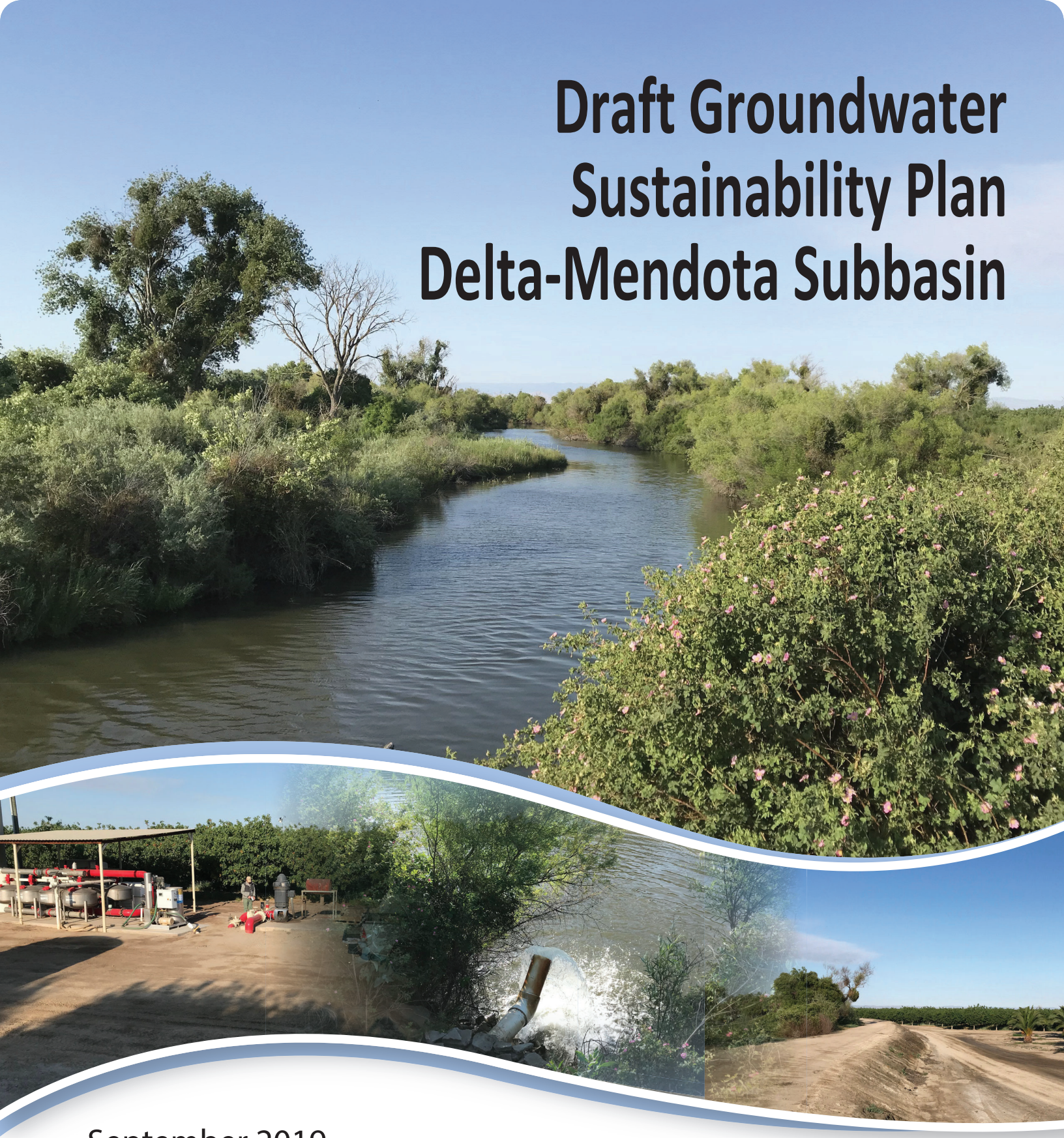
Draft Groundwater Sustainability Plan Delta-Mendota Subbasin



September 2019

FARMERS WATER DISTRICT

Luhdorff & Scalmanini
Consulting Engineers

DISCLAIMER

This work product is the Groundwater Sustainability Plan (GSP) for the Farmers Water District Groundwater Sustainability Agency (GSA). This GSP is one of six (6) individual GSPs being prepared for the Delta-Mendota Subbasin (DMS, Subbasin). Each GSP was prepared under the direction of a Professional Geologist (PG), Certified Hydrogeologist (CHG), or Professional Engineer (PE) as indicated by the stamp on each individual GSP. Each individual GSP for the Subbasin will be submitted in a coordinated manner. The stamp and signature herein represent the work completed on this GSP for the Farmers Water District GSA and none of the other GSPs prepared for the Subbasin. The undersigned assumes no responsibility for any errors or misleading statements presented in any other GSPs prepared in the DMS.

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Draft Groundwater Sustainability Plan
Delta-Mendota Subbasin

September 2019

Prepared For

Farmers Water District

Prepared by

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Contents

EXECUTIVE SUMMARY ES-1

1 INTRODUCTION 1

1.1 Purpose of Groundwater Sustainability Plan 1

1.1.1 Justification for Management Area 2

1.2 Sustainability Goal (Reg. § 354.24) 2

1.3 Agency Information 3

1.3.1 Organization Management and Structure of GSA 3

1.3.2 Legal Authority of the GSA 3

1.3.3 Estimated Cost of Implementing the GSP 4

1.4 GSP Organization 4

2 DESCRIPTION OF PLAN AREA (REG. § 354.8) 13

2.1 Summary of Jurisdictional Areas and Other Features 13

2.1.1 Existing Well Types and Density 13

2.2 Water Resources Monitoring and Management Programs 14

2.2.1 Mendota Pool Group 14

2.2.2 Other Monitoring and Management Programs 14

2.3 Land Use Elements or Topic categories of Applicable General Plans 15

2.3.1 Fresno County General Plan 15

2.3.2 Water Supply Assumptions 15

2.4 Additional GSP Elements 16

2.4.1 Well Construction, Well Destruction, and Abandonment Policies 16

2.4.2 Migration of Contaminated Groundwater and Cleanup Activities 16

2.4.3 Efficient Water Management Practices 17

2.4.4 Efforts to develop relationships with state and federal regulatory agencies 17

2.5 Notice and Communication (Reg. § 354.10) 17

2.5.1 Beneficial Uses and Users of Groundwater 17

2.5.2 Opportunity for Public Engagement 17

2.5.3 Comments on the Plan 19

2.5.4 Agencies Decision Making Process 19

DRAFT

3 BASIN SETTING 20
3.1 Hydrogeologic Conceptual Model (Reg. § 354.18) 20
3.1.1 Regional Geologic Setting 20
3.1.2 Local Geologic Setting 20
3.1.3 Aquifer and Aquitard Properties 23
3.1.3.1 Upper Aquifer 23
3.1.3.2 Lower Aquifer 24
3.1.4 Groundwater Quality 25
3.1.4.1 Local Groundwater Quality Monitoring 25
3.1.5 Soil Characteristics 25
3.1.6 Definable Bottom of the Basin 26
3.1.7 Surface Water Features and Areas of Recharge 26
3.1.8 Data Gaps 28
3.2 Current and Historic Groundwater Conditions (Reg. § 354.16) 29
3.2.1 Groundwater Levels and Flow Direction 29
3.2.2 Upper Aquifer 29
3.2.2.1 Shallow Zone 29
3.2.2.2 Deep Zone 30
3.2.3 Lower Aquifer 31
3.2.4 Change in Storage 32
3.2.5 Groundwater Quality 32
3.2.6 Seawater Intrusion 33
3.2.7 Subsidence 33
3.2.8 Interconnected Surface Water Systems 35
3.2.9 Identification of Groundwater Dependent Ecosystems 36
3.2.9.1 Final GDE Map 37
3.2.9.2 Ecological Conditions 37
3.2.9.3 Impacts to GDEs 37
3.3 Water Budget (Reg. § 354.18) 38
3.3.1 Description of Inflows, Outflows and Change in Storage 42
3.3.1.1 Land Surface Budget 42

DRAFT

3.3.1.2 Groundwater Budget 43
3.3.2 Quantification of Overdraft 44
3.3.3 Estimate of Sustainable Yield 45
3.3.4 Quantification of Current, Historic, and Projected Water Budget 45
3.3.4.1 Historic/Current Water Budget 45
3.3.4.2 Projected Water Budget 46
3.4 Management Areas 47
3.4.1 Reason for Creation of Each Management Area 47
3.4.2 Level of Monitoring and Analysis 47
3.4.2.1 Degraded Water Quality 47
3.4.2.2 Interconnected Surface Waters 48
3.4.2.3 Description of Management Area 48
3.4.3 Explanation of How Management of Management Areas Will Not Cause Undesirable Results Outside the Management Area 48
4 SUSTAINABLE MANAGEMENT CRITERIA AND MONITORING NETWORKS 49
4.1 Sustainability Goal (Reg. § 354.24) 50
4.2 Measurable Objectives and Interim Milestones (Reg. § 354.30) 50
4.2.1 Measurable Objectives for Chronic Lowering of Water Levels 51
4.2.1.1 Description of Measurable Objective 51
4.2.1.2 Reasonable Margin of Safety for Operational Flexibility 52
4.2.1.3 Path to Achieve and Maintain the Sustainability Goal 52
4.2.2 Measurable Objectives for Reduction in Groundwater Storage 52
4.2.2.1 Description of Measurable Objective 52
4.2.2.2 Reasonable Margin of Safety for Operational Flexibility 53
4.2.2.3 Path to achieve and Maintain the Sustainability Goal 53
4.2.3 Measurable Objectives for Subsidence 53
4.2.3.1 Description of Measurable Objective 53
4.2.3.2 Reasonable Margin of Safety for Operational Flexibility 54
4.2.3.3 Path to achieve and Maintain the Sustainability Goal 54
4.2.4 Measurable Objectives for Degraded Water Quality 54
4.2.4.1 Description of Measurable Objective 54

