Salinas Valley Groundwater Basin
Upper Valley Aquifer Subbasin
Groundwater Sustainability Plan

Salinas Valley Basin
Groundwater Sustainability Agency

(Approved by Salinas Valley Basin Groundwater Sustainability Agency Board of Directors on January 13, 2022)

Prepared by:

MONTGOMERY & ASSOCIATES
Water Resource Consultants

ACKNOWLEDGEMENTS

SVBGSA gratefully acknowledges the funding contribution from the California Department of Water Resources. Funding for this GSP has been provided in part from Proposition 1 (Round 2) and Proposition 68 (Round 3) grants from the Sustainable Groundwater Management Grant Program.

SVBGSA Member Agencies

County of Monterey
Monterey County Water Resources Agency
City of Salinas
City of Soledad
City of Gonzales
King City
Castroville Community Services District
Monterey One Water

SVBGSA Board Members

Steve Adams, *South County Cities Member*
Luis Alejo, *Other GSA Eligible Entities Member*
John Bramers, *Agriculture, Pressure Member*
Janet Brennan, *Environment Member*
Caroline Chapin, *Public Member*
Brenda Granillo, *CPUC Regulated Water Company Member*
Bill Lipe, *Agriculture, Upper Valley Member*
Steve McIntyre, *Agriculture, Forebay Member*
Colby Pereira, *Agriculture, Eastside/Langley Member and Chair*
Anthony Rocha, *City of Salinas Member*
Ron Stefani, *Disadvantaged Community or Public Water System Member*

Upper Valley Aquifer Subbasin Planning Committee

Andrea Bailey
Marc Bloom
Jeffrey Crank
Grant Cremers, Chair
Bill Lipe
Tom Merrifield
Roger Moitoso
Jason Smith

SVBGSA Staff

Donna Meyers, *General Manager*
Emily Gardner, *Deputy General Manager*
Gary Petersen, *Senior Advisor*
Les Girard, *General Counsel*
Merida Alvarez, *Administrative Assistant*
Ann Camel, *Administrative Support*
Harrison Tregenza, *Clerk of the Board*

Technical Consultants

Montgomery & Associates (M&A)
- Derrik Williams, P.G., C.Hg., *Principal Hydrogeologist*
- Abby Ostovar, Ph.D., *Water Policy Specialist*
- Tiffani Cañez, *Hydrogeologist*
- Joseph Oliver, *Senior Hydrogeologist*
- Staffan Schorr, *Principal Hydrogeologist*
- Greg Nelson, P.G., *Senior Hydrogeologist*
- Victoria Hermosilla, *Hydrogeologist*
- Michael Levengood, *GIS and Data Coordinator*
- Trevor Pontifex, *Hydrogeologist*
- Jon Reeves, *Hydrogeologist*

Wallace Group
- Kari Wagner, P.E., *Principal/Director of Water Resources*
- Greg Hulburd, P.E., *Senior Civil Engineer*

Wood Group
- Matt Baillie, P.G., C.Hg., *Senior Hydrogeologist*

Paris Kincaid Wasiewski
- Valerie Kincaid, *Principal*

Cite as: Salinas Valley Basin Groundwater Sustainability Agency. 2022. Upper Valley Aquifer Subbasin Groundwater Sustainability Plan. Prepared by Montgomery & Associates. Submitted to the California Department of Water Resources January 2022.

Salinas Valley: Upper Valley Aquifer Subbasin Groundwater Sustainability Plan

Prepared for:

Salinas Valley Basin Groundwater Sustainability Agency

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS x
EXECUTIVE SUMMARY ES-1
ES-1 INTRODUCTION (GSP CHAPTER 1) ES-1
ES-2 COMMUNICATIONS AND PUBLIC ENGAGEMENT (GSP CHAPTER 2) ES-2
ES-3 DESCRIPTION OF PLAN AREA (GSP CHAPTER 3) ES-3
ES-4 HYDROGEOLOGIC CONCEPTUAL MODEL (GSP CHAPTER 4) ES-4
ES-5 CROSS SECTION A-A' GROUNDWATER CONDITIONS (GSP CHAPTER 5) ES-5
ES-6 WATER BUDGETS (GSP CHAPTER 6) ES-7
ES-7 MONITORING NETWORKS (GSP CHAPTER 7) ES-9
ES-8 SUSTAINABLE MANAGEMENT CRITERIA (GSP CHAPTER 8) ES-11
ES-9 MANAGEMENT ACTIONS AND PROJECTS (GSP CHAPTER 9) ES-12
ES-10 IMPLEMENTATION (GSP CHAPTER 10) ES-14
1 INTRODUCTION TO THE UPPER VALLEY AQUIFER SUBBASIN GROUNDWATER SUSTAINABILITY PLAN 1-1
1.1 Introduction and Purpose 1-1
1.2 Agency Information 1-4
1.2.1 Agency Name, Mailing Address, and Plan Manager 1-4
1.2.2 SVBGSA Organization and Management Structure 1-6
1.2.3 Authority of Agency 1-7
1.3 Overview of this GSP 1-8
2 COMMUNICATIONS AND PUBLIC ENGAGEMENT 2-1
2.1 Introduction 2-1
2.2 Defining and Describing Stakeholders for Public Engagement 2-1
2.3 SVBGSA Governance Structure 2-3
2.4 Upper Valley Subbasin GSP Preparation 2-6
2.5 Upper Valley Subbasin Planning Committee 2-8
2.6 Communication and Public Engagement Actions 2-9
2.6.1 Goals for Communication and Public Engagement 2-9
2.6.2 Communication and Outreach Objectives 2-11
2.6.3 Target Audiences and Stakeholders 2-12
2.6.4 Stakeholder Database 2-13
2.6.5 Key Messages and Talking Points 2-13
2.6.6 Engagement Strategies 2-14
2.6.7 CPE Actions Timeline and Tactics 2-15
2.6.8 CPE Actions – Annual Evaluation and Assessment 2-16
2.7 Underrepresented Communities and Disadvantaged Communities Strategic Engagement and Communications 2-16

2.7.1 Underrepresented Communities and Disadvantaged Communities in the Salinas Valley 2-16
2.7.2 Additional activities scoped for engagement of Underrepresented Communities and Disadvantaged Communities 2-19
3 DESCRIPTION OF PLAN AREA 3-1
3.1 Summary of Adjudicated and Jurisdictional Areas 3-1
3.1.1 Adjudicated Areas, Other GSAs, and Alternatives 3-1
3.1.2 Jurisdictional Areas 3-3
3.2 Land Use 3-6
3.2.1 Water Source Types 3-8
3.2.2 Water Use Sectors 3-11
3.3 Existing Well Types, Numbers, and Density 3-13
3.4 Existing Monitoring Programs 3-17
3.4.1 Groundwater Elevation Monitoring 3-17
3.4.2 Groundwater Extraction Monitoring 3-17
3.4.3 Groundwater Quality Monitoring 3-17
3.4.4 Surface Water Monitoring 3-18
3.5 Existing Water Management Plans 3-20
3.5.1 Monterey County Groundwater Management Plan 3-20
3.5.2 Integrated Regional Water Management Plan 3-21
3.5.3 Urban Water Management Plans 3-21
3.6 Existing Water Regulatory Programs 3-23
3.6.1 Groundwater Export Prohibition 3-23
3.6.2 Agricultural Order 3-23
3.6.3 Water Quality Control Plan for the Central Coast Basins 3-23
3.6.4 Title 22 Drinking Water Program 3-24
3.7 County Public Policy of Safe and Clean Water 3-24
3.8 Incorporating Existing Programs into the GSP and Limits on Operational Flexibility 3-24
3.9 Conjunctive Use Programs 3-25
3.10 Land Use Plans 3-25
3.10.1 Land Use Plans in the Subbasin 3-25
3.10.2 Land Use Plans Outside of Basin 3-25
3.10.3 Well Permitting 3-26
3.10.4 Effects of Land Use Plan Implementation on Water Demand 3-27
3.10.5 Effects of GSP Implementation on Water Supply Assumptions 3-28
4 Hydrogeologic Conceptual Model 4-1
4.1 Subbasin Setting and Topography 4-1
4.2 Subbasin Geology 4-3
4.2.1 Geologic Formations 4-6
4.2.2 Structural Restrictions to Flow 4-7
4.2.3 Soils 4-8

4.3 Subbasin Extent 4-10
4.3.1 Lateral Subbasin Boundaries 4-10
4.3.2 Vertical Subbasin Boundaries 4-11
4.4 Subbasin Hydrogeology 4-15
4.4.1 Principal Aquifers and Aquitards 4-15
4.4.2 Aquifer Properties 4-21
4.4.3 Primary Aquifer Uses 4-22
4.4.4 Natural Recharge Areas 4-22
4.4.5 Natural Discharge Areas 4-25
4.5 Surface Water Bodies 4-31
4.5.1 Watersheds 4-33
4.5.2 Imported Water Supplies 4-35
4.6 Water Quality 4-35
4.6.1 General Mineral Chemistry 4-35
4.6.2 Seawater intrusion 4-37
4.7 Data Gaps and Uncertainty of the HCM 4-37
5 GROUNDWATER CONDITIONS 5-1
5.1 Groundwater Elevations 5-1
5.1.1 Data Sources 5-1
5.1.2 Groundwater Elevation Contours and Horizontal Groundwater Gradients 5-2
5.1.3 Hydrographs 5-9
5.1.4 Vertical Groundwater Gradients 5-14
5.2 Change in Groundwater Storage 5-16
5.2.1 Data Sources 5-16
5.2.2 Change in Groundwater Storage Due to Groundwater Elevation Changes 5-16
5.3 Groundwater Quality Distribution and Trends 5-20
5.3.1 Data Sources 5-20
5.3.2 Point Sources of Groundwater Contaminants 5-20
5.3.3 Distribution and Concentrations of Diffuse or Natural Groundwater Constituents 5-23
5.3.4 Groundwater Quality Summary 5-27
5.4 Subsidence 5-28
5.4.1 Data Sources 5-28
5.4.2 Subsidence Mapping 5-29
5.5 Interconnected Surface Water 5-31
5.5.1 Data Sources 5-32
5.5.2 Analysis of Surface Water and Groundwater Interconnection 5-32
6 WATER BUDGETS 6-1
6.1 Overview of Water Budget Development 6-1
6.1.1 Water Budget Components 6-2
6.1.2 Water Budget Time Frames 6-6
6.2 Overview of Data Sources for Water Budget Development 6-8

6.3 Historical and Current Water Budgets ... 6-11
6.3.1 Historical and Current Surface Water Budget ... 6-11
6.3.2 Historical and Current Groundwater Budget ... 6-15
6.3.3 Historical and Current Groundwater Budget Summary ... 6-21
6.3.4 Historical and Current Sustainable Yield ... 6-23
6.4 Projected Water Budgets ... 6-24
6.4.1 Assumptions Used in Projected Water Budget Development ... 6-24
6.4.2 Projected Surface Water Budget ... 6-26
6.4.3 Projected Groundwater Budget ... 6-26
6.4.4 Projected Sustainable Yield ... 6-29
6.4.5 Uncertainties in Projected Water Budget Simulations ... 6-30
6.5 Subbasin Water Supply Availability and Reliability ... 6-30
6.6 Uncertainties in Water Budget Calculations ... 6-31
7 MONITORING NETWORKS ... 7-1
7.1 Introduction ... 7-1
7.1.1 Monitoring Network Objectives ... 7-1
7.1.2 Approach to Monitoring Networks ... 7-1
7.1.3 Management Areas ... 7-2
7.2 Groundwater Level Monitoring Network ... 7-2
7.2.1 Groundwater Level Monitoring Protocols ... 7-7
7.2.2 Groundwater Level Monitoring Network Data Gaps ... 7-7
7.3 Groundwater Storage Monitoring Network ... 7-10
7.4 Groundwater Quality Monitoring Network ... 7-10
7.4.1 Groundwater Quality Monitoring Protocols ... 7-13
7.4.2 Groundwater Quality Monitoring Data Gaps ... 7-13
7.5 Land Subsidence Monitoring Network ... 7-13
7.5.1 Land Subsidence Monitoring Protocols ... 7-13
7.5.2 Land Subsidence Data Gaps ... 7-14
7.6 Interconnected Surface Water Monitoring Network ... 7-14
7.6.1 Interconnected Surface Water Monitoring Protocols ... 7-16
7.6.2 Interconnected Surface Water Data Gaps ... 7-16
7.7 Other Monitoring Networks ... 7-16
7.7.1 Groundwater Extraction Monitoring Network ... 7-16
7.7.2 Salinas River Watershed Diversions ... 7-17
7.8 Data Management System and Data Reporting ... 7-18
8 SUSTAINABLE MANAGEMENT CRITERIA ... 8-1
8.1 Definitions ... 8-1
8.2 Sustainability Goal ... 8-2
8.3 Maintaining Long-Term Sustainability ... 8-3
8.4 General Process for Establishing Sustainable Management Criteria ... 8-4
8.5 Sustainable Management Criteria Summary ... 8-4

8.6 Chronic Lowering of Groundwater Levels SMC 8-7
8.6.1 Locally Defined Significant and Unreasonable Conditions 8-7
8.6.2 Minimum Thresholds 8-7
8.6.3 Measurable Objectives 8-16
8.6.4 Undesirable Results 8-18
8.7 Reduction in Groundwater Storage SMC 8-20
8.7.1 Locally Defined Significant and Unreasonable Conditions 8-20
8.7.2 Minimum Thresholds 8-20
8.7.3 Measurable Objectives 8-24
8.7.4 Undesirable Results 8-25
8.8 Degraded Water Quality SMC 8-26
8.8.1 Locally Defined Significant and Unreasonable Conditions 8-26
8.8.2 Minimum Thresholds 8-26
8.8.3 Measurable Objectives 8-33
8.8.4 Undesirable Results 8-33
8.9 Land Subsidence SMC 8-36
8.9.1 Locally Defined Significant and Unreasonable Conditions 8-36
8.9.2 Minimum Thresholds 8-36
8.9.3 Measurable Objectives 8-38
8.9.4 Undesirable Results 8-39
8.10 Depletion of Interconnected Surface Water SMC 8-39
8.10.1 Locally Defined Significant and Unreasonable Conditions 8-40
8.10.2 Minimum Thresholds 8-40
8.10.3 Measurable Objectives 8-46
8.10.4 Undesirable Results 8-46
9 Management Actions and Projects 9-1
9.1 Introduction 9-1
9.2 General Process for Developing Management Actions and Projects 9-2
9.2.1 Process for Developing Management Actions and Projects 9-2
9.2.2 Cost Assumptions Used in Developing Projects 9-3
9.3 Overview of Management Actions and Projects 9-4
9.4 Management Actions to Maintain Sustainability 9-8
9.4.1 Management Action A1: Upper Valley Sustainable Management Criteria Technical Advisory Committee 9-8
9.4.2 Management Action A2: Conservation and Agricultural BMPs 9-12
9.4.3 Management Action A3: Fallowing, Fallow Bank, and Agricultural Land Retirement 9-14
9.4.4 Management Action A4: MCWRA Drought Reoperation 9-17
9.4.5 Management Action A5: Reservoir Reoperation 9-20
9.5 Project Options Over 50 Year Planning Horizon 9-24
9.5.1 Project B1: Multi-benefit Stream Channel Improvements 9-24
9.5.2 Project B2: Managed Aquifer Recharge of Overland Flow 9-36

9.6 Implementation Actions 9-41
9.6.1 Implementation Action C1: Well Registration 9-41
9.6.2 Implementation Action C2: GEMS Expansion and Enhancement 9-41
9.6.3 Implementation Action C3: Dry Well Notification System 9-42
9.6.4 Implementation Action C4: Water Quality Coordination Group 9-42
9.6.5 Implementation Action C5: Land Use Jurisdiction Coordination Program 9-43
9.7 Other Groundwater Management Activities 9-44
9.7.1 Continue Urban and Rural Residential Conservation 9-44
9.7.2 Promote Stormwater Capture 9-44
9.7.3 Watershed Protection and Management 9-44
9.7.4 Support Reuse and Recharge of Wastewater 9-44
9.8 Mitigation of Overdraft 9-45
10 Groundwater Sustainability Plan Implementation 10-1
10.1 Data, Monitoring, and Reporting 10-1
10.1.1 Annual Monitoring and Reporting 10-2
10.1.2 Updating the Data Management System 10-4
10.1.3 Improving Monitoring Networks 10-4
10.1.4 Addressing Identified Data Gaps in the Hydrogeologic Conceptual Model 10-5
10.2 Communication and Engagement 10-6
10.3 Road Map for Refining and Implementing Management Actions and Projects 10-9
10.4 Five-Year Update 10-11
10.5 Start-up Budget and Funding Strategy 10-12
10.5.1 SVBGSA Operational Fee 10-12
10.5.2 Upper Valley Subbasin Start-up Budget 10-12
10.5.3 Funding for Management Actions and Projects 10-15
10.6 Implementation Schedule and Adaptive Management 10-16
REFERENCES .... R-Error! Bookmark not defined.

LIST OF FIGURES

Figure 1-1. Upper Valley Aquifer Subbasin Location 1-3
Figure 1-2. Map of Area Covered by the SVBGSA in the Upper Valley Aquifer Subbasin 1-5
Figure 2-1. Phases of Planning and Community Outreach 2-5
Figure 2-2. GSP Development Process 2-7
Figure 2-3. Disadvantaged Communities in the Salinas Valley Groundwater Basin 2-18
Figure 3-1. Upper Valley Aquifer Subbasin Area Covered by GSP 3-2
Figure 3-2. Federal, State, County, City, and Local Jurisdictional Areas 3-4
Figure 3-3. MCWRA Zones in the Upper Valley Aquifer Subbasin 3-5
Figure 3-4. Existing Land Use 3-7

Figure 3-5. Salinas River Watershed Surface Water Points of Diversion in the Upper Valley Aquifer Subbasin ... 3-9
Figure 3-6. Communities Dependent on Groundwater ... 3-10
Figure 3-7. Map of Water Use Sectors ... 3-12
Figure 3-8. Density of Domestic Wells (Number of Wells per Square Mile) ... 3-14
Figure 3-9. Density of Production Wells (Number of Wells per Square Mile) ... 3-15
Figure 3-10. Density of Public Wells (Number of Wells per Square Mile) ... 3-16
Figure 3-11. Surface Water Gauge Location ... 3-19
Figure 4-1. Upper Valley Aquifer Subbasin Topography ... 4-2
Figure 4-2. Subbasin Geology ... 4-4
Figure 4-3. Composite Soils Map ... 4-9
Figure 4-4. Elevation of the Bottom of the Upper Valley Aquifer Subbasin ... 4-13
Figure 4-5. Depth to Bottom of the Upper Valley Aquifer Subbasin, in feet ... 4-14
Figure 4-6. Cross Section A-A' ... 4-17
Figure 4-7. Cross Section B-B' ... 4-18
Figure 4-8. Cross Section C-C' ... 4-19
Figure 4-9. Cross Section D-D' ... 4-20
Figure 4-10. SAGBI Soils Map for the Upper Valley Aquifer Subbasin ... 4-24
Figure 4-11. Locations of Interconnected Surface Water ... 4-26
Figure 4-12. Groundwater Dependent Ecosystems ... 4-30
Figure 4-13. Surface Water Bodies in the Upper Valley Aquifer Subbasin ... 4-32
Figure 4-14. HUC12 Watersheds within the Upper Valley Aquifer Subbasin ... 4-34
Figure 4-15. Piper Diagram of Upper Valley Aquifer Subbasin Representing Major Anions and Cations in Water Samples ... 4-36
Figure 5-1. MCWRA Management Subareas ... 5-4
Figure 5-2. Spring 2019 Groundwater Elevation Contours ... 5-5
Figure 5-3. Fall 2019 Groundwater Elevation Contours ... 5-6
Figure 5-4. Spring 1995 Groundwater Elevation Contours ... 5-7
Figure 5-5. Fall 1995 Groundwater Elevation Contours ... 5-8
Figure 5-6. Map of Example Hydrographs ... 5-10
Figure 5-7. Locations of Wells with Hydrographs Included in Appendix 5A ... 5-11
Figure 5-8. Cumulative Groundwater Elevation Change Graph for the Upper Valley Subbasin ... 5-13
Figure 5-9. Vertical Gradients ... 5-15
Figure 5-10. Cumulative Change in Groundwater Storage in the Upper Valley Subbasin, Based on Groundwater Elevations ... 5-18
Figure 5-11. Change in Groundwater Storage from Fall 1995 to Fall 2019 ... 5-19
Figure 5-12. Active Cleanup Sites ... 5-22
Figure 5-13. Estimated Nitrate Concentrations ... 5-24
Figure 5-14. Nitrate Concentrations, 1950 to 2007 ... 5-25
Figure 5-15. Estimated Average Annual InSAR Subsidence in Subbasin ... 5-30
Figure 5-16. Conceptual Representation of Interconnected Surface Water ... 5-31

Figure 6-1. Schematic Hydrogeologic Conceptual Model (from DWR, 2020d) 6-3
Figure 6-2. Zones and Boundary Conditions for the Salinas Valley Integrated Hydrologic Model 6-4
Figure 6-3. Climate and Precipitation for Historical and Current Water Budget Time Periods 6-7
Figure 6-4. Surface Water Network in Upper Valley Subbasin from the Salinas Valley Integrated Hydrologic Model 6-13
Figure 6-5. Historical and Current Surface Water Budget 6-14
Figure 6-6. SVIHM Simulated Inflows to the Groundwater System 6-16
Figure 6-7. SVIHM Simulated Outflows from the Groundwater System 6-17
Figure 6-8. SVIHM Simulated Groundwater Pumping by Water Use Sector 6-19
Figure 6-9. SVIHM Simulated Subsurface Inflows and Outflows from Watershed Areas and Neighboring Basins/Subbasins 6-20
Figure 6-10. SVIHM Simulated Historical and Current Groundwater Budget 6-22
Figure 7-1. Upper Valley Aquifer Monitoring Network for Groundwater Levels 7-4
Figure 7-2. Upper Valley Aquifer Representative Monitoring Network for Groundwater Levels 7-5
Figure 7-3. Data Gaps in the Groundwater Level Monitoring Network 7-9
Figure 7-4. DDW Public Water System Supply Wells in the Groundwater Quality Monitoring Network 7-11
Figure 7-5. ILRP Wells in the Groundwater Quality Monitoring Network 7-12
Figure 7-6. Interconnected Surface Water Monitoring Network 7-15
Figure 8-1. Groundwater Level Minimum Threshold Contour Map 8-9
Figure 8-2. Cumulative Groundwater Elevation Change Hydrograph with Selected Minimum Threshold and Measurable Objective for the Upper Valley Aquifer Subbasin 8-12
Figure 8-3. Groundwater Level Measurable Objective Contour Map 8-17
Figure 8-4. Cumulative Change in Storage and Average Change in Groundwater Elevation in the Upper Valley Aquifer Subbasin 8-22
Figure 8-5. Correlation Between Cumulative Change in Storage and Average Change in Groundwater Elevation 8-23
Figure 9-1. Implementation Schedule for SMC TAC 9-11
Figure 9-2. Annual Implementation Schedule for Stream Maintenance 9-33
Figure 9-3. Implementation Schedule for Invasive Species Eradication 9-34
Figure 9-4. Implementation Schedule for Floodplain Enhancement and Recharge 9-34
Figure 9-5. Implementation Schedule for Overland Flow MAR 9-39
Figure 10-1. General Schedule of 5-Year Start-Up Plan 10-17

LIST OF TABLES

Table 2-1. Subject Matter Workshops Held During GSP Preparation 2-9
Table 3-1. Land Use Summary 3-6
Table 3-2. Well Count Summary 3-13

Table 3-3. Monterey County Water Supply Guidelines for the Creation of New Residential or Commercial Lots ... 3-27
Table 3-4. Monterey County Well Permitting Guidelines for Existing Residential and Commercial Lots .. 3-27
Table 4-1. Federal and State Listed Threatened and Endangered Species, and Respective Groundwater Dependence for Monterey County ... 4-28
Table 5-1. Figures Showing Current and Historical Groundwater Elevation Contours in the Upper Valley Aquifer... 5-3
Table 5-2. Active Cleanup Sites ... 5-21
Table 5-3. Water Quality Constituents of Concern and Exceedances ... 5-27
Table 5-4. Average SVIHM Simulated Depletion of Interconnected Surface Waters (AF/yr.)... 5-32
Table 6-1. Summary of Historical and Current Water Budget Time Periods... 6-7
Table 6-2. Summary of Water Budget Component Data Source from the Salinas Valley Integrated Hydrologic Model ... 6-10
Table 6-3. SVIHM Simulated Surface Water Budget Summary (AF/yr.) ... 6-14
Table 6-4. SVIHM Simulated Groundwater Inflows Summary (AF/yr.) ... 6-16
Table 6-5. SVIHM Simulated and Adjusted Groundwater Outflows Summary (AF/yr.)... 6-17
Table 6-6. SVIHM Simulated and Adjusted Groundwater Pumping by Water Use Sector (AF/yr.)... 6-19
Table 6-7. SVIHM Simulated Net Subbasin Boundary Flows (AF/yr.) ... 6-21
Table 6-8. Summary of Groundwater Budget (AF/yr.) ... 6-23
Table 6-9. Historical Sustainable Yield for the Upper Valley Aquifer Subbasin Derived from GEMS and Adjusted Change in Storage (AF/yr.) ... 6-24
Table 6-10. SVOM Simulated Average Surface Water Inflow and Outflow Components for Projected Climate Change Conditions (AF/yr.)... 6-26
Table 6-11. SVOM Simulated Average Groundwater Inflow Components for Projected Climate Change Conditions (AF/yr.) ... 6-27
Table 6-12. SVOM Simulated and Adjusted Average Groundwater Outflow Components for Projected Climate Change Conditions (AF/yr.)... 6-27
Table 6-13. Average SVOM Simulated and Adjusted Annual Groundwater Budget for Projected Climate Change Conditions (AF/yr.)... 6-28
Table 6-14. SVOM Simulated and Adjusted Projected Annual Groundwater Pumping by Water Use Sector (AF/yr.)... 6-29
Table 6-15. Adjusted Projected Sustainable Yields (AF/yr.) ... 6-29
Table 7-1. Upper Valley Aquifer Groundwater Level Representative Monitoring Site Network... 7-6
Table 7-2. Datasets Available for Use in Populating the DMS... 7-19
Table 8-1. Sustainable Management Criteria Summary ... 8-6
Table 8-2. Chronic Lowering of Groundwater Levels Minimum Thresholds and Measurable Objectives ... 8-8
Table 8-3. Chronic Lowering of Groundwater Levels Interim Milestones... 8-18
Table 8-4. Degradation of Groundwater Quality Minimum Thresholds ... 8-27
Table 8-5. Summary of Constituents Monitored in Each Well Network... 8-29
Table 8-6. Reported Annual Surface Water Diversions in the Upper Valley Aquifer Subbasin... 8-42
Table 9-1. Management Actions and Projects... 9-5

Table 9-2. Estimated Cost of Fallowing and Agricultural Land Retirement ... 9-16
Table 9-3. Cost Estimate of Vegetation Management ... 9-35
Table 10-1. Upper Valley Aquifer Subbasin Specific Estimated Planning-Level Costs for First 5 Years of Implementation ... 10-14

ACRONYMS AND ABBREVIATIONS

$/AF	dollar per acre-foot
AF	acre-feet or acre-foot
AF/yr.	acre-feet per year
ASR	Aquifer Storage and Recovery
Basin	Salinas Valley Groundwater Basin
Basin Plan	Water Quality Control Plan for the Central Coastal Basin
BLM	U.S. Bureau of Land Management
BMPs	Best Management Practices
Caltrans	California Department of Transportation
CASGEM	California Statewide Groundwater Elevation Monitoring
CCGC	Central Coast Groundwater Coalition
CCRWQCB	Central Coast Regional Water Quality Control Board
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
COC	constituents of concern
CPE Actions	communication and public engagement actions
CSD	Castroville Community Services District
CSIP	Castroville Seawater Intrusion Project
DACs	Disadvantaged Communities
DDW	Division of Drinking Water
DEM	Digital Elevation Model
DMS	Data Management System
D-TAC	Drought Operations Technical Advisory Committee
DTSC	California Department of Toxic Substances Control
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EPA	Environmental Protection Agency
ET	evapotranspiration
eWRIMS	Electronic Water Rights Information Management System
GAMA	Groundwater Ambient Monitoring and Assessment Program
GDE	groundwater-dependent ecosystem
GEMS	Monterey County Groundwater Extraction Monitoring System

GIS ....Geographic Information System
GMP...............Groundwater Management Plan
GSA................Groundwater Sustainability Agency/Agencies
GSP or Plan....Groundwater Sustainability Plan
HCM ....hydrogeologic conceptual model
HCP................Habitat Conservation Plan
ILRP...............Irrigated Lands Regulatory Program
InSAR ....Interferometric Synthetic Aperture Radar
IRWMP..........Integrated Regional Water Management Plan
ISW ....interconnected surface water
JPA.................Joint Powers Authority
King City........City of King
LID.................Low Impact Development
MAR ....Managed Aquifer Recharge
MCLs ....Maximum Contaminant Levels
MCWRA........Monterey County Water Resources Agency
NAVD88........North American Vertical Datum of 1988
NCCAG..........Natural Communities Commonly Associated with Groundwater
NEPA ....National Environmental Policy Act
NMFS.............National Marine Fisheries Service
O&M..............Operations and maintenance fees
OSWCR ....Online System for Well Completion Reports
RCDMC.........Resource Conservation District of Monterey
River Series....Salinas River Discharge Measurement Series
RMA ....Routine Maintenance Agreement
RMS ....Representative Monitoring Sites
RWMG...........Greater Monterey County Regional Water Management Group
SAGBI............Soil Agricultural Groundwater Banking Index
SDACs ....Severely Disadvantaged Communities
SGMA............Sustainable Groundwater Management Act
SLOFCWCD..San Luis Obispo County Flood Control and Water Conservation District
SMC ....Sustainable Management Criteria
SMCLs ....Secondary Maximum Contaminant Levels
SMP................Salinas River Stream Maintenance Program
SRDF..............Salinas River Diversion Facility
Subbasin.........Upper Valley Aquifer Subbasin
SVBGSA........Salinas Valley Basin Groundwater Sustainability Agency
SVIHM...........Salinas Valley Integrated Hydrologic Model
SVOM............Salinas Valley Operational Model
SWRCB..........State Water Resources Control Board

TAC................Technical Advisory Committee
TDS................total dissolved solids
TNC................The Nature Conservancy
URCs..............Underrepresented Communities
USACE ....U. S. Army Corps of Engineers
USFWS ..........U.S. Fish and Wildlife Service
USGS ....U. S. Geological Survey
UWMP...........Urban Water Management Plan

EXECUTIVE SUMMARY

ES-1 INTRODUCTION (GSP CHAPTER 1)

The 2014 California Sustainable Groundwater Management Act (SGMA) requires that medium- and high-priority groundwater basins and subbasins develop Groundwater Sustainability Plans (GSPs) that outline how groundwater sustainably will first be maintained for 20 years, and then maintained for an additional 30 years. This GSP fulfills that requirement for the Salinas Valley—Upper Valley Aquifer Subbasin (Subbasin), which is designated by the DWR as a medium priority groundwater subbasin.

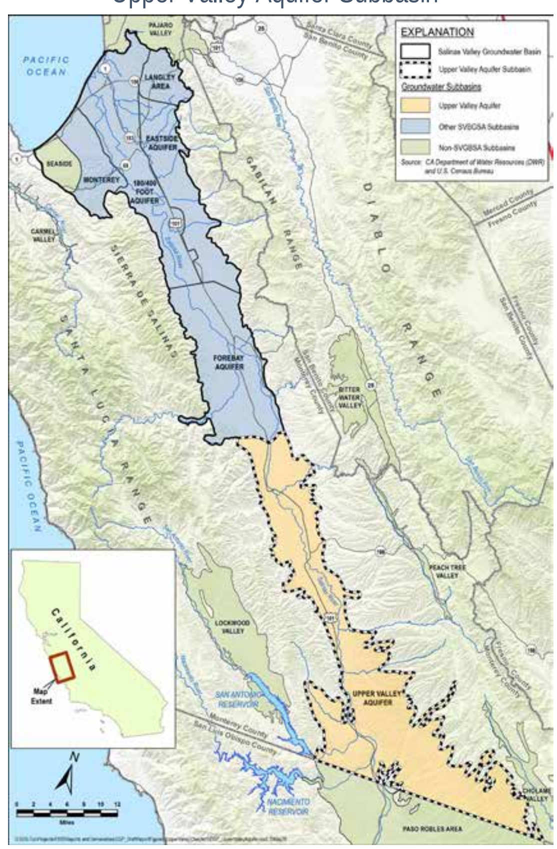
In 2017, local GSA-eligible entities formed the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) to develop and implement the GSPs for the Salinas Valley. The SVBGSA is a Joint Powers Authority (JPA) with membership comprising the County of Monterey, Monterey County Water Resources Agency (MCWRA), City of Salinas, City of Soledad, City of Gonzales, City of King, Castroville Community Services District, and Monterey One Water. The SVBGSA is governed by an 11-member Board of Directors, representing public and private groundwater interests throughout the Salinas Valley Groundwater Basin. In addition, an Advisory Committee ensures participation by, and input to, the Board by constituencies whose interests are not directly represented on the Board.

The Salinas Valley Groundwater Basin consists of 9 subbasins, of which 6 are entirely or partially under the SVBGSA's jurisdiction. One of the 9 subbasins, the Seaside Subbasin, is adjudicated and not managed by the SVBGSA. Another 2 subbasins, the Paso Robles and Atascadero Subbasins, lie completely in San Luis Obispo County and are managed by other groundwater sustainability agencies.

The SVBGSA developed this GSP for the Upper Valley Subbasin (DWR subbasin number 3-004.05) in concert with the GSPs for its five other Salinas Valley Subbasins: the 180/400-Foot Aquifer Subbasin (DWR subbasin number 3-004.01), the Eastside Aquifer Subbasin (DWR subbasin number 3-004.02), the Forebay Aquifer Subbasin (DWR subbasin number 3-004.04), the Langley Area Subbasin (DWR subbasin number 3-004.09) and the Monterey Subbasin (DWR subbasin number 3-004.10). Having a single GSA prepare all or part of the six plans promotes coordination and cooperation across subbasin boundaries.

This GSP covers the entire 237,670 acres of the Upper Valley Subbasin, on the figure below. The GSP describes current groundwater conditions, develops a hydrogeologic conceptual model, establishes the water budget, outlines locally defined sustainable management criteria, and provides management actions and projects that can be used to maintain sustainability until 2042.

Upper Valley Aquifer Subbasin



ES-2 COMMUNICATIONS AND PUBLIC ENGAGEMENT (GSP CHAPTER 2)

The SVBGSA designed all phases of SGMA implementation to be open collaborative processes with active stakeholder engagement that allows stakeholders and public participants opportunities to provide input and to influence the planning and development process and subsequently GSP implementation. The communications and public engagement process included the following:

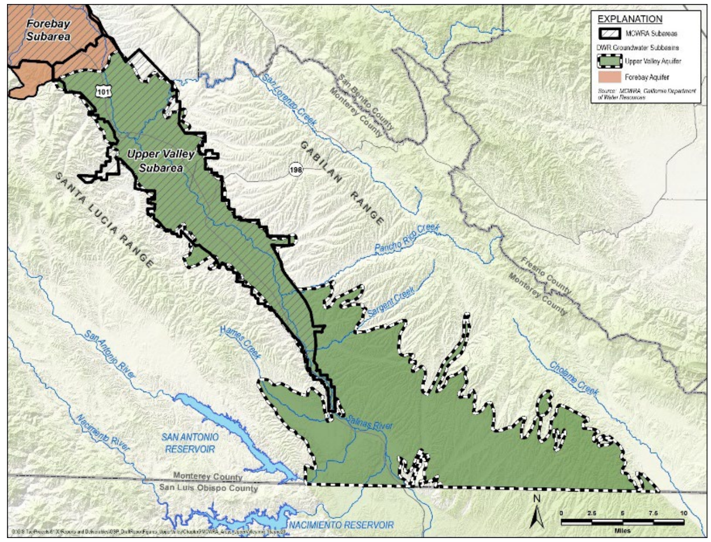
- **GSA formation and coordination.** SVBGSA formation and coordination took place from 2015 through 2017 and included completing a Salinas Valley Groundwater Stakeholder Issues Assessment, which resulted in recommendations for a transparent, inclusive process for the local implementation of SGMA and formation of the SVBGSA.
- **GSP preparation.** Given the importance of the Subbasin and the development of the GSP to the communities, residents, landowners, farmers, ranchers, businesses, and others, it is essential that inclusive stakeholder input is a primary component of the GSP process. A rigorous review process for each chapter in this GSP and for the final plan ensured that stakeholders had multiple opportunities to review and comment on the draft GSP.
- **Subbasin Planning Committee.** The Upper Valley Subbasin Planning Committee provides overall direction for GSP development. It comprises local stakeholders and a Board of Directors member, all of whom were appointed by the Board following a publicly noticed application process by the GSA. This Committee represents constituencies that are considered important stakeholders in the Upper Valley Subbasin, and who may not be represented on the Board. During the planning process, the SVBGSA held more than 37 Upper Valley planning meetings including 11 workshops.
- **Communication and public engagement actions (CPE Actions).** CPE Actions provide the SVBGSA Board and staff a guide to ensure consistent messaging about SVBGSA requirements and other related information. CPE Actions provide ways that beneficial users and other stakeholders can provide timely and meaningful input into the GSA decision-making process, are informed of milestones, and offered opportunities to participate in GSP implementation and plan updates.
- **Underrepresented communities (URCs) and disadvantaged communities (DACs).** During development of the 2022 GSPs SVBGSA assessed how URCs and DACs may be engaged with the GSA and how to develop GSA materials that are accessible and culturally responsive (visual and in Spanish). These materials will communicate impacts of groundwater management on local water conditions to engage URCs and DACs into GSA plan reviews and develop pathways for future involvement.

SVBGSA supports public participation by the development of an interactive website that allows access to all planning and meeting materials, data sets, and meeting notifications. The website can be accessed at: https://svbgsa.org.

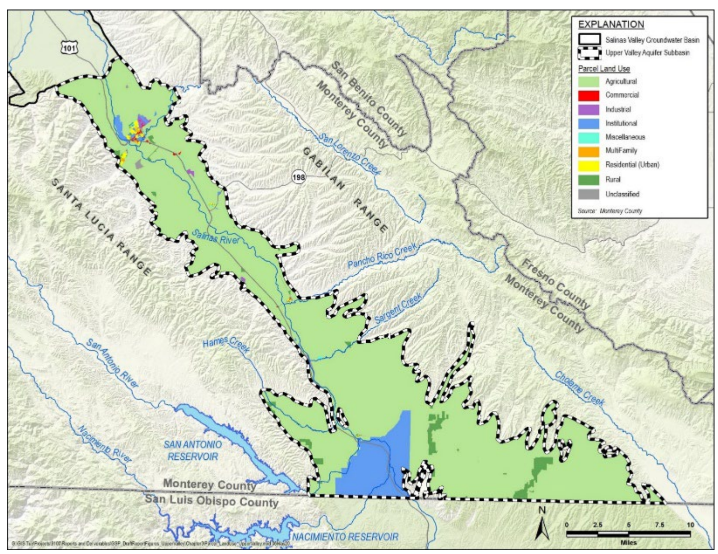
ES-3 DESCRIPTION OF PLAN AREA (GSP CHAPTER 3)

The Upper Valley Subbasin is located in southeastern Monterey County and in the southern portion of the Salinas Valley. The Upper Valley Subbasin is bounded by the Gabilan Range to the east, the Forebay Aquifer Subbasin to the north, the Santa Lucia Range to the west, and the Paso Robles Area Subbasin to the south. The Salinas River runs through the Upper Valley Subbasin and releases from San Antonio and Nacimiento Reservoirs drain into the Salinas River near the southwestern corner of the Subbasin. The only municipality in the Subbasin is King City. United States Highway 101 runs generally north-south roughly following the path of the Salinas River. The Subbasin encompasses most of MCWRA's Upper Valley Subarea but it is almost double the total acreage of the Upper Valley Subarea as shown on the first (top) figure at right

MCWRA Subareas
and the Upper Valley Aquifer Subbasin



Existing Land Use



The second figure, right, shows that the majority of land in the Subbasin is used for agriculture, accordingly, the primary water use sector is agriculture. Groundwater is the main water source in the Subbasin. Surface water is diverted all throughout the Subbasin. Some recycled water is used in the San Ardo Oil Field, where Chevron U.S.A. Inc. operates a reverse osmosis plant that treats a portion of the produced water generated during production.

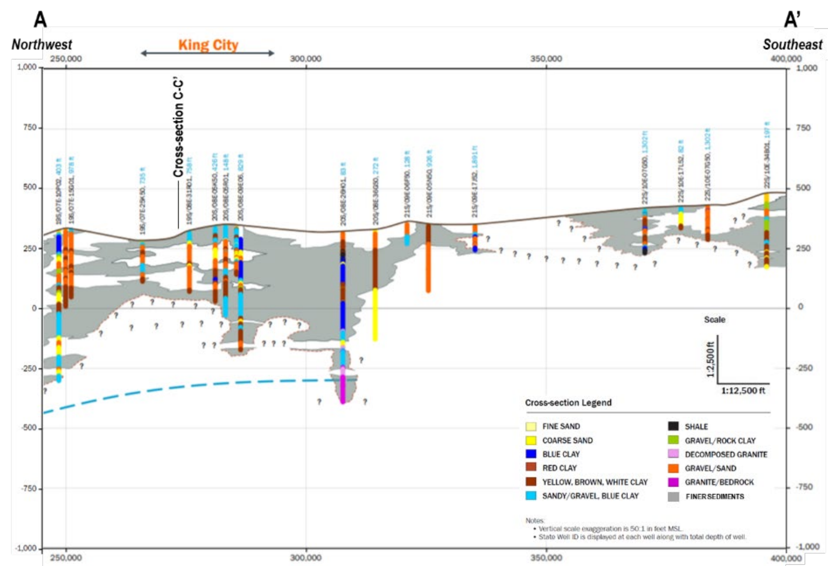
The Upper Valley Subbasin is entirely within the jurisdiction of the SVBGSA. This GSP takes into consideration and incorporates existing water resource management, monitoring, and regulatory programs. The sustainability goal, sustainable management criteria, and management actions and projects in this GSP reflect and build on existing local plans and programs. Any potential limits to operational flexibility have already been incorporated into this GSP. Implementation of this GSP is not anticipated to affect water supply assumptions of relevant land use plans over the planning and implementation horizon. The GSA does not have authority over land use planning. However, the GSA will coordinate with the County on General Plans and land use planning/zoning as needed when implementing the GSP.

ES-4 HYDROGEOLOGIC CONCEPTUAL MODEL (GSP CHAPTER 4)

The geology of the Upper Valley Subbasin is Subbasin is characterized by alluvium, terrace deposits, and the Paso Robles Formation. The eastern boundary of the Subbasin is marked by the contact between the alluvium and Paso Robles Formation with the rocks of the Gabilan Range's Pancho Rico and Monterey Formations (DWR, 2004; Jennings *et al.*, 2010; Rosenberg, 2001). The western boundary of the Upper Valley Subbasin is the contact between the alluvium and the sedimentary rocks of the Monterey Formation in the Santa Lucia Range. The Subbasin's northwestern boundary with the Forebay Aquifer Subbasin is south of the town of Greenfield and generally coincides with the narrowing of the Valley floor and shallowing of the base of the groundwater basin (DWR, 2004). The southern boundary with San Luis Obispo County and the Paso Robles Area Subbasin represents a jurisdictional divide between Monterey County and San Luis Obispo County. There are no reported hydraulic barriers separating the Upper Valley Subbasin from either of the Forebay Aquifer or Paso Robles Area Subbasins, and therefore there is potential for groundwater flow between these subbasins.

The Upper Valley Subbasin's principal aquifer is unconfined and is represented by alluvium and the Paso Robles Formation, where deposits west of the Salinas River are typically coarser grained than those to the east. These primary water-bearing units are laterally equivalent to those found in the 180/400-Foot and Forebay Aquifer Subbasins. The figure below shows a geologic cross section of the Subbasin.

This GSP adopts the base of the Subbasin defined by the USGS (Durbin, et al., 1978), and where not available, the Paso Robles Groundwater Basin Study Phase II by Fugro West, Inc. et al. (2005). The base, or bottom, of the Subbasin is not defined by a sharp interface between permeable sediments and lower-permeability basement rock across the entire Subbasin, because the permeable unconsolidated and semi-consolidated sediments of the Subbasin are very similar to the consolidated sedimentary rocks that bound the Subbasin. The usable portion of the Subbasin does not always include the full thickness of alluvium, and with depth the viability of the sediments as productive freshwater principal aquifer becomes increasingly limited. Furthermore, a fold located near the intersection of State Highway 198 and State Highway 101 causes the basin bottom to rise sharply, the basin bottom continues to shallow toward the southern boundary of the Subbasin.



Detailed aquifer property values (storativity, conductivity, and transmissivity) for the principal aquifer were not available at the time of GSP development. The SVBGSA will fill this data gap during GSP implementation. Specific capacity data is used as a proxy for transmissivity data and indicate that the principal aquifer is very transmissive with high well yields.

Natural groundwater recharge occurs through infiltration of surface water from streams and rivers, deep percolation of excess applied irrigation water, deep percolation of infiltrating precipitation, and subsurface inflow from adjacent subbasins. The areas with the highest potential for surficial recharge are found along the Salinas River and tributary streams. Most other soils in the Subbasin are classified as moderate for recharge potential, meaning that some of the water applied to the surface might make it into the principal aquifer. However, the relationship between surficial soils and subsurface units must be clearly understood because actual recharge to productive zones of the Subbasin could be limited due to discontinuous alluvial sediments and the interfingering clay lenses. Subsurface recharge is primarily through the Salinas River and its tributaries (DWR, 2004); however, is only known for the northern half of the Subbasin that overlaps with MCWRA's Upper Valley Subarea.

Groundwater can leave the aquifer in locations where surface water and groundwater are interconnected. There are potential locations of interconnected surface water mainly along the Salinas River and partially along some of its tributaries. In areas of interconnection, groundwater dependent ecosystems (GDEs) may depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface, and may discharge groundwater through evapotranspiration (ET).

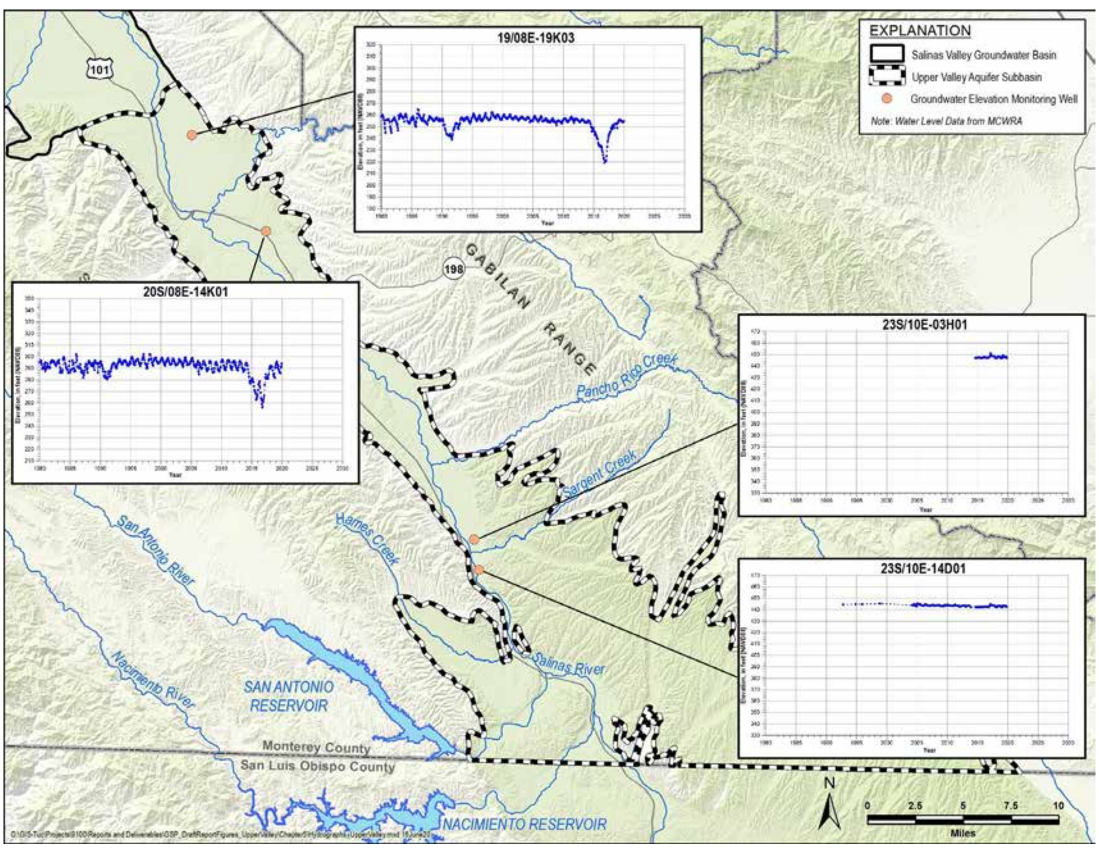
ES-5 CROSS SECTION A-A' GROUNDWATER CONDITIONS (GSP CHAPTER 5)

Historical groundwater conditions in the Subbasin occurred before January 1, 2015 and current conditions occurred after January 1, 2015. Where possible, 2019 was chosen as the representative current year for groundwater conditions. Groundwater elevations and change in storage are based on the area of the Subbasin that overlaps with the MCWRA Upper Valley Subarea, not the entire Subbasin.

- **Groundwater elevations.** Historically, groundwater hydrographs show that groundwater elevations are generally stable throughout most the Upper Valley Subbasin. Groundwater elevations lowered during drought conditions but subsequently rebound during wetter conditions. The figure on the next page shows example hydrographs for the Subbasin.
- **Change in groundwater storage.** The historical average annual gain of storage based on groundwater elevation change between 1944 and 2019 is approximately 266 acre-feet per year (AF/yr.) in the Upper Valley Subbasin, defined as the average change in groundwater that can be safely used for domestic, industrial, or agricultural purposes.

- **Groundwater quality.** Elevated nitrate concentrations in groundwater were locally present in the 1960s and significantly increased in 1970s and 1980s. In 2018, nitrate levels exceeded the drinking water MCL in 51% of on-farm domestic wells and 45% of irrigation supply wells in the Subbasin (CCRWQCB, 2018). Other constituents found at levels of concern for either potable or irrigation uses include 1,2,3-trichloropropane, boron, chloride, iron, manganese, specific conductance, sulfate, and total dissolved solids.
- **Subsidence.** No measurable subsidence has been recorded anywhere in the Subbasin between June 2015 and June 2019.
- **Interconnected surface water.** Provisional model results show that depletion of interconnected surface water (ISW) along the Salinas River due to groundwater pumping averages about 11,000 AF/yr. from June to September when MCWRA makes conservation releases to the Salinas River and 18,500 AF/yr. from May to October. For other surface waters, such as those along the tributaries of the Salinas River, depletion of ISW averaged about 1,100 AF/yr.

Map of Example Hydrographs

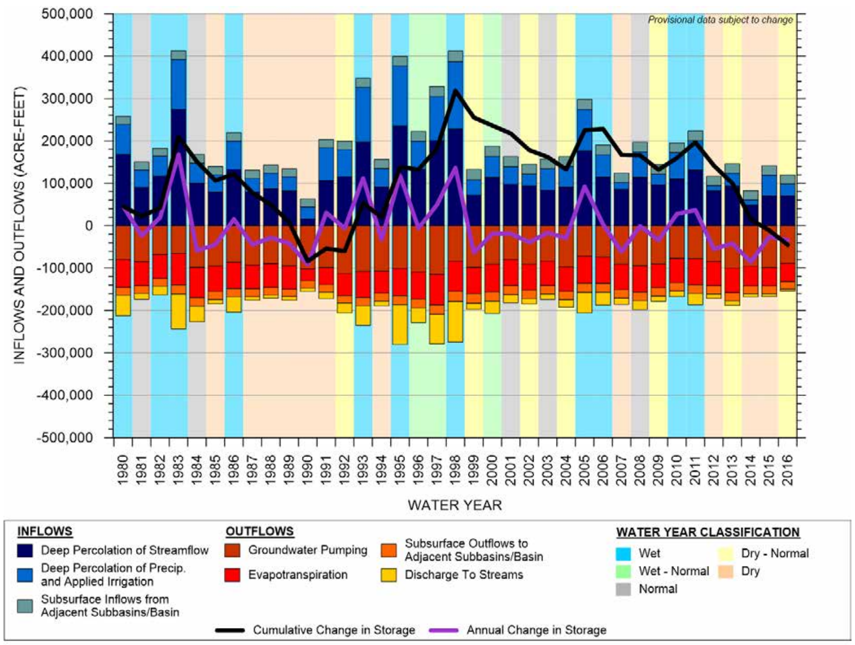


ES-6 WATER BUDGETS (GSP CHAPTER 6)

Water budgets provide an accounting and assessment of the total annual volume of surface water and groundwater entering and leaving the Subbasin. This GSP presents water budgets for 3 time periods – historical (1980 to 2016), current (2016), and projected with estimated 2030 and 2070 climate change factors. Water Year 2016 was the last year included in the models that could be used to develop water budgets for the GSP. Water Year 2016 meets the definition of current year found in the SGMA regulations (23 California Code of Regulations §354.18 (c)(1)); however, Water Year 2016 was preceded by multiple dry or dry-normal years and may not necessarily represent average current conditions. This chapter presents the surface water budget and groundwater budget for each time period. The groundwater budget contains aggregate numbers for the Subbasin and is not differentiated spatially.

The water budgets are developed using the historical Salinas Valley Integrated Hydrologic Model (SVIHM) and the predictive Salinas Valley Operational Model (SVOM), both developed by the USGS. The models are representations of natural conditions and are limited by assumptions and uncertainty associated with the data upon which they are based. The water budgets produced by the models are adjusted with reported extraction data to ensure the water budgets are based on the best available science and data.

SVIHM Simulated Historical and Current



This data (model and/or model results) are preliminary or provisional and are subject to revision. This model and model results are being provided to meet the need for timely best science. The model has not received final approval by the U.S. Geological Survey (USGS). No warranty, expressed or implied, is made by the USGS or the U.S. Government as to the functionality of the model and related material nor shall the fact of release constitute any such warranty. The model is provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the model.

Historical and Current Water Budgets and Historical Sustainable Yield. The groundwater budget accounts for the inflows and outflows to and from the Subbasin's groundwater system. This includes subsurface inflows and outflows of groundwater at the Subbasin boundaries, recharge, pumping, ET, and net streambed exchange.

The historical and current groundwater budget figure on the next page shows the annual groundwater inflows and outflows, annual change in groundwater storage, and cumulative change in storage. Changes in groundwater storage are generally driven by deep percolation of precipitation and streamflow, increasing during wet periods and declining during dry periods. Through analysis and comparison of groundwater level changes over time and model results, it is determined that the Subbasin has historically not been in overdraft so the change in storage is set to zero AF/yr. Therefore, the sustainable yield is assumed to be equivalent to the estimated range of historical pumping of 108,500 to 129,600 AF/yr. The sustainable yield of the Subbasin is an estimate of the quantity of groundwater that can be pumped on a long-term average annual basis without causing any of the 5 undesirable results defined in ES-8. The current sustainable yield represents a snapshot in time and is not used for groundwater management planning. These results are provisional and are subject to change in future GSP updates after the SVIHM and SVOM are released by the USGS.

Projected Water Budgets and Projected Sustainable Yield. Projected water budgets for 2030 and 2070 are extracted from the SVOM, which simulates future hydrologic conditions with assumed climate change based on the climate change factors recommended by DWR. Results are then adjusted based on extraction data to produce the water budget based on best available data. The projected water budget includes a surface water budget and groundwater budget, each quantifying all inflows and outflows. Assuming an average change in storage of zero AF/yr., the projected pumping and projected sustainable yield are 114,700 AF/yr. and 119,600 AF/yr. for 2030 and 2070, respectively.

The projected sustainable yield is the long-term estimate of the quantity of groundwater that can be pumped if all 5 undesirable results have been prevented; however, it does not include projects, management actions, or pumping reductions that might be needed to avoid undesirable results and maintain sustainability according to the 5 sustainability indicators. Although the sustainable yield values provide guidance for maintaining sustainability, simply increasing groundwater recharge or reducing pumping to within the sustainable yield is not proof of sustainability. Sustainability must be demonstrated through avoiding all 5 undesirable results. The projected water budgets are based on a provisional version of the SVOM and are subject to change. Model information and assumptions are based on provisional documentation on the model. The sustainable yield value will be updated in future GSP updates as more data are collected and additional analyses are conducted. The table below summarizes the historical and projected sustainable yields for the Subbasin.

Summary of Historical and Projected 2070 Sustainable Yields in AF/yr.

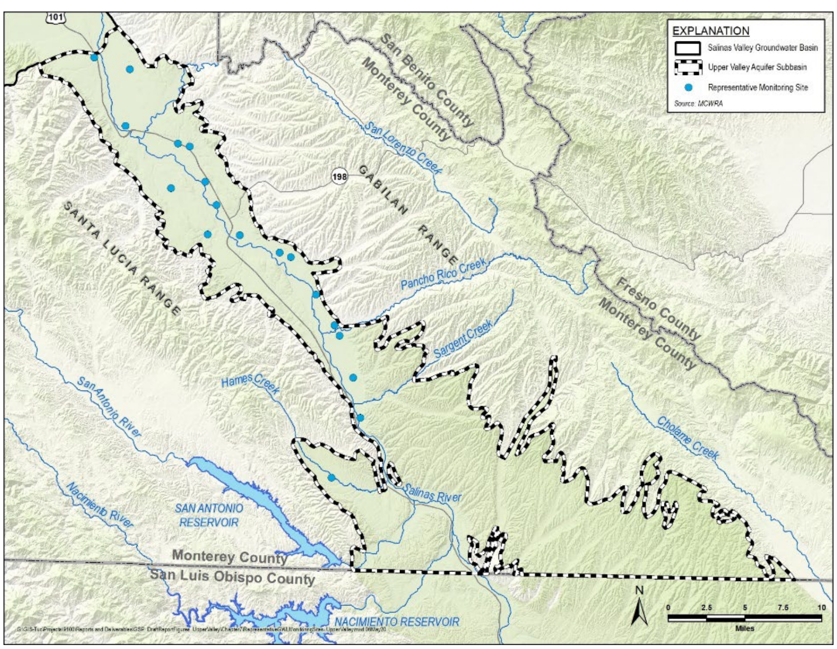
	Historical Sustainable Yield Range	2070 Projected Sustainable Yield
Groundwater Pumping	108,500 to 129,600	119,600
Change in Storage	0	0
Sustainable Yield	108,500 to 129,600	119,600

ES-7 MONITORING NETWORKS (GSP CHAPTER 7)

Monitoring networks are developed for data collection of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the Subbasin and to evaluate changing conditions that occur as the Plan is implemented. The SVBGSA developed monitoring networks for each of the 5 sustainability indicators, based on existing monitoring sites to the extent possible. The Upper Valley Subbasin encompasses, and extends well beyond, all of MCWRA's Upper Valley Subarea; thus, most of MCWRA's monitoring program do not cover the entire Subbasin. The existing groundwater elevation and extraction monitoring networks will be expanded and data gaps filled to improve the SVBGSA's ability to demonstrate sustainability and refine the hydrogeologic conceptual model.

- **Groundwater levels** are measured in 18 designated monitoring wells that form a network sufficient to demonstrate groundwater occurrence, flow directions, and hydraulic gradients The figure below shows the existing monitoring network, all monitoring is conducted by MCWRA.
- **Groundwater storage** is measured by groundwater elevations thus the groundwater storage and groundwater level monitoring networks are identical.
- **Groundwater quality** is evaluated by monitoring groundwater quality at a network of existing water supply wells. Drinking water constituents of concern will be assessed at public water system supply wells through the Division of Drinking Water program and at on-farm domestic wells through the Irrigated Lands Regulatory Program (IRLP), shown on the figures on the following page, respectively. Agricultural constituents of concern will be assessed at irrigation supply wells that are also monitored through the ILRP.

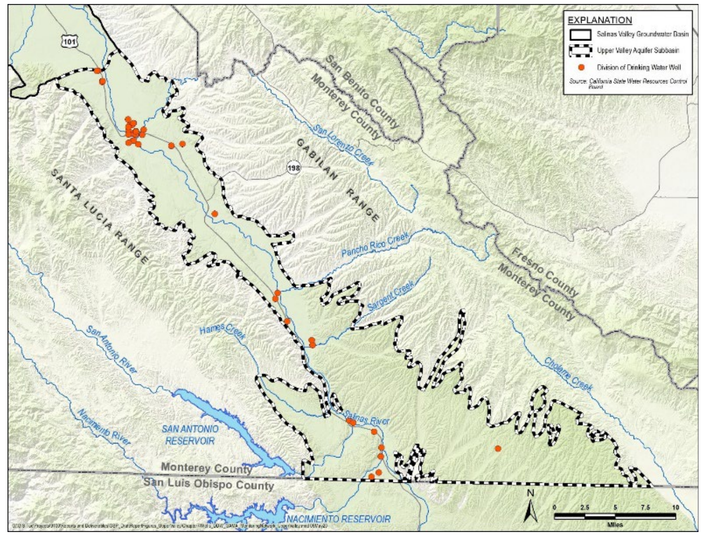
Upper Valley Aquifer Representative Monitoring Network for Groundwater Levels



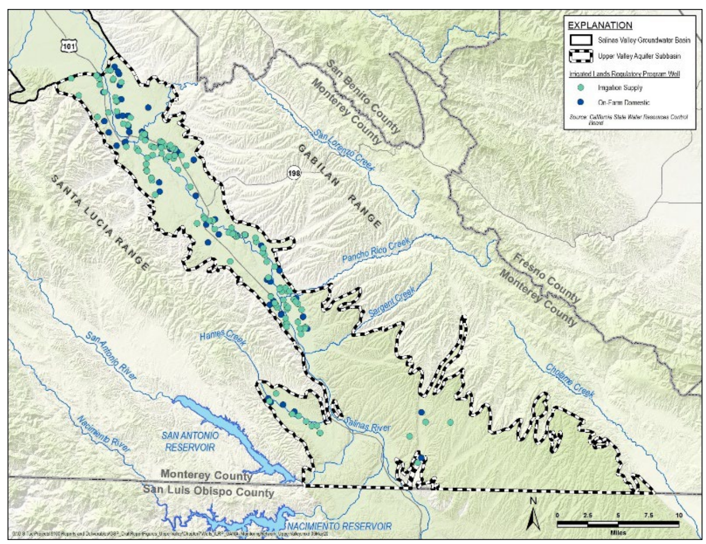
- **Land subsidence** is assessed based on the land subsidence data DWR has collected with InSAR satellite data.
- **Interconnected surface water** will be assessed through monitoring shallow groundwater elevations near locations of interconnection. Given the lack of shallow well near location of interconnection, a new shallow well will be installed along the Salinas River.
- **Other monitoring networks** are not necessary to monitor the 5 sustainability indicators in the Subbasin; however, DWR requires annual reporting of pumping and surface water use in the Subbasin.
    1. **Groundwater extraction** monitoring includes municipal and agricultural pumping reported to the MCWRA.
    2. **Salinas River Watershed Diversion** data from the Electronic Water Rights Information Management System (eWRIMS) is used to monitor the surface water diversions in the Subbasin.

The SVBGSA has developed a Data Management System (DMS) to store, review, and upload data collected as part of GSP development and implementation. The DMS includes a publicly accessible web-map hosted on the SVBGSA website; accessed at https://svbgsa.org/gsp-web-map-and-data/

ILRP On-Farm Domestic and Irrigation Supply Wells in the Groundwater Quality Monitoring Network



DDW Public Water System Supply Wells in the Groundwater Quality Monitoring Network



ES-8 SUSTAINABLE MANAGEMENT CRITERIA (GSP CHAPTER 8)

The sustainability goal of the Upper Valley Subbasin is to manage groundwater resources for long-term community, financial, and environmental benefits to the Subbasin's residents and businesses. The goal of this GSP is to ensure long-term viable water supplies while maintaining the unique cultural, community, and business aspects of the Subbasin. It is the express goal of this GSP to balance the needs of all water users in the Subbasin.

Sustainable Management Criteria (SMC) define the conditions that constitute sustainable groundwater management. The following table provides a summary of the SMC for each of the 5 sustainability indicators. Measurable objectives reflect the subbasin's goals for desired groundwater conditions for each sustainability indicator. These provide operational flexibility above the minimum thresholds. The minimum thresholds are quantitative indicators of the Subbasin's locally defined significant and unreasonable conditions. The undesirable result is a combination of minimum threshold exceedances that show a significant and unreasonable condition across the Subbasin. This GSP is designed to avoid undesirable results, and maintain the sustainability goals within 20 years, along with interim milestones every 5 years that show progress. The management actions and projects provide sufficient options for reaching the measurable objectives within 20 years and maintaining those conditions for 30 years for all 5 sustainability indicators.

Sustainable Management Criteria Summary

Sustainability Indicator	Minimum Threshold	Measurable Objective	Undesirable Result
Chronic lowering of groundwater levels	Minimum thresholds are set to 5 feet below the lowest groundwater elevation between 2012 and 2016 at each representative monitoring well.	Measurable objectives are set to 2011 groundwater elevations.	More than 15% of groundwater elevation minimum thresholds are exceeded. Allows for 2 exceedances per year in the Upper Valley Aquifer Subbasin.
Reduction in groundwater storage	Minimum thresholds are established by proxy using groundwater elevations. The reduction in groundwater storage minimum thresholds are identical to the chronic lowering of groundwater levels minimum thresholds.	Measurable objectives are established by proxy using groundwater elevations. The reduction in groundwater storage measurable objectives are identical to the chronic lowering of groundwater levels measurable objectives.	More than 15% of groundwater elevation minimum thresholds are exceeded. The undesirable result for reduction in groundwater storage is established by proxy using groundwater elevations.
Degraded groundwater quality	Minimum thresholds are zero additional exceedances of the regulatory drinking water standards (potable supply wells) or the Basin Plan objectives (irrigation supply wells) beyond those observed in 2019 for groundwater quality COC. Exceedances are only measured in public water system supply wells and ILRP on-farm domestic and irrigation supply wells.)	Measurable objectives are identical to the minimum thresholds.	Future or new minimum thresholds exceedances are caused by a direct result of GSA groundwater management action(s), including projects or management actions and regulation of groundwater extraction.
Land subsidence	Minimum threshold is zero net long-term subsidence, with no more than 0.1 foot per year of estimated land movement to account for InSAR errors.	Measurable objective is identical to the minimum threshold, resulting in zero net long-term subsidence.	There is an exceedance of the minimum threshold for subsidence due to lowered groundwater elevations.
Depletion of interconnected surface water	Minimum thresholds are established by proxy using shallow groundwater elevations observed in 2016 near locations of ISW.	Measurable objectives are established by proxy using shallow groundwater elevations observed in 2011 near locations of ISW.	There is an exceedance of the minimum threshold in a shallow groundwater monitoring well used to monitor ISW.

ES-9 MANAGEMENT ACTIONS AND PROJECTS (GSP CHAPTER 9)

This GSP identifies management actions and projects that provide stakeholders with options to maintain sustainability. The set of projects and actions achieve the following objectives:

- Maintaining groundwater sustainability through 2042 by meeting Subbasin-specific SMC
- Providing equity between who benefits from projects and who pays for projects
- Providing incentives to constrain groundwater pumping within the sustainable yield

The management actions and projects included in this GSP outline a framework for maintaining sustainability; however, many details must be negotiated before any of the management actions and projects can be implemented. The set of management actions and projects provide sufficient options for maintaining sustainability throughout the planning horizon, but they do not all necessarily need to be implemented.

This GSP is developed as part of an integrated effort by the SVBGSA to achieve groundwater sustainability in all 6 subbasins of the Salinas Valley under its authority. Therefore, the management actions and projects included in this GSP are part of a larger set of integrated projects and actions for the entire Valley.

This GSP focuses on the projects that directly help the Upper Valley Subbasin maintain sustainability, but also includes multi-subbasin projects outside the Subbasin that will likely benefit the Subbasin and reduce the need for additional management actions and projects. In addition, the chapter includes implementation actions that contribute to groundwater management and GSP implementation but do not directly help the Subbasin reach or maintain sustainability. The management actions, projects, and implementation actions for this GSP are listed in table on the next page.

Mitigation of Overdraft. The Upper Valley Subbasin has not historically been in overdraft. Based on the water budget components, the historical sustainable yield of the Subbasin is between 108,500 and 129,600 AF/yr. From 1980 to 2016, the Subbasin was in overdraft during only 5 years; therefore, the calculation of the mitigation of overdraft is not needed at this time. However, these results are provisional and subject to change in future GSP updates after the SVIHM is released by the USGS so their use as a basis to implement a management action or project is limited. Given that the Subbasin's extraction is currently close to the sustainable yield, this chapter includes a robust set of potential management actions and projects that could be undertaken if needed.

Management Actions and Projects

Project/ Management Action #	Name	Description	Project Benefits
A – MANAGEMENT ACTIONS			
A1	SMC Technical Advisory Committee (TAC)	Establish TAC to review groundwater conditions and provide advice on management actions and projects	Potential for increased groundwater elevations, increased groundwater storage, decreased groundwater extraction, protection of water quality
A2	Conservation and Agricultural BMPs	Promote agricultural best management practices (BMPs) and support use of ET data as an irrigation management tool for growers	Better tools assist growers to use water more efficiently; decreased groundwater extraction
A3	Fallowing, Fallow Bank, and Agricultural Land Retirement	Includes voluntary fallowing, a fallow bank whereby anybody fallowing land could draw against the bank to offset lost profit from fallowing, and retirement of agricultural land	Decreased groundwater extraction for irrigated agriculture
A4	MCWRA Drought Reoperation	Support the existing Drought Technical Advisory Committee (D-TAC) when it develops plans for how to manage reservoir releases during drought conditions	Additional regular winter reservoir releases; drought resilience
A5	Reservoir Reoperation	Collaborate with MCWRA to evaluate potential reoperation scenarios	Additional regular annual reservoir releases; drought resilience
B –PROJECTS			
B1	Multi-benefit Stream Channel Improvements	Prune native vegetation and remove non-native vegetation, manage sediment, and enhance floodplains for recharge. Includes 3 components: 1. Stream Maintenance Program 2. Invasive Species Eradication 3. Floodplain Enhancement and Recharge	Groundwater recharge, flood risk reduction, returns streams to a natural state of dynamic equilibrium
B2	Managed Aquifer Recharge with Overland Flow	Construct basins for managed aquifer recharge of overland flow before it reaches streams	Groundwater recharge, less stormwater and erosion, more regular surface temperature
C - IMPLEMENTATION ACTIONS			
C1	Well Registration	Register all production wells, including domestic wells	Better informed decisions, more management options
C2	GEMS Expansion and Enhancement	Update current GEMS program by collecting groundwater extraction data from wells in areas not currently covered by GEMS and improving data collection	Better informed decisions
C3	Dry Well Notification System	Develop a system for well owners to notify the GSA if their wells go dry. Refer those owners to resources to assess and improve their water supplies. Form a working group if concerning patterns emerge.	Support affected well owners with analysis of groundwater elevation decline
C4	Water Quality Coordination Group	Form a working group for agencies and organizations to collaborate on addressing water quality concerns	Improve water quality
C5	Land Use Jurisdiction Coordination Program	Review land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity.	Better aligned land use and water use planning

ES-10 IMPLEMENTATION (GSP CHAPTER 10)

This GSP lays out a roadmap for addressing all of the activities needed for GSP implementation between 2022 and 2042, focusing mainly on the activities between 2022 and 2027. Implementing this GSP requires the following formative activities:

Data, monitoring, and reporting. SGMA requires submittal of annual monitoring data and development of an annual report to track groundwater conditions with respect to the SMC. Monitoring will mostly rely on existing monitoring programs, and expansion of those programs. The groundwater level and groundwater extraction monitoring networks will be improved to provide sufficient temporal and spatial coverage of the Subbasin. Only ISW needs the establishment of a new monitoring network, which will comprise existing monitoring wells and a new shallow well along the Salinas River. Data from the monitoring programs will be maintained in the DMS and evaluated annually. SVBGSA also plans to fill the aquifer properties and lithologic and hydrostratigraphic data gaps in the HCM to gain a better understanding of the principal aquifer.

Continuing communication and stakeholder engagement. The SVBGSA website will be maintained as a communication tool for posting data, reports, and meeting information. Additionally, the SVBGSA will routinely report information to the public about GSP implementation, progress towards sustainability, and the need to use groundwater efficiently.

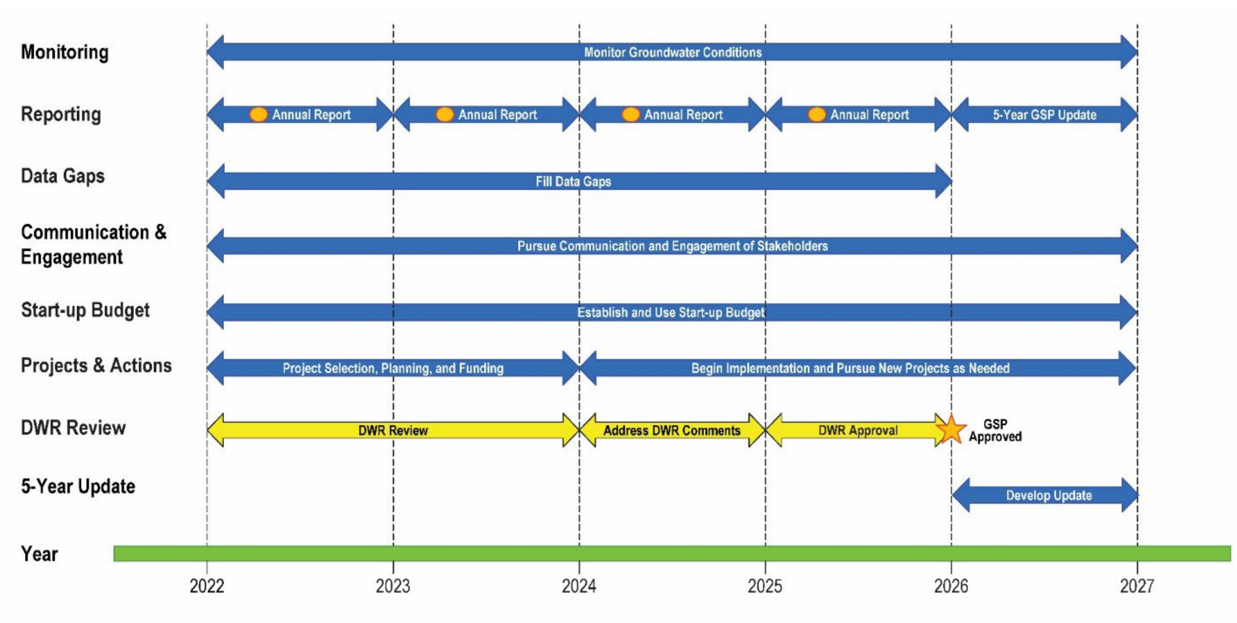
Refining and implementing management actions and projects. The management actions and projects in this GSP have been identified as beneficial and sufficient for maintaining sustainability in the Upper Valley Subbasin. During GSP implementation, they will be refined and prioritized, and impacts of management actions and projects on adjacent subbasins will be analyzed as part of the project selection process. The SVBGSA Board of Directors will approve management actions and projects that are selected for funding.

Adapting management with the 5-year update. SGMA requires assessment reports every 5 years to assess progress towards sustainability, a description of significant new information or data, and whether the GSP needs to be adapted. The 5-year update will include updating the SVIHM and SVOM with newly collected data and updating model scenarios to reflect both the additional data and refinements in project design or assumptions.

Developing a funding strategy. SVBGSA established a valley-wide Operational Fee to fund the typical annual operational costs of its regulatory program authorized by SGMA, including regulatory activities of management groundwater to sustainability (such as GSP development), day-to-day administrative operations costs, and prudent reserves. The cost is relatively low because SVBGSA can spread its administrative costs over the 6 subbasins it manages. In addition, this GSP provides an estimate of the start-up budget needed to implement this GSP within the Upper Valley Subbasin. The SVBGSA estimates that these planned activities will cost $753,000 over the first 5 years of implementation in the Upper Valley Subbasin. The start-up budget does not include funding for implementing specific management actions and projects. For management actions and projects funded by SVBGSA or funding SVBGSA raises to contribute to the implementation of management actions and projects, this GSP includes a list of potential funding mechanisms, and SVBGSA will evaluate the most appropriate mechanism for each management action and project.

Schedule: Implementation of the Upper Valley Subbasin GSP must be integrated with that of the 5 other GSPs in the Salinas Valley to ensure all subbasins can reach and maintain sustainability. The general implementation schedule for management actions and projects, provided on the figure below, focuses on implementation actions and the SMC TAC within the first 2 to 3 years. The D-TAC has already been created. Other management actions could be pursued at any point that groundwater conditions warrant them or at any point Subbasin stakeholders and the SVBGSA decide is appropriate. Projects will be considered for the Upper Valley Subbasin if conditions warrant it. Management actions and projects will be revisited and adjusted as needed throughout GSP implementation. Implementation of this GSP will rely on best available science and will be continually updated as new data and analyses are available. The GSP is intended to include adaptive management that will refine the implementation and direction of this GSP over time.

General Schedule of 5-Year Start-Up Plan



1 INTRODUCTION TO THE UPPER VALLEY AQUIFER SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

1.1 Introduction and Purpose

The 2014 Sustainable Groundwater Management Act (SGMA) requires groundwater basins or subbasins that are designated as medium or high priority to be managed sustainably. In general, satisfying the requirements of SGMA requires 4 activities:

1. Forming one or more Groundwater Sustainability Agency(s) (GSAs) in the basin
2. Developing a Groundwater Sustainability Plan (GSP, or Plan)
3. Implementing the GSP and managing to measurable, quantifiable objectives
4. Providing regular reports to the California Department of Water Resources (DWR)

DWR has designated the Salinas Valley – Upper Valley Aquifer Subbasin (Subbasin, or Upper Valley Subbasin) as a medium priority basin. The Upper Valley Subbasin is 1 of 9 subbasins in the Salinas Valley, and it is located along the southern edge of the Salinas Valley (Figure 1-1). This document satisfies the GSP requirement for the Upper Valley Subbasin and meets all of the regulatory standards.

Groundwater levels have remained generally stable in the Subbasin, largely due to regular reservoir releases that recharge the Subbasin. The Subbasin has limited storage capacity, however, and many wells have been impacted or rendered unusable when Salinas River flows did not provide sufficient recharge. Groundwater quality concerns in the Subbasin include nitrate levels above the Maximum Contaminant Level (MCL) and high total dissolved solids (TDS) recharge from the adjacent Gabilan Range (DWR, 2004). Limited groundwater data exist in much of the Subbasin, particularly for areas farther away from the Salinas River. The purpose of this GSP is to outline how the Salinas Valley Basin GSA (SVBGSA) will maintain groundwater sustainability in the Subbasin and address the primary management concerns; managing the limited groundwater storage capacity and expanding the geographically constrained groundwater data. Maintaining sustainability in the Subbasin will avoid undesirable results for any of the 5 sustainability indicators applicable in the subbasin: groundwater elevation declines, groundwater storage reductions, water quality degradation, land subsidence, and interconnected surface water (ISW) depletion. Sustainability must be achieved in 20 years and maintained for an additional 30 years.

This GSP first presents the stakeholders, plan area, geologic and hydrogeologic data, groundwater conditions, and water budget necessary to develop an informed and robust plan. This GSP is based on best available data and analyses. As additional data are collected and analyses are refined, the GSP will be modified to reflect changes in the local understanding.

Following the foundational information, the GSP introduces the current agreed-to sustainability goal for the Subbasin. It also locally defines significant and unreasonable conditions which underpin the quantifiable minimum thresholds, measurable objectives, and interim milestones for each of the corresponding sustainability indicators. The final chapters detail projects and actions that should be implemented to maintain sustainability and provide an implementation plan for maintaining sustainability. The GSP is intended to include adaptive management that will refine the implementaion and direction of this GSP over time.

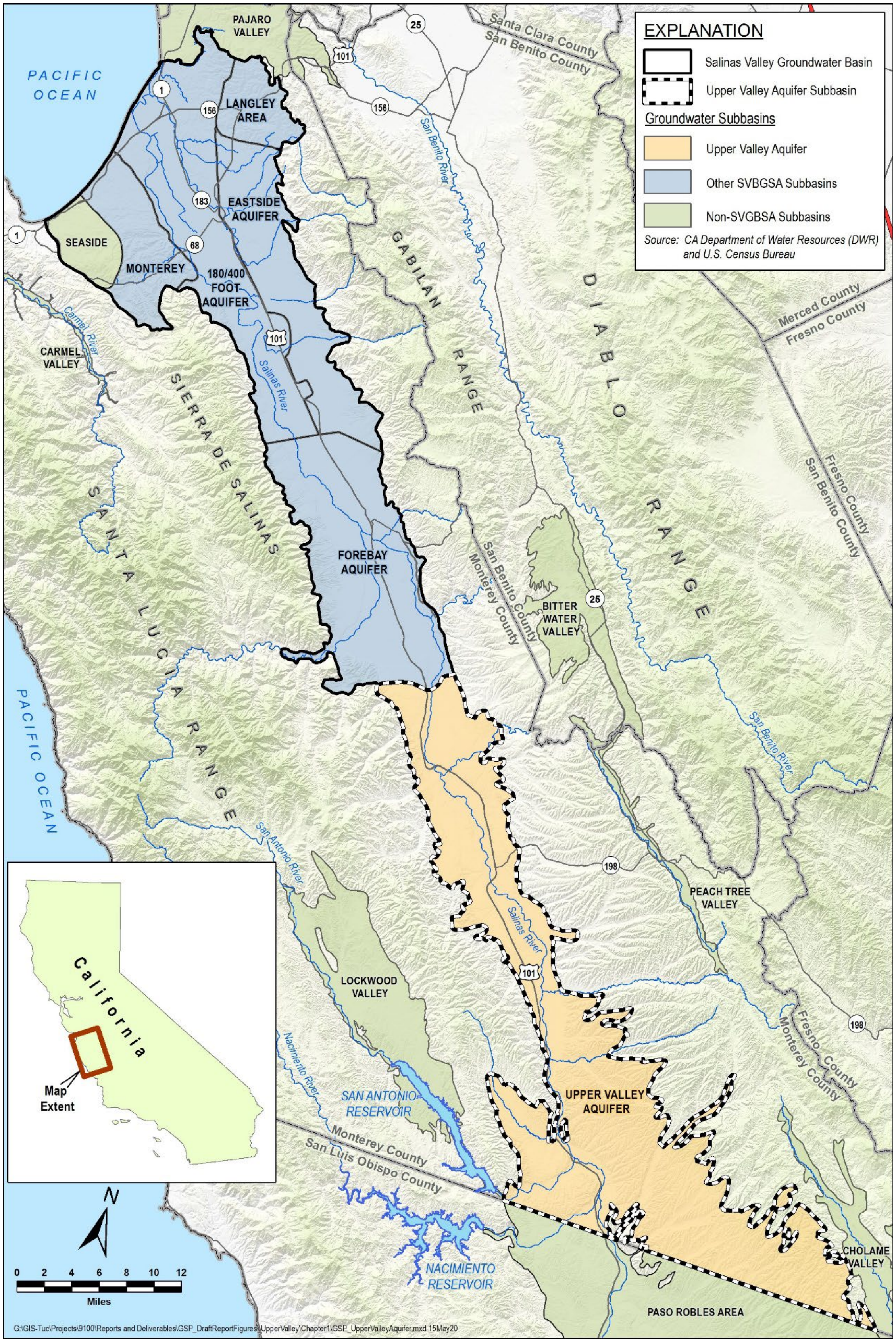


Figure 1-1. Upper Valley Aquifer Subbasin Location

1.2 Agency Information

The Upper Valley Subbasin falls entirely within the jurisdiction of the SVBGSA. The Subbasin boundary is shown on Figure 1-2.

1.2.1 Agency Name, Mailing Address, and Plan Manager

Pursuant to California Water Code § 10723.8, the name and contact information for the SVBGSA are:

Salinas Valley Basin Groundwater Sustainability Agency
Attn.: Donna Meyers, General Manager
1441 Schilling Place
Salinas, CA 93901
https://svbgsa.org

The Plan Manager and her contact information are:

Ms. Donna Meyers, General Manager
Salinas Valley Basin Groundwater Sustainability Agency
1441 Schilling Place
Salinas, CA 93901 | (831) 682-2592
meyersd@svbgsa.org
https://svbgsa.org

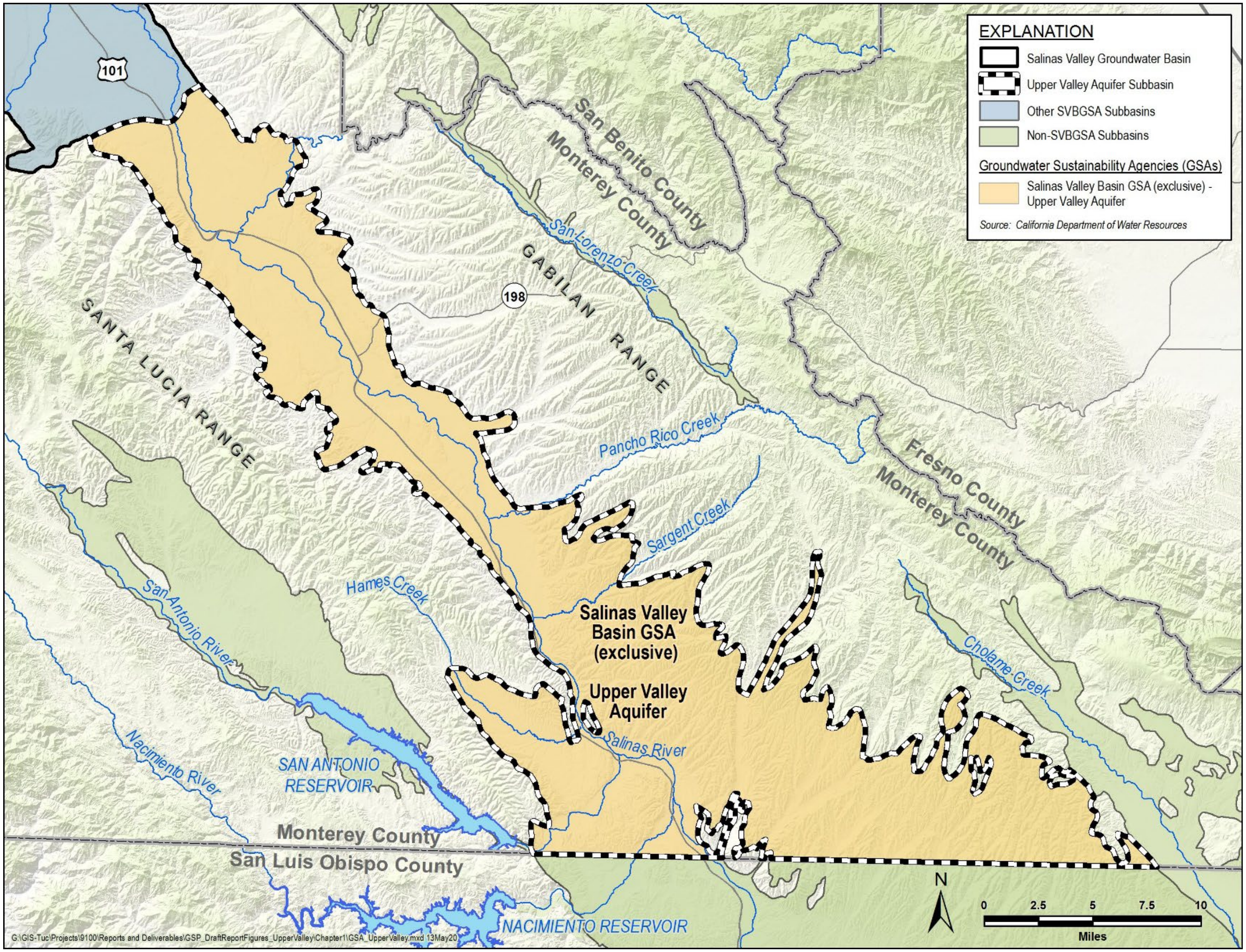


Figure 1-2. Map of Area Covered by the SVBGSA in the Upper Valley Aquifer Subbasin

1.2.2 SVBGSA Organization and Management Structure

Local GSA-eligible entities formed the SVBGSA in 2017. The SVBGSA represents agriculture, public utility, municipal, county, and environmental stakeholders, and is partially or entirely responsible for developing GSPs in 6 of the Salinas Valley Groundwater Subbasins.

The SVBGSA is a Joint Powers Authority (JPA), and its membership includes the County of Monterey, Monterey County Water Resources Agency (MCWRA), City of Salinas, City of Soledad, City of Gonzales, City of King (King City), the Castroville Community Services District (CSD), and Monterey One Water (formerly the Monterey Regional Water Pollution Control Agency). The SVBGSA is governed and administered by an 11-member Board of Directors (Board), representing public and private groundwater interests throughout the Valley. When a quorum is present, a majority vote is required to conduct business. Some business items require a super majority vote or a super majority plus vote. A super majority requires an affirmative vote by 8 of the 11 Board members. A super majority vote is required for:

- Approval of a GSP
- Amendment of budget and transfer of appropriations
- Withdrawal or termination of Agency members

A super majority plus requires an affirmative vote by 8 of the 11 Board members, including an affirmative vote by 3 of the 4 agricultural representatives. A super majority plus vote is required for:

- Decisions to impose fees not requiring a vote of the electorate or property owners
- Proposals to submit to the electorate or property owners (as required by law) decisions to impose fees or taxes
- Limitations on well extractions (pumping limits)

In addition to the Board of Directors, SVBGSA includes a Budget and Finance Committee consisting of 5 directors, an Executive Committee consisting of 5 directors, and an Advisory Committee consisting of irectors and non-directors. The Advisory Committee is designed to ensure participation by constituencies whose interests are not directly represented on the Board. The SVBGSA's activities are coordinated by a general manager. The SVBGSA established individual subbasin planning committees to advise the Board on each of the subbasins under its jurisdiction for which it is developing a 2022 GSP. This GSP has been guided and reviewed by the Upper Valley Subbasin Planning Committee, which comprises local representatives from the Subbasin. Once all GSPs are adopted, the subbasin planning committees will transition to implementation committees to advise on the implementation of the GSPs.

