SANTA MARGARITA
Groundwater Agency

# 2027 GROUNDWATER SUSTAINABILITY PLAN AMENDMENT

**DRAFT - SEPTEMBER 2026**

REGIONAL WATER
MANAGEMENT FOUNDATION

MONTGOMERY
& ASSOCIATES

# Contents

**Acronyms & Abbreviations** ..... **xvi**
**Executive Summary** ..... **1**
**Introduction** ..... **4**
**Plan Area and Basin Setting** ..... **4**
Plan Area ..... 4
Basin Setting ..... 9
Water Budget ..... 16
Sustainable Management Criteria and Monitoring Networks ..... 18
**Projects and Management Actions** ..... **25**
**Groundwater Sustainability Plan Implementation** ..... **28**
**1 Introduction** ..... **1-1**
**1.1 Purpose of the Groundwater Sustainability Plan** ..... **1-1**
**1.2 Sustainability Goal** ..... **1-2**
**1.3 Agency Information** ..... **1-4**
1.3.1 Organization and Management Structure of the Santa Margarita Groundwater Agency ..... 1-4
1.3.2 Legal Authority of the Santa Margarita Groundwater Agency ..... 1-5
1.3.3 Santa Margarita Groundwater Agency Guiding Principles ..... 1-7
1.3.4 Estimated Cost of Implementing the GSP and the Santa Margarita Groundwater Agency's Approach to Meet Costs ..... 1-7
**1.4 GSP Organization** ..... **1-9**
**2 Plan Area** ..... **2-1**
**2.1 Area Covered by the GSP** ..... **2-1**
2.1.1 Jurisdictional Areas ..... 2-3
2.1.1.1 .... County of Santa Cruz ..... 2-3
2.1.1.2 .... Water Districts ..... 2-3
2.1.1.3 .... City of Scotts Valley ..... 2-8
2.1.1.4 .... Federal and State Lands ..... 2-8
2.1.1.5 .... Tribal Lands ..... 2-8
2.1.2 City of Santa Cruz ..... 2-9
2.1.3 Basin Groundwater Management Areas ..... 2-9
2.1.3.1 .... GSP Management Areas ..... 2-9
2.1.3.2 .... Other Basin Management Areas ..... 2-9
**2.2 Water Resources Monitoring and Management Programs** ..... **2-10**
2.2.1 United States Geological Survey Surface Water Monitoring ..... 2-10
2.2.2 California Department of Water Resources Groundwater Level Monitoring Programs ..... 2-12
2.2.3 Central Coast Regional Water Quality Control Board Basin Plan ..... 2-12
2.2.4 County of Santa Cruz Monitoring ..... 2-16
2.2.4.1 .... Groundwater Elevation Monitoring ..... 2-16
2.2.4.2 .... Groundwater Quality Monitoring ..... 2-16
2.2.4.3 .... Local Area Management Program ..... 2-18

2.2.5 San Lorenzo Valley Water District Groundwater and Surface Water Monitoring and Management ..... 2-19
2.2.6 Scotts Valley Water District Groundwater Monitoring and Management ..... 2-20
2.2.7 Mount Hermon Association Groundwater Monitoring and Management ..... 2-22
2.2.8 City of Santa Cruz Surface Water Monitoring and Environmental Management ..... 2-23
2.2.8.1 .... Surface Water Monitoring and Management ..... 2-23
2.2.8.2 .... Habitat Management ..... 2-24
2.2.9 Environmental Monitoring Programs ..... 2-24
2.2.9.1 .... Groundwater Contamination Cleanup Sites ..... 2-25
2.2.9.2 .... Soil Contamination Cleanup Sites ..... 2-31
2.2.9.3 .... Migration of Contaminated Water Monitoring ..... 2-32
**2.3 Land Use Elements ..... 2-33**
2.3.1 Existing Land Use Designations ..... 2-33
2.3.2 General Plans ..... 2-37
2.3.2.1 .... City of Scotts Valley General Plan ..... 2-37
2.3.2.2 .... County of Santa Cruz General Plan ..... 2-37
2.3.3 Potential Water Demand Changes due to GSP Implementation ..... 2-40
2.3.4 Replenishment of Groundwater Extractions ..... 2-41
2.3.4.1 .... Conjunctive Use and Underground Storage ..... 2-41
2.3.4.2 .... Stormwater Recharge ..... 2-42
2.3.4.3 .... Diversions to Storage ..... 2-46
2.3.4.4 .... Water Conservation and Use Efficiency ..... 2-46
2.3.4.5 .... Recycled Water ..... 2-49
2.3.5 Additional GSP Elements ..... 2-51
2.3.5.1 .... Process for Permitting New and Replacement Wells ..... 2-51
2.3.5.2 .... Wellhead Protection ..... 2-52
2.3.6 Relationships with State and Federal Regulatory Agencies ..... 2-53
2.3.6.1 .... Land Use Planning Related to Potential Risks for Groundwater Quality or Quantity ..... 2-54
2.3.6.2 .... Impacts on Groundwater Dependent Ecosystems ..... 2-55
**2.4 Communication and Engagement ..... 2-55**
2.4.1 Beneficial Users of Groundwater ..... 2-56
2.4.1.1 .... Municipal Water Agencies ..... 2-56
2.4.1.2 .... Mount Hermon Association ..... 2-56
2.4.1.3 .... Small Water Systems ..... 2-57
2.4.1.4 .... Private Domestic Pumpers ..... 2-58
2.4.1.5 .... Disadvantaged Communities ..... 2-58
2.4.1.6 .... Agricultural Irrigators ..... 2-59
2.4.1.7 .... Industrial Users ..... 2-59
2.4.1.8 .... Ecological Users ..... 2-61
2.4.2 SMGWA Board of Directors ..... 2-65
2.4.3 Surface Water Technical Advisory Group ..... 2-66
2.4.4 Consideration of Public Input and GSP Review Process ..... 2-67
2.4.5 Communication and Engagement Plan ..... 2-68

**3 Basin Setting ..... 3-1**
**3.1 Overview ..... 3-1**
**3.2 Topography ..... 3-1**
**3.3 Climate ..... 3-4**
3.3.1 Historical Climate ..... 3-4
3.3.2 Projected Climate ..... 3-7
**3.4 Hydrogeologic Conceptual Model ..... 3-9**
3.4.1 Basin Boundaries ..... 3-10
3.4.2 Basin Stratigraphy ..... 3-12
3.4.2.1 .... Metasedimentary/Granitic Basement ..... 3-15
3.4.2.2 .... Locatelli Sandstone ..... 3-15
3.4.2.3 .... Butano Sandstone ..... 3-15
3.4.2.4 .... Lompico Sandstone ..... 3-16
3.4.2.5 .... Monterey Formation ..... 3-16
3.4.2.6 .... Santa Margarita Sandstone ..... 3-16
3.4.2.7 .... Santa Cruz Mudstone ..... 3-17
3.4.2.8 .... Purisima Formation ..... 3-17
3.4.2.9 .... Coastal Terrace Deposits ..... 3-17
3.4.2.10... Alluvium ..... 3-17
3.4.3 Geologic Structure ..... 3-18
3.4.3.1 .... Tectonic Setting ..... 3-18
3.4.3.2 .... Faults ..... 3-18
3.4.3.3 .... Folding and Geologic Structure ..... 3-20
3.4.4 Principal Hydrogeologic Units ..... 3-26
3.4.4.1 .... Santa Margarita Aquifer ..... 3-27
3.4.4.2 .... Lompico Aquifer ..... 3-28
3.4.4.3 .... Butano Aquifer ..... 3-29
3.4.5 Other Hydrogeologic Units ..... 3-29
3.4.5.1 .... Purisima Formation ..... 3-29
3.4.5.2 .... Santa Cruz Mudstone ..... 3-29
3.4.5.3 .... Monterey Formation ..... 3-30
3.4.5.4 .... Locatelli Sandstone ..... 3-30
3.4.5.5 .... Igneous and Metamorphic Basement Formations ..... 3-30
3.4.6 Soil Characteristics ..... 3-31
3.4.7 Recharge Areas ..... 3-33
3.4.8 Surface Water ..... 3-35
3.4.8.1 .... Rivers and Creeks ..... 3-35
3.4.8.2 .... Water Impoundments ..... 3-37
3.4.8.3 .... Springs ..... 3-37
3.4.8.4 .... Open Water ..... 3-38
3.4.9 Groundwater Dependent Ecosystems ..... 3-38
3.4.9.1 .... Riverine and Riparian GDEs ..... 3-43
3.4.9.2 .... Other Groundwater-Supported Wetlands ..... 3-43

3.4.10 Sources and Points of Water Supply ..... 3-43
3.4.11 Description of Surface Water Supply for Groundwater Recharge or In-Lieu Supply ..... 3-50
**4 Groundwater Conditions ..... 4-5**
**4.1 Historical Groundwater Demands ..... 4-5**
**4.2 Groundwater Elevations ..... 4-8**
4.2.1 Groundwater Elevation Subareas and Monitoring Wells ..... 4-8
4.2.2 Santa Margarita Aquifer Groundwater Elevations ..... 4-14
4.2.2.1 .... Santa Margarita Aquifer Groundwater Elevations over Time ..... 4-14
4.2.2.2 .... Santa Margarita Aquifer Groundwater Elevation Contours and Flow Directions ..... 4-17
4.2.3 Monterey Formation Groundwater Elevations ..... 4-25
4.2.4 Lompico Aquifer Groundwater Elevations ..... 4-27
4.2.4.1 .... Lompico Aquifer Groundwater Elevations over Time ..... 4-27
4.2.4.2 .... Lompico Aquifer Groundwater Elevation Contours and Flow Directions ..... 4-29
4.2.5 Butano Aquifer Groundwater Elevations ..... 4-33
4.2.5.1 .... Butano Aquifer Groundwater Elevations over Time ..... 4-33
4.2.5.2 .... Butano Aquifer Groundwater Elevation Contours and Flow Directions ..... 4-35
4.2.6 Vertical Hydraulic Gradients ..... 4-40
**4.3 Change of Groundwater in Storage ..... 4-43**
**4.4 Groundwater Quality ..... 4-45**
4.4.1 Groundwater Quality Standards ..... 4-45
4.4.2 Groundwater Quality Testing ..... 4-46
4.4.3 Naturally Occurring Groundwater Quality ..... 4-47
4.4.3.1 .... Salinity ..... 4-47
4.4.3.2 .... Iron and Manganese ..... 4-57
4.4.3.3 .... Arsenic ..... 4-70
4.4.4 Anthropogenic Constituents in Groundwater ..... 4-77
4.4.4.1 .... Nitrate ..... 4-77
4.4.4.2 .... Constituents of Emerging Concern ..... 4-87
4.4.4.3 .... Organic Compounds ..... 4-90
**4.5 Land Subsidence ..... 4-93**
**4.6 Interconnected Surface Water ..... 4-97**
4.6.1 Locations of Interconnected Surface Water ..... 4-97
4.6.2 Relationship Between Interconnected Surface Water and Groundwater Extraction ..... 4-101
4.6.3 Relationship Between Groundwater Elevation and Depletion of Interconnected Surface Water Based on Measured Data ..... 4-103
4.6.3.1 .... Comparison of Long-Term Water Groundwater Levels to Flow on the San Lorenzo River at Big Trees ..... 4-104
4.6.3.2 .... Comparison of Short-Term Groundwater Levels to Flow at Multiple Locations ..... 4-107
4.6.4 Modeled Information on Depletion of Interconnected Surface Water ..... 4-112
**5 Water Budget ..... 5-1**
**5.1 Water Budget Development ..... 5-1**
5.1.1 Precipitation Budget Components ..... 5-4

5.1.2 Surface Water Budget Components ..... 5-6
5.1.3 Groundwater Budget Components ..... 5-8
**5.2 Historical Water Budget ..... 5-10**
5.2.1 Historical Precipitation Budget ..... 5-11
5.2.2 Historical Surface Water Budget ..... 5-13
5.2.3 Historical Groundwater Budget ..... 5-15
5.2.4 Historical Groundwater Budget by Aquifer ..... 5-19
5.2.5 Historical Groundwater Change in Storage by Subarea ..... 5-20
**5.3 Current Water Budget ..... 5-24**
5.3.1 Current Precipitation Budget ..... 5-24
5.3.2 Current Surface Water Budget ..... 5-25
5.3.3 Current Groundwater Budget ..... 5-25
5.3.4 Current Groundwater Budget by Aquifer/Formation ..... 5-27
5.3.5 Current Groundwater Change in Storage by Subarea ..... 5-28
**5.4 Baseline Projected Water Budget ..... 5-28**
5.4.1 Baseline Projected Precipitation Budget ..... 5-29
5.4.2 Baseline Projected Surface Water Budget ..... 5-31
5.4.3 Baseline Projected Groundwater Budget ..... 5-33
5.4.4 Baseline Projected Groundwater Budget by Aquifer ..... 5-35
5.4.5 Baseline Projected Groundwater Change in Storage by Subarea ..... 5-37
**5.5 Projected Water Budget with Climate Change ..... 5-42**
5.5.1 Projected Precipitation Budget with Climate Change ..... 5-42
5.5.2 Projected Surface Water Budget with Climate Change ..... 5-44
5.5.3 Projected Groundwater Budget with Climate Change ..... 5-46
5.5.4 Projected Groundwater Budget by Aquifer with Climate Change ..... 5-48
5.5.5 Projected Groundwater Change in Storage by Subarea with Climate Change ..... 5-50
**5.6 Sustainable Yield ..... 5-56**
**6 Monitoring Networks ..... 6-1**
**6.1 Purpose of Monitoring Networks ..... 6-1**
**6.2 Groundwater Level Monitoring Network ..... 6-2**
**6.3 Groundwater Extraction Monitoring ..... 6-11**
6.3.1 Metered Groundwater Extraction ..... 6-15
6.3.2 Unmetered Groundwater Extraction ..... 6-15
**6.4 Groundwater Quality Monitoring Network ..... 6-17**
**6.5 Depletion of Interconnected Surface Water Monitoring ..... 6-22**
**6.6 Other Monitoring Networks ..... 6-22**
6.6.1 Streamflow Monitoring Network ..... 6-22
6.6.2 Groundwater Dependent Ecosystem Monitoring ..... 6-27
6.6.3 Subsidence Monitoring ..... 6-32
6.6.4 Climate Monitoring ..... 6-33
**6.7 Monitoring Protocols ..... 6-33**

6.7.1 Groundwater Level Measurement Protocols ..... 6-34
6.7.1.1 .... Manual Groundwater Level Measurement ..... 6-35
6.7.1.2 .... Groundwater Level Measurement with Continuous Recording Devices ..... 6-35
6.7.2 Groundwater Quality Monitoring Protocols ..... 6-36
6.7.3 Groundwater Extraction Measurement Protocols ..... 6-38
6.7.4 Other Monitoring Protocols ..... 6-38
6.7.4.1 .... Stream Gage Measurements ..... 6-38
6.7.4.2 .... Stream Accretion ..... 6-39
**6.8 Data Management System ..... 6-40**
**6.9 Assessment and Improvement of Monitoring Network ..... 6-42**
6.9.1 Groundwater Level Monitoring Improvements ..... 6-42
6.9.2 Groundwater Extraction Monitoring Improvements ..... 6-48
6.9.3 Groundwater Quality Monitoring Improvements ..... 6-49
6.9.4 Other Monitoring Improvements ..... 6-49
**7 Sustainable Management Criteria ..... 7-1**
**7.1 Sustainability Goal ..... 7-2**
**7.2 Process of Developing Sustainable Management Criteria ..... 7-5**
**7.3 Chronic Lowering of Groundwater Levels Sustainable Management Criteria ..... 7-7**
7.3.1 Undesirable Results - Chronic Lowering of Groundwater Levels ..... 7-8
7.3.1.1 .... Criteria for Defining Chronic Lowering of Groundwater Levels Undesirable Results ..... 7-9
7.3.1.2 .... Potential Causes of Undesirable Results ..... 7-11
7.3.1.3 .... Effects on Beneficial Users and Land Use ..... 7-11
7.3.2 Minimum Thresholds - Chronic Lowering of Groundwater Levels ..... 7-13
7.3.2.1 .... Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives ..... 7-13
7.3.2.2 .... Chronic Lowering of Groundwater Level Minimum Thresholds ..... 7-14
7.3.2.3 .... Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators . 7-18
7.3.2.4 .... Effect of Minimum Thresholds on Neighboring Basins ..... 7-19
7.3.2.5 .... Effects of Minimum Thresholds on Beneficial Users and Land Uses ..... 7-19
7.3.2.6 .... Relevant Federal, State, or Local Standards ..... 7-21
7.3.2.7 .... Method for Quantitative Measurement of Minimum Thresholds ..... 7-21
7.3.3 Measurable Objectives - Chronic Lowering of Groundwater Levels ..... 7-21
7.3.3.1 .... Measurable Objectives ..... 7-21
7.3.3.2 .... Interim Milestones ..... 7-22
**7.4 Reduction of Groundwater in Storage Sustainable Management Criteria ..... 7-23**
7.4.1 Undesirable Results - Reduction of Groundwater in Storage ..... 7-23
7.4.1.1 .... Criteria for Defining Undesirable Results ..... 7-23
7.4.1.2 .... Potential Causes of Undesirable Results ..... 7-24
7.4.1.3 .... Effects on Beneficial Users and Land Use ..... 7-24
7.4.2 Minimum Thresholds - Reduction of Groundwater in Storage ..... 7-25
7.4.2.1 .... Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives ..... 7-26

7.4.2.2 .... Reduction of Groundwater in Storage Minimum Thresholds ..... 7-26
7.4.2.3 .... Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators .7-33
7.4.2.4 .... Effect of Minimum Thresholds on Neighboring Basins ..... 7-33
7.4.2.5 .... Effects of Minimum Thresholds on Beneficial Users and Land Uses ..... 7-34
7.4.2.6 .... Relevant Federal, State, or Local Standards ..... 7-35
7.4.2.7 .... Method for Quantitative Measurement of Minimum Thresholds ..... 7-35
7.4.3 Measurable Objectives - Reduction of Groundwater in Storage ..... 7-35
**7.5 Degraded Water Quality Sustainable Management Criteria ..... 7-37**
7.5.1 Undesirable Results - Degraded Water Quality ..... 7-38
7.5.1.1 .... Criteria for Defining Degraded Water Quality Undesirable Results ..... 7-38
7.5.1.2 .... Potential Causes of Undesirable Results ..... 7-40
7.5.1.3 .... Effects on Beneficial Users and Land Use ..... 7-41
7.5.2 Minimum Thresholds - Degraded Water Quality ..... 7-42
7.5.2.1 .... Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives .....7-43
7.5.2.2 .... Degraded Water Quality Minimum Thresholds ..... 7-43
7.5.2.3 .... Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators .7-49
7.5.2.4 .... Effect of Minimum Thresholds on Neighboring Basins ..... 7-50
7.5.2.5 .... Effects of Minimum Thresholds on Beneficial Users and Land Uses ..... 7-51
7.5.2.6 .... Relevant Federal, State, or Local Standards ..... 7-52
7.5.2.7 .... Method for Quantitative Measurement of Minimum Thresholds ..... 7-52
7.5.3 Measurable Objectives - Degraded Water Quality ..... 7-52
7.5.3.1 .... Measurable Objectives ..... 7-52
7.5.3.2 .... Interim Milestones ..... 7-53
**7.6 Depletion of Interconnected Surface Water Sustainable Management Criteria ..... 7-55**
7.6.1 Undesirable Results - Depletion of Interconnected Surface Water ..... 7-56
7.6.1.1 .... Criteria for Defining Depletion of Interconnected Surface Water Undesirable Results ..... 7-65
7.6.1.2 .... Potential Causes of Undesirable Results ..... 7-66
7.6.1.3 .... Effects on Beneficial Users and Land Use ..... 7-66
7.6.2 Minimum Thresholds - Depletion of Interconnected Surface Water ..... 7-67
7.6.2.1 .... Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives .....7-68
7.6.2.2 .... Depletion of Interconnected Surface Water Minimum Thresholds ..... 7-70
7.6.2.3 .... Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators .7-76
7.6.2.4 .... Effect of Minimum Thresholds on Neighboring Basins ..... 7-77
7.6.2.5 .... Effects of Minimum Thresholds on Beneficial Users and Land Uses ..... 7-77
7.6.2.6 .... Relevant Federal, State, or Local Standards ..... 7-78
7.6.2.7 .... Method for Quantitative Measurement of Minimum Thresholds ..... 7-79
7.6.3 Measurable Objectives - Depletion of Interconnected Surface Water ..... 7-79
**7.7 Land Subsidence Sustainable Management Criteria ..... 7-80**

**8 Projects and Management Actions ..... 8-1**
**8.1 How Projects will be Accomplished ..... 8-4**
**8.2 Primary Projects and Management Actions ..... 8-10**
8.2.1 Project 1: SLVWD Expanded Conjunctive Use ..... 8-13
8.2.2 Management Action 1: Groundwater Quality Coordination with Santa Cruz County Environmental Health Division ..... 8-27
**8.3 Supplemental Projects and Management Actions ..... 8-31**
8.3.1 Project 2: SVWD/City of Santa Cruz Conjunctive Use ..... 8-34
8.3.2 Project 3: Expanded Stormwater Recharge ..... 8-55
**9 Groundwater Sustainability Plan Implementation ..... 9-1**
**9.1 Agency Funding ..... 9-3**
**9.2 Estimate of GSP Implementation Costs ..... 9-3**
9.2.1 Governance, Administration and Business Operations ..... 9-5
9.2.1.1 .... Governance and Administrative Services ..... 9-5
9.2.1.2 .... Administrative General Expenses ..... 9-6
9.2.1.3 .... Treasurer Services ..... 9-6
9.2.1.4 .... Annual Financial Audit ..... 9-6
9.2.1.5 .... Legal Counsel ..... 9-6
9.2.2 SGMA Compliance and GSP Implementation ..... 9-8
9.2.2.1 .... GSP Planning and Implementation Services ..... 9-8
9.2.2.2 .... Basin Monitoring ..... 9-8
9.2.2.3 .... Basin Monitoring – SMGWA Specific Expenses ..... 9-9
9.2.2.4 .... Technical Services – As Needed ..... 9-9
9.2.2.5 .... Data Management System ..... 9-9
9.2.2.6 .... GSP Annual Report ..... 9-9
9.2.2.7 .... GSP Periodic Evaluations (5-year) ..... 9-10
9.2.2.8 .... Community Outreach and Engagement ..... 9-10
9.2.3 Items Not Included in Estimate of Implementation Cost ..... 9-10
**9.3 Financial Reserves and Contingencies ..... 9-20**
**9.4 GSP Implementation Schedule ..... 9-21**
**10 References and Technical Studies ..... 10-1**

# Figures

Figure 1-1. Extent of SMGWA GSP Plan Area with Member Agency Boundaries ..... 1-6
Figure 2-1. Groundwater Basins Adjacent to the Santa Margarita Basin ..... 2-2
Figure 2-2. Jurisdictional Areas within the Santa Margarita Basin ..... 2-6
Figure 2-3. San Lorenzo Valley Water District Boundary and Water Systems ..... 2-7
Figure 2-4. Location of Groundwater Contamination Cleanup Sites in the Santa Margarita Basin ..... 2-27
Figure 2-5. Land Use in the Santa Margarita Basin ..... 2-36
Figure 2-6. Location of SVWD Low Impact Development Projects ..... 2-45
Figure 2-7. SVWD Recycled Water Deliveries, 2002-2020 ..... 2-50
Figure 2-8. Beneficial Users of Groundwater in the Santa Margarita Basin ..... 2-60
Figure 3-1. Santa Margarita Basin Topography ..... 3-2
Figure 3-2. Three-Dimensional Topography of the Santa Margarita Basin with Surface Geology (3x exaggeration) ..... 3-3
Figure 3-3. Distribution of Precipitation Across the Santa Margarita Basin ..... 3-5
Figure 3-4. Annual Precipitation and Cumulative Departure from Mean Annual Precipitation in the Santa Margarita Basin ..... 3-6
Figure 3-5. Precipitation Variability Between Climate Models ..... 3-9
Figure 3-6. Annual Reference Evapotranspiration Variability Between Climate Models ..... 3-9
Figure 3-7. Features Defining the Santa Margarita Basin Boundaries ..... 3-11
Figure 3-8. Santa Margarita Basin Stratigraphic Column ..... 3-13
Figure 3-9. Surface Geology of the Santa Margarita Basin ..... 3-14
Figure 3-10. A-A' Geologic Cross-Section through the Santa Margarita Basin (Johnson, 2009) ..... 3-22
Figure 3-11. B-B' Geologic Cross-Section through the Santa Margarita Basin (Johnson, 2009) ..... 3-23
Figure 3-12. C-C' Geologic Cross-Section through the Santa Margarita Basin (Johnson, 2009) ..... 3-24
Figure 3-13. D-D' Geologic Cross-Section through the Santa Margarita Basin (Johnson, 2009) ..... 3-25
Figure 3-14. Soil Characteristics of the Santa Margarita Basin ..... 3-32
Figure 3-15. Recharge Areas in the Santa Margarita Basin ..... 3-34
Figure 3-16. Surface Water Features ..... 3-36
Figure 3-17. Stormflow and Baseflow in San Lorenzo River and Boulder Creek (from Johnson, 2009) ..... 3-37
Figure 3-18. Identified Groundwater Dependent Ecosystems in the Santa Margarita Basin ..... 3-40
Figure 3-19. Detailed Map #1 of Identified Groundwater Dependent Ecosystems ..... 3-41
Figure 3-20. Detailed Map #2 of Identified Groundwater Dependent Ecosystems ..... 3-42
Figure 3-21. Current Water Supply Sources and Service Areas ..... 3-44
Figure 3-22. Supply Well Density Map ..... 3-45
Figure 3-23. Historical Annual Water Use in the Santa Margarita Basin by Source and User ..... 3-49
Figure 4-1. County of Santa Cruz Parcel Development in the San Lorenzo River Watershed ..... 4-5
Figure 4-2. County of Santa Cruz Historical Population ..... 4-6
Figure 4-3. Groundwater Extraction by User Type Relative to Bean Creek ..... 4-7
Figure 4-4. Santa Margarita Aquifer Subareas ..... 4-9
Figure 4-5. Monterey Formation, Lompico Aquifer and Butano Aquifer Subareas ..... 4-12
Figure 4-6. Groundwater Level Monitoring Locations ..... 4-13
Figure 4-7. Santa Margarita Aquifer Hydrographs ..... 4-15
Figure 4-8. Santa Margarita Aquifer Groundwater Elevations and Contours, Spring 2025 ..... 4-20
Figure 4-9. Santa Margarita Aquifer Groundwater Elevations and Contours, Fall 2025 ..... 4-21
Figure 4-10. Monterey Formation Hydrograph ..... 4-26

Figure 4-11. Lompico Aquifer Hydrographs ..... 4-28
Figure 4-12. Lompico Aquifer Groundwater Elevations and Contours, Spring 2025 ..... 4-30
Figure 4-13. Lompico Aquifer Groundwater Elevations and Contours, Fall 2025 ..... 4-32
Figure 4-14. Butano Aquifer Hydrographs ..... 4-34
Figure 4-15. Butano Aquifer Groundwater Elevations and Contours, Spring 2025 ..... 4-37
Figure 4-16. Butano Aquifer Groundwater Elevations and Contours, Fall 2025 ..... 4-39
Figure 4-17. Monitoring Well AB303 MW-3A and AB303 MW-3B Hydrographs Illustrating Vertical Gradients Over Time ..... 4-41
Figure 4-18. Monitoring Well SLVWD Pasatiempo MW-1 and SLVWD Pasatiempo MW-2 Hydrographs Illustrating Vertical Gradients Over Time ..... 4-42
Figure 4-19. Santa Margarita Basin Annual and Cumulative Change of Groundwater in Storage ..... 4-44
Figure 4-20. Total Dissolved Solids Concentrations in Select Wells from 1970-2025 ..... 4-48
Figure 4-21. Total Dissolved Solids Concentrations and Groundwater Elevations in SVWD Well #9 (Monterey Formation) and SVWD #10/10A (Lompico Aquifer) ..... 4-52
Figure 4-22. Total Dissolved Solids Concentrations and Groundwater Elevations in SVWD Well #11A and SVWD #11B (Lompico Aquifer) ..... 4-53
Figure 4-23. Total Dissolved Solids Concentrations and Groundwater Elevations in SVWD Wells #7A, Orchard, and #3B (Lompico/Butano Aquifer) ..... 4-54
Figure 4-24. Distribution of Total Dissolved Solids and Chloride Across the Santa Margarita Basin ..... 4-56
Figure 4-25. Iron Concentrations in Select Wells from 1980-2025 ..... 4-59
Figure 4-26. Manganese Concentrations in Select Wells from 1980-2025 ..... 4-60
Figure 4-27. Historical Iron and Manganese Concentrations and Groundwater Elevations in SLVWD Olympia #2 (Santa Margarita Aquifer) ..... 4-62
Figure 4-28. Historical Iron and Manganese Concentrations and Groundwater Elevations in SVWD Well #10/10A (Lompico Aquifer) ..... 4-66
Figure 4-29. Historical Iron and Manganese Concentrations and Groundwater Elevations in SVWD Well #11B (Lompico Aquifer) ..... 4-67
Figure 4-30. Historical Iron and Manganese Concentrations and Groundwater Elevations in SVWD Well #11A (Lompico Aquifer) ..... 4-68
Figure 4-31. Historical Iron and Manganese Concentrations and Groundwater Elevations in SVWD Well #3B (Lompico/Butano Aquifer) ..... 4-69
Figure 4-32. Historical Iron and Manganese Concentrations and Groundwater Elevations in SVWD Well #7A and Orchard (Lompico/Butano Aquifer) ..... 4-69
Figure 4-33. Arsenic Concentrations in Select Lompico Aquifer Wells from 1990-2025 ..... 4-73
Figure 4-34. Historical Arsenic Concentrations and Groundwater Elevations in SVWD #11A and SVWD #11B ..... 4-74
Figure 4-35. Historical Arsenic Concentrations and Groundwater Elevations in SLVWD Pasatiempo #8 4-75
Figure 4-36. Areas of Elevated Naturally Occurring Groundwater Quality ..... 4-76
Figure 4-37. Potential Groundwater Contamination Sources ..... 4-80
Figure 4-38. Historical Nitrate (as N) Concentrations, 1970-2025 ..... 4-84
Figure 4-39. Historical Nitrate Concentrations and Groundwater Elevations in SLVWD Quail Hollow #4A and #5A (Santa Margarita Aquifer) ..... 4-85
Figure 4-40. Areas of Known Anthropogenic Groundwater Quality Impacts ..... 4-86
Figure 4-41. Total Vertical Land Surface Displacement in Santa Margarita Basin from June 2015 – June 2026 (based on TRE ALTAMIRA Inc. InSAR) ..... 4-96
Figure 4-42. Interconnected Surface Water in the Santa Margarita Basin ..... 4-100
Figure 4-43. Daily Mean Flow on San Lorenzo River at Big Trees ..... 4-101

Figure 4-44. Relationship Between Minimum Flow at Big Trees Gage and Water Year Extraction in the Santa Margaria Aquifer ..... 4-103
Figure 4-45. Relationship Between Minimum Flow at Big Trees Gage and Water Year Extraction in the Santa Margaria Aquifer ..... 4-103
Figure 4-45. Interconnected Surface Water Data Gap Locations ..... 4-106
Figure 4-46. Model Simulated Effects of Groundwater Extractions on Groundwater Discharge to Creeks (Difference between Simulations Without Pumping and With Pumping) **Error! Bookmark not defined.**
Figure 4-47. Model Simulated Effects of Groundwater Extractions on Groundwater Discharge to Bean Creek in Minimum Flow Month ..... 4-113
Figure 5-1. Generalized Hydrologic Cycle from Water Budget BMP (DWR, 2016a) ..... 5-3
Figure 5-2. Precipitation Budget Components ..... 5-5
Figure 5-3. Surface Water Budget Components ..... 5-6
Figure 5-4. Groundwater Budget Components ..... 5-9
Figure 5-5. Historical and Current Precipitation Budget ..... 5-12
Figure 5-6. Historical and Current Surface Water Budget ..... 5-14
Figure 5-7. Historical and Current Groundwater Budget ..... 5-17
Figure 5-8. Historical Cumulative Change of Groundwater in Storage in the Santa Margarita Aquifer ..... 5-22
Figure 5-9. Historical Cumulative Change of Groundwater in Storage in the Monterey Formation ..... 5-22
Figure 5-10. Historical Cumulative Change of Groundwater in Storage in the Lompico Aquifer ..... 5-23
Figure 5-11. Historical Cumulative Change of Groundwater in Storage in the Butano Aquifer ..... 5-23
Figure 5-12. Baseline Projected Precipitation Budget ..... 5-30
Figure 5-13. Baseline Projected Surface Water Budget ..... 5-32
Figure 5-14. Baseline Projected Groundwater Budget ..... 5-34
Figure 5-15. Baseline Projected Cumulative Change of Groundwater in Storage in the Santa Margarita Aquifer ..... 5-38
Figure 5-16. Baseline Projected Cumulative Change of Groundwater in Storage in the Monterey Formation ..... 5-39
Figure 5-17. Baseline Projected Cumulative Change of Groundwater in Storage in the Lompico Aquifer 5-40
Figure 5-18. Baseline Projected Cumulative Change of Groundwater in Storage in the Butano Aquifer .. 5-41
Figure 5-19. Projected Precipitation Budget with Climate Change ..... 5-43
Figure 5-20. Projected Surface Water Budget with Climate Change ..... 5-45
Figure 5-21. Projected Groundwater Budget with Climate Change ..... 5-47
Figure 5-22. Projected Cumulative Change of Groundwater in Storage in the Santa Margarita Aquifer with Climate Change ..... 5-52
Figure 5-23. Projected Cumulative Change of Groundwater in Storage in the Monterey Formation with Climate Change ..... 5-53
Figure 5-24. Projected Cumulative Change of Groundwater in Storage in the Lompico Aquifer with Climate Change ..... 5-54
Figure 5-25. Projected Cumulative Change of Groundwater in Storage in the Butano Aquifer with Climate Change ..... 5-55
Figure 5-26. Historical and Projected Groundwater Extraction in the Unconfined Aquifer ..... 5-59
Figure 5-27. Historical, Current, and Projected Groundwater Extraction in the Confined Aquifer ..... 5-60
Figure 6-1. Groundwater Level Monitoring Network ..... 6-8
Figure 6-2. Groundwater Level Representative Monitoring Network ..... 6-9
Figure 6-3. Groundwater Extraction Wells in the Reduction in Storage Representative Monitoring Network6-14
Figure 6-4. Groundwater Quality Monitoring Network ..... 6-19

Figure 6-5. Groundwater Quality Representative Monitoring Network ..... 6-20
Figure 6-6. Location of Streamflow Gages and Surface Water Quality Monitoring Sites ..... 6-25
Figure 6-7. Location of Groundwater Dependent Ecosystem Monitoring Sites ..... 6-30
Figure 7-1. Unconfined Aquifer Historical and Projected Extraction, Minimum Threshold, and Measurable Objective ..... 7-30
Figure 7-2. Confined Aquifer Historical and Projected Extraction, Minimum Threshold, and Measurable Objective ..... 7-32
Figure 7-3: Cross-Section of Groundwater Level MTs, MOs. and WY2025 Groundwater Levels Relative to Interconnected Streams in the Quail Hollow and Olympia/Mission Springs Subareas ..... 7-73
Figure 7-4. Cross-Section of 2027 GSP Amendment Groundwater Level MTs, MOs. and WY2025 Groundwater Levels Relative to Interconnected Streams in the Olympia/Mission Springs and Mount Hermon / South Scotts Valley Subareas ..... 7-74
Figure 9-1. General Schedule of 5-year Implementation Plan ..... 9-22

# Tables

Table 2-1. Central Coast Basin Plan Groundwater Water Quality Objectives Applicable to the Santa Margarita Basin ..... 2-14
Table 2-2. Central Coast Basin Plan Groundwater and Surface Water Quality Objectives Applicable in the Santa Margarita Basin (Source: Central Coast Regional Water Quality Control Board, 2019) ..... 2-15
Table 2-3. SLVWD Groundwater Production and Groundwater Elevation Monitoring Wells ..... 2-19
Table 2-4. Wells Used for the Scotts Valley Water District Groundwater Management & Monitoring Program ... 2-21
Table 2-5. Wells Used for the Mount Hermon Association Groundwater Management & Monitoring Program ... 2-22
Table 2-6. Santa Margarita Basin Land Use Designation Summary ..... 2-34
Table 2-7. SVWD Low Impact Development Infiltration Volumes ..... 2-43
Table 2-8. Small Water Systems in the Santa Margarita Basin ..... 2-58
Table 2-9. Groundwater Dependent Species Identified for Priority Management ..... 2-62
Table 2-10. Groundwater Dependent Species Identified as Co-Beneficiaries of Priority Species ..... 2-62
Table 2-11. Steelhead and Coho Minimum Passage Criteria ..... 2-64
Table 2-12. Steelhead and Coho Spawning Criteria ..... 2-64
Table 3-1. Santa Margarita Basin Monthly Climate Summary (30-Year Average, updated through WY2025) ..... 3-7
Table 3-2. Principal Hydrogeologic Units Hydraulic Properties ..... 3-27
Table 3-3. Santa Margarita Basin Groundwater Dependent Ecosystem Classification ..... 3-38
Table 3-4. SLVWD Surface Water Diversions ..... 3-46
Table 3-5. Water Year 2025 Santa Margarita Basin Water Use by Source ..... 3-48
Table 4-1. Santa Margarita Basin Septic System Distribution ..... 4-78
Table 4-2. Constituents of Emerging Concern Detections in Raw Source Water Blend and/or Treated Drinking Water at the Graham Hill Water Treatment Plant (2016/2017) ..... 4-90
Table 4-3. Summary of Municipal Water Supply Wells Historical Detections of Organic Compounds ..... 4-92
Table 5-1. Precipitation Budget Components Data Sources and Uncertainty ..... 5-5
Table 5-2. Surface Water Budget Components Data Sources and Uncertainty ..... 5-7
Table 5-3. Groundwater Budget Components Data Sources and Uncertainty ..... 5-10
Table 5-4. Summary of Historical Precipitation Budget ..... 5-11
Table 5-5. Summary of Historical Surface Water Budget ..... 5-13
Table 5-6. Historical Groundwater Budget ..... 5-16
Table 5-7. Summary of Historical Groundwater Budget by Aquifer ..... 5-20
Table 5-8. Summary of Current Precipitation Budget ..... 5-24
Table 5-9.Summary of Current Surface Water Budget ..... 5-25
Table 5-10. Current Groundwater Budget ..... 5-26
Table 5-11. Summary of Current Groundwater Budget by Aquifer ..... 5-27
Table 5-12. Summary of Baseline Projected Precipitation Budget ..... 5-29
Table 5-13. Summary of Baseline Projected Surface Water Budget ..... 5-31
Table 5-14. Summary of Baseline Projected Groundwater Budget ..... 5-33
Table 5-15. Baseline Projected Groundwater Budget by Aquifer ..... 5-36
Table 5-16. Summary of Projected Precipitation Budget with Climate Change ..... 5-42
Table 5-17. Summary of Projected Surface Water Budget with Climate Change ..... 5-44
Table 5-18. Summary of Projected Groundwater Budget with Climate Change ..... 5-46

Table 5-19. Projected Groundwater Budget by Aquifer with Climate Change.....5-49
Table 5-20. Sustainable Yield by Aquifer Compared to Historical, Current Extraction.....5-58
Table 6-1. Applicable Sustainability Indicators in the Santa Margarita Basin.....6-2
Table 6-2. Summary of Groundwater Level Monitoring Network Wells.....6-5
Table 6-3. Metered Extraction Wells.....6-15
Table 6-4. Groundwater Quality Monitoring Network Wells by System.....6-18
Table 6-5. Summary of Groundwater Quality Monitoring Network RMPs.....6-18
Table 6-6. Streamflow Gages, Status, and Use.....6-26
Table 6-7. Groundwater Dependent Ecosystem Representative Monitoring Sites.....6-28
Table 6-8. Climate Stations in the Santa Margarita Basin.....6-33
Table 7-1. Minimum Thresholds, Measurable Objectives, and Interim Milestones for Chronic Lowering of Groundwater Levels.....7-16
Table 7-2. Reduction of Groundwater in Storage Minimum Thresholds by Aquifer Compared to Historical and Current Pumping.....7-27
Table 7-3. TDS Minimum Thresholds and Measurable Objectives.....7-45
Table 7-4. Nitrate (as N) Minimum Thresholds and Measurable Objectives.....7-46
Table 7-5. Arsenic Groundwater Quality Minimum Thresholds and Measurable Objectives.....7-47
Table 9-1. Santa Margarita Groundwater Agency 5-Year Estimated Costs for GSP Implementation.....9-5

# Appendices

Appendix 1A. Definition of SGMA and Groundwater Terms
Appendix 1B. Joint Exercise of Powers Agreement Creating the Santa Margarita Groundwater Agency
Appendix 1C. Santa Margarita Groundwater Agency Guiding Principles
Appendix 2A. Stakeholder Communications and Engagement Plan
Appendix 2B. Comments and Responses on Public Draft GSP
Appendix ~~2E~~3A. Santa Margarita Basin Groundwater Model Updates and Simulations for Groundwater Sustainability Planning
Appendix ~~2C~~4A. Well Hydrographs
Appendix ~~2D~~4B. Well Chemographs
~~Appendix 2E. Santa Margarita Basin Groundwater Model Updates and Simulations for Groundwater Sustainability Planning~~
~~Appendix 2F. Aquifer-Specific Groundwater Budgets~~Appendix 5A. Historical, Current, and Projected Baseline Model Hydrographs
Appendix 5B. Historical, Current, and Projected Baseline with Climate Change Model Hydrographs

Appendix ~~3A~~7A. Representative Monitoring Point Hydrographs with Sustainable Management Criteria
Appendix ~~3B~~7B. Representative Monitoring Point Chemographs with Sustainable Management Criteria
Appendix 8~~4~~A. Full Project and Management Action Summary Table
Appendix ~~5A~~9A. Detailed Explanation of Santa Margarita Groundwater Agency 5-Year Estimated Costs for GSP Implementation

# Acronyms & Abbreviations

1,2-DCE .....1,2-dichloroethylene
AACE.....Advancement of Cost Engineering
AB .....Assembly Bill
AF .....acre-feet
AFY.....acre-feet per year
AMI.....advanced metering infrastructure
amsl .....above mean sea level
AMTB .....Amah Mutsun Tribal Band
ASR.....Aquifer Storage & Recovery
AWPF .....Advanced Water Purification Facility
AWTF .....Advanced Wastewater Treatment Facility
~~Basin Plan .....Water Quality Control Plan, Central Coast Region~~
Basin .....Santa Margarita Groundwater Basin
Basin Plan .....Water Quality Control Plan, Central Coast Region
Basin Model ...Santa Margarita Basin Numerical Groundwater Flow Model
bgs .....below ground surface
BMO .....Basin Management Objective
BMP .....best management practices
C&E Plan .....Communication and Engagement Plan
CALEPA .....California Environmental Protection Agency
CASGEM.....California Statewide Groundwater Elevation Monitoring
CCR.....~~Consumer Confidence Report~~California Code of Regulations
CCRWQCB....Central Coast Regional Water Quality Control Board
CDFW .....California Department of Fish and Wildlife
CEC.....constituents of emerging concern
CEQA.....California Environmental Quality Act
cfs.....cubic feet per second
CGPS.....continuous global positioning station
cis-1,2-DCE~~CISDCE~~ cis-1,2-dichloroethene
COC .....~~chemical~~ constituents of concern
County.....County of Santa Cruz
CWC .....California Water Code
DAC .....Disadvantaged Community
DDW .....State Water Resources Control Board Division of Drinking Water
DMS.....data management system
DPR.....direct potable reuse
DTSC .....California Department of Toxic Substances Control
DWR .....California Department of Water Resources
DWSAP.....Drinking Water Source Assessment and Protection

EIR .....Environmental Impact Report
EVI.....Enhanced Vegetation Index
fte .....full-time equivalent
FY .....fiscal year
GAC .....granular activated carbon
GDE .....groundwater dependent ecosystem
GPCD.....gallons per capita per day
GRRR.....groundwater replenishment reuse regulations
GSA .....Groundwater Sustainability Agency
GSP .....Groundwater Sustainability Plan
GWMP .....Groundwater Management Plan
HCM .....Hydrogeologic Conceptual Model
HCP.....Habitat Conservation Plan
InSAR .....Interferometric Synthetic Aperture Radar
IRWM .....Integrated Regional Water Management
ISW .....Interconnected Surface Water
JPA.....Joint Powers Agreement
LAMP .....Local Area Management Program
LID.....low impact development
LUST.....leaking underground storage tank
MCL.....maximum contaminant level
mg/L.....milligrams per liter
MGA .....Santa Cruz Mid-County Groundwater Agency
MGD .....million gallons per day
MHA .....Mount Hermon Association
MNM.....Monitoring Network Module
MTBE .....methyl-tert-butyl ether
N.....nitrogen
NAVD 88.....North American Vertical Datum of 1988
NDMI.....Normalized Difference Moisture Index
NDVI.....Normalized Difference Vegetation Index
ng/L.....nanograms per Liter
NMFS.....National Marine Fisheries Service
$NO_3$ .....nitrate
NOI .....Notice of Intent
O&M.....operations and maintenance
OWTS .....Onsite Wastewater Treatment Systems
PCE .....tetrachloroethene
QA.....quality assurance
Qal.....Alluvium
QC.....quality control

Qt.....Terrance Deposits
RMP .....Representative Monitoring Point
RP.....Reference Point
SCEH .....County of Santa Cruz Environmental Health
SGMA .....Sustainable Groundwater Management Act
SLVWD .....San Lorenzo Valley Water District
SMC .....sustainable management criteria
SMGWA .....Santa Margarita Groundwater Agency
SMGWBAC...Santa Margarita Groundwater Basin Advisory Committee
SOC.....synthetic organic compound
SqCWD.....Soquel Creek Water District
SVWD.....Scotts Valley Water District
SWRCB.....State Water Resources Control Board
SWS .....small water system
TAG .....Surface Water Technical Advisory Group
Tbl.....Lower Butano
Tbm.....Middle Butano
Tbu.....Upper Butano
TCE.....trichloroethene
TDS.....total dissolved solids
Tl.....Locatelli Formation
Tlo.....Lompico Sandstone
Tm.....Monterey Formation
TMDL .....Total Maximum Daily Load
TNC.....The Nature Conservancy
Tp.....Purisima Formation
Tsc.....Santa Cruz Mudstone
Tsm .....Santa Margarita Sandstone
UCMR.....Unregulated Contaminant Monitoring Rule
USBR .....United States Bureau of Reclamation
USDA.....United States Department of Agriculture
USEPA.....United States Environmental Protection Agency
USFWS .....United States Fish and Wildlife Service
USGS .....United States Geological Survey
UST.....underground storage tank
UWMP .....Urban Water Management Plan
VC.....vinyl chloride
VOC .....volatile organic compound
WAAP.....Wasteload Allocation Attainment Program
WHO.....World Health Organization
WISKI.....Water Information Systems by Kisters

WRF .....Water Reclamation Facility
WTP .....Water Treatment Plant
WWTF .....Wastewater Treatment Facility
WY .....water year

# EXECUTIVE SUMMARY

The State of California enacted the Sustainable Groundwater Management Act (SGMA), effective January 1, 2015, as the first legislation in the state's history to mandate comprehensive sustainable groundwater resources management. The Santa Margarita Groundwater Agency (SMGWA) was formed under SGMA to develop the Groundwater Sustainability Plan (GSP or Plan) for the Santa Margarita Groundwater Basin (Basin). The GSP describes how the SMGWA intends to manage groundwater to achieve groundwater sustainability and meet the requirements of SGMA. The plan provides the basis for ongoing management of the Basin by SMGWA to ~~both~~ achieve sustainability ~~in the 20-year planning horizon~~by 2042 ~~and maintain sustainability over the 50-year implementation horizon specified by SGMA~~. By following the GSP, SMGWA, its cooperating agencies, and other local stakeholders will collaboratively manage the Basin to maintain a safe and reliable groundwater supply for all beneficial groundwater uses and users.

