainability and how these audiences can participate in discussion specific to their interests.

4.2.5. Regional/Statewide Interests and Regulators

Some degree of uncertainty remains in the overall legal, legislative and regulatory environment as it relates to SGMA implementation.

It is in the interest of the subbasin stakeholders to engage state and federal agencies and regulators throughout the process. These parties may have resources to assist the subbasin and a cooperative attitude will build good will in the event that adjustments are needed to achieve SGMA compliance.

4.2.6. Potential Agency Partners

A variety of collaborations to achieve GSP(s) development goals may be possible. The GSAs should consider the potential for collaboration with non-GSA members and inter-basin (adjacent subbasin) partners, as part of plan deliberations.

4.2.7. GSP Coordinators Planning Forum

A planning forum for subbasin GSP coordinators should be established to further inform a coordination strategy. This forum would include agency representatives as well as the consultant teams and be used for the sole purpose of coordination and mutual support. It is anticipated that this body might meet on a quarterly or as needed basis. This forum would also provide a central point of contact for adjacent subbasin coordinators.

4.2.8. Environmental Community

As noted in the SA, this community will be interested in a GSP features. The focus of messaging for this group being on how the GSP(s) development will contribute to a sustainable regional water portfolio. Special effort should be made to identify specific topics of interest. For example, as part of GSP development, a list of groundwater dependent species may be created, or impacts to wetlands may be identified. These types of lists would highlight where input from the environmental community might be needed.

4.2.9. Federal Government

Federal representatives interviewed for the assessment asked to be kept informed of subbasin SGMA activities. These agencies have a direct interest in surface water integration as well as SGMA activities that could impact wetlands restoration efforts or groundwater dependent ecosystems and species.

RISK MANAGEMENT

Risk management is the identification, assessment, and prioritization of risks (defined as *the effect of uncertainty on achieving objectives*) followed by coordinated, efficient and economical strategies and actions to minimize, monitor, and control the probability and/or impact of negative events. Strategies and actions may also be used to avert risk by leveraging strengths and opportunities.

Risks can come from uncertainty in economic factors, threats from project failures (at any phase), regulatory and legal uncertainties, natural causes and disasters (drought, flood, etc.), as well as dissention from adversaries, or events of uncertain or unpredictable circumstances. Several risk management standards have been developed. This analysis utilizes those from the Project Management Institute.

Table 6 outlines standardized risk categories and translates them to outreach risks.

Table 6. Risk Factors

RISK CATEGORY	Outreach RISK FACTORS
Technical, quality, or performance	• Realistic performance goals, scope and objectives
Project management	• Quality of outreach design • Outreach deployment and change management • Appropriate allocation of time and resources • Adequate support for Outreach in project management plans
Organizational / Internal	• Executive Sponsorship • Proper prioritization of efforts • Conflicts with other functions • Distribution of workload between organizational and consultant teams
Historical	• Past experiences with similar projects • Organizational relations with stakeholders • Policy and data adequacy • Media and stakeholder fatigue*
External	• Legal and regulatory environment • Changing priorities • Risks related to political dynamics

5.1. Technical, quality, or performance

The subbasin is fortunate to have a high level of water knowledge and skilled personnel available to assist with GSP planning. In general, stakeholder expectations for outreach and performance goals, scope and objectives are attainable. The larger concern in this category is properly communicating the scope of the GSP(s) development and the need for extensive coordination and outreach among a number of parties. Communication of SGMA requirements for outreach as a planning requirement should be an ongoing consideration and appears to be underestimated in emphasis.

5.2. Project management

A number of positive project management factors are present for the GSP(s) development outreach. Project managers view outreach as an important planning element. The outreach design is based on best management practices and industry standards. It is not overly complicated and with technical services support from DWR and other sources, sufficient resources should be available to properly execute it. Procedures and practices are already in place that can be leveraged to achieve communication goals.

The primary concern in this category relates to GSP coordination. This type of outreach will require additional assessment as the individual GSAs will determine their own protocols for representation.

5.3. Organizational / Internal

Conflicts with other GSA member functions and/or conflicts with outreach activities by efforts that include the same stakeholders (e.g. Irrigated Lands, IRWM, and CV-Salts) should be monitored.

One additional consideration will be the distribution of workload between GSA, organizational and consultant teams. Clear roles and responsibilities must be defined and continuous interaction in place to ensure successful execution.

The GSP(s) development process will also need identified, high level spokespersons or champions. These individuals should be able to discuss subbasin planning with the media, in discussions with regulators and potentially at professional conferences.

5.4. External

The legal and regulatory environment of the GSP(s) development process is complex and evolving. Ongoing issues with surface water deliveries and changing agricultural market conditions are outside of the control of the parties. It will be important for mechanisms to be in place that allow for relatively rapid responses to changing conditions.

5.5. Historical

The primary stakeholders in this process generally view interactions and meetings as productive. There is a history of cooperation and a willingness to work together to save costs and achieve better outcomes.

TACTICAL APPROACHES

Following are specific tactical approaches that may be utilized to deliver the activities, messages, and recommendations of the previous chapters. These approaches are based on best communication practices and grounded in the public participation philosophy of the International Association for Public Participation, Public Participation Spectrum as illustrated in **Table 7**.

The Spectrum represents a philosophy that outreach should match the desired level of input from both the stakeholder and the organizational entity.

Table 7. IAP2 Public Participation Spectrum

IAP2 Public Participation Spectrum

Developed by the International Association for Public Participation

INCREASING LEVEL OF PUBLIC IMPACT

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
Public Participation Goal:	To provide the public with balanced and objective information to assist them in understanding the problems, alternatives and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public issues and concerns are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision-making in the hands of the public.
Promise to the Public:	We will keep You informed.	We will keep you informed, listen to and acknowledge concerns and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and issues are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for direct advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.
Example Tools:	• Fact sheets • Web Sites • Open houses	• Public comment • Focus groups • Surveys • Public meetings	• Workshops • Deliberate polling	• Citizen Advisory Committees • Consensus-building • Participatory decision-making	• Citizen juries • Ballots • Delegated decisions

Based on the assessment findings for the GSP(s) development, most stakeholders would simply like to be <u>INFORMED</u> unless there is a potential for significant changes that may include that stakeholder. Tactics for this group will include fact sheets, websites, open houses, briefings, and informational items placed in publications they already read.

The next largest group of stakeholders, primarily groundwater pumpers and disadvantaged communities, wish to be <u>CONSULTED</u>. This group will have access to all the materials prepared as part of the informational phase. In addition they should be invited to provide comments on written materials and planning concepts and participate in focused workshops and/or briefings. They should also be invited to attend larger public meetings.

The development of some GSP features may require a higher degree of INVOLVEMENT. This would focus on engagement of a subset of stakeholders that may experience significant impacts associated with SGMA.

COLLABORATION opportunities have also been identified; however, they are of a different character than defined in the Spectrum. Collaboration in this GSP(s) development process will focus on working with partners that have mutual goals to achieve those goals together. This will more resemble a partnership than a public engagement activity.

6.1. Communications Coordination.

Each GSA is required to perform legally mandated outreach activities and the GSP submission guidelines require a minimum level of engagement.

The subbasin GSAs should coordinate outreach activities even if there is a decision to move forward with multiple GSPs. In addition to efficiency and cost savings (the GSAs can share resources) this strategy will allow for consistency in messaging and reduce confusion for stakeholders that may not know what GSA jurisdiction they are in, and/or are in multiple GSA jurisdictions. Following are suggested options for communications coordination.

1. Website
2. Meeting calendar
3. Branded informational Flyers, Templates, PowerPoint Presentations, etc.
4. Periodic newsletter
5. GSP related mailing lists
6. Descriptions of interested parties
7. Issues and interest statements for legally mandatory interested parties
8. Public workshops
9. Message calendar
10. Press releases and guest editorials
11. Speakers Bureau
12. Existing group venues
13. Outreach documentation

6.2. Tactics

6.2.1. Website

As part of the communications plan development, a list of website concepts and draft website content was prepared. The following describes the proposed approach:

a. Centralized – Establish a centralized website for the entire subbasin.

b. Individual GSAs – Posting of material to a website is part of the SGMA requirements. Those GSAs with their own webpages can link to and from the centralized site if they wish to provide their own customized information. For those GSAs without their own website, courtesy pages would be provided as an added feature of the main site. The courtesy pages would all use a single template with the same information to facilitate easy management and updates. Individual GSAs choosing to take advantage of the courtesy pages would be responsible for ensuring that information is current. The page should include a "Last Updated" box to indicate the timeliness of the information.

c. **Basic features** – A basic website framework has already been developed along with introductory information that has prepopulated each page. **Figure 10** illustrates the basic content of the site and includes:

1. Background information
2. Information about getting involved, including meeting information
3. A separate link for Spanish Language materials
4. Frequently asked questions
5. Links to GSAs
6. Contact information

Should a GSA decide to not participate in the Central website, a similar structure could be utilized.

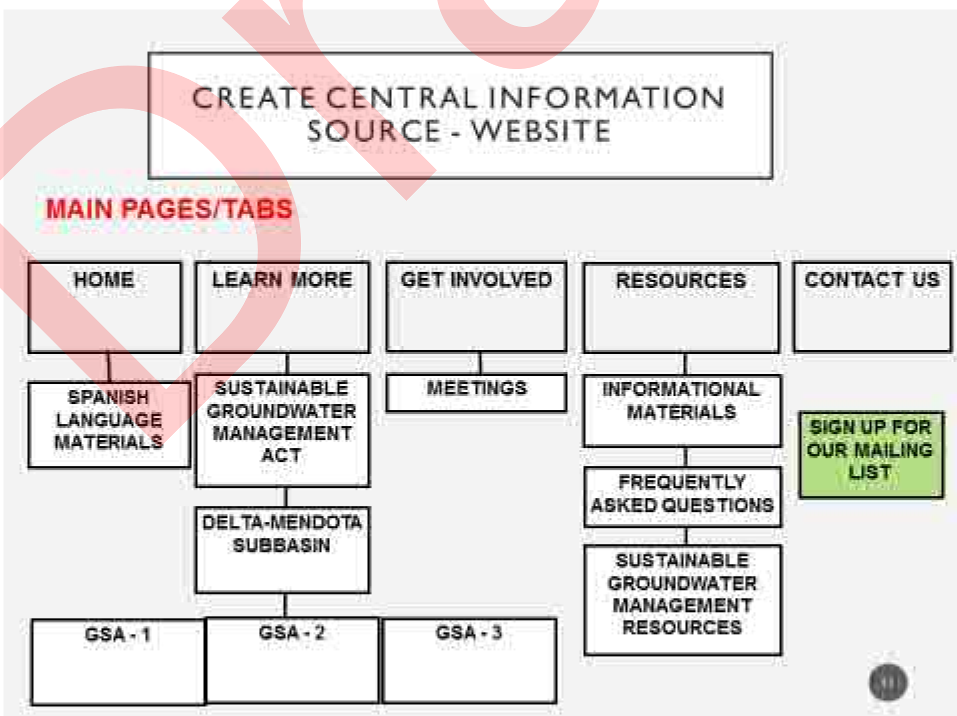


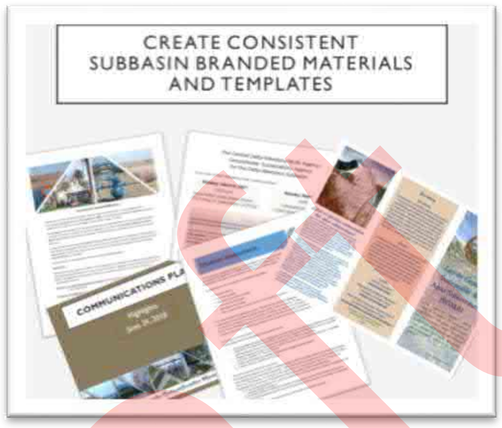
Figure 10. Website Structure

6.2.2. Meeting Calendar

A shared meeting calendar will provide a one-stop shop for stakeholders and assist in preventing meeting conflicts while creating more potential for shared activities. This calendar should include current and scheduled meetings and workshops as well as serve as the repository for agendas and meeting notes, along with copies of meeting materials and presentation.

An integrated project calendar should also be developed that links planning project milestones with communications milestones.

6.2.3. Branded Informational Flyers, Templates, PowerPoint Presentations, etc.



Subbasin level materials should have a single look and feel to create on-going consistency and visual recognition by stakeholders. Use of templates, shared presentations and flyers will create efficiencies and reinforce messaging. This communications plan incorporates some of this type of branding.

6.2.4. Periodic Newsletter

The need for regular communications cannot be overstated. One option is production of a periodic newsletter. Given the relatively short GSP(s) development process timeframe and the GSP development requirements for periodic outreach to identified stakeholders, a quarterly schedule would be realistic and achieve compliance with SGMA requirements for periodic updates to stakeholders. The newsletter should be designed so that individual GSAs can add tailored information if they choose to. For Portable Document Format (PDF) versions of the newsletter, a GSA could add a simple one or two page insert and the edition could be used as a handout or mailer. For a professional looking, email version of the newsletter, we recommend free or low cost services such as Mail Chimp or Constant Comment, which can be integrated with mailing lists.

Adding GSA specific information to an email newsletter can be done with web-links in the email to the very same PDF page prepared for the hardcopy mailer. An alternative is emailing the entire newsletter PDF as an attachment (although this format is less likely to be read than the mailer services).

6.2.5. GSP related mailing lists

Each GSA is required to develop notification lists. A central list may be utilized for GSP(s) related notifications.

6.2.6. Descriptions of Interested Parties

Each GSA is required to develop descriptions of interested parties. These lists should be updated and merged for use in the GSP(s) submittal(s). These can also be provided as background information on the website as part of constructing an administrative record. The SA in Chapter 4 provides an initial start for this documentation.

6.2.7. Issues and Interest Statements for Legally Mandatory Interested Parties

A GSP submission must include a statement of interests for listed stakeholders. As suggested earlier, this can also be included on the website.

6.2.8. Coordinated Public Workshops

SGMA requires a series of public hearings and some public workshops. Such workshops should be coordinated with other subbasin entities.

During the GSA formation process the County of Merced and a forming GSA body conducted a joint workshop to explain more about SGMA and the proposed GSA formation. Distribution of meeting flyers and notices was done concurrently, and DWR attended the event to answer questions. The GSP development process will offer similar opportunities, not only within the subbasin, but with adjacent subbasins.

6.2.9. Message Calendar

Basic messages should be associated with the planning schedule and each stage of GSP(s) development and serve as the theme for the communications materials being generated. For example, during the GSA formation period there was a need to communicate the basics of SGMA and groundwater management. During the GSP(s) initiation phase messages should focus on the basics of groundwater sustainability and the current state of the subbasin. As the GSP(s) begins to take form the specifics of the GSP(s) and what it means for each stakeholder would be the focus.

6.2.10. Press Releases and Guest Editorials

At some point in the GSP development and implementation process, it is likely that stakeholders will be asked to make changes and/or financially support a sustainability effort. It will be more productive for the GSAs and their GSP collaboration partners to frame discussions about these changes than to have others, perhaps with less knowledge, do so on their behalf. For that reason there is a need for press releases and/or guest editorials to offer the media and stakeholders accurate information offered in the context of SGMA. This type of outreach should be closely coordinated as consistency in messages is critical to stakeholder acceptance.

6.2.11. Speakers Bureau

Efforts should be made to conduct outreach at events and meetings that already occur (e.g. Farm Bureau meetings, Rotary Club, etc.). A list of knowledgeable presenters should be developed in the event an organization or other entity would like a presentation. Speakers Bureau engagements should be recorded on the planning project meeting calendar.

6.2.12. Existing Group Venues

Fully leverage the activities of existing groups.

- Maintain a roster of existing groups and typical meeting schedules with a nexus to GSP(s) development. Add the dates to the messaging calendar.
- The list of audiences, messages and existing groups should be referenced when there is a need to deploy information.
- Conduct informal outreach with the leaders of such groups to determine the best way to interact.
- Determine what communications channels these groups are using and equally leverage these, for example by placement of articles in newsletters.

6.2.13. Outreach Documentation

A central point of contact should be identified on the website and an outreach statistics inventory should be established that identifies dates, times, audiences and attendance. This information will be also be useful in conducting follow up with stakeholders as well as documenting outreach as part of GSP submittal guidelines.

6.3. Procedural and Legally Mandated Outreach

A discussion of SGMA outreach requirements was provided in Chapter 1 and a full list of requirements is contained in Appendix 1. One major feature of the requirements is a submission to DWR of the opportunities that interested parties will be given to participate in the GSP deliberations. The Situation Assessment provides an initial description that can be added to with additional outreach.

Following are the Required Interested Parties for the purpose of mandated outreach:

Table 9 provides a list of the mandated outreach and the timeframe in which is required.

Table 8. Mandated Outreach

Timeframe	Item
Prior to initiating plan development	1. Statement of how interested parties may contact the Agency and participate in development and implementation of the plan submitted to DWR.

Timeframe	Item
	2. Web posting of same information.
Prior to plan development	1. Must establish and maintain an interested persons list. 2. Must prepare a written statement describing the manner in which interested parties may participate in GSP development and implementation. Statement must be provided to: a. Legislative body of any city and/or county within the geographic area of the plan b. Public Utilities Commission if the geographic area includes a regulated public water system regulated by that Commission c. DWR d. Interested parties (see Section 10927) e. The public
Prior to and with GSP submission	1. Statements of issues and interests of beneficial users of basin groundwater, including types of parties representing the interests and consultation process 2. Lists of public meetings 3. Inventory of comments and summary of responses 4. Communication section in plan that includes: • Agency decision making process • ID of public engagement opportunities and response process • Description of process for inclusion • Method for public information related to progress in implementing the plan (status, projects, actions)
90 days prior to GSP Adoption Hearing	1. Prior to Public Hearing for adoption or amendment of the GSP, the GSP entities must notify cities and/or counties of geographic area 90 days in advance.
90 days or less prior to GSP Adoption Hearing	2. Prior to Public Hearing for adoption or amendment of the GSP, the GSP entities must: a. Consider and review comments b. Conduct consultation within 30 days of receipt with cities or counties so requesting
GSP Adoption or Amendment	1. GSP must be adopted or amended at Public Hearing.
60 days after plan submission	1. 60-day comment period for plans under submission to DWR. Comments will be used to evaluate the submission.
Prior to adoption of fees	1. Public meeting required prior to adoption of, or increase to fees. Oral or written presentations may be made as part of the meeting. 2. Public notice shall include: a. Time and place of meeting b. General explanation of matter to be considered

Timeframe	Item
	c. Statement of availability for data required to initiate or amend such fees d. Public posting on Agency Website and provision by mail to interested parties of supporting data (at least 20 days in advance) 3. Mailing lists for interested parties are valid for 1 year from date of request and may be renewed by written request of the parties on or before April 1 of each year. 4. Includes procedural requirements per Government Code, Section 6066.
Prior to conducting a fee adoption hearing.	1. Must publish notices in a newspaper of general circulation as prescribed. 2. Publication shall be once a week for two successive weeks. Two publications in a newspaper published once a week or oftener, with at least five days intervening between the respective publication dates not counting such publication dates, are sufficient. 3. The period of notice begins the first day of publication and terminates at the end of the fourteenth day, (which includes the first day.)

6.4. Items for Future Consideration

This GSP(s) Coms Plan outlines an outreach effort based on project and stakeholder needs and preferences. This document has been prepared as a working draft living document and should be updated as new information and the GSP(s) development process needs are developed.

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MEASUREMENTS & EVALUATION

A guiding principle for evaluation and measurement of the Coms Plan's success is to provide regular, unbiased reporting of progress toward achieving goals. Success may be evaluated in several ways, including process measures, outcome measures, and an annual evaluation of accomplishments. Optional evaluation measures are described below.

As part of each outreach effort debrief the following process and outcome measures will be discussed and recorded in a check sheet. The check sheets will be prepared with the goal of continuous improvement rather than criticisms.

7.2. Process Measures

Process measures track progress toward meeting the goals of the Coms Plan. These include:

- Level of attendance at outreach meetings
- Shared understanding of the overarching aims, activities, and opportunities presented by different planning approaches and project activities
- Productive dialogue among participants at meetings and events
- Sense of authentic engagement; people understand why they have been asked to participate, and feel that they can contribute meaningfully
- Timely and accurate public reporting of planning milestones
- Feedback from Coordinating Body and GSA members, regulators, stakeholders, and interested parties about the quality and availability of information materials
- Level of stakeholder interest in the GSP(s) development process information

7.3. Outcome Measures

Outcome measures track the level of success of the Coms Plan in meeting its overall goals. Some outcome measures considered for the GSP(s) development process include the following:

- Consistent participation by key stakeholders and interested parties in essential activities. Participants should have no difficulty locating the meetings, and should be informed as to when and where they will be held.
- Response from meeting participants that the engagement methods provided for a fair and balanced exchange of information.
- Feedback from interested parties that they understand how their input is used, where to track data, and what results to expect.
- The project receives quality media coverage that is accurate, complete and fair.

7.4. Mid-cycle Evaluation of Accomplishments

A mid-cycle evaluation provides an opportunity to examine the current effectiveness of the Coms Plan and provides a chance to reevaluate strategies to meet the GSP(s) development process objectives. The evaluation tasks may include:

- Preparation of an executive-level summary detailing high-level initiatives and accomplishments of the previous cycle. This evaluation should also include positive news, best practices, goals and objectives, notable changes, timelines, and priorities.
- Identifying gaps and areas for improvement.
- Highlighting how gaps and areas for improvement in the cycle has been addressed.
- Outlining process and outcome measures and their current results.

ROLES AND RESPONSIBILITIES

The GSP(s) development Coms Plan outlines numerous strategies, activities and tactics. While none are highly complex, there is a requirement for coordination and clarity regarding who will be responsible for executing the tasks.

After the planning team evaluates the timelines and priorities for each of the communications activities a recommended next step is completion of a Responsible, Accountable, Consulted, and Informed (RACI) Chart. This Chart, as displayed in **Table 10**, outlines key tasks and the assignment of roles and responsibilities for accomplishing them.

Table 9. Sample RACI Chart

Activity TYPE	SPECIFIC PRODUCT	RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
Internal Staff Communications, information materials for/briefings	Draft	Person A	Person E	Person I	
	Final Draft	Person A	Person E	Person I	Project Team
List Serves, mailing lists	Customer Contacts	Person B - Person A	Person E	Person I	Project Team
	Concurrent jurisdictions	Lisa Beutler/MWH	Person G	Person I	Project Team
	Other - identified stakeholders	Person A	Person G	Person I	Project Team
Web Content and Maintenance	Draft Content and Content Refresh	Lisa Beutler/MWH/	Person G	Person H	Project Team
	Site Administration	Person A	Person G	Person H	
General public Intro Packets, Fact Sheets and Brochures	Draft	Person D	Person E	Person I- Subject Matter Experts	Person J
	Revised Draft	Person D	Person E	Person I- Subject Matter Experts	Person J
	Final Draft	Person D	Person E	Person I- Subject Matter Experts	Project Team
Newsletter Content	Draft	Lisa Beutler/MWH	Person E	Person I- Subject Matter Experts	Person J
	Revised Draft	Person D	Person E	Person I- Subject Matter Experts	Person J
	Final Draft	Person D	Person E	Person I- Subject Matter Experts	Project Team

Responsible
Those who do the work to achieve the task. There is at least one person with a role of *responsible*, although others can be delegated to assist in the work required.

Accountable (also approver or final approving authority)
This is the person ultimately answerable for the correct and thorough completion of the deliverable or task, and the one who delegates the work to those responsible. <u>There **may only** be only one *accountable*</u> specified for each task or deliverable.

Consulted
Those whose opinions are sought, typically subject matter experts were people that are impacted by the activity; and with whom there is two-way communication.

Informed
Those who are kept up-to-date on progress, typically on the launch and completion of the task or deliverable. This is one way communication.

Role distinction
There is a distinction between a role and the individual assigned the task. Role is a descriptor of an associated set of tasks that could be performed by just one or many people.

In the case of the RACI Chart, the team may list as many people as is logical except for the Accountable role.

Scope of Work
Completion of the RACI Chart will also support development of any future scopes of work for consultant provided communication and outreach services.

LIST OF APPENDICES

Appendix 1. Public Outreach Requirements under SGMA

GSP Regulations

CODE	PUBLIC OUTREACH REQUIREMENT
§ 353.6. Initial Notification (a) Each Agency shall notify the Department, in writing, prior to initiating development of a Plan. The notification shall provide general information about the Agency's process for developing the Plan, including the manner in which interested parties may contact the Agency and participate in the development and implementation of the Plan. The Agency shall make the information publicly available by posting relevant information on the Agency's website.	1. Statement of how interested parties may contact the Agency and participate in development and implementation of the plan submitted to DWR. 2. Web posting of same information. **Timing**: *Prior to initiating development of a plan.*
§ 353.8. Comments (a) Any person may provide comments to the Department regarding a proposed or adopted Plan. (b) Pursuant to Water Code Section 10733.4, the Department shall establish a comment period of no less than 60 days for an adopted Plan that has been accepted by the Department for evaluation pursuant to Section 355.2. (c) In addition to the comment period required by Water Code Section 10733.4, the Department shall accept comments on an Agency's decision to develop a Plan as described in Section 353.6, including comments on elements of a proposed Plan under consideration by the Agency.	1. 60-day comment period for plans under submission to DWR. Comments will be used to evaluate the submission. 2. Parties may also comment on a GSA's (or GSAs') statements submitted under section 353.6 **Timing**: For GSP Submittal - *60 days after submission to DWR*
§ 354.10. Notice and Communication Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following: (a) A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties. (b) A list of public meetings at which the Plan was discussed or considered by the Agency. (c) Comments regarding the Plan received by the Agency and a summary of any responses by the Agency. (d) A communication section of the Plan that includes the following: (1) An explanation of the Agency's decision-making process. (2) Identification of opportunities for public engagement and a discussion of how public input and response will be used.	5. Statements of issues and interests of beneficial users of basin groundwater, including types of parties representing the interests and consultation process 6. Lists of public meetings 7. Inventory of comments and summary of responses 8. Communication section in plan that includes: • Agency decision making process • ID of public engagement opportunities and response process • Description of process for inclusion • Method for public information related to progress in implementing the plan (status, projects, actions) **Timing**: For GSP Submittal – *with plan* For GSP Development – *continuous.* *[Note: activities should be included*

CODE	PUBLIC OUTREACH REQUIREMENT
(3) A description of how the Agency encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin. (4) The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions.	*in the project schedule and information posted on web.]*
§ 355.2. (c) Department Review of Adopted Plan (c) The Department (DWR) shall establish a period of no less than 60 days to receive public comments on the adopted Plan, as described in Section 353.8.	1. 60 day public review period for public comment on submitted plan. **Timing**: After GSP Submittal to DWR – *60 days*
§ 355.4. & 355.10 Criteria for Plan Evaluation The basin shall be sustainably managed within 20 years of the applicable statutory deadline consistent with the objectives of the Act. The Department shall evaluate an adopted Plan for compliance with this requirement as follows: (b) (4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered. … (10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.	1. Required public outreach and stakeholder information is submitted, including statement of issues and interests of beneficial users. 2. Public and stakeholder comments and questions adequately addressed during planning process. **Timing**: For GSP Submittal – *with plan* For resubmittal related to corrective action – *with submittal*

California Water Code

CODE	PUBLIC OUTREACH REQUIREMENT
10720. This part shall be known, and may be cited, as the "Sustainable Groundwater Management Act." **10720.3** (a) This part applies to all groundwater basins in the state. … (c) The federal government or any federally recognized Indian tribe, appreciating the shared interest in assuring the sustainability of groundwater resources, may voluntarily agree to participate in the preparation or administration of a groundwater sustainability plan or groundwater management plan under this part through a joint powers authority or other agreement with local agencies in the basin. A participating tribe shall be eligible to participate fully in planning, financing, and management under this part, including eligibility for grants and technical assistance, if any exercise of regulatory authority, enforcement, or imposition and collection of fees is pursuant to	1. Tribes and the federal government may voluntarily participate in GSA governance and GSP development. **Timing**: *Prior to initiating development of a plan.*

CODE	PUBLIC OUTREACH REQUIREMENT
the tribe's independent authority and not pursuant to authority granted to a groundwater sustainability agency under this part.	
CHAPTER 4. Establishing Groundwater Sustainability Agencies [10723 - 10724]	
10723. a) Except as provided in subdivision (c), any local agency or combination of local agencies overlying a groundwater basin may decide to become a groundwater sustainability agency for that basin. (b) Before deciding to become a groundwater sustainability agency, and after publication of notice pursuant to Section 6066 of the Government Code, the local agency or agencies shall hold a public hearing in the county or counties overlying the basin.	1. Must hold public hearing in the county or counties overlying the basin, prior to becoming a GSA **Timing**: *Prior to becoming a GSA.*
10723.2 The groundwater sustainability agency shall consider the interests of all beneficial uses and users of groundwater, as well as those responsible for implementing groundwater sustainability plans. These interests include, but are not limited to, all of the following: (a) Holders of overlying groundwater rights, including: (1) Agricultural users. (2) Domestic well owners. (b) Municipal well operators. (c) Public water systems. (d) Local land use planning agencies. (e) Environmental users of groundwater. (f) Surface water users, if there is a hydrologic connection between surface and groundwater bodies. (g) The federal government, including, but not limited to, the military and managers of federal lands. (h) California Native American tribes. (i) Disadvantaged communities, including, but not limited to, those served by private domestic wells or small community water systems. (j) Entities listed in Section 10927 that are monitoring and reporting groundwater elevations in all or a part of a groundwater basin managed by the groundwater sustainability agency.	1. Must consider interest of all beneficial uses and users of groundwater. 2. Includes specific stakeholders as listed. **Timing**: *During development of a GSP.*
10723.4. The groundwater sustainability agency shall establish and maintain a list of persons interested in receiving notices regarding plan preparation, meeting announcements, and availability of draft plans, maps, and other relevant documents. Any person may request, in writing, to be placed on the list of interested persons.	3. Must establish and maintain an interested persons list. 4. Any person may ask to be added to the list **Timing**: *On forming a GSA.*
10723.8. (a) Within 30 days of deciding to become or form a groundwater sustainability agency, the local agency or combination of local agencies shall inform the department of its decision and its intent to undertake sustainable groundwater management. The	1. Creates notification requirements that include: a. A list of interested parties b. An explanation of how interests will be considered

CODE	PUBLIC OUTREACH REQUIREMENT
notification shall include the following information, as applicable: … (4) A list of interested parties developed pursuant to Section 10723.2 and an explanation of how their interests will be considered in the development and operation of the groundwater sustainability agency and the development and implementation of the agency's sustainability plan.	**Timing**: *On forming a GSA & with submittal of GSP*
10727.8 (a) Prior to initiating the development of a groundwater sustainability plan, the groundwater sustainability agency shall make available to the public and the department a written statement describing the manner in which interested parties may participate in the development and implementation of the groundwater sustainability plan. The groundwater sustainability agency shall provide the written statement to the legislative body of any city, county, or city and county located within the geographic area to be covered by the plan. The groundwater sustainability agency may appoint and consult with an advisory committee consisting of interested parties for the purposes of developing and implementing a groundwater sustainability plan. The groundwater sustainability agency shall encourage the active involvement of diverse social, cultural, and economic elements of the population within the groundwater basin prior to and during the development and implementation of the groundwater sustainability plan. If the geographic area to be covered by the plan includes a public water system regulated by the Public Utilities Commission, the groundwater sustainability agency shall provide the written statement to the commission. (b) For purposes of this section, interested parties include entities listed in Section 10927 that are monitoring and reporting groundwater elevations in all or a part of a groundwater basin managed by the groundwater sustainability agency.	2. Agencies preparing a GSP must prepare a written statement describing the manner in which interested parties may participate in its development and implementation. 3. Statement must be provided to: a. Legislative body of any city and/or county within the geographic area of the plan b. Public Utilities Commission if the geographic area includes a regulated public water system regulated by that Commission c. DWR d. Interested parties (see Section 10927) e. The public 4. GSP entities may form an advisory committee for the GSP preparation and implementation. 5. The GSP entities are to encourage active involvement of diverse social, cultural and economic elements of the affected populations. **Timing**: *On initiating GSP*
10728.4 Public Notice of Proposed Adoption, GSP Adoption Pubic Hearing A groundwater sustainability agency may adopt or amend a groundwater sustainability plan after a public hearing, held at least 90 days after providing notice to a city or county within the area of the proposed plan or amendment. The groundwater sustainability agency shall review and consider comments from any city or county that receives notice pursuant to this section and shall consult with a city or county that requests consultation within 30 days of receipt of the notice. Nothing in this section is intended to	3. GSP must be adopted or amended at Public Hearing. 4. Prior to Public Hearing for adoption or amendment of the GSP, the GSP entities must: a. Notify cities and/or counties of geographic area 90 days in advance. b. Consider and review comments

<table>
<tr><th>CODE</th><th>PUBLIC OUTREACH REQUIREMENT</th></tr>
<tr><td>preclude an agency and a city or county from otherwise consulting or commenting regarding the adoption or amendment of a plan.</td><td>c. Conduct consultation within 30 days of receipt with cities or counties so requesting</td></tr>
<tr><td>10730 Fees.
(a) A groundwater sustainability agency may impose fees, including, but not limited to, permit fees and fees on groundwater extraction or other regulated activity, to fund the costs of a groundwater sustainability program, including, but not limited to, preparation, adoption, and amendment of a groundwater sustainability plan, and investigations, inspections, compliance assistance, enforcement, and program administration, including a prudent reserve. A groundwater sustainability agency shall not impose a fee pursuant to this subdivision on a de minimis extractor unless the agency has regulated the users pursuant to this part.
(b) (1) Prior to imposing or increasing a fee, a groundwater sustainability agency shall hold at least one public meeting, at which oral or written presentations may be made as part of the meeting.
(2) Notice of the time and place of the meeting shall include a general explanation of the matter to be considered and a statement that the data required by this section is available. The notice shall be provided by publication pursuant to Section 6066 of the Government Code, by posting notice on the Internet Web site of the groundwater sustainability agency, and by mail to any interested party who files a written request with the agency for mailed notice of the meeting on new or increased fees. A written request for mailed notices shall be valid for one year from the date that the request is made and may be renewed by making a written request on or before April 1 of each year.
(3) At least 20 days prior to the meeting, the groundwater sustainability agency shall make available to the public data upon which the proposed fee is based.
(c) Any action by a groundwater sustainability agency to impose or increase a fee shall be taken only by ordinance or resolution.
(d) (1) As an alternative method for the collection of fees imposed pursuant to this section, a groundwater sustainability agency may adopt a resolution requesting collection of the fees in the same manner as ordinary municipal ad valorem taxes.
(2) A resolution described in paragraph (1) shall be adopted and furnished to the county auditor-controller and board of supervisors on or before August 1 of each year that the alternative collection of the fees is being requested. The resolution shall include a list of parcels and the amount to be collected for each parcel.
(e) The power granted by this section is in addition to any powers a groundwater sustainability agency has under any other law.</td><td>Related to GSAs
5. Public meeting required prior to adoption of, or increase to fees. Oral or written presentations may be made as part of the meeting.
6. Public notice shall include:
a. Time and place of meeting
b. General explanation of matter to be considered
c. Statement of availability for data required to initiate or amend such fees
d. Public posting on Agency Website and provision by mail to interested parties of supporting data (at least 20 days in advance)
7. Mailing lists for interested parties are valid for 1 year from date of request and may be renewed by written request of the parties on or before April 1 of each year.
8. Includes procedural requirements per Government Code, Section 6066.

Timing: Prior to adopting fees.</td></tr>
</table>

California Government Code

CODE	PUBLIC OUTREACH REQUIREMENT
6060 Whenever any law provides that publication of notice shall be made pursuant to a designated section of this article, such notice shall be published in a newspaper of general circulation for the period prescribed, the number of times, and in the manner provided in that section. As used in this article, “notice” includes official advertising, resolutions, orders, or other matter of any nature whatsoever that are required by law to be published in a newspaper of general circulation. **6066** Publication of notice pursuant to this section shall be once a week for two successive weeks. Two publications in a newspaper published once a week or oftener, with at least five days intervening between the respective publication dates not counting such publication dates, are sufficient. The period of notice commences upon the first day of publication and terminates at the end of the fourteenth day, including therein the first day.	4. Must publish notices in a newspaper of general circulation as prescribed. 5. Publication shall be once a week for two successive weeks. Two publications in a newspaper published once a week or oftener, with at least five days intervening between the respective publication dates not counting such publication dates, are sufficient. 6. The period of notice begins the first day of publication and terminates at the end of the fourteenth day, (which includes the first day.) **Timing**: *Prior to adopting fees*

Appendix 2. Communications Governance

Given the relatively large number of stakeholders, a recommendation for coordinated efforts, and the legal requirements for outreach[13] some form of communications governance is recommended.

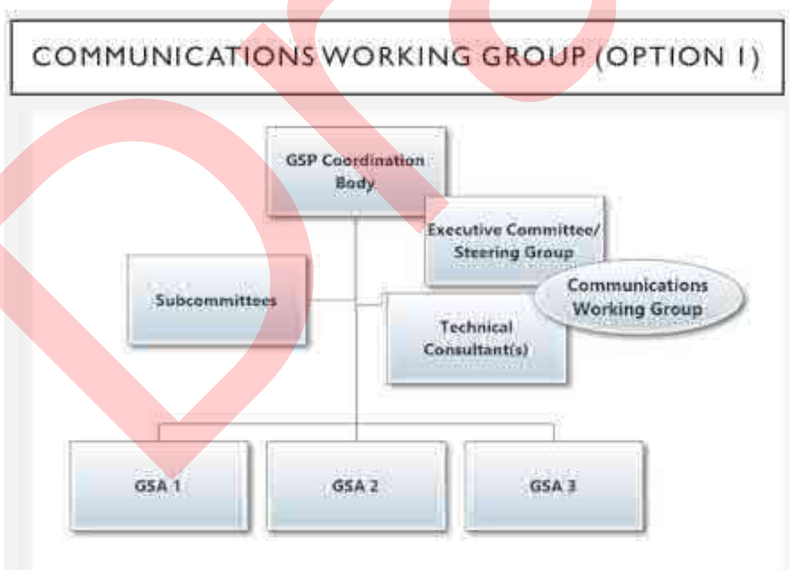
Execution of communications activities can be accomplished by an individual or multiple individuals, and/or include or be solely managed by project consultants. The actual form of the governance is less important than a clear understanding of the roles and responsibilities of those responsible for ensuring required communication. Also essential is a clear chain of command that ensures the elected representatives of GSAs are able to retain communications leadership and guidance.

A driving consideration for establishing a communications governance structure is the level of effort associated with required activities and the fact that communications are highly time dependent. That means that communications activities should be occurring that may happen outside of regularly scheduled GSA meetings. In this case delegation with guidance to a communications team is efficient and effective.

Several governance options for consideration are offered below.

Communications Option 1

Communications Option 1 is based on an overall GSP(s) development structure that includes a GSA member based leadership function that is guiding the Technical Consultants. A communications working group which might include staff, consultants and GSA elected officials, or some combination of those roles could be formed to serve as a communications working group that would ultimately report to the larger GSP coordinating body.



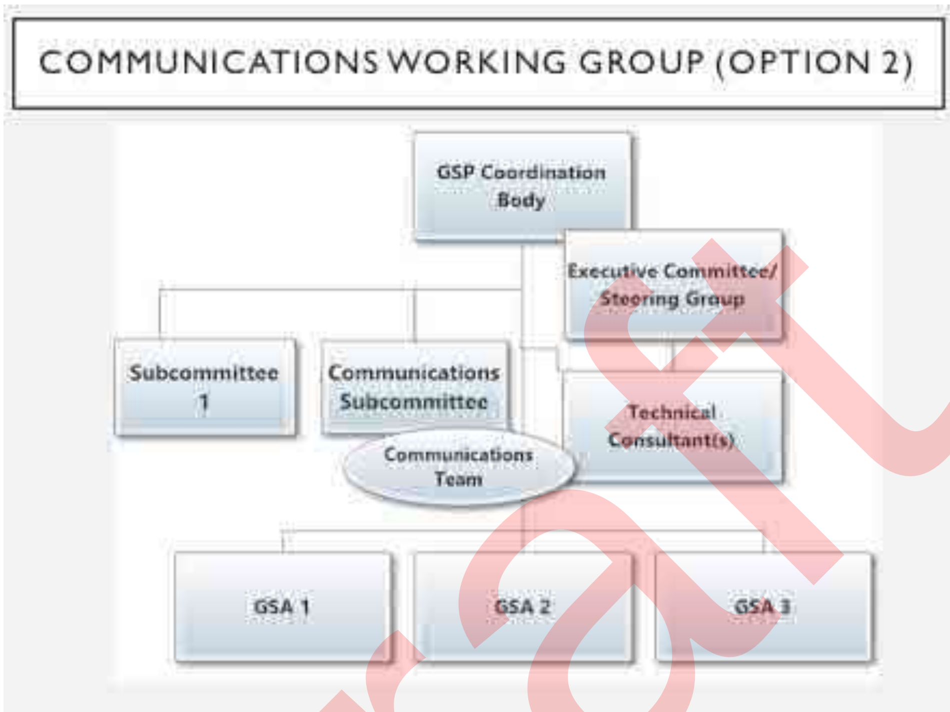
Communications Governance Option 1

Communications Option 2

[13] See Appendix 1

Appendix 1

Communications Option 1 is based on an overall GSP(s) development structure that includes a GSA member based subcommittee guiding the Technical Consultants. A communications working group which might include staff, consultants and GSA elected officials, or some combination of those roles could be formed to serve as a communications team that is affiliated with a subcommittee and would ultimately report to the larger GSP coordinating body



Communications Governance Option 2

Appendix F - Summaries of Coordinated Workshops

DELTA-MENDOTA SUBBASIN
SUSTAINABLE GROUNDATER MANAGEMENT ACT
SPRING 2018 COORDINATED WORKSHOPS

Monday, May 14, 2018, Los Banos
Wednesday, May 16, 2018, Patterson
Thursday, May 17, 2018, Mendota

WORKSHOP SUMMARY

- Three workshops were held in the northern, central, and southern parts of the Delta-Mendota Subbasin. The purpose of the workshops was to educate stakeholders and members about the public about the Sustainable Groundwater Management Act (SGMA) and introduce participants to their local Groundwater Sustainability Agency representatives. Topics covered during the workshop included what is SGMA, the Delta-Mendota Subbasin, and opportunities for public engagement.
- Workshop participants' questions and feedback are summarized as follows:
  - Are the local groundwater regulations going to be re-set on an annual basis based on the water year, snowpack, etc.?
  - Who is the governing board that will make these decisions?
  - If this is a state-wide initiative, who is the decision-making body?
  - Will the California Department of Fish and Wildlife be involved?
  - Has the State provided criteria to what is considered a "chronic loss" of groundwater?
  - Are natural springs included under SGMA?
  - What criteria will you use to measure whether or not springs are overused?
  - What is the ultimate goal of SGMA? What does it mean to us?
  - How is the water budget going to be developed?
  - The Irrigated Lands Program already has a lot of requirements for growers. Is this going to be the same level of detail and effort?
  - What is the goal SGMA is trying to achieve? How are we going to get to sustainability?
  - What will happen when the State and districts do not receive their full surface water allocation and cities keep expanding?
  - It seems to me that the biggest problem is that the State wants to export water to Southern California. How can we come up with a solution if there are factors out of our control?

- How will you know how much I am pumping?