1.2.3 Authority of Agency

The SVBGSA was formed in accordance with the requirements of California Water Code § 10723 *et seq*. This section lists its specific authorities for GSA formation and groundwater management.

SVBGSA is a JPA that was formed for the Salinas Valley Groundwater Basin (Basin) in accordance with the requirements of California Government Code § 6500 *et seq*. The JPA agreement is included in Appendix 1A. In accordance with California Water Code § 10723 *et seq.*, the JPA signatories are all local agencies under California Water Code § 10721 with water or land use authority that are independently eligible to serve as GSAs:

- The County of Monterey has land use authority over the unincorporated areas of the County, including areas overlying the Upper Valley Subbasin.
- The MCWRA is a California Special Act District with broad water management authority in Monterey County.
- The City of Salinas is incorporated under the laws of the State of California. The City provides water supply and land use planning services to its residents.
- The City of Soledad is incorporated under the laws of the State of California. The City provides water supply and land use planning services to its residents.
- The City of Gonzales is incorporated under the laws of the State of California. The City provides water supply and land use planning services to its residents.
- King City is incorporated under the laws of the State of California. The City provides water supply and land use planning services to its residents.
- The Castroville CSD is a local public agency of the State of California, organized and operating under the Community Services District Law, Government Code § 6100 *et seq*. Castroville CSD provides water services to its residents. Monterey One Water is itself a JPA whose members include many members of the SVBGSA.

Upon establishing itself as a GSA, the SVBGSA retains all the rights and authorities provided to GSAs under California Water Code § 10725 *et seq*. as well as the powers held in common by the members.

1.2.3.1 Coordination Agreement

No coordination agreement is needed for the Upper Valley Subbasin, because the SVBGSA is the only GSA with authority in the Subbasin.

1.3 Overview of this GSP

The SVBGSA developed this GSP for the entire Upper Valley Subbasin. This GSP is developed in concert with GSPs for 5 other Salinas Valley Groundwater Subbasins under SVBGSA jurisdiction: the 180/400-Foot Aquifer Subbasin, the Forebay Aquifer Subbasin, the Eastside Aquifer Subbasin, the Langley Area Subbasin, and the Monterey Subbasin. While this GSP is focused on the Upper Valley Subbasin, the GSP will be implemented in accordance with SVBGSA's role in maintaining and achieving sustainability for all subbasins within the Salinas Valley Groundwater Basin. The Upper Valley Subbasin is referred to as the Subbasin throughout this GSP, and the collection of Salinas Valley Groundwater Subbasins that fall partially or entirely under SVBGSA jurisdiction are collectively referred to as the Basin or the Valley.

The SVBGSA used a collaborative process to develop this GSP. Chapter 2 details the stakeholders that participated, and process followed, to develop this GSP. Stakeholders worked together to gather existing information, define sustainable management criteria (SMC) for the Subbasin, and develop a list of management actions and projects.

This GSP describes the basin setting, presents the hydrogeologic conceptual model (HCM), and describes historical and current groundwater conditions. It further establishes estimates of the historical, current, and future water budgets based on the best available information. This GSP defines local SMC, details required monitoring networks, and outlines management actions and projects for maintaining sustainability in the Subbasin by 2042.

The SVBGSA developed this GSP as part of an adaptive management process. This GSP will be updated and adapted as new information and more refined models become available. This includes updating SMCs and management actions and projects to reflect updates and future conditions. Adaptive management will be reflected in the required 5-year assessment to GSPs and annual reports.

2 COMMUNICATIONS AND PUBLIC ENGAGEMENT

2.1 Introduction

The Salinas Valley Basin Groundwater Sustainability Agency was formed in 2017 to implement SGMA locally within the Salinas Valley Groundwater Basin . GSA formation and coordination took place from 2015 through 2017 and included completing a Salinas Valley Groundwater Stakeholder Issues Assessment which resulted in recommendations for a transparent, inclusive process for the local implementation of SGMA and the formation of the SVBGSA. Through the development and implementation of the GSPs SVBGSA is committed to following the requirements for stakeholder engagement as defined by SGMA:

- Consider the interests of all beneficial uses of water and users of groundwater (§ 10723.2)
- Encourage the active involvement of diverse social, cultural, and economic elements of the population within the groundwater basin (§ 10727.8)
- 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 (§ 10723.4)
- Make available to the public and DWR a written statement describing the manner in which interested parties may participate in the development and implementation of the GSP (§ 10723.2)

2.2 Defining and Describing Stakeholders for Public Engagement

The SVBGSA stakeholders are highly diverse. Groundwater supports economic activities from small domestic scale to large industrial scale. Groundwater is an important supply for over 400,000 people living within the Salinas Valley Groundwater Basin. Beneficial users in the Basin are the key stakeholders targeted for robust public engagement for GSP development and implementation. Beneficial users in the Basin are listed below:

Agriculture. Includes row crops, field crops, vineyards, orchards, cannabis, and rangeland. The Salinas Valley agricultural region supports a $4.25 billion dollar production value and produces a large percentage of the nation’s produce and healthy foods including 61% of the leaf lettuce, 57% of celery, 56% of head lettuce, 40% of broccoli, and 38% of spinach. Agriculture is the largest user of groundwater in the Basin accounting for approximately 250,000 irrigated acres and 94% of pumping in the Basin.

Domestic Water Users. Includes urban water use assigned to non-agricultural water uses in the cities and census-designated places and rural residential wells used for drinking water. Urban water use includes small local water systems, small state water systems, and small and large public water systems.

Industrial Users. Includes industrial water users, such as quarries and oil production. There is little industrial use within the Basin.

Environmental Users. Environmental users include the habitats and associated species maintained by conditions related to surface water flows such as steelhead trout and groundwater dependent ecosystems (GDEs) including brackish and freshwater marsh and riparian habitats. Environmental users include native vegetation and managed wetlands.

Stakeholders associated with these beneficial users and uses include the following. These users are also represented on the SVBGSA Board and Advisory Committees as described in the next section.

- **Environmental organizations.** Environmental organizations that are stakeholders include Sustainable Monterey County, League of Women Voters of Monterey County, Landwatch Monterey County, Friends and Neighbors of Elkhorn Slough, California Native Plant Society Monterey Chapter, Trout Unlimited, Surfriders, the Nature Conservancy (TNC) and the Carmel River Steelhead
- **Underrepresented communities (URCs) and Disadvantaged Communities (DACs).** URCs and DACs include CSD, San Jerardo Cooperative, San Ardo Water District, San Vicente Mutual Water Company, Environmental Justice Coalition for Water
- **City and county government.** Cities of Gonzales, Soledad, Greenfield, King City, Marina, and Salinas, Monterey County, Monterey County Environmental Health Department
- **Land use nonprofits.** Sustainable Monterey County, League of Women Voters of Monterey County, Landwatch Monterey County, Friends and Neighbors of Elkhorn Slough
- **Residential well owners.** Represented by public members and members of mutual water companies and local small or state small water systems.
- **Water agencies.** Monterey County Water Resources Agency, Marina Coast Water District, Arroyo Seco Groundwater Sustainability Agency, Castroville Community Services District, Monterey One Water, Monterey Peninsula Water Management District
- **CPUC-regulated water companies.** Alco Water Corporation, California Water Service Company, California American Water.

2.3 SVBGSA Governance Structure

SVBGSA is governed by a local and diverse 11-member Board of Directors (Board) and relies on robust science and public involvement for decision-making. The Board meets monthly and all meetings are open to the public. The Board is the final decision-making body for adoption of GSPs completed by the GSA.

The SVBGSA Advisory Committee advises the SVBGSA Board. The Advisory Committee is comprised of 25 members. The Advisory Committee strives to include a range of interests in groundwater in the Salinas Valley and outlined in SGMA. Advisory Committee members live in the Salinas Valley or represent organizations with a presence or agencies with jurisdiction in the Basin including:

- All groundwater users
- Municipal well operators, Public-Utilities Commission-Regulated water companies, and private and public water systems
- County and city governments
- Planning departments/land use
- Local landowners
- Underrepresented communities
- Business and agriculture
- Rural residential well owners
- Environmental uses

The Advisory Committee, at this time, does not include representation from:

- Tribes
- Federal government

The Advisory Committee will review its charter following GSP completion for additional members if identified as necessary by the Board. The Advisory Committee provides input and recommendations to the Board and uses consensus to make recommendations to the Board. The Advisory Committee was established by Board action and operates according to a Committee Charter which serve as the bylaws of the Advisory Committee. The Advisory Committee reviews and provides recommendations to the Board on groundwater-related issues that may include:

- Development, adoption, or amendment of the GSP
- Sustainability goals

- Monitoring programs
- Annual work plans and reports
- Modeling scenarios
- Inter-basin coordination activities
- Management actions and projects to achieve or maintain sustainability
- Community outreach
- Local regulations to implement SGMA
- Fee proposals
- General advisory

Subbasin planning committees were established in May 2020 by the Board of Directors to inform and guide planning for the 5 GSPs due in January 2022. Membership is 7-12 people per subbasin planning committee and all meetings are subject to the Brown Act.

Together the Board, Advisory Committee, and subbasin planning committees are working to complete the 6 GSPs required within the SVBGSA jurisdiction. Subsequent to that, SVBGSA will complete a Salinas Valley Basin-wide Integrated Implementation Plan that is intended to be consistent with the groundwater sustainability plans of the subbasins within the Salinas Valley Groundwater Basin will detail project portfolios and groundwater sustainability programs to meet SGMA compliance for subbasins by 2040 and maintain sustainability through 2050. Once all the GSPs are filed, the subbasin planning committees will transition to implementation committees.

The following graphic captures the phases of GSA development and GSP planning and implementation intended by the SVBGSA through 2050.

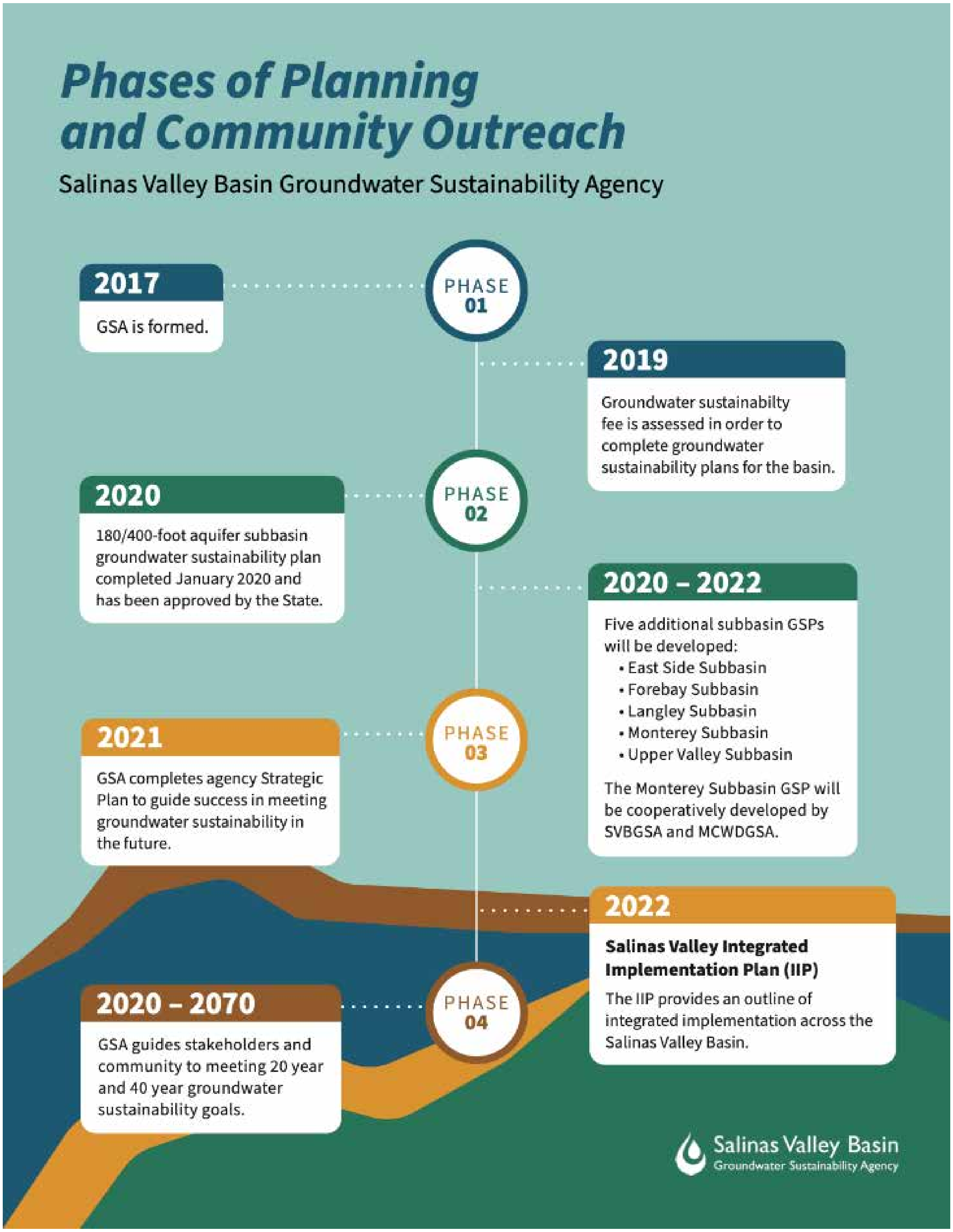


Figure 2-1. Phases of Planning and Community Outreach

2.4 Upper Valley Subbasin GSP Preparation

Given the importance of the Basin and the development of the Upper Valley GSP to the communities, residents, landowners, farmers, ranchers, businesses, and others, inclusive stakeholder input was a primary component of the Upper Valley GSP process. In order to encourage ongoing stakeholder engagement SVBGSA deployed the following strategies in the preparation of the Upper Valley Subbasin GSP:

- An inclusive outreach and education process conducted that best supports the success of a well-prepared GSP that meets SGMA requirements
- The public informed by distributing accurate, objective, and timely information
- Invited input and feedback from the public at every step in the decision-making process
- Established Subbasin Planning Committee for the Subbasin and completed a comprehensive planning process with this Committee including engagement on key items with the Board and Advisory Committee
- Publicly noticed drafts of the Upper Valley Subbasin GSP and allowed for required public comment periods as required by SGMA. Comments received and responses are included in Appendix 2A.

Additionally, a rigorous review process for each chapter in the Upper Valley GSP and for the final plan was completed. This process ensured that stakeholders had multiple opportunities to review and comment on the development of the chapters. A graphical presentation of the planning process is presented below.

Figure 2-2. GSP Development Process

2.5 Upper Valley Subbasin Planning Committee

Subbasin planning committees are comprised of local stakeholders and Board members and were appointed by the Board of Directors following a publicly-noticed application process by the GSA. Subbasin planning committees were convened in June and July 2020. Subbasin planning committees do the comprehensive work of plan development, review, and recommendations, with assistance provided by SVBGSA staff and technical consultants.

These committees represent constituencies that are considered important stakeholders to developing comprehensive subbasin plans for the Salinas Valley or are not represented on the Board. A list of the Upper Valley GSP Subbasin Planning Committee is included in the Acknowledgements section of this GSP.

Subbasin planning committee meetings are Brown Act meetings and noticed publicly on the SVBGSA website. Public comment is taken on all posted agenda items. Subbasin planning committees have been engaged in an iterative planning process that combines education of pertinent technical topics through presentations and data packets and receiving GSPs chapters for review and comment. A live GSP comment form is available on the SVBGSA website for ongoing comment submission on all GSP chapters. All GSP chapters were posted for public review and comment.

GSP chapters that have been taken to the Subbasin Planning Committee were also taken to the Advisory Committee for further review and comments. Community engagement and public transparency on SVBGSA decisions is paramount to building a sustainable and productive solution to groundwater sustainability in the Basin. At the conclusion of the planning process in August 2021 for the Upper Valley GSP the SVBGSA will have held more than 37 planning meetings and technical workshops on each aspect of the Upper Valley Subbasin GSP.

In addition to regularly scheduled committee meetings, a series of workshops were held for the Upper Valley Subbasin Planning Committee as detailed below. These workshops were informational for committee members, stakeholders, and the general public and covered pertinent topics to be included in the GSPs. Workshops were timed to specific chapter development for the GSP. Subject matter experts were brought in as necessary to provide the best available information to Subbasin Planning Committee members.

Table 2-1. Subject Matter Workshops Held During GSP Preparation

Topic	Date
Brown Act and Conflict of Interest	July 22, 2020
Sustainable Management Criteria	July 28, 2020
Water Law	August 10, 2020
Salinas Valley Watershed Overview	August 26, 2020
Web Map Workshop	September 30, 2020
Town Hall – Domestic Wells & Drinking Water	October 28, 2020
Pumping Allocations	November 18, 2020
Funding Mechanisms	January 27, 2021
Water Budgets	February 24, 2021
Communications and Implementation	March 31, 2021
Technical Modeling Workshop – SVIHM & SVOM	June 30, 2021

2.6 Communication and Public Engagement Actions

SVBGSA is focused on communication and public engagement targeted at the public, including beneficial users, regarding the development of the SVBGSA's GSP for the Upper Valley Subbasin. Communication and public engagement actions (CPE Actions) that have taken place during GSP development will continue during implementation of SVBGSA GSPs. CPE Actions provide the SVBGSA Board and staff a guide to ensure consistent messaging about SVBGSA requirements and other related information. CPE Actions provide ways that beneficial users and other stakeholders can provide timely and meaningful input into the GSA decision-making process. CPE Actions also ensure beneficial users and other stakeholders in the Basin are informed of milestones and offered opportunities to participate in GSP implementation and plan updates. Appendix 2B includes the SVBGSA's marketing and communications plan.

Notice and communication, as required by GSP Regulations § 354.10, were focused on providing the following activities during the development of the Upper Valley Subbasin GSP:

- Clear decision-making process on GSP approvals and outcomes
- Robust public engagement opportunities
- Encouragement of active involvement in GSP development

2.6.1 Goals for Communication and Public Engagement

Ultimately, the success of the Upper Valley Subbasin GSP will be determined by the collective action of every groundwater user. In order to meet ongoing water supply needs, both for drinking water and for economic livelihoods, the Subbasin must maintain sustainability into the future. This outreach strategy engages the public early and frequently, and keeps the internal information flow seamless among staff, consultants, committee members and the Board regarding the goals and objectives of the Upper Valley Subbasin GSP and associated monitoring and implementation activities.

Critical to the success of the Upper Valley GSP implementation will be public understanding of the management actions and projects planned for sustainability, as well as sustainability implementation actions and other groundwater management activities. These important actions are identified below (not in order of priority) and specifically described in Chapter 9 of the Upper Valley GSP.

Management Actions

- SMC Technical Advisory Committee (TAC)
- Conservation and Agricultural Best Management Practices (BMPs)
- Fallowing, Fallow Bank, and Agricultural Land Retirement
- MCWRA Drought Reoperation
- Reservoir Reoperation

Project Options Over 50 Year Planning Horizon

- Multi-benefit Stream Channel Improvements
- Managed Aquifer Recharge (MAR) of Overland Flow

Implementation Actions

- Well Registration
- Groundwater Extraction Monitoring System (GEMS) Expansion and Enhancement
- Dry Well Notification System
- Water Quality Coordination Group
- Land Use Jurisdiction Coordination Program

Additional important actions of GSP implementation will be the production of the required Annual Report by April 1st each year for the Upper Valley Subbasin. The Annual Report covers annual data collected each water year from October 1 through September 30. The Annual Report provides an annual benchmark for SVBGSA to provide to the public and stakeholders to assess progress towards sustainability. The Annual Report also includes assessment of the 6 SMC for the Subbasin. The Annual Report provides an important opportunity to reengage the Upper Valley Subbasin Planning Committee in its review and to discuss sustainability status and goals.

CPE Actions provide outreach during the Subbasin planning efforts and assists SVBGSA in being receptive to stakeholder needs through communication tools. The CPE Actions also forecast how SVBGSA will communicate during GSP implementation.

The goals of the CPE Actions are:

1. To keep stakeholders informed through the distribution of accurate, objective, and timely information while adhering to SGMA requirements for engagement (noted above)
2. To articulate strategies and communications channels that will foster an open dialogue and increase stakeholder engagement during the planning process
3. To invite input from the public at every step in the decision-making process and provide transparency in outcomes and recommendations
4. To ensure that the Board, staff, consultants, and committee members have up-to-date information and understand their roles and responsibilities
5. To engage the public on GSP Implementation progress especially for project and management actions and Annual Reports

2.6.2 Communication and Outreach Objectives

The following are the communications and outreach objectives of the CPE Actions:

- Expand Audience Reach
    - Maintain a robust stakeholder list of interested individuals, groups and/or organizations
    - Secure a balanced level of participants who represent the interests of beneficial uses and users of groundwater
- Increase Engagement
    - Keep interested stakeholders informed and aware of opportunities for involvement through email communications and/or their preferred method of communications
    - Publish meeting agendas, minutes, and summaries on the SVBGSA website: www.svbgsa.org
    - Inform and obtain comments from the general public through GSP online comment form and public meetings held on a monthly basis
    - Facilitate productive dialogues among participants throughout the GSP planning process
    - Seek the input of interest groups during the planning and implementation of the

GSP and any future planning efforts

- Increase GSP Awareness
    - Provide timely and accurate public reporting of planning milestones through the distribution of outreach materials and posting of materials on the SVBGSA website for the GSP
    - Secure quality media coverage that is accurate, complete, and fair
    - Utilize social media to engage with and educate the general public
- Track Efforts
    - Maintain an active communications tracking tool to capture stakeholder engagement and public outreach activities and to demonstrate the reporting of GSP outreach activities

2.6.3 Target Audiences and Stakeholders

SVBGSA stakeholders consist of other agencies and interested parties including all beneficial users of groundwater or representatives of someone who is. Under the requirements of SGMA, all beneficial uses and users of groundwater must be considered in the development of GSPs, and GSAs must encourage the active involvement of diverse social, cultural, and economic elements of the population.

There are a variety of audiences targeted within the Basin whose SGMA knowledge varies from high to little or none. Given this variance, SVBGSA efforts are broad and all-inclusive. Target audiences include:

- SVBGSA Board of Directors, Advisory Committee, and Subbasin Planning Committees
- SVBGSA Groundwater Sustainability Fee Payers
- Partner agencies including Monterey County Environmental Health Department, County of Monterey, MCWRA, and the Greater Monterey County Integrated Regional Water Management Group (RWMG)
- Municipal and public water service providers
- Private and local small or state small water system providers
- Local municipalities and communities
- Elected officials within the Basin
- Beneficial uses and users of groundwater including, agriculture, domestic wells and local small or state small water systems, and environmental uses such as wetlands
- Diverse social, cultural, and economic segments of the population within the Basin including URCs
- The general public

Stakeholder involvement and public outreach is critical to the GSP development because it helps promote the plan based on input and broad support. The following activities summarize involvement opportunities and outreach methods to inform target audiences and stakeholders. It is important to note that levels of interest will evolve and shift according to the GSP's implementation opportunities and priorities.

2.6.4 Stakeholder Database

A stakeholder database of persons and organizations of interest will be created and maintained. The database will include stakeholders that represent the region's broad interests, perspectives, and geography. It will be developed by leveraging existing stakeholder lists and databases and by conducting research of potential stakeholders that may be interested in one or all of the following categories: municipal users and groundwater users including agricultural, urban, industrial, commercial, institutional, rural, environmental, URCs, state lands and agencies, and integrated water management.

2.6.5 Key Messages and Talking Points

SVBGSA developed key messages focused on getting to know your GSA, an overview of groundwater sustainability planning for our community, and how we intend to continue outreach through implementaion. These messages were guided by the underlying statements:

- The GSP process, both planning and implementation, is transparent and direct about how the GSP will impact groundwater users.
- SVBGSA represents the groundwater interests of all beneficial uses/users of the basin equitably and transparently to ensure that the basin achieves and maintains sustainable groundwater conditions.
- SVBGSA is committed to working with stakeholders using an open and transparent communication and engagement process.
- As the overall GSP will be more comprehensive with an engaged group of stakeholders providing useful information, SVBGSA will create as many opportunities as possible to educate stakeholders and obtain their feedback on the GSP implementation and plan updates.

These messages are being used as the basis for specific talking points/Q&A to support effective engagement with audiences. The SVBGSA Key Messages are also used to support communication with audiences (Appendix 2C).

2.6.6 Engagement Strategies

SVBGSA utilizes a variety of tactics to achieve broad, enduring, and productive involvement with stakeholders during the development and implementation of the GSPs. Below are activities that SVBGSA uses to engage the public currently and anticipated activities for GSP implementation:

- Develop and maintain a list of interested parties
- Offer public informational sessions and subject-matter workshops and provide online access via Facebook Live or via Zoom
- Basin tours (currently on hold due to COVID restrictions)
- SVBGSA Web Map
- FAQS – Offer FAQs on several topics including SGMA, SVBGSA, GSP, projects, Monitoring Program, Annual Report, Programs and Groundwater Sustainability Fee
- Science of Groundwater – new examples (studies, etc.)
- Board, Advisory Committee, and other Committee Meetings
    - Regular public notices and updates; Brown Act compliance
    - Develop talking points for various topics and evolve as necessary
- Subbasin Implementation Committees
    - Each subbasin's planning committee for GSP development will transition to a subbasin implementation committee to be convened for GSP updates and annual report reviews.
- Integrated Implementation Committee
    - The Integrated Implementation Committee will be convened to discuss Basin-wide aspects to the 6 GSPs in the Basin including public outreach.
- Online communications
    - SVBGSA website: maintain with current information
    - SVBGSA Facebook page: maintain and grow social media presence
    - Direct email via Mailchimp newsletter
- Mailings to most-impacted water users and residents – topics to include: Annual Report dashboard, "What does your GSA do with the Sustainability Fee?" newsletter that accompanies each tax bill.
- Media coverage. Appendix 2D includes SVBGSA's media policy.

- Op-eds in the local newspapers
- Press releases
- Radio interviews

- Promote/Celebrate National Groundwater Week (held in December)
- Co-promotional opportunities and existing channels with agencies, committees, and organizations including email newsletters, social media, board meetings and mailings to customers.
- Talks and presentations to various stakeholder groups, associations, community organizations, and educational institutions.
- Educational materials

2.6.7 CPE Actions Timeline and Tactics

CPE Actions and GSP milestone requirements by phase include:

- Prior to initiating plan development: Share how interested parties may contact the GSA and participate in development and implementation of the plan submitted to DWR. (23 California Code of Regulations § 353.6)
- Prior to GSP development: Establish and maintain an interested persons list. (California Water Code § 10723.4)
- Prior to and with GSP submission:
    - Record statements of issues and interests of beneficial users of basin groundwater including types of parties representing the interests and consultation process
    - Lists of public meetings
    - Inventory of comments and summary of responses
    - Communication section in GSP (23 California Code of Regulations § 354.10) that includes: agency decision-making process, identification of public engagement opportunities and response process, description of process for inclusion, and method for public information related to progress in implementing the plan (status, projects, actions)
- Supporting tactics to be used to communicate messages and supporting resources available through GSP development and GSP implementation:
    - SVBGSA website, updated regularly to reflect meetings and workshop offerings
    - Direct email via Mailchimp sent approximately monthly to announce board meetings, special workshop offerings and other opportunities for engagement

- Outreach to local media to secure coverage of announcements and events, radio interviews, op-ed placement
- Workshops, information sessions and other community meetings
- Social media, specifically Facebook, updated regularly to share information and support other outreach efforts

2.6.8 CPE Actions – Annual Evaluation and Assessment

CPE Actions and GSP milestone requirements by phase include:

- What worked well?
- What didn't go as planned?
- Are stakeholders educated about the GSP development process and their own role?
- Is the timeline for implementation of the GSP clear?
- Has the GSA received positive press coverage?
- Do diverse stakeholders feel included?
- Has there been behavior changes related to the program goals? Or improved trust/relationships among participants?
- Community meeting recaps and next steps
- Lessons learned
- Budget analysis

2.7 Underrepresented Communities and Disadvantaged Communities Strategic Engagement and Communications

During development of the 2022 GSPs, SVBGSA conducted the scoping of an engagement strategy for URCs and \DACs that would provide both an assessment of how URCs and DACs may be engaged with the GSA and to develop GSA materials that are accessible and culturally responsive (visual and in Spanish). These materials will communicate impacts of groundwater management on local water conditions in order to engage URCs and DACs into GSA plan reviews and develop pathways for future involvement.

2.7.1 Underrepresented Communities and Disadvantaged Communities in the Salinas Valley

In this GSP, URCs and DACs are considered communities that currently have little or no representation in water management, or who historically have had disproportionately less representation in public policy decision making. URCs and DACs are inclusive of Severely Disadvantaged Communities (SDACs), Economically Distressed Areas (EDAs) and other communities that are traditionally underrepresented. The SVBGSA program area has well documented DAC designation including 7 Census Designated Places, 60 Block Groups, and 20 Tracts. Additionally, work conducted by the Greater Monterey County Integrated Regional Water Management Program (IRWMP) identified 25 small DACs, SDACs, and suspected disadvantaged communities in unincorporated areas of the IRWMP region (RWMG, 2018). Figure 2-3 shows where DACs, SDACs, and EDAs are located within the Salinas Valley Groundwater Basin, and Appendix 2E further describes DACs.

SVBGSA seeks to engage more constructively with URCs and DACs moving forward in subbasin planning processes and ultimately GSP implementation. In August 2019, SVBGSA hired the Consensus Building Institute (CBI) to conduct an assessment with URC and DAC community leaders via formal interviews. The purpose of the assessment was to capture insights and recommendations to inform an engagement strategy for URCs and DACs. CBI conducted 14 interviews and summarized findings from the assessment to identify initial strategic steps for work with URCs and DACs for GSP planning and implementation. Based on this work, an initial set of short and middle term actions to complete from January 2021-August 2021 was identified and work has begun on these items during the GSP development period and will be operational for implementation in Fall 2021. The Board of Directors affirmed these short and middle term actions on February 11, 2021, and are intended for focus during implementation of the GSP. Middle and long-term actions with URCs were identified for 2022. The Spectrum of Community to Ownership will be utilized as a guide in further shaping SVBGSA work with URCs and DACs communities in the Basin in consultation with community leaders.

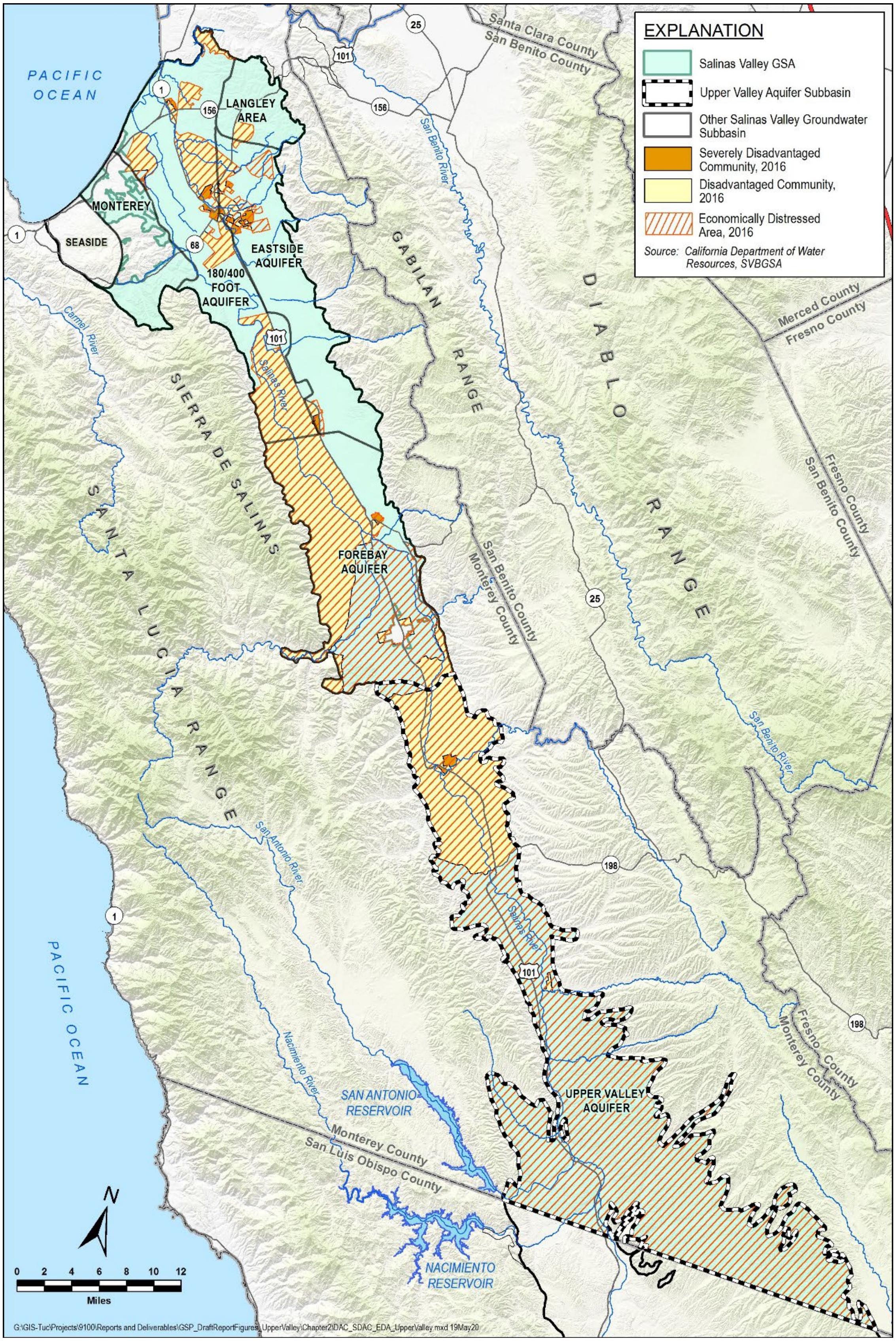


Figure 2-3. Disadvantaged Communities in the Salinas Valley Groundwater Basin

2.7.2 Additional activities scoped for engagement of Underrepresented Communities and Disadvantaged Communities

Additional activities scoped for engagement of URCs and DACs include:

- Conduct workshops with partners on importance of water and groundwater sustainability
- Identify URC and DAC concerns and needs for engagement
- Plan listening sessions around GSA milestones
- Coordinate with partner organizations to develop a "resource hub" where people can go for support
- Identify community allies in groundwater engagement work and bring down barriers for participation
- Consider particular URC and DAC impacts during routine GSA proceedings
- Convene a working group on domestic water, including URCs and DACs

3 DESCRIPTION OF PLAN AREA

This GSP covers the entire Upper Valley Subbasin, as shown on Figure 3-1. The Subbasin covers an area of approximatley 237,670 acres. It lies in southeastern Monterey County and the southern portion of the Salinas Valley Groundwater Basin. The Upper Valley Subbasin is bounded by the Gabilan Range to the east, the Forebay Subbasin (DWR subbasin number 3-004.05) to the north, the Santa Lucia Range to the west, and the Paso Robles Area Subbasin (DWR Subbasin number 3-004.06) to the south. The Upper Valley Subbasin encompasses, and extends well beyond, all of MCWRA's Upper Valley Subarea.

The Upper Valley Subbasin has several tributaries that drain from the western slopes of the Gabilan Range and flow westward across the Subbasin. Most tributaries drain into the Salinas River. Releases from San Antonio Reservoir drain into the San Antonio River, which is a tributary to the Salinas River. Releases from Nacamiento Reservoir drain into the Salinas River and enter into the Subbasin through the Paso Robles Subbasin. The Upper Valley Subbasin contains the municipality of King City. United States Highway 101 runs generally north-south roughly following the path of the Salinas River. Rivers and streams, urban areas, and major roads are shown on Figure 3-1.

This description of the plan area has been prepared in accordance with the GSP Regulations § 354.8. Information from existing water resource monitoring, management, and regulatory programs have been incorporated into this GSP through the development of the sustainability goal, SMC, and projects and management actions. This GSP has been developed to reflect the principles outlined in existing local plans, programs, and policies, and will build off them during GSP implementation.

3.1 Summary of Adjudicated and Jurisdictional Areas

3.1.1 Adjudicated Areas, Other GSAs, and Alternatives

The Upper Valley Subbasin is not adjudicated. The only adjudicated area in the Salinas Valley Groundwater Basin is the Seaside Subbasin (DWR subbasin number 3-004.08), which is not adjacent to the Upper Valley Subbasin.

No alternative plans have been submitted for any part of the Subbasin, or for any other Salinas Valley Groundwater Subbasins.

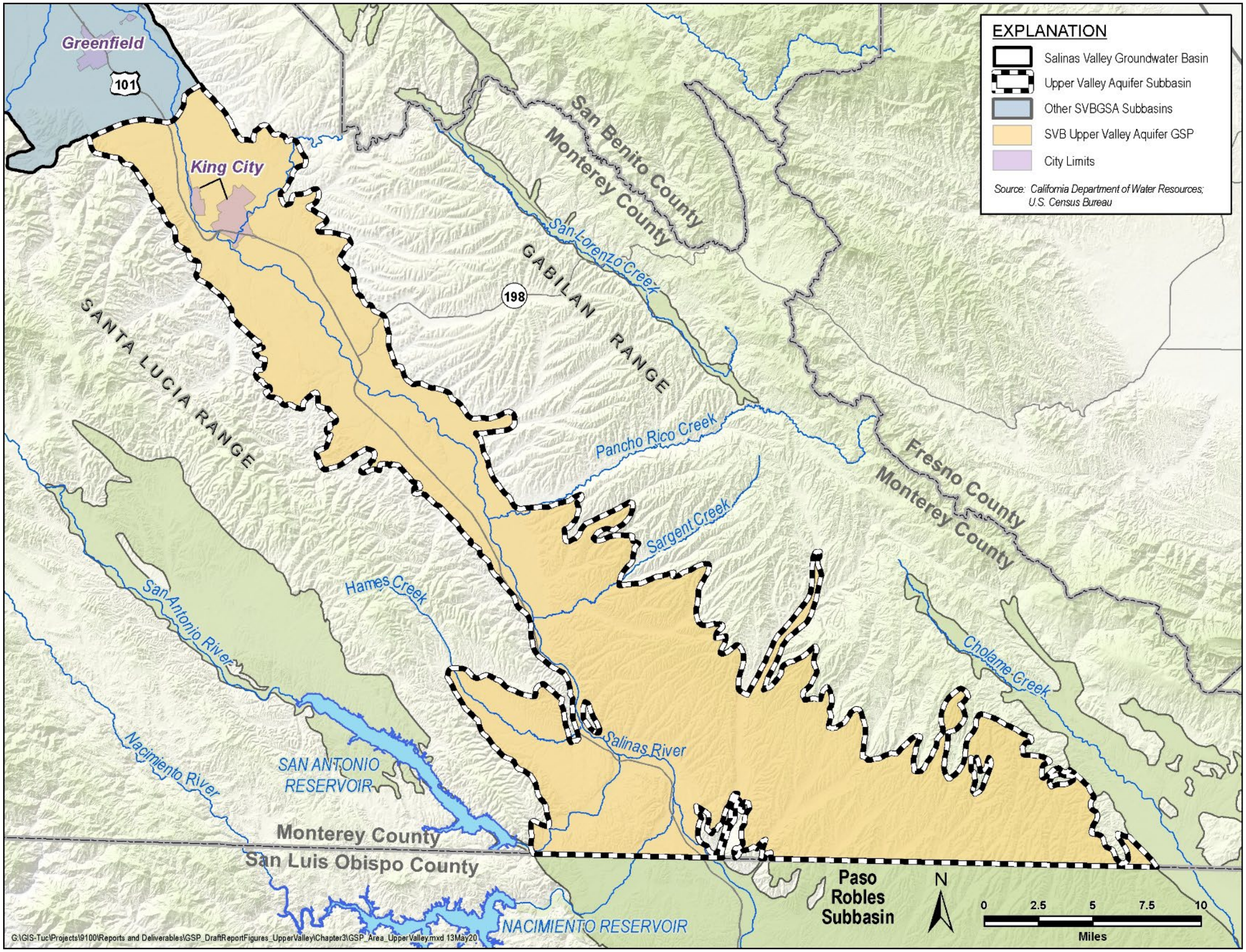


Figure 3-1. Upper Valley Aquifer Subbasin Area Covered by GSP

3.1.2 Jurisdictional Areas

3.1.2.1 Federal and State Jurisdictional Areas

Maps of federal and state jurisdictional areas are based on data from the U.S. Bureau of Land Management National Surface Management Agency National Geospatial Data Asset (BLM, 2020). Camp Roberts National Guard Camp is located on the southern edge of the Subbasin. Near Camp Roberts, the California Department of Fish and Wildlife (CDFW) has jurisdiction over the Big Sandy Wildlife Area. The Subbasin also does not contain any tribal lands (RWMG, 2018).

3.1.2.2 County Jurisdiction

The County of Monterey has jurisdiction over the unincorporated area of the Subbasin. Specific lands managed by the County include San Lorenzo Park, shown on Figure 3-2 (BLM, 2020).

MCWRA has broad water management authority in Monterey County, with its jurisdiction covering the entire Upper Valley Subbasin, as shown on Figure 3-2. MCWRA manages, protects, stores, and conserves water resources in the Monterey County for beneficial and environmental use. Originally formed under a different name for flood control and management, it also has jurisdiction over water conservation, purveying water, and preventing extractions that are harmful to the groundwater basin. Key assessment zones for various projects and programs administered by MCWRA are shown in Figure 3-3. MCWRA is governed by a 9-member Board of Directors who are appointed by the 5-member MCWRA Board of Supervisors. The Board of Supervisors of the County is ex officio the Board of Supervisors of MCWRA (Monterey County Water Resources Agency Act, Sec. 15).

3.1.2.3 City and Local Jurisdiction

The jurisdictional boundaries of cities and local jurisdictions shown on Figure 3-2 (U.S. Census Bureau, 2018). King City is located within the Subbasin and has water management authority. California Water Service provides water within King City and the surrounding area.

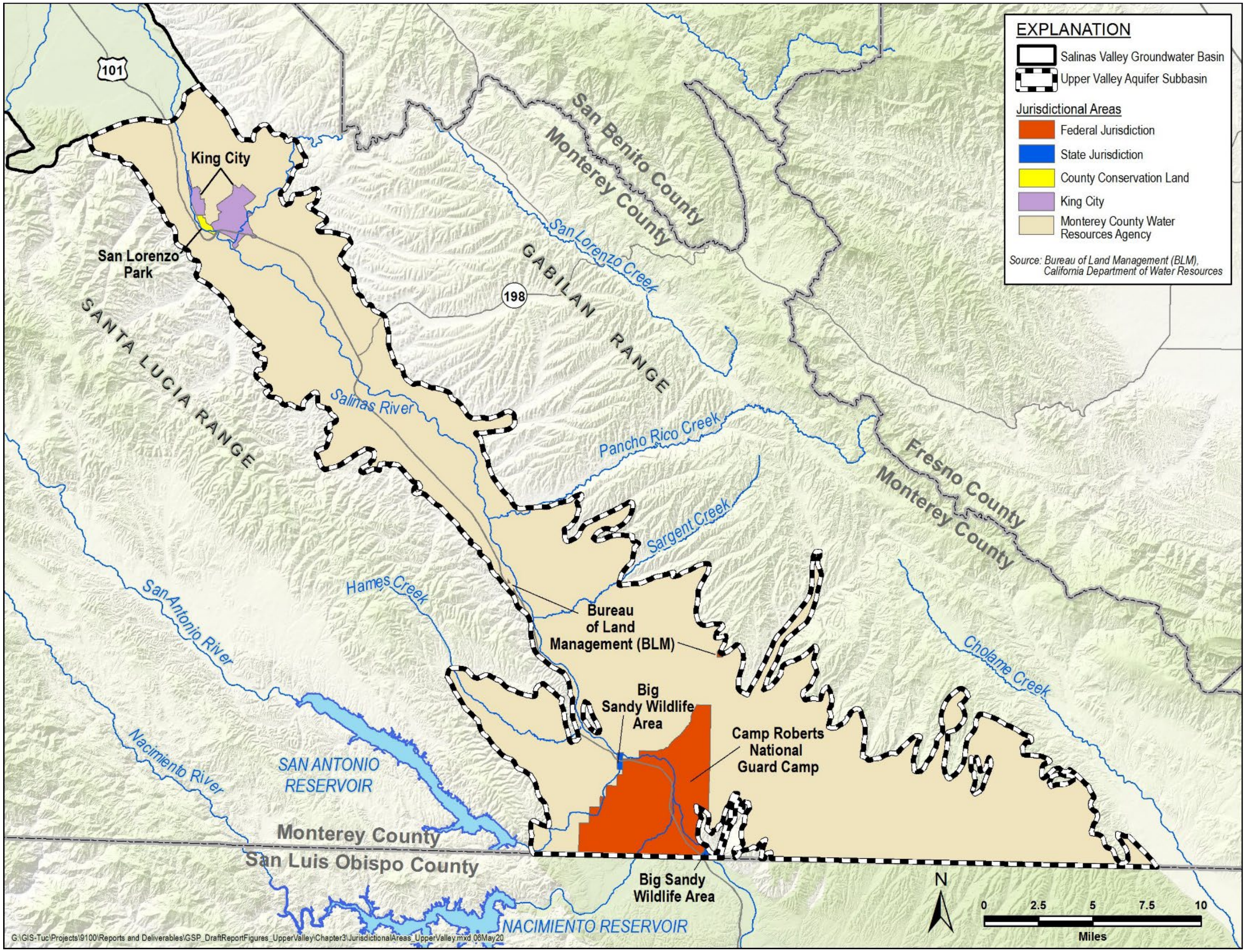


Figure 3-2. Federal, State, County, City, and Local Jurisdictional Areas

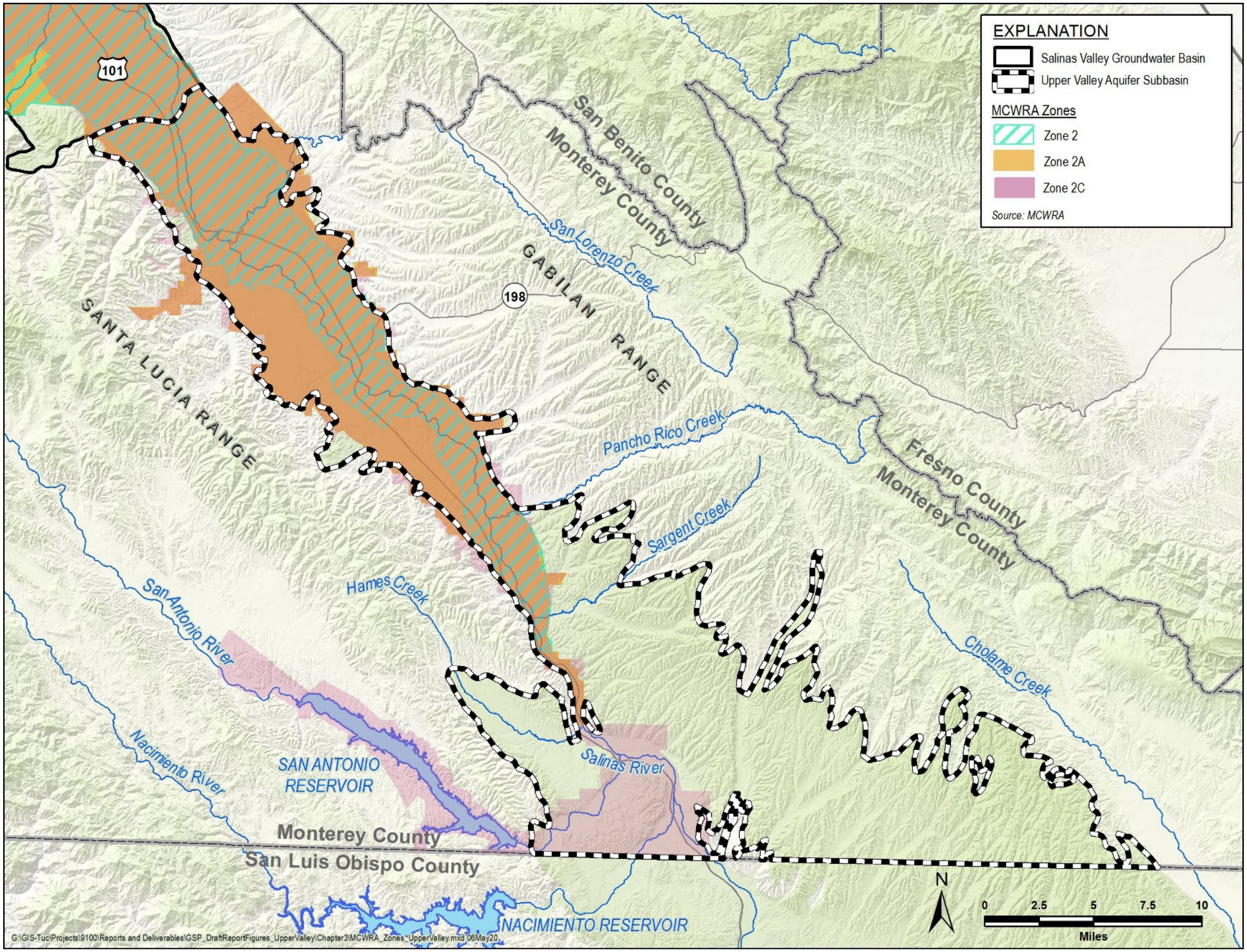


Figure 3-3. MCWRA Zones in the Upper Valley Aquifer Subbasin

3.2 Land Use

The Monterey County Assessor's office maintains a Geographic Information System (GIS) database of land use at the parcel level. Current land use (2019) in the Upper Valley Subbasin is shown on Figure 3-4 and summarized by major category in Table 3-1. The difference between the land use area in Table 3-1 and the total Subbasin area of 237,670 acres is the result of 1) some parcels having null land use values and 2) small gaps between parcels that are not counted.

Table 3-1. Land Use Summary

Category	Area in Subbasin (acres)
Agriculture (Irrigated)	72,102
Agriculture (Dry)	136,496
Commercial	183
Industrial	458
Institutional	18,223
Miscellaneous	207
Multi-Family	137
Residential (Urban)	541
Rural	5,638
Not Classified	692
Total	234,677

Source: Monterey County Assessor's Office parcel data

The majority of land in the Subbasin is used for agriculture; the top 3 crops by value in Monterey County in 2017 were lettuce, strawberries, and broccoli (Monterey County Agriculture Commissioner, 2018). Vineyards are also a major crop in Monterey County. Other irrigated crops include various row crops, field crops, alfalfa, pasture, orchards (fruits and nuts), and irrigated agricultural preserves.

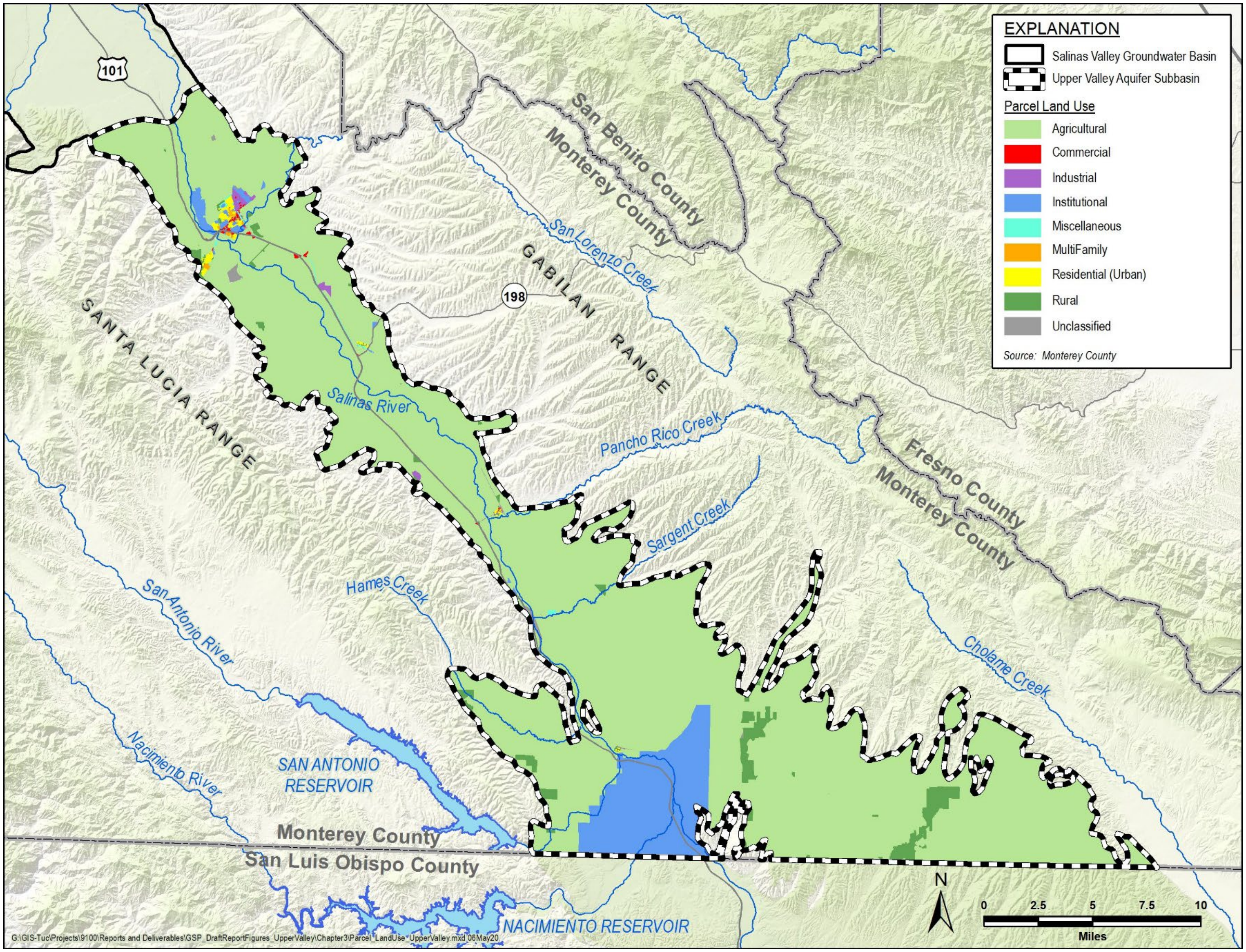


Figure 3-4. Existing Land Use

3.2.1 Water Source Types

In the San Ardo Oil Field, Chevron U.S.A. Inc. operates a reverse osmosis plant that treats a portion of the produced water generated during production. After oil separation, some of the produced water is sent directly to Class II injection wells permitted for injection by the California Geologic Energy Management Division. The remaining produced water is treated by the reverse osmosis plant and constructed wetlands prior to discharge to a groundwater recharge basin pursuant to a permit issued by the Central Coast Regional Water Quality Control Board (CCRWQCB).

Surface water diversions within the Salinas River watershed are reported to the State Water Resources Control Board (SWRCB) under Electronic Water Rights Information Management System (eWRIMS).The locations of the reported surface water diversions are shown on Figure 3-5. This figure does not show land that is dependent on the reported diversions, but rather infers areas through locations of diversion permits. Some reported surface water diversions are also reported to MCWRA as groundwater extractions. Based on an initial analysis comparing Water Year 2018 SWRCB diversion data and MCWRA pumping data, the estimated locations that reported both surface water diversions and groundwater pumping are identified with pink dots on Figure 3-5.

Groundwater is the primary water source for all water use sectors in the Subbasin. Communities that depend on groundwater are shown on Figure 3-6. The large public water systems shown on this figure are derived from data provided by Tracking California (Tracking California, 2020). Monterey County provided the boundaries for the small public water systems and the local small or state small water systems shown on Figure 3-6. More information on these water systems can be found on SVBGSA’s Web Map, accessible at: https://portal.elmontgomery.com. Groundwater is also used for rural residential areas, small community systems, and small commercial operations such as wineries and schools. The complete list of water systems and their number of connections, if available, are listed in Appendix 3A.

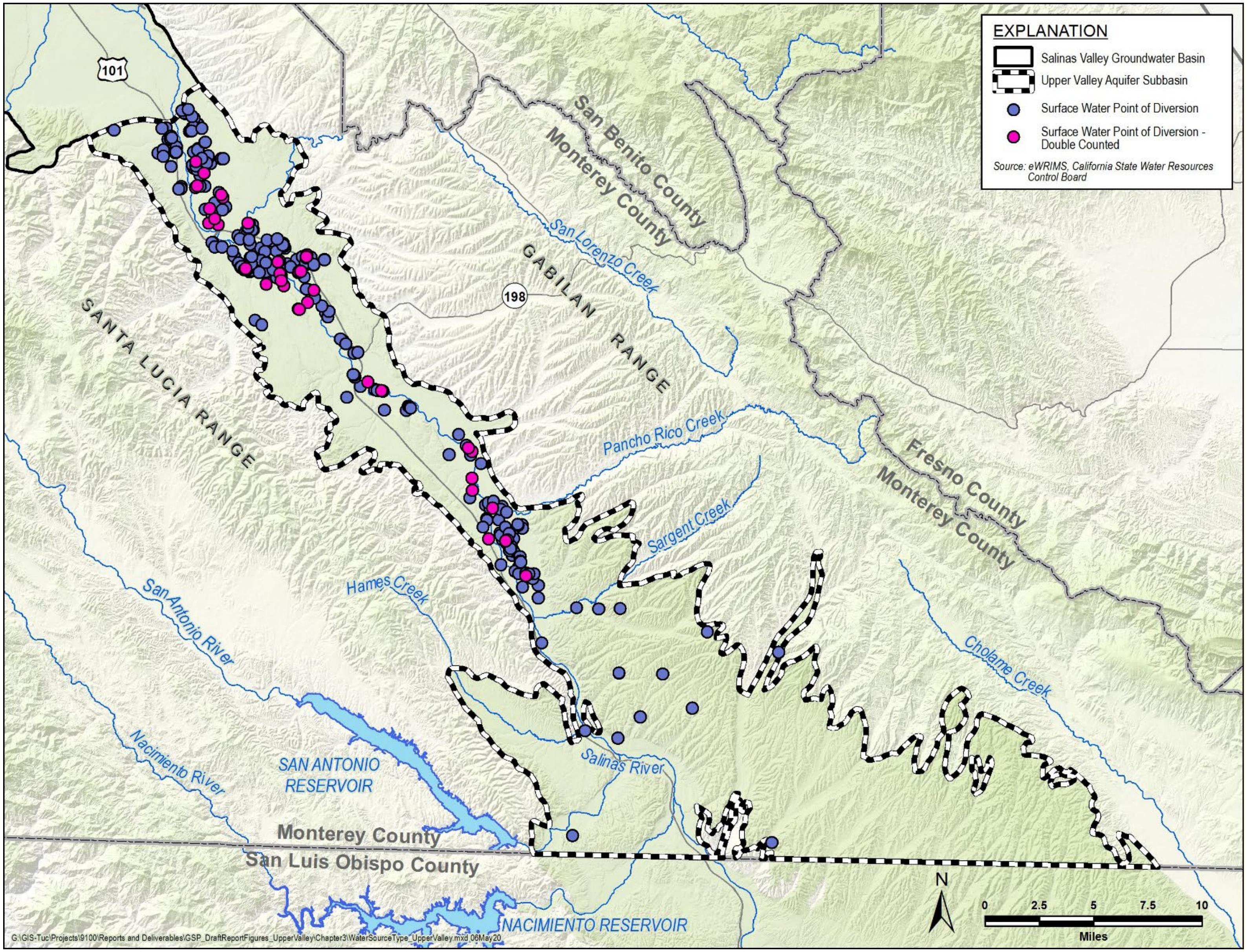


Figure 3-5. Salinas River Watershed Surface Water Points of Diversion in the Upper Valley Aquifer Subbasin

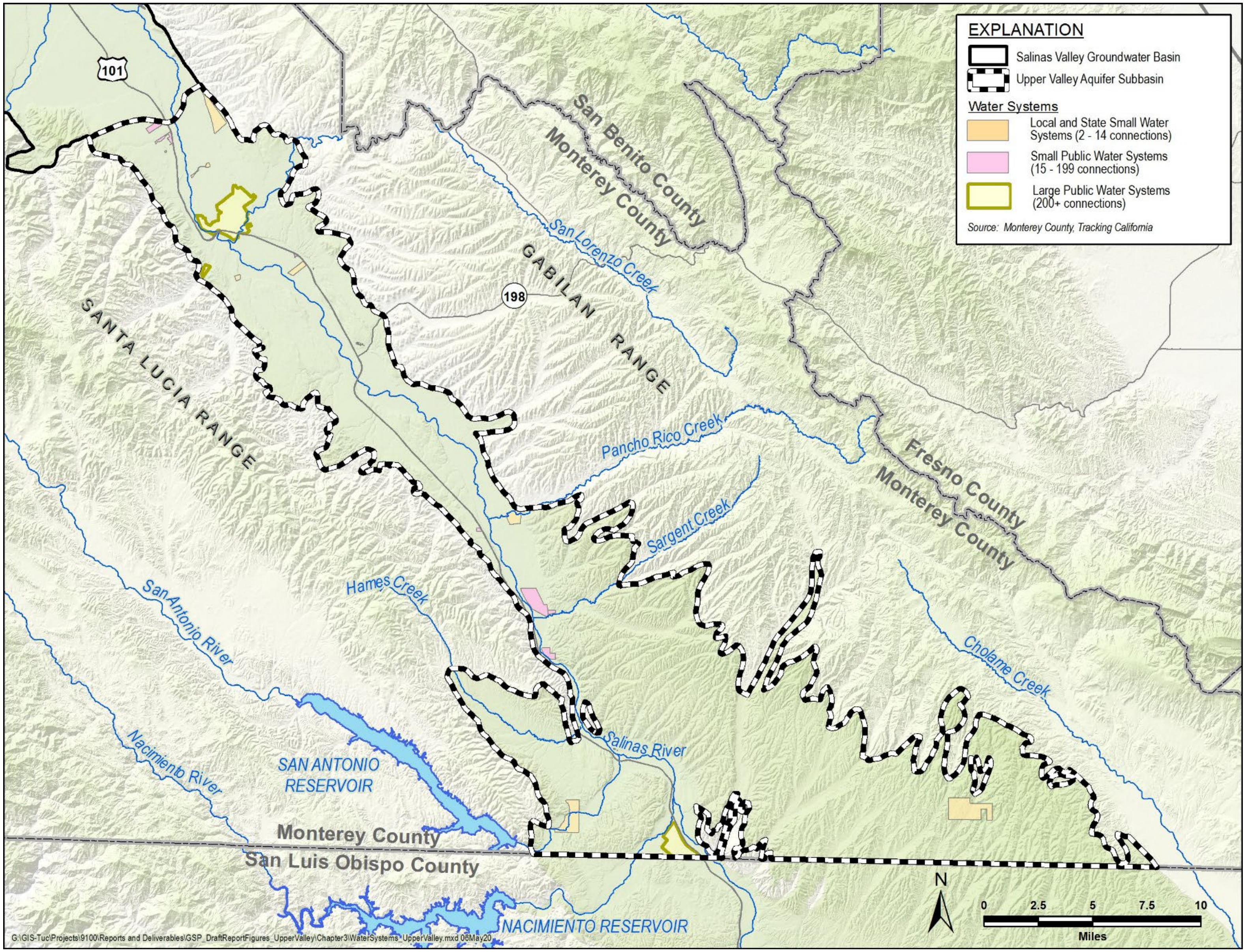


Figure 3-6. Communities Dependent on Groundwater

3.2.2 Water Use Sectors

Groundwater demands in the Subbasin are classified into the 6 water use sectors identified in the GSP Regulations. The water use sectors are shown on Figure 3-7. Groundwater demand categories include:

- **Urban.** Urban water use is assigned to non-agricultural water uses in the cities and census-designated places. Domestic use outside of census-designated places is not considered urban use.
- **Industrial.** There is limited industrial use in the Subbasin.
- **Agricultural.** This is the largest water use sector in the Subbasin and includes grazing land.
- **Managed wetlands.** DWR land use records indicate that there are no managed wetlands in the Upper Valley Subbasin.
- **Managed recharge.** There is no managed recharge in the Subbasin.
- **Native vegetation.** Groundwater use by native vegetation is minimal. Although not a native species, water use by *Arundo donax* is estimated at between 32,000 and 64,000 acre-feet per year (AF/yr.) in the entire Salinas Valley Groundwater Basin (Giessow, 2011); an unknown quantity occurs within the Upper Valley Subbasin.
- **Other.** This includes rural residential water use and any water use not captured in the other water use sectors.

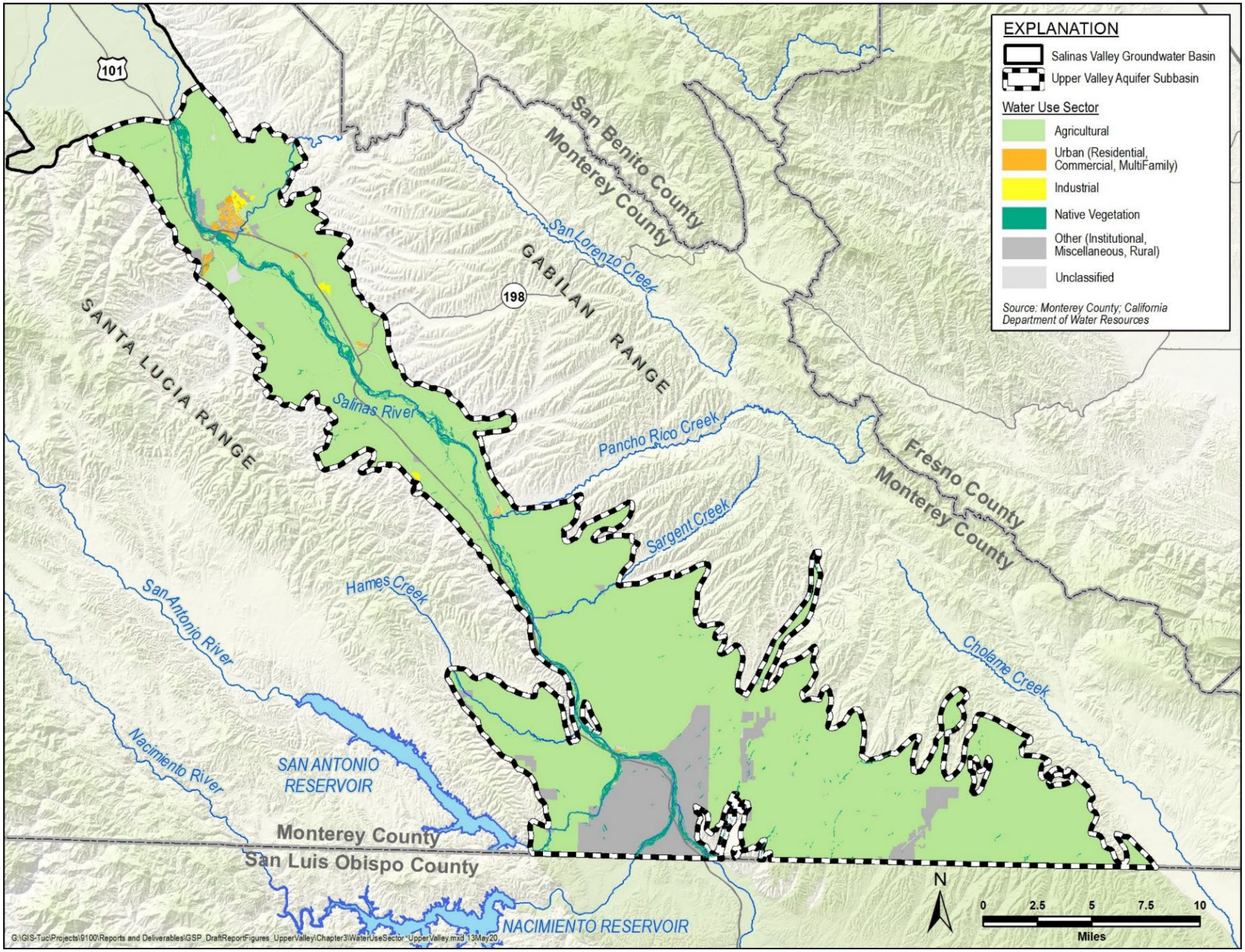


Figure 3-7. Map of Water Use Sectors

3.3 Existing Well Types, Numbers, and Density

Well density data were derived from DWR's Online System for Well Completion Report (OSWCR) Map Application (DWR, 2020a). Other data sources are available from MCWRA or other sources, and they may result in different well densities that are not reflected in DWR's OSWCR database. However, the DWR data were used for simplicity and consistency with other DWR data used in this GSP.

DWR's OSWCR Map Application classifies wells as domestic, production, and public supply; production wells include wells that are designated as irrigation, municipal, public, or industrial, and only exclude those designated as domestic. Most of the wells in the Subbasin are desginated production wells. Fewer than 4% of wells in the Subbasin are classified as public supply wells, even though groundwater is the primary water source for urban and rural communities in the Subbasin. Domestic wells account for most of the remaining wells and have an average depth of approximately 298 feet. Some of the domestic wells identified by DWR may be classified as *de minimis* extractors, defined as pumping less than 2 AF/yr for domestic purposes. Approximate well counts in the Subbasin are summarized in Table 3-2, with public supply wells subtracted from the production category so as to not double count. DWR provides well counts by Public Land Survey System sections; well counts for sections that are only partially in the Subbasin use the proportion of the section in the subbasin to proportion the well count. These well counts may not be reflective of active wells in the Subbasin, as some wells may have been abandoned or are inactive.

Figure 3-8, Figure 3-9, and Figure 3-10 show the density of domestic, production, and public supply wells, respectively, in the Subbasin, with the production wells being inclusive of the public supply wells.

Table 3-2. Well Count Summary

Category	Number of Wells
Domestic	286
Production	341
Public Supply	21
Total	648

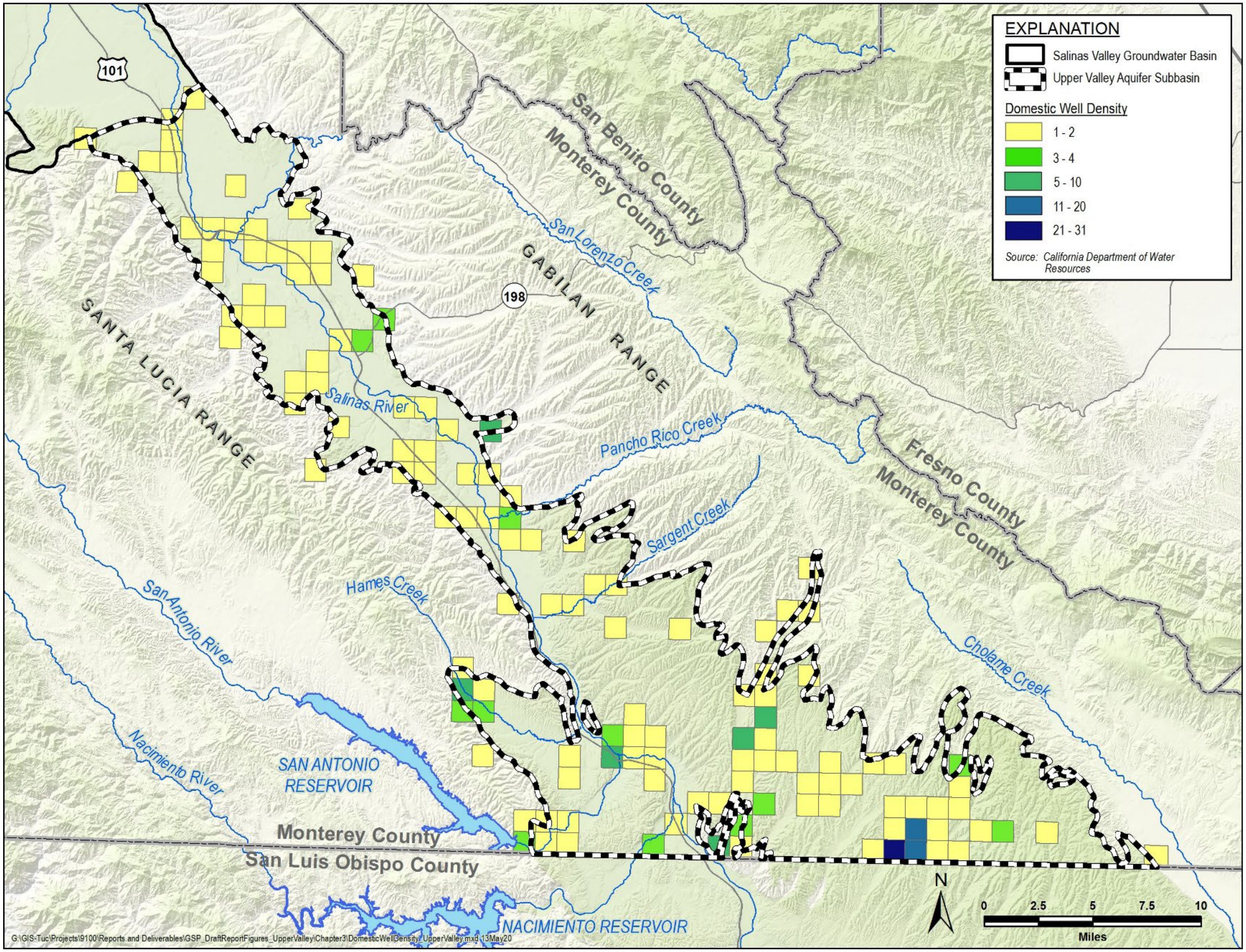


Figure 3-8. Density of Domestic Wells (Number of Wells per Square Mile)

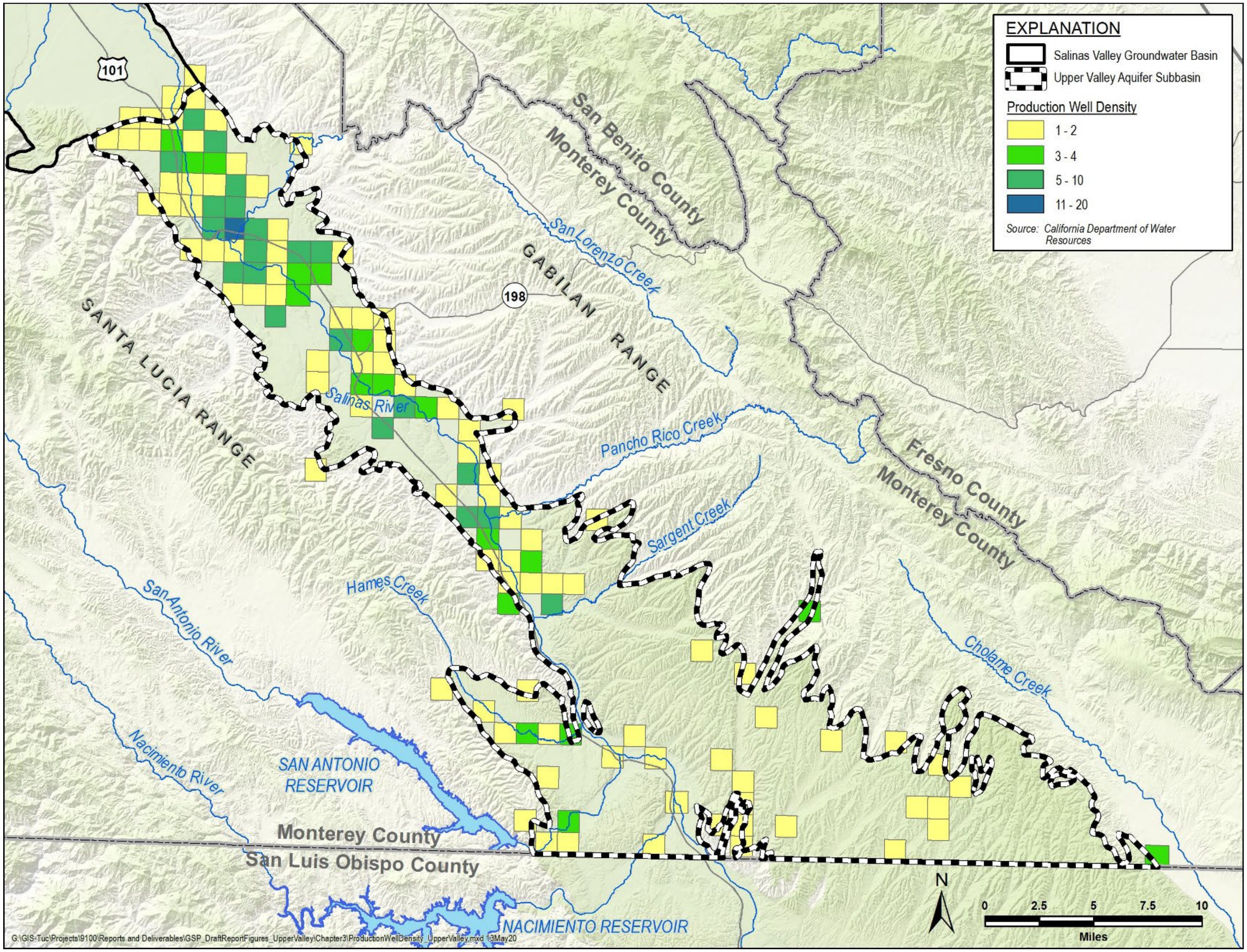


Figure 3-9. Density of Production Wells (Number of Wells per Square Mile)

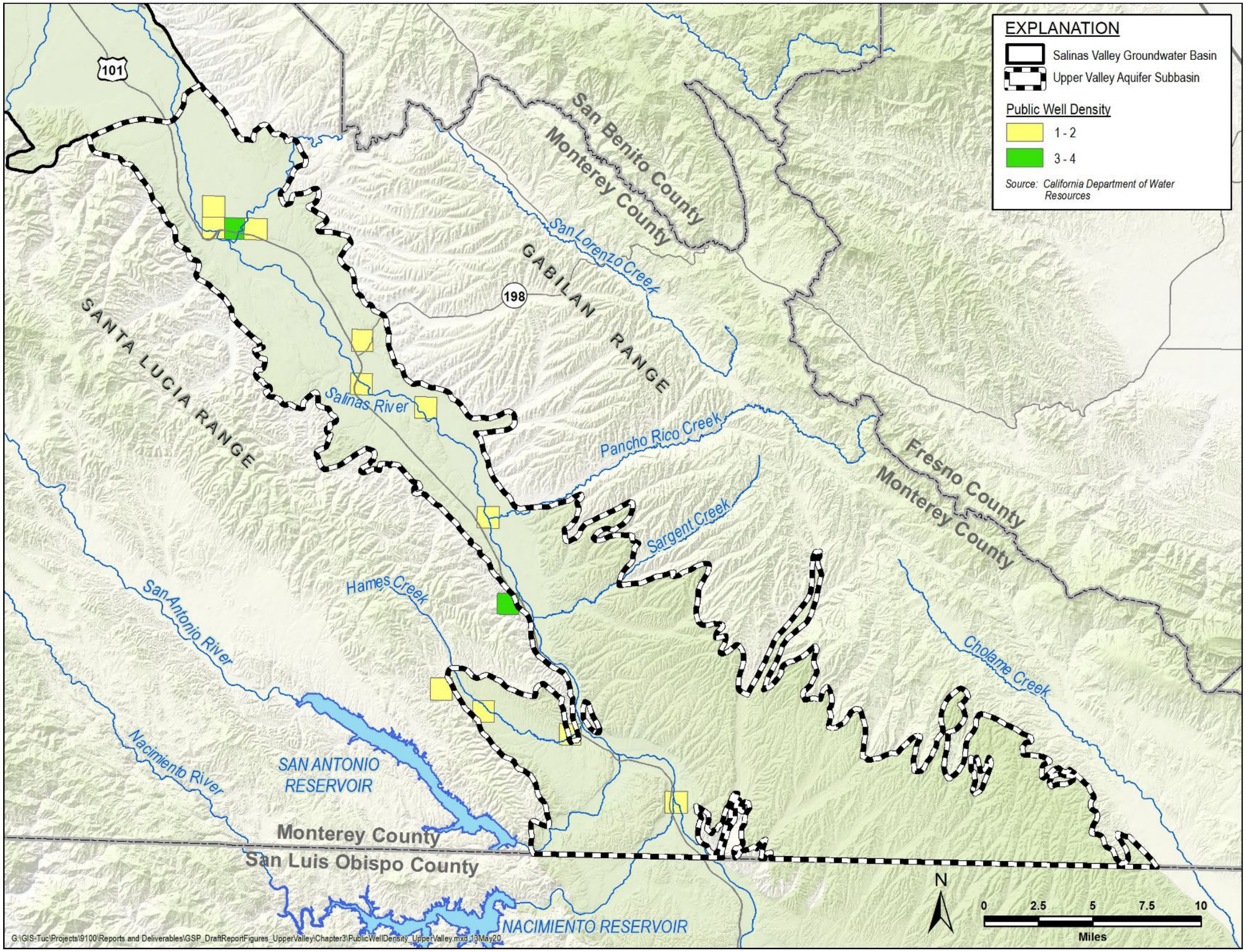


Figure 3-10. Density of Public Wells (Number of Wells per Square Mile)

3.4 Existing Monitoring Programs

3.4.1 Groundwater Elevation Monitoring

MCWRA operates existing groundwater elevation monitoring programs in the Salinas Valley Groundwater Basin, which are incorporated into the monitoring plan of this GSP as appropriate. MCWRA has annual fall, August, and monthly groundwater elevation monitoring programs, and is the responsible agency for the California Statewide Groundwater Elevation Monitoring (CASGEM) program in most areas of Monterey County. The existing groundwater elevation monitoring programs will be updated and improved to document the avoidance of undesirable results in the principal aquifer in the Subbasin.

MCWRA historically has monitored 4 wells within the Upper Valley Subbasin as part of the CASGEM network. Two of the CASGEM monitoring wells are owned by MCWRA, and two are privately owned by owners who have volunteered the well for inclusion in the CASGEM program. MCWRA collects monthly groundwater elevation data from the CASGEM wells and reports the groundwater elevation data to DWR twice per year. The CASGEM wells jave been migrated to the SGMA monitoring network and will be supplemented with 15 other wells that are already part of the MCWRA groundwater elevation monitoring networks. Groundwater elevation data from all wells in the monitoring network are publicly available. This network will be used for water elevation monitoring under this GSP, as described further in Chapter 7. It will be updated and improved as needed to monitor groundwater elevations for this Subbasin.

3.4.2 Groundwater Extraction Monitoring

MCWRA collects groundwater extraction information from all wells within Zones 2, 2A, and 2B that have discharge pipes of 3 inches or greater in internal diameter. These zones only include the northwest section of the Upper Valley Subbasin as shown in Figure 3-3. These data have been collected since 1993.

This network will be used for groundwater extraction monitoring under this GSP, as described in Chapter 7. SVBGSA will work with MCWRA to update and enhance the program to enable it to sufficiently monitor groundwater extractions for this Subbasin.

3.4.3 Groundwater Quality Monitoring

Groundwater quality is monitored under several different programs and by different agencies including the following:

- Municipal and community water purveyors must collect water quality samples on a routine basis for compliance monitoring and reporting to the SWRCB Division of Drinking Water (DDW). These purveyors include municipal systems; community water systems; non-transient, non-community water systems; and non-community water systems that provide drinking water to at least 15 service connections or serve an average of at least 25 people for at least 60 days a year.

- Local small or state small water system wells are regulated by the Monterey County Department of Public Health. Local small water systems serve 2 to 4 service connections and state small water systems serve 5 to 14 connections.
- To fulfill the groundwater quality regulatory requirements of the Irrigated Lands Regulatory Program (ILRP), the CCRWQCB requires monitoring of both on-farm domestic wells and agricultural wells for irrigation and livestock supply.
- In addition to the ILRP, the CCRWQCB conducts groundwater quality monitoring at multiple sites as part of investigation or compliance monitoring programs. These sites are discussed further in Chapter 5.

For this GSP, groundwater quality data will be downloaded and reviewed from SWRCB's DDW for municipal public water system supply wells and the ILRP irrigation supply wells and on-farm domestic wells monitored under the CCRWQCB's Agricultural Order, as described in Section 3.6.2.

3.4.4 Surface Water Monitoring

One streamflow gauge operated by the U.S. Geological Survey (USGS) within the Upper Valley Subbasin: the Salinas River gauge near Bradley (USGS Site #11150500). The location of this stream gauge surface-water monitoring facility is depicted on Figure 3-11.

On years when there are conservation releases from the Nacimiento and San Antonio Reservoirs, the MCWRA and USGS conduct the Salinas River Discharge Measurement Series (River Series) to monitor changes in streamflow along different river reaches. Reservoir releases are held constant for 5 days to ensure that the discharge measurements account for losses to the aquifer, stream vegetation, or evapotranspiration (ET).

The SWRCB eWRIMS is used to collect surface water rights data in the Salinas River watershed for the points of diversion in the Subbasin that are shown on Figure 3-5. This includes monthly surface water diversions from the Salinas River and its tributaries.

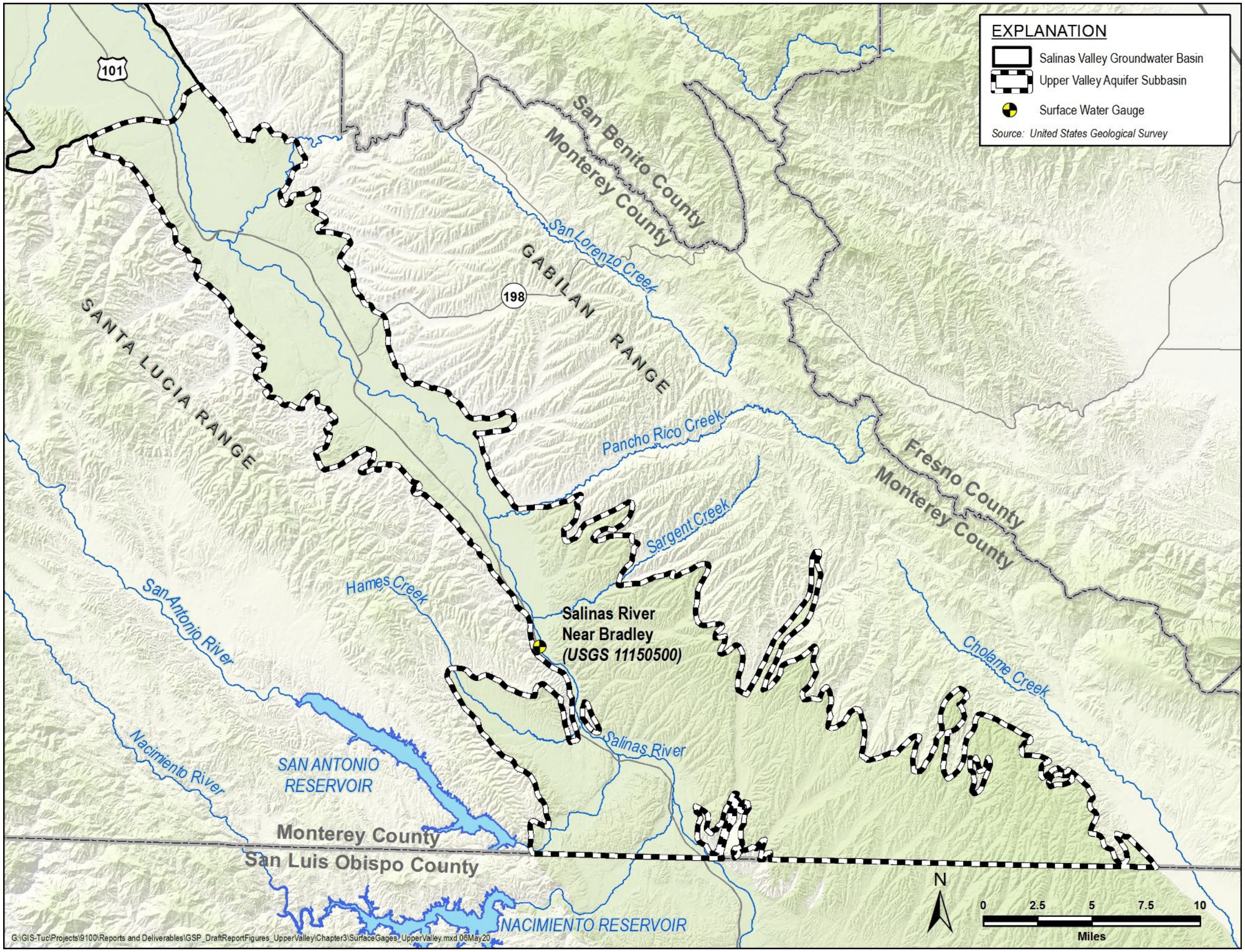


Figure 3-11. Surface Water Gauge Location

3.5 Existing Water Management Plans

3.5.1 Monterey County Groundwater Management Plan

MCWRA developed a Groundwater Management Plan (GMP) that is compliant with AB3030 and SB1938 legislation (MCWRA, 2006). This GMP exclusively covered the Salinas Valley Groundwater Basin in Monterey County. This GSP replaces the GMP.

The GMP identified 3 objectives for groundwater management:

Objective 1: Development of Integrated Water Supplies to Meet Existing and Projected Water Requirements

Objective 2: Determination of Sustainable Yield and Avoidance of Overdraft

Objective 3: Preservation of Groundwater Quality for Beneficial Use

To meet these 3 objectives, the GMP identified 14 elements that should be implemented by MCWRA:

Plan Element 1: Monitoring of Groundwater Elevations, Quality, Production, and Subsidence

Plan Element 2: Monitoring of Surface Water Storage, Flow, and Quality

Plan Element 3: Determination of Basin Yield and Avoidance of Overdraft

Plan Element 4: Development of Regular and Dry Year Water Supply

Plan Element 5: Continuation of Conjunctive Use Operations

Plan Element 6: Short-Term and Long-Term Water Quality Management

Plan Element 7: Continued Integration of Recycled Water

Plan Element 8: Identification and Mitigation of Groundwater Contamination

Plan Element 9: Identification and Management of Recharge Areas and Wellhead Protection Areas

Plan Element 10: Identification of Well Construction, Abandonment, and Destruction Policies

Plan Element 11: Continuation of Local, State, and Federal Agency Relationships

Plan Element 12: Continuation of Public Education and Water Conservation Programs

Plan Element 13: Groundwater Management Reports

Plan Element 14: Provisions to Update the GMP

3.5.2 Integrated Regional Water Management Plan

The Integrated Regional Water Management Plan (IRWMP) for the Greater Monterey County Region was developed by the Greater Monterey County RWMG, which consists of government agencies, nonprofit organizations, educational organizations, water service districts, private water companies, and organizations representing agricultural, environmental, and community interests.