This GSP is organized into sections per the California Department of Water Resources (DWR) guidance (DWR, 2016).

The Introduction describes SMGWA's formation and organization, and it introduces the sustainability goals for the Basin. The Plan Area and Basin Setting describe~~s~~ current knowledge of the physical aspects of the Basin, relying on a multitude of studies conducted by the SMGWA's cooperating agencies. ~~It~~ The Groundwater Conditions section includes a summary of current basin conditions, including groundwater levels, groundwater quality, and interconnected surface water. The Water Budget~~s~~ section provides historical, current, and projected water budgets based on groundwater model simulations ~~results~~. The groundwater conditions are used to identify representative Monitoring Networks ~~is information is used in the GSP to~~ and guide development of Sustainable Management Criteria (SMC) for the SMGWA to reach during the GSP implementation period. In order for the SMGWA to achieve ~~the~~ sustainability ~~goals and SMC~~, additional P~~p~~rojects and M~~m~~anagement A~~a~~ctions (PMAs) documented in the GSP may ~~likely~~be needed ~~to achieve sustainability~~~~to be implemented~~. ~~The GSP introduces potential projects and management actions~~

Groundwater Sustainability Plan Sections

- Executive Summary
- Section 1. Introduction
- Section 2. Plan Area
- Section 3. ~~&~~ Basin Setting
- Section 4~~3~~. Groundwater Conditions
- Section 5. Water Budget
- Section 6. Monitoring Networks
- Section 7. Sustainable Management Criteria
- Section 8~~4~~. Projects & Management Actions
- Section 9~~5~~. GSP Implementation
- ~~Section 10~~6. ~~References & Technical~~
- ~~Section 10. References and Studies~~

~~that may be considered by the SMGWA~~Finally, ~~the~~ GSP Implementation ~~and provides details on how and when they may be implemented to achieve sustainability. The GSP also~~ describes how the SMGWA intends to ~~comply with SGMA requirements for monitoring and reporting~~implement the plan ~~-~~and provides an estimated cost and schedule for the ~~first~~ next 5 years ~~of GSP implementation~~.

## Introduction

The SMGWA has developed the Santa Margarita Basin GSP to provide a roadmap for achieving groundwater sustainability in the Basin. The Introduction section of the GSP describes in detail the SMGWA organization and management structure, and the GSP sustainability goal~~, and defines the many terms specific to SGMA and groundwater used in the GSP~~.

The SMGWA has legal authority to perform duties, exercise powers, and accept responsibility for managing groundwater sustainably within the Basin. The SMGWA was formed through a Joint Powers Agreement (JPA) in June 2017, among the Scotts Valley Water District (SVWD), the San Lorenzo Valley Water District (SLVWD), and the County of Santa Cruz (County). The SMGWA is governed by a Board of Directors comprising 2 representatives from each member agency, single representatives from the City of Scotts Valley, City of Santa Cruz, and Mount Hermon Association (MHA), and 2 private well owners.

The Introduction ~~section~~ includes the sustainability goal for the Basin used as a guide to develop the GSP. In general, ~~T~~the ~~The Basin~~SMGWA's sustainability goal is to achieve and maintain groundwater conditions that support beneficial uses and users and sustain the long-term health of the Basin's community, economy, and environment. ~~Groundwater sustainability is generally defined as follows:~~

~~• Providing a safe and reliable groundwater supply that meets the current and future needs of beneficial users~~

~~• Supporting groundwater sustainability measures and projects that enhance a sustainable and reliable groundwater supply~~

~~• Providing for operational flexibility within the Basin by supporting a drought reserve that accounts for future climate change~~

~~Planning and implementing cost-effective projects and activities to achieve sustainability~~

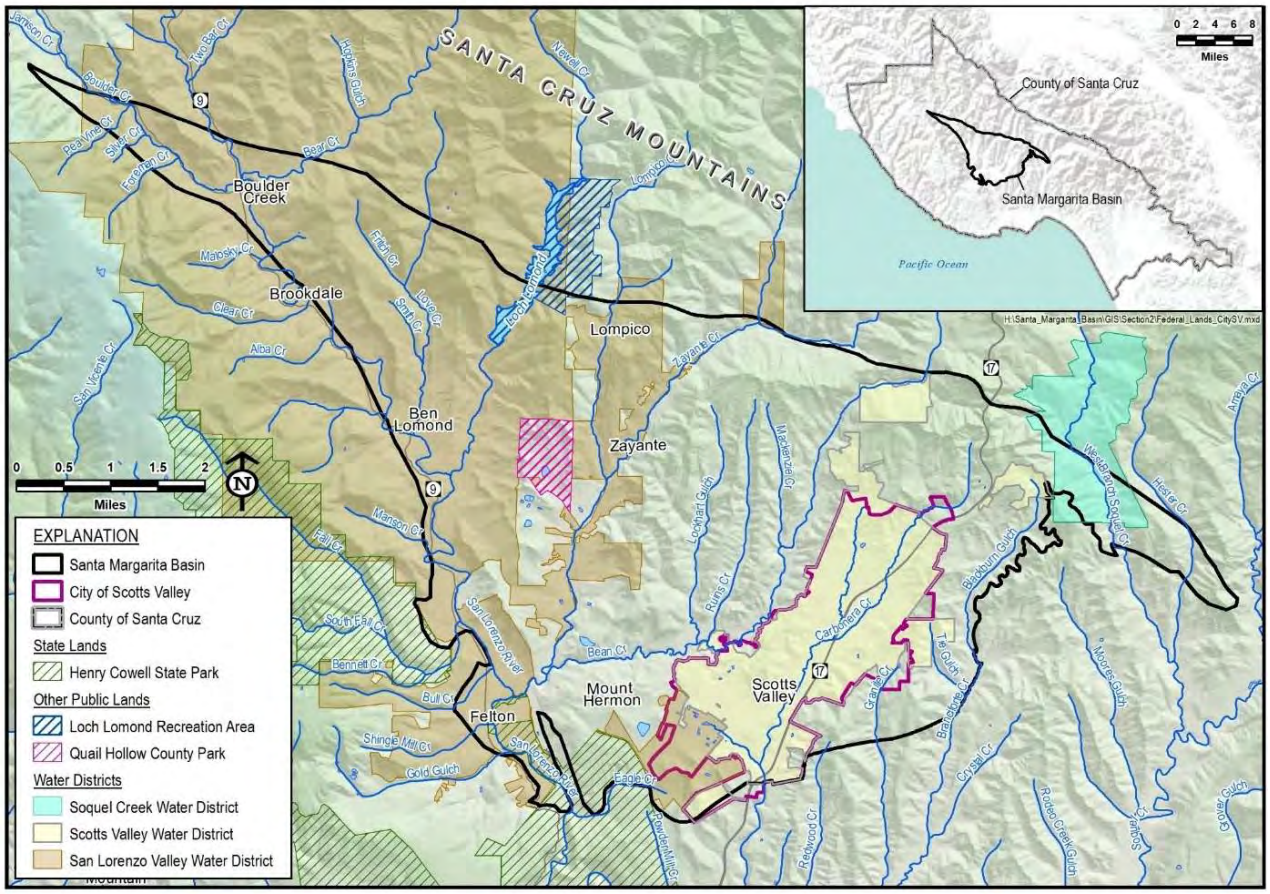
The ~~SMGWA~~ GSP will successfully be implemented ~~the GSP~~ by monitoring and maintaining ~~groundwater~~ Basin conditions and ~~implementing~~practicing cost-effective adaptive management~~managing groundwater and surface water use conjunctively and by implementing projects and management actions~~, as needed, to meet the sustainability goal.

## Plan Area and Basin Setting

The Plan Area and Basin Setting section summarizes the Basin physical properties and describes how groundwater is historically used and ~~currently~~ managed ~~in the Basin~~by SMWGA member agencies and other beneficial users. ~~and describes groundwater conditions in the past, present, and future.~~

### ~~Description of the~~ Plan Area

The Santa Margarita Groundwater Basin is a 34.8-square-mile area defined in DWR's




Bulletin 118, which is the State's official publication on the occurrence and nature of groundwater in California ~~(**Error! Reference source not found.**)~~. The Basin forms a roughly triangular area that extends from Scotts Valley in the east, to Boulder Creek in the northwest, to Felton in the southwest. The Basin is bounded on the north by the Zayante trace of the active, strike-slip Zayante-Vergeles fault zone, on the east by a buried granitic high that separates the Basin from Santa Cruz Mid-County Basin, and on the west by the Ben Lomond fault, except where areas of alluvium lie west of the fault. The southern boundary of the Basin with the West Santa Cruz Terrace Basin is located where Tertiary sedimentary formations thin over a granitic high and give way to young river and coastal terrace deposits.

Almost half of the Basin is classified as open space with much of that being moderately rugged, forested terrain. Rural residential development is the next largest land use type, followed by smaller suburban developments in the communities of Scotts Valley, Boulder Creek, Felton, Ben Lomond, and Lompico. Approximately ~~29,000~~30,600 people reside in the Basin~~, and about 63% of these people live in census-designated communities. The remaining population (about 37%) live in~~

Figure ES- 1. Santa Margarita Basin Location

~~rural areas~~. The City of Scotts Valley is the only local entity with land use jurisdiction. The County has land use jurisdiction for all unincorporated areas outside of Scotts Valley. Commercial land use is concentrated in the City of Scotts Valley and the community of Felton. Much of this development occurred during a period of population growth between 1980 and 2000, which coincided with construction of commercial and industrial complexes. General Plans for the County and City of Scotts Valley are reviewed in the GSP to identify local development goals and how the GSP can operate within these confines

Water supply in the Basin is sourced from groundwater, surface water, springs, and recycled water. The SLVWD and SVWD are the 2 largest water suppliers in the Basin, with both dependent on local water sources.

SLVWD's water supply is from surface water diverted, just outside of the basin, on tributaries of the San Lorenzo River, and from springs and groundwater. The SLVWD supplies water to a 5.6-square-mile service area with about 13,000 customers in the Basin.

SVWD uses groundwater exclusively for potable supply and recycled water for non-potable supply. The SVWD supplies water to a 5.5-square-mile service area with about 10,700 customers in the Basin.

The remaining approximately 5,300 people residing in the Basin use groundwater pumped by small water systems or their own private domestic wells. MHA is the largest private water supplier that includes a year-round conference center and camp that serves more than 60,000 guests each year and a permanent community of approximately 1,300 people. There are 12 small water systems in the Basin serving a population of about 1,000. Springs or groundwater are the source of water for 11 of the 12 small water systems. Based on residential parcels that are not served water by one of the water districts, an estimated 777 private wells are pumping less than 2 acre-feet per year (AFY) that supply water to about 3,000 people.

The City of Santa Cruz does not pump any groundwater in the Basin. However, it is an indirect user of groundwater in the Basin because the surface water it diverts from the San Lorenzo River partially comprises baseflows supported by Basin groundwater discharge to creeks. It does own and operate the 2.8-billion-gallon capacity Loch Lomond Reservoir that it uses for water storage. The City has 2 diversion points on the San Lorenzo River: at Felton within the Basin and at Tait Street 5 miles downstream of the Basin. The San Lorenzo River provides roughly 55% and Loch Lomond (Newell Creek) provides roughly 14% of Santa Cruz's municipal water supply.

In addition to public supply and private domestic use, groundwater is used for a few commercial and industrial purposes. It is used for dust control and operations at a single remaining sand quarry and for large-scale landscaping and pond filling at a few locations. There are also a few small wineries that ~~cumulatively~~ irrigate ~~less than 2 acres~~ with groundwater.

The SLVWD and SVWD, prior to SGMA, managed groundwater in the Basin ~~and developed a number of water management~~

~~plans includin~~through their~~g~~ master plans, surface water management plans, and independent analyses of water supply availability and reliability~~ for the Basin~~. The information generated in past management efforts ~~is~~ was instrumental in developing this GSP.

Existing conjunctive use strategies, low impact development, conservation, recycled water, and other water efficiency programs have been used successfully by the water districts to manage groundwater use and to lower potable demand. The water districts comply with all regulatory water quality testing and Drinking Water Source assessments for active supply wells.

The County is also involved in a variety of management efforts related to water quality, stormwater management, threatened and endangered species monitoring, and watershed and stream habitat protection. The County is responsible for all permitting for well construction and destruction. ~~If needed, the County may update its well ordinance to implement elements of this GSP.~~

Regulatory agencies are involved in protecting the Basin's ~~overall good~~ groundwater quality. The County has been working for decades to reduce nitrate loading of surface water. The County's Local Area Management Plan, developed in 2021, allows for the continued use of septic systems in Santa Cruz County while providing protection of water quality and public health. The Central Coast Regional Water Quality Control Board and Santa Cruz County Environmental Health (SCEH) ~~is~~ are responsible for overseeing point source groundwater pollution from chemical spills or leaks. Several groundwater contamination sites in Scotts Valley and Felton have had past remediation of volatile organic compounds (VOC) and gasoline-related chemicals in groundwater. These remediation programs have generally been resolved and there are no sites undergoing active groundwater remediation at present.

Groundwater dependent ecosystems (GDEs) in the Basin support threatened and endangered species. Priority species identified in the GSP that rely on GDEs in the Basin include steelhead trout, coho salmon, lamprey, western pond turtle, California giant salamander, and California red-legged frog. Ongoing programs such as the City of Santa Cruz Habitat Conservation Plan (HCP) and Santa Cruz County's Juvenile Steelhead and Stream Habitat Monitoring Program have monitored steelhead density and stream habitat since 1994, but clear associations between groundwater extraction and a reduction in fish density or available habitat has not been made. ~~The species and habitat data are compiled into an annual report and a geodatabase for spatially referenced information. This work is ongoing and can be used to establish links between~~The GSP is integrated with these plans by establishing groundwater level and extraction SMC that aim to maintain groundwater conditions that support streamflow, ~~groundwater conditions,~~ GDE habitat, and ~~presence or absence of priority~~ aquatic species.

GSP development is a collaborative effort among the SMGWA's cooperating agencies, ~~and~~ technical consultants, and other local stakeholders. Decisions shaping policy are made by the SMGWA Board of Directors

and informed by public input ~~from resource management agencies, community members, and interested stakeholders~~. Extensive public outreach and engagement efforts prior to and during GSP development are documented in a Communication and Engagement Plan (C&E Plan) and public comment records.

The GSP considers all beneficial uses and users, in accordance with California Water Code (CWC) §106.3 which recognizes that "every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes." Beneficial users of groundwater recognized by the GSP ~~in the Basin identified in the C&E Plan~~ include municipal water suppliers, agricultural users, private domestic well owners, small water systems, local land use planning agencies, surface water users, ecological users, California Native American Tribes, disadvantaged communities, protected lands (including recreational areas), and public trust uses (including wildlife, aquatic habitat, fisheries, recreation, and navigation).

~~When developing the GSP, the SMGWA considered impacts on all beneficial uses and users, including domestic well owners, Disadvantaged Communities (DACs), and priority species. California Water Code (CWC) §106.3 recognizes that "every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes." The Human Right to Water bill extends to all Californians, including disadvantaged individuals, groups, and communities in rural and urban areas.~~

## Basin Setting

The ~~basin~~ Basin ~~setting~~ Setting section ~~is described in the form of~~provides the ~~a~~ hydrogeologic conceptual model (HCM) for the GSP. ~~to provide~~The HCM documents the current ~~an~~ understanding of the Basin's general physical characteristics ~~in the Basin~~ related to regional hydrology, land use, geology and geologic structure, groundwater quality, principal aquifers, and aquitards. The HCM also provides the context to develop ~~Basin~~ water budgets, the GSP groundwater model~~s~~, and monitoring networks. The HCM was developed ~~based on~~using ~~-~~prior studies and monitoring data collected by cooperating agencies over the past ~~30~~ 35 years.

The Basin's climate is classified as Mediterranean, characterized by warm summers and mild winters. Almost all precipitation occurs from November through April. Due to increased elevation and the orographic effect of Ben Lomond Mountain west of the Basin, precipitation increases across the Basin east to west from about 42 inches to 52 inches per year.

The Basin's subsurface consists of interbedded sandstone, siltstone, mudstone, and shale overlying granitic and metamorphic rocks, all of which have been folded into a geologic trough called the Scotts Valley Syncline. The sandstone units in the geologic sequence are the principal aquifers that supply much of the groundwater produced for local water supply. The Basin's principal aquifers are the Santa Margarita, Lompico, and Butano Sandstones. The Monterey Formation is an aquitard between the Santa Margarita and Lompico Sandstones. The following describes the general characteristics of the principal aquifers and Monterey Formation:

- The **Santa Margarita aquifer** is the shallowest principal aquifer, with widespread surface exposures in the southern and central portions of the Basin. It is a high-yielding aquifer that is critical to SLVWD public supply, creek baseflow, and private ~~domestic~~ water supply.

- The **Monterey Formation**, a low-yielding aquitard that is only used for ~~domestic~~ private and small system water supply. ~~found at relatively shallow depths and not for municipal supply.~~ The low permeability formation ~~Monterey Formation interacts with surface water where it outcrops in creek beds. Its low permeability~~ limits recharge of the underlying Lompico aquifer and is associated with surface water discharge and springs sourced by the overlying Santa Margarita aquifer.

- The **Lompico aquifer** is used extensively for municipal supply in the Mount Hermon / Scotts Valley area where the formation is thickest. This mostly confined aquifer has significantly less direct recharge from precipitation than the Santa Margarita aquifer because of its much smaller surface exposure. The area where the Monterey Formation is absent beneath the Santa Margarita aquifer in ~~the~~ southern Scotts Valley / Camp Evers ~~area~~ is important for groundwater recharge of the Lompico aquifer.

- The **Butano aquifer** is the deepest of the productive aquifers and is only used for water supply in northern Scotts Valley. It is recharged by surface water and precipitation

where it is exposed along the Basin's northern boundary. SVWD is the only municipal user of the Butano aquifer, although private well owners pump from it in areas where it occurs at or close to the surface.

Precipitation is the main source of natural groundwater recharge to the Basin's aquifers. It enters the shallowest aquifers either as direct infiltration through the soil or indirectly from streamflow infiltrating through the streambed. Most creeks in the Basin are fed by groundwater discharges with groundwater accounting for most summer and fall baseflows.

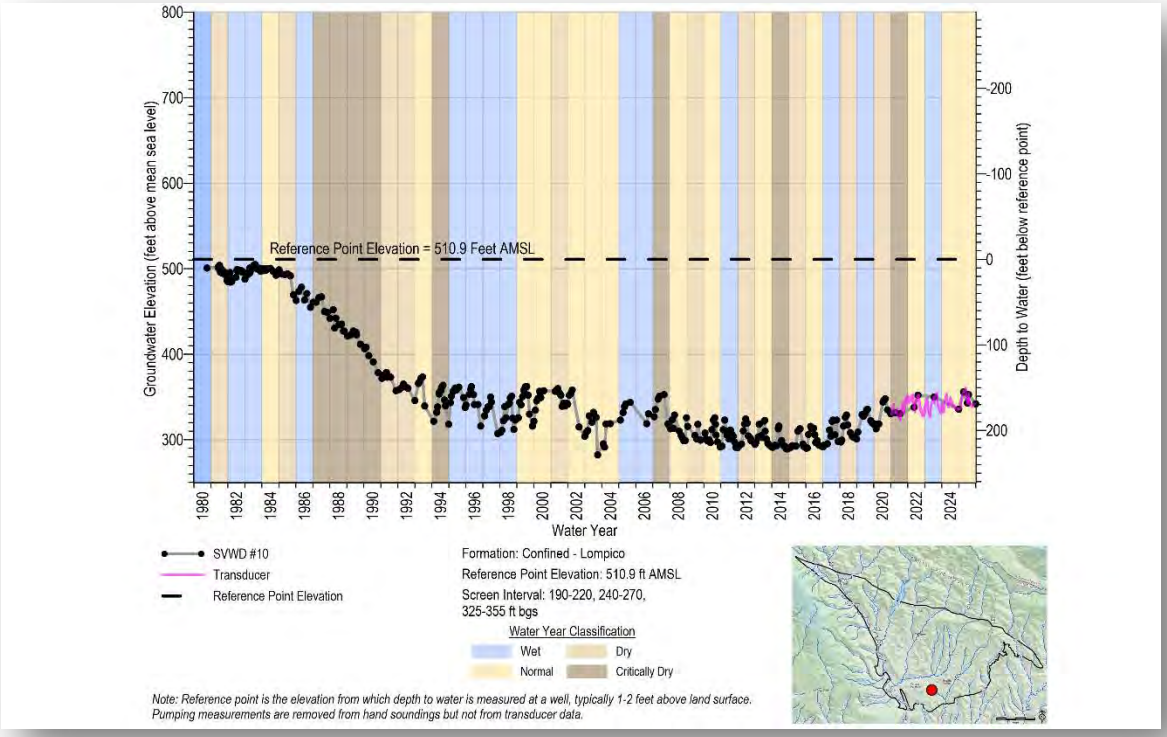
The major creeks and river in the Basin include the San Lorenzo River, Boulder Creek, Love Creek, Newell Creek, Lompico Creek, Zayante Creek, Bean Creek, and Carbonera Creek. Many of these are home to protected species. GDEs are widespread through the Basin and consist of springs, riverine, riparian, open water and groundwater supported wetlands. Fall Creek and the San Lorenzo River have bypass flow requirements that limit diversion timing and rates at certain times of the year.

~~SMGWA cooperating agencies regularly monitor groundwater elevations, groundwater extraction, groundwater quality, and surface water flow and quality for groundwater management and operations of their water systems. These data are critical for evaluation of past and current groundwater conditions.~~

The HCM is relatively well understood after decades of evaluation and studies. ~~Data gaps in the HCM coincide with areas of uncertainty in the GSP. The primary data gap is a lack of monitoring wells in parts of the basin that are not provided public water supply and have concentrated private well extractions. These include areas where groundwater is connected to surface water and areas where there is no nearby creek. Additionally, t~~The only remaining data gap identified in the GSP is the lack of a dedicated monitoring well in the deep Butano aquifer ~~is poorly understood because it only has 2 dedicated monitoring wells.~~where it is used for municipal water supply. ~~**In parts of the Basin, data gaps lead to uncertainty on how aquifers interact with each other and surface water, and how they respond to stresses such as groundwater pumping and reduced precipitation. Eight new monitoring wells to be completed in 2022 will address these data gaps.**~~

**Groundwater Conditions**

Groundwater ~~conditions in the Basin are generally currently sustainable because groundwater~~ levels ~~are~~have been stable to increasing over the past 20 years and at a level that ~~is suitable for~~supports all beneficial uses and users. However, there are areas of the Basin that historically experienced groundwater level declines prior to SGMA that would benefit from continued groundwater level recovery to provide a drought reserve.

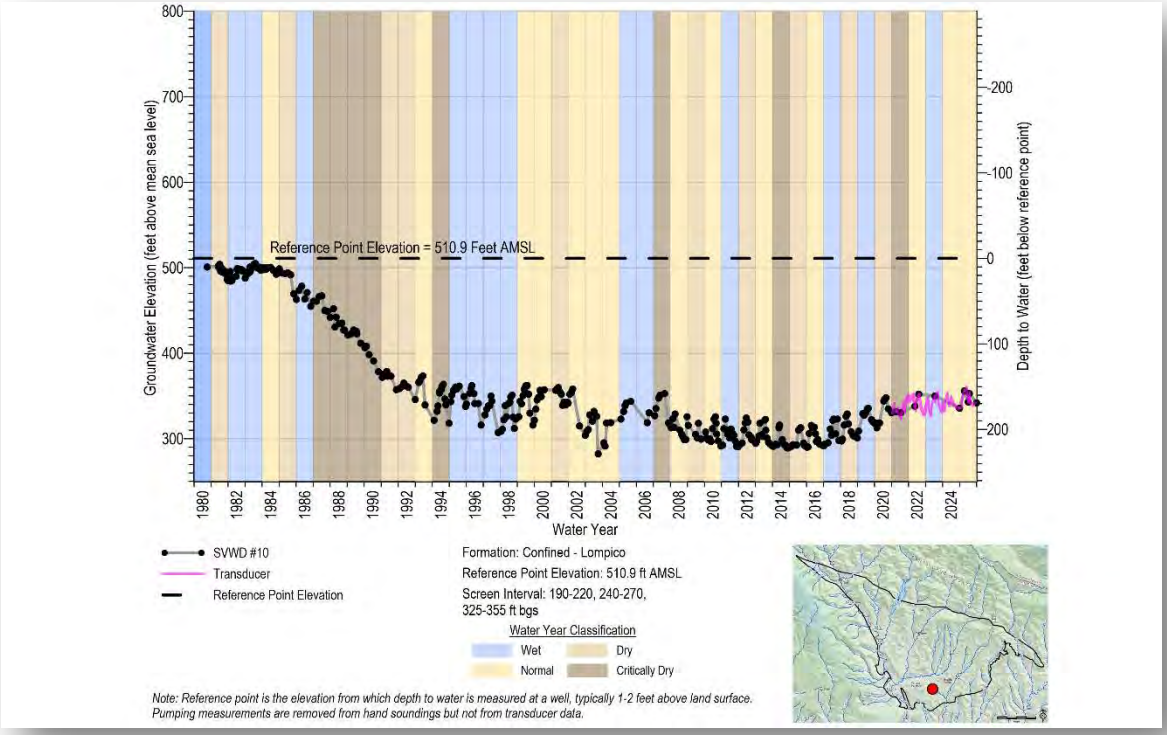


Historically, groundwater levels in the Mount Hermon / South Scotts Valley area started to decline as early as the 1970s when there was extensive development in the south Scotts Valley area. Groundwater level declines were exacerbated by an 11-year drought starting in 1984. ~~, with the exception of the Mount Hermon / South Scotts Valley area where there are lowered groundwater levels in 2 of the Basin's primary aquifers.~~ In this area, a portion of the Santa Margarita aquifer ~~is~~ has been dewatered ~~due to a 30- to 40-foot drop in groundwater level~~, and the Lompico aquifer has had a 150- to 200-foot groundwater level decline as shown on Figure ES- 2. Groundwater levels

~~Groundwater levels in both aquifers started to decline as early as the 1970s when there was extensive development in the south Scotts Valley area. Groundwater level declines were exacerbated by an 11-year drought starting in 1984. During this drought, the Scotts Valley area experienced an average rainfall deficit of 8.6 inches relative to the long-term average annual rainfall of 42 inches.~~

~~Coinciding with a climate-driven reduction of natural aquifer recharge, water demand in the Basin peaked thereby further worsening groundwater conditions. At this time, there were a number of different groundwater users pumping from the Santa Margarita aquifer in the Mount Hermon / South Scotts Valley area including 2 groundwater contamination remediation systems, Valley Gardens golf course, Hanson Quarry, Manana Woods Mutual Water Company, MHA, SVWD and SVVD.~~

Figure ES- 2. Hydrograph at SVWD #10 in the South Scotts Valley Area Showing Long-Term Decline of Groundwater Elevations




~~As Santa Margarita aquifer groundwater levels fell as much as 40 feet during the drought, levels~~ dropped to pump intakes in several wells screened in the Santa Margarita aquifer and upper parts of the Lompico aquifer, including MHA, SLWVD, and SVWD wells, forcing them to drill new wells screened in deeper parts of the Lompico aquifer. Groundwater extraction has decreased since the mid-1990s and groundwater levels are recovering. Currently, groundwater levels are close to levels observed in 1994.

Even though the Santa Margarita aquifer recharges quickly when there is average or better rainfall, its groundwater levels in the Mount Hermon / South Scotts Valley area have not recovered much from the initial decline that ended in 1994. The main reason ~~it has not had much~~for a lack of recovery is thought to be that lowered groundwater levels, especially in the dewatered portions of the aquifer, cause water infiltrating at the

surface to pass through the Santa Margarita aquifer and into the underlying formations instead of ~~r~~ remaining in the Santa Margarita aquifer. Underlying formations are either the top of the low permeability Monterey Formation from where it mostly flows out at surface seeps to Bean Creek, or the Lompico aquifer where it is in direct contact with the Santa Margarita aquifer due to the absence of the Monterey Formation.

~~Other contributing factors that have leading to decreased recharge of the Santa Margarita aquifer since the 1980s include conversion of the City of Scotts Valley to a sewer system that has reduced the amount of septic systems return flow to groundwater, and increased development that has reduced the amount of pervious area available for recharge.~~

~~The Santa Margarita aquifer in the Olympia area of the Basin also has gradual declining groundwater levels over the past 35 years. With a decline of about 20 feet (average rate of 0.6 foot per year), the change is much smaller than declines experienced in the South Scotts Valley area.~~

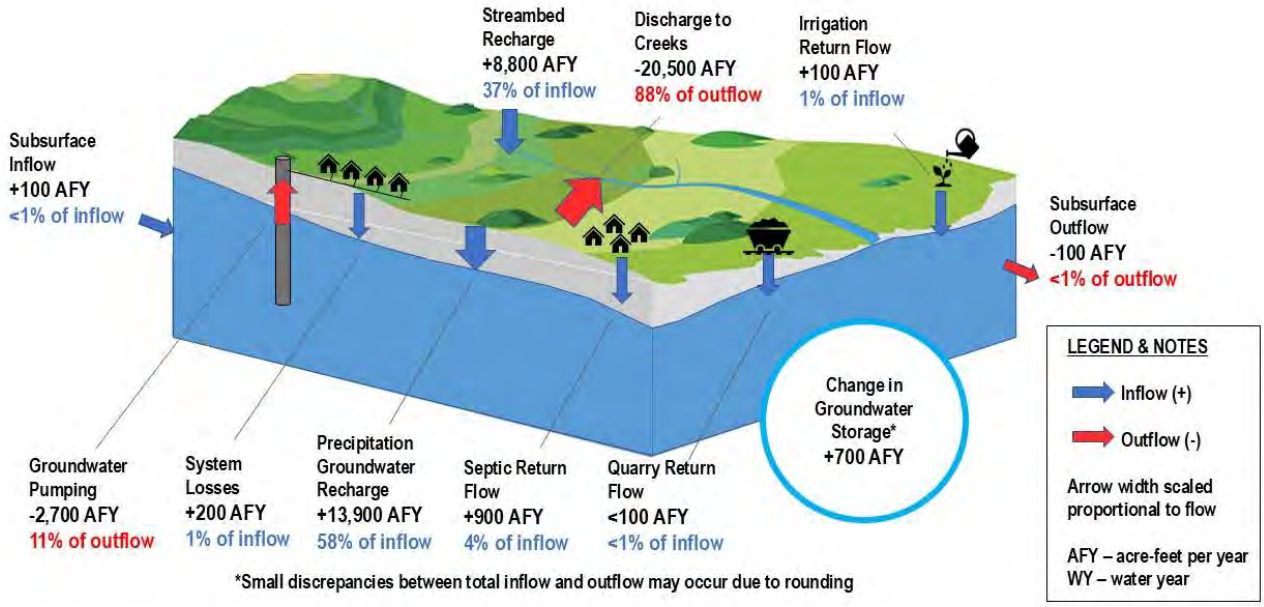
Climate change is projected to generally result in more variable precipitation (i.e., longer and more extreme droughts with fewer but more extreme rainfall events), slightly lower total precipitation, and warmer temperatures in comparison to current conditions. These climate conditions will 1) reduce natural recharge to groundwater causing further lowering of groundwater levels if groundwater extraction is not supplemented with other sources, and 2) reduce available surface water which will, at times, result in greater pressure on groundwater to meet water demands within the Basin.

~~Lowered~~ Declining groundwater levels in certain parts of the Basin ~~have caused a correspondcorresponded to historicalcaused~~ consistent groundwater in storage losses ~~ing reduction in groundwater stored in the Basinstorage~~. However, since the passage of SGMA in 2015, reduced groundwater extraction has allowed groundwater levels to stabilize and recover, resulting in a balanced water budget~~Since the 1980s, and even possibly starting in the 1960s, there has been a consistent loss of groundwater stored in the Basin due primarily to over-pumping the Lompico aquifer in the Mount Hermon / South Scotts Valley area~~.

Figure ES- 3. Hydrograph at SVWD #10 in the South Scotts Valley Area Showing Long-Term Decline of Groundwater Elevations

Groundwater in the Basin is generally of good quality and does not regularly exceed primary drinking water standards. However, both naturally occurring and anthropogenic groundwater quality constituents of concern (COCs) are present in some aquifers and areas. The main naturally occurring groundwater quality concerns in the Basin are salinity (measured as total dissolved solids and chloride~~), iron, manganese,~~) and arsenic. The main anthropogenic groundwater quality concern~~s~~ ~~are~~ is nitrate ~~and constituents of emerging concern (CEC) which are mainly~~ from septic and sewer discharges. Historically, point source contaminant releases impacted aquifers used for water supply, but these releases have either been remediated or naturally attenuated-. ~~together with organic compounds from environmental cleanup sites or other unidentified local releases.~~

Surface water is connected to groundwater throughout the Basin and groundwater discharge to creeks is an important source of creek baseflow to support GDEs and priority species habitat. The highly permeable nature of the Santa Margarita aquifer and its proximity to surface water features lends it to being the main source of baseflows to creeks. ~~The Butano aquifer also contributes a significant volume of baseflow where it outcrops and is intersected by numerous creeks along the Basin's northern boundary. The upper Bean Creek watershed and its tributaries are one of the few areas where streams lose water to groundwater. This is an important source of groundwater recharge to the aquifers.~~ Groundwater elevations ~~in the Basin's only 2 monitoring wells near creeks show groundwater levels~~in the Santa Margarita aquifer are consistently higher than the streambed, indicating that groundwater is contributing to streamflow ~~in these locations~~ year-round.~~The Butano aquifer also contributes a significant volume of baseflow where it outcrops and is intersected by numerous creeks along the Basin's northern boundary. The upper Bean Creek watershed and its tributaries are one of the few areas where streams lose water to groundwater. This is an important source of~~



~~groundwater recharge to the aquifers. Four additional shallow monitoring wells will be completed in 2022 to improve understanding of interconnected surface water, to add as representative monitoring points, and to improve how the groundwater model simulates groundwater and surface water interactions.~~

There is no known evidence of land subsidence in the Basin. The consolidated geology makes subsidence unlikely. Subsidence caused by land surface movement related to tectonics and other phenomena besides groundwater pumping is not subject to SGMA.