DELTA-MENDOTA SUBBASIN
SUSTAINABLE GROUNDATER MANAGEMENT ACT
FALL 2018 COORDINATED WORKSHOPS

Monday, October 22, Firebaugh
5:00 – 7:00 PM
Firebaugh Middle School MPR

Wednesday, October 24, Los Banos
4:00 – 6:00 PM
College Greens Building

Thursday, October 25, Patterson
4:00 – 6:00 PM
Patterson Senior Center

WORKSHOP SUMMARY

- Three workshops were held in the northern, central, and southern parts of the Delta-Mendota Subbasin. The purpose of the workshops was to educate stakeholders and members about the public about key Sustainable Groundwater Management Act (SGMA) topics in preparation for Groundwater Sustainability Plan (GSP) development workshops in 2019.
- The format and content of each workshop was the same. The workshops began with a 45-minute presentation, followed by an open house period for participants to talk with their Groundwater Sustainability Agency (GSA) representative. Spanish interpretation was provided at each workshop.
- In total, approximately 45 individuals (not including GSA representatives and supporting staff) participated in the workshops. Attendance by location was as follows: Firebaugh – 5 participants; Los Banos – 23 participants; Patterson – 17 participants. Three participants requested Spanish interpretation.
- Most participants heard about the workshops through emails from their local water or irrigation district, or direct flyers and bill inserts sent to them by their water/irrigation district or municipality.
- Presentation topics included: Overview of SGMA, GSP development and implementation process, data management, hydrogeologic conceptual model, numerical and analytical models, and the water budget.
- Workshop participants' questions and feedback are summarized as follows:

  Data

  - How much historical data are the GSAs using to make their assumptions?
  - Will data from counties be used?

- Is the numerical data available on the Delta-Mendota website?
- How big will the GSAs' monitoring network be? Do the GSAs anticipate drilling new monitoring wells?
- How will the GSAs monitor water quality and subsidence? Do the GSAs already have subsidence monitoring wells and data?
- How much data have the GSAs gathered? When will the GSAs stop gathering data?
- How much data will the GSAs be collecting from individual landowners?

Models

- Will the models take into account availability of surface water supplies?
- Will the models take into account changing crops?
- Will the models take into account agricultural areas that are being converted to commercial or urban areas?

Water Budget and Sustainable Yield

- What is the sustainable yield for the Delta-Mendota Subbasin?
- It sounds like the sustainable yield will be a number that oscillates around a baseline. What is this baseline?
- How will the GSAs determine the minimum threshold for the subbasin?
- How will the water budgets account for existing and new wells?
- What are the years for the historic water budget? How was this period set?

Projects and Management Actions

- Based on what is currently known, will the GSAs be able to limit groundwater pumping in the future?
- When the GSAs come up with groundwater management policies, will the policies impact groundwater pumping on an individual level, regional level, or basin-wide level?
- Will the California Department of Water Resources (DWR) or the GSAs be the ones to limit pumping?
- Could a potential management action be limiting pumping?
- Will the GSAs be the agencies to determine if new wells can or cannot be drilled?

Integration with Other Programs/Organizations

- How much are the GSAs integrating with the Irrigated Lands Program?
- How closely do GSAs work with local farm bureaus?

Other

- Will there be an administrative fee for the GSAs to oversee GSP implementation?
- How will the costs for GSP development and implementation be covered?
- Do the GSAs know what DWR's GSP review and certification process will consist of?

- Will the GSAs in the region have influence over how surface water resources are managed on a state-wide level?
- How many GSAs were formed after SGMA passed in 2014?

DELTA-MENDOTA SUBBASIN
SUSTAINABLE GROUNDATER MANAGEMENT ACT
WINTER 2019 COORDINATED WORKSHOPS

Tuesday, February 19, 2019, Los Banos
4:00 – 6:00 PM
College Greens Building

Wednesday, February 20, 2019, Patterson
4:00 – 6:00 pm
City of Patterson City Hall

Monday, March 4, 2019, Santa Nella
6:00 – 8:00 PM
Romero Elementary School

WORKSHOP SUMMARY

- Three workshops were held in the northern, central, and southern parts of the Delta-Mendota Subbasin during February and March 2019. The purpose of the workshops was to educate stakeholders and members about the public about topics covered in the draft Groundwater Sustainability Plans (GSP) being developed for the subbasin. Topics covered during the workshop included historic and current water budgets, sustainability criteria, undesirable results, and projects and management actions.
- Workshops were promoted via emails sent to each GSA's interested parties database, flyers and utility bill inserts, and social media posts.
- The format and content of each workshop was the same. The workshops began with a short presentation, followed by an open house period for participants to talk with their Groundwater Sustainability Agency (GSA) representative. Spanish interpretation was provided at each workshop.
- In total, approximately 30 individuals (not including GSA representatives and supporting staff) participated in the workshops. Attendance by location was as follows: Patterson – 14, Los Banos – 4, and Santa Nella – 12. Participants represented a range of beneficial users in the subbasin, including domestic well owners, agricultural water users, public water systems, and disadvantaged communities.

- Workshop participants' questions and feedback are summarized as follows:

  Water Budgets

    - Does the land surface budget include inflows from precipitation and applied water to crops?
    - Who provides the information about the inflows and outflows of the aquifer?
    - How is the aquifer recharged?
    - Do reservoirs lose water?
    - What happened between 1985 – now [regarding the historic water budget]?
    - What affect does precipitation have on the aquifer?

  Projects and Management Actions

    - Who will make the decision on who can drill wells and how much can well owners can pump?
    - Will GSAs in the subbasin be able to restrict selling of groundwater outside of the subbasin?
    - Projects and management actions should emphasize flood and stormwater capture and increased stormwater storage.
    - Will use of recycled water in new developments be considered a source of water to balance the water budget?
    - Are there percolation ponds by golf course?

  Sustainability Criteria and Undesirable Results

    - Is it the GSAs' responsibility to set the sustainability criteria for the subbasin?
    - Could this region experience seawater intrusion?
    - What's going to happen in areas like Dos Palos that have poor groundwater quality?

  Other

  - Does the GSP only cover of agricultural uses of groundwater or does it also cover residential and commercial uses of groundwater?
  - Who is doing the work to prepare the GSP?
  - How much does it cost to prepare a GSP?
  - Are there any agencies currently monitoring groundwater pumping and levels?
  - How is groundwater currently being removed from the groundwater basin?
  - How many monitoring stations have been identified? Have GSAs already identified where these monitoring pumps are?
  - Does the California Aqueduct affect the water table in the subbasin?
  - What is the rationale for the North-Central GSP group's boundaries? The north and south areas of the North-Central GSP group are very different.
  - Do water agencies in the subbasin send water to the Santa Clara Valley Water District?
  - Where are the coordinated meetings are held? What time are these meetings?
  - Will this raise our water rates?
  - The community of Tranquillity is currently experiencing land subsidence.

DELTA-MENDOTA SUBBASIN
SUSTAINABLE GROUNDATER MANAGEMENT ACT
SPRING 2019 COORDINATED WORKSHOPS

Monday, May 20, 2019, Patterson
4:00 – 6:00 pm
City of Patterson City Hall

Tuesday, May 21, 2019, Los Banos
4:00 – 6:00 PM
College Greens Building

Wednesday, May 22, 2019, Santa Nella
6:30 – 8:30 PM
Romero Elementary School

Thursday, May 23, 2019, Mendota
6:00 – 8:00 PM
Mendota Library

WORKSHOP SUMMARY

- Four workshops were held in the northern, central, and southern parts of the Delta-Mendota Subbasin. The purpose of the workshops was to educate stakeholders and members about the public about topics covered in the draft Groundwater Sustainability Plans (GSP) being developed for the subbasin. Topics covered during the workshop included water budgets, sustainable yield, projects and management actions, and groundwater monitoring networks.
- Workshops were promoted via emails sent to each GSA's interested parties database, flyers and utility bill inserts, social media posts, and direct outreach to community stakeholders.
- The format and content of each workshop was the same. The workshops began with a short presentation, followed by an open house period for participants to talk with their Groundwater Sustainability Agency (GSA) representative. Spanish interpretation was provided at each workshop.
- In total, approximately 30 individuals participated in the workshops. Attendance by location was as follows: Patterson – 7, Los Banos – 10, Santa Nella – 4, and Mendota – 9. Participants represented a range of beneficial users in the subbasin, including domestic well owners, agricultural water users, public water systems, and disadvantaged communities.

- Workshop participants' questions and feedback are summarized as follows:

  Water Budgets

  - Why is there a difference between the water budgets for the upper and lower aquifers?
  - Why is the change in storage negative?
  - Is there a water budget for each aquifer?
  - When the projected water budgets are finalized, will they include specific projects and management actions?
  - How was the data for the climate change factors developed?
  - Historically, California goes through periodic droughts. Do the projected water budgets account for future droughts?
  - Do the projected water budgets account for future population growth and new developments?
  - Do the water budgets account for percolation from water applied to crops?

  Projects and Management Actions

  - Will management actions include a charge for water pumping?
  - Will pumping restrictions be implemented during dry periods or drought?
  - Will the GSPs identify specific projects and management actions?
  - Will GSAs in the subbasin form a water bank?
  - If pumping restrictions are enacted, GSPs should include a provision that allows private well owners to demonstrate that they aren't overpumping or causing undesirable results.
  - The region needs more surface water storage to supplement groundwater pumping.
  - There should be restrictions on development in the region.

  Sustainable Yield

  - Does increases in groundwater demand relate to the cost of surface water supplies?

  Groundwater Monitoring

  - When local agencies monitor for groundwater, how far down do they monitor?

  GSP Adoption, Implementation and Enforcement

  - What agency approves the GSPs?
  - Will the California Department of Water Resources be the lead agency for providing oversight after the GSP is submitted?
  - Could the State Water Resources Control Board mandate pumping restrictions?
  - Will the state be looking at the drawdown of individual, private wells?
  - Where does the funding to implement GSPs come from?
  - How much will GSP implementation cost?
  - Who has to submit the annual report?

  Other

  - GSAs should be divided into even smaller units to manage projects and management actions locally.

Appendix G - Examples of Promotional Materials

Groundwater management in our community is changing.

Learn more about how this may impact you.

Collaborating local agencies are hosting a series of public workshops about the Sustainable Groundwater Management Act. Come learn how this landmark legislation may impact our community, what we are doing about it, and how you can get involved. Representatives from local groundwater sustainability agencies will be available to answer questions. You have three opportunities to attend:

Los Banos
Monday, May 14
4:00 - 6:00 PM
San Luis & Delta-Mendota
Water Authority Office
842 6th St, Los Banos

Patterson
Wednesday, May 16
4:00 - 6:00 PM
Hammon Senior Center
1033 W Las Palmas Ave, Patterson

Mendota
Thursday, May 17
4:00 - 6:00 PM
Mendota Branch Library
Mendota Meeting Room
1246 Belmont Ave, Mendota

The content of each workshop will be the same. The first thirty minutes of each workshop will consist of an informational presentation, followed by an open house until 6:00 PM. For more information, please visit our website at: www.deltamendota.org.

We look forward to seeing you there!

El manejo del agua subterránea en nuestra comunidad está cambiando.

Obtenga más información sobre como esto puede afectarlo.

Las agencias locales colaboradoras están organizando una serie de talleres públicos sobre la Ley de gestión sostenible del agua subterránea. Venga y aprenda como esta histórica legislación puede afectar a nuestra comunidad, que estamos haciendo al respecto y como puede participar. Los representantes de las agencias locales de sostenibilidad del agua subterránea estarán disponibles para responder preguntas. Tienes tres oportunidades para asistir:

Los Baños
Martes, 14 de Mayo
4:00 - 6:00 PM
San Luis & Delta-Mendota
Water Authority Office
842 6th St, Los Baños

Patterson
Miércoles, 16 de Mayo
4:00 - 6:00 PM
Hammon Senior Center
1033 W Las Palmas Ave, Patterson

Mendota
Jueves, 17 de Mayo
4:00 - 6:00 PM
Mendota Branch Library
Mendota Meeting Room
1246 Belmont Ave, Mendota

El contenido de cada taller será el mismo. Los primeros treinta minutos de cada taller serán consisten de una presentación informativa, seguida de una jornada de puertas abiertas hasta las 6:00 P.M. Para obtener más información, visite nuestro sitio web en: www.deltamendota.org.

Public Notice

Public Groundwater Meeting

Santa Nella County Water District and other local water agencies are developing plans for the future of our groundwater resources. We want to hear from you! Come to an upcoming public workshop to learn more:

Santa Nella
Monday, March 4, 6:000 - 8:00 PM
Romero Elementary School MPR
13500 Luis Ave, Gustine, CA 95322

The first forty minutes of the workshop will consist of a bilingual informational presentation. The presentation will be followed by an interactive discussion on the region's groundwater "budget" and how to define "sustainability" for our groundwater resources. This workshop is open to people with all level of knowledge about water.

Spanish-language interpreters and materials will be available.

For more information, please visit our website at www.deltamendota.org and www.sncwd.com.

For questions or comments, email DMSGMA@sldmwa.org or contact Amy Montgomery, Santa Nella County Water District, at amontgomery@sncwd.com.

We look forward to seeing you there!

Engage in the Future of Our Water Resources!

Week of May 20th

Delta-Mendota SGMA invite you to learn why your local agencies are developing groundwater sustainability plans for the future of our groundwater. Please come to one

- **Patterson**: Mon., May 20, 4:00 – 6:00pm Patterson City Hall 1 Plaza Circle
- **Los Banos**: Tue., May 21, 4:00 – 6:00pm College Greens Building 1815 Scripps Drive
- **Santa Nella**: Wed., May 22, 6:30 – 8:30pm Romero Elem. School 13500 Luis Ave.
- **Mendota**: Thu., May 23, 6:00 – 8:00pm Mendota Library 1246 Belmont Ave.

For more information please visit www.deltamendota.org, To register visit: tinyurl.com/y3bxw3yv

PROP 1

#DeltaMendotaSGMA | #SLDMWA | #SGMA2020

DELTA-MENDOTA SGMA

Su Opinión es Importante!

Participe en una serie de talleres sobre el futuro de sus recursos hídricos!

Semana del 20 de mayo

Agencias locales están desarrollando planes de sostenibilidad para el futuro de los recursos hídricos del agua subterránea en la región y necesitan su opinión.

Acompáñenos en uno de los siguientes talleres:

- **Patterson**: Lun.,20 de Mayo , 4–6pm Ayuntamiento de Patterson 1 Plaza Circle
- **Los Banos**: Mar., 21 de May, 4–6pm College Greens Building 1815 Scripps Dr.
- **Santa Nella**: Mie., 22 de Mayo, 6:30–8:30pm Escuela Pri. Romero 13500 Luis Ave.
- **Mendota**: Jue., 23 de Mayo, 6–8pm Biblioteca de Mendota 1246 Belmont Ave.

Para más información visite:
www.deltamendota.org
Tel: 916-418-8288
#DeltaMendotaSGMA | #SLDMWA

PROP 1 WATER BOND 2014

DELTA-MENDOTA SGMA

DELTA-MENDOTA SGMA

Contact: Kirsten Pringle, Delta-Mendota Subbasin, Stantec
(916) 418-8243, Kirsten.Pringle@stantec.com

FOR IMMEDIATE RELEASE
October 19, 2018

MEDIA ADVISORY

Sustainable Groundwater Management Act Public Workshops

What: Collaborating local agencies are hosting a series of public workshops about the Sustainable Groundwater Management Act. Learn how this landmark legislation may impact our communities, the planning process, and how people can get involved. Spanish translation will be provided.

Format: There are three workshop opportunities to attend; the content of each workshop will be the same. The first 45 minutes of each workshop will consist of an informational presentation, followed by an open house.

When:

Firebaugh – Monday, October 22, 2018
5:00 - 7:00 PM
Firebaugh Middle School MPR
1600 16th Street, Firebaugh, CA

Los Banos – Wednesday, October 24, 2018
4:00 – 6:00 PM
College Greens Building
1815 Scripps Drive, Los Banos, CA

Patterson – Thursday, October 25, 2018
4:00 – 6:00 PM
Hammon Senior Center
1033 W. Las Palmas Avenue, Patterson, CA

Who: Representatives from local groundwater sustainability agencies will be available to answer questions.

Additional Resources: The Sustainable Groundwater Management Act, www.deltamendota.org/,

Background: *The Sustainable Groundwater Management Act (SGMA) is a package of three bills (AB 1739, SB 1168, and SB 1319) that provides local agencies with a framework for managing groundwater basins in a sustainable manner. Recognizing that groundwater is most effectively managed at the local level, the SGMA empowers local agencies to achieve sustainability within 20 years.*

Appendix H - List of Stakeholders and Community Organizations Contacted

Stakeholder and Community Organizations Contacted Regarding Coordinated SGMA Workshops

Organization Name	Organization Type
Fresno County Farm Bureau	Agriculture
Merced County Farm Bureau	Agriculture
North Grassland Wildlife Foundation	Agriculture
Patterson Apricot Fiesta	Agriculture
Stanislaus County Farm Bureau	Agriculture
Asociación de Charros La Internacional del Valle de Patterson	Business
Adobe Valley Ranch	Business
Gustine Chamber of Commerce	Business
Los Banos Chamber of Commerce	Business
Patterson-Westley Chamber of Commerce	Business
Santa Nella Chamber of Commerce	Business
American Association of University Women	Civic
Gustine Rotary Club	Civic
International Association of Lions Clubs - Patterson	Civic
League of United Latin American Citizens	Civic
Los Banos Lions Club	Civic
Los Banos Rotary Club	Civic
Mendota Community Corporation	Civic
Newman Lions Club	Civic
Newman Rotary Club	Civic
Newman Women's Club	Civic
Patterson Lions Club	Civic
International Association of Lions Clubs - Mendota	Civic
International Association of the Lions Clubs - Los Banos	Civic
Italian Catholic Federation of CA Inc.	Civic
Kiwanis International	Civic
Rotary International - Los Banos	Civic
Rotary International - Patterson	Civic
Firebaugh Rotary Club Inc.	Community General Public
Casa Mobile Home Park	Community/General Public
Center for Environmental Science Accuracy & Reliability	Community/General Public
Firebaugh Senior Center	Community/General Public
Friends of Green Valley Charter	Community/General Public
Friends of the Public Library	Community/General Public
Habitat for Humanity International	Community/General Public
Los Banos Senior Center	Community/General Public
Mendota Community Center	Community/General Public
Mendota Senior Center	Community/General Public
Merced County Library - Dos Palos	Community/General Public
Merced County Library - Gustine	Community/General Public
Merced County Library - Los Banos	Community/General Public
Merced County Library - Santa Nella	Community/General Public
San Joaquin River Resource Mgmt. Coalition	Community/General Public

Santa Nella RV Park	Community/General Public
Stanislaus County Library - Newman	Community/General Public
Stanislaus County Library - Patterson	Community/General Public
Dos Palos Oro Loma Joint Unified School District	Education
Firebaugh-Las Deltas Unified School District	Education
Gustine Unified School District	Education
Los Banos Unified School District	Education
Mendota Unified School District	Education
Merced College	Education
Creekside Parent Club	Education
Academy West Insurance	Other
Academy West Insurance Firebaugh	Other
Amaral & Associates Realty	Other
American Legion	Other
American Legion Auxiliary Elijah B Hayes	Other
Andrea Brandt State Farm Insurance	Other
Benevolent & Protective Order of Elks	Other
Borelli Real Estate Services	Other
California Garden Clubs Inc.	Other
Century 21 M&M & Assoc - Los Banos	Other
Century 21 M&M & Assoc - Patterson	Other
Coldwell Banker Kaljian & Assoc	Other
Eric Rodriguez - Patterson	Other
Farmers Insurance Antonio Gonzales	Other
First Prioirty of the Central Valley	Other
Greg Nunes Real Estate	Other
Joe G. Gutierez State Farm Insurance	Other
Mendota Land Co	Other
Noah’s Ark Foundation of Tracy Inc.	Other
PMZ Real Estate - Patterson	Other
PMZ Real Estate - Los Banos	Other
Rafael Ruiz - Patterson	Other
Shane P. Donion Ranch Broker	Other
The Boyd Company	Other
Valley West Properties	Other
Adventure Christian Church of Patterson	Religious
Agape Baptist Church	Religious
Bethel Community Church	Religious
Church of Christ of Patterson	Religious
Church of God of Prophecy	Religious
Connections Christian Church	Religious
Evangelical Church of Los Banos	Religious
Family Christian Center	Religious
First Baptist Church	Religious
Full Gospel Businessmen’s Fellowship International	Religious
Harvest Samoan Assembly of God	Religious

Mountain House Foursquare Church	Religious
Movimiento Familiar Cristiano Catolico	Religious
Patterson Covenant Church	Religious
Patterson Christian Fellowship	Religious
Patterson Seventh Day Adventist Church	Religious

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Prepared by:

WOODARD & CURRAN

In association with:

PROVOST & PRITCHARD CONSULTING GROUP

1545 River Park Dr., Suite 425
Sacramento, CA 95815
916.999.8700

Appendix B – Kenneth D Schmidt & Associates - HCM and GW Conditions Report

HYDROGEOLOGIC CONCEPTUAL MODEL AND GROUNDWATER CONDITIONS FOR THE GRASSLAND WATER DISTRICT EXPANDED GSP

prepared for

Grassland Water District

Los Banos, California

by

Kenneth D. Schmidt & Associates

Groundwater Quality Consultants

Fresno, California

December 2018

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Table of Figures

HYDROGEOLOGIC CONCEPTUAL MODEL AND GROUNDWATER CONDITIONS FOR THE GRASSLAND WATER DISTRICT EXPANDED GSP

INTRODUCTION

This report is intended to satisfy Sections 354.14 (Hydrologics Conceptual Model) and Section 354.16 (Groundwater Conditions) of a Groundwater Sustainability Plan (GSP) for the Grassland Water District (GWD), several wildlife refuges within the Grassland Resource Conservation District (GRCD) (together the Grassland Groundwater Sustainability Agency), and some other areas in Merced County within the Merced County Delta-Mendota (MCDM) Groundwater Sustainability Agency.

The GWD is divided into two divisions. The North Division is north of Highway 152 and is generally bounded to the east by the San Luis Drain. Three federal wildlife refuges are located adjacent to the Northern Division and are included in the area evaluated. The South Division is located south of Highway 152 and is located east and north of the Central California Irrigation District (CCID) Main Canal. The other MCDM GSA areas include 1) private wetlands, 2) ag lands, 3) the San Luis National Wildlife Refuge, and 4) state refuges (all outside of the Grassland GSA).

SURFICIAL CHARACTERISTICS OF BASIN

Topography

Figure 1 shows topographic conditions in the basin. The land generally slopes to the northeast towards the San Joaquin River. Major drainages that pass through the area are Los Banos Creek, San Luis Creek, Mud Slough, and Salt Slough. The San Joaquin River bounds the San Luis NWR to the north and Los Banos Creek joins the river north of Highway 140. Land surface elevations range from about 130 to 140 feet above mean sea level along the Main Canal south of the Southern Division to about 70 feet above mean sea level near the Highway 140 crossing of the San Joaquin River at Fremont Ford.

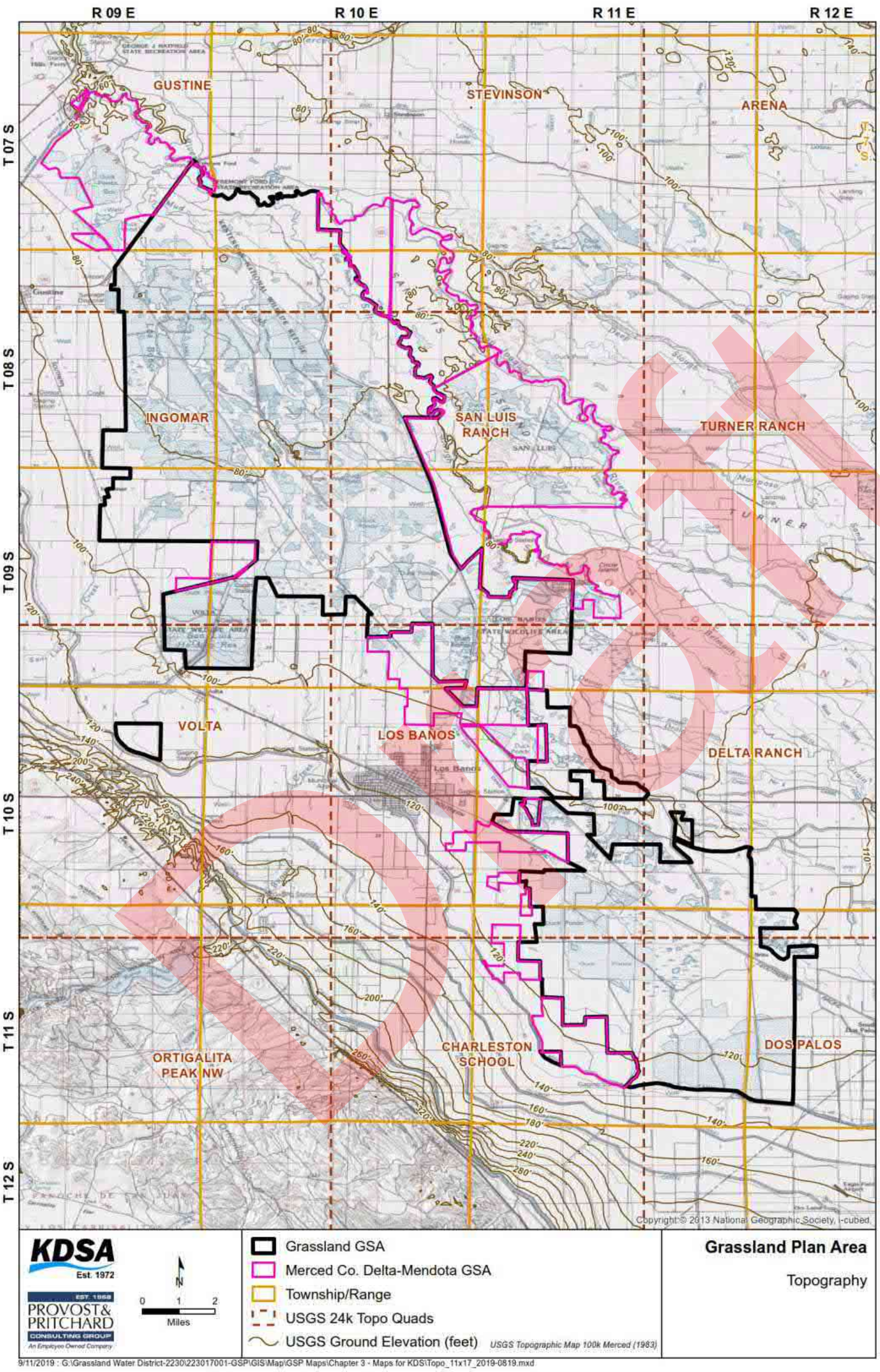

Figure 1 - Topography

Surficial Geology

Hotchkiss and Balding (1971, Plate 1) mapped the surficial geology of the Tracy-Dos Palos Area, which include the area evaluated. Figure 2 shows the part of their map that covers the area evaluated. Except in the southwest edge of the GWD, surficial deposits are mapped as flood basin deposits. These are unconsolidated clay, silt, sand, and gravel deposits on the floodplan of the San Joaquin River. Along the southwest edge of the GWD, alluvial deposits are present, primarily along the San Luis Creek and Los Banos Creek alluvial fans. These are unconsolidated clay, silt, sand, and gravel.

Topsoils

Figure 3 shows the major types of topsoils in the area evaluated, from the U.S. Soils Conservation Service report on soils in the Los Banos area. The soils have been divided into coarse-grained, intermediate textured, and clay and silty clay. Most of the coarse-grained soils are in the north part of the area. In the south part of the area the predominant soils are clay and silty clay, and few coarse-grained soils are present.

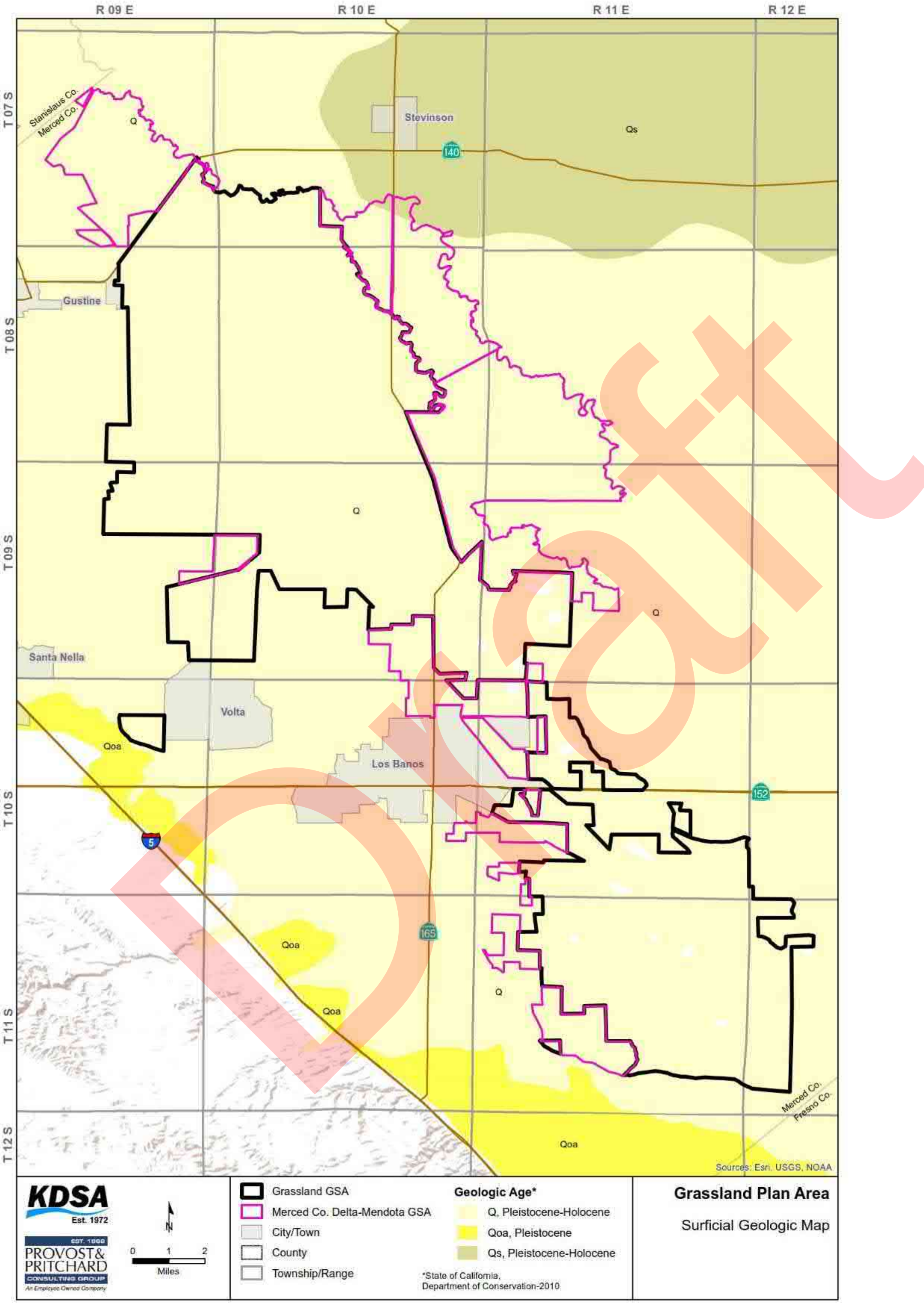

Figure 2 - Surficial Geologic Map

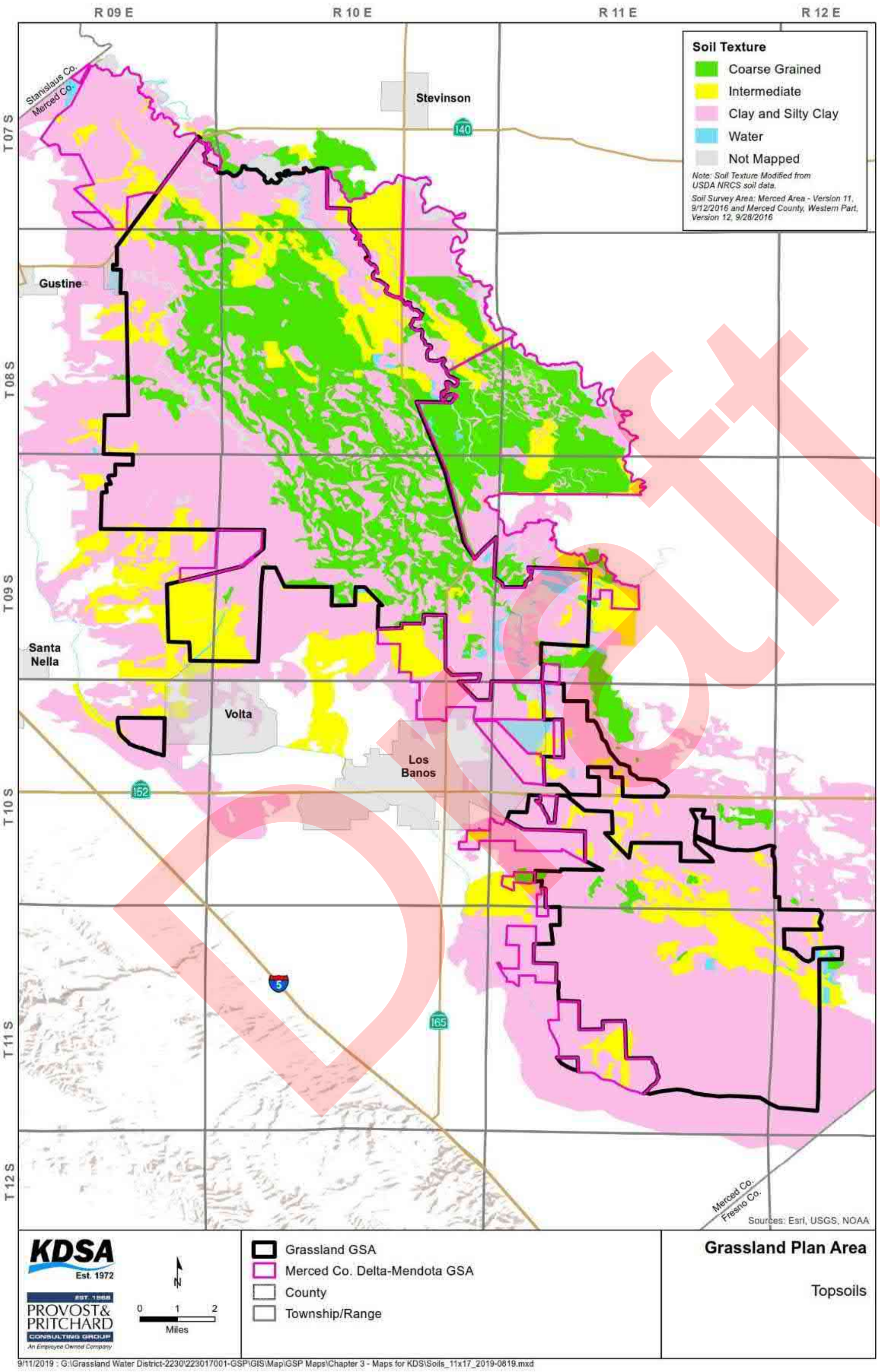

Figure 3 - Topsoils

Surface Water Bodies

Figure 4 shows the location of surface water bodies in the area evaluated. Streams on the west side are San Luis Creek and Los Banos Creek, both of which have been dammed, and Garzas Creek and Ortigalita Creek. Other drainages in the area are Mud Slough and Salt Slough. Los Banos Creek and Mud Slough join the San Joaquin River near or north of the north boundary of the San Luis NWR. Major canals in the area include the Delta-Mendota Canal (DMC) and the CCID's Main and Outside Canals, which are located upslope and to the southwest of the GRCD. Other important canals are the Santa Fe and San Luis Canals. The San Luis Drain was designed to carry subsurface drainage flows, which formerly were discharged to the Kesterson Reservoir, located just east of the north part of the Northern Division.

Lakes and reservoirs are shown as of April 5, 2001, from the California Department of Fish and Game.

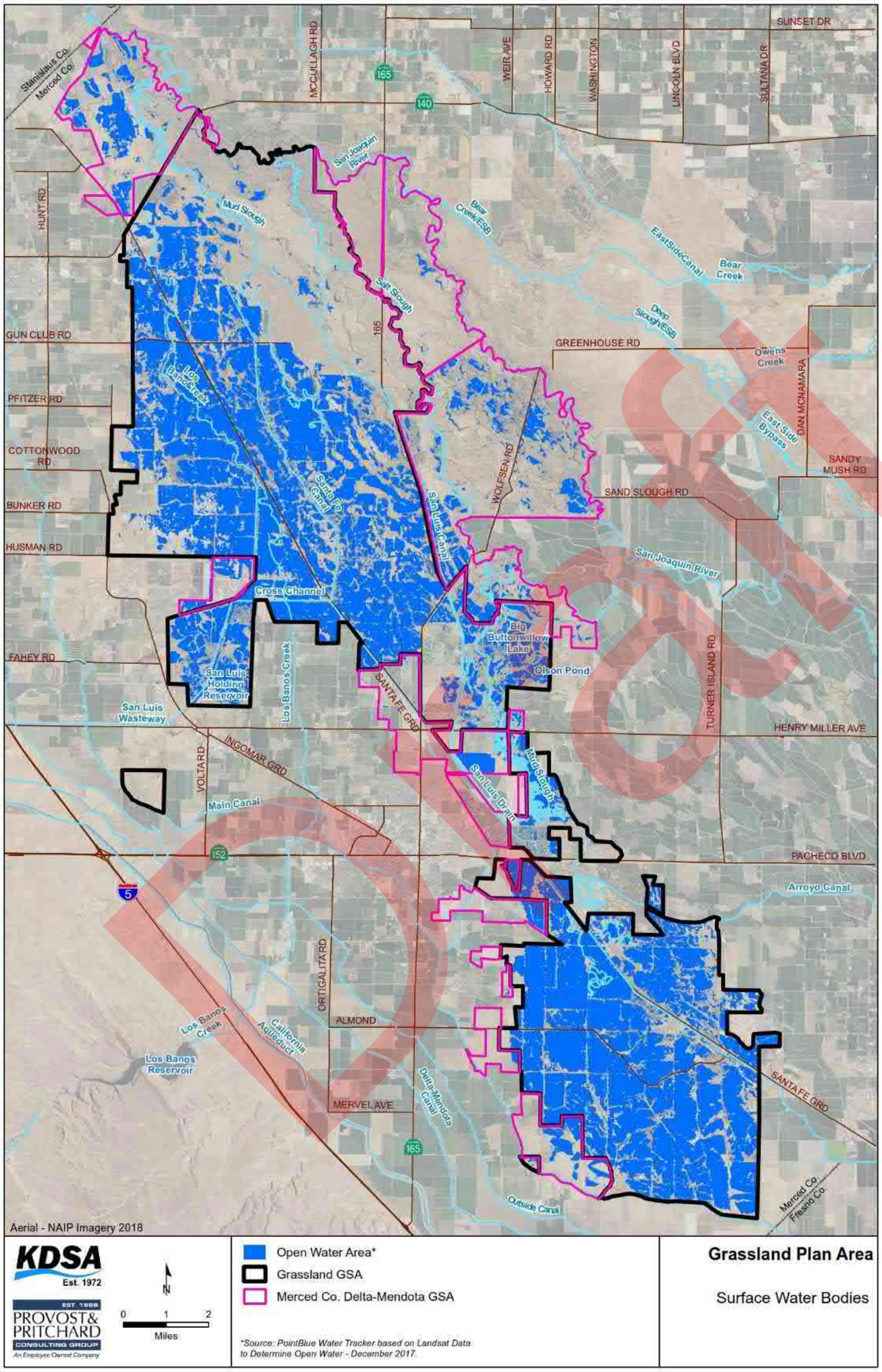

Figure 4 - Surface Water Bodies

SUBSURFACE GEOLOGIC CONDITIONS

Hotchkiss and Balding (1971) described the geology, hydrology, and water quality of the Tracy-Dos Palos Area, which includes the area evaluated. In addition, Kenneth D. Schmidt & Associates (KDSA 1997a) provided a report for the CCID on groundwater conditions in the area between Mendota and Crows Landing. These reports provide significant information on sub-surface geologic conditions that was used in this report.

Regional Geologic and Structural Setting

The area evaluated is within the San Joaquin Valley, which is a topographic and structural trough bounded on the east by the Sierra Nevada fault block and on the west by the folded and faulted Coast Ranges. Both mountain blocks have contributed to marine and continental deposits in the Valley. In the west-central part of the valley, more than 12,000 feet of sediments are present. Groundwater is present in alluvial deposits that dip slightly toward the through of the valley (the San Joaquin River).

Lateral Basin Boundaries

Figure 1 shows the boundaries of the basin. The basin boundaries include the San Joaquin River on the north end, and the CCID Main Canal on the south end. The west boundary of most of the area evaluated is a political boundary with the CCID, whereas the east boundary of the part of the basin north of Highway 152 is the Salt Slough or the San Joaquin River. For the part farther south, the east boundary is the CCID or the San Luis Canal Water Co. All of the basin is in Merced County. A number of national wildlife refuges and State refuges are also included in the area evaluated.

Definable Bottom of the Basin

Figure 5 shows the definable bottom of the basin. Historically, the U.S. Geological Survey (Page, 1973) used an electrical conductivity of about 3,000 micromhos per centimeter at 25°C to delineate the regional base of the fresh groundwater in the San Joaquin Valley. The underlying groundwater is termed "connate water" and is of higher salinity. Page indicated that the base of the fresh groundwater ranged from about 800 to 1,000 feet deep in most of the area evaluated. As part of this evaluation, electric logs for a number of deep holes were obtained from the California Division of Oil & Gas. A review of these logs indicated depths to the base of the fresh groundwater ranging from about 860 to 1,160 feet. For most of the area, the base of the fresh groundwater was less than 1,070 feet deep. When considering depths of the deepest water supply wells in the area (about 800 to 900 feet), this range is reasonable. Deeper deposits are either primarily clay and/or contain brackish groundwater.

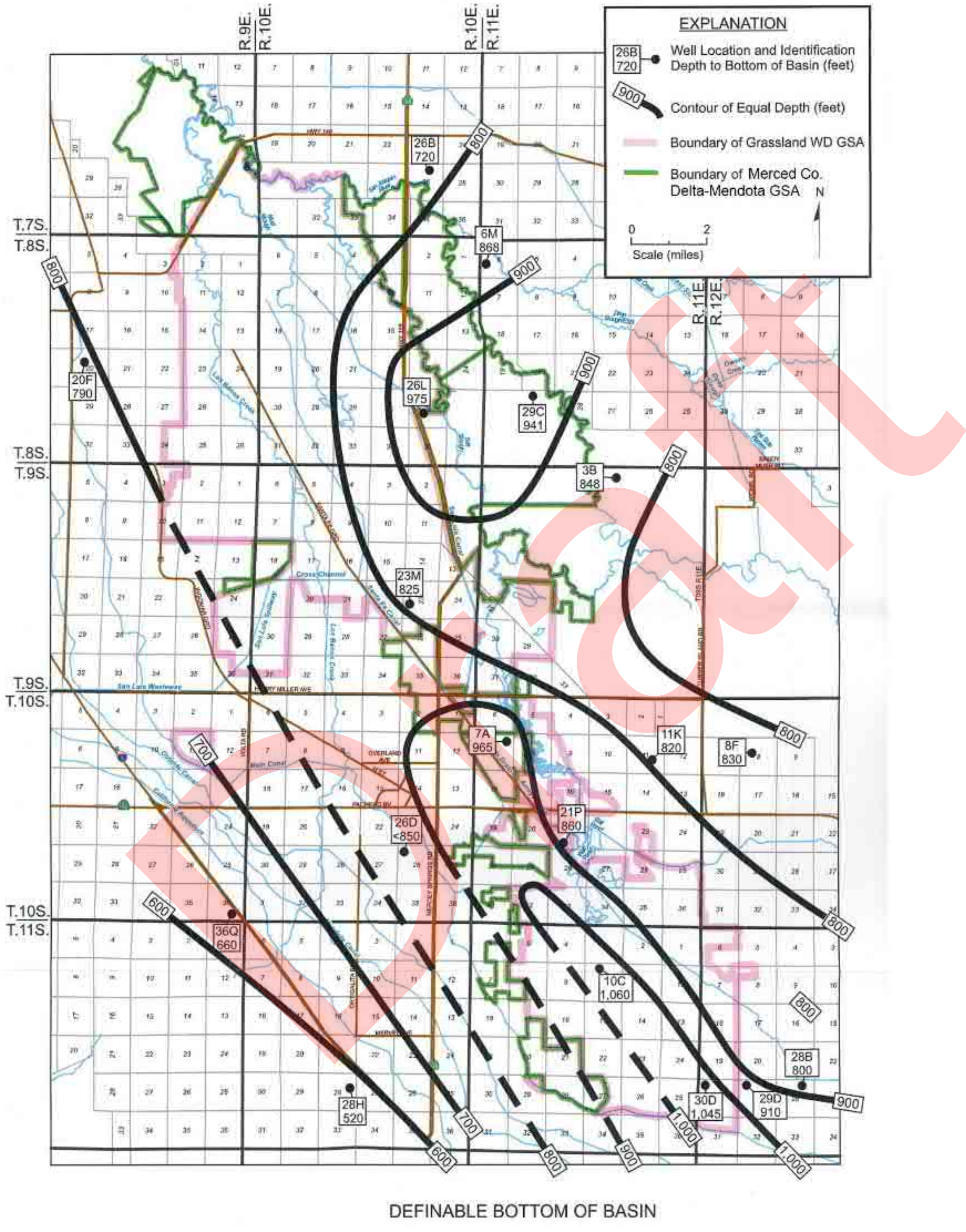

Figure 5 - Definable Bottom of Basin

Formation Names

Hutchkiss and Balding (1971) divided the unconsolidated de-posits in the Tracy-Dos Palos area into flood basin deposits (normally less than 50 feet thick), Quaternary alluvium (usually less than 200 feet thick), and the Tulare Formation (up to almost 1,000 feet thick). The Tulare Formation has an upper, thinner section which is above the Corcoran Clay, and a thicker, lower section below the clay. The Corcoran Clay is a regional confining bed, which divides the groundwater into an upper aquifer and lower aquifer. Deposits in the west part of the area evaluated are generally tan in color and are termed the Diablo Range deposits. Deposits to the east are brown, gray, or white in color and are termed the Sierra deposits. These deposits are shown on a number of subsurface geologic cross sections that are presented later in this report.