DRAFT

4.2.4.2 Reasonable Margin of Safety for Operational Flexibility 54
4.2.4.3 Path to achieve and Maintain the Sustainability Goal 55
4.2.4.4 Management Area Status 55
4.2.5 Measurable Objectives for Interconnected Surface Waters 55
4.2.5.1 Description of Measurable Objective 55
4.2.5.2 Reasonable Margin of Safety for Operational Flexibility 56
4.2.5.3 Path to achieve and Maintain the Sustainability 56
4.2.5.4 Management Area Status 56
4.3 Minimum Thresholds (Reg. § 354.28) 56
4.3.1 Minimum Thresholds for Chronic Lowering of Groundwater Levels 57
4.3.1.1 Description of Minimum Threshold 57
4.3.1.2 Quantitative Measurements 57
4.3.1.3 Existing local, State, or Federal Standards 58
4.3.1.4 Avoidance of Undesirable Results 58
4.3.1.5 Affects to the beneficial uses and users of groundwater 58
4.3.2 Minimum Thresholds for Reduction in Groundwater Storage 59
4.3.2.1 Description of Minimum Thresholds 59
4.3.2.2 Quantitative Measurements 59
4.3.2.3 Existing local, State, or Federal Standards 60
4.3.2.4 Avoidance of Undesirable Results 60
4.3.2.5 Affects to the beneficial uses and users of groundwater 60
4.3.3 Minimum Thresholds for Subsidence 60
4.3.3.1 Description of Minimum Thresholds 60
4.3.3.2 Quantitative Measurements 60
4.3.3.3 Existing local, State, or Federal Standards 60
4.3.3.4 Avoidance of Undesirable Results 60
4.3.3.5 Affects to the Beneficial Uses and Users of Groundwater 61
4.3.4 Minimum Thresholds for Groundwater Quality 61
4.3.4.1 Description of Minimum Thresholds 61
4.3.4.2 Quantitative Measurements 61
4.3.4.3 Existing local, State, or Federal standards 61

DRAFT

4.3.4.4 Avoidance of Undesirable Results 62
4.3.4.5 Affect to beneficial uses and users of groundwater 62
4.3.4.6 Management Area Status 62
4.3.5 Minimum Thresholds for Interconnected Surface Waters. 63
4.3.5.1 Description of Minimum Threshold 63
4.3.5.2 Quantitative Measurement 63
4.3.5.3 Exiting local, State, or Federal standards 63
4.3.5.4 Affects to the beneficial uses and users of groundwater 63
4.3.5.5 Avoidance of Undesirable Results 63
4.3.5.6 Management Area Status 63
4.3.6 Relationship Between Sustainability Indicator Minimum Thresholds 64
4.4 Undesirable Results (Reg. § 354.26) 64
4.4.1 Description of Undesirable Results 65
4.4.1.1 Groundwater Elevation 65
4.4.1.2 Groundwater Storage 65
4.4.1.3 Subsidence 65
4.4.1.4 Groundwater Quality 65
4.4.1.5 Interconnected Surface Waters 66
4.4.2 Cause of Groundwater Conditions that Lead to Undesirable Results 66
4.4.3 Criteria Used to Define Undesirable Results based on Minimum Thresholds 66
4.4.4 Potential Effects on the Beneficial Users of Groundwater 66
4.5 Monitoring Network (Reg. § 354.34) 67
4.5.1 Description of Monitoring Network 67
4.5.2 Groundwater Elevation Monitoring Network 68
4.5.3 Groundwater Storage Monitoring Network 68
4.5.4 Subsidence Monitoring Network 68
4.5.5 Groundwater Quality Monitoring Network 68
4.5.6 Interconnected Surface Waters Monitoring Network 69
4.6 Monitoring Protocols for Data Collection and Monitoring (Reg. § 352.2) 69
4.6.1 Groundwater Level Elevation 69
4.6.1.1 Protocols for Measuring Groundwater Levels 69

DRAFT

4.6.1.2 Recording Groundwater Level Measurements 70
4.6.1.3 Installing Pressure Transducers and Downloading Data 70
4.6.2 Groundwater Quality Measurements 71
4.6.3 Groundwater Storage Measurements 73
4.6.4 Groundwater Pumping Measurement 73
4.6.5 Subsidence Measurements 73
4.6.6 Interconnected Surface Water Measurements 74
5 PROJECTS AND MANAGEMENT ACTIONS TO ACHIEVE SUSTAINABILITY GOAL (REG. § 354.44) 75
5.1 Targeted Pumping Reductions 76
5.1.1 Measurable objective that is expected to benefit from the project or management action. 76
5.1.2 Circumstances for implementation 76
5.1.3 Public noticing 76
5.1.4 Permitting and regulatory process 77
5.1.5 Timetable for initiation and completion, and the accrual of expected benefits 77
5.1.6 Expected benefits and how they will be evaluated 77
5.1.7 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. 77
5.1.8 Legal authority required 77
6 PLAN IMPLEMENTATION 78
6.1 Estimate of GSP Implementation Costs (354.6) 78
6.1.1 Operations and Monitoring Costs 78
6.1.2 Management, Administration, and Other Costs 80
6.1.3 Plan Update Costs 80
6.1.4 Projects and Management Actions Development and Implementation Costs 81
6.1.5 Total Costs 81
6.1.6 Funding Sources 82
6.2 Reporting 82
6.3 Periodic Evaluation and Reporting 83
7 REFERENCES 85

DRAFT

LIST OF TABLES

Table 1-1 Preparation Checklist for GSP Submittal 5

Table 2-1 Types of Wells 13
Table 2-2 Opportunities for Public Engagement 17

Table 3-1 General Water Quality Data 25
Table 3-2 Surface Water Seepage to Farmers Water District 36
Table 3-3 Delta-Mendota Historic/Current Year Types 40
Table 3-4 Delta-Mendota Projected Year Types 40
Table 3-5 Land Surface and Groundwater Budget Components 42
Table 3-6 Upper Aquifer Overdraft 44
Table 3-7 Upper Aquifer Sustainable Yield 45
Table 3-8 Current and Historic Land Surface Budget ..... after pg. 46
Table 3-9 Current and Historic Groundwater Budget ..... after pg. 46
Table 3-10 Projected Baseline Land Surface Budget ..... after pg. 46
Table 3-11 Projected Climate Change Land Surface Budget ..... after pg. 46
Table 3-12 Projected Baseline Groundwater Budget ..... after pg. 46
Table 3-13 Projected Climate Change Groundwater Budget ..... after pg. 46

Table 4-1 Groundwater Elevation Measurable Objectives and Interim Milestones 52
Table 4-2 Reduction in Groundwater Storage Measurable Objectives and Interim Milestones 53
Table 4-3 Subsidence Measurable Objectives and Interim Milestones 54
Table 4-4 Degraded Water Quality Measurable Objectives and Interim Milestones 55
Table 4-5 Interconnected Surface Waters Measurable Objectives and Interim Milestones 56
Table 4-6 Groundwater Elevation Minimum Thresholds 58
Table 4-7 Identified Well Completion Reports in Farmers Water District 58
Table 4-8 Reduction in Groundwater Storage Minimum Threshold 59
Table 4-9 Subsidence/Compaction Minimum Thresholds 60
Table 4-10 Degraded Water Quality Minimum Thresholds 61
Table 4-11 Interconnected Surface Waters Minimum Threshold 63

DRAFT

Table 4-12 Farmers Water District Monitoring Schedule 65

Table 6-1 Schedule for Implementation - Overview 78
Table 6-2 Operations and Monitoring Costs 79
Table 6-3 Management, Administration, and Other Costs 80
Table 6-4 Plan Update Costs 81
Table 6-5 Total Costs 81

LIST OF FIGURES

After page

Figure 2-1 Delta Mendota – GSAs and Surrounding Subbasins 19
Figure 2-2 Farmers Water District and Adjoining GSAs 19
Figure 2-3 Land Status 19
Figure 2-4 Domestic Well Density 19
Figure 2-5 Production Well Density 19
Figure 2-6 Farmers Water District Land Use 19

Figure 3-1 Surface Geology 28
Figure 3-2 Ground Surface Elevation 28
Figure 3-3 Geologic Cross Section Locations 28
Figure 3-4 Cross Section A-A' 28
Figure 3-5 Cross Section B-B' 28
Figure 3-6 Depth to E-Clay (Corcoran) 28
Figure 3-7 Depth to C-Clay 28
Figure 3-8 Depth to A-Clay 28
Figure 3-9 Soils Map, Farmers Water District 28
Figure 3-10 Soil Infiltration Rates 28
Figure 3-11 Base of Fresh Water 28
Figure 3-12 Surface Water Features 28
Figure 3-13 Well Hydrograph Locations 36
Figure 3-14 Shallow Zone Groundwater Elevation Contours Season High 2013 36