## Water Budget

~~In compliance with SGMA,~~The GSP includes 4 water budgets ~~in the GSP~~ – ~~cover~~ historical pre-SGMA conditions (1985-~~2018~~2014), current conditions (~~2010~~2015-~~2018~~2025), and projected conditions (~~2020~~2026-2072) ~~timeframes~~both with and without climate change. The water budgets ~~are developed from an inventory of~~ summarize inflows and outflows for the land surface, ~~precipitation,~~ surface water, and groundwater ~~inflows and outflows~~systems. ~~.~~

~~Water inflow and outflow volumes across the land surface, via surface water, and for groundwater are estimated using the Santa Margarita Basin groundwater model.~~

~~The availability of water for groundwater recharge is driven by precipitation, surface runoff to creeks, and evapotranspiration.~~ Surface water flows into and out of the Basin, and is connected to groundwater in ~~much of the Basin~~many stream reaches. Although there are months where there are losing reaches, creeks in the Basin consistently have a net annual gain from groundwater contributions regardless of water year type. Overall, there is about 2.5 times more groundwater discharge to creeks than creek recharge of groundwater. This results in widespread gaining stream conditions and contributes to greater surface water outflow than inflow. ~~Water flows both from creeks to groundwater and vice versa based on the gradient between creek stage and adjacent groundwater levels.~~

~~Figure ES- 4~~Figure ES-3 graphically depicts the ~~historical~~current (~~1985~~2015-~~2018~~2025)

- Santa Margarita Basin Groundwater Model

~~To be used as a tool for developing the GSP, a~~An existing groundwater model was improved and updated as a tool to support GSP planning and implementation. The model was first developed in 2006 and updated ~~in 2015, 2016, and 2017~~to support the 2022 GSP development and 2027 GSP Amendment. Structural and model input refinements made for the 2022 GSP are documented in ~~For the model to be a suitable tool for quantifying water budgets, simulating future~~

average annual groundwater budget inflows, outflows, and change in storage. The groundwater budget demonstrates the importance of streamflow interactions in the Basin. ~~The c~~Current groundwater pumping averages 2,700 acre-feet per year (AFY), while groundwater discharge to creeks is

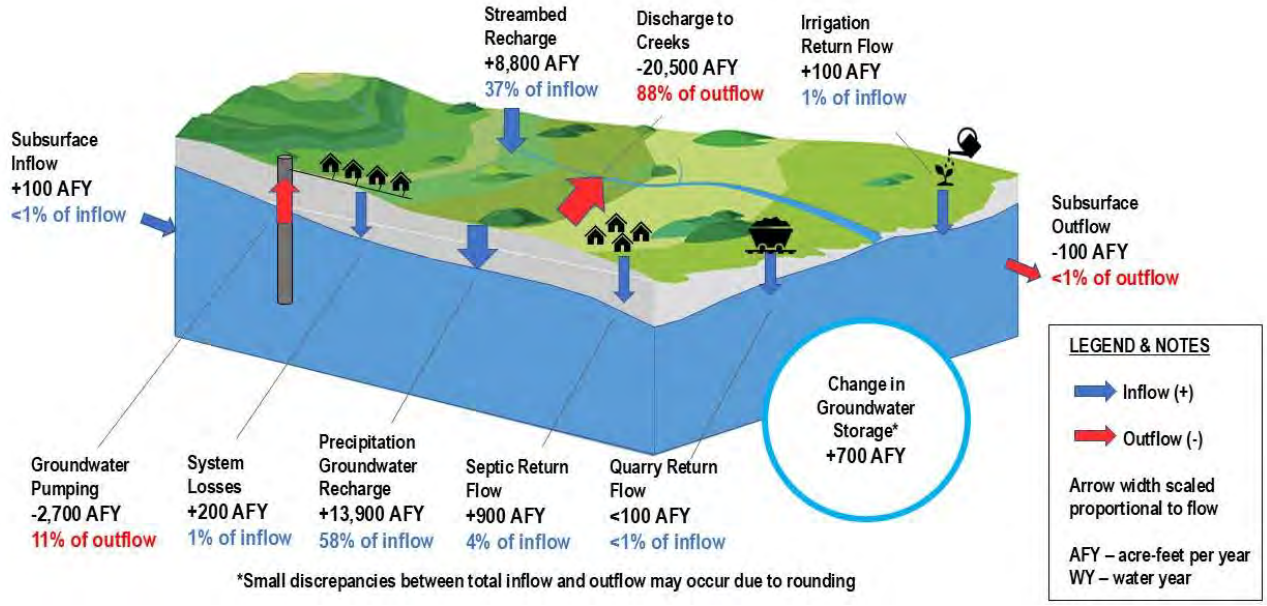
~~Figure ES- 4~~Figure ES-3. ~~Historical~~ Current Groundwater Budget (Average from Water Year 2016~~1986~~ through

nearly 10 times greater at 20,500 AFY. Groundwater recharge from precipitation and losing streams offsets ~~the~~ groundwater discharging to creeks and extractions to create a near balanced water budget with a net gain in storage of 700 AFY over the current water budget timeframe.

~~Overall, more groundwater discharges to creeks than is being recharged by creeks. Groundwater pumping removes groundwater from the aquifer system, though some of it reenters as return flows from septic systems, quarry usage, landscape irrigation, and sewer and water distribution system losses.~~

timeframe. ~~basin-wide changes of groundwater in storage average 1,100 AFY, mostly from the Lompico aquifer in the Mount Hermon / South Scotts Valley area implementation.~~

~~Notable differences between the current (2010 – 2018) and historical (1985 – 2018) groundwater budgets are reduced precipitation recharge due to less than average rainfall and reduced groundwater pumping from improved water efficiency and other management efforts. Decreased water demand from these efforts have resulted in about 1,000 AFY less groundwater lost from storage compared to the historical period.~~




~~Figure ES-~~ 4Figure ES-3. ~~Historical~~ Current Groundwater Budget (Average from Water Year 2016~~1986~~ through

Historically, the groundwater budget was not in balance with cumulative storage loss of about 1,300 AFY due to ~~more~~over extraction ~~basinwide~~, ~~but~~ especially from the Lompico aquifer in the Mount Hermon / South Scotts Valley area. Historical groundwater extraction averaged 3,900 AFY, or 1,200 AFY more than the current

In the future, groundwater demands are expected to be similar to the current average extraction which continues to result in balanced volumes of groundwater in storage. Both current and projected periods have average extraction of about 2,600 AFY. If future climate conditions are similar to the historical and current conditions, the

groundwater system should remain in balance with 100 AFY loss of storage between WY 2026-2072. However, if climate change results in a hotter and more variable climate than reduced groundwater recharge will result in greater loss of groundwater in storage of 400 AFY. ~~cause undesirable results to occur.~~

The sustainable yield is an estimated volume of groundwater that can be pumped on a long-term average annual basis without causing undesirable results. ~~.~~ Table ES-1 shows the historical, current, and projected pumping, which are the basis for the sustainable yield. To achieve groundwater sustainability the current balanced conditions will need to be maintained and adaptively managed if future water demands or climate change cause groundwater extraction to exceed the sustainable yield and cause undesirable results to occur.

~~Table ES-1. Santa Margarita Basin Sustainable Yield~~

| ~~Aquifer~~~~Aquifer~~<br><br>~~/Formation~~ | ~~Historical Pumping~~<br><br>~~1985 – 2014~~<br><br>~~(AFY)~~~~Historical Pumping~~<br><br>~~1985 – 2018~~<br><br>~~(AFY)~~ | ~~Current Pumping~~<br><br>~~2015 – 2025~~<br><br>~~(AFY)~~~~Current Pumping~~<br><br>~~2010 – 2018~~<br>~~(AFY)~~ | ~~Sustainable Yield & Projected Pumping~~<br><br>~~2026-2072~~<br><br>~~(AFY)~~~~Sustainable Yield~~<br><br>~~(AFY)~~ |
|---|---|---|---|
| ~~Santa Margarita~~<br><br>~~(Unconfined Aquifer Total)~~~~Santa Margarita~~ | ~~1,100~~~~1,070~~ | ~~700~~~~770~~ | ~~700~~~~850~~ |
| ~~*Monterey*~~~~Monterey Formation~~ | ~~*400*~~~~320~~ | ~~*200*~~~~180~~ | ~~*100*~~~~140~~ |
| ~~*Lompico*~~~~Lompico~~ | ~~*1,800*~~~~1,770~~ | ~~*1,200*~~~~1,520~~ | ~~*1,200*~~~~1,290~~ |
| ~~*Butano*~~~~Butano~~ | ~~*600*~~~~530~~ | ~~*500*~~~~480~~ | ~~*600*~~~~540~~ |
| ~~Confined Aquifer Total~~ | ~~2,800~~ | ~~1,900~~ | ~~1,900~~ |
| ~~Total Extraction~~ | ~~3,900~~ | ~~2,600~~ | ~~2,600~~ |

## Sustainable Management Criteria and Monitoring Networks

~~Developing SMC as metrics of groundwater sustainability sustainable management~~

~~criteria (SMC) is a requirement of the SGMA. Of the 6 indicators of sustainability~~There are ~~,~~ 4 ~~apply~~ applicable sustainability indicators ~~to~~ in the Basin: chronic lowering of groundwater levels, reduction of groundwater in storage, degraded groundwater quality, and depletion of interconnected surface water. ~~Land subsidence and seawater intrusion are not applicable.~~

The GSP identifies monitoring networks for evaluating conditions for each indicator.

Locally defined, quantitative SMC define what constitutes sustainable groundwater conditions in the Basin. SMC were developed using best available information and science, direction provided by the SMGWA Board, public feedback, and input from -stakeholders. Current groundwater conditions are generally sustainable as there are no undesirable results occurring in the Basin. ~~and commit the~~ SMGWA and its member agencies will continue to ~~to actions to~~adaptively manage the Basin to ~~demonstrate~~ maintain sustainable conditions in the future ~~by~~~~achieve those conditions by 2042~~.

Table ES-1. Santa Margarita Basin Sustainable Yield

| Aquifer | Historical Extraction 1985 – 2014 (AFY) | Current Extraction 2015 – 2025 (AFY) | Sustainable Yield & Projected Extraction 2026-2072 (AFY) |
|---|---|---|---|
| **Santa Margarita (Unconfined Aquifer Total)** | **1,100** | **700** | **700** |
| *Monterey* | *400* | *200* | *100* |
| *Lompico* | *1,800* | *1,200* | *1,200* |
| *Butano* | *600* | *500* | *600* |
| **Confined Aquifer Total** | **2,800** | **1,900** | **1,900** |
| **Total Extraction** | **3,900** | **2,600** | **2,600** |

~~SMC were developed using best available information and science, direction provided by the SMGWA Board, public feedback, and input from cooperating agencies and a Surface Water Technical Advisory Group (TAG).~~

~~There are known data deficiencies in the hydrogeologic conceptual model related to parts of the Basin and aquifers that do not have monitoring wells, including areas of private domestic pumping and interconnected surface water. The SMC in this GSP are likely to be reevaluated and potentially modified in the future as new data and monitoring features are developed.~~

The SMC for each sustainability indicator includes the following 4 quantitative metrics: ~~GWA developed Sustainability Goals discussed in Section 3.1 and identified~~ undesirable results (URs), minimum thresholds (MTs), measurable objectives (MOs), and interim milestones (IMs)~~for each of the applicable sustainability indicators~~ as~~, and~~ . ~~The details of the metrics are covered in Sections 3.4 through 3.7 and are~~ summarized in Table ES-2. SMC are ~~assigned~~ evaluated at ~~to~~ a subset of the existing monitoring network called representative monitoring points (RMPs).

~~A summary of the management goals for t~~The general approach for each of the Basin's 4 applicable sustainability indicators is ~~provided~~ summarized below.

**Chronic Lowering of Groundwater Levels:** ~~Do not allow~~Maintain groundwater levels ~~to decline~~ above fall 2013~~to~~ levels with an objective of achieving fall 2006 levels to ~~s~~provide public ~~that~~ water supply reliability, support priority species habitat, protect domestic wells from going dry, maintain high quality groundwater in the water supply aquifers, and create a drought reserve, among other benefits.~~materially impair groundwater supply, negatively impact beneficial uses, or cause undue financial burden to a significant number of beneficial users.~~

**Reduction of Groundwater in Storage:** ~~Maintain~~ Maintain- groundwater extractions ~~less than~~ ~~so that other sustainability indicators are not negatively affected~~ ~~2010-2015 volumes and~~at or below the sustainable yield on a 5-year rolling average basis to support conjunctive use of groundwater and surface water as a drought resiliency strategy.~~.~~

**Degradation of Groundwater Quality:** Manage groundwater extraction and PMAs to By implementing the GSP, mprevent aintain groundwater quality so that degradation of existing groundwater quality forState drinking water standards for chemical constituents of concern (COCs) and exceedance of relevant drinking water standards are not exceeded, with the exception of nitrate (as N) which must be less than half the regulatory standard.

**Depletion of Interconnected Surface Water:** Manage groundwater levels and extraction to maintain For interconnected surface waters, ensure that groundwater use or projects or management actions do not adversely impact the sustainability ofgroundwater baseflow to streams that supports GDEs and or selected priority species habitat (Figure ES-4) and is used for or cause undue financial burden to beneficial users of surface waterpublic water supply by downstream users in the City of Santa Cruz.

The SMGWA will use existing monitoring

Figure ES- 45. Lompico Creek Habitat (left) and Olympia Quarry Floor Habitat (right)

networks, supplemented with additional new monitoring wells to fill data gap areas, for annual assessments and reporting of groundwater levels, groundwater quality, groundwater and surface water use, precipitation, and streamflow. Data collected will be used to monitor progress towards sustainability during GSP implementation. Details on the Basin's GSP monitoring network are provided in Section 3.3.

Historical and future data collected by the monitoring network will be stored in a

~~regional Data Management System (DMS) that will facilitate a centralized source of data when the GSP's annual reports are prepared.~~

Table ES-2. Santa Margarita Basin Sustainable Management Criteria Summary

| Sustainability Indicator | Measurement | Minimum Threshold | Measurable Objective | Interim Milestones | Undesirable Result |
|---|---|---|---|---|---|
| Chronic lowering of groundwater levels | Groundwater elevation measured in representative monitoring point (RMP) wells | ~~Average groundwater elevation of the 5 lowest historical measured values in each RMP~~Fall 2013 groundwater levels | ~~*Santa Margarita aquifer RMPs:* seasonal low groundwater levels in each well in WY2004~~<br>~~Monterey Formation, Lompico and Butano aquifer RMPs: average annual minimum groundwater elevation measured from 2016 to 2020 plus the projected groundwater elevation increase in seasonal low groundwater elevations projected by a 540 AFY conjunctive use project in the Mount Hermon / South Scotts Valley area~~Fall 2006 groundwater levels | For wells with groundwater levels below the MO, the 2032 IM is 1/3 of the difference and 2037 IM is 2/3 of the difference between the current conditions and MO~~Santa Margarita aquifer RMPs: seasonal low groundwater levels in each well in WY2004~~<br>~~Monterey Formation, Lompico and Butano aquifer RMPs: simulated groundwater elevations projected from implementation of a 540 AFY conjunctive use project~~ | Fall groundwater elevations in 3 or more unconfined aquifer RMPs are below the MT in 2 consecutive years; or<br><br>Fall groundwater elevations in 3 or more confined aquifer RMPs are below the MT in 2 consecutive years.<br>~~Groundwater elevation in any RMP falls below the minimum threshold in 2 or more consecutive non-drought years and is not caused by emergency operational issues or extended droughts~~ |
| Reduction in groundwater storage | Rolling 5-year average ~~M~~metered and estimated groundwater extractions. ~~Municipal and small water systems are metered, while *de minimis* and other non-*de minimis* extractions are estimated~~ | 750 AFY in the unconfined aquifer group and 2,250 AFY in the confined aquifer group, totaling 3,000 AFY<br><br>~~Average baseline groundwater pumping from 2030 to 2049 in the Santa Margarita aquifer and after 2022 for Monterey Formation and Lompico and Butano aquifers, plus 5% additional pumping~~ | 700 AFY in the unconfined aquifer group and 1,900 AFY in the confined aquifer group, totaling 2,600 AF ~~Average groundwater pumping projected in a model simulation incorporating a 540 AFY conjunctive use project in the Mount Hermon / South Scotts Valley area~~ | ~~Equivalent to minimum thresholds prior to 2027 and equivalent to~~Identical to measurable objectives ~~measurable objectives from 2027 onward~~ | Groundwater extraction volumes exceed the MT in the Unconfined aquifer.<br><br>Groundwater extraction volumes exceed the MT in the Confined aquifers.<br>~~Groundwater extraction volumes that exceed the reduction in groundwater storage MTs for the unconfined or confined aquifers system for 2 consecutive years~~~~Groundwater extraction volumes exceed minimum thresholds in one or multiple principal aquifers~~ |

| | | | | | |
|---|---|---|---|---|---|
| Degraded groundwater quality | Concentrations of ~~chemical~~ constituents of concern (COCs) in RMP wells | Unique value for each RMP based on degradation from historical concentrations and maintaining ~~State~~ drinking water quality below regulatory standards~~, except for nitrate, which is half the State drinking water standard~~ | Unique value for each RMP based on degradation from historical concentrations and maintaining drinking water quality below regulatory standards ~~Average concentration for each constituent of concern at each RMP between January 2010 and December 2019~~ | Identical to measurable objectives | URs will occur if 3 or more RMPs experience an MT exceedance for the same constituent for 2 consecutive years~~Minimum thresholds are exceeded at RMPs where:~~<br>~~• Minimum thresholds have not been exceeded prior to SMGWA approved project(s) or management action(s)~~<br>~~• An immediate resampling confirms the exceedance~~<br>~~The exceedance is caused by SMGWA approved project(s) or management action(s)~~ |
| Depletion of interconnected surface water | Groundwater elevations measured in RMP wells as a proxy and extraction volumes are used ~~as a proxy~~ for measuring depletion of interconnected surface water | ~~Average groundwater elevation of the 5 lowest measured values in each RMP~~Use chronic lowering of groundwater levels as a proxy and reduction in groundwater storage MTs ~~as a proxy~~ | Use chronic lowering of groundwater levels as a proxy and reduction in groundwater storage MOs ~~as a proxy~~~~Seasonal low groundwater levels in each RMP from the fall of WY 2004~~ | Use chronic lowering of groundwater levels as a proxy and reduction in groundwater storage IMs ~~as a proxy~~~~Identical to measurable objectives~~ | • Groundwater elevations in 3 or more RMPs fall below the MT in 2 consecutive years in the Unconfined aquifer; or.<br>• Groundwater elevations in 3 or more RMPs fall below the MT in 2 consecutive years in the Confined aquifers; or<br>• Groundwater extraction volumes exceed the MT in the Unconfined aquifer; or<br>Groundwater extraction volumes exceed the MT in the Confined aquifers. |

## Projects and Management Actions

~~Section 4 of the GSP describes potential~~SMGWA member agencies have implemented PMAs to ~~improve~~manage water resources ~~management~~ for decades. ~~projects and management actions that may be implemented to achieve the Basin's sustainability goal.~~Existing and ongoing projects include conjunctive use of groundwater and surface water, conservation, stormwater recharge, and recycled water use. Modeling of projected conditions with future demands indicates that the Basin is generally in balance and will likely be sustainable with limited PMAs. However additional PMAs are in various planning stages should they be needed to achieve sustainability.~~Projects and management actions discussed in this section are in varying stages of development.~~

~~Several projects have the added benefit of creating supplemental drought supply to improve water supply reliability for the City of Santa Cruz, SLVWD, and SVWD. Some projects will benefit groundwater levels in aquifers pumped by *de minimis* groundwater users. Projects are grouped based on where the water resources are sourced and the type of water.~~

~~**Baseline Projects and Management Actions (Group 1):** Projects and management actions considered existing commitments by cooperating agencies and are currently being implemented. They are expected to continue, as needed, throughout GSP implementation. These projects and management actions do not achieve sustainability on their own. Group 1 projects include:~~

- ~~Water use efficiency programs~~
- ~~SVWD low-impact development~~
- ~~SLVWD conjunctive use~~
- ~~SVWD recycled water use~~

~~**Projects and Management Actions Using Existing Water Sources Within the Basin (Group 2, Tier 1):** Projects representing current thinking regarding the Basin's best option for reaching sustainability. Projects and management actions rely on existing water sources within the Basin and include expansion of some of the Group 1 baseline projects. Group 2, Tier 1 projects include:~~

- ~~SLVWD and SVWD additional water use efficiency~~
- ~~SLVWD existing infrastructure expanded conjunctive use (Phase 1)~~
- ~~SLVWD and SVWD inter-district conjunctive use with Loch Lomond (Phase 2)~~

- ~~SLVWD Olympia groundwater replenishment~~

~~**Projects and Management Actions Using Surface Water Sources Outside the Basin (Group 2, Tier 2):** Projects that rely on surface water sources outside of the Basin. Group 2, Tier projects include:~~

- ~~Transfer of inter-district conjunctive use~~
- ~~Aquifer Storage & Recovery (ASR) in the Scotts Valley area~~

~~**Projects and Management Actions Using Purified Wastewater Sources (Group 2, Tier 3):** Projects that recharge purified wastewater in the Basin. Potential projects include:~~

- ~~Purified wastewater recharge of 710 to 1,500 AFY in the Scotts Valley area with wastewater treated at Soquel Creek Water District's Chanticleer Advanced Water Purification Facility (AWPF)~~
- ~~Purified wastewater recharge of 3,500 AFY in the Scotts Valley area with wastewater treated at a new facility within the Basin~~
- ~~Purified wastewater augmentation at Loch Lomond.~~

~~**Identified Projects and Management Actions Requiring Future Evaluation (Group 3):** New projects or extensions of existing projects that need feasibility analysis. If Group 2 projects are deemed unfeasible or projected outcomes change, SMGWA may look to Group 3 projects to meet SMGWA sustainability goals. Group 3 projects include:~~

- ~~Public/private stormwater recharge and low-impact development~~
- ~~Enhanced Santa Margarita aquifer conjunctive use~~
- ~~SLVWD Quail Hollow pumping redistribution~~
- ~~Santa Margarita aquifer private pumpers connected to public water system~~
- ~~Direct potable reuse~~
- ~~Water use restrictions~~
- ~~Scotts Valley non-potable / potable reuse~~

~~Not all projects and actions are needed to attain sustainability, but they provide possible options in the event that backup projects are needed. Importantly, the listed projects are not developed enough for SMGWA cooperating agencies to fully commit to any projects prior to submission of the GSP to DWR in January 2022. Project development will be led by cooperating agencies. For projects with multi-stakeholder benefits, cooperating agencies will work in coordination with one another.~~

~~Measures that the SMGWA member agencies will take to achieve Basin sustainability are focused on increasing Lompico aquifer groundwater levels in the Mount Hermon / South Scotts Valley area, supporting groundwater baseflow to interconnected streams, and preventing groundwater quality degradation.~~ The ~~most immediate action~~primary project being developed being ~~taken~~ in the Basin will be to expand SLVWD conjunctive use of surface water and groundwater using existing infrastructure. Expanding conjunctive use will allow SLVWD to optimize use of currently available treated surface water sources in their North System and Felton System by using existing system interties and potential capacity enhancements to offset groundwater pumping in their South System where lowered groundwater levels have occurred and North System where extraction occurs in the Santa Margarita aquifer.

~~It is likely that this measure will be followed by development of infrastructure to gain access to SLVWD's entitlement of 313 AFY of Loch Lomond water for further~~

~~conjunctive use opportunities. Combining the 2 projects would potentially provide for a long-term average of 540 AFY of in-lieu recharge by SLVWD and SVWD resting their extraction wells during the wet seasons when surface water is available for conjunctive use. Groundwater modeling has demonstrated the combined projects will raise Mount Hermon / South Scotts Valley area Lompico aquifer groundwater levels by 20 to 50 feet. The anticipated increases in groundwater levels from 540 AFY of conjunctive use enables the SMGWA to meet its long-term measurable objectives for chronic lowering of groundwater levels, depletion of interconnected surface water, and reduction of groundwater in storage, while having no impact on groundwater quality.~~

~~Costs associated with new project infrastructure would be funded through a combination of increased operating revenue and outside funding sources. Potential outside funding sources could include Integrated Regional Water Management Grant Programs (IRWM), Sustainable Groundwater Management Grant Program, State Revolving Fund low interest loans, U.S. Department of Agriculture grants and/or low interest loans, or U.S. Bureau of Reclamation Drought Resiliency and/or Title XVI Recycled Water. For many projects included in the GSP, securing outside funding to supplement operating revenue will be essential for them to be financially feasible over the long-term and affordableand.~~A specific in included in ~~Section 8~~ If the primary expanded conjunctive use project is deemed infeasible or anticipated outcomes change, SMGWA may look to supplemental projects to meet SMGWA sustainability goals. SVWD and the City of Santa Cruz are working on a similar conjunctive use project to SLVWD's effort to improve drought resiliency. SVWD and the City of Santa Cruz have constructed infrastructure to transfer water between them and are planning how to implement the project to maximize benefits and prevent causing undesirable results. ~~Basin stakeholders are involved in a few local s~~Stormwater recharge is a supplemental project ~~supplemental projects that would capture stormwater runoff for aquifer recharge.~~that would install small- to medium-scale stormwater capture facilities (10 to 1,000 AFY per site) to recharge the Santa Margarita aquifer at feasible locations.

A ~~new~~ management action is ~~added to the 2027 GSP to help prevent groundwater quality degradation.~~for SGMWA and County of Santa Cruz Environmental Health Department (SCEH) ~~will~~to routinely collaborate and share information on potential water quality issues as they arise. This approach will help proactively track and identify issues of emerging concern and will assist SCEH in its oversight role in working with responsible parties to protect the beneficial uses of groundwater.

## Groundwater Sustainability Plan Implementation

The estimated cost to implement the GSP over the next 5 years is $1,~~967~~995,~~900~~000, or $~~393~~397,~~580~~ 000 annualized over 5 years. ~~Approximately 57% of the 5-year~~

~~estimated costs are existing activities included in SMGWA and member agency budgets.~~

The estimated cost by GSP implementation activity can be found in Section ~~5~~9, Table ~~5~~9-1. The budget's major cost categories include:

- Governance, Administration and Business Operations~~Administration and business operations~~
  - 
- SGMA Compliance and GSP Implementation ~~GSP management and coordination~~
- Monitoring and GSP reporting ~~(annual and 5-year update reports)~~
  - 
- ~~Maintaining the data management system~~

~~Monitoring, regulatory reporting, filling data gaps, and maintaining the DMS accounts for roughly half the budget. The remaining budget covers activities associated with supporting SMGWA governance and management~~Each of these cost categories account for about half of the SMGWA budget.

The GSP implementation budget does not include the cost of evaluating, planning, designing, and constructing a project(s) to achieve groundwater sustainability. Individual cooperating agencies will cover their respective costs of these activities because the SMGWA will not serve as the lead agency for implementing ~~projects and management actions~~PMAs. Project costs may be shared between multiple agencies if the project provides greater water supply reliability and resiliency benefit to multiple agencies. Regional collaboration to achieve both basin sustainability and increase regional water supply reliability and resiliency is encouraged by the SMGWA.

The SMGWA is funded by its member agencies through annual contributions based on a cost sharing agreement. The SMGWA is funded by its 3 member agencies and other agencies represented on the SMGWA Board through annual contributions. The cost allocation is currently established at: 46.4% to SVWD; 31.7% to SLVWD; 12.5% County of Santa Cruz; 5.0% City of Santa Cruz; and 4.5% Mount Hermon Association. Future contribution amounts may be reassessed based upon SMGWA's annual budgetary requirements and equitable cost share rationale between the member and

other represented agencies~~The cost allocation is currently established at 60% to SVWD, 30% to SLVWD, and 10% to the County of Santa Cruz; the cost allocation is subject to change. SMGWA's approach to meeting GSP implementation costs is considered in 2 phases. In the GSP Implementation Phase 1 (2022 2027–2027~~2032~~) funding is anticipated to be obtained from annual contributions from the SMGWA member agencies. Contribution amounts will be assessed based upon the SMGWA's annual budgetary requirements and equitable cost share rationale between the member agencies~~. The SMGWA will continue to pursue funding opportunities from state and federal sources to support GSP implementation activities.

As authorized under Chapter 8 of the SGMA, a GSA may impose fees, including, but not limited to, permit fees and fees on groundwater extraction or other regulated activity, to fund the costs including groundwater sustainability planning and program activities and administration. While the SMGWA has elected to not assess other private users of groundwater in the Basin, SMGWA reserves the right to evaluate assessing fees on other private users of groundwater should they be determined to either cause impacts to Basin sustainability or substantially benefit from SMGWA's management activities. There are no current plans to impose a fee on private users of groundwater in the Basin.~~The approach for meeting GSP implementation costs after 2027 will be evaluated as GSP implementation proceeds. As authorized under Chapter 8 of the SGMA, a GSA may impose fees, including, but not limited to, permit fees and fees on groundwater extraction or other regulated activity, to fund the costs including groundwater sustainability planning and program activities and administration.~~

Glenwood Preserve; photo credit: Brian Largay/Land Trust of Santa Cruz County

# 1 INTRODUCTION

## 1.1 Purpose of the Groundwater Sustainability Plan

In 2014, the State of California enacted the Sustainable Groundwater Management Act (SGMA). This act requires groundwater basins in California that are designated as medium- or high-priority be managed sustainably~~ over at least a 50-year planning and implementation horizon~~. Satisfying the requirements of the SGMA generally requires 4 basic activities:

1. Forming one or multiple Groundwater Sustainability Agency(s) (GSAs) to fully cover a basin;
2. Developing one or multiple Groundwater Sustainability Plan(s) (GSPs) that fully cover the basin;
3. Implementing the GSP and managing the basin according to the GSP to achieve quantifiable objectives; and
4. Regular reporting of groundwater conditions and progress towards sustainability to the California Department of Water Resources (DWR).

This document fulfills the GSP requirement for the Santa Margarita Basin (Basin) categorized as a medium-priority basin. The GSP describes the Basin's physical attributes related to groundwater, surface water, and land use; develops quantifiable management objectives that take into account interests of the Basin's beneficial groundwater uses and users; and identifies a group of projects and management actions (~~projects and management actions~~PMAs) that will allow the Basin to achieve sustainability within 20 years of Plan adoption (2042), and to maintain sustainability for an additional 30 years beyond 2042.

The GSP was developed specifically to comply with SGMA's statutory and regulatory requirements. As such, the GSP uses terminology used in these requirements (see Water Code Section (CWC) §~~)~~10721 and 23 California Code of Regulations (CCR) Section 351) which is oftentimes different from the terminology used in other contexts (e.g. past reports or studies, past analyses, judicial rules or findings). Definitions used in this GSP, including those from SGMA statutes and regulations are included in Appendix 1A for reference.

## 1.2 Sustainability Goal~~s~~

The GSP requires that the GSA for the Basin, called the Santa Margarita Basin Groundwater Agency (SMGWA), establish a sustainability goal that culminates in the absence of undesirable results within 20 years of the applicable statutory deadline. The 20-year deadline to achieve the sustainability goal is January 2042.

~~Sustainability goals were discussed by the SMGWA Board of Directors at several Board meetings.~~

SMGWA's sustainability goal is to achieve and maintain groundwater conditions that support beneficial uses and users and sustain the long-term health of the Basin's community, economy, and environment.

The sustainability goal will be achieved by:

- Monitoring and managing groundwater conditions to meet established sustainable management criteria and striving to achieve measurable objectives to enhance Basin conditions.
  - Maintaining groundwater levels sufficient to protect domestic, municipal, agricultural, and industrial supply wells.
  - Maintaining groundwater levels that support streamflow and groundwater dependent ecosystems, where applicable.
  - Maintaining groundwater quality for current and future beneficial uses.

Implementing cost-effective adaptive management strategies, including expanding conjunctive use and drought response measures, to enhance drought resilience and long-term supply reliability.~~The Basin sustainability goal is to achieve and maintain groundwater conditions that support beneficial uses and users and sustain the long-term health of the Basin's community, economy, and environment.~~

~~This goal will be achieved by:~~

- ~~Monitoring and managing groundwater conditions to meet established sustainable management criteria.~~
- ~~Maintaining groundwater levels sufficient to protect domestic and municipal supply wells~~
- ~~Supporting continued groundwater contributions to streamflow and groundwater dependent ecosystems, where applicable.~~

- ~~Maintaining groundwater quality for current and future beneficial uses.~~
- ~~Implementing adaptive management strategies, including expanding conjunctive use and drought response measures, to enhance drought resilience and long-term supply reliabilityContributions from Board directors, agency staff, and the public resulted in the sustainability goals of the SMGWA to:~~
- ~~Implement the Sustainable Groundwater Management Act (SGMA), which requires the management and use of groundwater in the Basin in a manner that can be maintained during the planning and implementation horizon without causing undesirable results.~~
- ~~Provide a safe and reliable groundwater supply that meets the current and future needs of beneficial users.~~
- ~~Support groundwater sustainability measures and projects which enhance a sustainable and reliable groundwater supply in the Basin, utilizing integrated water management principles by:~~
- ~~Safeguarding water supply availability for public health and welfare~~
- ~~Maintaining and enhancing groundwater availability for municipal, private, and industrial users and uses~~
- ~~Maintaining and enhancing groundwater contributions to streamflow, where beneficial users are dependent upon such contributions (fish, frogs, salamanders, dragonflies etc.)~~
- ~~Maintaining and enhancing groundwater levels that support groundwater dependent ecosystems~~
- ~~Maintaining and enhancing groundwater quality for existing and future beneficial uses~~
- ~~Provide for operational flexibility within the Basin by supporting a drought reserve that considers future climate change~~
- ~~Plan and implement projects and activities to achieve sustainability that are cost effective and do not place undue financial hardship on the SMGWA, its member agencies, or basin stakeholders. A cost-benefit analysis, taking into consideration financial, social, environmental, and adverse consequences, may be conducted to evaluate whether a project or activity results in undue financial hardship.~~

~~Measures that the SMGWA member agencies will take to achieve Basin sustainability are focused on increasing Lompico aquifer groundwater levels in the Mount Hermon/South Scotts Valley area. The most immediate action will be to expand conjunctive use of surface water and groundwater using existing infrastructure. It is likely that this measure will be followed by development of infrastructure to gain access to San Lorenzo Valley Water District's (SLVWD) entitlement of 313 acre-feet per year (AFY) of Loch Lomond water for further conjunctive use opportunities. Combining the 2 projects would potentially provide for a long-term average of~~

~~540 AFY of in-lieu recharge by SLVWD and Scotts Valley Water District (SVWD) resting their extraction wells during the wet seasons when surface water is available for conjunctive use. Groundwater modeling has demonstrated the combined projects will raise Mount Hermon/South Scotts Valley area Lompico aquifer groundwater levels by 20 to 50 feet and Monterey Formation levels by 20 feet. Additionally, resting SVWD wells extracting from the Butano aquifer may raise Butano aquifer groundwater levels by 20 to 50 feet in the central to northern Scotts Valley areas. Anticipated increases in groundwater levels from 540 AFY of conjunctive use enables the SMGWA to meet its long-term measurable objectives for chronic lowering of groundwater levels, depletion of interconnected surface water, and reduction of groundwater in storage, while having no impact on groundwater quality.~~

~~Larger, more costly projects using either treated surface water or purified wastewater imported from outside the Basin, as described in Section 4, will be evaluated during the first 5 years of GSP implementation. The larger projects will provide cooperating agencies additional water supply resiliency and drought protection, beyond the level likely needed for sustainable management of groundwater in the Basin.~~

## 1.3 Agency Information

The Santa Margarita Basin GSP has been developed by one exclusive GSA, the SMGWA.

### 1.3.1 Organization and Management Structure of the Santa Margarita Groundwater Agency

The SMGWA was formed through a Joint Powers Agreement (JPA) in June 2017 among the SVWD, SLVWD, and the County of Santa Cruz (County). SLVWD uses both local surface water and groundwater resources to supply potable water to their customers, while SVWD relies only on groundwater resources. The County of Santa Cruz regulates land use, issues well permits, oversees small public water systems, and conducts various watershed management efforts in the Basin.

The SMGWA is governed by a Board of Directors comprising 2 representatives from each member agency, 1 representative from the City of Scotts Valley, 1 from the City of Santa Cruz, 1 from Mount Hermon Association (MHA), and 2 private well owner representatives. There are a total of 11 directors.

Each member agency has one alternate to act as a substitute director. One alternate acts as a substitute director for the 2 directors representing private well owners, and 1 alternate for each entity acts as a substitute director for the City of Scotts Valley, City of Santa Cruz and MHA. Alternate directors have no vote, and do not participate in any discussions or deliberations of the Board unless appearing as a substitute for a director due to absence or conflict of interest.

There are no dedicated SMGWA staff. All staffing support and funding for the SMGWA is provided by its 3 member agencies. Although not a member agency, the City of Santa Cruz provides staff support to the SMGWA because it obtains approximately 69% of its water supply from the San Lorenzo River watershed which covers almost the entire groundwater basin.

Mr~~s~~. ~~Piret Harmon~~David McNair is the authorized representative for the SMGWA. His~~er~~ contact information is listed below:

> Mr~~s~~. ~~Piret Harmon~~David McNair
> General Manager
> Scotts Valley Water District
> 2 Civic Center Drive
> Scotts Valley, CA 95066
> Phone: (831) 600-1902
> Email: ~~pharmon~~dmcnair@svwd.org

### 1.3.2 Legal Authority of the Santa Margarita Groundwater Agency

Figure 1-1 shows the extent of the Santa Margarita Basin. This GSP covers the entire Basin area for which the SMGWA is the exclusive GSA. No portion of the Basin is covered by a non-exclusive GSA. Therefore, the SMGWA provides the sole legal authority to implement this GSP throughout the entire Plan area and no authority is needed from any other GSA to implement the GSP.

The SMGWA has legal authority to perform duties, exercise powers, and accept responsibility for managing groundwater sustainably within the Santa Margarita Basin. Legal authority comes from the SGMA, the JPA signed by SMGWA member agencies effective on June 1, 2017, and JPA Bylaws. The JPA is included as Appendix 1B. These laws and agreements, taken together, provide the necessary legal authority for the SMGWA Board of Directors to carry out the preparation and implementation of the Basin's GSP.

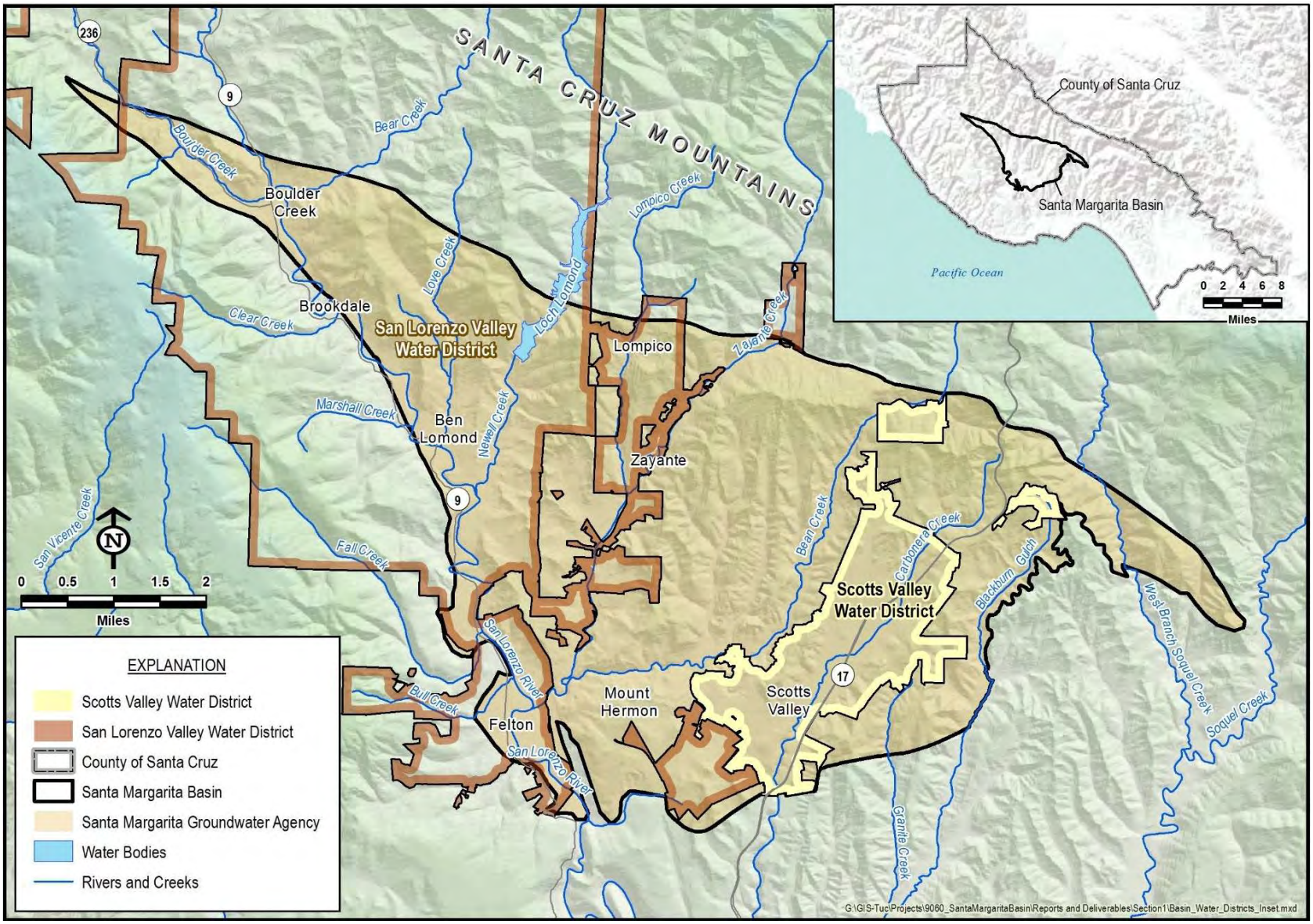



Figure 1-1~~1~~ ~~11~~ ~~1~~. Extent of SMGWA GSP Plan Area with Member Agency Boundaries

### 1.3.3 Santa Margarita Groundwater Agency Guiding Principles

Prior to starting GSP development, the SMGWA Board conducted a joint goal setting process that allowed them to establish a solid foundation for the planning work required during the GSP development. The process was facilitated by Dave Ceppos, a Managing Senior Mediator at California State University Sacramento, College of Continuing Education, Consensus and Collaboration Program. Mr. Ceppos conducted background reviews, conducted a situation assessment presenting the report to the Board at its July 2018 meeting.

The Board formed a Facilitation Committee to work with the facilitator in designing and implementing a joint goal setting process. The Facilitation Committee met several times reviewing the recommendations from the assessment report, preparing guiding principles and determining the appropriate timeline for necessary activities. Collectively they developed a proposed "Santa Margarita Groundwater Agency (SMGWA) Guiding Principles" document (Guiding Principles) that was approved at the November 2018 Board meeting, and then amended at the December 2018 Board meeting. The final Guiding Principles are included as Appendix 1C to this GSP.

Development of the Guiding Principles marked a major milestone for the SMGWA. They define a set of mutual core values and commitments that the current Board and future Boards will focus their efforts towards. The Guiding Principles add to the SMGWA's other documents, including the agency's JPA (Appendix 1B) and Bylaws, that define how the Agency does and will function. As used by other organizations and agencies, Guiding Principles (and similar) are an important and applied tool that guides the work of a governing body. Amongst many uses, the SMGWA Guiding Principles can:

- Be provided to the Basin Beneficial Users as a written description of key interests and a commitment/pledge by the Board as to how it will implement SGMA.
- Be used by all Board members to regularly assess the direction of discussions and potential Board decisions and to ensure that said discussions and decisions are consistent with these Guiding Principles.

### 1.3.4 Estimated Cost of Implementing the GSP and the Santa Margarita Groundwater Agency's Approach to Meet Costs

Over the next 5 years, the estimated cost to implement the GSP is $~~1,967,900~~1,96~~0~~95,000. The annualized cost over those 5 years is $~~393,580~~39~~2~~7,000. Estimated costs by GSP implementation activity are included in Section 9~~9~~5, ~~Table~~ Table 9-1~~5~~9~~ 1~~.

The estimated cost of implementing the GSP is presented by category identified below but also includes maintaining a prudent fiscal reserve and other miscellaneous costs. The cost estimate's major cost categories include:

- Governance, Administration and Business Operations
- SGMA Compliance and GSP Implementation Monitoring and GSP reporting
- 

Each of these cost categories account for about half of the SMGWA budget.