Confining Beds

The Corcoran Clay is indicated to be the most important confining bed in the area evaluated. Figure 6 shows the depth to the top of the Corcoran Clay, which was mapped for this evaluation, primarily based on electric logs and geologic logs for test holes and wells. The depth to the top of this clay is generally the greatest in the south central part of the area evaluated. The shallowest depth (about 200 feet) is along the west and east edges of the area evaluated. The shallowest depth along the east edge is about 185 feet. North of Highway 152, the depths to the top of the Corcoran Clay in the central part of the area range from about 250 to 300 feet. South of Highway 152, the depths to the top of the clay range from about 200 to 350 feet. The depths to the top of the Corcoran Clay essentially define the base of the upper aquifer.

The thickness of the Corcoran Clay also tends to be less towards the west and east edges of the area evaluated (Figure 7). For the area north of Highway 152, the thinnest part (less than 40 feet thick) is beneath the northeast part. The Corcoran Clay ranges from about 35 to 50 feet thick along the east edge of the area evaluated, and from about 65 to 120 feet along the west edge. In the area south of Highway 152, the thinnest clay (about 80 feet thick) is along the east edge of the area evaluated, and along the west edge south of Almond Drive Ditch. The thickest area (greater than 120 feet) is west of South Dos Palos.

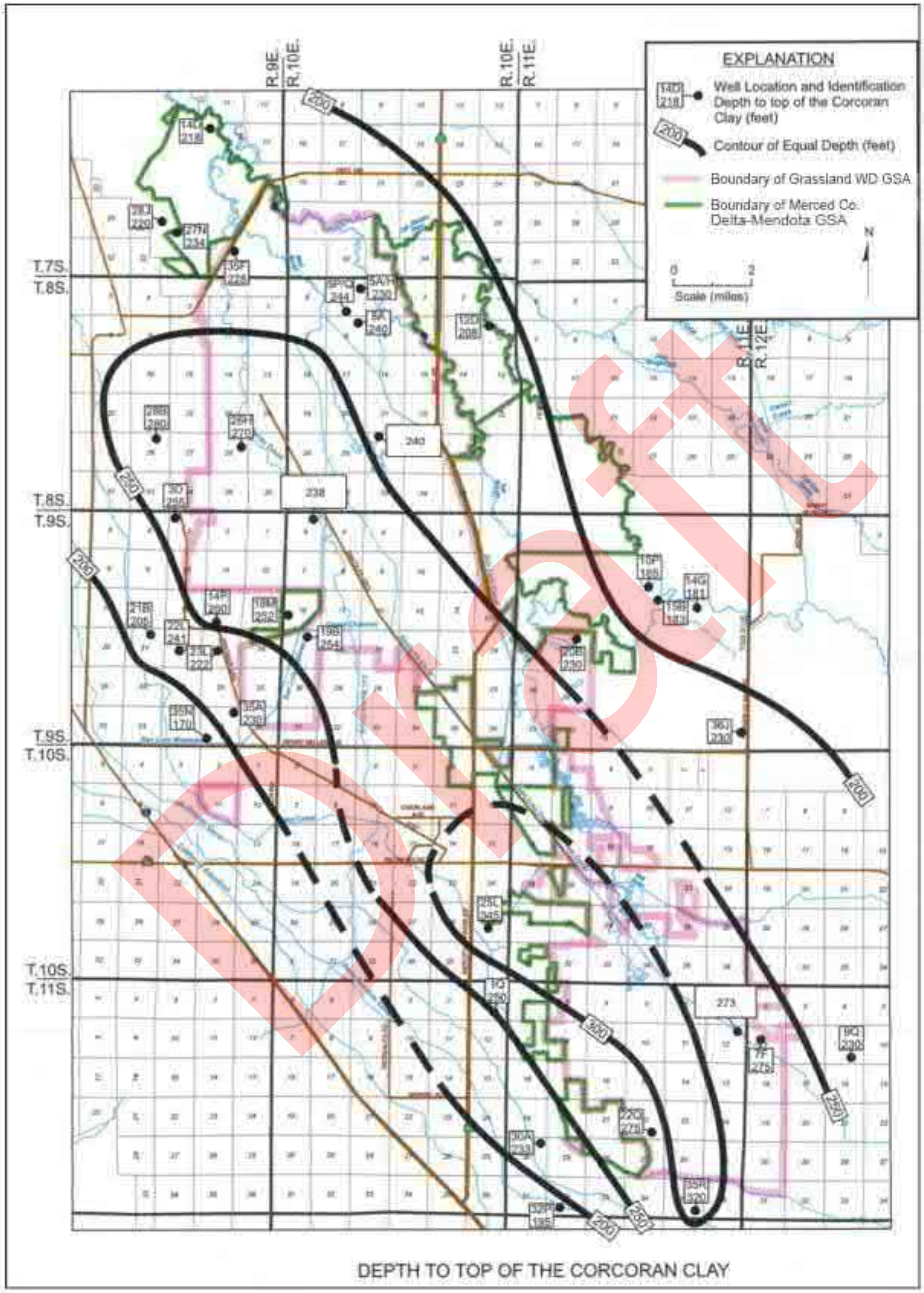

Figure 6 - Depth to Top of the Corcoran Clay

The shallowest depth (about 200 feet) is along the west and east edges of the area evaluated. The shallowest depth along the east edge is about 185 feet. North of Highway 152, the depths to the top of the Corcoran Clay in the central part of the area range from about 250 to 300 feet. South of Highway 152, the depths to the top of the clay range from about 200 to 350 feet. The depths to the top of the Corcoran Clay essentially define the base of the upper aquifer.

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Principal Aquifers

Based on subsurface geologic cross sections (presented in the next section) and water well drillers logs and completion reports, the upper aquifer is the principal aquifer in most of the area adjoining the GWD (i.e. in the CCID and San Luis Canal Co. service areas). However, in the Panoche WD, the lower aquifer is the principal aquifer. In the GWD, both the upper and lower aquifers are tapped by water supply wells. Most pumping occurs from the upper aquifer, which is considered the principal aquifer.

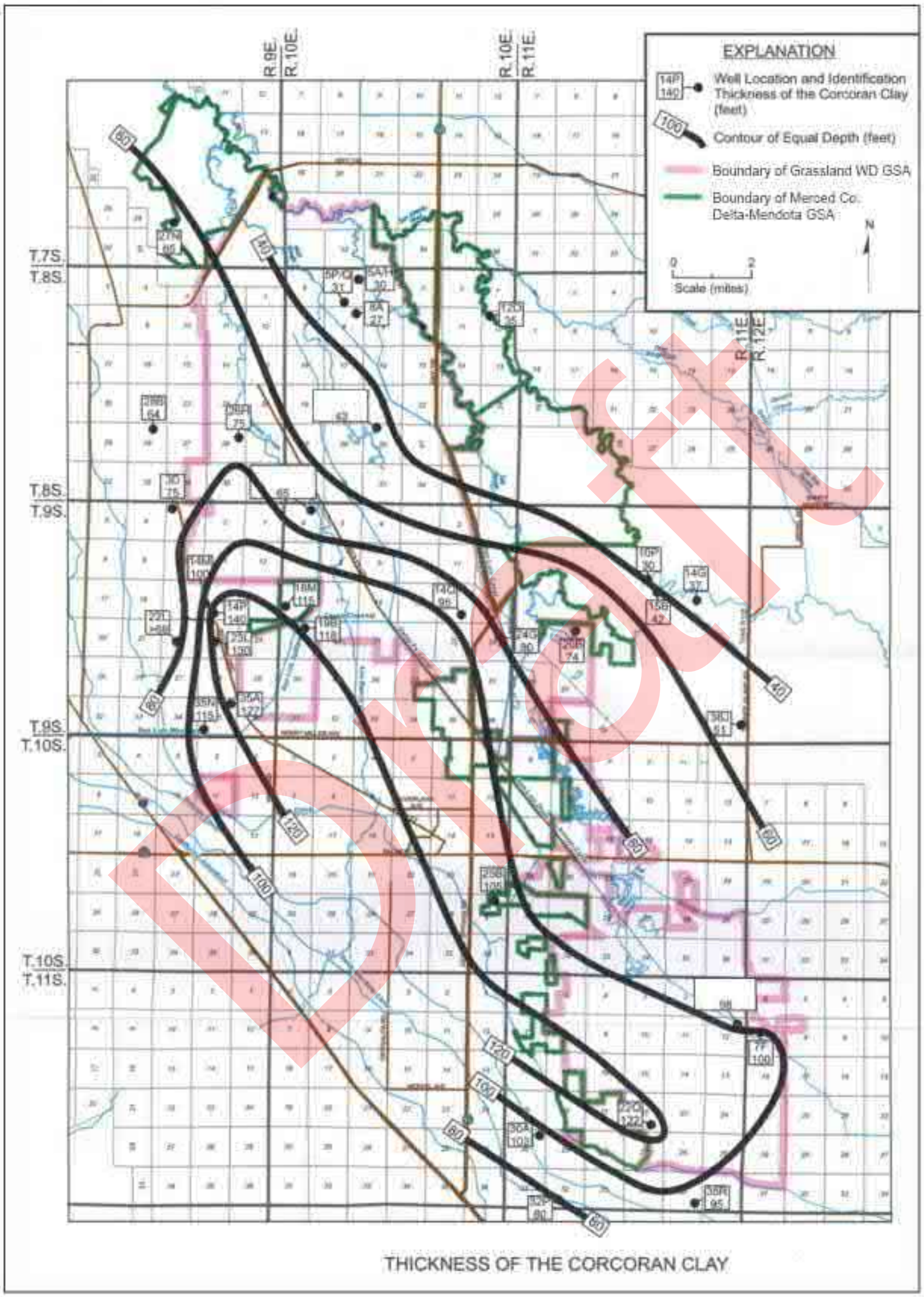


Figure 7 - Thickness of the Corcoran Clay

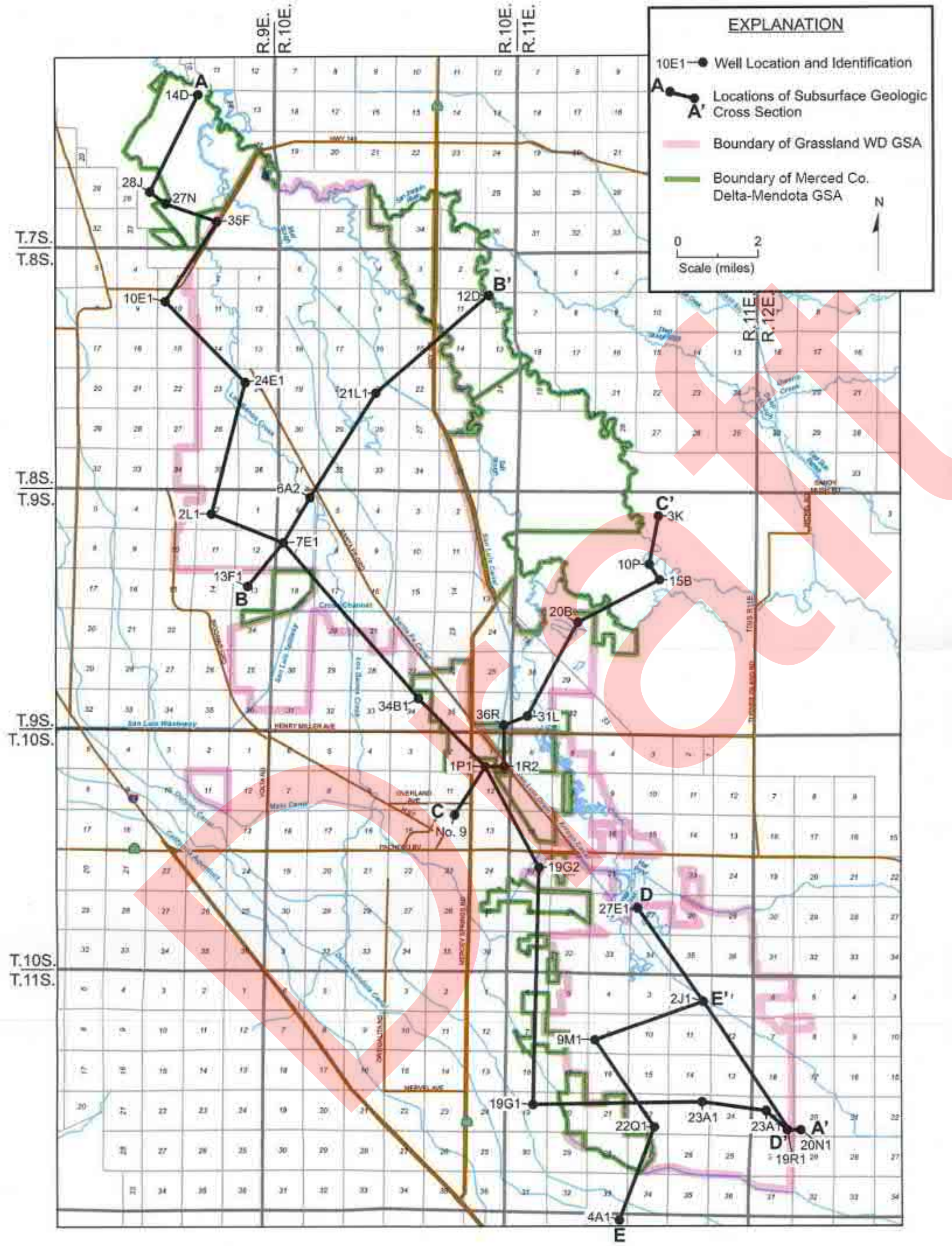
Subsurface Geologic Cross Sections

The subsurface geologic cross sections presented in this report were either ones modified by KDSA from Hotchkiss and Balding (1971) or prepared by KDSA for the CCID and City of Los Banos (KDSA, 1997 and 2013). Locations of the cross sections are provided on Figure 8.

Northern Area

For the area north of Highway 152, three subsurface cross sections are provided. Cross Section A-A' extends from north of Highway 140 on the north end to the south and southeast, to near the Merced County-Fresno County line (Figure 9). This section is generally near the west edge of the area evaluated. The base of the unconsolidated deposits (base of the aquifer) ranges from about 800 to 1,000 feet along this section and Diablo Range deposits are predominant. The Corcoran Clay is at an average elevation of about 200 feet below sea level along the section.

Along the west edge of the Northern Division north of Husman Road, Diablo Range deposits are predominant above the Corcoran Clay, whereas farther south, Sierra deposits are predominant along this section. Below the Corcoran Clay, Sierra deposits are only predominant above a depth of about 600 feet in the area north of Husman Road. Otherwise, Diablo Range deposits are predominant.



LOCATION OF SUBSURFACE GEOLOGIC CROSS SECTIONS

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Figure 8 - Location of Subsurface Geologic Cross Sections

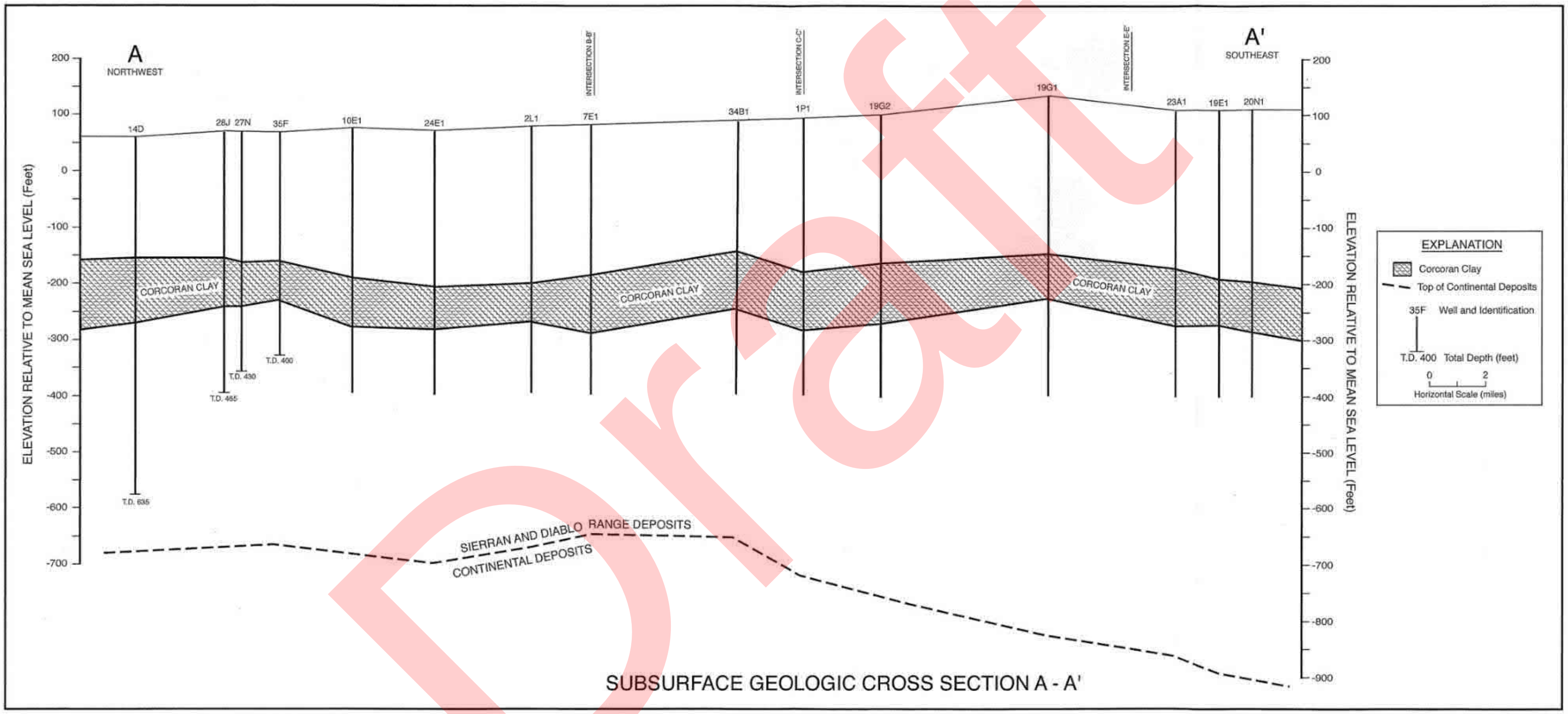


Figure 9 - Subsurface Geologic Cross Section A - A'

Cross Section B-B' (Figure 10) extends from near Husman Road and about half a mile east of the boundary between R9E and R10E, to the northeast to near the San Joaquin River. The former Kesterson Reservoir is located near the northeast edge of the section. This cross section illustrates well the predominance of the Sierra deposits, both above and below the Corcoran Clay in most of the area with the Northern Division and the adjacent San Luis WWR. The Diablo Range deposits are only significant above the Corcoran Clay beneath the west part of the Northern Division along this section, and within the lower 100 to 200 feet of unconsolidated deposits beneath the Sierra deposits.

Cross Section C-C' (Figure 11) was modified from Cross Section A-A' from KDSA. The part of this section northeast of City of Los Banos Well No. 8 was used, and the section was extended to the northeast, past the San Joaquin River. The Corcoran Clay is shallower to the northeast along this section and sand strata above the Corcoran Clay are more extensive to the southwest. Sand strata are common above and below the clay along the southwest and northeast parts of the section.

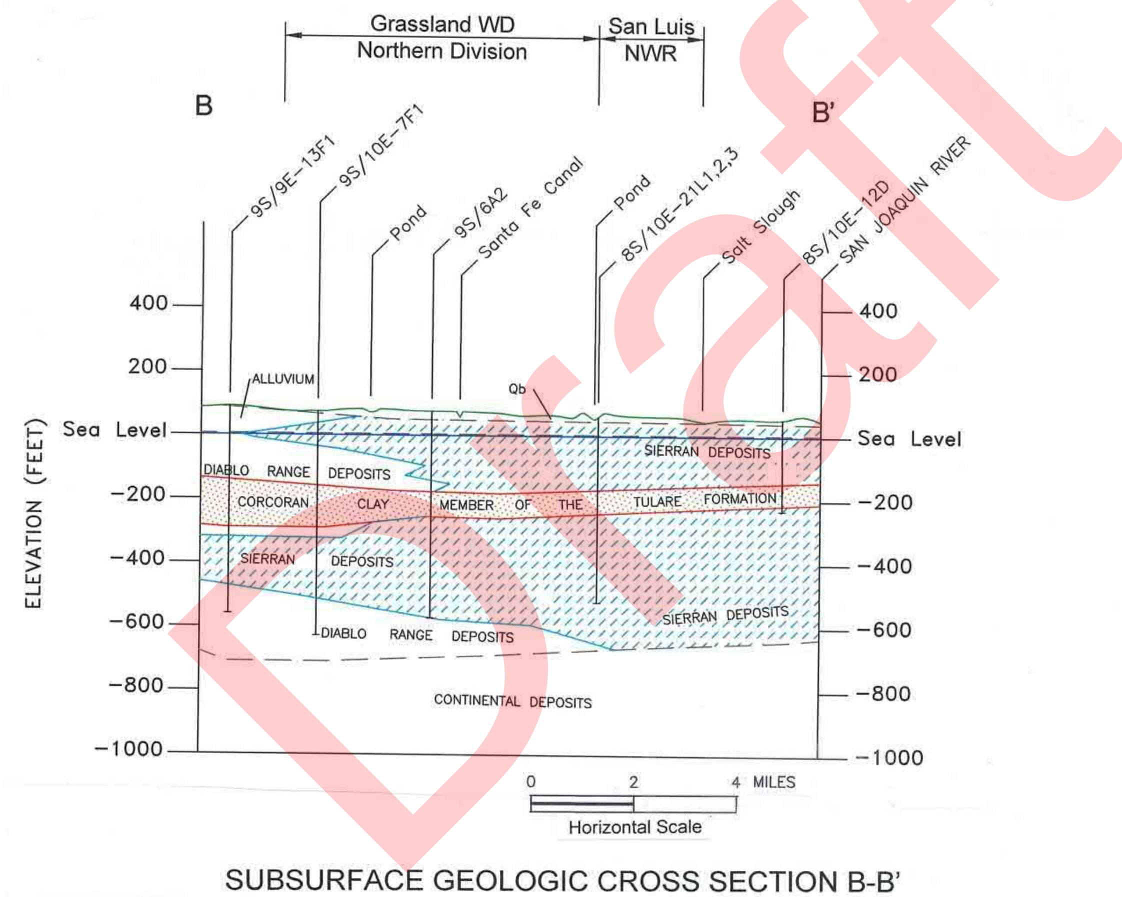


Figure 10 - Subsurface Geologic Cross Section B - B'

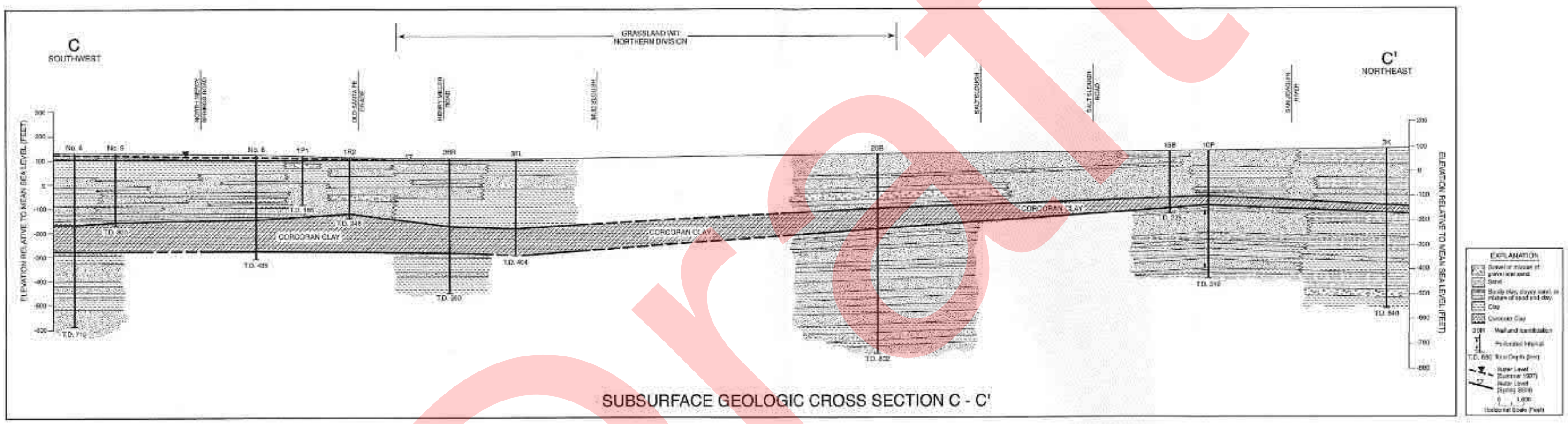
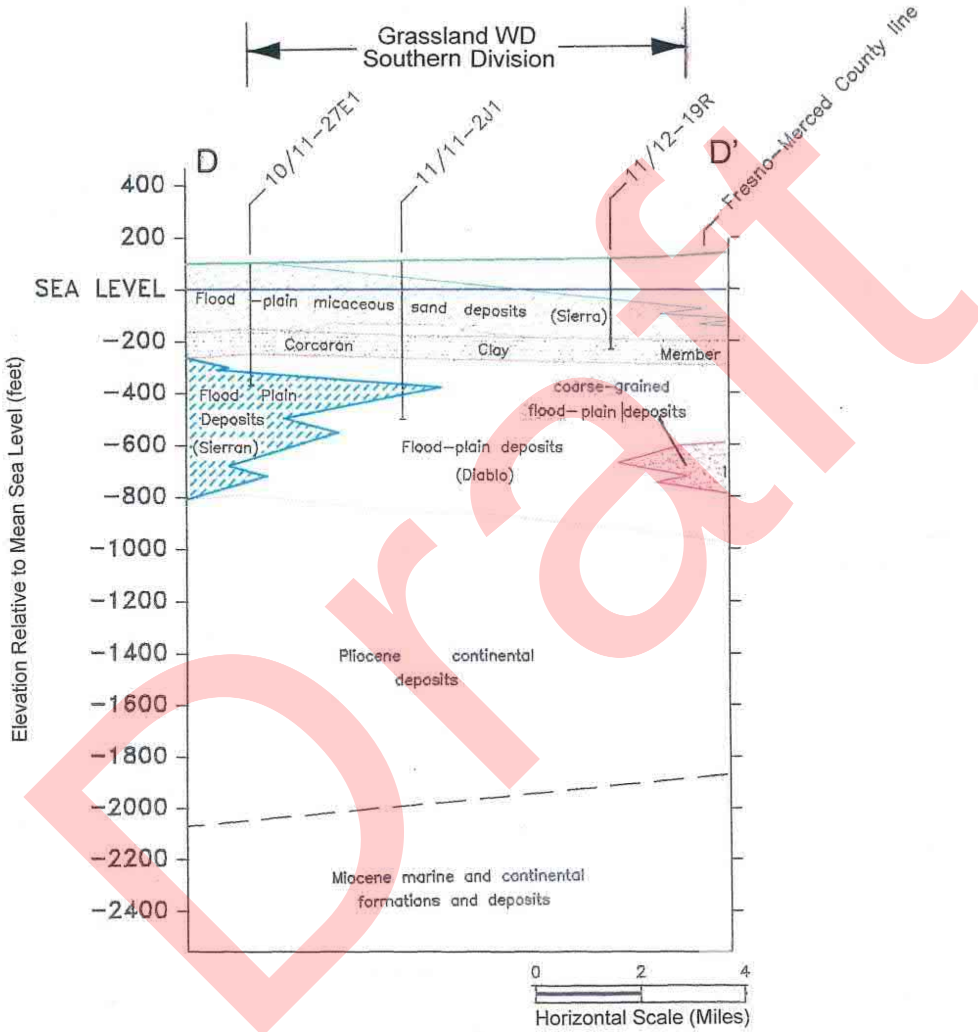


Figure 11 - Subsurface Geologic Cross Section C - C'

Southern Area

Cross Section D-D' (Figure 12) was modified from Meade (198). This section extends from southeast of Los Banos to the south to near Eagle Field. The top of the consolidated deposits deepens to the south along the section, and ranges from about 900 to 1,000 feet deep beneath the Southern Division. The Corcoran Clay averages about 200 feet deep along the part of the section in the Southern Division. Deposits above the Corcoran clay are primarily Sierra floodplain deposits. Deposits below the clay along the north part of this section in the Southern Division are primarily Sierra floodplain deposits, whereas beneath the south part, Diablo floodplain deposits are predominant.

Subsurface Geologic Cross Section E-E' (Figure 13) modified from Hotchkiss and Balding (1971), extends from the northeast near Copa De Oro Avenue and Brito Road to the southwest near Delta Road and the boundary of T11S and T12S, between the Outside Canal and the DMC. The Corcoran Clay dips to the northeast along the southwest part of the section, and to the southwest along the northeast part. Sierra deposits are predominant above the Corcoran Clay, whereas Diablo Range deposits are predominant below the Corcoran Clay along this section. A thin wedge of Sierra deposits is present at a depth of about 600 feet along the east part of the Southern Division along this section.



SUBSURFACE GEOLOGIC CROSS SECTION D-D'

Figure 12 - Subsurface Geologic Cross Section D - D'

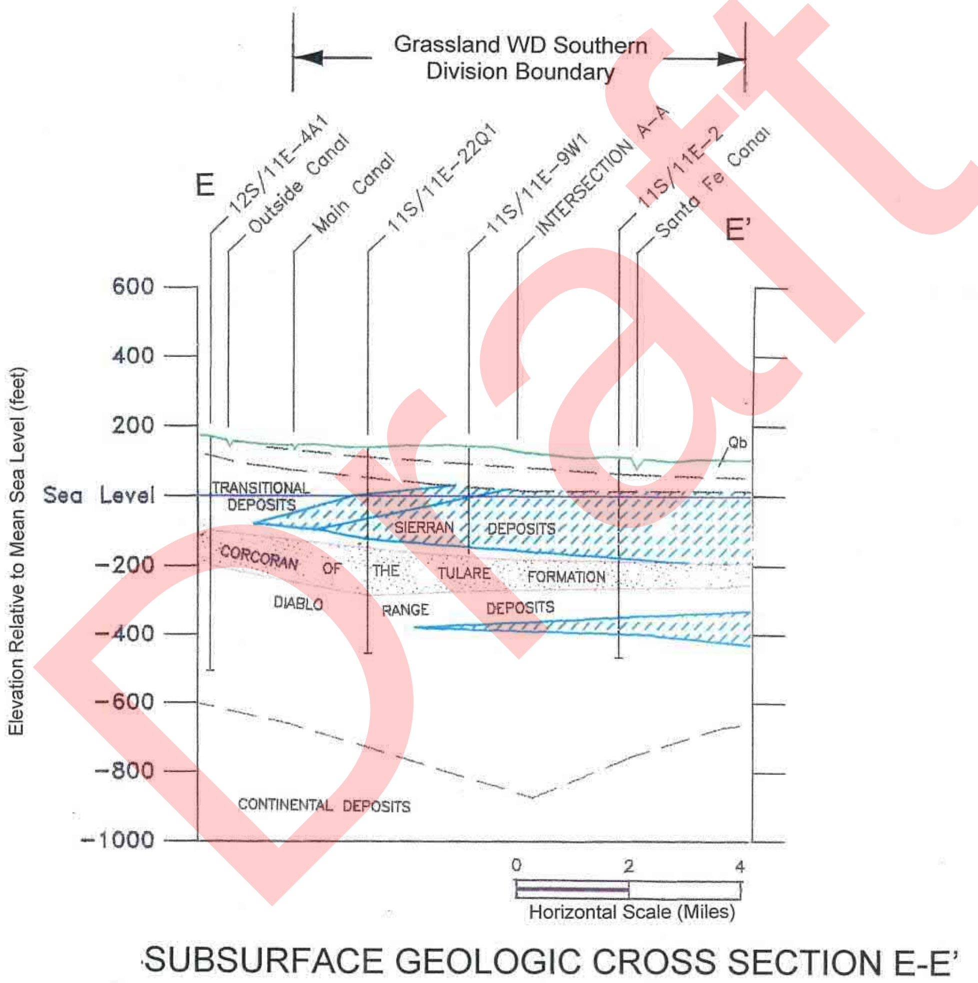


Figure 13 - Subsurface Geologic Cross Section E - E

GROUNDWATER USE AND WELL DATA

Primary Uses of Each Aquifer

The GWD provided drillers logs and electric logs for test holes and water supply wells in and near the GWD. Logs for the federal wildlife refuges, state refuges, and other areas were obtained from the DWR. Most upper aquifer wells generally extend to near the top of the Corcoran Clay, and thus range from about 200 to 300 feet deep. The deepest water supply wells with records in the north part of the area are from about 780 to 870 feet deep. The deepest water supply wells with records in the south part of the area are about 600 to 700 feet deep. Most water supply wells either tap the upper aquifer or lower aquifer, and this has often been based on groundwater quality considerations. The most important chemical constituents in terms of the GWD and the wildlife refuges are total dissolved solids (TDS), selenium, and boron (discussed later in this report). For public supply uses, such as in the City of Los Banos, hexavalent chromium, manganese, TDS, and sulfate are additional constituents of concern.

WATER LEVELS

Water-level records are available from three primary sources in the area evaluated. Included are records from DWR, GWD, and the San Joaquin River Exchange Contractors (SJREC) Water Authority.

Depth to Water

In Spring 2018, the GWD installed shallow monitor wells at ten sites to allow monitoring of shallow water levels. In early March 2018, the depth to water in these wells ranged from about one to five feet. Except for two of these wells, depth to water was 2.5 feet or less. In August-September 2018, depth to water in these wells ranged from 4.2 to 9 feet. Except for two wells, depth to water ranged from about 5.0 to 7.0 feet. These measurements indicate that the groundwater is shallow enough, particularly in the spring and early summer, to be directly evaporated.

The GWD provided a report on February 1, 2016 entitled "Incremental Level 4 Groundwater Development Project Initial Study and Negative Declaration". This project allows the District to acquire up to 29,000 acre-feet per year of privately held groundwater supplies and/or exchange a portion of its surface water for such groundwater supplies. Data for 21 wells was provided in that report, and most of these are along the Santa Fe Canal and tap the upper aquifer. Records for this project indicate that static water levels in most upper aquifer wells were from about 10 to 20 feet deep during 2012-14. On the other hand, static water levels in two lower aquifer wells ranged from about 80 to 100 feet deep.

In Fall 2015, nested monitor wells were installed at three sites in the GWD (Figure 6). Two wells are located in the North Division near the San Luis Drain and Taglio Road and the Santa Fe Canal and Cottonwood Road, respectively. One well is located in the South Division, near Santa Fe Grade and north of Charleston Avenue. The static water level in the one upper aquifer monitor well was 16 feet deep in Fall 2015. The static water levels in two upper aquifer wells at the southern site were about 26 feet deep at that time. The static level in three lower aquifer wells at one of the northern sites ranged from about 50 to 100 feet deep in Fall 2015. The static water levels in four lower aquifer wells at another northern site ranged from about 80 to 90 feet deep at that time.

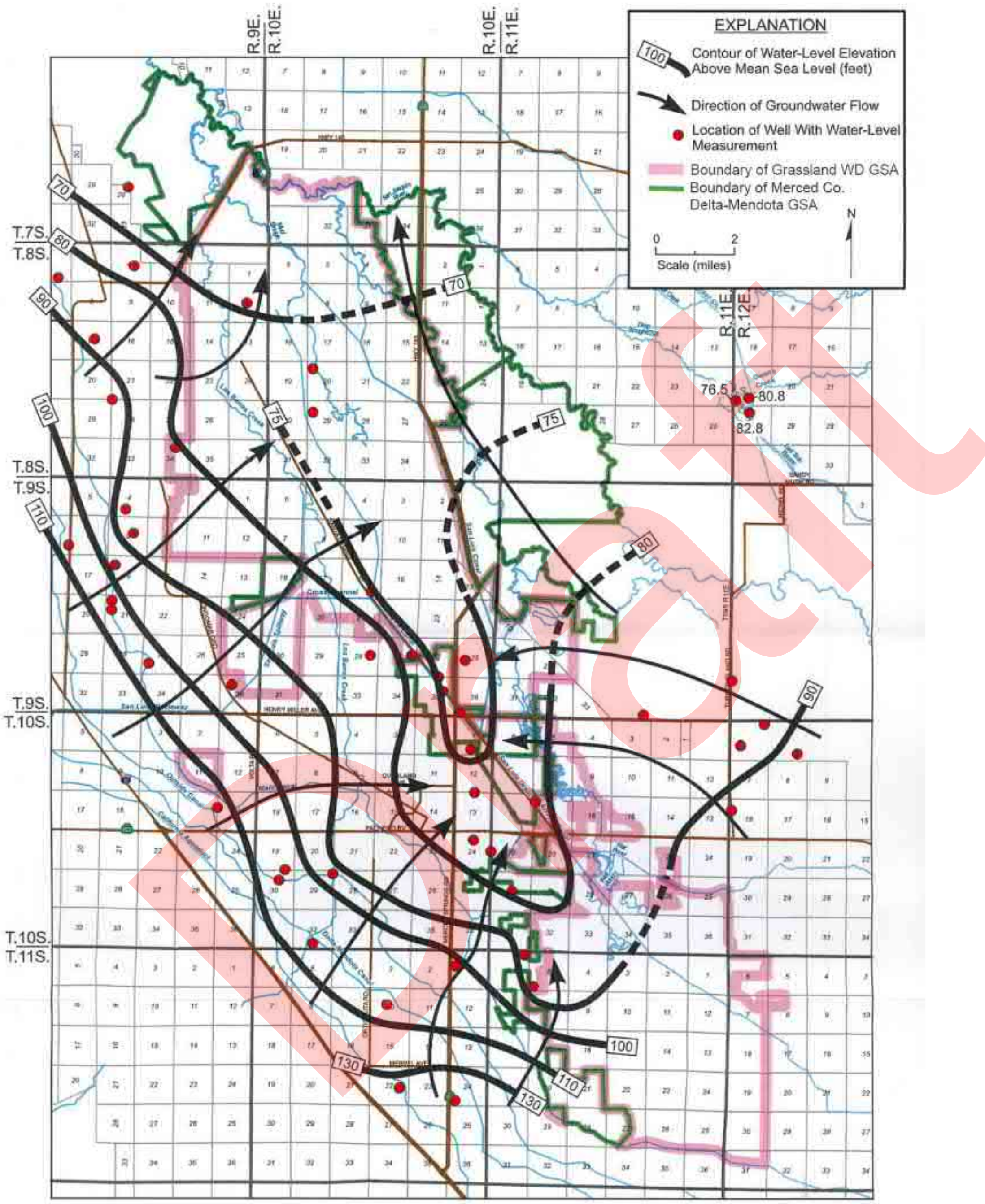
Water-Level Elevations and Direction of Groundwater Flow

Water-level elevation and direction of groundwater flow maps for both the upper aquifer and lower aquifer have been prepared by KDSA for the SJREC service areas, and these maps extend into part of the area evaluated. These maps were prepared to show both normal (Fall 1981) and drought conditions (Spring 1992).

Upper Aquifer

For the north part of the area, water-level elevations in Fall 1981 ranged from about 60 to 90 feet above near sea level and indicated a north to north-northeasterly direction of groundwater flow. Groundwater was moving from west of the North Division in the CCID, through the Northern Division, toward the San Joaquin River. The water-level elevations and direction of groundwater flow in Spring 1992 were essentially the same, indicating little variation in groundwater flow direction with climatic conditions. For the south part of the area, water-level elevations in Fall 1981 ranged from about 90 to 120 feet above mean sea level. The direction of groundwater flow was primarily to the north or northwest. The groundwater in the upper aquifer was flowing toward the Northern Division. Groundwater inflow was coming from the CCID, Pacheco WD, and Panoche WD. The water-level elevations and directions of groundwater flow in Spring 1992 were essentially the same, also indicating little variation with climatic conditions.

Figure 14 shows water-level elevations and the direction of groundwater flow for the upper aquifer for Spring 2015. Essentially, the same water-level elevations and direction of ground-water flow were present beneath the area north of Highway 152 and south of Highway 152 as in Fall 1981. Water-level elevations exceeded 130 feet above mean sea level near the south boundary of the area evaluated (Merced Avenue) and were less than 70 feet near the north boundary. A cone of depression was located east and north east of Los Banos. Groundwater in the south division of the GWD was primary moving to the north towards this depression. In the Northern Division and south of the Cross Channel, groundwater was also moving toward the northwest of these wells. North of Henry Miller road in the east part of the area evaluated, there was a groundwater divide. Northeast of this divide, groundwater moved towards the San Joaquin River.



WATER-LEVEL ELEVATIONS AND DIRECTION OF GROUNDWATER FLOW IN THE UPPER AQUIFER (SPRING 2015)

30

Figure 14 - Water-Level Elevations and Direction of Groundwater Flow in the Upper Aquifer (Spring 2015)

Lower Aquifer

For the Northern Division, water-level elevations ranged from less than 40 feet above mean sea level to about 60 feet in Fall 1981. There was a depression cone indicated beneath the Northern Division. Groundwater inflow was coming from the CCID on the west and northwest, the CCID and GWD Southern Division to the south, and the San Luis Canal Company, Turner Island W.D., and an undistricted area to the northeast.

For the Southern Division, water-level elevations in Fall 1981 ranged from about 60 feet above mean sea level east of Los Banos to 30 feet near the south end of the GWD. Groundwater was flowing into the Southern Division from the northeast and north-northeast, primarily from the San Luis Canal Company and CCID. Groundwater out-flow was to the south and southwest toward the Pacheco W.D. and Panoche W.D. Water-level elevations in Spring 1992 ranged from about 65 feet above mean sea level east of Los Banos to about 10 feet near the south end of the Southern division. The lower water levels to the south compared to Fall 1981 were likely due to greater lower aquifer pumpage in the Panoche W.D. and nearby areas during the drought.

Figure 15 shows water elevations and the direction of groundwater flow for the lower aquifer in Spring 2015. There was a groundwater divide near Henry Miller Avenue. North of the divide, groundwater flowed into a depression beneath the north part of the area. South of the divide, groundwater flowed to the south into the Panoche W.D. and Westlands W.D. In the north part of the area, water levels in the lower aquifer were about 60 to 90 feet deeper than in the upper aquifer. In the south part of the area, water levels in the lower aquifer were about 50 to 110 feet deeper than in the upper aquifer.