The Upper Valley Subbasin falls within the IRWM Plan area. The IRWM Plan consists of a set of goals and objectives that were identified by the RWMG as being critical to address water resource issues within the planning area in the areas of:

- Water Supply
- Water Quality
- Flood Protection and Floodplain Management
- Environment
- Regional Communication and Cooperation
- Disadvantaged Communities
- Climate Change

The IRWM Plan includes more than 25 projects that could assist regional groundwater management (RWMG, 2018).

3.5.3 Urban Water Management Plans

One Urban Water Management Plan (UWMP) has been developed in the Subbasin by California Water Service. California Water Service provides water to King City and the surrounding area. Its 2015 UWMP (CA Water Service, 2016) describes the service area; reports historic and projected population; identifies historic and projected water demand by category (single-family, multi-family, commercial, industrial, institutional/government, and other); and describes the distribution system and identifies losses. The UWMP for the King City District notes that groundwater levels have been relatively stable during the past 25 years, except for drought periods; however, low groundwater elevations during these droughts were followed by prompt water-level recoveries.

The UWMP notes that nitrate contamination is a concern in the King City District and that 6 wells have been removed from service due to nitrate levels in excess of the U. S. Environmental Protection Agency (EPA) MCL.

The UWMP describes the system's reliance on groundwater and California Water Service's support for efforts to avoid overdraft, including working cooperatively with MCWRA and participation in the development of this GSP. Specific activities that California Water Service intends to conduct in the King City district are identical to those proposed for the Salinas district:

- Outreach to public agencies to ensure that the Company's presence, rights, and interests, as well as historical and current resource management concerns are honored/incorporated within the GSA and GSP formulation process(es).
- Outreach to applicable local and regulatory agencies to ensure that the Company is at full participation, while also meeting the requirements and expectations set forth by SGMA.
- The enhanced use of digital/electronic groundwater monitoring equipment and other new technology aimed at measuring withdrawal rates, pumping water levels, and key water quality parameters within the context of day-to-day operations.
- Full participation in the development of GSPs and formulation of groundwater models being constructed in basins where the Company has an operating presence.
- Full participation in individual and/or joint projects aimed at mitigating seawater intrusion and other "undesirable results."
- Inclusion of sound groundwater management principles and data in all applicable technical reports, studies, facility master plans, and UWMPs (including this 2015 update), particularly as these undertakings relate or pertain to water resource adequacy and reliability.
- Inclusion of sound groundwater management principles and data in all general rate case (GRC) filings and grant applications to ensure that resource management objectives remain visible and central to California Water Service's long-term planning/budgeting efforts.

Given King City's inland location, the UWMP notes that desalination is not expected to be a viable future water supply source. Use of recycled water is not expected to be economically viable. The UWMP assumes that future water demands in the King City District will be met by groundwater. The UWMP includes sections on water shortage contingency planning and demand reduction efforts to address reductions in groundwater supplies.

3.6 Existing Water Regulatory Programs

3.6.1 Groundwater Export Prohibition

The MCWRA Act, § 52.21 prohibits the export of groundwater for uses outside the Salinas Valley Groundwater Basin from any part of the Basin, including the Upper Valley Subbasin. In particular, the Act states:

> *For the purpose of preserving [the balance between extraction and recharge], no groundwater from that basin may be exported for any use outside the basin, except that use of water from the basin on any part of Fort Ord shall not be deemed such an export. If any export of water from the basin is attempted, the Agency may obtain from the superior court, and the court shall grant, injunctive relief prohibiting that exportation of groundwater.*

3.6.2 Agricultural Order

In 2021 the CCRWQCB issued Agricultural Order No. R3-2021-0040, the Proposed General Waste Discharge Requirements for Discharges from Irrigated Lands (CCRWQCB, 2021). The permit requires that growers implement practices to reduce nitrate leaching into groundwater and improve receiving water quality. Specific requirements for individual growers are structured into 3 phases based on the relative risk their operations pose to water quality. Each of the 3 phases encompasses a different area of the Central Coast Basin. Monitoring results from this new Agricultural Order (Ag Order 4.0) will be incorporated into this GSP's groundwater quality network.

3.6.3 Water Quality Control Plan for the Central Coast Basins

The Water Quality Control Plan for the Central Coastal Basin (Basin Plan) was most recently updated in June 2019 (CCRWQCB, 2019). The objective of the Basin Plan is to outline how the quality of the surface water and groundwater in the Central Coast Region should be managed to provide the highest water quality reasonably possible. Water quality objectives for both groundwater and surface water are provided in the Basin Plan.

The Basin Plan lists beneficial users, describes the water quality that must be maintained to allow those uses, provides an implementation plan, details SWRCB and CCRWQCB plans and policies to protect water quality, and describes statewide and regional surveillance and monitoring programs. Present and potential future beneficial uses for waters in the Basin are municipal supply; agricultural supply; groundwater recharge; recreation; sport fishing; warm freshwater habitat; wildlife habitat; rare, threatened or endangered species habitat; and spawning, reproduction, and/or early development of fish.

3.6.4 Title 22 Drinking Water Program

The SWRCB DDW regulates public water systems in the State to ensure the delivery of safe drinking water to the public. A public water system is defined as a system for the provision of water for human consumption that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year. Private domestic wells, wells associated with drinking water systems with fewer than 15 residential service connections, industrial, and irrigation wells are not regulated by the DDW.

The DDW enforces the monitoring requirements established in Title 22 of the California Code of Regulations for public water system wells, and all the data collected must be reported to the DDW. Title 22 also designates the MCLs and Secondary Maximum Contaminant Levels (SMCLs) for various waterborne contaminants including volatile organic compounds, non-volatile synthetic organic compounds, inorganic chemicals, radionuclides, disinfection byproducts, general physical constituents, and other parameters.

3.7 County Public Policy of Safe and Clean Water

To recognize the Human Right to Water, the County of Monterey established a public policy in December 2018 that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes and that the human right to water extends to all residents of Monterey County, including disadvantaged individuals and groups and communities in rural and urban areas. The County intended for the policy to inform the County when implementing policies and regulations affecting water supply and usage and to help the County to focus on the issue of drinking water pollution in certain Monterey County domestic wells and water systems as well as potential future threats due to drought and a lack of available drinking water, while not impacting water rights or expanding or creating new County obligations.

3.8 Incorporating Existing Programs into the GSP and Limits on Operational Flexibility

Information from existing water resource monitoring, management, and regulatory programs have been incorporated into this GSP. They are taken into consideration during the preparation of the sustainability goal, when establishing SMC, and when developing management actions and projects. This GSP has been developed to reflect the principles outlined in those existing local plans and builds off existing plans during GSP implementation. Some of the existing management plans and ordinances may limit operational flexibility. These potential limits to operational flexibility have already been incorporated into the management actions and projects included in this GSP. Examples of limits on operational flexibility include:

- The groundwater export prohibition included in the Monterey County Water Resources Agency Act prevents export of water out of the Salinas Valley Groundwater Basin. This prohibition is not expected to adversely affect SVBGSA's ability to reach sustainability.
- The Basin Plan and the Title 22 Drinking Water Program restrict the quality of water that can be recharged into the Subbasin.
- The Habitat Conservation Plan (HCP) being developed by MCWRA on the Salinas River will limit operational flexibility for Nacimiento and San Antonio reservoir releases for groundwater recharge in the Basin.

The other monitoring, management, and regulatory programs do not limit the operational flexibility in this Subbasin.

3.9 Conjunctive Use Programs

There are currently no conjunctive use programs in the Upper Valley Subbasin.

3.10 Land Use Plans

3.10.1 Land Use Plans in the Subbasin

Land use is an important factor in water management. Monterey County and King City have land use authority over portions of the Upper Valley Subbasin. Each of these entities has developed a general plan that guides land use in the Subbasin. General descriptions of these land use plans and how implementation may affect groundwater management in the Upper Valley Subbasin are included in Appendix 3B.

3.10.2 Land Use Plans Outside of Basin

Monterey County's General Plan is applicable throughout the unicorporated area of the County, including the adjoining Forebay Subbasin. The cities of Greenfield and Soledad have general plans with land use elements in the neighboring Forebay Subbasin. Each of these entities has developed a general plan that guides land use in the Forebay Subbasin. Because Soledad is a member of the SVBGSA, management actions taken by the SVBGSA will be in alignment with the concerns and plans of that city and the County. The SVBGSA and ASGSA have developed an Implementation Agreement that establishes that the ASGSA will implement the GSP in the Arroyo Seco Cone Management Area. The ASGSA was formed through agreement with the City of Greenfield. Therefore, it is unlikely that these 2 land use plans will affect the ability of the SVBGSA to maintain sustainable groundwater management.

3.10.3 Well Permitting

The Public Service element of the Monterey County General Plan addresses permitting of individual wells in rural or suburban areas. Table 3-3 summarizes the Monterey County General Plan's water supply guidelines for the creation of new residential or commercial lots (Monterey County, 2010, Table PS-1). Table 3-4 depicts the decision matrix from the Monterey County General Plan for permitting new residential or commercial wells for existing lots (Monterey County, 2010, Table PS-2).

On August 29, 2018, the State Third Appellate District Court of Appeal published an opinion in *Environmental Law Foundation v. State Water Resources Control Board* (No. C083239), a case that has the potential to impact future permitting of wells near navigable surface waters to which they may be hydrologically connected. The Court of Appeal found that while groundwater itself is not protected by the public trust doctrine, the doctrine does protect navigable waters from harm caused by extraction of groundwater if it adversely affects public trust uses. Further, it found that Siskiyou County, as a subdivision of the State, shares responsibility for administering the public trust. Similarly, Monterey County is responsible for well permitting. Therefore, it has a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting wells near areas where groundwater may be interconnected with navigable surface waters.

Moreover, California Supreme Court's decision in *Protecting Our Water and Environmental Resources v. County of Stanislaus* (2020) held that Stanislaus County could not categorically classify its issuance of groundwater well construction permits as ministerial decisions exempt from environmental review under the California Environmental Quality Act (CEQA). Chapter 15.08 of the Monterey County Code sets forth the application and decision-making process for the County in considering applications for well construction permits. The Chapter sets forth certain technical requirements that appear to be purely ministerial in their application; however, the Chapter also gives the Health Officer discretion to impose unspecified conditions on a permit, grant variances, and deny an application if in his/her judgment it would defeat the purposes of the Chapter. The Monterey County Code has not yet been amended, so permits are currently issued according to Chapter 15.08 and the 2010 General Plan, as applicable. The Monterey County Health Department, Environmental Health Bureau issues well permits and receives input from the County of Monterey Housing and Community Development to determine what, if any, level of CEQA review is necessary.

Table 3-3. Monterey County Water Supply Guidelines for the Creation of New Residential or Commercial Lots

Major Land Groups	Water Well Guidelines
Public Lands	Individual Wells Permitted in Areas with Proven Long-Term Water Supply
Agriculture Lands	Individual Wells Permitted in Areas with Proven Long-Term Water Supply
Rural Lands	Individual Wells Permitted in Areas with Proven Long-Term Water Supply
Rural Centers	Public System; Individual Wells Allowed in limited situations
Community Areas	Public System

Table 3-4. Monterey County Well Permitting Guidelines for Existing Residential and Commercial Lots

Characteristics of Property	Water Connection Existing or Available from the Water System	Not Within a Water System or a Water Connection Unavailable
Greater than or equal to 2.5 Acres connected to a Public Sewage System or an on-site wastewater treatment system	Process Water Well Permit	Process Water Well Permit
Less than 2.5 Acres and connected to a Public Sewage System	Process Water Well Permit	Process Water Well Permit
Less than 2.5 Acres and connected to an on-site wastewater treatment system	Do not Process Water Well Permit	Process Water Well Permit

3.10.4 Effects of Land Use Plan Implementation on Water Demand

The GSA does not have authority over land use planning; however, the GSA will coordinate with the County on general plans and land use planning/zoning as needed when implementing the GSP.

A lawsuit filed against the County of Monterey's 2010 General Plan led to a settlement agreement that could affect water supplies. The settlement agreement requires the County of Monterey to develop a study of the Salinas Valley Groundwater Basin within Zone 2C which largley overlaps the Basin and includes, among other items:

- An assessment of whether the total water demand for all uses designated in the General Plan for the year 2030 are likely to be reached or exceeded
- An evaluation and conclusions regarding future expected trends in groundwater elevations
- An evaluation and conclusions regarding expected future trends in seawater intrusion

Should the study conclude that:

- Total water demand for all uses is likely to be exceeded by 2030, or
- Groundwater elevations are likely to decline by 2030, or
- The seawater intrusion boundary is likely to advance inland by 2030

Then the study shall make recommendations on how to address those conditions.

The outcomes from this study may affect the GSP implementation. However, the GSP will consider multiple approaches to keep extraction within the sustainable yield through the measures laid out in Chapter 9. The study and GSP implementation are 2 parallel efforts, and the results of the County’s study will be reviewed when finalized and considered during GSP implementation. SGMA may preempt implementation of the County’s study if it were to conflict with the purposes of SGMA and the efforts of the SVBGSA to attain sustainability in the Basin.

Monterey County has chosen to retain the USGS to develop the Salinas Valley Integrated Hydrologic Model (SVIHM), which will be used during implementation of this GSP. The USGS is currently planning to publicly release it in 2022.

3.10.5 Effects of GSP Implementation on Water Supply Assumptions

Implementation of this GSP is not anticipated to affect water supply assumptions of relevant land use plans over the planning and implementation horizon. This GSP includes sufficient management actions and projects to keep extraction within the sustainable yield, should they need to be implemented. Changes in the cost of groundwater may affect whether surface water or groundwater is used. Land use changes may occur as a result of these activities and based on financial decisions by individual growers. However, there is no direct impact from the GSP implementation on land use management.

4 HYDROGEOLOGIC CONCEPTUAL MODEL

The HCM characterizes the geologic and hydrologic framework of the Subbasin in accordance with the GSP Regulations §354.14. It is based on best available data, technical studies, and qualified maps that characterize the physical components and surface water/groundwater interaction in the Subbasin. This HCM provides comprehensive written descriptions and illustrated representations of subsurface conditions. The chapter describes the Subbasin characteristics and processes which govern the flow of water across the Subbasin boundaries, and outlines the general groundwater setting that may be encountered in the subsurface environment. Current and historical groundwater conditions are discussed in greater detail in the subsequent chapter. This current HCM in this GSP will be part of an iterative process where current conditions and data gaps are described, investigated, and then updated accordingly.

4.1 Subbasin Setting and Topography

The Upper Valley Subbasin is in the upper portion of the Salinas Valley Groundwater Basin – an approximately 90-mile long alluvial basin underlying the elongated, intermountain valley of the Salinas River. The Subbasin is oriented southeast to northwest, with several streams draining both the Gabilan and the Santa Lucia Ranges. These streams flow into the Salinas River which then drains towards the northwest into the Pacific Ocean at Monterey Bay (Figure 4-1).

The colored bands on Figure 4-1 show the topography of the Subbasin, derived from the USGS 30 meter Digital Elevation Model (DEM). The Subbasin slopes at an average grade of approximately 30 feet/mile, generally from the southeast to the northwest along the Salinas River. The steepest portions of the subbasin are along the southern portion of the Gabilan Range where the land slopes towards the Salinas River, from the northeast to the southwest. Land surface elevations in the Subbasin range from approximately 2,750 feet along the southern border to approximately 250 feet where the Subbasin it meets the Forebay Subbasin near the City of Greenfield.

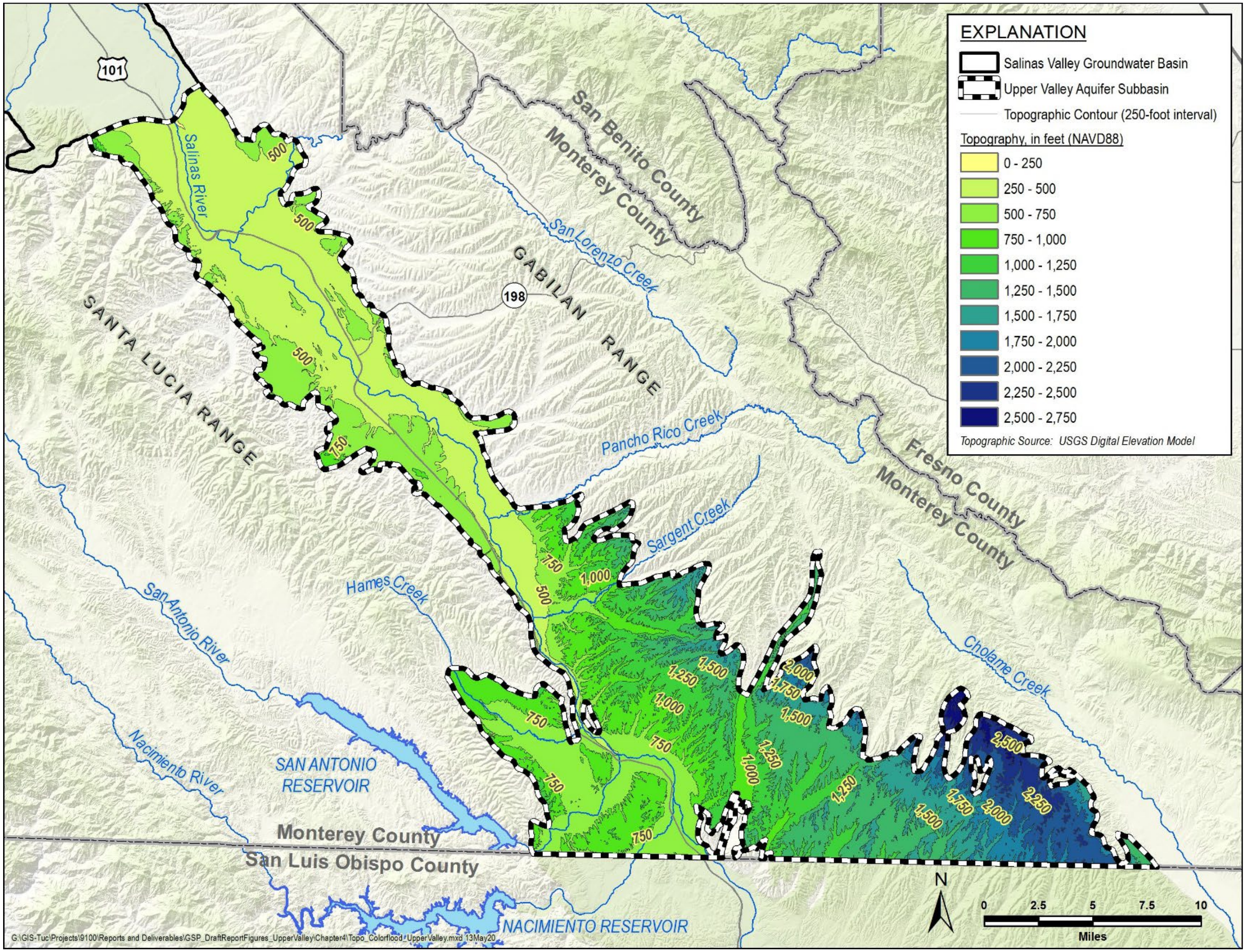


Figure 4-1. Upper Valley Aquifer Subbasin Topography

4.2 Subbasin Geology

The subbasin geology describes the physical framework in which groundwater occurs and moves. The geology of the subbasin controls the locations and depths of aquifers and aquitards, as well as the subbasin boundaries. The geologic descriptions included here are derived from previously published scientific reports, and from investigations conducted by the USGS, State of California, and academic institutions.

The Subbasin was formed through periods of structural deformation and periods of marine and terrestrial sedimentation in a tectonically active area on the eastern edge of the Pacific Plate. Figure 4-2 presents a geologic map of the Subbasin and vicinity. This geologic map was adopted from the California Geologic Survey’s 2010 statewide geologic map (Jennings, *et al.*, 2010; Rosenberg, 2001). The locations of cross sections used to define principal aquifers in Section 4.4 are also shown on Figure 4-2. The legend on Figure 4-2 presents the age sequence of the geologic materials from the youngest unconsolidated Quaternary sediments to the oldest pre-Cambrian basement rock.

The geology of the Upper Valley Subbasin is characterized by alluvium, terrace deposits, and the Paso Robles Formation (DWR, 2004). These features are in contact with the more consolidated sedimentary rocks that comprise the Santa Lucia and the Gabilan Ranges that mark the western and eastern boundaries of the Subbasin, respectively.

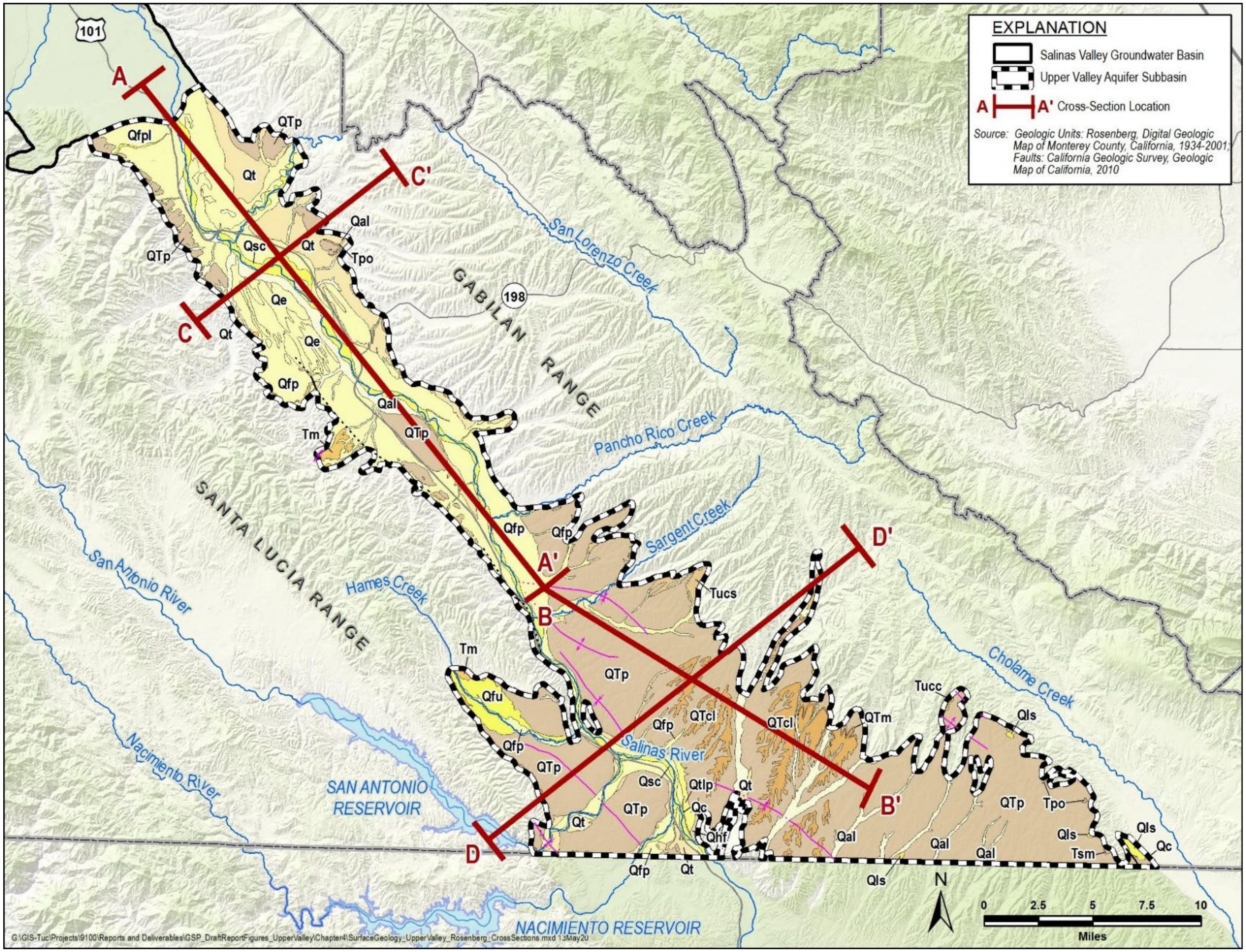


Figure 4-2. Subbasin Geology
(from Jennings, *et al*., 2010; Rosenberg 2001)

FIGURE 4-2. EXPLANATION

QUATERNARY

Qal	Alluvial deposits, undifferentiated
Qhf	Alluvial fan deposits, Holocene
Qfp	Flood-plain deposits, undifferentiated
Qsc	Stream channel deposits
Qc	Colluvium
Qls	Landslide deposits
Qe	Eolian deposits
Qfu	Pleistocene alluvial fans, undifferentiated
Qfpl	Alluvial fans, late Pleistocene
Qt	Fluvial terrace deposits, undifferentiated
Qtlp	Fluvial terrace deposits, late Pleistocene

TERTIARY

Tucc	Unnamed clastic sedimentary unit
Tucs	Unnamed clastic sedimentary unit
Tpo	Pancho Rico Formation, mudstone
Tpi	Pancho Rico Formation, siltstone
Tpd	Pancho Rico Formation, diatomite
Tps	Pancho Rico Formation, sandstone
Tsm	Santa Margarita Sandstone
Tmi	Monterey Formation, siltstone
Tm	Monterey Formation, siliceous
Tml	Monterey Formation, semi-siliceous
Tms	Unnamed clastic sediments, marine sandstone
Tn	Unnamed clastic sediments, red beds

QUATERNARY-TERTIARY

QTp	Paso Robles Formation, undifferentiated
QTcl	Paso Robles Formation, clay
QTm	Paso Robles Formation, marl
QTpc	Paso Robles Formation, clay and gravel

GEOLOGIC FEATURES

- fault, approx. located
- fault, certain
- fault, concealed
- anticline, certain
- fold axis, certain
- fold axis, concealed
- syncline, certain

4.2.1 Geologic Formations

Major geologic units present in the Upper Valley Subbasin are described below, starting at the surface and moving through the geologic layers from youngest to oldest. Geologic descriptions are derived from a combination of sources (Jennings, *et al.*, 2010; DWR, 2004). The corresponding designations on Figure 4-2 are provided in parentheses.

Quaternary Deposits

- *Alluvium from streams and small drainages (Qal, Qsc, and Qfp)* – These youngest units are the loose sediment in and along streams and drainages, or where streams have recently flooded. Qsc fills the bed of the Salinas River. Qal is found in more minor drainages. Both are moderately sorted and consist mostly of silt and sand with some areas of gravel. Salinas River floodplain deposits (Qfp) are the dominant feature of the northern subbasin, stretching all the way across the valley in places. These loose sand and silt deposits are the foundation for the Subbasin's fertile agricultural lands.
- *Sediments not transported by water (Qc, Qls, and Qe)* – Colluvium (Qc) and landslides (Qls) are the result of gravity alone. Colluvium collects gradually, landslides occur suddenly. These small, isolated deposits are found on the edges of the Subbasin, where the topography is steeper. They consist of loose, poorly to moderately sorted silt, sand, and gravel. Eolian deposits (Qe) are transported by the wind and form irregular patches over the widest, flattest part of Upper Valley, between King City and San Lucas. Eolian deposits are exclusively sand and finer grains, as gravel is too heavy to be carried by the wind.
- *Alluvial fans (Qhf, Qfpl, and Qfu)* – Alluvial fans are sediments deposited in a distributary manner at the base of mountain fronts where streams emerge (Kennedy/Jenks, 2004). They consist of moderately to poorly sorted sand, silt, and gravel. Holocene alluvial fans (Qhf) tend to be weakly consolidated, whereas late Pleistocene alluvial fans (Qfpl) can be moderately consolidated. Some fans are of unknown age (Qfu).
- *Terrace deposits (Qtlp and Qt)* – Terrace deposits are the remains of ancient floodplains. They are partially consolidated and consist mostly of sand mixed with silt and gravel. Some are known to be from the late Pleistocene (Qtlp). Others are of indeterminate age (Qt).

Quaternary-Tertiary Deposits

- *Paso Robles Formation (QTp, QTcl, QTm, and QTpc)* – This Pliocene to lower Pleistocene (1.6 million to 5.3 million years ago) unit is composed of loosely consolidated continental sandstone, shale, and gravel deposits (Jennings *et al.*, 2010; Rosenberg, 2001). These deposits are found as lenticular beds of sand, gravel, silt, and clay from terrestrial deposition (Thorup, 1976, Durbin et. al., 1978). The depositional environment is largely fluvial (Durbin, 1974) but also includes alluvial fan, lake, and floodplain deposition (Thorup, 1976; Greene, 1977). The alternating beds of fine and coarse materials typically have bed thicknesses of 20 to 60 feet (Durbin *et. al.*, 1978).

Tertiary Deposits

- *Pancho Rico Formation (Tpo, Tpi, Tpd, and Tps)* – This Pliocene (2.6 million to 5.3 million years ago) unit consists of sandy marine strata and interbedded finer grained rocks (Durham and Addicott, 1965). This unit conformably underlies the Paso Robles formation (Durham and Addicott, 1965). This unit crops out near the Arroyo Seco tributary, along Reliz Canyon, and ranges from approximately 20 feet to more than 1,000 feet in thickness (Durham and Addicott, 1965). The contact of the Paso Robles Formation with this unit also marks several of the lateral boundaries for the Subbasin shown in Figure 4-2 (DWR, 2004; Jenning *et al.*, 2010).

- *Santa Margarita Sandstone (Tsm)* – The Santa Margarita Sandstone is exposed at the surface in only a couple locations along the southern edge of the Subbasin. Conformably overlying the Monterey Formation, it is a white, arkosic sandstone made of very fine to coarse sand. It has very thick beds and some localized crossbedding.

- *Monterey Formation (Tmi, Tm, Tml)* – This Miocene (5.3 million to 23 million years ago) unit consists of shale and mudstone deposited in a shallow marine environment (Greene, 1977). This unit typically underlies the Salinas Valley Groundwater Basin and acts as a boundary for vertical groundwater flow. It also marks some lateral boundaries for the Subbasin shown in Figure 4-2 (DWR, 2004; Jenning *et al.*, 2010).

4.2.2 Structural Restrictions to Flow

The Upper Valley Subbasin overlies the axis of a northwest-plunging synclinal flexure in the bottom of the Subbasin (Durbin, 1978). This fold is evident in both Figure 4-4 and Figure 4-5 where the shallower depths to the basin bottom are shown along the Subbasin eastern and western peripheries, and across the Subbasin approximately where State Highway 198 meets State Highway 101. This fold causes the depth of the basin bottom to decrease sharply from approximately 800 feet to 300 feet near the center of the Subbasin where Sargent Creek meets the Salinas River (Durbin, 1978). The bottom continues to shallow as it approaches the southern boundary of the Subbasin, however, the current information on the depths to the basin bottom are limited in this area (Figure 4-4, and Figure 4-5).

4.2.3 Soils

The soils of the Subbasin are derived from the underlying geologic formations and influenced by the historical and current patterns of climate and hydrology. Soil types can influence groundwater recharge and the placement of recharge projects. Productive agriculture in the Subbasin is supported by deep, dark, fertile soils. The arable soils of the Subbasin historically are classified into 4 groups (Carpenter and Cosby 1925): residual soils, old valley-filling soils, young valley-filling soils, and recent-alluvial soils.

More recent surveys classify the soils into categories based on detailed soil taxonomy (U.S. Department of Agriculture, 2018). Figure 4-3 is a composite soil map of soils in the Subbasin from the USDA Natural Resources Conservation Service (NRCS) and the Gridded Soil Survey Geographic (gSSURGO) Database that is produced by the National Cooperative Soil Survey (NCSS).

The Subbasin is dominated by 4 soil orders: mollisols, entisols, alfisols, and vertisols. Minor soils include histosols and inceptisols. The 4 major soil orders are described below.

- **Mollisols** are the most widespread soil order in the Upper Valley Subbasin. Mollisols are characterized by a dark surface horizon, indicative of high organic content. The organic content often originates from roots of surficial grasses or similar vegetation. They are highly fertile and often alkaline rich (calcium and magnesium). Mollisols can have any moisture regime, but typically have enough available moisture to support perennial grasses.
- **Entisols** are the predominant soil order along the river corridor. Entisols are mineral soils without distinct soil horizons because they have not been in place long enough for distinct horizons to develop. These soils are often found in areas of recent deposition such as active flood plains, river basins, and areas prone to landslides. Nearly all the soils along the active river corridor are entisols.
- **Alfisols** are present along in portions of the Subbasin. Alfisols are known to have natural fertility both from the tapering of clay in the subsurface horizons and from leaf litter when under forested conditions. This order of soils is commonly associated with high base minerals such as calcium, magnesium, sodium, and potassium.
- **Vertisols** are relatively rare in the Subbasin. Vertisols are predominantly clayey soils with high shrink-swell potential. Vertisols are present in climates that have distinct wet and dry seasons. During the dry season, these soils commonly have deep, wide cracks. During the wet season, these soils trend to have water pooling on the surface due to the high clay content.

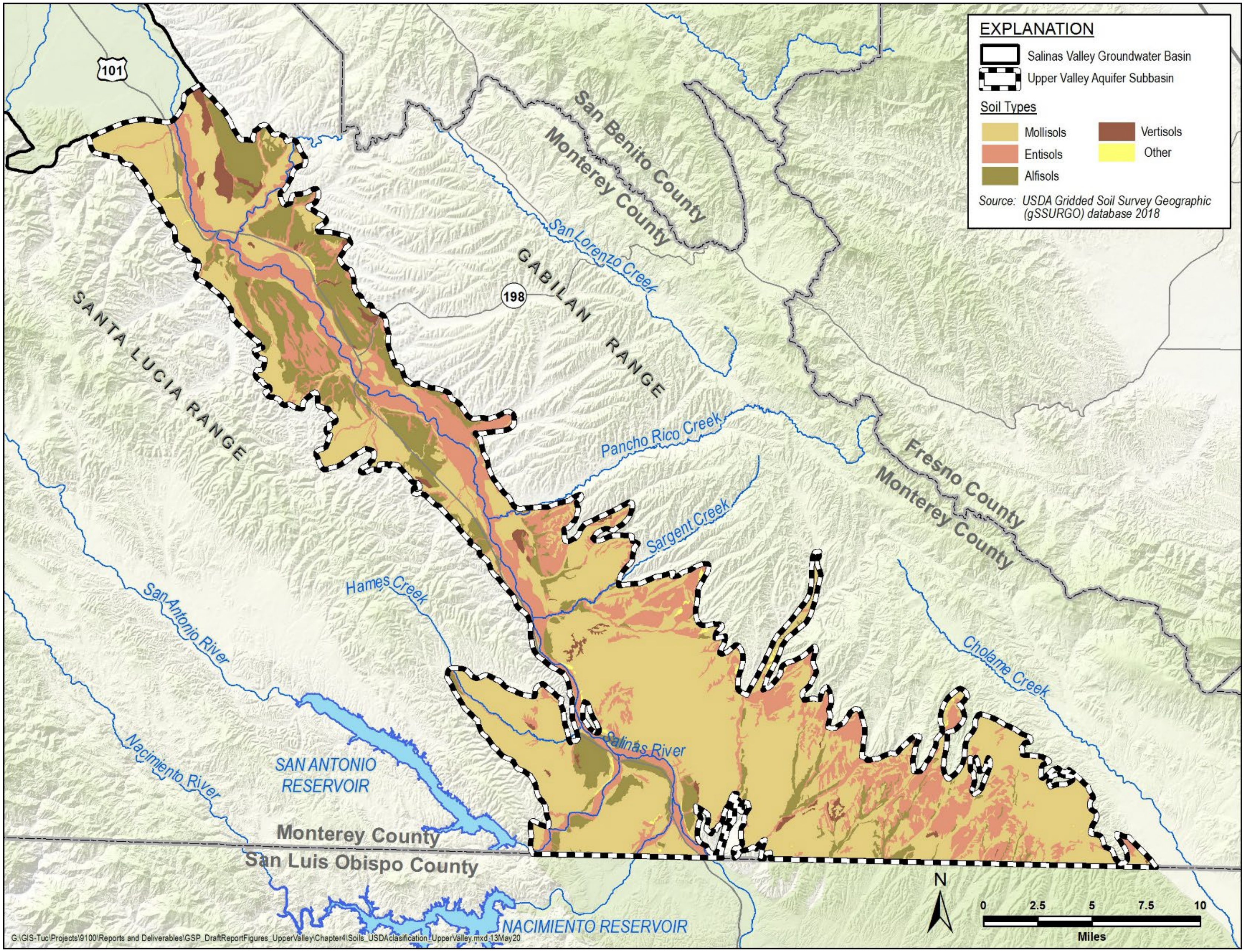


Figure 4-3. Composite Soils Map

4.3 Subbasin Extent

The subbasin extents describe both the lateral and vertical extents of the Subbasin. The Subbasin extents are defined by the DWR and are documented in Bulletin 118, (DWR, 2003; DWR, 2016a). Figure 4-1 illustrates the extent of the Subbasin.

4.3.1 Lateral Subbasin Boundaries

The Upper Valley Subbasin is laterally bounded by a combination of Subbasin boundaries and physical boundaries of the Salinas Valley Groundwater Basin, all shown on Figure 1-1.

4.3.1.1 Boundaries with Adjacent Subbasins

The Upper Valley Subbasin is bounded by the following subbasins:

- **Forebay Subbasin.** The Subbasin's northwestern boundary with the adjacent Forebay Subbasin is near the town of Greenfield (DWR, 2004). This boundary generally coincides with the southern limit of the regional clay layers above the 400-Foot Aquifer in the 180/400-Foot Aquifer Subbasin that exist intermittently in the Forebay Subbasin (DWR, 2004). At this boundary there is also a constriction of the Valley floor caused by encroachment from the west by the Arroyo Seco Cone and Monroe Creek (DWR, 2004). Additionally, this boundary also marks the shallowing of the base of the groundwater basin. There are no reported hydraulic barriers separating these subbasins and therefore the GSP needs to consider potential for groundwater flow between these adjacent subbasins.
- **San Luis Obispo County/Paso Robles Area Subbasin.** The southern boundary with the San Luis Obispo County and the Paso Robles Area Subbasin represents a jurisdictional divide between Monterey County and San Luis Obispo County. The GSAs follow the county lines.

4.3.1.2 Physical Basin Boundaries

The Upper Valley Subbasin is bounded by the following physical features:

- **The Gabilan Range.** The eastern boundary of the Subbasin is generally the contact between the unconsolidated Alluvium and semi-consolidated Quaternary Paso Robles Formation with the consolidated rocks of the Gabilan Range. In this portion of the Gabilan Range, the consolidated rocks are the Pancho Rico Formation and the Monterey Formation shown in Figure 4-2 (DWR, 2004; Jennings *et al.*, 2010; Rosenberg, 2001). Groundwater flow across this boundary has not been studied extensively, and some reports indicate groundwater recharge for this Subbasin is primarily through the stream channels originating in the Gabilan Range. There are no published mapped faults or significant fracture sets that could contribute to mountain block recharge for the Subbasin.

- **The Santa Lucia Range.** The western boundary of the Upper Valley Subbasin is the contact between the unconsolidated Alluvium with the sedimentary rocks of the Santa Lucia Range. In this portion of the Santa Lucia Range, the consolidated rocks are the Monterey Formation shown in Figure 4-2 (DWR, 2004; Jennings *et al.*, 2010; Rosenberg, 2001). Groundwater flow across this boundary has not been studied extensively.

4.3.2 Vertical Subbasin Boundaries

The base, or bottom, of the Subbasin is not defined by a sharp interface between permeable sediments and lower-permeability basement rock across the entire Subbasin. Since the permeable unconsolidated and semi-consolidated alluviumt of the Subbasin are very similar to the consolidated sedimentary rocks that bound the Subbasin, it is difficult to define a sharp interface between the groundwater basin and the underlying basement rocks. Furthermore, the usable portion of the Subbasin may not always include the full thickness of the entire sedimentary sequence, which includes consolidated and unconsolidated sediments. Previous investigations have estimated that the entire sedimentary sequence in the Salinas Valley Groundwater Basin might range between 10,000 and 15,000 feet thick. However, the productive freshwater principal aquifer in this Subbasin are at shallower depths.

With increasing depth, 3 factors limit the viability of the sediments as a productive, principal aquifers:

1. Increased consolidation and cementation of the sediments decrease well yields.
2. Deeper strata contain poor-quality brackish water unsuitable for most uses.
3. Discontinuous alluvial fan deposits interfingered with clay lenses impede vertical and horizontal groundwater flow.

Because these factors gradually change with depth, there is not a sharp well-defined bottom of aquifers throughout the Salinas Valley Groundwater Basin. This GSP adopts the bottom of the aquifer that was defined by the USGS (Durbin *et al.*, 1978). Figure 4-4 is a map of elevation contours of the bottom of the Subbasin; it was created with data from Durbin *et al.,* and one other study. Figure 4-5 shows a contour map of depth to bottom of the Subbasin prepared using the extrapolated bottom elevation and ground surface elevation.

It is important to note the maps do not display the extrapolated information defining the bottom for the entire Subbasin. This is due to a recent DWR boundary revision. The Durbin *et al.* data shown on Figure 4-4 and Figure 4-5 were only developed for the MCWRA Subarea boundary. This is a data gap that needs to be filled during GSP implementation.

Contours from Paso Robles Groundwater Basin Study Phase II by Fugro West, Inc. *et al.* (2005) have been added to the southern portion of the Subbasin. There is about a 2-mile gap between the Fugro and Durbin data sets. Where they would meet, if the Fugro contours were extended, the Fugro elevations are about 400 feet higher than the Durbin elevations. This might be explained by differing definitions of the bottom of the Subbasin. Fugro defines the bottom of the Subbasin as the base of the Paso Robles Formation, whereas Durbin considers it to be the base of unconsolidated sediments. Fugro also notes that, “The Paso Robles Formation has been folded and faulted, resulting in significant variations in the base of the aquifer.” Geologic maps in Fugro and in this GSP (Figure 4-2) show structural folding where the 2 data sets come together at the intersection of cross sections A-A’, and B-B’.

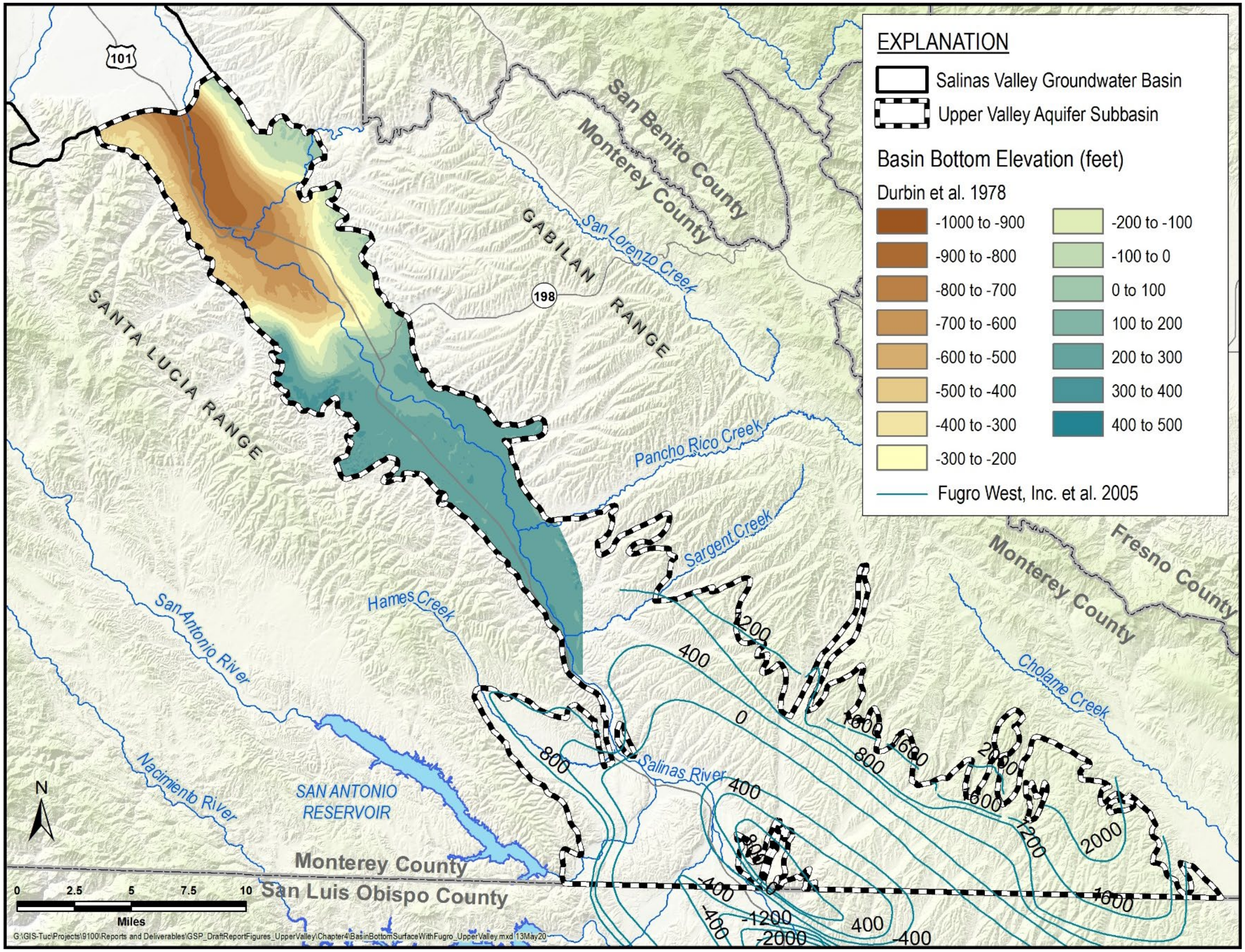


Figure 4-4. Elevation of the Bottom of the Upper Valley Aquifer Subbasin

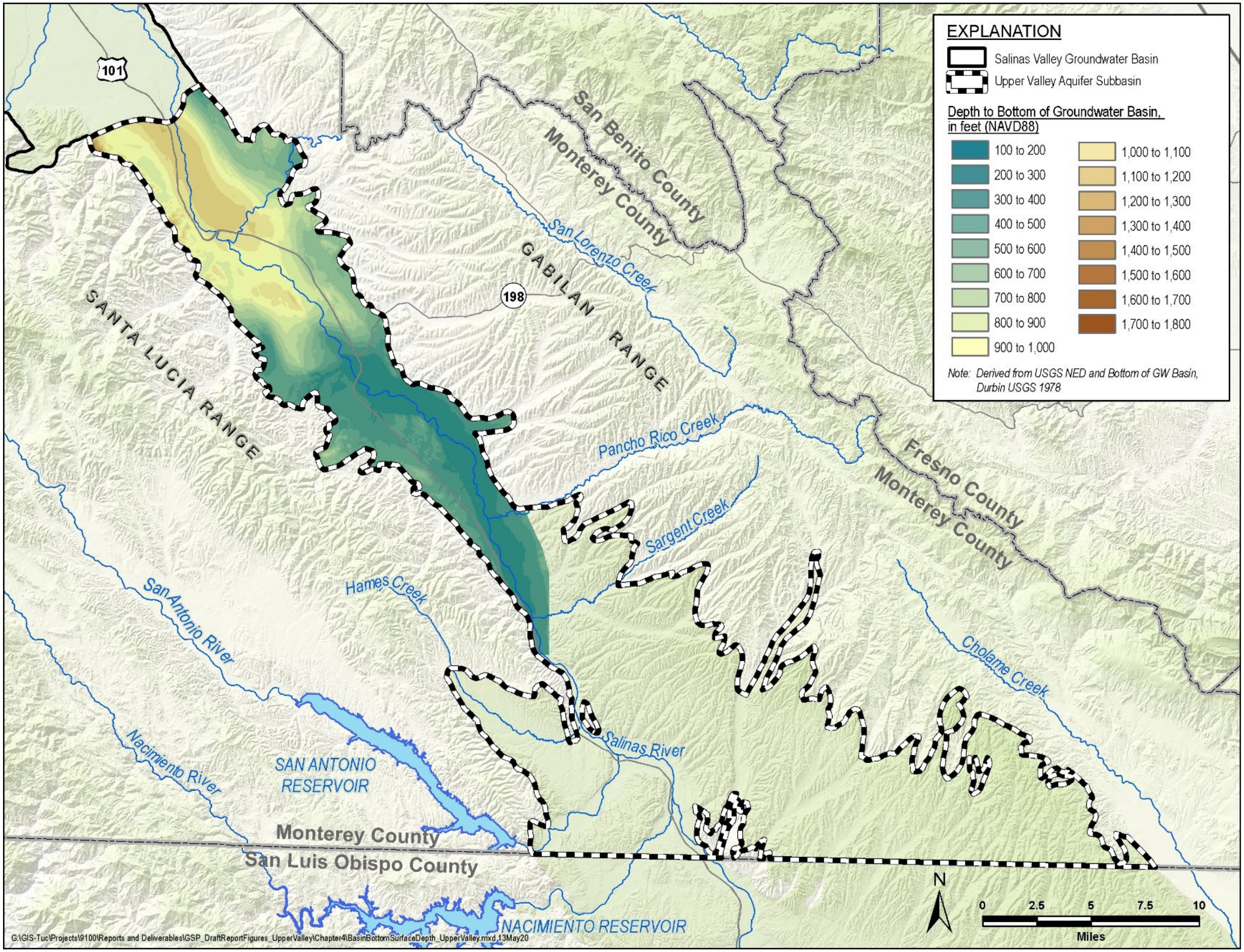


Figure 4-5. Depth to Bottom of the Upper Valley Aquifer Subbasin, in feet

4.4 Subbasin Hydrogeology

The Subbasin hydrogeology details the principal aquifers and aquitards that occur in the Subbasin, inventories known aquifer properties, and identifies naturally occurring groundwater inputs and outputs which will be incorporated into the groundwater budgets described in Chapter 6. This section also includes cross sections which give graphical representations of what is described in the following subsections.

Groundwater in the Upper Valley Subbasin occurs primarily in a single, unconfined aquifer. The aquifer is composed of unconsolidated to semi-consolidated interbedded gravels, sands, and silts of the Paso Robles Formation, alluvial fan deposits, and river deposits. These deposits represent the lateral equivalents of the 180-Foot and 400-Foot Aquifers located in the lower Salinas Valley (DWR, 2004). The aquifer sediments west of the Salinas River are generally coarser than those to east of the River.

4.4.1 Principal Aquifers and Aquitards

Although groundwater can be found throughout most of the Holocene Alluvium and the Quaternary Older Alluvium, not all groundwater is part of a principal aquifer. SGMA defines a principal aquifer as "…aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems" (23 California Code of Regulations § 351 (aa)).

There has been limited hydrogeologic analysis of the aquifer in the Subbasin. The most recent, detailed hydrostratigraphic analysis of the Upper Valley Subbasin was published in 2015 (Brown and Caldwell, 2015). Cross sections for the Subbasin are shown on Figure 4-6 through Figure 4-9. The location of these cross sections is depicted on Figure 4-2. Cross section A-A' was modified from the 2015 State of the Salinas River Groundwater Basin Report (Brown and Caldwell, 2015), and extends down part of the length of the Upper Valley Subbasin. Cross section B-B' adds on to cross section A-A' to cover the southern portion of Subbasin. Cross section C-C' and cross section D-D' extend across the width of the Subbasin. Cross sections B-B', C-C', and D-D' were developed for this GSP and follow the general style of the Brown and Caldwell cross sections. These 3 cross sections group the coarse and fine sediments encountered within the Upper Valley Subbasin. The finer sediments are grouped in the shaded regions; the coarser sediments have no shading. The generalized relationships of finer or coarser sediments between boreholes should be interpreted with caution and an understanding of alluvial fan sedimentation as well as the overall climatic settings over geologic time.

The cross sections are based on geologic logs provided in DWR Water Well Drillers Reports. Geologic log descriptions were grouped into hydrologic units as follows:

- Fine-grained sediments such as clay, silt, sandy clay, and gravelly clay are shown as aquitards.
- Coarse-grained sediments such as sand, gravel, and sand-gravel mixtures are shown as aquifers.
- Sediments logged as gravel/clay, sand/clay, and sand/gravel/clay are interpreted to consist of interbedded coarse-grained and fine-grained deposits and are included with aquifer materials.

In some cases, the logs may be old, the depth resolution poor, or the lithologic distinction suspect, and therefore the lithology shown on the well logs should not be viewed as precise.

The 4 cross sections show the discontinuous and interbedded nature of the thin lenses of alluvial sediments that is characteristic of alluvial fan and fluvial deposits. The cross sections show generalized areas of finer material, both vertically and horizontally. However, individual lenses of fine material are not traceable over long distances and do not correlate well between boreholes (Kennedy/Jenks, 2004).

Within the Upper Valley Subbasin, the principal aquifer comprises alluvial and the Paso Robles Formation. Deposits west of the Salinas River are typically coarser grained than those to the east. These primary water-bearing units are laterally equivalent to those found in the 180/400-Foot and Forebay Subbasins. However, the Salinas Valley Aquitard does not extend into the Forebay or the Upper Valley Subbasins (DWR, 2004). Therefore, due to the lack of extensive and traceable subsurface units, the principal aquifer of the Upper Valley is generally unconfined and considered to be 1 unit (Brown and Caldwell, 2015).

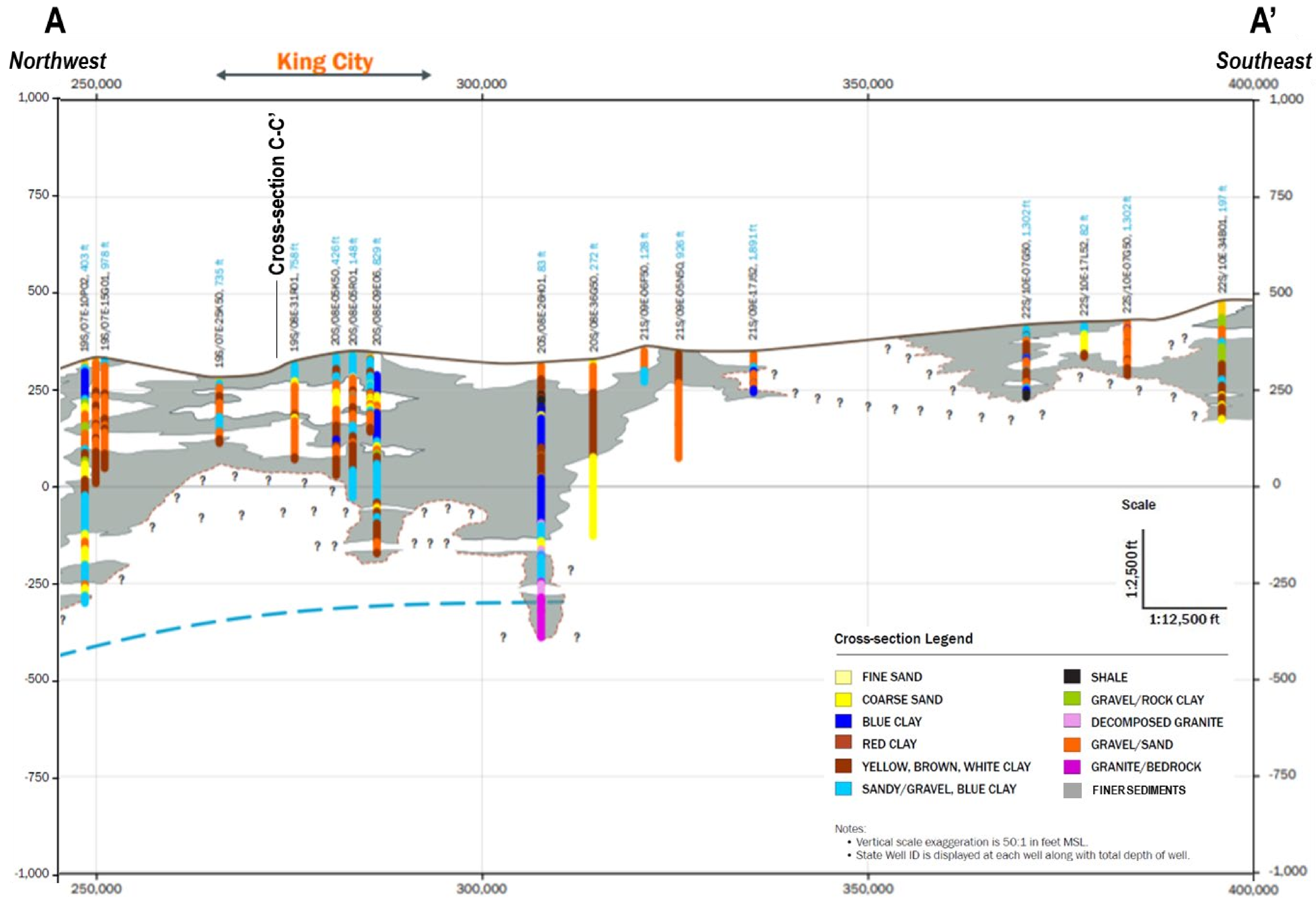


Figure 4-6. Cross Section A-A’
(modified from Brown and Caldwell, 2015)

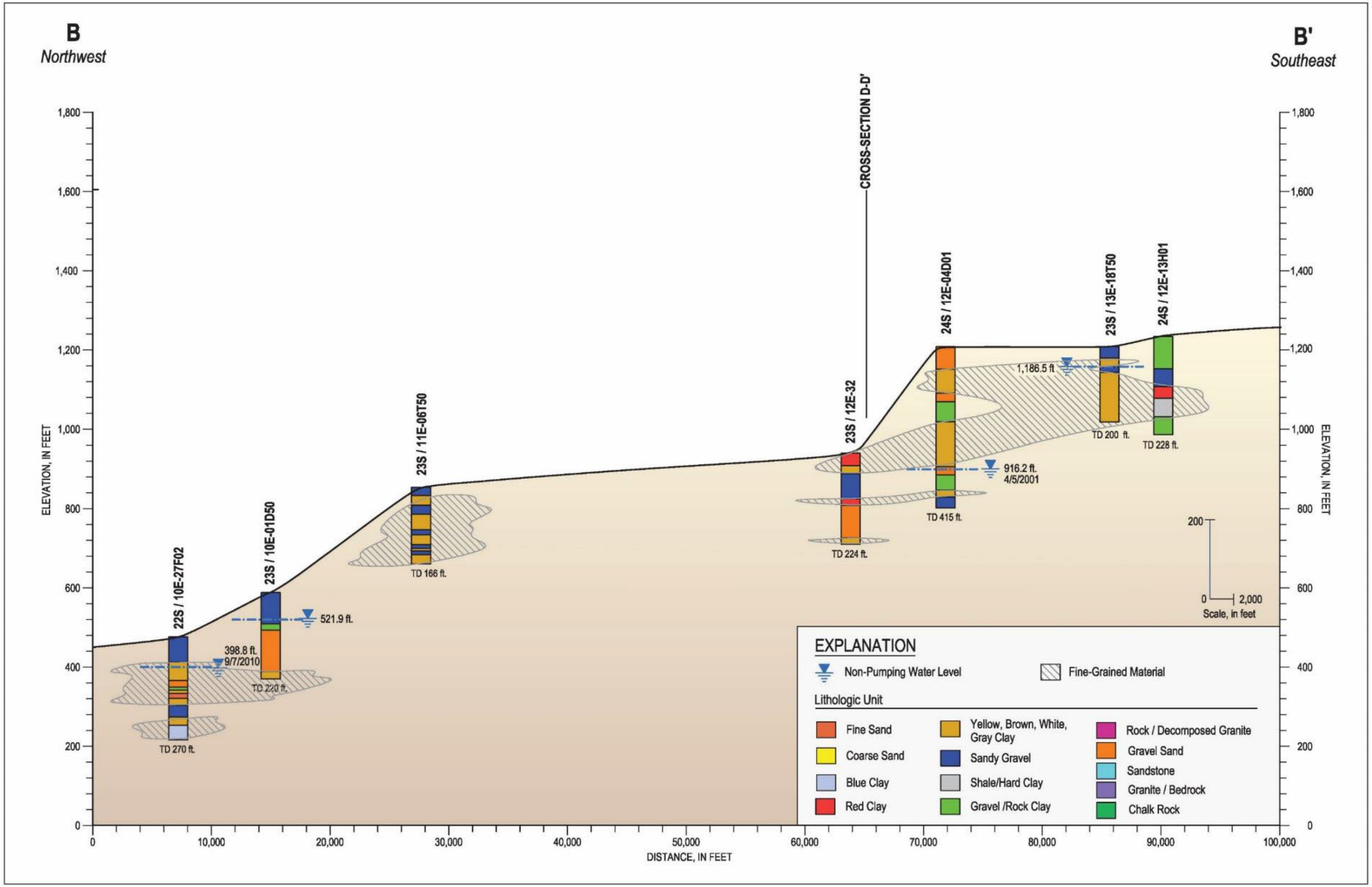


Figure 4-7. Cross Section B-B'

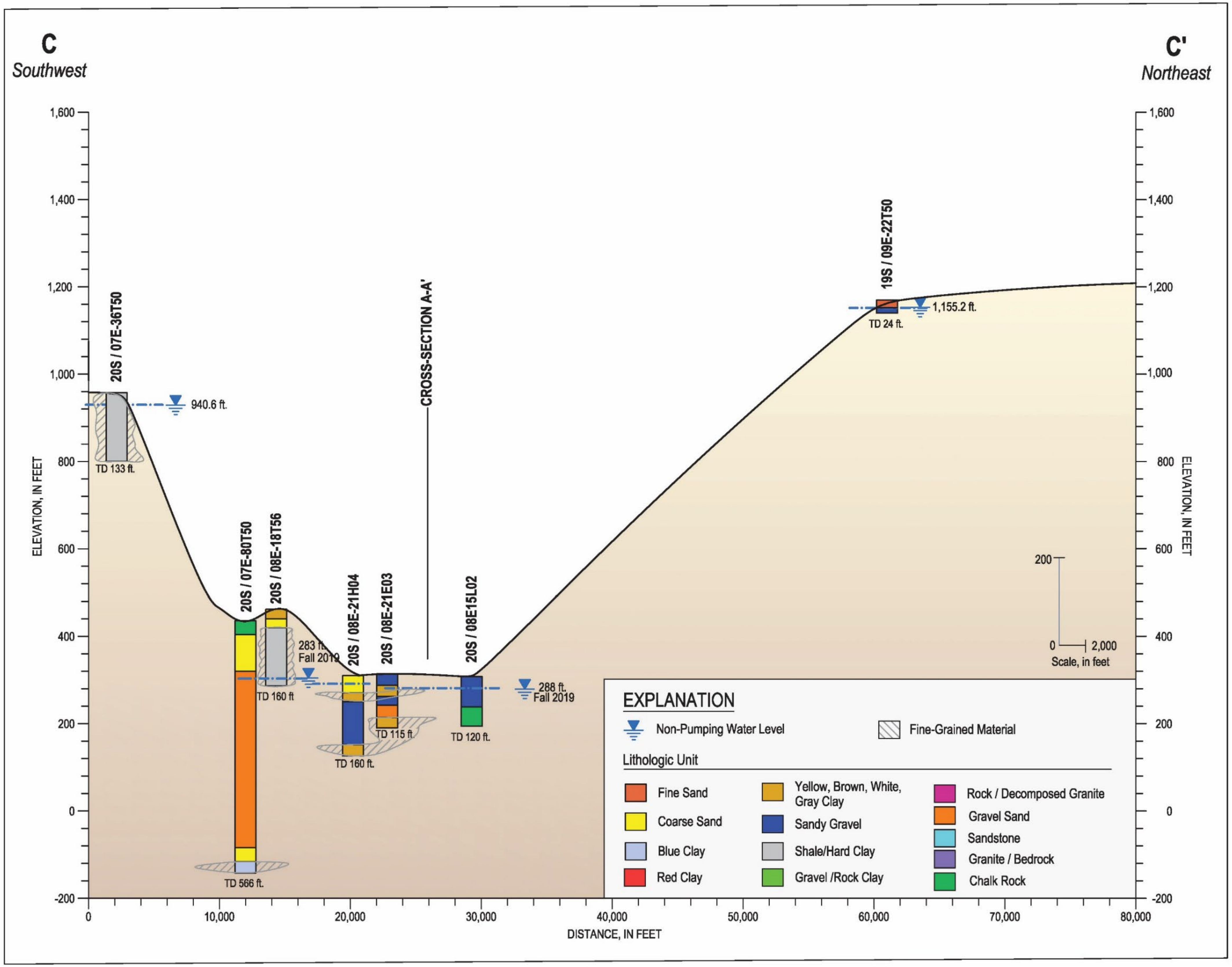


Figure 4-8. Cross Section C-C'

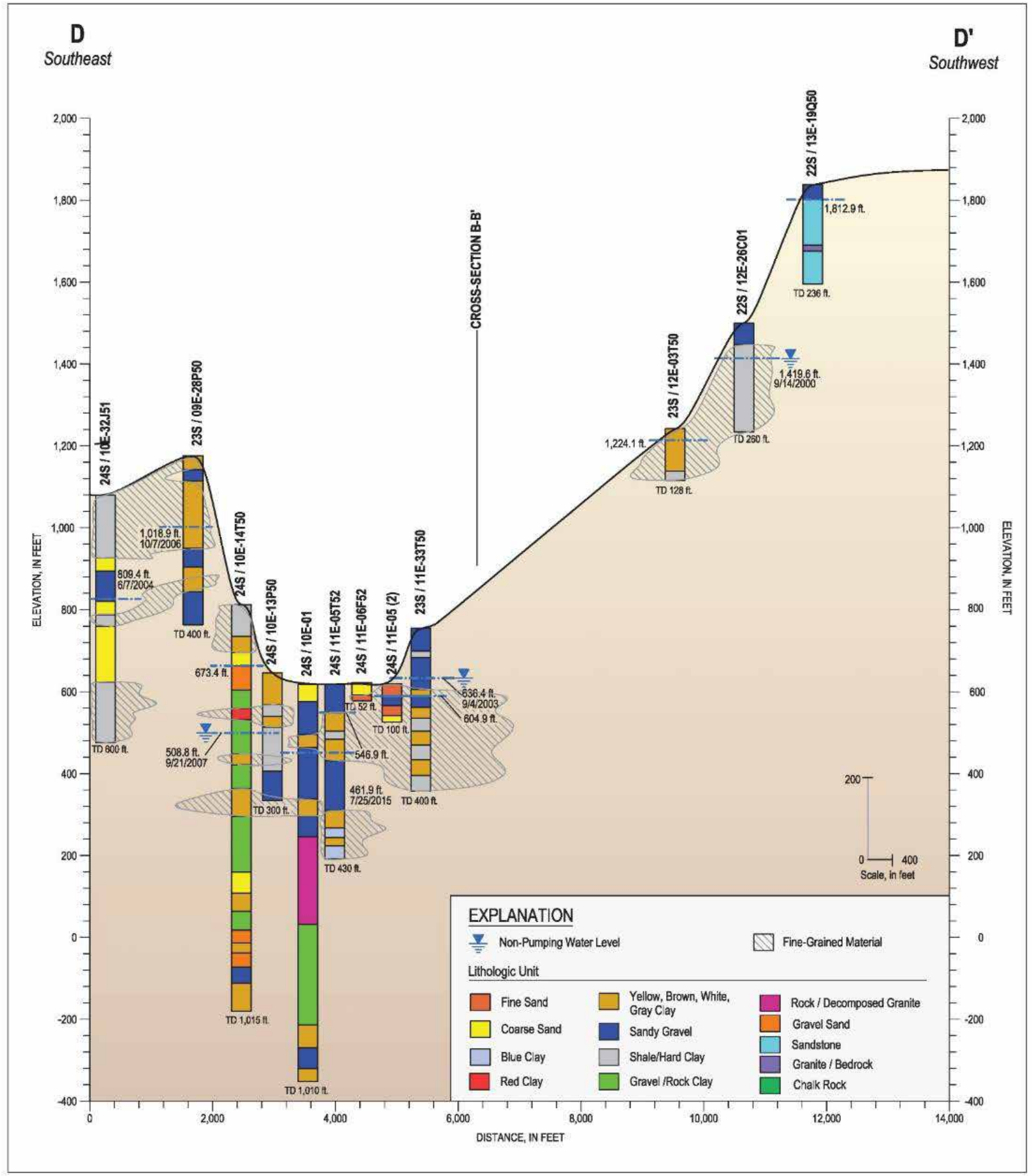


Figure 4-9. Cross Section D-D'

4.4.2 Aquifer Properties

Aquifer properties define how groundwater is stored and how groundwater moves in the subsurface. This information is needed to understand current groundwater conditions, to predict future groundwater conditions, and to assess strategies for maintaining sustainability.

The values and distribution of aquifer properties in the Upper Valley Subbasin have not been well characterized and documented. The relatively sparse amount of measured aquifer properties throughout the Subbasin is considered a data gap that will be addressed during implementation of the GSP.

Although hydrogeologic properties have not been measured at many specific locations in the Subbasin, the aquifer properties have been estimated through the process of numerical model calibration. Aquifer property calibration has been completed for numerous published modeling studies including studies by Durbin (1974), Yates (1988), WRIME (2003), and the SVIHM that is used to develop this GSP.

There are 2 general types of aquifer properties relevant to groundwater management:

- **Aquifer storage properties.** These properties control the relationship between the volume of groundwater stored in the aquifer and the groundwater elevations measured in the aquifer.
- **Groundwater transmission properties.** These properties control the relationship between hydraulic gradients and the rate of groundwater flow.

4.4.2.1 Aquifer Storage Properties

The aquifer properties that characterize the relation between groundwater elevation and amount of water stored in an aquifer are specific yield for unconfined aquifers and specific storage for confined aquifers. Storativity, or storage coefficient, is equal to specific storage multiplied by the thickness of the aquifer for confined aquifers. Both specific yield and specific storage are measured in units of cubic feet of water per cubic feet of aquifer material. These ratios are often expressed as a percentage.

- **Specific yield** is the amount of water that drains from pores when an unconfined aquifer is dewatered. Often, specific yield values range from 8% for the northern Subbasin to 15% for the southern Subbasin (Yates, 1988).
- **Specific storage** is the amount of water derived from a unit volume of a confined aquifer due to a unit decline in pressure change in the aquifer. Specific storage values are often on the order of $5x10^{-4}$ to $1x10^{-5}$ in units of 1/L. There are no estimated specific storage values published for the Upper Valley Aquifer as this aquifer is generally unconfined.

Detailed aquifer property values specific to the Subbasin were not available at the time of this GSP development. This is a data gap that will be filled during implementation.

4.4.2.2 Groundwater Transmission Properties

Hydraulic conductivity measures the ability of an aquifer to transmit water. Hydraulic conductivity is expressed in units of length per unit time, such as feet per day. Materials with higher hydraulic conductivities, such as sands and gravels, transmit groundwater more readily than units with lower hydraulic conductivities, such as clay. Transmissivity is equal to the hydraulic conductivity multiplied by the aquifer thickness and will vary based on the saturated thickness of the aquifer. Few estimates of either hydraulic conductivity or transmissivity exist for the Subbasin. This is a data gap that will be addressed during GSP implementation.

Specific capacity of a well is sometimes used as a surrogate for estimating aquifer transmissivity. The specific capacity of a well is the ratio between the well pumping rate in gallons per minute (gpm), and the drawdown in the well during pumping measured in feet. Specific capacity is moderately well correlated, and approximately proportional to, aquifer transmissivity. Specific capacities of wells in the Upper Valley Subbasin range from 80 to 200 gal/min/ft (Yates, 1988). These high specific capacities demonstrate very transmissive sediments.

4.4.3 Primary Aquifer Uses

The primary uses of groundwater from this single aquifer include domestic, agricultural, and municipal water supply uses (DWR, 2004).

4.4.4 Natural Recharge Areas

Natural recharge areas allow rainfall, local runoff, and streamflow to replenish aquifers by percolating through the subsurface. Identifying areas of potentially significant natural recharge can inform water budgets and help government planners promote good groundwater management by incorporating recharge areas into land use plans. This section only identifies areas of natural recharge; quantitative information about all natural and anthropogenic recharge is provided in Chapter 6.

Natural groundwater recharge occurs through the following processes:

- Recharge of surface water from the Salinas Rivers and its tributary streams originating in the Gabilan and Santa Lucia Ranges
- Deep percolation of infiltrating precipitation
- Subsurface inflow from the adjacent Paso Robles Subbasin

Recharge of surface water and deep percolation of precipitation are both surficial sources of natural groundwater recharge. An area's capacity for surficial groundwater recharge is dependent on a combination of factors, including steepness of grade, soil surface conditions such as paving or compaction, and ability of soil to transmit water past the root zone. To assist agricultural communities in California with assessing groundwater recharge potential, a consortium of researchers at University of California, Davis developed a Soil Agricultural Groundwater Banking Index (SAGBI) and generated maps of recharge potential in agricultural areas of California (O'Geen, *et al.*, 2015). Figure 4-10 presents the SAGBI index map for the Upper Valley Subbasin. This map ranks soil suitability for groundwater recharge based on 5 major factors including: deep percolation, root zone residence time, topography, chemical limitations, and soil surface condition. Areas with excellent recharge properties are shown in green. Areas with poor recharge properties are shown in red. Not all land is classified, like in the southern part of the Subbasin where the boundaries of the Subbasin expand into the Gabilan Range. Mountainous areas are more likely to contribute to recharge through mountain front recharge. Although limited, this map provides helpful guidance on where natural recharge could occur.

Areas with the highest potential for recharge are along the Salinas River. Many of the other soils are classified as having moderate potential for recharge, which means some water applied at the surface might make it into the aquifer. This map should not be used exclusively to identify recharge areas that will directly benefit the aquifers in the Upper Valley Subbasin. Rather, it should be used in conjunction with additional research and investigation tools.

Subsurface recharge is primarily from percolation through the Salinas River's channel deposits and drainage from its tributaries (DWR, 2004). This inflow is estimated to be 7,000 acre-feet on an annual basis (DWR, 2004). Total natural recharge is estimated to be 165,000 acre-feet (DWR, 2004).

Again, it is important to note the map does not display the information for the entire Subbasin. This is due to a recent DWR boundary revision. The information shown on Figure 4-10 is for the MCWRA Subarea boundary.

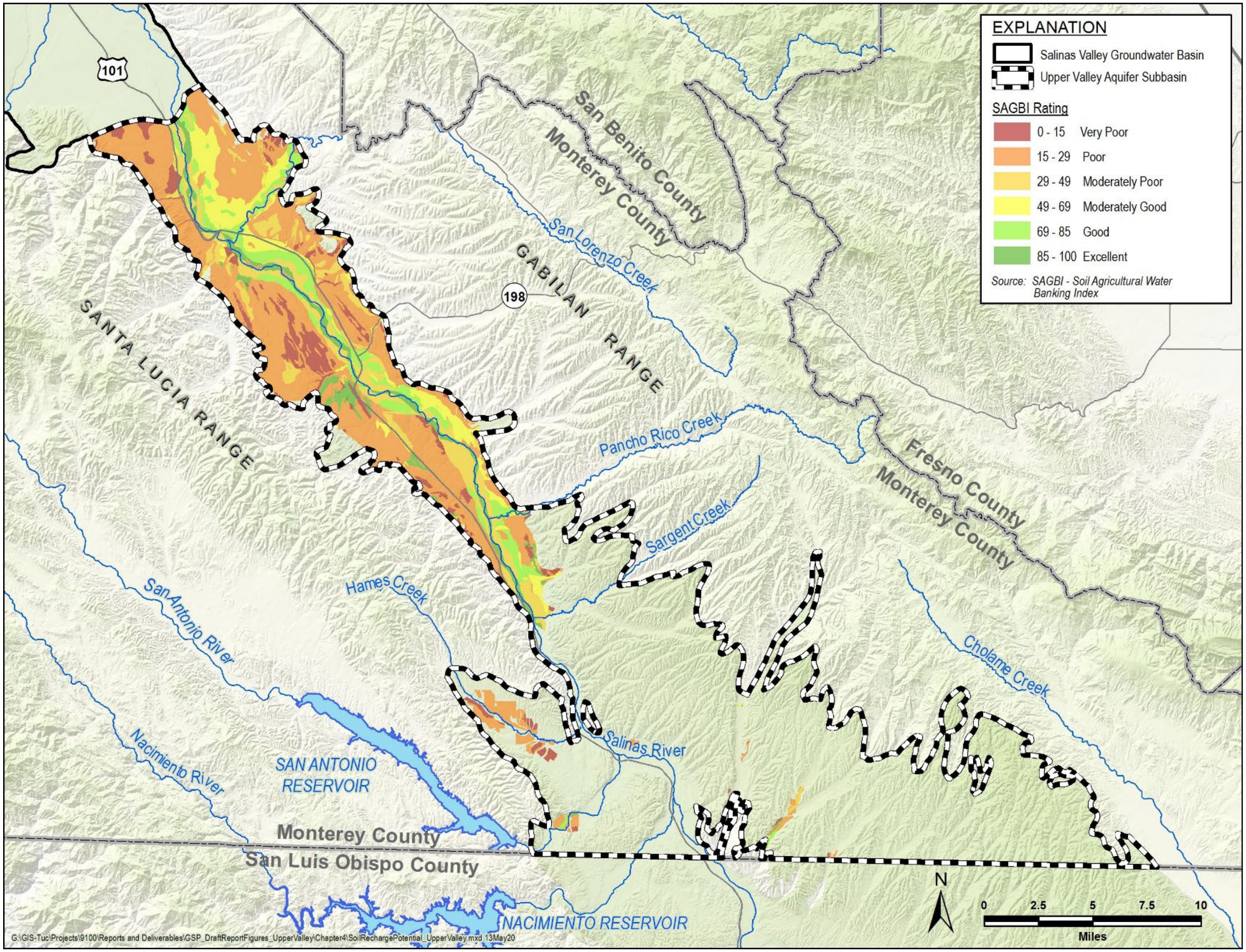


Figure 4-10. SAGBI Soils Map for the Upper Valley Aquifer Subbasin

4.4.5 Natural Discharge Areas

Natural discharge areas are areas where groundwater naturally leaves aquifers through flow to adjoining basins or percolation to the ground surface. Identifying areas of potentially significant natural discharge can inform water budgets and help locate important environmental uses of groundwater. Quantitative information about all natural and anthropogenic discharge is provided in Chapter 6.

Natural groundwater discharge areas within the Subbasin include wetlands and other surface water bodies that receive groundwater discharge and ET by vegetation types commonly associated with the sub-surface presence of groundwater. There are no springs and seeps in the Subbasin as identified in the National Hydrology Dataset (NHD). Natural groundwater discharge to streams–primarily, the Salinas River and its tributaries–has not been mapped to date.

4.4.5.1 Potential Interconnected Surface Water

Figure 4-11 shows locations of ISW, in the Upper Valley Subbasin evaluated on a monthly basis over the entire model period from 1967 to 2017. This analysis also excludes the period from June to September assuming that the majority of flow in the river during these months is from conservation releases from the reservoirs. The blue cells indicate areas where surface water is connected to groundwater for more than 50% of the number of months in the model period and are designated as areas of ISW. The clear cells represent areas that have interconnection less than 50% of the model period and require further evaluation to determine whether the SMC, discussed in Chapter 8, apply. The gray cells show locations of canals, drains, or connectors and were excluded from the analysis. These ISW locations are based on simulated results from the preliminary SVIHM, which is calibrated to measured groundwater levels and streamflows. Although seepage along the ISW reaches is based on assumed channel and aquifer parameters as model inputs, the preliminary SVIHM is the best available tool to estimate ISW locations. The model construction and uncertainty are described in Chapter 6 of this GSP. This map does not show the extent of interconnection which is estimated in Chapter 5. Interconnection between surface water and groundwater can vary both in time and space. A seasonal analysis is included in Appendix 4A. Figure 4-11 is based on provisional version of the SVIHM[1] and is subject to change.

[1] These data (model and/or model results) are preliminary or provisional and are subject to revision. This model and model results are being provided to meet the need for timely best science. The model has not received final approval by the U.S. Geological Survey (USGS). No warranty, expressed or implied, is made by the USGS or the U.S. Government as to the functionality of the model and related material nor shall the fact of release constitute any such warranty. The model is provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the model.

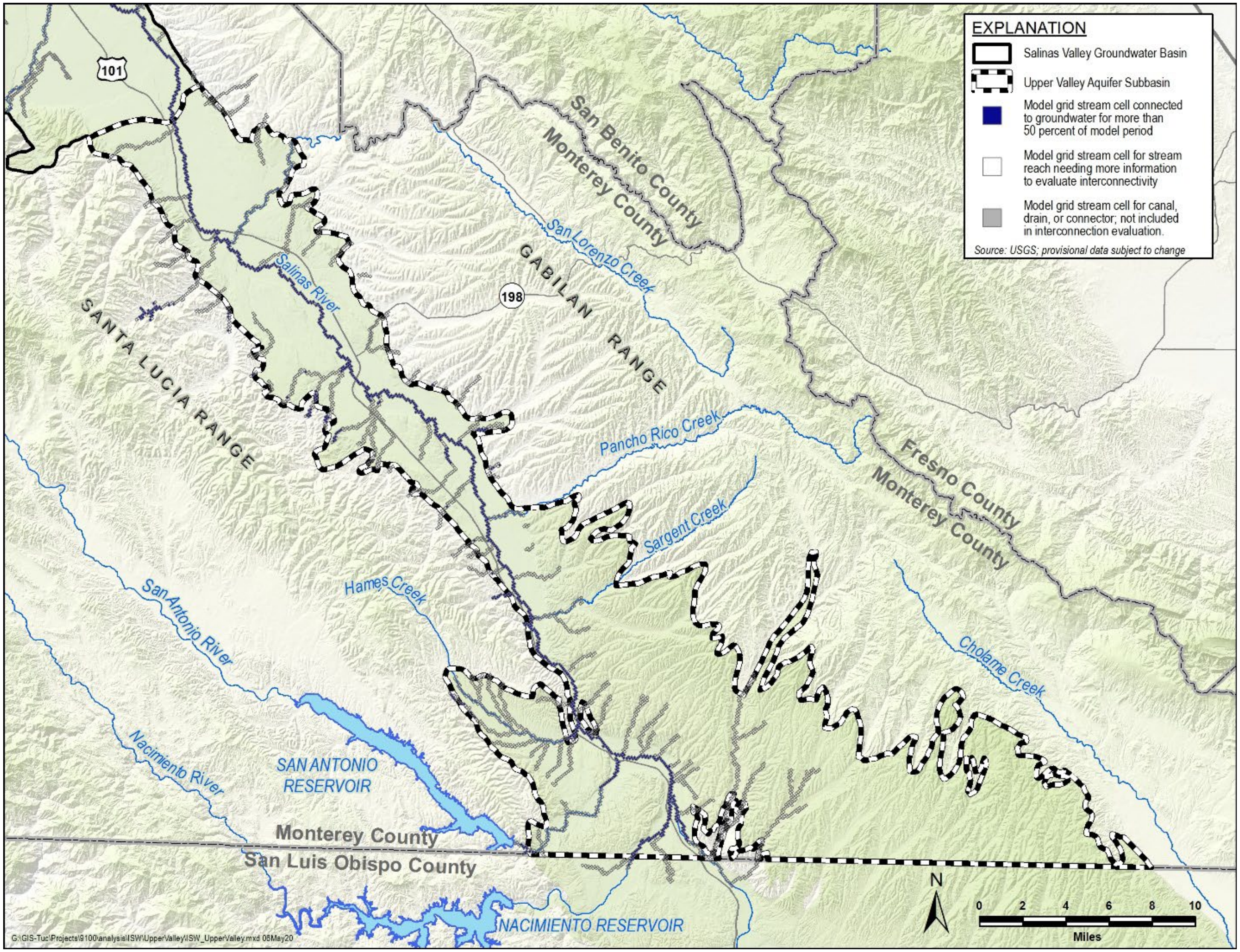


Figure 4-11. Locations of Interconnected Surface Water

4.4.5.2 Groundwater Dependent Ecosystems

GDEs refer to ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. Two main types of ecosystems are commonly associated with groundwater: wetlands associated with the surface expression of groundwater and vegetation that typically draws water from a shallow water table (phreatophytes).

GDEs may provide critical habitat for threatened or endangered species. Areas designated as critical habitat for threatened or endangered species contain the physical or biological features that are essential to the conservation of these species, and may need special management or protection (USFWS, 2017). A list of threatened and endangered species that might rely on GDEs in the Subbasin was compiled using information from the U.S. Fish and Wildlife Service (USFWS), CDFW, and TNC. Several steps were taken to determine which threatened and endangered species were likely found in the Subbasin and of those, which were likely to rely on GDE habitat. A list of threatened and endangered species for Monterey County was downloaded from the USFWS website and cross-referenced to species identified in the CDFW California Natural Diversity Database. The threatened and endangered species for Monterey County was further cross-referenced with the TNC Critical Species LookBook to identify which species are likely to depend on groundwater, as indicated in Table 4-1.

Ten threatened and endangered species, including the Southern California Steelhead and the California Red-legged Frog, were identified as likely to rely directly on groundwater in Monterey County, several of which may be found in the Subbasin. Ten species were identified as likely to rely indirectly on groundwater, and the remaining species are unknown with respect to whether they directly rely on GDEs or groundwater. All species listed have the potential for groundwater dependence. There are 8 species that appear in both the federal and state list for threatened or endangered species.

Table 4-1. Federal and State Listed Threatened and Endangered Species, and Respective Groundwater Dependence for Monterey County

Groundwater Dependence	Common Name	Federal Status	State Status
Direct	California black rail	-	Threatened
	California red-legged frog	Threatened	-
	California Ridgway's rail	Endangered	Endangered
	longfin smelt	-	Threatened
	Santa Cruz long-toed salamander	Endangered	Endangered
	steelhead - central California coast DPS	Threatened	-
	steelhead - south-central California coast DPS	Threatened	-
	Tidewater Goby	Endangered	-
	tricolored blackbird	-	Threatened
Direct and Indirect	arroyo toad	Endangered	-
Indirect	bald eagle	-	Endangered
	bank swallow	-	Threatened
	Belding's savannah sparrow	-	Endangered
	California condor	Endangered	Endangered
	California least tern	Endangered	Endangered
	least Bell's vireo	Endangered	Endangered
	southwestern willow flycatcher	Endangered	Endangered
	Swainson's hawk	-	Threatened
	willow flycatcher	-	Endangered
Unknown	Bay checkerspot butterfly	Threatened	-
	California tiger salamander	Threatened	Threatened
	foothill yellow-legged frog	-	Endangered
	San Joaquin kit fox	Endangered	Threatened
	short-tailed albatross	Endangered	-
	Smith's blue butterfly	Endangered	-
	vernal pool fairy shrimp	Threatened	-

The areas in the Upper Valley Subbasin where GDEs may be found are mainly along the Salinas River, and in tributary canyons and washes where shallow alluvium is present. The shallow alluvium along the Salinas River may be saturated, but more investigation is needed to determine whether a continuous saturated zone connects to the principal aquifer. This area will require more analysis into the near surface stratigraphy to determine the connection of the principal aquifer to surface water.

Figure 4-12 shows the distribution of potential GDEs within the Subbasin based on the Natural Communities Commonly Associated with Groundwater (NCCAG) Dataset (DWR, 2020b). The NCCAG dataset maps vegetation, wetlands, springs, and seeps in California that are commonly associated with groundwater. These include: 1) wetland features commonly associated with the surface expression of groundwater under natural, unmodified conditions; and 2) phreatophytes. This map does not account for the depth to groundwater or level of interconnection between surface water and groundwater. Actual rooting depth data are limited and will depend on the plant species and site-specific conditions, and availability to other water sources.

The NCCAG dataset and the additional shallow groundwater analysis are not a determination of GDEs by DWR or SVBGSA, but rather represent the best available data to provide a starting point for this GSP, as well as to direct monitoring, fill data gaps, guide implementation, and support other field activities initiated or partnered by the SVBGSA. Field data are needed to ascertain the degree to which identified ecosystems are groundwater dependent, rather than sustained by soil moisture.

Additional resources that contributed to an initial mapping of GDE locations are the CDFW Vegetation Classification and Mapping program (VegCAMP), the USFWS National Wetlands Inventory, and the USFWS online mapping tool for listed species critical habitat, as described in the methodology for the NCCAG development which is publicly accessible on the NC dataset website: https://gis.water.ca.gov/app/NCDatasetViewer/.

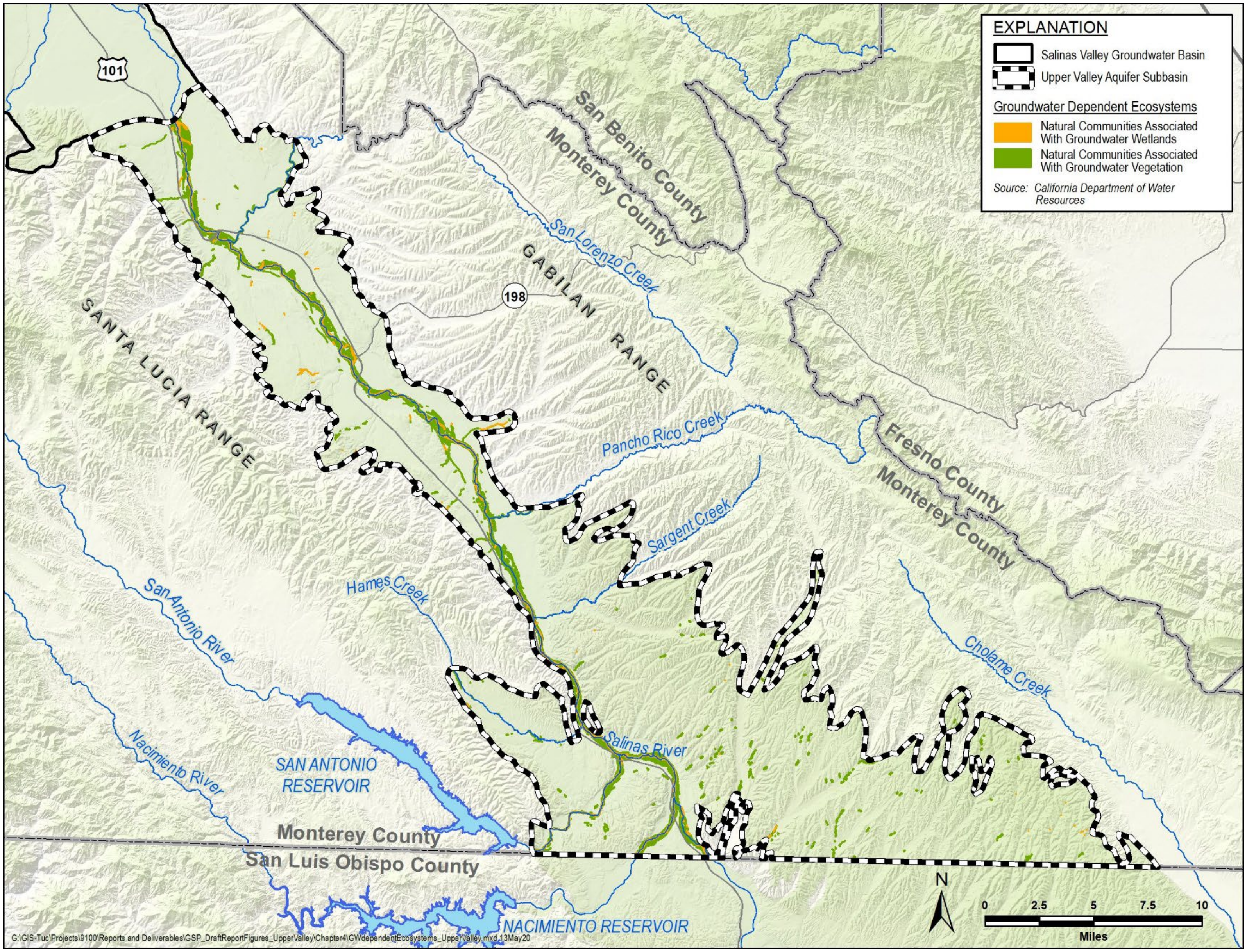


Figure 4-12. Groundwater Dependent Ecosystems

4.5 Surface Water Bodies

The primary surface water bodies in the Subbasin are the Salinas River and its tributaries (Figure 4-13). Significant, named tributaries in the Upper Valley Subbasin include the San Antonio River, the Nacimiento River and the following intermittent streams that drain the Gabilan Range and Santa Lucia Range, and contribute to the Salinas River:

- San Lorenzo Creek
- Pancho Rico Creek
- Sargent Creek
- Hames Creek

Two reservoirs are located outside of the subbasin but are important controls on the rate and timing of Salinas River flows in the subbasin.