~~Administration and business operations~~

- ~~GSP management and coordination~~
- ~~Monitoring and GSP reporting (annual and 5-year reports)~~
- ~~Maintaining the data management system (DMS)~~

~~Monitoring, regulatory reporting, filling data gaps, and maintaining the DMS accounts for roughly half the cost estimate. The remaining costs cover activities associated with supporting SMGWA governance and management.~~

The GSP implementation cost estimate does not include the cost of evaluating, planning, designing, and constructing a project(s) to achieve groundwater sustainability. As discussed in Sections 8~~4~~ 8 and 9~~5~~9, cooperating agencies will cover their respective costs of these activities because the SMGWA will not serve as the lead agency for implementing ~~projects and management actions~~PMAs. Project costs may be shared between multiple agencies if the project provides greater water supply reliability and resiliency benefit to multiple agencies. Regional collaboration to achieve both basin sustainability and increase regional water supply reliability and resiliency is encouraged by the SMGWA.

Costs associated with implementing new projects would be funded through a combination of increased operating revenue and outside funding sources. Potential outside funding sources could include Integrated Regional Water Management (IRWM) Grant Programs, Sustainable Groundwater Management Grant Program, Watershed ~~Resilicience~~Resilience-, State Revolving Fund low interest loans, United States Department of Agriculture (USDA) grants and/or low interest loans, or United States Bureau of Reclamation (USBR) Drought Resiliency and/or Title XVI Recycled Water. For many projects included in the GSP, securing outside funding to supplement local revenue streams will be critical. Considering the size of the population and scale of the projects required to achieve sustainability, it is important to ensure financial feasibility and long-term affordability.

The SMGWA is funded by its member agencies and other agencies represented on the SMGWA Board through annual contributions based on a cost sharing agreement. The cost allocation is currently established at: 6046.4% to SVWD;, 3031.7% to SLVWD;, and 1012.5% to the County of Santa Cruz; 5.0% City of Santa Cruz; and 4.5% Mount Hermon Association. the cost allocation is subject to change. SMGWA's approach to meeting GSP implementation costs is considered in 2 phases. In the GSP Implementation Phase 1 (2022 – 2027) funding is anticipated to be obtained from annual contributions from the SMGWA member agencies. Future cContribution amounts will may be reassessed based upon the SMGWA's annual budgetary requirements and equitable cost share rationale between the member and other represented agencies. The SMGWA will continue to pursue funding opportunities from state and federal sources to support GSP implementation activities.

The approach to meeting the GSP implementation costs after 2027 will be evaluated as GSP implementation proceeds. As authorized under Chapter 8 of the SGMA, a GSA may impose fees, including, but not limited to, permit fees and fees on groundwater extraction or other regulated activity, to fund the costs including groundwater sustainability planning and program activities and administration. While the SMGWA has elected to not assess other private users of groundwater in the Basin, The SMGWA will further evaluate the funding mechanisms, the potential application of fees and the fee criteria for non-*de minimis* and *de minimis* users alikereserves the right to evaluate assessing fees on other private users of groundwater should they be determined to either cause impacts to Basin sustainability or substantially benefit from SMGWA's management activities.

## 1.4 GSP Organization

### 1.4.1 Groundwater Sustainability Plan Organization

The SMGWA's GSP is organized based upon the DWR's GSP Annotated Outline with additional information to address content requirements found in the *Preparation Checklist for GSP Submittal* (DWR, 2016).

The GSP is organized as follows:

**Executive Summary**

The executive summary presents an overview of the overall GSP, background information on the groundwater conditions in the Basin, an overview the GSP development process, and key information from each of the 5 GSP sectionspertinent to GSP implementation.

**Section 1. Introduction**

~~This first section~~Introduces ~~presents~~ the purpose of the GSP, the Basin's Sustainably Goal, information about the SMGWA, and organization of the GSP.

**Section 2. Plan Area ~~and Basin Setting~~**

~~This section d~~Describes the ~~Santa Margarita Groundwater Basin's~~ beneficial users of groundwater, including existing water resources management efforts that were either incorporated into the GSP or are directly related.

**Section 3. Basin Setting**

Describes the physical attributes related to groundwater, surface water, and land use in the Basin, including the Hydrogeologic Conceptual Model (HCM).

**Section 4. Groundwater Conditions**

Summarizes h~~H~~istorical and current ~~Basin~~ groundwater conditions for the groundwater sustainability indicators subject to SGMA.~~and groundwater management are described together with~~

**Section 5. Water Budget**

Presents the Basin's historical~~, and~~ current, and ~~water budget. In addition to historical and current water budgets, projected water budgets covering the 50-year period planning horizon with and without projects and management actions are included to estimate future conditions of supply, demand, and aquifer response to Plan implementation~~projected water budgets both with and without climate change to demonstrate how water use and climate relate to groundwater conditions. ~~This section provides the background information needed to develop the technical aspects of Section 3: Sustainable Management Criteria and Section 4: Projects and Management Actions to Achieve Sustainability Goal.~~

**Section ~~7~~6. Monitoring Networks**

Describes the monitoring networks and protocols for the groundwater sustainability indicators subject to SGMA.

**Section ~~3~~7. Sustainable Management Criteria**

~~This section presents~~Documents the sustainable management criteria which are used to evaluate the sustainability of groundwater conditions and use ~~the Basin's sustainability goal and provides the management criteria, for the Basin's applicable sustainability indicators, by which to measure the Basin's sustainability. This section also describes the monitoring networks used to assess groundwater levels, groundwater quality, and interconnected surface water~~.

**Section 48. Projects and Management Actions**

This section provides a description ofDescribes PMAs projects and management actions necessary to achieve the Basin's sustainability goal while being responsive to projected changes in future water demand and climate change. Projects and management actions are specifically developed to address sustainability goals and SMC from Section 3.

**Section 59. Plan Implementation**

This final section of the GSP pProvides an estimate of GSP implementation costs and, its iimplementation schedule, and outlines of the procedural and substantive requirements for annual and periodic (5-year) GSP evaluations.

**Section 610. References and Technical Studies**

This final section provides references to the reports and studies cited in the GSP with links to electronic versions where available.

### 1.4.2 Preparation Checklist for GSP Submittal

This GSP must be submitted online to DWR by January 31, 2022. The DWR online submittal process includes an Elements Guide where each statutory requirement in the GSP regulations is linked to the relevant page number and section in this GSP. Access to the checklist and GSP can be found at: https://sgma.water.ca.gov/portal/gsp/status.

# 2 PLAN AREA

## 2.1 Area Covered by the GSP

This GSP covers the entire Santa Margarita Basin (DWR Basin 3-027) as defined in DWR Bulletin 118 (DWR, 2016b). The Basin is located at the northern end of the Central Coast hydrologic region. The area of the Basin is 34.8 square miles (22,249 acres). To the south and southeast of the Basin is the Santa Cruz Mid-County Basin, and to the south is the West Santa Cruz Terrace Basin. The Santa Margarita Basin includes the City of Scotts Valley, and the communities of Boulder Creek, Brookdale, Ben Lomond, Lompico, Zayante, Felton, and Mount Hermon. The Santa Margarita Basin's neighboring basins are shown on Figure 2-1. Based on ~~2010~~ 2020 census block data, the population of the Basin is approximately ~~29~~30,~~06~~00 (U.S. Census Bureau, ~~201~~2020).

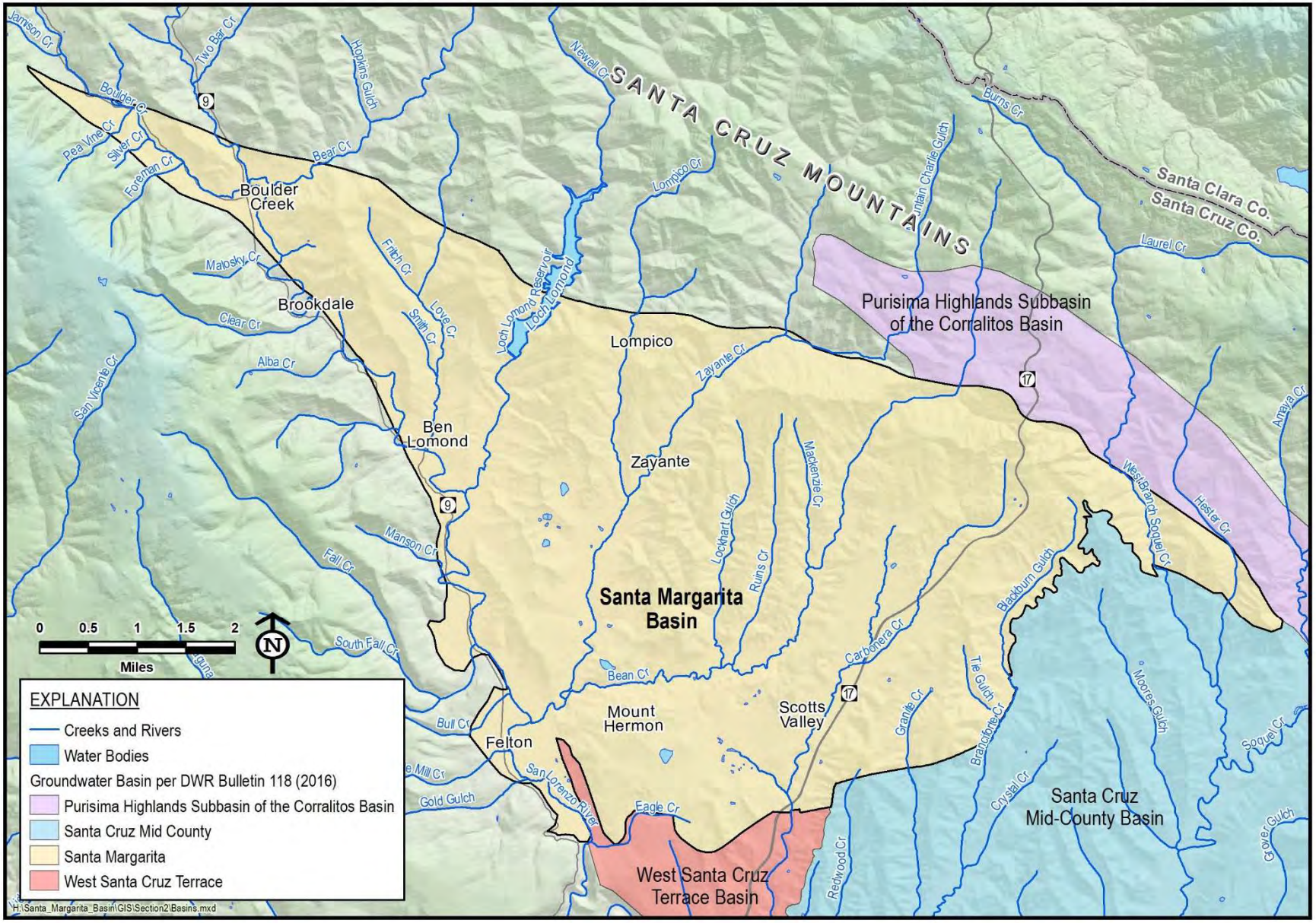



Figure 2-1. Groundwater Basins Adjacent to the Santa Margarita Basin

### 2.1.1 Jurisdictional Areas

#### 2.1.1.1 County of Santa Cruz

The Basin is completely within the County of Santa Cruz as shown on the inset map of Figure 2-2. The County was founded in 1850 as 1 of the 27 original California counties at the time of statehood. The County has a total area of 607 square miles (388,480 acres), 445 square miles of which is land area (73%) and the remaining 162 square miles is water (27%) (US Census, 2010).

In the Basin, ~~T~~the County has land use jurisdiction for all unincorporated areas outside of the City of Scotts Valley and is the largest agency with land use jurisdiction~~ in the Basin~~. The population residing in the Basin's unincorporated areas is approximately 18,300 (California Department of Finance, ~~2020~~2019). Of the population in unincorporated areas, it is estimated that 5,300 people are within the jurisdictional area of 1 of the Basin's 2 water districts, but because there is no water service to those parcels, they rely on small water systems or private wells.

The County is not a supplier of water but does permit and regulate private groundwater wells and small water systems that serve this population. The County of Santa Cruz Environmental Health Division (SCEH) of the County's Health Services Agency includes the Water Resources Program which participates in countywide planning and management efforts on a variety of water resource programs, including groundwater management, water quality, stormwater management, water conservation, fish (steelhead) monitoring, and watershed and stream habitat protection. The County is a member agency of the SMGWA.

#### 2.1.1.2 Water Districts

##### *2.1.1.2.1 SAN LORENZO VALLEY WATER DISTRICT*

The SLVWD is a member agency of the SMGWA. SLVWD, established in 1941, supplies water to the communities of Boulder Creek, Brookdale, Lompico, Ben Lomond, Zayante, Mañana Woods and Felton, and to a portion of the City of Scotts Valley, through a network of over 185 miles of distribution lines, pump stations and reservoirs. SLVWD's jurisdictional boundaries encompass approximately 62 square miles (39,680 acres, Figure 2-3). Its current service area served by existing infrastructure in the Basin is approximately 5.6 square miles (3,885 acres, Figure 2-3). There are more than 7,900 connections that serve approximately 26,000 customers throughout its service area, some of which is outside of the Basin. The SLVWD serves approximately 13,000 customers in the Basin. Water used to supply customers in the Basin is from 3 sources within the Basin:

1. Nine ~~S~~stream diversions on tributaries to the San Lorenzo River. Currently, 4 of 9 diversions are active due to damage sustained to the other diversions in the CZU

Lightning Complex wildfire in the summer of 2020. The estimated reconstruction timeframe for these damaged diversions is 2 to 4 years.

2. One groundwater spring.
3. Seven active groundwater production wells.

SLVWD owns, operates, and maintains 2 water systems:

1. The *San Lorenzo Valley System* is split into 2 sub-systems: north and south. The North San Lorenzo Valley System includes the unincorporated communities of Boulder Creek, Brookdale, Lompico (SLVWD annexed the Lompico County Water District in 2016), and Ben Lomond. Its source of water is surface water and groundwater. Part of the North San Lorenzo Valley System is outside of the Basin (Figure 2-3). The South San Lorenzo Valley System encompasses portions of the City of Scotts Valley and adjacent unincorporated neighborhoods. The Mañana Woods subdivision became part of the San Lorenzo Valley System as a result of the District's annexation of the Mañana Woods Mutual Water Company in July 2006. The southern portion of the system is supplied by groundwater pumped in the Pasatiempo area and through an emergency intertie with the northern portion of the system. SLVWD is pursuing efforts to utilize its emergency interties on a routine basis for conjunctive use and improved resiliency.

2. The *Felton System* was acquired by SLVWD from California American Water in September 2008 and includes the town of Felton and adjacent unincorporated areas. It was owned and operated by Citizen Utilities Company of California prior to 2002. The system is supplied by surface water and springs and covers an area of 2.9 square miles or 1,884 acres. Part of the Felton System is outside of the Santa Margarita Basin (Figure 2-3). The Felton System is connected to the San Lorenzo Valley System by an intertie that is only used at this time for emergencies.

#### *2.1.1.2.2 SCOTTS VALLEY WATER DISTRICT*

The SVWD is a public agency responsible for the management and supply of water to the Scotts Valley area (Figure 2-2). SVWD is a member agency of the SMGWA.

SVWD was formed under the County Water District Law, specifically California Water Code ~~Section~~ (CWC) § ~~)~~ 30321 and received certification from the California Secretary of State in 1961. SVWD serves an area of about 5.5 square miles (3,520 acres, Figure 2-2) ~~in northern Santa Cruz County and is located approximately 5 miles inland from the Monterey Bay~~. It provides water to most of the incorporated area of the City of Scotts Valley and a portion of an unincorporated area north of the City. SVWD supplies potable water to approximately 10,700 customers through 4,300 service connections, excluding fire services. SVWD relies exclusively on groundwater from municipal wells for potable water supply, while supplementing non-potable demand with

recycled water from the City of Scotts Valley Tertiary Treatment Plant. Non-potable recycled water is primarily used for landscape irrigation.

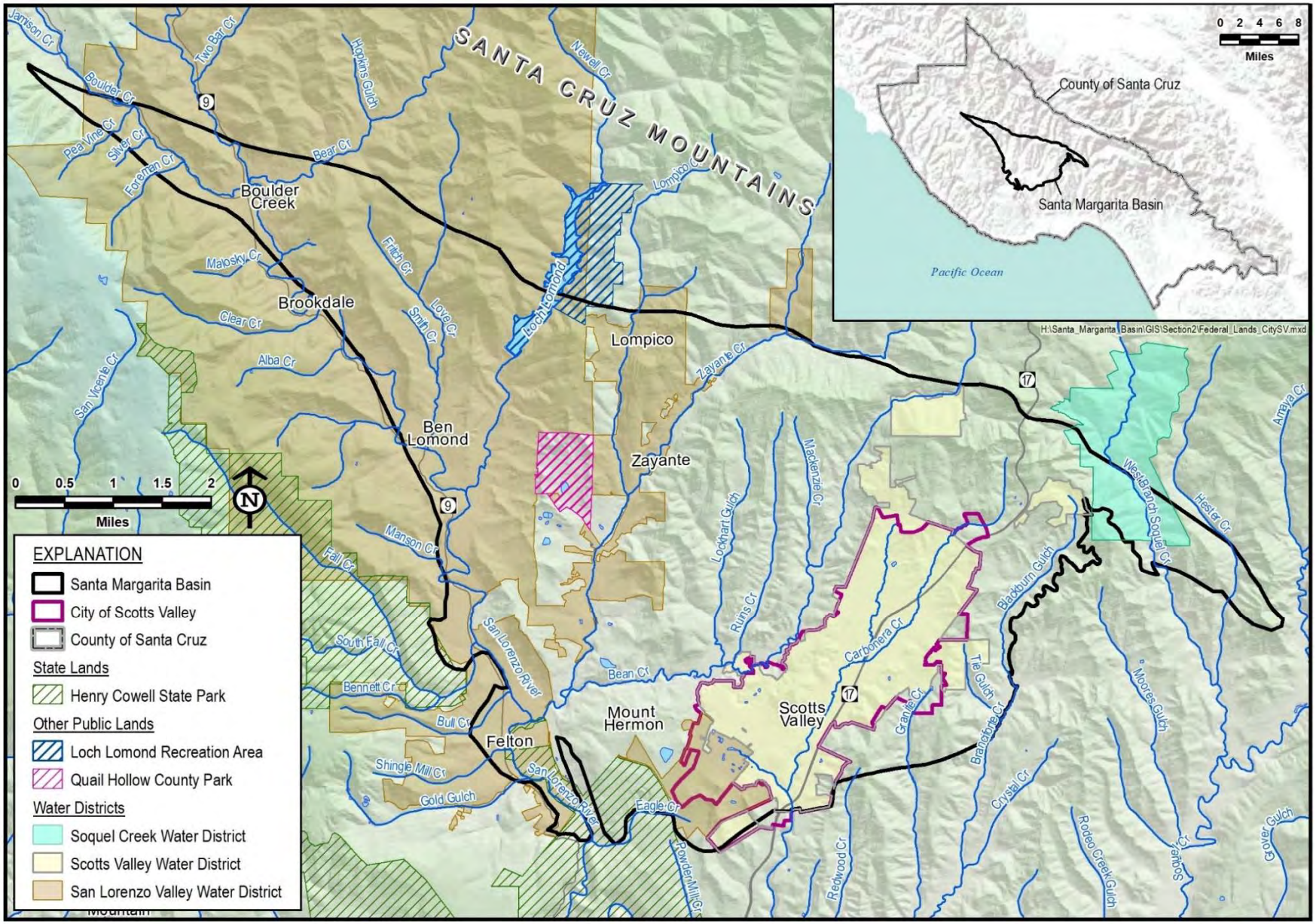



Figure 2-22 22 2 2. Jurisdictional Areas within the Santa Margarita Basin

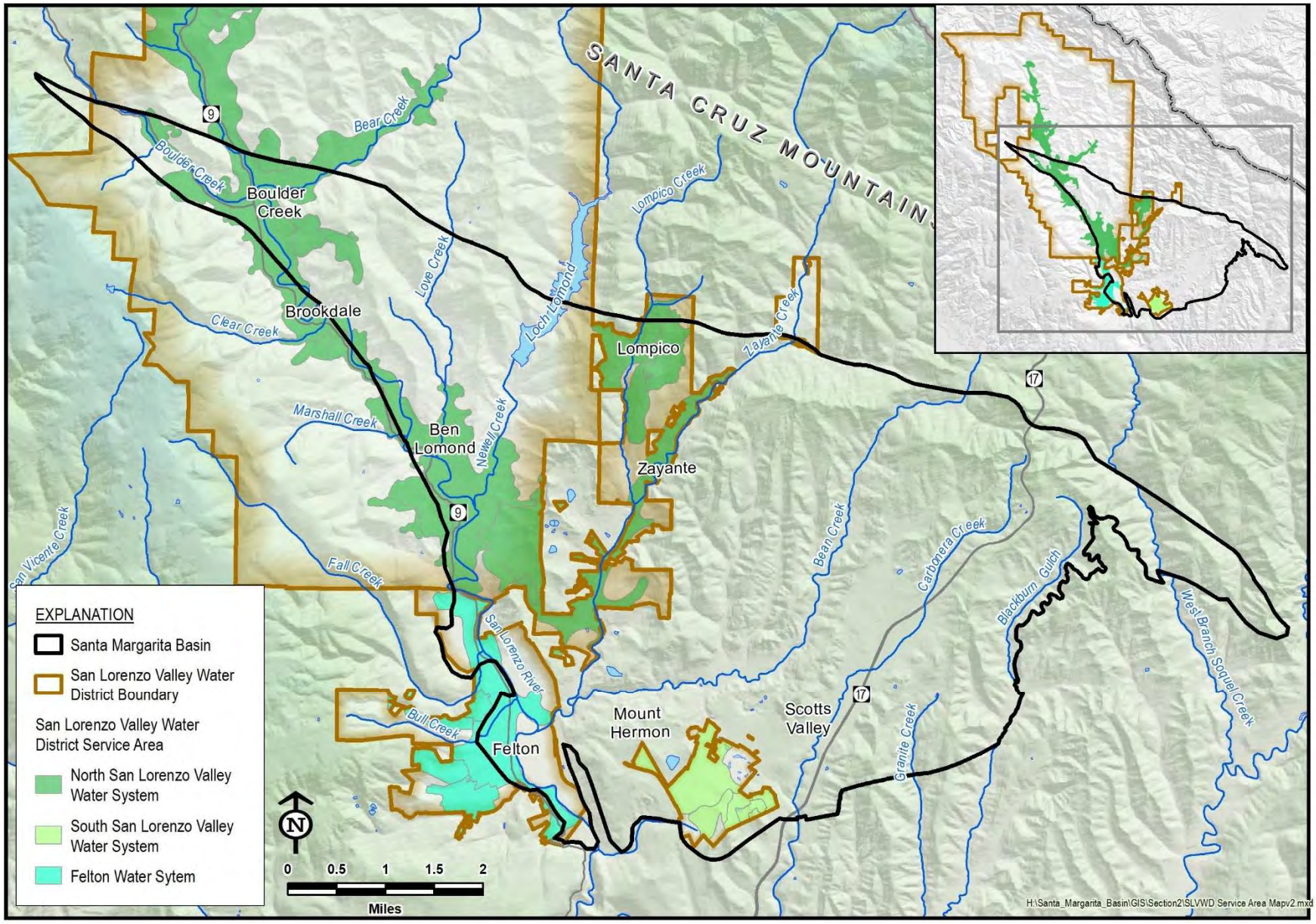



Figure 2-3~~2-32-2-3~~. San Lorenzo Valley Water District Boundary and Water Systems

#### *2.1.1.2.3 SOQUEL CREEK WATER DISTRICT*

The Soquel Creek Water District (SqCWD) ~~extracts its water supply from aquifers within the neighboring Santa Cruz Mid-County Basin and does not have any active service area or extract groundwater in the Santa Margarita Basin. Figure 2-2Figure 2-2 shows a small portion of the SqCWD within~~ owns approximately 1 square mile of land (640 acres) in the northeastern part of the Basin. The jurisdictional area is a legacy of a now-abandoned plan to construct a reservoir on the West Branch of Soquel Creek. SqCWD does not supply or extract water from the Basin.

### 2.1.1.3 City of Scotts Valley

The City of Scotts Valley is not a potable water supplier, but it is responsible for storm water and wastewater management. City of Scotts Valley residents and businesses are supplied potable water by SVWD and SLVWD (Figure 2-2). The City of Scotts Valley and SVWD Recycled Water Program is a cooperative effort to reuse treated wastewater. The City of Scotts Valley operates the Scotts Valley Water Reclamation Facility (WRF) and the Tertiary Treatment Plant which ~~since 2002~~ has produced recycled water since 2002 for its own use and for distribution by SVWD. The recycled water is non-potable and is used primarily for landscape irrigation and to a lesser extent for dust control. Effluent from the WRF that is not used in the Basin is transported through a ~~land outfall~~pipeline to the City of Santa Cruz marine outfall in ~~the~~ Monterey Bay operated and maintained by the City of Santa Cruz Public Works Department.

### 2.1.1.4 Federal and State Lands

The only state managed land in the Basin is Henry Cowell State Park (Figure 2-2). There are no federal lands. The United States Geological Survey (USGS) National Map (USGS, 2019) show portions of the Loch Lomond Recreation Area and Quail Hollow County Park as state lands (Figure 2-2). They are however, managed by the City of Santa Cruz and County of Santa Cruz, respectively.

### 2.1.1.5 Tribal Lands

There are no federally designated tribal lands and no federally recognized tribes in the Basin. The Basin is located within a California Tribal and Cultural Area that historically belonged to a division of the Ohlone people known as the Awaswas. There is no currently active or known group representing the descendants of the Awaswas. The neighboring tribe to the Awaswas were the Mutsun, now represented through the Amah Mutsun Tribal Band (AMTB). The AMTB people inhabited the land from present-day Davenport to Aptos. Descendants of the Awaswas people are members of the AMTB. The Tribal Band is petitioning the federal government for tribal recognition and has formed the Amah Mutsun Land Trust to access, protect, and steward lands important to the tribe (Amah Mutsun, 2019).

Staff met with a representative of the AMTB who indicated their focus currently is on their ancestral lands, however they do maintain an interest in the surrounding areas as well. As rivers are of particular importance, SMGWA and contributing agencies will notify the AMTB about projects that may impact waterways, and work with them to accommodate any actions they recommend.

### 2.1.2 City of Santa Cruz

The City of Santa Cruz has no service area in the Basin and is not a member agency of the SMGWA. However, the City is an indirect groundwater user in the Basin because the surface water it diverts from the San Lorenzo River for municipal use partially comprises baseflows supported by Basin groundwater discharge to creeks. The City owns property, which is partly located in the Basin, associated with water supply use and construction of the Loch Lomond Reservoir (Figure 2-2).

The San Lorenzo River and Loch Lomond Reservoir provide about 69% of the water supplied to approximately 95,000 City of Santa Cruz Water Department customers (City of Santa Cruz, 2016a). Surface water from Loch Lomond Reservoir is conveyed by the Newell Creek Pipeline to the Graham Hill Water Treatment Plant (WTP) in the City of Santa Cruz. Surface water from the San Lorenzo River is diverted in 2 locations for use by the City of Santa Cruz. There is 1 diversion location in the Basin in Felton that is used to divert water upstream to the Loch Lomond Reservoir and 1 location downstream of the Basin that is used to divert water to the City treatment plant. Between 2006 and 2015, 14% of the City of Santa Cruz water supply was from Loch Lomond Reservoir storage and 55% was from the San Lorenzo River. Additional details are provided in Section 3.4.8 on surface water bodies in the Basin.

### 2.1.3 Basin Groundwater Management Areas

#### 2.1.3.1 GSP Management Areas

SGMA allows GSAs to define 1 or more management areas within a groundwater basin if the agency determines that the creation of management areas will facilitate implementation of its GSP. ~~Management areas may have different minimum thresholds and be operated to different measurable objectives than the basin at large, provided that undesirable results are defined consistently throughout the basin.~~ The SMGWA ~~found~~ finds no additional benefit to establishing separate management areas within the Basin at this time, although management areas may be needed in the future.

#### 2.1.3.2 Other Basin Management Areas

There are no adjudicated or alternative GSP managed areas within the Basin.

## 2.2 Water Resources Monitoring and Management Programs

Groundwater resources in the Basin have been used as a shared resource for many decades and collaboratively managed for nearly 2 decades by local agencies. The SMGWA was preceded by a local advisory committee called the Santa Margarita Groundwater Basin Advisory Committee (SMGWBAC) that had some of the same functions and same member agencies as the SMGWA. The SMGWBAC was formed by a Memorandum of Understanding in 1995 by the SVWD, SLVWD, MHA, Lompico County Water District (merged with SLVWD in 2016), City of Scotts Valley and County of Santa Cruz. The SMGWBAC consisted of 1 representative and 1 alternate from each member agency. The committee met biannually and was actively involved in all facets of groundwater management of the Basin. In 2016, the SMGWBAC established a GSA Formation Committee, which led the effort of preparing a draft JPA for the SMGWA. With the creation of the SMGWA, the SMGWBAC function became redundant, and the committee was dissolved in 2017.

The SMGWA cooperating agencies have had active roles in groundwater resource management and monitoring in the Basin as members of the SMGWBAC and independently to support their water supply operations. The subsections that follow describe the cooperating agencies' groundwater elevations, groundwater extraction, groundwater quality, and surface water flow and quality management and monitoring programs. The purpose of these monitoring efforts is to responsibly manage the water resources relied upon for public water supply.

~~None~~ Most of the existing water resources monitoring and management programs that use water within the Basin do not have triggers that limit operational flexibility with respect to groundwater or surface water use. However, the City of Santa Cruz, which diverts San Lorenzo River surface water at Felton to Loch Lomond Reservoir and at Tait Street (downstream of the Basin has explicit triggers related to bypass flows at the San Lorenzo River Big Trees gage. The water rights permit for Fall Creek diversions, a tributary to the San Lorenzo River, has similar bypass flow requirements on the San Lorenzo River that influence SLVWD diversion timing and rates. Groundwater and surface water monitoring programs that are in operation in the Basin are incorporated into SMGWA's monitoring network described in Section 6~~3~~.

### 2.2.1 United States Geological Survey Surface Water Monitoring

The USGS has operated and reported on the Big Trees streamflow gage (11160500) on the San Lorenzo River, south of Felton (Section 6.6.1) ~~()~~, since October 1937.

~~Figure 2-4. Surface Water Monitoring Sites~~

### 2.2.2 California Department of Water Resources Groundwater Level Monitoring Programs ~~CASGEM Program~~

Prior to SGMA, DWR implemented the ~~The Santa Cruz County Environmental Health Services Department administers the DWR~~ California Statewide Groundwater Elevation Monitoring (CASGEM) program to evaluate regional groundwater elevations. ~~The CASGEM well network includes monitoring locations throughout the County, including 6 wells within the Basin. Statewide g~~Groundwater elevation monitoring through CASGEM ~~has~~ provided DWR with data needed to track seasonal and long-term groundwater elevation trends ~~in groundwater basins throughout the state~~. The ~~Santa Cruz County Environmental Health Services Department~~SCEH administered CASGEM in the Basin.

~~Following submittal of the GSP, CASGEM wells within the Basin will be migrated into the SMGWA's monitoring network to monitor groundwater conditions resulting from GSP implementation.~~Under SGMA implementation, groundwater level monitoring is now coordinated through the SGMA Portal and Monitoring Network Module (MNM), which serves as the primary platform for submission, storage, and public dissemination of groundwater elevation and other monitoring data. CASGEM monitoring sites within the Basin have been incorporated into this broader SGMA monitoring ~~framework~~data and are now reported as part of SMGWA's monitoring network. ~~This integration supports consistent statewide data management, facilitates evaluation of sustainable management criteria, and enables ongoing assessment of groundwater conditions in response to GSP implementation.~~

### 2.2.3 Central Coast Regional Water Quality Control Board Basin Plan

Surface water and groundwater quality in the Basin is managed per the water quality objectives and beneficial uses described in the Central Coast Region, Water Quality Control Plan (Basin Plan; Central Coast Regional Water Quality Control Board (CCRWQCB), 2019). The Basin Plan is developed by the CCRWQCB, together with the State Water Resources Control Board (SWRCB), and California Environmental Protection Agency (CALEPA). The Basin Plan lists various beneficial water uses and describes the water quality which must be maintained to allow those uses. Present and potential future beneficial uses for inland waters in the Basin Plan are surface water and groundwater as municipal supply; agricultural; industrial; groundwater recharge; water recreation; cold freshwater habitat; wildlife habitat; sport fishing; rare, threatened or endangered species; migration of aquatic organisms; and, spawning, reproduction, and/or early development of fish.

Water quality is an important factor in determining water use and benefit. For example, drinking water must be of higher quality than the water used to irrigate pastures. Since the Santa Margarita Basin does not have its own Basin-specific groundwater quality objectives, the broad groundwater objectives of the Central Coast Region Basin Plan are summarized in Table 2-1.

Site-specific median groundwater quality objectives are provided at 2 locations within the Basin: near Felton and near Boulder Creek (Table 2-2). It is unclear from the Basin Plan which aquifers these apply to. The County has interpreted the location near Felton to apply to the Santa Margarita Sandstone, and the location near Boulder Creek to apply to the Butano Sandstone within the Basin (personal communication with John Ricker, March 2020). The Basin Plan also includes mean surface water quality objectives, or concentrations in milligrams per Liter (mg/L) for total dissolved solids (TDS), chloride, sulfate, boron, sodium for Boulder Creek, Zayante Creek, and the San Lorenzo River (Table 2-2**Error! Reference source not found.**).

The Basin Plan ~~addresses the problem of~~sets limits for nitrate loading in the San Lorenzo River. Nitrate released from septic systems, livestock, fertilizer use, and other sources passes readily through the sandy soil, into the Basin groundwater, and eventually into the San Lorenzo River. As such, the San Lorenzo River has been designated as impaired by the State and the United States Environmental Protection Agency (USEPA) due to elevated levels of nitrate, which stimulate increased algal growth and release of compounds that degrade drinking water quality and require increased cost for treatment. Increased nitrate and algal growth also cause impacts in the San Lorenzo lagoon[1], degrading salmonid habitat and potentially creating harmful algal blooms. Approximately 65% of the nitrate load in the San Lorenzo River originates from the Basin's Santa Margarita Sandstone, the majority of which comes from septic systems (County of Santa Cruz, 1995).

To reduce nitrate levels in the San Lorenzo River, the County developed the San Lorenzo Nitrate Management Plan in 1995, and the CCRWQCB adopted a Nitrate Total Maximum Daily Load (TMDL) in the Basin Plan. These plans call for various measures to prevent any increased nitrate discharge and to reduce existing sources, particularly requiring individual enhanced treatment systems as existing septic systems in sandy soils are replaced or upgraded. Further, the use of recycled water in the basin requires additional treatment for denitrification before the water can be used.

The Basin Plan update in 2003 described the San Lorenzo River as impaired for both sediment and pathogens. The San Lorenzo River Technical Advisory Committee was formed to help the CCRWQCB develop actionable plans to decrease the levels of these constituents in the river. Responsibility for tracking, reporting status, and evaluating the effectiveness of voluntary implementation actions, is shared by the Regional Board and participating members of the San Lorenzo River Technical Advisory Committee. TMDLs have been adopted for both sediments and pathogens and are being implemented to reduce the sources of those pollutants. The technical advisory committee has found that the highly erodible soils of the Santa Margarita Sandstone have been a significant source of sediment in the ~~River~~river. Measures are needed to

[1] The San Lorenzo lagoon is found at the mouth of the San Lorenzo River and is most prominent when a sandbar disconnects the river from the ocean.

reduce site disturbance, reduce runoff, promote infiltration, and implement erosion control practices. The pathogen TMDL calls for improved septic system management to reduce failures and address other sources such as livestock, stormwater runoff, and homeless encampments.

Table 2-12~~-12-1~~. Central Coast Basin Plan Groundwater Water Quality Objectives Applicable to the Santa Margarita Basin

| Chemical Constituent | General Objectives for Groundwater | Objectives for Municipal & Domestic Groundwater Supply |
|---|---|---|
| Tastes and odors | Groundwaters shall not contain taste or odor producing substances in concentrations that adversely affect beneficial uses. | --- |
| Radioactivity | Radionuclides shall not be present in concentrations that are deleterious to human, plant, animal, or aquatic life; or result in the accumulation of radionuclides in the food web to an extent which presents a hazard to human, plant, animal, or aquatic life. | Groundwaters shall not contain concentrations of radionuclides in excess of the limits specified in ~~California Code of Regulations~~CCR, Title 22, Division 4, Chapter 15, Article 5, Section 64443. This incorporation-by-reference is prospective including future changes to the incorporated provisions as the changes take effect. |
| Bacteria | --- | The median concentration of coliform organisms over any 7-day period shall be less than 2.2/100 mL |
| Organic Chemicals | --- | Groundwaters shall not contain concentrations of organic chemicals in excess of the maximum contaminant levels for primary drinking water standards specified in ~~California Code of Regulations~~CCR, Title 22, Division 4, Chapter 15, Article 5.5, Section 64444, Table 64444-A. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect. |
| Inorganic Chemicals | --- | Groundwaters shall not contain concentrations of inorganic chemicals in excess of the maximum contaminant levels for primary drinking water standards specified in ~~California Code of Regulation~~CCR~~s~~, Title 22, Division 4, Chapter 15, Sections 64431 and 64433.2. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect. |

Table 2-2~~2-22-2~~. Central Coast Basin Plan Groundwater and Surface Water Quality Objectives Applicable in the Santa Margarita Basin (Source: Central Coast Regional Water Quality Control Board, 2019)

| Chemical Constituent | Median Groundwater Quality Objectives (mg/L) | | | Mean Surface Water Quality Objectives (mg/L) | | |
|---|---|---|---|---|---|---|
| | Near Felton | Near Boulder Creek | San Lorenzo River (above Bear Creek) | San Lorenzo River (at Tait Street Check Dam)* | Zayante Creek | Boulder Creek |
| Total dissolved solids | 100 | 250 | 400 | 250 | 500 | 150 |
| Chloride | 20 | 30 | 60 | 30 | 50 | 10 |
| Sulfate | 10 | 50 | 80 | 60 | 100 | 10 |
| Boron | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Sodium | 10 | 20 | 50 | 25 | 40 | 20 |
| Nitrate as N | 1 | 5 | --- | --- | --- | --- |

* Downstream of the Santa Margarita Basin

~~2.2.4 To reduce nitrate levels in the San Lorenzo River, the County developed the San Lorenzo Nitrate Management Plan in 1995, and the CCRWQCB adopted a Nitrate Total Maximum Daily Load (TMDL) in the Basin Plan. These plans call for various measures to prevent any increased nitrate discharge and to reduce existing sources, particularly requiring individual enhanced treatment systems as existing septic systems in sandy soils are replaced or upgraded. Further, the use of recycled water in the basin requires additional treatment for denitrification before the water can be used.~~

~~2.2.5 The Basin Plan update in 2003 described the San Lorenzo River as impaired for both sediment and pathogens. The San Lorenzo River Technical Advisory Committee was formed to help the CCRWQCB develop actionable plans to decrease the levels of these constituents in the river. Responsibility for tracking, reporting status, and evaluating the effectiveness of voluntary implementation actions, is shared by the Regional Board and participating members of the San Lorenzo River Technical Advisory Committee. TMDLs have been adopted for both sediments and pathogens and are being implemented to reduce the sources of those pollutants. The technical advisory committee has found that the highly erodible soils of the Santa Margarita Sandstone have been a significant source of sediment in the River. Measures are needed to reduce site disturbance, reduce runoff, promote infiltration, and implement erosion control practices. The pathogen TMDL calls for improved~~

~~septic system management to reduce failures and address other sources such as livestock, stormwater runoff, and homeless encampments.~~

## ~~2.2.6~~2.2.4 County of Santa Cruz Monitoring

The County of Santa Cruz has several water resources monitoring and management programs, including programs for groundwater levels, groundwater quality, surface water flow, and nitrate control from septic sources.

### ~~2.2.6.1~~2.2.4.1 Groundwater Elevation Monitoring

SCEH has a private well groundwater elevation monitoring network in parts of the County, including in the adjacent Santa Cruz Mid-County Basin. Since the 2022 GSP, ~~two wells have been added to the~~ SCEH has added a private well in the Weston Road area of ~~network in the~~ Santa Margarita Basin. This was previously identified as a data gap in an area with a high concentration of domestic users.~~While this network does not currently include wells in the Santa Margarita Basin, SCEH staff expects to add Santa Margarita Basin wells in the near future.~~

### ~~2.2.6.2~~2.2.4.2 Groundwater Quality Monitoring

#### ~~2.2.6.2.1~~2.2.4.2.1 *PRIVATE WELLS*

SCEH monitors groundwater quality for domestic wells serving up to four parcels in three ways:

- At the time of new well construction, water must be tested for 21 different potential contaminants. Treatment may be required to meet primary drinking water standards. Results of the water quality testing are provided to the County.
- At the time that a property served by a domestic well is sold, the water must be tested for the same 21 contaminants, and those results are provided to the buyer and the County. Even if there are exceedances, treatment is not required.
- The County is partnering with the Regional Water Quality Control Board to provide free water quality testing to all domestic wells in the County. The program will cover testing for 35 potential contaminants for all residents, and income qualifying residents may also have PFAS included. Results are anonymized and made available online at https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/.

~~SCEH requires private well owners to report submission of data on well production and groundwater quality data (nitrate, chloride, total dissolved solids, iron, and manganese) as a condition of approval for all new developments served by an individual well. Additionally, Ssince 2010, the County requires submittal of those groundwater quality data for any new well~~

~~construction. There are no ongoing monitoring requirements for private wells after the initial sample is collected and reported to the County.~~

#### ~~2.2.6.2.2~~2.2.4.2.2 *SMALL WATER SYSTEMS*

SCEH Drinking Water Program regulates state small water systems (5-14 connections) and public water systems (15-199 connections) to ensure the water provided through these small water systems meets federal and state water quality standards. The County requires sampling, testing, and reporting of chemical and biological parameters and oversees regulatory compliance for these systems. All systems are also required to report their monthly water production at the end of each year.

- State Small Water Systems with 5-14 connections are regulated under both county and state regulations through the SCEH Drinking Water Program. State small water systems are required to provide quarterly bacteriologic water quality results to the County, and additional results on a less frequent basis.