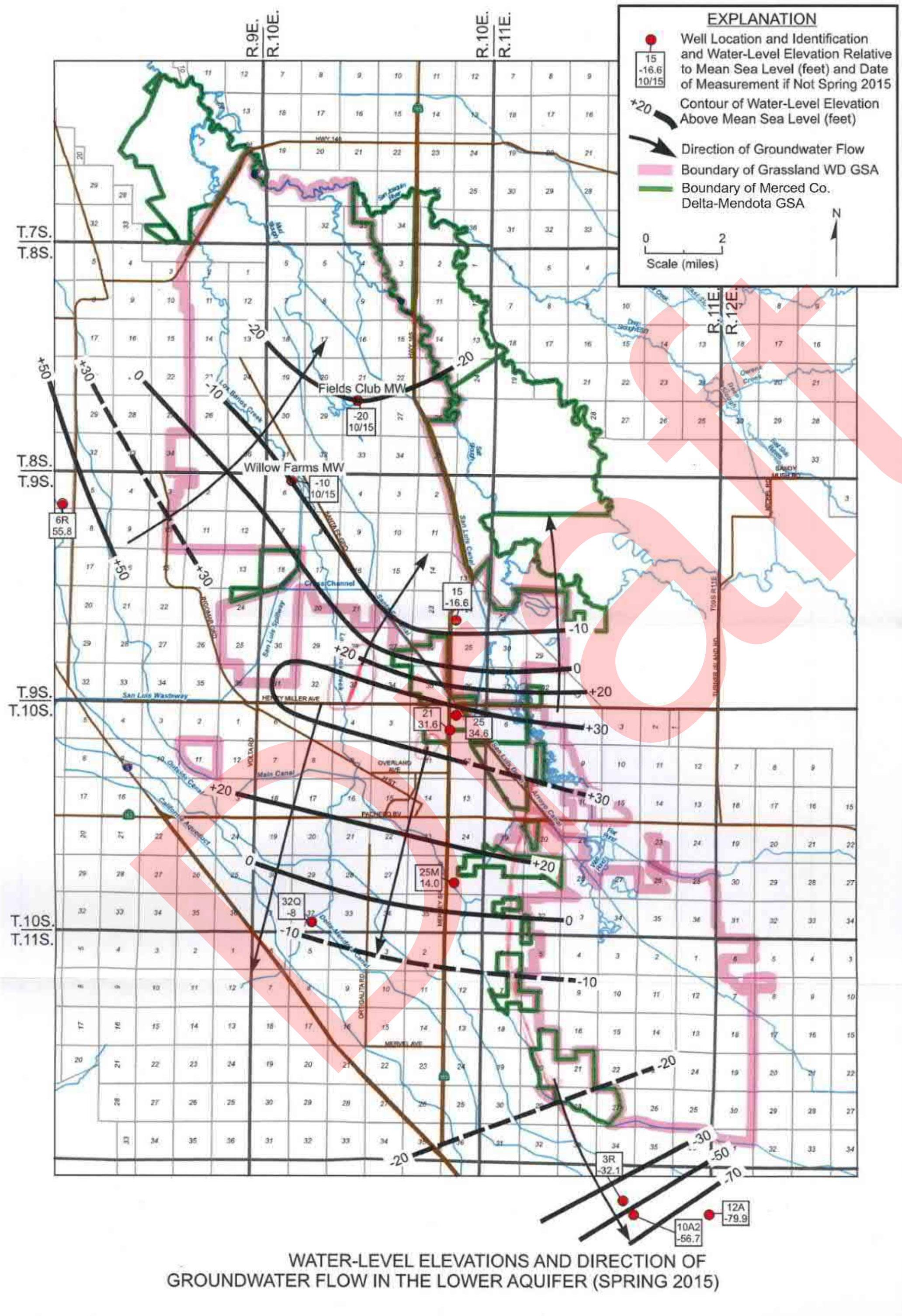


Figure 15 - Water-Level Elevations and Direction of Groundwater Flow in the Lower Aquifer (Spring 2015)

Water-Level Fluctuations

Water-level measurements and hydrographs for wells in and near the GRCD were obtained from DWR websites and from the CCID. In addition, the GWD provided water-level data for a number of wells for 2012-2014.

Upper Aquifer

Long-term water-level records are available for seven upper aquifer wells within or near the Northern Division:

T8S/R9E-10E1, 13E1, and 34G1

T8S/R10E-17N2 and 30E1

T9S/R9E-3C1 and 36P1

Water levels in five of these wells have risen over the long-term, extending back to the 1960s or 1970's. Water levels in two of these wells were relatively stable. Figure 16 shows representative water-level hydrographs for CASGEM wells in the Northern Division. Water levels in the wells have temporarily fallen during drought periods, such as the early 1990s, and then have recovered.

Long-term water-level records are available for 13 upper aquifer wells in or near the Southern Division:

T1OS/R10E-1M1

TlOS/R11E-17E1, 32N1, and 36A1

T11S/R11E-4N1, 6B1, 12P1, 12P3, 17E1, and 17E2

T11S/R12E-8C1, 30H1, and 30H2.

Figure 17 shows representative water-level hydrographs for two CASGEM wells in or near the Southern Division. Water levels in these wells have either risen or been relatively stable during the past several decades.

Static water levels in a number of upper aquifer wells in the GWD were measured prior to pumping and about a day after pumping for the wetlands stopped during 2012-2014. Water-level differences between the pre-pumping and after pumping were generally only several feet. In a number of cases, the post pumping water levels were shallower than those prior to pumping. The upper aquifer water-level fluctuations are indicative of an unconfined aquifer. They clearly indicate that there has been no groundwater overdraft in the GWD. This is consistent with conditions in the surrounding parts of the CCID and San Luis Canal Co. service areas.

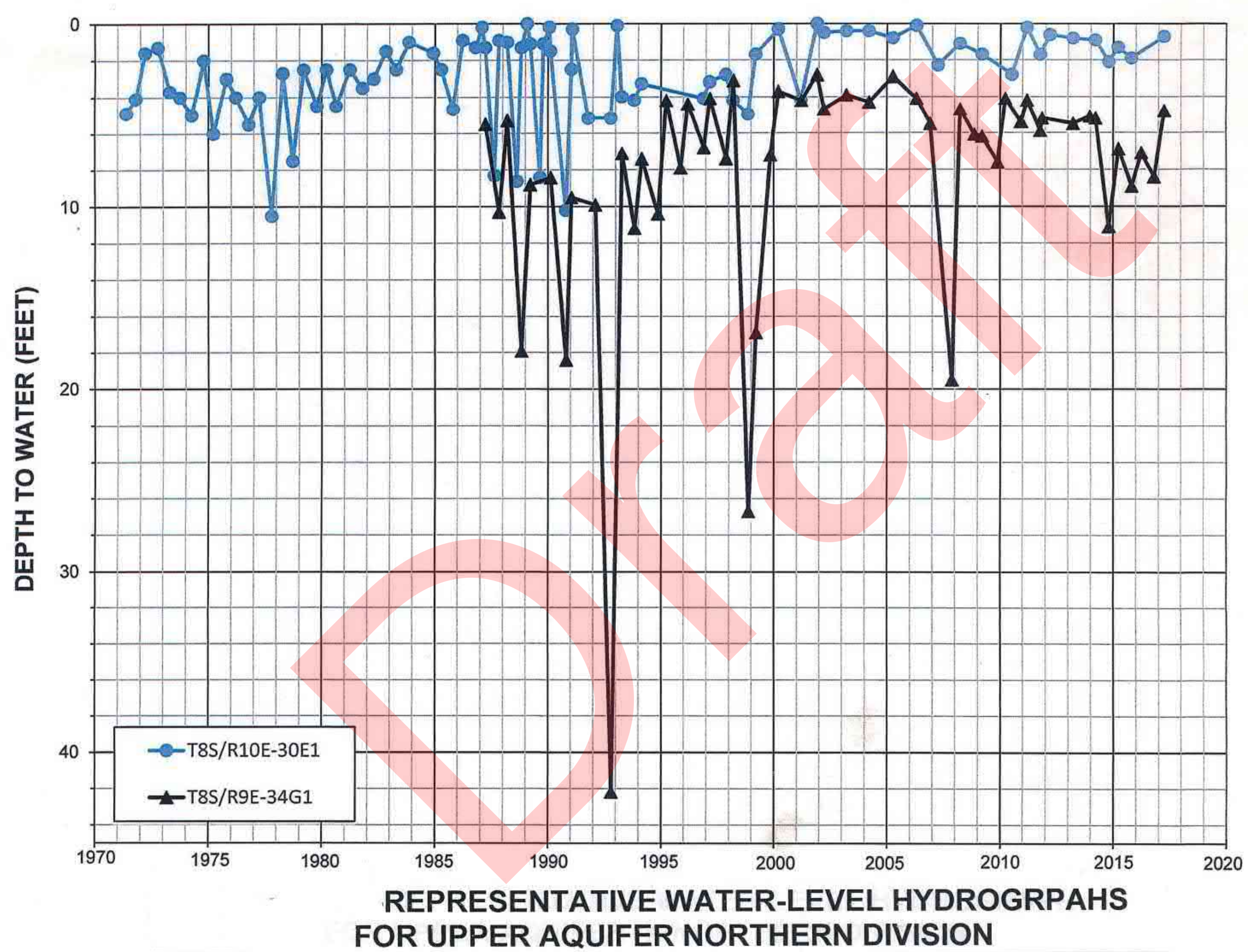


Figure 16 - Representative Water-Level Hydrographs for Upper Aquifer Northern Division

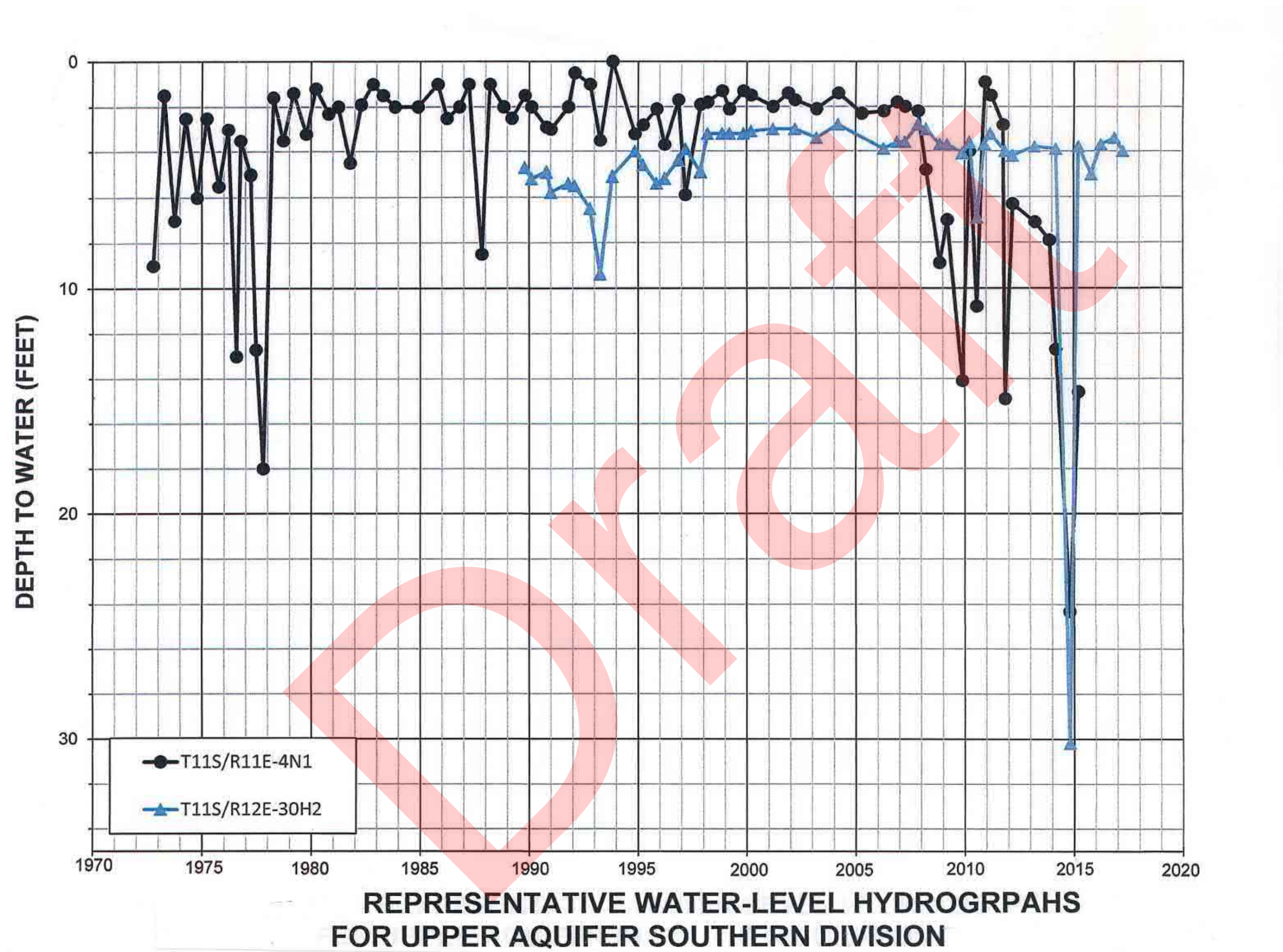


Figure 17 - Representative Water-Level Hydrographs for Upper Aquifer Southern Division

Lower Aquifer

Depth to water in lower aquifer wells has been substantially deeper than in upper aquifer wells, commonly from 50 to 100 feet deep. Long term water-level records aren't available for wells solely tapping the lower aquifer in the GWD. However, records are available for two Volta area wells, which tap both the upper and lower aquifers. Continuous water-level records are available for those wells for 2011-2016. Records for these wells indicate very quick water-level recovery after pumping steps. In 2012, water levels were much shallower after pumping stopped than prior to pumping.

POTENTIAL SOURCES OF GROUNDWATER RECHARGE

Figure 18 shows major potential sources of recharge to groundwater in the area evaluated. The major sources of recharge are groundwater inflow, seepage from conveyance facilities, and deep percolation from the wetlands. The GWD has imported an average of 150,000 acre-feet per year of water from the DMC. Summers Engineering estimated that an average of about 29,000 acre-feet per year have been recharged through unlined conveyance canals within the District. For the upper aquifer, groundwater inflow is primarily from the southwest and south. For the lower aquifer, groundwater in the Northern Division flows into the GWD from almost all directions. In the Southern Division, groundwater inflow was from the north-northwest and northeast. Also, because hydraulic heads are lower in wells tapping the lower aquifer than in those tapping the upper aquifer, there is a trend for downward flow of groundwater through the Corcoran Clay. Amounts of this downward flow in the SJREC service area were estimated by KDSA (1997b).

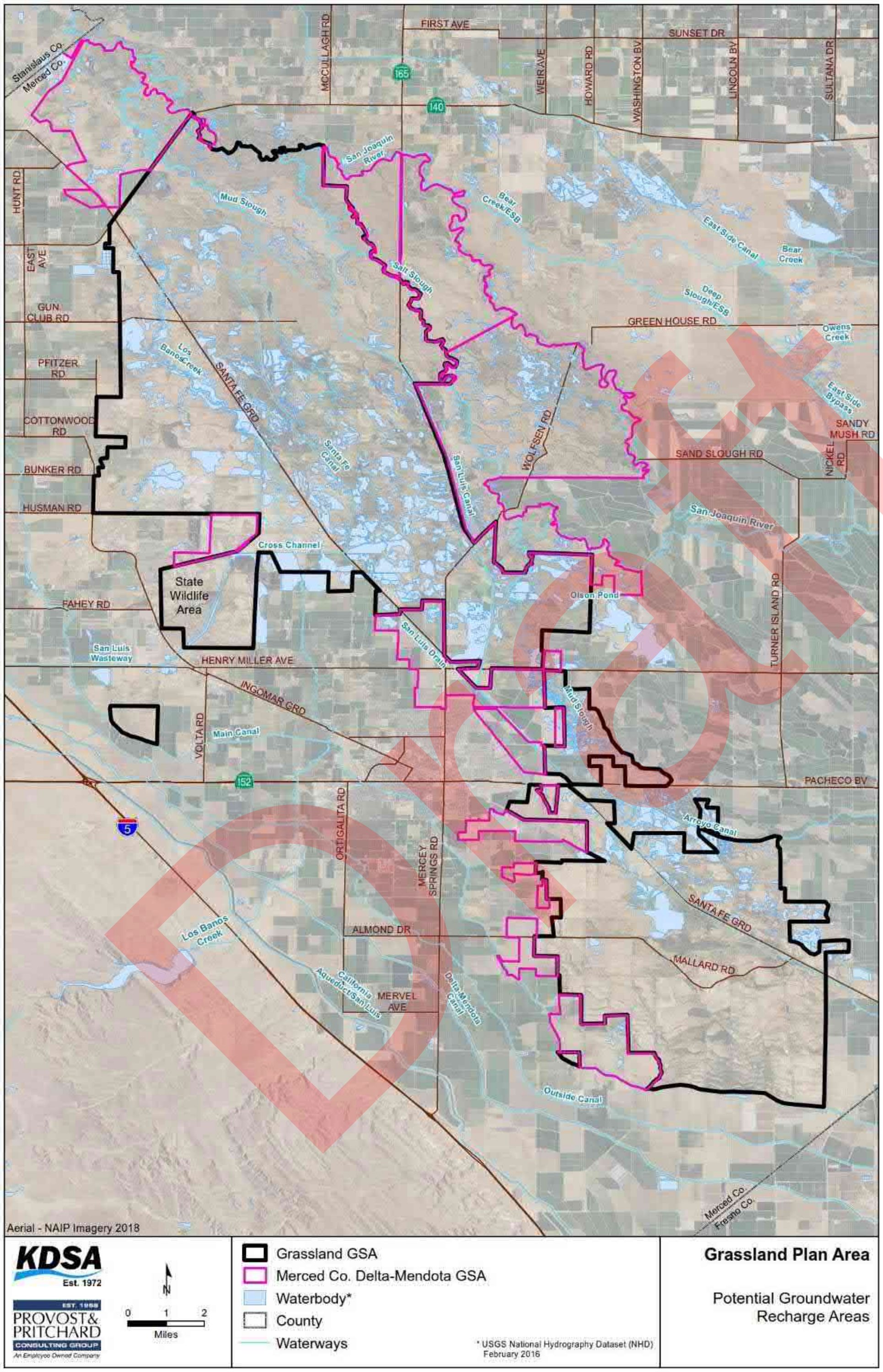


Figure 18 - Potential Groundwater Recharge Areas

POTENTIAL SOURCES OF GROUNDWATER DISCHARGE

Groundwater discharge from the upper aquifer is from pumping wells, groundwater outflow toward the San Joaquin River, downward flow of groundwater through the Corcoran Clay, and from evaporation or evapotranspiration of shallow groundwater. Groundwater discharge from the lower aquifer is primarily from pumping wells and groundwater outflow from the Southern Division.

AQUIFER CHARACTERISTICS

The GWD provided pumping rates for 23 wells in their pilot program. Pumping rates ranged from about 500 to 3,700 gpm. Pumping rates for most of these wells ranged from about 1,350 to 2,300 gpm. Pump tests are available for some of these wells.

Transmissivities

Aquifer transmissivities based on aquifer tests on wells in or near the area evaluated were assembled. Specific capacities for upper aquifer wells can be multiplied by a factor of 1,500 to estimate the transmissivity for areas where aquifer tests aren't available. Similarly, specific capacities for lower aquifer wells can be multiplied by 2,000 to estimate the transmissivity. In addition to these estimates, KDSA (2018) determined transmissivities for specific flow estimates along some of the boundaries with the GWD. For the upper aquifer, these included several inflow segments on the west side, and segments near the south and east side of the Northern Division, and two inflow segments near the southwest side of the Southern Division. For the lower aquifer, transmissivity values were developed for segments northwest, west, south and northeast of the Northern Division. Outflow segments were developed for areas south and southeast of the Northern Division.

KDSA (2018) determined aquifer transmissivities for the upper and lower aquifers from the results of aquifer tests and specific capacity values for wells in the SJREC service areas. KDSA (2018) indicated that transmissivities for the various segments for upper aquifer flow ranged from about 100,000 to 190,000 gpd per foot. The highest values were generally along the area near the southwest boundary of the south part of the area evaluated, and along the east edge of the southerly part of the area evaluated. For the lower aquifer, transmissivities ranged from about 60,000 to 160,000 gpd per foot.

Vertical Hydraulic Conductivities

The vertical hydraulic conductivity of the Corcoran Clay at this location was determined to be less than 0.001 gpd per square foot. For the SJREC service areas, an average vertical hydraulic conductivity for the Corcoran Clay was estimated to be 0.0075 gpd per square foot. This higher value was indicated to be due to a thinner Corcoran Clay in many areas compared to that at the leaky aquifer test site (110 feet), and to the presence of more well conduits compared to those near the leaky aquifer test site.

Storativity

Values for the specific yield from textural descriptions of deposits tapping the upper aquifer are the best way to estimate specific yields. The U.S. Geological Survey has estimated specific yields in many parts of the San Joaquin Valley. Based on the subsurface geologic cross sections available, an average specific yield of 12 percent is used for the upper aquifer. Storage coefficients for strata confined by the Corcoran Clay are sparse in this area. However, a one-week long leaky aquifer test was conducted using wells located along the DMC near Russell Avenue in January 1997 (KDSA, 1997b). This best value for storage coefficient for the lower aquifer for the test was 0.001.

CHANGES IN GROUNDWATER STORAGE

Changes in storage for coarse-grained deposits in the lower aquifer are indicated to be insignificant, because despite water-level declines, the aquifer remains full of water. However, land subsidence has occurred due to compaction of clays, and the volume of land subsidence can be used to estimate the decrease in storage for confining beds in the lower aquifer, including the Corcoran Clay. For the upper aquifer, long-term water-level changes can be used to determine storage changes during periods when the water levels significantly declined. Because of the relatively small changes in storage, year to year changes are often insignificant, except during severe droughts. Over the long-term, water levels in upper aquifer wells have slightly risen. Thus two changes in storage for the upper aquifer were evaluated: 1) annual decreases in storage during droughts, and 2) long-term increases in storage.

Northern Division

Annual water-level declines during the 1987-93 drought aver-aged 1.4 feet per year. For an acreage of about 90,000 acres and an average specific yield of about 12 percent, the annual loss in groundwater storage was about 15,000 acre-feet per year. As in most areas, water-level hydrographs for wells showing these declines indicated full recovery within several years. Long-term water-level hydrographs for the area evaluated indicate an average water-level rise of about 0.04 foot per year. The in-crease in groundwater storage averaged about 400 acre-feet per year. Over a 30-year period, this would total about 12,000 acre-feet.

Southern Division

Annual water-level declines during the droughts of 1987-93 and the recent one of 2008-14 indicate average annual water-level declines of 1.7 feet per year. For an area of about 60,000 acres and an average specific yield of about 12 percent, this annual loss in groundwater storage was about 12,000 acre-feet per year. It should be noted that water-level hydrographs for the period following the first of these droughts generally indicate full recovery within a few years. Long-term hydrographs indicate an average water-level rise of about 0.04 foot per year. The increase in groundwater storage would be about 300 acre-feet per year. Over a 30-year period, this would total about 9,000 acre-feet.

LAND SUBSIDENCE

Historically, there was little subsidence monitoring in most of the GRCD. However, land surface elevations were periodically measured along Highway 152, between Los Banos and Highway 99 (Figure 19). Near Los Banos, little subsidence was indicated, due to the paucity of pumpage from the lower aquifer in this area. Prior to about 2000, most of the land subsidence along Highway 152 was east of the Eastside Bypass, where numerous wells were present that pumped for the lower aquifer. Starting in about 2008, many more wells tapping the lower aquifer were constructed south of Red Top, both east and west of the Bypass. Pumping of these wells had caused significant land subsidence as of 2016. Figure 20 shows land subsidence determined by the U.S. Geological Survey for July 2012-July 2016. Contours are shown for the area evaluated and to the east. Near the west edge of the north part of the area evaluated, subsidence was apparently about 0.05 foot. Near the eastern edge of the north part of the area evaluated, subsidence was averaged about 0.5 foot. Near the west edge of the south part of the area evaluated, subsidence was about 0.3 foot, and near the east edge averaged about 0.6 foot. In both divisions subsidence increased to the east-northeast. There is some pumpage from lower aquifer wells in the area evaluated and adjoining areas. To the east of the area evaluated, the subsidence increased to more than 2.0 feet for July 2012-July 2016. Land subsidence in part of that area decreased after July 2016 due to mitigating measures that were enacted.

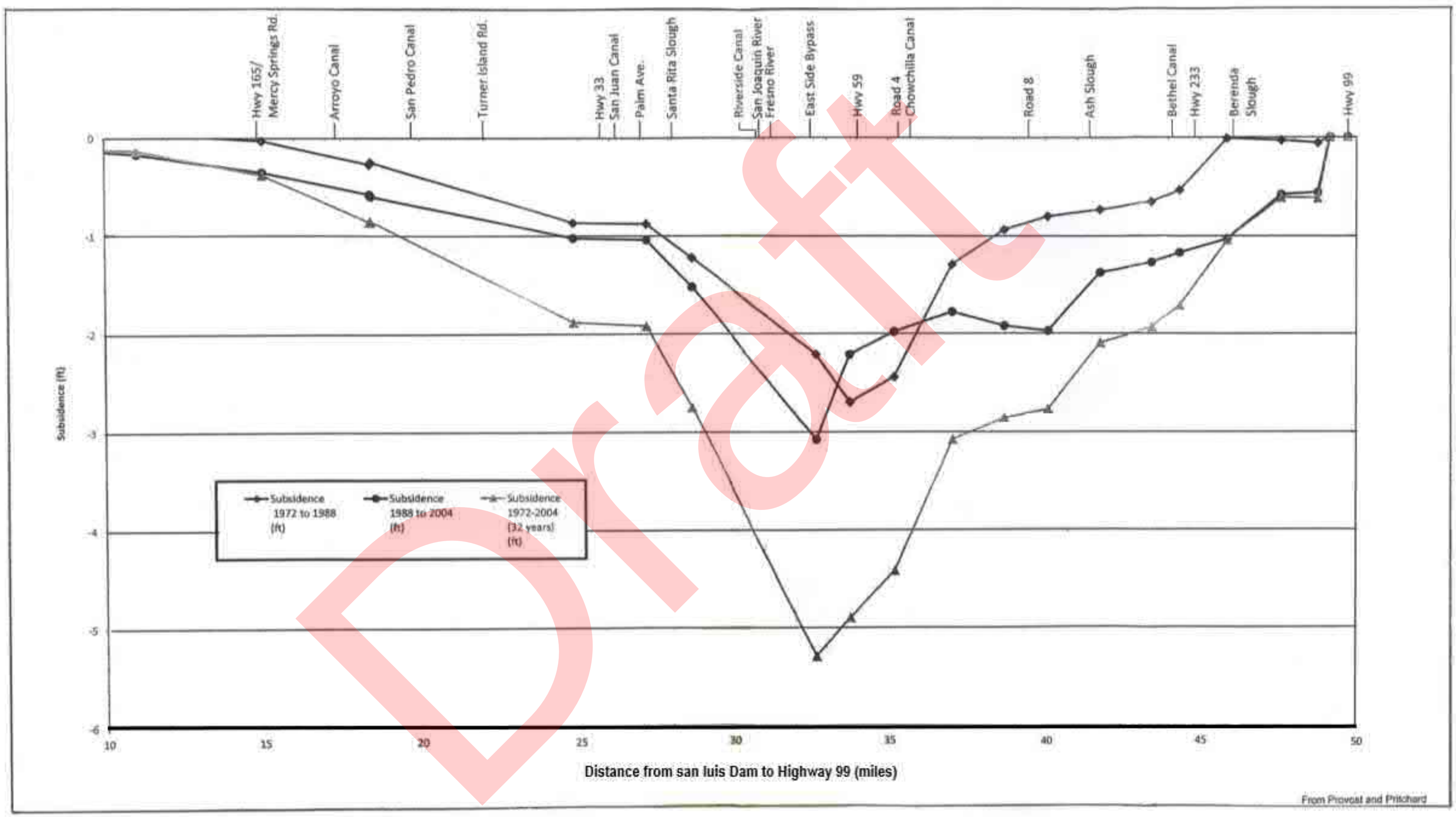


Figure 19 - Land Surface Elevations Along Highway 152

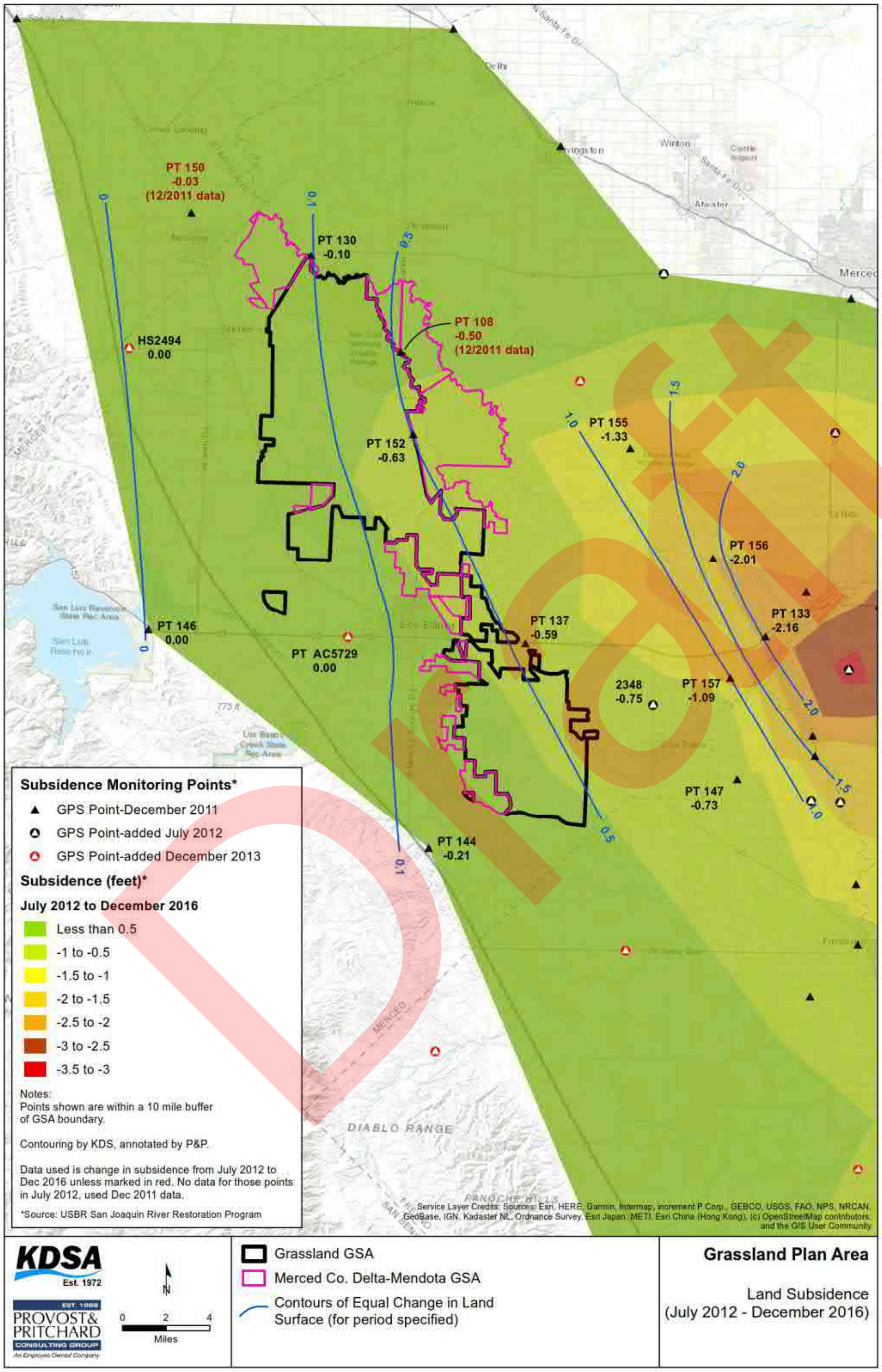


Figure 20 - Land Subsidence (July 2012 - December 2016)

GROUNDWATER QUALITY

Recent information on the chemical quality of groundwater in the area evaluated was derived primarily from the GWD report of February 1, 2016 on the Incremental Level 4 Groundwater Development Project and from the installation of the nested monitor wells at the three sites. Monitoring plans require that the GWD have samples from the District's surface water channels analyzed for total dissolved solids (TDS), selenium, and boron. The Regional Water Quality Control Board has established a maximum selenium concentration in surface water of 2 ppb. The GWD's Board of Directors has adopted a surface water quality objective for TDS of 2,500 mg/l. The GWD and Reclamation have agreed to establish an objective of 4 mg/1 for boron in the receiving channel downstream of a well discharge.

Figure 21 shows recent groundwater quality data for the area evaluated. The 22 supply wells with chemical analyses generally indicate the quality of groundwater that was acceptable for pumping into the GWD system. Much worse quality groundwater is present at some locations and in-depth intervals that are not tapped by these wells.

Northern Division

Most of the chemical analyses for the Northern Division are for wells within about five miles of Los Banos. Also shown are data from the two sites where nested monitor wells were installed.

TDS concentrations in water from upper aquifer supply wells north of Highway 152 ranged from 1,160 to 2,390 mg/l. TDS concentrations exceeding 2,000 mg/1 were present in water from a well near Gun Club Road and two other wells near Henry Miller Road and the Santa Fe Canal. TDS concentrations of less than 1,500 mg/1 were present in water from a well near Carnation Road near the north edge of the GWD, and from six other wells between Highway 152 and Husman Road.

Selenium concentrations in water from upper aquifer wells were only detectable (0.4 ppb or greater) in water from five wells. These five wells were south of Henry Miller Road and north of Highway 152, near or west of the Santa Fe Canal. Selenium concentrations in water from these five wells ranged from 1.6 to 3.6 ppb. Boron concentrations in water from upper aquifer wells ranged from 1.0 to 3.5 mg/l. Boron concentrations exceeding 3.0 mg/1 were present in water from two wells (one near Gun Club Road and another south of Henry Miller Road). Boron concentrations were less than 1.5 mg/1 in north from four upper aquifer wells. One well was located near the north edge of the GWD, east of Santa Fe Grade. The other three were located south of Husman Road near Santa Fe Grade.

Water from a lower aquifer well north of China Camp Road and near the Santa Fe Canal had a TDS concentration of 500 mg/1, boron concentration of 0.66 mg/l, and no detectable selenium.

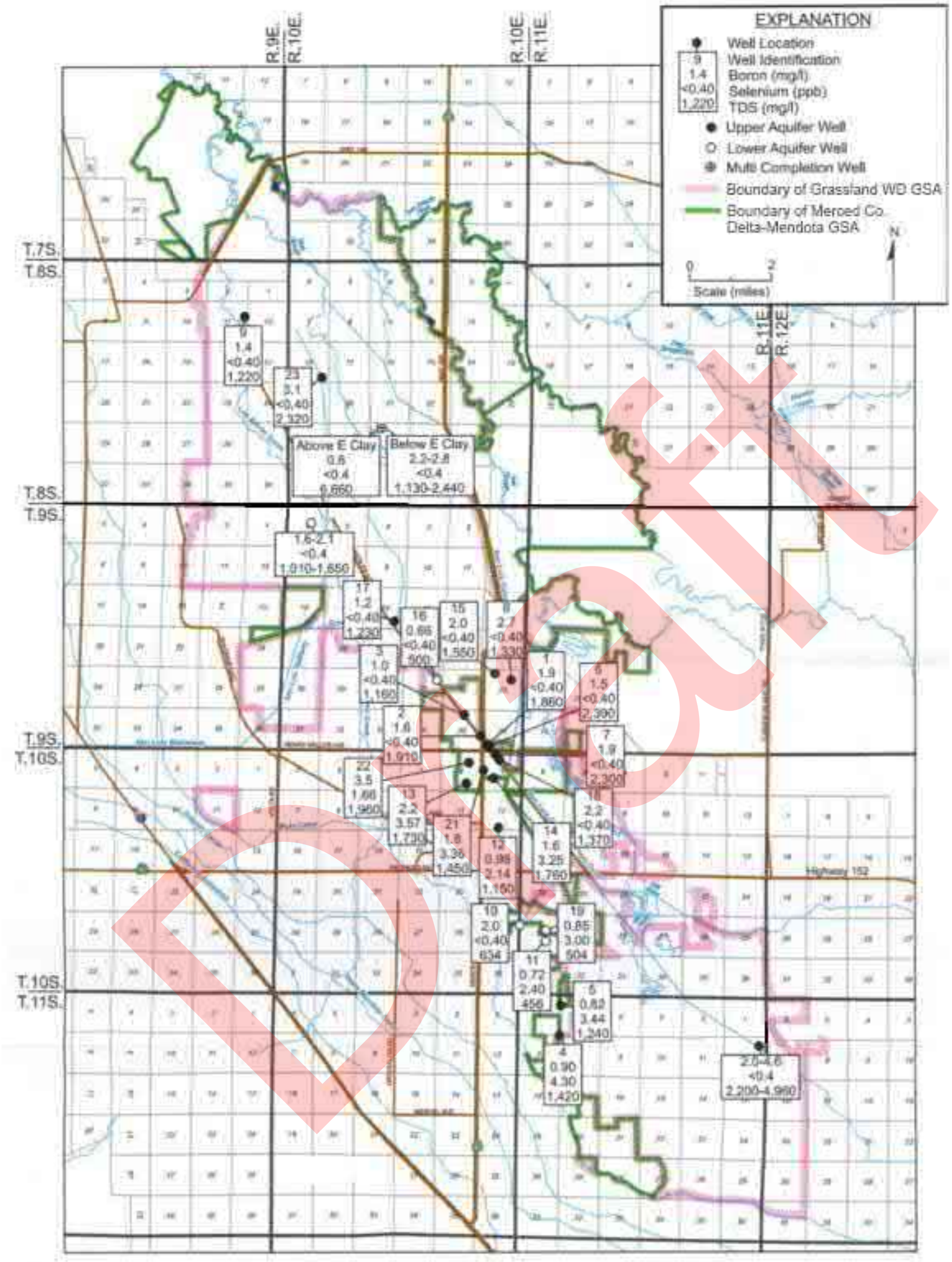


FIGURE 23 - GROUNDWATER QUALITY IN THE GWD

Figure 21 – Groundwater Quality in the GWD

At a northern monitoring site, water samples were collected from both above and below the Corcoran Clay. The water sample from above the Corcoran Clay had a TDS concentration of 6,660 mg/1, a boron concentration of 0.6 mg/1, and the selenium concentration was less than 0.4 ppb. For water samples collected from below the Corcoran Clay, TDS concentrations ranged from 1,130 to 2,440 mg/1, boron concentrations ranged from 2.2 to 2.8 mg/1, and selenium concentrations were not detectable.

At another northern monitoring site, water samples were collected only from below the Corcoran Clay, as brackish groundwater was indicated above the clay. TDS concentrations ranged from 1,010 to 1,650 mg/1, boron concentrations from 1.6 to 2.1 mg/1, and selenium concentrations were less than 0.4 ppb.

Southern Division

All five of the sampled supply wells in the Southern Division were located along the west side of the GWD, between Pioneer and Almond Drive Road. Two of these wells were upper aquifer wells and three were lower aquifer wells. TDS concentrations in water from the upper aquifer wells ranged from 1,240 to 1,470 mg/l. Boron concentrations ranged from 0.8 to 0.9 mg/1 and selenium concentrations ranged from 3.4 to 4.3 ppb. Three wells that tapped the lower aquifer had TDS concentrations ranging from 456 to 634 mg/l. Boron concentrations ranged from 0.7 to 2.0 mg/l. Selenium concentrations ranged from less than 0.4 to 3.0 ppb.

At a southern monitoring site, water samples were collected from two depth intervals above the Corcoran Clay. TDS concentrations ranged from 2,200 to 4,960 mg/1 and boron concentrations ranged from 2.0 to 4.6 mg/l. The selenium concentration in both samples was less than 0.4 ppb. The electric log for the test hole at the site indicated high salinity groundwater below the Corcoran Clay. A similar situation has been found in groundwater elsewhere in the Dos Palos area and to the southeast.

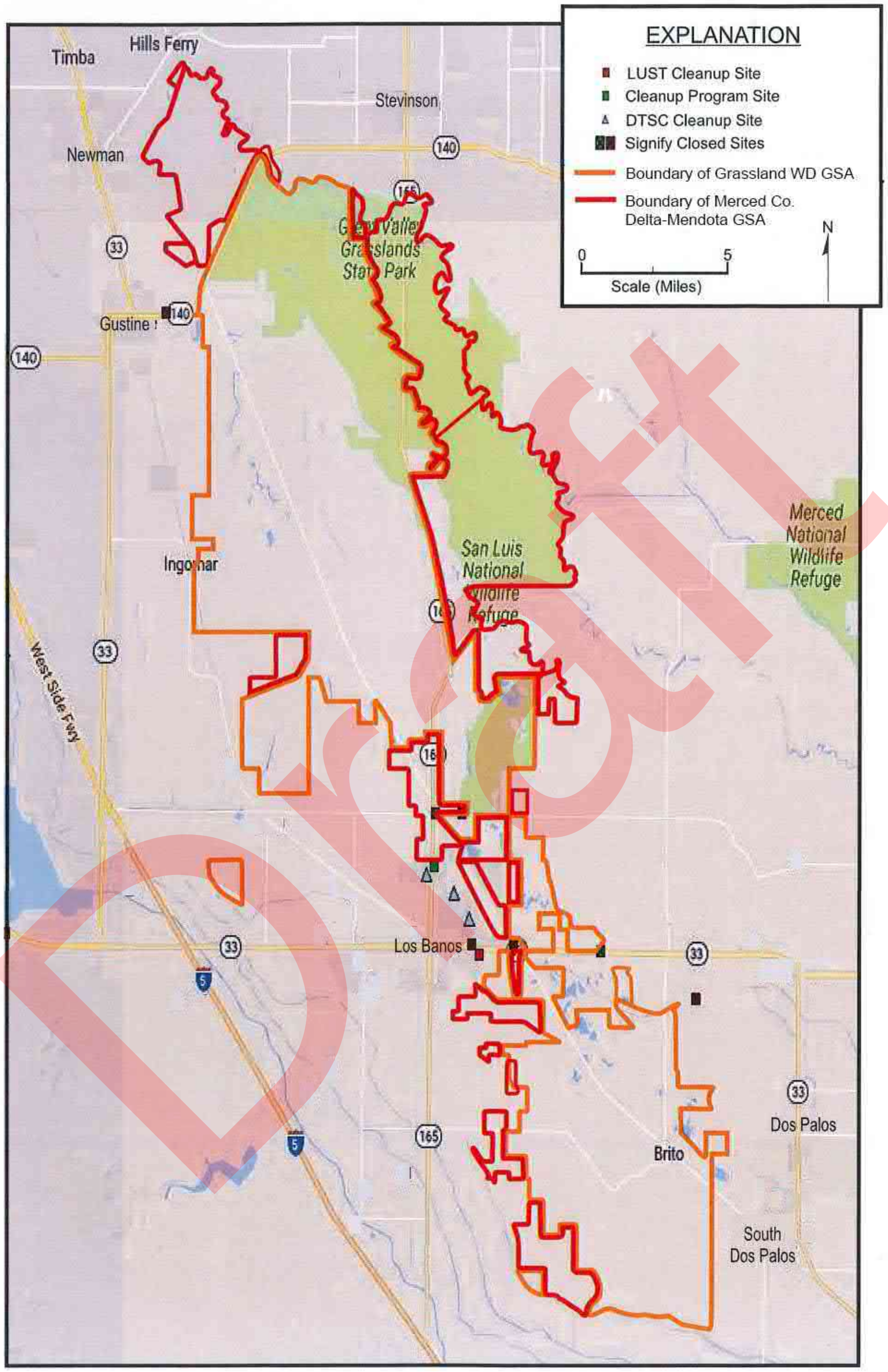
INTERCONNECTED SURFACE AND GROUNDWATER SYSTEMS

The only locations in the area evaluated where groundwater is known to be in direct hydraulic communication with a stream is along a nine-mile long reach of the San Joaquin River, on the north edge of the San Luis WLR. A series of shallow monitor wells has been installed by Reclamation as part of the San Joaquin River restoration project. Water-level maps indicate that groundwater in the upper aquifer discharges to the river along this reach. The GWD has installed a network of shallow (10 to 20 feet deep) observation wells in the District.