DRAFT

Figure 3-15 Shallow Zone Groundwater Elevation Contours Season Low 2013 37
Figure 3-16 MW-09-57 Upper Aquifer Shallow Zone Hydrograph 37
Figure 3-17 MF-2 Upper Aquifer Shallow Zone Hydrograph 37
Figure 3-18 Deep Zone Groundwater Elevation Contours Season High 2013 37
Figure 3-19 Deep Zone Groundwater Elevation Contours Season Low 2013 37
Figure 3-20 R-8 Upper Aquifer Deep Zone Hydrograph 37
Figure 3-21 MW-10 Upper Aquifer Deep Zone Hydrograph 37
Figure 3-22 Lower Aquifer Groundwater Elevation Contours Season High 2013 37
Figure 3-23 Lower Aquifer Groundwater Elevation Contours Season Low 2013 37
Figure 3-24 USGS 31J6 Upper Aquifer Deep Zone Hydrograph 37
Figure 3-25 Vertical Hydraulic Gradient Between Upper and Lower Aquifer 37
Figure 3-26 Upper Aquifer Annual and Cumulative Change in Storage 37
Figure 3-27 Lower Aquifer Annual and Cumulative Change in Storage 37
Figure 3-28 2015 Maximum EC Values Upper Aquifer Shallow Zone 37
Figure 3-29 2015 Maximum EC Values Upper Aquifer Deep Zone 37
Figure 3-30 R-1 Upper Aquifer Deep Zone EC Measurements 37
Figure 3-31 Compaction and Subsidence Monitoring Sites 37
Figure 3-32 Compaction at Yearout Ranch Extensometer 37
Figure 3-33 Compaction at Fordel Extensometer 37
Figure 3-34 P304 Subsidence 37
Figure 3-35 SJRRP 9-55, 9-55b Upper Aquifer Shallow Zone Vertical Gradient 37
Figure 3-36 Spring 2015 Depth to Water Measurements 37
Figure 3-37 Ecological Conditions Critical Habitats 37
Figure 3-38 Model Domain 46

Figure 4-1 Groundwater Elevation Representative Monitoring Network 74
Figure 4-2 Subsidence Representative Monitoring Network 74
Figure 4-3 Groundwater Quality Representative Monitoring Network 74
Figure 4-4 Interconnected Surface Waters Representative Monitoring Network 74

DRAFT

Figure 4-5 R-8 - Groundwater Elevation Representative Monitoring Site Sustainable Management Criteria 74

Figure 4-6 USGS 31J6 - Groundwater Elevation Representative Monitoring Site Sustainable Management Criteria 74

Figure 4-7 Yearout and P304 – Subsidence Sustainable Management Criteria 74

Figure 4-8 FWD Groundwater Quality Sustainable Management Criteria 74

Figure 4-9 SJRRP-09-55, 55b - Interconnected Surface Waters Sustainable Management Criteria.. 74

Figure 4-10 Farmers Water District Water Levels Sustainable Management Criteria..... 74

APPENDICES

Appendix A – Common Chapters

Appendix B – Coordination Agreement

Appendix C – GSA Formation Documents

Appendix D – Delta-Mendota Subbasin Technical Memoranda

Appendix E – Herminghouse Agreement

Appendix F – Fresno County Well Documents

Appendix G – Spreckels Sugar Company Cleanup and Abatement Orders

Appendix H – Farmers Water District Soils

Appendix I - Numerical Flow Model Report

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LIST OF ABBREVIATIONS & ACRONYMS

AF	Acre- Feet
amsl	above mean sea level
bgs	Below Ground Surface
CAO	Clean-up and Abatement Order
CCID	Central California Irrigation District
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CDPH	California Department of Public Health
CFS	Cubic Feet per Second
CGS	California Geological Survey
CIMIS	California Irrigation Management Information System
Cr	Chino loam
CVP	Central Valley Project
CVRWQCB	Central Valley Regional Water Quality Control Board
DM	Delta Mendota
DMC	Delta Mendota Canal
DMS	Data Management System
DO	Dissolved Oxygen
DTW	Depth to Water
DWR	Department of Water Resources
EC	Electrical Conductivity
EIS	Environmental Impact Statement
ET	Evapotranspiration
ft	Feet
ft/day	Feet per day
FWD	Farmers Water District
FCGP	Fresno County General Plan
GDE	Groundwater Dependent Ecosystem

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GDEi	Groundwater Dependent Ecosystem indicator
GPS	Global Positioning System
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GWE	Groundwater Elevations
In/hr	Inches per Hour
JPA	Joint Powers Authority
KDSA	Kenneth D. Schmidt & Associates
LSCE	Luhdorff & Scalmanini Consulting Engineers
MDL	Minimum Detection Limit
mg/L	Milligrams per Liter
MO	Measurable Objective
MOA	Memorandum of Agreement
MPG	Mendota Pool Group
msl	Mean Sea Level
MT	Minimum Threshold
MWA	Mendota Wildlife Area
NAIP	National Agricultural Imagery Program
NAVD 88	The North American Vertical Datum of 1988
NRCS	Natural Resources Conservation Service
ORP	Oxidation-Reduction Potential
PBO	Plate Boundary Observation
PMAs	Projects and Management Actions
QA/QC	Quality Assurance/Quality Control
RP	Reference Point
RPE	Reference Point Elevation
Pool	Mendota Pool
SGMA	Sustainable Groundwater Management Act
SI	Sustainability Indicator

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SJR	San Joaquin River
SJREC	San Joaquin River Exchange Contractors
SJRI	San Joaquin River Index
SJRRP	San Joaquin River Restoration Program
SLDMWA	San Luis Delta Mendota Water Authority
SMC	Sustainable Management Criteria
SSURGO	Soil Survey Geographic Database
SWRCB	California State Water Resources Control Board
TDS	Total Dissolved Solids
TM	Technical Memoranda
TNC	The Nature Conservancy
umhos/cm	Micromhos per Centimeter
USGS	United States Geologic Survey
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
Valley	San Joaquin Valley
WO	Wonder Orchards
WWD	Westlands Water District

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EXECUTIVE SUMMARY

CHAPTER 1 – INTRODUCTION

The Sustainable Groundwater Management Act (SGMA) was signed into law in 2014 for the purpose of protecting California's groundwater resources. SGMA requires all high and medium priority basins to develop Groundwater Sustainability Plans (GSP) to prevent overdraft and achieve sustainability in the utilization of groundwater resources. The Delta-Mendota Subbasin (Basin 5-022.07 in the California Department of Water Resources (DWR) Bulletin 118) (Subbasin) is a high priority Subbasin that has been assigned a critical overdraft designation by DWR. The Subbasin consists of 23 Groundwater Sustainability Agencies (GSA) who together created six individual GSA groups, each preparing a GSP in a coordinated manner as required by SGMA. Farmers Water District elected to form a GSA on June 14, 2016 in order to represent the interest of local landowners in the District in the development of a GSP with FWD designated as a Management Area in GSP.

This GSP includes a description of groundwater conditions and basin settings of the Subbasin that is common to all six of the GSPs developed for the Delta-Mendota Subbasin in addition to describing the hydrogeologic conditions and management practices in the area of FWD. It also contains the steps that will be taken to achieve sustainability over the next 20 years by preventing undesirable results by monitoring for the following sustainability indicators as defined by SGMA:

- Chronic Lowering of Groundwater Levels
- Reduction in Groundwater Storage
- Degraded Water Quality
- Subsidence
- Depletion of Interconnected Surface Water
- Seawater Intrusion

All but seawater intrusion applies to FWD, and each applicable sustainability indicator will be addressed in this GSP and is integrated into the Subbasin-wide and FWD monitoring program. Measurable objectives and minimum thresholds have been set for each sustainability indicator based on projected hydrologic conditions through the use of a numerical groundwater flow model. This GSP, in coordination with the five other GSPs for the Subbasin, will be implemented and result in the sustainable use of groundwater resources for all beneficial users in FWD and the Subbasin.

CHAPTER 2 – PLAN AREA

FWD is located in the southern portion of the Delta-Mendota Subbasin near the City of Mendota (**Figure ES-1**). FWD borders one adjacent subbasin (Kings), and four GSAs within the Delta-Mendota Subbasin (Fresno County Management Area A, Fresno County Management Area B, SJREC, and Aliso Water District). FWD is approximately 3.5 square miles and is just south of the San Joaquin River (SJR).

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GSP regulations require the identification of federal and state land within the area covered by this GSP. All land within FWD is privately owned (BLM, 2016) and consists of agricultural land uses and four private homes. Location of state and federal lands within the Subbasin are identified in the Common Chapter and the other five coordinated GSPs of the Subbasin.

Prior to the existence of SGMA, FWD and the surrounding area has been extensively monitored by the existing Mendota Pool Group Monitoring Program. The Mendota Pool Group is a group of farmers, including landowners within FWD, that are involved in an exchange program under the US Bureau of Reclamation. Groundwater is pumped into the Mendota Pool in exchange for Central Valley Project (CVP) water delivered to FWD land in the Westside Subbasin. The Bureau of Reclamation and GSAs surrounding the Mendota Pool utilize the groundwater pumped into the Pool by FWD for local irrigation. Annual monitoring reports are produced by the Mendota Pool Group in compliance with *Agreement No. 2 for Mendota Pool Transfer Pumping Project* (Agreement No. 2), the annual extension of Agreement No. 2, and the Environmental Impact Statement (EIS) entitled *Mendota Pool 10-Year Exchange Agreements* (U.S. Bureau of Reclamation [USBR], 2005a). The purpose of the monitoring program and annual reporting is to identify the effects of transfer pumping on local water supplies in the vicinity of the Mendota Pool.