- Public Water Systems located within communities serving 15-199 connections and those that serve more than 25 people for more than 60 days a year through non-community or transient uses (businesses, schools, restaurants, etc.) are regulated by the SCEH Drinking Water Program acting for the State Water Resources Control Board Division of Drinking Water (DDW) through a Local Primacy Agency agreement. Public water systems are required to provide monthly bacteriologic sampling results to the County, with other results provided on an annual or less frequent basis.

#### ~~2.2.6.2.3~~2.2.4.2.3 *WASTELOAD ALLOCATION ATTAINMENT PROGRAM*

The County's WAAP identifies, prioritizes, and describes programs to reduce contaminant loads in surface water that could impact the health of the community's surface water and drinking water. The program monitors surface water quality for nitrate and *E. coli*, identifies impaired waters by comparing monitoring results to federal water quality standards, identifies the sources of pollution, and prioritizes best management practices (BMPs) to bring impaired surface waters into compliance with federal standards.

### ~~2.2.6.3 Surface Water Flow Monitoring and Management~~

~~The County currently operates 5 low-flow stream gages (Figure 2-4Figure 2-4) () within the Basin with the goal of understanding dry-season flows in support of coho and steelhead habitat-enhancement efforts. More recently, stream flow monitoring has supported the ongoing GSP process. The 5 gauging locations with their periods of record by water year (WY) are:~~

- ~~Zayante Creek at Woodwardia (WY2009 – WY2010; WY2017 – current)~~

- ~~Bean Creek at Mount Hermon Camp (WY2009 – WY2012; WY2017 – current)~~

- ~~Bean Creek at Mount Hermon Road (WY2012 – WY2013 sponsored by SVWD, WY2019 – current)~~

- ~~Newell Creek 100 feet upstream of the San Lorenzo River (WY2019 – current)~~

- ~~Eagle Creek above its entry into the San Lorenzo River (WY2018 – current)~~

~~These gages are only operated during the dry season, with monthly site visits to make field observations, repair equipment, calibrate devices, and measure flow and specific conductance. Each gage is equipped with a pressure transducer, which collects continuous water depth data at 15-minute intervals. Field observations and measurements are used to calibrate the gauging records. In addition to collecting data at these gage locations, flow at specific tributaries (e.g., Ferndell Creek) are measured to improve understanding of the Santa Margarita boundary aquifer conditions. Balance Hydrologics has made these observations and prepared annual reports as deliverables to the County.~~

~~The USGS operated a gage on Bean Creek at the Mount Hermon Road site (Figure 3-16Figure 3-16) from WY1998 through WY2007, also with continuous flow measurements calibrated by monthly visits. No record of specific conductance or other water-quality measurements were published.~~

~~Beginning in 2017, Balance Hydrologics conducted annual late-season stream observation walks ("accretion runs"), where flow, nitrate, and specific conductance are measured at select locations along the San Lorenzo River and its tributaries. Measurements are collected along the reach from Felton up through Boulder Creek. The goal of the accretion study is to improve understanding of the surface water and groundwater interactions within the Basin. As part of the GSP process, sites along Zayante Creek, Lompico Creek, and Bean Creek were added to the accretion runs in the summer of 2019. Most of the added sites are focused along Bean Creek and its tributaries. During the summer and fall of 2019, 3 separate accretion runs (May, July, and September) were conducted on the San Lorenzo River, Lompico Creek, Zayante Creek, Bean Creek, and Eagle Creek. Measurements were collected at all sites over a period of 1 to 2 days for each run. The number of accretion runs was increased during 2019 to capture the changes in flow during the dry-season recession and to aid in understanding the surface-water groundwater interactions within the Basin.~~

### ~~2.2.6.4~~2.2.4.3 Local Area Management Program

- The County's Local Area Management Program (LAMP) was adopted by the Santa Cruz County Board of Supervisors on August 23, 2022~~developed in 2021~~. The purpose of the LAMP is to provide for the continued use of Onsite Wastewater Treatment Systems (OWTS, also known as septic systems) in Santa Cruz County while providing protection of

water quality and public health. The LAMP updates and expands the wastewater management approaches conducted by Santa Cruz County since 1985.

### ~~2.2.7~~2.2.5 San Lorenzo Valley Water District Groundwater and Surface Water Monitoring and Management

SLVWD conducts routine groundwater extraction, groundwater level, and streamflow monitoring to support its water resource management. SLVWD has monitored groundwater production since 1984, with current monthly production monitoring ongoing in the SLVWD's 7 active extraction wells. Groundwater elevations have also been monitored in production areas since the 1960s, with consistent monitoring since the mid-1970s. SLVWD monitors groundwater elevations in all its production wells plus monitoring wells listed in Table 2-3. SLVWD monitors streamflow downstream of its diversions (Section 6.6.1). ~~SLVWD's 2025 Urban Water Management Plan (UWMP; SLVWD, 2026) update aligns the district groundwater monitoring and management with the GSP.~~

Table 2-3~~2-3~~2-3. SLVWD Groundwater Production and Groundwater Elevation Monitoring Wells

| Well Name | Well Status | Reference Point Elevation (feet msl) | Primary Screened Formation | Screen Interval Depth (feet bgs) |
|---|---|---|---|---|
| **SLVWD Production Wells – Groundwater Production and Groundwater Elevation Measured Monthly** | | | | |
| **San Lorenzo Valley System – Northern Portion** | | | | |
| Quail Hollow #4A | active | 600.0 | Santa Margarita | 180 – 250 |
| Quail Hollow #5A | active | 519.0 | Santa Margarita | 124 – 164 |
| Olympia #2 | active | 527.0 | Santa Margarita | 225 – 245, 275 – 298 |
| Olympia #3 | active | 540.0 | Santa Margarita | 230 – 308 |
| **San Lorenzo Valley System – Southern Portion** | | | | |
| Pasatiempo #5A | active | 757.0 | Lompico | 400 – 700 |
| Pasatiempo #7 | active | 739.0 | Lompico | 380 – 440, 495 – 525 |
| Pasatiempo #8 | active | 780.0 | Lompico | 560 – 660, 680 – 780 |
| ~~Mañana Woods #1~~ | ~~inactive~~ | ~~~515~~ | ~~Santa Margarita /Lompico~~ | ~~136 - 436~~ |
| ~~Mañana Woods #2~~ | ~~inactive~~ | ~~~516~~ | ~~Santa Margarita /Lompico~~ | ~~156 – 196, 236 – 276, 306 – 326~~ |
| **Well Name** | **Well Status** | **Reference Point Elevation (feet msl)** | **Primary Screened Formation** | **Screen Interval Depth (feet bgs)** |

| SLVWD Monitoring Wells – Groundwater Elevation Measured Monthly | | | | |
|---|---|---|---|---|
| **San Lorenzo Valley System – Northern Portion** | | | | |
| Quail Hollow MW-A | active | 430.7 | Santa Margarita | 38 – 88 |
| Quail Hollow MW-B | active | 578.4 | Santa Margarita | 95 – 195 |
| Quail Hollow MW-C | active | 629.6 | Santa Margarita | 120 – 220 |
| ~~Quail Hollow Ranch~~ | ~~inactive~~ | ~~627.0~~ | ~~Santa Margarita~~ | ~~225 – 275~~ |
| Quail Hollow #8* | inactive | 407.0 | Santa Margarita | 100 – 130 |
| Olympia #1* | active | 448.0 | Santa Margarita | 131 – 159, 127-157 |
| **San Lorenzo Valley System – Southern Portion** | | | | |
| Pasatiempo MW-1 | active | 788.7 | Lompico | 600 – 660 |
| Pasatiempo MW-2 | active | 788.7 | Santa Margarita | 280 – 340 |
| Pasatiempo #3* | active | 570.39 | Lompico | 23 - 147, 169 - 260 |

*Former production well
feet msl = elevation in feet relative to mean sea level
feet bgs = depth in feet below ground surface

### ~~2.2.8~~2.2.6 Scotts Valley Water District Groundwater Monitoring and Management

The SVWD has been actively managing groundwater since the early 1980s; with the goal of increasing water supply reliability and protecting local water supply sources. In 1983, SVWD instituted a Water Resources Management Plan to monitor and manage water resources in the Scotts Valley area. In 1994, SVWD formally adopted a Groundwater Management Plan ([GWMP], Todd Engineers, 1994) in accordance with Assembly Bill 3030 (AB 3030), also known as the Groundwater Management Act (CWC §10750 *et seq.*). The overall purpose of the GWMP was to provide a planning tool that helps guide SVWD manage the quantity and quality of its groundwater supply, and to comply with the requirements of AB3030. The goal of the SVWD GWMP is stated as:

> *By implementation of a groundwater management plan for Scotts Valley, SVWD hopes to preserve and enhance the groundwater resource in terms of quality and quantity, and to minimize the cost of management by coordination of efforts among agencies.*

Development of Basin Management Objectives (BMOs) are required for the GWMP under CWC § 10753.7(a)(1) as a systematic process to support groundwater basin management. The BMOs for SVWD's GWMP are summarized as:

- Encouraging public participation through an annual report of groundwater management activities and its presentation at 1 or more public meetings
- Coordinating with other local agencies

- Continued monitoring and evaluation of groundwater conditions
- Implementing groundwater augmentation projects
- Investigating groundwater quality and preventing groundwater contamination

These BMOs guided the SVWD groundwater management program and served as major ~~objectives of~~ groundwater management objectives. The ~~for SVWD. Groundwater management covered by the GWMP will be replaced by this~~BMOs are fundamental goals that ~~were~~are incorporated into the GSP ~~GSP.~~.

Starting in 1994, annual reports that analyze and describe the condition of the Basin were produced as part of GWMP implementation. The format of the annual reports has evolved over time to meet the needs of SVWD. ~~Starting in 2013, the format began following a 2-year cycle with more comprehensive reports being produced in even years. Based on past experience, there were only incremental year-to-year changes in the Basin; therefore, the 2-year cycle provided a more cost-effective approach to accomplish the objectives of the annual report. The odd year reports are concise summaries focused on SVWD operations whereas the even year reports provide more regional assessments that include an evaluation of data from neighboring water districts and private suppliers, an assessment of water quality issues, an assessment of Basin conditions and change in groundwater in storage simulations from the updated Basin's groundwater model.~~Currently, SVWD uses annual spring groundwater conditions reports to help assess water shortages and implement drought contingency plans, as needed. ~~SVWD's 2025 Urban Water Management Plan (SVWD, 2026) update aligns the district groundwater monitoring and management with the GSP.~~

Development of a monitoring network to track Basin conditions within SVWD's service area has been part of GWMP implementation. Table 2-4 lists the SVWD monitoring wells that are currently included in their monitoring network. All existing monitoring wells will be incorporated into the SMGWA monitoring network.

Table 2-4~~2-4~~~~2-4~~. Wells Used for the Scotts Valley Water District Groundwater Management & Monitoring Program

| Well Name | Well Status | Reference Point Elevation (feet msl) | Primary Screened Formation | Screen Interval Depth (feet bgs) |
|---|---|---|---|---|
| **SVWD Extraction Wells ~~– Measurements taken monthly for both static and dynamic levels~~** | | | | |
| SVWD Grace Way~~SVWD Well #3B~~ | ~~active~~active | 585 (lidar elevation)~~660.0~~ | Lompico, Butano~~Lompico, Butano~~ | 570-700, 720-950~~700-730, 880-1050, 1180-1370, 1400-1670~~ |
| SVWD Orchard Well | active | 716.4 | Lompico, Butano | 705-784, 805-1063, 1084-1455 |
| SVWD Sucinto | Aactive | 660 | Lompico, Butano | 700-730, 1070-1390 |
| SVWD Well #9 | inactive extraction active monitoring | 528.1 | Monterey | 155-195, 315-355 |
| SVWD Well #10 | inactive extraction | 510.9 | Lompico | 190-220, 240-270, 325-355 |

| | | | | |
|---|---|---|---|---|
| | active monitoring | | | |
| SVWD Well #10A | active | 512.0 | Lompico | 280-380, 400-450 |
| SVWD Well #11A | active | 602.6 | Lompico | 399-419, 459-469,495-515 |
| SVWD Well #11B | active | 588.0 | Lompico | 348-388, 423-468, 500-515 |
| **Well Name** | **Well Status** | **Reference Point Elevation (feet msl)** | **Primary Screened Formation** | **Screen Interval Depth (feet bgs)** |
| **SVWD Monitoring Wells ~~- Key Indicator Wells – Measurements taken monthly~~** | | | | |
| #15 Monitoring Well[2] | active | 660.0 | Lompico, Butano | 700-1100 |
| #9 Monitoring Well | active | 528.1 | Monterey | N/A |
| **~~SVWD Monitoring Wells - Measurements taken semi-annually~~** | | | | |
| SVWD AB303 MW-1[1,2,~~3~~] | active | 561.7 | Santa Margarita | 114-124 |
| SVWD AB303 MW-2[2] | active | 524.2 | Lompico | 705-715, 810-850 |
| SVWD AB303 MW-3A[1,2,~~3~~] | active | 526.2 | Lompico | 630-680 |
| SVWD AB303 MW-3B[1,2,~~3~~] | active | 524.4 | Santa Margarita | 120-125 |
| SVWD Canham ~~Well~~ [2] | active | 782.8 | Butano | 1,281-1,381 |
| SVWD Stonewood ~~Well~~ [2] | active | 898.5 | Butano | 799-859 |
| SVWD SV1-MW | inactive | 704.3 | Santa Margarita | 60-80 |
| SVWD SV3-MW A ~~[2]~~ | inactive | 593.0 | Santa Margarita | 60-80 |
| SVWD SV3-MW B ~~[2]~~ | inactive | 593.0 | Santa Margarita | 100-110 |
| SVWD SV3-MW C ~~[2]~~ | inactive | 593.0 | Lompico | 150-160 |
| SVWD SV4-MW | active | 455.3 | Santa Margarita | 50-60 |
| SVWD TW-18[1,2,~~3~~] | active | 715.0 | Santa Margarita | 285-345 |
| SVWD TW-19[1,2,~~3~~] | active | 659.6 | Lompico | 960-1060 |

Notes: [1] Groundwater elevation measurement data submitted to DWR CASGEM Program
[2] Equipped with electronic data transducer

- ~~[3] CASGEM well~~

feet msl = elevation in feet relative to mean sea level

feet bgs = depth in feet below ground surface

## ~~2.2.9~~2.2.7 Mount Hermon Association Groundwater Monitoring and Management

~~The Mount Hermon Association~~ MHA has 2 active and 1 inactive supply well that are used to measure~~s~~ ~~monthly depth to~~ groundwater levels and extraction (Table 2-5) ~~data from their actively pumped wells and reports it to SVWD as part of the GWMP described in Section 2.1.2.6~~. MHA also has an exploration well, MHA-MW1, that was converted to a monitoring well that supplements the groundwater level monitoring network.

Table 2-5~~2-5~~ ~~2-5~~. Wells Used for the Mount Hermon Association Groundwater Management & Monitoring Program

| Well Name | Well Status | Reference Point Elevation (feet msl) | Primary Producing Formation | Screen Interval Depth (feet bgs) |
|---|---|---|---|---|
| **MHA Production Wells – Measurements taken monthly for both static and dynamic levels** | | | | |
| MHA #1 | inactive | 727.1 | Monterey, Lompico | 255-265, 285-395, 435-495 |
| MHA #2 | active | 746.8 | Lompico | 290-300, 400-415, 430-460, 490-590, 600-615, 625-725 |
| MHA #3 | active | 584.0 | Lompico | 680-800, 860-980 |
| **MHA Monitoring Wells** – Measurements taken monthly | | | | |
| MHA-MW1 | active | 279.0 | Lompico | 120-300 |

### ~~2.2.10~~2.2.8 City of Santa Cruz Surface Water Monitoring and Environmental Management

As both an in-Basin user (Loch Lomond Reservoir, Felton diversion) and downstream user (Tait diversion) of San Lorenzo River watershed surface water, the City of Santa Cruz actively participates in surface water monitoring and management in the Basin. The key issues that have implications on the City of Santa Cruz water supply are nitrate impacts on surface water quality from the more than 13,000 septic systems in the San Lorenzo River watershed and groundwater use impacts on surface water baseflow supporting anadromous fisheries, particularly in Bean and Zayante Creeks. Reduced surface water baseflow in the Basin that may impact important coho salmon rearing streams increases the regulatory burden on the City, as any impact caused by the City's operations is evaluated within the context of overall habitat and population conditions. Finally, water resource management in the Basin also has impacts on the City of Santa Cruz's ability to fully exercise its water rights, which further complicates its ability to maintain supply reliability and improve habitat conditions for special status salmonids in the watershed.

#### ~~2.2.10.1~~2.2.8.1 Surface Water Monitoring and Management

The City of Santa Cruz monitors surface water stage and discharge in conjunction with their surface water supply diversions on the San Lorenzo River and Newell Creek. The City of Santa Cruz contributes financially to operation of the USGS flow gage on the San Lorenzo River at Big Trees, upstream of the City operated diversion in Felton. The City monitors surface water discharge on Newell Creek both upstream and downstream of the Loch Lomond Reservoir, at locations shown in ~~(~~Section 6.6.1~~Figure 3-16Figure 3-16)~~.

~~The City of Santa Cruz is preparing an Environmental Impact Report (EIR) to support proposed water rights changes that would apply minimum streamflow requirements on its water rights permits and licenses. The EIR will also address the City's water supply reliability issues by, among other things, improving the flexibility of operations and enabling conveyance of water to neighboring agencies, including the member agencies of the SMGWA. These operations could~~

~~support enhanced conjunctive use of surface water and groundwater for the City of Santa Cruz, and potentially the region. Flexibility in the diversion location for San Lorenzo River water and a consistent place of use for all City water rights may encourage regional water resource management.~~

#### ~~2.2.10.2~~2.2.8.2 Habitat Management

The City's Anadromous Salmonid Habitat Conservation Plan (HCP) was adopted by the Santa Cruz City Council in September 2025 (City of Santa Cruz, 2025). The HCP had been in development since 2001 and intends to restore habitats and populations of steelhead and coho salmon, which are priority species in the Basin, while minimizing the impacts of the City's water diversion to meet its long-term water supply needs. The City worked with the California Department of Fish and Wildlife (CDFW) and National Marine Fisheries Service (NMFS) in developing the HCP. ~~The City of Santa Cruz is committed to enhancing stream flows and habitat in the San Lorenzo River for local anadromous fisheries, particularly for coho salmon and steelhead. Since 2007, the City has provided bypass flows to benefit salmonids in its water source streams beyond what was required by its water rights. The City has conducted extensive studies on flows needed for all steelhead life stages, and the effect of maintaining flows at various levels in the San Lorenzo River downstream of the Tait Street diversion. The City has also assessed passage flows downstream of Felton Diversion.~~

The City continues to monitor various attributes related to fish habitat in the San Lorenzo River watershed and is evaluating development of monitoring to support the 2025 HCP. Under the existing City of Santa Cruz Water Department Watershed Monitoring Program, the following are specifically monitored:

- Temperature monitoring in a variety of locations throughout the San Lorenzo River watershed
- Turbidity monitoring upstream of Loch Lomond
- Dissolved oxygen and pH monitoring below Loch Lomond
- Juvenile salmonid and habitat in a variety of locations throughout the San Lorenzo River watershed, as a part of a collaborative effort funded by the City of Santa Cruz, SLVWD, SVWD and the County

### ~~2.2.11~~2.2.9 Environmental Monitoring Programs

There are currently no contamination sites undergoing groundwater extraction and treatment remediation within the Basin. Ongoing remediation and mitigation efforts taking place include soil vapor extraction, passive in situ remediation using injection barriers, soil excavation, and land use controls, as described in the subsections below. ~~Environmental contamination assessment and remediation programs within the County and Basin are overseen by~~ SCEH is the

local agency authorized by the CCRWQCB~~,~~ and California Department of Toxic Substances Control (DTSC) to oversee investigation and cleanup of waste releases in Santa Cruz County~~and. The SCEH is also involved with sites with hazardous materials impacts to soils~~. To protect their potable water supplies and more effectively manage the Basin, SMGWA member agencies are informed about local environmental compliance sites where groundwater quality has been impacted by pollution or chemical spills. SMGWA has a management action in this GSP to coordinate annually with SCEH to share updates on groundwater quality cleanup sites and supply well monitoring, discussed further in Section 8.2.2.

#### ~~2.2.11.1~~2.2.9.1 Groundwater Contamination Cleanup Sites

~~There are currently no contamination sites undergoing active groundwater remediation within the Basin; cleanup efforts taking place in the Basin are only related to soil vapor as described in the subsections below.~~ Historically, groundwater remediation of volatile organic compounds (VOCs) and gasoline-related chemicals in groundwater occurred at several Scotts Valley and Felton sites. The remediation efforts at these sites concluded after the concentrations of contaminants in groundwater decreased below the established water quality standards or no longer presented exposure risks. There is always a possibility that groundwater will be re-impacted in the future from these sites if the contaminant source was not completely addressed. Detailed information for all sites regardless of open or closed status is available from the SWRCB GeoTracker website at: https://geotracker.waterboards.ca.gov/ and the ~~Department of Toxic Substances Contro~~DTSC~~l~~ Envirostor web site at: www.envirostor.dtsc.ca.gov/public. One ~~additional~~ groundwater contamination cleanup site located 275 feet outside of the Basin at the former Valeteria Dry Cleaners in Felton is included in the summaries below since it ~~impacts~~ impacted water quality in the San Lorenzo River located only 400 feet to the east of it and within the Basin.

Figure 2-4 shows the location of all SWRCB GeoTracker sites, and for reference, those sites described in more detail below are labeled on the map. Sites indicated on Figure 2-4 include cleanup program sites, land disposal sites, and leaking underground storage tank (LUST) sites. Organic and emerging contaminant threats to water quality in the Basin are discussed in more detail in Section 4.4.4.

Descriptions of active and recently closed groundwater cleanup sites are included below.

**~~Watkins-Johnson Superfund Site~~**

~~The Watkins-Johnson site, located at 440 Kings Village Road in Scotts Valley, is a former semiconductor manufacturer where industrial processes included metal machining, degreasing operations, metal plating, glass cleaning, glass etching, welding, soldering, painting, and photo lab activities. A variety of organic chemicals, inorganic acids, and metals were used at the site. The site is a Federal Superfund Site listed on the National Priorities List, with remediation activities under the jurisdiction of USEPA Region 9 and the RWCQB.~~

~~The site's remedial investigation and feasibility study started in 1984 after organic chemicals were detected in the soil and groundwater at the site and in the surface water of Bean Creek near the site. Groundwater remediation began in October 1986. Key constituents detected in the groundwater include trichloroethene (TCE), cis-1,2-dichloroethene (CISDCE), and vinyl chloride (VC). In the soil, key constituents include TCE, methylene chloride, and chloroform. Of primary interest was the potential for contaminants in the soil to migrate into the underlying aquifers: the Santa Margarita Sandstone and Lompico Sandstone. SVWD Well #9, which is located approximately 400 feet south of the Watkins-Johnson site and screened in the lower Santa Margarita and Monterey Formations, has been impacted by TCE and CISDCE at concentrations below drinking water standards. Although this well is no longer used by SVWD, when it was used, water pumped from it required filtration by a granular activated carbon (GAC) system prior to putting the water into the distribution system.~~

~~Groundwater remediation at the site consisted of pumping groundwater beneath the site with a series of extraction wells and treating it using a GAC adsorption system. Treated water was used onsite, recharged to the perched zone onsite, and discharged to Bean Creek. The groundwater remediation system was deactivated on July 5, 2016.~~

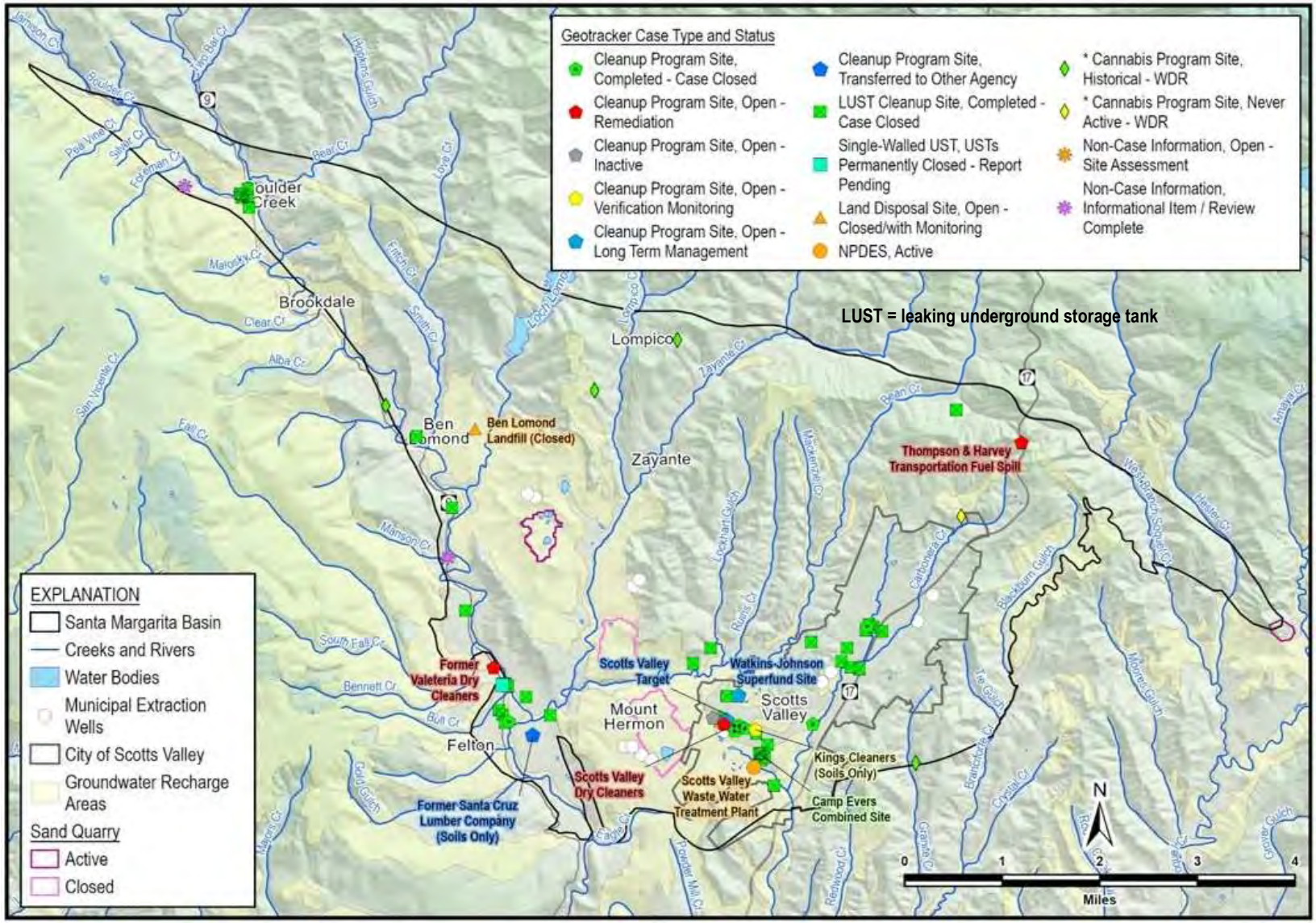



Figure 2-~~42~~-~~42~~-~~2~~-~~5~~. Location of Groundwater Contamination Cleanup Sites in the Santa Margarita Basin

#### *2.2.9.1.1 WATKINS-JOHNSON SUPERFUND SITE*

The Watkins-Johnson site, located at 440 Kings Village Road in Scotts Valley, is a former semiconductor manufacturer where industrial processes included metal machining, degreasing operations, metal plating, glass cleaning, glass etching, welding, soldering, painting, and photo lab activities. A variety of organic chemicals, inorganic acids, and metals were used at the site. The site is a Federal Superfund Site listed on the National Priorities List, with remediation activities under the jurisdiction of USEPA Region 9 and the RWCQB.

The site's remedial investigation and feasibility study started in 1984 after organic chemicals were detected in the soil and groundwater at the site and in the surface water of Bean Creek near the site. Groundwater remediation began in October 1986. Key constituents detected in the groundwater include trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC). In the soil, key constituents include TCE, methylene chloride, and chloroform. Of primary interest was the potential for contaminants in the soil to migrate into the underlying aquifers: the Santa Margarita Sandstone and Lompico Sandstone. SVWD Well #9, which is located approximately 400 feet south of the Watkins-Johnson site and screened in the lower Santa Margarita and Monterey Formations, has been impacted by TCE and cis-1,2-DCE at concentrations below drinking water standards. Although this well is no longer used by SVWD, when it was used, water pumped from it required filtration by a granular activated carbon (GAC) system prior to putting the water into the distribution system.

Groundwater remediation at the site consisted of pumping groundwater beneath the site with a series of extraction wells and treating it using a GAC adsorption system. Treated water was used onsite, recharged to the perched zone onsite, or discharged to Bean Creek. The groundwater remediation system was deactivated on July 5, 2016.

More than 3 decades after investigations began at the Watkins-Johnson site, its remediation is moving towards closure, but the current site owner still needs to complete the source control component of the remedial action to ensure protectiveness over the long-term. The site is now designated as Open – long term management ~~currently designated~~ by the CCRWQCB ~~as an open case with ongoing remediation for residential use~~and remains open due to existing soil gas plumes of benzene, TCE, tetrachloroethene (PCE), arsenic and cadmium in soils. ~~A draft Focused Feasibility Study proposing potential remediation alternatives including soil excavation was submitted to USEPA in January 2019~~The site is undergoing planning for residual contamination in soil and the vadose zone including a vapor intrusion monitoring and mitigation plan and evaluation of land use controls.~~.~~

~~2.2.11.1.1~~

### ~~2.2.11.1.2~~2.2.9.1.2 *SCOTTS VALLEY DRY CLEANERS*

Remediation of the Scotts Valley Dry Cleaners site, located at 272 Mount Hermon Road in Scotts Valley, is overseen by the CCRWQCB. PCE, which is used as a dry-cleaning solvent, was found in the soils and groundwater both on-site and off-site of the dry-cleaning operations in 1993. The site is classified as an open remediation cleanup site.

Groundwater extraction remediation systems were used at the site from August 2005 to August 2015. The extracted water was treated by a GAC adsorption system and discharged under a National Pollution Discharge Elimination System Permit to the City of Scotts Valley storm water drain system. *In situ* ~~In addition to groundwater extraction, injection of sodium permanganate into groundwater through dedicated injection wells in 2009 attempted in situ~~chemical oxidation ~~cleanup~~ via ~~of chlorinated solvents in groundwater~~sodium permanganate injection was also used for remediation in 2009.

Cleanup at the Scotts Valley Dry Cleaners site currently involves operation of soil vapor extraction and air sparging systems. These remediation systems only extract soil vapor in the unsaturated soils above groundwater and thus no groundwater is extracted.

### 2.2.9.1.3 *SCOTTS VALLEY TARGET*

The Scotts Valley Target is an open, long--term management cleanup program site opened in 2022. The site is likely impacted by VOCs from the neighboring Scotts Valley Cleaners and is being remediation using soil vapor extraction.

~~2.2.11.1.3~~

### ~~2.2.11.1.4~~2.2.9.1.4 *FORMER VALETERIA DRY CLEANERS*

The former Valeteria Dry Cleaners site, located at 6519-6539 Highway 9 in Felton, released PCE into groundwater just outside of the Basin. The site is now an open remediation cleanup site following its initial assessment and interim remedial action. ~~It is included in this discussion regarding groundwater cleanup sites because it could potentially impact the Basin even though it is physically located outside of the Basin; it is only 400 feet west of the San Lorenzo River that flows through the Basin and VOC contaminated groundwater discharges to the river via springs.~~

The PCE in groundwater from the site is thought to have originated from dry cleaning solvent wastes being disposed into the onsite septic system (Integral Consulting Inc, 2020). In the 1980s, PCE was first detected in surface water samples from both the San Lorenzo River and springs on the river's western bank. Associated with PCE are lower concentrations of TCE, and limited detections of cis-1,2-DCE~~CISDCE~~. PCE and TCE are the only VOCs consistently detected

above their drinking water maximum contaminant levels (MCLs) of ~~5 µg/L (equal to~~ 0.005 mg/L~~)~~.

Integral Consulting Inc. (2020) summarizes previous environmental assessments and remediation as:

> "~~Subsequent a~~Assessment activities in the 1990s and 2000s included a passive soil gas survey, additional surface water sampling, septic system sludge sampling, aquifer testing, and installation and sampling of numerous groundwater monitoring wells and soil borings. Initial remedial activities were conducted in 2002 with the removal of the historical septic tank and 325 cubic yards of surrounding soils from the onsite area. An on- and offsite area soil vapor assessment was conducted in 2008 followed by installation of a soil vapor extraction and sub-slab venting system in 2009 and sub-slab sampling in onsite area structures in 2010 and 2011. The onsite area soil vapor extraction system has since been operated periodically primarily for soil venting."

A July 21, 2020 Remedial Action Plan describes ~~the~~ a VOC plume ~~of chemical constituents of concern (COC) above the MCL to~~ extending laterally 320 feet long by 180 feet wide downgradient from the former source area to Spring 1A at the San Lorenzo River. The vertical extent of the plume in groundwater generally follows the groundwater table at around 20 feet below ground and extends to an approximate depth of 60 feet below ground. The downgradient extent of ~~COCs~~ the plume has been delineated to the extent practical at the springs near the San Lorenzo River. The authorized parties are in the process of permitting and installing a permeable reactive barrier between the site and the San Lorenzo River to prevent surface water contamination.

#### ~~2.2.11.1.5~~2.2.9.1.5 *Camp Evers Combined Site (Closed)*

The Camp Evers combined site is associated with 4 current and former gasoline stations (BP, Shell, Chevron, and Tosco), that were located at or near the intersection of Scotts Valley Drive and Mount Hermon Road. The primary ~~COCs~~ constituents at this site are Methyl-tert-butyl ether (MTBE) and other fuel-related compounds. The Camp Evers combined site cleanup was overseen by the CCRWQCB. Historically, the plume ~~has~~ extended at least 1,700 feet north of SLVWD's Mañana Woods Well #2. When this well was used, its pumped water was passed through a pre-treatment system to remove low MTBE concentrations. The well is no longer pumped by SLVWD.

Remediation at the various sites consisted of underground storage tank (UST) removal, and groundwater extraction and treatment before discharging to the City of Scotts Valley storm water drain system. Remedial efforts started in the early 2000s and the Camp Evers Combined Site completed their remediation efforts and closed all cases as of November 21, 2017.

#### ~~2.2.11.1.6~~2.2.9.1.6 *BEN LOMOND LANDFILL (CLOSED)*

The Ben Lomond Landfill, west of Newell Creek at 9835 Newell Creek Road in Ben Lomond, operated as a landfill until 2012~~, but~~ and is now a trash transfer station. Groundwater monitoring has been ongoing at the ~~now-closed~~ former landfill since 1980, as the site is associated with elevated levels of VOCs and heavy metals. Contamination associated with the was detected in SLVWD's Quail Hollow wellfield in the late 1990s, but concentrations of VOCs have been non-detectable since 2007 ~~site is not predicted to expand its footprint and is not thought to significantly impact 2 municipal Quail Hollow wells operated by SLVWD east of Newell Creek~~ (Johnson, 2009).

~~2.2.11.2~~

### 2.2.9.2 Soil Contamination Cleanup Sites

The following 2 non-LUST sites do not have groundwater contamination, only soil contamination and cleanup.

#### ~~2.2.11.2.1~~2.2.9.2.1 *KING'S CLEANERS*

PCE was detected in soil and soil gas samples in 2020 at th~~Th~~e King's Cleaners site, located at 222 Mount Hermon Road in Scotts Valley~~, was found in 2000 to have some PCE in the soil samples and elevated soil gas concentrations~~. No PCE was detected in groundwater in subsequent investigations. SCEH assumed oversight responsibility for this site from the CCRWQCB in April 2017 and it is an open verification monitoring site.

No remedial actions have occurred at the Kings Cleaners site over the past several years. However, in 2019/2020 there has been regulatory oversight for development of a Work Plan to confirm current soil vapor concentrations and whether residual PCE concentrations detected in soil vapor investigations conducted during September 2000 and November 2009 pose a vapor intrusion health risk at the subject site and adjacent commercial businesses.

#### ~~2.2.11.2.2~~2.2.9.2.2 *FORMER SANTA CRUZ LUMBER COMPANY*

Santa Cruz Lumber Company, located at 5843 Graham Hill Road in Felton, operated from 1945 to 1986. Operations at the site included pressure treatment of a variety of wood products with the chemical Wood-Last, a water-based copper, chromium, and arsenic solution. Soil contamination was found d~~D~~uring initial investigations in 1986~~, groundwater contamination was not found, but soils were contaminated by CCA~~.

Remedial excavation and removal of over 2.6 thousand tons of contaminated soil took place in 1987~~ because it contained elevated levels of metals and other constituents associated with wood products~~. More recent soil sampling, in April 2018, found elevated levels of arsenic, hexavalent chromium, and formaldehyde, though hexavalent chromium may be naturally occurring.

Contaminants ~~were~~ have not been found in groundwater (Trinity Source Group, Inc., 2017). A Work Plan to ~~remove these~~remediate these remaining chemical constituents was requested by SCEH. The site has since been transferred to DTSC who approved a removal action work plan for additional excavation and a soil cap in 2022.

A privately owned well screened in the Lompico aquifer, 250 feet west of the site, has elevated arsenic concentrations in groundwater between 0.014 mg/L and 0.026 mg/L (the primary drinking water standard is 0.01 mg/L). Slightly elevated arsenic is also found in other wells in the vicinity, such as SLVWD Pasatiempo #6 and wells just outside the Basin, southeast of Felton. As described above, onsite investigations did not find groundwater contamination, and therefore given the information available, elevated arsenic in this area's groundwater is considered naturally occurring in the Lompico aquifer.

#### *2.2.9.2.3 THOMPSON AND HARVEY TRANSPORTATION FUEL SPILL*

The Thompson and Harvey Transportation Fuel is classified as an open remediation cleanup program site. A fuel tanker truck overturned on Highway 17 north of Scotts Valley on September 4, 2025. Emergency response actions included containment of the spill using vacuum recovery, absorbents, and excavation of contaminated soil under oversight of the California Department of Fish and Wildlife Office of Spill Prevention and Response (CDFW/OSPR). The site is recommended for closure.

### ~~2.2.11.3~~2.2.9.3 Migration of Contaminated Water Monitoring

Groundwater quality sampling of supply wells in the Basin allows for analysis of contaminated water migration. Historical supply well water quality data indicates that contaminated water migration is spatially and temporally limited to only a few locations over time. Detected contaminants in supply wells have mostly been from point source contaminant releases related to the regulated sites discussed above and contaminant concentrations were typically at or below relevant drinking water standards. Nitrate has also been detected in supply wells in some areas of the Basin at concentrations less than the drinking water standards, likely due to non-point source septic system releases. More information on groundwater quality is provided in Section 4.4

Contaminated groundwater detected in supply wells originated from 3 main areas in Scotts Valley: Camp Evers area gas stations, downtown dry cleaners, and the Watkins-Johnson Superfund Site. Contaminated groundwater has generally migrated down-hydraulic gradient from these sites within the Santa Margarita aquifer, but plume migration has also been influenced at various times by the operation of each of the sites' groundwater extraction and treatment systems, and cones of depression created by municipal extraction wells. Currently, all groundwater extraction and treatment systems have been decommissioned, and there is no municipal pumping in the Santa Margarita aquifer in the area where contamination originated.

There are 2 known locations where contamination has migrated down through the Santa Margarita aquifer into the underlying Monterey Formation or Lompico aquifer and impacted SLVWD and SVWD public supply wells. ~~These 2 wells are currently inactive:~~

- SLVWD Mañana Woods #2 is screened in both the Santa Margarita and Lompico aquifers in an area where the Monterey Formation is absent between the 2 aquifers. This well was impacted with MTBE and other gasoline breakdown products that were first detected in 2006. After discovering the impacts, groundwater pumped from this well was passed through a GAC treatment system to reduce VOCs below drinking water standards (Johnson, 2009). This well was destroyed in 2026.

- SVWD Well #9 is down-hydraulic gradient from Camp Evers and only 300 feet up-hydraulic gradient from onsite Watkins-Johnson monitoring wells impacted with VOCs. It is screened in the Monterey Formation. SVWD Well #9 is impacted with MTBE and several VOCs at concentrations below applicable drinking water standards. This well is no longer used by SVWD for extraction, but continues to serve as a GSP groundwater level monitoring location.

Given that concentrations of contaminants in municipal extraction wells have not increased with time, it is assumed that contaminant sources have been addressed such that there is now limited migration of contaminant plumes. Regulating agencies provide impacted SMGWA member agencies with relevant information on monitoring and clean-up. This information combined with regular monitoring of groundwater quality at all municipal extraction wells provides the information the public water supply agencies need to protect their wells. In addition, a management action described in Section 8.2.2 establishes an annual meeting with SCEH to confirm that groundwater quality degradation is not occurring.

Nitrate concentrations in groundwater throughout the Basin associated with septic systems appear to have stabilized at a level that is well below drinking water standards. County standards now require that any new or replacement septic systems in sandy soils must incorporate enhanced treatment and denitrification to reduce nitrate discharge to groundwater.

## 2.3 Land Use Elements

### 2.3.1 Existing Land Use Designations

Land use planning in the Basin is the responsibility of the County of Santa Cruz and the City of Scotts Valley. Boulder Creek, Felton, Lompico, and Ben Lomond are all census-designated areas within the county but are not incorporated towns. Current land use designations in the Basin are shown on Figure 2-5 and are summarized in Table 2-6 by major land use groups. The land use features on Figure 2-5 were developed by the County of Santa Cruz, in collaboration with the Cities of Capitola, Santa Cruz, Scotts Valley, and Watsonville, to aggregate individual land use

designation datasets into a summarized single dataset for use in the July 2015 Wasteload Allocation Attainment Program (WAAP) for Watersheds in Santa Cruz County (County of Santa Cruz, 2016).

Just under half the Basin is identified as open space/undeveloped (Table 2-6). Open space includes areas for outdoor recreation, preservation of natural resources, or vacant lands. Rural residential land use is the next largest land use covering 5,755 acres of the Basin (25.9% of the Basin, Table 2-6). This land use consists primarily of single-family residential housing located outside of the suburban centers and typically between the tributaries of the San Lorenzo River. Suburban residential housing (13.2% of the Basin) occurs within the San Lorenzo Valley and south of Bean Creek. It includes the City of Scotts Valley, and the communities of Mount Hermon, Felton, Ben Lomond, Brookdale, Boulder Creek, Lompico, and Zayante (Figure 2-5). The Basin has several camps and conference centers which account for approximately 3.5% of land use.