Monitoring of such wells will provide more definitive information on the relation between shallow groundwater and streamflow at same locations.

KNOWN CONTAMINATION SITES

Figure 22 shows known groundwater contamination sites, in with the vicinity of the area evaluated, taken from the Central Valley Regional Water Quality Central Board Geotracker website. There were sites near the boundary of the original GSA which have since been closed.



KNOWN CONTAMINATION SITES

Figure 22 - Known Contamination Sites

Appendix C – Water Conservation Plan Annual Report

Grasslands Resource Conservation District

Water Management Plan

December 31, 2017
Final plan submittal date, September 30, 2018

Section A - Background

1. *Identify the staff member responsible for developing and implementing the Plan. Provide their contact information*

   Name: Michael Gardner Title: Chief of Field Operations/Watermaster

   Address: 200 W. Willmott Ave.

   Telephone: 209-826-5188 Fax: 209-826-4984

   E-mail mgardner@gwdwater.org

2. *Year Resource Conservation District established* January 11, 1972

Define year-type used consistently throughout plan Water Year (March 1 – February 28)

3. *Water supplies*

List each annual entitlement of surface water under each water right and/or contract

Supplier	*Water source*	*Contract #*	*Contract restrictions*	*Acre-feet/year*
Federal Level 2	CVP water delivered via the Delta-Mendota Canal (DMC)	01-WC-20-1754	Contingent on Shasta Index Trigger, 3.2 MAF, being reached	125,000
Federal Incremental Level 4	Various depending on Bureau of Reclamation's (BOR or Reclamation) ability to acquire	01-WC-20-1754	Based on the BOR's ability to provide	55,000
State				
Appropriative				
Other, riparian				

4. *Provide a narrative on pre-CVPIA water supplies and water management*

Prior to CVPIA, Grassland Water District contracted for 53,500 acre-feet of water (Contract Nos. 14-06-200-6106, 14-06-200-4658A and 14-06-200-3447A) with Reclamation from the Central Valley Project (CVP). This water was available annually from September 15 through November 30. Along with the CVP water allocations, the District obtained contractual agreements with adjacent agricultural irrigation districts to accept drain water comprised of both surface and subsurface flows. The agricultural drain water was estimated to be 75,000 acre-feet of additional water annually. Typically the wetland waters are held until the middle of March when most landowners drawdown the wetlands. During the spring and summer months, return flows from adjacent agriculture irrigation districts supplied only enough water to provide for brood habitat and cattle pasture with a minor amount remaining to carry out the irrigation of moist soil plants. An evaluation of the District's spring and summer water supply required to optimize habitat was estimated at approximately 55,000 acre-feet and is referred to as Incremental Level 4. Fall flood up was estimated at 125,000 acre-feet (Level 2), totaling a full need of 180,000 acre-feet (Level 4).

In 1985, new regulatory guidelines prohibited the District from applying water containing over a 2 ppb selenium concentration monthly mean to wetlands. The new selenium regulatory guideline resulted in the loss of nearly two-thirds of the District's water supply forcing the District to begin a search to secure additional water supplies. Various programs were initiated to secure this needed water including off-stream storage projects, temporary contracts with the Bureau of Reclamation, contributions from outside entities, and groundwater acquisition projects. Even with these attempts to supplement the CVP water, the District's supplies remained inadequate to meet habitat requirements. For example, in water year 1991 the total amount of water available for delivery for the entire year was 73,500 acre feet; in water year 1992, deliveries totaled only 77,500 acre feet.

5. *Land use history--Identify habitat types specific to this Resource Conservation District.*
Attach a map showing habitat location and size
List habitat-types with 5% or more of total acreage

Habitat type	*Original size*	*1992 acres*	*1997 acres*	*2015 acres*
Seasonal wetland – timothy (not irrig)	NA	NA	NA	0*
Seasonal wetland – timothy (irrigated)	NA	NA	NA	30,800*
Seasonal wetland – smartweed	NA	NA	NA	1,600*
Seasonal wetland - watergrass	NA	NA	NA	3,200*
Permanent wetland	NA	NA	NA	1,200*
Semi-permanent wetland/brood pond	NA	NA	NA	1,200*
Reverse cycle wetlands	NA	NA	NA	0*
Riparian	NA	NA	NA	1,200*
Irrigated pasture	NA	NA	NA	800*
Upland	NA	NA	NA	18,000*
Upland (not irrigated)	NA	NA	NA	18,000*
Upland (managed)	NA	NA	NA	0*
Upland (grains)	NA	NA	NA	0*
Other (>5%)	NA	NA	NA	
Misc. habitat (<5%)				
Sub-total – habitat acres				58,000*
Roads, buildings, etc.				2,000*
Total (size of refuge)				60,000*

*The acres of habitat types listed above are current best estimates. A map detailing these estimates is currently unavailable. GWD, in cooperation with Ducks Unlimited and California Waterfowl Association continues to work on habitat distributions for the wetland complex. GWD supplies 192 private and public landowners. For a list of private lands and corresponding acreages see *Attachment #1*.

Describe Resource Conservation District habitat-type water use characteristics

Habitat type	*AF/ac*	*# of irrigations*	*Flood-up date*	*Draw-down date*
Seasonal wetland	3-6	1-4	August-September	March-May
Seasonal wetland - timothy	3	1	August-September	March-April
Seasonal wetland – watergrass	5	3-4	August-September	April-May
Permanent wetland	9	0	NA	0
Semi-permanent wetland/brood pond	8	2.5	August-September	July
Riparian	6	0	August-September	0
Irrigated pasture	NA			
Upland (not irrigated)	NA			
Upland (managed)	NA			
Upland (grains)	NA			
Other (>5%)	NA			
Misc. habitat (<5%)	NA			

Section B - Water Management Related Goals and Objectives

1. *Describe the Resource Conservation District mission relative to water management. (i.e. crop depredation, legislative mandates, service to landowners)*

   Grassland Water District/Grassland Resource Conservation District is dedicated to maintaining and operating its conveyance system for the purpose of providing its landowners and adjacent refuge areas with water available for the preservation and enhancement of wetland habitat throughout the year.

2. *Describe specific habitat management objectives. Include pertinent information from Resource Conservation District management plans*

   The District's primary habitat management objective is providing water to its landowners and adjacent refuges for the purpose of maintaining wetland habitat during the fall and winter. A co-equal objective, which is entirely dependent upon the availability of Incremental Level 4 water, is providing water for the optimum management of that habitat through the spring and summer months to provide brood habitat and maximize beneficial moist soil plant production to help meet the metabolic needs of migratory water birds.

3. *Describe the strategies used to attain objectives listed above*

   Contingent on a 100% L4 water supply, the District will reserve a minimum of 70% of its water supply for achieving its primary objective of providing fall and winter waterfowl habitat. Any additional water will be reserved for the enhancement of this habitat during the spring and summer months.

4. *Describe constraints that prevent attainment of objectives and explain the effect on operations*

The lack of full acquisition of Level 4 water supplies by BOR greatly affects the District's ability to provide spring and summer water for optimum habitat management. The relatively short timeframe the District has to conduct its annual construction and maintenance will always create problems with delivery and efficiency of operations. These constraints are in part due to limitations imposed by the Endangered Species Act and the sensitive environment and strict water schedule that the District must work with.

5. *Describe the strategies used to remedy the constraints listed above*

The Interagency Refuge Water Management Team (IRWMT) comprised of District personnel, along with representatives of the U.S Fish and Wildlife Service, the California Department of Fish and Wildlife and Reclamation, collaborate on the scheduling of refuge water supplies and the acquisition and allocation of Incremental Level 4 water supplies. The District is a strong proponent of securing permanent water supplies in order to assure full spring and summer water supplies are available each and every year. Also, the District has been working with south of Delta agricultural districts to diversify sources of Level 2 water supplies.

Section C - Policies and Procedures

1. *Describe the Resource Conservation District policies/procedures on accepting agricultural drainage water as supply*

The District does receive a modest amount of operational spill from adjacent agricultural districts and higher quality drainage water provided that meet all objectives set forth by the Central Valley Regional Water Quality Control Board for delivery to wetlands. The District collects regular grab samples at the points of acceptance of these various sources of water to monitor TDS, selenium and boron concentrations.

2. *Describe the Resource Conservation District policies/procedures on water pooling, transfers, reallocations or exchanges*

As per the GRCD water contract # 01-WC-20-1754 for pooling and transfers:

Pooling of Water Supplies:

(a) Whenever the maximum quantities of Level 2 Water Supplies and/or the Incremental Level 4 Water Supplies depicted in Exhibit "B" are reduced pursuant to Article 9 of this Contract, the remaining Level 2 Water Supplies and/or the Incremental Level 4 Water Supplies may be pooled for use on other Refuges(s); Provided, that no individual Refuge shall receive more Level 2 Water Supplies than would have been made available to it absent a reduction pursuant to article 9 of this Contract; or be reduced by more than 25%; Provided further, that the Contracting Officer makes a written determination that pooling of water for use on other Refuge(s) would not have an adverse impact, that cannot be reasonably mitigated, on Project operations, other Project Contractors, or other Project purposes; Provided further, that the Contracting Officer determines that such reallocation is permitted under the terms and conditions of the applicable underlying water right permit and/or license; and Provided still further, that water made available under this contract may not be scheduled for delivery outside the Contractor's Boundary without prior written approval of the Contracting Officer.

(b) An Interagency Refuge Water Management Team, to be chaired by the Contracting Officer and to be established upon execution of this Contract, shall be entitled to collaboratively allocate the pooled water supplies and provide a schedule for delivery of the pooled supplies to meet the highest priority needs of the Refuge(s) as depicted in Exhibit "B"; Provided, however, nothing in this Article is intended to require the Contractor to pool the water supply provided for in this contract. The Interagency Refuge Water Management Team shall be composed of designees of the Bureau of Reclamation, the United States Fish and Wildlife Service, the California Department of Fish and Wildlife, and the Grassland Water District.

Transfers, Reallocations or Exchanges of Water:

(a) Subject to the prior written approval of the Contracting Officer, the Project Water made available under this Contract may be transferred, reallocated or exchanged in that Year to other Refuge(s) or Project contractors if such transfer, reallocation or exchange is requested by the Contractor and is authorized by applicable Federal and California State laws, and then-current applicable guidelines or regulations.

The District is a participant in the Interagency Refuge Water Management Team (IRWMT) that coordinates the acquisition, distribution and allocation of Level4 waters provided by Reclamation. The District encourages any and all pooling, transfers, reallocations or exchanges that will enhance or improve the delivery of water to or through our system.

3. *Describe the Resource Conservation District water accounting policies/procedures for inflow, internal flow and outflow.*

All contract water delivered to the District is monitored and measured by Reclamation or its contractual agent. The District's inflow, internal flow and outflow measurements and recording procedures are established under the direction of the District's General Manager and are currently being accounted for by the District's Chief of Field Operations/Watermaster. All water delivery is based on a water year beginning March 1 and ending on the last day of February of the following year. Outflow is based on a seasonal event period beginning October 1 and ending on September 30 of the following year. The District, in cooperation with Reclamation, the Department of Fish and Wildlife, and United States Fish and Wildlife Service, has implemented a Real-Time Water Quality Monitoring Network (RTWQMN). The RTWQMN currently consists of 20 stations located at major points of acceptance, delivery, canal system confluences, and drainages of the GRCD (*See Attachment 5e – RTWQMN Map*). The RTWQMN continuously monitors flow, temperature, pH and electrical conductivity (EC). Real-time water quality monitoring data is proofed on a monthly basis through a Quality Assurance Program Plan (QAPP). The QAPP includes site visitations where technicians conduct sensor maintenance, calibration, and instantaneous and redundant flow and EC measurements to insure that the data is representative and comprehensive.

4. *Attach a copy of the Resource Conservation District's shortage policies, drought plan, or any similar document.*

The District has established the following priorities (in descending order of importance) for the delivery and use of available water supplies (*See Attachment #2*)

1. Fall habitat water: August 15 - February 28
2. Spring & summer irrigation, brood habitat: March 1 - August 14
3. Moist soil plant management: March 1 - August 14
4. Permanent pasture irrigation, native pasture irrigation: March 1 - August 14

5. *(GRCD only) Describe water policies as they pertain to:*

a. water allocation policy to customers (Attachment #3a),

Water is delivered to the District's landowners on a pro-rata basis determined by total available water versus the total acres being serviced. As of March 1, 2010, lands that were not wetland habitat at the time of the CVPIA passage were notified that any water they would request in the future for restored habitat would be provided only on a "when available " basis due to restricted amounts of Incremental Level 4 water supplies. Fall habitat water is distributed to clubs from August 15 through the month of February. Customers are charged an annual water service assessment and standby fees on a per acre basis. Water for the optimization of wetland habitat is available for use by the clubs for spring and summer irrigation and brood habitat maintenance when available from March 1 through August 14. The summer water is charged for on a per acre-foot basis.

b. lead time for water orders (Attachment #3b - sample water order form),

The District requires its customers provide at least 72 hours advance notice for all water orders, deliveries and shut-offs.

c. policies for wasteful use of water (Attachment #3a)

The District will notify individual clubs that they are in violation of water conservation policies and request the violations be corrected. If no action is taken, the District will terminate any District controlled deliveries until the situation is corrected. The District may refuse water delivery to any club that does not properly maintain its private water conveyance system or water conveyance structures.

d. pricing and billing policies (Attachment #4a, 4b - sample bills)

The District has two separate charges for water delivery to clubs within the District boundary. Fall habitat water, delivered August 15 through the end of February, is billed on a per acre basis. These charges cover all water needed to fill and maintain the wetland habitat within each individual hunting club. Spring and summer irrigation water, delivered March 1 through August 14, is provided to the clubs for irrigation and brood habitat maintenance and is billed on a per acre-foot basis.

Fixed Charges			
Charges ($ unit)	*Charge units ($/acre), ($/customer) etc.*	*Units billed during year (acres, customer) etc.*	*$ collected ($ times units)*
$21.75	$/Acre	51,200	1,113,604

Volumetric charges			
Charges ($ unit)	*Charge units ($/AF)*	*Units billed during year (AF)*	*$ collected ($ times units)*
$4.00	$/AF	26,000 (average)	104,000

Section D - Inventory of Existing Facilities

1. *Mapping*

   Attach existing facilities map(s) that show points of delivery, turnouts (internal flow), and outflow (spill) points, measurement locations, conveyance system, storage facilities, operational loss recovery system, wells, and water quality monitoring locations. Describe in the body of the plan the information contained in each attached map. (*See Attachment #5a-5d*)

   Attachment 5 is a series of maps including an ownership map and all major canal systems. A second map has been provided that identifies points of delivery and points of measurement. Additionally a map of the Real Time Water Quality Monitoring Network has been provided that currently consists of 20 stations located at major points of acceptance, delivery, canal system confluences, and drainages of the GRCD (*See Attachment #5e*).

2. *Water measurement*

   a. *Inflow/deliveries*

      Total # of inflow locations/points of delivery ______37_____

      Total # of measured points of delivery ___________37_____

      Percentage of total inflow (volume) measured during report year _100___

Delivering agency	Conveyance facility	*Measuring point*	*Resource Conservation District distribution facility*	*% of total inflo w*	*Type of measurement*	*Measuring agency*
1-CCID	Helm 1st Point	Helm 1st Point	Helm Canal	1	Rated canal gate	CCID
2-CCID	Main Canal	Agatha gate	Agatha Canal	15	Rated canal gate	CCID
3-CCID	Main Canal	Coaches gate	Helm Canal	3	Rated canal gate	CCID
4-CCID	Main Canal	Frog Pond gt.	Helm Canal	1>	Rated canal gate	CCID
5-CCID	Main Canal	Meyers gate	Helm Canal	2	Rated canal gate	CCID
6-CCID	Main Canal	Vista gate	Helm Canal	1	Rated canal gate	CCID
7-CCID	Main Canal	Ram gate	Ram Ranch	1>	Rated canal gate	CCID
8-CCID	Main Canal	Camp-13 gate	Camp-13	11	Rated canal gate	CCID
9-CCID	Main Canal	Bayshore gate	Bayshore	1>	Rated canal gate	CCID
10-CCID	Main Canal	Triangle gate	Triangle	1>	Rated canal gate	CCID
11-CCID	Main Canal	Ascot gate	Ascot Ditch	1	Rated canal gate	CCID
12-CCID	Main Canal	Almond gate	Almond Drive	8	Rated canal gate	CCID
13-CCID	Main Canal	Costa gate	Costa	1>	Rated canal gate	CCID
14-CCID	Main Canal	SL gate	San Luis Canal	17	Rated canal gate	CCID
15-CCID	Main Canal	LBCr. gate	Los Banos Creek	1	Rated canal gate	CCID
16-CCID	Main Canal	Sloan gate	Sloan	1>	Rated canal gate	CCID
17-SLDMWA	Volta Wasteway	Pond 10	Cross Channel	10	Rated canal gate	SLDMWA

18-SLDMWA	Volta Wasteway	Pond 10	Mosquito Ditch	6	Rated canal gate	SLDMWA
19-SLDMWA	Volta Wasteway	Pond 10	Malia Ditch	2	Rated canal gate	SLDMWA
20-CCID	Main Canal	Cottonwood Lateral gate	Cottonwood Lateral	1>	Rated canal gate	CCID
21-CCID	Main Canal	Hunt Road	Garzas Creek	9	Rated drop structure	CCID
22-CCID	Outside Canal	Cook gate	Charleston Drain	1>	Rated canal gate	CCID
23-CCID	Helm 1st Point	Gables gate	Gables Ditch	1	Rated canal gate	CCID
24-CCID	Helm 1st Point	Roberts gate	Roberts gate	1>	Rated canal gate	CCID
25-CCID	Branch-3	Branch-3	Bennett Drain	1>	Rated canal gate	CCID
26-SLCC	Arroya Canal	Fagundes gate	Fagundes	1>	Rated canal gate	SLCC
27-SLCC	Arroya Canal	La Canada gt.	La Canada	1>	Rated canal gate	SLCC
28-SLCC	Arroya Canal	Piedmont gate	Piedmont	1>	Rated canal gate	SLCC
29-SLCC	Arroya Cana	San Pedro gt.	San Pedro	1>	Rated canal gate	SLCC
30-SLCC	Arroya Cana	Bardin gate	Bardin	1>	Rated canal gate	SLCC
31-SLCC	San Pedro Canal	Bardin gate	Bardin	1>	Rated canal gate	SLCC
32-SLCC	San Pedro Canal	San Pedro gt.	San Pedro	1>	Rated canal gate	SLCC
33-SLCC	San Pedro Canal	Stevens Creek Quarry gate	Stevens Creek Quarry	1>	Rated canal gate	SLCC
34-SLCC	San Pedro Canal	Klamath gate	Klamath	1>	Rated canal gate	SLCC
35-SLCC	San Pedro Canal	Tramontana gt	Tramontana	1>	Rated canal gate	SLCC
36-SLCC	San Pedro Canal	McDonald gt.	McDonald	1>	Rated canal gate	SLCC
37-SLCC	Arroya Canal	Cocke Ditch gate	Mud Slough Unit (CDF&G)	1	Rated canal gate	SLCC

b. *Internal flow at turnouts*

Total # of Resource Conservation District water management units (units) 192

Total # of Resource Conservation District water management unit turnouts 230

Total # of Resource Conservation District measured turnouts 225

Estimated % of total internal flow (volume) during report year that was measured at a turnout 98%

Number of turnouts supplying more than one unit or not directly off delivery system 5

Measurement type	*Number of devices*	*Acres served*	*Accuracy (avg or range)*	*Reading frequency*	*Calibration frequency (months)*	*Maintenance frequency (months/days)*
Orifices	212		+/- 12%	Daily	Annually	NA
Propeller						
Weirs	15		+/- 18%	Daily	NA	NA
Flumes						

Venturi						
Alfalfa valves						
Metered gates						
Other, Doppler	3		+/- 5%	Continuous	Monthly	Monthly

* The weirs are canal internal flow water-control devices

c. *Outflow*

Outflow (AF/yr) 48,408 (average)

Total # of outflow locations/points of spill 8

Total # of measured outflow points 8

Percentage of total outflow (volume) measured during report year 100%

Outflow point	*Measuring point*	*Type of measurement*	*Percent of total outflow (estimated)*	*Measuring agency*	*Acres drained*
DS-31	Los Banos Creek @ Hwy. 140	Doppler Measurement	20	GWD	8,113
DS-32	City Gates	Rated Canal Gate Measurement	16	GWD	Emergency drain
DS-33	Santa Fe Canal Bypass	Weir Measurement	7	GWD	Emergency drain
DS-34	S-Lake Drain	Doppler Measurement	8	GWD	3,802
DS-35	Hollow Tree Drain	Doppler Measurement	11	GWD	2,833
SD-36	Santa Fe Canal (Skeleton Weir)	Weir Measurement	17	GWD	3,190
SD-37	Mud Slough Gun Club Rd.	Doppler Measurement	16	GWD	8,178
DS-38	Fremont Drain	Doppler Measurement	5	GWD	1,996

3. *Identify the type and length of the Resource Conservation District internal distribution system*

Miles unlined canal	*Miles lined canal*	*Miles piped*	*Miles – other*
135	0	0	0

a. *Describe the location and types of identified leaks and areas of higher than average canal seepage, and any relation to soil type*

It is the intent of the District to further evaluate seepage and evaporation related losses within its conveyance system. Estimates provided in Table 2 are based on approximations made by District staff and should not be used for any other purpose.

A 1.5 mile section of the Kesterson Ditch, which crosses the old historic Mud Slough (North) channel, is subject to higher than normal seepage losses due to the large areas of Turlock Sandy Loam soils that are present in the area. There appears to be cross stratums of deeper, more porous sandy loam that intersect the ditch in areas. No plans have been developed to try to correct the situation because of the cost involved. The ditch has a maximum flow capacity of 45 cfs and is used mostly in the fall and spring. After fall deliveries, the surrounding areas become saturated and losses become minimal. Spring irrigations are done quickly to reduce operation times.

4. *Describe the Resource Conservation District's operational loss recovery system*

Initiated in 1996, the Grassland Bypass Project consolidates subsurface drain water from the 97,000 acre Grassland Drainage Area into the San Luis Drain effectively circumventing the wetland complex serviced by the Grassland Water District. Since the Grassland Bypass Project the District has been able to recapture its entire operational spill and return flows from the South Grassland area (20,538 acres) for the reuse in the North Grassland area. Many of the drainage subareas currently flow through other conveyance and wetland unit areas. The entire southern portion of the District (20,538 acres) flows into the Santa Fe Canal. These flows can be mixed with deliveries from the San Luis Canal and the Cross Channel to dilute salts and constituents and reused in the northern portion of the District.

Although there are currently no recover systems in place to move water back upstream in the North Grasslands area, operational spill leaving impoundments do re-enter conveyance for delivery downstream. All discharges leaving the District enter natural riparian areas and therefore are beneficial since the natural flow of most of these streams and tributaries have been diverted by upstream water projects. Seven of the eight discharge sites flow directly into State or Federal Refuges. Under a cooperative agreement with Reclamation the District prepared a project feasibility assessment report (PFAR) for the North Grasslands Water Conservation and Water Quality Control Project (Project) to be located in the northern portion of the District. Based on the findings and recommendations of the PFAR the District worked with Reclamation to develop and complete the required environmental documentation and design of the Project. A small portion of the Project was constructed in 2017 as part of a larger culvert replacement project on the Santa Fe Canal. The remainder of the Project is scheduled to be completed by September 2019. This project will result in the average annual recovery and reuse of approximately 15,000 acre- feet of water.

Unit name	*Current acres*	*Reason for change*	*Proposed acres*	*Estimated cost (in $1,000s)*		
				2017	*2018*	*2019*
*NGWCWQCP	0	Water Conservation	7,778	600	10,000	5,000

*North Grasslands Water Conservation and Water Quality Control Project

5. *Groundwater*
   Describe groundwater availability, quality and potential for use

The District is currently implementing a groundwater acquisition project in conjunction with BOR to develop groundwater from privately owned wells to augment currently available Incremental Level 4 water supplies. For additional information on groundwater in the region, see BOR July 2004 "Evaluation of

Groundwater Potential for Incremental Level 4 Refuge Water Supply". Current groundwater availability is limited by funding and water quality constraints. The quality of the District's groundwater highly variable, with TDS levels ranging from approximately 790-1630, as observed in the wells under current agreement with Reclamation.

In addition, the District has implemented several groundwater exchange projects with local CVP contractors in which Level 2 refuge water is exchanged for a greater volume of groundwater. In 2017, the District received 100% of its level 2 and level 4 supplies, so no groundwater exchanges were made.

Groundwater plan *No* ________ *Yes* __X__ *(Attachment #11)*

Groundwater basin(s) that underlie the Resource Conservation District

Name of basin underlying Resource Conservation District	*Size (sq. mi.)*	*Usable capacity (AF)*	*Safe yield (AF/Y)*	*Management agency*	*Relevant reports*
San Joaquin	13,500	80,000,000	Unknown	None	USBR 2004 GW

Identify Resource Conservation District -operated ground water wells[1]

#	*Location/Name*	*Status*	*HP*	*2017 (AF/Y)*	*Future plans*
1	M-3	Operational	N/A	0	Continue to utilize
2	M-4	Operational	N/A	0	Continue to utilize
3	M-5	Operational	N/A	0	Continue to utilize
4	R-1	Operational	N/A	48	Continue to utilize
5	R-2	Operational	N/A	0	Continue to utilize
6	LT-1	Operational	N/A	166	Continue to utilize
7	ABAR-1	Operational	N/A	0	Continue to utilize
8	BS-1	Operational	N/A	0	Continue to utilize
9	BS-2	Operational	N/A	0	Continue to utilize
10	MUR-1	Operational	N/A	0	Continue to utilize
11	ORN-1, 2	Operational	N/A	0	Continue to utilize
12	ORN-3	Operational	N/A	0	Continue to utilize
13	ORN-4	Operational	N/A	0	Continue to utilize

14	ORN-5	Operational	N/A	0	Continue to utilize
15	ORN-6	Operational	N/A	0	Continue to utilize
16	RW-1	Operational	N/A	0	Continue to utilize
17	RW-4	Operational	N/A	0	Continue to utilize
18	RW-10	Operational	N/A	0	Continue to utilize
19	CZ2, CZ3	Operational	N/A	0	Continue to utilize
20	H, K, CVW1, CVE3-4	Operational	N/A	0	Continue to utilize
21	V-1, 2	Operational	N/A	0	Continue to utilize
22	SOU-1	Operational	N/A	92	Continue to utilize

[1] **All acquired groundwater is developed from privately operated wells.**

In addition, the District has formed the Grassland Groundwater Sustainability Agency (GGSA) to comply with California's Sustainable Groundwater Management Act. The District is currently developing its Groundwater Sustainability Plan (GSP) that is required to be adopted by 2020. The GSP will cover the management of groundwater throughout the GRCD and a small amount of land adjacent to the GRCD that works cooperatively with the District in developing refuge water supplies.

Section E - Environmental Characteristics

1. Topography - describe and discuss impact on water management

The topography in this region was created by natural flows from the floodwaters of the San Joaquin River. In the late 1800's cattle became the primary source of income from the land with duck hunting as a secondary activity. In the 1920's duck hunting began to become more prevalent and by the 1950's duck hunting became the predominant use of the land. Clubs began to develop shallow open water to attract wintering waterfowl. Currently there are 188 individual clubs that rely on gravity flow water to operate and maintain year-round wetland habitat for wildlife. There is 65 feet of elevation fall from the southern boundary of the District to the northern boundary, an approximate distance of 26.6 miles. The District still relies on canals that were built in the late 1800's and are quite efficient. The District is entirely gravity flow with central, natural sloughs flowing through the District to provide drainage.

2. Soils - describe and discuss impact on water management (*See Attachment #6a-6c Soil Survey Maps*)

The northern portion of the District is predominantly made up of Turlock sandy loam. This very deep, very poorly drained soil is on the valley basin rim and on low alluvial fans. It formed in mixed alluvium derived dominantly from granitic rock. Slope is 0 to 2 percent. The micro-relief is hummocky. The characteristic plant community is mainly saltgrass, annual barley, and iodine bush. Elevation is 70 to 110 feet. Typically, the surface layer is grayish brown sandy loam about 3 inches thick. The subsurface layer is olive gray loam about 1 inch thick. The soil is calcareous below a depth of 25 inches, and it has excess lime below a depth of 36 inches. The soil is saline-sodic below a depth of 11 inches.

Mixed throughout this Turlock sandy loam is Triangle clay. This is a very deep, very poorly drained soil within the basin. It formed in mixed alluvium derived dominantly from sedimentary rock. Slope is 0 to 2 percent. The characteristic plant community is mainly swampgrass and alkali heath. Elevation is 80 to 120 feet.

Also found in the north Grasslands is Triangle clay. This very deep, very poorly drained soil is in the valley basin. It formed in mixed alluvium derived dominantly from granitic rock. Slope is 0 to 2 percent. The characteristic plant community is mainly alkali heath, swamp grass, knot grass, spike rush, and iodine bush. Elevation is 70 to 110 feet. Typically the surface layer is olive gray and dark gray clay about 34 inches thick.

Moving southward, north of Los Banos, the general soil makeup is Turmound sandy loam. This very deep, poorly drained soil is in higher lying, ponded areas of the valley basin. It formed in mixed alluvium derived dominantly from granitic rock. Slope is 0 to 2 percent. The characteristic plant community is mainly saltgrass, Baltic rush, rabbitfootgrass, and iodinebush. Elevation is 70 to 80 feet. Typically the surface layer is dark grey over gray sandy loam about 13 inches thick. Included in this unit are small areas of Triangle clay and Turlock sandy loam in the higher lying areas.

Areas south of Los Banos are made up of Checker loam. This very deep, somewhat poorly drained soil is in higher lying, ponded areas in the valley basin. It formed in mixed alluvium derived dominantly from sedimentary rock. Slope is 0 to 2 percent. The characteristic plant community is mainly saltgrass, Spanish broam, Mediterranean barley, and alkali heath. Elevation is 100 to 110 feet. Typically, the upper 4 inches of the surface layer is grayish brown loam.

Directly east and southeast of Los Banos the soils are mixed with Agnal clay loam and El Nido sandy loam, wet. The Agnal clay loam is very deep, very poorly drained soil in the valley basin. It formed in mixed alluvium derived from Igneous and/or sedimentary rock mixed alluvium. Slope is 0 to 2 percent. The characteristic plant community is mainly saltgrass, iodinebush, and alkali heath. Elevation is 60 to 110 feet. Typically, the upper 2 inches of the surface layer is gray clay loam and the lower 7 inches is dark gray clay. The El Nido sandy loam, wet, is very deep, poorly drained soil in higher lying, ponded areas in the valley basin. It formed in mixed alluvium derived dominantly from granitic rock. Slope is 0 to 2 percent. The characteristic plant community is mainly saltgrass, barley, and alkali sacaton. Elevation is 75 to 110 feet. Included in this unit are small areas of Bolfar clay loam, hummocky, and Dos Palos clay ("Soil Survey of Merced County, CA, Western Part", USDA, Soil Conservation Service – Issued March 1990).

The habitat diversity coupled with and responding to the varieties of soils found within the grassland area imposes challenges in water management. Sandy soils, like the Turlock sandy loam, that is predominant in the northern portion of the District, can cause the greatest amount of seepage losses. The historic delivery of irrigation water imported large deposits of silt that has help seal canals and reduce seepage in District facilities. No attempts have been made to line District facilities since natural earthen channels are more favorable to wildlife and shallow groundwater recharge. Once groundwater saturation is reached, usually occurring in late November through March of the following year, seepage losses are minimal.

Soil Series Name	Soil Classification	Parent Material
Agnal	Fine, smectitic, thermic Typic Aquisalids	Igneous and/or sedimentary rock mixed alluvium
Bolfar	Fine-loamy, mixed, superactive, calcareous, thermic Cumulic Endoaquolls	Granitic mixed alluvium
Checker	Fine-loamy, mixed, active, thermic Calcic Aquisalids	Sedimentary rock mixed alluvium
Dos Palos clay	Fine, smectitic,calcareous, thermic Vertic Endoaquoll	Granitic mixed alluvium
El Nido	Coarse-loamy, mixed, superactive, thermic Typic Endoaquolls	Granitic mixed alluvium
Tirangle clay	Fine, smectitic, thermic Sodic Epiaquert	Granitic mixed alluvium
Turlock sandy loam	Fine-loamy, mixed, superactive, thermic Albic Natraqualfs	Sedimentary rock mixed alluvium
Turmound	Fine-loamy, mixed, superactive, thermic Glossic Natraqualfs	Granitic mixed alluvium

Soil Series Name	K_{sat}	$CaCO^3$	EC_e	SAR	pH	AWC	Depth to water table
	(in/hr)	(max)	dS/m	(max)		(in)	(ft)
Agnal clay loam	0.00 - 0.06	3%	16.0 - 99.0	300	8.0 - 8.8	2.4	0
Bolfar	0.20 - 0.57	5%	0.0 - 8.0	-	8.0	8.6	3.0 - 5.0
Checker loam	0.06 - 0.20	40%	10.0 - 100.0	60	8.0 - 8.5	3.1	3.0 - 4.0
Dos Palos clay loam	0.06 - 0.20	15%	2.0 - 16.0	-	8.0	9.5	3.0 - 5.0
El Nido sandy loam	1.98 - 5.95	0	0.0 - 2.0	-	8.0 - 8.3	6.6	3.5
Tirangle clay	0.00 - 0.06	10%	1.0 - 16.0	30	8.0 - 9.2	5.4 - 6.8	-
Turlock sandy loam	0.00 - 0.06	15%	15.0 - 35.0	35	7.4 - 8.6	4.4	-
Turmound sandy loam	0.06 - 0.20	5%	8.0 - 16.0	45	8.0 - 8.5	4.5	1.5 - 2.5

3. Climate

Western Regional Climate Center, Los Banos, Ca. (045118)

	Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Annual*
avg precip-1	1.93	1.97	1.65	0.63	0.44	0.07	0.04	0.05	0.28	0.56	1.11	1.22	9.95
avg. temp-1	45.9	51.5	55.7	60.6	67.2	73.4	78.1	77.1	73.1	65.1	53.4	45.3	62.2
max temp-1	54.9	62.4	67.5	74.1	81.6	89.0	94.6	93.5	88.8	79.6	65.3	55.1	75.5
min temp-1	36.8	40.5	43.9	47.0	52.7	57.7	61.5	60.6	57.3	50.6	41.4	35.4	48.8
ET_{O-2}	1.08	1.98	3.95	5.61	7.84	8.53	8.30	7.24	5.65	3.93	1.75	1.18	57.05

1=Weather Station ID: WRCC Los Banos. Date Period: 1970 to 2000

2=Weather Station ID: CIMIS Panoche. Date Period: 1996 to 2006

Discuss the impact of climate, and any microclimates, on water management

During the high ET_O observed in the summer and early fall months the wetlands require a much higher rate of water application relative to the same areas flooded and maintained over the winter. Additionally, northern prevailing winds, high winds and winds out of the Pacheco Pass raise ET_O during the spring months. Summer water ponds are maintained at depths to prevent unwanted vegetation from invading the wetlands. Ponds flooded at shallower depths must be disked on an annual basis and kept dry every other year to control invasive vegetation. The southern portion of the District experiences less precipitation during rain events relative to the north grasslands due to the rain shadow of the coast range. Water managers account for these differences in precipitation and make adjustments in the conveyance and pond levels accordingly.

4. *Water quality monitoring (attach water quality test result forms Attachment #7)*
   If the refuge has a water quality monitoring program complete this table

Analyses performed	*Frequency range*	*Concentration range*	*Average (mean)*
Selenium (mg/L)	Monthly	ND	ND
TDS (mg/L)	Continuous	183-1,525	793
Boron (mg/L)	Monthly	1.0-2.0	1.5
EC (uS/cm)	Continuous	300-2,500	1,300

Discuss the impact of water quality on water management

The major water quality constituents of concern in the GRCD include selenium, boron, and salt. In the current Basin Plan, the Regional Water Quality Control Board (RWQCB) objective for selenium in the Grassland Watershed Wetland Channels is 2 ppb (monthly mean). Since CVPIA, TDS levels of the District's fall and winter water supply have ranged from 130 ppm to 1,500 ppm with a mean of 582 ppm. The elevated TDS levels usually occur during summer months at a time when there is minimal flow moving through the District's conveyance.

Although the Grassland Bypass Project removed the majority of drain water flows from the wetland water supply channels, the District does receive operational spill from adjacent irrigation districts. These additional flows are of good quality and do not exceed RWQCB water quality objectives.

The RWQCB's 2 ppb monthly mean objective for selenium has seldom been observed through instantaneous grab sampling within the District's conveyance at times of limited or no flow or during extremely heavy rain events. During times of limited to no flow selenium enriched shallow groundwater can accrete into the unlined canal system. Once the conveyance is charged, selenium concentrations fall below the RWQCB objective monthly objective of 2 ppb. The District's ability to utilize fresh water dilution flows is an integral component in meeting the RWQCB water quality objectives.

Occasionally selenium and salt enriched flood waters from Grassland Basin Drainers (GBD) discharges exceed the capacity of the San Luis Drain (SLD) forcing the GBD to utilize the GWD conveyance for flood control to prevent selenium enriched sediment disturbance in the SLD. Since the implementation of the Grassland Bypass Project (GBP), there have been three years where the GBP has reached its maximum capacity and the remaining flood waters beyond the GBP maximum capacity were required to be routed through the District's conveyance. During these instances, all District deliveries were terminated and subsequently required the District's canal system to be flushed with CVP delivery water prior to reestablishing deliveries. The flushing usually requires 100 to 200 acre-feet of water to recharge and clean the system.

Selenium and boron concentrations are relatively low during the fall and winter months when District deliveries are substantial enough to provide adequate dilution flow and prevent shallow ground water from accreting into the conveyance. During spring and summer months, when deliveries are at a minimum, the District can observe elevated EC measurements, however salt load leaving the District during this time is minimal because of the low volume of water being discharged. Drainage water from the District's lands during spring draw down can at times also have elevated EC although recent monitoring indicates the majority of salt load leaving the District occurs during winter storm events. During winter months, operational spill from wetland units is often routed into the delivery conveyance and diluted with fresh water improving the quality in the conveyance and discharges leaving the District.

The District's RTWQMN adds a key tool aiding in decision support to optimize water quality management and water conservation. The District's RTWQMN monitors flow and water quality at 20 key water supply points, inter-conveyance, and drains throughout the District. Use of the RTWQMN, pending RWQCB approval, would allow for the utilization of the Real Time Salt Load Allocation as identified in the RWQCB's Salt and Boron TMDL.

Diversification of the District's Level 2 supply and development of Incremental Level 4 supply could also have an impact on water quality management within the District. Development of groundwater for refuge use is being implemented as a means of providing needed Incremental Level 4 water and to diversify the District's Level 2 supply which benefits both CVP South of Delta Ag Contractors and refuges. Groundwater can contain higher concentrations of salts than project water during certain times of the year. Lower EC project water during times of moderate to high flow can be used to minimize surface water degradation. Conversely the District has observed higher salt concentrations in the surface water than ground water during low flow conditions, due to shallow ground water infiltration into the conveyance. During these low flow conditions deep ground water production has the potential to improve water quality by diluting salts and other constituents.

The District contracts with the Bureau of Reclamation for the delivery of water to both State and Federal wildlife refuges. This contract requires the District to deliver the best quality water that it can provide.

Section F - Transfers, Exchanges and Trades

Provide information on any transfers, exchanges and/or trades into or out of the Resource Conservation District

From whom	To whom	Report year (AF)	Use
GWD	San Luis and Del Puerto WDs	0	Refuge and Ag
GWD	Panoche Water District	0	Refuge and Ag
	TOTAL	0	

The San Luis Water District (SLWD) and the Del Puerto Water District (DPWD) entered into an agreement with BOR for the exchange of groundwater provided to GWD by the Districts for GRCD Level 2 refuge water on an unequal exchange rate. For every two AF of groundwater delivered to GWD, combined SLWD and DPWD received one AF of Level 2 water in the San Luis Reservoir. A total of 0 AF of groundwater was delivered to GWD in exchange for 0 AF of Level 2 water made available to the Districts in Water Year 2017.

Panoche Water District (PWD) also entered into an agreement with BOR for the exchange of groundwater provided to GWD by PWD for GRCD Level 2 refuge water on an unequal exchange rate. For every two AF of groundwater delivered to GWD, PWD received one AF of Level 2 water in the San Luis Reservoir. A total of 0 AF of groundwater was delivered to PWD in exchange for 0 AF of Level 2 water made available to the PWD in Water Year 2017.

Section G - Water Inventory

See Attached Tables, 5 Year update only.

Section H - Critical Best Management Practices

Describe the 3-year implementation plan and the proposed 3-year funding budget.

1. *Management programs*

   a. *Education*

Program	*Estimated cost (in $1,000s)*		
	2017	*2018*	*2019*
Landowners Meeting (information)	5	5	5
Grassland Environmental Education Center	100	100	100
District Website	15	3	3

Describe the specifics of each program (number of participants, topics, purpose, etc.) and attach program materials, if available.

The District conducts an annual Landowner's Meeting in the spring of each year for the purpose of informing its customers about current issues. Presentations cover a wide range of topics from current and pending legislation to water quality issues and wetland management. Water conservation techniques are often presented to the landowners with the purpose of encouraging them to employ best water management practices and to introduce them to new products and ideas designed to improve water deliveries and water use efficiency. Attendance may range from 80 to 150 landowners and concerned individuals (*See Attachment #8 2017 Landowner Meeting Agenda*).

In conjunction with the Department of Fish and Wildlife, the District sponsors the Grassland Environmental Education Center (GEECe) for the purpose of educating elementary school students and others about the benefits of wetlands and the valuable role that agriculture can play in the conservation of wildlife habitat. In 2017, 4,680 students and 1,365 adults were given a hands-on introduction to wildlife and wetland habitat. The District and DFW jointly fund a full-time interpreter to coordinate and conduct education classes at a designated wetland site (*See Attachment #9 GEECe Program Flier*).

The District created a website designed to update and inform its landowners and others on current water issues and other important topics. Topics range from current water status to legislative updates. Other topics include conservation programs, wetland enhancement programs, water quality regulation, water quality monitoring, and other wetland water issues (*See Attachment #10 Grassland Water District Website at gwdwater.org*).

   b. *Water quality monitoring*

Type of water	*Existing Estimated cost (in $1,000s)*		
	2017	*2018*	*2019*
Surface Water	10	10	10
Groundwater	30	30	30

Short description of existing or planned program – i.e., required by which agency, coordinated with whom, constituents monitored and frequency.

Since the mid 1980's the District has collected and recorded water quality data on surface inflows and drainage leaving the District. Inflow sites continue to be monitored throughout each water year for TDS, EC, boron and selenium. The grab sampling occurs on a monthly basis at major drainages and at delivery locations to State and Federal Refuges temporarily coinciding with the monthly Irrigated Lands Regulatory Program Ag Waiver sampling efforts. The DFW conducts and shares weekly EC measurements from 19 supply and drainage locations to the Los Banos Wildlife Area and Volta Wildlife Area. Additionally DFW collects groundwater elevation data from monitoring wells on a weekly basis on the Mud Slough Unit of the Los Banos Wildlife Management Area. The District's RTWQMN consists of 20 monitoring stations located at key inflow, delivery and drainages continuously measuring flow, EC, temp, and pH (*See Attachment #5e*).

c. Cooperative efforts

The District, in cooperation with the State Water Resource Control Board, CALFED Bay Delta ERP, the DFW, the Department of Water Resources, UC Davis, and UC Merced investigated Wetland Responses to Adaptive Salinity Drainage Management. The proposed modified hydrology delayed the drainage from the wetland complex to match the assimilative capacity in the San Joaquin River during the flow releases of the Vernalis Adaptive Management Program. This investigation found significant degradation in both seed and biomass production in response to a proposed delayed draw down of seasonal wetlands due to less than optimal germination temps and a shortened growing season. Furthermore the delayed drainage hydrology required significantly more water to maintain the ponds and cause water quality and soil degradation.