- Nacimiento Reservoir, in San Luis Obispo County, was constructed in 1957 and has a storage capacity of 377,900 AF (MCWRA, 2015).
- San Antonio Reservoir, in Monterey County, was constructed in 1967 and has a storage capacity of 335,000 AF (MCWRA, 2015).

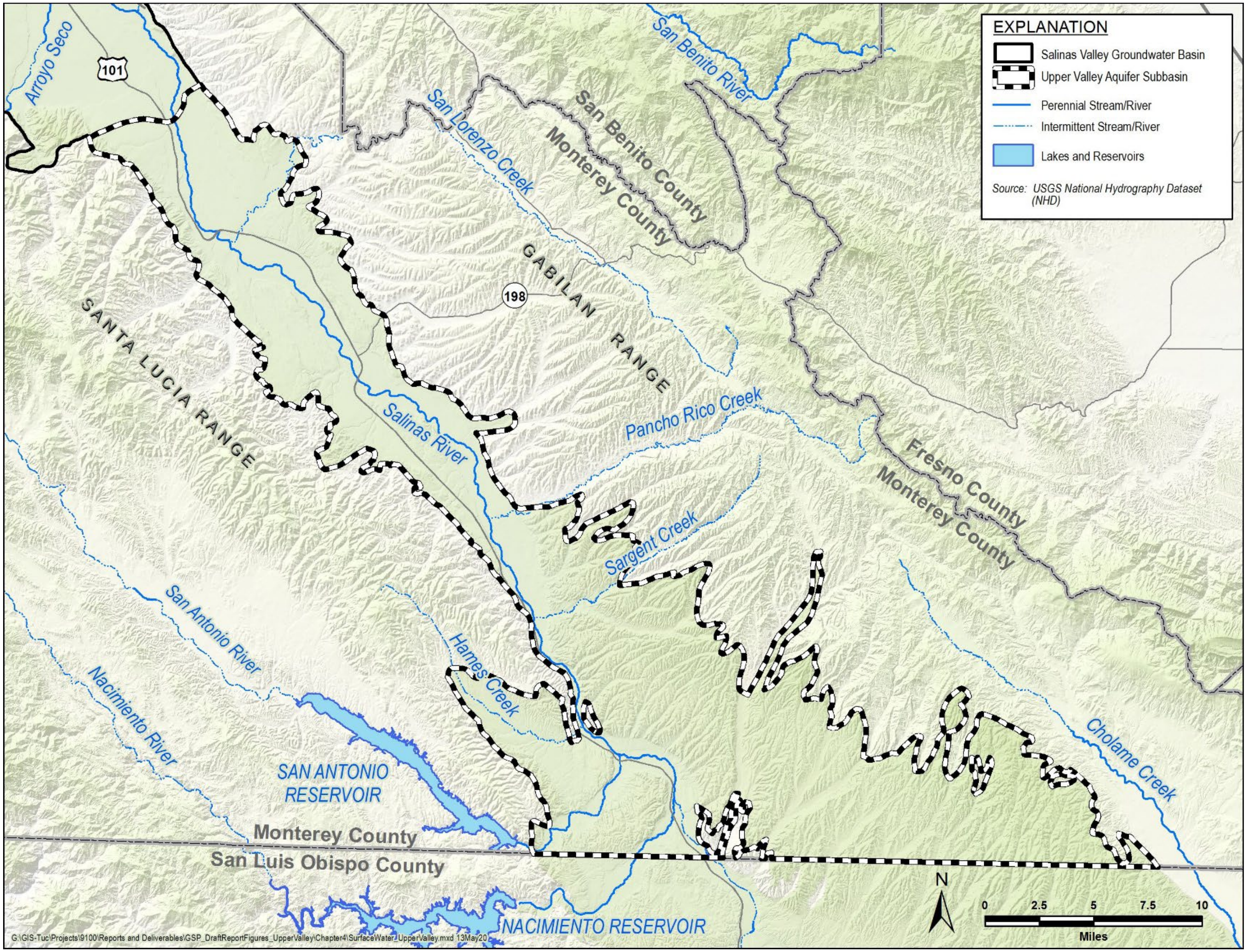


Figure 4-13. Surface Water Bodies in the Upper Valley Aquifer Subbasin

4.5.1 Watersheds

Figure 4-14 show several watersheds that contribute small tributary streams to the Salinas River in the Upper Valley Subbasin. From the boundary with the Paso Robles Area Subbasin to the Forebay Subbasin from the Gabilan to Santa Lucia Range, the HUC12 watersheds within the Upper Valley Subbasin are as follows:

- 180600040205
- Shimmin Canyon
- Pine Creek-Estrella River
- Mason Canyon
- Keyes Canyon-Estrella River
- Hog Canyon
- Town of Estrella-Estrella River
- Ranchito Canyon
- San Jacinto Creek
- Portuguese Canyon-Salinas River
- 180600050611-Nacimiento River
- Kemp Canyon-San Antonio River
- Upper Cholame Creek
- Headwaters Cholame Creek
- Vineyard Canyon
- Lower Big Sandy Creek
- Los Lobos Springs-Salinas River
- Hames Creek
- Upper Big Sandy Creek
- Sheehee Spring
- Sargent Creek
- Lynch Canyon
- Garrissere Canyon-Salinas River
- Pancho Rico Creek
- Pine Creek
- Coyote Canyon-Salinas River
- Espinosa Canyon-Salinas River
- Long Valley
- Wildhorse Canyon
- Hamilton Canyon-Salinas River
- Quinado Canyon
- Pine Canyon
- Sweetwater Canyon
- Lower San Lorenzo Creek
- Monroe Creek-Salinas River
- Agua Grande Canyon-Salinas River

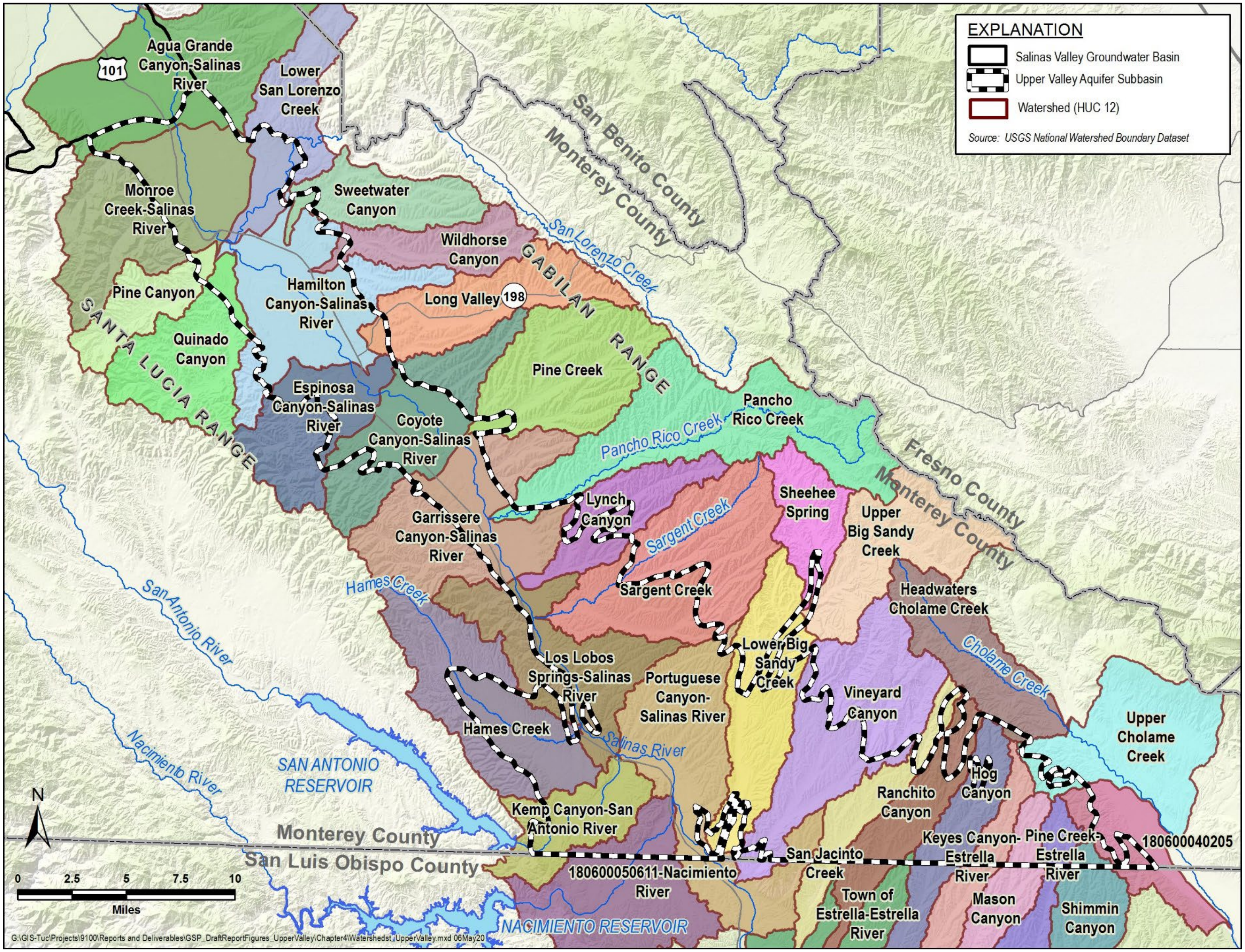


Figure 4-14. HUC12 Watersheds within the Upper Valley Aquifer Subbasin

4.5.2 Imported Water Supplies

There is no water imported into the Upper Valley Subbasin.

4.6 Water Quality

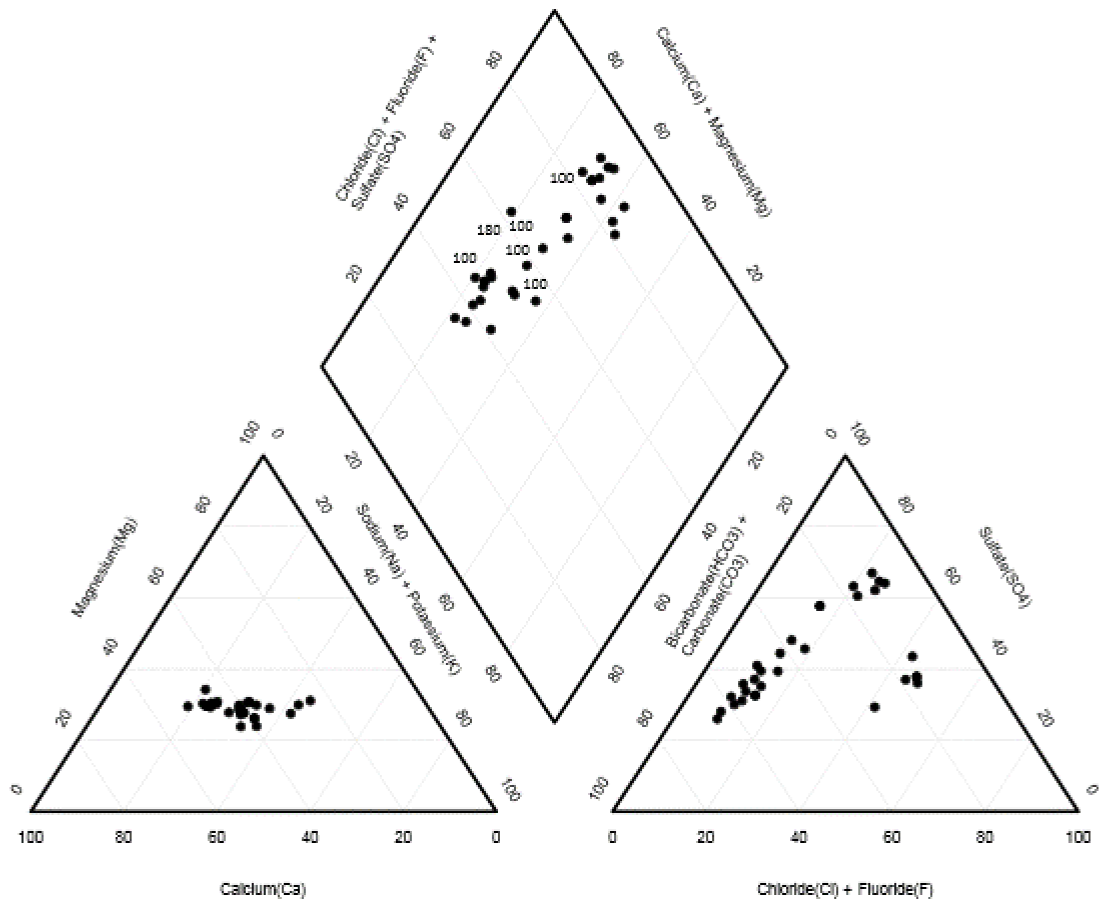
Natural groundwater quality can determine how much treatment may be needed prior to being used for municipal uses, or how the water may impact crop production. This chapter presents a general discussion of the natural groundwater quality in the Subbasin, focusing on general minerals. This discussion is based on data from previous reports. Discussion of the distribution and concentrations of specific constituents of concern (COC) is presented in Chapter 5.

4.6.1 General Mineral Chemistry

The major ion chemistry of the Salinas Valley Groundwater Basin groundwater is summarized on the Distribution of Groundwater Nitrate Concentrations, Salinas Valley, California report, prepared for the Central Coast Groundwater Coalition (CCGC) (HydroFocus, 2014). This report was a response to the CCRWQCB requirement for monitoring elevated nitrate concentrations near drinking water supply wells. The report included the results of extensive groundwater quality sampling and thus provided a good characterization of the Subbasin's general mineral water quality.

General water chemistry provides a baseline of understanding of the water by showing major ions that are dissolved in the groundwater. The major ions that are dissolved can inform users if the water is more alkaline or more acidic. In many areas with more alkaline water, which has more dissolved cations such as calcium, magnesium, and sodium, many users report their water as being 'hard.'

Figure 4-15 presents a Piper diagram from the CCGC report that plots major ion data from within and near the Subbasin. The diagram provides a means of representing the proportions of major anions and cations in water samples. The lower left triangle of the piper diagram plots the relative abundance of cations in groundwater samples. The lower right triangle of the piper diagram plots the relative abundance of anions in groundwater samples. The diamond in the middle of the diagram combines the cation and anion abundances into a single plot. Groundwater samples with similar general mineral chemistries will group together on these diagrams. The data plotted on Figure 4-15 show that the groundwater samples cluster in a similar area.



Note: Well depths indicated when available.

Figure 4-15. Piper Diagram of Upper Valley Aquifer Subbasin Representing Major Anions and Cations in Water Samples
(from CCGC, 2015)

4.6.2 Seawater intrusion

There is no recorded seawater intrusion in the Upper Valley Subbasin. The Subbasin is over 30 miles from the coastline and is not affected by seawater intrusion even though it contains similar aquifer materials as those found in the 180/400-Foot Aquifer Subbasin where seawater intrusion is occurring. Furthermore, the groundwater elevations in the Upper Valley Subbasin remain above sea level, maintaining a groundwater gradient towards the coast.

4.7 Data Gaps and Uncertainty of the HCM

The HCM in the Upper Valley Subbasin includes a few notable data gaps, including:

- Very few measurements of aquifer properties such as hydraulic conductivity and specific yield exist in the Subbasin.
- The hydrostratigraphy, vertical and horizontal extents, and potential recharge areas of the water producing zones are poorly known.
- Lithologic, hydrostratigraphic, and aquifer data for the area included with the updated DWR boundary, as compared to the previous MCWRA boundary. The Subbasin boundaries redefined by DWR has nearly doubled the total acreage of the subbasin, which will intensify the effect of data gaps.

These data gaps have led to some minor uncertainties in how the principal aquifer functions, and the SVBGSA will minimize these uncertainties by filling data gaps. As described in Chapter 7, the GSP will include ongoing data collection and monitoring recommendations that will allow continued refinement and quantification of the groundwater system. Chapter 10 includes activities to address the identified data gaps and improve the HCM.

5 GROUNDWATER CONDITIONS

This chapter describes the historical and current groundwater conditions in the Upper Valley Subbasin in accordance with the GSP Regulations §354.16. In this GSP, current conditions are any conditions occurring after January 1, 2015. Where possible, 2019 was chosen as the representative current year. By implication, historical conditions are any conditions occurring prior to January 1, 2015. The chapter focuses on information required by the GSP Regulations and information that is important for developing an effective plan to and maintain sustainability. This chapter provides a description of current and historical groundwater conditions at a scale and level of detail appropriate for meeting the GSP sustainability requirements under SGMA.

This chapter is organized to align the groundwater conditions descriptions with the 5 sustainability indicators relevant to this Subbasin, including:

1. Chronic lowering of groundwater levels
2. Changes in groundwater storage
3. Groundwater quality
4. Subsidence
5. Depletion of ISW

5.1 Groundwater Elevations

5.1.1 Data Sources

The assessment of groundwater elevation conditions is largely based on data collected by MCWRA from 1944 through the present. MCWRA's monitoring programs are described in Chapter 3, which is only in the Upper Valley Subarea (Figure 5-1).

Groundwater elevation data are analyzed and presented with 3 sets of graphics:

- Maps of groundwater elevation contours show the geographic distribution of groundwater elevations at a specific time. These contours represent the elevation of the groundwater in feet, using the NAVD88 vertical datum. The contour interval is 20 feet, meaning each blue line represents an area where groundwater elevations are either 20 feet higher or 20 feet lower than the next blue line (Figure 5-2 to Figure 5-5). These figures are summarized in Table 5-1. The contours are dashed where groundwater elevation is uncertain.
- Hydrographs of individual wells show the variations in groundwater elevations at individual wells over an extended period (Figure 5-6).

- Vertical hydraulic gradients in a single location assess the potential for vertical groundwater flow direction, as discussed in Section 5.1.4.

5.1.2 Groundwater Elevation Contours and Horizontal Groundwater Gradients

Groundwater elevation data are analyzed and presented with 3 sets of graphics:

- Maps of groundwater elevation contours show the geographic distribution of groundwater elevations at a specific time. These contours represent the elevation of the groundwater in feet, using the NAVD88 vertical datum. The contour interval is 20 feet, meaning each blue line represents an area where groundwater elevations are either 20 feet higher or 20 feet lower than the next blue line (Figure 5-2 to Figure 5-5). These figures are summarized in Table 5-1. The contours are dashed where groundwater elevation is uncertain.
- Hydrographs of individual wells show the variations in groundwater elevations at individual wells over an extended period (Figure 5-6).
- Vertical hydraulic gradients in a single location assess the potential for vertical groundwater flow direction, as discussed in Section 5.1.4.

MCWRA annually produces groundwater elevation contour maps for the Salinas Valley Groundwater Basin using data from their annual fall measurement program that takes place from mid-November to December. MCWRA uses fall groundwater elevations because these measurements are taken after the end of the irrigation season and before seasonal recharge from winter precipitation increases groundwater levels. MCWRA does not produce groundwater elevation contour maps in the spring. The contours only extend up to the MCWRA boundary of the Upper Valley Subarea, which covers the northern half of the Upper Valley Subbasin (Figure 5-1). MCWRA currently does not collect groundwater elevation information in wells located outside their Subarea boundary. Additionally, there are no groundwater elevation data for the southern half of the Upper Valley Subbasin stored in the SGMA Data Viewer webpage or the California Water Data Library webpage.

To fill this spatial data gap, groundwater elevations in the southern half of the Upper Valley Subbasin were interpolated using Paso Robles Area Subbasin data. Groundwater elevation data for the Paso Robles Area Subbasin are collected by the San Luis Obispo County Flood Control and Water Conservation District (SLOFCWCD). SLOFCWCD collects spring measurements in April and fall measurements in October. MCWRA's monthly program April data were combined with the SLOFCWCD groundwater elevation data to produce the spring groundwater elevation contours for the Upper Valley Subbasin, which represent the seasonal high. SLOFCWCD's October data were used to extend MCWRA's fall groundwater elevation contours through the southern half of the Subbasin. The fall measurements are chosen to represent seasonal low conditions in the Subbasin in this GSP.

The following 4 maps present the Current (2019) and Historical (1995) groundwater elevation contours.

Table 5-1. Figures Showing Current and Historical Groundwater Elevation Contours in the Upper Valley Aquifer

Figure #	Year	Season
Figure 5-2	Current (2019)	Spring
Figure 5-3	Current (2019)	Fall
Figure 5-4	Historical (1995)	Spring
Figure 5-5	Historical (1995)	Fall

The groundwater elevation contours do not always extend to the Subbasin margins; nor do they cover the entire Upper Valley Subbasin. This is a data gap that will be addressed during GSP implementation.

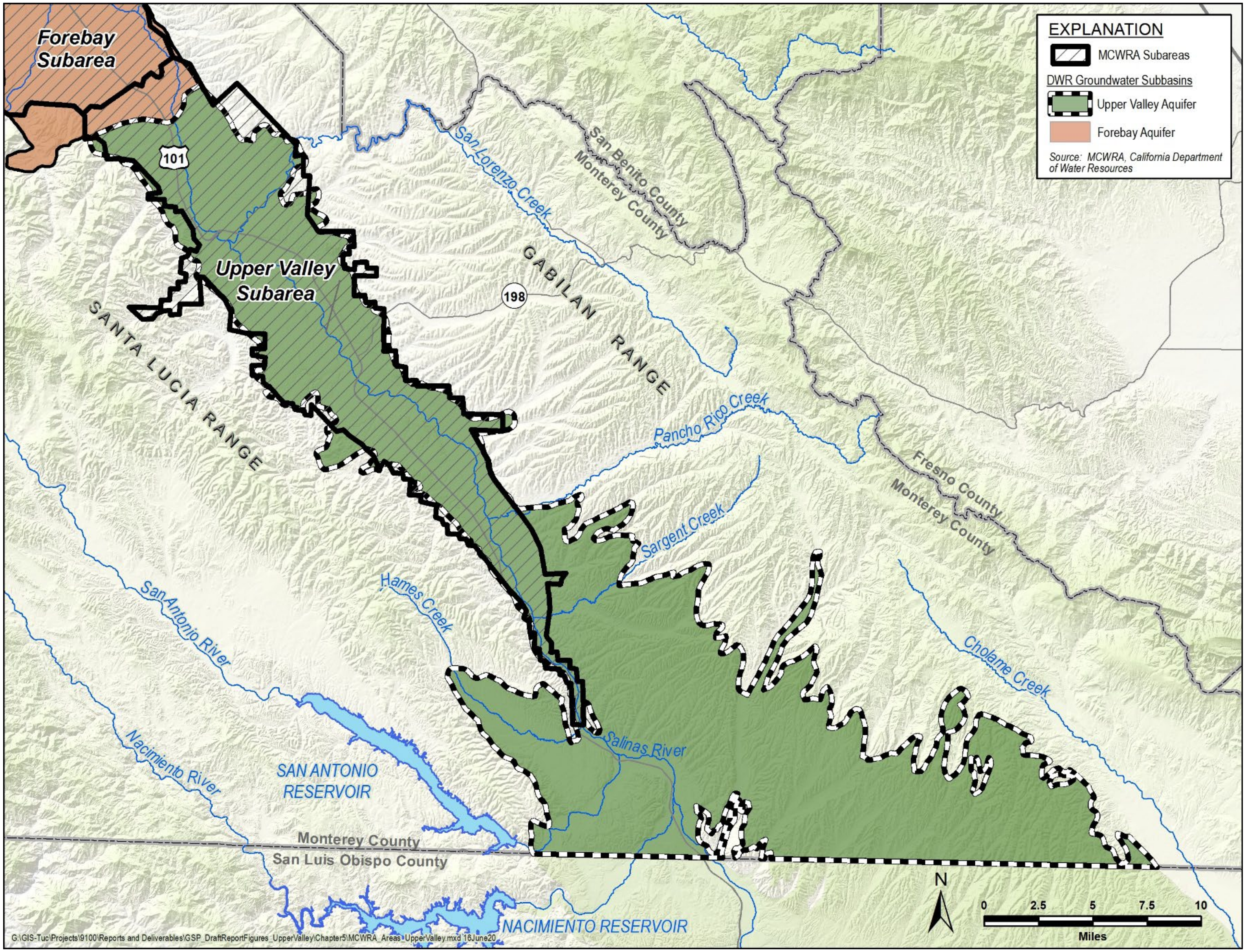


Figure 5-1. MCWRA Management Subareas

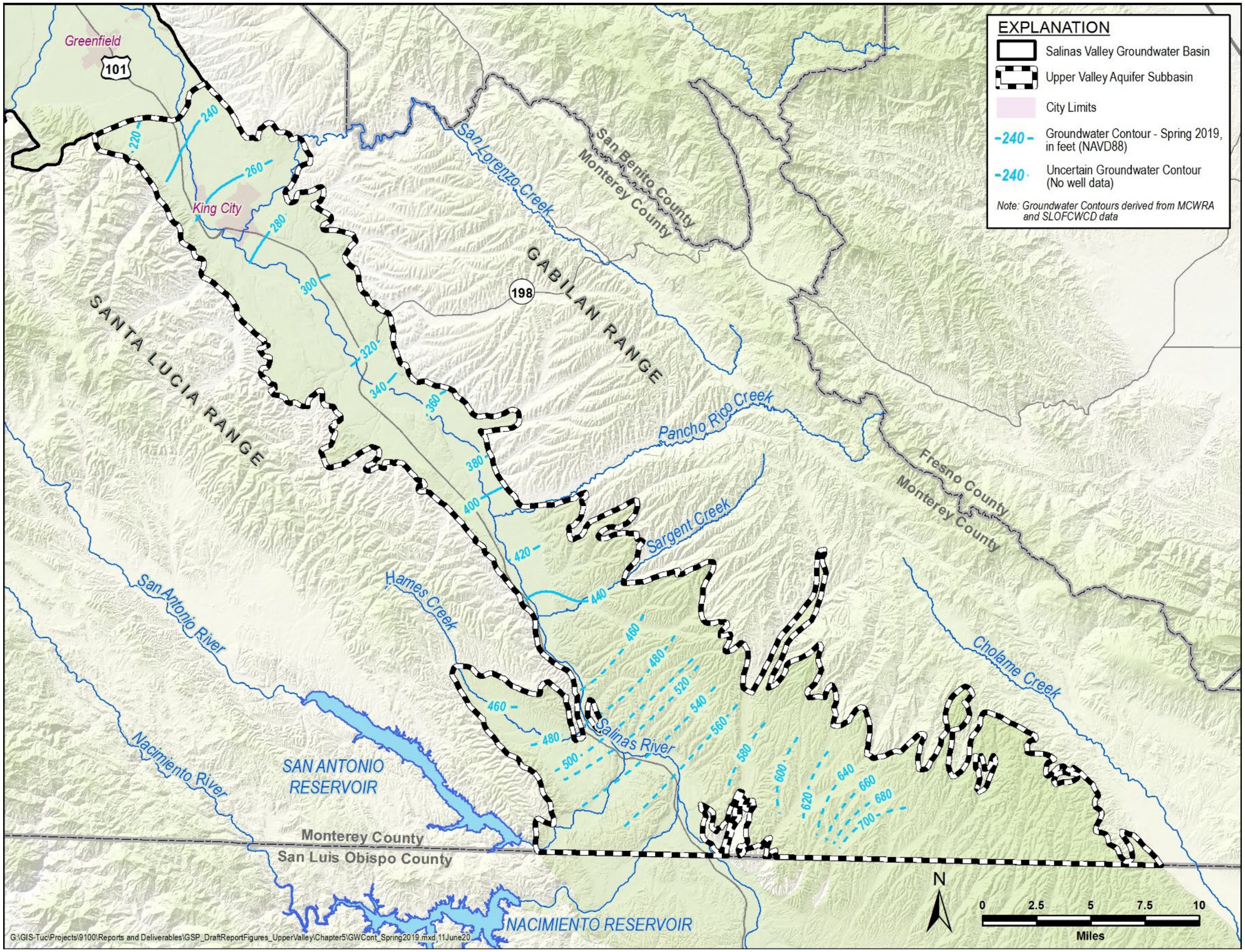


Figure 5-2. Spring 2019 Groundwater Elevation Contours

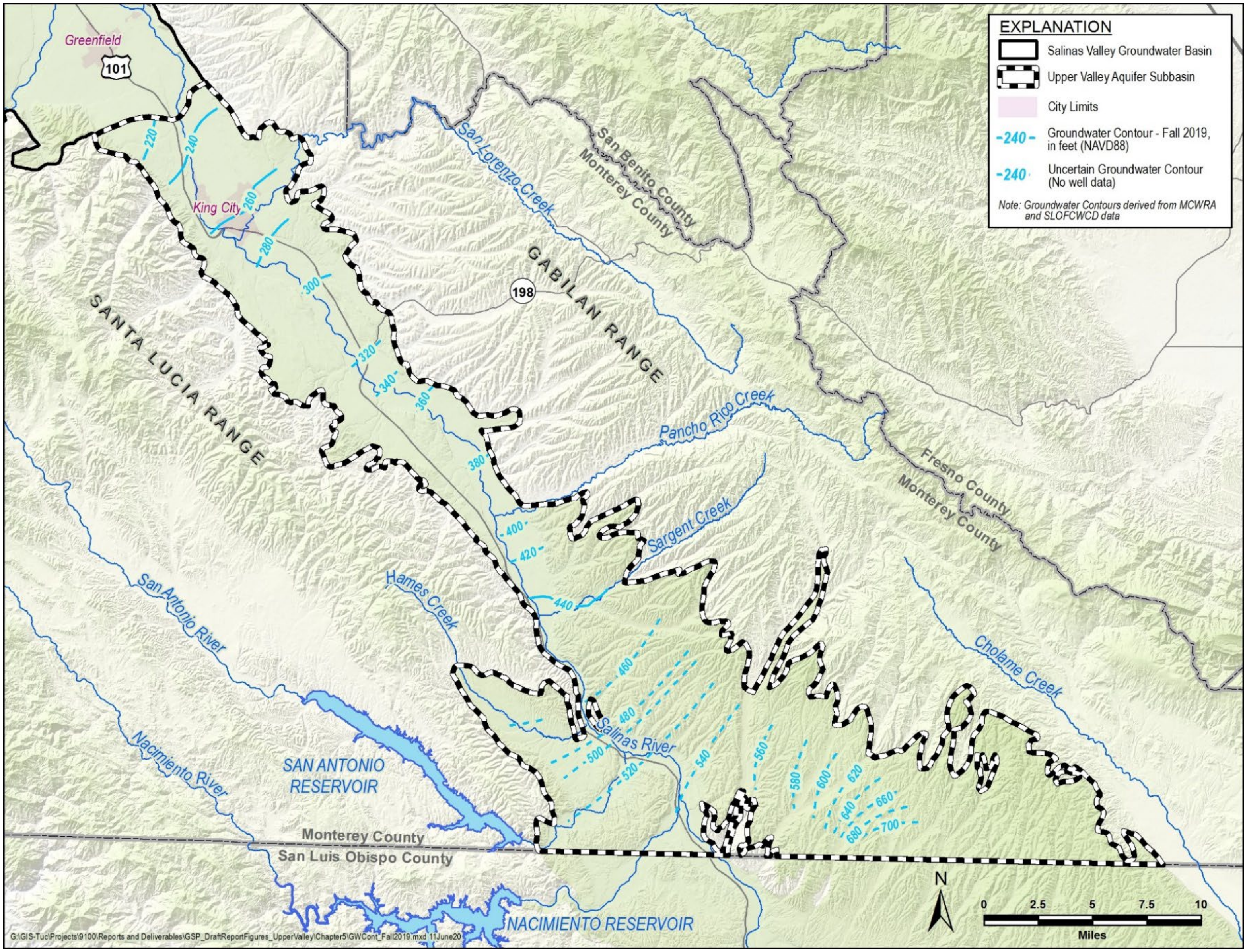


Figure 5-3. Fall 2019 Groundwater Elevation Contours

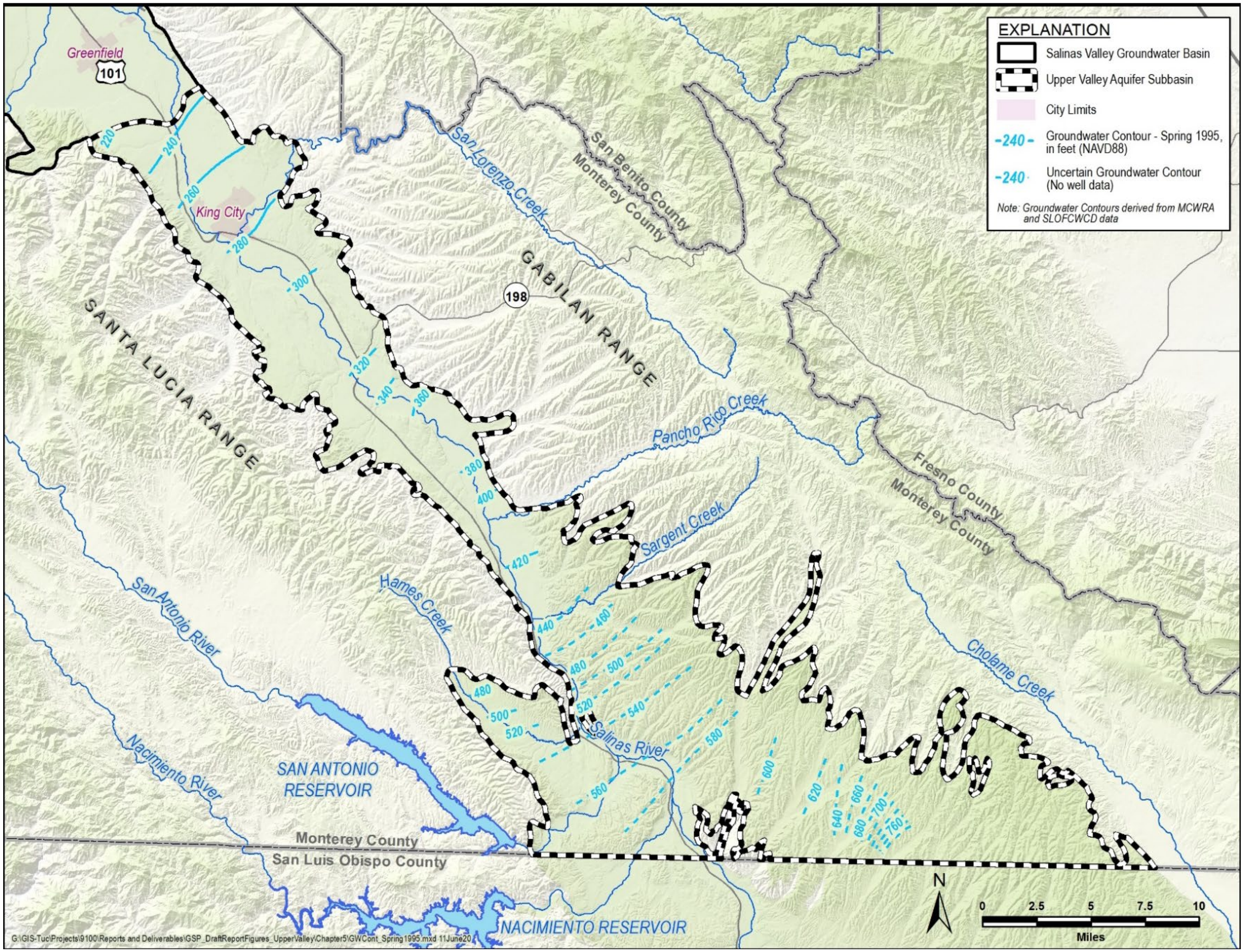


Figure 5-4. Spring 1995 Groundwater Elevation Contours

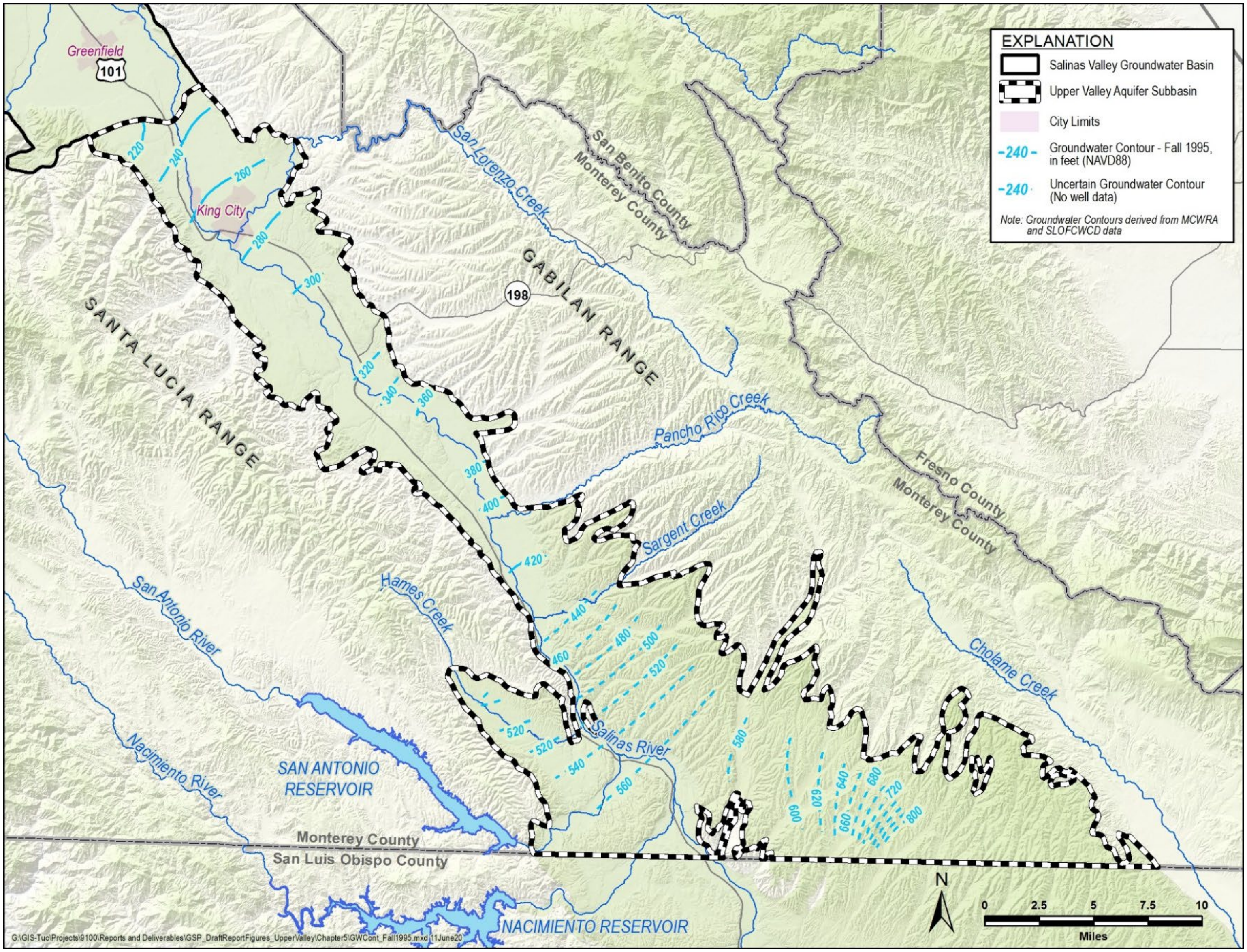


Figure 5-5. Fall 1995 Groundwater Elevation Contours

Groundwater in the Upper Valley Subbasin generally flows parallel to the Subbasin's axis, from south to north-northwest. The lowest groundwater elevations in the Subbasin occur along the boundary with the Forebay Subbasin near King City. The minimum groundwater elevations are approximately 220 feet NAVD88 during both the Spring measurements and the Fall measurements. The hydraulic gradient across the Upper Valley Subbasin is approximately 0.002 ft/ft, or 11 ft/mile in Spring 2019. Groundwater elevations near the southern boundary with the Paso Robles Area Subbasin are greater than 700 feet NAVD88 in both the Spring of 2019 and 1995. Examples of historical groundwater elevation changes at specific wells are presented in Section 5.1.3.

5.1.3 Hydrographs

Representative temporal trends in groundwater elevations can be assessed with hydrographs, which plot changes in groundwater elevations over time. Groundwater elevation data from wells within the Subbasin are available from monitoring conducted and reported by MCWRA.

Figure 5-6 depicts the locations and hydrographs of example monitoring wells in the Subbasin. Larger versions of the hydrographs for these wells, as well as all representative monitoring wells, are included in Appendix 5A. The locations of all the representative monitoring wells are shown on Figure 5-7 Chapter 7 provides more information specific to the wells and the monitoring system.

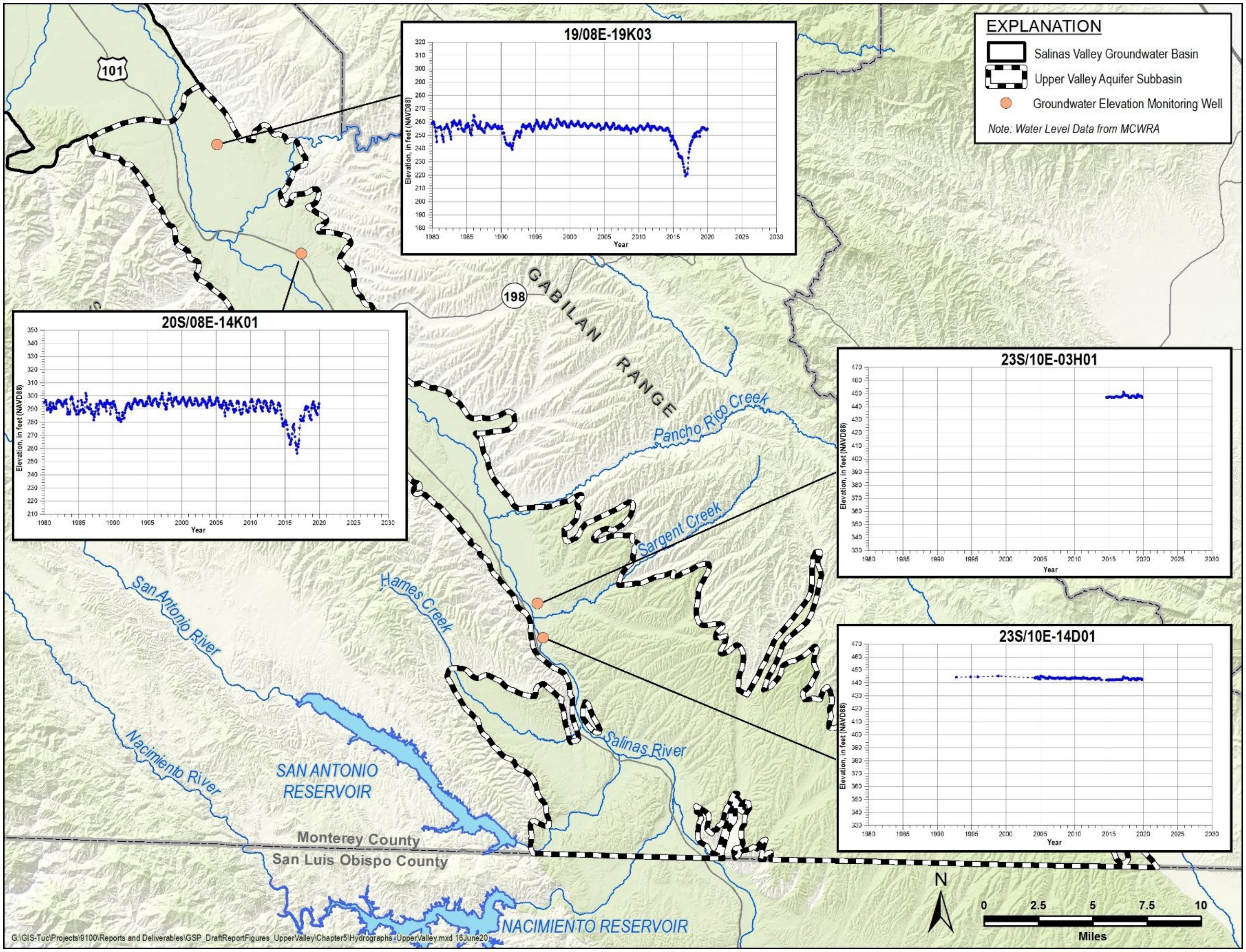


Figure 5-6. Map of Example Hydrographs

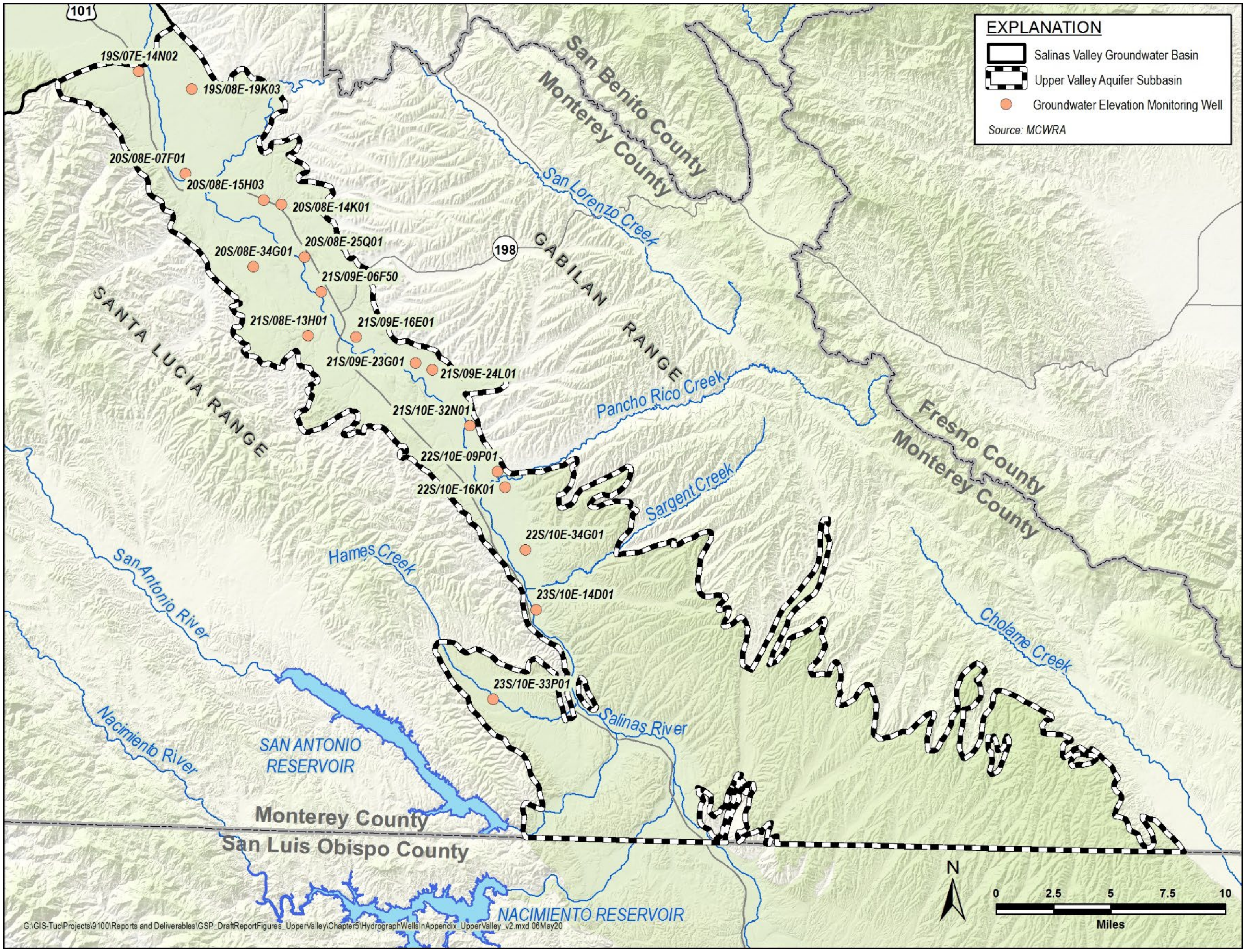


Figure 5-7. Locations of Wells with Hydrographs Included in Appendix 5A

Figure 5-8 presents a graph of cumulative groundwater elevation change for the Upper Valley Subbasin. The Upper Valley Subarea used by MCWRA for its analyses overlaps approximately half of the Upper Valley Subbasin, along with a small portion of the Forebay Subbasin, as shown on Figure 5-1. The graph was initially developed by MCWRA and is based on averaged change in fall groundwater elevations for designated wells in the Upper Valley Subarea each year. The Upper Valley Subarea used by MCWRA for its analyses overlaps approximately half of the Upper Valley Subbasin, along with a small portion of the Forebay Subbasin, as shown on Figure 5-1. The figure was adapted to reflect the cumulative change in groundwater elevations specific to the Upper Valley Subbasin.

Fall measurements occur at the end of the irrigation season and before groundwater levels increase due to seasonal recharge by winter rains. These measurements record annual changes in storage reflective of groundwater recharge and withdrawals in the Subbasin. The cumulative groundwater elevation change plot is therefore an estimated average hydrograph for wells in the Subbasin. Although this plot does not reflect the groundwater elevation change at any specific location, it provides a general illustration of how the average groundwater elevation in the Subbasin changes in response to climatic cycles, groundwater extraction, and water resources management at the subbasin scale.

The cumulative elevation change estimates and the specific hydrographs presented in the appendix show that groundwater elevations in the Upper Valley Subbasin are generally steady with several discrete declines during dry periods that rebound following the dry periods.

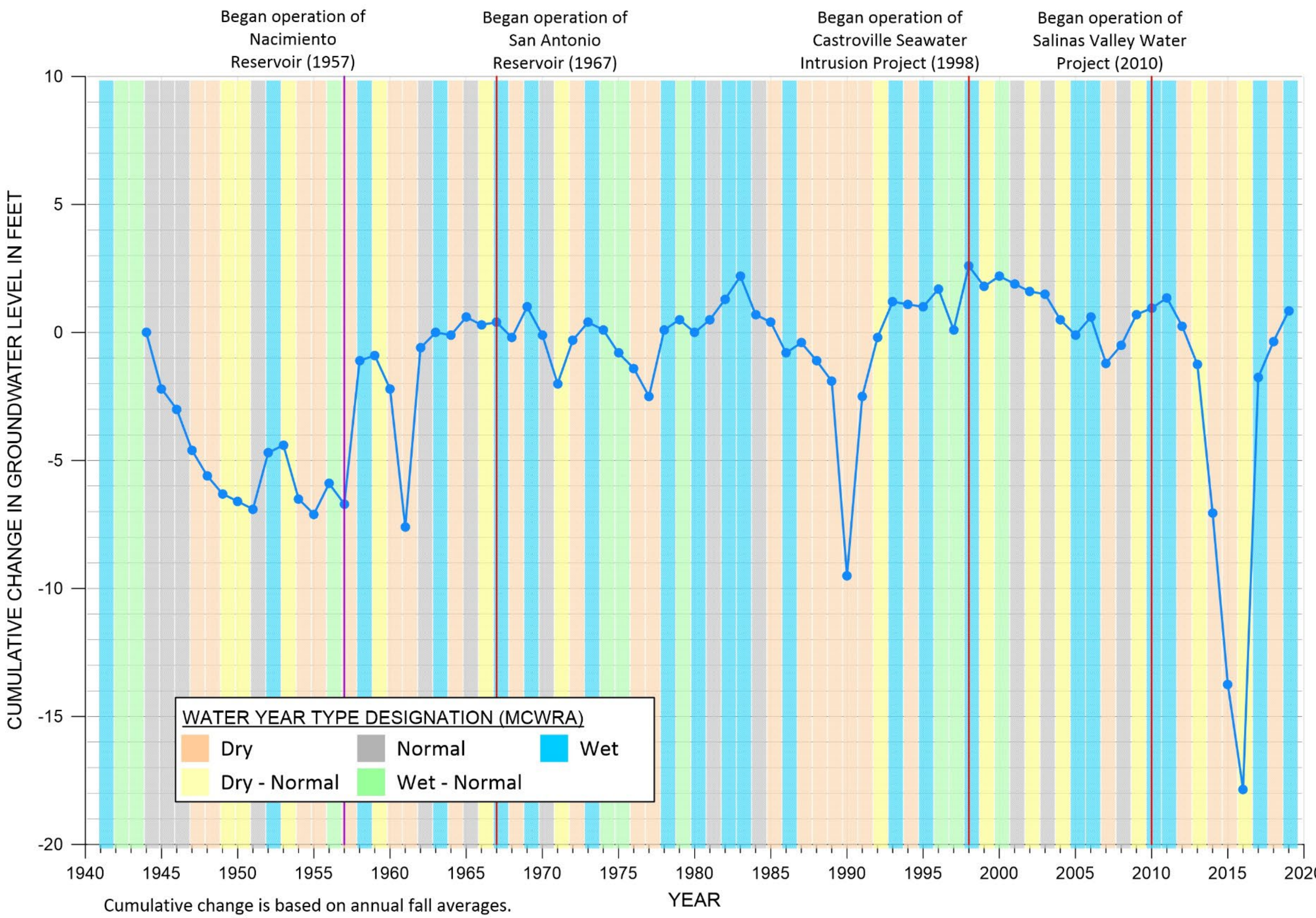


Figure 5-8. Cumulative Groundwater Elevation Change Graph for the Upper Valley Subbasin
(Adapted from MCWRA, 2018a, personal communication)

5.1.4 Vertical Groundwater Gradients

The Upper Valley Subbasin is considered to be a single, unconfined aquifer. As mentioned in Chapter 4, there has been limited detailed hydrostratigraphic analysis in this Subbasin; thus, the level of interconnection among fine sediments is not well defined. Although no extensive aquitard has been mapped in the Subbasin, vertical gradients could still exist due to the cumulative confinement from numerous, small clay lenses. The potential presence of vertical groundwater gradients was investigated by comparing groundwater level measurements from pairs of shallow wells and deep wells located closely together. Figure 5-9 shows groundwater elevations at 2 well pairs in the Subbasin. Both well pairs have noticeably similar trends in groundwater elevations at the 2 depths, suggesting that there is very little vertical groundwater gradient.

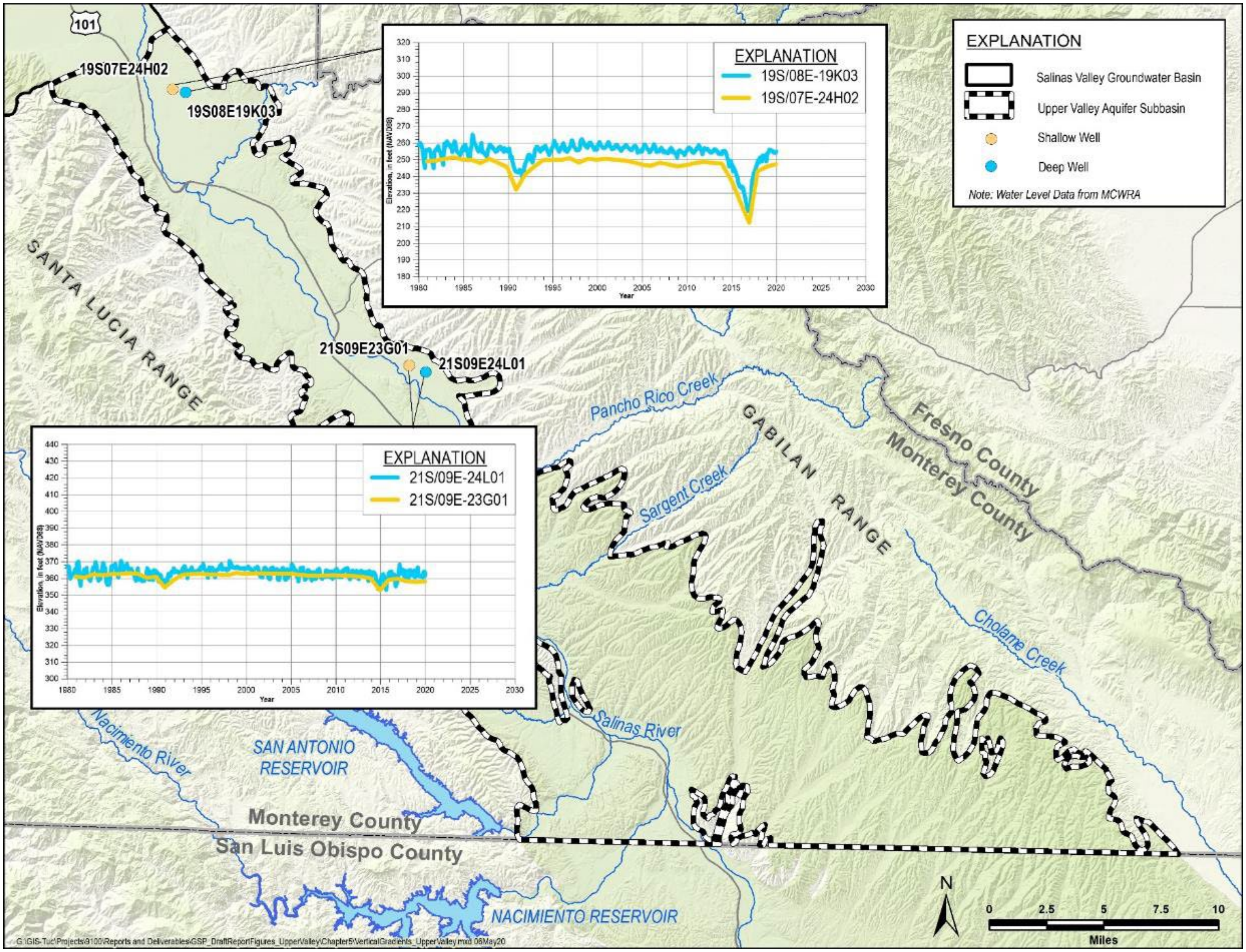


Figure 5-9. Vertical Gradients

5.2 Change in Groundwater Storage

5.2.1 Data Sources

Change in storage is developed based on MCWRA's fall groundwater elevation measurements. This includes historical groundwater elevations used to develop the cumulative change in groundwater elevation graph (Figure 5-8) that is used to estimate the cumulative change in groundwater storage over time. Groundwater elevation measurements are also used to create fall groundwater elevation contour maps; MCWRA's fall 1995 and fall 2019 contour maps are used to determine the spatial distribution of storage change. MCWRA's contour maps were adapted to extend throughout the entire Subbasin using monthly October data measured by SLOFCWCD in the Paso Robles Subarea Subbasin. Fall groundwater elevation contour maps were used rather than spring contour maps to retain consistency with the cumulative change in the groundwater elevation graph.

5.2.2 Change in Groundwater Storage Due to Groundwater Elevation Changes

Change in groundwater storage is derived from change in groundwater elevations in the Subbasin in 2 ways: 1) using the cumulative subbasin-wide average change in groundwater elevations and 2) subtracting the 1995 from the and fall 2019 groundwater elevation maps. Both approaches rely on observed groundwater elevation changes that provide a measure of the gain and loss of groundwater in storage each year. The change in storage is calculated by multiplying a change in groundwater elevation by a storage coefficient. Storage coefficients depend on the hydraulic properties of the aquifer materials and are commonly measured through long-term pumping tests or laboratory tests. The storage coefficient for the Upper Valley Subbasin was estimated at 0.10 based on the State of the Basin Report (Brown and Caldwell, 2015). The area of the Upper Valley Subbasin is approximately 237,800 acres.

Both approaches for calculating the change in storage using groundwater elevation changes are based on the following relationship

$$\Delta S = \Delta WL \times A \times SC$$

Where: ΔS = Annual change in storage volume in the Subbasin (AF/yr.)

ΔWL= Annual change in average groundwater elevation in the Subbasin (ft/yr.)

A = Land area of Subbasin (acres)

SC = Storage coefficient (ft^3/ft^3)

Figure 5-10 shows an estimated cumulative change in groundwater storage in the part of the Upper Valley Subbasin that overlaps with MCWRA's Upper Valley Subarea (Figure 5-1). This graph is based on MCWRA's cumulative change in fall groundwater elevation data (Figure 5-8). The magnitudes of the groundwater storage changes are calculated by multiplying the annual groundwater elevation change by the storage coefficient and size of the Subbasin. Figure 5-10 also shows that groundwater storage in Upper Valley Subarea has remained steady, with the exception of several decreases associated with declines in groundwater elevations due to extended dry periods. The Subarea experienced an overall gain in average annual storage of approximately 266 AF/yr. between 1944 and 2019. Groundwater elevations have fluctuated over this time period, but the change in storage calculation is a reflection of groundwater elevations in the start and end years. Although calculation of change in storage based on these years results in a positive number, the cumulative change in storage line on Figure 5-10 shows there has been little change. Figure 5-10 also shows the annual change in storage and annual groundwater extractions. This gain is consistent with what is presented on Figure 5-11 that shows the northern half of the Subbasin that overlaps with the Subarea generally experiences a gain in storage.

Figure 5-11 shows the estimated change in groundwater storage calculated by subtracting the Fall 2019 and Fall 1995 groundwater elevation maps (Figure 5-3 and Figure 5-5, respectively). The change in groundwater storage map shows calculated change in storage for an area of approximately 121,600 acres rather than the total Subbasin area because that is the approximate area of the Subbasin that is contoured. The greatest loss in groundwater storage occurs south of Sargent Creek where there was a loss of storage of -1 to 5 AF per acre over an area of approximately 67,000 acres. Groundwater storage in the northern half of the Subbasin generally increased slightly during this period (Figure 5-11).

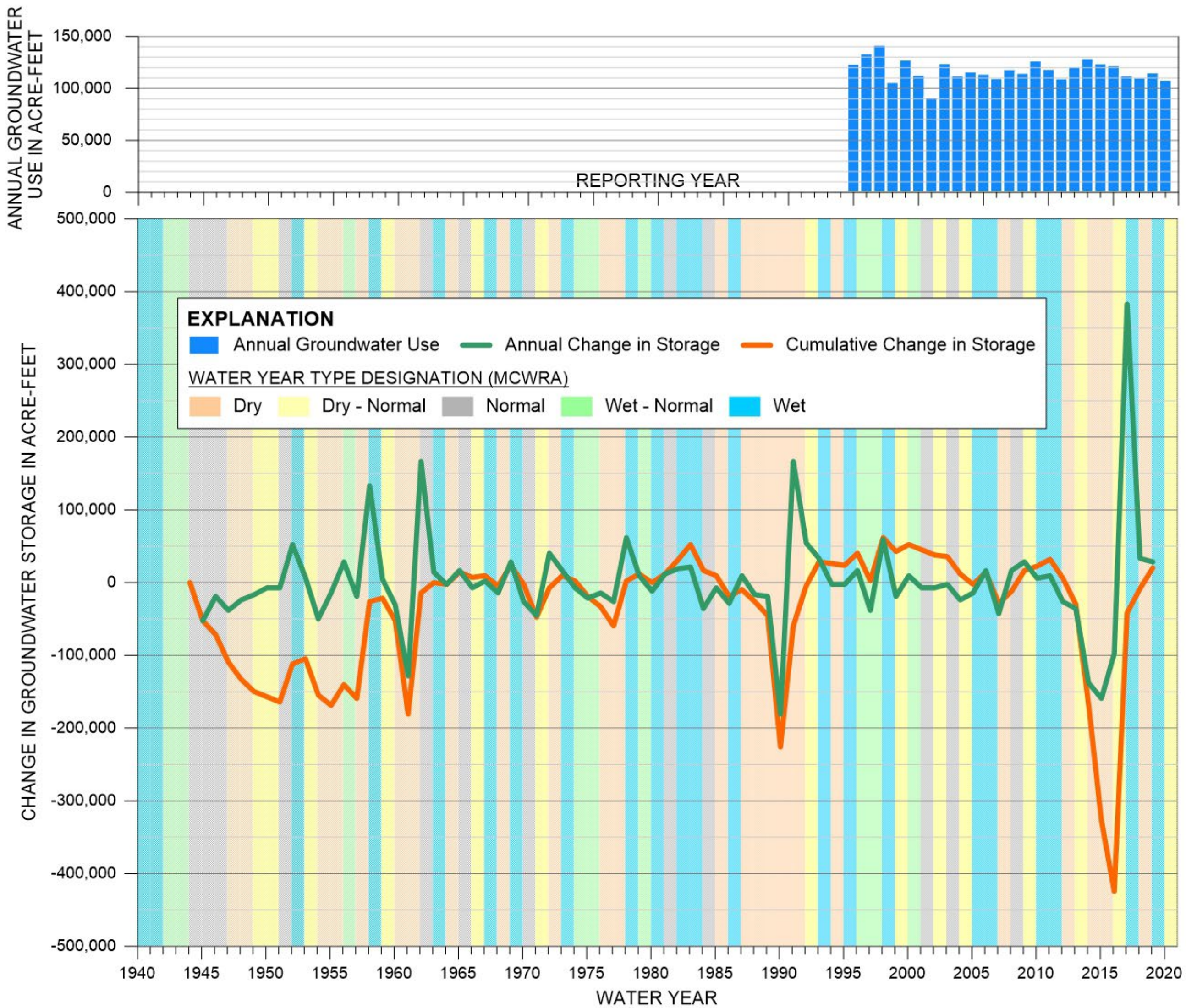


Figure 5-10. Cumulative Change in Groundwater Storage in the Upper Valley Subbasin, Based on Groundwater Elevations (Adapted from MCWRA, 2018a, personal communication)

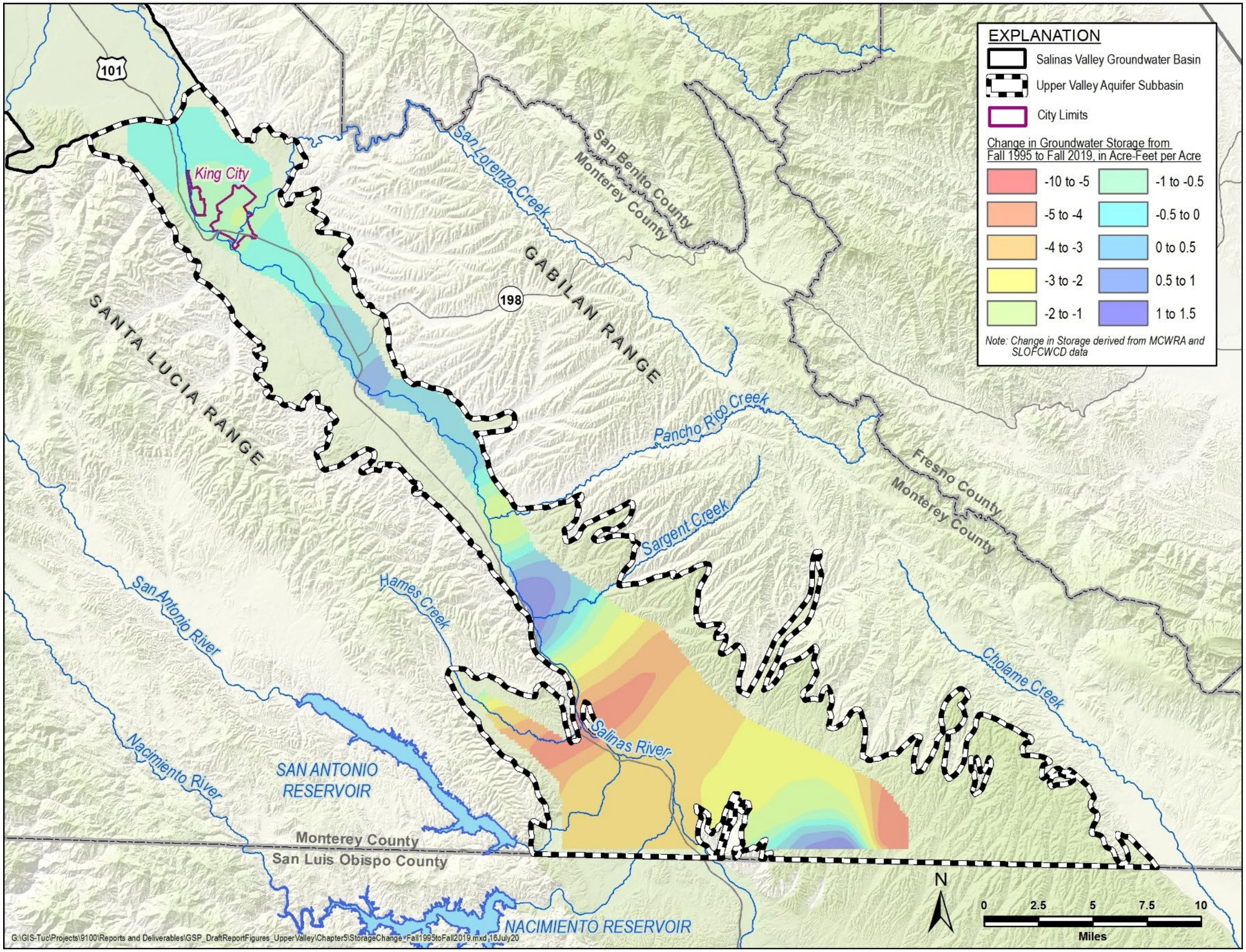


Figure 5-11. Change in Groundwater Storage from Fall 1995 to Fall 2019

5.3 Groundwater Quality Distribution and Trends

The SVBGSA does not have sole regulatory authority over groundwater quality and is not charged with improving groundwater quality in the Salinas Valley Groundwater Basin. Projects and actions implemented by the SVBGSA are not required to improve groundwater quality; however, they must not further degrade it.

5.3.1 Data Sources

Groundwater quality samples have been collected and analyzed in the Subbasin for various studies and programs. Groundwater quality samples have also been collected on a regular basis for compliance with regulatory programs. Groundwater quality data for this GSP were collected from:

- The Northern Counties Groundwater Characterization report (CCGC, 2015)
- The USGS Groundwater Ambient Monitoring and Assessment Program (GAMA) reports (Kulongoski and Belitz, 2005; Burton and Wright, 2018)
- SWRCB's GeoTracker Data Management System (DMS) (SWRCB, 2020a)
- SWRCB's GAMA Groundwater Information System (SWRCB, 2020b)
- DTSC's EnviroStor DMS (DTSC, 2020)

5.3.2 Point Sources of Groundwater Contaminants

Clean-up and monitoring of point source pollutants may be under the responsibility of either the CCRWQCB or the DTSC. The locations of these clean-up sites are visible in SWRCB's GeoTracker database map, publicly available at: https://geotracker.waterboards.ca.gov/. The GeoTracker database is linked to the DTSC's EnviroStor DMS that is used to track clean-up, permitting, and investigation efforts.

Table 5-2 and Figure 5-12 provide a summary and map of the active clean-up sites within the Subbasin. They do not include sites that have leaking underground storage tanks, which are not overseen by DTSC or the CCRWQCB.

Table 5-2. Active Cleanup Sites

Label	Site Name	Site Type	Status	Constituents of Concern (COCs)	Address	City
1	Chalone Peaks Middle School	School	Certified / Operation & Maintenance	arsenic, naturally occurring asbestos, organochlorine pesticides	667 Meyer Avenue	King City
2	Sabec Inc. (Vt Petroleum)	Cleanup Program Site	Open - Remediation	gasoline	412 Metz Rd.	King City
3	Toro Petroleum	Cleanup Program Site	Open - Remediation	diesel, gasoline	448 Metz Rd.	King City
4	Camp Roberts - Robert Yard	Military Cleanup Site	Open - Site Assessment	none specified	789 Dixie	Bradley

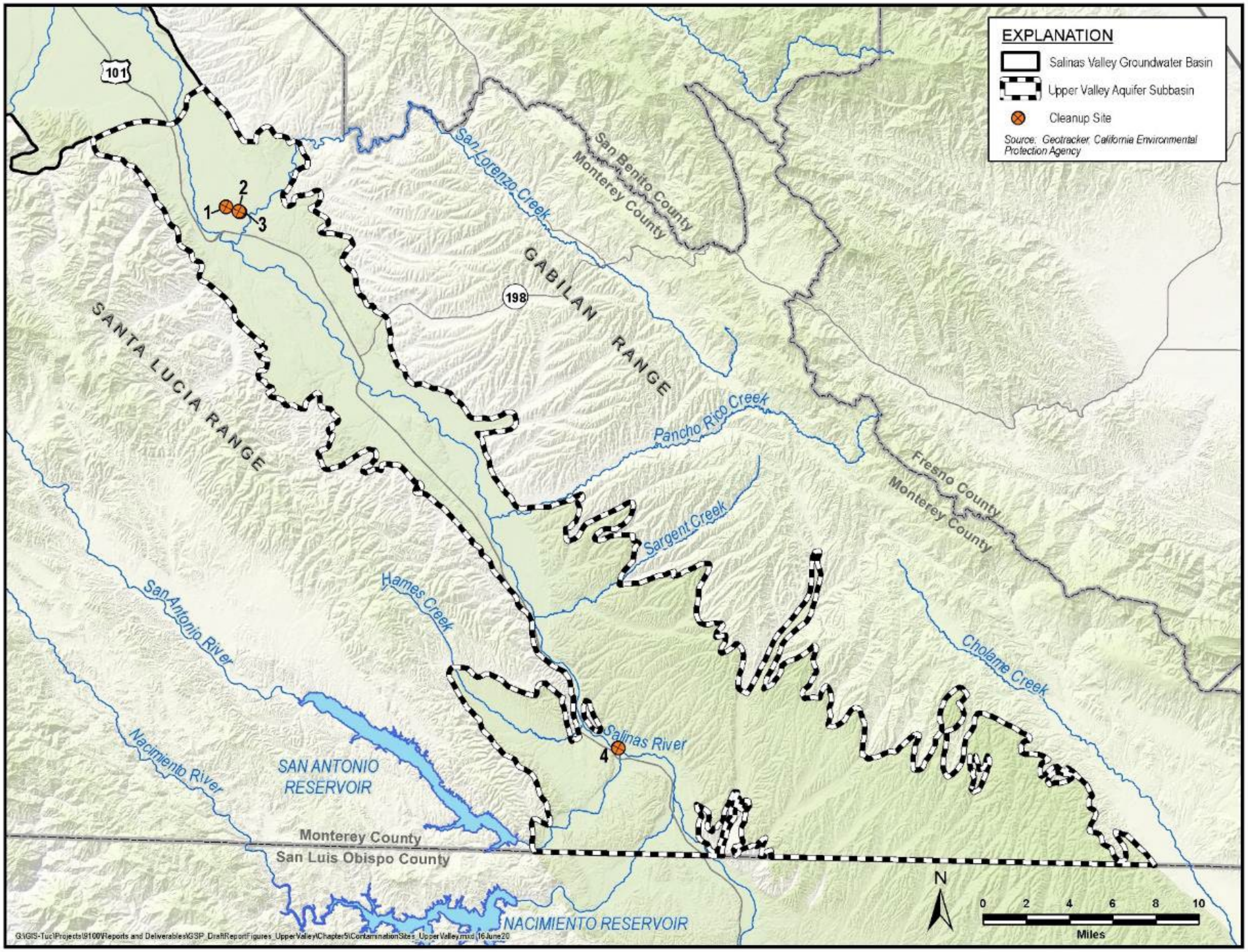


Figure 5-12. Active Cleanup Sites

5.3.3 Distribution and Concentrations of Diffuse or Natural Groundwater Constituents

In addition to the point sources described above, the CCRWQCB monitors and regulates activities and discharges that can contribute to non-point pollutants that are released to groundwater over large areas. In the Subbasin, the most prevalent non-point water quality concern is nitrate. The current distribution of nitrate was extensively monitored and evaluated by the CCGC and documented in a report submitted to the CCRWQCB (CCGC, 2015).

Figure 5-13 shows a map of nitrate distribution in the northern part of the Subbasin prepared by CCGC. The orange and red areas around King City and along the eastern boundary of the Subbasin illustrate where groundwater has nitrate concentrations above the drinking water MCL of 45 mg/L NO_3.

Figure 5-14 shows maps of measured nitrate concentration from 6 decades of monitoring for the entire Salinas Valley Groundwater Basin. These maps, prepared by MCWRA, indicate that elevated nitrate concentrations in groundwater were locally present through the 1960s, but significantly increased in 1970s and 1980s. Nitrate concentrations above the drinking water MCL have been present for 20 to 30 years, as shown on Figure 5-13.

A May 2018 staff report to the CCRWQCB included a summary of nitrate concentrations throughout the Central Coast Region, including the Salinas Valley Groundwater Basin. This staff report includes data from 2008 to 2018 collected at 2,235 wells in the Salinas Valley Groundwater Basin, during Agricultural Orders 2.0 and 3.0 sampling events. The report states that 51% of on-farm domestic wells in the Upper Valley Subbasin exceeded the drinking water MCL with a mean concentration of 87.2 mg/L NO_3. In addition, 45% of irrigation supply wells in the Subbasin exceeded this MCL with a mean concentration of 69.9 mg/L NO_3 (CCRWQCB, 2018).

Some COC can be concentrated at various aquifer depths. Nitrate is a surficial constituent derived from such sources as fertilizer, livestock, and septic systems. Because the sources are all near the surface, nitrate is usually highest near ground surface, and decreases with depth. Raising groundwater levels may mobilize additional nitrate. By contrast, arsenic concentrations usually increase with depth, and lowering groundwater levels may mobilize additional arsenic. The distribution and concentrations of constituents of concern can be further complicated by location and rate of groundwater pumping. The extent to which pumping affects groundwater quality depends on aquifer properties, distance to contamination, constituent characteristics and transport rate, and the time at which contaminants entered the subsurface. These general relationships have not been analyzed in this Subbasin.

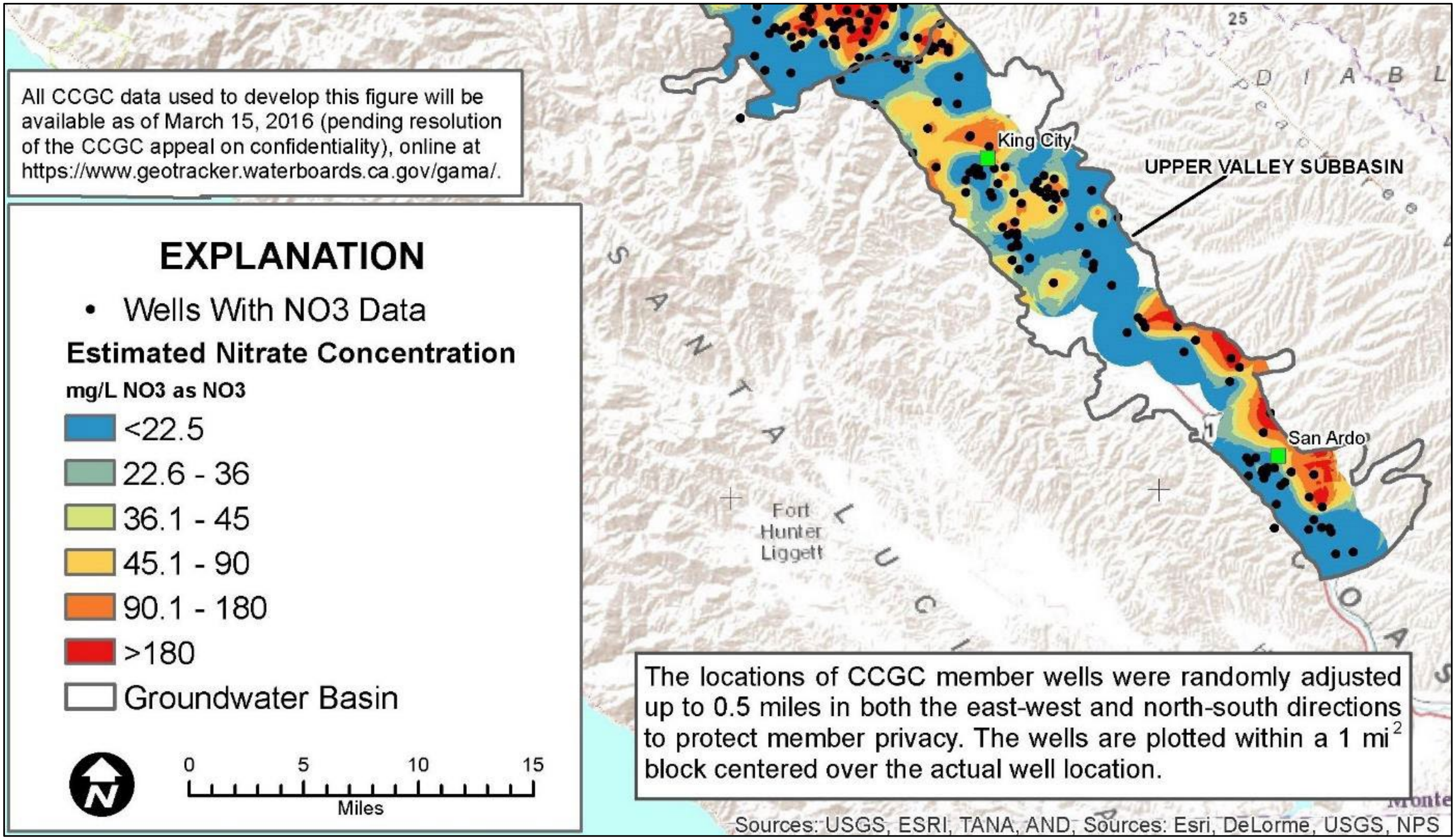


Figure 5-13. Estimated Nitrate Concentrations
(from CCGC, 2015)

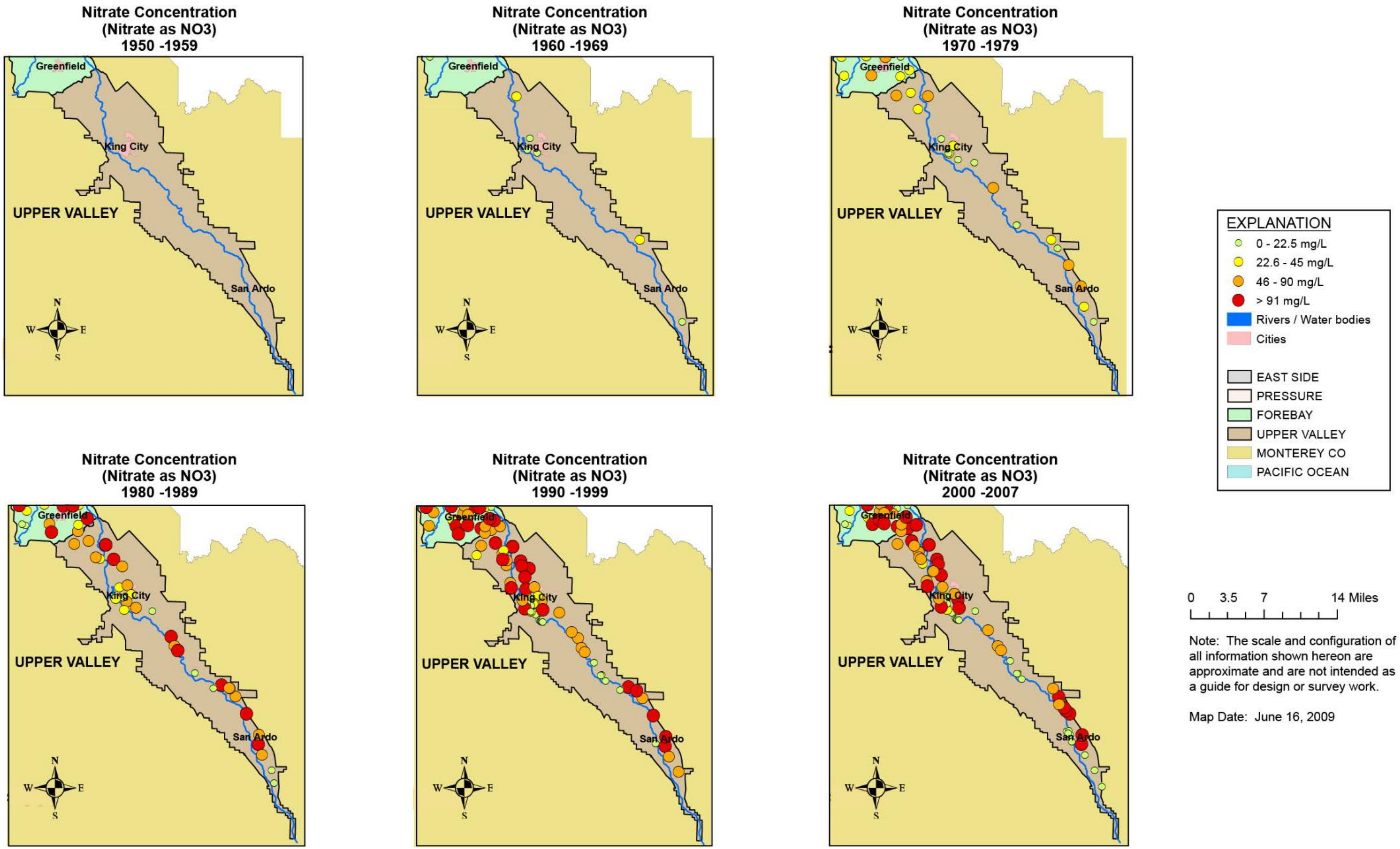


Figure 5-14. Nitrate Concentrations, 1950 to 2007
(modified from MCWRA data)

Additional groundwater quality conditions in the Basin are summarized in 2 USGS water quality studies in the Salinas Valley. The USGS 2005 GAMA study characterized deeper groundwater resources used for public water supply (Kulongoski and Belitz, 2005). The USGS 2018 GAMA study focused on domestic well water quality (Burton and Wright, 2018). The source data used in these 2 studies and additional publicly available water quality data can be accessed through the SWRCB GAMA Groundwater Information System database at https://gamagroundwater.waterboards.ca.gov/gama/datadownload.

The GAMA Groundwater Information System database includes groundwater quality data for public water system supply wells from the SWRCB DDW, and on-farm domestic wells and irrigation supply wells from CCRWQCB's ILRP. This GSP relies on established thresholds for COC: MCLs and SMCLs established by the State's Title 22 drinking water standards for public water system supply wells and on-farm domestic wells, and COC levels that may lead to reduced crop production for irrigation supply wells, as outlined in the CCRWQCB's Basin Plan (CCRWQCB, 2019).

Table 5-3 reports the constituents of concern in the Upper Valley Subbasin based on GAMA Groundwater Information System data up to 2019. The number of wells that exceed the regulatory standard for any given COC is based on the latest sample for each well in the monitoring network. Not all wells have been sampled for all COC. Therefore, the percentage of wells with exceedances is the number of wells that exceed the regulatory standard divided by the total number of wells that have ever been sampled for that COC. Additionally, Table 5-3 does not report all of the constituents that are monitored under Title 22 or the Basin Plan, it only includes the constituents that exceed a regulatory standard. The total list of constituents sampled in the water quality monitoring network are listed in Table 8-5. Maps with the locations of wells that exceeded the regulatory standard for any of the COC listed in Table 5-3 from 2013 to 2019 are provided in Appendix 5B.

Table 5-3. Water Quality Constituents of Concern and Exceedances

Constituent of Concern	Regulatory Exceedance Standard	Standard Units	Number of Wells Sampled for COC	Number of Wells Exceeding Regulatory Standard from latest sample	Percentage of Wells with Exceedances
DDW Wells (Data from February 1981 to December 2019)					
1,2,3-Trichloropropane	0.005	UG/L	37	4	11%
Boron	1	MG/L	18	2	11%
Lindane	0.2	UG/L	24	2	8%
Benzo(a)Pyrene	0.2	MG/L	22	1	5%
Cadmium	5	UG/L	39	1	3%
Dinoseb	7	UG/L	29	1	3%
Iron	300	UG/L	40	8	20%
Hexachlorobenzene	1	UG/L	20	1	5%
Manganese	50	UG/L	39	6	15%
Nitrate (as nitrogen)	10	MG/L	44	8	18%
Specific Conductance	1600	UMHOS/CM	40	5	13%
Sulfate	500	MG/L	40	4	10%
Total Dissolved Solids	1000	MG/L	37	7	19%
Vinyl Chloride	0.5	UG/L	44	1	2%
ILRP On-Farm Domestic Wells (Data from September 2012 to December 2019)					
Chloride	500	MG/L	74	7	9%
Nitrate (as nitrogen)	10	MG/L	72	40	56%
Nitrate + Nitrite (sum as nitrogen)	10	MG/L	28	11	39%
Specific Conductance	1600	UMHOS/CM	72	42	58%
Sulfate	500	MG/L	74	26	35%
Total Dissolved Solids	1000	MG/L	74	37	50%
ILRP Irrigation Supply Wells (Data from September 2012 to December 2019)					
Chloride	350	MG/L	133	13	10%

5.3.4 Groundwater Quality Summary

Based on the water quality information for the DDW and ILRP wells from GAMA Groundwater Information System, the following are the COC for drinking water supply wells in the Subbasin and will be included in the GSP monitoring program:

- 1,2,3-trichloropropane
- benzo(a)pyrene
- boron
- cadmium

- chloride
- dinoseb
- hexachlorobenzene
- iron
- lindane
- manganese
- nitrate (as nitrogen)
- nitrate + nitrite (sum as nitrogen)
- specific conductance
- sulfate
- total dissolved solids
- vinyl chloride

The only COC in the Subbasin for irrigation wells is chloride, which can cause reductions in crop production when the concentration exceeds the agricultural water quality objectives.