CHAPTER 3 – BASIN SETTING

Hydrogeologic Conceptual Model

The Hydrogeologic Conceptual Model (HCM) provides an overview of regional and local geologic conditions and conditions that govern the response of groundwater conditions to groundwater management. The depositional environments that created the subsurface conditions that FWD now overlies was a combination of alluvial and lacustrine settings. Lacustrine, or lake settings, created thick deposits of clays that created the confining units in the subsurface. The alluvial setting provided the larger grain materials that constitute the groundwater producing aquifers. FWD and the Delta-Mendota Subbasin consists of two principal aquifers, the Upper and Lower Aquifers separated by the Corcoran Clay. The Upper Aquifer is a semi-confined to unconfined aquifer due to the presence of intermitted clay layers such as the A-Clay and C-Clay. The Lower Aquifer is a confined aquifer due to the presence of the Corcoran Clay which underlies all of FWD and the Delta-Mendota Subbasin.

General groundwater quality conditions are described for the region surrounding FWD. Groundwater quality concerns in the FWD area are related to the transport and fate of salts measured in as electrical conductivity of total dissolved solids. FWD has historically had groundwater quality that was suitable for agricultural purposes with no contamination concerns.

The primary surface water feature in the area is the San Joaquin River which flows along the northern boundary of FWD.

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Groundwater Conditions

Groundwater conditions are described with a focus on the historic and current period. The historic period is defined as 2003 to 2012 and the current water year is 2013. The trend of groundwater levels and quality over the historic period provide the basis for establishing sustainable conditions. Historic groundwater levels have been generally stable in FWD in the Upper Aquifer where declines in groundwater elevations are observed during extended dry periods and rapid recovery during wet and normal conditions (**Figure ES-2**). The historic record of the Lower Aquifer has shown a continual decline where groundwater levels do not fully recovery after extended dry periods (**Figure ES-3**).

Groundwater in the flow in the Upper Aquifer is generally to the northeast. Groundwater flow in the Lower Aquifer is to the southwest. Seasonal high and seasonal low conditions differ, but the regional groundwater flow remains consistent.

FWD has historically had groundwater quality that was suitable for agricultural purposes. However, groundwater quality values in FWD are still of higher quality as compared to other areas in the region due to the migration of the Steffens Plume from the south which threatens operations in FWD. Electrical Conductivity (EC) and Total Dissolved Solids (TDS) levels have slowly increased in recent years in FWD.

Subsidence as a result of groundwater extraction is a common problem throughout the Central Valley. Near FWD, subsidence is measured as Upper Aquifer compaction and total subsidence. The difference between the two is Lower Aquifer compaction. Historic data indicates that a majority of land subsidence is the result of Lower Aquifer Compaction. FWD has extracted most of its groundwater from the Upper Aquifer, and, throughout the GSP implementation, will only extract groundwater from the Upper Aquifer.

Water Budget

Groundwater flow models were developed in a coordinated effort amongst the six GSAs in the Subbasin. The groundwater model was used to calculate a water budget over three different time periods: historic (2003 through 2012), current (2013), and projected (2014 through 2070). The historic period represents a long-term average annual hydrologic period. The current water year of 2013 was selected based on the availability of data and because it immediately followed the historic water budget period. The water budgets consist of a land surface budget and groundwater budget which each have designated inflows and outflows. The land surface budget inflows include precipitation, applied water (groundwater and imported water), and surface water inflows, and the outflows include evapotranspiration, deep percolation, surface water outflows, and surface water seepage. The groundwater budget inflows include subsurface inflows, deep percolation, and surface water seepage. Groundwater budget outflows include subsurface outflows and groundwater extractions. Storage change for the historic/current, projected baseline, and projected climate change water budgets were -600 AFY, 0 AFY, and 0 AFY, respectively. The estimated sustainable yield for the subbasin is presented in the Subbasin Common Chapter. Based on the projected water budget analysis, FWD will be sustainably pumping groundwater

at 9,200 AFY, which represents a long-term average. FWD does not pump from the Lower Aquifer but has established a sustainable yield based on the basin-wide value of 0.33 AF/acre/year as described in the Common Chapter. FWD is approximately 2,200 acres which results in a Lower Aquifer sustainable yield of 733 AF/year.

The historic/current water budget exhibits that FWD's activities solely rely on the extraction of groundwater for farming operations and domestic uses and do not depend on the availability of surface water deliveries. Historically, on an annual basis, groundwater extractions have ranged from 3,000 to 12,000 AF which has resulted in variable changes in groundwater storage. On an annual basis, changes in storage have ranged from -5,900 to +5,500 AF for the Upper Aquifer while Lower Aquifer changes were between -100 and 600 AF. Dry years have higher pumping and typically result in a decline in storage, but the years of the greatest extraction do not result in the greatest decline in storage. Change in storage in FWD is a function of groundwater extraction but also external conditions, primarily seepage from surface water and lateral subsurface inflows and outflows.

FWD's projected water budget was calculated under two different conditions. The first was under the Baseline Conditions, which took the historic hydrologic conditions and projected land use (Current year 2013) and pumping practices. The second was the climate change conditions, where historic precipitation and ET values were adjusted with climate change factors provided by DWR (CCTAG, 2015). Change in storage over the projected period showed less variation than the historic period. The baseline groundwater budget shows a range of -1,800 to +2,400 AFY for annual Upper Aquifer storage change, and changes in the Lower Aquifer ranging from -600 to 500 AF. The climate change budget shows a range of -2,000 to 2,600 AFY for annual Upper Aquifer storage change, and changes in the Lower Aquifer ranging from 500 to -500 AF. In general, over the projected water budget period through 2040 and to 2070, the groundwater management practices of FWD are sustainable.

CHAPTER 4 – SUSTAINABLE MANAGEMENT CRITERIA

Sustainable Management Criteria (SMC) were developed for five of the six sustainability indicators: chronic lowering of groundwater elevation, reduction of groundwater storage, degraded water quality, land subsidence, and interconnected surface waters. Given the location of FWD, seawater intrusion was not an applicable sustainability indicator. For each of these sustainability indicators, measurable objectives, interim milestones, and minimum thresholds were set based on conditions that are considered significant and unreasonable. SMC were established for both principal aquifers but the focus of management in FWD will be on the Upper Aquifer where all beneficial users utilize groundwater. These conditions were defined by interactions with local stakeholders and analysis of historic and projected groundwater conditions.

Sustainability Goal

FWD will manage groundwater resources in a manner that results in the absence of undesirable results for the Upper Aquifer by the year 2040. FWD is not expected to extract groundwater from the Lower

Aquifer during the projected water budget period. Lower Aquifer conditions will be monitored and managed in coordination with other entities that utilize the Lower Aquifer to a much greater degree than FWD as a source of groundwater. Sustainability will be accomplished through the continuation of existing monitoring and data collection and intra-basin and inter-basin coordination to improve our understanding of regional influences on Lower Aquifer conditions. Coordination and communication with surrounding GSAs will be conducted to implement management actions that will prevent over extraction of groundwater and maintain stable conditions for each of the sustainability indicators in the Upper and Lower Aquifers.

FWD has exhibited sustainable conditions during normal hydrogeologic conditions when the average change in storage is slightly positive and groundwater levels are generally stable over the historic period. Extended dry periods, such as those during 2012 through 2016, exhibited significant reductions in groundwater storage and conditions that are not sustainable.

Using the current understanding of groundwater conditions in the FWD as they relate to variable hydrologic conditions, the FWD plan area will be managed and monitored to assure the sustainability goal is met by 2040. Further investigation of existing data gap areas and development of future projects and management actions will assure that sustainable conditions are maintained through the planning and implementation horizon (2040 through 2070).

Measurable Objectives and Interim Milestones

Measurable objectives (MOs) quantify groundwater conditions that are representative of sustainable conditions for each sustainability indicator, and Interim Milestones represent the trend of groundwater conditions, in 5-year increments, required to reach sustainable conditions over the 20-year implementation period. MOs and Interim Milestones were established for each of the applicable sustainability indicators as follows:

Chronic Lowering of Groundwater Levels

MO's were set for monitoring wells in each aquifer based on seasonal high conditions observed in 2015. Interim milestones were set as a linear projection between recent (post 2016) groundwater elevations and MO levels representing 2040 (**Table ES-1**).

Table ES-1: Groundwater Elevation Measurable Objectives and Interim Milestones

Well Name	Aquifer	Interim Milestone 5 Years (ft NAVD88)	Interim Milestone 10 Years (ft NAVD88)	Interim Milestone 15 Years (ft NAVD88)	Measurable Objective (ft NAVD88)
R-8	Upper	111	109	107	105
31J6	Lower	0	-9	-18	-27

Reduction in Groundwater Storage

MO values for reduction in groundwater storage for the Upper and Lower Aquifer are based on the difference between the recent water levels and MO values. The MO for decline in groundwater storage is the estimated cumulative decline in storage that the GSP area is able to experience while maintaining sustainable groundwater conditions over the next 20 years. Interim milestones for groundwater storage are the projection between recent levels and the MOs in 5-year increments (**Table ES-2**).