Additionally, the District is currently in a cooperative agreement, in cooperation with the DFW and the U.S. Fish and Wildlife Service, to further characterize flow and water quality entering, conveyed within, and leaving the wetland complex. Preliminary findings indicate that the majority of salt loading to the river from the wetland complex is associated with winter storm events and not wetland draw down. The RTWQMN and the aforementioned flow and water quality assessment has fostered the development of a Decision Support System allowing water and wetland mangers to maximize water quality through the mixing of flows from drainage subareas of variable water quality with CVP supplies.

The District is a participant in the Westside San Joaquin River Watershed Coalition's program to implement the requirements of the Central Valley Regional Water Quality Control Board's Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands. Additionally, the District contributes a semi-annual water quality report to the State Board characterizing flow and salt load at the major drainages leaving the District.

The District also participates in other cooperative efforts with numerous agencies to promote more efficient and effective wetland and water management practices. For additional information see Section 1.f. below.

d. Pump evaluations (mobile labs)

Total number of groundwater pumps on Resource Conservation District ______No District owned wells______

Total number of surface water (low-lift) pumps on Resource Conservation District ___None__

Groundwater pumps	*Estimated cost (in $1,000s)*		
	2016	*2017*	*2018*
# of groundwater pumps tested	NA	NA	NA
# of pumps to be fixed or replaced	NA	NA	NA
# of low-lift pumps to be tested	NA	NA	NA
# of pumps to be fixed or replaced	NA	NA	NA

e. Policy evaluation

The District's Board of Directors has formed a Water Management Committee to review and update the District's water conservation policies. This committee reports monthly to the Board of Directors, at their regularly scheduled meeting, and may present proposed modifications or additions to the existing policies for consideration or adoption by the Board.

The ability of districts and refuges to share or transfer waters among agencies would be very valuable. If agricultural districts could trade and transfer water with refuge supplies, without undue paperwork, there could be huge savings in overall water use. Carryover water could be used by Ag and returned at a more desirable time for wetlands.

f. (GRCD only) *Provide Customer Services - Facilitate physical/structural improvements for member units; provide management services and technical advice to raise funds for BMP Implementation and provide customers with water efficiency education programs.*

Service	Number of units needing assistance	Number of units to be assisted yearly	Proposed schedule	Estimated cost
Facilitate physical /structural improvements for member units	5% to 7.5%	8 to 12	None	Billed to customer
Provide management services, technical advice	5% to 7.5%	8 to 12	None	Approx. 20 hrs. staff time
Facilitate fundraising	5%	8	None	10 hrs

The District cooperates with wetland related organizations that provide direct services to its customers. These services include installation of water control structures, development of drainage swales, habitat improvements, water efficiency improvements and water management techniques. Organizations that assist landowners include Ducks Unlimited, California Waterfowl Association, Natural Resource

Conservation Service, Wildlife Conservation Board, U.S. Fish and Wildlife Service and DFW. These agencies are instrumental in writing grants for wetland habitat improvements.

2. *(GRCD only) Pricing structure*

The District has established current pricing on its spring and summer water deliveries on a per acre-foot basis. This water may also be referred to as optimum habitat water (Incremental Level 4). The present rate is set to encourage the use of the water since the ultimate goal is to produce the best quality habitat for brooding and wintering waterfowl. The water delivered for fall habitat (Level 2) is charged on a per acre basis and is designed to promote the full usage of this water for the benefit of the resource (See Attachments 4a and 4b - Sample Water Bills).

3. *(GRCD only) Plan to measure deliveries*

The District has installed 20 Real-Time Water Quality Monitoring Stations including flow measurement devices within the past 8 years and is presently evaluating their performance for effectiveness and dependability. Depending on funding, immediate expansion of the RTWQM Network is planned at 3 key locations on the Santa Fe Canal, Garzas Creek and Mosquito Ditch. The Garzas Creek proposed monitoring station is a major supply to North Grassland wetland habitats from Central California Irrigation District. The Santa Fe Canal @ Hwy 165 monitoring station would quantify flow and salt load downstream of the San Luis Canal/ Santa Fe Canal confluence, a key drainage and delivery location in the GWD. The Mosquito Ditch at Volta Wildlife Area Pond 10 is a major delivery location from the San Luis and Delta-Mendota Water Authority to GWD.

The District has developed a personal data assistant (PDA) with the ability to run “submerged orifice” water formulas. The program is derived from “Brater & King, Handbook of Hydraulics”. District water tenders will measure the head differential between upstream and downstream at customer delivery gates and calculate a daily average flow for the customer. Staff gauges are presently used throughout the district to keep track of water surface elevations for the purpose of consistency and accuracy.

The District has also developed a customer delivery system that will catalog all customer delivery gates, by number, and account for all water delivered. Each delivery system will contain all pertinent information needed for an accurate measurement. Gate size, pipe length, roughness coefficient and acreage are included in the program. To compliment this program and to improve on the accuracy, the District will be evaluating its delivery system to establish which areas can be improved by the installation of water elevation sensors. These sensors will improve the recording of accuracy levels and should result in a +/-6% targeted result.

Along with this measurement system, the District is in the process of identifying and calculating the actual acreage serviced by each individual customer turnout. This will allow the water tenders to better estimate water needs and thus reduce the possibility of over-watering areas. This will also help in determining a proper amount of maintenance water that will be needed during the late fall and wintering season.

The recording of data involved in the water delivery system will ultimately benefit the overall water efficiency of the District. The additional data, such as acres served and projected water requirements, will be at the water tender’s fingertips, readily accessible through the use of the PDAs.

The District is always exploring new innovations in water measurement to see if they can be adapted into the District’s delivery system.

Location	*Measurement devices to be installed*	*Accuracy*	*Estimated Cost*	*Planned installation date*				
				2016	*2017*	*2018*	*2019*	*2020*
Garzas Creek	1– Doppler	+/- 5%	$29,000			*X*		
Santa Fe Canal –Hwy 165	1 – Doppler	+/- 5%	$29,000			*X*		
Mosquito Ditch	1 – Doppler	+/- 5%	$29,000			*X*		

4. Water management coordinator

Name: Michael A. Gardner Title: Watermaster

Address: 200 W Willmott Ave, Los Banos, Ca. 93635

Telephone: 209-704-5394 E-mail: mgardner@gwdwater.org

Section I - Exemptible Best Management Practices

Describe the 5-year implementation plan and the proposed 3-year funding budget.

1. *Improve management unit configuration*

Unit name	*Current acres*	*Reason for change*	*Proposed acres*	*Estimated cost (in $1,000s)*		
				2017	*2018*	*2019*
*NGWCWQCP	0	Water Conservation	7,778	600	10,000	5,000

*North Grasslands Water Conservation and Water Quality Control Project

(GRCD only) Assist customers to improve management unit configurations.
The GRCD works with Ducks Unlimited, California Waterfowl Association, and its landowners to secure funding for habitat improvements through grants.

2. *Improve internal distribution system*

a. *New control structures within distribution system*

Proposed location	*Type of structure*	*Reason for new structure*	*Estimated cost (in $1,000s)*		
			2017	*2018*	*2019*
Santa Fe Canal-Men	Pipe Replacement	Improve Delivery	6.4		
Rubino Ditch	Pipe Replacement	Improve Delivery	5.9		
Santa Fe Canal-L11	Pipe Replacement	Improve Delivery	4		
Los Banos Creek-LT	Weir Replacement	Improve Delivery	75		
Santa Fe Canal @ Gun Club Road	Pipe Replacement	Improve Delivery	580		
Kesterson Ditch	Weir Replacement	Improve Delivery	8		
Agatha Extension	Weir Replacement	Improve Delivery	8		
Mud Slough @ Arroyo Canal	Pipe Replacement	Improve Delivery		100	
Gadwall Unit	Replace Pipe	Improve Delivery		60	
LBC/Wallie Ditch	Pipe/Gate Replace	Improve Delivery		6	
Eagle Ditch	Pipe/Gate Replace	Improve Delivery		6	
Wallie Ditch	Weir	Improve Delivery		8	
Almond Drive	Pipe	Improve Delivery		1	
Porter Blake Bypass	Overshot Gates	Improve Delivery			200
SFC/Skeleton Weir	Weir Replacement	Improve Delivery			200
SLC/SL-3	Over Shot Gate	Improve Delivery			200
SFC/SLC	Over Shot Gate and Pipe	Improve Delivery			300
SFC/SF-2	Over Shot Gate	Improve Delivery			200
Mosquito Ditch	Replace Weirs	Improve Delivery			100
Los Banos Creek	Replace Weir	Improve Delivery			100
Gadwall Unit	Pipe	Improve Delivery			100

All aforementioned projects will be based on a yearly budget and potential grant funding!!

b. *Line/pipe sections of distribution system*

Proposed reach/sect.	*Reason for new structure*	*Estimated cost (in $1,000s)*		
		2017	*2018*	*2019*
None				

Pipelines are not in the District's immediate plans. There is a direct habitat benefit in maintaining open, unlined delivery systems in that they provide additional habitat to a variety of wildlife. In dry summer months, open canals and ditches are sometimes the only source of deep water available to brooding waterfowl and provide their only means of escape from predators. Nevertheless, certain conditions may warrant the installation of pipelines as a part of future projects. For example, if construction of an open ditch would interfere with access or if it was predetermined that extreme seepage losses would occur, the District would consider installing pipelines.

c. Independent water control for each unit

Each unit, private land owner or refuge, is required to maintain their own independent water control system, however the District has at times made these types of improvements. An example would be the District replacing a major water control structure within its canal system and moving or installing a new structure for the landowner as part of the project. These types of changes are usually done to improve water delivery and efficiency.

The District has only a few units that do not have independent water control structures. The long-term goal of the District is to ultimately provide independent systems for all units. The District is always striving to extend delivery systems to accomplish this goal. Because the extension of facilities requires easements from one or more landowners, who may not directly benefit from the project, it sometimes proves difficult to accomplish these goals.

Proposed control point	*Reason for new control point*	*Estimated cost (in $1,000s)*		
		2017	*2018*	*2019*
NA				

d. New internal distribution sections (pipe, canal) to provide water to existing and new habitat units

Proposed new section	*Units served*	*Reason for new section*	*Estimated cost (in $1,000s)*		
			2017	*2018*	*2019*
NA					

(GRCD only) Provide assistance to member units to improve internal distribution
The GRCD provides technical assistance to its landowners for the purpose of correctly sizing water control structures.

Develop a Water Use Schedule

Plan element	*Completion date*	*Estimated development/update cost (in $1,000s)*		
		2017	*2018*	*2019*
Flood up dates by unit		2	2	2
Drawdown dates by unit		NA	NA	NA
Irrigation dates by unit		2	2	2

4. *Plan to measure outflow*
   Identify locations, prioritize, determine best measurement method/cost, submit funding proposal

	Estimated cost (in $1,000s)		
	2017	*2018*	*2019*
Identify locations	NA		
Estimate outflow quantity/rank	NA		
Develop plan	NA		
Estimate construction start date	NA		
Estimate construction completion date	NA		

5. *(GRCD only) Incentive pricing*

   The District does not have an incentive pricing structure applied to its water delivery. The District controls water efficiency by monitoring intake and drainage areas. The District has been working on refinement of water delivery to individual customers for the sole purpose of improving water efficiency. Monitoring and recording water delivery to a private unit can prove to be the most efficient method of controlling customer discharge throughout the year. The District charges $4/AF for Incremental Level 4 supply and $21.75/Acre for Level 2 supply.

6. *Construct and operate operational loss recovery systems*

   See Section "D" number 4.

7. *Optimize conjunctive use of surface and groundwater*

Proposed production/injection well	*Anticipated yield*	*Estimated cost (in $1,000s)*		
		2017	*2018*	*2019*
N/A				

   The District is currently developing and utilizing groundwater to supplement limited water supplies under its previously described acquisition and exchange agreements with Reclamation. Reclamation acquired a total of 306 AF of groundwater in Water Year 2017 for delivery to the GRCD. The District has worked with BOR to develop a long-term groundwater acquisition program that will include all of the previously mentions programs that will allow the District to utilize up to 29,000 AF per year of groundwater which is the estimated amount of annual recharge that occurs from the District's conveyance system alone. This estimate of annual recharge attributed to the water imported and delivered by the District does not include the estimated recharge that occurs from the flooding and holding of water in the managed wetlands of the District for 8 to 9 months every year.

8. *Facilitate use of available recycled urban wastewater that otherwise would not be used beneficially, meets all health and safety criteria, and does not cause harm to wildlife management goals.*

   The District supports the development and implementation of the North Valley Regional Recycled Water

Project (Project) that could develop up to 16,000 AF of water for refuge use. Reclamation has entered into an agreement with Del Puerto Water District (DPWD) and has contributed $25 million to fund a portion of the Project in exchange for a share of the developed water supply for the SOD CVPIA refuges (refuges). The Project would deliver recycled water from the wastewater treatment plants of the cities of Turlock and Modesto to the Delta-Mendota Canal for delivery to DPWD and the refuges. The Project is currently in the testing phase and deliveries should start in early 2018.

9. *Mapping*

GIS map layers	*Estimated cost (in $1,000s)*		
	2017	*2018*	*2019*
Map 1 – Distribution System	5	5	5
Map 2 – Drainage System	5	5	5
Map 3 – Habitat Types	5	5	5

10. *CALFED Quantifiable Objectives*

Describe any past, present, or future plans that address the goals identified for this Resource Conservation District If reducing nonproductive ET involves removing invasive plants, complete the following:

Invasive unwanted species name	Estimated acres			***Estimated cost (in $1,000s)***		
	2017	*2018*	*2019*	*2017*	*2018*	*2019*
Water Hyacinth	80	80	80	25	25	25
Water Primrose	80	80	80	25	25	25
South American Sponge Plant	80	80	80	25	25	25

San Luis NWR, Grassland Resource Conservation District

1. *Describe actions that reduce salinity in the San Joaquin River, Grassland Marshes and Mud and Salt Sloughs. (TB 95, 96, 98)*

The potential for the reduction of salinity load released from the wetland complex to the San Joaquin River is limited. The productivity of the wetland complex is dependent on a cycle of flooding, maintenance flows and drainage to flush salts imported by supplies to maintain soil salt concentrations conducive to beneficial vegetation productivity. The District, in cooperation with the State Water Resource Control Board, CALFED Bay Delta ERP, the California Department of Fish and Wildlife, the Department of Water Resources, UC Davis, and UC Merced investigated Wetland Response to Adaptive Salinity Drainage Management. This investigation found significant degradation in both seed and biomass production in response to a delayed draw drown of seasonal wetlands focused on matching assimilative capacity in the San Joaquin River when implemented for two consecutive years. Additionally, the District is currently in a cooperative agreement with Reclamation, in cooperation with the DFW and the U.S. Fish and Wildlife Service to characterize flow and water quality entering, translocation within, and leaving the wetland complex. Preliminary findings indicate that the majority of salt loading to the river from the wetland complex is associated with winter storm events and not wetland draw down. The Real Time Water Quality Network and the aforementioned flow and water quality assessment has fostered the development of a Decision Support System allowing water and wetland mangers to maximize water quality through the mixing of flows from drainage subareas of variable water quality with CVP supplies. This network also allows managers to minimize operational spill by reducing supply deliveries ultimately saving water for use at other times. Accurate flow measurements now insure that deliveries are accurate and accounted for. Additionally, development of water and salt balances at the impoundment level will facilitate the establishment of regional wetland water requirements and models describing the transport of salt through the wetland complex and the characterization of drainage subareas.

2. *Describe actions that reduce salinity in the Grassland Marshes and Mud and Salt Sloughs. (TB 102, 103, 104*) *(All of these six contaminant TBs could be incorporated into one* Resource *Conservation District manager response, e.g. addressed through the Grassland Drainage Program.*

The removal of salts imported to this area would have the most pronounced effect on salinity reduction. The most obvious method of reducing the amount of salt imported into the area would be to replace the water imported from the Delta with cleaner water from the eastside of the valley. (See previous section for Water Quality Decision Support through the RTWQMN).

3. *Describe actions that reduce nonproductive ET. (TB 107)*

How the District moves water can produce beneficial results in achieving a reduction in the amount of water lost to evapotranspiration (ET). Timing of water deliveries is part of the District's operation plan that helps promote water conservation. Also, the use of aquatic herbicides to control invasive aquatic plants has a huge positive effect on reducing water losses. Clean, vegetation-free canals allow for a quicker, more efficient delivery of water. Vegetation control within the private management units requires cooperation between District and landowners. The District has had success with consulting and advising private landowners on which plants to avoid and/or remove from their property. The District also advises landowners on which herbicides are effective and how to best manage invasive plants. The District also has, as a part of its water delivery policy, a requirement that all clubs must maintain intake structures and intake delivery waterways free of vegetation that will impair the flow of water and thereby contribute to undue water losses.

Section J - BMP Exemption Requests

For each BMP for which the refuge is seeking an exemption, provide a detailed narrative and complete the summary table

Summary of BMP exemptions

BMP	*Constraint*[1]	*Outstanding Need*[2]
		N/A

1. *Constraint – list existing constraint. Use additional rows for multiple BMPs or constraints. Identify Legal (L), Environmental (EN), or Economic (EC) issues using code. If the BMP is not seen as beneficial, provide detailed information*
2. *Outstanding need – identify assistance required to implement the BMP. State specific funding or other assistance required*

Provide a detailed exemption request below for each BMP listed in the summary table

Non-Applicability (N/A) of Exemptible BMPs

To establish that a BMP is not applicable to the Refuge, the Plan should explain the reasons why the BMP does not apply to the Refuge. This justification must be consistent with Section A of the Criteria titled, "Background." Examples of non-applicability for each exemptible BMP are listed below. This list is not all-inclusive.

Section I, B. Exemptible Best Management Practices

2. *Improve the Distribution System*
   b. Line/pipe sections of distribution system
   N/A if the Current system can distribute water effectively with regular maintenance and on-going improvements to open channels – thus maximizing habitat.

3. *Construct and operate operational loss recovery systems*
   See Section I.6.

4. *Optimize conjunctive use of surface and groundwater N/A*
   See Section I.7.

5. *Facilitate use of available recycled urban wastewater that otherwise would not be used beneficially, meets all health and safety criteria, and does not cause harm to wildlife management goals.*

   See Section I.8.

Data, including estimated habitat acreages and water requirements for optimal production and maintenance, included in this document and associated tables are referenced from the San Joaquin Basin Action Plan/Kesterson Mitigation Plan Report (1989) and Report on Refuge Water Supply Investigations (1989), developed by the Bureau of Reclamation, Fish and Wildlife Service, and the Department of Fish and Wildlife. Precipitation data was drawn from local weather stations and may be unrepresentative given the expansive distribution of the CVPIA wetlands. Evaporation and seepage data were derived from gross estimates and are unrepresentative of actual conditions given the high variability in vegetation and soil type. Furthermore, estimated applied acre-feet per wetland acre data was calculated based on the aforementioned assumptions and water delivery estimates. Given the inherent numerous assumptions utilized to generate the data included in this document and associated tables, this information is not intended for any other purpose and should not be used without the written consent of the author agencies.

Appendix D – Projected Water Budget

Land Surf Descriptio	Surrogate Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
	Actual Year	2014*	2015*	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030*
	Surrogate Water Year Type**	Dry	Dry	Dry	Wet	Normal	Wet	Dry	Wet	Wet	Normal	Dry	Wet	Dry	Dry	Dry	Dry	Dry
Inflows																		
1)	Precipitation	41319	59202	101183	92331	95246	111081	68582	129513	181809	70016	66644	108864	62615	84261	66366	62619	69106
2)	Surface Water Inflows	26368	26368	39168	52864	39168	52864	39168	52864	52864	39168	39168	52864	39168	39168	39168	39168	26368
3)	Applied Water - Groundwater	53200	53200	52100	32700	52100	32700	52100	32700	32700	52100	52100	32700	52100	52100	52100	52100	53200
4)	Applied Water - Surface Water Diversion	160300	160300	233800	265000	233800	265000	233800	265000	265000	233800	233800	265000	233800	233800	233800	233800	160300
5)	Other Direct Recharge	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6)	Other Pumping (M&I)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7)	Projects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Inflows	**281,187**	**299,070**	**426,251**	**442,895**	**420,314**	**461,645**	**393,650**	**480,077**	**532,373**	**395,084**	**391,712**	**459,428**	**387,683**	**409,329**	**391,434**	**387,687**	**308,974**
Outflows																		
1)	Runoff/Outflow	8832	8832	8932	42353	8960	50934	8932	59386	83366	8960	8932	49918	8932	8932	8932	8932	8832
2)	Crop Evapotranspiration	293000	260000	272000	301000	298237	283584	307088	290706	285686	315640	295667	299854	302854	289615	298088	283750	276249
3)	Surface Water Outflows	2884	2884	29984	36582	31384	36582	29984	36582	36582	31384	29984	36582	29984	29984	29984	29984	2884
4)	Deep Percolation	53100	53200	70300	81900	72600	82000	70100	82200	82600	72400	70100	82000	70000	70200	70100	70000	53200
	Total Outflows	**357,816**	**324,916**	**381,216**	**461,835**	**411,181**	**453,100**	**416,104**	**468,874**	**488,234**	**428,384**	**404,683**	**468,354**	**411,770**	**398,731**	**407,104**	**392,666**	**341,165**

Groundwa Descriptio	Surrogate Year	-	-	-	-	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
	Actual Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030*
	Surrogate Water Year Type**	Dry	Dry	Dry	Wet	Normal	Wet	Dry	Wet	Wet	Normal	Dry	Wet	Dry	Dry	Dry	Dry	Dry
Inflows																		
1)	Deep Percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Precipitation Infiltration	500	600	800	800	800	900	600	1100	1500	600	600	900	500	700	600	500	600
	Surface Water Infiltration	32600	32600	45300	55200	47600	55200	45300	55200	55200	47600	45300	55200	45300	45300	45300	45300	32600
	Applied Water Infiltration	8300	8300	45721	7700	20125	20808	7500	20258	42403	7500	7500	7700	7500	22010	7500	10289	8300
4)	Subsurface Groundwater Inflows	30600	30600	25600	25600	25600	25600	25600	25600	25600	25600	25600	25600	25600	25600	25600	25600	30600
5)	Other Direct Recharge (Pond Seepage)	15500	15500	20500	22900	21200	22900	20500	22900	22900	21200	20500	22900	20500	20500	20500	20500	15500
6)	Projects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Inflows	**87,500**	**87,600**	**137,921**	**112,200**	**115,325**	**125,408**	**99,500**	**125,058**	**147,603**	**102,500**	**99,500**	**112,300**	**99,400**	**114,110**	**99,500**	**102,189**	**87,600**
Outflows																		
1)	Groundwater Extraction from Upper Aquifer	47000	47000	52100	32700	52100	32700	52100	32700	32700	52100	52100	32700	52100	52100	52100	52100	47000
2)	Groundwater Extraction from Lower Aquifer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3)	Subsurface Groundwater Outflows	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
4)	Other Consumptive Use of Groundwater	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Flow to Lower Aquifer	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600
	Discharge to Surface Water/Consumptive use by GDEs/Lateral Flow	27900	27900	14400	70000	14400	70000	12500	70000	70000	14400	12500	70000	12500	12500	12500	12500	27900
	Groundwater transferred intra Plan Area	5500	5500	13600	0	13600	0	13600	0	0	13600	13600	0	13600	13600	13600	13600	5500
	Total Outflows	**101,900**	**101,900**	**101,600**	**124,200**	**101,600**	**124,200**	**99,700**	**124,200**	**124,200**	**101,600**	**99,700**	**124,200**	**99,700**	**99,700**	**99,700**	**99,700**	**101,900**
Change in Storage																		
	Estimated Annual Change in Groundwater Storage																	
	Inflows	87,500	87,600	137,921	112,200	115,325	125,408	99,500	125,058	147,603	102,500	99,500	112,300	99,400	114,110	99,500	102,189	87,600
	Outflows	101,900	101,900	101,600	124,200	101,600	124,200	99,700	124,200	124,200	101,600	99,700	124,200	99,700	99,700	99,700	99,700	101,900
	Change in Storage	-14,400	-14,300	36,321	-12,000	13,725	1,208	-200	858	23,403	900	-200	-11,900	-300	14,410	-200	2,489	-14,300
	Change in Elevation	-1.15	-1.14	2.89	-0.96	1.09	0.10	-0.02	0.07	1.86	0.07	-0.02	-0.95	-0.02	1.15	-0.02	0.20	-1.14
	Cumulative Change in Storage (2020-2070)							0	858	24,261	25,161	24,961	13,061	12,761	27,171	26,971	29,460	15,160
	Cumulative Change in Elevation (2020-2070)							0.00	0.07	1.93	2.00	1.99	1.04	1.02	2.16	2.15	2.35	1.21
	Cumulative Change in Storage (2014-2070)	0	-14,300	22,021	10,021	23,747	24,954	24,754	25,612	49,015	49,915	49,715	37,815	37,515	51,925	51,725	54,214	39,914
	Cumulative Change in Elevation (2014-2070)	0.00	-1.14	1.75	0.80	1.89	1.99	1.97	2.04	3.90	3.98	3.96	3.01	2.99	4.14	4.12	4.32	3.18

Land Surface Description	Surrogate Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
	Actual Year	2031*	2032	2033*	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
	Surrogate Water Year Type**	Dry	Wet	Dry	Wet	Wet	Wet	Wet	Normal	Normal	Dry	Dry	Normal	Dry	Wet	Wet	Dry	Dry
Inflows																		
1)	Precipitation	87332	135967	75942	147132	114432	117608	224560	71018	92731	91673	66487	90059	83134	141580	103850	44220	76816
2)	Surface Water Inflows	26368	52864	26368	52864	52864	52864	52864	39168	39168	39168	39168	39168	39168	52864	52864	39168	39168
3)	Applied Water - Groundwater	53200	32700	53200	32700	32700	32700	32700	52100	52100	52100	52100	52100	52100	32700	32700	52100	52100
4)	Applied Water - Surface Water Diversion	160300	265000	160300	265000	265000	265000	265000	233800	233800	233800	233800	233800	233800	265000	265000	233800	233800
5)	Other Direct Recharge	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6)	Other Pumping (M&I)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7)	Projects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Inflows	**327,200**	**486,531**	**315,810**	**497,696**	**464,996**	**468,172**	**575,124**	**396,086**	**417,799**	**416,741**	**391,555**	**415,127**	**408,202**	**492,144**	**454,414**	**369,288**	**401,884**
Outflows																		
1)	Runoff/Outflow	8832	62346	8832	67465	52471	53927	102969	8960	8960	8932	8932	8960	8932	64920	47619	8932	8932
2)	Crop Evapotranspiration	287392	288176	284359	282864	307738	306412	277910	287911	298891	297415	297229	290909	301653	282154	302501	314959	299381
3)	Surface Water Outflows	2884	36582	2884	36582	36582	36582	36582	31384	31384	29984	29984	31384	29984	36582	36582	29984	29984
4)	Deep Percolation	53300	82200	53200	82300	82000	82100	83000	72400	72600	70300	70100	72500	70200	82300	82000	69900	70100
	Total Outflows	**352,408**	**469,304**	**349,275**	**469,211**	**478,791**	**479,021**	**500,461**	**400,655**	**411,835**	**406,631**	**406,245**	**403,753**	**410,769**	**465,956**	**468,702**	**423,775**	**408,397**

Groundwater Description	Surrogate Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
	Actual Year	2031*	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
	Surrogate Water Year Type**	Dry	Wet	Dry	Wet	Wet	Wet	Wet	Normal	Normal	Dry	Dry	Normal	Dry	Wet	Wet	Dry	Dry
Inflows																		
1)	Deep Percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Precipitation Infiltration	700	1100	600	1200	900	1000	1900	600	800	800	600	700	700	1200	900	400	600
	Surface Water Infiltration	32600	55200	32600	55200	55200	55200	55200	47600	47600	45300	45300	47600	45300	55200	55200	45300	45300
	Applied Water Infiltration	8300	26610	8300	31828	7700	7700	62710	7500	17483	18189	7500	21614	8747	33460	7700	7500	10497
4)	Subsurface Groundwater Inflows	30600	25600	30600	25600	25600	25600	25600	25600	25600	25600	25600	25600	25600	25600	25600	25600	25600
5)	Other Direct Recharge (Pond Seepage)	15500	22900	15500	22900	22900	22900	22900	21200	21200	20500	20500	21200	20500	22900	22900	20500	20500
6)	Projects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Inflows	**87,700**	**131,410**	**87,600**	**136,728**	**112,300**	**112,400**	**168,310**	**102,500**	**112,683**	**110,389**	**99,500**	**116,714**	**100,847**	**138,360**	**112,300**	**99,300**	**102,497**
Outflows																		
1)	Groundwater Extraction from Upper Aquifer	47000	32700	47000	32700	32700	32700	32700	52100	52100	52100	52100	52100	52100	32700	32700	52100	52100
2)	Groundwater Extraction from Lower Aquifer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3)	Subsurface Groundwater Outflows	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
4)	Other Consumptive Use of Groundwater	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Flow to Lower Aquifer	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600
	Discharge to Surface Water/Consumptive use by GDEs/Lateral Flow	27900	70000	27900	70000	70000	70000	70000	14400	14400	12500	12500	14400	12500	70000	70000	12500	12500
	Groundwater transferred intra Plan Area	5500	0	5500	0	0	0	0	13600	13600	13600	13600	13600	13600	0	0	13600	13600
	Total Outflows	**101,900**	**124,200**	**101,900**	**124,200**	**124,200**	**124,200**	**124,200**	**101,600**	**101,600**	**99,700**	**99,700**	**101,600**	**99,700**	**124,200**	**124,200**	**99,700**	**99,700**
Change in Storage																		
	Estimated Annual Change in Groundwater Stor																	
	Inflows	87,700	131,410	87,600	136,728	112,300	112,400	168,310	102,500	112,683	110,389	99,500	116,714	100,847	138,360	112,300	99,300	102,497
	Outflows	101,900	124,200	101,900	124,200	124,200	124,200	124,200	101,600	101,600	99,700	99,700	101,600	99,700	124,200	124,200	99,700	99,700
	Change in Storage	-14,200	7,210	-14,300	12,528	-11,900	-11,800	44,110	900	11,083	10,689	-200	15,114	1,147	14,160	-11,900	-400	2,797
	Change in Elevation	-1.13	0.57	-1.14	1.00	-0.95	-0.94	3.51	0.07	0.88	0.85	-0.02	1.20	0.09	1.13	-0.95	-0.03	0.22
	Cumulative Change in Storage (2020-2070)	960	8,170	-6,130	6,398	-5,502	-17,302	26,808	27,708	38,790	49,479	49,279	64,392	65,539	79,699	67,799	67,399	70,197
	Cumulative Change in Elevation (2020-2070)	0.08	0.65	-0.49	0.51	-0.44	-1.38	2.14	2.21	3.09	3.94	3.93	5.13	5.22	6.35	5.40	5.37	5.59
	Cumulative Change in Storage (2014-2070)	25,714	32,924	18,624	31,152	19,252	7,452	51,562	52,462	63,544	74,233	74,033	89,146	90,293	104,453	92,553	92,153	94,951
	Cumulative Change in Elevation (2014-2070)	2.05	2.62	1.48	2.48	1.53	0.59	4.11	4.18	5.06	5.91	5.90	7.10	7.19	8.32	7.37	7.34	7.56

Land Surf	Surrogate Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	1965	1966	1967	1968	1969	1970	1971	1972
Descriptio	Actual Year	2048	2049	2050	2051	2052	2053*	2054*	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064
	Surrogate Water Year Type**	Normal	Normal	Wet	Dry	Dry	Dry	Dry	Dry	Wet	Wet	Normal	Wet	Dry	Wet	Normal	Normal	Dry
Inflows																		
1)	Precipitation	62635	125842	126143	95752	91833	63934	45332	64244	126143	90626	75876	118438	58189	163499	81308	84696	38230
2)	Surface Water Inflows	39168	39168	52864	39168	39168	26368	26368	39168	52864	52864	39168	52864	39168	52864	39168	39168	39168
3)	Applied Water - Groundwater	52100	52100	32700	52100	52100	53200	53200	52100	32700	32700	52100	32700	52100	32700	52100	52100	52100
4)	Applied Water - Surface Water Diversion	233800	233800	265000	233800	233800	160300	160300	233800	265000	265000	233800	265000	233800	265000	233800	233800	233800
5)	Other Direct Recharge	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6)	Other Pumping (M&I)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7)	Projects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Inflows	**387,703**	**450,910**	**476,707**	**420,820**	**416,901**	**303,802**	**285,200**	**389,312**	**476,707**	**441,190**	**400,944**	**469,002**	**383,257**	**514,063**	**406,376**	**409,764**	**363,298**
Outflows																		
1)	Runoff/Outflow	8960	8960	57841	8932	8932	8832	8832	8932	57841	41555	8960	54308	8932	74970	8960	8960	8932
2)	Crop Evapotranspiration	314502	294684	303159	308272	298832	294228	295786	309915	303159	310934	321683	310286	318834	308379	322182	308491	311646
3)	Surface Water Outflows	31384	31384	36582	29984	29984	2884	2884	29984	36582	36582	31384	36582	29984	36582	31384	31384	29984
4)	Deep Percolation	72300	72800	82100	70300	70300	53100	53000	70000	82100	81900	72400	82100	70000	82500	72500	72500	69800
	Total Outflows	**427,146**	**407,828**	**479,682**	**417,488**	**408,048**	**359,044**	**360,502**	**418,831**	**479,682**	**470,971**	**434,427**	**483,276**	**427,750**	**502,432**	**435,026**	**421,335**	**420,362**

Groundwa	Surrogate Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	1965	1966	1967	1968	1969	1970	1971	1972
Descriptio	Actual Year	2048	2049	2050	2051	2052	2053*	2054*	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064
	Surrogate Water Year Type**	Normal	Normal	Wet	Dry	Dry	Dry	Dry	Dry	Wet	Wet	Normal	Wet	Dry	Wet	Normal	Normal	Dry
Inflows																		
1)	Deep Percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Precipitation Infiltration	500	1000	1000	800	800	500	400	500	1000	800	600	1000	500	1400	700	700	300
	Surface Water Infiltration	47600	47600	55200	45300	45300	32600	32600	45300	55200	55200	47600	55200	45300	55200	47600	47600	45300
	Applied Water Infiltration	7500	44661	10387	13811	21442	8300	8300	7500	10387	7700	7500	7700	7500	20466	7500	7500	7500
4)	Subsurface Groundwater Inflows	25600	25600	25600	25600	25600	30600	30600	25600	25600	25600	25600	25600	25600	25600	25600	25600	25600
5)	Other Direct Recharge (Pond Seepage)	21200	21200	22900	20500	20500	15500	15500	20500	22900	22900	21200	22900	20500	22900	21200	21200	20500
6)	Projects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Inflows	**102,400**	**140,061**	**115,087**	**106,011**	**113,642**	**87,500**	**87,400**	**99,400**	**115,087**	**112,200**	**102,500**	**112,400**	**99,400**	**125,566**	**102,600**	**102,600**	**99,200**
Outflows																		
1)	Groundwater Extraction from Upper Aquifer	52100	52100	32700	52100	52100	47000	47000	52100	32700	32700	52100	32700	52100	32700	52100	52100	52100
2)	Groundwater Extraction from Lower Aquifer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3)	Subsurface Groundwater Outflows	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
4)	Other Consumptive Use of Groundwater	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Flow to Lower Aquifer	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600	19600
	Discharge to Surface Water/Consumptive use by GDEs/Lateral Flow	14400	14400	70000	12500	12500	27900	27900	12500	70000	70000	14400	70000	12500	70000	14400	14400	12500
	Groundwater transferred intra Plan Area	13600	13600	0	13600	13600	5500	5500	13600	0	0	13600	0	13600	0	13600	13600	13600
	Total Outflows	**101,600**	**101,600**	**124,200**	**99,700**	**99,700**	**101,900**	**101,900**	**99,700**	**124,200**	**124,200**	**101,600**	**124,200**	**99,700**	**124,200**	**101,600**	**101,600**	**99,700**
Change in Storage																		
	Estimated Annual Change in Groundwater Stor																	
	Inflows	102,400	140,061	115,087	106,011	113,642	87,500	87,400	99,400	115,087	112,200	102,500	112,400	99,400	125,566	102,600	102,600	99,200
	Outflows	101,600	101,600	124,200	99,700	99,700	101,900	101,900	99,700	124,200	124,200	101,600	124,200	99,700	124,200	101,600	101,600	99,700
	Change in Storage	800	38,461	-9,113	6,311	13,942	-14,400	-14,500	-300	-9,113	-12,000	900	-11,800	-300	1,366	1,000	1,000	-500
	Change in Elevation	0.06	3.06	-0.73	0.50	1.11	-1.15	-1.16	-0.02	-0.73	-0.96	0.07	-0.94	-0.02	0.11	0.08	0.08	-0.04
	Cumulative Change in Storage (2020-2070)	70,997	109,458	100,345	106,656	120,598	106,198	91,698	91,398	82,285	70,285	71,185	59,385	59,085	60,451	61,451	62,451	61,951
	Cumulative Change in Elevation (2020-2070)	5.66	8.72	7.99	8.50	9.61	8.46	7.31	7.28	6.56	5.60	5.67	4.73	4.71	4.82	4.90	4.98	4.94
	Cumulative Change in Storage (2014-2070)	95,751	134,212	125,099	131,410	145,352	130,952	116,452	116,152	107,039	95,039	95,939	84,139	83,839	85,205	86,205	87,205	86,705
	Cumulative Change in Elevation (2014-2070)	7.63	10.69	9.97	10.47	11.58	10.43	9.28	9.25	8.53	7.57	7.64	6.70	6.68	6.79	6.87	6.95	6.91

Land Surf	Surrogate Year	1973	1974	1975	1976	1977	1978
Descriptio	Actual Year	2065	2066	2067	2068*	2069*	2070
	Surrogate Water Year Type**	Normal	Wet	Wet	Dry	Dry	Wet
Inflows							
1)	Precipitation	146758	97216	96363	63934	45332	174983
2)	Surface Water Inflows	39168	52864	52864	26368	26368	52864
3)	Applied Water - Groundwater	52100	32700	32700	53200	53200	32700
4)	Applied Water - Surface Water Diversion	233800	265000	265000	160300	160300	265000
5)	Other Direct Recharge	0	0	0	0	0	0
6)	Other Pumping (M&I)	0	0	0	0	0	0
7)	Projects	0	0	0	0	0	0
	Total Inflows	**471,826**	**447,780**	**446,927**	**303,802**	**285,200**	**525,547**
Outflows							
1)	Runoff/Outflow	8960	44577	44186	8832	8832	80236
2)	Crop Evapotranspiration	298541	312024	308318	294228	295786	302914
3)	Surface Water Outflows	31384	36582	36582	2884	2884	36582
4)	Deep Percolation	73000	81900	81900	53100	53000	82600
	Total Outflows	**411,885**	**475,083**	**470,986**	**359,044**	**360,502**	**502,331**

Groundwa	Surrogate Year	1973	1974	1975	1976	1977	1978
Descriptio	Actual Year	2065	2066	2067	2068*	2069*	2070
	Surrogate Water Year Type**	Normal	Wet	Wet	Dry	Dry	Wet
Inflows							
1)	Deep Percolation	0	0	0	0	0	0
	Precipitation Infiltration	1200	800	800	500	400	1500
	Surface Water Infiltration	47600	55200	55200	32600	32600	55200
	Applied Water Infiltration	57326	7700	7700	8300	8300	30903
4)	Subsurface Groundwater Inflows	25600	25600	25600	30600	30600	25600
5)	Other Direct Recharge (Pond Seepage)	21200	22900	22900	15500	15500	22900
6)	Projects	0	0	0	0	0	0
	Total Inflows	**152,926**	**112,200**	**112,200**	**87,500**	**87,400**	**136,103**
Outflows							
1)	Groundwater Extraction from Upper Aquifer	52100	32700	32700	47000	47000	32700
2)	Groundwater Extraction from Lower Aquifer	0	0	0	0	0	0
3)	Subsurface Groundwater Outflows	1900	1900	1900	1900	1900	1900
4)	Other Consumptive Use of Groundwater	0	0	0	0	0	0
	Flow to Lower Aquifer	19600	19600	19600	19600	19600	19600
	Discharge to Surface Water/Consumptive use by GDEs/Lateral Flow	14400	70000	70000	27900	27900	70000
	Groundwater transferred intra Plan Area	13600	0	0	5500	5500	0
	Total Outflows	**101,600**	**124,200**	**124,200**	**101,900**	**101,900**	**124,200**
Change in Storage							
	Estimated Annual Change in Groundwater Stor						
	Inflows	152,926	112,200	112,200	87,500	87,400	136,103
	Outflows	101,600	124,200	124,200	101,900	101,900	124,200
	Change in Storage	51,326	-12,000	-12,000	-14,400	-14,500	11,903
	Change in Elevation	4.09	-0.96	-0.96	-1.15	-1.16	0.95
	Cumulative Change in Storage (2020-2070)	113,277	101,277	89,277	74,877	60,377	72,280
	Cumulative Change in Elevation (2020-2070)	9.02	8.07	7.11	5.97	4.81	5.76
	Cumulative Change in Storage (2014-2070)	138,031	126,031	114,031	99,631	85,131	97,034
	Cumulative Change in Elevation (2014-2070)	11.00	10.04	9.08	7.94	6.78	7.73

Appendix E – Memorandum of Agreement

MEMORANDUM OF AGREEMENT
TO FORM A GROUNDWATER SUSTAINABILITY AGENCY

This Memorandum of Agreement ("MOA"), dated November 22, 2016 by and between the Grassland Water District ("GWD") and the Grassland Resource Conservation District ("GRCD") is for the purpose of forming a Groundwater Sustainability Agency ("GSA") pursuant to the Sustainable Groundwater Management Act of 2014 ("SGMA"), California Water Code section 10720 et seq. GWD and GRCD are collectively referred to herein as "Parties" and separately referred to as a "Party" to this MOA.

<u>Recitals</u>

1. SGMA authorizes each groundwater basin or subbasin to be regulated by one or more GSAs. Water Code section 10723.6 authorizes a combination of local public agencies to form a GSA for the portion of a basin or subbasin within their service areas, through a memorandum of agreement or other legal agreement.

2. Once a GSA is formed, SGMA requires the development of a groundwater sustainability plan ("GSP"), or multiple coordinated plans, for each basin or subbasin.

3. The Parties overlie a portion of the Delta-Mendota Subbasin of the San Joaquin Valley Groundwater Basin, as identified in the California Department of Water Resources ("DWR") Bulletin 118 ("Subbasin"). DWR has designated the Subbasin as critically overdrafted, which means that GSAs must be formed by June 30, 2017, and must submit GSPs to DWR by January 31, 2020.

4. The Parties are local agencies authorized to exercise powers related to groundwater management and land use within their jurisdictional boundaries. The Parties enter into this MOA to form a multi-agency GSA (the "Grassland GSA") for the purpose of implementing cost-effective, sustainable groundwater management and coordinating the use of their existing powers and those powers described in Water Code section 10725.

<u>Agreement</u>

In consideration of the recitals above, GWD and GRCD agree as follows:

1. Formation of the Grassland GSA

The purpose of this MOA is to establish terms and conditions for the formation and administration of an exclusive multi-agency Grassland GSA and the preparation and implementation of a GSP. This MOA is not intended to form a new legal entity. The boundaries of the Grassland GSA shall encompass the portion of the Delta-Mendota Subbasin that lies within the combined service area boundaries of the GWD and GRCD, not including approximately 303 acres within the GRCD identified as Merced County Assessor Parcel numbers 073-220-005, 073-220-006, 073-220-011, and 084-010-77, which lie within the boundary of the City of Los Banos. This MOA shall take effect immediately and remain in effect unless one or both Parties withdraw.