The COC for active cleanup sites listed in Table 5-2 are not part of the monitoring network described in Chapter 7. However, the status of these constituents at these sites will continue to be monitored by DTSC or CCRWQCB. Furthermore, the COC for these sites that have a regulatory standard under Title 22 for drinking water wells, or the Basin Plan for irrigation supply wells will be monitored in the DDW and ILRP wells that are part of the monitoring network.

This GSP relies on data from existing monitoring programs to measure changes in groundwater quality. Therefore, the GSA is dependent on the monitoring density and frequency of the DDW and ILRP. The monitoring system is further defined in Chapter 7.

5.4 Subsidence

Land subsidence is the lowering of the ground surface elevation. This is often caused by pumping below thick clay layers. Land subsidence can be elastic or inelastic. Elastic subsidence consists of small, lowering and rising of the ground surface that is reversible, while inelastic subsidence is generally irreversible and is the focus of this GSP.

5.4.1 Data Sources

DWR has made Interferometric Synthetic Aperture Radar (InSAR) satellite data available on their SGMA Data Viewer web map to estimate subsidence that is accessible on https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#landsub. These are the only data used for estimating subsidence in this GSP.

5.4.2 Subsidence Mapping

Figure 5-15 presents a map showing the average annual InSAR subsidence data in the Upper Valley between June 2015 and June 2019 (DWR, 2020c). The yellow area on the map is the area with measured changes in ground elevation of between -0.1 and 0.1 foot. As discussed in Section 8.8.2.1, because of measurement error in this methodology, any measured ground level changes between -0.1 and 0.1 foot are not considered subsidence. The white areas on the map are areas with no data available. The map shows that no measurable subsidence has been recorded anywhere in the Subbasin.

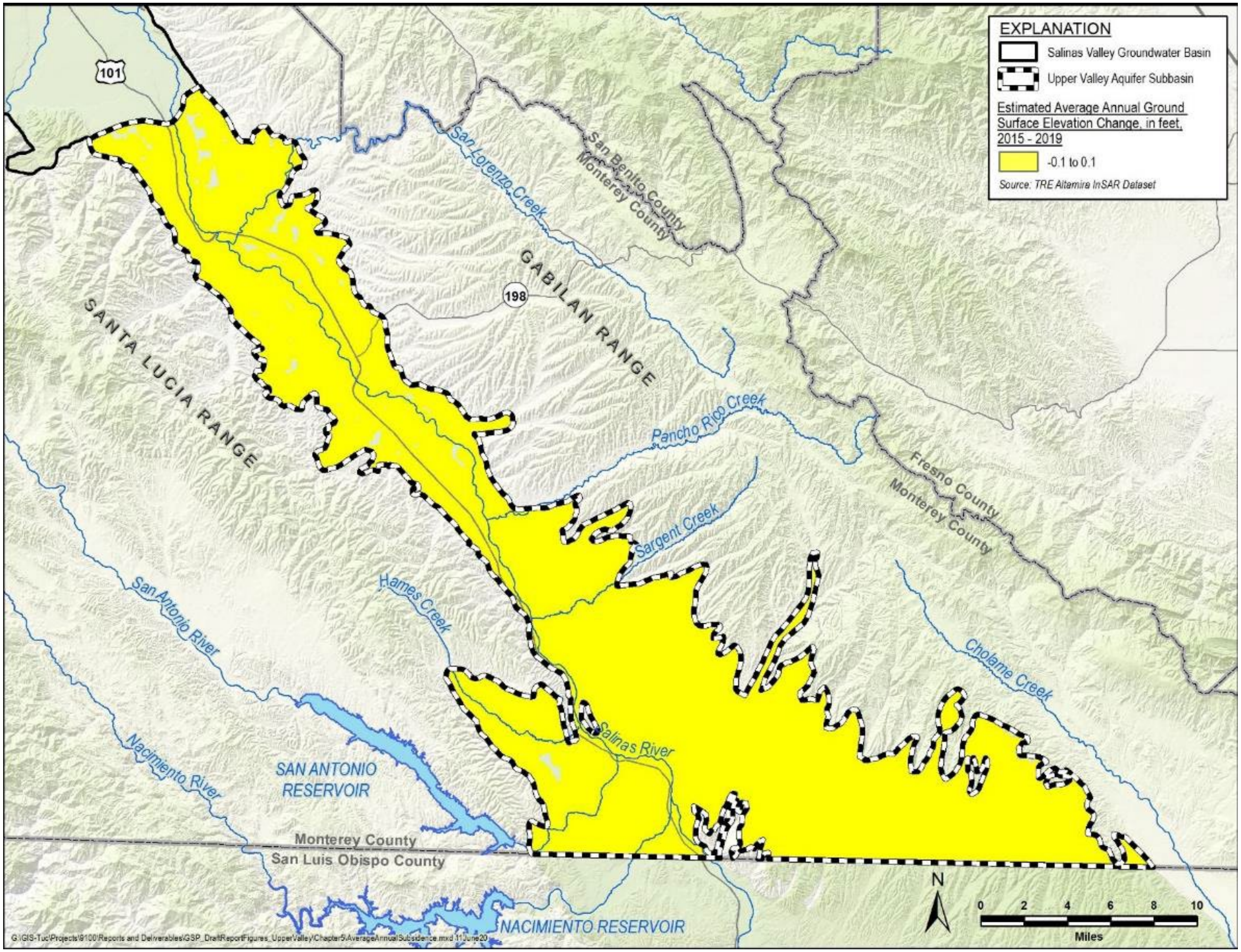


Figure 5-15. Estimated Average Annual InSAR Subsidence in Subbasin

5.5 Interconnected Surface Water

ISW is 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 completed. If groundwater elevations are higher than the water level in the stream, the stream is said to be a gaining stream because it gains water from the surrounding groundwater. If the groundwater elevation is lower than the water level in the stream, it is termed a losing stream because it loses water to the surrounding groundwater. If the groundwater elevation is below the streambed elevation, the stream and groundwater are disconnected. SGMA does not require that disconnected stream reaches be analyzed or managed. These concepts are illustrated on Figure 5-16.

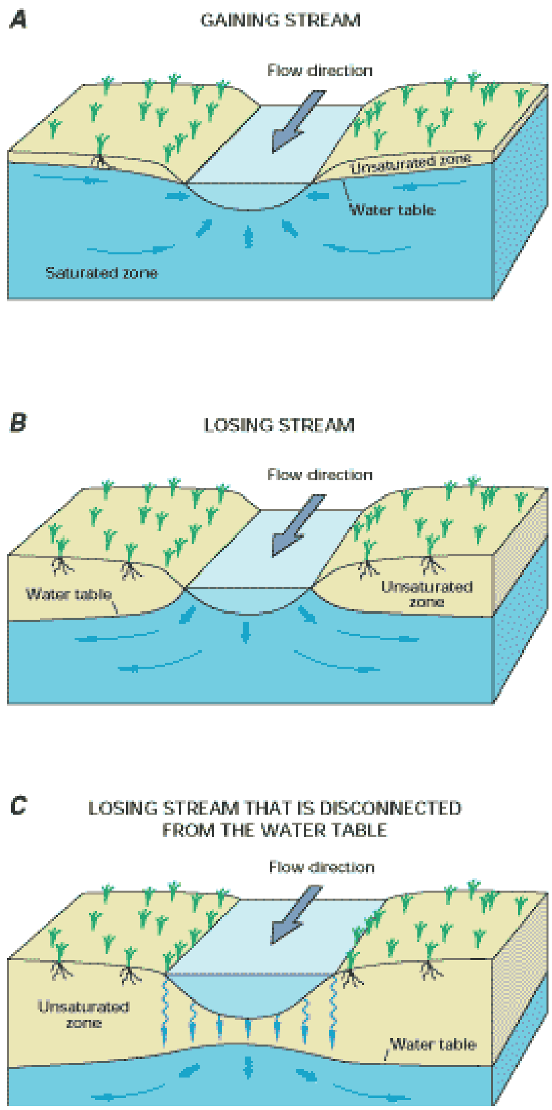


Figure 5-16. Conceptual Representation of Interconnected Surface Water (Winter, et al., 1999)

5.5.1 Data Sources

The preliminary SVIHM is used to map the potential locations of ISW, as described in Chapter 4 and shown on Figure 4-11. There is no data that verifies the location and extent of surface water connection to groundwater, nor the extent to which groundwater extraction depletes surface water. Therefore, this section describes the hydraulic principles that establish the relationship between surface water and groundwater, upon which the current conditions and monitoring network are based.

5.5.2 Analysis of Surface Water and Groundwater Interconnection

Groundwater extraction can alter flows between surface water and groundwater. Flow changes related to interconnected surface and groundwater could be due to reductions in groundwater discharge to surface water or increases in surface water recharge to groundwater. These 2 changes together constitute the change in the amount of surface water depletion.

Depletion of ISW is estimated by evaluating the change in the modeled stream leakage with and without pumping (i.e., water flowing from the stream into the groundwater system). A model simulation without any groundwater pumping in the model (i.e., SVIHM with no pumping) was compared to the model simulation with groundwater pumping (i.e., SVIHM with pumping). The difference in stream depletion between the 2 models is the depletion caused by the groundwater pumping. This comparison was undertaken for the entire area of the Salinas Valley included in the model and also for the Subbasin. The stream depletion differences are only estimated for the interconnected segments identified in Figure 4-11. The methodology for quantifying stream depletion is described in detail by Barlow and Leake (2012).

This analysis uses the "peak" conservation release period from June to September that reflects when most conservation releases are made, not the full April to October MCWRA conservation release period when releases can be made. Depletion of interconnected sections of the Salinas River is estimated separately for the peak conservation release period of June through September, and the non-peak conservation release period of October through May. Depletion of interconnected sections of other surface water bodies is estimated for the entire year. Table 5-4 shows the estimated annual average depletion of the ISW along the stream segments shown in Figure 4-11 due to groundwater pumping.

Table 5-4. Average SVIHM Simulated Depletion of Interconnected Surface Waters (AF/yr.)

	Peak Conservation Release Period	Non-Peak Conservation Release Period
Salinas River	11,000	18,500
Other Surface Waters	1,100	

Note: provisional data subject to change[1].

6 WATER BUDGETS

This chapter summarizes the estimated water budgets for the Upper Valley Subbasin, including information required by the GSP Regulations and information that is important for developing an effective plan to maintain sustainability. In accordance with the GSP Regulations § 354.18, this water budget provides an accounting and assessment of the total annual volume of surface water and groundwater entering and leaving the basin, including historical, current, and projected water budget conditions, and the change in the volume of groundwater in storage. Water budgets are reported in graphical and tabular formats, where applicable.

6.1 Overview of Water Budget Development

The water budgets are presented in 2 subsections: (1) historical and current water budgets, and (2) future water budgets. Within each subsection a surface water budget and groundwater budget are presented.

Historical and current water budgets are developed using a provisional version of the SVIHM[2], developed by the United States Geological Survey (USGS). The SVIHM is a numerical groundwater-surface water model that is constructed using version 2 of the MODFLOW-OWHM code (Boyce *et al.*, 2020). This code is a version of the USGS groundwater flow code MODFLOW that estimates the agricultural supply and demand through the Farm Process.

The model area covers the Salinas Valley Groundwater Basin from the Monterey-San Luis Obispo County Line in the south to the Pajaro Basin in the north, including the offshore extent of the major aquifers. The model includes operations of the San Antonio and Nacimiento reservoirs. The SVIHM is supported by 2 sub models: a geologic model known as the Salinas Valley Geologic Model (SVGM) and a watershed model known as the Salinas Valley Watershed Model (SVWM) which uses the Hydrologic Simulation Program – Fortran (HSPF) code. The SVIHM is not yet released by the USGS. Details regarding source data, model construction and calibration, and results for historical and current water budgets will be summarized in more detail once the model and associated documentation are available. Appendix 6A includes an overview of the development and progress of the SVIHM.

The USGS has not yet submitted modeling files or documentation to Salinas Valley stakeholders for review. During the GSP development process, stakeholders who reviewed model output

[2] These data (model and/or model results) are preliminary or provisional and are subject to revision. This model and model results are being provided to meet the need for timely best science. The model has not received final approval by the U.S. Geological Survey (USGS). No warranty, expressed or implied, is made by the USGS or the U.S. Government as to the functionality of the model and related material nor shall the fact of release constitute any such warranty. The model is provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the model.

discovered apparent errors or inaccuracies relating to pumping amounts, groundwater storage changes. Some of the apparent errors are discussed in this chapter, and they are of a magnitude that could potentially affect conclusions or proposed management actions. Although the model was used to estimate some water budget items for this chapter, it needs more review and broader acceptance by stakeholders before it will be suitable for designing and evaluating management actions or projects.

Future water budgets are being developed using an evaluation version of the Salinas Valley Operational Model (SVOM), developed by the USGS and MCWRA. The SVOM is a numerical groundwater-surface water model constructed with the same framework and processes as the SVIHM. However, the SVOM is designed for simulating future scenarios and includes complex surface water operations in the Surface Water Operations (SWO) module. The SVOM is not yet released by the USGS. Details regarding source data, model construction and calibration, and results for future budgets will be summarized in more detail once the model and associated documentation are available. Appendix 6A includes an overview of the SVOM, its development, and inputs.

In accordance with GSP Regulations §354.18, an integrated groundwater budget is developed for each principal aquifer for each water budget period. Groundwater in the Upper Valley Subbasin is pumped from only 1 principal aquifer.

6.1.1 Water Budget Components

The water budget is an inventory of the Subbasin’s surface water and groundwater inflows and outflows. Some components of the water budget can be measured, such as groundwater pumping from metered wells, precipitation, and surface water diversions. Other components are not easily measured and can be estimated using groundwater models, such as the SVIHM; these include unmetered agricultural pumping, recharge from precipitation and applied irrigation, and change of groundwater in storage. Figure 6-1 presents a general schematic diagram of the HCM that is included in the water budget (DWR, 2020d).

The water budgets for the Subbasin are calculated within the following boundaries:

- Lateral boundaries: The perimeter of the Upper Valley Subbasin within the SVIHM is shown on Figure 6-2. The southeast portion of the Subbasin is not included in the groundwater model area.
- Bottom: The base of the groundwater subbasin is described in the HCM and is defined as the base of the usable and productive unconsolidated sediments (Durbin *et al.* 1978). This ranges from less than 200 feet below ground surface along parts of the Salinas River to almost 1,800 feet deep along at the northern edge of the Subbasin. The base of the usable aquifer as defined by Durbin et al. is supplemented with the base of aquifer contours included in the *Paso Robles Groundwater Basin Study Phase*

II report (Fugro West, Inc. *et al.*, 2005). The water budget is not sensitive to the exact definition of this base elevation because the base is defined as a depth below where there is not significant inflow, outflow, or change in storage.

- Top: The top of the water budget area is above the ground surface, so that surface water is included in the water budget.

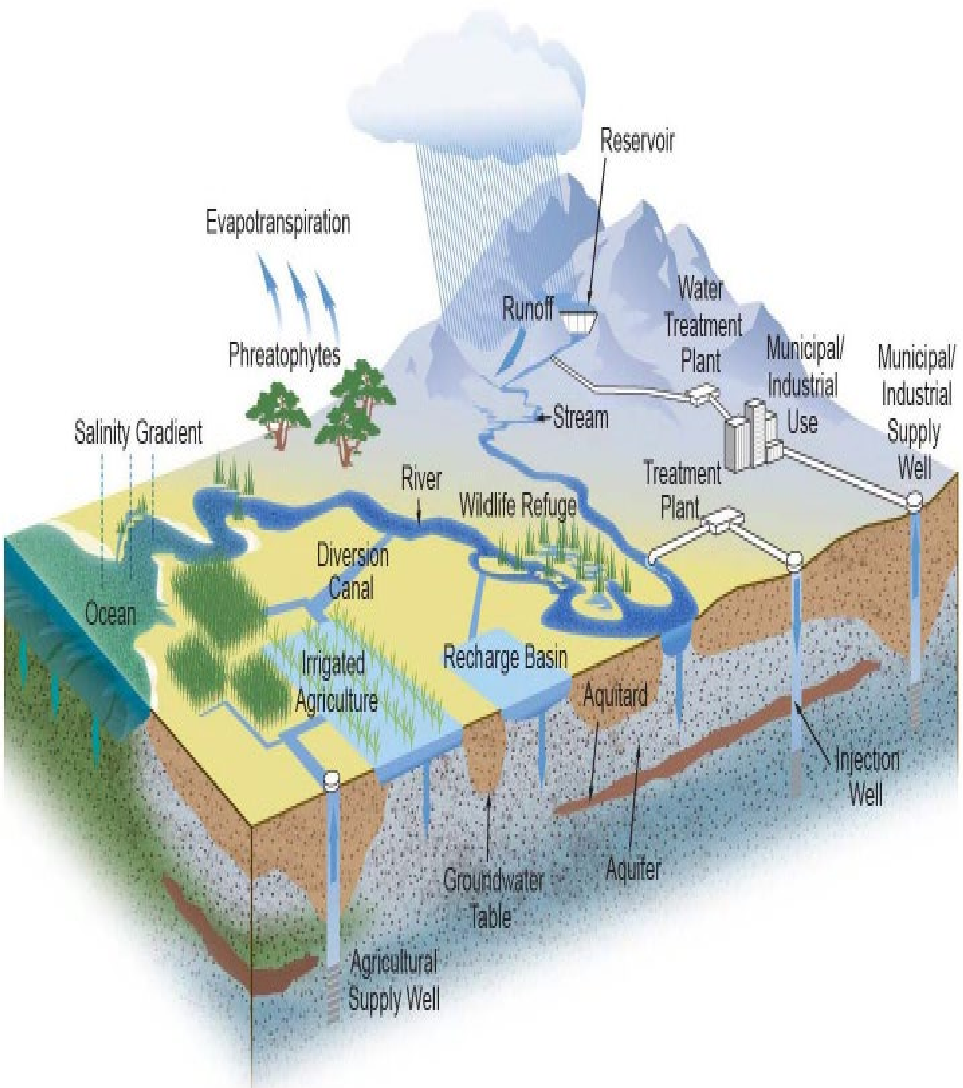


Figure 6-1. Schematic Hydrogeologic Conceptual Model (from DWR, 2020d)

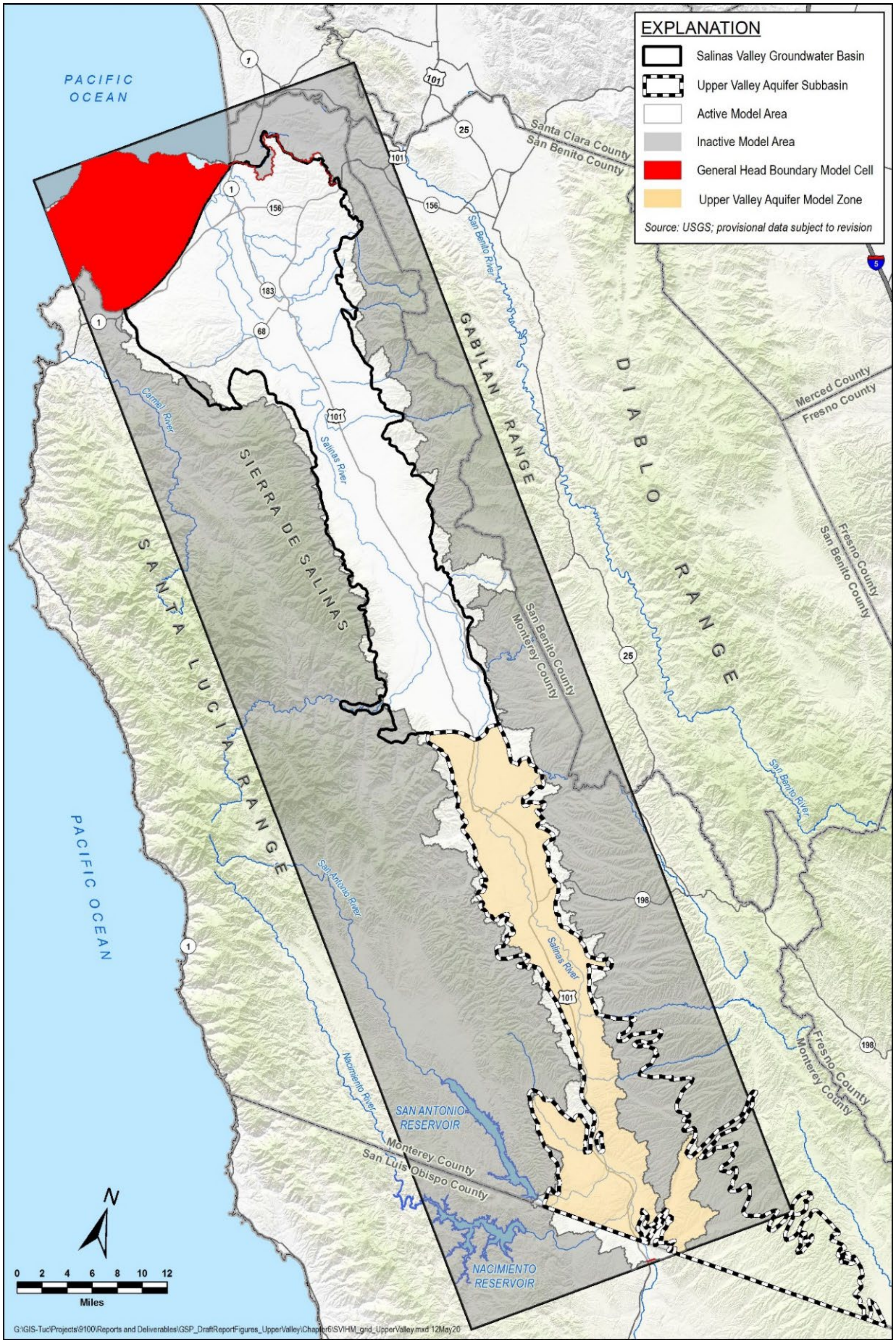


Figure 6-2. Zones and Boundary Conditions for the Salinas Valley Integrated Hydrologic Model

The Upper Valley Subbasin water budget includes the following components:

Surface Water Budget:

- Inflows
    - Runoff of precipitation
    - Surface water inflows from streams that enter the subbasin, including the Salinas River, San Lorenzo Creek, Pancho Rico Creek, Sargent Creek, Hames Creek, and the San Antonio and Naciemento Rivers. Reservoir operations influence Salinas River inflow; however, reservoir operations are not under the purview of the GSA.
    - Groundwater discharge to streams
- Outflows
    - Stream discharge to groundwater
    - Outflow to neighboring subbasins, principally the Salinas River

Groundwater Budget:

- Inflows
    - Deep percolation from precipitation and applied irrigation
    - Stream discharge to groundwater
    - Subsurface inflows including:
        - Inflow from the Forebay Subbasin
        - Inflow from the Paso Robles Area Subbasin
        - Inflow from surrounding watershed that are not in other DWR subbasins.
- Outflows
    - Groundwater pumping, including urban, industrial, domestic, and agricultural
    - Crop and riparian ET
    - Groundwater discharge to streams
    - Subsurface outflows including:
        - Outflow to the Forebay Subbasin
        - Outflow to the Paso Robles Area Subbasin

The difference between groundwater inflows and outflows is equal to the change of groundwater in storage.

6.1.2 Water Budget Time Frames

In estimating the Subbasin water budget, a time period for the budget needs to be specified. The GSP Regulations require water budgets for 3 different time frames, representing historical conditions, current conditions, and projected conditions, as follows:

- The historical water budget is intended to evaluate how past land use and water supply availability has affected aquifer conditions and the ability of groundwater users to operate within the sustainable yield. GSP Regulations require that the historical water budget include at least the most recent 10 years of water budget information. DWR's Water Budget BMP document further states that, the historical water budget should help develop an understanding of how historical conditions concerning hydrology, water demand, and surface water supply availability or reliability have impacted the ability to operate the basin within the sustainable yield. Accordingly, historical conditions should include the most reliable historical data that are available for GSP development and water budgets calculations.
- The current water budget is intended to allow the GSA and DWR to understand the existing supply, demand, and change in storage under the most recent population, land use, and hydrologic conditions. Current conditions are generally the most recent conditions for which adequate data are available and that represent recent climatic and hydrologic conditions. Current conditions are not well defined by DWR but can include an average over a few recent years with various climatic and hydrologic conditions.
- The projected water budget is intended to quantify the estimated future baseline conditions. The projected water budget estimates the future baseline conditions concerning hydrology, water demand, and surface water supply over a 50-year planning and implementation horizon. It is based on historical trends in hydrologic conditions which are used to project forward 50 years while considering projected climate change and sea level rise if applicable.

Although there is a significant variation between wet and dry seasons, the GSP does not consider separate seasonal water budgets for the groundwater budget. All water budgets are developed for complete water years. Selected time periods for the historical and current water budgets are summarized in Table 6-1 and on Figure 6-3. and described in Sections 6.1.2.1 and 6.1.2.2.

Table 6-1. Summary of Historical and Current Water Budget Time Periods

Time Period	Proposed Date Range	Water Year Types Represented in Time Period	Rationale
Historical	Water years 1980 through 2016	Dry: 11 Dry-Normal: 7 Normal: 5 Wet-Normal: 3 Wet: 11	Provides insights on water budget response to a wide range of variations in climate and groundwater use over an extensive period of record. Begins and ends in years with average precipitation.
Current	Water Year 2016	Dry-Normal: 1	Best reflection of current land use and water use conditions based on best available data.

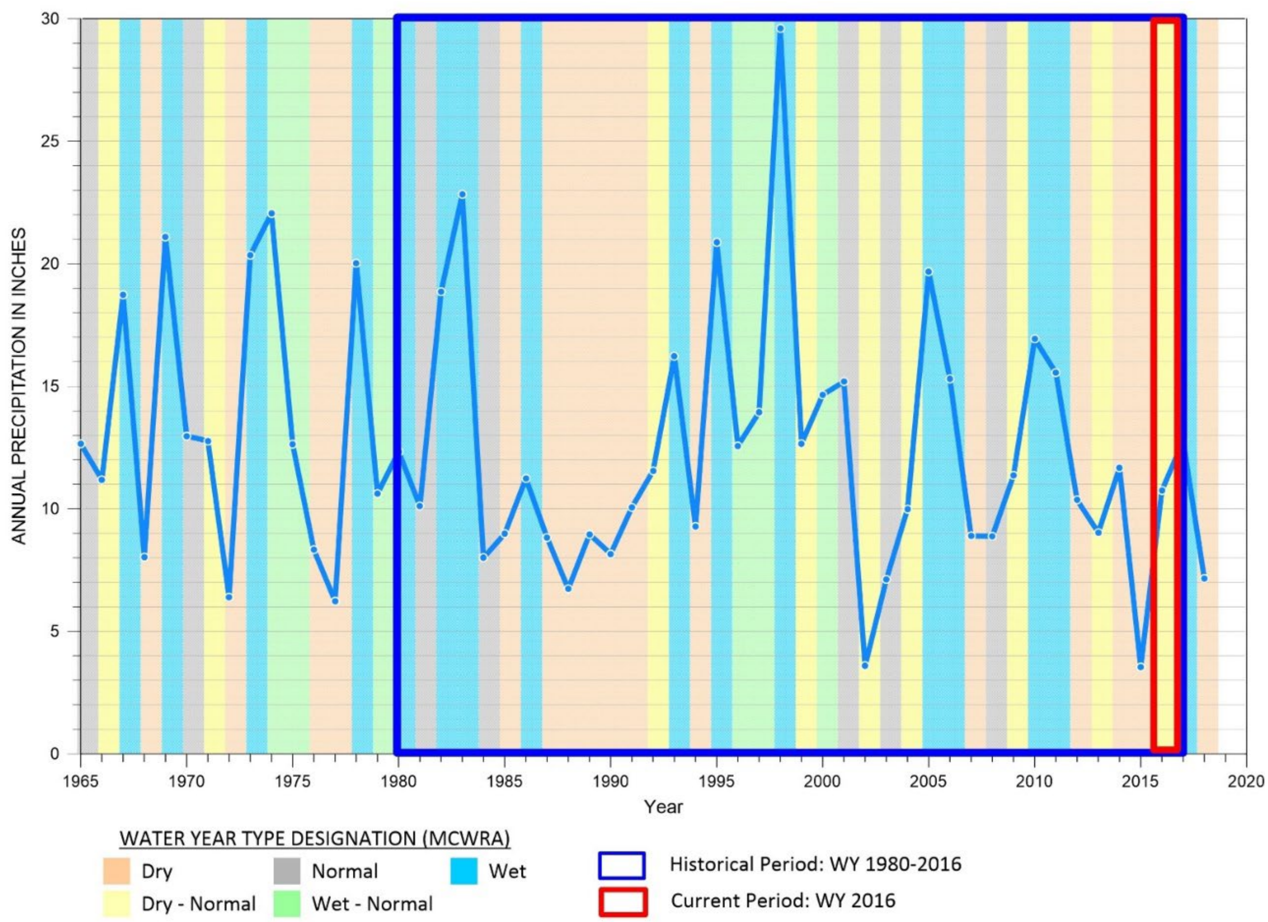


Figure 6-3. Climate and Precipitation for Historical and Current Water Budget Time Periods

6.1.2.1 Historical Water Budget Time Period

GSP Regulations §354.18 require that the historical water budget be based on at least 10 years of data.

The water budget is computed using results from the SVIHM numerical model for the period from October 1980 through September 2016. Although the SVIHM simulation covers water years 1967 through 2017, model results for years prior to 1980 and the year 2017 were not used for this water budget due to potential limitations and uncertainties in the provisional SVIHM. Water years 1980 through 2016 comprise a representative time period with both wet and dry periods in the Subbasin (Table 6-1, Figure 6-3).

6.1.2.2 Current Water Budget Time Period

The current water budget time period is also computed using the SVIHM numerical model and is based on water year 2016. Water Year 2016 is classified as dry-normal and is reflective of current and recent patterns of groundwater use and surface water use. Although Water Year 2016 appropriately meets the regulatory requirement for using the "…most recent hydrology, water supply, water demand, and land use information" (23 California Code of Regulations §354.18 (c)(1)), it is noted that Water Year 2016 was preceded by multiple dry or dry-normal years.

6.1.2.3 Future Projected Water Budgets Time Period

Future projected conditions are based on model simulations using the SVOM numerical flow model, using current reservoir operations rules, projected climate-change scenarios, and estimated sea level rise. The projected water budget represents 47 years of future conditions. Following DWR guidance on implementing climate change factors, the future water budget simulations do not simulate a 47-year projected future, but rather simulate 47 likely hydrologic events that may occur in 2030 and 47 likely hydrologic events that may occur in 2070.

6.2 Overview of Data Sources for Water Budget Development

Table 6-2 provides the detailed water budget components and known model assumptions and limitations for each. A few water budget components are directly measured, but most water budget components are either estimated as input to the model or simulated by the model. Both estimated and simulated values in the water budgets are underpinned by certain assumptions. These assumptions can lead to uncertainty in the water budget. However, inputs to the preliminary SVIHM were carefully selected by the USGS and cooperating agencies using best available data, reducing the level of uncertainty.

In addition to the model assumptions, additional uncertainty stems from any model's imperfect representation of natural condition and level of calibration. The water budgets for the Upper Valley Subbasin are based on a preliminary version of the SVIHM, with limited documentation of model construction. The model is in internal review at the USGS, and a final version will likely not be released to the SVBGSA until after the GSP is submitted. Nonetheless, the SVIHM's calibration error is within reasonable bounds. Therefore, the model is the best available tool for estimating water budgets for the GSP.

As GSP implementation proceeds, the SVIHM will be updated and recalibrated with new data to better inform model simulations of historical, current, and projected water budgets. Model assumptions and uncertainty will be described in future updates to this chapter after model documentation is released by the USGS.

Table 6-2. Summary of Water Budget Component Data Source
from the Salinas Valley Integrated Hydrologic Model

Water Budget Component	Source of Model Input Data	Limitations
Precipitation	Incorporated in calibrated model as part of land use process	Estimated for missing years
	Surface Water Inflows	
Inflow from Streams Entering Basin	Simulated from calibrated model for all creeks	Not all creeks are gauged
Groundwater Discharge to Streams	Simulated from calibrated model	Based on calibration of streamflow to available data from gauged creeks
Overland Runoff	Simulated from calibrated model	Based on land use, precipitation, and soils specified in model
	Surface Water Outflows	
Streambed Recharge to Groundwater	Simulated from calibrated model	Based on calibration of streamflow to available data from gauged creeks and groundwater level data from nearby wells
Diversions	Model documentation not available at this time	Based on calibration of streamflow to available data from gauged creeks
Outflow to Streams Leaving Basin	Simulated from calibrated model for all creeks	Not all creeks are gauged
	Groundwater Inflows	
Streambed Recharge to Groundwater	Simulated from calibrated model	Based on calibration of streamflow to available data from gauged creeks and groundwater level data from nearby wells
Deep percolation of irrigation water	Simulated from demands based on crop, acreage, temperature, and soil zone processes	No measurements available; based on assumed parameters for crops and soils
Subsurface Inflow from neighboring basins	Simulated from calibrated model	Limited groundwater calibration data at adjacent subbasin boundaries
Subsurface Inflow from surrounding watershed other than neighboring basins	Simulated from calibrated model	Limited groundwater calibration data at adjacent subbasin boundaries

Water Budget Component	Source of Model Input Data	Limitations
	Groundwater Outflows	
Groundwater Pumping	Reported data for historical municipal and agricultural pumping, and some small water systems. Model documentation not available at this time.	Water budget pumping reported herein is from the SVIHM and might contain errors. Domestic pumping not simulated in model
Groundwater Discharge to Streams	Simulated from calibrated model	Based on calibration of streamflow to available data from gauged creeks and groundwater level data from nearby wells
Subsurface Outflow to Adjacent Basins	Simulated from calibrated model	Limited calibration data at adjacent subbasin boundaries
Riparian ET	Simulated from calibrated model	Based on representative plant group and uniform extinction depth

6.3 Historical and Current Water Budgets

Water budgets for the historical and current periods are presented below. The surface water budgets are presented first, followed by the groundwater budgets. These water budgets are based on the provisional SVIHM and are subject to change in the future. Water budgets will be updated in future GSP updates after the SVIHM is formally released by the USGS.

6.3.1 Historical and Current Surface Water Budget

The surface water budget accounts for the inflows and outflows for the streams within the Subbasin. This includes streamflows of rivers and tributaries entering and exiting the Subbasin, overland runoff to streams, and stream-aquifer interactions. ET by riparian vegetation along stream channels is estimated by the provisional SVIHM as part of the groundwater system and is accounted for in the groundwater budget.

Figure 6-4 shows the surface water network simulated in the provisional SVIHM. The network includes the Salinas River and other streams in the subbasin. The model accounts for surface water flowing in and out across the subbasin boundary. For this water budget, boundary inflows and outflows are the sum of all locations that cross the Subbasin boundary. In some instances, a simulated stream might enter and exit the Subbasin boundary at multiple locations, such as along the southern boundary of the Upper Valley Subbasin. Boundary inflows include releases from the San Antonio and Nacimiento reservoirs. The principal boundary outflow in the Subbasin is the Salinas River.

Figure 6-5 shows the surface water budget for the historical period, which also includes the current period. Table 6-3 shows the average values for components of the surface water budget for the historical and current periods, respectively. Positive values are inflows into the stream system, and negative values are outflows from the stream system. Boundary inflows and outflows dominate the surface water budget in all but the driest years. The flow between surface water and groundwater in the Subbasin is generally net negative, which indicates more seepage from the streams to groundwater, rather than discharge of groundwater to streams.

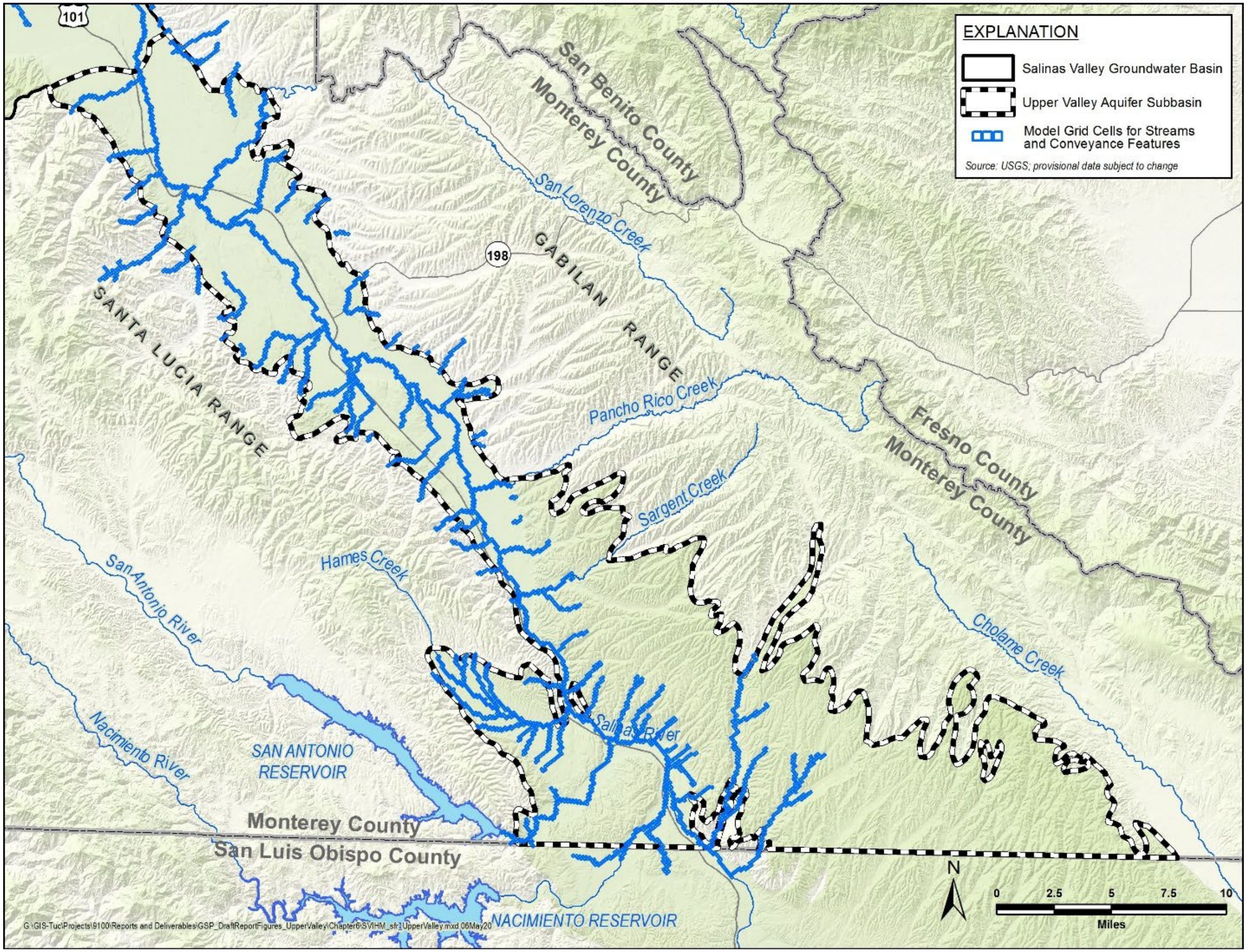


Figure 6-4. Surface Water Network in Upper Valley Subbasin from the Salinas Valley Integrated Hydrologic Model

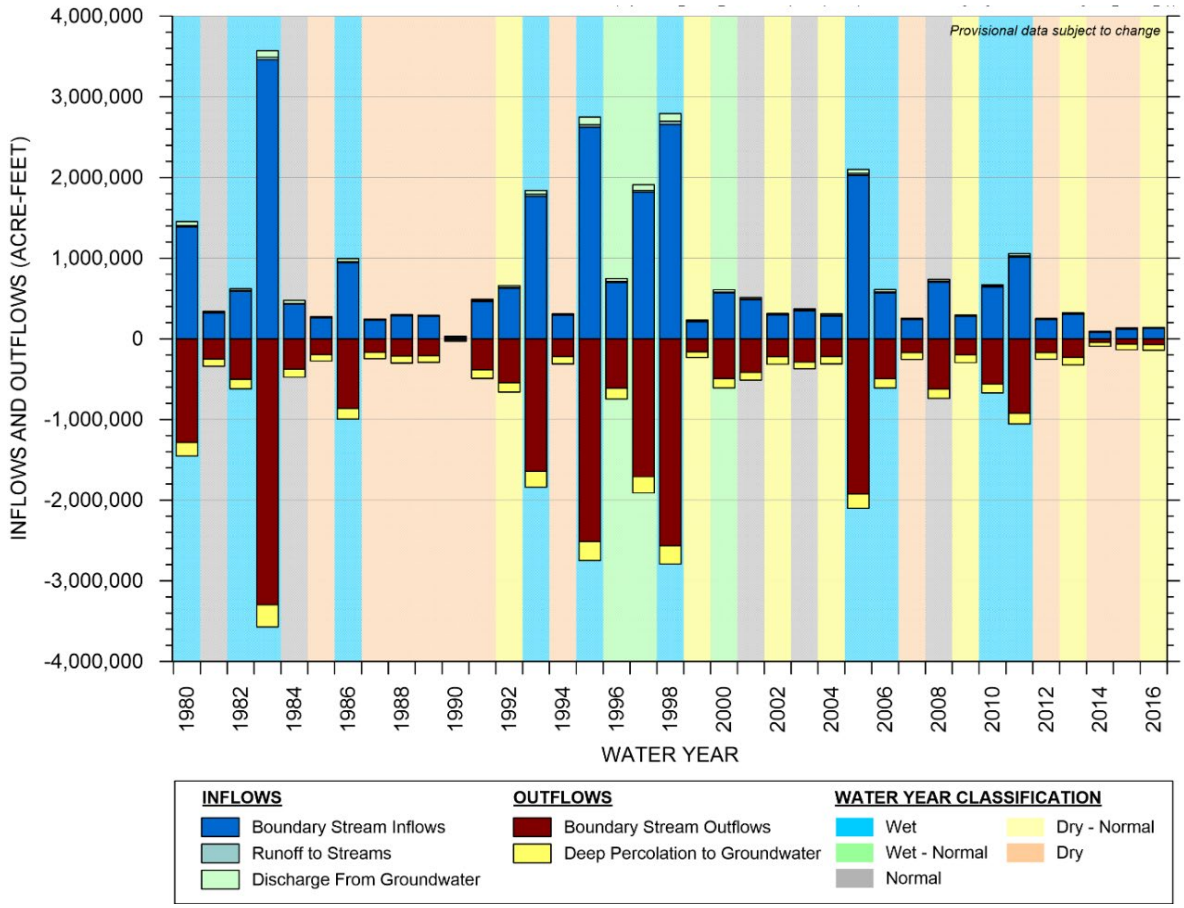


Figure 6-5. Historical and Current Surface Water Budget

Table 6-3. SVIHM Simulated Surface Water Budget Summary (AF/yr.)

	Historical Average (WY 1980-2016)	Current (WY 2016)
Overland Runoff to Streams	12,200	6,700
Boundary Stream Inflows	748,400	130,700
Net Flow between Surface Water and Groundwater	-89,100	-65,500
Boundary Stream Outflows	-671,500	-71,900

Note: provisional data subject to change.

6.3.2 Historical and Current Groundwater Budget

The groundwater budget accounts for the inflows and outflows to and from the Subbasin's aquifers, based on results from the SVIHM. This includes subsurface inflows and outflows of groundwater at the Subbasin boundaries, recharge, pumping, ET, and net flow between surface water and groundwater.

SVIHM estimated annual groundwater inflows for the historical and current time periods are shown on

Figure 6-6. Inflows vary substantially from year to year. Table 6-4 provides average groundwater inflows for the historical and current period. The largest inflow component is deep percolation of streamflow, ranging from approximately 16,200 AF in 1990 to more than 275,000 AF in 1983, with a historical average of about 115,600 AF/yr. The estimated historical average deep percolation of precipitation and applied irrigation is about 57,300 AF/yr. Subsurface inflows contribute a relatively minor amount of groundwater to the Subbasin. The largest subsurface inflows enter from the surrounding watersheds and average approximately 16,900 AF/yr. over the historical period. Total recharge for the current period is less than average total recharge over the historical period. All inflows are represented by positive values in Table 6-4.

Figure 6-7 shows the SVIHM estimated groundwater outflows from for the historical and current time periods. Outflows vary from year to year; however, the annual variation is dampened compared to the inflows. Table 6-5 provides SVIHM estimated annual averages for groundwater outflows of the historical and current period. The largest outflow components in the Subbasin are pumping and ET. Historical and current groundwater pumping ranges from approximately 65,000 to 115,000 AF/yr., and groundwater ET ranges from approximately 28,000 to 75,000 AF/yr. Outflows for the current period are similar to historical average outflows for subsurface flows, ET, and pumping. Discharge to streams in 2016 is lower than in the historical period. This is consistent with the fact that discharges to streams increases during wetter years. All outflows are shown as negative values in Table 6-5.

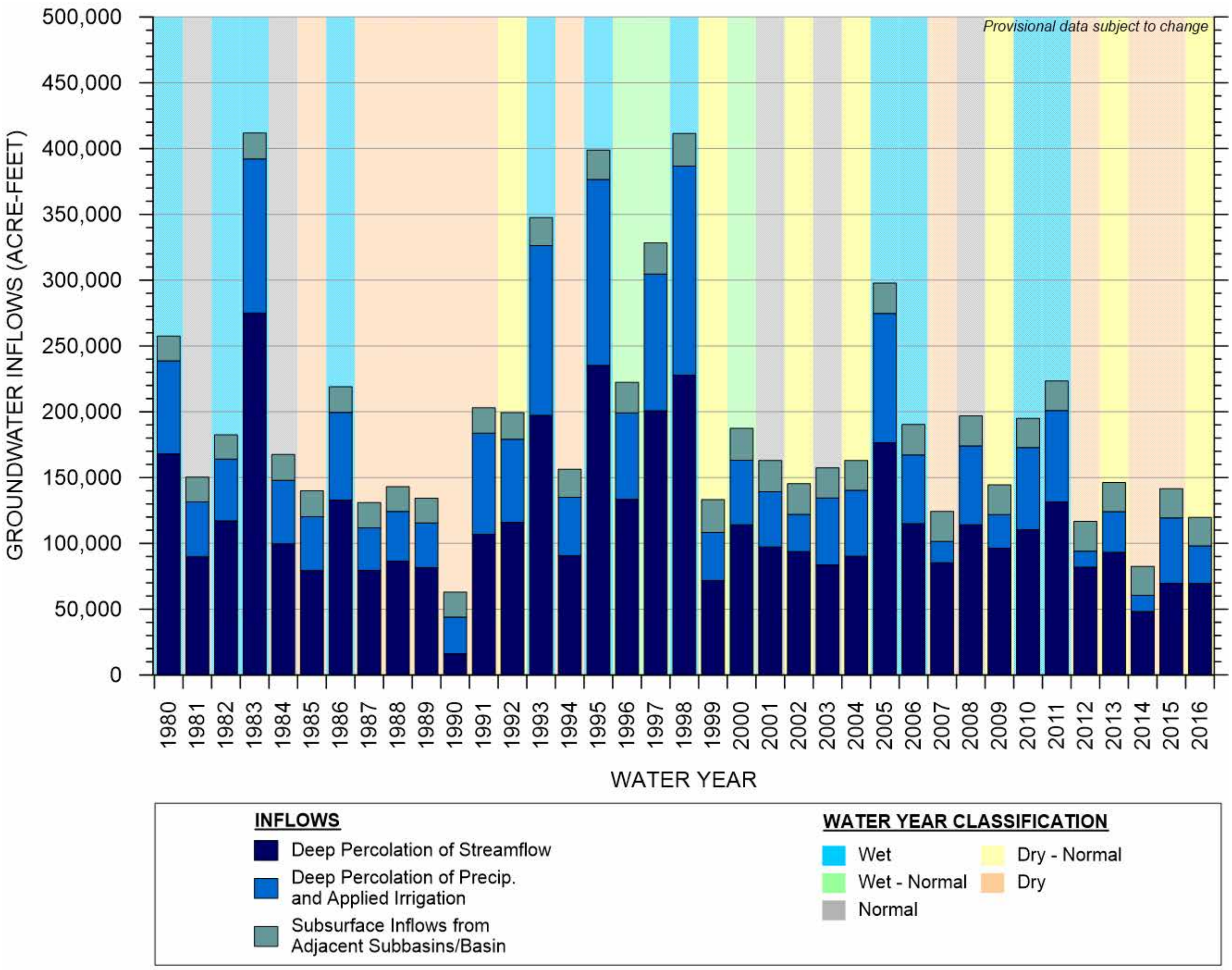


Figure 6-6. SVIHM Simulated Inflows to the Groundwater System

Table 6-4. SVIHM Simulated Groundwater Inflows Summary (AF/yr.)

	Historical Average (WY 1980-2016)	Current (WY 2016)
Deep Percolation of Precipitation and Applied Water	57,300	28,600
Deep Percolation of Streamflow	115,600	69,500
Subsurface Inflow from Adjacent Subbasins/Basins	21,600	21,700

Note: provisional data subject to change.

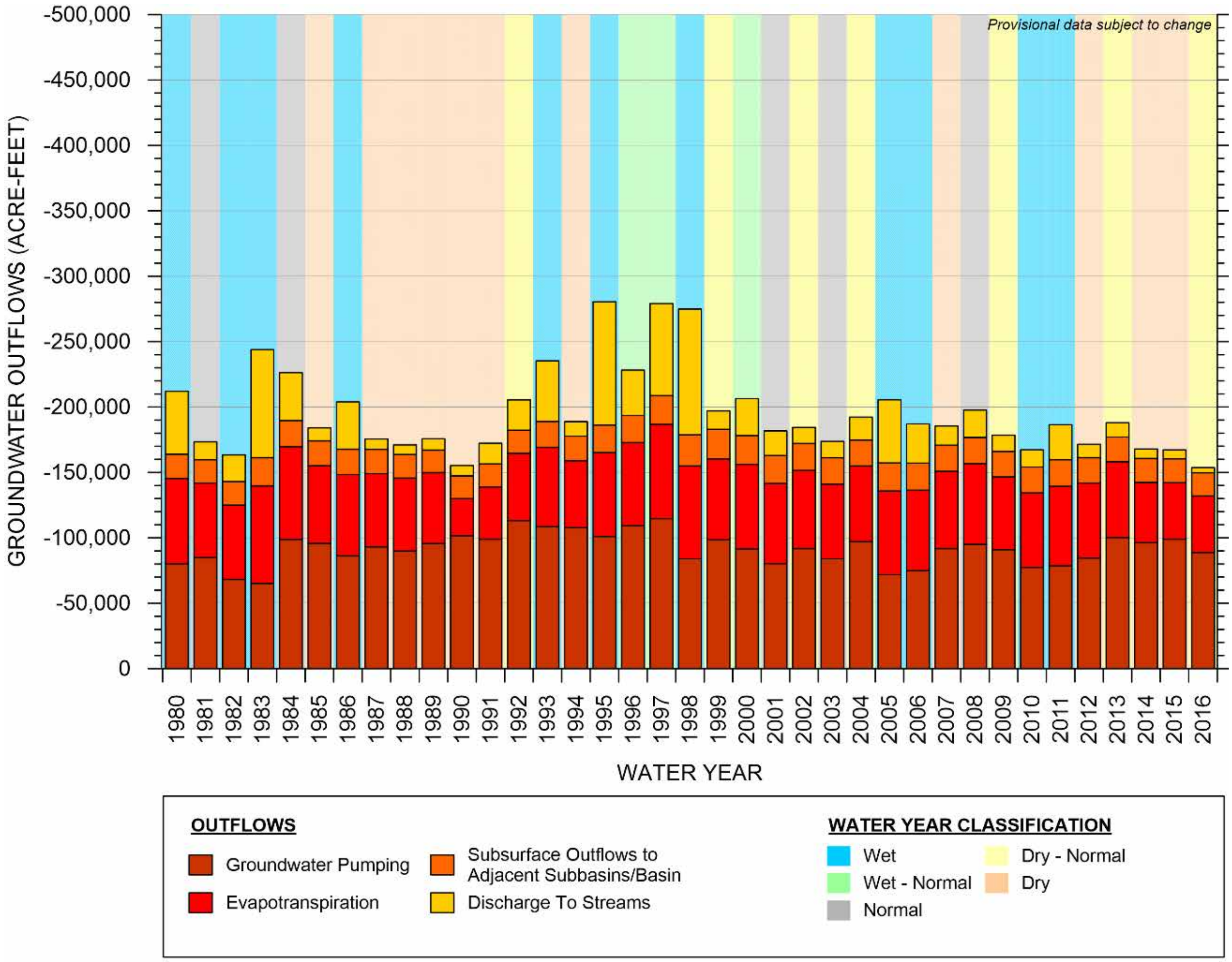


Figure 6-7. SVIHM Simulated Outflows from the Groundwater System

Table 6-5. SVIHM Simulated and Adjusted Groundwater Outflows Summary (AF/yr.)

	Simulated Historical Average (WY 1980-2016)	Simulated Current (WY 2016)	Adjusted Historical Average (WY 1980-2016)	Adjusted Current (WY 2016)
Groundwater Pumping	-91,600	-88,900	-120,500	-117,000
Groundwater ET	-57,900	-43,100	-57,900	-43,100
Subsurface Outflow to Adjacent Subbasins/Basins	-19,700	-17,700	-19,700	-17,700
Discharge to Streams	-26,500	-4,000	-26,500	-4,000

Notes: provisional data subject to change.
Adjusted pumping is described below.

Comparing SVIHM output to GEMS data reveals that on average, the preliminary SVIHM estimates only approximately 76% of the pumping reported in the GEMS database for the Subbasin between 1995 and 2016. These GEMS data are likely more representative of historical conditions than the model generated pumping numbers, however, reliable GEMS data are only available since 1995. To accurately estimate groundwater extraction for the full historical period, this 76% ratio was applied to the SVIHM estimated historical pumping shown in Table 6-5, yielding an estimated historical average pumping rate of 120,500 AF/yr. The 2016 current extraction in the GEMS database for the Upper Valley Subbasin is 112,700 AF.

SVIHM simulated groundwater pumping by water use sector is summarized on Figure 6-8 and in Table 6-6. More than 95% of groundwater pumping in the Subbasin is used for agricultural purposes. Groundwater pumping varies from year to year; however, total pumping in the Subbasin has generally decreased since the early-1990s, with a slightly increasing trend in recent years. Municipal and agricultural pumping are simulated in the SVIHM; however, domestic pumping, including *de minimis* pumping, is not included in the model. The SVIHM does not simulate domestic pumping because it is a relatively small portion of overall groundwater pumping in the larger Salinas Valley Basin, and it is not included in the Upper Valley Subbasin water budget. GEMS extraction data by water use sector are shown in . The historical average in Table 6-6 is not strictly comparable to the historical average in or the average GEMS estimated pumping of 120,500 listed above because the time periods used to calculate the averages are different.

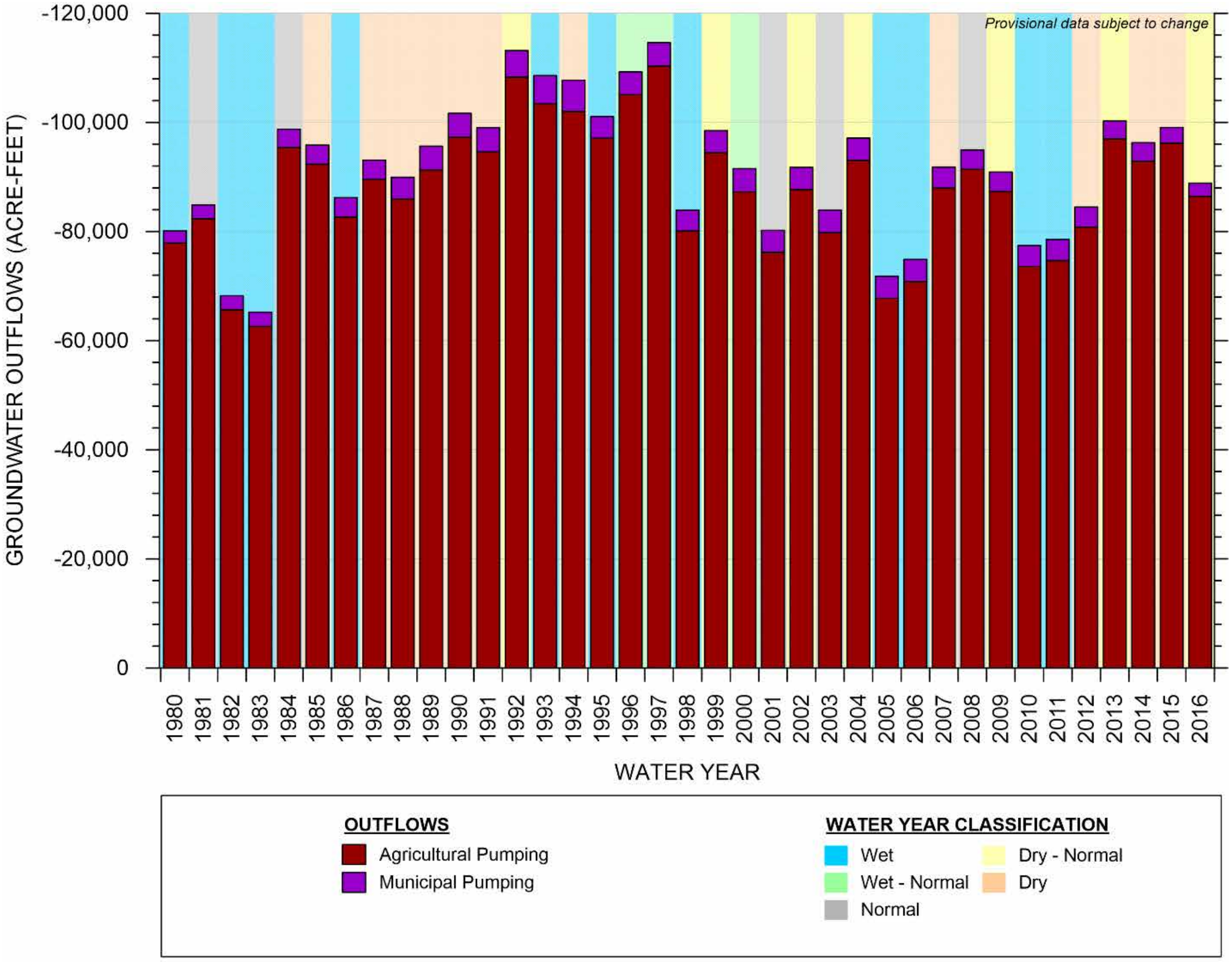


Figure 6-8. SVIHM Simulated Groundwater Pumping by Water Use Sector

Table 6-6. SVIHM Simulated and Adjusted Groundwater Pumping by Water Use Sector (AF/yr.)

	Simulated Historical Average (WY 1980-2016)	Simulated Current (WY 2016)	GEMS Historical Average (WY 1995-2016)	GEMS Current (WY 2016)	Adjusted Historical Average (WY 1980-2016)	Adjusted Current (WY 2016)
Municipal and Industrial	-3,800	-2,400	-4,100	-3,000	-5,000	-3,200
Agricultural	-87,800	-86,500	-114,900	-109,700	-115,500	-113,800
Total Pumping	-91,600	-88,900	-119,000	-112,700	-120,500	-117,000

Note: provisional data subject to change.

Figure 6-9 shows net subsurface flows entering and exiting the Subbasin by watershed and neighboring subbasins. For most of the historical period, the Subbasin's subsurface outflows are approximately equal to the inflows. Table 6-7 shows historical average and current year subsurface flows. The amount of simulated flow to and from areas not mapped as DWR subbasins may be partially due to how the Subbasin zone relates to the SVIHM area (Figure 6-2) and the accounting methods used for developing the water budgets. There is a net inflow from the upgradient Paso Robles Area subbasin and the outside areas, and a net outflow downgradient to the Forebay Subbasin.

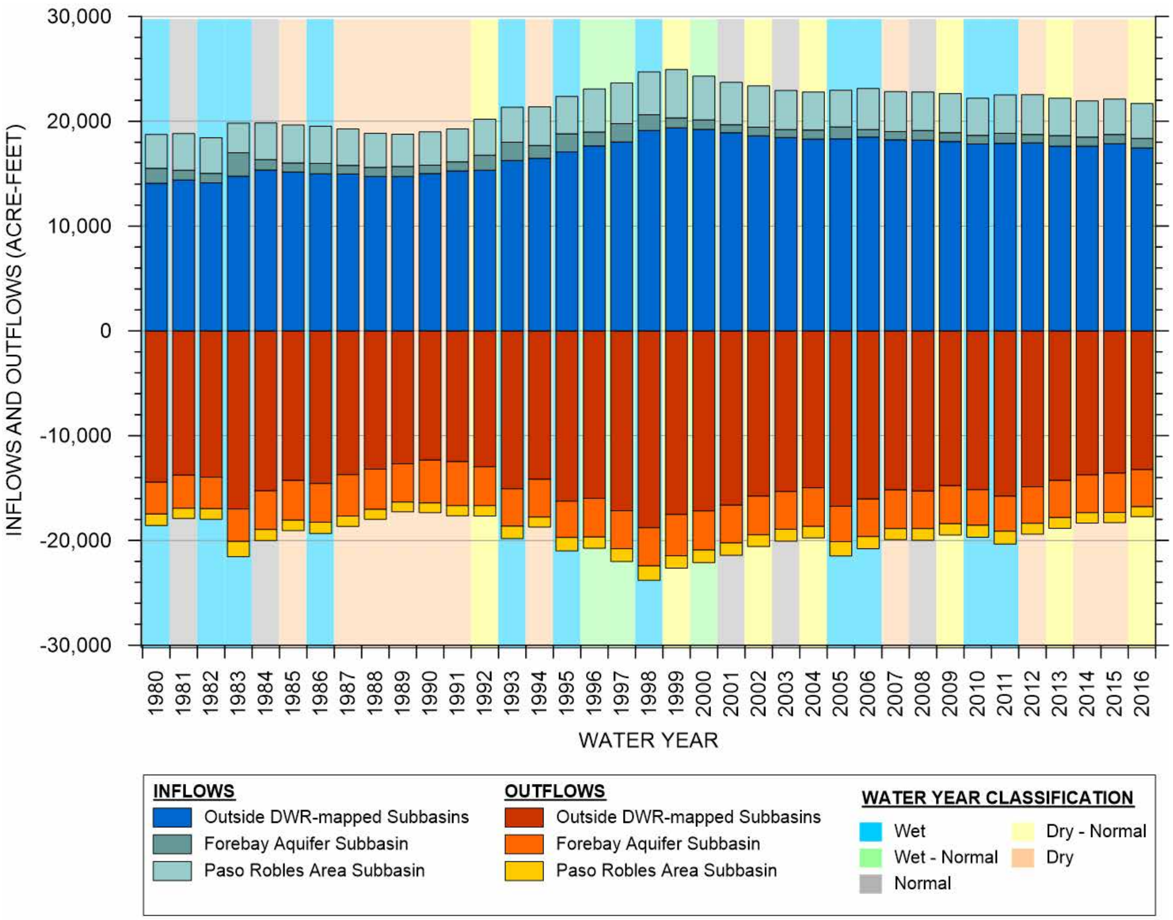


Figure 6-9. SVIHM Simulated Subsurface Inflows and Outflows from Watershed Areas and Neighboring Basins/Subbasins

Table 6-7. SVIHM Simulated Net Subbasin Boundary Flows (AF/yr.)

	Historical Average (WY 1980-2016)	Current (WY 2016)
Forebay Subbasin	-2,500	-2,600
Paso Robles Area Subbasin	2,500	2,400
Outside Areas	1,900	4,200

Note: provisional data subject to change.

Change in groundwater storage is equal to inflow to storage minus outflows from storage. A negative change in groundwater storage value in indicates groundwater storage depletion associated with lower groundwater levels; while a positive value indicates groundwater storage accretion associated with higher groundwater levels. Averaged over the historical period, the preliminary SVIHM estimates that the Upper Valley Subbasin is in overdraft (storage depletion) by about 1,200 AF/yr.

The estimated overdraft contains significant variability and uncertainty. Figure 6-10 shows considerable variability in change in storage from one year to the next. In water year 2016, outflows exceeded inflows by nearly 34,000 AF, while in 1983 inflows exceeded outflows by roughly 168,000 AF. These results are provisional and subject to change in future updates of the GSP after the SVIHM is officially released to the public.

The SVIHM results suggest a small average annual decline in groundwater storage in the historical water budget period. The simulated historical decline in groundwater storage of 1,200 AF/yr. is small and within the error of the model. The black line of cumulative groundwater in storage shown on Figure 6-10 suggests that the Subbasin's recent loss of groundwater storage occurred only after 2011, during the recent drought. Therefore, the small, simulated decline in groundwater storage appears to be a result of the beginning and ending years of the historical period, not due to a trend of declining storage. Therefore, the Subbasin is not considered to be in overdraft, and the historical average annual change in storage is set to zero AF/yr.

6.3.3 Historical and Current Groundwater Budget Summary

The main groundwater inflows into the subbasin are: (1) deep percolation of precipitation and applied agricultural irrigation water and (2) streambed recharge. Groundwater pumping is the predominant groundwater outflow. The smaller outflow terms are ET, discharge to streams, and subsurface outflows to adjacent subbasins.

Figure 6-10 shows the entire groundwater water budget from the SVIHM and includes annual change in groundwater storage. Changes in groundwater storage are strongly correlated with changes in deep percolation of precipitation and streamflow. For example, 1983 and 1998 were comparatively very wet years and represent the greatest increase in deep percolation and, correspondingly, the greatest increase in groundwater storage over the historical period. The current (2016) amount of groundwater in storage is slightly less than at the beginning of the historical period.

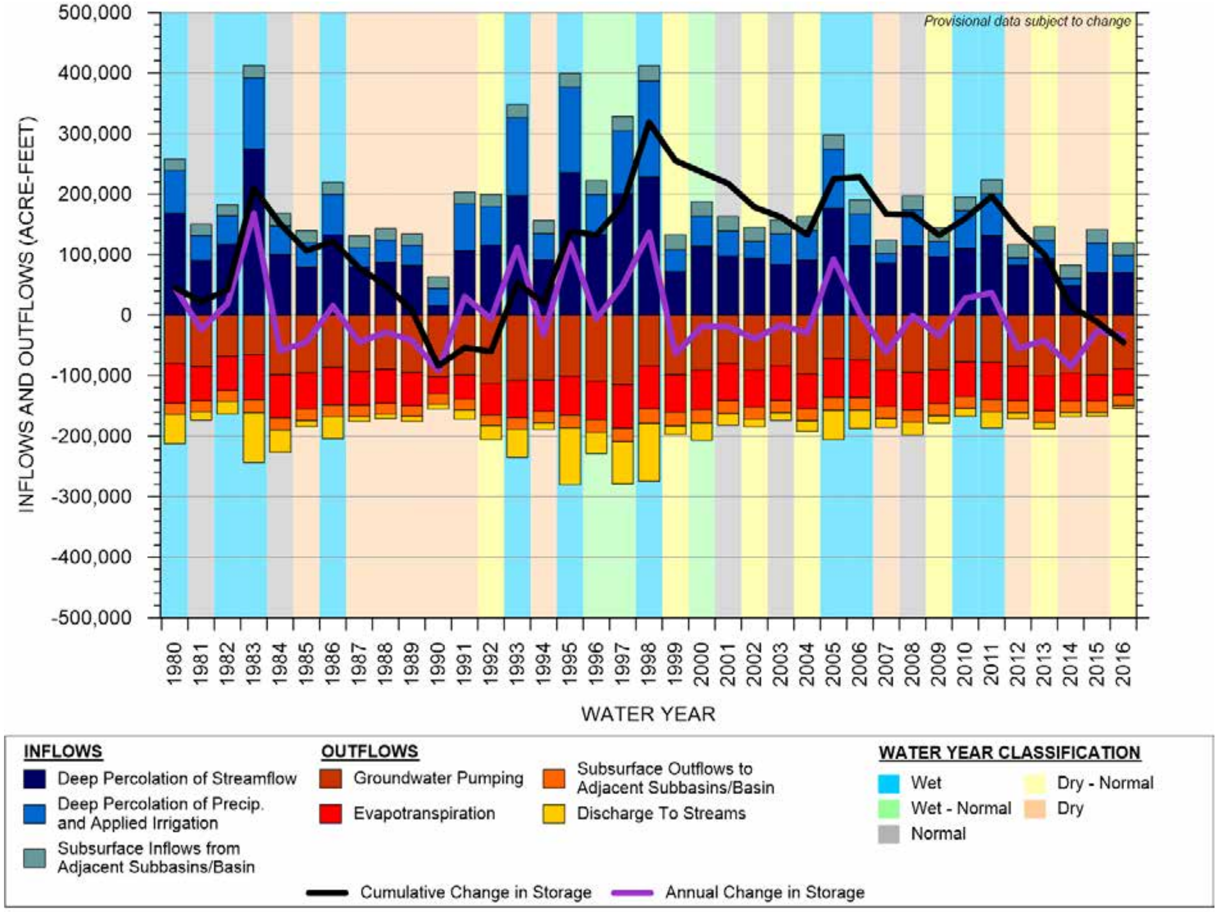


Figure 6-10. SVIHM Simulated Historical and Current Groundwater Budget

A comparison of the historical and current groundwater budgets is shown in Table 6-8. The values in the table are based on the inflows and outflows presented in previous tables. Negative values indicate outflows or depletions. This table is informative in showing the relative magnitude of various water budget components; however, these results are based on a provisional model which might contain errors. The results will be updated in future updates to this chapter after the SVIHM is completed and released by the USGS.

Table 6-8. Summary of Groundwater Budget (AF/yr.)

	Historical Average (WY 1980-2016)	Current (WY 2016)
Groundwater Pumping	-120,500	-117,000
Net Stream Exchange (gain from streams)	89,100	65,500
Deep Percolation	57,300	28,600
Net flow to Adjacent Subbasins/Basin	1,900	4,000
Groundwater ET	-57,900	-43,100
Net Storage Gain (+) or Loss (-)	0	-34,000

Notes: Provisional data subject to change.
The net storage value is the estimated historical overdraft based on observed groundwater levels, as described in Section 6.3.2. Water budget error, as reflected in change in storage, for the historical average period is 15%, which is considered unreasonably large and will be addressed and improved in future updates to the GSP.

6.3.4 Historical and Current Sustainable Yield

The historical and current sustainable yields reflect the amount of Subbasin-wide pumping reduction needed to balance the water budget, resulting in no net decrease in storage. The sustainable yield can be estimated as:

$$\text{Sustainable yield} = \text{pumping} + \text{change in storage}$$

For this sustainable yield discussion and associated computations, groundwater pumping outflows are reported as positive values, which is opposite of how the values are reported in the water budget tables.

Table 6-9 provides estimates of the historical sustainable yield using the GEMS derived historical pumping. Since the Subbasin has historically not been in overdraft, the average change in storage for the calculations in Table 6-9 is set to zero.

Because the Subbasin has not historically been in overdraft, it is impossible to estimate the historical sustainable yield. Therefore, Table 6-9 presents a likely range of sustainable yields. This range represents plus and minus 1 standard deviation around the average GEMS reported pumping between 1995 and 2016. These values are the likely range of the minimum sustainable yield of the Subbasin. This GSP adopts the range of likely minimum sustainable yields as the best estimate for the Subbasin.

Table 6-9. Historical Sustainable Yield for the Upper Valley Aquifer Subbasin Derived from GEMS and Adjusted Change in Storage (AF/yr.)

	Low Historical Average (1995-2016)	High Historical Average (1995-2016)
Total Subbasin Pumping	108,500	129,600
Change in Storage	0	0
Estimated Sustainable Yield	108,500	129,600

Note: Pumping is shown as positive value for this computation. Change in storage value is based on adjusted storage, as previously described in the text.

6.4 Projected Water Budgets

Projected water budgets are extracted from the SVOM, which simulates future hydrologic conditions with assumed climate change. Two projected water budgets are presented, one incorporating estimated 2030 climate change projections and one incorporating estimated 2070 climate change projections.

The climate change projections are based on data provided by DWR (2018). Projected water budgets are useful for showing that sustainability will be maintained for the 50-year planning and implementation horizon. The projected water budgets are based on a provisional version of the SVOM and are subject to change. Model information and assumptions summarized in this section of the report are based on provisional documentation on the model. Additional information will be provided in future GSP updates after the model is released by the USGS.

6.4.1 Assumptions Used in Projected Water Budget Development

The assumptions incorporated into the SVOM for the projected water budget simulations include:

- Land Use: The land use is assumed to be static, aside from a semi-annual change to represent crop seasonality. The annual pattern is repeated every year in the model. Land use specified in the model by USGS reflects the 2014 land use.
- No urban growth is included in this simulation to remain consistent with USGS assumptions. If urban growth is infill, this assumption may result in an underestimate of net pumping increases and an underestimate of the Subbasin’s future extraction. If urban growth replaces agricultural irrigation, the impact may be minimal because the urban growth will replace existing agricultural water use.
- Reservoir Operations: The reservoir operations reflect MCWRA’s current approach to reservoir management, as described in MCWRA’s Nacimiento Dam Operation Policy (MCWRA, 2018b).

- Stream Diversions: The SVOM explicitly simulates only 2 stream diversions in the Salinas Valley Basin: Clark Colony and the Salinas River Diversion Facility (SRDF). The Clark Colony diversion is located along Arroyo Seco and diverts stream water to an agricultural area nearby. The SRDF came online in 2010 and diverts water from the Salinas River to the Castroville Seawater Intrusion Project (CSIP) area. Clark Colony diversions are repeated from the historical record to match the water year. SRDF diversions are made throughout the duration of the SVOM whenever reservoir storage and streamflow conditions allow during the period from April through October. For purposes of the projected water budgets, SRDF diversions are specified at a rate 18 cubic feet per second.
- Recycled Water Deliveries: Recycled water has been delivered to the CSIP area since 1998 as irrigation supply. The SVOM includes these recycled water deliveries throughout the duration of the model, but may not include all sources of recycled water.

6.4.1.1 Future Projected Climate Assumptions

Several modifications were made to the SVOM in accordance with recommendations made by DWR in their *Guidance for Climate Change Data Use During Groundwater Sustainability Plan Development* (DWR, 2018). Three types of datasets were modified to account for 2030 and 2070 projected climate change: climate data including precipitation and potential ET, streamflow, and sea level.

Climate Data. DWR provided gridded change factors for 2030 and 2070 climate conditions that can be applied to historical hydrologic data. These change factors are derived from the statewide gridded datasets for the Variable Infiltration Capacity hydrologic model and are provided as monthly gridded values that can be multiplied by historical data between 1915 and 2011 to produce a dataset of climate inputs for each climate change scenario. Because the change factors are only available through December 2011 and the SVOM uses a climate time series through December 2014, monthly change factors for January 2012 to December 2014 are assumed. Historical data were analyzed from the Salinas Airport precipitation gauge record to identify years from 1968 to 2011 that were most similar to conditions in 2012, 2013, and 2014. Based on this analysis, climate data from 1981, 2002, and 2004 are applied as the climate inputs for 2012, 2013, and 2014, respectively.

The modified gridded monthly climate data for the entire model period are applied as inputs to the model, which reads precipitation and potential ET data on a monthly basis. The gridded climate data consist of a precipitation and a potential ET value for every grid cell in the model.

Streamflow. DWR provided monthly change factors for unimpaired streamflow throughout California. For the Salinas Valley and other areas outside of the Central Valley, these change factors are provided as a single time series for each major watershed. Streamflows along the margins of the Basin are modified by the monthly change factors. As with the climate data, an assumption is required to extend the streamflow change factor time series through December 2014. It is assumed that the similarity in rainfall years at the Salinas Airport rainfall gauge could reasonably be expected to produce similar amounts of streamflow; therefore, the same years of 1981, 2002, and 2004 are repeated to represent the 2012, 2013, and 2014 streamflows.

Sea Level. DWR guidance recommends using a single static value of sea level rise for each of the climate change scenarios (DWR, 2018). For the 2030 climate change scenario, the DWR-recommended sea level rise value of 15 centimeters is used. For the 2070 climate change scenario, the DWR-recommended sea level rise value of 45 centimeters is used. The amount of sea level rise is assumed to be static throughout the duration of each of the climate change scenarios.

6.4.2 Projected Surface Water Budget

Average projected surface water budget inflows and outflows for the simulation period with 2030 and 2070 climate change assumptions are quantified in Table 6-10. As with the historical period, the largest components projected surface water budget are boundary inflows and outflows.

Table 6-10. SVOM Simulated Average Surface Water Inflow and Outflow Components for Projected Climate Change Conditions (AF/yr.)

Projected Climate Change Timeframe	2030	2070
Overland Runoff to Streams	13,400	14,600
Boundary Inflows	845,800	944,200
Net Flow Between Surface Water and Groundwater	-72,500	-73,200
Boundary Outflows	-786,600	-885,700

Note: provisional data subject to change.

6.4.3 Projected Groundwater Budget

Average projected groundwater budget inflows for the simulation period with 2030 and 2070 climate change assumptions are quantified in Table 6-11. In both the 2030 and 2070 simulations, the biggest contributors to groundwater inflows are deep percolation of streamflow, and deep percolation of precipitation and irrigation.

Table 6-11. SVOM Simulated Average Groundwater Inflow Components for Projected Climate Change Conditions (AF/yr.)

Projected Climate Change Timeframe	2030	2070
Deep Percolation of Streamflow	75,300	76,200
Deep Percolation of Precipitation and Irrigation	61,200	66,700
Underflow from Forebay Subbasin	1,300	1,500
Underflow from Paso Robles Area Subbasin	5,400	5,600
Underflow from Surrounding Watersheds	17,300	18,500
Total Inflows	160,500	168,500

Note: provisional data subject to change.

Average projected groundwater budget outflows for the simulation period with 2030 and 2070 climate change assumptions are quantified in Table 6-12. Like the historical and current groundwater budget, the largest outflow is groundwater pumping. The negative values shown in Table 6-12 represent outflows.

Table 6-12. SVOM Simulated and Adjusted Average Groundwater Outflow Components for Projected Climate Change Conditions (AF/yr.)

Projected Climate Change Timeframe	2030 (Simulated)	2070 (Simulated)	2030 (Adjusted)	2070 (Adjusted)
Groundwater Pumping	-87,200	-90,900	-114,700	-119,600
Flow to Streams	-2,800	-3,000	-2,800	-3,000
Groundwater ET	-43,800	-46,300	-43,800	-46,300
Underflow to Forebay Subbasin	-2,800	-2,800	-2,800	-2,800
Underflow to Paso Robles Area Subbasin	-1,900	-1,900	-1,900	-1,900
Underflow to Surrounding Watersheds	-11,700	-12,600	-11,700	-12,600
Total Outflows	-150,200	-157,500	-177,700	-186,200

Note: provisional data subject to change.

[1] Adjusted pumping is based on the ratio between historical average SVIHM and GEMS agricultural pumping, as described in Section 6.3.2.

As described for the historical water budget, the Subbasin is not considered to be in overdraft. Even though, the SVOM projects 10,200 AF/yr. and 10,800 AF/yr. for 2030 and 2070 respectively, the historical decline in storage is used with the adjusted pumping estimates to provide a likely more reasonable estimate for projected sustainable yield. The model includes increased precipitation from climate change; however, it does not account for the frequency and magnitude of storm events. If storm events concentrate precipitation within short periods, more water may run off than infiltrate. More analysis needs to be done with regards to future recharge. Therefore, this projected water budget adopts the historical annual change in storage as the most reasonable estimate, assuming extraction continues. This is reflected in the adjusted average change in storage in Table 6-13, which is set to zero AF/yr.

Combining Table 6-11 and Table 6-12 yields the SVOM simulated net groundwater inflow and outflow data for the simulation with 2030 and 2070 climate change assumptions. These flows are shown in Table 6-13. Negative values indicate outflows or depletions of groundwater.

Table 6-13. Average SVOM Simulated and Adjusted Annual Groundwater Budget for Projected Climate Change Conditions (AF/yr.)

Projected Climate Change Timeframe	2030 (Simulated)	2070 (Simulated)	2030 (Adjusted)	2070 (Adjusted)
Groundwater Pumping	-87,200	-90,900	-114,700	-119,600
Net Stream Exchange	72,500	73,200	72,500	73,200
Deep Percolation of Precipitation and Irrigation	61,200	66,700	61,200	66,700
Net Flow to Forebay Subbasin	-1,400	-1,400	-1,400	-1,400
Net Flow to Paso Robles Area Subbasin	3,600	3,800	3,600	3,800
Net Flow to Surrounding Watersheds	5,600	5,900	5,600	5,900
Groundwater ET	-43,800	-46,300	-43,800	-46,300
Net Storage Gain (+) or Loss (-)	10,200	10,800	0	0

Notes: provisional data subject to change.
Based on the adjusted change in storage, which is the historical average decline as described in the text, water budget error is 11% for 2030 and 6.5% for 2070; these error values are unreasonably large and will be addressed and improved in future updates to the GSP.
[1] Adjusted pumping is based on the ratio between historical average SVIHM and GEMS agricultural pumping, as described in Section 6.3.2.

SVOM projected groundwater pumping by water use sector is summarized in Table 6-14. Because the model assumes no urban growth, future municipal pumping was assumed to be equal to current municipal pumping. Future agricultural pumping is then calculated as the total projected pumping minus the current municipal pumping. The 2030 and 2070 model simulations predict that agriculture will account for more than 95% of pumping. Similar to the SVIHM, domestic pumping is not included in the SVOM future projections simulation.

Table 6-14. SVOM Simulated and Adjusted Projected Annual Groundwater Pumping by Water Use Sector (AF/yr.)

Water Use Sector	2030	2070	2030	2070
Urban Pumping	-2,400	-2,400	-3,100	-3,100
Agricultural Pumping	-84,800	-88,500	-111,600	-116,400
Total Pumping	-87,200	-90,900	-114,700	-119,500

Note: provisional data subject to change.
[1] Adjusted pumping is based on the ratio between historical average SVIHM and GEMS agricultural pumping, as described in Section 6.3.2.

6.4.4 Projected Sustainable Yield

Projected sustainable yield is the long-term pumping that can be sustained once all undesirable results have been addressed. However, it is not the amount of pumping needed to stop undesirable results before sustainability is reached. The SVBGSA recognizes that, depending on the success of various proposed management actions and projects, there may be some years when pumping must be held at lower levels to achieve minimum thresholds. The actual amount of allowable pumping from the Subbasin will be adjusted in the future based on the success of management actions and projects.

To retain consistency with the historical sustainable yield, projected sustainable yield can be estimated by summing all the average groundwater extractions and adding the average change in storage. This represents the change in pumping that results in no change in storage, assuming no other projects or management actions are implemented. For this sustainable yield discussion and associated computations, groundwater pumping outflows are reported as positive values, which is opposite of how the values are reported in the water budget tables.

Table 6-15 provides estimates of the future sustainable yield using estimated future pumping calculated in Table 6-14. As with the historical sustainable yield, the model estimated change in storage is within the model error, and the average change in storage for the calculations in Table 6-15 is set to zero.

Table 6-15. Adjusted Projected Sustainable Yields (AF/yr.)

	2030 Projected Sustainable Yield	2070 Projected Sustainable Yield	Historical Sustainable Yield Range
Groundwater Pumping	114,700	119,600	108,500 to 129,600
Change in Storage	0	0	0
Projected Sustainable Yield	114,700	119,600	108,500 to 129,600

Table 6-15 includes the GEMS database estimate of historical sustainable yield for comparison purposes. Although the sustainable yield values provide guidance for maintaining sustainability, simply reducing pumping to within the sustainable yield is not proof of sustainability. Sustainability must be demonstrated through the SMC. The sustainable yield value will be modified and updated as more data are collected, and more analyses are performed.

6.4.5 Uncertainties in Projected Water Budget Simulations

Models are mathematical representations of physical systems. They have limitations in their ability to represent physical systems exactly and due to limitations in the data inputs used. There is also inherent uncertainty in groundwater flow modeling itself, since mathematical (or numerical) models can only approximate physical systems and have limitations in how they compute data. However, DWR (2018) recognizes that although models are not exact representations of physical systems because mathematical depictions are imperfect, they are powerful tools that can provide useful insights.

There is additional inherent uncertainty involved in projecting water budgets with projected climate change based on the available scenarios and methods. The recommended 2030 and 2070central tendency scenarios that are used to develop the projected water budgets with the SVIHM provide a dataset that can be interpreted as what might be considered the most likely future conditions; there is an approximately equal likelihood that actual future conditions will be more stressful or less stressful than those described by the recommended scenarios (DWR, 2018).

As stated in DWR (2018):

> *"Although it is not possible to predict future hydrology and water use with certainty, the models, data, and tools provided [by DWR] are considered current best available science and, when used appropriately should provide GSAs with a reasonable point of reference for future planning."*

6.5 Subbasin Water Supply Availability and Reliability

Water is not imported into the Upper Valley Subbasin. However, a significant portion of the Subbasin's recharge is derived from reservoir releases that regulate Salinas River streamflow. The historical water budget incorporates years when there was little availability of surface water flow and groundwater elevations declined as a result. Figure 6-5 shows that when Salinas River flows were low, deep percolation to groundwater was also low. Declines during these years did not affect the ability to operate within the sustainable yield, as groundwater elevations rebounded during years when there was greater surface water flow. The projected water budgets are developed with the SVOM, which is based on historical surface water flows and groundwater conditions, and therefore projected water budgets incorporate reasonable fluctuations in water supply availability. MCWRA plans to revise the HCP for the Salians River, which may change the current reservoir release schedule. A revised reservoir release schedule could influence the reliability of groundwater recharge.

6.6 Uncertainties in Water Budget Calculations

The level of accuracy and certainty is highly variable between water budget components. A few water budget components are directly measured, but most water budget components are either estimated inputs to the model or simulated by the model. Additional model uncertainty stems from an imperfect representation of natural condition and is reflected in model calibration error. However, inputs to the models are carefully selected using best available data, the model's calculations represent established science for groundwater flow, and the model calibration error is within acceptable bounds. Therefore, the models are the best available tools for estimating water budgets. The model results are provisional and subject to change in future GSP updates after the models are released by the USGS.

The following list groups water budget components in increasing order of uncertainty. Measured: metered municipal, agricultural, and some small water system pumping

- Estimated: domestic pumping, including depth, rate, and location
- Simulated primarily based on climate data: precipitation, ET, irrigation pumping
- Simulated based on calibrated model: all other water budget components

Simulated components based on calibrated model have the most uncertainty because those simulated results encompass uncertainty of other water budget components used in the model in addition to model calibration error.

7 MONITORING NETWORKS

This chapter describes the networks that will monitor the SMC discussed in Chapter 8. This description of the monitoring network has been prepared in accordance with the GSP Regulations § 354.32 *et seq.* to include monitoring objectives, monitoring protocols, and data reporting requirements.

7.1 Introduction

7.1.1 Monitoring Network Objectives

SGMA requires monitoring networks collect data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the Subbasin, and to evaluate changing conditions that occur as the Plan is implemented. The monitoring networks are intended to:

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

7.1.2 Approach to Monitoring Networks

Monitoring networks are developed for each of the 5 sustainability indicators that are relevant to the Subbasin:

1. Chronic lowering of groundwater levels
2. Reduction in groundwater storage
3. Degraded water quality
4. Land subsidence
5. Depletion of ISW

Other monitoring networks, such as groundwater extraction, that are necessary to comply with GSP Regulations are also included in this chapter. Representative Monitoring Sites (RMS) are a subset of the monitoring network and are limited to sites with data that are publicly available and not confidential.

The SVBGSA estimated the density of monitoring sites and the frequency of measurements required to demonstrate short-term, seasonal, and long-term trends. If the required monitoring site density does not currently exist, the SVBGSA will expand monitoring networks during GSP implementation. Filling data gaps and developing more extensive and complete monitoring networks will improve the SVBGSA's ability to demonstrate sustainability and refine the existing conceptual and numerical hydrogeologic models. Chapter 10 provides a plan and schedule for resolving data gaps. The SVBGSA will review the monitoring network in each 5-year assessment, including a determination of uncertainty and whether there are remaining data gaps that could affect the ability of the Plan to achieve the sustainability goal for the Subbasin.

7.1.3 Management Areas

No management areas have been defined for the Upper Valley Subbasin.

7.2 Groundwater Level Monitoring Network

The sustainability indicator for chronic lowering of groundwater levels is evaluated by monitoring groundwater elevations in designated monitoring wells. The Regulations require a network of monitoring wells sufficient to demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features.

Figure 7-1 shows the 24 well in the Subbasin monitored by MCWRA for groundwater elevations that are used to develop groundwater elevation contours and have publicly available data on the SVBGSA Web Map.

Of the wells shown on Figure 7-1, 18 are selected for inclusion in the groundwater level monitoring network as RMS wells, and are shown on Figure 7-2. Criteria for selecting wells as part of the RMS network include:

- RMS wells must have known depths and well completion data
- RMS wells should have a relatively long period of historical data
- Hydrographs of RMS wells should be visually representative of the hydrographs from surrounding wells. Appendix 5A includes the hydrograph comparisons used to establish that RMS wells are representative of surrounding wells
- RMS locations must cover the basin and provide data near basin boundaries
- RMS should be selected for each aquifer. There is only 1 aquifer in the Upper Valley Subbasin
- Data from RMS wells is public data and will be used for groundwater elevation maps and analysis. SVBGSA notified well owner of intent to include well in monitoring network.

The RMS wells in the water level monitoring network are listed in Table 7-1. The need for any additional wells is discussed in Section 7.2.2. Appendix 5A presents well construction information and historical hydrographs for each RMS well.