Table 2-6~~2-6~~ ~~2-6~~. Santa Margarita Basin Land Use Designation Summary

| Land Use Category | Area in Acres | Area in Square Miles | Relative Percent |
|---|---|---|---|
| Open Space/Undeveloped | 10,117 | 15.8 | 45.5% |
| Rural Residential | 5,755 | 9.0 | 25.9% |
| Suburban Residential | 2,930 | 4.6 | 13.2% |
| Roads/Parking Lots/Utilities | 1,491 | 2.3 | 6.7% |
| Camps/Church/Institutions | 772 | 1.2 | 3.5% |
| Industrial/Sand Quarries | 741 | 1.2 | 3.3% |
| Commercial | 425 | 0.7 | 1.9% |
| Agriculture | 18 | 0.03 | 0.1% |
| **Total** | **22,249** | **34.8** | **100%** |

Commercial land use is concentrated in the City of Scotts Valley and the community of Felton. Much of this development occurred during a period of population expansion between 1970 and 2000, which coincided with construction of commercial and industrial complexes. Three large sand quarries exist within the Basin area: Hanson (also known as Kaiser) Quarry, Olympia (also known as Lone Star) Quarry, and Quail Hollow Quarry. Hanson and Olympia Quarries ceased operations in the early 2000s and are currently undergoing restoration. Quail Hollow is still active.

Most irrigated areas in the Basin are in or near Scotts Valley and consist of schools and large parks. Agriculture within the Basin is limited due to the steep and forested nature of the Basin, and relatively shallow soils. Currently, only approximately 0.1% of the Basin is zoned

agricultural. There are a few very small wineries that cumulatively irrigate ~~less than~~about 20 acres. Currently, there are no official records of cannabis cultivation and water use in the Basin although there is speculation that it is occurring.

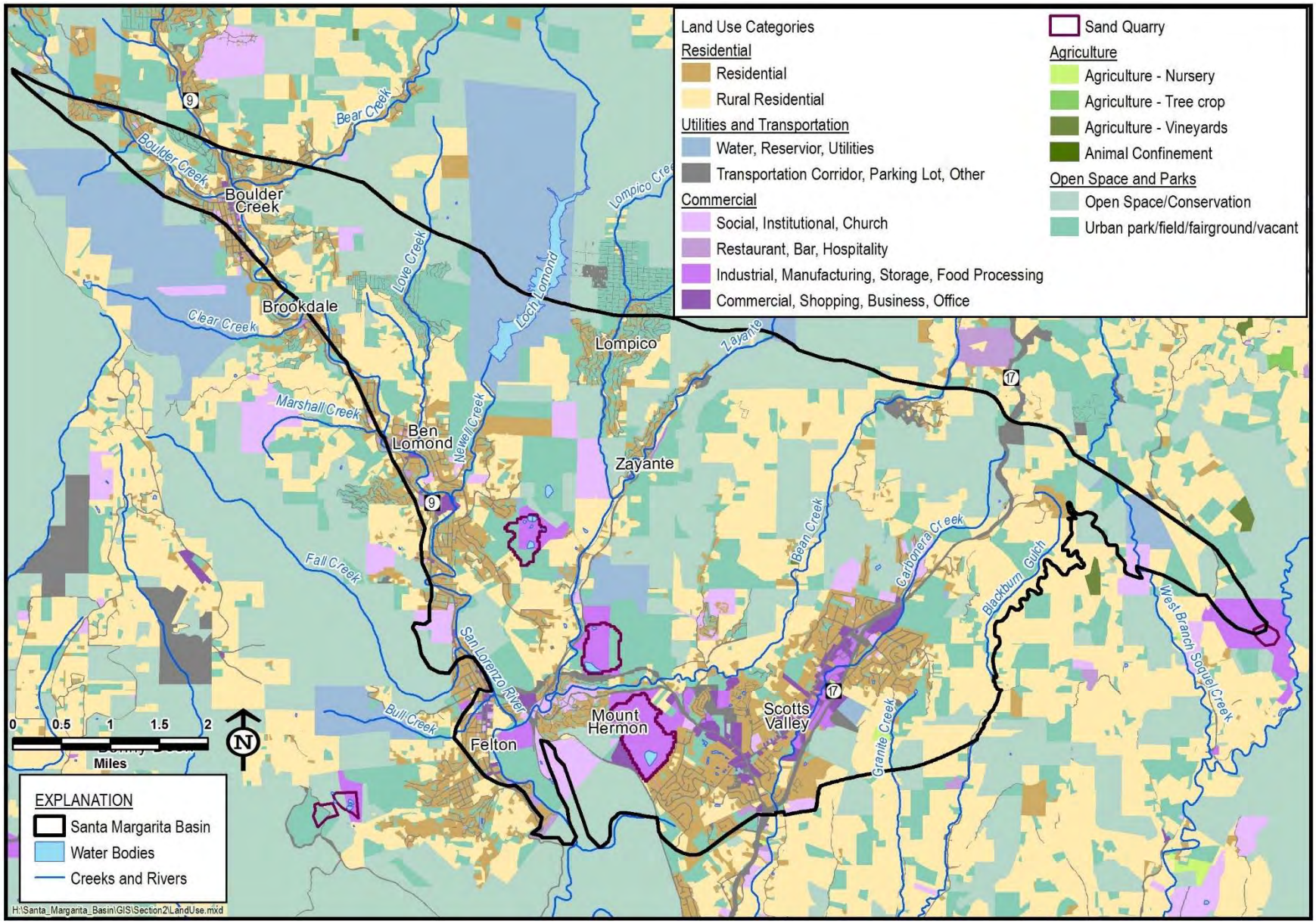



Figure 2-5~~2-52-2-6~~. Land Use in the Santa Margarita Basin

### 2.3.2 General Plans

Land use authority in the Basin falls under the jurisdiction of 2 agencies, the County of Santa Cruz and the City of Scotts Valley. These agencies have each adopted general plans with land use classifications that identify desired areas for development, open space, and conservation ~~purposes~~. The general plans also cover zoning regulations and development standards that determine the location, type and density of growth allowed in the region, along with various policies for protection of watershed and groundwater resources. General plans are reviewed to understand the adverse environmental impacts they may have when implemented.

State general plan guidance was significantly revised in 2017 (Governor's Office of Planning and Research, 2017). Changes to planning laws triggered these revisions, including SGMA's requirement that general plans consider water supply at their next update. Any significant update to a general plan, including to its housing element, will trigger the SGMA mandate to consider potential development impacts on groundwater supply and consistency between the general plan and the GSP.

#### 2.3.2.1 City of Scotts Valley General Plan

The City of Scotts Valley adopted its updated General Plan on November 29, 2023, replacing a plan that dated to 1994 and establishing a long-range policy framework to guide development and conservation for the next 20+ years. The plan serves as the city's fundamental governance document, embodying community values and setting direction across seven elements: Land Use, Economic Development, Housing, Mobility, Open Space and Conservation, Community Services & Facilities, and Public Safety & Noise. Key updates include revised land use policies addressing compatibility and development intensities, new impact thresholds for future projects, and programs aimed at enabling sustainable growth while preserving community character and conserving natural resources. ~~The City of Scotts Valley adopted its General Plan in 1994 and began updating it in 2012 to address the changes the city has experienced throughout the past 2 decades since its implementation. The update is not yet complete; however, when it is, it will create a blueprint for development through the year 2040 and will address many topics including physical growth, transportation, quality of life, economic vitality, municipal services, and environmental conservation. A draft EIR associated with the General Plan is currently under development, with a public hearing expecting in early fall 2021 and adoption of the EIR and General Plan shortly thereafter.~~

#### 2.3.2.2 County of Santa Cruz General Plan

The County of Santa Cruz originally adopted its General Plan in 1994 and completed a comprehensive update in November 2022. The 1994 plan had remained in place for nearly three

decades and required updating to align with new state laws, new regional and local plans, and a community vision focused on sustainable growth. Prior to the 2022 update, the County adopted the Sustainable Santa Cruz County Plan in 2015 to promote sustainable land use, housing, economic development, and transportation objectives in the urban areas of the County, with a planning horizon through 2035. The 2022 update, known as the Sustainability Policy and Regulatory Update, amended General Plan goals, objectives, policies, and implementation strategies across 5 chapters; revised the County Code; adopted County Design Guidelines; and incorporated land use and zoning map amendments to identify opportunity sites and correct mapping inconsistencies. The California Coastal Commission approved the Sustainability Update amendments in March 2024, bringing the update fully into effect countywide.

Two components of the County General Plan significantly affect the management of water resources within the Basin: Measure J and the Conservation and Open Space Element of the County General Plan. Measure J was passed by voters in 1978, establishing a comprehensive growth management system with population growth limits, affordable housing provisions, preservation of agricultural lands and natural resources, and a defined distinction between urban and rural areas. This has resulted in greatly diminished development density and growth rates in areas that do not receive municipal water service. Each year when the Board of Supervisors adopts the growth goal and annual building permit allocation, limitations of water supply are taken into consideration.

The Conservation and Open Space Element of the County General Plan establishes goals, policies, and programs to conserve farmland, timber, biotic, and water resources, including policies for protection and management of groundwater resources, recharge areas, wetlands, streams, riparian corridors, and sensitive habitat areas — many of which are incorporated into the County Code. An example of such a program is the restriction on building disturbance in Santa Cruz Sandhills habitat. The Sandhills are a unique community of plants and animals found only on Zayante soils, which are derived from the Santa Margarita Sandstone and are mostly found in the Scotts Valley, Ben Lomond, and Bonny Doon areas. Due to their limited geographic range and narrow habitat specificity, the endemic communities and species of the Sandhills are naturally extraordinarily rare and are also associated with areas of high groundwater recharge potential. Estimated to have originally covered 6,000 acres, approximately 40% of Sandhills habitat has been lost, primarily due to sand quarrying and development. The County has developed a detailed process to identify whether parcels fall within the Sandhills, accessible at: https://www.sccoplanning.com/Portals/2/County/Planning/env/Permit%20Processing%20Chart.pdf.

These policies, programs, and code requirements were reviewed during development of GSP elements for depletion of surface waters and groundwater dependent ecosystems (GDEs). The County General Plan maps of recharge areas, sensitive habitats, and biotic resources were also used. The Conservation and Open Space Element was updated as part of the 2022 Sustainability

Update, and language referencing the GSP has been incorporated into the updated General Plan. The County has also updated its well ordinance (County Code Chapters 7.70 and 7.73) to modernize well construction and individual water system management considering groundwater sustainability requirements, public trust impacts, drought risk for domestic wells, and drinking water quality concerns.

~~2.3.3 The County adopted its current general plan in 1994. A Sustainable Santa Cruz County Plan was adopted in 2015 to promote sustainable land use, housing, economic development, and transportation objectives in the urban areas of the County (County of Santa Cruz, 2014). The Sustainable Santa Cruz County Plan has a timeframe through the year 2035. The County is currently in the process of updating various parts of the General Plan, including the water resource protection policies. The update is expected to be completed in 2022.~~

~~2.3.4 The County General Plan contains 2 components that significantly affect the management of water resources within the Basin. Measure J was passed by voters in 1978, which called for a comprehensive growth management system which established population growth limits, affordable housing provisions, the preservation of agricultural lands and natural resources, and the retention of a distinction between urban and rural areas. This has resulted in greatly diminished development density and growth rates in areas that do not receive municipal water service. Each year when the Board of Supervisors adopts the growth goal and annual building permit allocation, limitations of water supply are taken into consideration.~~

~~2.3.5 The Conservation and Open Space Element of the County General Plan includes many policies and programs for protection and management of groundwater resources, recharge areas, wetlands, streams, riparian corridors, and sensitive habitat areas. Many of these polices are incorporated into the County Code. An example of such a program is the restriction on building disturbance in Santa Cruz Sandhills habitat. The Sandhills are a unique community of plants and animals found only on Zayante soils, which are derived from the Santa Margarita Sandstone, and mostly found in the Scotts Valley, Ben Lomond, and Bonny Doon areas. Due to their limited geographic range and narrow habitat specificity (Zayante soils), the endemic communities and species of the Sandhills are naturally extraordinarily rare. The Sandhills~~

~~are also areas of high groundwater recharge potential. Estimated to cover 6,000 acres originally, approximately 40% of Sandhills habitat has been lost, primarily due to sand quarrying and development. A detailed process has been developed by the County to identify whether parcels fall within the Sandhills or not. This process is accessed online at: https://www.sccoplanning.com/Portals/2/County/Planning/env/Permit%20Processing%20Chart.pdf.~~

~~2.3.6 These policies, programs, and code requirements were reviewed during development of GSP elements for depletion of surface waters and groundwater dependent ecosystems (GDEs). The County General Plan maps of recharge areas, sensitive habitats, and biotic resources are also used. Several elements including the Conservation and Open Space Element are currently in the process of being updated and wording has been proposed to incorporate references to the GSP into the updated General Plan. The updates are expected to be adopted in 2022.~~

### ~~2.3.7~~2.3.3 Potential Water Demand Changes due to GSP Implementation

GSP implementation is not expected to increase water demand over the next 20 years. The only anticipated changes in water demand ~~changes anticipated as part of GSP implementation~~ are ~~due~~attributable to urban water use factors. ~~a~~A ~~slight~~ small decrease in municipal demand due to water use efficiency achieved through ongoing technological improvements ~~and~~, regulatory compliance, ~~as well as~~ and customer conservation~~, and reduced water losses due to increased efforts on pressure control, leak detection and innovative data analytics and management. However,~~ is expected to be offset by increased demand from population growth. ~~is projected to slightly outpace water demand reductions from water use efficiency, resulting in slightly increasing~~ Overall, water demands are projected to increase slightly during the GSP planning and implementation horizon ~~for the next 20 years~~ (~~WSC and M&A, 2021~~SLVWD, 2026; SVWD, 2026).

~~Pumping reductions are not included as part of GSP implementation.~~ The small ~~amount~~ increase of projected ~~increased~~ municipal demand ~~is expected~~may be ~~met~~ offset by water conservation, conjunctive use, ~~and~~/or development of new water supplies in the Basin ~~of existing surface water and groundwater sources to raise groundwater levels in the Mount Hermon / South Scotts Valley area to SMGWA's desired elevations. Supplemental water sources in the form of treated surface water from outside of the Basin or indirect potable reuse of purified wastewater may be needed if conjunctive use does not increase groundwater levels as expected~~. These potential projects are described in more detail in Section 8~~4~~.

There are no known water demand or land use ~~plan~~ changes in neighboring ~~basins~~ areas that would affect water demands in the Basin ~~the ability of the SMGWA to achieve groundwater sustainability~~.

## ~~2.3.8~~2.3.4 Replenishment of Groundwater Extractions

Managed replenishment of groundwater extractions has historically occurred or is currently taking place in the Basin using indirect methods. Groundwater recharge and demand reduction is achieved using conjunctive use, stormwater recharge, recycled water, and conservation.

### ~~2.3.8.1~~2.3.4.1 Conjunctive Use and Underground Storage

Conjunctive use is the coordinated operation of multiple water sources to achieve improved supply reliability. Most conjunctive use concepts are based on storing groundwater supplies in times of surplus for use during dry periods when surface water supplies would likely be reduced. Opportunities exist to improve water supply reliability in the Basin using conjunctive use and underground storage.

While there are no formal conjunctive use programs between SMGWA members and other water agencies, conjunctive use practices have been studied and are implemented by SMGWA member agencies with access to surface water. For example, SLVWD meets demand through conjunctive use of surface water and groundwater sources. Since SLVWD has limited storage other than natural groundwater storage, they ~~divert~~ use surface water for water supply ~~from streams~~ as much as possible to store groundwater for use during dry periods when surface water is not available.

There are bidirectional interties in the Basin that could be used to expand conjunctive use. ~~between~~ SLVWD's water systems ~~that~~are connected by intertie that~~,~~ although only permitted for emergency use, could potentially be used to transfer water supplies within its service area (Exponent, 2019). SLVWD is pursuing routine conjunctive use of its emergency interties to improve water supply flexibility and system resiliency. Emergency operations of the interties after the 2020 CZU Lightning Complex wildfire demonstrated the operational benefits of these interconnections. An intertie also connects the SLVWD and SVWD systems to allow water transfers in emergency situations; however, no formal conjunctive use agreement between the two districts is currently in place~~SLVWD is pursuing efforts to utilize its emergency interties on a routine basis for conjunctive use and improved resiliency as emergency operation since the 2020 CZU Lightning Complex wildfire has demonstrated the benefits for conjunctive use. There is also an intertie connecting SLVWD and SVWD systems for transfer of water in emergency situations. There is no formal conjunctive use agreement between the districts~~.

An intertie between the City of Santa Cruz and SVWD water systems ~~is under construction~~was completed in 2026, enabling the two agencies to better coordinate and maximize the use of

surface and groundwater supplies and support active and passive recharge of the Basin. The intertie project follows decades of discussion about regional cooperation, with a goal of storing surplus City of Santa Cruz surface water in the Basin for later recall when needed in dry years. Options for both passive and active groundwater recharge, along with potential water-banking strategies, will be evaluated ~~once the connection is operational~~. The intertie will also improve fire protection through increased fire-response flows and the addition of new fire hydrants along the alignment.

The project is part of a broader regional strategy for water supply resilience. The Santa Cruz water system has been connected by an intertie with the Soquel Creek Water District since 2018, and SVWD completed an intertie with SLVWD in 2016, though both connections have been used primarily for emergency purposes rather than routine conjunctive use. The new City of Santa Cruz–SVWD intertie ~~is intended~~allows for opportunities to move beyond emergency-only operations and enable substantive conjunctive use coordination between the two agencies.

#### ~~2.3.8.2 SMGWA members and other agencies are continually exploring regional partnerships to enhance water supplies through a range of potential options that can benefit the Basin as a whole. Projects under consideration are described in more detail in Section 4: Projects and Management Actions.~~

#### ~~2.3.8.3~~2.3.4.2 Stormwater Recharge

There are intentional efforts to reduce stormwater runoff in the Basin by increasing on-site recharge. Stormwater retention and recharge is required by the City of Scotts Valley guidelines for new development projects (City of Scotts Valley, 2017). The City's guidelines are based on the CCRWQCB adopted Order R3-2013-0032 (July 2013). The Post-Construction Requirements mandate that development projects use Low Impact Development (LID) to detain, retain, and treat runoff. This has resulted and will continue to result in new on-site stormwater recharge in the Basin.

SVWD contributes to stormwater recharge via the implementation of LID projects in Scotts Valley. LID projects consist of applying stormwater BMPs – such as infiltration basins, vegetated swales, bio-retention and/or tree box filters – to retain and infiltrate stormwater that is currently being diverted into the storm drain system.

Infiltrated stormwater recharges the shallow aquifers in a manner similar to natural processes. The infiltration helps augment groundwater elevations and sustains groundwater contributions to stream baseflow that support local fish habitats. A complicating factor in implementing LID projects in the Scotts Valley area is that there is no centralized stormwater collection system, which limits the ability for large-scale projects to implement groundwater augmentation in the most beneficial areas.

~~Figure 2-7Figure 2-7 shows the location of the LID facilities in relation to surface geology and the area where Santa Margarita Sandstone directly overlies Lompico Sandstone due to the absence of the less permeable Monterey Formation.~~ All 3 LID facilities are located where Santa Margarita Sandstone overlies the Monterey Formation; therefore, there is less potential for the LID facilities to recharge the Lompico Sandstone. Figure 2-6 shows the location of the LID facilities relative to ~~the gap in~~where the Monterey Formation is absent.

Monitoring equipment is installed to assess the performance of the facilities. The total amount of stormwater infiltrated through WY2025 at the 3 LID facilities is summarized in Table 2-7~~, which now includes data through Water Year 2025 and indicates continued variability in a~~. The annual infiltration volumes fluctuate with precipitation, ~~with a maximum of 40.38 acre-feet in WY 2019 and a minimum of 16.67 acre-feet in WY 2021~~averaging 25.7 AFY since 2018.~~.~~

Table 2-7~~2-7~~~~2-7~~. SVWD Low Impact Development Infiltration Volumes

| Water Year | Transit Center (AFY) | Woodside HOA (AFY) | Scotts Valley Library (AFY) | Total (AFY)~~Acre-Feet~~ |
|---|---|---|---|---|
| 2018 | 1.75 | 17.30 | 3.39 | 22.44 |
| 2019 | 3.08 | 31.17* | 6.11* | 40.38 |
| 2020 | 1.50* | 14.97* | 2.94* | 19.42* |
| 2021 | 1.40 | 13.86 | 1.41 | 16.67 |
| 2022 | 1.75 | 13.87 | 1.41* | 17.03* |
| 2023 | 2.39 | 28.79 | 6.26 | 37.44 |
| 2024 | 2.16 | 21.95 | 4.28 | 28.39 |
| 2025 | 3.06 | 17.34 | 3.42 | 23.82 |
| Average | 2.19 | 19.91 | 3.65 | 25.70 |
| Total | 15.34 | 141.95 | 25.83 | 183.15 |

* estimated because dataloggers were not recording correctly

#### ~~2.3.8.3.1~~2.3.4.2.1 *TRANSIT CENTER LID*

SVWD obtained grant funding through a County Prop 84 grant from the SWRCB for the planning, design, and construction of an LID retrofit at the Scotts Valley Transit Center site (Figure 2-6). The design included construction of a vegetated swale, a below-ground infiltration basin, and pervious pavement. Construction began in October 2016 and was completed in May 2017. SVWD completed an expansion of the Transit Center LID project in WY2025 that is expected to contribute approximately 7 AFY of additional stormwater recharge to the Santa Margarita aquifer. The expansion project was supported by a 2022 Urban Community Drought Relief grant from DWR. ~~In 2020, SVWD recorded a total of 1.5 acre-feet (AF) of infiltrated stormwater at this location (Montgomery & Associates, 2021)~~ Average recharge is 2.19 AFY since 2018 (Table 2-7~~Table 2-7~~).

#### ~~2.3.8.3.2~~2.3.4.2.2 *WOODSIDE HOA LID*

As part of the Prop 84 grant match, SVWD worked with a local developer to install a stormwater recharge facility at the Woodside HOA along Scotts Valley Drive (Figure 2-6). This facility includes a large below-ground infiltration basin. Stormwater is routed from the development to the basin where it can percolate down into the groundwater. Initial hydrology reports estimated recharge on the order of 20 to 40 AFY might be achieved (Ruggeri, Jensen and Azar, 2010). Average recharge is 19.9 AFY since 2018 (Table 2-7).~~). In 2020, a total of 15 AF of stormwater infiltrated at this location (Montgomery & Associates, 2021)~~ ~~additional annual infiltration volumes through WY 2025 are summarized in Table 2-7.~~.

#### ~~2.3.8.3.3~~2.3.4.2.3 *SCOTTS VALLEY LIBRARY LID*

This LID was an earlier grant-funded project that installed a below-ground infiltration basin at the Scotts Valley Library (Figure 2-6). Average recharge is 3.65 AFY since 2018 (Table 2-7~~In 2020, a total of 3 AF of stormwater infiltrated at this location (Montgomery & Associates, 2021~~).

In addition to the large LID projects described above, SVWD was part of the Strategic and Technical Resources Advisory Groups for Ecology Action's regional sponsorship of the Prop 84 LID Incentives Grant. SVWD staff provided input on rating criteria for the landscape certification program and the structure of the grant reporting. Through 2018, 32 SVWD customers were awarded grant incentives for making stormwater management improvements to their properties, with strategies such as rainwater harvesting, lawn and hardscape removal, and stormwater retention methods, such as swales and rain gardens. According to SVWD staff records, the program provided 31,733 square-feet (0.73 acres) of permeable recharge area.

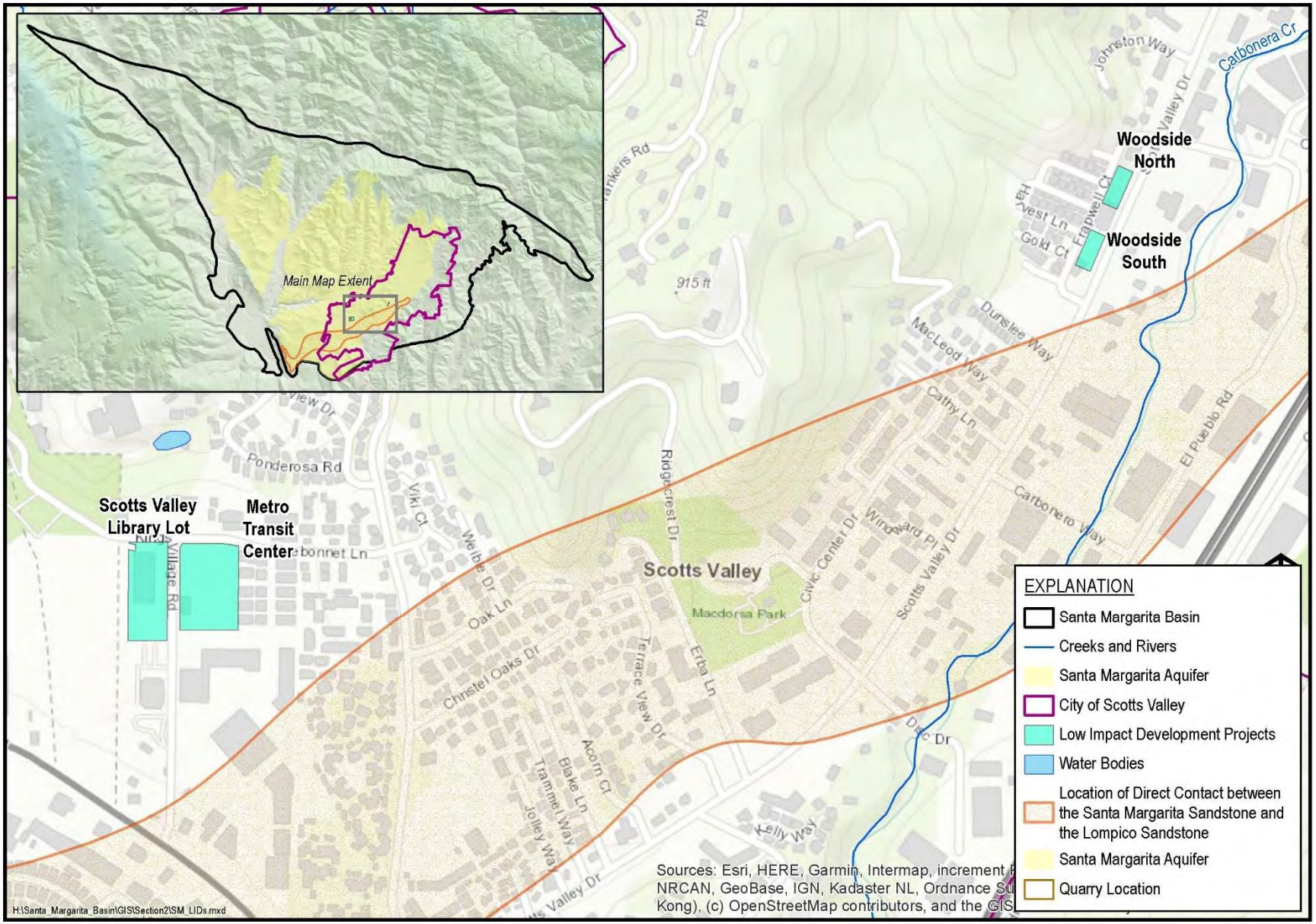



Figure 2-6~~2-6~~2-2-7. Location of SVWD Low Impact Development Projects

### ~~2.3.8.4~~2.3.4.3 Diversions to Storage

SLVWD has limited storage capacity in their distribution system other than natural groundwater stored in the aquifers. In total it has 26 acre-feet (AF) of storage within its service area. Of that total storage capacity, 21.8 AF is in 33 tanks serving the North System, 1.3 AF in 5 tanks serving the South System, and 2.9 AF in 8 tanks serving the Felton System. Both pumped groundwater and diverted surface water are stored in these facilities. Bennett Spring is designated as a surface water source not permitted to be stored.

SVWD uses tanks to store up to 1.8 AF of recycled water and 13.3 AF of treated groundwater.

The City of Santa Cruz created the Loch Lomond Reservoir in the early 1960s by impounding Newell Creek with construction of the Newell Creek Dam. The reservoir is supplied by runoff from the Newell Creek watershed, as well as by flows diverted from the San Lorenzo River that are pumped up from the Felton Diversion Dam to the Loch Lomond Reservoir. It is the City's only reservoir and raw water storage facility. This makes it an integral part of their water system as it provides water supply for peak season demands and as a drought reserve. When full, the reservoir holds approximately 8,600 AF (or 2.8 billion gallons).

Private individuals who have riparian water rights for surface water diversion in the Basin are not permitted to store surface water.

### ~~2.3.8.5~~2.3.4.4 Water Conservation and Use Efficiency

#### *~~2.3.8.5.1~~2.3.4.4.1 SAN LORENZO VALLEY WATER DISTRICT CONSERVATION ACTIVITIES*

SLVWD customers continue to demonstrate commitment to ongoing proactive conservation efforts. Currently, they are maintaining at least a 15-22% reduction in yearly water usage from 2013 consumption levels. According to SLVWD's 2020 Urban Water Management Plan (UWMP), its 2025 target water use is 85 gallons per capita per day (GPCD). The population served by SLVWD has met the 85 GPCD target during the latter part of the 2012-2015 drought and from 2018 to 2020. Since 1995, per capita water usage varied from a high of 104 GPCD in 2006 to a low of 70 GPCD in 2015.

SLVWD actively pursues incidents of water waste by investigating, recommending corrective action, and providing follow-up documentation of resolution. The water waste prevention ordinance (106) was most recently revised in May 2018 (Water Shortage Emergency Ordinance 106).

All SLVWD service connections are currently metered, and customers are billed by monthly volume of usage. As of July 2016, SLVWD's Board of Directors approved the Badger Meter project with the goal of installing the advanced metering technology at all meters. As of Water Year (WY) 2025~~April 2020~~, about 5~~2~~0% of the meters have been upgraded. The new meters,

combined with the Badger Eye on Water engagement portal, allow customers to view hourly usage history, setup leak detection alerts, and receive high bill notifications. As of WY2025, 1,115 customers are participating.

The majority of SLVWD's customer accounts are residential; therefore, they target indoor and outdoor water savings programs toward these customers. Residential water conservation is promoted by disseminating technical information on methods to reduce indoor and outdoor water use and by offering credits on customer bills for installation and/or replacement of appliances and lawns with approved water saving appliances and plantings. In WY2025~~Fiscal Year 2017/2018~~, SLVWD issued ~~46~~ 27 rebates with an estimated water savings of ~~630,044~~208,545 gallons.

SLVWD conducts a variety of public education activities such as a dedicated Water Use Efficiency Page on its website, e-Newsletters, billing inserts, and Instagram and Facebook postings. ~~As a member of the Santa Cruz Water Conservation Coalition (watersavingtips.org), SLVWD contributes to presentations to the general public and professional organizations, and informational workshops.~~

In compliance with SB555, SLVWD has been conducting and submitting water loss audit reports to DWR. The SLVWD audit score was consistently between 49 and 51 in 2016 to 2019.

#### ~~2.3.8.5.2~~2.3.4.4.2 *Scotts Valley Water District Water Use Efficiency Activities*

SVWD recognizes that using water efficiently is an integral component of a responsible water management strategy and is committed to providing education, tools, and incentives to help its customers understand and manage the amount of water they use. SVWD's water demand has already shown significant decline in recent years, which is attributed to SVWD's ongoing water use efficiency activities in conjunction with the expansion of recycled water use for landscape irrigation. Since 2010, SVWD's water demand has been lower than its SB X7-7 2020 target of 154 GPCD (WSC AND M&A, 2021). In December 2015, with the continuance of the drought and the Governor's Emergency Drought Regulations, SVWD potable demand was reduced to 93 GPCD. SVWD's calculated GPCD for 2020 is 96 GPCD. Since 2015, SVWD's annual potable demand has averaged 96 GPCD, ranging between 93 and 100 GPCD.

SVWD actively pursues incidents of water waste by investigating, recommending corrective action, and providing follow-up documentation of resolution. A water waste prevention ordinance was first adopted in 1983 and most recently revised in June 2020 (Policy P500-15-1).

All potable and recycled water use in SVWD is metered, and customers are billed by volume of usage on a bimonthly basis. An increasing block rate structure for residential customers has been in place since 1992 incentivizing the efficient use of water.

In 2017, the SVWD Board of Directors approved the advanced metering infrastructure (AMI) project with a goal of installing advanced metering technology at all meters. As of April 2021, all but less than 10 meters in the District have been upgraded. The new meters, combined with the WaterSmart customer engagement portal, allow customers to view hourly usage history, receive leak alerts and high-bill notifications, explore water saving actions and apply for rebates.

SVWD conducts a variety of public education activities such as a dedicated Water Use Efficiency Page on its website, regular ads in the local newspapers, e-newsletters, billing inserts, Instagram, and Facebook postings. SVWD's Water Use Efficiency Coordinator also makes presentations to the general public and professional organizations, conducts informational tours and is available for free water-wise house calls.

In response to the 2012-2015 Statewide drought, SVWD created a Think Twice Water Efficiency Campaign comprised of a customer scorecard, bumper stickers, lawn signs, 2-day per week watering schedule, enhanced rebates, hotel and food service placards, and a direct toilet replacement program. Customer response to the campaign was very positive and resulted in a 24% drop in potable water demand. The trend of efficient water use has continued with no significant bounce back in consumption since 2016.

~~SVWD continues to use the Think Twice Program, which has been slightly modified since the 2012-2015 drought. The 2020 Program comprises the following components:~~

~~1. Education and outreach,~~
~~2. Rebates,~~
~~3. Water waste policy, and~~
~~4. Water targets for potable landscape accounts.~~
~~https://www.svwd.org/sites/default/files/documents/reports/Program_Think_Twice.pdf~~SVWD currently uses the WaterSmart online platform to inform its customers on usage and water use efficiency. As of WY2025, 3,141, customers are participating.

The Rebate Program is reviewed annually, and components are changed to achieve optimal use of ratepayers' dollars for incentivizing the efficient use of water. The 2020 Rebate Program includes 9 categories: lawn or impervious hardscape replacement, spray irrigation replacement, spray to rotator nozzle replacement, greywater irrigation, rainwater cistern, downspout diversion, pressure regulator, toilet replacement, and urinal replacement. An example of the benefit of this program is demonstrated in estimated water savings of 950,00 gallons from 133 rebates in WY2019 and 923,000 gallons from 133 rebates in WY2020. These are estimated annual savings which carry over into subsequent years and realize cumulative savings as more rebates are added every year. In WY2025, SVWD issued 17 rebates with an estimated savings of 144,127 gallons.

An additional conservation effort by SVWD, in compliance with SB555, involves conducting and submitting annual water loss audit reports to DWR. SVWD's audit score has improved every year: from 51 in 2016 to 53 in 2017 to 60 in 2019.

#### ~~2.3.8.5.3~~2.3.4.4.3 *COUNTY OF SANTA CRUZ CONSERVATION ACTIVITIES*

The County of Santa Cruz is not a water purveyor and therefore does not have ratepayers that typically form the backbone of a water conservation rebate program. Despite this, they promote water conservation throughout the County in several ways. ~~The County participates in the Water Conservation Coalition of Santa Cruz County (watersavingtips.org) to provide outreach and education to residents, and to offer trainings to specialists such as landscapers.~~ The County requires source metering and reporting of monthly usage on all public water systems with 5 or more connections. County staff offer well soundings to private well owners who want to see if their water levels have changed.

The County's water conservation program includes the following elements:

- Enforcement of an ordinance on all residential users prohibiting wasteful uses of water
- Requirement for replacement of inefficient toilet and showerheads at time of property sale
- Implementing building code requirements for efficient fixtures for all new construction and remodels
- Requiring water conservation forms and meters to be installed as part of any new well permits for wells expected to use over 2 AFY

### ~~2.3.8.6~~2.3.4.5 Recycled Water

The City of Scotts Valley owns and operates the Scotts Valley WRF and Tertiary Treatment Plant. Influent to the WRF is sourced entirely from within the City of Scotts Valley. The recycled water is used by SVWD to augment its water supply and to offset its groundwater extraction for non-potable uses. Recycled water has been used in the Basin since WY2002. Recycled water use increased quickly over the first 9 years of its use, and since 2011 use has been stable between 160 to 200 AFY in most years. From WY2002 through ~~WY2020~~WY2025, approximately ~~2,670~~3,500 AF of recycled water has been used in the Basin (Figure 2-7).

The following specific recycled water programs are implemented by the City of Scotts Valley and SVWD and discussed in more detail in Section 2.1.1.3:

- The City of Scotts Valley has an order mandating use of recycled water for irrigation for new construction when permissible and economically feasible.

- Recycled Water Fill Stations ~~was activated in 2016-2018 and 2021 to~~ offer free recycled water to District customers and City residents for permitted uses since 2016.
- ~~In 2016,~~ T~~t~~he City of Scotts Valley and Pasatiempo Golf Club, located outside of the Basin, reached an agreement in 2016 ~~for the City of Scotts Valley~~ to provide treated wastewater to the golf course for irrigation. This allows Pasatiempo Golf Club to reduce its reliance on potable water from the City of Santa Cruz during peak-use months when irrigation demand is high. ~~In support of this regional effort,~~ SVWD ~~released 10% of its total recycled water allocation in exchange for compensation~~compensation for the water ~~that~~ can be applied toward funding future projects. SVWD did not have a current identified use for the amount of recycled water that it supplied to the golf course.

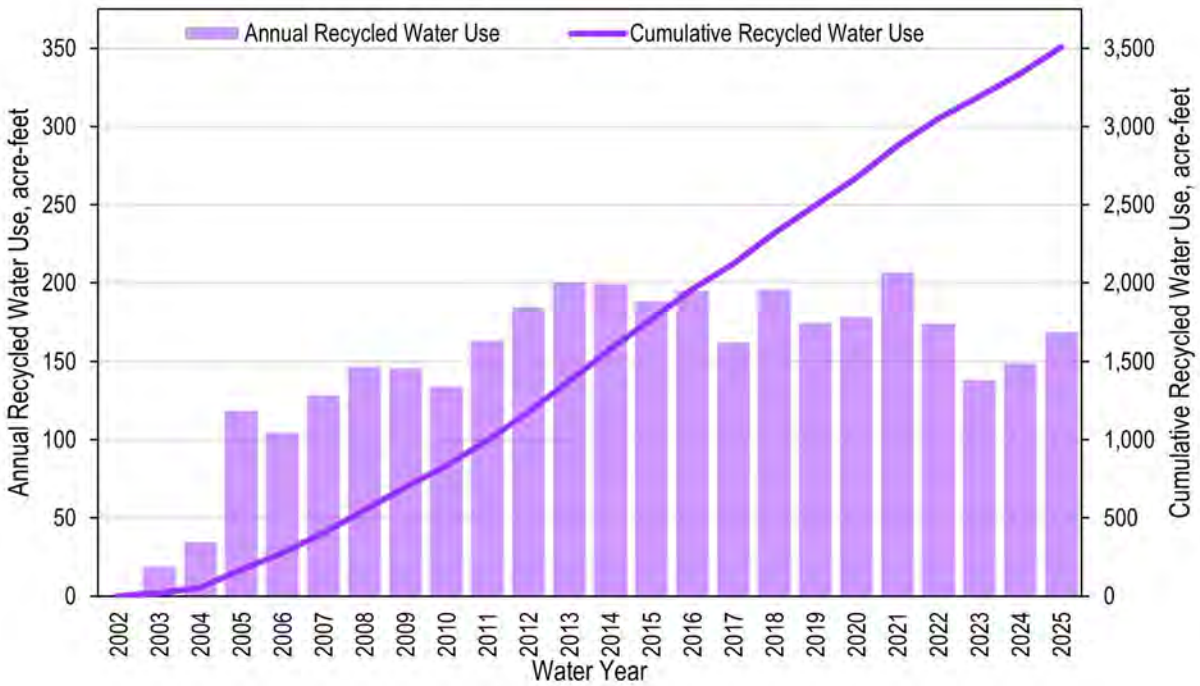



Figure 2-7~~2-7~~~~2-2~~ ~~8~~. SVWD Recycled Water Deliveries, 2002-2020

## ~~2.3.9~~2.3.5 Additional GSP Elements

### ~~2.3.9.1~~2.3.5.1 Process for Permitting New and Replacement Wells

The County of Santa Cruz regulates well siting, construction, repair, and destruction of wells to protect groundwater resources and ensure suitable water supply for the intended use through Santa Cruz County Code (SCCC) Chapters 7.70 (Water Wells). The County undertook a two-year update process to modernize the Well Ordinance in response to evolving state and local policy. An updated Well Ordinance was adopted by the Board of Supervisors effective July 21, 2025 and subsequently approved by the California Coastal Commission. ~~SCEH is the only agency responsible for issuing water well permits within the Basin. The Santa Cruz County water well permit requirements are outlined in Chapter 7.70 of the County Code and are based on water well standards developed and updated by DWR and are available at: http://www.codepublishing.com/CA/SantaCruzCounty/html/SantaCruzCounty07/SantaCruzCounty0770.html~~

The updated Well Ordinance introduces a tiered review system that scales the level of review and protective measures to the type of well, volume of pumping, and potential for impacts on streams, public trust resources, nearby wells, groundwater sustainability, and control zones. Wells meeting Tier 1, 2, or 3 requirements receive ministerial permits, while Tier 4 wells — those that cannot meet protective standards — are subject to discretionary CEQA review and may be denied if impacts cannot be mitigated.

Other significant changes to Chapter 7.70 include: increased setbacks from streams and deeper well seals for newly permitted wells to reduce streamflow depletion and protect salmonid habitat; mandatory metering of all newly installed non-domestic wells; required notification to and comment from affected water agencies and groundwater sustainability agencies on well applications; new provisions regulating soil borings and stormwater infiltration devices, which were previously unregulated at the county level; designation of Groundwater Extraction Concern Areas where groundwater availability is limited or new wells may cause significant adverse impacts; and new penalties for code violations.

The update also adopted a new Resource Protection Policy to guide evaluation of well permit applications. The policy is grounded in analytical modeling of groundwater pumping impacts on streamflow, and incorporates specific construction measures — including increased stream setbacks and deeper well seals — to reduce impacts from small domestic and replacement wells. For new non-domestic wells involving significant increases in water use, more extensive analysis is required and denial is possible if impacts cannot be mitigated.