Table ES-2: Reduction in Groundwater Storage Measurable Objectives and Interim Milestones

Aquifer	Interim Milestone 5 Years (AF)	Interim Milestone 10 Years (AF)	Interim Milestone 15 Years (AF)	Measurable Objective (AF)
Upper	-900	-1900	-2800	-3700
Lower	-100	-200	-250	-300

Subsidence

MOs and interim milestone values for subsidence and compaction are based on the rate observed during historic conditions prior to the most recent drought for the Yearout extensometer and P304. Subsidence will only be monitored for the Upper Aquifer, as FWD does not extract water from the Lower Aquifer and is not responsible for Lower Aquifer compaction. The interim milestones were set to the same rate as the MO (**Table ES-3**).

Table ES-3: Subsidence Measurable Objectives and Interim Milestones

Monitoring Site	Interim Milestone 5 Years (ft/year)	Interim Milestone 10 Years (ft/year)	Interim Milestone 15 Years (ft/year)	Measurable Objective (ft/year)
Yearout	0.009	0.009	0.009	0.009
P304	0.036	0.036	0.036	0.036

Degraded Water Quality

MO values were developed based on evaluation of historic TDS concentrations and input with local stakeholders. Interim milestones were set based on a linear interpretation between the MO and MT. MO's and interim milestones were set for each well in the monitoring network.

Table ES-4: Degraded Groundwater Quality Measurable Objectives and Interim Milestones

Well Name	Interim Milestone 5 Years (TDS)	Interim Milestone 10 Years (TDS)	Interim Milestone 15 Years (TDS)	Measurable Objective (TDS)
R-1	1,130 mg/L	1,060 mg/L	990 mg/L	920 mg/L
R-3	1,130 mg/L	1,060 mg/L	990 mg/L	920 mg/L
R-8	1,130 mg/L	1,060 mg/L	990 mg/L	920 mg/L
R-11	1,130 mg/L	1,060 mg/L	990 mg/L	920 mg/L
PCF-1	1,130 mg/L	1,060 mg/L	990 mg/L	920 mg/L

Interconnected Surface Waters

The MO for interconnected surface waters was established based on the historic vertical gradient at two Shallow Zone wells in the Upper Aquifer along the SJR. The MO was set as the minimum observed value during 2015, the baseline year of SGMA. Interim milestones were set as the projection over the GSP implementation from recent measurements to the MO in 2040 (**Table ES-5**).

Table ES-5: Interconnected Surface Waters Measurable Objectives and Interim Milestones

Monitoring Site	Interim Milestone 5 Years (ft/ft)	Interim Milestone 10 Years (ft/ft)	Interim Milestone 15 Years (ft/ft)	Measurable Objective (ft/ft)
SJRRP 09-55, 55b	-0.44	-0.49	-0.54	-0.60

Minimum Thresholds

Minimum Thresholds (MTs) refer to a numeric value for each sustainability indicator used to define undesirable results. The GSP must establish MTs to quantify groundwater conditions for each applicable sustainability indicator at each monitoring site, and it must represent a point in the subbasin that, if exceeded, may cause undesirable results. MTs for the applicable sustainability indicators are as follows:

Chronic Lowering of Groundwater Levels

To establish MT's, the annual maximum groundwater elevation for each year was determined for the historic period of record. This was used to determine the largest continual decline in groundwater elevation throughout the GSP area which was applied to the MO to establish a MT for each monitoring site (**Table ES-6**).

Tables ES-6: Groundwater Elevation Minimum Thresholds

Well Name	Aquifer	Maximum Seasonal high 2015 GWE	Max Decline in GWE	Minimum Threshold (ft NAVD 88)
R-8	Upper	105	-16	89
31J6	Lower	-27	-71	-98

Reduction in Groundwater Storage

MT values for change in storage were estimated by using the most recent water level elevations to compare to the MT for groundwater elevation in the Upper Aquifer and Lower Aquifer. The average change in groundwater elevation from current level to the MT level for all representative sites was used to calculate a change in storage over the entire GSP area (**Table ES-7**).

Table ES-7: Groundwater Storage Minimum Thresholds

Aquifer	Difference Between MT and Recent GWE	GSP Area (Acres)	Specific Yield (Upper)/ Storativity (Lower – Inelastic +Elastic)	Total Storage Change (AF)
Upper	-24 ft	2,213	0.21	11,000
Lower	-98	2,213	0.0041+0.058	4,400

Subsidence

MTs for land subsidence were established based on the maximum rate of subsidence or compaction that occurred during the historic groundwater period (**Table ES-8**).

Tables ES-8: Subsidence/Compaction Minimum Thresholds

Monitoring Site	Monitoring Type	Minimum Threshold (ft/year)
Yearout	Upper Aquifer Compaction	0.017
P304	Land Subsidence	0.1

Degraded Water Quality

MT values for groundwater quality were set at all wells in the monitoring network at a value slightly higher the historic high TDS to maintain historic agricultural practices and prevent impacts to all beneficial uses of groundwater (**Table ES-9**).

Tables ES-9: Degraded Water Quality Minimum Thresholds

Well Name	Minimum Threshold (TDS)
R-1	1200 mg/L
R-3	1200 mg/L
R-8	1200 mg/L
R-11	1200 mg/L
PCF-1	1200 mg/L

Interconnected Surface Waters

The MT for interconnected surface waters was set based on the maximum magnitude of decline observed at the nested monitoring wells over the period of record applied to the established MO (**Table ES-10**).

Tables ES-10: Interconnected Surface Waters Minimum Threshold

Well Name	Minimum Threshold (ft/ft)
SJRRP-09-55, 55b	-1.17

Undesirable Results

Undesirable results occur when the effects caused by groundwater conditions throughout the basin cause significant and unreasonable impacts to any of the six sustainability indicators. Over extraction during extended dry periods will likely lead to undesirable results for groundwater elevation, groundwater storage, and subsidence. Groundwater quality undesirable results may occur in accordance with continued migration of the Steffens Plume, but FWD is not responsible for the cleanup and migration of contaminated groundwater. Undesirable results for interconnected surface waters occur as a result of lower groundwater elevations and reduced flow in the SJR. While FWD management actions can influence the groundwater elevation, reduced flow in the SJR is beyond the control of FWD.

Chronic Lowering of Groundwater Levels

Undesirable results occur when groundwater levels exceed the MT at the Upper Aquifer representative site for two consecutive years. FWD will monitor but is not be responsible for Lower Aquifer conditions. In the event of undesirable results for the Upper Aquifer, FWD will develop project and management actions to prevent future MT exceedances.

Reduction in Groundwater Storage

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Groundwater storage calculations will be estimated with groundwater elevation measurements at multiple sites. Undesirable results occur when groundwater storage exceeds the MT for the Upper Aquifer for two consecutive years. Storage changes will be calculated for the Lower Aquifer, but FWD actions are not responsible for these conditions. In the event of undesirable results for the Upper Aquifer, FWD will develop project and management actions to prevent future MT exceedances.

Subsidence

Undesirable results for subsidence will occur when the rate of compaction for the Upper Aquifer exceeds MT rate for two consecutive years. Similar to groundwater level and storage, FWD will only extract groundwater from the Upper Aquifer and is not responsible for Lower Aquifer compaction. Upper Aquifer compaction is only responsible for a fraction of the total subsidence. In the event of undesirable results for the Upper Aquifer, FWD will develop project and management actions to prevent future MT exceedances.

Degraded Groundwater Quality

Undesirable results occur when any two wells in the representative network exceed the MT value. FWD has been designated as a management area for groundwater quality. Projects or management actions will not be implemented in the event of undesirable results for groundwater quality. FWD will work with adjacent GSAs to address water quality concerns.

Interconnected Surface Waters

Undesirable results occur when the vertical gradient exceeds the MT value for two consecutive years. FWD has been designated as a Management Area for interconnected surface water and will not implement projects or management actions in the event of interconnected surface water undesirable results.

Monitoring Network

The FWD monitoring network consists of 10 sites (**Table ES-11**) that will monitor conditions for each of the five applicable sustainability indicators across the plan area (**Figure ES-4**). The individual monitoring sites were selected to have an even distribution over the plan area where groundwater management practices vary and to utilize the existing monitoring network as much as possible. The monitoring network for each of the applicable sustainability indicators is described below:

Groundwater Elevation Monitoring Network

The groundwater elevation monitoring network consists of two representative monitoring sites, one in the Upper Aquifer (R-8) and one in the Lower Aquifer (USGS 31J6). Groundwater elevation measurements will be made at least twice a year to capture seasonal high and seasonal low levels.

Groundwater Storage Monitoring Network

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Groundwater storage calculations will be made by creating groundwater elevation contour maps, evaluating the changes in groundwater elevations at each groundwater level monitoring site, and taking the difference in groundwater levels between the current and previous water year. These contours will be created from the seasonal high groundwater elevation measurements throughout the GSP area.

Subsidence

The subsidence monitoring network will utilize one USGS extensometer and one UNAVCO GPS monitoring site. The USGS extensometer (Yearout Ranch) measures the amount of compaction in the Upper Aquifer, and the UNAVCO GPS monitoring site (P304) measures the total amount of subsidence due to compaction in both the Upper and Lower Aquifer.

Groundwater Quality Monitoring Network

The groundwater quality monitoring consists of five monitoring sites all screened in the Upper Aquifer. TDS samples are to be collected at least once a year between May and August for annual reporting purposes.