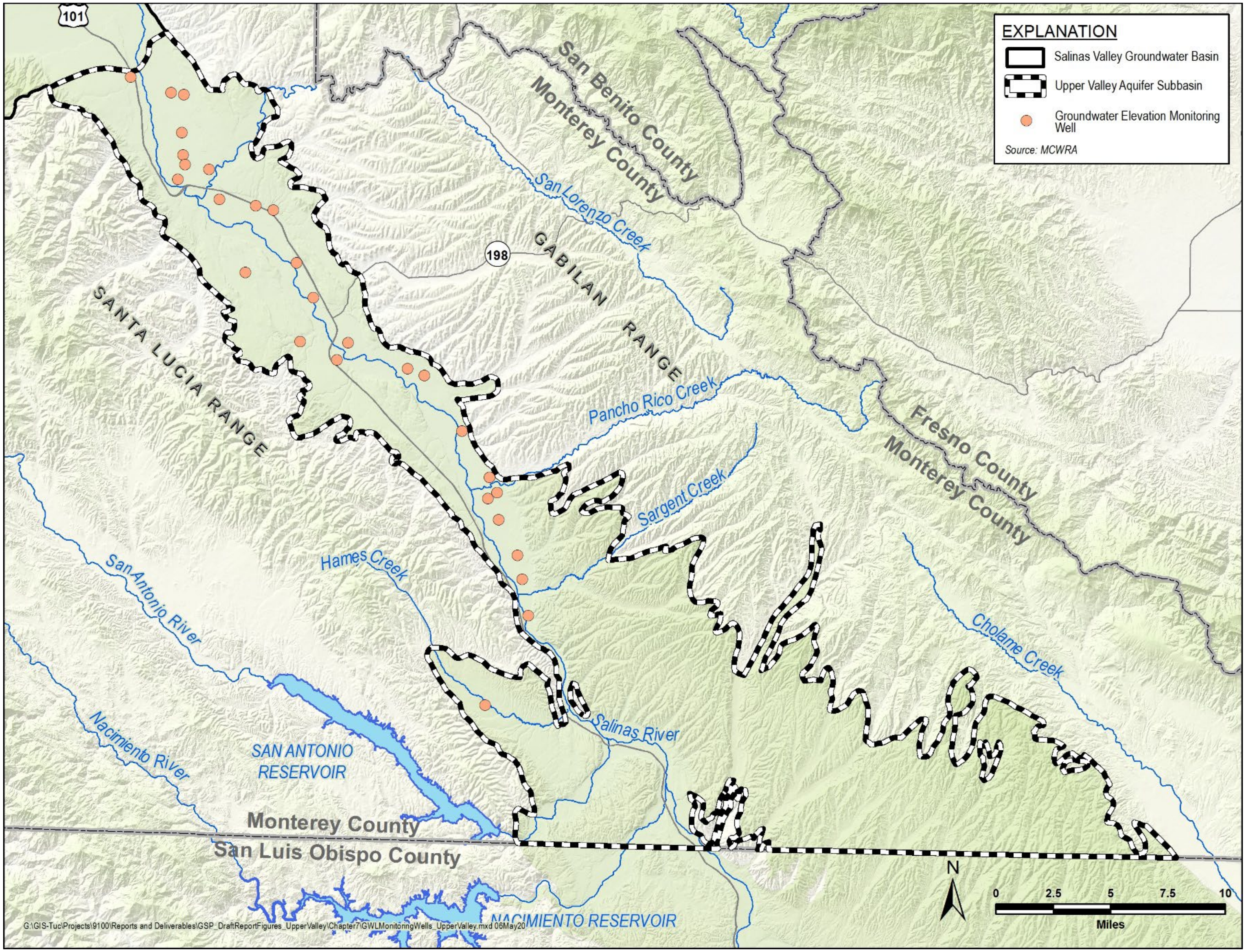


Figure 7-1. Upper Valley Aquifer Monitoring Network for Groundwater Levels

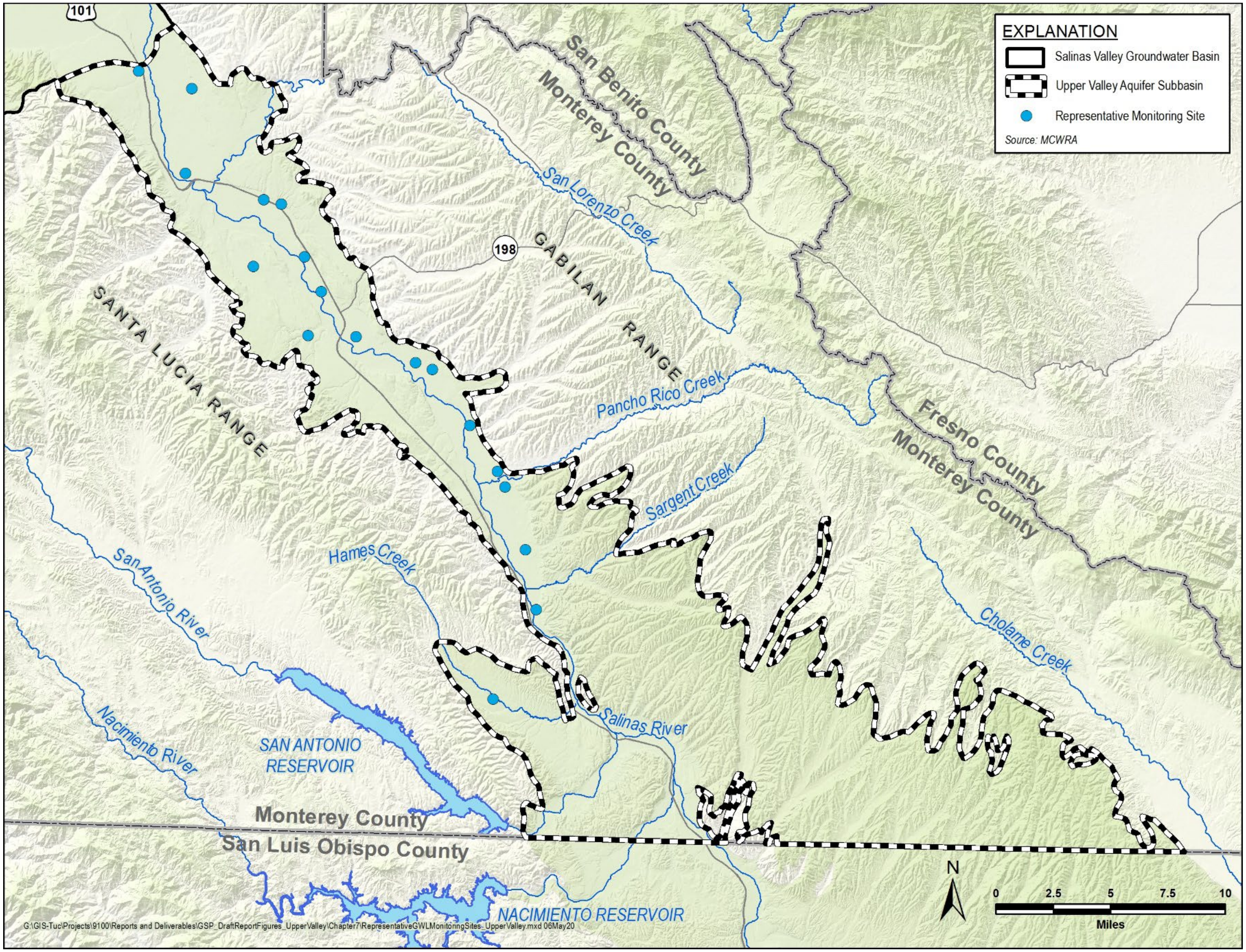


Figure 7-2. Upper Valley Aquifer Representative Monitoring Network for Groundwater Levels

Table 7-1. Upper Valley Aquifer Groundwater Level Representative Monitoring Site Network

State Well Number	CASGEM Well Number	Local Well Designation	Well Use	Total Well Depth (ft)	Reference Point (ft, NAVD88)	Latitude (NAD 83)	Longitude (NAD 83)	Period of Record (years)
19S/07E-14N02	N/A	1822	Irrigation	228	315.8	36.27197	-121.18495	24
19S/08E-19K03	362614N1211432W001	1379	Irrigation	212	282.0	36.26142	-121.14319	50
20S/08E-07F01	N/A	1453	Irrigation	189	292.4	36.20795	-121.14653	24
20S/08E-14K01	361903N1210713W001	1735	Irrigation	236	462.7	36.19034	-121.07133	57
20S/08E-15H03	N/A	355	Irrigation	170	318.9	36.19219	-121.08509	24
20S/08E-25Q01	N/A	2595	Irrigation	80	335.0	36.15672	-121.05221	24
20S/08E-34G01	N/A	10077	Domestic	432	456.0	36.14981	-121.09201	24
21S/08E-13H01	N/A	26413	Irrigation	N/A	484.0	36.10682	-121.04824	1
21S/09E-06F50	N/A	23311	Irrigation	65	352.2	36.13490	-121.03857	6
21S/09E-16E01	N/A	555	Irrigation	100	358.0	36.10673	-121.01083	24
21S/09E-23G01	N/A	55	Irrigation	65	386.0	36.09105	-120.96389	24
21S/09E-24L01	N/A	2611	Irrigation	120	397.5	36.08697	-120.95076	24
21S/10E-32N01	N/A	733	Irrigation	N/A	400.0	36.05220	-120.92062	24
22S/10E-09P01	N/A	1137	Irrigation	N/A	463.0	36.02334	-120.89832	24
22S/10E-16K01	N/A	189	Irrigation	N/A	472.0	36.01370	-120.89202	24
22S/10E-34G01	N/A	1761	Irrigation	182	483.6	35.97422	-120.87543	24
23S/10E-14D01	359362N1208661W001	SArdoS19450	Observation	142	463.6	35.93624	-120.86607	27
23S/10E-33P01	N/A	10134	Irrigation	780	747.5	35.87910	-120.89823	24

7.2.1 Groundwater Level Monitoring Protocols

Chapter 4 of the MCWRA CASGEM monitoring plan includes a description of existing groundwater elevation monitoring procedures (MCWRA, 2015). The CASGEM groundwater elevation monitoring protocols established by MCWRA are adopted by this GSP and are included in Appendix 7A. Groundwater elevation measurements will be collected at least 2 times per year to represent seasonal low and seasonal high groundwater conditions. The monitoring protocols described in Appendix 7A cover multiple monitoring methods for collecting data by hand and by automated pressure transducers. These protocols are consistent with data and reporting standards described in GSP Regulations § 352.4.

7.2.2 Groundwater Level Monitoring Network Data Gaps

Based on the GSP Regulations and BMPs published by DWR on monitoring networks (DWR, 2016b), a visual analysis of the existing monitoring network was performed using professional judgment to evaluate whether there are data gaps in the groundwater level monitoring network.

While there is no definitive requirement on monitoring well density, the BMP cites several studies (Heath, 1976; Sophocleous, 1983; Hopkins and Anderson, 2016) that recommend 0.2 to 10 wells per 100 square miles. The BMP notes that professional judgment should be used to design the monitoring network to account for high-pumping areas, proposed projects, and other subbasin-specific factors.

The Upper Valley Subbasin encompasses 371 square miles. If the BMP guidance recommendations are applied to the Subbasin, the well network should include between 1 and 37 wells. The current network includes 18 wells. The number of groundwater elevation monitoring wells in the Subbasin exceeds the range of the BMP guidance. However, visual inspection of the geographic distribution of the well network indicates that additional wells are necessary to adequately characterize the Subbasin. A higher density of monitoring wells may also be recommended in areas of groundwater withdrawal.

Figure 7-3 shows the locations of existing groundwater level monitoring wells and the generalized locations where monitoring wells are needed in the Upper Valley Subbasin. Not all areas in the southeastern portion of the Subbasin are covered by wells or data gaps. This is because much of the southeastern portion of the Subbasin is lightly populated with no significant cropping. The data gap areas shown on Figure 7-3 will be addressed during GSP implementation by drilling a new well in each area, as further described in Chapter 10. The generalized locations for new monitoring wells were based on addressing the criteria listed in the monitoring BMP including:

- Providing adequate data to produce seasonal potentiometric maps
- Providing adequate data to map groundwater depressions and recharge areas

- Providing adequate data to estimate change in groundwater storage
- Demonstrating conditions at Subbasin boundaries

Additionally, groundwater elevation measurements for most of the monitoring wells in the Subbasin occur only once a year. SVBGSA will work with MCWRA to e have groundwater levels collected at least twice a year as outlined in Section 7.2.1. Furthermore, some of the wells in the monitoring network have unknown well construction information and that is a data gap that will be addressed during GSP implementation.

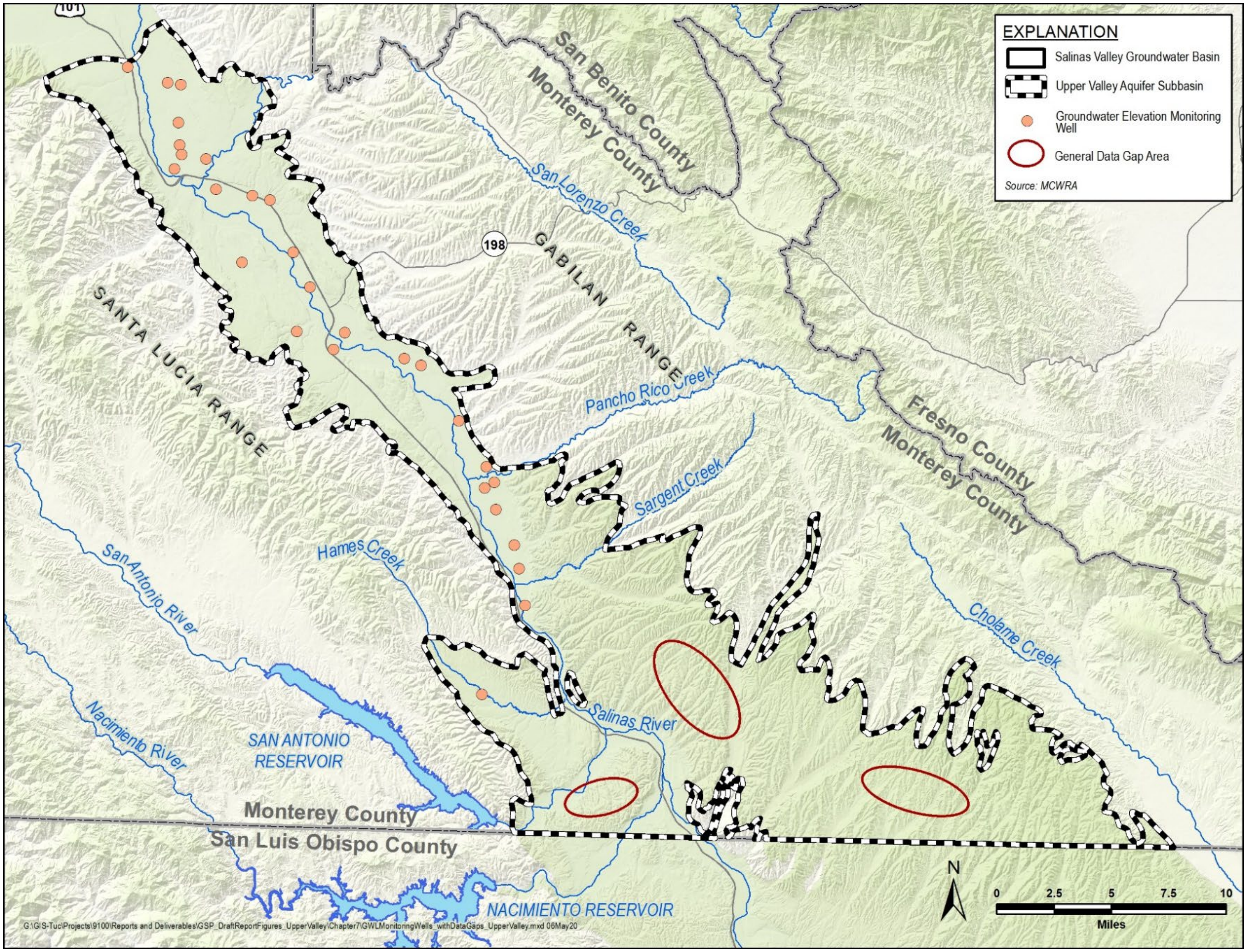


Figure 7-3. Data Gaps in the Groundwater Level Monitoring Network

7.3 Groundwater Storage Monitoring Network

As discussed in Chapter 8, the sustainability indicator for reduction of groundwater storage is measured using groundwater elevations as proxies. Thus, the groundwater storage monitoring network is the same as the groundwater level monitoring network.

7.4 Groundwater Quality Monitoring Network

The sustainability indicator for degraded water quality is evaluated by adopting the SWRCB DDW and CCRWQCB ILRP groundwater quality networks. The water quality monitoring network for the Subbasin is composed of public water system supply wells monitored under DDW, and on-farm domestic wells and irrigation supply wells monitored under ILRP.

As described in Chapter 8, separate minimum thresholds are set for the constituents of concern for public water system supply wells, on-farm domestic wells, and irrigation supply wells. Therefore, although there is a single groundwater quality monitoring network, different wells in the network are reviewed for different constituents. COC for drinking water are assessed at public water supply wells and on-farm domestic wells, and COC for crop health are assessed at irrigation supply wells. The COC for the 3 sets of wells are listed in Chapter 5.

The public water system supply wells included in the monitoring network were identified by reviewing data from the SWRCB DDW. The SWRCB collects data for municipal systems; community water systems; non-transient, non-community water systems; and non-community water systems that provide drinking water to at least 15 service connections or serve an average of at least 25 people for at least 60 days a year. The RMS network consists of 31 DDW wells, as shown on Figure 7-4 and listed in Appendix 7B.

All on-farm domestic wells and irrigation supply wells that have been sampled through the CCRWQCB's ILRP are included in the RMS network. Under the existing, Ag Order, there are 216 ILRP wells, consisting of 134 irrigation supply wells and 82 on-farm domestic wells that are all part of the RMS network. The locations of these wells are shown on Figure 7-5 and listed in Appendix 7B. The SVBGSA assumes that Ag Order 4.0, anticipated in 2021, will have a similar representative geographic distribution of wells within the Subbasin. The agricultural groundwater quality monitoring network will be revisited and revised when the Ag Order 4.0 monitoring network is finalized.

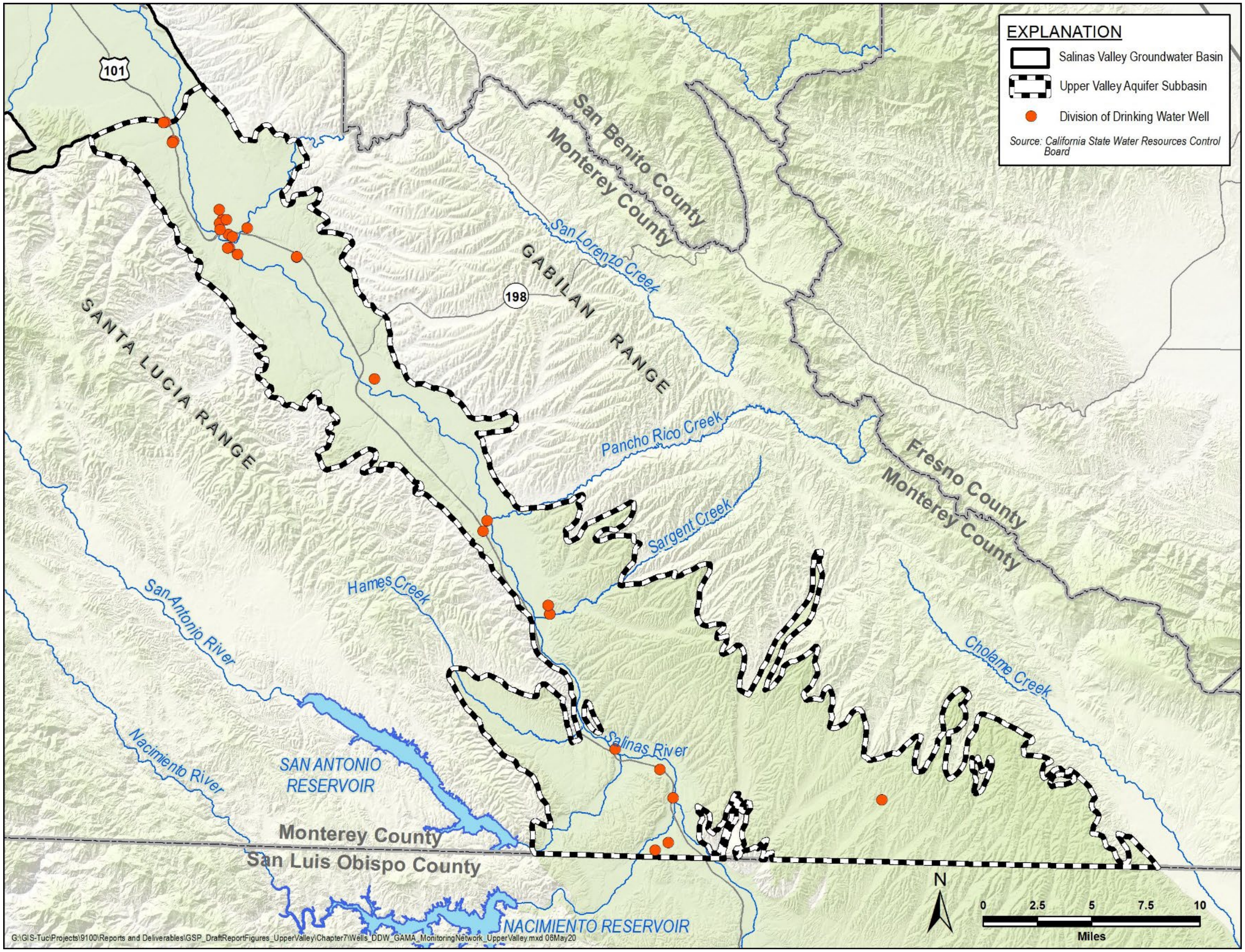


Figure 7-4. DDW Public Water System Supply Wells in the Groundwater Quality Monitoring Network

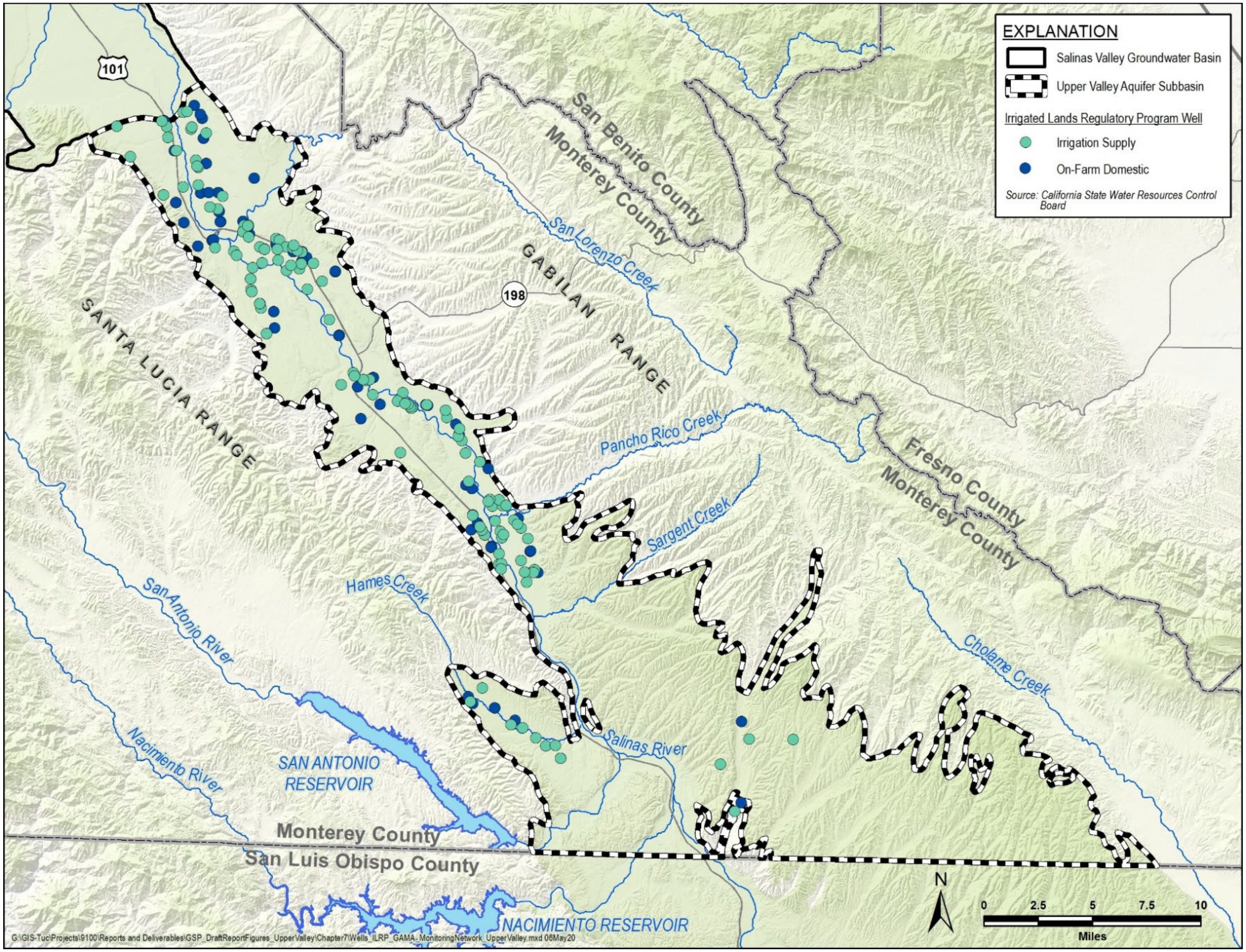


Figure 7-5. ILRP Wells in the Groundwater Quality Monitoring Network

7.4.1 Groundwater Quality Monitoring Protocols

The SVBGSA does not independently sample wells for any constituents of concern. Instead, the GSA analyzes water quality data that are collected through the DDW and ILRP. Therefore, the GSA is dependent on the monitoring density and frequency of DDW and ILRP.

Water quality data from public water systems are collected, analyzed, and reported in accordance with protocols that are reviewed and approved by the SWRCB DDW, in accordance with the state and federal Safe Drinking Water Acts. Monitoring protocols may vary by agency.

ILRP data are currently collected under CCRWQCB Ag Order 3.0. ILRP samples are collected under the Tier 1, Tier 2, or Tier 3 monitoring and reporting programs. Under Ag Order 4.0, ILRP data will be collected in 3 phases and each groundwater basin within the Central Coast Region has been assigned to one or more of these phases. The designated phase for each ILRP well is provided in SWRCB's GeoTracker database and is publicly accessible at: https://geotracker.waterboards.ca.gov/. Ag Order 4.0 will take effect in the Subbasin beginning in 2023. Copies of the Ag Orders 3.0 and 4.0 monitoring and reporting programs are included in Appendix 7C and are incorporated into this GSP. These protocols are consistent with data and reporting standards described in GSP Regulations § 352.4.

7.4.2 Groundwater Quality Monitoring Data Gaps

The DDW and ILRP monitoring network provide sufficient spatial and temporal data to determine groundwater quality trends for water quality indicators to address known water quality issues. Additionally, there is adequate spatial coverage in the water quality monitoring network to assess impacts to beneficial uses and users.

7.5 Land Subsidence Monitoring Network

As described in Section 5.4, DWR collects land subsidence data using InSAR satellite data and makes these data available to GSAs. This subsidence dataset represents the best available science for the Upper Valley Subbasin and is therefore used as the subsidence monitoring network.

7.5.1 Land Subsidence Monitoring Protocols

Land Subsidence monitoring protocols are the ones used by DWR for InSAR measurements and interpretation. DWR adapted their methods to measure subsidence on hard surfaces only and interpolate between them to minimize the change in land surface elevation captures in soft surfaces that are likely not true subsidence. The cell size of this interpolated surface is 302 ft by 302 ft. If the annual monitoring indicates subsidence is occurring at a rate greater than the minimum thresholds, then additional investigation and monitoring may be warranted. In particular, the GSAs will implement a study to assess if the observed subsidence can be correlated to groundwater elevations, and whether a reasonable causality can be established. These protocols are consistent with data and reporting standards described in GSP Regulations § 352.4.

7.5.2 Land Subsidence Data Gaps

There are no data gaps associated with the subsidence monitoring network.

7.6 Interconnected Surface Water Monitoring Network

The primary tool for assessing depletion of ISW due to pumping will be shallow monitoring wells adjacent to the Salinas River. Figure 7-6 shows the existing wells from MCWRA's groundwater monitoring programs that will be added to the ISW monitoring network and the location of a proposed new monitoring well. Existing wells were chosen based on the locations of ISW determined by the preliminary SVIHM, well depth, and proximity to the Salinas River. Furthermore, the wells are also located in vicinity of to a USGS stream gauge or MCWRA River Series measurement site shown on Figure 7-6. This allows for monitoring of groundwater elevations near the rivers in the Subbasin and may provide insight on the relationship between streamflow and groundwater elevations. Additionally, the combined use of groundwater elevation and streamflow data will allow SVBGSA to assess temporal changes in conditions due to variations in stream discharge and regional groundwater extraction, as well as other factors that may be necessary to identify adverse impacts on beneficial uses of the surface water as discussed in Chapter 8. All ISW monitoring wells are RMS. More information on the development of the ISW monitoring network is provided in Appendix 7D.

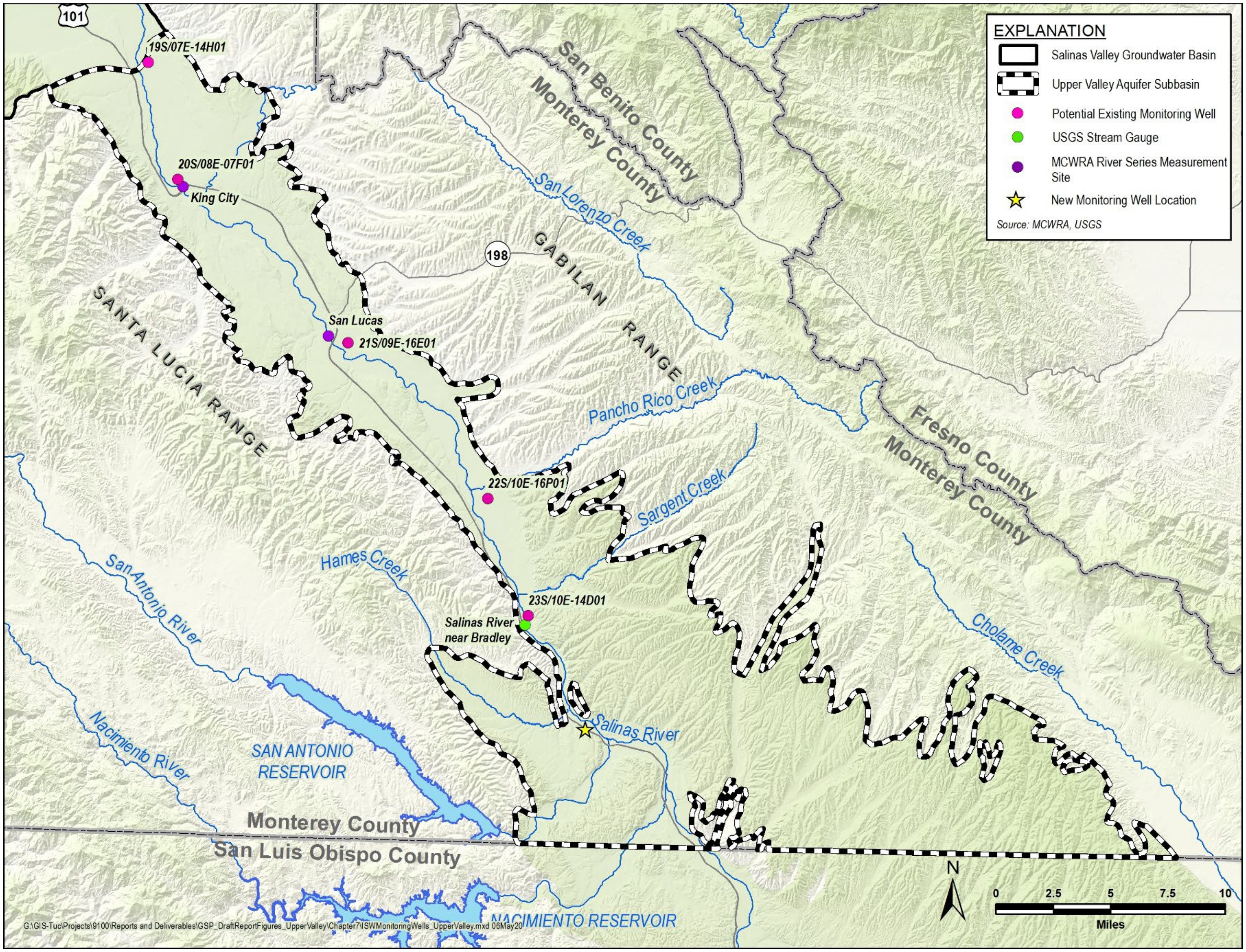


Figure 7-6. Interconnected Surface Water Monitoring Network

7.6.1 Interconnected Surface Water Monitoring Protocols

Monitoring protocols for shallow wells monitoring ISW will be identical to MCWRA's current groundwater elevation monitoring protocols, included in Appendix 7A. These protocols are consistent with data and reporting standards described in GSP Regulations § 352.4. Additionally, each well that is added to the monitoring network will be equipped with a data logger that will allow SVBGSA to access if seasonal pumping is resulting in streamflow depletions.

7.6.2 Interconnected Surface Water Data Gaps

As shown on Figure 7-6, the data gap in the ISW monitoring network will be filled with a new well added along the Salinas River after conservation releases from the Reservoirs come into the River, as discussed in Chapter 10. The new shallow well will be added to MCWRA's groundwater elevation monitoring program.

7.7 Other Monitoring Networks

SGMA requires that Annual Reports include annual groundwater extractions and surface water diversions in order to report total water use for the Subbasin; thus, the following monitoring networks are needed in addition to the monitoring networks outlined above for sustainability indicators.

7.7.1 Groundwater Extraction Monitoring Network

SGMA requires that Annual Reports include annual groundwater extraction for the Subbasin. MCWRA's GEMS will be used to monitor urban and agricultural extraction in the Subbasin. Under Monterey County Ordinance No. 3717, public water systems and agricultural pumpers using wells with an internal discharge pipe greater than 3 inches within Zones 2, 2A, and 2B report extractions annually to GEMS. Extraction is self-reported by well owners or operators. Agricultural wells report their data based on MCWRA's reporting year that runs from November 1 through October 31. Urban and industrial wells report extraction on a calendar year basis. When extraction data is summarized annually, MCWRA combines industrial and urban extractions into a single urban water use. As depicted on Figure 3-3, these zones do not provide sufficient coverage of the whole Upper Valley Subbasin. This data gap is further discussed in Section 7.7.1.2.

SVBGSA will work with MCWRA to obtain the GEMS data through a coordinated reporting program such that wells owners can provide a single annual reporting to fulfill the requirements of both the GSP and the existing County Ordinances No. 3717 and No. 3718.

7.7.1.1 Groundwater Extraction Monitoring Protocols

Groundwater extraction monitoring is accomplished using the GEMS data provided by MCWRA. Existing GEMS protocols are consistent with data and reporting standards described in GSP Regulation §352.4.

7.7.1.2 Groundwater Extraction Monitoring Data Gaps

Accurate assessment of the amount of pumping requires an accurate count of the number of municipal, agricultural, and domestic wells in the GSP area. As proposed in Chapter 9, SVBGSA will undertake well registration during implementation to develop a database of existing and active groundwater wells. This database will draw from the existing MCWRA database, DWR's OSWCR database, and the Monterey County Health Department database of state small and local small water systems. As part of the assessment, the SVBGSA will verify well completion information and location, and whether the well is active, abandoned, or destroyed as is discussed further in Chapter 9.

The new DWR Upper Valley Subbasin boundaries result in a large potential data gap in agricultural extraction information. Currently, pumping records are available only for the portion of the Subbasin that overlaps with MCWRA's Upper Valley Subarea. SVBGSA will work with MCWRA to address this data gap during GSP implementation by expanding the GEMS program as described in Chapter 9. Crop data and crop duty multipliers for estimating unreported pumping could be developed or compiled from existing sources, such as the SVIHM, for areas where agricultural extraction is not reported while the GEMS program is expanded. These crop duty multipliers will be used to estimate groundwater pumping based on crop type and acreage.

In addition, the accuracy and reliability of groundwater pumping reported through GEMS is constantly being updated. SVBGSA will work with MCWRA to evaluate methods currently in place to assure data reliability. Based on the results of that evaluation, the protocols for monitoring may be revised and a protocol for well meter calibration may be developed. SVBGSA will work with MCWRA to consider the value of developing protocols for flowmeter calibration and other potential enhancements to the GEMS programs that are discussed in Chapter 9.

7.7.2 Salinas River Watershed Diversions

Salinas River watershed monthly diversion data are collected annually in the SWRCB's eWRIMS, which is used track information of water rights in the state and is publicly accessible at: https://ciwqs.waterboards.ca.gov/ciwqs/ewrims/reportingDiversionDownloadPublicSetup.do. These data include diversions from tributaries of the Salinas River.

As mentioned in Chapter 3, growers and residents have noted that some irrigation is reported both to the SWRCB as Salinas River diversions and to the MCWRA as groundwater pumping.

Comparing surface water diversion data to groundwater pumping data is complicated by the fact that diversions and pumping are reported on different schedules. To estimate the quantity that is potentially double counted and reported as both groundwater extraction and surface water diversions, an initial analysis was undertaken by matching unique locations and monthly diversion amounts summed by the GEMS reporting year (November 1 to October 31) to reported annual pumping data as shown in Figure 3-4.

7.7.2.1 Salinas River Watershed Diversions Monitoring Protocols

Salinas River watershed diversion monitoring protocols are those that the SWRCB has established for the collection of water right information. These protocols are consistent with data and reporting standards described in GSP Regulations § 352.4.

7.7.2.2 Salinas River Watershed Diversions Monitoring Data Gaps

These data are lagged by a year because the reporting period does not begin until February of the following year.

7.8 Data Management System and Data Reporting

The SVBGSA has developed a DMS in adherence to GSP Regulations §352.6 and §354.40 that is used to store, review, and upload data collected as part of the GSP development and implementation.

The SVBGSA DMS consists of 2 SQL databases. The HydroSQL database stores information about each well and time-series data for water level and extraction. Fields in the HydroSQL database include:

- Subbasin
- Cadastral coordinates
- Planar coordinates
- Well owner
- Well name
- Well status
- Well depth
- Screened interval top and bottom
- Well type
- Water level elevation

- Annual pumping volume

Well owner and annual pumping information will be stored in HydroSQL, however, neither will be publicly accessible due to confidentiality requirements.

Streamflow gauge data from the USGS is stored in the HydroSQL similarly to the well water level information.

Water quality data are stored in the EnviroData SQL database, which is linked to the HydroSQL for data management purposes. EnviroData SQL contains fields such as:

- Station
- Parameter
- Sample Date
- Detection (detect or non-detect)
- Value
- Unit

The data used to populate the SVBGSA DMS are listed in Table 7-2. Categories marked with an X indicate datasets that were used in populating the DMS, including data that are publicly accessible or that are available to SVBGSA from MCWRA. Some data, such as groundwater extraction is confidential, and cannot be made publicly accessible by SVBGSA unless aggregated. Additional datasets will be added in the future as appropriate, such as recharge or diversion data.

Table 7-2. Datasets Available for Use in Populating the DMS

Data Sets	Well and Site Information	Well Construction	Water Level	Pumping[1]	Streamflow	Water Quality
DWR (CASGEM)	X	X				
MCWRA	X	X	X	X		
GAMA Groundwater Information System	X					X
USGS Gauge Stations					X	

[1] Pumping data not publicly accessible

Data were compiled and reviewed to comply with quality objectives. The review included the following checks:

- Identifying outliers that may have been introduced during the original data entry process by others.
- Removing or flagging questionable data being uploaded in the DMS. This applies to historical water level data and water quality data.

The data were loaded into the database and checked for errors and missing data. The error tables identify water level and/or well construction data as missing. Another quality check was completed with the water level data by plotting each well hydrograph to identify and remove anomalous data points.

In the future, well log information will be entered for selected wells and other information will be added as needed to satisfy the requirements of the SGMA regulations.

The DMS also includes a publicly accessible web map hosted on the SVBGSA website; accessible at https://svbgsa.org/gsp-web-map-and-data/. This web map gives interested parties access to non-confidential technical information used in the development of the GSP and annual reports, and includes public well data, analysis such as water level contour maps, seawater intrusion, as well as various local administrative boundaries. In addition, the web map has functionalities to graph time series of water levels and search for specific wells in the database. This web map will be regularly updated as new information is made available to the SVBGSA.

8 SUSTAINABLE MANAGEMENT CRITERIA

This chapter defines the conditions that constitute sustainable groundwater management and establishes minimum thresholds, measurable objectives, and undesirable results for each sustainability indicator. The minimum thresholds, measurable objectives, and undesirable results detailed in this chapter define the Subbasin's future conditions and commit the GSA to actions that will meet these criteria. This chapter includes adequate data to explain how SMC were developed and how they influence all beneficial uses and users.

The chapter is structured to address all the GSP Regulations § 354.22 *et. seq.* regarding SMC. To retain an organized approach, the SMC are grouped by sustainability indicator. The discussion of each sustainability indicator follows a consistent format that contains all the information required by the GSP Regulations, and as further clarified in the SMC BMP (23 California Code of Regulations § 352.22 *et seq.*; DWR, 2017).

8.1 Definitions

The SGMA legislation and GSP Regulations contain terms relevant to the SMC. The definitions included in the GSP Regulations are repeated below. Where appropriate, additional explanatory text is added in italics. This explanatory text is not part of the official definitions of these terms.

- **Sustainability indicator** refers to any of the effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results, as described in Water Code Section 10721(x).

  The 5 sustainability indicators relevant to this subbasin include chronic lowering of groundwater levels; reduction of groundwater storage; degraded water quality; land subsidence; and depletion of ISW.

- **Significant and Unreasonable**

  Significant and unreasonable is not defined in the Regulations. However, the definition of undesirable results states, "Undesirable results occur when significant and unreasonable effects … are caused by groundwater conditions…." This GSP adopts the phrase significant and unreasonable to be the qualitative description of undesirable conditions due to inadequate groundwater management. Minimum thresholds are the quantitative measurement of the significant and unreasonable conditions.

- **Minimum threshold** refers to a numeric value for each sustainability indicator used to define undesirable results.

  Minimum thresholds are indicators of an unreasonable condition.

- **<u>Measurable objective</u>** refers to a specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions that have been included in an adopted Plan to achieve the sustainability goal for the basin.

  Measurable objectives are goals that the GSP is designed to achieve.

- **<u>Interim milestone</u>** refers to a target value representing measurable groundwater conditions, in increments of 5 years, set by an Agency as part of a Plan.

  Interim milestones are targets such as groundwater elevations that will be achieved every 5 years to demonstrate progress toward the sustainability goal.

- **<u>Undesirable Result</u>**

  Undesirable Result is not defined in the Regulations. However, the description of undesirable result states that it should be a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the subbasin. An example undesirable result is more than 10% of the measured groundwater elevations being lower than the minimum thresholds. Undesirable results should not be confused with significant and unreasonable conditions. Significant and unreasonable conditions are qualitative descriptions of conditions to be avoided; an undesirable result is a quantitative assessment based on minimum thresholds.

8.2 Sustainability Goal

The sustainability goal of the Upper Valley Subbasin is to manage groundwater resources for long-term community, financial, and environmental benefits to the Subbasin's residents and businesses. The goal of this GSP is to ensure long-term viable water supplies while maintaining the unique cultural, community, and business aspects of the Subbasin. It is the express goal of this GSP to balance the needs of all water users in the Subbasin.

Several management actions and projects are included in this GSP and detailed in Chapter 9. Implementation of management actions and projects is not currently needed to maintain sustainability. If conditions change and the Subbasin is no longer sustainable, some combination of these will be implemented to ensure the Subbasin is operated within its sustainable yield and continues to operate sustainably according to all 5 sustainability indicators throughout the planning and implementation horizon. Management actions include establishing an SMC TAC, promoting conservation and agricultural BMPs, agricultural land fallowing and retirement, the MCWRA Drought TAC, and reservoir reoperation. Projects that are not currently needed, but could be implemented in the future if needed, include the multi-benefit stream channel improvements and MAR of overland flow. Finally, Chapter 9 includes implementation actions that do not directly help meet the SMC, but contribute to GSP implementation through data collection, assistance to groundwater users, and collaboration with partner agencies. This suite of management actions and projects provide sufficient options to maintain sustainability in the Upper Valley Subbasin throughout GSP implementation.

The management actions and projects are designed to maintain sustainability for the next 20 years by one or more of the following means:

- Educating stakeholders and prompting changes in behavior to improve chances of maintaining sustainability
- Increasing awareness of groundwater pumping impacts to promote voluntary reductions in groundwater use through improved water use practices or fallowing crop land
- Increasing basin recharge
- Developing new alternative water supplies for use in the Subbasin to offset groundwater pumping

8.3 Maintaining Long-Term Sustainability

The GSP addresses long-term groundwater sustainability. Correspondingly, the SVBGSA intends to develop SMC to avoid undesirable results under future hydrologic conditions. The understanding of future conditions is based on historical precipitation, ET, streamflow, and reasonable anticipated climate change, which have been estimated on the basis of the best available climate science (DWR, 2018). These parameters underpin the estimated future water budget over the planning horizon (see Section 6.4). The average hydrologic conditions include reasonably anticipated wet and dry periods. Groundwater conditions that are the result of extreme climatic conditions and are worse than those anticipated do not constitute an undesirable result. However, SMC may be modified in the future to reflect observed future climate conditions.

The GSA will track hydrologic conditions during GSP implementation. These observed hydrologic conditions will be used to develop a value for average hydrologic conditions, which will be compared to predicted future hydrologic conditions. This information will be used to interpret the Subbasin's performance against SMC. Year-by-year micro-management is not the intent of this GSP; this GSP is developed to avoid undesirable results with long-term, deliberate groundwater management. For example, groundwater extractions may experience variations caused by reasonably anticipated hydrologic fluctuations. However, under average hydrologic conditions, there will be no chronic depletion of groundwater storage.

Further, since the GSP addresses long-term groundwater sustainability, exceedance of some SMC during an individual year does not constitute an undesirable result. Pursuant to SGMA Regulations (California Water Code § 10721(w)(1)), "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.” Therefore, groundwater levels may temporarily exceed minimum thresholds during prolonged droughts, which could be more extreme than those that have been anticipated based on historical data and anticipated climate change conditions. Such temporary exceedances do not constitute an undesirable result.

The SMC presented in this chapter are developed on the basis of historically observed hydrologic conditions and, in most cases, reasonably anticipated climate change. These SMC may be updated in future drafts to reflect changes in anticipated climate conditions and climate change based upon groundwater modeling results.

8.4 General Process for Establishing Sustainable Management Criteria

The SMC presented in this chapter were developed using publicly available information, feedback gathered during public meetings including Subbasin Committee meetings, hydrogeologic analysis, and meetings with SVBGSA staff and Advisory Committee members. The general process included:

- Presenting to the Upper Valley Subbasin Committee on the general SMC requirements and implications. These presentations outlined the approach to developing SMC and discussed initial SMC ideas.
- Providing supplemental data to the subbasin committee to guide the approach to setting SMC.
- Polling and receiving feedback from the subbasin committee to establish preferences for establishing SMC.
- Obtaining additional input on SMC from with GSA staff and GSA Board Members.
- Modifying minimum thresholds and measurable objectives based on input from the public, GSA staff, and GSA Board Members, as needed.

The SMC presented in this chapter are intended to address GSP Regulations, not other laws and regulations; however, they are developed so as to be compatible with existing laws.

8.5 Sustainable Management Criteria Summary

Table 8-1 provides a summary of the SMC for each of the 5 sustainability indicators. Measurable objectives are the goals that reflect the subbasin’s desired groundwater conditions for each sustainability indicator. These provide operational flexibility above the minimum thresholds. The minimum thresholds are quantitative indicators of the Subbasin’s locally defined significant and unreasonable conditions. The undesirable result is a combination of minimum threshold exceedances that show a significant and unreasonable condition across the Subbasin as a whole. This GSP is designed to not only avoid undesirable results, but to achieve the sustainability goals within 20 years, along with interim milestones every 5 years that show progress. The management actions and projects provide sufficient options for reaching the measurable objectives within 20 years and maintaining those conditions for 30 years for all 5 sustainability indicators. The rationale and background for developing these criteria are described in detail in the following sections.

The SMC are individual criteria that will each be met simultaneously, rather than in an integrated manner. For example, the groundwater elevation and ISW SMC are 2 independent SMC that will be achieved simultaneously. The groundwater elevation SMC do not hinder ISW SMC, but also, they do not prevent unreasonable ISW depletion by themselves, because the ISW SMC will be met simultaneously. The SMC presented in Table 8-1 are part of the GSA's 50-year management plan: SGMA allows for 20 years to reach sustainability and requires the Subbasin have no undesirable results for the subsequent 30 years.

Table 8-1. Sustainable Management Criteria Summary

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Undesirable Result
Chronic lowering of groundwater levels	Measured through groundwater elevation representative monitoring well network.	Minimum thresholds are set to 5 feet below the lowest groundwater elevation between 2012 and 2016 at each representative monitoring well. See Table 8-2.	Measurable objectives are set to 2011 groundwater elevations.	More than 15% of groundwater elevation minimum thresholds are exceeded. Allows 2 exceedances in the Upper Valley Subbasin.
Reduction in groundwater storage	Measured by proxy through groundwater level representative monitoring well network.	Minimum thresholds are established by proxy using groundwater elevations. The reduction in groundwater storage minimum thresholds are identical the chronic lowering of groundwater levels minimum thresholds.	Measurable objectives are established by proxy using groundwater elevations. The reduction in groundwater storage measurable objectives are identical to the chronic lowering of groundwater levels measurable objectives.	More than 15% of groundwater elevation minimum thresholds are exceeded. The undesirable result for reduction in groundwater storage is established by proxy using groundwater elevations.
Degraded groundwater quality	Groundwater quality data downloaded annually from GeoTracker GAMA groundwater information system.	Minimum thresholds are zero additional exceedances of the regulatory drinking water standards (potable supply wells) or the Basin Plan objectives (irrigation supply wells) for groundwater quality constituents of concern. Exceedances are only measured in public water system supply wells and ILRP on-farm domestic and irrigation supply wells. See Table 8-4.	Measurable objectives are identical to the minimum threshold.	Future or new minimum thresholds exceedances are caused by a direct result of GSA groundwater management action(s), including projects or management actions and regulation of groundwater extraction.
Land subsidence	Measured using DWR provided InSAR data.	Minimum threshold is zero net long-term subsidence, with no more than 0.1 foot per year of estimated land movement to account for InSAR errors.	Measurable objective is identical to the minimum threshold, resulting in zero net long-term subsidence.	There is an exceedance of the minimum threshold for subsidence due to lowered groundwater elevations.
Depletion of interconnected surface water	Groundwater elevations in shallow wells adjacent to locations of ISW identified using the SVIHM.	Minimum thresholds are established by proxy using shallow groundwater elevations observed in 2016 near locations of ISW.	Measurable objectives are established by proxy using shallow groundwater elevations observed in 2011 near locations of ISW.	There is an exceedance of the minimum threshold in a shallow groundwater monitoring wells used to monitor ISW.

8.6 Chronic Lowering of Groundwater Levels SMC

8.6.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable groundwater elevations in the Subbasin are those that:

- Are at or below the observed groundwater elevations during the 2012 to 2016 drought. Public and stakeholder input identified these historical groundwater elevations as significant and unreasonable
- Cause significant financial burden to local agricultural interests
- Interfere with other sustainability indicators

These significant and unreasonable conditions were determined based on input from the Subbasin Committee and discussions with GSA staff. During GSP development, the Subbasin Committee opted to establish minimum thresholds 5 feet below the levels identified as significant and unreasonable. This was done to ensure a minimum 5-foot span between the minimum threshold and measurable objective to provide operational flexibility. Setting the minimum threshold at the observed low would have pushed measurable objectives to an unreasonably high groundwater level, based on historical hydrographs, as shown in Appendix 5A. Therefore, the minimum threshold was lowered to provide operational flexibility. The goal is still to reach the measurable objective.

8.6.2 Minimum Thresholds

> *The minimum thresholds for chronic lowering of groundwater levels are set to 5 feet below the lowest groundwater elevation between 2012 and 2016 at each representative monitoring well.*

Since there is very little fluctuation in groundwater elevations for most wells in the Upper Valley, the 5-foot buffer helps allow for operational flexibility and provides a better threshold for distinguishing minimum thresholds. The minimum threshold values for each well within the groundwater level monitoring network are provided on Figure 8-1. The minimum threshold contour maps, along with the RMS well locations for the single principal aquifer in the Upper Valley Subbasin, are shown on Figure 8-1.

Table 8-2. Chronic Lowering of Groundwater Levels Minimum Thresholds and Measurable Objectives

Monitoring Site	Minimum Threshold (ft)	Measurable Objective (ft)
19S/07E-14N02	187.7	232.6
19S/08E-19K03	215.5	256.1
20S/08E-07F01	216.9	267.3
20S/08E-14K01	258.4	294.6
20S/08E-15H03	247.0	290.4
20S/08E-25Q01	309.7	316.7
20S/08E-34G01	384.1	403.8
21S/08E-13H01	387.9*	397.1*
21S/09E-06F50	322.9	332.7*
21S/09E-16E01	330.0	344.7
21S/09E-23G01	347.9	361.6
21S/09E-24L01	352.5	364.7
21S/10E-32N01	368.0	378.1
22S/10E-09P01	383.6	401.7
22S/10E-16K01	375.5	400.8
22S/10E-34G01	419.4	425.0
23S/10E-14D01	437.2	443.3
23S/10E-33P01	506.7	528.0

*Groundwater elevation was estimated.

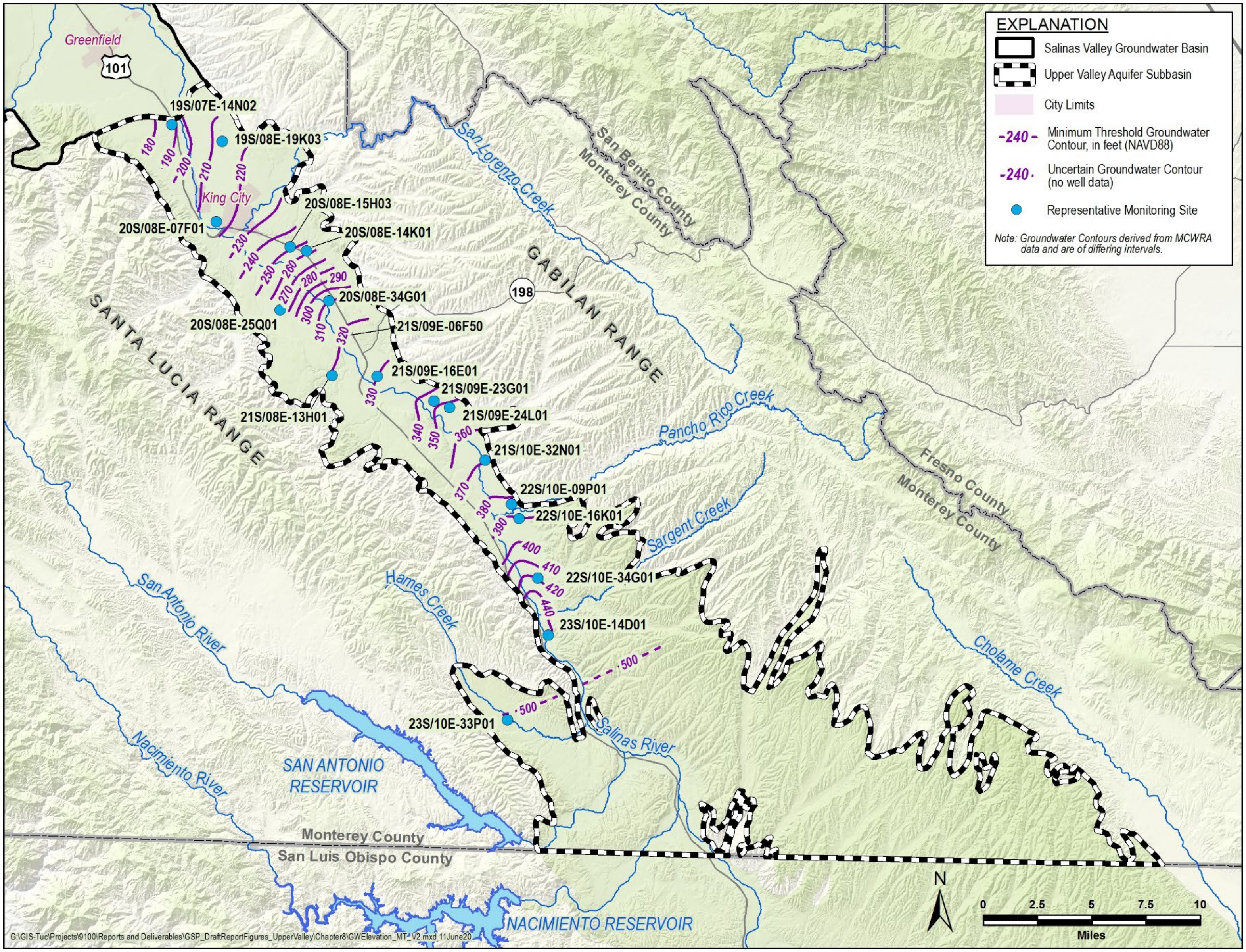


Figure 8-1. Groundwater Level Minimum Threshold Contour Map

8.6.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

The development of both minimum thresholds and measurable objectives followed similar processes, which is described in this section. The information used includes:

- Feedback from discussions with the Subbasin Committee on challenges and goals
- Historical groundwater elevation data and hydrographs from wells monitored by the MCWRA
- Maps of current and historical groundwater elevation data
- Analysis of the impact groundwater elevations on domestic wells

The general steps for developing minimum thresholds and measurable objectives were:

1. The Subbasin Committee selected an approach and criteria for to setting the groundwater level minimum thresholds and measurable objectives.
2. SVBGSA used MCWRA's average groundwater elevation change hydrographs to select representative years that could define minimum thresholds and measurable objectives for the Subbasin. Groundwater elevations like those experienced during the representative climatic cycle between 1967 and 1998 were used to identify minimum thresholds and measurable objectives to ensure that they were achievable under reasonably expected climatic conditions. This representative period corresponds to important water management milestones for the Salinas Valley Groundwater Basin; water year 1967 marks the beginning of operations at San Antonio Reservoir, with first water releases in November 1966. CSIP began operating in 1998.
3. The average groundwater elevation change hydrograph with minimum threshold and measurable objective lines for the Upper Valley Subbasin. The groundwater elevations during the 2012 to 2016 drought in the Upper Valley Subbasin are the lowest groundwater elevations seen in the Subbasin and are considered significant and unreasonable. The minimum thresholds were therefore set to 5 feet below the lowest groundwater elevation between 2012 and 2016. The measurable objective is set to 2011 groundwater elevations, which is an achievable goal for the Subbasin under reasonably expected climatic conditions shown on Figure 8-2. Additionally, average 2011 groundwater elevations are similar to those average groundwater elevations experienced during the representative climatic cycle.
4. SVBGSA identified the appropriate minimum thresholds and measurable objectives on the respective monitoring well hydrographs. Each hydrograph was visually inspected to check if the minimum threshold and measurable objective was reasonable. If an RMS did not have measurements from the minimum threshold or

measurable objective years, the SMC were interpolated from the groundwater elevation contours. The RMS location was intersected with groundwater elevation contour maps to estimate the initial minimum thresholds and measurable objectives. Moreover, if the SMC seemed unreasonable for an RMS, they were adjusted based on historical water levels and on groundwater elevation trends seen in surrounding wells. The interpolated or adjusted minimum thresholds and measurable objectives are indicated by an asterisk in Table 8-2.

Hydrographs with well completion information showing minimum thresholds for each RMS are included in Appendix 8A.

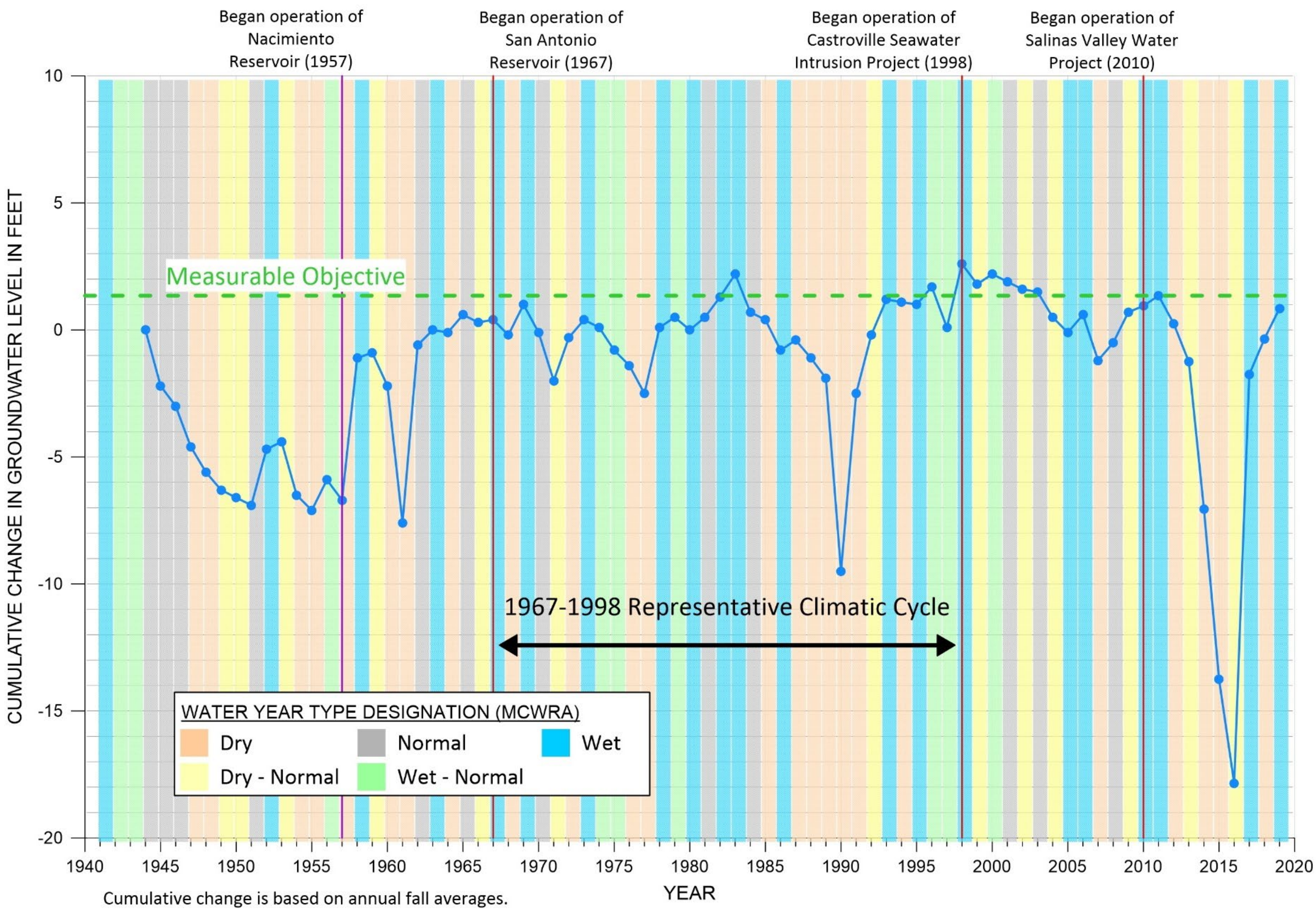


Figure 8-2. Cumulative Groundwater Elevation Change Hydrograph with Selected Minimum Threshold and Measurable Objective for the Upper Valley Aquifer Subbasin

8.6.2.2 Minimum Thresholds Impact on Domestic Wells

SVBGSA intended to assess the Human Right to Water with respect to the groundwater level SMC through a domestic well analysis; however, insufficient data was available to do such an analysis. SVBGSA was unable to accurately evaluate the impact of groundwater level minimum thresholds on domestic wells due to limited data in the Upper Valley Subbasin. Domestic well depths are derived from the Public Land Survey System sections data in DWR's OSWCR database. In the Upper Valley, only 4 of the 145 domestic wells from the OSWCR database had accurate locations. Without an accurate location, whether a well would be negatively impacted when groundwater elevations are at the minimum threshold cannot be determined. In addition, groundwater elevation contours in the Upper Valley Subbasin are based on MCWRA groundwater elevation data that is limited to the MCWRA Upper Valley Subarea, which covers only a portion of the SVBGSA Upper Valley Subbasin. Groundwater elevation contours for the Subbasin are extrapolated from this limited well data, which adds further inaccuracy to this analysis. Since data for the analysis is limited, further assessment may be done when more data becomes available.

8.6.2.3 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

The SVBGSA compared minimum thresholds between RMS to understand the relationship between RMS (i.e., describe why or how a water level minimum threshold set at a particular RMS is similar to or different from water level thresholds in nearby RMS). The minimum thresholds are unique at every well, but when combined represent a reasonable and potentially realistic groundwater elevation map. Because the underlying groundwater elevation map is a reasonably achievable condition, the individual minimum thresholds at RMS do not conflict with each other.

Groundwater level minimum thresholds can influence other sustainability indicators. SVBGSA reviewed the groundwater level minimum thresholds' relationship with each of the other sustainability indicators' minimum thresholds to ensure a groundwater level minimum threshold would not trigger an undesirable result for any of the other sustainability indicators. The groundwater level minimum thresholds are selected to avoid undesirable results for other sustainability indicators.

- **Reduction in groundwater storage.** The chronic lowering of groundwater levels minimum thresholds are identical to the groundwater storage minimum thresholds. Thus, the groundwater level minimum thresholds will not result in an undesirable loss of groundwater storage.
- **Degraded water quality.** The chronic lowering of groundwater levels minimum could affect groundwater quality through 2 processes:

1. Changes in groundwater elevation could change groundwater gradients, which could cause poor quality groundwater to flow toward production and domestic wells that would not have otherwise been impacted. These groundwater gradients, however, are only dependent on differences between groundwater elevations, not on the groundwater elevations themselves. Therefore, the minimum threshold groundwater levels do not directly lead to a significant and unreasonable degradation of groundwater quality in production and domestic wells.
2. Decreasing groundwater elevations can mobilize constituents of concern that are concentrated at depth, such as arsenic. The groundwater level minimum thresholds are near historical lows. Therefore, any depth dependent constituents have previously been mobilized by historical groundwater levels. Maintaining groundwater elevations above the minimum thresholds assures that no new depth dependent constituents of concern are mobilized and are therefore protective of beneficial uses and users.

- **Land subsidence.** The chronic lowering of groundwater levels minimum thresholds are set at or above recent low groundwater elevations. Thus, avoiding the dewatering and compaction of clay-rich sediments that causes subsidence in response to lowering groundwater elevations.
- **Depletion of ISW.** The chronic lowering of groundwater levels minimum thresholds are lower than recent groundwater elevations, which could cause significant and unreasonable depletion rates if groundwater elevations near interconnected water bodies fall to the groundwater level minimum threshold. However, stakeholders locally defined significant and unreasonable conditions differently for chronic lowering of groundwater levels and depletion of ISW due to groundwater use. The groundwater level minimum threshold is set to provide operational flexibility across the entire Subbasin, not just near locations of ISW. Therefore, the minimum threshold for ISW will govern acceptable groundwater elevations in monitoring wells adjacent to surface water bodies.

8.6.2.4 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The Upper Valley Subbasin has 2 neighboring subbasins. The Forebay Subbasin is within the SVBGSA jurisdiction to the north and the Paso Robles Area Subbasin is a neighboring subbasin to the south that lies outside of SVBGSA jurisdiction.

The SVBGSA is one of the coordinating GSAs for the adjacent Forebay Subbasin. Because the SVBGSA covers both these subbasins, the SVBGSA is coordinating the development of the minimum thresholds and measurable objectives for the 2 subbasins. The Forebay Subbasin is also in the process of GSP development for submittal in January 2022. Minimum thresholds for the Upper Valley Subbasin will be reviewed relative to information developed for the neighboring subbasin’s GSP to ensure that these minimum thresholds will not prevent the neighboring subbasin from achieving or maintaining sustainability.

The Paso Robles Area Subbasin lies directly to the south of the Subbasin. Because the minimum thresholds in the Upper Valley Subbasin are above historical low groundwater elevations, it is likely that the minimum thresholds will not prevent the neighboring subbasin from achieving or maintaining sustainability. The SVBGSA will coordinate closely with the Paso Robles Area Subbasin GSAs to ensure that the basins do not prevent each other from achieving sustainability.

8.6.2.5 Effects on Beneficial Users and Land Uses

The groundwater level minimum thresholds may have several effects on beneficial users and land uses in the Subbasin.

Agricultural land uses and users. The groundwater level minimum thresholds prevent continued lowering of groundwater elevations in the Subbasin. This may have the effect of limiting the amount of groundwater pumping in the Subbasin. Limiting the amount of groundwater pumping may limit the amount and type of crops that can be grown in the Subbasin. The groundwater level minimum thresholds could therefore limit expansion of the Subbasin's agricultural economy. This could have various effects on beneficial users and land uses:

- Agricultural land currently under irrigation may become more valuable as bringing new lands into irrigation becomes more difficult and expensive.
- Agricultural land not currently under irrigation may become less valuable because it may be too difficult and expensive to irrigate.

Urban land uses and users. The groundwater level minimum thresholds may limit the amount of groundwater pumping in the Subbasin. This may limit urban growth or result in urban areas obtaining alternative sources of water. This may result in higher water costs for urban water system users.

Domestic land uses and users. The groundwater level minimum thresholds are intended to protect most domestic wells. Therefore, the minimum thresholds will likely have an overall beneficial effect on existing domestic land uses by protecting the ability to pump from domestic wells. However, extremely shallow domestic wells may become dry, requiring owners to drill deeper wells. Additionally, the groundwater level minimum thresholds may limit the number of new domestic wells that can be drilled to limit future declines in groundwater elevations caused by more domestic pumping.

Ecological land uses and users. The groundwater level minimum thresholds may limit the amount of groundwater pumping in the Subbasin and may limit both urban and agricultural growth. This may benefit ecological land uses and users by curtailing the conversion of native vegetation to agricultural or domestic uses, and by reducing pressure on existing ecological land caused by declining groundwater elevations.

8.6.2.6 Relevant Federal, State, or Local Standards

No federal, state, or local standards exist for chronic lowering of groundwater levels.

8.6.2.7 Method for Quantitative Measurement of Minimum Thresholds

Groundwater level minimum thresholds will be directly measured from the representative monitoring well network. The groundwater elevation monitoring will be conducted according to the monitoring plan outlined in Chapter 7. Furthermore, the groundwater elevation monitoring will meet the requirements of the technical and reporting standards included in the GSP Regulations.

As noted in Chapter 7, the current groundwater level representative monitoring network in the Subbasin includes 18 wells. Data gaps were identified in Chapter 7 and will be resolved during implementation of this GSP.

8.6.3 Measurable Objectives

The measurable objectives for chronic lowering of groundwater levels represent target groundwater elevations that are higher than the minimum thresholds, but still reasonably achievable given historical levels. These measurable objectives provide operational flexibility to ensure that the Subbasin can be managed sustainably over a reasonable range of hydrologic variability.

> *The measurable objectives for the chronic lowering of groundwater levels are set to 2011 groundwater elevations.*

The measurable objectives are summarized in Table 8-2 and are also shown on the hydrographs for each RMS in Appendix 8A.

8.6.3.1 Methodology for Setting Measurable Objectives

The methodology for establishing measurable objectives is described in detail in Section 8.6.2.1. A year from the relatively recent past was selected for setting measurable objectives to ensure that objectives are achievable. Groundwater elevations from 2011 were selected as representative of the measurable objectives for the Upper Valley Subbasin. The measurable objective contour map along with the representative monitoring network wells are shown on Figure 8-3 for the Upper Valley Subbasin.

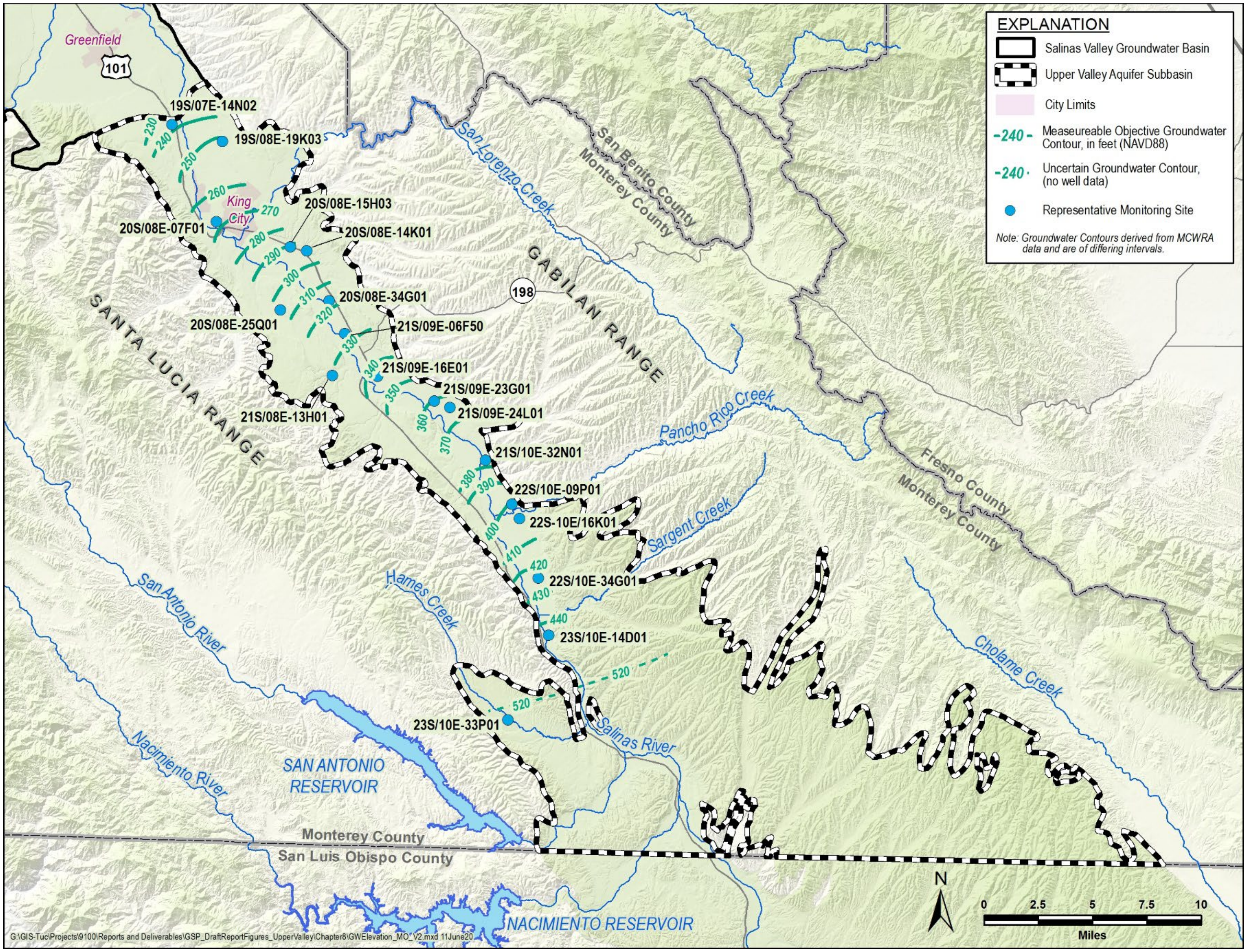


Figure 8-3. Groundwater Level Measurable Objective Contour Map

8.6.3.2 Interim Milestones

Interim milestones for groundwater levels are shown in Table 8-3. These are only initial estimates of interim milestones. Interim milestones for groundwater levels will be modified as better data, analyses, and project designs become available.

Table 8-3. Chronic Lowering of Groundwater Levels Interim Milestones

Monitoring Site	Current Groundwater Elevation (ft) (Fall 2019)	Interim Milestone at Year 2027 (ft)	Interim Milestone at Year 2032 (ft)	Interim Milestone at Year 2037 (ft)	Measurable Objective (ft) (goal to reach at 2042)
19S/07E-14N02	234.3	233.9	233.5	233.0	232.6
19S/08E-19K03	254.9	255.2	255.5	255.8	256.1
20S/08E-07F01	267.5	267.5	267.4	267.4	267.3
20S/08E-14K01	294.1	294.2	294.4	294.5	294.6
20S/08E-15H03	290.5	290.5	290.5	290.4	290.4
20S/08E-25Q01	314.1	314.8	315.4	316.1	316.7
20S/08E-34G01	385.8	390.3	394.8	399.3	403.8
21S/08E-13H01	397.1	397.1	397.1	397.1	397.1*
21S/09E-06F50	331.5	331.8	332.1	332.4	332.7*
21S/09E-16E01	345.6	345.4	345.1	344.9	344.7
21S/09E-23G01	358.2	359.1	359.9	360.8	361.6
21S/09E-24L01	361.8	362.5	363.3	364.0	364.7
21S/10E-32N01	377.2	377.4	377.7	377.9	378.1
22S/10E-09P01	401.0	401.2	401.4	401.5	401.7
22S/10E-16K01	400.1	400.3	400.5	400.6	400.8
22S/10E-34G01	424.6	424.7	424.8	424.9	425.0
23S/10E-14D01	442.5	442.7	442.9	443.1	443.3
23S/10E-33P01	503.0	509.3	515.5	521.8	528.0

*Groundwater elevation was estimated.

8.6.4 Undesirable Results

8.6.4.1 Criteria for Defining Chronic Lowering of Groundwater Levels Undesirable Results

The chronic lowering of groundwater level undesirable result is a quantitative combination of groundwater level minimum threshold exceedances. The undesirable result is:

More than 15% of the groundwater elevation minimum thresholds are exceeded.

Since the GSP addresses long-term groundwater sustainability, exceedances of groundwater levels minimum thresholds during a drought do not constitute an undesirable result. Pursuant to SGMA Regulations (California Water Code § 10721(w)(1)), “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." Therefore, groundwater levels may temporarily exceed minimum thresholds during droughts, and do not constitute an undesirable result, as long as groundwater levels rebound.

Undesirable results provide flexibility in defining sustainability. Increasing the percentage of allowed minimum threshold exceedances provides more flexibility but may lead to significant and unreasonable conditions for some beneficial users. Reducing the percentage of allowed minimum threshold exceedances ensures strict adherence to minimum thresholds but reduces flexibility due to unanticipated hydrologic conditions. The undesirable result was set at 15% to balance the interests of beneficial users with the practical aspects of groundwater management under uncertainty.

The 15% limit on minimum threshold exceedances in the undesirable result allows for 2 exceedances in the 18 existing representative monitoring wells. This was considered a reasonable number of exceedances given the hydrogeologic uncertainty of aquifer characteristics of the Subbasin. As the monitoring system grows, additional exceedances will be allowed. One additional exceedance will be allowed for approximately every 7 new monitoring wells.

8.6.4.2 Potential Causes of Undesirable Results

An undesirable result for chronic lowering of groundwater levels does not currently exist, since groundwater elevations in 17 out of 18 existing representative monitoring wells (94%) in the Subbasin were above the minimum threshold in the Fall 2019 groundwater elevation measurements. Conditions that may lead to an undesirable result include the following:

- **Localized pumping clusters.** Even if regional pumping is maintained within the sustainable yield, clusters of high-capacity wells may cause excessive localized drawdowns that lead to undesirable results.
- **Expansion of *de minimis* pumping.** Individual *de minimis* pumpers do not have a significant impact on groundwater elevations. However, many *de minimis* pumpers are often clustered in specific residential areas. Pumping by these *de minimis* users is not regulated under this GSP. Adding additional domestic *de minimis* pumpers in these areas may result in excessive localized drawdowns and undesirable results.
- **Departure from the GSP's climatic assumptions, including extensive, unanticipated drought.** Minimum thresholds were established based on historical groundwater elevations and reasonable estimates of future climatic conditions and groundwater elevations. Departure from the GSP's climatic assumptions or extensive, unanticipated droughts may lead to excessively low groundwater elevations and undesirable results.

8.6.4.3 Effects on Beneficial Users and Land Uses

The primary detrimental effect on beneficial users from allowing multiple exceedances occurs if more than 1 exceedance occurs in a small geographic area. Allowing 15% exceedances is reasonable if the exceedances are spread out across the Subbasin, and as long as any 1 well does not regularly exceed its minimum threshold. If the exceedances are clustered in a small area, it will indicate that significant and unreasonable effects are being borne by a localized group of landowners.

8.7 Reduction in Groundwater Storage SMC

8.7.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable conditions in groundwater storage in the Subbasin are those that:

- Lead to chronic, long-term reduction in groundwater storage, or
- Interfere with other sustainability indicators

These significant and unreasonable conditions were determined based on input from the Subbasin Committee and discussions with GSA staff.

8.7.2 Minimum Thresholds

> *The minimum thresholds for reduction in groundwater storage are established by proxy using groundwater elevations. The reduction in groundwater storage minimum thresholds are identical to the chronic lowering of groundwater levels minimum thresholds.*

Although not the metric for establishing change in groundwater storage, the GSAs are committed to pumping at or less than the Subbasin's long-term sustainable yield. SGMA allows 20 years to reach sustainability.

8.7.2.1 Information and Methodology Used to Establish Minimum Thresholds

Since groundwater storage and groundwater elevation minimum thresholds are identical, the methodology used to the establish minimum thresholds for reduction in groundwater storage are detailed in Section 8.6.2.1.

The general relationship between groundwater storage and groundwater elevations is described in greater detail in Chapter 4, Section 4.4.2. The Subbasin-specific data analysis to establish the proxy relationship between groundwater storage and groundwater elevations is discussed below.

The GSP Regulations § 354.28 (d) states that: “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.”

Figure 8-4 compares the Subbasin’s cumulative change in storage, plotted on the black line, with the average annual change in groundwater elevation, plotted on the blue line. The groundwater elevation change data are derived from the groundwater elevation network; the cumulative change in groundwater storage is derived from the SVIHM. Although the data come from 2 sources, the data show similar patterns between 1998 and 2016. The decrease in storage modeled by the SVIHM from 1983 to 1998 is not reflected in the change in groundwater elevations blue line, because the modeled storage is dependent on the simulated groundwater elevations in the SVIHM.

Figure 8-5 shows a scatter plot of cumulative change in storage and average change in groundwater elevation. The blue data points show data for the entire model period from 1980 to 2016 and the orange data points show data from 1998 to 2016. Although, the data for the entire model period demonstrate a weak correlation (R^2=0.3302), a more significant positive correlation exists between groundwater elevations and the amount of groundwater in storage between 1998 and 2016 (R^2=0.8191). The correlation for the 1998 to 2016 period is sufficient to show that groundwater elevations are an adequate proxy for groundwater storage.

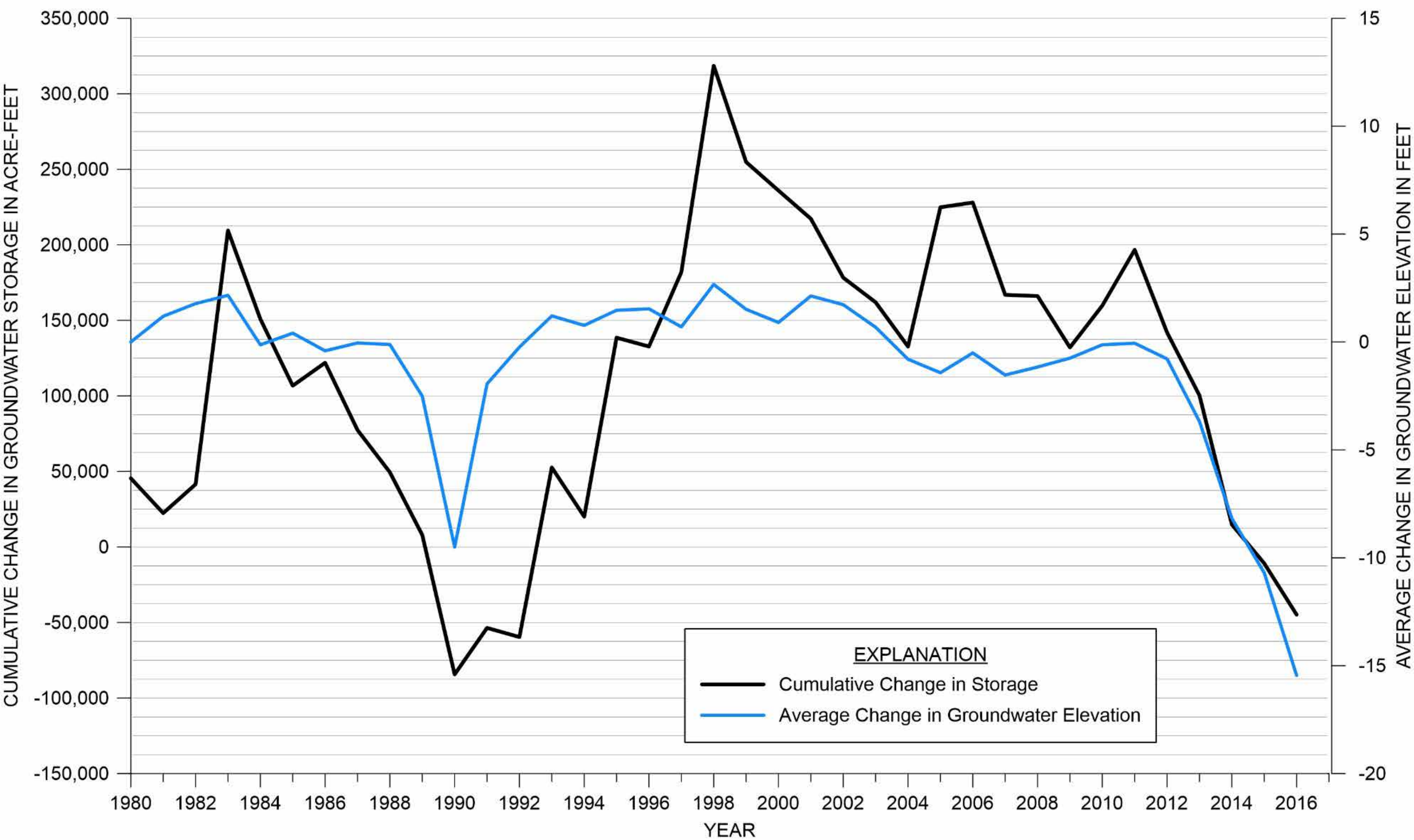


Figure 8-4. Cumulative Change in Storage and Average Change in Groundwater Elevation in the Upper Valley Aquifer Subbasin

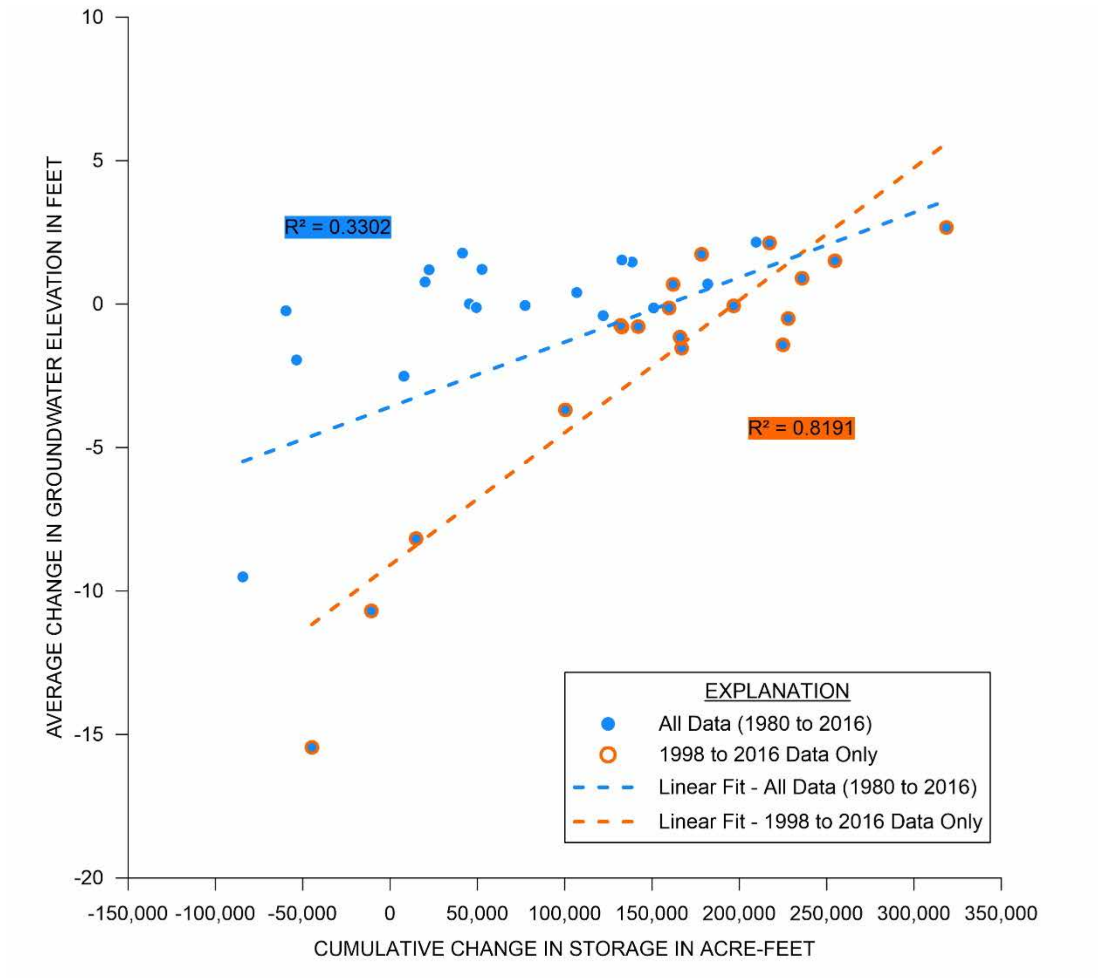


Figure 8-5. Correlation Between Cumulative Change in Storage and Average Change in Groundwater Elevation

8.7.2.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

The groundwater storage minimum thresholds are identical to groundwater level minimum thresholds, which are consistent with other sustainability indicators, as described in Section 0.

8.7.2.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The Upper Valley Subbasin has 2 neighboring subbasins. The Forebay Subbasin is within the SVBGSA jurisdiction to the north, and the Paso Robles Area Subbasin is a neighboring subbasin to the south that lies outside of SVBGSA jurisdiction.