2. Activities

Each Party warrants that it has authority to perform the activities required to accomplish the purposes of this MOA, and will cooperate to implement the following activities and other activities consistent with SGMA:

a. Preparing and maintaining a list of interested parties.

b. Obtaining DWR approval of the Grassland GSA.

c. Coordinating boundary modifications if necessary.

d. Conducting public outreach and engagement.

e. Consulting and contracting with the United States, State of California, County of Merced, City of Los Banos, and adjacent water agencies and individual landowners.

f. Entering into coordination agreements with other GSAs.

g. Conducting investigations and analyzing data.

h. Developing, adopting and implementing a GSP, which may be part of a broader GSP for the Subbasin.

i. Approving and collecting groundwater management fees.

j. Pursuing financial assistance through grants or similar opportunities.

k. Obtaining third-party services for groundwater modeling, data collection and reports, as needed.

3. Administration

The Parties acknowledge that SGMA is a complex law, and implementation regulations are still under development. Demonstrating and maintaining sustainable groundwater use under SGMA will require coordination among the Parties and other entities, and will likely require third-party services. The Parties may independently or jointly provide services utilizing their own staff or consultants, and may jointly enter into contracts to obtain services necessary for the operation of the Grassland GSA. Nothing in this MOA shall be construed to limit or otherwise interfere with a Party`s rights and authorities, including but not limited to surface water supplies, groundwater supplies, facilities, finances and operations, subject to terms of this MOA. The following terms shall govern the formation and administration of the Grassland GSA:

a. Principal Administration by GWD. Subject to the terms of this MOA, GWD shall assume the principal responsibilities for administering the GSA and developing and implementing a GSP. Principal responsibilities will include selecting and recommending third-party consultants, coordinating with other GSAs, conducting outreach to interested parties, collecting and administering fees, developing and implementing a GSP, collecting data, and monitoring groundwater use within the Grassland GSA boundary.

b. Approval by the Parties. When the terms of this MOA or applicable law require the approval of a Party, written documentation of such approval, whether by Resolution, motion, or other form of authorization, shall be included in the permanent records of the GSA. Approval by the Parties shall be required for the following actions:

i. Approval of an annual budget to implement this MOA, and the allocation of expenses to each Party;

ii. Amendment of this MOA;

iii. Adoption of a GSP;

iv. A Party becoming obligated to take specific actions to implement SGMA;

v. A recommendation that the Parties should utilize SGMA`s enforcement powers set forth in Water Code section 10732;

vi. A recommendation that the Parties should impose fees authorized by SGMA;

vii. A recommendation for adoption by the Parties of rules, regulations, policies and procedures; and

viii. A recommendation to appoint a mediator to resolve disputes among the Parties.

c. Discretion to Appoint Advisory Committee. If deemed necessary by the Parties for efficient administration of the Grassland GSA, the governing body of each Party may appoint two of its members to a GSA Advisory Committee. The General Manager of GWD shall serve as a fifth member of the GSA Advisory Committee. Vacancies shall be filled in the same manner as the appointment of initial Advisory Committee members. Any compensation of an Advisory Committee member shall be paid by the Party appointing such representative. Subject to the authorization from the Parties, the Advisory Committee shall coordinate, advise, and recommend, or shall determine, the actions necessary for carrying out the MOA. The Advisory Committee shall meet regularly on a designated meeting date selected by the Advisory Committee from time to time, and is authorized to call special meetings as necessary. Advisory Committee Meetings shall be subject to the Ralph M. Brown Act, California Government Code section 54950. Informational sessions may be conducted by less than a quorum of the Advisory Committee members. A majority of Advisory Committee members present constitutes a quorum. Each Advisory Committee member shall have one vote, and all actions of the Advisory Committee must be taken by majority vote of the members present.

d. Recordkeeping. The Parties shall maintain books and accounts for this MOA in accordance with that Party`s practices. The books and records shall be open to inspection by the Parties at all reasonable times, and shall be made available to the issuers of any grants or loans to the extent required by the terms of any such grants or loans.

4. Termination

Any Party may voluntarily withdraw from this MOA by giving written notice not less than 30 days prior to the withdrawal date. Upon withdrawal, the Party shall notify DWR that it shall act as its own GSA or join an alternate GSA that has entered into or will enter into a Coordination Agreement with the Grassland GSA. Unless the withdrawing Party is covered by an alternate GSP, the withdrawing Party shall remain subject to the terms of the GSP prepared by the Grassland GSA, so as to not put the Subbasin in jeopardy under SGMA.

5. Dispute Resolution

Should any controversy arise between the Parties concerning the interpretation of this

MOA or the rights and duties of any Party under this Agreement, the Parties shall submit the matter to a third person appointed by mutual agreement of the Parties. The appointed mediator shall have knowledge of and experience in the management of groundwater resources. The appointed mediator shall utilize best efforts to reach an agreement settling the matter in dispute and will be compensated as an expense under this MOA. This provision shall be a condition precedent to but shall not otherwise replace the rights of the Parties to seek arbitration under the procedures set forth in the Code of Civil Procedure or judicial resolution of their disputes.

6. Indemnification

Each Party agrees that it shall indemnify the other Party from the costs, losses, damages, claims or liabilities arising from such Party's performance or non-performance of its obligations under this Agreement.

7. Miscellaneous

a. Amendments. This Agreement may only be amended in a writing signed by the Parties hereto.

b. Assignment; Binding on Successors. Except as otherwise provided in this MOA, the rights and duties of the Parties may not be assigned or delegated without the written consent of the other Parties. This MOA shall inure to the benefit of, and be binding upon, the successors and assigns of the Parties.

c. Counterparts. This MOA may be executed by the Parties in separate counterparts.

d. Governing Law. This MOA shall be governed by the laws of the State of California.

e. Severability. If one or more provisions of this MOA shall be held to be unlawful, invalid or unenforceable, the remainder of the MOA shall not be affected thereby.

f. Signature Authorization. Each Party represents that the representative executing this MOA on its behalf has been duly authorized to execute the MOA on behalf of the Party.

IN WITNESS, WHEREOF, the Parties have executed this MOA as of the date first above written.

GRASSLAND WATER DISTRICT

By: ______________________

Title: President

GRASSLAND RESOURCE CONSERVATION DISTRICT

By: ______________________

Title: President

Appendix F – Communication and Engagement Plan

Grassland Groundwater Sustainability Agency

Communication & Engagement Plan

Merced County, California
Updated September 2019

Prepared for:

200 W. Willmott Avenue, Los Banos, CA 93635

Prepared by:

Provost & Pritchard Consulting Group
286 W. Cromwell Avenue, Fresno, California 93711

Report Prepared for:

Grassland Groundwater Sustainability Agency

200 W. Willmott Avenue

Los Banos, CA 93635

Contact:

Ric Ortega, General Manager

Telephone: (209) 826-5188

Email: rortega@gwdwater.org

Website: www.gwdwater.org/sustainability-agency/

Report Prepared by:

Provost & Pritchard Consulting Group

Trilby Barton, Public Outreach Coordinator

Contact:

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Note: This Communication & Engagement Plan is a living document and will be updated as necessary throughout the GSP development, public review, and implementation phases.

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Abbreviations

AB	Assembly Bill
C&E	Communication & Engagement
CDFW	California Department of Fish & Wildlife
CSD	Community Services District
CVP	Central Valley Project
DAC	Disadvantaged Community
DWR	Department of Water Resources
Grassland GSA	Grassland Groundwater Sustainability Agency
GRCD	Grassland Resource Conservation District
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GWD	Grassland Water District
MOA	Memorandum of Agreement
MWC	Mutual Water Company
PSA	Public service announcement
SB	Senate Bill
SDAC	Severely Disadvantaged Community
SGMA	Sustainable Groundwater Management Act
SJRECWA	San Joaquin River Exchange Contractors Water Authority
SLDMWA	San Luis-Delta Mendota Water Authority
USBR	United States Bureau of Reclamation
USFWS	United States Fish & Wildlife Service

Introduction

SGMA Overview

The Sustainable Groundwater Management Act (**SGMA**) is a combination of three bills signed by California Governor Jerry Brown in 2014: Assembly Bill (**AB**) 1739, Senate Bill (**SB**) 1168, and SB 1319. SGMA provides local agencies with the framework to manage groundwater basins in a sustainable manner. The legislation recognizes that groundwater is most effectively managed at the local level, and local agencies will need to achieve groundwater sustainability by 2040.

In SGMA, sustainable groundwater management is defined as management of groundwater supplies in a manner that can be maintained in planning and implementation phases without causing undesirable results. Undesirable results include significant and unreasonable chronic lowering of groundwater levels, reduction of groundwater storage, seawater intrusion, degraded water quality, land subsidence, and interconnected surface waters.

Implementation of SGMA and outreach requirements are broken down into four phases (**Figure 0-1**):

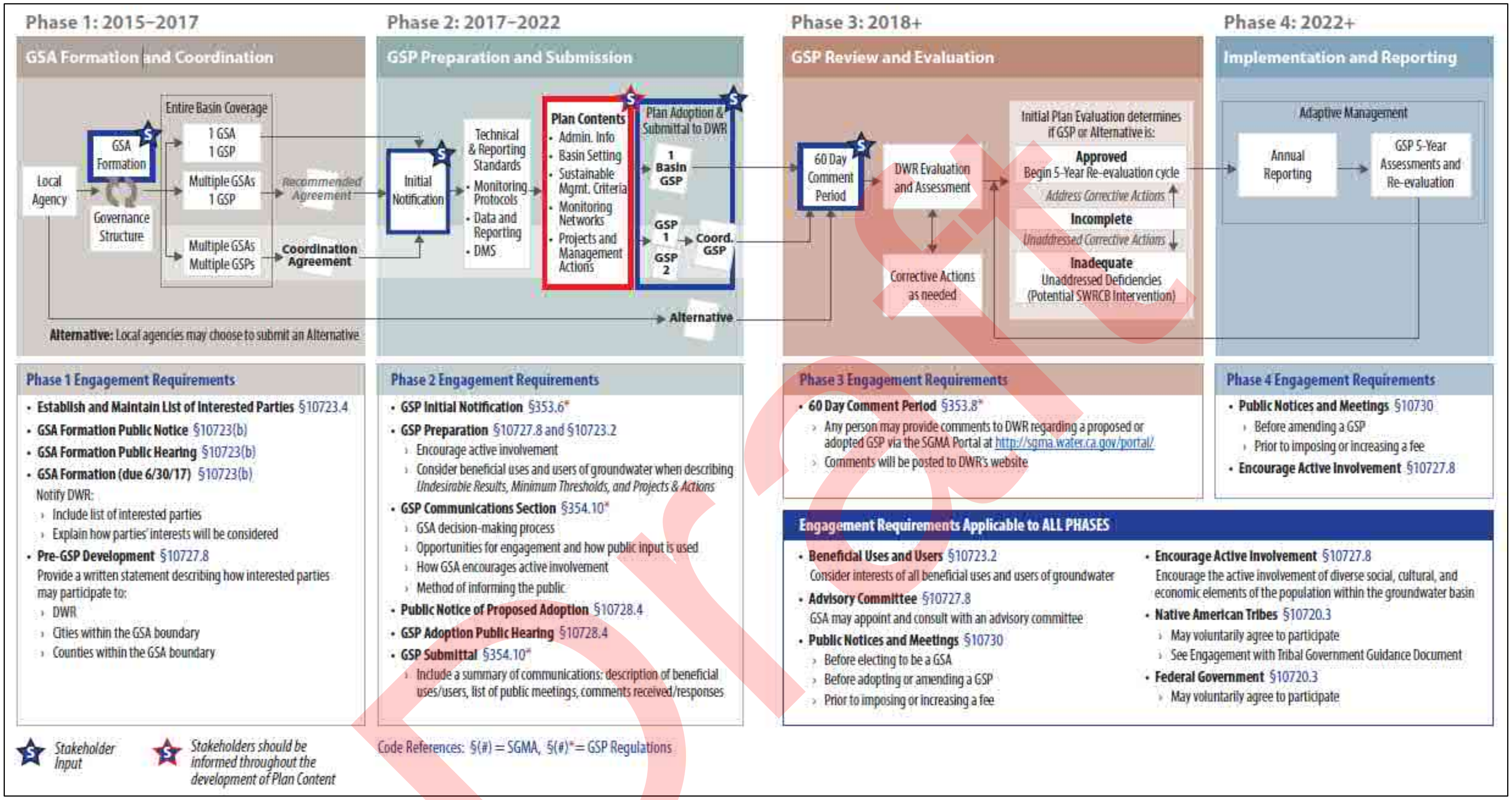
- **Phase 1: GSA Formation and Coordination –** Phase 1 ranged from 2015 to 2017, and during this phase, local agencies created groundwater sustainability agencies (**GSA**). The responsibility of a GSA is to develop and implement a groundwater sustainability plan (**GSP**) that will consider all beneficial uses and groundwater users within the basin. GSAs were required to be formed by June 30, 2017.
- **Phase 2: GSP Preparation and Submission –** Phase 2 ranges from 2017 through 2020, and during this phase, GSAs must develop GSPs with measurable objectives and milestones that ensure basin sustainability. A basin may be managed by a single GSP or multiple-coordinated GSPs. The California Department of Water Resources (**DWR**) developed regulations for evaluating GSPs and alternatives to GSPs by June 1, 2016.
- **Phase 3: GSP Review and Evaluation –** Phase 3 will be held in 2019, and consists of the public review period, which will be held 90 days prior to the adoption of the GSP. Once the GSP has been submitted to the DWR by January 31, 2020, DWR will hold another 60-day review and comment period for stakeholders.
- **Phase 4: Implementation and Reporting –** Following the submission of the GSP in 2020, GSAs will immediately begin the implementation of efforts described in the GSP to reach sustainability within the basin. This will be an ongoing phase, as the required goal of SGMA is to reach sustainability as described in the GSP by 2040.

Communication & Engagement Plan

As required by SGMA, GSAs must consider the interests of all beneficial uses and users of groundwater and include them in the GSP development process. The Grassland Groundwater Sustainability Agency's (**Grassland GSA**) Communication & Engagement (**C&E**) Plan addresses how stakeholders within the GSA's boundary will be engaged through stakeholder education and opportunities for input and public review during the development and implementation of the GSP and will be updated throughout the phases. This plan provides an overview of the Grassland GSA, its stakeholders, and decision-making process; identifies opportunities for public engagement and discussion of how public input and responses will be used; describes how the Grassland GSA encourages the active involvement of diverse, social, cultural, and economic elements of the population within the GSA boundary; and the methods the GSA will use to inform the public stakeholders about the progress of GSP development, public review and implementation.

As outlined by the DWR in the GSP Stakeholder Communication and Engagement Guidance Document, this Communication & Engagement Plan defines the Grassland GSA's process for accomplishing the seven general steps in stakeholder communication and engagement:

- **Set Goals and Desired Outcomes –** Description of the situation at a high level with clear goals and objectives, identifying overriding concerns
- **Identify Stakeholders –** Development of a broad list of individuals, groups and organizations who need to be engaged in the process
- **Stakeholder Survey and Mapping –** Conducting a stakeholder survey to develop a "Lay of the Land" overview
- **Messages and Talking Points –** Definition of the key messages needed to effectively convey to the various subbasin stakeholders
- **Venues for Engaging –** Identification of opportunities (venues and methods) to engage stakeholders
- **Implementation Timeline –** Creation of a timeline to inform the process and highlight when to engage with stakeholders
- **Evaluation and Assessment –** Definition of a process to evaluate if communication and engagement goals are being met at the individual GSA level and through any collaborative subbasin efforts



Source: GSP Stakeholder Communication and Engagement Guidance Document, California Department of Water Resources, June 2017

Figure 0-1. Stakeholder Engagement Requirements by Phase

I. Goals and Desired Outcomes

This section of the Communication & Engagement Plan provides a description of the Grassland GSA, defines the goals of how to address the challenges, regulatory requirements and opportunities, and how to reach the desired outcomes of communication efforts.

A. Description and Background of the Grassland GSA

I.A.1 GSA Description & Boundary

SGMA required all high- and medium-priority groundwater basins, as designated by the DWR Bulletin 118, to be managed by a GSA or multiple GSAs. Part of the San Joaquin Valley Basin, the Delta-Mendota Subbasin (Bulletin 118 Subbasin 5-22.07) is a high-priority basin that is in critical groundwater overdraft and is split into 23 GSAs (**Table I-1**), including the Grassland GSA.

Table I-1. Delta-Mendota Subbasin GSAs and GSA Member Entities

GSA	Counties	GSA Member Entities	
Grassland GSA	Merced	Grassland Water District	Grassland Resource Conservation District
City of Dos Palos GSA	Merced	City of Dos Palos	
City of Gustine GSA	Merced	City of Gustine	
DM-II	Merced, San Joaquin, Stanislaus	Del Puerto Water District	Oak Flat Water District
Ora Loma Water District	Fresno	Ora Loma Water District	
Fresno County – Management Area "B"	Fresno	County of Fresno	
Fresno County – Management Area "A"	Fresno	County of Fresno	
City of Firebaugh GSA	Fresno, Madera	City of Firebaugh	
Central Delta-Mendota Region Multi-Agency GSA	Fresno, Merced	Eagle Field Water District County of Fresno Fresno Slough Water District County of Merced Mercy Springs Water District Oro Loma Water District	Pacheco Water District Panoche Water District San Luis Water District Santa Nella County Water District Tranquillity Irrigation District
Widren Water District GSA	Fresno	Widren Water District	
Merced County – Delta-Mendota	Merced	County of Merced	
Turner Island Water District – 2 GSA	Merced	Turner Island Water District	

GSA	Counties	GSA Member Entities	
Northwestern Delta-Mendota GSA	Merced, Stanislaus	County of Merced County of Stanislaus Crows Landing CSD El Solyo Water District	Eastin Water District Blewett MWC White Lakes MWC
City of Patterson	Stanislaus	City of Patterson	
County of Madera – 3	Madera	County of Madera	
City of Los Banos GSA	Merced	City of Los Banos	
City of Mendota GSA	Fresno	City of Mendota	
City of Newman	Stanislaus	City of Newman	
Farmers Water District	Fresno	Farmers Water District	
Aliso Water District GSA	Madera	Aliso Water District	
Patterson Irrigation District	Stanislaus	Patterson Irrigation District	
West Stanislaus Irrigation District	San Joaquin, Stanislaus	Grayson CSD City of Modesto	West Stanislaus Irrigation District
San Joaquin River Exchange Contractors Water Authority*	Fresno, Madera, Merced, Stanislaus	Central California Irrigation District Firebaugh Canal Water District	San Luis Canal Company Columbia Canal Company

*Boundary borders Grassland GSA

Under SGMA, Grassland GSA is responsible for submitting a GSP to the DWR by January 31, 2020. On November 22, 2016, a resolution was adopted by the Grassland GSA member agencies to become an official GSA for the portion of the Delta-Mendota Subbasin designated in **Figure I-1**. These member agencies are also listed in **Table I-2**. The official GSA formation notice was submitted to the DWR on December 22, 2016.

The boundaries of the Grassland GSA's member agencies (**Table I-2**) overlie a portion of the Delta-Mendota Subbasin within the San Joaquin Valley Basin. The GSA boundary (**Figure I-1**) encompasses the combined service area boundaries of the Grassland Water District (**GWD**) and Grassland Resource Conservation District (**GRCD**), excluding approximately 303 acres within the GRCD that lies within the boundary of the City of Los Banos.

Table I-2. Grassland GSA Member Entities

Grassland GSA Member Agencies	
Grassland Water District	Grassland Resource Conservation District

Throughout the SGMA phases, the Grassland Water District and Grassland Resource Conservation District's Boards of Directors and technical team will be responsible for collecting and organizing data, engaging and retaining experts and consultants, and soliciting feedback from beneficial users of groundwater and interested parties within the GSA boundary. The specific role of the Boards of Directors is described in **Section II.A**.

The Grassland GSA intends to work cooperatively and collaborate with stakeholders and other GSAs within the Delta-Mendota Subbasin for the development and implementation of a groundwater sustainability plan.

I.A.2 Industries, DACs, Municipalities

I.A.2.1 Industries

I.A.2.1.1 Wetlands

The primary use of groundwater within the Grassland GSA is wetland habitat. These habitats consist of wildlife refuges established to manage habitat for waterfowl. According to the GRCD, natural hydrology within the Grassland GSA boundary has been lost, and these wetlands depend on water deliveries. Wetland habitats within the Grassland GSA are managed to produce standing crops of moist soil, food plants and invertebrates that benefit wildlife, particularly the waterfowl and other migratory birds that inhabit these wetlands.

I.A.2.2 Public Agencies and Districts

The public agencies and districts within the Grassland GSA consist of the member entities listed in **Table I-2** (**Figure I-2**). These agencies and districts will be engaged in outreach efforts throughout the GSP development, public review and implementation phases, as described in **Section II.C**.

I.A.2.2.1 Grassland Water District

Grassland Water District is dedicated to the protection and delivery of water to the private, state and federal wildlife refuges within the Grassland Resource Conservation District. The district delivers water to 75,000 acres within the GRCD. A California water agency formed under Section 34000 of the State Water Code, CWD receives and delivers Federal Central Valley Project (**CVP**) water, with the primary function to protect, secure and deliver water to the critical wetland habitat within the district boundary. The GWD also delivers water to state and federal wildlife refuges on behalf of the U.S. Bureau of Reclamation (**USBR**), and works closely with the California Department of Fish and Wildlife (**CDFW**) and the U.S. Fish and Wildlife Service (**USFWS**) to maximize the availability of food and habitat needed for migratory birds.

Over the course of 60 years, GWD has been successful in securing and managing a long-term water supply to preserve and enhance the wildlife resource areas within the district's boundaries. In addition to the public wetlands, the private landowners and sportsmen, working with the GWD and other organizations, have been responsible for preserving the largest remaining freshwater marsh in the western United States.

I.A.2.2.2 Grassland Resource Conservation District

The GRCD is consists of privately-owned wetlands, comprised of 160 clubs ranging from a few acres to over 2,500 acres. Ninety percent of the district is preserved under permanent wetland conservation easements and is one of 19 wildlife refuges in the Central Valley Improvement Act (**CVPIA**), which provides adequate and reliable water supplies to the critical wetlands.

I.A.2.3 DACs

Communication and educational outreach efforts with disadvantaged communities (**DAC**) and severely disadvantaged communities (**SDAC**) are essential for the development and implementation of GSPs within the San Joaquin Valley Basin, and residents are generally dedicated to bettering their communities, particularly when it comes to their water supplies. However, there are no DACs or SDACs within the Grassland GSA boundary.

I.A.3 Grassland GSA's Decision-Making Process

The Grassland GSA's decision-making process is broken down by the roles of the Boards of Directors and an advisory committee, if necessary, in the future. The roles of these Grassland GSA entities and their responsibilities are outlined below and described in more detail in **Section II.A**.

- **Boards of Directors –** Responsible for all final decisions relative to the development of the GSA, GSP adoption, implementation of the GSP, and other related matters
- **Advisory Committee –** Not currently formed, but if necessary, for efficient administration of the Grassland GSA, the governing body of each member agency may appoint two of its members to an advisory committee. The fifth member will be the general manager of the Grassland Water District. The Advisory Committee will coordinate, advise and recommend, or determine actions necessary for carrying out the Memorandum of Agreement (**MOA**), and will meet regularly at a designated meeting time and location. These meetings will be public, and meeting notices will be distributed to the Interested Parties List.

B. Goals/Desired Outcomes of GSP Development

The overall, main goal of the Grassland GSA is to reach groundwater sustainability as required by SGMA, by properly managing groundwater resources to help protect communities, farms and the environment against prolonged dry periods and climate change and preserve water supplies for existing and potential beneficial use within the GSA boundary and across California. Both metered pumps and monitoring wells are already being utilized in order to ensure the quality and longevity of groundwater supplies within the Grassland GSA.

C. Communication Objectives to Support the GSP

The communication objectives during GSA formation/coordination, GSP development, public review, and implementation phases of the SGMA compliance is to encourage active involvement of diverse, social, cultural, and economic elements of the population within the GSA boundary. The Grassland GSA will give beneficial users and users of groundwater opportunities to engage in the GSP process by providing educational outreach opportunities for stakeholders while reaching out through specific communication avenues (**Section V**). As active stakeholders, members of the GWD and GRCD Boards of Directors and the GSA Advisory Committee (if formed) are direct representatives of their districts, communities and industries, and it is important for them to continually gather feedback/input, and concerns/needs of their constituents and report back to their respective meetings. Any stakeholder input received will be reviewed and taken into consideration during GSP development and public review phases.

I.C.1 Phase 1: GSA Formation and Coordination

Phase 1: GSA Formation and Coordination has been completed. This phase stretched from 2015 through 2016 and consisted of forming the Grassland GSA and establishing and maintaining the List of Interested Parties (**Section II.D**). Stakeholder input was utilized during the GSA formation phase, as beneficial users and stakeholders with interests in groundwater usage within the Grassland GSA's boundary were notified via public meeting notices as soon as the process began (**Table I-3**).

Table I-3. GSA Formation Public Hearing Notice

Publication	Date Published	Date Public Hearing Held
Merced Sun-Star	November 8, 2016 November 15, 2016	3 p.m., Tuesday, November 22, 2016 at the Grassland Water District (200 W. Willmott Avenue, Los Banos)

I.C.2 Phase 2: GSP Preparation and Submission

Phase 2: GSP Preparation and Submission spans from 2017 through 2020. With the goal of having the draft GSP by the first quarter of 2019, 2018 consisted primarily of the technical development of the plan, while working with stakeholders (**Section II.A**) for feedback and input. This phase also consists of creating the Communication & Engagement Plan to outline communication efforts for the GSP development, public review and implementation phases. During 2018 and 2019, direct interaction with stakeholder groups (**Section II.B**) and other industry organizations and entities (**Section II.C**) will be held with the purpose of educating and informing stakeholders about SGMA and the GSP process, while also soliciting feedback and input from these groups (**Section III.A**) to mitigate the negative impacts to beneficial users of groundwater as much as possible.

I.C.3 Phase 3: GSP Review and Evaluation

During mid-2019, Phase 3: GSP Review and Evaluation will be the primary focus of communication and engagement efforts. Once the draft of the GSP is completed in the second quarter of 2019, the public review process will begin. A 90-day comment period will be held, with the GSP draft posted on the Grassland GSA's webpage for stakeholders to conveniently download and review. Outreach meetings will be held during this phase at locations throughout the GSA boundary (potential venues are listed in **Table V-1**). These meetings will focus on an overview of the GSP content, while giving stakeholders a public forum to provide their feedback and comments.

Once the public review period is completed, public comments will be taken into consideration and incorporated into the final version of the Grassland GSA's GSP before submitting to the DWR by the January 31, 2020 deadline. Following submittal, stakeholders will be given a second 60-day comment period through the DWR's SGMA portal at http://sgma.water.ca.gov/portal/. Comments will be posted to the DWR's website prior to the state agency's evaluation, assessment and approval.

I.C.4 Phase 4: Implementation and Reporting

Phase 4: Implementation and Reporting will begin once the plan is submitted in January 2020. Even while the DWR is reviewing the GSP, implementation must proceed at the GSA-level. During the implementation phase, communication and engagement efforts will be shifted to educational and informational awareness of the requirements and processes of reaching groundwater sustainability. Active involvement of all stakeholders is encouraged during this phase, and public notices are required prior to imposing, and later increasing, any fees.

D. Overriding Concerns, Major Concerns or Challenges

Through preliminary discussions with stakeholders within the Grassland GSA boundary, overriding concerns, major concerns or challenges are centralized around maintaining water supplies in the wetlands, which serve as waterfowl migration staging areas and breeding grounds. In addition, while the majority of the Grassland GSA interests are related to preserving water supplies within the wetlands, the agricultural industry is also present within the GSA. Concerns for economic impacts hitting the ag industry could include loss of jobs and loss of tax revenue due to the decreased land values of fallowed ground.

Because of the significant impact SGMA implementation will have on these beneficial users of groundwater, members of the GWD and GRCD, environmental users and agricultural users within the Grassland GSA boundary will be the main target audiences for direct outreach methods.

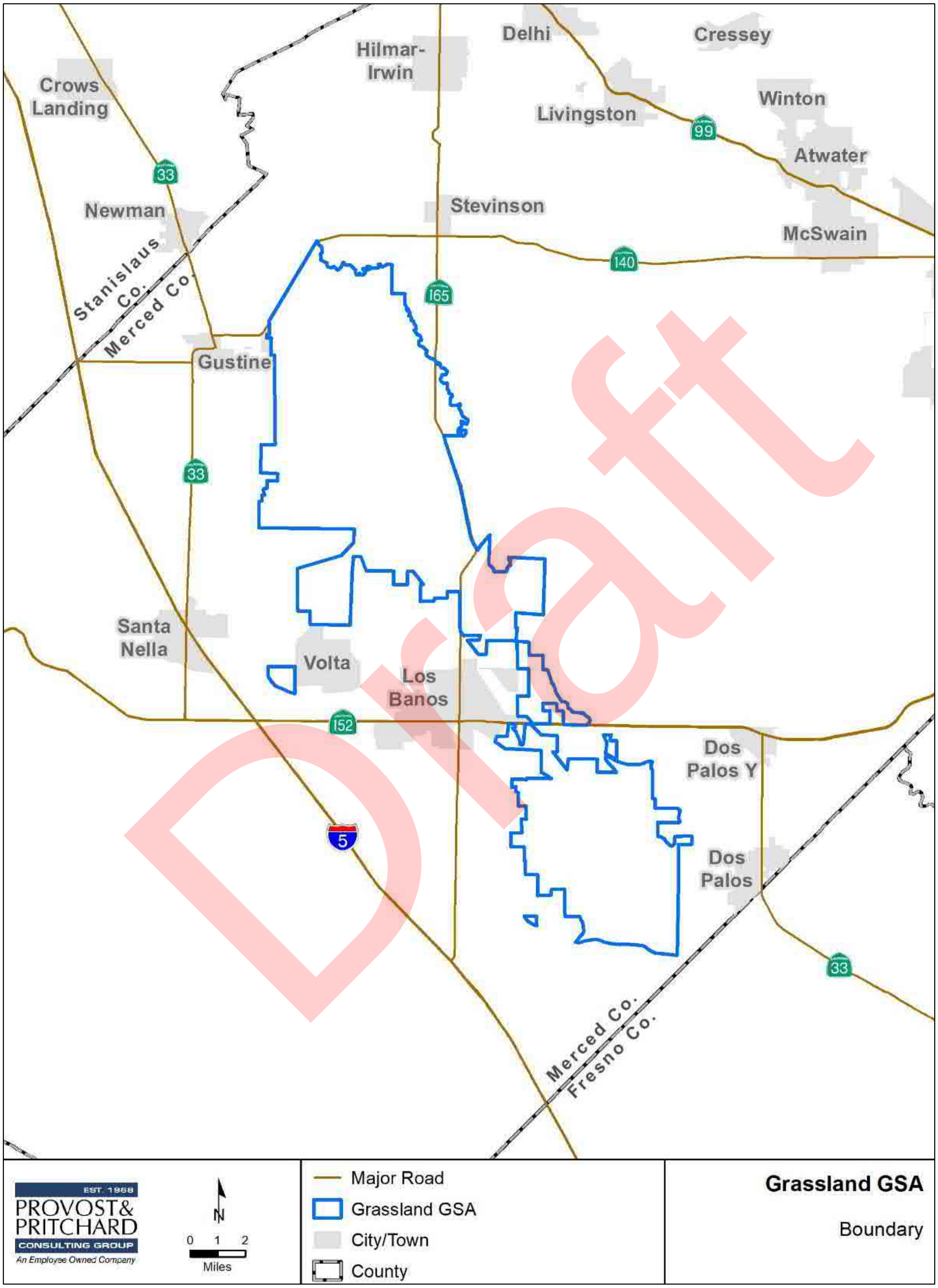


Figure I-1. Grassland GSA Boundary

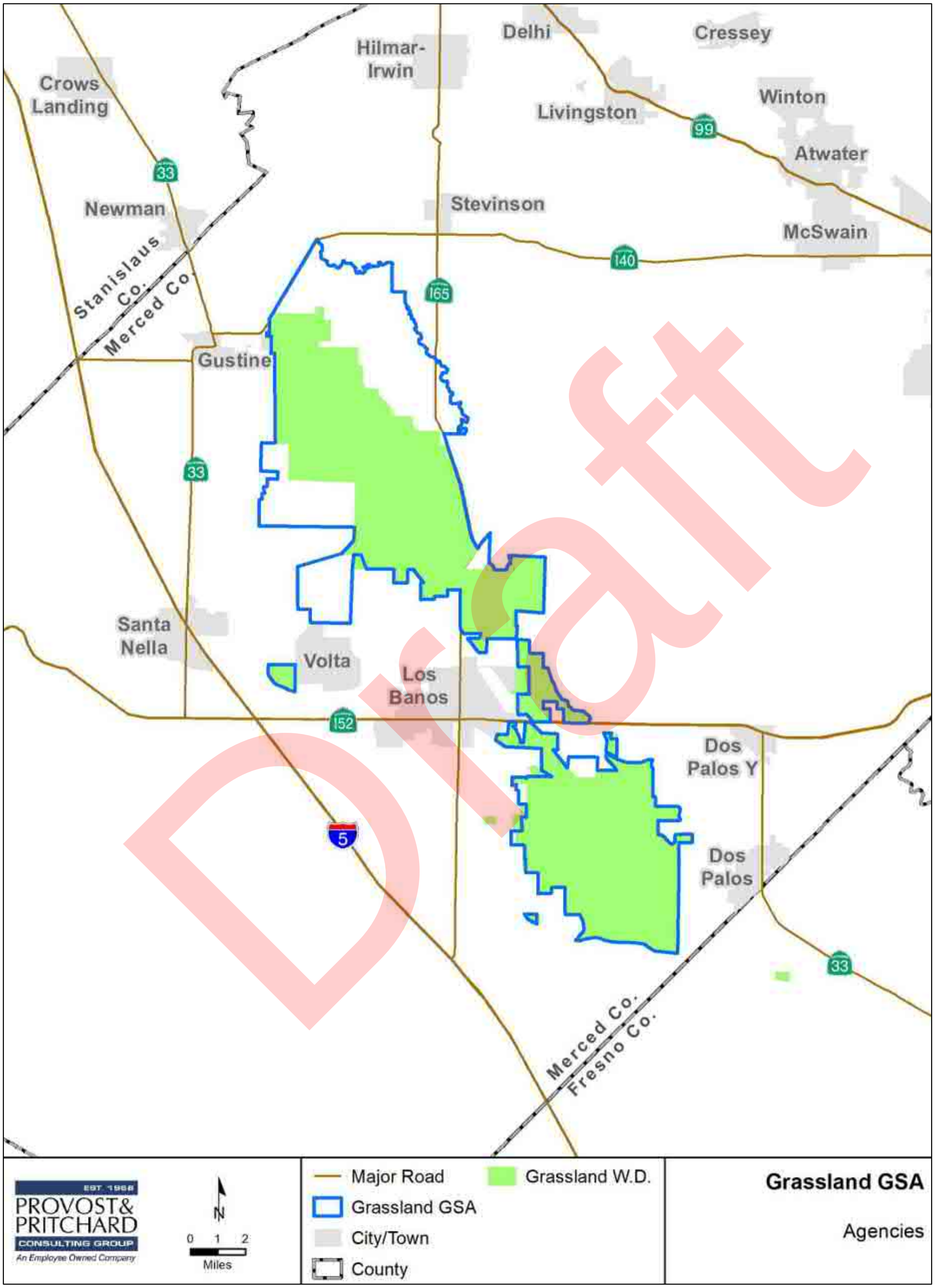


Figure I-2. Grassland GSA Public Agencies and Water Districts

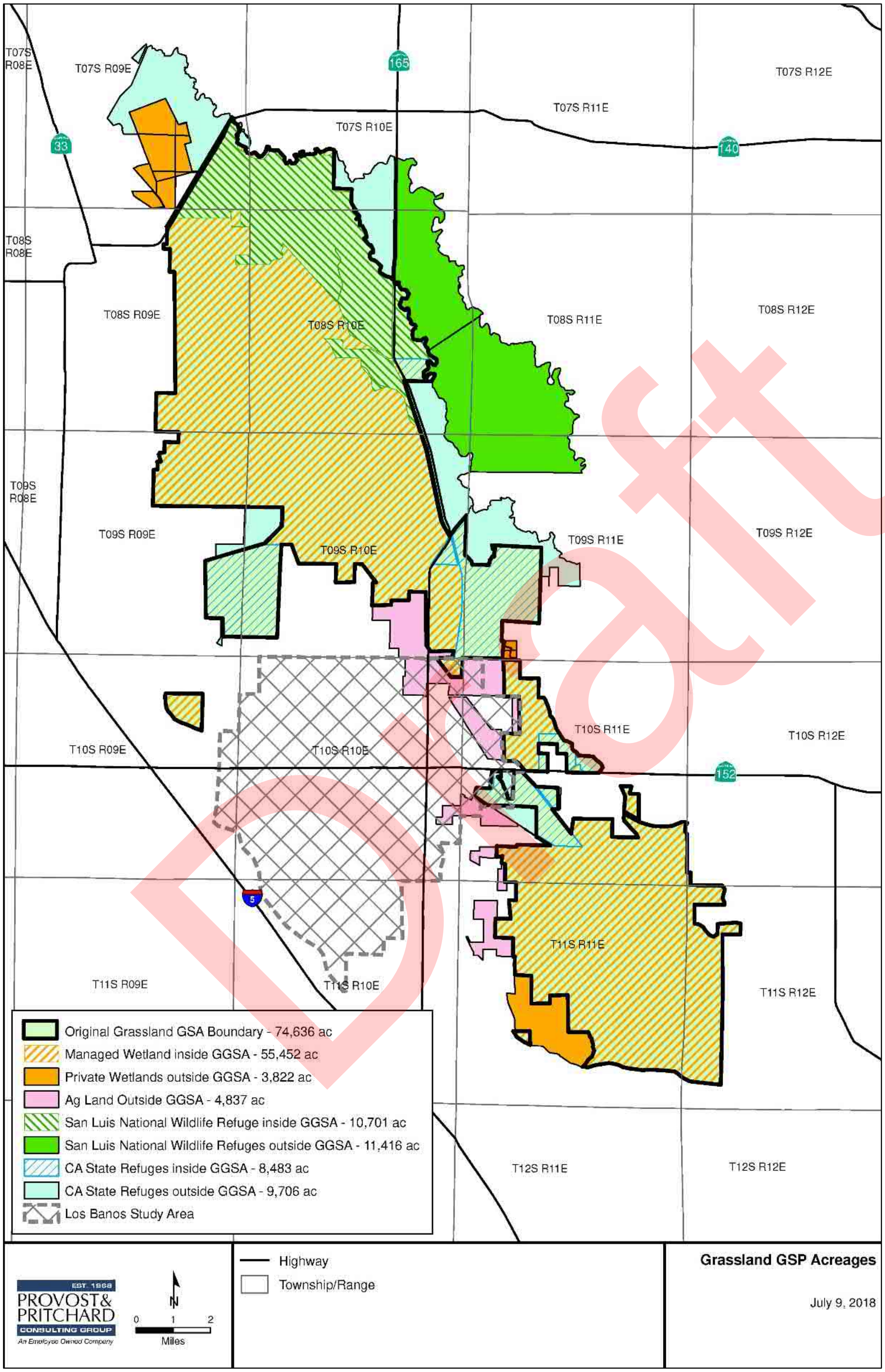


Figure I-3. Grassland GSA Boundary and Extended Area

II. Audience Identification

A. Active Stakeholder Groups

The active stakeholder groups of the Grassland GSA are members of the GWD and GRCD Board of Directors, GSA advisory committee (if formed in the future), and subbasin coordination committees and working groups. Their specific roles in the communication and engagement process are discussed in this section.

II.A.1 Role of Board of Directors

The boards of directors of the GWD and GRCD are responsible for all final decisions related to the GSA, development and adoption of the GSP, and implementation of the GSP, and other related matters, fully considering recommendations of the GSA committee members and input from GSA stakeholders.

The GWD Board of Directors' meetings are held on the second Tuesday of each month at 3 p.m., and the GRCD Board of Directors' are held on the fourth Tuesday of each month at 1:30 p.m. Both agencies' board meetings are held at the Grassland Water District office, located at 200 W. Wilmott Avenue in Los Banos and are open to the public.

II.A.2 Role of GSA Advisory Committee

The option for the formation of one standing committee is identified in the Grassland GSA's Memorandum of Agreement. The standing committee has not yet been developed but will be formed if deemed necessary to give GSA stakeholders an additional voice in the GSP development process.

- **Advisory Committee –** If deemed necessary by the Grassland GSA entities for efficient administration of the GSA, an advisory committee may be formed. As discussed in Section I.A.3, the board of directors of each member agency may appoint two of its members to an advisory committee, with the fifth member being the general manager of the GWD. The advisory committee will be responsible for coordinating, advising and recommending, or determining actions necessary for carrying out the Memorandum of Agreement, and will meet regularly at the GWD office at a designated meeting time, which will be noticed publicly.

II.A.3 Role of Delta-Mendota Subbasin Committees & Working Groups

In a collaborated effort to work together in the development of the Delta-Mendota Subbasin-wide GSP, the six GSAs have comprised committees that meet regularly: Subbasin Coordination Committee, Subbasin Technical Working Group, and Subbasin Communications Working Group. A complete subbasin calendar of meetings is available at http://deltamendota.org/meetings/.

- **Subbasin Coordination Committee –** This committee is comprised of members who represent the six GSA entities with the purpose of providing overall guidance and resolving conflicts among the GSAs to ensure compliance with SGMA's requirement for coordinated efforts among GSAs within a subbasin. The Subbasin Coordination Committee meets the fourth Thursday of each month at 1 p.m. at the San Luis-Delta Mendota Water Authority (**SLDMWA**) Administrative Office, located at 842 6th Street in Los Banos.

- **Delta-Mendota Subbasin Technical Working Group –** The Technical Working Group was formed to address and coordinate technical issues, including, but not limited to, data sharing and confirmation of use of same data and methods in preparing the six GSPs within the subbasin. This Technical Working Group meets the third Tuesday of every month at 10 a.m. at the SLDMWA Administrative Office (842 6th Street in Los Banos).
- **Delta-Mendota Subbasin Communications Working Group –** The Delta-Mendota Subbasin Communications Working Group coordinates messaging, education and outreach efforts throughout the Delta-Mendota Subbasin related to SGMA and GSP requirements. This working group meets the fourth Tuesday of each month at 1 p.m. at the SLDMWA Administrative Office (842 6th Street in Los Banos).

B. GSA Stakeholders

Stakeholder groups have been identified by the Grassland GSA, based on those listed in SGMA, Section 10723.2 "Consideration of All Interests of All Beneficial Uses and Users of Groundwater" (**Table II-1**).

Table II-1. Consideration of All Interests of All Beneficial Uses and Users of Groundwater

SGMA, Section 10723.2. Consideration of All Interests of All Beneficial Uses and Users of Groundwater		
Agricultural Users	Domestic Well Owners	Municipal Well Operators
Public Water Systems	Local Land Use Planning Agencies	Environmental Users of Groundwater
Surface Water Users	Federal Government	California Native American Tribes
Disadvantaged Communities	Entities monitoring and reporting groundwater elevations in all or part of a groundwater basin	

Beneficial users of groundwater to be targeted for communication and engagement during the GSP development, public review and implementation phases have been narrowed to those with financial, political, business or personal stakes in the management and sustainability of groundwater within the jurisdiction of the Grassland GSA. These stakeholders are listed in **Table II-2** as beneficial users of groundwater within the GSA.

Table II-2. All Beneficial Uses and Users of Groundwater with Interests in the Grassland GSA

Stakeholder Group	Description
Agricultural Users	There are very few agricultural water users within the Grassland GSA. All have existing relationships with the GWD and the GRCD.
Domestic Well Owners	There are very few domestic wells within the Grassland GSA, but some do exist, and have existing relationships with the GWD and the GRCD.
Local Land Use Planning Agencies	County of Merced and City of Los Banos (although not included within the GSA boundary, there is the potential for collaborative management)
Environmental Users	Primary use of groundwater users within the Grassland GSA through public wildlife refuges owned and managed by the California Department of Fish & Wildlife (**CDFW**), U.S. Fish & Wildlife Service (**USFWS**), U.S. Bureau of Reclamation (**USBR**), and private wetland landowners. These environmental users have existing relationships with the GWD and the GRCD.