Interconnected Surface Waters Monitoring Network

Interconnected surface waters will be monitored at SJRRP 09-55 and 55b, which are a set of nested wells in Shallow Zone of the Upper Aquifer adjacent to the SJR in FWD. Groundwater elevations from these sites are measured on a weekly basis by the USBR.

Table ES-11: FWD Monitoring Network

Sustainability Indicator	Monitoring Site	Monitoring Frequency	Monitoring Time Frame	Existing Monitoring Program
Groundwater Elevation	USGS 31J6	Semi Annual	Season High: (February-April) Season Low: (September-October)	USGS
	R-8			MPG
Groundwater Quality	R-1	Annual	May -August	MPG
	R-3			
	R-8			
	R-11			
	PCF-1			
Subsidence	Yearout	Annual	Annual High: (December-May)	USGS
	P304-PBO			UNAVCO
Interconnected Surface Waters	SJRRP-09-55, 55b	Semi Annual	Season High: (February-April) Season Low: (September-October)	USBR

CHAPTER 5 – PROJECTS AND MANAGEMENT ACTIONS

FWD has not formally developed any projects or management actions. Projected conditions indicate FWD will operate under sustainable conditions. In the event of undesirable results, FWD will work with local stakeholders to develop targeted pumping reductions to achieve sustainable conditions.

CHAPTER 6 – PLAN IMPLEMENTATION

GSP costs are estimated to be about $4.3 million dollars over the next 20 years with an annual average of $215,000. The GSP will be implemented in accordance with SGMA with annual updates and 5-year updates submitted to DWR by April 1st and January 31st on the years they are due, respectively.

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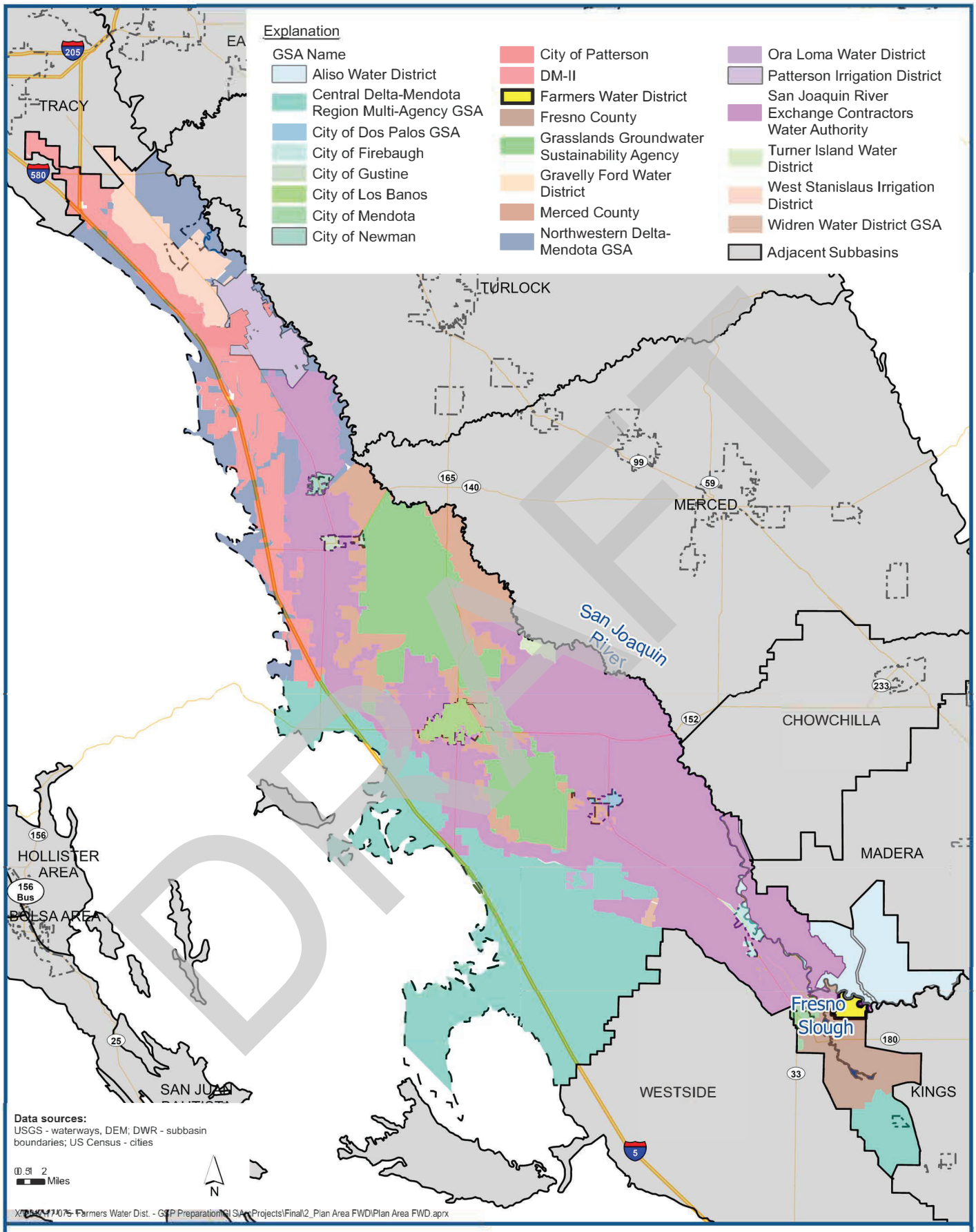

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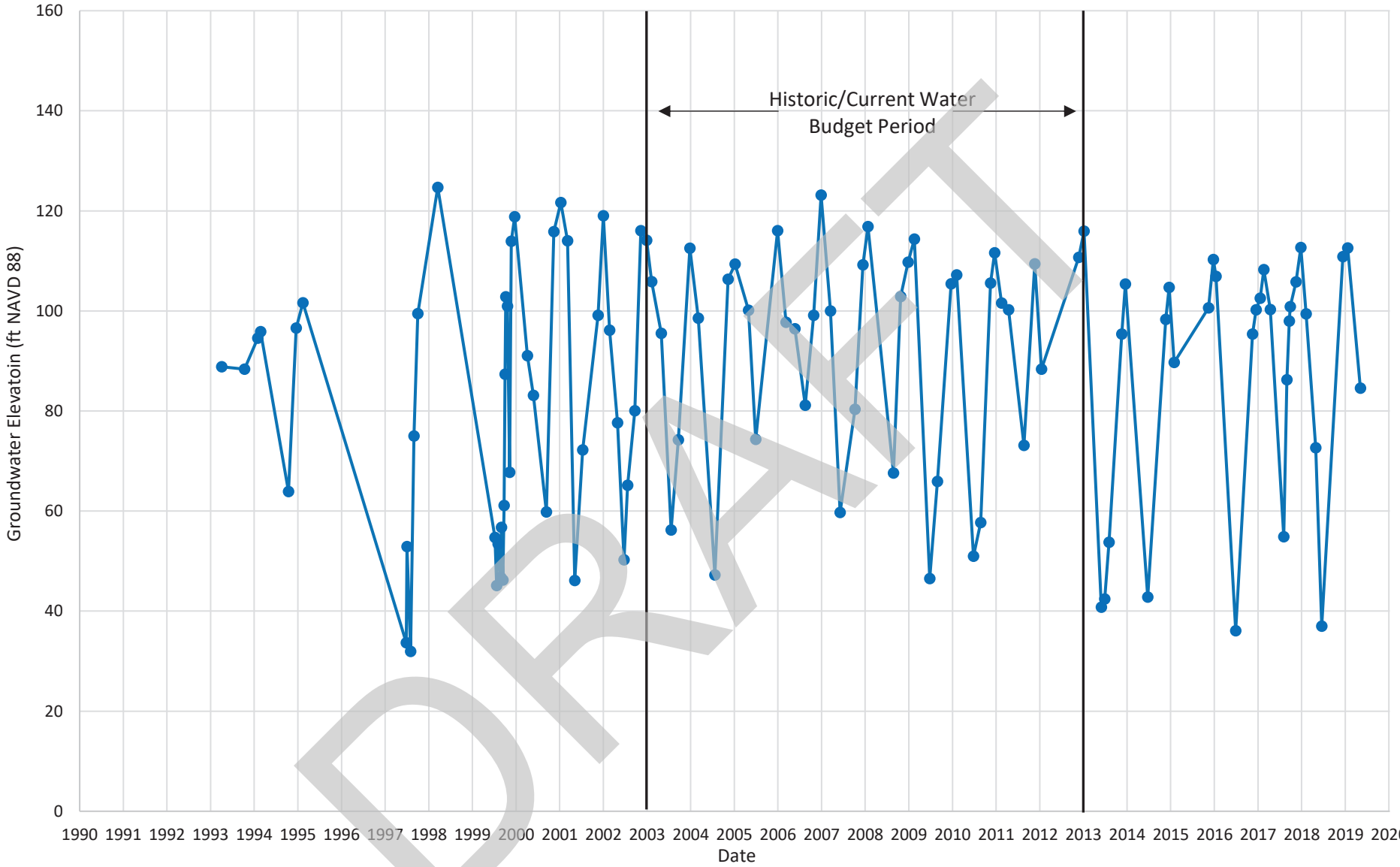
Consulting Engineers