The SVBGSA is one of the coordinating GSAs for the adjacent Forebay Subbasin. Because the SVBGSA covers both these subbasins, the SVBGSA is coordinating the development of the minimum thresholds and measurable objectives for the subbasins. The Forebay Subbasin is also in the process of GSP development for submittal in January 2022. Minimum thresholds for the

Upper Valley Subbasin will be reviewed relative to information developed for the neighboring subbasin's GSP to ensure that these minimum thresholds will not prevent the neighboring subbasin from achieving or maintaining sustainability.

The Paso Robles Area Subbasin lies directly to the south of the Subbasin. Because the minimum thresholds in the Upper Valley Subbasin are set to avoid dropping below recent storage levels, it is likely that the minimum threshold will not prevent the neighboring subbasin from achieving or maintaining sustainability. The SVBGSA will coordinate closely with the Paso Robles Area Subbasin GSAs to ensure that the basins do not prevent each other from achieving sustainability.

8.7.2.4 Effect on Beneficial Uses and Users

Because the groundwater storage minimum thresholds are defined based on groundwater level minimum thresholds, the effects of groundwater storage minimum threshold on beneficial uses and users are identical to those described in Section 8.6.2.5.

8.7.2.5 Relation to State, Federal, or Local Standards

No federal, state, or local standards exist for reductions in groundwater storage.

8.7.2.6 Method for Quantitative Measurement of Minimum Threshold

The groundwater level minimum thresholds will be used as proxies for reduction of groundwater storage. Therefore, the measurement of change in groundwater storage will be measured as outlined in Section 8.6.2.7 using the groundwater level monitoring network described in Chapter 7.

8.7.3 Measurable Objectives

> *The measurable objectives for reduction in groundwater storage are established by proxy using groundwater elevations. The reduction in groundwater storage measurable objectives are identical to the chronic lowering of groundwater levels measurable objectives.*

8.7.3.1 Methodology for Setting Measurable Objectives

As stated in Section 8.6.3, the groundwater level measurable objectives for chronic lowering of groundwater levels provide an adequate margin of operational flexibility for managing the Subbasin. Therefore, the change in storage measurable objectives were set to be identical to the groundwater level measurable objectives: providing the same margin of operation flexibility.

8.7.4 Undesirable Results

8.7.4.1 Criteria for Defining Reduction in Groundwater Storage Undesirable Results

The criteria used to define undesirable results for reduction of groundwater storage are based on minimum thresholds established for chronic lowering of groundwater levels. The reduction of storage undesirable result is:

> *More than 15% of groundwater elevation minimum thresholds are exceeded. The undesirable result for reduction in groundwater storage is established by proxy using groundwater elevations.*

Since the GSP addresses long-term groundwater sustainability, exceedances of groundwater storage minimum thresholds during a drought do not constitute an undesirable result. Pursuant to SGMA Regulations (California Water Code § 10721(w)(1)), "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." Therefore, groundwater storage may temporarily exceed minimum thresholds during droughts, and do not constitute an undesirable result, as long as groundwater levels rebound.

8.7.4.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result for the reduction in groundwater storage sustainability indicator include the following:

- **Expansion of agricultural or municipal pumping**. Additional agricultural or municipal pumping may result in exceedance of the long-term sustainable yield, an undesirable result.
- **Expansion of *de minimis* pumping**. Pumping by *de minimis* users is not regulated under this GSP. Adding domestic *de minimis* pumpers in the Subbasin may result in low groundwater levels that reduce the groundwater storage below to an undesirable result.
- **Departure from the GSP's climatic assumptions, including extensive, unanticipated drought**. The undesirable result is established based on reasonable anticipated future climatic conditions. Departure from the GSP's climatic assumptions or extensive, unanticipated droughts may lead to excessively low groundwater recharge and unanticipated high pumping rates that could reduce groundwater in storage to an undesirable result.

8.7.4.3 Effects on Beneficial Users and Land Use

The practical effect of the reduction in groundwater storage undesirable result is no chronic, long-term net change in groundwater storage. Therefore, beneficial uses and users will have access to a similar amount of water in storage, and the undesirable result will not have an additional negative effect on the beneficial users and uses of groundwater. However, pumping at the long-term sustainable yield during dry years will temporarily reduce the amount of groundwater in storage. If this occurs, there could be short-term impacts from a reduction in groundwater in storage on all beneficial users and uses of groundwater.

8.8 Degraded Water Quality SMC

8.8.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable changes in groundwater quality in the Subbasin are increases in a COC caused by a direct result of a GSA groundwater management action that either:

- Result in groundwater concentrations in a potable water supply well above an established MCL or SMCL, or
- Lead to significantly reduced crop production.

These significant and unreasonable conditions were determined based on input from the Subbasin Committee and discussions with GSA staff.

8.8.2 Minimum Thresholds

> *The minimum thresholds for degraded water quality are zero additional exceedances of the regulatory drinking water standards (potable supply wells) or Basin Plan objectives (irrigation supply wells) beyond those observed in 2019 for groundwater quality constituents of concern.*

The minimum thresholds for DDW public water system supply wells and ILRP on-farm domestic wells reflect California's Title 22 drinking water standards. The minimum thresholds for irrigation supply wells are based on the water quality objectives listed in the Water Quality Control Plan for the Central Coastal Basin (CCRWQCB, 2019). The minimum threshold values for the COC for all 3 sets of wells are provided in Table 8-4 and are based on data up to 2019. Full discussion of these current conditions is included in Chapter 5. Because the minimum thresholds reflect no additional exceedances, the minimum thresholds are set to the number of existing exceedances. Surpassing the number of existing exceedances for any of the listed constituents will lead to an undesirable result. Not all wells in the monitoring network are sampled for every COC.

Table 8-4. Degradation of Groundwater Quality Minimum Thresholds

Constituent of Concern (COC)	Minimum Threshold/Measurable Objective – Number of Wells Exceeding Regulatory Standard from latest sample (December 1985 to June 2019)
DDW Wells	
Boron	2
Lindane	2
Benzo(a)Pyrene	1
Cadmium	1
Dinoseb	1
Iron	8
Hexachlorobenzene	1
Manganese	6
Nitrate (as nitrogen)	8
Specific Conductance	5
Sulfate	4
1,2,3-Trichloropropane	4
Total Dissolved Solids	7
Vinyl Chloride	1
ILRP On-Farm Domestic Wells	
Chloride	7
Nitrate (as nitrogen)	30
Nitrate + Nitrite (sum as nitrogen)	11
Specific Conductance	33
Sulfate	26
Total Dissolved Solids	35
ILRP Irrigation Supply Wells	
Chloride	13

8.8.2.1 Information and Methodology Used to Establish Water Quality Minimum Thresholds and Measurable Objectives

As noted in the GSP Regulations, minimum thresholds are based on a degradation of groundwater quality, not an improvement of groundwater quality (23 California Code of Regulations §354.28 (c)(4)). Therefore, this GSP is designed to avoid taking any action that may inadvertently move groundwater constituents already in the Subbasin in such a way that the constituents have a significant and unreasonable impact that would not otherwise occur. COC must meet 2 criteria:

1. They must have an established level of concern such as an MCL or SMCL, or a level known to affect crop production.
2. They must have been found in the Subbasin at levels above the level of concern.

Based on the review of groundwater quality in Chapter 5, the COC that may affect drinking water supply wells include those for DDW and ILRP on-farm domestic wells listed in Table 8-4. The COC that are known to cause reductions in crop production are those for ILRP irrigation supply wells listed in Table 8-4.

As discussed in Chapter 7, 3 existing water quality monitoring networks were reviewed and used for developing SMC:

- Public water system supply wells regulated by the SWRCB DDW.
- On-farm domestic wells monitored as part of CCRWQCB ILRP. This dataset was obtained from the SWRCB through the GAMA Groundwater Information System database. The ILRP data were separated into 2 data sets, 1 for on-farm domestic wells and the other for irrigation supply wells (discussed below) for purposes of developing initial draft minimum thresholds and measurable objectives for each type of well. The monitoring well network for the ILRP will change when the monitoring network for Ag Order 4.0 is finalized. At that time, the new ILRP domestic monitoring network will be incorporated into this GSP, replacing the current network, for water quality monitoring.
- Irrigation supply wells monitored as part of ILRP. As mentioned above, this dataset was obtained from the SWRCB through the GAMA Groundwater Information System database. Like the on-farm domestic well dataset, the IRLP irrigation supply monitoring network will change when Ag Order 4.0 is finalized.

Each of these well networks are monitored for a different set of water quality parameters. Furthermore, some groundwater quality impacts are detrimental to only certain networks. For example, high nitrates are detrimental to public water system supply wells and on-farm domestic wells but are not detrimental to irrigation supply wells. The constituents monitored in each well network are indicated by an X in Table 8-5. An X does not necessarily indicate that the constituents have been found above the regulatory standard in that monitoring network.

Table 8-5. Summary of Constituents Monitored in Each Well Network

Constituent	Public Water System Supply	On-Farm Domestic[1]	Irrigation Supply
Boron	X	X	X
Chloride	X	X	X
Iron	X	X	
Manganese	X	X	
Nitrate (as nitrogen)	X	X	X
Nitrate + Nitrite (sum as nitrogen)		X	X
Nitrite	X	X	X
Specific Conductance	X	X	X
Sulfate	X	X	X
Total Dissolved Solids	X	X	X
1,1,1-Trichloroethane	X		
1,1,2,2-Tetrachloroethane	X		
1,1,2-Trichloro-1,2,2-Trifluoroethane	X		
1,1,2-Trichloroethane	X		
1,1-Dichloroethane	X		
1,1-Dichloroethylene	X		
1,2 Dibromo-3-chloropropane	X		
1,2,3-Trichloropropane	X		
1,2,4-Trichlorobenzene	X		
1,2-Dichlorobenzene	X		
1,2-Dichloroethane	X		
1,2-Dichloropropane	X		
1,4-Dichlorobenzene	X		
2,4,5-TP (Silvex)	X		
Alachlor	X		
Aluminum	X		
Antimony	X		
Arsenic	X		
Atrazine	X		
Barium	X		
Bentazon	X		
Benzene	X		
Benzo(a)Pyrene	X		
Beryllium	X		
Cadmium	X		
Carbofuran	X		
Carbon Tetrachloride	X		
Chlordane	X		
Chlorobenzene	X		
Chromium	X		
cis-1,2-Dichloroethylene	X		

Constituent	Public Water System Supply	On-Farm Domestic[1]	Irrigation Supply
Copper	X		
Cyanide	X		
Dalapon	X		
Di(2-ethylhexyl) adipate	X		
Di(2-ethylhexyl) phthalate	X		
Dichloromethane (a.k.a. methylene chloride)	X		
Dinoseb	X		
Diquat	X		
Endrin	X		
Ethylbenzene	X		
Fluoride	X		
Foaming Agents (MBAS)	X		
Glyphosate	X		
Heptachlor	X		
Hexachlorobenzene	X		
Hexachlorocyclopentadiene	X		
Lindane	X		
Mercury	X		
Methoxychlor	X		
Methyl-tert-butyl ether (MTBE)	X		
Molinate	X		
Nickel	X		
Oxamyl	X		
Pentachlorophenol	X		
Perchlorate	X		
Picloram	X		
Polychlorinated Biphenyls	X		
Selenium	X		
Silver	X		
Simazine	X		
Styrene	X		
Tetrachloroethene	X		
Thallium	X		
Thiobencarb	X		
Toluene	X		
Toxaphene	X		
trans-1,2-Dichloroethylene	X		
Trichloroethene	X		
Trichlorofluoromethane	X		
Vinyl Chloride	X		
Xylenes	X		

[1]Basin plan states domestic wells are monitored for Title 22 constituents; however, GAMA Groundwater Information System only provides data for the constituents listed above.

8.8.2.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

Preventing migration of poor groundwater quality may limit activities needed to achieve minimum thresholds for other sustainability indicators.

- **Chronic lowering of groundwater levels.** The degradation of groundwater quality minimum thresholds could influence groundwater level minimum thresholds by limiting the types of water that can be used for recharge to maintain or raise groundwater elevations. Water used for recharge cannot exceed any groundwater quality standards.
- **Reduction in groundwater storage.** The degradation of groundwater quality minimum thresholds do not promote lower groundwater elevations. Therefore, the groundwater quality minimum thresholds will not result in an exceedance of the groundwater storage minimum threshold.
- **Land subsidence.** The degradation of groundwater quality minimum thresholds do not promote additional pumping that could cause subsidence. Therefore, the groundwater quality minimum thresholds will not result in an exceedance of the subsidence minimum threshold.
- **Depletion of ISW.** The degradation of groundwater quality minimum thresholds do not promote additional pumping or lower groundwater elevations adjacent to ISW. Therefore, the groundwater quality minimum thresholds will not result in a significant or unreasonable depletion of ISW.

8.8.2.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The Upper Valley Subbasin has 2 neighboring subbasins. The Forebay Subbasin is within the SVBGSA jurisdiction to the north and the Paso Robles Area Subbasin is a neighboring subbasin to the south that lies outside of SVBGSA jurisdiction.

The SVBGSA is one of the coordinating GSAs for the adjacent Forebay Subbasin. Because the SVBGSA covers both these subbasins, the SVBGSA is coordinating the development of the minimum thresholds and measurable objectives for the subbasins. The Forebay Subbasin is also in the process of GSP development for submittal in January 2022. Minimum thresholds for the Upper Valley Subbasin will be reviewed relative to information developed for the neighboring subbasin’s GSP to ensure that these minimum thresholds will not prevent the neighboring subbasin from achieving or maintaining sustainability.

The Paso Robles Area Subbasin lies directly to the south of the Subbasin. Because the minimum thresholds in the Upper Valley Subbasin are to prevent degradation of water quality, it is likely that the minimum thresholds will not prevent the neighboring subbasin from achieving or maintaining sustainability. The SVBGSA will coordinate closely with the Paso Robles Area Subbasin GSAs to ensure that the basins do not prevent each other from achieving sustainability.

8.8.2.4 Effect on Beneficial Uses and Users

Agricultural land uses and users. The groundwater quality minimum thresholds generally provide positive benefits to the Subbasin's agricultural water users. Preventing any GSA actions that would result in additional agricultural supply wells exceeding levels that could reduce crop production ensures that a supply of usable groundwater will exist for beneficial agricultural use.

Urban land uses and users. The groundwater quality minimum thresholds generally provide positive benefits to the Subbasin's urban water users. Preventing any GSA actions that would result in COC in additional drinking water supply wells exceeding MCLs or SMCLs ensures adequate groundwater quality for public water system supplies.

Domestic land uses and users. The groundwater quality minimum thresholds generally provide positive benefits to the Subbasin's domestic water users. Preventing any GSA actions that would result in COC in additional domestic supply wells exceeding MCLs or SMCLs ensures adequate groundwater quality for domestic supplies.

Ecological land uses and users. Although the groundwater quality minimum thresholds do not directly benefit ecological uses, it can be inferred that the degradation of groundwater quality minimum thresholds provide generally positive benefits to the Subbasin's ecological water uses. Preventing any GSA actions that would result in COC migrating will prevent unwanted contaminants from impacting ecological groundwater uses.

8.8.2.5 Relation to State, Federal, or Local Standards

The groundwater quality minimum thresholds specifically incorporate state and federal standards for drinking water and basin plan objectives.

8.8.2.6 Method for Quantitative Measurement of Minimum Thresholds

Degradation of groundwater quality minimum thresholds will be directly measured from existing public water system supply wells, on-farm domestic wells, and irrigation supply wells. Groundwater quality will be measured with SWRCB GeoTracker GAMA data submitted through existing monitoring programs—DDW and ILRP—as discussed in Chapter 7.

- Exceedances of MCLs and SMCLs in public water system supply wells will be monitored with annual water quality data submitted to the DDW.
- Exceedances of MCLs and SMCLs in on-farm domestic wells will be monitored with ILRP data.

- Exceedances of water quality objectives for crop production will be monitored with ILRP data.

Initially, the review of drinking water MCLs, SMCLs, and water quality objectives that maintain adequate crop production will be centered around the COC identified above. If during review of the water quality data additional constituents appear to exceed any of the regulatory standards, these additional constituents will be added to the list of constituents of concern for the Subbasin.

8.8.3 Measurable Objectives

The measurable objectives for degradation of groundwater quality represent target groundwater quality distributions in the Subbasin. SGMA does not mandate the improvement of groundwater quality. Therefore, the measurable objectives are based on no groundwater quality degradation and are identical to the minimum thresholds, as defined in Table 8-4.

> *The measurable objectives for degraded water quality are zero additional exceedances of the regulatory drinking water standards (potable supply wells) or Basin Plan objectives (irrigation supply wells) beyond those observed in 2019 for groundwater quality constituents of concern.*

8.8.3.1 Methodology for Setting Measurable Objectives

As described above, measurable objectives are set to be identical to the minimum thresholds and therefore follow the same method as detailed in Section 8.8.2.1.

8.8.3.2 Interim Milestones

There is no anticipated degradation of groundwater quality during GSP implementation that results from the implementation of projects and actions as described in Chapter 9. Therefore, the expected interim milestones are identical to current conditions.

8.8.4 Undesirable Results

8.8.4.1 Criteria for Defining Undesirable Results

The degradation of groundwater quality becomes an undesirable result when a quantitative combination of groundwater quality minimum thresholds is exceeded. For the Subbasin, the exceedance of minimum thresholds is unacceptable as a direct result of GSP implementation. Some groundwater quality changes are expected to occur independent of SGMA activities; because these changes are not related to SGMA activities, nor GSA management, they do not constitute an undesirable result. Additionally, SGMA states that GSAs are not responsible for addressing water quality degradation that was present before January 1, 2015 (California Water

Code § 10727.2(b)(4)). Therefore, the degradation of groundwater quality reaches an undesirable result when:

> *Future or new minimum thresholds exceedances are caused by a direct result of GSA groundwater management action(s), including projects or management actions and regulation of groundwater extraction.*

The groundwater level SMC is designed and intended to help protect groundwater quality. Setting the groundwater level minimum thresholds at or above historical lows assures that no new depth dependent constituents of water quality concern are mobilized. The GSA may pursue projects or management actions to ensure that groundwater levels do not fall below groundwater level minimum thresholds.

This undesirable result recognizes there is an existing regulatory framework in the form of the California Porter Cologne Act and the federal Clean Water Act that addresses water quality management; and considers existing federal, state, and local groundwater quality standards, which were used in the development of minimum thresholds in the GSP. SVBGSA is not responsible for enforcing drinking water requirements or for remediating violations of those requirements that were caused by others (Moran and Belin, 2019). The existing regulatory regime does not require nor obligate the SVBGSA to take any affirmative actions to manage or control existing groundwater quality. However, SVBGSA is committed to monitoring and disclosing changes in groundwater quality and ensuring its groundwater management actions do not cause drinking water or irrigation water to be unusable.

SVBGSA will work closely with the Central Coast Regional Water Quality Control Board and other entities that have regulatory authority over water quality. SVBGSA will lead the Water Quality Coordination Group, as described in Chapter 9, which includes meeting annually with these partner agencies to review the status of water quality data and discuss any action needed to address water quality degradation.

If the GSA has not implemented any groundwater management actions in the Subbasin, including projects, management actions, or pumping management, no such management actions constitute an undesirable result. If minimum thresholds are exceeded after the GSA has implemented actions in the Subbasin, the GSA will review groundwater quality and groundwater gradients in and around the project areas to assess if the exceedance resulted from GSA actions to address sustainability indicators, or was independent of GSA activities. Both the implementation of actions and assessment of exceedances will occur throughout the GSP timeframe of 50 years as required by SGMA. The general approach to assess if a minimum threshold exceedance is due to GSA action will include:

- If no projects, management actions, or other GSP implementation actions have been initiated in a subbasin, or near the groundwater quality impact, then the impact was not caused by any GSA action.
- Many projects will likely include a new monitoring network. If data from the project-specific monitoring network do not show groundwater quality impacts, this will suggest that the impact was not caused by any GSA actions.
- If a GSA undertakes a project that changes groundwater gradients, moves existing constituents, or results in the exceedance of minimum thresholds, SVBGSA will undertake a more rigorous technical study to assess local, historical groundwater quality distributions, and the impact of the GSA activity on that distribution.

For SGMA compliance, undesirable results for groundwater quality are not caused by (1) lack of action; (2) GSA required reductions in pumping; (3) exceedances in groundwater quality minimum thresholds that occur, if there are fewer exceedances than if there had been a lack of management; (4) exceedances in groundwater quality minimum thresholds that would have occurred independent of projects or management actions implemented by the GSA; (5) past harm. .

8.8.4.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result include the following:

- **Required Changes to Subbasin Pumping**. If the location and rates of groundwater pumping change as a result of projects implemented under the GSP, these changes could alter hydraulic gradients and associated flow directions, and cause movement of one of the constituents of concern toward a supply well at concentrations that exceed relevant standards.
- **Groundwater Recharge**. Active recharge of imported water or captured runoff could modify groundwater gradients and move one of the constituents of concern toward a supply well in concentrations that exceed relevant limits.
- **Recharge of Poor-Quality Water**. Recharging the Subbasin with water that exceeds an MCL, SMCL, or level that reduces crop production will lead to an undesirable result.

8.8.4.3 Effects on Beneficial Users and Land Use

The undesirable result for degradation of groundwater quality is avoiding groundwater degradation caused by a direct result of a GSA groundwater management action. Therefore, the undesirable result will not impact the use of groundwater and will not have a negative effect on the beneficial users and uses of groundwater. This undesirable result does not apply to groundwater quality changes that occur due to other causes.

8.9 Land Subsidence SMC

8.9.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable subsidence in the Subbasin is defined as follows:

- Any inelastic land subsidence that is caused by lowering of groundwater elevations in the Subbasin or
- Any inelastic subsidence that causes an increase of flood risk

These significant and unreasonable conditions were determined based on input from the Subbasin Committee and discussions with GSA staff.

Subsidence can be elastic or inelastic. Inelastic subsidence is generally irreversible. Elastic subsidence is the small, reversible lowering and rising of the ground surface. This SMC only concerns inelastic subsidence.

8.9.2 Minimum Thresholds

> *The minimum threshold for land subsidence is zero net long-term subsidence, with no more than 0.1 foot per year of measured subsidence to account for InSAR measurement errors.*

8.9.2.1 Information Used and Methodology for Establishing Subsidence Minimum Thresholds

The minimum threshold was established using InSAR data available from DWR. The general minimum threshold is for no long-term irreversible subsidence in the Subbasin. The InSAR data provided by DWR are subject to measurement error. DWR stated that, on a statewide level, for the total vertical displacement measurements between June 2015 and June 2019, the errors are as follows (DWR, 2019, personal communication):

1. The error between InSAR data and continuous GPS data is 16 mm (0.052 feet) with a 95% confidence level.
2. The measurement accuracy when converting from the raw InSAR data to the maps provided by DWR is 0.048 feet with 95% confidence level.

By adding errors 1 and 2, the combined error is 0.1 foot. While this is not a robust statistical analysis, it does provide an estimate of the potential error in the InSAR maps provided by DWR.

Additionally, the InSAR data provided by DWR reflects both elastic and inelastic subsidence. While it is difficult to compensate for elastic subsidence, visual inspection of monthly changes in ground elevations suggest that elastic subsidence is largely seasonal. To minimize the influence of elastic subsidence on the assessment of long-term, permanent subsidence, changes in ground level will only be measured annually from June of one year to June of the following year.

8.9.2.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

The subsidence minimum threshold has little or no impact on other minimum thresholds, as described below.

- **Chronic lowering of groundwater levels**. The land subsidence minimum threshold will not decrease groundwater elevations and therefore will not result in significant or unreasonable groundwater elevations.
- **Reduction in groundwater storage.** The land subsidence minimum threshold will not change the amount of pumping and therefore will not result in a significant or unreasonable change in groundwater storage.
- **Degraded water quality.** The land subsidence minimum threshold does not promote decreasing groundwater elevations that lead to exceedance of groundwater quality minimum thresholds and therefore will not result in significant of unreasonable degradation of water quality.
- **Depletion of ISW.** The land subsidence minimum threshold does not promote additional pumping or lower groundwater elevations adjacent to ISW. Therefore, the subsidence minimum threshold will not result in a significant or unreasonable depletion of ISW.

8.9.2.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The Upper Valley Subbasin has 2 neighboring subbasins. The Forebay Subbasin is within the SVBGSA jurisdiction to the north, and the Paso Robles Area Subbasin is a neighboring subbasin to the south that lies outside of SVBGSA jurisdiction.

The SVBGSA is one of the coordinating GSAs for the adjacent Forebay Subbasin. Because the SVBGSA covers both these subbasins, the SVBGSA is coordinating the development of the minimum thresholds and measurable objectives for the subbasins. The Forebay Subbasin is also in the process of GSP development for submittal in January 2022. Minimum thresholds for the Upper Valley Subbasin will be reviewed relative to information developed for the neighboring subbasin's GSP to ensure that these minimum thresholds will not prevent the neighboring subbasin from achieving or maintaining sustainability.

The Paso Robles Area Subbasin lies directly to the south of the Subbasin. Because the minimum threshold in the Upper Valley Subbasin is zero subsidence, it is likely that the minimum threshold will not prevent the neighboring subbasin from achieving or maintaining sustainability. The SVBGSA will coordinate closely with the Paso Robles Area Subbasin GSAs to ensure that the basins do not prevent each other from achieving sustainability.

8.9.2.4 Effects on Beneficial Uses and Users

The subsidence minimum threshold is set to prevent any long-term inelastic subsidence. Available data indicate that there is currently no long-term subsidence occurring in the Subbasin, and therefore the minimum thresholds have no impact on current pumping rates. Since the subsidence minimum threshold does not require any additional reductions in pumping, there is no negative impact on any beneficial user. Increased pumping, however, could initiate subsidence and require pumping restrictions. Due to the geology of the Upper Valley Subbasin, this is very unlikely.

8.9.2.5 Relation to State, Federal, or Local Standards

There are no federal, state, or local regulations related to subsidence.

8.9.2.6 Method for Quantitative Measurement of Minimum Threshold

The minimum threshold will be assessed using DWR-supplied InSAR data.

8.9.3 Measurable Objectives

The measurable objective for subsidence represents a target subsidence rates in the Subbasin. Because the minimum threshold of zero net long-term subsidence is the best achievable outcome, the measurable objective is identical to the minimum threshold.

> *The measurable objective for land subsidence is zero net long-term subsidence, with no more than 0.1 foot per year of estimated land movement measured subsidence to account for InSAR measurement errors.*

8.9.3.1 Methodology for Setting Measurable Objectives

The measurable objective will be assessed using DWR-supplied InSAR data.

8.9.3.2 Interim Milestones

The subsidence measurable objective is set at current conditions of no long-term subsidence. There is no change between current conditions and sustainable conditions. Therefore, the interim milestones are identical to current conditions of zero long-term subsidence, and annual measurements of no more than 0.1 foot of subsidence per year.

8.9.4 Undesirable Results

8.9.4.1 Criteria for Defining Undesirable Results

By regulation, the subsidence undesirable result is a quantitative combination of subsidence minimum threshold exceedances. For the Subbasin, no long-term subsidence is acceptable. Therefore, the land subsidence undesirable result is:

> *There is an exceedance of the minimum threshold for land subsidence due to lowered groundwater elevations.*

Should potential subsidence be observed, the SVBGSA will first assess whether the subsidence may be due to elastic subsidence. If the subsidence is not elastic, the SVBGSA will undertake a program to assess whether the subsidence is caused by lowered groundwater elevations. The first step in the assessment will be to check if groundwater elevations have dropped below historical lows. If groundwater elevations remain above historical lows, the GSA shall assume that any observed subsidence was not caused by lowered groundwater elevations. If groundwater elevations have dropped below historical lows, the GSA will attempt to correlate the observed subsidence with measured groundwater elevations. Additionally, if the Subbasin experiences subsidence in multiple consecutive years that are due to InSAR measurement error, the GSAs will confirm if the error is not actually net long-term subsidence.

8.9.4.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result include a shift in pumping locations. A significant increase in the amount of pumping in an area that is susceptible to subsidence could trigger subsidence that has not been observed before. Although unlikely because of the Upper Valley Subbasin's geology, future increases in pumping could initiate subsidence.

8.9.4.3 Effects on Beneficial Users and Land Use

The undesirable result for subsidence does not allow any subsidence to occur in the Subbasin. Therefore, there is no negative effect on any beneficial uses and users.

8.10 Depletion of Interconnected Surface Water SMC

Areas with ISW occur where shallow groundwater may be connected to the surface water system. This SMC applies only to locations of ISW, as shown on Figure 4-11.

The SVIHM is used to identify the locations of ISW and to develop an estimate of the quantity and timing of stream depletions due to pumping during current and historical groundwater conditions. Shallow groundwater and surface water levels simulated by the SVIHM are used to identify the location of interconnection and evaluate the frequency with which different stream reaches are connected with groundwater in the underlying aquifer. The magnitude of stream depletions in relation to shallow groundwater elevations in interconnected reaches are evaluated in Chapter 5.

8.10.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable depletion of ISW in the Subbasin is defined as:

- Depletions from groundwater extraction that would result in a significant and unreasonable impact on other beneficial uses and users such as riparian water rights holders, appropriative surface water rights holders, ecological surface water users, and recreational surface water uses.
- Depletion from groundwater extraction more than observed in 2016, as measured by shallow groundwater elevations near locations of ISW. While a documented determination of whether past depletions was significant is not available, staying above 2016 depletions was determined to be a reasonable balance for all the beneficial uses and users.

These significant and unreasonable conditions were determined based on input collected Subbasin Committee meetings and discussions with GSA staff. There is currently no data that determines what level of depletion from groundwater extraction has a significant adverse effect on steelhead trout or other beneficial use or user of ISW. Should there be a determination regarding what level of depletion from groundwater extraction is significant, SVBGSA will take that into consideration as it reviews how it locally defines significant and unreasonable conditions for the SMC in the 5-Year Update.

8.10.2 Minimum Thresholds

> *The minimum thresholds for depletion of interconnected surface water are established by proxy using shallow groundwater elevations observed in 2016 near locations of interconnected surface water.*

No minimum thresholds are established for times when flow in a river is due to conservation releases from a reservoir. One purpose for these conservation releases is to recharge the Salinas Valley Groundwater Basin. Therefore, depletion of conservation releases is a desired outcome, and the minimum thresholds and measurable objectives do not apply to these flows.

The locations of ISW identified with the SVIHM are based on best available data but contain uncertainty, which is discussed in Chapters 4, 5, and 6. Additional stream and groundwater level data are needed to reduce uncertainty, verify with observed conditions, and track changes over time. The shallow groundwater monitoring wells, USGS stream gauges, and MCWRA River Series measurement sites will be used to supplement the analysis of locations of connectivity provided by the SVIHM. These monitoring points will also become part of the ISW monitoring network that is discussed in Chapter 7. Data from the ISW monitoring network will be used to monitor and evaluate the interconnection through time.

As discussed in Chapter 7, a monitoring network for ISW composed of shallow groundwater monitoring wells is in the process of development. Existing shallow wells will be added to the monitoring network where possible and will be supplemented with new shallow wells if needed. The monitoring network is dependent on the location and magnitude of stream reaches determined by the SVIHM. Once the monitoring network is fully established, SMC will be determined using the wells' groundwater elevations during the minimum threshold and measurable objective years, or interpolated values from the groundwater elevation contour maps for wells that do not have shallow groundwater elevation measurements for those years.

8.10.2.1 Information Used and Methodology for Establishing Depletion of Interconnected Surface Water Minimum Thresholds and Measurable Objectives

8.10.2.1.1 Establishing Groundwater Elevations as Proxies

The GSP Regulations § 354.28(d) states that: "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."

The evaluation of ISW in the Salinas Valley Groundwater Basin is based on an approach recommended by the Environmental Defense Fund (EDF, 2018) that uses groundwater elevations as surrogates for streamflow depletion rates caused by groundwater use. Basic hydraulic principles state that groundwater flow is proportional to the difference between groundwater elevations at different locations along a flow path. Using this basic principle, groundwater flow to a stream, or conversely seepage from a stream to the underlying aquifer, is proportional to the difference between water elevation in the stream and groundwater elevations at locations away from the stream. Assuming the elevation in the stream is relatively stable, changes in interconnectivity between the stream and the underlying aquifer is determined by changes in groundwater levels in the aquifer. Thus, the change in hydraulic gradient between stream elevation and surrounding groundwater elevations is representative of change in interconnection between surface water and groundwater. Monitoring the hydraulic gradient in the aquifer adjacent to the stream monitors the interconnectivity between stream and aquifer. Therefore, the gradient can be monitored by measuring and evaluating groundwater elevations at selected shallow monitoring wells near streams. No existing estimations of the quantity and timing of depletions of ISW exist, nor data available to make estimations, so the hydraulic principles provide the best available information.

8.10.2.1.2 Review of Beneficial Uses and Users of Surface Water

The various beneficial uses and users of surface waters were addressed when setting the ISW depletion minimum thresholds. The classes of beneficial uses and users that were reviewed include riparian rights holders, appropriative rights holders, ecological surface water users, and recreational surface water users. This is not a formal analysis of public trust doctrine, but it is a reasonable review of all uses and users in an attempt to balance all interests. This is not an assessment about what constitutes a reasonable beneficial use under Article X, Section 2 of the California Constitution. The minimum thresholds for depletion of ISW are developed using the definition of significant and unreasonable conditions described above, public information about critical habitat, locations of ISW derived from the SVIHM, and public information about water rights described below.

Riparian water rights holders. The second line of data in Table 8-6 provides a summary of water diversions reported to the SWRCB by riparian water rights holders on the Salinas River and its tributaries within the Upper Valley Subbasin. The diversion data were obtained from queries of the SWRCB eWRIMS water rights management system. The diversions are self-reported by water-rights holders within the Subbasin. Some of the diversions shown in Table 8-6 are also reported to MCWRA as groundwater pumping.

The SVBGSA is not aware of any current riparian water rights litigation or water rights enforcement acts along the Salinas River in the Subbasin. Therefore, SVBGSA assumes that the current level of depletion has not injured any riparian water rights holders in the Subbasin.

Table 8-6. Reported Annual Surface Water Diversions in the Upper Valley Aquifer Subbasin

Diversions (Acre-Feet)	2011	2012	2013	2014	2015	2016	2017	2018	2019
Appropriation per Permit	4	4	4	6	4	4	4	4	3
Statement of Diversion and Reported Riparian Diversions	61,493	100,004	107,694	76,359	46,502	39,576	35,649	53,010	46,246
Total	61,497	100,008	107,698	76,365	46,506	39,580	35,653	53,014	46,249

Appropriative water rights holders. There are 4 permitted appropriative water right holders in the Upper Valley Subbasin, whose reported diversions are shown in Table 8-6. These reported surface water diversions are not a determination of water rights and may not include all pre-1914 water rights. In addition, MCWRA releases water from upstream appropriative diversion points, the Nacimiento Reservoir and San Antonio Reservoir, which flows through the Subbasin.

The SVBGSA is not aware of any current appropriative water rights litigation or water rights enforcement acts along the Salinas River in the Subbasin. Therefore, SVBGSA assumes that the current level of depletion has not injured any appropriative water rights holders in the Subbasin.

Ecological surface water users. Review of MCWRA’s Nacimiento Dam Operation Policy (MCWRA, 2018b) and MCWRA’s water rights indicates MCWRA operates the Dam in a manner that meets downstream demands and considers ecological surface water users. Since the reservoir operations consider ecological surface water users and reflect reasonable existing surface water depletion rates, this GSP infers that stream depletion from existing groundwater pumping is not unreasonable. If further river management guidelines are developed to protect ecological surface water users, the SMC in this GSP will be revisited.

Recreational surface water users. No recreational activities such as boating regularly occur on surface water bodies in the Subbasin.

As shown by the analysis above, the current rate of surface water depletion is not having an unreasonable impact on the various surface water uses and users in the Subbasin. Therefore, the minimum thresholds are based on 2016 groundwater elevations, when surface water depletions were not unreasonable.

8.10.2.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

The minimum thresholds for depletion of ISW are set to 2016 groundwater elevations in the shallow monitoring wells within the Subbasin. The minimum thresholds all reference the same historical year and have existed simultaneously in the past. Therefore, no conflict exists between minimum thresholds measured at various locations within the Subbasin.

The depletion of ISW minimum thresholds could influence other sustainability indicators as follows:

- **Chronic lowering of groundwater levels.** The depletion of ISW minimum thresholds are set higher than the groundwater level minimum thresholds. Therefore, the ISW minimum thresholds will not result in chronic lowering of groundwater elevations.
- **Reduction in groundwater storage.** The depletion of ISW minimum thresholds are set higher than the change in storage minimum thresholds, which are the same as the groundwater level minimum thresholds. Therefore, the ISW minimum thresholds will not result in an undesirable loss of groundwater storage.

- **Degraded water quality.** The depletion of ISW minimum thresholds do not promote decreasing groundwater elevations that lead to exceedance of groundwater quality minimum thresholds. Therefore, groundwater quality will not be affected by the ISW minimum thresholds.
- **Land subsidence.** The depletion of ISW minimum thresholds do not promote additional pumping that could cause subsidence. Therefore, subsidence will not be affected by the ISW minimum thresholds.

8.10.2.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The Upper Valley Subbasin has 2 neighboring subbasins. The Forebay Subbasin is within the SVBGSA jurisdiction to the north and the Paso Robles Area Subbasin is a neighboring subbasin to the south that lies outside of SVBGSA jurisdiction.

The SVBGSA is one of the coordinating GSAs for the adjacent Forebay Subbasin. Because the SVBGSA covers both these subbasins, the SVBGSA is coordinating the development of the minimum thresholds and measurable objectives for the subbasins. The Forebay Subbasin is also in the process of GSP development for submittal in January 2022. Minimum thresholds for the Upper Valley Subbasin will be reviewed relative to information developed for the neighboring subbasin's GSP to ensure that these minimum thresholds will not prevent the neighboring subbasin from achieving or maintaining sustainability.

The Paso Robles Area Subbasin lies directly to the south of the Subbasin. Because the Paso Robles Subbasin is upstream of the Upper Valley Subbasin, depletion of ISW minimum thresholds in the Upper Valley Subbasin will not prevent the neighboring subbasin from achieving or maintaining sustainability. The SVBGSA will coordinate closely with the Paso Robles Area Subbasin GSAs to ensure that the basins do not prevent each other from achieving sustainability.

8.10.2.4 Effect on Beneficial Uses and Users

Table 3-9 of the *Salinas River Long-Term Management Plan* (MCWRA, 2019a) includes a list of 18 different designated beneficial uses on certain reaches of the river. In general, the major beneficial uses on the Salinas River are:

- Surface water diversions for agricultural, urban/industrial, and domestic supply
- Groundwater pumping from recharged surface water
- Freshwater habitat
- Rare, threatened, or endangered species, such as the Steelhead Trout

The depletion of ISW minimum thresholds may have varied effects on beneficial users and land uses in the Subbasin.

Agricultural land uses and users. The depletion of ISW minimum thresholds prevent lowering of groundwater elevations adjacent to certain parts of streams and rivers beyond historical lows. While the measurable objectives are higher, this leaves flexibility for needed groundwater extraction during droughts or periods of low reservoir releases. If the minimum thresholds were higher than these historical levels, it might affect the quantity and type of crops that can be grown in the land adjacent to streams and the ability of crops to withstand droughts.

Urban land uses and users. The depletion of ISW minimum thresholds prevent lowering of groundwater elevations adjacent to certain parts of streams and rivers beyond historical lows. While the measurable objective is higher, this leaves flexibility for needed groundwater extraction during droughts or periods of low reservoir releases. If the minimum thresholds were higher than these historical levels, it may limit the amount of urban pumping near rivers and streams, which could limit urban growth in these areas to historical levels. Also, if pumping is limited beyond historical levels, municipalities may have to obtain alternative sources of water to achieve urban growth goals. If this occurs, this may result in higher water costs for municipal water users.

Domestic land uses and users. The depletion of ISW minimum thresholds protect existing domestic land users and uses near locations of ISW from groundwater elevation declines below historical lows by maintaining shallow groundwater elevations near streams and protecting the operability of relatively shallow domestic wells.

Ecological land uses and users. The depletion of ISW minimum thresholds address ecological uses and users by preventing depletion of ISW from groundwater pumping beyond what was historically experienced. Additionally, by setting future groundwater levels at or above recent lows, there should be less impact to ecological users than has been seen to date.

8.10.2.5 Relation to State, Federal, or Local Standards

There are no explicit federal, state, or local standards for depletion of ISW. However, both state and federal provisions call for the protection and restoration of conditions necessary for endangered and threatened species.

8.10.2.6 Method for Quantitative Measurement of Minimum Threshold

The SVIHM is used to preliminarily identify areas of ISW and will help determine when any flow in a river is primarily due to conservation releases from Nacimiento and San Antonio reservoirs. Groundwater elevations measured in shallow wells adjacent to these areas of ISW will serve as the primary approach for monitoring depletion of ISW. As discussed in Chapter 7, existing shallow wells will be added, or new shallow wells will be installed to monitor groundwater elevations adjacent to surface water bodies during GSP implementation.

New shallow monitoring wells installed pursuant to the GSP will not have data from 2016. Minimum thresholds for those wells will be estimated by either correlation with nearby deeper wells with water-level records that include 2016, or from groundwater model results.

8.10.3 Measurable Objectives

The measurable objectives for depletion of ISW target groundwater elevations that are higher than the minimum thresholds. The measurable objectives are consistent with the chronic lowering of groundwater elevation and reduction in groundwater storage measurable objectives.

> *The measurable objectives for depletion of interconnected surface water are established by proxy using shallow groundwater elevations observed in 2011 near locations of interconnected surface water.*

8.10.3.1 Methodology for Setting Measurable Objectives

The depletion of ISW measurable objectives are set to be identical to the groundwater level measurable objectives. The methodology for establishing measurable objectives is outlined in Section 8.6.2.1. Groundwater elevations from 2011 were selected as representative of the measurable objectives for the Upper Valley Subbasin.

8.10.3.2 Interim Milestones

The interim milestones leading to the depletion of ISW measurable objectives will be added when the monitoring network is established.

8.10.4 Undesirable Results

8.10.4.1 Criteria for Defining Undesirable Results

By regulation, the depletion of ISW undesirable result is a quantitative combination of minimum threshold exceedances. The undesirable result for depletion of ISW is:

> *There is an exceedance of the minimum threshold in a shallow groundwater monitoring well used to monitor interconnected surface water.*

Streamflow depletion in the Subbasin is complicated by many factors, such as reservoir releases, recharge of the aquifer from streamflow, losses to vegetation, and ET. The ISW SMC applies to depletion of ISW from groundwater use. For SGMA compliance purposes, the default assumption is that any depletions of surface water beyond the level of depletion that occurred prior to 2016, as evidenced by reduction in groundwater levels, represent depletions that are significant and unreasonable. Any additional depletions of surface water flows caused by groundwater conditions in excess of conditions as they were in 2016 would likely be an undesirable result that must be addressed under SGMA. There is currently no biological opinion or habitat conservation plan that indicates additional protection is needed for species protected under the Endangered Species Act; however, if it is determined that additional protection is needed and streamflow loss is due to groundwater extraction not surface water flows, SVBGSA will adapt as necessary to adhere to environmental laws.

8.10.4.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result for the depletion of ISW include the following:

- **Localized pumping increases**. Even if the Subbasin is adequately managed at the Subbasin scale, increases in localized pumping near ISW bodies could unreasonably increase surface water depletion.
- **Expansion of riparian water rights**. Riparian water rights holders often pump from wells adjacent to the Salinas River. Pumping by these riparian water rights holder users is not regulated under this GSP. Additional riparian pumpers near interconnected reaches of rivers and streams may result in excessive localized surface water depletion.
- **Changes in Nacimiento and San Antonio Reservoir Releases**. Since the Salinas River is dependent on reservoir releases for sustained flows, releases at low levels could cause undesirable results. The ability to avoid undesirable results for ISW is partially dependent on reservoir releases.
- **Departure from the GSP's climatic assumptions, including extensive, unanticipated drought**. Minimum thresholds were established based on anticipated future climatic conditions. Departure from the GSP's climatic assumptions or extensive, unanticipated droughts may lead to excessively low groundwater elevations that increase surface water depletion rates.

8.10.4.3 Effects on Beneficial Users and Land Use

The depletion of ISW undesirable result is to have no net increase in surface water depletion due to groundwater use beyond 2016 levels, as determined by shallow groundwater elevations. The effects of undesirable results on beneficial users and land use are the same as the effects of minimum thresholds on beneficial uses and users, as described in Section 8.10.2.4.

SVBGSA will work with National Marine Fisheries Service (NMFS) and MCWRA to further evaluate the effects of the ISW measurable objectives, minimum thresholds, and undesirable results on surface water flows and beneficial users.

9 MANAGEMENT ACTIONS AND PROJECTS

9.1 Introduction

This chapter describes the management actions and projects that will allow the Subbasin to maintain sustainability in accordance with §354.42 and §354.44 of the GSP Regulations should they be needed. At the time of GSP development, projects are not necessary to maintain sustainability and are only included to provide sufficient options for maintaining sustainability throughout the 50-year planning horizon. Implementation of management actions and projects will only be initiated in the Upper Valley Subbasin after the benefits and impacts of the actions have been analyzed with a publicly available groundwater model that has technical acceptance. As stated in Chapter 6, the model used for developing this GSPs groundwater budgets should be improved before it can be used for analyzing management actions in the Subbasin.

This chapter includes a description of proposed projects and proposed groundwater management actions. In this GSP, projects are activities supporting groundwater sustainability that require infrastructure or physical change to the environment. Projects include green infrastructure projects that achieve benefits through alteration of vegetation or soils, such as removal of invasive species and floodplain restoration. The term groundwater management actions generally refer to activities that support groundwater sustainability without infrastructure.

The management actions and projects included in this GSP are designed to achieve a number of outcomes, including:

- Maintaining groundwater sustainability through 2042 by continuing to meet Subbasin-specific SMC
- Providing equity between who benefits from projects and who pays for projects
- Providing incentives to keep groundwater pumping within the sustainable yield

The management actions and projects included in this chapter outline a framework for maintaining sustainability; however, many details must be negotiated before any of the management actions and projects can be implemented. Costs will be additional to the agreed-upon funding to sustain the operational costs of SVBGSA, and funding needed for monitoring and reporting.

This GSP is developed as part of an integrated effort by the SVBGSA to achieve groundwater sustainability in all 6 subbasins of the Salinas Valley under its authority. Therefore, the projects and actions included in this GSP are part of a larger set of integrated projects and actions for the entire Valley, all of which account for the uncertainty associated with the basin setting.

The management actions and projects are based on existing infrastructure, including the reservoirs and their spillways. The reservoirs are currently operated according to the Nacimiento Dam Operations Policy (MCWRA, 2018b), which reflects the Salinas Valley Water Project. The Nacimiento Spillway has an elevation of 787.75 feet mean sea level (msl), with an inflatable gate that can temporarily raise the spillway gate to 800 feet msl to accommodate flood flows. If current infrastructure is operated differently, such as required reductions if deferred maintenance is not completed or changes resulting from the planned HCP, or if other projects are implemented within the Valley that affect groundwater conditions, SVBGSA will consider the effect of any such changes in meeting sustainability goals and will act in furtherance of reaching such goals.

Discussions and decisions regarding specific management actions and projects will continue throughout GSP implementation and be part of the adaptive management of the Subbasin. Members of the GSA and stakeholders in the Subbasin should view these management actions and projects as a starting point for more detailed discussions, not a commitment to implementing any specific project or management action. Where appropriate, details that must be agreed upon are identified for each management action or project.

As a means to compare projects, this chapter estimates the cost per AF of water. The cost per AF is the amortized cost of the project divided by the annual yield. It is not the cost of water for irrigation or the domestic cost of drinking water for households on water systems. It is included to help compare projects; however, more refined cost analyses and future special benefit analyses will be completed if projects are needed during GSP implementation.

The specific design for implementing management actions and projects will provide landowners and public entities flexibility in how they manage water and how the Subbasin maintains groundwater sustainability. Upper Valley stakeholders will work collaboratively to determine which management actions and projects to implement in order to maintain sustainability of the Upper Valley and will pursue adaptive management if conditions change.

9.2 General Process for Developing Management Actions and Projects

9.2.1 Process for Developing Management Actions and Projects

The general process for developing the management actions and projects presented in this chapter included a combination of reviewing publicly available information, gathering feedback during public meetings including Subbasin Committee meetings, conducting hydrogeologic analysis, consulting with SVBGSA staff, and meeting with Advisory Committee and Board members.

Building off the previously identified projects, SVBGSA undertook an iterative process at the subbasin level to develop the management actions and projects in this GSP. An overview of the purpose and types of management actions and projects was presented to the Subbasin Committee, and initial ideas were solicited. Subbasin Committee members completed a survey for feedback and further solicitation of ideas. After these ideas were gathered, a list of potential management actions and projects was presented to the Subbasin Committee and discussed. Potential management actions and projects were also discussed in terms of meeting the SMC outlined in Chapter 8.

9.2.2 Cost Assumptions Used in Developing Projects

Project cost estimates are provided in Appendix 9A. Assumptions and issues for each project need to be carefully reviewed and revised during the pre-design phase of each project. Project designs, and therefore costs, could change considerably as more information is gathered.

The cost estimates included for each SVBGSA project are order of magnitude estimates. These estimates were made with little to no detailed engineering data. The expected accuracy range for such an estimate is within plus 50% or minus 30%. The cost estimates are based on perceptions of current conditions at the project location and reflect professional opinions of costs at this time and are subject to change as project designs mature.

Capital costs for infrastructure projects include major components such as pipelines, pump stations, customer connections, turnouts, injection wells, recharge basins, and storage tanks. Capital costs also include 30% contingency for plumbing appurtenances, 15% increase for general conditions, 15% for contractor overhead and profit, and 9.25% for sales tax. Engineering, legal, administrative, and project contingencies was assumed as 30% of the total construction cost and included within the capital cost. For capital projects, land acquisition at $45,000/acre was also included within capital costs.

Annual operations and maintenance (O&M) fees include the costs to operate and maintain new project infrastructure. O&M costs also include any pumping costs associated with new infrastructure. O&M costs do not include O&M or pumping costs associated with existing infrastructure, because these are assumed to be part of water purchase costs. Water purchase costs are assumed to include repayment of loans for existing infrastructure; however, these purchase costs will need to be negotiated. The terms of such a negotiation could vary widely.

Capital costs were annualized over 25 years and added with annual O&M costs and water purchase costs to determine an annualized $/AF cost for each project.

9.3 Overview of Management Actions and Projects

This GSP is part of an integrated plan for managing groundwater in all 6 subbasins of the Salinas Valley that are managed by the SVBGSA. This GSP focuses on the management actions that directly help the Upper Valley Subbasin maintain sustainability, but also includes projects that could be implemented if needed and multi-subbasin projects outside the Subbasin that could benefit the Subbasin.

The following are the major types of management actions and projects that can be developed to supplement the Upper Valley Subbasin’s groundwater supplies:

- Direct recharge through recharge basins or injection/dry wells
- Indirect recharge through decreased ET
- Reoperation of reservoir releases to achieve greater or more regular recharge
- Demand management

The management actions and projects for this GSP are listed in Table 9-1.

Table 9-1. Management Actions and Projects

Project/ Management Action #	Name	Description	Project Benefits	Quantification of Project Benefits	Cost
A - MANAGEMENT ACTIONS					
A1	SMC Technical Advisory Committee (TAC)	Establish TAC to review groundwater conditions and provide advice on management actions and projects	Potential for increased groundwater elevations, increased groundwater storage, decreased groundwater extraction, protection of water quality	Dependent on specific recommendations implemented	Staffing costs plus $10,000 per year
A2	Conservation and Agricultural BMPs	Promote agricultural best management practices (BMPs) and support use of ET data as an irrigation management tool for growers	Better tools assist growers to use water more efficiently; decreased groundwater extraction	Unable to quantify benefits until specific BMPs are identified and promoted	Approximately $100,000 for 4 workshops, grant writing, and demonstration trials. Cost could be reduced if shared between subbasins.
A3	Fallowing, Fallow Bank, and Agricultural Land Retirement	Includes voluntary fallowing, a fallow bank whereby anybody fallowing land could draw against the bank to offset lost profit from fallowing, and retirement of agricultural land	Decreased groundwater extraction for irrigated agriculture	Dependent on program participation	$195-$395/AF if land is fallowed $810-$2,000/AF if land is retired
A4	MCWRA Drought Reoperation	Support the existing Drought Technical Advisory Committee (D-TAC) when it develops plans for how to manage reservoir releases during drought conditions	Additional regular winter reservoir releases; drought resilience	Unable to quantify benefits since drought operations have yet to be triggered	No additional costs since already formed
A5	Reservoir Reoperation	Collaborate with MCWRA to evaluate potential reoperation scenarios	Additional regular annual reservoir releases; drought resilience	Unable to quantify benefits until feasibility study completed	Approximately $400,000 - $500,000

Project/ Management Action #	Name	Description	Project Benefits	Quantification of Project Benefits	Cost
B - PROJECTS					
B1	Multi-benefit Stream Channel Improvements	Prune native vegetation and remove non-native vegetation, manage sediment, and enhance floodplains for recharge. Includes 3 components: Stream Maintenance Program Invasive Species Eradication Floodplain Enhancement and Recharge	Groundwater recharge, flood risk reduction, returns streams to a natural state of dynamic equilibrium	Component 1: Multi-subbasin benefits not quantified Component 2: Multi-subbasin benefits of 2,790 to 20,880 AF/yr. of increased recharge Component 3: Upper Valley benefits of 400 AF/yr. from 4 recharge basins	<u>Component 1</u> Multi-subbasin Cost: $150,000 for annual administration and $95,000 for occasional certification; $780,000 for the first year of treatment on 650 acres, and $455,000 for annual retreatment of all acres <u>Component 2</u> Multi-subbasin Average Cost: $16,500,000 Unit Cost: $60 to $740/AF <u>Component 3</u> Upper Valley Cost: $4,464,000 Unit Cost: $930/AF
B2	MAR with Overland Flow	Construct basins for MAR of overland flow before it reaches streams	Groundwater recharge, less stormwater and erosion, more regular surface temperature	400 AF/yr. in increased recharge	Capital Cost: $4,128,000 Unit Cost: $870/AF

Project/ Management Action #	Name	Description	Project Benefits	Quantification of Project Benefits	Cost
C - IMPLEMENTATION ACTIONS					
C1	Well Registration	Register all production wells, including domestic wells	Better informed decisions, more management options	N/A – Implementation Action	Not estimated at this time
C2	Groundwater Extraction Management System (GEMS) Expansion and Enhancement	Update current GEMS program, by collecting groundwater extraction data from wells in areas not currently covered by GEMS and improving data collection	Better informed decisions	N/A – Implementation Action	Not estimated at this time
C3	Dry Well Notification System	Develop a system for well owners to notify the GSA if their wells go dry. Refer those owners to resources to assess and improve their water supplies. Form a working group if concerning patterns emerge.	Support affected well owners with analysis of groundwater elevation decline	N/A – Implementation Action	Not estimated at this time
C4	Water Quality Coordination Group	Form a working group for agencies and organizations to collaborate on addressing water quality concerns.	Improve water quality	N/A – Implementation Action	Not estimated at this time
C5	Land Use Jurisdiction Coordination Program	Review land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity.	Better aligned land use and water use planning	N/A – Implementation Action	Not estimated at this time

9.4 Management Actions to Maintain Sustainability

Management actions that could be used to maintain sustainability were the most reliable, feasible, cost-effective, and acceptable to stakeholders. Descriptions of these management actions are included below and are not in order of priority. Generalized costs are included for planning purposes and to show the general level of effort necessary to undertake the actions. Components of these management actions may change based on future analyses. Therefore, each of the management actions described in this GSP should be treated as a generalized action representative of a range of potential configurations.

9.4.1 Management Action A1: Upper Valley Sustainable Management Criteria Technical Advisory Committee

This management action establishes the Upper Valley SMC TAC to give valuable science-based information and advice to the Subbasin Implementation Committee to manage groundwater resources sustainably. This is a technical-based committee that may include outside experts.

The SMC TAC will be established during the first 2 years of GSP implementation. SVBGSA will work with the Subbasin Committee to determine membership, which will include professional and scientific experts. The SMC TAC will initially meet to develop guiding principles, triggers, and the decision-making process. The triggers are groundwater condition levels that trigger the need for management actions or projects according to the SMC. Over the course of GSP implementation, the SMC TAC will also review the data required for decision making to ensure needed data is being collected to monitor the 5 SMC potentially present in the Upper Valley Subbasin. TAC members will work with the Upper Valley Subbasin Committee to develop recommendations to correct negative trends in groundwater conditions and continue to meet the measurable objectives.

After the meetings associated with its establishment, the SMC TAC will convene annually in April, and subsequently as needed, to:

- Review the Upper Valley Subbasin Annual Report and whether conditions trigger the need for management actions or projects to maintain sustainability.
- Recommend implementation of specific management actions and projects to the Subbasin Committee for approval by the Board for final implementation.
- Review data and make recommendations on data acquisition and analysis needed.

The SMC TAC will consider and make recommendations to the Upper Valley Subbasin Committee on management actions and projects. These could include:

- Recharge projects, such as stream channel improvements or MAR of overland flow.
- Demand management, such as voluntary or mandatory pumping restrictions depending on spatial and temporal conditions, voluntary fallowing, or other demand management strategies.
- Management actions and projects that mitigate groundwater quality degradation from GSA actions.

In addition, the SMC TAC may analyze how non-SVBGSA projects will affect maintaining sustainability in the Upper Valley, primarily regarding projects that modify reservoir operations at Nacimiento and San Antonio. There may be other projects in the future that need to be analyzed upstream or downstream on the Salinas River north of the Upper Valley boundaries.

This management action relies on monitoring data that covers the entire Subbasin. Therefore, the GEMS Expansion and Enhancement Management Action and other monitoring tasks identified in Chapter 10 are critical to collect the data the SMC TAC needs for decision making.

The MCWRA D-TAC, described in Management Action A4, convenes and develops a schedule for releases from the Nacimiento and San Antonio reservoirs during drought periods. The D-TAC and SMC TAC are unique but complimentary, as the D-TAC's recommendation of reservoir releases affect stream flow and therefore groundwater recharge, and the SMC TAC advises on groundwater status.

Through this approach, the Subbasin will be able to react in real time with hydrological situations derived from additional data, provided by a robust SVBGSA monitoring program that includes other local agencies that interface with the Upper Valley.

9.4.1.1 Relevant Measurable Objectives

The measurable objectives benefiting from the SMC TAC management action include:

- **Groundwater levels**. This measurable objective will benefit from actions the TAC recommends to maintain groundwater elevations at or above the measurable objectives.
- **Groundwater storage.** This measurable objective will benefit from actions the TAC recommends to maintain groundwater storage at or above the measurable objectives.
- **Groundwater quality**. This measurable objective will benefit from actions the TAC recommends to maintain groundwater quality at or above the measurable objectives.
- **Land subsidence**. This measurable objective will benefit from actions the TAC recommends to prevent any potential land subsidence from occurring based on groundwater conditions.
- **Interconnected Surface Water**. This measurable objective will benefit from actions the

TAC recommends to maintain shallow groundwater elevations at or above the measurable objectives near areas of ISW.

9.4.1.2 Expected Benefits and Evaluation of Benefits

The primary benefits for this management action are that there will be a stakeholder-accepted, science-based process to assess the annual report and recommend actions as needed to maintain sustainability. Recharge management actions and projects will increase groundwater elevations and storage. Demand management actions will reduce groundwater extraction. Groundwater quality projects will mitigate groundwater quality degradation from GSA action. The specific management actions and projects implemented will determine whether the groundwater benefits expected are related to groundwater elevations, groundwater storage, groundwater quality, land subsidence, and/or ISW. Because future conditions are unknown and the actions recommended and taken depend on those conditions, it is difficult to quantify the expected benefits at this time.

In addition to helping the Subbasin meet SMC measurable objectives, the SMC TAC provides a process to assist the Subbasin Committee in responding to drought impacts to groundwater.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Groundwater storage will be monitored using groundwater elevations. Land subsidence will be measured using InSAR data provided by the DWR. When data gaps are filled, ISWs will be measured through shallow groundwater wells and river flow.

9.4.1.3 Circumstances for Implementation

The SMC TAC can be established at any time. Subbasin stakeholders plan to establish it within the first 2 years of GSP implementation. After it is established, the TAC will meet annually in April and subsequently if needed.

9.4.1.4 Permitting and Regulatory Process

The GSA Board of Directors will need to authorize the establishment of the SMC TAC. If the Upper Valley Subbasin Committee recommends pumping restrictions, the development and implementation of pumping restrictions is a regulatory activity and would be embodied in a GSA regulation. The regulation could be established to provide for automatic implementation upon existence of specific criteria or to require the vote of the Board to implement.

9.4.1.5 Legal Authority

The California Water Code §10725.4 allows GSAs to pursue investigations to determine the need for groundwater management and to implement GSPs. In addition, the California Water Code §10726.4(a)(2) provides GSAs the authorities to control groundwater extractions by regulating, limiting, or suspending extractions from individual groundwater wells or extractions from groundwater wells in the aggregate.

9.4.1.6 Implementation Schedule

The SMC TAC will be established within the first 2 years of GSP implementation, as shown on Figure 9-1. After it is established, it will convene at least annually.

Task Description	Year 1	Year 2	Annually
Establish TAC (membership, guiding principles, and decision-making process)			
Convene annually and meet additionally as needed			

Figure 9-1. Implementation Schedule for SMC TAC

9.4.1.7 Estimated Cost

The costs of convening and supporting the SMC TAC will be staff time and any additional analyses requested by the TAC. Development of the Annual Report occurs independent of the TAC and therefore does not incur any additional costs. The cost for SVBGSA technical support to the SMC TAC is estimated at $10,000/year, variable based on the number of meetings and additional analyses needed.

9.4.1.8 Public noticing

As part of the approval of the establishment of the SMC TAC, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on it. The general steps in the public notice process will include the following:

- GSA staff will bring an assessment of the need for the TAC to the SVBGSA Board in a publicly noticed meeting. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed management action
    - An estimated cost and schedule for the proposed management action
    - Any alternatives to the proposed management action
- The SVBGSA Board will notify stakeholders in the area of the proposed TAC and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether to establish the TAC and will notify the public if approved via an announcement on the SVBGSA website and mailing lists.

In addition to the process detailed above, all projects will follow the public noticing requirements per CEQA or NEPA.

9.4.2 Management Action A2: Conservation and Agricultural BMPs

This would be a program to incentivize and/or assist with conservation and agricultural BMPs to reduce groundwater pumping. It may also improve groundwater quality. SVBGSA acknowledges that BMPs are being developed as part of Ag Order 4.0 and will work to complement and not replicate those efforts. Potential practices that will be part of a program include:

- **ET DATA**
  ET data indicate crops' theoretical water needs as determined by crop type and weather conditions. Some ET data sets are 100% automated, relying on satellite imagery and weather stations to provide affordable data for large areas of land. Other ET data sets are generated automatically, but then subjected to expert verification, resulting in higher quality data at higher cost. The incorporation of ET data with soil moisture sensors, soil nutrient data, and flow meter data can help inform more efficient irrigation practices. The GSA could support the development and utilization of these tools through securing funding or coordinating with existing local agricultural extension specialists who conduct research and provide technical assistance to growers.
- **EDUCATION AND OUTREACH**
  SVBGSA will support existing local agricultural extension specialists with their education and outreach on BMPs that would increase water conservation and decrease pumping. Efforts will promote irrigation practices to reduce water use. Efforts could also include supporting practices to increase water retention such as compost application and use of cover crops. These BMPs could also support compliance with Ag Order regulations applicable to groundwater. Effective implementation of BMPs will require buy-in from growers. SVBGSA will work with local agricultural extension specialists and growers to understand preferred BMPs and those that could yield the greatest water savings. SVBGSA could partner with existing organizations or technical assistance providers to help growers identify which BMPs they could pursue and analyze the potential savings from their implementation. Technical workshops and professional referrals can be utilized with partners to accomplish outreach effectively and efficiently with growers.

9.4.2.1 Relevant Measurable Objectives

The measurable objectives benefiting from outreach and education include:

- **Groundwater elevation measurable objective**. This measurable objective will benefit from BMPs that promote less pumping or greater recharge that result in higher groundwater levels.

- **Groundwater storage measurable objective**. Reducing pumping or adding water to the principal aquifer will ultimately have the effect of increasing groundwater in storage.
- **Land subsidence measurable objective.** This measurable objective will benefit from BMPs that reduce the pumping stress on the local aquifer and thereby reduce any potential for subsidence.

9.4.2.2 Expected Benefits and Evaluation of Benefits

The primary benefit of implementing this management action is to provide the latest technologies and opportunities to modify agricultural practices that would allow farmers to reduce pumping needs but realize the same crop yields. This program could also be a mechanism for grant opportunities, funded through the SVBGSA to identify pilot programs and other innovative technological advancements that could provide an overall groundwater basin benefit.

Improving ET data allows for improved modeling and sets more accurate expectations for climate change impacts on crops. This in turn is translated into expected water demand for the crops. With more accurate data and information, pumpers can work with the SVBGSA to improve water extractions and potentially keep more water in the ground. This would result in protected groundwater elevations and storage. Furthermore, education and outreach activities can help inform farmers about cutting-edge technology that would help maximize irrigation efficiency. This would also improve groundwater elevations and storage. Benefits cannot be quantified until specific BMPs are identified and promoted.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Land subsidence will be measured using InSAR data provided by the DWR.

9.4.2.3 Circumstances for Implementation

The circumstance for implementation is for willing farmers to participate in an education and outreach program and to work with the SVBGSA to identify opportunities. No other triggers are necessary or required.

9.4.2.4 Permitting and Regulatory Process

No permitting or regulatory processes are necessary for an education and outreach program.

9.4.2.5 Implementation Schedule

If selected, the option for an outreach and education program could begin immediately. This program will be ongoing.

9.4.2.6 Legal Authority

No legal authority is needed to promote outreach and education.

9.4.2.7 Estimated Cost

The Conservation and Agricultural BMP activities would be conducted as an ongoing program funded annually. This would cost approximately $100,000 to promote opportunities for education seminars, grant writing tasks, demonstration projects, and other activities focused on BMPs in the agricultural industry.

9.4.2.8 Public Noticing

The SVBGSA will endeavor to have the broadest possible public noticing of educational and outreach activities to inform stakeholders, interested parties, landowners, and agricultural interests of conservation and agricultural BMPs.

9.4.3 Management Action A3: Fallowing, Fallow Bank, and Agricultural Land Retirement

To reduce groundwater extraction temporarily or permanently, this management action includes 3 actions that could be implemented on an as-needed basis to reduce irrigated land. These actions provide options for voluntary fallowing and land retirement that can be targeted to specific locations that have declining groundwater elevations or recharge potential, such as floodplains. Water quality and access to drinking water wells will also be considered when deciding where to incentivize fallowing or land retirement. Greater analysis of the incentive to growers and funding for these actions needs to be undertaken. The following could be included under an overarching program, even if implemented independently:

- **Rotational fallowing**: Participating growers fallow some percentage of land or fallow on a rotating basis. This could be modified to include partial fallowing, such as growing fewer crops per year instead of completely fallowing land.
- **Fallow bank**: Growers could contribute to a fallow bank whereby anybody fallowing land could draw against the bank to offset the lost income from fallowing. This could be combined with other fallowing plans. The specific design of a fallow bank will be developed during GSP implementation, including options such as exempting growers from rotational fallowing if they contribute a certain amount of money to the fallow bank.
- **Agricultural land retirement**: SVBGSA could develop a system for voluntary agricultural land retirement or pay to retire agricultural land, effectively reducing the amount of groundwater used in the Subbasin. The benefit from this program depends on identifying willing participants.

9.4.3.1 Relevant Measurable Objectives

The measurable objectives benefiting from reduced groundwater extraction include:

- **Groundwater elevation measurable objective**. Depending on the location of fallowing or land retirement, this measurable objective will benefit from decreased pumping that will result in higher groundwater levels.
- **Groundwater storage measurable objective**. Depending on the location of fallowing or land retirement, reducing pumping from the principal aquifer will ultimately have the effect of increasing groundwater in storage.
- **Land subsidence measurable objective**. Depending on the location of fallowing or land retirement, this measurable objective will benefit from pumping allowances and controls that reduce the pumping stress on the local aquifer and thereby reduce any potential for subsidence.

9.4.3.2 Expected Benefits and Evaluation of Benefits

The primary benefits expected for this management action is reduced Subbasin pumping. This management action is costed for saving 1,000 AF/yr.; however, it could be scaled to any size. The less water that is extracted from the principal aquifer, the more water is in storage. Depending on the location of fallowing and land retirement, benefits may include halting the decline of or raising groundwater elevations and avoiding any potential subsidence in specific areas. Because it is unknown how many landowners will willingly enter the land retirement program, it is difficult to quantify the expected benefits at this time.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. A direct correlation between agricultural land retirement and changes in groundwater elevations is likely not possible because this is only one among many management actions and projects that may be implemented in the Subbasin. Groundwater storage will be monitored using groundwater elevations as proxies. Land subsidence will be measured using InSAR data provided by DWR.

9.4.3.3 Circumstances for implementation

Agricultural land retirement relies on willing participants, be it for participation or land sale. No other triggers are necessary or required. The circumstance for implementation is for SVBGSA to identify the need for the management action and identify willing participants and secure their participation.

9.4.3.4 Permitting and Regulatory Process

While no permitting or regulatory processes are necessary for buying land or securing agreements with landowners for fallowing or land retirement, the SVBGSA will secure and record as appropriate, the necessary agreements or deed restrictions to implement the management action.

9.4.3.5 Legal Authority

California Water Code §10726.2 provides GSAs the authority to purchase, among other things, land, water rights, and privileges.

9.4.3.6 Implementation Schedule

Fallowing and land retirement will be developed when conditions warrant implementation. If selected, the process and GSA incentives for fallowing and/or land retirement will be developed over 2 years. The development of a fallow bank may take additional time. Although the program will be ongoing, it is reliant on willing participants and may be implemented intermittently or on an as-needed basis.

9.4.3.7 Estimated Cost

The cost of voluntary fallowing and land retirement depends on the extent of fallowing and land retirement. These are cost estimates are based on average rent and land value, and they do not capture the additional economic benefits associated with agriculture. The average cost of land and rent was derived from a source that had county-specific estimates. It is understandable that even within a county the cost of land acquisition is highly variable; however, this was the best available information on the average cost of land. The cost of fallowing land sufficient to reach 1,000 AF/yr. water conserved are shown in Table 9-2, which could be scaled to the amount desired. The average rent between the low and high estimates is $2,250/acre, which would result in a unit cost of $823/AF water conserved when fallowing.

Table 9-2. Estimated Cost of Fallowing and Agricultural Land Retirement

Annual Fallowing	Low Estimate	High Estimate	Description
Annual rent (cost/acre)	$1,000	$3,500	Rent for row crops in Monterey County (ASFMRA, 2020)
Unit cost/AF water conserved	$419	$1,226	Based on vegetable water use in the Upper Valley (MCWRA, 2019b), cover crop water usage (RCDSCC, 2018), and cover crop cost (Highland Economics, 2017)
Acres fallowed annually to conserve 1,000 AF/yr.	323 acres	323 acres	
Annual cost to conserve 1,000 AF/yr. through fallowing	$135,276	$395,421	

Annual Fallowing	Low Estimate	High Estimate	Description
Agricultural Land Retirement	Low Estimate	High Estimate	Description
Land value per acre	$27,500	$75,000	Cost per acre row crops in Monterey County (ASFMRA, 2020)
Unit cost/AF water conserved	$810	$2,000	Using cover crop value as annual O&M, 6% interest, and annualized over 25 years

9.4.3.8 Public Noticing

All appropriate documentation for any agricultural land retirement achieved through a land sale, agreement or deed restriction will be recorded with the County of Monterey Assessor – Clerk – Recorder's Office. All agricultural land retirement by any means through the GSA will be recorded and publicly accessible.

9.4.4 Management Action A4: MCWRA Drought Reoperation

MCWRA formed a Drought Operations Technical Advisory Committee (D-TAC) to provide, when drought triggers occur, technical input and advice regarding the operations of Nacimiento and San Antonio Reservoirs. The D-TAC developed Standards and Guiding Principles to be used in the development of a proposed reservoir release schedule triggered under specific, seasonally defined conditions. This management action would inform decisions on reservoir operation and flow releases during a drought.

The proposed reservoir release operations schedule triggered under specific, seasonally defined conditions of drought will be developed based on the best available scientific knowledge, data, and understanding of the environmental biology, hydrology, and hydrogeology of the Salinas Valley; under the technical expertise of the members of the D-TAC. If adopted, the proposed reservoir release schedule will be implemented based on specific tools and templates made available to the D-TAC. These are discussed further in the Implementation Procedures. The proposed reservoir release schedule will acknowledge, address, and balance the water needs of various stakeholders for limited resources during a drought.

The D-TAC will use a MCWRA provided template when developing the release schedule. The specific actions will also be described in a narrative form to expound upon the actions taken for each month shown in the release schedule. Reservoir releases will be made under direction of the MCWRA Board of Directors or Board of Supervisors through the adoption of a reservoir release schedule or dry winter release priorities, to be executed by MCWRA staff. Appendix 9B outlines the D-TAC Standards, Guiding Principles, and Implementation Procedures. The recommendations of the D-TAC may change with the development and adoption of a HCP, but the D-TAC Standards, Guiding Principles, and Implementation procedures will remain in place unless modified by an HCP.

Summary Actions

The Standards and Guiding Principles Document and any recommended release schedule prepared by the D-TAC will first be received by the Reservoir Operations Advisory Committee. The Reservoir Operations Advisory Committee will meet to discuss recommended release schedules and will solicit information, data, and public comment regarding appropriate MCWRA operations during droughts. Following receipt of public input on the recommended release schedule, the Reservoir Operations Advisory Committee will then prepare a written recommendation regarding reservoir operations which will be transmitted to the MCWRA Board of Directors for consideration and action. Any interested party that dissents from the Reservoir Operations Committee's recommendation may submit separate written comments to the MCWRA Board of Directors. The MCWRA Board of Directors will determine, in accordance with applicable law, whether MCWRA will adopt a release schedule, provided the MCWRA General Manager may, in his sole discretion, refer the question of whether MCWRA should implement a recommended release schedule to the MCWRA Board of Supervisors for final determination. In the event the MCWRA General Manager elects not to refer the question of implementation of a recommended release schedule to the MCWRA Board of Supervisors, the decision of the MCWRA Board of Directors regarding such questions shall constitute final agency action for all purposes. The MCWRA Board of Directors (or MCWRA Board of Supervisors, if applicable) will retain full discretion and authority to accept or reject, in whole or in part, the written recommendations of the Reservoir Operations Advisory Committee.

9.4.4.1 Relevant Measurable Objectives

The measurable objectives benefiting from MCWRA Drought Reoperation include:

- **Groundwater elevation measurable objective**. Releasing additional water from the reservoirs even during droughts should help ensure annual groundwater recharge in the Upper Valley, which will help prevent lowering of groundwater elevations.
- **Groundwater storage measurable objective**. Releasing additional water from the reservoirs even during droughts should help ensure annual groundwater recharge in the Upper Valley, which will increase the amount of groundwater in storage.
- **Land subsidence measurable objective**. Increasing both groundwater elevations and groundwater storage will have the added benefit of preventing any potential land subsidence. Although subsidence is not a concern in this Subbasin, adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion.

9.4.4.2 Expected Benefits and Evaluation of Benefits

The D-TAC will help develop a release schedule aimed at mitigating negative effects from droughts, including from surface water flows and groundwater recharge. The proposed reservoir release schedule will be based on scientific data and will acknowledge, address, and balance the water needs of various stakeholders for limited resources during a drought. The proposed reservoir release schedule will maintain geographic equity, avoid adverse impacts to Valley-wide agricultural operations, and avoid, to the extent possible, consecutive years where only minimum releases are made from the reservoirs. Annual reservoir releases will help recharge the aquifer in the Upper Valley, which will help prevent declines in groundwater elevations and storage during drought periods. Subsequently, although subsidence is not likely in this Subbasin, this will help reduce the risk of subsidence and prevent water quality degradation.

This GSP is unable to quantify the benefits at this time because the D-TAC decisions will be different each time it convenes. Drought conditions have not been triggered to cause the D-TAC to convene.

If and when D-TAC does convene, benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Groundwater storage will be monitored using groundwater elevations as proxies. Land subsidence will be measured using InSAR data provided by DWR.

9.4.4.3 Circumstances for Implementation

The D-TAC is already established. Its convening will occur when conditions trigger it on an annual basis.

9.4.4.4 Permitting and Regulatory Process

This management action follows the ongoing permitting and regulatory process used by MCWRA for reservoir operations.

9.4.4.5 Implementation Schedule

The D-TAC is already established. Its convening will occur when conditions trigger it on an annual basis.

Annually, the D-TAC will meet any time a “drought trigger” occurs to develop a recommended release schedule for Nacimiento and San Antonio Reservoirs. MCWRA presents the annual reservoir release schedule update at the October meeting of the MCWRA Reservoir Operations Advisory Committee. If the December 1 forecasted combined reservoir storage volume is below 220,000 AF and the San Antonio Reservoir forecasted storage is below 82,000 AF, the D-TAC release schedule process will begin. MCWRA will schedule a D-TAC meeting to occur no earlier than February 15 and the D-TAC will meet as needed through March 31. The release schedule will be developed for April through December of the current year. If significant inflow occurs during this period, then modifications to the release schedule will be made through existing MCWRA protocols. Provided that neither of the aforementioned threshold storage volumes has been exceeded by inflow as of February 15, the D-TAC will develop a recommended release schedule consistent with its Standards and Guiding Principles. The D- TAC's Standards and Guiding Principles and any subsequent release schedule will be presented to the MCWRA Board of Directors and/or Board of Supervisors for consideration and decision.

9.4.4.6 Legal Authority

MCWRA, who owns and operates the reservoirs, is implementing the D-TAC. Since MCWRA is a member of the SVBGSA, it benefits 1 of the SVBGSA members. The SVBGSA will participate in and work in cooperation with MCWRA on the D-TAC. No additional legal authority is needed.

9.4.4.7 Estimated Cost

This management action is already underway. MCWRA is already funding costs associated with facilitation of the D-TAC. SVBGSA costs include staff participation in the D-TAC.

9.4.4.8 Public Noticing

As this management action is already underway, MCWRA has already completed initial public noticing. Public noticing will occur for the October Reservation Operations meeting that activates the D-TAC, and when the reservoir release schedule developed by the D-TAC goes to Reservation Operations and/or the Board of Directors for consideration.

9.4.5 Management Action A5: Reservoir Reoperation

This management action consists of SVBGSA collaborating with MCWRA and other interested parties to evaluate potential reoperation scenarios to ensure the sustainability of the Upper Valley Subbasin to prevent undesirable results while also operating within the existing committed purposes of existing infrastructure, such as the Salinas Valley Water Project. This management action is reliant on a new source of dedicated funding. Groundwater conditions in the Upper Valley are currently sustainable; however, it should be noted some areas have the potential for undesirable results associated with water-level declines during multi-year drought periods. This management action is focused on reoperation of the Nacimiento and San Antonio Reservoirs that would prevent the curtailment of reservoir releases in consecutive year droughts.

This management action includes a feasibility study by working with MCWRA on existing models or developing new ones to simulate reservoir operations and groundwater-surface water interactions along the Salinas River. This management action would take under consideration the other beneficial users dependent on reservoir flows, such as steelhead trout and users in other subbasins.

This management action could be paired with potential capital projects that are within the sustainability horizon of the GSP. Both projects referenced below rely on infrastructure owned and operated by MCWRA and implementing either would require a cooperative effort between SVBGSA and MCWRA. These projects include:

1) **ILT and Spillway Modification -** The proposed Interlake Tunnel project consists of design, permitting, construction, and maintenance of a tunnel for diversion of water from the Nacimiento Reservoir to the San Antonio Reservoir. The San Antonio and Nacimiento Reservoirs have storage capacities of 335,000 and 377,900 AF, respectively; however, the Nacimiento River watershed produces nearly 3 times the average annual flow of the San Antonio River watershed. Consequently, more available storage capacity must be maintained in Nacimiento Reservoir to prevent downstream flooding during storm events than must be maintained in San Antonio Reservoir. Initial modeling shows the proposed Interlake Tunnel project would divert 49,400 AF/yr. of flood control water on average from Nacimiento Reservoir to San Antonio Reservoir, or 47,800 AF/yr. with the spillway modification (MCWRA, 2020). This would increase the total volume of water in storage by 39,000 AF/yr., or 54,300 AF/yr. with the spillway modification. The reservoir operating rules for this modeling reflect the current Nacimiento Dam Operations Policy (MCWRA, 2018b), and therefore reflect changes due to the project as compared to current reservoir operations, not considering any potential reductions in reservoir capacity that may be required if deferred maintenance does not occur. This project is intended to primarily increase water available for conservation releases to the Salinas River between April and October. Any additional conservation releases would be diverted at the SRDF for irrigation within the CSIP area. Without the spillway modification, model results show the additional conservation releases would result in approximately 30,500 AF/yr. of additional groundwater recharge from the Salinas River in the basin over the entire modeled hydrologic period. With the spillway modification, there would be approximately 32,000 AF/yr. of additional groundwater recharge (MCWRA, 2020).

2) **Seasonal Reservoir Release with Aquifer Storage and Recovery (ASR) or Direct Delivery -** This project entails modifying reservoir releases for the MCWRA's Conservation Program and SRDF diversions to store at least a portion of these releases during alternate seasons in the 180-Foot and 400-Foot Aquifers. This seasonal storage would reduce or eliminate the need for Conservation Program summer releases and initial modeling shows it would increase annual carryover in the reservoirs, allowing for more consistent alternate season releases. This alternate season release water would be diverted at the SRDF, treated, and recharged through ASR injection wells into an unimpaired part of the aquifer in the winter/spring and later extracted during peak irrigation season demands for use through the CSIP system. ASR is a critical component of this project because it enables summer releases for CSIP to be shifted to winter/spring releases;

however, a benefits assessment will be done to assess differing levels of special benefits. As an alternative to direct injection for groundwater recharge, seasonal reservoir releases could be used for direct delivery for municipal supply within the Basin. Under direct delivery use, this water would act as in-lieu recharge by reducing the need for pumping from municipal wells, resulting in less groundwater demand when water is directly delivered. This project would require additional infrastructure.

This GSP is primarily concerned with project benefits that maintain groundwater sustainability. However, ancillary benefits and relative costs must also be addressed and carefully evaluated. These projects will affect the entire Salinas Valley, and the analyses of these projects must consider the impact on all subbasins. This GSP includes reservoir reoperation as a management action to help maintain groundwater sustainability along the Salinas River, including some portion that augments groundwater in the Upper Valley Subbasin. This management action will likely be subject to new flow restrictions and reservoir operations resulting from the planned HCP, and subject to any biological opinion or incidental take permit issued by NMFS, or other regulations issued by applicable regulatory agencies.

9.4.5.1 Relevant Measurable Objectives

Should reservoir reoperation move forward, the intended Upper Valley Subbasin GSP measurable objectives benefiting include:

- **Groundwater elevation measurable objective**. Releasing additional water from the reservoirs even during droughts should help ensure annual groundwater recharge in the Upper Valley Subbasin, which will help prevent lowering of groundwater elevations.
- **Groundwater storage measurable objective**. Releasing additional water from the reservoirs even during droughts should help ensure annual groundwater recharge in the Upper Valley Subbasin, which will increase the amount of groundwater in storage.
- **Land subsidence measurable objective**. Increasing both groundwater elevations and groundwater storage will have the added benefit of preventing any potential land subsidence. Although subsidence is not a concern in this Subbasin, adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion.
- **ISW measurable objective**. Continuing to release some water from the reservoirs even during droughts should benefit ISW by maintaining groundwater elevations at or above historical lows.

9.4.5.2 Expected Benefits and Evaluation of Benefits

Benefits that may arise from this management action would be the development of additional reservoir reoperation analysis. Wells in the vicinity of the Salinas River may be projected to experience sustained elevations depending on modeling results. The effort may produce additional management alternatives to be applied during drought conditions. Modeling outputs could be publicly reviewed with partner agency Boards of Directors.

Should reservoir reoperation move forward, intended expected benefits for the Upper Valley include more consistent annual releases, including during dry years. However, these intended expected benefits for the Upper Valley will need to be balanced with the needs of other affected subbasins.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations and groundwater storage will be measured with a network of wells that is monitored by MCWRA. Land subsidence will be measured using InSAR data provided by the DWR. When data gaps are filled, ISW will be measured through shallow groundwater wells and river flow.

9.4.5.3 Circumstances for Implementation

In order for this management action to move ahead MCWRA and SVBGSA would need to agree to coordinate on such an analysis and SVBGSA would lead the effort to source associated funding. Ultimately MCWRA would determine whether such an effort would be pursued under their role as owner and operator of the reservoirs.

9.4.5.4 Permitting and Regulatory Process

The initial phases of this management action include a feasibility study, which do not require permitting or meeting regulatory requirements. This will include an evaluation of the permitting and regulatory steps needed for potential reoperation.

Implementing the ultimate reoperation scenario will require coordination with permits from NMFS, the SWRCB, or other agencies that have authority over Salinas River flows.

9.4.5.5 Implementation Schedule

The feasibility study associated with this management action will be conducted within the first 5 years of the Upper Valley Aquifer GSP implementation.

9.4.5.6 Legal Authority

No legal authority is required to undertake the feasibility study. MCWRA, SVBGSA, NMFS, and other project partners will participate in the study. Implementing the ultimate reoperation scenario will be under the authority of MCWRA.

9.4.5.7 Estimated Cost

This management action is estimated to cost approximately $400,000 - $500,000.

9.4.5.8 Public Noticing

The work associated with this effort would be under the purview of MCWRA. SVBGSA would utilize publicly noticed meetings of the SVBGSA Board of Directors, Advisory Committee, Integrated Implementation Committee, and Subbasin Committees to update the public on such analysis and outcomes from model efforts.

9.5 Project Options Over 50 Year Planning Horizon

Projects are not currently needed to maintain sustainability. However, changes in future conditions over the next 50 years, such as changes in land use, groundwater extraction, reservoir releases, weather, or groundwater recharge could affect the sustainability of the Subbasin. If monitoring data show~~s~~ the Subbasin is no longer sustainable according to the 5 relevant sustainability indicators, and management actions are not sufficient, SVBGSA and Subbasin stakeholders may consider implementing a project(s). Descriptions of potential projects that could contribute to the sustainability of the Upper Valley Subbasin are included below and are not in order of priority. If a project is implemented by another agency, SVBGSA could work with that agency to support a design and implementation plan that considers groundwater sustainability. Generalized costs are included for planning purposes and to show the general level of effort necessary to undertake each project, regardless of project sponsor. If any project is pursued, the distribution of costs and special benefits will be determined through additional analysis, either by SVBGSA or the lead project sponsor. The inclusion of projects in the GSP does not obligate the SVBGSA to participate in paying for projects; however, SVBGSA must be strategic in its efforts to track and support projects that could impact groundwater conditions. The design of these projects may change based on future analyses. Therefore, each of the projects described in this GSP should be treated as a generalized project representative of a range of potential configurations and associated costs.

9.5.1 Project B1: Multi-benefit Stream Channel Improvements

Over the past half century, the Salinas River has been impacted by the construction of the San Antonio and Nacimiento Dams and flood control levees intended to move water away from agricultural fields. These have changed natural river geomorphology, resulting in sediment build up and vegetation encroachment on the historically dynamic channels of the River. This alteration of natural floodplains and geomorphology has increased flood risk, decreased direct groundwater recharge, and contributed to increased ET through vegetation build-up. Targeted, geomorphically-informed stream maintenance and floodplain enhancement can improve stream function both morphologically and biologically.

This program takes a 3-pronged approach to stream channel improvements. First, it addresses vegetation growth and geomorphic conditions in the river channel by removing perennial native and non-native vegetation in designated maintenance channels (and removing *Arundo donax* (arundo) and *Tamarix sp.* (tamarisk) throughout the river corridor). Second, the program reduces the height of sediment bars that have been identified to meet criteria for impeding flow. Third, it enhances floodplains to increase groundwater recharge.

This 3-pronged approach increases flow by removing dense native and non-native vegetation, provides vegetation free channel bottom areas for infiltration, stabilizes stream banks and earthen levees by reducing downstream velocities, and reduces flood risk. This program's activities also benefit native species throughout the river ecosystem. By improving geomorphological function through vegetation and sediment removal activities, the coordinated efforts allow native species to reestablish in areas where invasive species have become dominant. River maintenance activities enhance groundwater recharge efforts through the streambed by providing additional open channel bed for infiltration, and floodplain enhancement can further recharge potential of high flows. Infiltration through the streambed accounts for a significant portion of the groundwater budget, and invasive species such as arundo, which can take up to 4 times as much water as native riparian species, thereby negatively impacting both river flows as well as infiltration in to the subsurface through the streambed (Cal-IPC, 2011).

Surface water flows, and notably flood flows, can be impacted by the density of vegetation and whether the vegetation is comprised of native or non-native species. Native riparian species allow for dynamic action that scours the riverbed and resorts sediment in a manner that encourages natural infiltration and conveyance of flood waters in the broader active flood terraces in the river. This wider use of the floodplain by flood waters slows velocities and distributes flood waters over a broader spatial area of the riverbed.

Stream channel vegetation removes water from the river through ET. Water loss through ET from invasive species such as arundo can take up between 3.1 and 23.2 AF/yr. per acre, whereas ET from native vegetation can take up to 4 AF/yr. per acre (Melton and Hang, 2021; Cal-IPC, 2011). This illustrates the difference in water consumption between vegetation types and how these water consumptions can have major impacts on water in the river (Cal-IPC, 2011). The Salinas River is characterized by a braided channel in some areas of the floodplain and a confined channel in other areas. Plants can take root in channel locations that adversely impact the flow of water, resulting in either a channelized river or in creating directional velocities that can cause localized damages including levee failure. Poorly functioning sedimentation can also negatively impact water flow in drought and flood conditions, as well as impeded proper infiltration to the subsurface. Geomorphological processes are important to managing a natural riverbed and floodplain to enhance recharge, groundwater levels, and groundwater storage.