Stakeholder Group	Description
Surface Water Users	GWD, CDFW, and USFWS hold the surface water rights within the Grassland GSA boundary. The rights of other nearby holders of surface water rights will be considered in the development of the GSP.
Federal Government	USFWS and USBR manage federal lands within the Grassland GSA, and the Grassland GSA member agencies consulted with both agencies during Phase I: GSA Formation. GWD has a contractional relationship with the USBR.
Entities monitoring and reporting groundwater elevations in all or part of a groundwater basin	The SLDMWA monitors groundwater elevations with the subbasin.

Stakeholder groups will be engaged through direct communication, district correspondence, email blasts with newsletters and other pertinent GSA/GSP information, and one-on-one and public outreach meetings held during Phase 2: GSP Preparation and Submission, Phase 3: GSP Review and Evaluation, and Phase 4: Implementation and Reporting.

C. Organizations, Public Agencies and Other Entities

There are many organizations, public agencies and other entities throughout the Grassland GSA boundary that will be utilized to reach out to stakeholders. These resources identified as avenues for outreach opportunities are listed in **Table II-3**. Additional organizations, public agencies and entities may be added to the list as GSP development and implementation phases move forward, and additional connections are made between the Grassland GSA and the beneficial groundwater users within its boundary.

Grassland GSA will communicate with these resources and request opportunities to give presentations at their respective meetings or distribute informational materials such as public meeting notices and newsletters to their membership/contact lists. If a Board of Director or committee member is currently involved with, or has contacts within an organization, public agency or other entity, they may want to present on behalf of the Grassland GSA to streamline outreach efforts. Presentations and/or one-on-one discussions may include an overview on SGMA and why it is important to stakeholders, explanation and updates of the GSP development process including an awareness of the public review period, and education of GSP requirements during the implementation phase.

Table II-3. Organizations, Public Agencies and Entities

Organizations & Public Agencies	Stakeholder Group(s)	Contact Information
Agriculture & Industry Organizations		
California Waterfowl Association	Agricultural Users, Domestic Well Owners, Environmental Users	Address: 1346 Blue Oaks Boulevard, Roseville, CA 95678 Telephone: (916) 648-1406 Website: www.calwaterfowl.org
Ducks Unlimited – California	Agricultural Users, Domestic Well Owners, Environmental Users	Contact: Anne Hansen, Director Development, Northern California Address: Western Regional Office, 3074 Gold Canal Drive, Rancho Cordova, CA 95670 Telephone: (916) 851-5333; Email: ahansen@ducks.org Website: https://www.ducks.org/california

Organizations & Public Agencies	Stakeholder Group(s)	Contact Information
Merced County Farm Bureau	Agricultural Users, Domestic Well Owners	Address: 646 South Highway 59, Merced, CA 95341 Mailing Address: PO Box 1232, Merced, CA 95341 Telephone: (209) 723-3001 Email: info@mercedfarmbureau.org; bramos@mercedfarmbureau.org Website: www.mercedfarmbureau.org
Environmental Organizations		
Audubon California	Environmental Users	Address: 220 Montgomery Street, Suite 1000, San Francisco, CA 94104 Telephone: (415) 644-4600; Email: auduboncalifornia@audubon.org Website: http://ca.audubon.org/
Environmental Defense Fund	Environmental Users	Contact: Robyn Grimm, Senior Manager – Water Information Systems Address: 1107 9th Street, Suite 1070, Sacramento, CA 95814 Telephone: (916) 492-7070 Website: https://www.edf.org/
Point Blue Conservation Science	Environmental Users	Address: 3820 Cypress Drive, Suite #11, Petaluma, CA 94954 Telephone: (707) 781-2555; Email: pointblue@pointblue.org Website: www.pointblue.org
The Nature Conservancy – California	Environmental Users	Address: 201 Mission Street, 4th Floor, San Francisco, CA 94105 Telephone: (415) 777-0487; Email: california@tnc.org Website: https://www.nature.org/en-us/
Government Agencies		
CDFW – Los Banos Wildlife Area and North Grasslands Wildlife Area	Environmental Users, Surface Water Users	Address: Wildlife Branch Lands Program, 1812 9th Street, Sacramento, CA 95811 Telephone: (209) 826-0463 (Los Banos Office) Website: https://www.wildlife.ca.gov/lands/places-to-visit/
USFWS – Central Valley Joint Venture	Environmental Users, Federal Government, Surface Water Users	Contact: Mike Dunphy, Coordinator Address: 2800 Cottage Way, Suite W-1916, Sacramento, CA 95825 Telephone: (916) 414-6459; Email: michael_dunphy@fws.gov Website: http://www.centralvalleyjointventure.org/
Wildlife Conservation Board – State of California	Environmental Users	Contact: Elizabeth Hubert, Manager – Restoration & Development Address: PO Box 944209, Sacramento, CA 94244 Telephone: (916) 445-109; Email: Elizabeth.Hubert@wildlife.ca.gov Website: https://wcb.ca.gov/
USFWS – San Luis National Wildlife Refuge	Environmental Users, Federal Government, Surface Water Users	Address: San Luis NWR Complex, PO Box 2176, Los Banos, CA 93635 Telephone: (209) 826-3508 Website: https://www.fws.gov/refuge/San_Luis/visit/plan_your_visit.html
Water Agencies		
San Joaquin River Exchange Contractors Water Authority	Agricultural Users, Domestic Well Users, Surface Water Users,	Address: PO Box 2115, Los Banos, CA 93635 Telephone: (209) 827-8616; Email: contactus@sjrecwa.net Website: www.sjrecwa.net
San Luis-Delta Mendota Water Authority	Agricultural Users, Domestic Well Owners, Surface Water Users; Monitoring & Reporting Entities	Address: PO Box 2157, Los Banos, CA 93635 Telephone: (209) 826-9696; Email: youtellus@sldmwa.org Website: www.sldmwa.org

D. Interested Persons List

SGMA Section 10723.4 "Maintenance of Interested Persons List" states:

> *"The groundwater sustainability agency shall establish and maintain a list of persons interested in receiving notices regarding plan preparation, meeting announcements, and availability of draft plans, maps, and other relevant documents. Any person may request, in writing, to be placed on the list of interested persons."*

In compliance with the SGMA requirement, Grassland GSA established and maintains a list of interested persons, and routinely distributes meeting notices and relevant information to the stakeholders who have requested to be included, and to members of both the GWD and GRCD. Grassland GSA will continue to grow this contact list through the process discussed in **Section V.A.4**.

III. Audience Survey and Mapping

Through ongoing communications and public education and outreach efforts described in **Section V**, stakeholders will have the opportunity to have a voice in the GSP development process. This section discusses in detail the preliminary discussion with stakeholders, and implementation of verbal stakeholder surveys, which will be a valuable source in collecting feedback from target audiences who have vested interests in how the implementation of the GSP will affect their interests.

A. Stakeholder Survey

III.A.1 Identification of Stakeholder Issues, Interests and Challenges

Stakeholder issues, interests and anticipated challenges are routinely discussed in GWD and GRCD Board of Directors and subbasin coordination committee and working group meetings, and through direct discussions with stakeholders within the GSA. Stakeholder surveys will be conducted through one-on-one discussions with stakeholders to solicit input to identify issues, interests and challenges stakeholders are facing and concerned about. **Table III-1** outlines preliminary concerns, which will be taken into consideration during the GSP development process and used as a basis for the development of fact sheets and public meeting presentations for public outreach opportunities.

Table III-1. Stakeholder Issues, Interests & Challenges

Stakeholder Issues, Interests & Challenges	
Top Concerning Issues Regarding Groundwater Usage and SGMA:	• Economic impacts (loss of jobs, loss of complete industries, loss of tax revenue due to decrease in land values of fallowed ground) • Government regulations and involvement (i.e. SGMA and ILRP), and the impacts on investments and livelihoods • Long-term water quantity and quality • Fallowing of farmland (loss of production) • Legal rights to groundwater (concerns of unequal representation amongst landowners) • Water usage (surface water vs. groundwater) • Decreased quality of food for California and the United States as a whole • Concerns that the agriculture industry will have to pay for SGMA implementation for all of the beneficial users of groundwater

III.A.2 Survey Questions

Stakeholders need to have an opportunity to be heard during the GSP development process, in addition to the involvement of the active stakeholders who represent their interests. Conducting verbal stakeholder surveys is a way to gather information from these individuals.

Survey questions recommended by the DWR are listed below.

1. Are you familiar with Sustainable Groundwater Management Act (SGMA) regulations?
2. Are you currently engaged in activity of discussions regarding groundwater management in this region?
3. Do you own or manage/operate land in this region?
4. Do you manage water resources? If yes, what is your role?
5. What is your primary interest in land or water resources management?

6. Do you have concerns about groundwater management? If so, what are they?
7. Do you have recommendations regarding groundwater management? If so, what are they?

The Grassland GSA may add additional questions to the survey discussions that specifically pertain to information and feedback needed from stakeholders and industries represented within the GSA boundary. Those questions will be added to this section once developed. If the Grassland GSA so chooses, a written/digital survey specific to the landowners and other beneficial users of groundwater can be created. This section will be updated accordingly if necessary.

III.A.3 Stakeholder Survey Distribution

If the Grassland GSA finds it beneficial, printed and online distribution methods for the Stakeholder Survey will be added to **Section V.A.3.2** and **Section V.A.4**. Survey results will then be compiled and reviewed on a monthly basis by GWD and GRCD Boards of Directors and the Grassland GSA's technical team.

B. "Lay of the Land" Overview

The purpose of a "Lay of the Land" overview is to map stakeholders' known issues, interests, challenges, strategies, and roles for engagement. Results from discussions will be tracked on an ongoing basis during Grassland GSA meetings as a "Lay of the Land Overview" so the technical team can utilize the information during the GSP development phase. These discussions will include:

- Type of stakeholder
- Key interests related to groundwater
- Key issues (documented or specific issues of past events)
- Which section of the GSP is this applicable to?

Results can also be used as a basis for the development of fact sheets and key messages and talking points (**Section IV**), as necessary to educate and inform stakeholders effectively.

III.B.1 Types of Stakeholders

Types of stakeholders with the greatest interests in the Grassland GSA's GSP development and resulting implementation efforts to reach groundwater sustainability include environmental users, agricultural users, domestic well owners, surface water users, local land use planning agencies, federal government agencies, and entities monitoring and reporting groundwater elevations in all or part of the groundwater basin (**Table II-2**). One-on-one conversations and collaborative discussions, and other outreach efforts will be scheduled with these stakeholder groups for comprehensive input through the GSP development and public review phases.

III.B.2 Stakeholder Key Interests Related to Groundwater

The key interests of stakeholders related to groundwater within the Grassland GSA boundary include:

- Environmental
- Recreational
- Agriculture – Farming
- Drinking water and residential usage

III.B.3 Key Documented Issues

Several key documented water resources issues have affected, or have the potential to affect, the key interests of stakeholders within the Grassland GSA boundary. As key documented issues arise throughout GSP development, public review and implementation phases, they will be added to this section.

IV. Messages and Talking Points

Key messages and talking points will be broken down by phases and stakeholder groups, as different factors and issues will affect different groundwater interests. These messages and talking points are also prone to evolve as the GSP is developed, leaving this section open to being amended and finetuned as communication and engagement efforts move forward. Developing talking points will unify the responses from the GSA (GWD and GRCD) Board of Directors, committee members and technical team, ultimately delivering consistent messages to stakeholders.

These messages and talking points will also be incorporated into presentations, newsletters and fact sheets throughout GSP development, public review and implementation phases, and made available for public education efforts described in **Section V.A.3** and **Section V.A.4**.

IV.A.1 Key Messages & Talking Points

IV.A.1.1 Universal Key Messages

Universal key messages will be a consistent part of fact sheets and talking points throughout all phases of GSP development, public review and implementation.

- What is SGMA
- SGMA schedule
- What is the role of a GSA
- Grassland GSA's Goal – "Preserving the largest remaining wetland in the west."

IV.A.1.2 Phase 1: GSA Formation and Coordination

The Phase 1: GSA Formation and Coordination has been completed. During this phase, key messages centered around the official formation of the GSA and soliciting input from individuals who represent the interests of all beneficial usages and users of groundwater within the Grassland GSA boundary.

IV.A.1.3 Phase 2: GSP Preparation and Submission

The key messages for the GSP development and submission phase includes:

- Universal key messages
- Timeline of the GSP process
- Industry-related water usage and economic impacts – Common practices and conservation efforts
- "What's Next" and upcoming public outreach opportunities
- Direction on providing input/voicing concerns (outreach meetings, stakeholder input process)

IV.A.1.4 Phase 3: GSP Review and Evaluation

Once the draft of the Grassland GSA's GSP is completed, key messages will be updated to focus on:

- Universal key messages
- Timeline of the GSP process

- Main points/overview of the GSP
- Process for public review of GSP draft and providing comments to the GSA
- "What's Next"
- Additional key messages may be added for this phase.

IV.A.1.5 Phase 4: Implementation and Reporting

Once the Grassland GSA's GSP has been submitted to the DWR, the implementation phase will begin, and key messages will be developed to focus on implementation efforts that will affect the stakeholder groups. As with the previous phases, universal key messages will be included.

IV.A.2 Likely Questions or Issues and Responses

The "Likely Questions or Issues" list in **Table IV-1** will evolve through the GSP development, public review and implementation phases. This table will be updated with additional questions, and responses will be updated as the Grassland GSA's GSP is developed and answers are more clearly defined.

Table IV-1. Likely Questions or Issues

Likely Question or Issue	Response	Phase
"Will I have to fallow any of my land?"	That information has not been determined yet, as we are in the preliminary stages of GSP development.	Phase 1, 2 & 3
"How can I voice my concerns about how SGMA is going to affect me?"	The public is invited to GWD and GRCD Boards of Directors meetings to be informed about the progress of GSA and GSP development. Public outreach meetings will be held in 2019 for SGMA educational purposes and public review periods. Stakeholders may also contact the GSA directly to provide input and voice concerns regarding the development of the GSP.	Phase 2 & 3
"How much water are we going to be able to pump?"	That information has not been determined yet, as we are in the preliminary stages of GSP development.	Phase 1, 2 & 3
"Are our ag pumps going to be metered? If so, who is going to pay for it?"	That information has not been determined yet, as we are in the preliminary stages of GSP development.	Phase 1, 2 & 3
"What types of management actions and/or projects can help improve groundwater conditions?"	That information has not been determined yet, as we are in the preliminary stages of GSP development.	Phase 1, 2 & 3

V. Venues for Engaging

There are a variety of opportunities, venues and methods for the Grassland GSA to connect with and engage stakeholders throughout GSA formation, GSP development, GSP review, and GSP implementation phases. Stakeholders identified in **Section II** will be engaged in communication efforts as detailed below.

A. Direct Stakeholder Outreach

V.A.1 Collaboration Meetings with Active Stakeholders

As detailed in **Section II.A**, regular meetings with active stakeholder groups will be held during their regularly scheduled times. Members of the public and partners from other local agencies are encouraged to attend Board of Directors and, if formed, advisory committee meetings to voice their thoughts and concerns throughout the GSP development, public review and implementation phases. Meeting notices and agendas are routinely distributed to the Interested Parties List and posted on the GSA's webpage, as well as webpages for the GWD and GRCD under the Grassland Water District umbrella website (see **Table V-2**).

Active stakeholder meetings are held:

- **GWD Board of Directors Meetings –** Held on the second Tuesday of each month at 3 p.m. at the Grassland Water District, located at 200 W. Willmott Avenue in Los Banos.
- **GRCD Board of Directors Meetings –** Held on the fourth Tuesday of the month at 1:30 p.m. at the Grassland Water District, located at 200 W. Willmott Avenue in Los Banos.
- **GSA Advisory Committee Meetings –** If the Advisory Committee is developed in the future, dates, time and locations for Advisory Committee meetings will be added to this section. These meetings will be open to all stakeholders, interested parties and the public.
- **Subbasin Coordination Committee Meetings –** Held on the fourth Thursday of each month at 1 p.m. at the SLDMWA Administrative Office, located at 842 6th Street in Los Banos.
- **Delta-Mendota Subbasin Technical Working Group Meetings –** Held the third Tuesday of every month at 10 a.m. at the SLDMWA Administrative Office, located at 842 6th Street in Los Banos.
- **Delta-Mendota Subbasin Communications Working Group Meetings –** Held the fourth Tuesday of each month at 1 p.m. at the SLDMWA Administrative Office, located 842 6th Street in Los Banos.

V.A.2 Educational/Outreach Public Meetings

V.A.2.1 General Stakeholders

Educational/outreach public meetings will be scheduled for Phase 2: GSP Preparation and Submission, Phase 3: GSP Review and Evaluation, and Phase 4: Implementation and Reporting (see **Section VI** for the previous and proposed timeline). These meetings will be important as the GSP will affect all groundwater users within the Grassland GSA jurisdiction, and the impact of the SGMA implementation is significant. Stakeholders are already inquiring about the impacts of implementation, while many stakeholders are unaware of the SGMA. Spanish translation services will be available at educational/outreach public meetings, if needed.

- **Phase 2: GSP Preparation and Submission –** Public outreach and one-on-one meetings held during Phase 2 will give stakeholders an opportunity to be involved in the GSP development and share their thoughts and concerns. Presentations and discussions will be geared towards an overview of SGMA, overview of the process of GSP development, public review and implementation (what stakeholders can expect), and question/answer sessions. Potential venues within the Grassland GSA are listed in **Table V-1**.
- **Phase 3: GSP Review and Evaluation –** During Phase 3, the draft of the Grassland GSA GSP will be distributed for public review. During the public review period, public meetings will be held at the same venues as during Phase 2 (**Table V-1**). The presentations and discussions will include an overview of the GSP and will give stakeholders the opportunity to comment on the draft in a public forum.
- **Phase 4: Implementation & Reporting –** Public meetings will be crucial during Phase 4 and will likely be ongoing to educate stakeholders on implementation requirements and guide them through the steps to compliance and groundwater sustainability.

V.A.2.2 Organizations, Public Agencies & Other Entities

Organizations, public agencies and other entities are listed in **Table II-3**, and will be contacted to schedule opportunities to present or facilitate discussions with their members throughout the GSP development phase. Presentations and discussions will include an overview on SGMA and why it is important to them, an explanation of the GSP development process, including an awareness of the public review period. In addition, the Grassland GSA will work with these organizations and agencies to distribute newsletters, public outreach meeting notices, and other educational information via email distribution, social media posts, and printed materials.

V.A.2.3 Meeting Notification Process

Stakeholders will be invited to public meetings through direct mail and/or email blasts by obtaining mailing and email addresses of property owners, residents and businesses within the Grassland GSA boundary from the member agencies, and notifications will be posted on the Grassland Water District's Facebook page. For direct mailings, postcards are most cost effective for mailing and can later be used to expedite meeting check-in and track attendance, if required during the implementation phases. Organizations, such as the Merced County Farm Bureau, will be asked to distribute meeting notices via email blasts to their membership/contact lists.

V.A.2.4 Ideal Venues

Venue locations will need to have a capacity to hold large audiences. The location list in **Table V-1** will be updated with additional information and other venue possibilities as meetings are scheduled, and venue availability and rental price is confirmed.

Table V-1. Potential Public Meeting Venues & Locations

Venue	Location	Contact Information
Grassland Water District	Los Banos	Address: 200 West Willmott Avenue, Los Banos, CA 93635 Telephone: (209) 826-5188 Website: www.gwdwater.org
City of Los Banos Community Center	Los Banos	Address: 645 7th Street, Los Banos, CA 93635 Telephone: (209) 827-7034 x 10 or 11 Website: www.losbanos.org
Al Goman Community Center	Gustine	Address: 745 Linden Avenue, Gustine, CA 95322 Telephone: (209) 854-6471 Website: www.cityofgustine.com

V.A.3 Printed Communication

V.A.3.1 Branding

Branding is defined as the process of creating distinctive and durable perceptions in the minds of a target audience. A brand is a specific look – a persistent, consistent, unique identity for an organization, making it easy for an audience to identify an organization through its consistent and frequent use of branding. The Grassland GSA will incorporate the Grassland GSA brand on all forms of communication and engagement with the public, which includes consistent usage of the official logo, fonts and colors (**Appendix A**).

V.A.3.2 Printed Materials

Printed materials will incorporate the visual imagery established through branding efforts and will be tailored for specific means of communication throughout the phases of GSP development, public review and implementation. All printed materials will be translated into Spanish if requested.

- **Newsletter –** Quarterly newsletters will be created as necessary during the GSP development, public review, and implementations phase to inform stakeholders of compliance requirements and groundwater sustainability updates, opportunities and programs within the Grassland GSA and the Delta-Mendota Subbasin. The newsletter will be distributed to those on the Interested Parties List and made available in public locations such as school sites, post offices, and city/district offices.
- **Fact Sheets, Fliers, Post Cards –** Fact sheets, fliers or post cards will be developed, as needed. Information may include meeting notices to mail to GWD and GRCD members and post at various locations within the Grassland GSA boundary, or general SGMA information updated with the key messages for each of the GSP phases. These materials will be available for download on the Grassland GSA's webpage, distributed at public meetings and community organizations/entities meetings, and emailed to the Interested Parties List and other organizations' email distribution lists.
- **Letter Correspondence –** When letter correspondence is necessary, particularly during the public review and implementation phases, letters will be distributed via email or direct mail. Letters will include pertinent facts and explanations that need to be communicated to stakeholders.
- **Presentation Materials –** Power Point presentations will be utilized at educational/outreach public meetings. If a Power Point isn't possible to display for a meeting, display boards printed at 24-inch x 36-inch or larger in size will be used and set up on easels. Handouts of presentations and smaller versions of display boards will be distributed to stakeholders in attendance and will also be posted on Grassland GSA's webpage for stakeholder access as a recap of past meetings.
- **Other Printed Materials –** Other printed materials may be needed to be developed during the GSP development, public review and implementation phases.

V.A.4 Digital Communication

Digital communication outlets will be a significant mode of communication through the GSP development, public review and implementation phases.

- **Website –** Public meeting notices and agendas of the special GSA-specific GWD/GRCD Boards of Directors meetings will be posted on the Grassland GSA's webpage and under "Meetings & Events" webpages for both the GWD and GRCD. The Grassland Water District website (http://gwdwater.org) is an umbrella website for the GWD, GRCD and Grassland GSA (**Table V-2**), ultimately serving as an integral resource for all stakeholders within the GSA boundary. Electronic files of GSA-specific newsletters, presentations, fact sheets/fliers/postcards, and other educational resources will be accessible via the website. This serves as a way for stakeholders to easily educate themselves on the GSP process and phases.

Table V-2. GSA & Member Agencies' Websites

GSA	Website
Grassland GSA	http://gwdwater.org/sustainability-agency/
Grassland Water District	http://gwdwater.org/
Grassland Resource Conservation District	http://gwdwater.org/grcd/
Delta-Mendota Subbasin	http://deltamendota.org/

- **Social Media –** Meeting notices, and graphics associated with informational pieces prepared for the Grassland GSA will be posted with links on the Grassland Water District's Facebook page (@GrasslandWD).
- **Email Distribution –** As required by SGMA 10723.4 "Maintenance of Interested Persons List," Grassland GSA maintains a contact list. Interested persons may sign up for this list by visiting http://gwdwater.org/sustainability-agency/ and complete the form. This list is utilized to regularly distribute emails to those who have expressed interest in the GSA's progress. Email blasts consist of meeting notices and other documents that are pertinent to the Grassland GSA and stakeholder communication efforts. Stakeholders may also fill out the "Stay Connected" form on the Delta-Mendota SGMA website, http://deltamendota.org/get-involved/. This process will continue.

  Email blasts with newsletter links, meeting notices, public review notices, and other crucial information will also be coordinated with stakeholder groups by utilizing their distribution lists. Examples of these groups are duck clubs and environmental organizations within the Grassland GSA boundary. A working list of organizations that will be contacted are listed in **Table II-3**.

V.A.5 Media Coverage

Press releases and public service announcements (**PSA**) will be written and distributed to the media list of local newspaper publications. These press releases and PSAs will focus on notification of public engagement opportunities such as targeted stakeholder meetings, public review/comment processes and opportunities, and GSP implementation.

Direct story pitches will be made when necessary via direct communication with news outlets throughout GSP development and implementation phases. These story pitches will focus on GSP development status updates, how public input is being used, and general overview of SGMA and how it will affect stakeholders (residents and industry) within the Grassland GSA boundary.

Table V-3. Media Outlets within the Grassland GSA

Media Outlet	Submission Information
Business Journal	Submit: Online Website: www.thebusinessjournal.com Telephone: (559) 490-3400
California Ducks Unlimited Email Newsletter	Submit: Chris Jennings, Editor – cjennings@ducks.org Website: https://www.ducks.org/Media/Ducks-Unlimited-Email-Newsletter?poe=footer-m
California Water Fowl Magazine	Submit: Holly Heyser, Editor – hheyser@calwaterfowl.org Website: www.calwaterfowl.org/magazine Telephone: (916) 648-1406
“Farm News” by Merced County Farm Bureau	Submit: info@mercedfarmbureau.org Website: www.mercedfarmbureau.org Telephone: (209) 723-3001
Los Banos Enterprise	Submit: vshanker@losbanosenterprise.com; glieb@losbanosenterprise.com Website: www.losbanosenterprise.com Telephone: (800) 540-4200
Merced Sun-Star	Submit: rparsons@mercedsun-star.com; tmiller@mercedsun-star.com Website: www.mercedsunstar.com Telephone: (209) 722-1511
Modesto Bee	Submit: kvaline@modbee.com; pguerra@modbee.com Website: www.modbee.com Telephone: (209) 578-2330
West Side Index & Gustine Press Standard	Submit: dharris@mattosnews.com Website: www.westsideconnect.com Telephone: (209) 862-2222

VI. Implementation Timeline

The timeline for implementing the Grassland GSA's Communication & Engagement Plan will be broken down by phase:

- Phase 1: GSA Formation and Coordination – 2015 through 2017 (**Figure VI-1**)
- Phase 2: GSP Preparation and Submission – 2017 through 2019 (**Figure VI-2**)
- Phase 3: GSP Review and Evaluation – 2019 through 2020 (**Figure VI-2**)
- Phase 4: Implementation and Reporting – 2020 and ongoing

The timeline is tentative and subject to change with the progression of the GSP development, public review and implementation phases. The public review phase will be in accordance with SGMA's public review standards and the implementation timeline will reflect that timeframe once a definitive timeline has been established with the completion of the GSP draft.

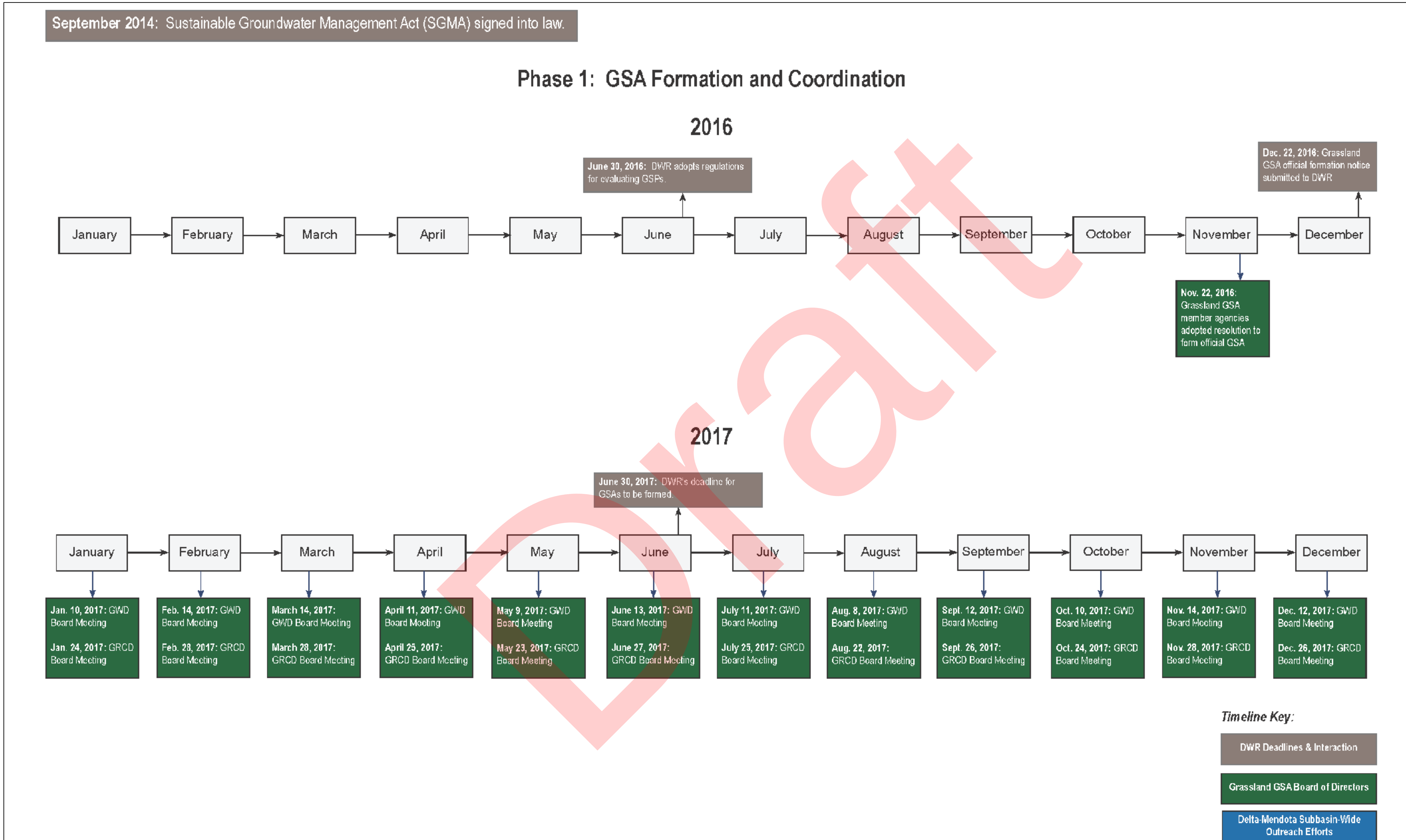


Figure VI-1. Grassland GSA Communication & Engagement Timeline – Phase 1: GSA Formation and Coordination

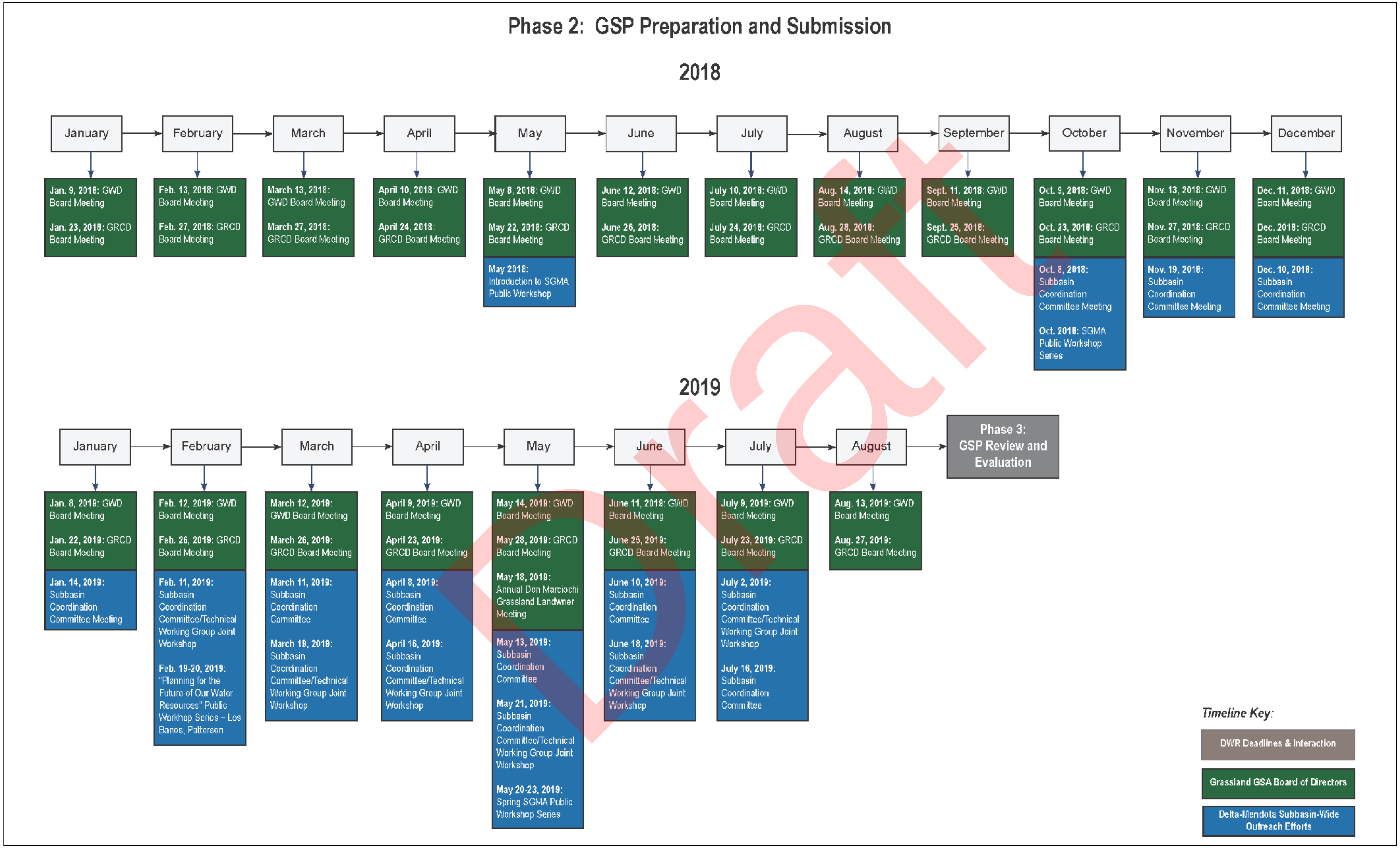


Figure VI-2. Grassland GSA Communication & Engagement Timeline – Phase 2: GSP Preparation and Submission

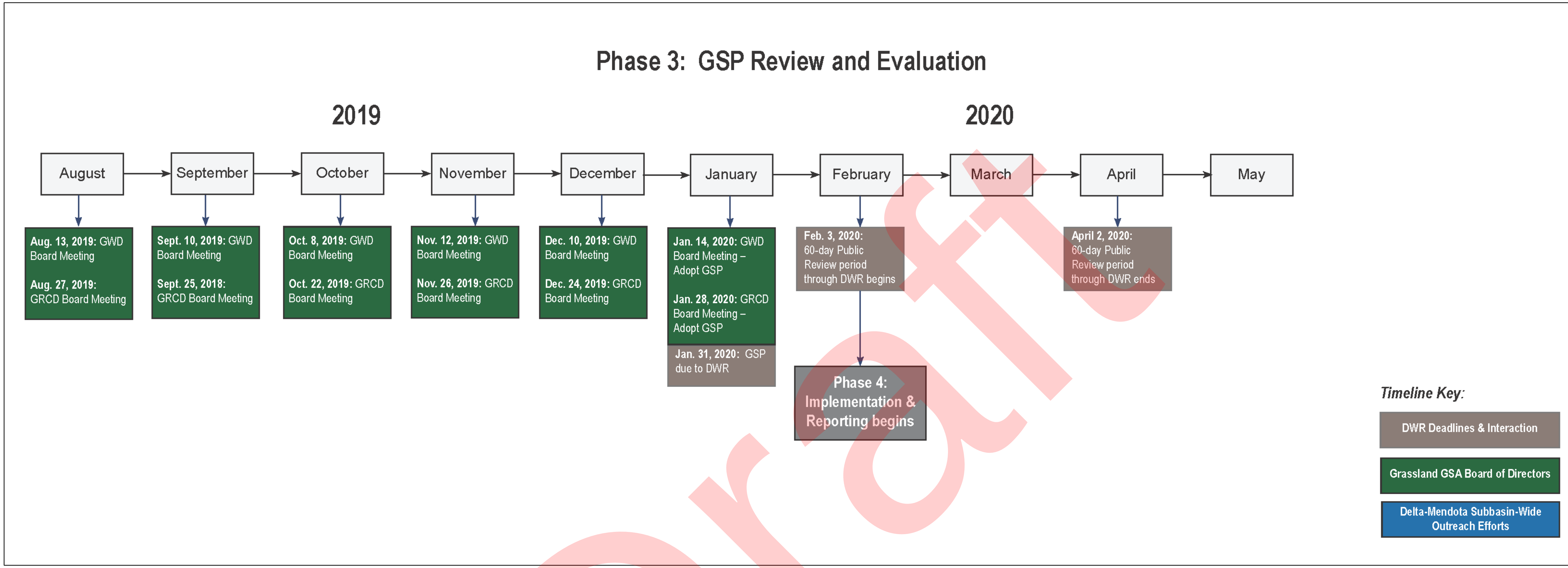


Figure VI-3. Grassland GSA Communication & Engagement Timeline – Phase 4: GSP Review and Evaluation

VII. Evaluation and Assessment

A. Evaluation and Assessment Process

Having an established "checks and balances" process is essential in keeping public outreach goals on target. SGMA and the resulting GSP will affect everyone within the subbasin, and outreach efforts must be all-encompassing. To evaluate and assess how outreach efforts are performing as compared to the goals and objectives detailed in the Communication & Engagement Plan, the Grassland GSA has established a process:

VII.A.1 Outreach Reports

GSA management will provide periodic updates to the Boards of Directors. These updates will include, but will not be limited to:

- Status of upcoming outreach events, and recaps of past outreach events including dates, times, audience and attendance numbers
- Milestone updates/revisions
- Review/input and approval of printed materials (fliers, fact sheets, talking points, etc.)
- Results and status updates of stakeholder discussions

VII.A.2 Milestone Review

Once per quarter or as determined, the GSA management will facilitate a more in-depth discussion with the Boards of Directors for feedback regarding communication and engagement efforts for the stakeholder groups they specifically represent. These discussions will cover:

- What has worked well?
- What hasn't worked as planned or could be finetuned for more effective results?
- Lessons learned
- Outreach needs that should be added to the implementation timeline
- Next steps

VII.A.3 Completed Outreach Tracking

The Grassland GSA will update the C&E Plan on a quarterly basis with completed public outreach efforts. The summaries will be added to **Appendix B** and will be included in the final GSP submitted to the DWR in January 2020.

Quarterly updates will include:

- Public outreach meetings and workshops (locations, times, target audience, number of people who attended).
    - For each, include PDF copy of agenda, handouts and presentation materials.

- PDFs of any distributed printed or digital materials distributed (public outreach workshop notices, informational materials posted within communities, email blasts, press releases, newsletters, social media posts, etc.)
    - For each, include date distributed, methods of distribution, and number distributed to (if applicable).

Appendix A

Grassland GSA Branding Summary

Branding Summary

Logo

Color Scheme

- Dark Green ("Grassland" text): 89-35-100-30 (CMYK); 13-99-51 (RGB)
- Blue: 91-56-9-0 (CMYK); 1-109-170 (RGB)
- Brown: 48-73-84-68 (CMYK); 64-35-18 (RGB)
- Light Green: 63-0-100-0 (CMYK); 105-189-69 (RGB)

Appendix B

Completed Outreach Efforts

Completed Outreach Tracking

The following pages provides a detailed list of public outreach efforts completed by the Grassland GSA, or that the Grassland GSA was involved in through subbasin-wide efforts. These events are also reflected on the timelines in **Section VI** (**Figure VI-1**, **Figure VI-2** and **Figure VI-3**). The information includes:

- Public meetings (GSA and subbasin-wide board and coordination committee)
- Public outreach meetings
- Other public presentations
- Copies of any distributed materials

Grassland GSA Public Meetings & Outreach Events		
Event/Meeting	**Event/Meeting Details**	
2017		
GWD Board Meetings	January 10, 2017 February 14, 2017 March 14, 2017 April 11, 2017 May 9, 2017 June 13, 2017	July 11, 2017 August 8, 2017 September 12, 2017 October 10, 2017 November 14, 2017 December 12, 2017
GRCD Board Meeting	January 24, 2017 February 28, 2017 March 28, 2017 April 25, 2017 May 23, 2017 June 27, 2017	July 25, 2017 August 22, 2017 September 26, 2017 October 24, 2017 November 28, 2017
2018		
GWD Board Meeting	January 9, 2018 February 13, 2018 March 13, 2018 April 10, 2018 May 8, 2018 June 12, 2018	July 10, 2018 August 14, 2018 September 11, 2018 October 9, 2018 November 13, 2018 December 11, 2018
GRCD Board Meeting	January 23, 2018 February 27, 2018 March 27, 2018 April 24, 2018 May 22, 2018 June 26, 2018	July 24, 2018 August 28, 2018 September 25, 2018 October 23, 2018 November 27, 2018 December 2018

Grassland GSA Public Meetings & Outreach Events		
Event/Meeting	**Event/Meeting Details**	
2019		
GWD Board Meeting	January 8, 2019 February 12, 2019 March 12, 2019 April 9, 2019 May 14, 2019 June 11, 2019	July 9, 2019 August 13, 2019 September 10, 2019 October 8, 2019 November 12, 2019 December 10, 2019
GRCD Board Meeting	January 22, 2019 February 26, 2019 March 26, 2019 April 23, 2019 May 28, 2019 June 25, 2019	July 23, 2019 August 27, 2019 September 25, 2019 October 22, 2019 November 26, 2019 December 24, 2019
Annual Don Marciochi Grassland Landowner Meeting	May 18, 2019	

Delta-Mendota Subbasin-Wide Outreach Meetings/Events	
Event/Meeting	**Event/Meeting Details**
Introduction to SGMA Public Workshop	May 2018
Delta-Mendota Subbasin Coordination Committee Meeting	10 a.m., October 8, 2018, SLDMWA Los Banos office
SGMA Public Workshop Series	October 22, 2018
Delta-Mendota Subbasin Coordination Committee Meeting	10 a.m., November 19, 2018, SLDMWA Los Banos office
Delta-Mendota Subbasin Coordination Committee Meeting	10 a.m., December 10, 2018, SLDMWA Los Banos office
Delta-Mendota Subbasin Coordination Committee Meeting	10 a.m., January 14, 2019, SLDMWA Los Banos office
Delta-Mendota Subbasin Coordination Committee and Technical Working Group Joint Workshop	10 a.m., February 11, 2019, SLDMWA Los Banos office
Subbasin-Wide Public Workshop Series – "Planning for the Future of Our Water Resources"	4 p.m., February 19, 2019, Los Banos 4 p.m., February 20, 2019, Patterson
Delta-Mendota Subbasin Coordination Committee Meeting	10 a.m., March 11, 2019, SLDMWA Los Banos office
Subbasin Coordination Committee and Technical Working Group Joint Workshop	10 a.m., March 19, 2019, SLDMWA Los Banos office
Delta-Mendota Subbasin Coordination Committee Meeting	9:30 a.m., April 8, 2019, SLDMWA Los Banos office
Subbasin-Wide Coordination Committee and Technical Working Group Joint Workshop	10 a.m., April 16, 2019, SLDMWA Los Banos office
Delta-Mendota Subbasin Coordination Committee Meeting	9:30 a.m., May 13, 2019, SLDMWA Los Banos office
Delta-Mendota Spring Public Workshop Series	4 p.m., May 20, 2019, Patterson 4 p.m., May 21, 2019, Los Banos 6:30 p.m., May 22, 2019, Santa Nella 6 p.m., May 23, 2019, Mendota
Subbasin-Wide Coordination Committee and Technical Working Group Joint Workshop	10 a.m., May 21, 2019, SLDMWA Los Banos office
Delta-Mendota Subbasin Coordination Committee Meeting	9:30 a.m., June 10, 2019, SLDMWA Los Banos office
Subbasin-Wide Coordination Committee and Technical Working Group Joint Workshop	10 a.m., June 18, 2019, SLDMWA Los Banos office
Subbasin-Wide Coordination Committee and Technical Working Group Joint Workshop	12:30 p.m., July 2, 2019, SLDMWA Los Banos office
Delta-Mendota Subbasin Coordination Committee Meeting	10 a.m., July 16, 2019, SLDMWA Los Banos office