Delta-Mendota GSAs and Surrounding Subbasins

Figure ES-1

Groundwater Sustainability Plan
Farmers Water District
Delta-Mendota Subbasin



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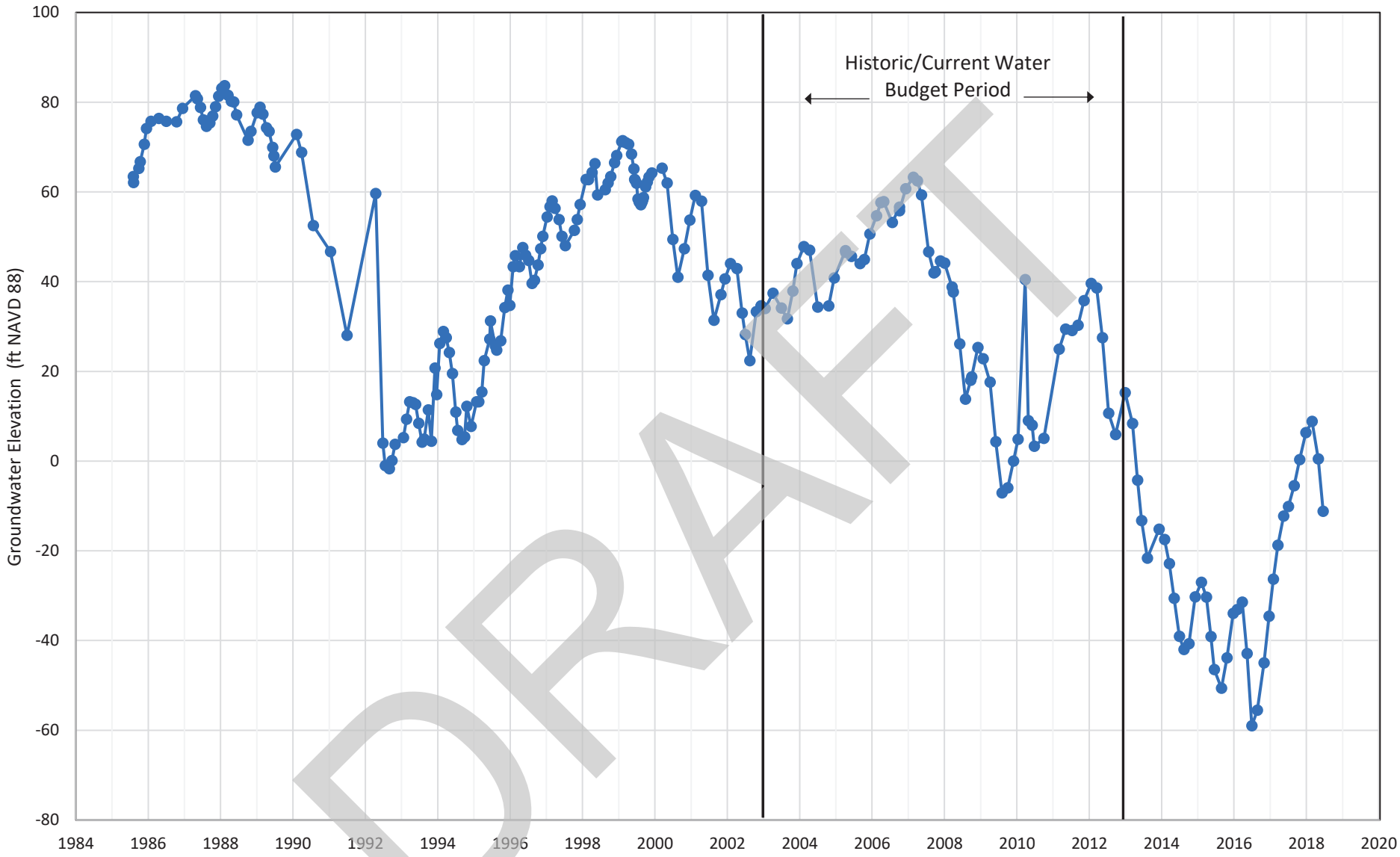
R-8 Upper Aquifer Deep Zone Hydrograph

Groundwater Sustainability Plan
Farmers Water District
Delta-Mendota Subbasin

Figure ES-2



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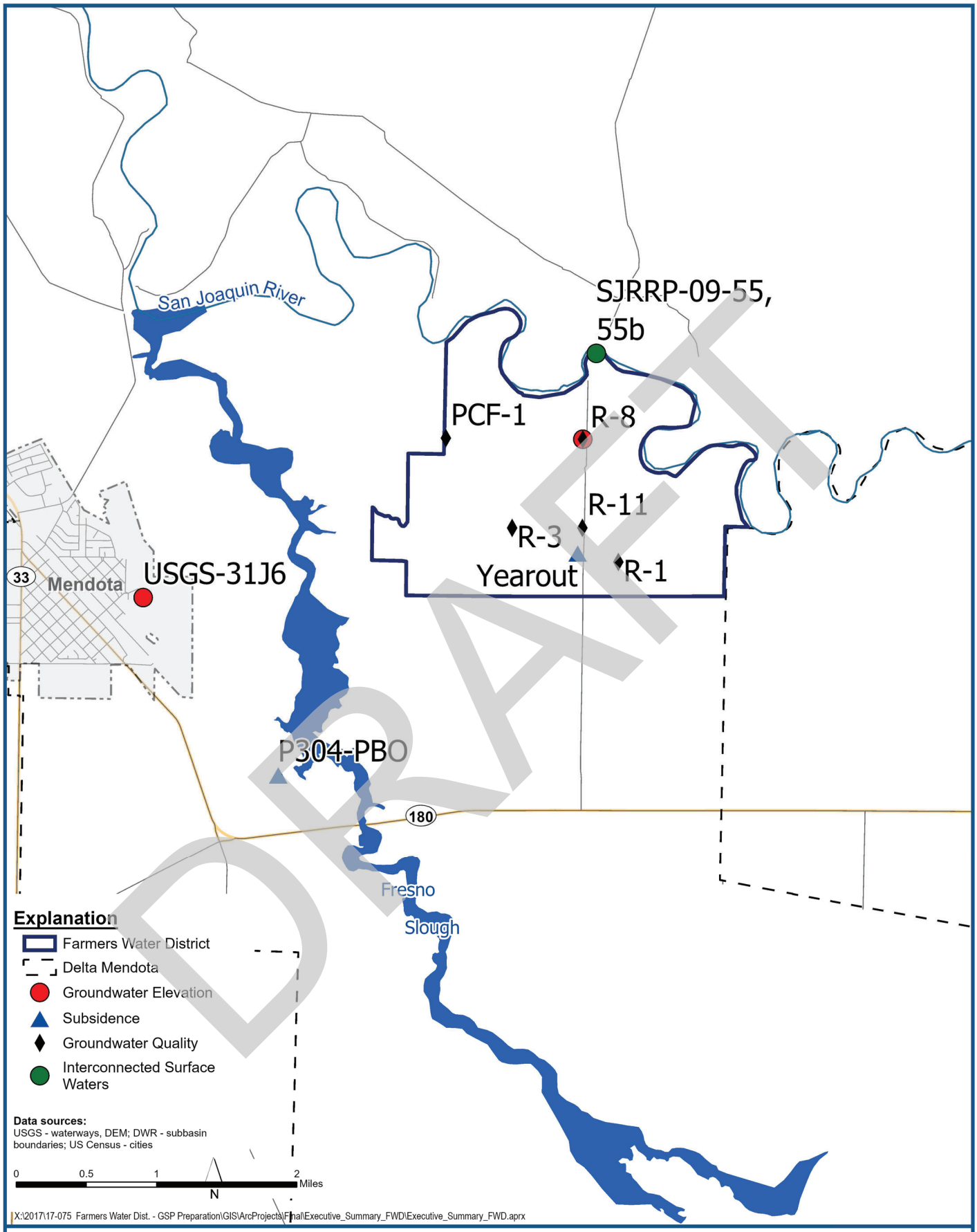
USGS 31J6 Lower Aquifer Hydrograph

Groundwater Sustainability Plan
Farmers Water District
Delta-Mendota Subbasin

Figure ES-3



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Luhdorff & Scalmanini Consulting Engineers

Farmers Water District Monitoring Network

Groundwater Sustainability Plan
Farmers Water District
Delta-Mendota Subbasin

Figure ES-4

1 INTRODUCTION

1.1 Purpose of Groundwater Sustainability Plan

The Sustainable Groundwater Management Act (SGMA) was signed into law in 2014 for the purpose of protecting California's groundwater resources. SGMA requires all high and medium priority basins to develop Groundwater Sustainability Plans (GSP) to prevent overdraft and achieve sustainability in the utilization of groundwater resources. The Delta-Mendota Subbasin (Basin 5-022.07 in the California Department of Water Resources (DWR) Bulletin 118) (Subbasin) is a high priority Subbasin that has been assigned a critical overdraft designation by DWR. The Subbasin consists of 23 Groundwater Sustainability Agencies (GSA) who together created six individual GSP groups, each preparing a GSP in a coordinated manner as required by SGMA. In addition to the six individual GSPs, a GSP for the entire subbasin (Groundwater Sustainability Plan: Common Chapters) was developed by Woodard Curran. This plan included information on the entire subbasin including governance, subbasin setting, sustainable management criteria, subbasin monitoring network, and stakeholder outreach (**Appendix A**). A coordination agreement for GSP development and implementation among the 23 GSAs in the Subbasin was finalized in December 12, 2018 (**Appendix B**).