This program is not meant to restore the Salinas River to historical conditions, but rather to enhance geomorphological function through targeted maintenance sites for flood risk reduction and floodplain enhancement for increased recharge. The MCWRA has developed a science-based approach to river management that recognizes the value of critical habitat, environmental resources, cost to landowners, and coordination among stakeholders (MCWRA, 2016). A key feature of this modified management approach is providing protection for critical habitats and water quality (MCWRA, 2016). One of the important functions of a river is to provide habitat for native species. In a poorly functioning river, invasive species have more opportunities to crowd out native species and in turn, further degrade the river conditions. Therefore, this program will result in flood risk reduction, increased recharge, and a multitude of benefits that address critical functions of the Salinas River.

This program includes 4 main types of tasks: vegetation maintenance, non-native vegetation removal, sediment management, and floodplain enhancement and recharge.

- **Vegetation Maintenance –** Vegetation, both native and non-native, will be removed within designated maintenance areas using a scraper, mower, bulldozer, excavator, truck, or similar equipment to remove the vegetation above the ground and finishing by ripping roots to further mobilize the channel bottom. Vegetation maintenance includes pruning up to 25 percent of canopy cover and removing dead mass. Maintenance activities will not include disturbance of emergent wetland vegetation that provides suitable habitat for threatened California red-legged frogs or for the endangered tidewater gobies. In instances where native vegetation needs to be removed for site-specific conditions or tie-ins, these impacts can be compensated with replanting and revegetation in other areas as a form of mitigation offset for stream channel maintenance. Native trees will be planted during the rainy season to enhance their rate of success.
- **Non-Native Vegetation Removal –** Non-native vegetation removal primarily focuses on the arundo present in the region but may include tamarisk shrubs as well. Arundo is a grass that was introduced to the Americas in the 1800s for construction material and for erosion control purposes (Cal-IPC, 2011). In 2011, the California Invasive Plant Council determined that the Salinas Watershed had the second largest invasion with approximately 1500 infested acres. While arundo thrives near water, such as wetlands and rivers, it grows in many habitats and soil types. It requires a substantial amount of water, previously estimated making it one of the thirstier plants in a given region and outpacing the water demands of native vegetation. To manage this invasive species, arundo biomass is typically sprayed, sometimes mowed or hand cut if needed, and then treated with multiple applications of herbicide over several years. Permits allow arundo removal in the entire riparian corridor, including along the low-flow channel.
- **Sediment Management –** Sediment management includes channel bed grading and sediment removal. Sediment grading and removal may occur exclusively, or after vegetation maintenance activities described above. Sediment removal and grading activities help reestablish proper gradients to allow for improved drainage downstream, encourage preferential flow into and through secondary channels, and minimize resistance to flow (until dunes form) (MCWRA, 2016). Sediment removal will follow best practices to protect native species while producing maximum benefit for flood

reduction and groundwater recharge.

- **Floodplain Enhancement and Recharge –** Floodplain enhancement restores areas along the River, creeks, and floodplains to slow and sink high flows and encourage groundwater recharge. Restored floodplain and riparian habitat can slow down the velocity of the River and creeks and encourage greater infiltration. Due to agricultural and urban encroachment, streams have become more highly channelized, and flow has increased in velocity, particularly during storm events. This flow has resulted in greater erosion and loss of functional floodplains.

Program Components

This multi-benefit stream channel improvements program is implemented through various program components. These build off existing programs and permits to undertake the 4 main types of tasks. During GSP implementation, these components may be modified as needed to most efficiently accomplish the program goals.

Component 1: Stream Maintenance Program

The first component continues the Salinas River Stream Maintenance Program (SMP), which maintains the river corridor to reduce flood risk and minimize bank and levee erosion, while maintaining and improving ecological conditions for fish and wildlife consistent with other priorities for the Salinas River (MCWRA, 2016). It is a coordinated Stream Maintenance Program that includes MCWRA, the Resource Conservation District of Monterey County (RCDMC), and the Salinas River Management Unit Association representing approximately 50 landowner members along the river corridor. Project benefits include increased water availability, flood risk reduction, reduced velocities during high flows to lessen bank and levee erosion, and enhanced infiltration by managing vegetation and sediment throughout the river and its tributaries.

The SMP occurs along the area of the Salinas River in Monterey County. The 92-miles of the river in Monterey County is broken into 7 River Management Units from San Ardo in the south to Highway 1 in the north. The management activities are focused on the secondary channels of the Salinas River located outside of the primary low-flow channel and are preferentially aligned with low-lying undeveloped areas that are active during times of higher flow (MCWRA, 2016). The SMP includes 3 main activities as part of stream maintenance: vegetation maintenance, non-native vegetation removal, and sediment management.

Component 2: Invasive Species Eradication

The second Component supports and/or undertakes removal of arundo and tamarisk done by the RCDMC. RCDMC is the lead agency on an estimated 15 to 20-year effort to fully eradicate arundo from the Salinas River Watershed, working in a complementary manner with the SMP.

This project focuses on removal of woody invasive species such as arundo, tamarisk (*Tamarix sp*.), and tree tobacco (*Nicotiana glauca*) along the Salinas River, as well as retreatments needed to keep it from coming back. It includes 3 distinct phases: initial treatment, re-treatment, and on-going monitoring and maintenance treatments. As of April 2021, estimated arundo under treatment was 850 acres. Original mapped acreage had expanded by 20%, leaving 900 arundo acres remaining to be treated. The initial treatment phase includes mechanical and/or chemical treatment in all areas of the river that have yet to be treated. The re-treatment phase includes re-treatment of the approximately 850 acres that have already had an initial treatment and re-treatment of the remaining 900 acres done in stages, with each area treated over a 3- to 5-year period following initial treatment. The final phase is the ongoing monitoring and maintenance treatment phase. This phase requires monitoring for regrowth of the invasive species or new invasive species and chemical treatment every 3 to 5 years.

Component 3: Floodplain Enhancement and Recharge

The third component complements the first 2 by restoring and enhancing floodplains to enable high flows to be slowed and directed toward areas where it can infiltrate into the ground. For this component, SVBGSA will partner with the Integrated Regional Water Management (IRWM) Group, Central Coast Wetlands Group (CCWG), and other organizations that are already undertaking creek and floodplain restoration efforts and encourage inclusion of features that would enhance recharge.

Restored floodplain and riparian habitat along creeks can slow down the velocity of creeks and encourage greater infiltration. Due to agricultural and urban encroachment, streams have become more highly channelized, and flow has increased in velocity, particularly during storm events. This flow has resulted in greater erosion and loss of functional floodplains.

9.5.1.1 Relevant Measurable Objectives

Relevant measurable objectives benefiting from this project include:

- **Groundwater elevation measurable objective**. Removing the invasive species, better managing streams, and directing high flows into restored floodplains will facilitate more water infiltrating and percolating into the subsurface to raise groundwater elevations. This has the effect of adding water to the principal aquifer. Adding water to the principal aquifer will ultimately increase groundwater elevations or decrease their decline.
- **Groundwater storage measurable objective**. Adding water to the principal aquifer will ultimately have the effect of increasing groundwater in storage.
- **Land subsidence measurable objective**. Increasing both groundwater elevations and groundwater storage will have the added benefit of preventing any potential land subsidence. Maintaining and adding water in the subsurface will keep pore spaces

saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion.

- **ISW measurable objective**. By removing vegetation pathways for ET, less interconnected groundwater and less surface water will be depleted, leaving more water available in the river for flows as well as for connection to the principal aquifer.

9.5.1.2 Expected Benefits and Evaluation of Benefits

The groundwater-related expected benefits are increased groundwater elevations in the vicinity of the river channel due to increased infiltration and percolation to the principal aquifers, increased groundwater in storage, better water quality, decreased depletion of ISW, and protection against any potential land subsidence due to groundwater extractions. In addition, the project provides habitat restoration, increased connectivity for wildlife, and flood risk reduction.

Increased storage of flood waters can increase groundwater elevations in the vicinity of the Salinas River. This typically will be seen as groundwater mounding subparallel to the river corridor. However, as more water infiltrates into the subsurface, more water will flow laterally, thereby expanding the zone of influence from the river outward and raise groundwater elevations laterally. Additionally, water stored underground is not subject to ET in the same way water stored above ground is. With annual removal of arundo, ET will decrease over time, allowing for more water to remain in the system. Arundo removal is coupled with identified native species removal where native species have encroached in high flow channels where they may not typically grow; however, there is significant uncertainty in the recharge benefits, as arundo and many native species draw both surface and groundwater.

Removal of arundo on 900 acres along the Salinas River will decrease ET by 2,790 to 20,880 AF/yr. throughout the Salinas Valley. This will enhance recharge from the Salinas River within the Upper Valley Subbasin and leave more water in the River to get down to the CSIP, where surface water is used in lieu of groundwater to help address seawater intrusion and declining groundwater elevations. With this reduction of non-productive water consumption, less water can be released from the reservoirs to get the same amount of water downstream, which increases the Valley's sustainable yield and drought resilience. It also results in indirect recharge as removal reduces groundwater use by the plants.

Component 3 of this project includes various floodplain enhancement features and restoration activities. Preliminary project scoping includes the development of 4 recharge basins within the Upper Valley Subbasin, each with a recharge capacity of about 100 AF/yr. However, greater analysis is needed to determine the exact number, size, and type of features. The combined benefit of the 4 recharge basins is expected to be 400 AF/yr. in increased recharge.

This program will also enhance streamflow by returning patterns of flow to a more natural state. Arundo infestation decreases the natural channel migration and complexity of sandy-bottomed streams by confining the channel to an armored, single stem with faster flowing water, which then becomes susceptible to erosion and incision. A narrowing channel with reduced capacity also heightens flood risk. Removing arundo will allow greater normalization of natural geomorphic processes and sediment transport by de-armoring low-flow channel banks and adjacent floodplain areas to enable channel migration and braiding.

Stream channel improvements will provide many additional ecosystem benefits, including:

Habitat restoration: This project will help restore riparian habitat. Results from 4 years of plant community monitoring of arundo sites initially treated in 2016 show that diversity and abundance of native plants have increased over this time period and this trend is expected to continue. Field biologists conducting pre-activity surveys have also observed increased wildlife activity post-arundo removal.

Increased connectivity for wildlife: Within the Central Coast region there are several mountain ranges, coastal areas, valley floors, and upland habitats that need to be connected to allow for the wildlife movement necessary for gene flow and healthy populations (Thorne *et al.* 2002). The Salinas River riparian area is an important linkage for wildlife movement between upland habitat via tributaries. Removal of dense arundo stands will reduce physical impediments to movement for wildlife species such as mountain lion, bobcat, deer, and American badger. RCDMC has documented this through wildlife camera monitoring, which has shown increased detections of large mammals such as deer, bobcat, and coyote after arundo removal. This project will promote habitat use and movement of wildlife by increasing availability of food and nesting resources.

Flood risk reduction: Stream maintenance has the societal benefit of reducing flood risk to neighboring lands, which are mostly agricultural fields. Arundo's dense structure creates increased surface roughness, thus backing up water and causing flooding during high flow events. When agricultural fields are flooded with river water, farmers lose crops and thus considerable income, and must leave their fields fallow for months after flooding due to food safety concerns. Flooding can also damage levees which then have to be repaired and bring weed seeds and propagules (including arundo) into fields which then have to be controlled.

Enhanced conveyance and infrastructure protection: The work conducted in the SMP improves conveyance of storm, flood, and nuisance waters by keeping water in the stream channel and flowing freely rather than being blocked by the invasive species. The SMP protects city infrastructure by keeping water more in the channel rather than blocked and rerouted by arundo, which reduces the cost of infrastructure repairs to nearby cities.

Project benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Land subsidence will be measured using InSAR data provided by the DWR. When data gaps are filled, ISWs will be measured through shallow groundwater wells and river flow.

The expected benefits to groundwater in the Upper Valley Subbasin will be defined through further investigation.

9.5.1.3 Circumstances for Implementation

The SMP and invasive species eradication are ongoing projects with MCWRA, the RCDMC, and the Salinas River Management Unit Association. Program administration is provided by the RCDMC and the Salinas River Management Unit Association. Landowners currently pay for all maintenance activities in the maintenance channels and for associated biological monitoring and reporting. SVBGSA could support the program, become an administrative partner in the program with other program partners, or fund maintenance and monitoring activities.

Floodplain enhancement will be implemented if additional water is required to maintain sustainability. A number of agreements and rights must be secured before individual projects are implemented. Primarily, a more formal cost/special benefit analysis must be completed to determine how many site options are preferable. Water diversion rights may need to be secured to divert stormwater, which may take a significant number of years.

9.5.1.4 Permitting and Regulatory Process

For Components 1 and 2, the permitting process has already been initiated by MCWRA and RCDMC and permits are in place until 2025 for the program. Invasive species eradication will be continued under existing permitting. All participants in the SMP must enter into an agreement with MCWRA and comply with all terms, conditions, and requirements of the permits and Program Guidelines.

Component 3 may require a CEQA environmental review process and may require an Environmental Impact Report (EIR) or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, permits from a variety of state and federal agencies may be necessary, and any project that coordinates with federal facilities or agencies may require National Environmental Policy Act (NEPA) documentation.

Permits for all 3 components are detailed below.

Component 1 Permits:

- ***U.S. Army Corps of Engineers (USACE)-*** The Department of the Army Regional General Permit (RGP) 20 for the SMP, Corps File No. 22309S, was executed on September 28, 2016, by the USACE. The RGP is authorized under § 404 of the Clean Water Act (33 U.S.C. § 1344) through November 15, 2021. The NMFS and the USFWS concurred with the USACE determination that the project was not likely to adversely affect the following federally endangered or threatened species: the San Joaquin kit fox (*Vulpes macrotis mutica*), the California tiger salamander (*Ambystoma californiense*), the

Monterey spineflower (*Chorizanthe pungens* var. *pungens*) , the yellow-billed cuckoo (*Coccyzus americanus*), or the South-Central California Coast (S-CCC) steelhead (*Oncorhynchus mykiss*). The USFWS issued a Biological Opinion on August 22, 2016, for the federally endangered least Bell's vireo (*Vireo bellii pusillus*) and tidewater goby (*Eucyclogobius newberryi*) and its critical habitat and the federally threatened California red-legged frog (*Rana draytonii*).

- ***National Marine Fisheries Service (NMFS)* –** The RCDMC also has a letter of concurrence in which NMFS supports USACE's decision that the SMP "is not likely to adversely affect species listed as threatened or endangered or critical habitats designated under the Endangered Species Act."
- ***State of California Regional Water Quality Control Board*** - The Clean Water Act § 401 Water Quality Certification for Discharge of Dredged and/or Fill Materials, Certification No. 32716WQ02, was approved on August 31, 2016, and is set to expire on November 30, 2025. The Central Coast Water Board staff will assess the implementation and effectiveness of the SMP after 5 years and consider modifications to this Certification for the second 5 years of the permit term.
- ***California Department of Fish & Wildlife*** - The SMP is authorized under a Routine Maintenance Agreement (RMA) 1600-2016-0016-R4, approved October 14, 2016, and held by the RCDMC. The RMA was amended and restated on June 16, 2017, and subsequently amended on April 10, 2018. The RMA covers all impacts under the program from the original date of approval through December 31, 2026.
- ***California Natural Resources Agency* –** An EIR was completed in compliance with the CEQA.

Component 2 Permits:

- ***California Department of Fish & Wildlife* –** The invasive species eradication is authorized under an RMA 1600-2012-0154-R4, approved April 11, 2014, and held by the RCDMC. The RMA was amended on September 30, 2014. It covers all impacts under the program from the original date of approval through April 10, 2026.
- ***Environmental Protection Agency (EPA)* –** National Pollutant Discharge Elimination System (NPDES) permit CAG990005 allows the Salinas River Arundo Control Program to apply pesticides to waterways.
- In addition, the Salinas River Arundo Control Program filed a CEQA Mitigated Negative Declaration, received a technical assistance letter from NMFS, completed a USFWS No Take Request, and received a technical assistance letter from USFWS.

Component 3 Permits that may be required for floodplain enhancement include:

- ***United States Army Corps of Engineers (USACE)* –** A Regional General Permit may be required if there are impacts to wetlands or connections to waters of the United States.
- ***California Department of Fish and Wildlife (CDFW)* –** A Standard Agreement is required if the project could impact a species of concern.
- ***EPA Region 9* –**NEPA documentation must be submitted for any project that coordinates with federal facilities or agencies. Additional permits may be required if there is an outlet or connection to waters of the United States.
- ***NMFS* –** A project may require authorization for incidental take, or another protected resources permit or authorization from NMFS.
- ***California Natural Resources Agency* –** Projects of a magnitude capable of having a demonstrable impact on the environment will require a CEQA environmental review process. Projects will require either an EIR, Negative Declaration, or a Mitigated Negative Declaration.

9.5.1.5 Implementation Schedule

If selected, the components of this program may be implemented on different schedules. The annual implementation schedule for Component 1 is outlined on Figure 9-2. About 40 new acres could be added to the program each year, taking about 10 years to add the remaining acres if selected for full implementation. Annual maintenance needs to be continued indefinitely. For Component 2, up to 100 of the remaining 900 acres of uncontrolled arundo could begin treatment each year, as shown on Figure 9-3. Component 3 is contingent on the first 2 components but could be initiated shortly after Component 2. This schedule is shown on Figure 9-4.

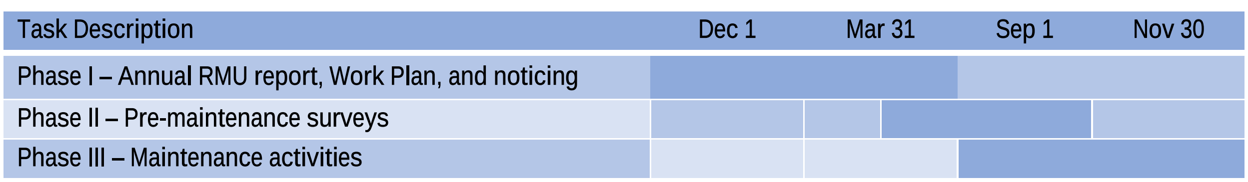


Figure 9-2. Annual Implementation Schedule for Stream Maintenance

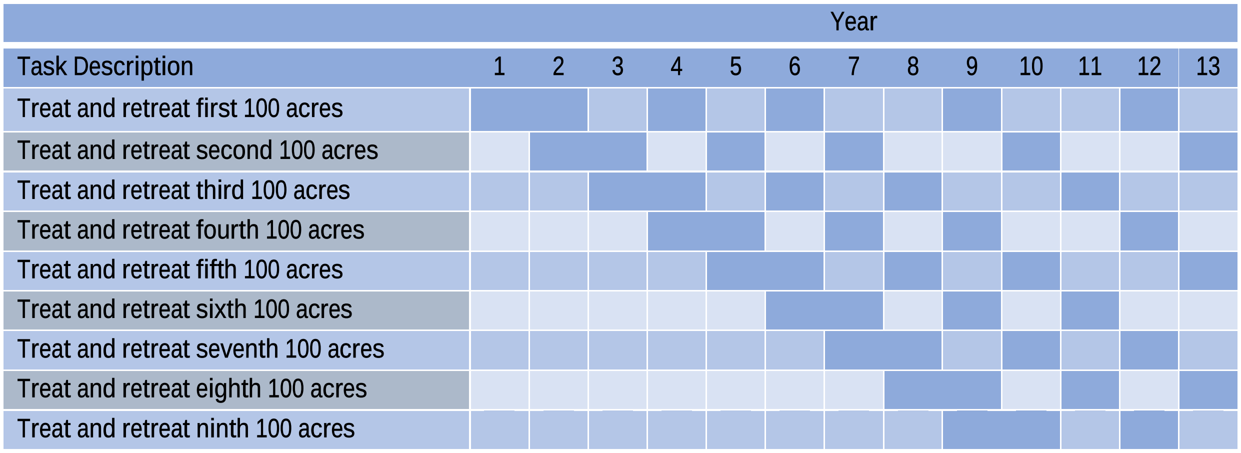


Figure 9-3. Implementation Schedule for Invasive Species Eradication

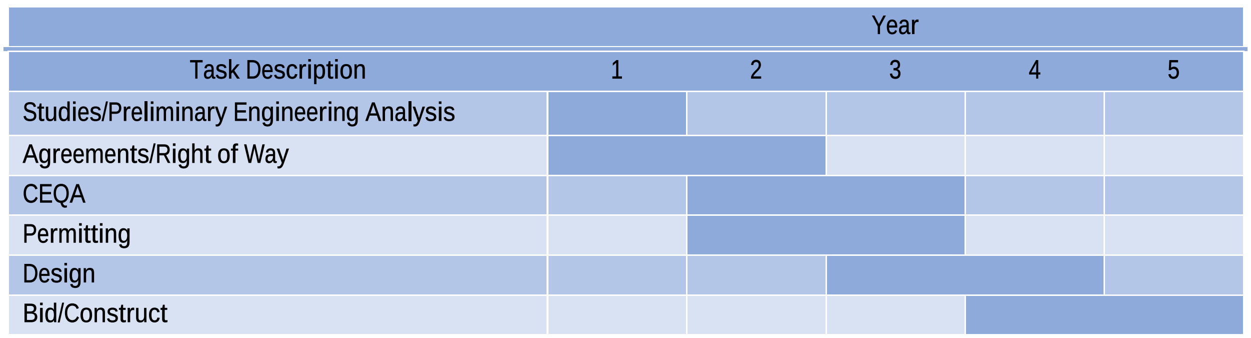


Figure 9-4. Implementation Schedule for Floodplain Enhancement and Recharge

9.5.1.6 Legal Authority

MCWRA has legal authority over the Component 1 SMP for program administration and permitting. Private landowners and local cities who conduct maintenance in the permitted work areas must agree to permit conditions and execute an agreement annually with each agency. Private landowners and local cities currently pay for all maintenance activities including heavy equipment work and biological monitoring and reporting.

For Component 2 invasive species removal, the RCDMC has legal authority for program administration and permitting. The RCDMC obtains Landowner Access Agreements with property owners or managers (tenants) to allow them to do the work or to allow the RCDMC to oversee landowner-conducted work.

For floodplain restoration activities, the SVBGSA has the right to divert and store water once it has access to the appropriate water rights. Pursuant to California Water Code § 10726.2 (b), the SVBGSA has the right to acquire and hold real property, and to divert and store water once it has acquired any necessary real property or appropriative water rights.

9.5.1.7 Estimated Cost

Component 1 program permits have been completed and are operational through 2026. Renewal of the 401 Certification with the Central Coast Regional Water Control Board will include a cost of $95,000 in the timeframe of 2024 to 2026. The annual administrative cost of Component 1 of this program is approximately $150,000. This cost does not include stream maintenance activities, required biological monitoring, and reporting, which are currently paid by program participants. These costs vary from year to year based on number of participants and work site conditions. This program could cover the costs of stream maintenance activities, biological monitoring, and/or reporting in order to reach higher participation rates from landowners and therefore increased project benefit. The cost for the vegetation management is approximately $1,200/acre for the first year and $700/acre for annual maintenance thereafter. This does not include the cost of sediment management, which can be costly. The cost estimate for stream maintenance activities, required biological monitoring, and reporting is included in Table 9-3, which may continue to be paid by participants, be funded by the GSA, or be funded through a different source. So far 254 acres have received their first year of vegetation management.

Table 9-3. Cost Estimate of Vegetation Management

	Acres	First year of vegetation management ($1,200/acre)	Subsequent years of vegetation management ($700/acre)
Upper Valley	250	$300,000	$175,000
Forebay	263	$315,600	$184,100
180/400-Foot Aquifer Subbasin	137	$164,400	$95,900
Subtotal	650	$780,000	$455,000

For Component 2, the estimated capital cost is estimated at between $14,536,943 and $18,898,026. Annual O&M costs are anticipated to be approximately $165,200. The indirect projected yield for the invasive species eradication project is estimated at between 3.1 AF/yr. and 23.2 AF/yr. per acre of invasive species removed. With the range of costs and range of project benefits, the amortized cost of water for this project is estimated to range between $60/AF and $600/AF. See Appendix 9A for a cost estimate.

Component 3 includes the construction of 4 recharge basins, each with an expected benefit of 100 AF/yr. and a capital cost of $1,116,000 each, for a total of $4,464,000. Spread over 25 years and assuming a 6% discount rate, the annualized cost is $93,300 per recharge basin, including annual maintenance. The unit cost is $930/AF. These costs were estimated assuming that only 1 recharge basin would be built, but there may be economies of scale that lower the cost if more are built. These costs are approximate; exact costs will depend on site specifics.

9.5.1.8 Public Noticing

Component 1 implementation and permitting requires annual notification of potential program participants and this notification is announced via direct mail to program participants as well as announced on MCWRA website. Program related annual reporting as required and is published on the MCWRA website.

Component 2 public noticing practices and requirements of the existing RCDMC invasive species eradication programs will be continued as part of this project. This includes reaching out to specific landowners and tenants in areas of potential work and completing annual permit reports that are posted to the RCDMC website.

Component 3 public noticing will be conducted prior to any project initiates construction to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board in a publicly noticed meeting. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed project
    - An estimated cost and schedule for the proposed project
    - Any alternatives to the proposed project
- The SVBGSA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve design and construction of the project and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

In addition to the process detailed above, all projects will follow the public noticing requirements per CEQA or NEPA.

9.5.2 Project B2: Managed Aquifer Recharge of Overland Flow

This program incentivizes development of groundwater recharge basins that recharge overland flow and stormwater runoff from the Coastal Ranges before they reach streams and the Salinas River. This program is structured similar to the program instituted in Pajaro Valley, whereby agricultural landowners dedicate a portion of their land to recharge ponds and direct overland flood flows into the ponds. This could include some type of incentive for recharge basins would be situated to collect runoff before it enters a local stream and allowed to infiltrate. It could also be combined with Project B1 and include multi-benefit projects along the floodway to increase floodplain capacity, since floodplains generally have high recharge.

This program will require additional analysis on actual available runoff from each of the watersheds. It assumes that the stormwater is not being diverted upstream; however, many of the mountain ranges have diversion operations already occurring upstream in the watershed. Rain gauges and studies will be required to determine the true estimate of water available from each subwatershed.

Four recharge basins are included in this cost estimate, each with a recharge capacity of about 100 AF/yr. Their locations will be chosen based on site availability and suitability. The most suitable sites have clean soil and high recharge potential. Soil tests will guide site selection so that contaminants do not leach into groundwater and contaminate drinking water. Aquifer recharge potential is highest where there are areas of highly permeable soils, good connection to underlying aquifers, and topography that directs surface runoff toward retention/catchment areas. The SVBGSA will investigate where recharge ponds would yield the greatest amount of groundwater recharge, combining data on soil permeability, stratigraphy, and land use to map areas of high potential recharge.

The program will reach out to landowners to increase awareness of the benefits of recharge basins and work with local stakeholders to identify lands with high recharge capacity. It could also work with interested landowners to identify sites, undertake potential site analyses with cone penetration tests (push tests), and design recharge basins. This program will involve monitoring water quality and could potentially improve stormwater quality and reduce stormwater volume which is regulated under the ILRP. Water recharged will comply with regulatory standards. The project could potentially include development of a permit coordination program for recharge projects. The program could also work with various organizations and government agencies to connect existing incentivization programs and funding to landowners interested in collaborative recharge projects that require land and access.

9.5.2.1 Relevant Measurable Objectives

Relevant measurable objectives benefiting from this project include:

- **Groundwater elevation measurable objective**. By routing stormwater and runoff from streams into recharge facilities and restored floodplains, there will be more water added to the principal aquifer. This water will be slowed down and allowed to infiltrate, which has the effect of addition water to the aquifer. Adding water into the principal aquifer will raise groundwater elevations over time.
- **Groundwater storage measurable objective**. Furthermore, adding water to the principal aquifer will ultimately have the effect of increasing groundwater in storage. Groundwater storage is also calculated from measured groundwater elevations. By raising groundwater

elevations, the calculation of change in storage will be positive.

- **Land subsidence measurable objectives**. Increasing both groundwater elevations and groundwater storage will have the added benefit of preventing any potential land subsidence. Maintaining and adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion.

9.5.2.2 Expected Benefits and Evaluation of Benefits

This project will increase sustainable yield and groundwater elevations through enhanced infiltration of runoff. Runoff occurs when the rate of rainfall exceeds the soil infiltration rate. This runoff then flows over the land surface before accumulating into washes and streams as measurable stream flow. In the initial phases of overland flow, this water often infiltrates into the soils, which enhances soil moisture, and facilitates recharge to the aquifer. The benefits to increased soil moisture go beyond increased opportunity for recharge. Enhanced soil moisture contributes to erosion protection as well as near-surface temperature regulating processes (Rivas, 2006; Mittelbach *et al*., 2011). Four recharge basins are planned for this project with a combined benefit of about 400 AF/yr. in increased recharge.

Project benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Projects may include monitoring wells if they are not close enough to the existing monitoring network for the impacts to be measured. Various volumetric measurement methods may be installed along with either recharge basins or dry wells to assist in calculating increases to groundwater storage. Land subsidence will be measured using InSAR data provided by DWR.

9.5.2.3 Circumstances for Implementation

If selected, the overland flow MAR project will be implemented if stakeholders determine it is necessary to maintain sustainability. A number of agreements and rights must be secured before the project is implemented. Primarily, a more formal cost/special benefit analysis must be completed to determine if the on-farm modifications will provide quantifiable benefits to the principal aquifer. Recharge basins installed as part of this project could be directly funded by the SVBGSA or grant funding, or SVBGSA could develop an incentive program. Funding must be approved by the SVBGSA Board of Directors.

9.5.2.4 Permitting and Regulatory Process

Projects described in this section may require a CEQA environmental review process and may require an EIR or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, permits from a variety of state and federal agencies may be necessary, and any project that coordinates with federal facilities or agencies may require NEPA documentation.

In addition, permits from the following government organizations that may be required for overland flow MAR projects include:

- ***USACE*** – A Regional General Permit may be required if there are impacts to wetlands or connections to waters of the United States.
- ***CDFW*** – A Standard Agreement is required if the project could impact a species of concern.
- ***EPA Region 9*** –NEPA documentation must be submitted for any project that coordinates with federal facilities or agencies. Additional permits may be required if there is an outlet or connection to waters of the United States.
- ***NMFS*** – A project may require authorization for incidental take, or another protected resources permit or authorization from NMFS.
- ***State Water Board Stormwater Pollution Prevention Plan (SWPPP)*** – A General Permit to Discharge Stormwater may be required depending on how stormwater is rerouted.
- ***California Department of Transportation (Caltrans)*** – An Encroachment Permit is required if any state highway will be obstructed.
- ***Monterey County*** – A Use Permit may be required. A Grading Permit is required if 100 cubic yards or more of soil materials are imported, moved, or exported. An Encroachment Permit is required if objects will be placed in, on, under, or over any County highway.

9.5.2.5 Implementation Schedule

If selected, a proposed implementation schedule for this project is presented on Figure 9-5. The schedule will depend on whether programmatic permitting can be obtained or whether each individual project needs its own feasibility, permitting, and design.

	Year				
Task Description	1	2	3	4	5
Studies/Preliminary Engineering Analysis					
Agreements/Right of Way					
CEQA					
Permitting					
Design					
Bid/Construct					

Figure 9-5. Implementation Schedule for Overland Flow MAR

9.5.2.6 Legal Authority

Pursuant to California Water Code §10726.2 (a) and (b), the SVBGSA has the right to acquire and hold real property, and to divert and store water once it has acquired any necessary real property or appropriative water rights. Some right in real property (whether fee title, easement, license, leasehold or other) may be required to implement a recharge project. A permit to appropriate water may not needed to infiltrate overland flow if constructed on a parcel without a USGS blue line stream. If a blue line stream crosses the parcel, SVBGSA will evaluate whether a permit is needed. SVBGSA recognizes that this process takes several years to complete. If a permit is needed, SVBGSA will pursue a SWRCB 5-year temporary permit under the Streamlined Permit Process while it applies for the diversion permit.

9.5.2.7 Estimated Cost

This project proposes the construction of 4 recharge basins, each with an expected benefit of 100 AF/yr. and a capital cost of $1,032,000 for a total of $4,128,000. Spread over 25 years and assuming a 6% discount rate, the annualized cost is $86,700 per recharge basin, including annual maintenance. The unit cost is $870/AF. These costs were estimated assuming that only 1 recharge basin would be built, but there may be economies of scale that lower the cost if more are built. These costs are approximate; exact costs will depend on site specifics.

9.5.2.8 Public Noticing

Before construction is initiated on any project as part of GSP implementation, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- GSA staff will bring an assessment of the need for the project to the SVBGSA Board in a publicly noticed meeting. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed project
    - An estimated cost and schedule for the proposed project
    - Any alternatives to the proposed project
- The SVBGSA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve design and construction of the project and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

In addition to the process detailed above, all projects will follow the public noticing requirements per CEQA or NEPA.

9.6 Implementation Actions

Implementation actions include actions that contribute to groundwater management and GSP implementation but do not directly help the Subbasin maintain sustainability. Four included here for the Upper Valley are well registration, GEMS expansion and enhancement, dry well notification system, Water Quality Coordination Group, and Land Use Jurisdiction Coordination Program.

9.6.1 Implementation Action C1: Well Registration

All groundwater production wells, including wells used by *de minimis* pumpers, will be required to be registered with the SVBGSA. Well registration is intended to establish a relatively accurate count of all the active wells in the Subbasin. This implementation action will help gain a better understanding of the wells in active use, verses those that have been decommissioned. Well registration will collect information on active wells, such as the type of well meter, depth of well, and screen interval depth. Well metering is intended to improve estimates of the amount of groundwater extracted from the Subbasin. A GSA may not require *de minimis* users (as defined) to meter or otherwise report annual extraction data. Other public agencies such as the County of MCWRA may have such authority. The details of the well registration program, and how it integrates with existing ordinances and requirements, will be developed during the first 2 years of GSP implementation.

9.6.2 Implementation Action C2: GEMS Expansion and Enhancement

SGMA requires GSAs to manage groundwater extractions within a basin’s sustainable yield. Accurate extraction data is fundamental to this management. MCWRA’s GEMS collects groundwater extraction data from certain areas in the Salinas Valley. The system was enacted in 1993 under Ordinance 3663 and was later modified by Ordinances 3717 and 3718. The MCWRA provides the SVBGSA annual GEMS data that can be used for groundwater management.

Most of the Upper Valley Subbasin’s estimated groundwater extraction data is derived from MCWRA’s GEMS Program, which is only implemented in Zones 2, 2A, and 2B. There are limited data on groundwater extraction within the Upper Valley Subbasin outside of MCWRA Zones 2, 2A and 2B.

SVBGSA will work with MCWRA to expand the existing GEMS Program to cover the entire Upper Valley Subbasin, which would capture all wells that have at least a 3-inch internal diameter discharge pipe. Program revisions will consider and not contradict related state regulations. Alternatively, SVBGSA could implement a new groundwater extraction reporting program that collects data outside of MCWRA Zones 2, 2A, and 2B. The groundwater extraction information will be used to report total annual extractions in the Subbasin and assess progress on the groundwater storage SMC as described in Chapter 8. Additional improvements to the existing MCWRA groundwater extraction reporting system may include some subset of the following:

- Developing a comprehensive database of extraction wells
- Expanding reporting requirements to all areas of the Salinas Valley Groundwater Basin
- Including all wells with a 2-inch discharge or greater
- Requiring automatically reporting flow meters
- Comparing flow meter data to remote sensing data to identify potential errors and irrigation inefficiencies.

9.6.3 Implementation Action C3: Dry Well Notification System

The GSA could develop or support the development of a program to assist well owners (domestic or state small and local small water systems) whose wells go dry due to declining groundwater elevations. The program could include a notification system whereby well owners can notify the GSA or relevant partner agency if their well goes dry, such as the Household Water Supply Shortage System (DWR, 2021). The information collected through this portal is intended to inform state and local agencies on drought impacts on household water supplies. It could also include referral to assistance with short-term supply solutions, technical assistance to assess why it went dry, and/or long-term supply solutions. For example, the GSA could set up a trigger system whereby it would convene a working group to assess the groundwater situation if the number of wells that go dry in a specific area cross a specified threshold. A smaller area trigger system would initiate action independent of monitoring related to the groundwater level SMC. The GSA could also support public outreach and education.

9.6.4 Implementation Action C4: Water Quality Coordination Group

The Water Quality Coordination Group will include the RWQCB, local agencies and organizations, water providers, domestic well owners, technical experts, and other stakeholders. The purpose of the Coordination Group is to coordinate amongst and between agencies that regulate water quality directly and the GSA, which has an indirect role to monitor water quality and ensure its management does not cause undesirable water quality results.

Numerous agencies at the local and State levels are involved in various aspects of water quality. The SWRCB and RWQCBs are the principal state agencies with primary responsibility for the coordination and control of water quality for the health, safety, and welfare of the people of the state pursuant to the Porter-Cologne Water Quality Control Act 1969 (California Water Code

Division 7 Section 13001). There are many efforts to address water quality by the SWRCB. For example, at the State level, the Department of Drinking Water's Safe and Affordable Funding for Equity and Resilience (SAFER) program is designed to meet the goal of safe drinking water for all Californians. In addition, at the local level, the County of Monterey Health Department Drinking Water Protection Service is designed to regulate and monitor water systems and tests water quality for new building permits for systems with over 2 connections.

The locally based Groundwater Sustainability Agencies established pursuant to SGMA are required to develop and implement GSPs to avoid undesirable results (including an undesirable result related to water quality) and mitigate overdraft in the groundwater basin within 20 years. SVBGSA [and MCWD GSA/ASGSA] will coordinate with the appropriate water quality regulatory programs and agencies in the Subbasin to understand and develop a process for determining when groundwater management and extraction are resulting in degraded water quality in the Subbasin.

Both the State and Monterey County have committed to a Human Right to Safe Drinking Water. SGMA outlines a specific role for GSAs related to beneficial users of groundwater including drinking water, which is to manage groundwater according to the 6 sustainability indicators. The Coordination Group will help define the unique role for the GSAs, not related to specific sustainability metrics. Under this implementation action, the GSAs will play a convening role by developing and coordinating a Water Quality Coordination Group.

The Coordination Group will review water quality data, identify data gaps, and coordinate agency communication. The Coordination Group will convene at least annually to share groundwater quality conditions, as assessed for the GSP Annual Reports, and assesses whether groundwater management actions are resulting in unsustainable conditions. The goal of the Coordination Group will include documenting agencies' actions that address water quality concerns including outlining each agency's responsibilities. An annual update to the GSAs' BODs will be provided regarding Coordination Group efforts and convenings.

This Coordination Group will also serve to collaborate with agencies on local regulation that could affect groundwater contamination, such as county or city groundwater requirements that relate to regulation of septic systems, well drilling, capping and destruction, wellhead protection and storage and/or leaking of hazardous materials.

9.6.5 Implementation Action C5: Land Use Jurisdiction Coordination Program

The Land Use Jurisdiction Coordination Program outlines how the SVBGSA review land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity. The goal is to ensure that the GSA and Land Use Jurisdiction efforts are aligned. Examples of these activities include the application of the B-8 Zoning district by the County of Monterey in areas with water supply, water quality and other constraints on development, and the consideration of recharge potential for new developments. While the SVBGSA does not have land use authority, and the Land Use Jurisdictions retain all such authority, the Coordination Program also describes how local agencies should consider adopted GSPs when revising or adopting policies, such as adopting and amending general plans and approving land use entitlements, regulations, or criteria, or when issuing orders or determinations, where pertinent. The Coordination Program will be developed immediately upon implementation of this GSP.

9.7 Other Groundwater Management Activities

Although not specifically funded or managed by this GSP, a number of associated groundwater management activities will be promoted and encouraged by the GSAs as part of general good groundwater management practices. If any particular action is scoped further and shown to significantly improve groundwater conditions, SVBGSA may consider implementing it as a project or management action under this GSP.

9.7.1 Continue Urban and Rural Residential Conservation

Existing water conservation measures should be continued, and new water conservation measures promoted for residential users. Conservation measures may include the use of low flow toilet fixtures, or laundry-to-landscape greywater reuse systems. Conservation projects can reduce demand for groundwater pumping, thereby acting as in-lieu recharge.

9.7.2 Promote Stormwater Capture

Stormwater and dry weather runoff capture projects, including Low Impact Development (LID) standards for new or retrofitted construction, should be prioritized and implemented. The Storm Water Resource Plan outlines an implementation strategy to ensure valuable, high-priority projects with multiple benefits (Hunt *et al*., 2019). While not easily quantified and therefore not included as projects in this document, stormwater capture projects may be worthwhile and benefit the basin.

9.7.3 Watershed Protection and Management

Watershed restoration and management can reduce stormwater runoff and improve stormwater recharge into the groundwater basin. While not easily quantified and therefore not included as projects in this GSP, watershed management activities may be worthwhile and benefit the basin.

9.7.4 Support Reuse and Recharge of Wastewater

Wastewater collection and treatment provides opportunities to use and reuse water in various ways. Each wastewater treatment facility has unique infrastructure with different plans for expansion or upgrades. Potential upgrades could result in greater reliability, improved water quality, the ability to reuse treated wastewater or increase water reuse yields, or increased recharge to groundwater. These upgrades may directly or indirectly affect groundwater conditions.

9.8 Mitigation of Overdraft

The Upper Valley Subbasin has not historically been in overdraft. Based on the water budget components, the historical sustainable yield of the Subbasin is on the order of 108,500 to 129,600 AF/yr., as summarized in Table 6-10. The historical sustainable yield incorporates historical reservoir releases, and therefore is not the natural safe yield. From 1980 to 2016, the basin was in overdraft during only 5 years. Therefore, the calculation of the mitigation of overdraft is not needed at this time. However, given that the Subbasin's extraction is currently close to the sustainable yield, this chapter includes a robust set of potential management actions and projects that could be undertaken if needed. These results are provisional and uncertain and are subject to change in future GSP updates after the SVIHM is released by the USGS. The management actions and projects selected will ensure that lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater levels or storage during other periods.

10 GROUNDWATER SUSTAINABILITY PLAN IMPLEMENTATION

This chapter describes how the GSP for the Upper Valley Aquifer Subbasin will be implemented. The chapter serves as a roadmap for addressing all of the activities needed for GSP implementation between 2022 and 2042 but focuses on the activities between 2022 and 2027.

Implementing this GSP will require the following formative activities, each of which is detailed in a subsequent subsection:

- Data, monitoring, and reporting
  - Annual monitoring and reporting
  - Updating the DMS
  - Improving monitoring networks
  - Addressing identified data gaps in the HCM
- Continuing communication and stakeholder engagement
- Refining and implementing management actions and projects
- Adapting management with the 5-year Update
- Developing a funding strategy

The implementation plan in this chapter is based on the best available data used to understand groundwater conditions in the Subbasin and the current assessment of management actions and projects described in Chapter 9. The Subbasin's conditions and the details of the projects and actions will likely evolve over time based on future data collection, model development, and input from Subbasin stakeholders. As described in Chapter 9, there is currently no need to implement management actions or projects in the Upper Valley Subbasin. Monitoring and expansion of the data network will be a focus for the Subbasin. Implementation of management actions and projects will only be initiated in the Upper Valley Subbasin after the benefits and impacts of the actions have been analyzed with a publicly available groundwater model that has technical acceptance. As stated in Chapter 6, the model used for developing this GSPs groundwater budgets should be improved before it can be used for analyzing management actions in the Subbasin.

10.1 Data, Monitoring, and Reporting

Beginning in the first year of GSP implementation, SGMA requires submittal of annual monitoring data and development of an annual report. This annual process tracks groundwater conditions with respect to the SMC established in Chapter 8. The SVBGSA will hire consultant(s), form agreements with agencies, and/or hire staff to implement the monitoring and reporting functions.

Monitoring of the 5 sustainability indicators will begin upon adoption of the GSP. Most of the monitoring networks described in Chapter 7 rely on existing monitoring programs. Only ISW needs the establishment of a new monitoring network. Data from the monitoring programs will be maintained in the DMS and evaluated annually to ensure progress is being made toward sustainability or to identify exceedances of minimum thresholds. SVBGSA will assess monitoring data to prepare annual reports and guide decisions on management actions and projects.

10.1.1 Annual Monitoring and Reporting

SGMA requires completion of annual reports to document Subbasin conditions relative to the SMC presented in Chapter 8. Starting on April 1, 2022, SVBGSA will submit annual reports for the Upper Valley Subbasin to DWR and make them publicly available. The purpose of the reports is to provide monitoring, groundwater extraction, and total water use data to DWR, compare monitoring data to the SMC, and adaptively manage actions and projects implemented to achieve sustainability.

The monitoring of the 5 sustainability indicators relevant to the Subbasin are described below. Chapter 7 outlines the data collected through the monitoring programs that will be used to complete annual reports. Where possible, SVBGSA will leverage data collection and analysis completed by MCWRA to avoid duplication of efforts.

10.1.1.1 Groundwater Levels

For groundwater level monitoring, SVBGSA relies on MCWRA's collection of groundwater elevation data and analyzes it to meet SGMA requirements. MCWRA collects groundwater elevation monitoring data under the statewide CASGEM program and their annual, monthly, and August groundwater elevation monitoring programs. The CASGEM system will be replaced by the SGMA groundwater level monitoring program after GSP submission. The new monitoring system will include 3 existing CASGEM wells and at least 15 additional wells that are already part of MCWRA's monitoring programs. Groundwater monitoring will continue to be conducted by MCWRA, and they will make these data available to the SVBGSA. The GSA will use MCWRA's annual fall contour maps and develop additional spring contour maps. These contours will be adapted to expand into the entire Upper Valley Subbasin using groundwater elevation data collected from the groundwater level monitoring network and adjacent subbasins. Although not always the lowest groundwater elevations, fall groundwater elevations are taken at the end of the irrigation season before winter rains begin to recharge the aquifer and raise groundwater levels. Thus, fall measurements represent annual change in storage due to recharge and pumping. The GSA will also prepare summary tables and figures, compare the data to SMC, and annually upload the data for DWR and to the DMS.

10.1.1.2 Groundwater Quality

For groundwater quality, SVBGSA relies on state monitoring systems and analyzes it to meet SGMA requirements. SWRCB compiles groundwater quality monitoring data for DDW and ILRP wells in their GAMA groundwater information system. The GSA will annually download these data, analyze exceedances for the COC, prepare summary tables, compare the data to SMC, and upload them to the DMS.

10.1.1.3 Land Subsidence

For land subsidence, SVBGSA relies on data provided by the State and analyzes it to meet SGMA requirements. DWR provides InSAR data that SVBGSA will use to assess land subsidence. InSAR data will be downloaded annually and are provided through DWR's SGMA Data Viewer, if available, and used to create annual change in subsidence maps to compare to SMC in the annual report.

10.1.1.4 Interconnected Surface Water

No entity currently monitors ISW. As described in Chapter 7, the monitoring network for ISW is in the process of development. Shallow groundwater elevations will be used as proxies for depletion rates; thus, shallow wells near the areas of ISW are needed. Monitoring wells will be located near USGS stream gauges and MCWRA's Salinas River Series measurement sites to evaluate groundwater gradient and effects of groundwater levels on surface water depletion. This will also help determine the extent of interconnection. The ISW monitoring wells will be incorporated into MCWRA's existing monitoring network and MCWRA will make these data available to SVBGSA. Water level measurements will be made at least once a year at each ISW monitoring site during MCWRA's annual fall groundwater monitoring event that occurs from mid-November to December. The GSA will annually prepare summary tables and figures and compare the data to SMC.

10.1.1.5 Groundwater Extraction

SVBGSA relies on MCWRA's collection of groundwater extraction data and analyzes it to meet SGMA requirements. Through the GEMS, MCWRA collects groundwater pumping data for agricultural supply wells and public groundwater system wells that have discharge pipes larger than 3 inches within MCWRA Zones 2, 2A and 2B. SVBGSA will work with MCWRA to update and enhance this program, as detailed in Section 9.6.2. The GSA will annually use these data to prepare summary tables and figures and compare the data to SMC. Due to the GEMS reporting period and submittal deadlines defined by Monterey County Ordinance No. 3717 and 3718, groundwater extraction reported in the annual reports will be lagged by 1 year.

10.1.2 Updating the Data Management System

The SVBGSA has developed a DMS that is used to store, review, and upload data collected from the monitoring programs outlined above, as described in Chapter 7. A web application reporting these data is available on the SVBGSA's website for stakeholders to view the data. The DMS will be updated as new information is collected for annual reports, developed as part of GSP implementation, and provided by stakeholders.

10.1.3 Improving Monitoring Networks

As discussed in Chapter 7, the existing groundwater quality and subsidence monitoring networks already provide sufficient spatial coverage and do not need to be improved.

10.1.3.1 Groundwater Levels

Chapter 7 identifies spatial data gaps in the groundwater level monitoring network due to insufficient coverage of wells in the southeastern half of the Subbasin. These data gaps are largely due to the lack of overlap between the MCWRA's Upper Valley Subarea boundaries and the new DWR Upper Valley Subbasin boundaries shown on Figure 5-1. There are 3 general data gaps in the groundwater level monitoring network, shown on Figure 7-3, that would require at least 3 new monitoring wells to fill. To add wells to the monitoring network, SVBGSA will first incorporate existing wells if possible. SVBGSA will contact well owners to gain permission and secure access agreements to incorporate their wells into the groundwater elevation monitoring network. All candidate existing wells for incorporation into the monitoring network will be inspected to ensure they are adequate for monitoring and to determine depth, and perforated intervals.

If an existing well cannot be identified, or permission to use data from an existing well cannot be secured to fill a data gap, then a new monitoring well will be drilled and added to the monitoring network. The SVBGSA will obtain required permits and access agreements before drilling new wells. The SVBGSA will retain the services of licensed geologists or engineers and qualified drilling companies for drilling new wells. To the extent possible, the SVBGSA will use grant funds and technical assistance support services through DWR or other entities for new wells. Once drilled, the new wells will be tested as necessary and equipped with dedicated data loggers for monitoring. All new monitoring wells identified as RMS locations will be added to MCWRA's monitoring network for continuity and consistency in data collection.

Additionally, some of the wells in the groundwater level monitoring network are only sampled annually. Thus, SVBGSA will work with MCWRA to update monitoring protocols for these well to be sampled at least twice a year as is required by SGMA. Moreover, for wells in the monitoring network that lack well construction information, SVBGSA will try to address that data gap.

10.1.3.2 Interconnected Surface Water

Depletion of ISW will be monitored through shallow wells adjacent to locations of ISW. The SVBGSA identified 4 existing wells adjacent to the Salinas River that will be added to the ISW monitoring network. These existing wells have been deemed adequate based on their shallow groundwater elevations but still require preliminary inspection. SVBGSA will secure an agreement with the well owner to incorporate the well into the monitoring network and report data from the well. Despite these 4 existing wells, there is a spatial data gap near the southern boundary of the Subbasin where SVBGSA plans to install a new shallow well along the Salinas River. The new shallow well will be added to MCWRA's monitoring program. All existing wells are already part of MCWRA's groundwater elevation monitoring programs.

10.1.3.3 Groundwater Extraction

Accurate extraction data is necessary to meet the SGMA requirement of reporting annual groundwater extractions. As shown on Figure 3-3, the current GEMS area that includes Zones 2, 2A, and 2B does not provide adequate coverage of the Upper Valley Subbasin. SVBGSA and MCWRA will work together to expand the existing GEMS Program to cover the entire Subbasin and potentially include other program improvements.

10.1.4 Addressing Identified Data Gaps in the Hydrogeologic Conceptual Model

Chapter 4 identified a few key data gaps related to the HCM. Filling these data gaps would allow the SVBGSA to improve the HCM and thus, the characterization of the Subbasin and the principal aquifer. The data gaps are related to aquifer properties for the Subbasin and the Salinas Valley, and lithologic and hydrostratigraphic data for the southern half of the Subbasin.

To fill these key data gaps and meet GSP Regulations § 354.14, during early GSP implementation SVBGSA will implement:

- **Aquifer properties assessment.** The values and distribution of aquifer properties throughout the entire Subbasin have not been well characterized and documented. There are very few measured aquifer parameters in the Salinas Valley Groundwater Basin overall. Aquifer properties are important to understanding groundwater flow directions and magnitude within the aquifer. This informs the model with better data, which in turn leads to better model predictions. With better understanding of the aquifer and potential future conditions, SVBGSA and stakeholders will be better equipped to guide the management of water resources throughout the entire Subbasin. To develop better estimates of aquifer properties, the SVBGSA will identify up to 2 wells in the Upper Valley Aquifer for aquifer testing. Each well test will last a minimum of 8 hours and will be followed by a minimum 4-hour monitored recovery period. Wells for testing will be identified using the following criteria:

- Wells are owned by willing well owners
- Wells have known well completion information
- Wellheads are completed such that water elevations in wells can be monitored with data loggers
- Wells are equipped with accurate flow meters
- Wells have area for discharge of test water
- Preferred wells will have nearby wells that can be monitored during the test.

- **Lithologic and hydrostratigraphic data collection.** The Upper Valley Subbasin boundaries defined by DWR are nearly double the total acreage of previously defined MCWRA Upper Valley Subarea boundaries. This leaves a large area of hydrogeologic data gaps in the southern half of the Subbasin where the MCWRA Upper Valley Subarea does not overlap with the Subbasin (Figure 5-1). These data gaps can be filled during the drilling and installation of new monitoring wells. Lithologic data such as sediment composition and formation designation, as well as hydrologic data such as groundwater elevation data and depth-specific water chemistry can be collected during drilling activities. Additionally, more hydrologic data can be collected during well development and well testing. These data will improve the understanding of the aquifer properties and potential groundwater-surface water relationships. The southern half of the Subbasin consists of more than the area adjacent to the Salinas River, and therefore gathering more subsurface data in these added areas will help characterize not only the lateral and vertical extent of the principal aquifer with greater resolution, but also the associated aquifer characteristics for improved understanding of groundwater flow. These data will inform SVBGSA and stakeholders for future development location decisions, injection or recharge project locations, as well as overall groundwater management directions to use the aquifer sustainably under all climatic and future development conditions. Many stakeholders have discussed the importance of data for their decisions throughout the GSP development process; acquiring these data will improve all future GSP updates and subsequent implementation activities.

10.2 Communication and Engagement

The SVBGSA will routinely report information to the public about GSP implementation and progress towards sustainability and the need to use groundwater efficiently. The SVBGSA website will be maintained as a communication tool for posting data, reports, and meeting information. This website features a link to an interactive mapping function for viewing Salinas Valley Groundwater Basin-wide data that were used during GSP development.

- **GSP Implementation – Data, Monitoring, and Reporting.** During GSP implementation, SVBGSA will engage in technical collaboration with partner agencies and stakeholders on data collection and analysis. Correspondingly, it will report out on findings to stakeholders through a variety of engagement strategies and pathways, including but not limited to:
    - Annual report presentations to the Subbasin Committee, Upper Valley SMC TAC, Advisory Committee, and Board of Directors
    - FAQs
    - Online communications, including SVBGSA website and Facebook page and direct emails
    - Mailings to most-impacted water users and residents
    - Media coverage
    - Talks and presentations to interested stakeholders, agencies, and groups

  This collaboration and outreach will be done on an annual basis as data are analyzed for the annual report. Additional outreach will occur more frequently depending on the data collection and analysis undertaken and its relevance for projects, management actions, and other implementation activities.

- **GSP Implementation – Management Actions and Projects.** SVBGSA will engage in outreach, communication, and engagement as part of its efforts to maintain sustainability through undertaking management actions and projects. This will include engagement of stakeholders and other decision-making processes, such as the Upper Valley Subbasin Committee, the Integrated Implementation Committee, the Advisory Committee, and the Board of Directors. It will also involve outreach to interested and potentially affected stakeholders through engagement strategies such as:
    - FAQs
    - Online communications
    - Mailings to most-impacted water users and residents
    - Co-promotional opportunities with partner entities
    - Talks and presentations to interested stakeholders, agencies, and groups
- **Engagement in Governance and Partnerships.** In addition to Subbasin-specific processes, SVBGSA will continue to pursue multiple means of engagement in governance and partnerships that directly or indirectly affect the Upper Valley Subbasin. These include:

- Valley-wide – The Integrated Implementation Committee will consolidate the needs of all Salinas Valley subbasins and create an integrated approach to groundwater management throughout the Salinas Valley.
- Other agencies – In close collaboration with MCWRA, SVBGSA will also work with other local, state, and federal agencies, to meet the Upper Valley Subbasin sustainability goals as detailed in this GSP. This includes working with the CCRWQCB, Monterey County Health Department, and other agencies on water quality, and the NMFS on protection of steelhead trout.

- **General Outreach on Groundwater.** SVBGSA will further pursue outreach in order to ensure stakeholders and interested or affected users are aware of SVBGSA efforts, as well as promote broader awareness of groundwater conditions and management. It will do this through means such as:
  - Offer public informational sessions and subject-matter workshops and if possible, provide online access via Facebook Live or via Zoom
  - SVBGSA Web Map
  - FAQs
  - Online communications
  - Media coverage
  - Promote/Celebrate National Groundwater Week
  - Educational materials available through mailers or at public events

- **URCs.** SVBGSA acknowledges that URCs have little or no representation in water management and have often been disproportionately less represented in public policy decision making. SVBGSA will engage more constructively with URCs, including activities such as to:
  - Conduct workshops with specific partners on the importance of water and groundwater sustainability
  - Identify URCs concerns and needs for engagement, as well as URCs' specific engagement strategies
  - Plan listening sessions around GSA milestones
  - Coordinate with partner organizations to develop a "resource hub" where people can go for support
  - Identify community allies in groundwater engagement work and bring down barriers for participation
  - Consider particular URCs impacts during routine GSA proceedings

- Convene a partnership group on domestic water, including URCs with partner entities

10.3 Road Map for Refining and Implementing Management Actions and Projects

The management actions and projects identified in Chapter 9 are sufficient for maintaining sustainability in the Upper Valley Subbasin over the 50-year planning horizon. They will be integrated with projects for the other Salinas Valley subbasins during GSP implementation. The management actions and projects described in this plan have been identified as beneficial for the Upper Valley Subbasin. The impacts of management actions and projects on other subbasins will be analyzed and taken into consideration as part of the project selection process. Prior to implementation, they will be evaluated in the context of this Subbasin and the entire Valley. In addition, to consider the human right to water, SVBGSA will assess the potential impacts of management actions and projects on water quality in nearby domestic wells and other wells supplying drinking water systems, and it will establish additional monitoring as necessary to monitor for groundwater quality impacts. Management actions and projects will be approved by the Board of Directors and will be implemented in a coordinated manner if they affect multiple subbasins. These projects assume continued operation of current infrastructure. If conditions change, such as other projects being undertaken that are outside of this GSP, SVBGSA will adapt its approach to maintaining sustainability, including the management actions and projects considered.

Management actions and projects are not needed to maintain sustainability at this time, so do not need to be implemented immediately. Rather, they will move forward only if conditions warrant it, the Subbasin Committee or SVBGSA decides to pursue them, or if the Upper Valley Subbasin can leverage projects or management actions initiated by other subbasins.

This section outlines a road map to refining and implementing management actions and projects. It organizes the key steps SVBGSA will undertake with respect to Upper Valley management actions and projects and the contingency of certain actions.

1. **Implementation Actions**

   Data collection and analysis are critical for the implementation of the Upper Valley Subbasin GSP. These actions, as highlighted in the sections above, are a top priority to be able to better understand the groundwater conditions and necessity of management actions and projects. Along with the expansion of monitoring networks, including updating and enhancing GEMS to improve the collection of extraction data, SVBGSA will register wells to gain more information on active wells, especially *de minimis* users. In addition, it will begin standing up the Dry Well Notification System within the first 2 years of GSP implementation, which will assist well owners whose access could be jeopardized if groundwater elevations decline. SVBGSA plans to undertake the development of these actions within the first 2 years after GSP submittal, and fully implement them through years 3 and 4 through actively reaching out to well owners, visiting and checking wells, and inputting data.

The Water Quality Coordination Group and Land Use Jurisdiction Coordination Program are also a critical implementation action to coordinate with other agencies that have responsibilities affecting water quality and access and land use, respectively. After undertaking preliminary planning work, SVBGSA plans to establish the these efforts in the first 2 years after implementation.

2. Upper Valley SMC TAC

Subbasin stakeholders plan to establish the SMC TAC within the first 2 years of GSP implementation. SVBGSA will work with the Subbasin Committee to determine the criteria for professional and scientific experts that will serve on the SMC TAC. After it is established, the SMC TAC will establish guiding principles, triggers, and the decision-making process. The SMC TAC will convene annually in April, and subsequently as needed, to review the annual report and whether conditions trigger the need for management actions and projects, recommend implementation of specific management actions and projects, and review data.

3. Management Actions

The Upper Valley Subbasin Planning Committee voiced preference for pursuing management actions before projects. Along with the SMC TAC, this includes Conservation and Agricultural BMPs, Fallowing, Fallow Bank, and Agricultural Land Retirement, and the MCWRA D-TAC. The D-TAC is already established. Conservation and agricultural BMPs and fallowing, fallow bank, and agricultural land retirement will move forward if conditions warrant it.

The evaluation of potential reoperation of the Nacimiento and San Antonio Reservoirs will occur within the first 5 years of GSP implementation. MCWRA owns and operates the reservoirs. SVBGSA will continue and deepen conversations with MCWRA regarding reservoir reoperation, including potential projects, and their impact on groundwater conditions. The SVGBSA needs to establish a funding mechanism for the feasibility study to occur.

4. Multi-benefit Stream Channel Improvements

Upper Valley stakeholders voiced differing levels of support for the multi-benefit stream channel improvements. Early in GSP implementation, the Subbasin Committee will evaluate whether pursuing any components of this project will contribute to groundwater sustainability. The initial steps that need to be undertaken to further the existing programs include working with MCWRA, the RCDMC, and the Salinas River Management Unit

Association on outreach to landowners, extension of permits, and the establishment of funding mechanism. Current Stream Maintenance Program permits are in place until 2025. The permitting process includes development of work plans, noticing, and pre-maintenance surveys. After undertaking maintenance activities, biological monitoring and reporting must be completed. During GSP implementation, SVBGSA will evaluate the extent to which funding the maintenance activities themselves could increase participation.

5. **Recharge Projects**

Projects are not currently needed to maintain sustainability. If changes in future conditions affect the ability of the Subbasin to maintain sustainability and management actions are insufficient, projects could be implemented. Some projects may be pursued by other subbasins or the Integrated Implementation Committee, in which case the benefits to the Upper Valley will be considered.

The remaining project, overland flow MAR, is not currently needed; however, it could be pursued if it is determined that it is are needed in the Upper Valley or if the Upper Valley can leverage similar efforts in other subbasins. Therefore, this project will move forward only if conditions warrant it.it.

The implementation of all management actions and projects will be a dynamic, adaptive process. Refinement of the projects and actions will occur simultaneously with adjustment of the funding mechanism that supports the projects and actions. A start-up budget that covers required actions such as data, monitoring, and reporting initial funds for selecting and scoping management actions and projects that would need to occur prior to financing a project. Management actions and projects will be approved by the Board of Directors and will be implemented in a coordinated manner across the entire Salinas Valley.

10.4 Five-Year Update

SGMA requires the development of 5-year GSP assessment reports, starting in 2027. The 5-year update will assess whether the GSA is achieving the sustainability goal in the Subbasin. The assessment will include a description of significant new information that has been made available since GSP submittal, whether any new information warrants changes to any aspect of the plan, and how the GSP will be adapted accordingly.

The 5-year update will include updating the SVIHM and SVOM with newly collected data and updating model scenarios to reflect both the additional data and refinements in project design or assumptions. It will also include a reevaluation of climate change to ensure assumptions in the GSP are still valid.

SVBGSA will engage stakeholders in the development of the 5-year update. In contrast to the annual reports, which share monitoring data and progress related to the SMC, the 5-year update will involve a more systemic reevaluation of the SMC minimum thresholds and measurable results, as well as report on progress meeting the interim milestones.

10.5 Start-up Budget and Funding Strategy

10.5.1 SVBGSA Operational Fee

SVBGSA established a valley-wide Operational Fee to fund the typical annual operational costs of its regulatory program authorized by SGMA, including regulatory activities of management groundwater to sustainability (such as GSP development), day-to-day administrative operations costs, and prudent reserves. The Operational Fee funds GSA operational costs, and therefore covers any tasks undertaken by staff, such as planning, technical review, partnership development, communication, stakeholder engagement, and support for the selection, development, and implementation of management actions and projects. The fee is a regulatory fee with the purpose of ensuring that ground water use is managed sustainably so that adequate supplies remain for all users. The Operational Fee is also used as local cost share for grants.

The Operational Fee is based on the 2018 Regulatory Fee Study (Hansford Economic Consulting, 2019) commissioned by SVBGSA. The SVBGSA has the authority to charge fees, as set forth in the California Water Code §10730, 10730.1, and 10730.2. The Operational Fee is a regulatory fee authorized under California Water Code § 10730 and is exempt from voter approval, as it is not a tax pursuant to California Constitution Article XIIIC (Proposition 26, Section 1(e)(3)). As the fee must be proportional and related to the benefits of the program, this study analyzed options and proposed a regulatory fee structure whereby agricultural beneficiaries are responsible for 90% of the cost and all other beneficiaries are responsible for 10% of the cost. The SVBGSA Board of Directors approved this fee in March 2019.

The Upper Valley Subbasin urban and agricultural groundwater are charged the Operational Fee by domestic connection or irrigated acreage by land use code. The Operational Fee funds valley-wide activities, including initial GSP development; however, individual subbasins need additional funding for meeting future requirements, GSP implementation, and management actions and projects.

10.5.2 Upper Valley Subbasin Start-up Budget

Table 10-1 summarizes the conceptual planning-level costs for the initial 5 years of GSP implementation for the Upper Valley Subbasin. This table does not include the Valley-wide costs for routine administrative operations and other Valley-wide costs funded through the SVBGSA operational fee outlined in Section 10.5.1. The Subbasin specific costs, shown on Table 10-1, include data collection and analysis beyond tasks already undertaken by other agencies. These tasks could be undertaken by staff, consultants, or partner agencies. The costs comprise activities required by SGMA: annual analysis and reporting of sustainability conditions; improvements to the monitoring networks, including installation of 4 new monitor wells; and supplemental hydrogeologic investigations to address data gaps.

The start-up budget includes implementation actions envisioned to occur within the first 5 years of GSP implementation. It does not include funding for development or implementation of management actions and projects; however, does include some funding for refinement and selection of management actions and projects. When management actions and projects move forward with implementation, they will require additional funding for project feasibility and design studies, environmental permitting, and landowner outreach. These are initial estimates of costs and will likely change as more data become available.

These costs are independent of fees currently collected by MCWRA; SVBGSA will aim to not duplicate fees already being collected by MCWRA.

For components of this GSP being developed in coordination with other GSPs in the Salinas Valley, the establishment costs are split between subbasins, and initial implementation costs are estimated based on the direct costs to the Upper Valley Subbasin. These are initial estimates; however, the final cost and division between subbasins will be reviewed and revised as necessary prior to implementation and per approval of the SVBGSA Board.

Table 10-1. Upper Valley Aquifer Subbasin Specific Estimated Planning-Level Costs for First 5 Years of Implementation

Activity	Estimated Annual Cost	Total Cost for 5 years or Lump Sum	Assumptions
Required Compliance Activities: Data, Monitoring, and Reporting		$683,000	
Annual Monitoring and Reporting	$50,000	$250,000	
Updating the Data Management System	$3,000	$15,000	Valley-wide cost split equally between subbasins; includes hosting fee and updating information
Improving Monitoring Networks		$217,000	
Install up to 3 wells for groundwater elevation monitoring		$75,000	
Development of GEMS expansion ordinance		$7,000	Valley-wide cost split equally between subbasins; includes hosting fee and updating information
Implementation of GEMS expansion		$100,000	Estimate for implementation in the Upper Valley
Install up to 1 shallow wells for monitoring ISW		$15,000	
Additional groundwater level monitoring	$4,000	$20,000	
Addressing Identified Data Gaps in the HCM – Aquifer properties assessment		$11,000	For 2aquifer properties tests
Coordination with MCWRA		$10,000	Setting up a shared system; MCWRA time
Required 5-year Update		$200,000	
SVIHM and SVOM update (gathering data, getting it into model)		$9,000	
Reevaluate climate change		$2,000	Valley-wide cost split equally between subbasins; includes evaluating extent to which previous estimates of climate change are still valid
Update model scenarios		$14,000	
Stakeholder engagement		$50,000	
Analysis and report-writing		$125,000	
Refine and Implement Management Actions and Projects		$50,000	Depends on management actions and projects pursued; Could be grant or project match
Engineering feasibility studies and project design			
Permitting and environmental review			
Cost-benefit analyses			
Total		$753,000	

10.5.3 Funding for Management Actions and Projects

The start-up budget does not include funding for specific management actions and projects. Management actions and projects implemented by other agencies and organizations that contribute to groundwater sustainability will follow the funding strategies developed by those respective agencies and organizations. For management actions and projects funded by SVBGSA or funding SVBGSA raises to contribute to the implementation of management actions and projects, SVBGSA will evaluate the most appropriate funding mechanisms and engage stakeholders and the Board of Directors in this analysis. These include:

- **Grant funding.** SVBGSA will pursue grants to the extent possible to fund management actions and projects.
- **Contributions from local jurisdictions, partner agencies, organizations, and companies.** Where appropriate, SVBGSA will work with partners to solicit contributions to jointly implement a project or management action.
- **Benefit assessment (Proposition 218 vote).** For projects with considerable capital cost or that benefit multiple subbasins, SVBGSA will consider holding a 218 vote to levy an assessment based upon the special benefits conferred from a specific project. Before doing so, SVBGSA will undertake an analysis to identify the special benefit of the conferred project, the cost of the benefit, the zone of benefit, and method of calculating the assessments to be levied. This requires a public hearing and is subject to a majority protest.
- **Fees.** Fees may be collected for a variety of purposes, such as funding a regulatory program or providing a product or service. Fees are not subject to a vote or protest proceeding, but they cannot exceed the cost of running the program or providing the product or service. Some regulatory programs need to be implemented via ordinance.
- **Fines and penalties.** With the establishment of an ordinance, SVBGSA has the authority to impose fines and penalties, such as may be associated with a regulatory program. Imposition of a fine or penalty must provide due process, usually a hearing after notice/citation and before assessment of the fine or penalty, and funds must be put back into the program.
- **Special taxes.** SVBGSA has the authority to levy a special tax for a specific purpose, such as a parcel tax or some sales tax components. This requires a two-thirds vote of the electorate.

SVBGSA acknowledges that the costs associated with management actions and projects will need to be funded through mechanisms such as these. It will work with funding agencies and local partners to do so. Although a water charges framework and water marketing are potential funding mechanisms, the Upper Valley Subbasin Planning Committee agreed they are not their preferred funding mechanisms.

10.6 Implementation Schedule and Adaptive Management

The SVBGSA oversees all or part of 6 subbasins in the Salinas Valley Groundwater Basin. Implementing the Upper Valley Subbasin GSP must be integrated with the implementation of the 5 other GSPs in the Salinas Valley. The implementation schedule reflects the significant integration and coordination needed to implement all 6 GSPs in a unified manner.

A general schedule showing the major tasks and estimated timeline during the first 5 years of GSP implementation is provided on Figure 10-1.

The general implementation schedule for management actions and projects focuses on implementation actions and the SMC TAC within the first 2 to 3 years. The D-TAC has already been created. Other management actions could be pursued at any point that groundwater conditions warrant them or at any point Subbasin stakeholders and the SVBGSA decide is appropriate. Projects will be considered for the Upper Valley if conditions warrant it. Management actions and projects will be revisited and adjusted as needed throughout GSP implementation. Implementation of this GSP will rely on best available science and will be continually updated as new data and analyses are available.

SVBGSA will adaptively manage groundwater and the implementation of the GSP. The work of SVBGSA and stakeholders to complete this GSP provides a solid base to guide groundwater management; however, certain conditions may provide the need to adapt and change management as envisioned in this plan. For example, if existing conditions change, such as a prolonged drought that affects groundwater conditions, or additional funding for specific projects becomes available, SVBGSA may adapt its management strategy. If that occurs, SVBGSA will work through an open and transparent process with stakeholders, partner agencies, and DWR to ensure it continues to meet regulatory requirements and reaches sustainability.

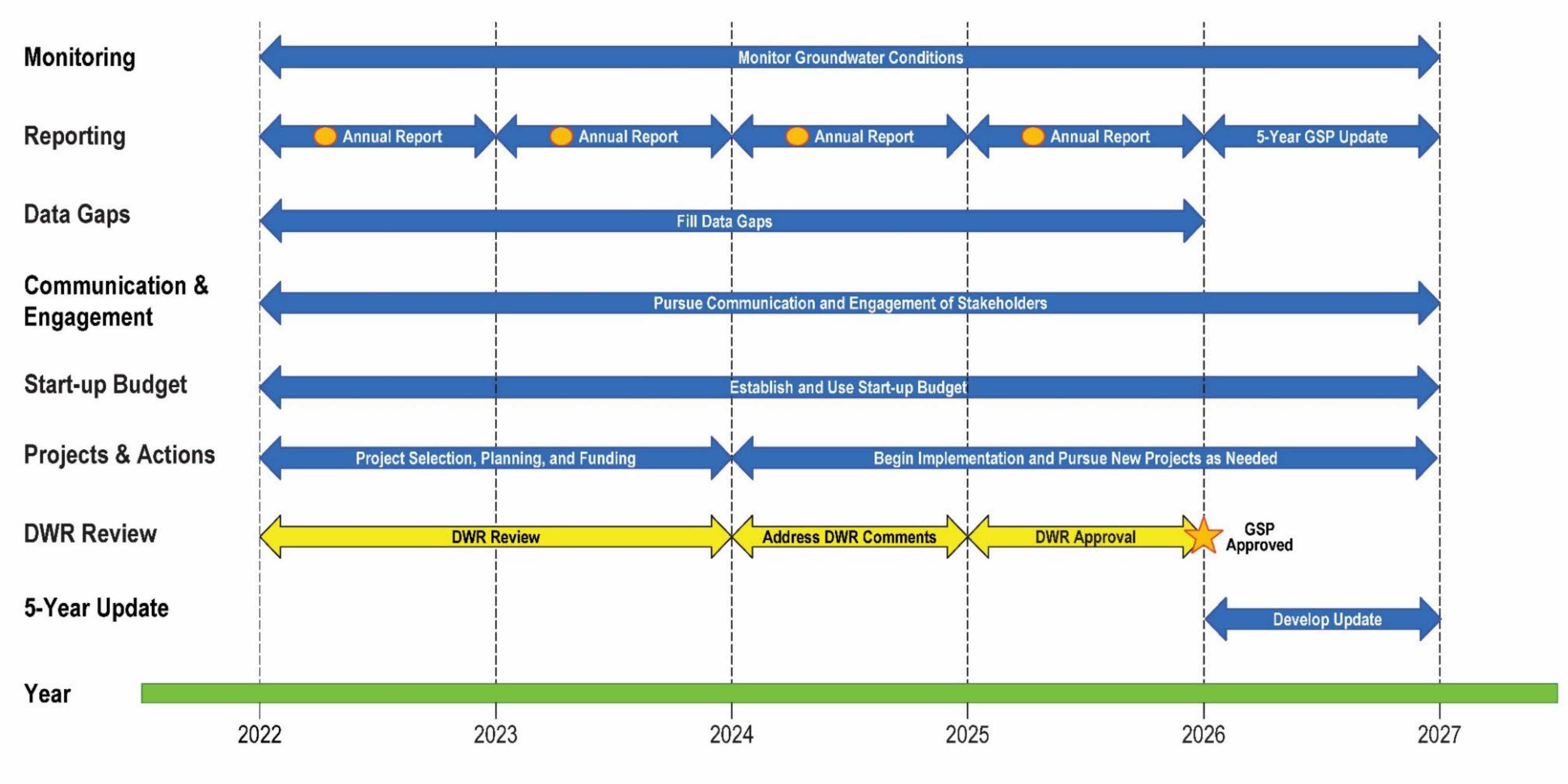


Figure 10-1. General Schedule of 5-Year Start-Up Plan

REFERENCES

American Society of Farm Managers & Rural Appraisers, California Chapter. 2020. 2020 Trends in Agricultural Land & Lease Values. 124 p. https://calasfmra.com/product/2020-trends-report-2/.

Barlow, Paul M., and Stanley A. Leake. 2012. Streamflow Depletion by Wells – Understanding and Managing the Effects of Groundwater Pumping on Streamflow. U.S. Geological Circular 1376. 84 p. https://pubs.usgs.gov/circ/1376/.

Boyle Engineering Corporation. 1991. Water Capital Facilities Plan Volume 1 Report. Prepared for MCWRA. 118 p. https://www.co.monterey.ca.us/home/showdocument?id=73378.

Brown and Caldwell. 2015. State of the Salinas River Groundwater Basin - Hydrology Report. Monterey County Water Resources Agency Water Reports. http://digitalcommons.csumb.edu/hornbeck_cgb_6_a/21.

Bureau of Land Management (BLM). 2020. BLM National Surface Management Agency Area Polygons - National Geospatial Data Asset (NGDA). Updated April 16, 2020. https://catalog.data.gov/dataset/blm-national-surface-management-agency-area-polygons-national-geospatial-data-asset-ngda.

Burton, Carmen A., and Michael T. Wright. 2018. Status and Understanding of Groundwater Quality in the Monterey-Salinas Shallow Aquifer Study Unit, 2012–13: California GAMA Priority Basin Project. U.S. Geological Survey. Scientific Investigations Report 20185057. Prepared in cooperation with the California State Water Resources Control Board.132p.

California Invasive Plant Council (Cal-IPC). 2011. Arundo donax: Distribution and Impact Report. Agreement No. 06-374-559-0. Submitted to State Water Resources Control Board. https://www.cal-ipc.org/wp-content/uploads/2017/11/Arundo_Distribution_Impact_Report_Cal-IPC_March-2011_small.pdf.

California Water Service. 2016. 2015 Urban Water Management Plan, Salinas District. https://www.calwater.com/docs/uwmp2015/sln/2015_Urban_Water_Management_Plan_Final_(SLN).pdf.

Carpenter, E.J. and S. Cosby. 1925. Soil Survey of the Salinas Area, California. U.S. Department of Agriculture, Bureau of Chemistry and Soils. no. 11.

Central Coast Groundwater Coalition (CCGC). 2015. Northern Counties Groundwater Characterization: Salinas Valley, Pajaro Valley and Gilroy-Hollister Valley. Submitted to the Central Coast Regional Water Quality Control Board on June 1, 2015. Salinas, CA Prepared by Luhdorff & Scalmanini Consulting Engineers. 454 p.

Central Coast Regional Water Quality Control Board (CCRWQCB). 2018. Groundwater Quality Conditions and Agricultural Discharges in the Central Coast Region. Staff Report for Regular Meeting of May 10-11, 2018.

_____. 2019. Water Quality Control Plan for the Central Coast Basin. 595 p. https://www.waterboards.ca.gov/centralcoast/publications_forms/publications/basin_plan/docs/2019_basin_plan_r3_complete_webaccess.pdf.

_____. 2021. "Proposed General Waste Discharge Requirements for Discharges from Irrigated Lands." Order R3-2021-0040. https://www.waterboards.ca.gov/centralcoast/water_issues/programs/ag_waivers/docs/ag_order4_renewal/2021april/pao4_order_clean.pdf.

Department of Toxic Substances Control (DTSC). 2020. Envirostor Website. Accessed June 27, 2020. https://www.envirostor.dtsc.ca.gov/public/.

Department of Water Resources (DWR). 2003. California's Ground Water. Bulletin 118. Update 2003. http://wdl.water.ca.gov/waterdatalibrary/docs/historic/Bulletins/Bulletin_118/Bulletin_118__2003.pdf.

_____. 2004. Bulletin 118 Interim Update 2004; Salinas Valley Groundwater Basin, 180/400 Foot Aquifer Subbasin. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Bulletin-118/Files/2003-Basin-Descriptions/3_004_05_UpperValleyAquiferSubbasin.pdf.

_____. 2016a. California's Groundwater. Bulletin 118 Interim Update 2016. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Bulletin-118/Files/B118-Interim-Update-2016.pdf.

_____. 2016b. Monitoring Networks and Identification of Data Gaps. Best Management Practices for the Sustainable Management of Groundwater. 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_ay_19.pdf.

_____. 2017. Sustainable Management Criteria. Best Management Practices for the Sustainable Management of Groundwater. 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_ay_19.pdf.

_____. 2018. Guidance for Climate Change Data During Groundwater Sustainability Plan Development. 101 p. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Resource-Guide-Climate-Change-Guidance_v8_ay_19.pdf.

_____. 2019. Email sent by Benjamin Brezing (DWR) on May 30, 2019. Subject: Error bounds on subsidence raster.

_____. 2020a. Well Completion Report Map Application. Accessed April 2020. https://www.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37.

_____. 2020b. Natural Communities Commonly Associated with Groundwater (NCCAG) – GIS Data Set. Data queried and downloaded from California Department of Water Resources GIS Map Server on 4/29/2020. https://gis.water.ca.gov/app/ncdatasetviewer/sitedocs/.

_____. 2020c. SGMA Data Viewer Map Application. Accessed July 2020. https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

_____. 2020d. Handbook for Water Budget Development With or Without Models. 446 p. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Water-Budget-Handbook.pdf?la=en&hash=30AD0DFD02468603F21C1038E6CC6BFE32381233

_____. 2021. Household Water Supply Shortage Reporting System web form. Accessed July 16, 2021. https://mydrywatersupply.water.ca.gov/report/.

Durbin, Timothy J. 1974. Digital simulation of the effects of urbanization on runoff in the upper Santa Ana Valley, California. U.S. Geological Survey Water Resources Investigations. no.73-41. https://pubs.usgs.gov/wri/1973/0041/report.pdf.

Durbin, Timothy J., G.W. Kapple, and J.R. Freckleton. 1978. Two-Dimensional and Three-Dimensional Digital Flow Models of the Salinas Valley Ground-Water Basin, California. U.S. Geological Survey. Water Resources Investigations Report 78-113. Prepared in cooperation with the U.S. Army Corps of Engineers. 134 p.

Durham, D.L., Addicott, W. O. 1965. *Pancho Rico Formation Salinas Valley, California.* U.S. Geological Survey Professional Paper 524-A, 1965, 38p.

Environmental Defense Fund (EDF). 2018. Addressing Regional Surface Water Depletions in California, A Proposed Approach for Compliance with the Sustainable Groundwater Management Act. 12 p.

Forebay Implementation Agreement, 2021. Forebay Subbasin Groundwater Sustainability Plan Implementation Agreement between the SVBGSA and the Arroyo Seco Groundwater Sustainability Agency. April.

Fugro West, Inc., ETIC Engineering, Inc., Cleath Associates. 2005. *Final Report - Paso Robles Groundwater Basin Study Phase II, Numerical Model Development, Calibration, and Application*. Prepared for County of San Luis Obispo Public Works Department, February 2005. 162 p.

Greater Monterey County Integrated Regional Water Management Group (RWMG). 2018. Greater Monterey County Integrated Regional Water Management Plan. http://www.greatermontereyirwmp.org/documents/plan/.

Greene, H.G. 1977. Geology of the Monterey Bay Region, California. U.S. Geological Survey Open-File Report 77-718.

Hansford Economic Consulting, 2019. 2018 Regulatory Fee Study: Prepared for Salinas Valley Basin Groundwater Sustainability Agency.

Heath, R. C. 1976. “Design of ground-water level observation-well programs.” *Ground Water*. v. 14, no. 2, p. 71-77.

Highland Economics. 2017. Rotational Cover Crop Plan Economic Analysis: Private Costs and Public Benefits of Cover Crop Fallowing in the Pajaro Valley and Potential Incentive Structures. Prepared for RCDSCC. 78 p. http://www.communitywaterdialogue.org/images/coveredfallow/Pajaro_Valley_Covered_Fallow_Plan_Economic_Analysis_final2.pdf.

Hopkins, J. and B. Anderson. 2016. A Field Manual for Groundwater-level Monitoring at the Texas Water Development Board. User Manual 52, 26 p. https://www.twdb.texas.gov/groundwater/docs/UMs/UM-52.pdf.

HydroFocus, Inc. 2014. Distribution of Groundwater Nitrate Concentrations, Salinas Valley, California. 30 April. 42p.

Jennings, C.W., with modifications by C. Gutierrez, W. Bryant, G. Saucedo, and C. Wills, 2010. Geologic map of California: California Geological Survey, Geologic Data Map No. 2, scale 1:750,000. https://www.conservation.ca.gov/cgs/Pages/Program-RGMP/2010_geologicmap.aspx.

Kennedy-Jenks. 2004. Hydrostratigraphic Analysis of the Northern Salinas Valley. Prepared for Monterey County Water Resources Agency. 14 May, 113p.

Kulongoski Justin T. and Kenneth Belitz. 2005. Ground-Water Quality Data in the Monterey Bay and Salinas Valley Basins, California, 2005 - Results from the California GAMA Program. U.S. Geological Survey. Scientific Investigations Report 2011-5058. Prepared in in cooperation with the California State Water Resources Control Board. 98p.

Melton, F. & Hang, M. 2021. Remote Sensing of Evapotranspiration from Arundo donax in the Salinas River Channel. Prepared for the Resources District of Monterey County by California State University Monterey Bay & NASA Ames Research Center, Cooperative for Research in Earth Science Technology. March 31, 2021.

Mittelbach, H., Casini, F., Lehner, I., Teuling, A., & Seneviratne, S. 2011. Soil moisture monitoring for climate research: Evaluation of a low-cost sensor in the framework of the Swiss Soil Moisture Experiment (SwissSMEX) campaign. *Journal of Geophysical Research*. 116. 11. 10.1029/2010JD014907. https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/2010JD014907.

Monterey County Agricultural Commissioner. 2018. 2018 Monterey County Crop Report. Accessed September 26, 2018. https://www.co.monterey.ca.us/home/showdocument?id=78579.

Monterey County Housing and Community Development. 2010. Monterey County General Plan, Chapter 5. https://www.co.monterey.ca.us/home/showpublisheddocument/45810/636389938521570000.

Monterey County Water Resources Agency (MCWRA). 2006. Monterey County Groundwater Management Plan. 2006.

_____. 2015. CASGEM Monitoring Plan for High and Medium Priority Basins in the Salinas Valley Groundwater Basin.

_____. 2016. Salinas River Stream Maintenance Program Permit Application Supplemental Attachment. 229 p.

_____. 2018a. Email sent by Tamara Voss (MCWRA) on August 9, 2018. Subject: Data Request from MCWRA - GWL Change and Website Link for Extraction Reports.

_____. 2018b. Nacimiento Dam Operation Policy. https://www.co.monterey.ca.us/Home/ShowDocument?id=63151

_____. 2019a. Salinas River Long-Term Management Plan. http://www.salinasrivermanagementprogram.org/ltmp_doc.html.

_____. 2019b. 2018 Groundwater Extraction Summary Report. 20 p. https://www.co.monterey.ca.us/Home/ShowDocument?id=85416.

_____. 2020. Interlake Tunnel Progress Report. Presented to MCWRA Board of Directors on May 18, 2020 and presented to MCWRA Board of Supervisors on June 9, 2020.

Moran, Tara, and Alletta Belin. 2019. "A Guide to Water Quality Requirements Under the Sustainable Groundwater Management Act." Stanford Water in the West. Available at https://stacks.stanford.edu/file/druid:dw122nb4780/A%20Guide%20to%20Water%20Quality%20Requirements%20under%20SGMA.pdf.

O'Geen, A.T., M.B.B. Saal, H. Dahlke, D. Doll, R. Elkins, A. Fulton, G. Fogg, T. Harter, J.W. Hopmans, C. Ingels, F. Niederholzer, S. Sandovol Solis, P. Verdegaal, and M. Walkinshaw. 2015. "Soil suitability index identifies potential areas for groundwater banking on agricultural lands." *California Agriculture* 69:75-84.

Resource Conservation District of Santa Cruz County (RCDSCC). 2018. Pajaro Valley Covered Fallow Plan. 44 p. http://www.communitywaterdialogue.org/images/coveredfallow/Covered_Follow_Plan_FINAL_LowRes.pdf.

Rivas, T. 2006. Erosion Control Treatment Selection Guide. U.S. Forest Service National Technology & Development Program: 7700 Transportation Management. United States Department of Agriculture. 0677 1203—SDTDC. December 2006. https://www.fs.fed.us/t-d/pubs/pdf/hi_res/06771203hi.pdf.

Rosenberg, Lewis I. 2001. Digital Geologic Map of Monterey County, California, 1934-2001. Monterey County (Calif.) Planning Department. http://purl.stanford.edu/cm427jp1187.

Sophocleous, M. 1983. “Groundwater observation network design for the Kansas groundwater management districts, USA.” *Journal of Hydrology*, 61: 371-389.

State Water Resources Control Board (SWRCB). 2020a. GeoTracker Website. Accessed June 27, 2020. https://geotracker.waterboards.ca.gov/.

_____. 2020b. Groundwater Ambient Monitoring and Assessment Program (GAMA) Groundwater Information System Website. Accessed June 27, 2020. https://gamagroundwater.waterboards.ca.gov/gama/datadownload.

Thorne, J., Cameron, D., & Jigour, V. 2002. A guide to wildlands conservation in the central region of California. California Wilderness Coalition, Davis. https://escholarship.org/uc/item/41m0z72f.

Thorup, R.R. 1976. Report on Castroville Irrigation Project Deep Test Hole and Freshwater Bearing Strata Below the Pressure 400-Foot Aquifer, Salinas Valley, CA.

Tracking California. 2020. Water System Service Areas. Accessed April 2020. https://trackingcalifornia.org/water-systems/water-systems-landing.

U.S. Census Bureau. 2018. TIGER/Line Geodatabases. Accessed December 2018. https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-geodatabase-file.html.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2018. National Soil Survey Handbook. Title 430-VI. Accessed September 30, 2019. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_054242.

U.S. Fish and Wildlife Service (USFWS). 2017. Critical Habitat: What is it? https://www.fws.gov/endangered/esa-library/pdf/critical_habitat.pdf.

Winter, T.C., J.W. Harvey, O.L. Franke, and W.M. Alley. 1999. Ground water and surface water- A Single Resource. U.S. Geological Survey Circular 1139. 88 p.

WRIME, Inc. 2003. Deep Aquifer Investigation – Hydrogeologic Data Inventory, Review, Interpretation and Implications. Technical Memorandum.

Yates, Eugene B. 1988. Simulated Effects of Ground-Water Management Alternatives for the Salinas Valley, California. U.S. Geological Survey Water-Resources Investigations Report 87-4066.