The updated ordinance defines a *de minimis* well as one serving up to 4 primary residences using less than 2 acre-feet per year (AFY) total. Wells exceeding this threshold — whether serving

additional domestic connections, agricultural uses, industrial/commercial uses, or new development — are classified as non-*de minimis* and subject to progressively more stringent review depending on the tier in which they fallThe County also requires documentation of water efficiency measures as a condition of approval for any well serving any proposed groundwater use expected to use greater than 2 acre-feet per year (AFY). Non-*de minimis* well permit applications must be accompanied by supplemental water use efficiency information as specified by the Health Officer, demonstrating that groundwater will be put to beneficial use and not wasted

**2.3.10 The County plans to update its well ordinance to implement elements of this GSP, including metering requirements for non-*de minimis* users by the end of 2022. The County will also address the need to prevent impact on public trust values in surface water from new wells, depending on how this issue evolves in the State. This could include a requirement for increased setbacks from streams and/or deeper seals to reduce the potential to draw from alluvium that is in direct hydraulic contact with a stream.**

### 2.3.10.12.3.5.2 Wellhead Protection

The California Department of Health Services' Division of Drinking Water and Environmental Management developed the Drinking Water Source Assessment and Protection (DWSAP) Program in January 1999. The program was developed in response to the 1996 reauthorization of the federal Safe Drinking Water Act, which included an amendment requiring states to develop a program to assess sources of drinking water and encourage protection measures. The DWSAP program enables partnership between local, state, and federal agencies to ensure that drinking water quality is maintained and protected.

Several sSpecific efforts related to wellhead protection in the Basin include the following:

- SLVWD and SVWD have met DWSAP requirements for all active water supply wells since 1999.
- The City of Santa Cruz and SLVWD have completed periodic watershed sanitary surveys of potential sources of contamination in the water supply watersheds, which encompass the entire Basin (Kennedy/Jenks Consultants, 2018a).
- The State Water Board'sSWRCB 2012 Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems (OWTS) establishes additional setback and design requirements for OWTS located within 600 feet of municipal wells. These requirements are incorporated into the County's August 2022 LAMP for OWTS.

#### ~~2.3.10.2 Well Construction Policies~~

~~As discussed above in Section 2.1.3.3, the County permits water wells within the Basin. Well construction standards are found in the County Code, Chapter 7.70. The purpose of the County's well construction standards is to regulate the location, construction, repair, and modification of all wells to prevent groundwater contamination and ensure that water obtained from groundwater wells is suitable for the purpose for which it is used and will not jeopardize the health, safety, or welfare of the people of Santa Cruz County. The County requires application of well construction and modification standards developed by DWR in Bulletin 74-90.~~

#### ~~2.3.10.3 Well Abandonment and Destruction Program~~

~~The County issues well destruction permits for wells being abandoned within the Basin. The purpose of the County's well abandonment and well destruction policies is to prevent inactive or abandoned wells from acting as vertical pathways for the movement of contaminants into groundwater. Well destruction requirements are found in the County Code, Chapter 7.70.100. SCEH requires that well destruction standards developed by DWR in Bulletin 74-90 be followed.~~

### ~~2.3.11~~2.3.6 Relationships with State and Federal Regulatory Agencies

Section 2.1.3 includes a description of monitoring and management programs that involve coordination with state and federal agencies. The SMGWA coordinated with representatives from the DWR throughout the GSP development. The following state and federal agencies were consulted during the preparation of ~~this~~ the 2022 GSP and 2027 GSP Amendment:

- California Department of Fish and Wildlife (CDFW)
- California Department of Water Resources (DWR)
- Central Coast Regional Water Quality Control Board (~~CVRWQCB~~CCRWQCB)
- National Marine Fisheries Service (NMFS, formerly NOAA Fisheries)
- State Water Resources Control Board (SWRCB)
- U.S. Fish and Wildlife Service (USFWS)

As discussed in Section 2.4.3, the SMGWA established a Surface Water Technical Advisory Group (TAG) that included local resource area experts, non-governmental organizations with extensive resource management and protection experience, and state and federal resource and regulatory agencies. The purpose of this group was to gather experts to discuss the resources, agency mandates, and best available science to develop recommendations for the SMGWA Board to consider when developing its depletion of interconnected surface water ~~SMC~~ policies for the ~~initial~~2022 GSP.

~~In addition to working with various resource management agencies during the development of the GSP,~~ SMGWA member agencies ~~including the County of Santa Cruz, SLVWD, and SVWD~~ have ~~all~~ established long-term working relationships with the resource management agencies identified above. Ongoing coordination and collaboration with these agencies focus on planning for and ~~managing utility and~~ resource protection programs ~~and projects~~, utility operations, and development and construction of capital improvement projects.

### ~~2.3.11.1~~2.3.6.1 Land Use Planning Related to Potential Risks for Groundwater Quality or Quantity

~~The land use change that could potentially affect groundwater quantity would be an expanded~~ Land use planning, development, and population growth all have an ~~affect~~effect on groundwater quality and quantity. ~~suburban population and accompanying increase in municipal groundwater demand. Commercial and suburban residential land development can increase paved surfaces in the Basin, which potentially decrease recharge if not offset with onsite infiltration of runoff. Decreased recharge in areas underlain by the Santa Margarita aquifer could potentially cause reduced quantity and quality of groundwater in that aquifer.~~ Current planning by SVWD, SLVWD, and the County does not anticipate a large increase in the Basin's population. SVWD population is projected to increase annually by 0.87% from 2020 to 2045 and SLVWD's population is projected to increase annually by 0.15% over the same time period (WSC AND M&A, 2021).

Commercial and suburban residential land development can increase paved surfaces in the Basin, which potentially decrease recharge if not offset with onsite infiltration of runoff. Decreased recharge in areas underlain by the Santa Margarita aquifer could potentially cause reduced quantity and quality of groundwater in that aquifer. Current CCRWQCB stormwater policies require that all new development and redevelopment include measures to maintain runoff and infiltration rates at pre-development levels (City of Scotts Valley, 2017). Furthermore, ~~projects and management actions~~PMAs to be implemented and included in Section 8~~4~~ of this GSP increase water supply resiliency and achieve sustainability while considering anticipated future water demands related to population growth.

An increase in the Basin's rural population, most of whom are served by septic systems rather than by municipal wastewater systems, may also affect groundwater quantity and quality by increasing groundwater use and potentially leaching nitrate and other organic compounds to groundwater. There is no expected expansion of communities on septic systems according to the County. Any new rural development using septic systems in the sandy soils of the Basin requires use of enhanced treatment to reduce nitrogen ~~(N)~~ and other constituents prior to wastewater dispersal. The Scotts Valley Waste Water Treatment Plant releases treated effluent to surface water under a National Pollution Discharge Elimination System permit.

There are several sand quarry sites in the Basin that are now either closed or not operating at full capacity. A land use change at these sites, either to a recurrence of mining or to another land use, has the potential to impact groundwater quality by mobilizing contaminants present on site. Permitting by SCEH should identify and mandate solutions to groundwater quality issues at these sites.

#### ~~2.3.11.2~~2.3.6.2 Impacts on Groundwater Dependent Ecosystems

The SGMA legislation identified protection of GDEs as ~~1 of the~~a goal~~s~~ of sustainable groundwater management. Per the definitions in the GSP Regulations § 351(m), GDEs refer to "ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface." Interconnected surface water is defined by § 351(o) as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted."

Impacts to GDEs within the Basin have yet to be identified. The groundwater model shows a Basin-wide reduction in streamflow from pumping~~, but without GDE monitoring data, a quantifiable correlation has yet to be established~~. However, given the current condition of waterways that continue to support threatened and endangered species, these impacts are not thought to be significant and unreasonable. On~~-~~going programs such as Santa Cruz County's Juvenile Steelhead and Stream Habitat Monitoring Program have monitored steelhead density and stream habitat since 1994. No correlation between the amount of creek baseflow and fish density or habitat availability has been identified, perhaps because other factors, both anthropogenic and naturally occurring, can affect habitat abundance. GDE health data collected ~~per the monitoring plan in Section 3 is anticipated to provide the necessary data to establish whether there is a connection between groundwater conditions and the abundance of GDE habitat and priority species~~~~using~~through remote sensing methods demonstrate ~~that likely~~ GDE habitat is healthy even during droughts like WY2020 to~~-~~2022. Additional GDE information is presented in Section 3.4.9.

## 2.4 ~~Notice and~~ Communication and Engagement

### ~~2.4.1 Communication and Engagement~~

#### ~~2.4.1.1 Decision-Making Process~~

The SMGWA represents the beneficial users of groundwater in the Basin. The public agency maintains robust communication and engagement procedures to ensure that all stakeholders are considered in plan development and implementation.

### ~~2.4.2~~2.4.1 Beneficial Users of Groundwater

As part of the GSP process, beneficial users of groundwater in the Basin are identified by the SMGWA based on categories described in the SGMA and codified in CWC §10723.2. Beneficial users of groundwater in the Basin include municipal well operators, agricultural users, private domestic well owners, small water systems, local land use planning agencies, surface water users, environmental users of groundwater, California Native American Tribes, disadvantaged communities (DACs), protected lands (including recreational areas), public trust uses (including wildlife, aquatic habitat, fisheries, recreation, and navigation), and entities engaged in monitoring and reporting groundwater elevations.

CWC §106.3 recognizes that "every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes." The Human Right to Water extends to all Californians, including disadvantaged individuals, groups, and communities in rural and urban areas. This GSP considers impacts on all beneficial uses and users, addressing California's Human Right to Water.~~When developing this GSP, the SMGWA considered impacts on all beneficial uses and users, including domestic well owners and DACs. By addressing all beneficial uses and users, the GSP has addressed California's Human Right to Water.~~

#### ~~2.4.2.1~~2.4.1.1 Municipal Water Agencies

The primary groundwater extractors in the Basin are the 2 municipal water agencies described earlier in this GSP for SLVWD (Section 2.1.1.2.1) and SVWD (Section 2.1.1.2.2). Figure 2-8 shows the locations of active municipal water supply wells used by the 2 water districts, and Figure 3-23 shows their historical annual extractions relative to other groundwater extractors. Where the municipal water agencies' source of water supply is groundwater, their customers are beneficial users of groundwater.

The City of Santa Cruz and its customers are indirect users of groundwater in the Basin. Since surface water is interconnected with groundwater in the Basin, the City of Santa Cruz indirectly uses groundwater that supports the San Lorenzo River for their municipal surface water diversions. The City also owns property, which is partly located in the Basin, associated with water supply use and storage in the Loch Lomond Reservoir.

#### ~~2.4.2.2~~2.4.1.2 Mount Hermon Association

The MHA is located southwest of Scotts Valley near the confluence of Bean Creek and the San Lorenzo River (Figure 2-8). MHA is a year-round conference center and camp that serves more than 60,000 guests each year and a community of approximately 1,300 people living in 450 homes. Groundwater is the sole source of potable water supply for the conference center and

surrounding homes. MHA's water supply is from 2 wells located on MHA property. Figure 3-23 shows MHA's historical annual extractions relative to other groundwater extractors. Average groundwater extracted since MHA started using groundwater in 1991 is 172 AFY. Over the past 5 years pumping has been reduced to around 140 AFY due to increased water conservation awareness in the community. The JPA provides that MHA has 1 representative on the Board.

#### ~~2.4.2.3~~2.4.1.3 Small Water Systems

There are 12 small water systems (SWS) supplying water to 5 or more residential connections within the Basin, serving a population of approximately 1,000 (Figure 2-8). Most SWS use groundwater, but some have water rights to divert surface water as their water source (Table 2-8).

Table 2-8~~2-82~~. Small Water Systems in the Santa Margarita Basin

| Small Water System | Approximate Number of Connections | Water Source |
|---|---|---|
| Fern Grove Water Club | 67 | groundwater |
| Fernbrook Woods Mutual Water Company | 10 | groundwater |
| Forest Springs | 126 | supplied water from outside the Basin |
| Hidden Meadow Mutual Water Company | 17 | groundwater |
| Karls Dell | 8 | groundwater |
| Love Creek Heights Mutual Water Association | 7 | groundwater |
| Mission Springs Conference Center | 118 | groundwater |
| Moon Meadows Water Company | 5 | groundwater |
| Quail Hollow Circle Mutual Water Company | 7 | spring |
| Roaring Camp | non-community | groundwater |
| Vista Robles Association | 21 | groundwater |
| Zayante Acres Mutual Water Company | 8 | spring |

Source: State Water Resources Control Board, Division of Drinking Water

#### ~~2.4.2.4~~2.4.1.4 Private Domestic Pumpers

In areas where there is no municipal or small water system supply, private individuals extract groundwater for residential purposes from wells they own or share ownership with fewer than 5 other homes. It is estimated that the population of the Basin depending on private water supply is approximately 3,000. The approximate locations of private domestic pumpers are shown on Figure 2-8. Typically, these users extract less than 2 AFY. Under SGMA, domestic use less than 2 AFY is called *de minimis* use and is exempt from metering.

#### ~~2.4.2.5~~2.4.1.5 Disadvantaged Communities

There is a single ~~2023~~ DAC Census Block Group (DWR, 2025) partially located within the Basin (Figure 2-8). The entire DAC has an estimated population of ~~1,814~~967, most of which is outside the Basin. Within the Basin, the DAC includes part of the Census Designated Places of Boulder Creek and Brookdale. These communities were severely impacted by the CZU Complex wildfires in August 2020. The majority of the DAC population residing in the Basin are supplied water by SLVWD (both surface water and groundwater). Based on the location of private domestic wells, the estimated DAC population within the Basin that rely on their own wells for domestic use is fewer than 10. All parcels within the DAC are on septic or a small community wastewater disposal system.

Unlike many DACs throughout California, the Block Groups are not a cohesive community. They are generally made up of small parts of several disparate larger communities that have been grouped together by the Census. The Block Group also provides an artificial boundary within which to focus special attention. In all of the communities located within the Basin, there are people who meet the income requirements considered "disadvantaged," but they are not concentrated together in a defined location. Communities within the Block Group are grouped into beneficial user types under their source of water supply, which is either municipal water or privately pumped (Figure 2-8).

#### ~~2.4.2.6~~2.4.1.6 Agricultural Irrigators

~~Of the approximately 18 acres of agriculture-zoned parcels in the Basin, less than 0.2 acres are being irrigated. This irrigation is at a vineyard currently owned by Skov Winery. A vineyard has existed here since 1972. Currently, there are no official records of cannabis cultivation and its irrigation in the Basin. In future updates to the GSP, cannabis irrigation should be considered when records are available.~~

There is minimal agricultural groundwater use in the Basin for small vineyards. There ~~is~~are approximately 18 acres of agriculture-zoned parcels in the Basin, but there are multiple small vineyards scattered through the Basin that are not zoned as agriculture. ~~The largest of these is the 20-acre Roberts Ranch Vineyards east of Brookdale. Currently, there are no official records of cannabis cultivation and its irrigation in the Basin. In future updates to the GSP, cannabis irrigation should be considered if records are available.~~

#### ~~2.4.2.7~~2.4.1.7 Industrial Users

Groundwater pumping for industrial use in the Basin is currently minimal. Historically, more groundwater was pumped by the operators of the 3 sand quarries (Hanson Quarry, Olympia Quarry, and Quail Hollow Quarry) for process water and dewatering. Hanson and Olympia Quarries ceased operations in the early 2000s and are undergoing restoration. Quail Hollow is still an active quarry~~, though concurrent reclamation efforts are underway in some areas where mining has ceased~~.

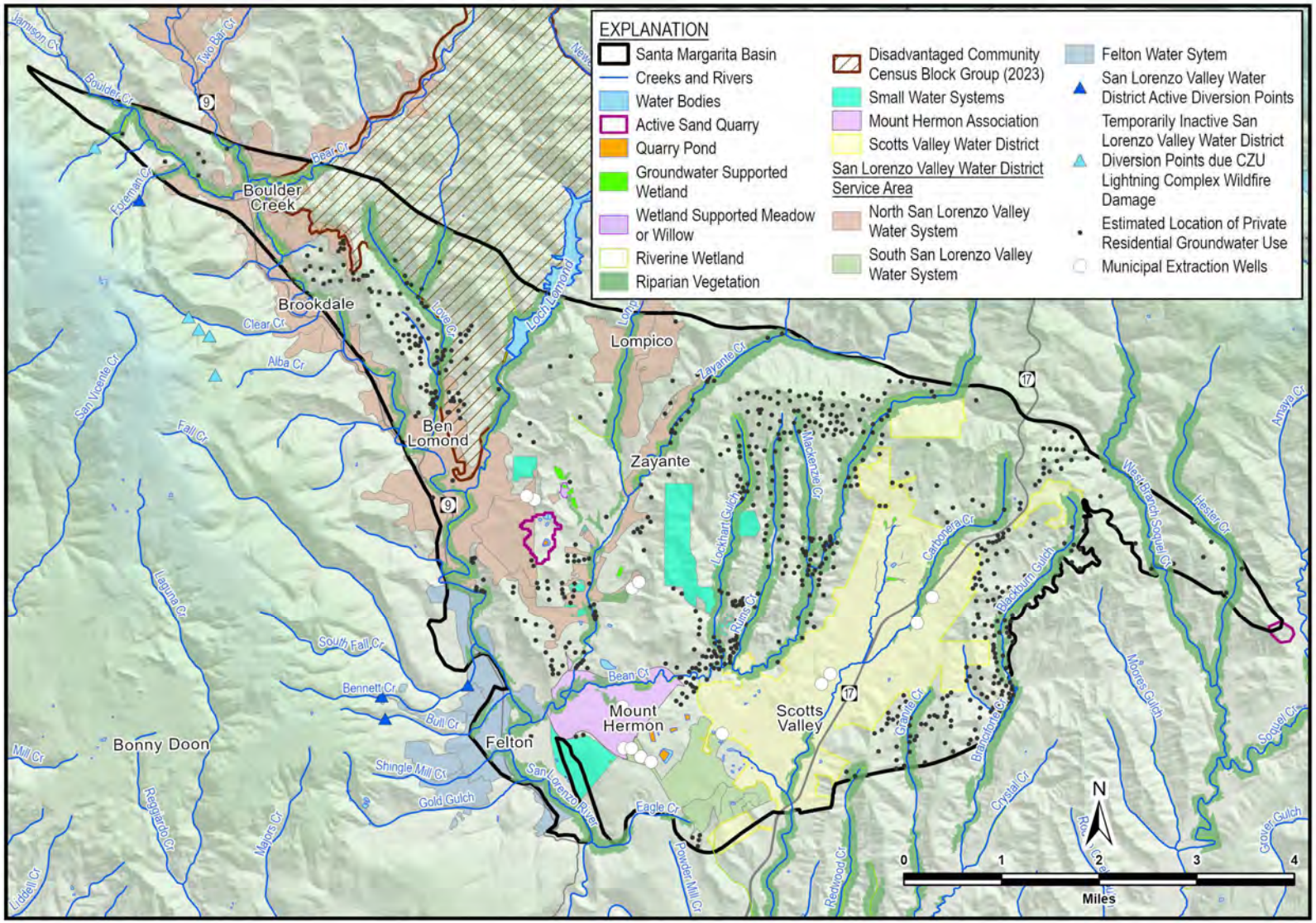



Figure 2-8~~2-82-9~~. Beneficial Users of Groundwater in the Santa Margarita Basin

### ~~2.4.2.8~~2.4.1.8 Ecological Users

GDEs in the Basin support many different species, some of which are listed as priority species by either the federal Endangered Species Act of 1973 (U.S.C. §1531 et seq.; USFWS, 2021) or the California Endangered Species Act of 1970 (Fish and Game Code § 2050 et seq.; CDFW, 2021). For example, Central California Coast coho salmon and Central California Coast steelhead trout are federally listed as endangered and threatened, respectively. Other priority species that depend on instream flows for sustenance including lamprey, California red-legged frog, western pond turtle, and California giant salamander.

The San Lorenzo River is an important river for local fisheries. Historically, the river supported the largest coho salmon and steelhead trout fishery south of San Francisco Bay. While coho salmon are critically endangered in the San Lorenzo Watershed (and Santa Cruz and San Mateo Counties, in general), the federal recovery plan identifies the San Lorenzo Watershed as an "independent watershed" and critical for recovery within the Central California Coast evolutionary significant unit. Coho salmon successfully reproduced in the San Lorenzo Watershed in 1981, 2005 and 2008 in limited areas. In addition, adult coho salmon have been observed in the lagoon and in Felton during other years. Coho salmon do have the capacity for recovery, as shown by their new intermittent (i.e., not every year) population in Laguna Creek. As required by SGMA, the GSP should conform with existing management plans such as federal recovery plans.

The San Lorenzo River has been designated as a fully appropriated stream during the summer months to maintain environmental flows in the river to support fish habitat. While these bypass flows produce important instream benefits in riverine environments, they produce equally important benefits for the San Lorenzo River estuary/lagoon that provides critical habitat for rearing of juvenile steelhead.

Critical species in the Basin that likely rely on GDEs are compiled from the California Natural Diversity Database and information available from the CDFW and The Nature Conservancy (TNC; CDFW, 2020a; TNC, 2021). The priority species, and their locations either known or thought to be found in the Basin are summarized in Table 2-9. GDEs in the Basin are discussed in more detail in Section 3.4.9. Additional species that should be considered but are not listed as priority species and are likely co-beneficiaries of the priority species, are presented in Table 2-10. If the habitat requirements of the priority species are met then the habitat requirements of the co-beneficiary species are also met. The co-beneficiaries are currently not listed as threatened or endangered species.

Table 2-9~~2-92~~. Groundwater Dependent Species Identified for Priority Management

| Species Common Name | Type of Species | Occurrence Frequency | Location(s) |
|---|---|---|---|
| California Giant Salamander | Amphibian | Frequently present | Probably distributed widely in basin. Bean Creek, Lockhart Gulch, Ruins Creek, Zayante Creek, Lompico Creek, San Lorenzo River |
| California Red-Legged Frog | Amphibian | - | Bean Creek, Mountain Charlie |
| Coho Salmon | Fish | Rare | Bean Creek, Zayante Creek, San Lorenzo River |
| Lamprey | Fish | Occasional to Common | Bean Creek, Zayante Creek, Newell Creek, San Lorenzo River |
| Steelhead | Fish | Common | Bean Creek, Zayante Creek, Lompico, Mackenzie, San Lorenzo River, Newell Creek, Love Creek, Boulder Creek |
| Western Pond Turtle | Reptile | Rare | Zayante Creek, Newell Creek, San Lorenzo River |

Species with no quantified frequency marked with "-"

Table 2-10~~2-102~~. Groundwater Dependent Species Identified as Co-Beneficiaries of Priority Species

| Species Common Name | Type of Species | Occurrence Frequency |
|---|---|---|
| Belted Kingfisher | Bird | Occasional |
| California Dipper | Bird | Rare; feeds in streams |
| California Newt | Amphibian | - |
| California Roach | Fish | Common |
| Coastrange Sculpin | Fish | Common |
| Common Merganser | Bird | Uncommon |
| Dace | Fish | Common |
| Deceiving Sedge/Santa Cruz Sedge | Plant | - |
| Downy Woodpecker | Bird | Common |
| Marsh Sandwort | Plant | - |
| Mount Hermon June Beetle | Insect | - |
| Prickly Sculpin | Fish | Common on Newell Creek |
| Rough Skinned Newt | Amphibian | - |
| Sacramento Sucker | Fish | Common |
| Santa Cruz Black Salamander | Amphibian | - |
| Slender Salamander | Amphibian | - |
| Swamp Harebell | Plant | - |
| Tidewater Goby | Fish | Rare |
| Warbling Vireo | Bird | Uncommon |
| Western Bumble Bee | Insect | - |
| Western Pearshell | Bivalve (Mussel) | - |

| Species Common Name | Type of Species | Occurrence Frequency |
|---|---|---|
| Western Red Bat | Mammal | CA species of special concern |
| Western Sycamore | Plant | - |
| Western Wood-Pewee | Bird | Uncommon |

Species with no quantified frequency marked with "-"

~~The City of Santa Cruz has reached a level of agreed flows in the San Lorenzo River and will be formalizing those flows through its pending water rights action.~~ Current regulatory instream flow requirements exist on Fall Creek upstream of its confluence with the San Lorenzo River ~~( SEQ Figure * ARABIC \s 1 **Error! Reference source not found.**)~~, Newell Creek below Loch Lomond Reservoir, and the San Lorenzo River at Felton. For Fall Creek, the minimum November through March bypass flow is 0.75 cubic feet per second (cfs) for dry years, and 1.5 cfs for other years; April through October bypass flow is 0.5 cfs for dry years, and 1.0 cfs for other years. Dry years are defined based on cumulative flow volume in the San Lorenzo River at Big Trees from the beginning of the water year. On Newell Creek below Loch Lomond Reservoir, a flow of 1.0 cfs must be maintained year-round to provide adequate depths for fish passage and spawning. On the San Lorenzo River at Big Trees, if flows fall below monthly minimum rates of 10.0 cfs in September, 25.0 cfs in October, or 20.0 cfs November through May, diversions from Fall and Bull Creeks must be terminated (Exponent, 2019).

While these are currently the only locations with mandated flows in the Basin, there are many resources available to evaluate instream flows if a basin-wide approach is warranted. North Coast Instream Flow Policy (R2 Resource Consultants, Inc and Stetson Engineers, 2008) provides guidelines for maintaining instream flows to protect anadromous salmonids. In general, summer rearing flows are just as critical, if not more so than spawning and passage flows. Summer rearing flows when the creek flow mostly comprises baseflows fed by groundwater are more impacted by groundwater extraction than spawning and migration flows, which are primarily influenced by rainfall and runoff. Table 2-11 lists minimum stream depth and dates for passage, and Table 2-12 lists dates, minimum stream depths, favorable velocities, and useable substrate for spawning.

Table 2-11~~2-112-~~. Steelhead and Coho Minimum Passage Criteria

| Species | Dates | Minimum Passage Depth Criterion (feet) |
|---|---|---|
| Steelhead | November 1 to March 31 | 0.7 |
| Coho | October 1 to February 28 | 0.6 |

Source: R2 Resource Consultants, Inc and Stetson Engineers, 2008

Table 2-12~~2-122-12~~. Steelhead and Coho Spawning Criteria

| Species | Dates | Minimum Depth (feet) | Favorable Velocities (feet/second) | Useable Substrate $D_{50}$ (millimeter) |
|---|---|---|---|---|
| Steelhead | December 1 to March 31 | 0.8 | 1.0-3.0 | 12-46 |
| Coho | November 1 to February 28 | 0.8 | 1.0-2.6 | 5.4-35 |

Source: R2 Resource Consultants, Inc and Stetson Engineers, 2008

A variety of other methods and models can be used to estimate instream flow requirements that provide the minimum depths required for fish passage or spawning:

- 1-D and 2-D hydraulic models to assess flow depths and velocities for streams with available topographic data.
- Physical Habitat Simulation developed by the USGS combines both biologic and hydraulic inputs to simulate the relationship between streamflow and physical habitat to establish instream flow requirements (USGS, 2012).
- Regression equations are another option when site-specific topographic data are absent, but streamflow data are available (R2 Resource Consultants, Inc and Stetson Engineers, 2008). These equations were developed by establishing a relationship between cross-sectional data with mean annual flow for unimpaired gaged.
- Field-based approaches such as the Wetted Perimeter Method can also be used by performing repeat transects at various flow rates at known hydraulic bed controls (CDFW, 2020b).

Understanding the biological response of priority species to available habitat is an important consideration. Santa Cruz County's Juvenile Steelhead and Stream Habitat Monitoring Program measures the density of juvenile steelhead and assesses habitat conditions for steelhead and coho salmon in 4 watersheds in Santa Cruz County including the San Lorenzo River watershed. Presence/absence data are collected for select species of fish, amphibian, and reptiles including all the priority species listed in Table 2-9. Habitat data are also collected in select stream reaches. The species and habitat data are compiled into an annual report and a geodatabase for spatially

referenced information. This work is ongoing and has occurred in every fall since 1994 (Beck *et al*., 2019), and can be used to establish links between streamflow, groundwater conditions, GDE habitat, and presence or absence of priority aquatic species.

The City of Santa Cruz is ~~currently in the process of preparing or~~ implementing 3 different ~~Habitat Conservation Plan(s) [~~HCPs~~(s)]~~ that will help protect environmental beneficial users of groundwater (City of Santa Cruz, 2011 and 2025~~0~~). An HCP is a planning document required as part of an Incidental Take Permit under the Endangered Species Act. The HCP describes effects of City activities that may result in any harm or damage to threatened and endangered species (incidental take), and how those effects will be tracked, avoided, minimized, and mitigated.

Multiple species are covered by 3 different HCPs for City activities:

- ~~Administrative draft~~ Anadromous Salmonid HCP ~~submitted to the NMFS and CDFW on July 10, 2020~~adopted in 2025
- Administrative draft USFWS HCP for 10 species that are state or federally listed as threatened, endangered, or species of special concern is currently in final review
- Low Effect Mount Hermon June beetle HCP currently being implemented
- ~~The City of Santa Cruz has agreed with NMFS and CDFW on long-term minimum streamflows (Agreed Flows). The City of Santa Cruz plans to complete the Anadromous Salmonid HCP with NMFS and an Incidental Take Permit with CDFW by 2023.~~

### ~~2.4.3~~2.4.2 SMGWA Board of Directors

The JPA between SVWD, SLVWD, and the County of Santa Cruz (included as Appendix 1B) that created the SMGWA requires the GSA to hold public meetings at least quarterly. The meetings are required to be noticed and meet all of the requirements of the Ralph M. Brown Act for transparency in California government. To hold a valid meeting, the SMGWA must have a quorum of the Board of Directors, which consists of an absolute majority of directors plus 1 director or designated alternates. With these requirements in mind, the SMGWA:

- Holds board meetings on a regular schedule ~~(every month)~~
- Provides written notice of meetings with meeting agenda and meeting materials available at least 72-hours prior to the meeting time
- Sends email meeting reminders to SMGWA's contact lists that includes approximately ~~345~~ 824 unique email addresses
- Posts meeting agenda at the meeting location prior to the meeting as required

Under SGMA, the SMGWA Board of Directors is responsible for ~~to~~ approving and submitting ~~e~~ a GSP ~~and submit it to DWR on or before January 31, 2022~~and subsequent amendment(s), if

needed. Once a quorum is present, most SMGWA decisions require a simple majority of all appointed directors participating in the vote. If a director is disqualified from voting on a matter before the Board because of a conflict of interest, that director shall be excluded from the calculation of the total number of directors that constitute a majority.

There are certain matters that come before the SMGWA Board of Directors that require a unanimous vote of all participating SMGWA ~~member agency~~ directors ~~participating in the vote~~. These include approval of any of the following:

- Capital expenditures estimated to cost $50,000 or more
- Annual budget
- GSP for the Basin or any future amendments
- Levying of assessments or fees
- Issuance of indebtedness
- Stipulations to resolve litigation concerning groundwater rights within or groundwater management for the Basin

~~diSMGWA agendas include general public comments at the beginning of each board meeting. General comments allow community members to raise any groundwater related issue that is not on the agenda. Public comment time is also given prior to a vote on all agenda items to ensure public opinion can be incorporated into SMGWA Board of Director decisions. The public may also make submissions to the board for inclusion in the meeting packet.~~

The SMGWA Board directs agency staff to fulfill the various requirements of SGMA. To do this, SMGWA staff provides the Board with research and recommendation staff reports, work plans, technical summaries, budgets, and other work products as required to support Board decision-making.

### ~~2.4.4~~2.4.3 Surface Water Technical Advisory Group

Representatives from the following organizations and agencies participated in 2 technical Surface Water TAG meetings to assist with ~~initial~~ 2022 GSP development ~~of SMC~~:

- California Department of Fish and Wildlife
- California Department of Water Resources
- City of Santa Cruz Water Department
- County of Santa Cruz Environmental Health (SCEH)

- Environmental Defense Fund
- Land Trust of Santa Cruz County
- National Marine Fisheries Service (formerly NOAA Fisheries)
- ~~The Nature Conservancy~~
- Resource Conservation District of Santa Cruz County
- San Lorenzo Valley Water District
- Santa Margarita Groundwater Agency
- Scotts Valley Water District
- The Nature Conservancy
- U.S. Fish and Wildlife Service

The 2 meetings held on August 14, 2020, and February 24, 2021, provided the TAG background information on the hydrogeological setting of the Basin, City of Santa Cruz habitat conservation planning, Santa Cruz County fish monitoring, potential conjunctive use opportunities for SLVWD, water budget, and current understanding of the relationship between surface water and groundwater. Based on the background information available, the technical team shared potential approaches for developing SMC for the depletion of interconnected surface water and plans for GDE monitoring. The TAG's ~~was asked to provided specific input on the SMGWA Board's statement of significant and unreasonable, potential SMC approaches, and GDE monitoring plan. Their~~ expert input was taken into account in the development of SMC and the GDE monitoring plan for the 2022 GSP. SMGWA did not reconvene a TAG for the 2027 GSP Amendment, but implementation of the 2022 GSP based on their prior input informed the revised approach to SMC related to depletion of interconnected surface water.

### ~~2.4.5~~2.4.4 Consideration of Public Input and GSP Review Process

During SMGWA Board meetings, ~~the~~ a meeting facilitator regularly ~~provided~~ provides opportunities for public comments on topics being discussed ~~during each meeting~~. Consistent with and expanding on Brown Act requirements, each Board meeting included the following periods of public comment on the agenda:

- Introductory public comment period at the beginning of the meeting for topics not included in the agenda
- Public comment periods for each agenda item
- Public comment periods prior to any formal action taken by the Board

A table-based comment tracking system was adopted for ~~initial~~2022 GSP development ~~as part of the GSP Administrative Record to continually~~ to record beneficial user input. The public comment tracking table is included as an appendix to the Communication and Engagement Plan (C&E Plan) summarized in Section 2.4.5 below. The full C&E Plan is included as Appendix 2A. All public comments provided at Board meetings were heard by directors and staff, and considered before formal action were made or direction to staff provided.

During ~~initial~~2022 GSP development, ~~As each~~ draft sections of the GSP ~~was~~ were developed by consultants and member agency staff, presented to the Board for~~, staff from SLVWD, SVWD, County, and City of Santa Cruz provided~~ initial feedback, refined, and then ~~on the section. Thereafter, the next version was~~ provided as a draft for ~~to the~~ Board ~~while also being made~~ and public review on the SMGWA's website. The Board provided written comments on each section and ~~discussed~~ significant comments were discussed at the ~~next~~ subsequent Board meeting. During Board meetings covering specific draft sections of the GSP, the public was encouraged to provide verbal feedback on the topics being discussed.

All comments provided by the Board and public were reviewed by GSP consultants and staff, and revisions made to relevant sections of the GSP as applicable. A complete draft of the ~~initial~~2022 GSP was compiled and uploaded to the SMGWA website on July 26, 2021 for a 60-day public review period. The GSP was finalized considering public comments received. Comments received on the public draft GSP and responses are documented in Appendix 2B.

The 2027 GSP Amendment was developed ~~…. *Describe approach*~~consistent with the requirements of preparing and adopting a GSP. Following public notices published in the San Lorenzo Valley Press Banner and Scotts Valley Press Banner on February 13, 2026 and February 20, 2026, the SMGWA Board adopting a notice of intent to prepare a GSP Amendment at its February 26, 2026 meeting. On July 24, 2026, SMGWA notified the City of Scotts Valley and the County of Santa Cruz of its intent to adopt a GSP Amendment at least 90 days after providing notice. *[GSP Review Draft Note – additional information on the adoption process and public comment on the draft GSP will be included in the final GSP Amendment]*

### ~~2.4.6~~2.4.5 Communication and Engagement Plan

A Stakeholder C&E Plan ~~has been~~was prepared ~~developed~~ to assist the SMGWA in its efforts to disseminate and receive feedback on relevant information and to engage the public, including groundwater beneficial users, regarding the development and implementation of SMGWA's GSP with a particular focus on fulfilling and exceeding the requirements of § 354.10 Notice and Communication of the SGMA~~)~~. The C&E Plan covers a 4-phase approach that includes ongoing communication efforts, GSP development, GSP rollout, and future efforts following GSP submission and beyond as the GSP is implemented. The C&E Plan is~~,~~ included as Appendix 2A~~, is a work plan to ensure sufficient opportunities for public participation are included in the GSP process~~.

The C&E Plan ~~palso p~~rovides SMGWA board members and staff a guide to ensure consistent messaging about SGMA requirements and other related information. It ~~establishes~~ established a roadmap for GSP development that identifies how and when beneficial users and other stakeholders can provide timely and meaningful input into GSA decision-making. Additionally, the C&E Plan ensures beneficial users and other stakeholders in the SMGB are informed of milestones and offered opportunities to participate in GSP development and implementation.

~~The C&E Plan covers a 4-phase approach that includes ongoing communication efforts, GSP development, GSP rollout, and future efforts following GSP submission in January 2021 and beyond as the GSP is implemented.~~

Stakeholder involvement and public outreach is critical to GSP development and implementation because it helps promote the plan development based on input and broad support. Some essential elements of public outreach are providing timely and accurate public reporting of planning milestones through the distribution of outreach materials and posting of materials on the SMGWA website, securing quality media coverage and utilizing social media.

The phased approach to outreach allows opportunities to assess the program and evaluate how the C&E Plan is performing against its goals and objectives. Assessment is conducted by the cooperating agency staff and reviewed by Board members during quarterly communications updates to the Board.

Ongoing activities in the GSP implementation phase starting in 2022 ~~are expected to~~ include: maintenance of the SMGWA website; continued social media presence through Facebook and Instagram; email newsletter; youth engagement efforts; promoting and conducting community meetings, workshops and events; coordination with member agencies to share information; and developing print materials, as necessary.

# 3 BASIN SETTING

## 3.1 Overview

The Santa Margarita Groundwater Basin lies in the north central portion of Santa Cruz County (Figure 2-1) in the Santa Cruz Mountains. The Basin is a geologically complex area that was formed by the same tectonic forces along the San Andreas fault zone that created uplift of the Santa Cruz Mountains and the rest of the California Coast Range.

The Basin consists of a section of sandstone, siltstone, and shale/mudstone overlying a basement of granitic and metamorphic rocks, all of which have been folded into a geologic trough called the Scotts Valley Syncline. The sedimentary rocks are divided into numerous formations based on the types of rock and their relative ages, as determined by field mapping and paleontological studies performed by the United States Geological Survey (Clark, 1981; Brabb *et al*, 1997; McLaughlin *et al*, 2001). The sandstone formations make the best aquifers due to their large porosity and permeability. Three sandstone formations – the Santa Margarita, Lompico, and Butano Sandstones ~~form~~~~serve~~are ~~as~~ the principal aquifers that ~~are pumped to~~ supply much of the Basin's water demand~~: Butano Sandstone, Lompico Sandstone, and Santa Margarita Sandstone~~.

## 3.2 Topography

~~In general, surface elevation within the Basin~~Surface topography is varied in the Basin, increasing in ~~elevatoine~~elevation~~es~~ to the north and east. Elevations within the Basin range from approximately 300 feet above mean sea level (amsl) in the vicinity of the San Lorenzo River at the southern end of the Basin, to more than 1,500 feet amsl along the northern boundary of the Basin at the peak of Mount Roberta. Figure 3-1 is a topographic map for the Basin.

At its northern margin, the Basin is characterized by a series of ridges and peaks running roughly parallel to the Zayante-Vergeles Fault. Named peaks include Mount Roberta (~1,500 ft amsl) and Eagle Dell Peak (~1,400 ft amsl). The rugged terrain of the northern part of the Basin ~~is comprised of~~includes several north-south trending, steep ridges ~~alternating with~~~~seperated~~separated by V-shaped valleys formed by Newell Creek, Zayante Creek and Bean Creek and their branches and ~~tributatires~~tributaries. The topography is gentler and rolling in the southern and central parts of the Basin where the ~~weakly consolidated~~ Santa Margarita Sandstone occurs at the surface. At the south end of the Basin a relatively low-lying area stretches from Scotts Valley to Felton, where it joins the San Lorenzo River Valley. The San Lorenzo River Valley crosses the entire Basin near its western margin. ~~Similarly, low-elevation valleys contain Newell Creek, Zayante Creek and Bean Creek, which are tributaries to the San Lorenzo River.~~ The varied topography in the Basin is illustrated in a 3-dimensional rendering in Figure 3-2.