Farmers Water District (FWD) elected to form a GSA in June 14, 2016 (**Appendix C**) in order to represent the interest of local landowners in the District in the development of a GSP with Farmers Water District as a designated Management Area in the GSP.

SGMA requires consistent data and methodologies in GSP development when multiple GSPs are developed for a single groundwater basin. Eight technical memoranda (TM) were developed by the Delta-Mendota Technical Working Group to ensure that GSPs were consistent across the Subbasin. The following is a list of TMs created for GSP development in the Subbasin. Each of the TMs can be seen in **Appendix D**.

- TM 1 - Common Datasets and Assumptions used in the Delta-Mendota Subbasin GSPs
- TM 2 – Assumptions for the Hydrogeological Conceptual Model of the Delta-Mendota Subbasin
- TM 3 – Assumptions for the Historic, Current, and Projected Water Budgets of the Delta-Mendota Subbasin, Change in Storage Cross-Check and Sustainable Yield
- TM 4 – Assumptions for the Delta-Mendota Subbasin Management Areas, Sustainable Management Criteria
- TM 5 – Assumptions for the Delta-Mendota Subbasin Monitoring Network
- TM 6 – Coordination of the Delta-Mendota Subbasin Data Management System
- TM 7 – Adoption and Use of the Subbasin Coordination Agreement
- TM 8 – Coordinated Noticing, Communication, and Outreach Activities in the Delta-Mendota Subbasin

This GSP includes a description of groundwater conditions and basin settings of the Subbasin that is common to all six of the GSPs developed for the Delta-Mendota Subbasin in addition to describing the

hydrogeologic conditions and management practices in the area of FWD. It also contains the steps that will be taken to achieve sustainability over the next 20 years by preventing undesirable results by monitoring for the following sustainability indicators as defined by SGMA:

- Chronic Lowering of Groundwater Levels
- Reduction in Groundwater Storage
- Degraded Groundwater Quality
- Subsidence
- Depletion of Interconnected Surface Water
- Seawater Intrusion

All but seawater intrusion applies to the FWD, and each applicable sustainability indicator will be addressed in this GSP and is integrated into the Subbasin-wide and FWD monitoring programs. Measurable objectives and minimum thresholds have been set for each sustainability indicator based on projected hydrologic conditions through the use of a numerical groundwater flow model. This GSP, in coordination with the five other GSPs for the Subbasin, will be implemented and result in the sustainable use of groundwater resources for all beneficial users in FWD and the Subbasin.

1.1.1 Justification for Management Area

FWD has designated the area within the District's boundary as a management area of the Delta-Mendota Subbasin. The management area designation for FWD is justified by the pumping restrictions that are currently in place for FWD in the upper portion (Shallow Zone) of the Upper Aquifer. Under the Herminghouse Agreement (**Appendix E**), FWD is restricted from pumping groundwater from the portion of the Upper Aquifer that overlies the A-Clay. FWD is also impacted by the San Joaquin River Restoration Program (SJRRP) which will impact future land use in FWD by constructing set-back levees along the San Joaquin River to mitigate seepage impacts on landowners as a result of restoration flows. FWD is also designated as a management area due to the migration of the Steffens Plume from the adjacent Fresno County Management Area A. The Spreckels Sugar Company operated from 1961 until 2008, employing waste discharge practices which resulted in a plume of saline groundwater in the portion of the Upper Aquifer from which FWD pumps groundwater. Mitigation plans to contain the migration of the plume northward into FWD are being planned through a Cleanup and Abatement Order issued by the Regional Water Quality Control Board. However, the effects of the plume on groundwater quality in the southern portion of FWD have been experienced which have resulted in FWD altering pumping operations to minimize the migration of this plume. The unique groundwater conditions at FWD that are impacted by the SJRRP and the Steffens Plume require monitoring and different minimum thresholds and measurable objectives, which will facilitate implementation of the GSP in the FWD GSA.

1.2 Sustainability Goal (Reg. § 354.24)

FWD will manage groundwater resources responsibly and sustainably in order to maintain acceptable standards of groundwater levels and quality, groundwater storage, depletion of surface resources, and

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subsidence. FWD's goal is to continue agriculture production while maintaining groundwater supplies and quality for all beneficial users of groundwater within FWD.

1.3 Agency Information

1.3.1 Organization Management and Structure of GSA

FWD is located in the southern portion of the Delta-Mendota Subbasin within Fresno County. The FWD GSA is surrounded by Fresno County Management Areas A and B GSAs to the west and south, the San Joaquin River Exchange Contractors GSA to the north, and the Aliso Water District GSA to the north and east. The McMullin GSA in the Kings Subbasin is also located to the southeast of FWD.

FWD was formed in 1949 and encompasses approximately 2,500 acres. The San Joaquin River separates FWD from the San Joaquin River Exchange Contractors (SJREC) and Aliso Water District (Aliso) GSAs while the Mendota Pool separates FWD from the Fresno County Management Area B GSA. The District's landowners rely solely on groundwater to irrigate crops and for a de minimus amount of domestic water use. The District also has an agreement with the Bureau of Reclamation to pump groundwater into the Mendota Pool for use by other entities and Districts within the Subbasin.

The FWD Board of Directors serves as the GSA Board. The GSA Board is comprised of three members, each of whom represents or is a landowner in the District. Board elections are held every two years and Directors are elected to four-year terms of office. The current Board includes Jim Stilwell (Chairman), Barry Baker (Secretary), and Don Peracchi. All members of the GSA Board of Directors have the authority to implement the GSP. The Board meets on the second Wednesday of every month and meetings are open to the general public. Agendas and minutes are available on the District's website (www.farmerswd.com). Contact information for FWD is provided below.

Farmers Water District
4460 W. Shaw Avenue, #219
Fresno, CA 93720

Plan Manager: Jim Stilwell
Phone: 559-659-3942
Email: Jim@bakerfarming.com

1.3.2 Legal Authority of the GSA

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 powers authority (JPA), a memorandum of agreement (MOA), or other legal agreement (DWR, 2016).

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Resolution No. 2016-05 was passed and adopted by the Board of Directors of Famers Water District on July 14, 2016, giving FWD the legal authority to implement a Groundwater Sustainability Plan (GSP). A Notice of Public Hearing was published in the Firebaugh-Mendota Journal and The Mendota Times on May 12, 2016 (**Appendix C**).

1.3.3 Estimated Cost of Implementing the GSP

The GSP development costs were funded through the Subbasin's coordinated efforts at successfully pursuing and obtaining 1.5 million dollars in Proposition 1 grant funds for GSP development that was subdivided among the six GSP groups. The portion of Proposition 1 grant funds to FWD was augmented by additional FWD landowner fees to develop this GSP. The FWD GSA Board will continue to use landowner-based fees to implement the GSP. Annual GSP implementation and maintenance efforts by FWD are an estimated $4.3 million over the next 20 years. Further details on estimated costs for GSP implementation are presented in Chapter 6 of this GSP.

1.4 GSP Organization

SGMA requires that each GSP include a table that catalogs all GSP requirements and their location in the document.

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Table 1-1: Preparation Checklist for GSP Submittal

GSP Regulation 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 4.6. Pg. 69
Article 5. Plan Contents, Subarticle 1. Administrative Information				
354.4		General Information	- Executive Summary - List of References and Technical Studies	Executive Summary: Pg. ES-1 References: Section 7, Pg. 85
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 1.3, Pg. 3
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	Section 2.1, Pg. 12
354.8.b		Description of the Plan Area	- Summary of jurisdictional areas and other features	

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354.8.c, d, 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 2.2, Pg. 14
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 2.3, Pg. 15

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354.8.g	10727.4	Additional GSP Elements	**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 2.4, P. 16
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 2.5 Pg. 17
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	Section 3.1, Pg. 20

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			Characteristics: topographic information, surficial geology, soil characteristics, surface water bodies, source and point of delivery for imported water supplies	
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	Section 3.1.5, Pg. 25
	10727.2.(d).4	Recharge Areas	- Description of how recharge areas identified in the plan substantially contribute to the replenishment of the basin	Section 3.1.5, Pg. 25
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 3.2, Pg. 29
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 3.3, Pg. 38
	10727.2.(d).5	Surface Water Supply	- Description of surface water supply used or available for use for groundwater recharge or in-lieu use	N/A

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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 won't cause undesirable results outside the Management Area - Description of Management Areas	Section 3.4, Pg. 47
Article 5. Plan Contents, Subarticle 3. Sustainable Management Criteria				
354.24		Sustainability Goal	- Description of the Sustainability Goal	Section 4.1, Pg. 50
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 4.4, Pg. 64
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 4.3, Pg. 56

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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 4.2, Pg. 50
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 Network	- 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	Section 4.5, Pg. 67

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			- 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	cont.
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	N/A
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 4.5, Pg. 67
Article 5. Plan Contents, Subarticle 5. Projects and Management Actions				

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354.44		Projects and management actions	- Description of projects and management actions that will help achieve sustainability goal - Measurable objective that is expected to benefit from each project and management actions - Circumstances for implementation - Public noticing - Permitting and regulatory process - Time-table 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	Section 5, Pg. 75
354.44.b.2	10727.2.(d).3		- Overdraft mitigation projects and management actions	Section 5, Pg. 75

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