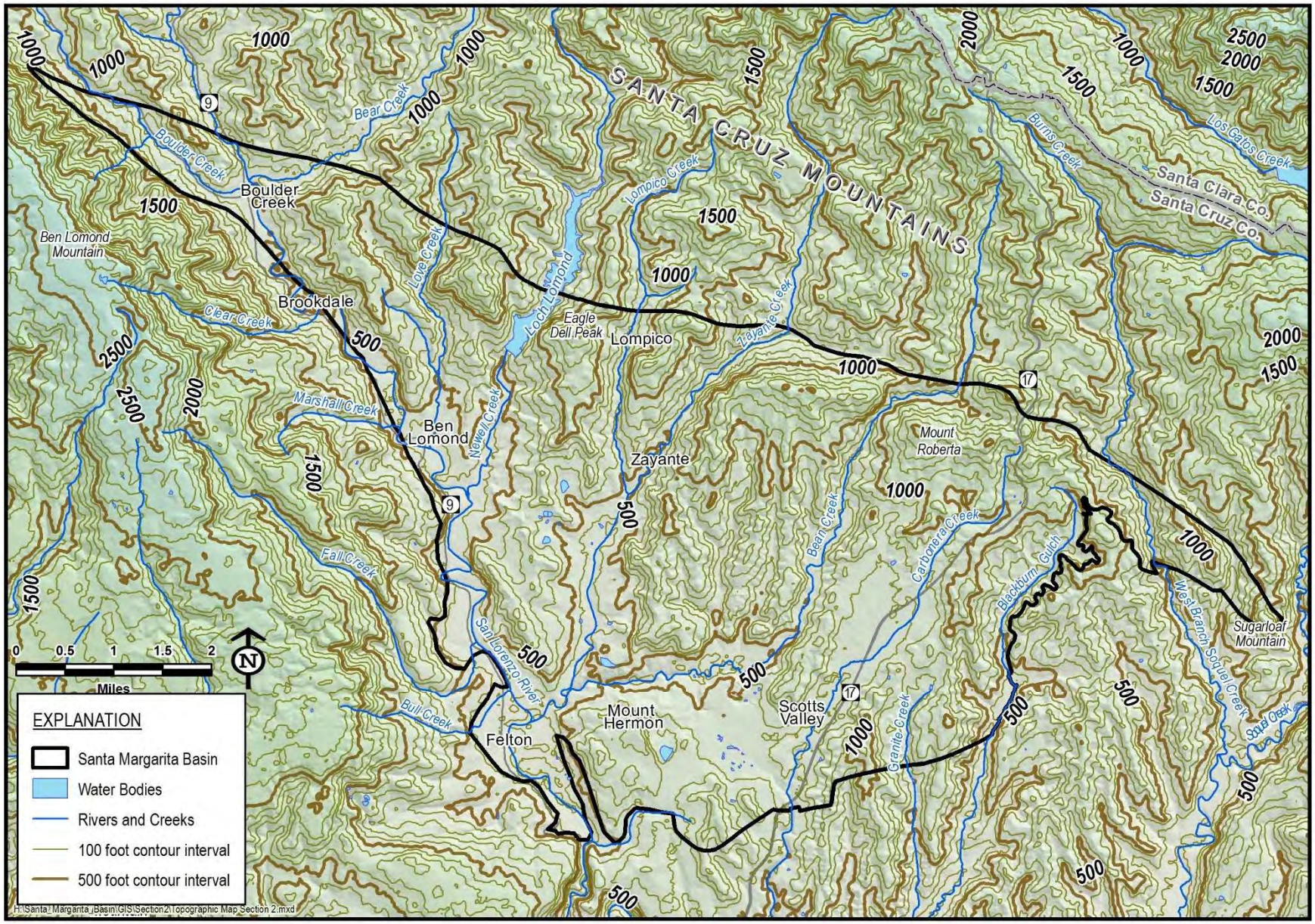



Figure 3-~~13~~-~~13~~-~~3~~-~~1~~. Santa Margarita Basin Topography

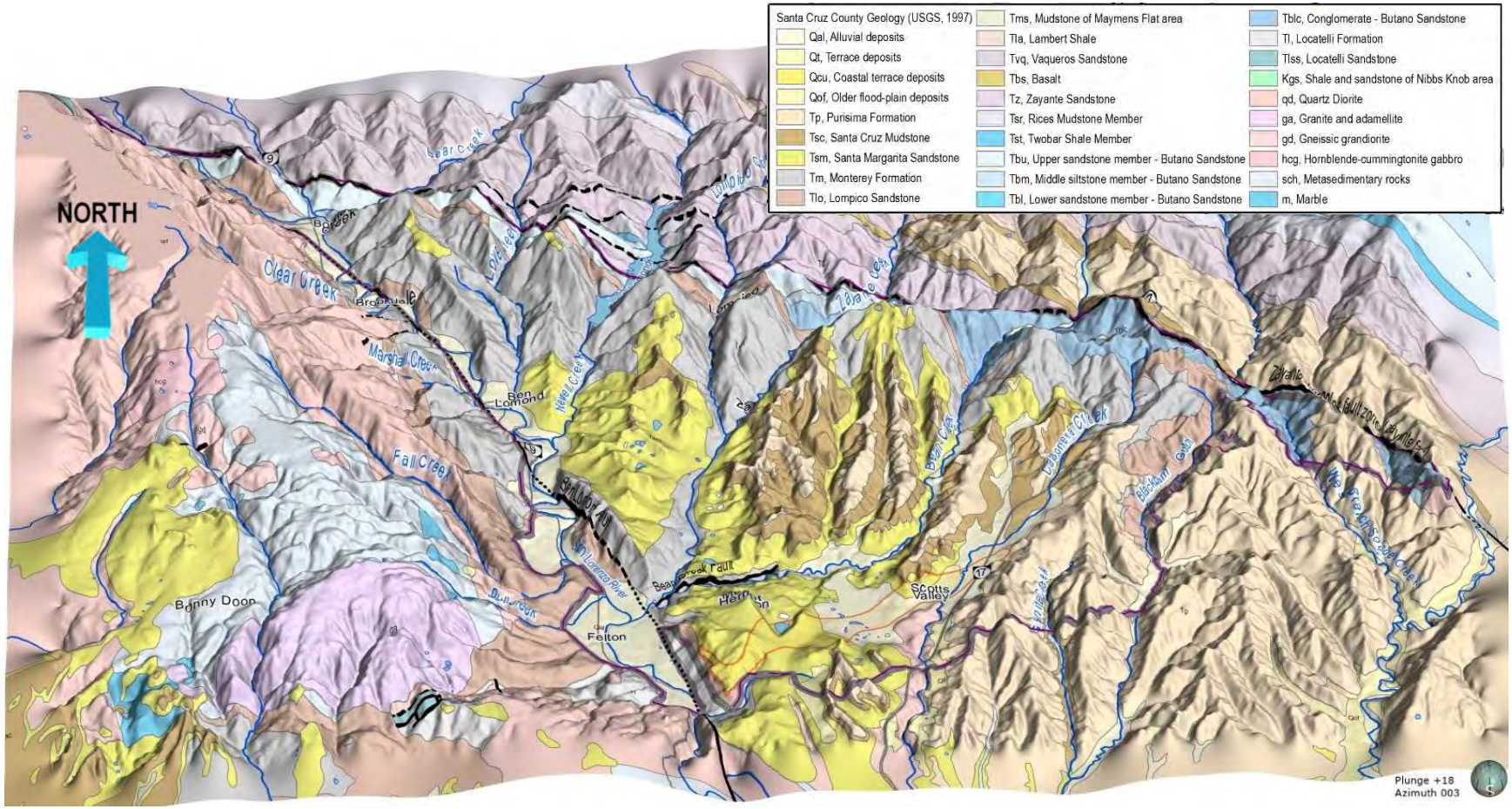



Figure 3-2~~3-23-3-2~~. Three-Dimensional Topography of the Santa Margarita Basin with Surface Geology (3x exaggeration)

## 3.3 Climate

### 3.3.1 Historical Climate

The climate in Santa Margarita Basin is classified as Mediterranean, characterized by distinct rainy and dry seasons, warm summers, and mild winters (Kennedy/Jenks Consultants, 2015). In an average year, almost all the Basin's precipitation occurs from November through April. Almost all precipitation is rainfall, though occasionally snow falls at the higher elevations. Precipitation increases across the Basin east to west from about ~~42~~ 40 inches per year to ~~52~~ 50 inches per year due to increased elevation and the orographic effect of Ben Lomond Mountain west of the Basin. The distribution of precipitation across the Basin from 1981-2010 is displayed on Figure 3-3.

Precipitation and temperature are measured at the El Pueblo Yard weather station in Scotts Valley (elevation ~580 feet amsl) and at the Boulder Creek weather station in downtown Boulder Creek (elevation ~508 feet amsl). Station-specific precipitation range, average, and annual departure from the average for the full period of record (1947 through WY2025)~~period between 1947 and 2018~~ are provided on Figure 3-4. ~~Average annual precipitation at the El Pueblo Yard station is 42 inches, with a maximum of 86 inches in WY1983, and a minimum of 20 inches in WY2014~~ Consistent with the WY2025 Annual Report and standard climatological practice, the most recent 30-year period (1995–2024) is used to define long-term average conditions in the Basin. The 30-year ~~A~~average annual precipitation ~~at the El Pueblo Yard station~~ is approximately 41.1 inches at the El Pueblo Yard station ~~based on the 30-year reference period~~ (Table 3-1)~~. And~~ and ~~average annual precipitation at the Boulder Creek station is~~ approximately 50.1 inches at the Boulder Creek station~~based on the same 30-year reference period~~. ~~Average annual precipitation at the Boulder Creek station is 52 inches, with a maximum of 112 inches in WY1983, and a minimum of 19 inches in WY1986~~ (Table 3-1). The temperature record is similar at the 2 stations. The average minimum and maximum temperatures are about 32ºF and 77ºF, respectively. In the warmer dry season, from May to October, average minimum and maximum monthly temperatures are around 41ºF and 95ºF, respectively.

Water year type is determined using the City of Santa Cruz water year classification that is no longer used by the city, but is used in the GSP for consistency with past classification practices. This classification is based on total annual runoff in the San Lorenzo River measured at the USGS Big Trees gage, just south of its confluence with Bean and Zayante Creeks. Water year types are defined as Wet when annual runoff exceeds 119 AF, Normal when runoff ranges from 49 to 119 AF, Dry when runoff ranges from 29 to 48 AF, and Critically Dry when runoff is less than 29 AF. The water year types are displayed on most of the hydrographs in this GSP.

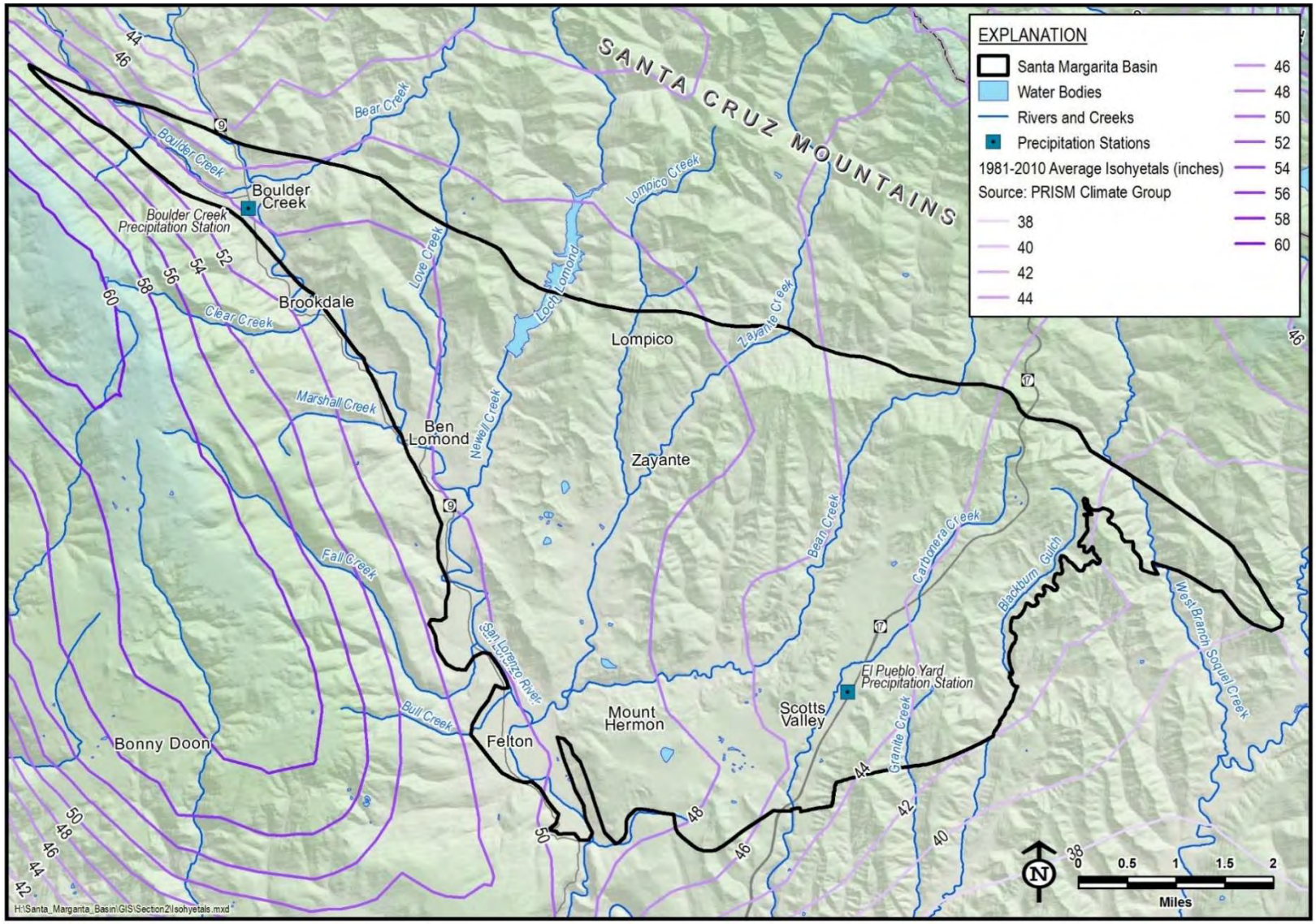



Figure 3-3~~3-33-3~~. Distribution of Precipitation Across the Santa Margarita Basin

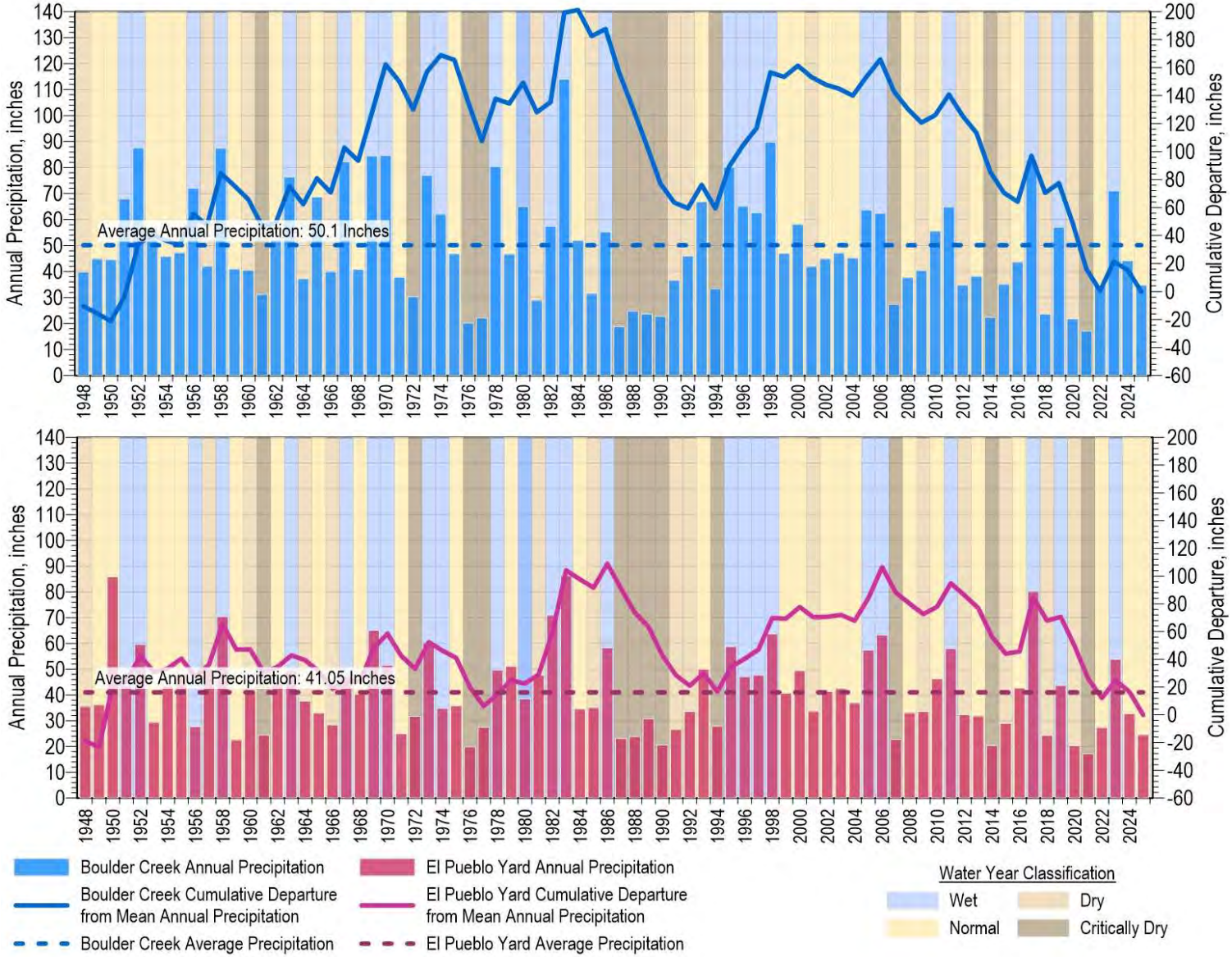



Figure 3-~~43~~-~~43~~-4. Annual Precipitation and Cumulative Departure from Mean Annual Precipitation in the Santa Margarita Basin

Table 3-13 13 . Santa Margarita Basin Monthly Climate Summary (30-Year Average, updated through WY2025)

| Month | Boulder Creek (SLVWD) | | | El Pueblo Yard (SVWD) | | |
|---|---|---|---|---|---|---|
| | Average RainfallPrecipitation (inches) | Average Monthly Minimum Temperature (ºF) | Average Monthly Maximum Temperature (ºF) | Average Precipitation Rainfall (inches) | Average Monthly Minimum Temperature (ºF) | Average Monthly Maximum Temperature (ºF) |
| January | 11.310.4 | 29.3 | 71.6 | 8.88.7 | 31.3 | 73.4 |
| February | 9.910.0 | 32.2 | 71.5 | 7.57.6 | 30.2 | 72.9 |
| March | 6.37.3 | 32.3 | 81.6 | 5.76.1 | 34.3 | 80.6 |
| April | 3.12.9 | 37.6 | 85.6 | 2.42.9 | 37.9 | 85.7 |
| May | 1.31.1 | 40.2 | 85.5 | 10.9 | 41.3 | 85.9 |
| June | 0.20.2 | 42.2 | 97.3 | 0.20.2 | 45.2 | 96.9 |
| July | 00.0 | 47.7 | 101.9 | 00.1 | 14.4 | 96.5 |
| August | 0.10.1 | 48.3 | 100.8 | 00.1 | 50.1 | 94.6 |
| September | 0.10.2 | 40.7 | 102.1 | 0.20.4 | 44.2 | 100.0 |
| October | 2.12.0 | 37.6 | 87.0 | 22.1 | 41.5 | 89.8 |
| November | 4.75.6 | 31.8 | 82.4 | 4.15.1 | 34.3 | 83.2 |
| December | 10.89.3 | 30.4 | 66.2 | 97.8 | 30.4 | 69.0 |

Data sourcesNotes:
Precipitation Rainfall values represent average monthly precipitation based on the most recent 30-year period (WY19956–2025)4), updated through WY2025. The full period of record (WY1947–WY2025) is shown in figureson Figure 3-4 to characterize long-term variability

**SVWD rainfall data based on measurements from 8/1946 – 9/1/2019, temperature data based on measurements from 10/2016 – 7/2020**
**SLVWD rainfall data based on measurements from 10/1980 – 9/2019, temperature data based on measurements from 1/2017 – 12/2019**

### 3.3.2 Projected Climate

Climate change is expected to impact the Basin in the future because of a rise in atmospheric greenhouse gases such as carbon dioxide and methane. Projecting climate change is a challenging task that has inherent uncertainty regardless of the method selected. The DWR provides 1 a set of assumptions that can be used for GSP development, but the SMGWA elected to use a slightly different approach that better suited the groundwater model already developed for the Basin. The method described below was selected for use in the GSP projected scenario because it is based on the best available science, is consistent with other regional planning efforts, and provides a conservative estimate of future conditions in the Basin.

~~The~~ DWR's ~~provides~~ projected climate change data sets for use in GSP development ~~that~~ incorporate a single set of assumptions about future temperature, evapotranspiration, precipitation, and hydrology in 2 future years (2030 and 2070). Generally, DWR anticipates future regional climate conditions to be warmer than current conditions, with greater evapotranspiration, and more variable precipitation and streamflow (DWR, 2018). In part because this steady-state approach is not directly applicable to transient groundwater models where model inputs vary over time (i.e. the Santa Margarita Basin Numerical Groundwater Flow Model, or "Basin Model"~~GSP groundwater model~~), the DWR guidance document on climate change states that other climate change approaches can be used for developing projected water budgets in the GSP. The DWR climate change guidance states:

> *Local considerations and decisions may lead GSAs to use different approaches and methods than the ones provided by DWR for evaluating climate change. For example, the use of a transient climate change analysis approach may be appropriate where local models and data have been developed that include the best available science in that watershed or groundwater basin.*

The transient climate projection approach used for the ~~GSP~~Basin Model, is described generally below and in more detail in ~~the groundwater model description in~~ Appendix 3A: Section 7.1. ~~, is a transient climate~~ The climate projection is developed based on an ensemble of 4 commonly used and scientifically defensible global climate models. The approach is similar to that being used by the City of Santa Cruz to develop their recent HCPs. Similar to DWR's dataset, ~~T~~the climate projection generally results in more variable precipitation (i.e., longer and more extreme droughts with fewer but more extreme rainfall events), slightly lower total precipitation, and warmer temperatures in the future in comparison to current conditions.

Projected trends for the 4-model ensemble projection are compared against historical data and other climate models~~-~~ to demonstrate how the climate projections compare to conditions observed historically and projected in the future by others.

Streamflow and evapotranspiration are simulated in the Basin Model based on the precipitation and temperature projections. Figure 3-5 shows projected precipitation and Figure 3-6 shows projected reference evapotranspiration controlled by temperature. It is important to note that the set of assumptions used in the climate projection ~~used in developing this GSP~~ is ~~1~~ a single scenario selected to be representative of the region, is consistent with other regional planning efforts, and is conservative about future climate change. There are many other equally likely climate scenarios that could also occur.

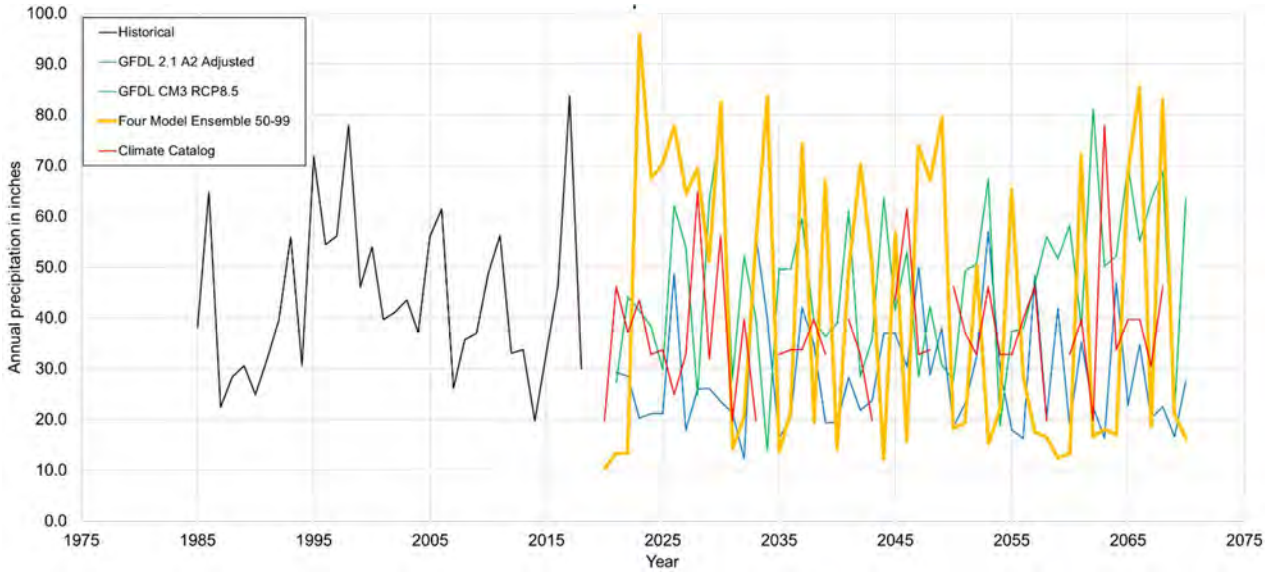



Figure 3-5~~3-53-3-5~~. Precipitation Variability B~~b~~etween Climate Models

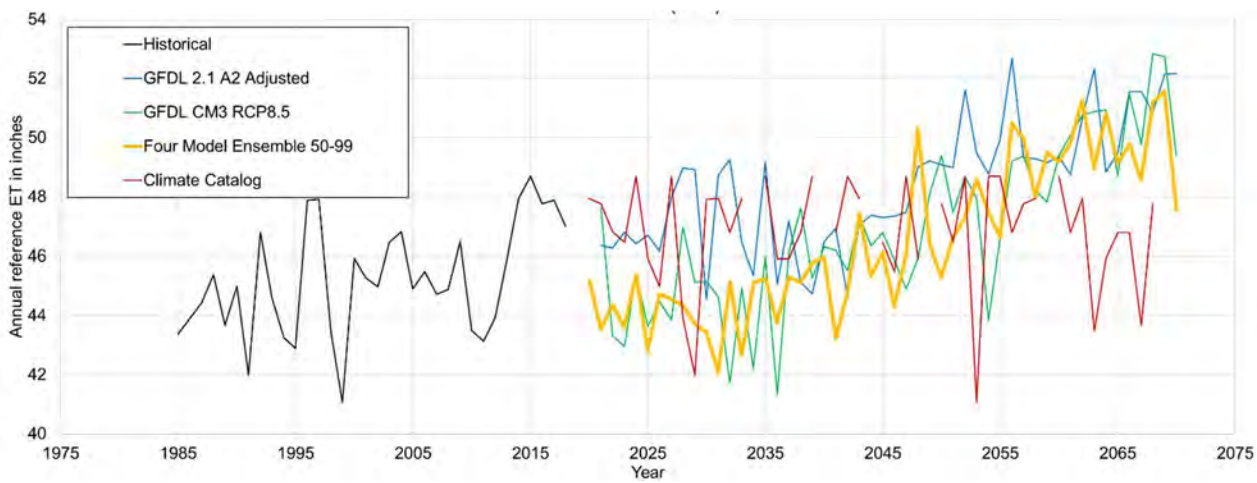



Figure 3-6~~3-63-3-6~~. ~~Variation of~~ Annual Reference Evapotranspiration Variability B~~b~~etwe~~e~~en Climate Models

## 3.4 Hydrogeologic Conceptual Model

This subsection describes the Hydrogeologic Conceptual Model (HCM) of the Basin, including its boundaries, geologic formations and structures, and principal aquifer units. Also described is general Basin groundwater quality, interactions between groundwater and surface water, and generalized groundwater recharge and discharge areas. The HCM primarily relies upon previously published studies, including the following:

- Nicholas M. Johnson (2009) San Lorenzo Valley Water District Water Supply Master Plan
- Kennedy/Jenks Consultants (2015) Santa Margarita Basin Groundwater Modeling Technical Study

- SVWD annual groundwater management program reports (2008 – 2019)

### 3.4.1 Basin Boundaries

The Basin forms a roughly triangular area that extends from Scotts Valley in the east, to Boulder Creek in the northwest, to Felton in the southwest (Figure 3-7). Sedimentary rocks within the Basin include, from oldest to youngest, the Tertiary-aged Butano Sandstone, Lompico Sandstone, Monterey Formation, and Santa Margarita Sandstone. The sandstone formations form the Basin's principal aquifers. The Basin is bounded on the north by the Zayante trace of the active, strike-slip Zayante-Vergeles fault zone, on the east by a buried granitic high that separates the Basin from Santa Cruz Mid-County Basin, and on the west by the Ben Lomond fault except where areas of alluvium (previously designated as the Felton Basin lie west of the fault). The southern boundary of the Basin with the West Santa Cruz Terrace Basin is located where the Tertiary sedimentary formations thin over a granitic high and give way to young river and coastal terrace deposits.

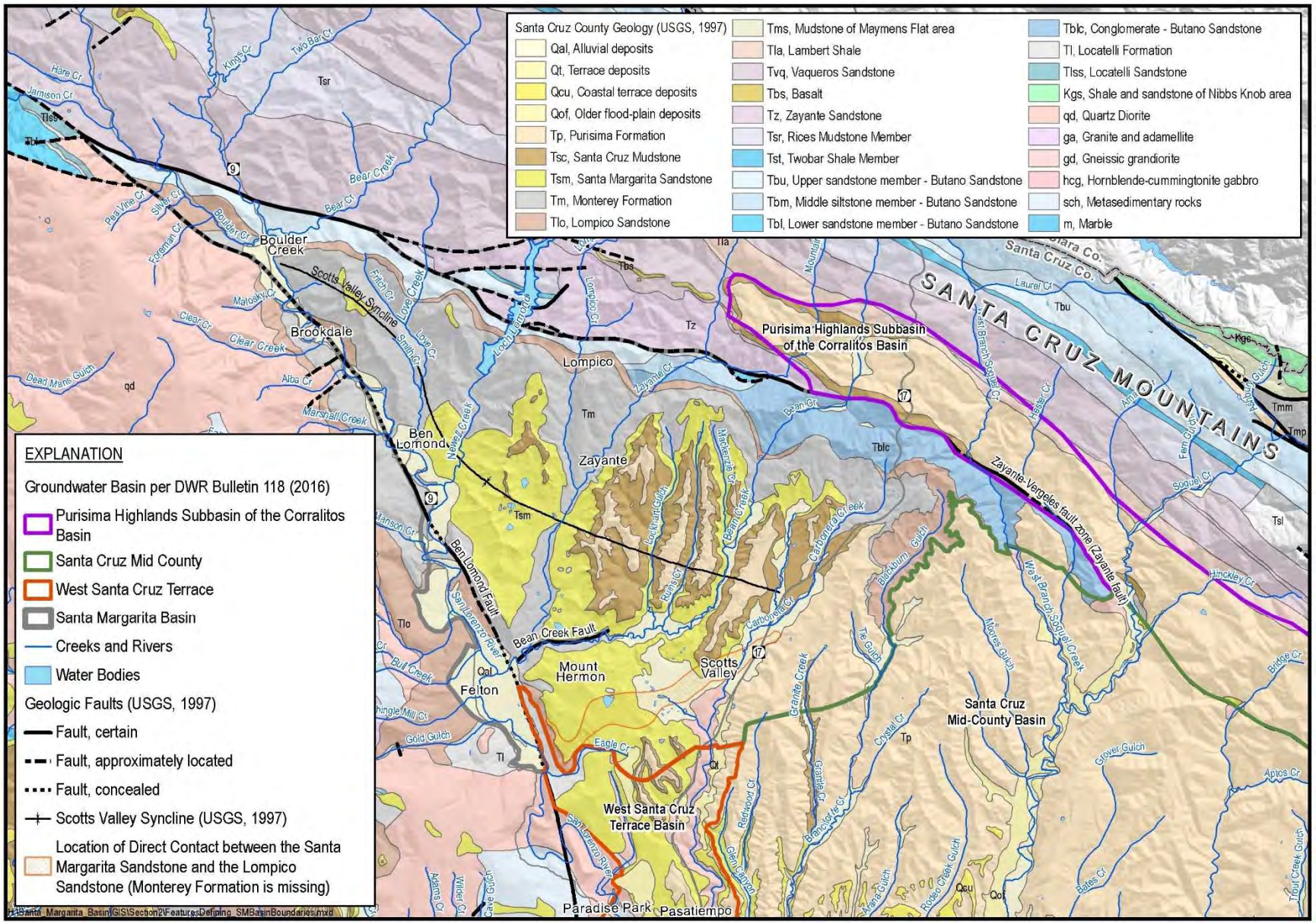



Figure 3-7~~3~~-7~~3~~-3-7. Features Defining the Santa Margarita Basin Boundaries

### 3.4.2 Basin Stratigraphy

Figure 3-8 is a generalized stratigraphic column for the Basin that shows the age relationships and thickness of geologic units ~~and the thicknesses of the sedimentary formations~~. The thick section of Tertiary-age sedimentary formations does not represent a continuous marine depositional sequence. Episodes of deformation and uplift combined with changes in global sea level led to erosion that resulted in 4 unconformities, or gaps, in the geological record represented by wavy lines on the stratigraphic column. These episodes of folding and uplift followed by erosion account for the thickness variations across the Basin of the sedimentary layers or their local absence, with important consequences for the HCM.

The subsections below describe the stratigraphic units from oldest to youngest and indicate where they occur in the Basin as depicted in the geologic map shown on Figure 3-9.

| Era | Period | Series | Geologic Formation | | Lithology | Maximum Thickness in Basin (feet) |
|---|---|---|---|---|---|---|
| Cenozoic | Quaternary | Pleistocene-Holocene | Alluvium (Qal) and Terrace Deposits (Qt) | | Alluvium – unconsilidated, moderately sorted silt, sand and gravel | 40 |
| | | | | | Terrace Deposits – weakly consolidated, poorly sorted sandy gravel to medium-grained sands | 60 |
| | Tertiary | Pliocene | Purisima Formation (Tp) | | Very thickly bedded tuffaceious and diatomaceous siltstone with thick interbeds of semi-friable andestic sandstone | 200 |
| | | Miocene | Santa Cruz Mudstone (Tsc) | | Medium- to thick-bedded and faintly laminated pale siliceous mudstone with scattered speriodal dolomite concretions; locally graded to sandy siltsone | 250 |
| | | | Santa Margarita Sandstone (Tsm) | | Very thick bedded and thickly crossbedded friable arkosic sandstone | 450 |
| | | | Lompico Sandstone (Tlo) | Monterey Formation (Tm) | Medium- to thick-bedded and laminated subsiliceous organic mudstone and sandy siltstone with few thick dolomite interbeds | 2,000 |
| | | | | | Thick-bedded to massive arkosic sandstone | 400 |
| | | Eocene | Butano Sandstone | Upper (Tbu) | Thin- to very thick-bedded medium arkosic sandstone with thin interbeds of siltstone | 3,000 |
| | | | | Middle (Tbm) | Thin- to medium-bedded nodular pyritic siltstone | 250 – 750 |
| | | | | Lower (Tbl) | Very thick bedded to massive arkosic sandstone with thick to very thick interbeds of sandy pebble conglomerate in lower part | 1,500 |
| | | Paleocene | Locatelli Formation (Tl) | | Nodular micaceous siltstone; micaceous arlosic sandstone locally at base | 800 |
| Mesozoic | Cretaceous | | Crystalline Basement | | Metasedimentary rocks intruded by granodiorite and quartz diorite | |

unconformity

principal aquifer

Modified after Johnson (2009) and Kennedy/Jenks Consultants (2015)

Figure 3-8~~3-8~~ ~~3-8~~. Santa Margarita Basin Stratigraphic Column

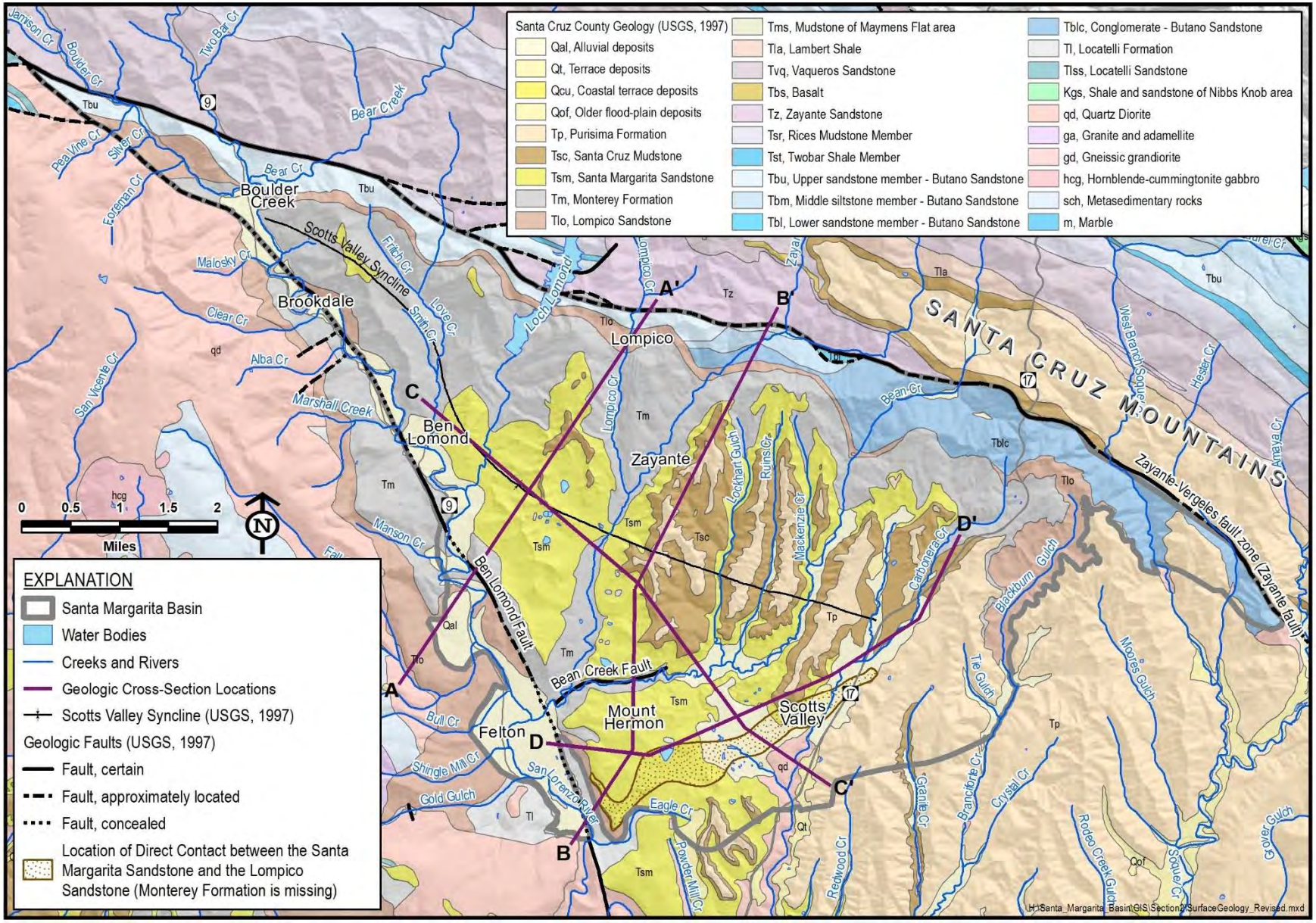



Figure 3-9~~3-93-9~~. Surface Geology of the Santa Margarita Basin

#### 3.4.2.1 Metasedimentary/Granitic Basement

The local basement for the Basin consists of metasedimentary rocks (including marble) that have been intruded by quartz diorite and granodiorite of Cretaceous age. The basement rocks are exposed only at the southernmost margin of the Basin, along Carbonera Creek; however, they underlie the southern part of the Basin at shallow depths. A buried high of basement rocks is defined by DWR as the boundary that separates the Basin from the Santa Cruz Mid-County Basin to the east.

The basement rocks are part of the Salinian Block, which constitutes a continental terrain that originated more than 1,200 miles south of its present location and collided with the North American plate prior to Eocene time. Since about 20 million years ago, the Salinian Block has been transported northward along the San Andreas Fault Zone as a part of the Pacific Plate. It was profoundly eroded prior to the Eocene, accounting for the limited occurrence of Paleocene sediments like the Locatelli Sandstone. It also means that sedimentary units Eocene and younger in age were deposited on an irregular erosional surface, which results in some of the near-shore sedimentary units like the Lompico Sandstone and the Santa Margarita Sandstone showing a range of original depositional thicknesses across the Basin.

#### 3.4.2.2 Locatelli Sandstone

The Paleocene Locatelli Sandstone (Tl on Figure 3-9) is primarily a grey sandy siltstone with a thin basal sandstone. It is exposed at the southern margin of the Basin, on both sides of the San Lorenzo River, where it is lapping onto the basement. It is, however, present widely in the subsurface, with a thickness as great as 800 feet thick (Kennedy/Jenks Consultants, 2015).

#### 3.4.2.3 Butano Sandstone

The Eocene Butano Sandstone is a thick sedimentary unit that was deposited in deep water (Clark, 1991) in an environment analogous to where modern-day shelf sediments are swept down submarine Monterey Canyon to be deposited off the continental shelf in the Monterey submarine fan. It has 3 defined members ~~defined~~ shown on Figure 3-9: an upper sandstone member (Tbu), a middle siltstone member (Tbm), and a lower massive sandstone with conglomerate near its base (Tbl) (Clark, 1981). The middle member is more fine-grained and contains pyrite, making it unsuitable as an aquifer, but the upper and lower sandstone units are important aquifers in the Basin

The Butano Sandstone is exposed in the south-dipping limb of the Scotts Valley syncline at the northern margin of the Basin in a band parallel to the Zayante-Vergeles fault (Figure 3-9). The upper, middle, and lower members outcrop from northwest to southeast across this band, respectively. The thickness of the Butano Sandstone varies across the Basin, from several

hundred to as much as 5,000 feet thick (Clark, 1982; Kennedy/Jenks Consultants, 2015). The upper 2 members of the Butano Sandstone ~~are~~form part of one of the ~~a~~ principal aquifers in the Basin.

#### 3.4.2.4 Lompico Sandstone

The Miocene Lompico Sandstone (Tlo on Figure 3-9) is a thick-bedded to massive, fine- to medium-grained arkosic sandstone that was deposited on the continental shelf at moderate depths (Clark, 1991). The Lompico Sandstone has a relatively uniform thickness of up to 400 feet, though it is slightly thinner and finer grained in the northern and eastern areas of the Basin (Kennedy/Jenks Consultants, 2015). As is the case for the underlying Butano Sandstone, the Lompico Sandstone outcrops as a strip parallel to the Basin's northern boundary (Figure 3-9). The width of this outcropping strip ranges from approximately 2,000 feet in the northwest near Boulder Creek to 100 feet in the southeast, where it joins up with another significant outcrop alongside the headwaters of Blackburn Gulch near the Basin's boundary with the Santa Cruz Mid-County Basin (Figure 3-9). The Lompico Sandstone is a principal aquifer in the Basin.~~Although the Lompico Sandstone has limited surface exposure, it is present throughout the Basin in the subsurface, making it an important aquifer~~.

#### 3.4.2.5 Monterey Formation

The Miocene Monterey Formation (Tm on Figure 3-9) is composed mostly of medium- to thick-bedded and organic mudstone and shale with sandy siltstone interbeds. It represents deposition in a deeper-water continental-shelf environment as sea level rose following deposition of the Lompico Formation (Clark, 1991). The Monterey Formation is thickest near the center of the Basin, where it is more than 2,000 feet thick. It is absent near the southeastern margin of the Basin (see the brown stippled area on Figure 3-9). The absence of Monterey Formation in this area has important consequences for the HCM, as the Lompico aquifer and the overlying Santa Margarita aquifer are in direct contact, allowing for ~~greater~~ direct recharge of the Lompico aquifer through the Santa Margarita aquifer~~ than in areas where the Monterey Formation aquitard intervenes~~.

The Monterey Formation is not a principal aquifer, but because it is exposed widely in the Basin, it is utilized ~~in~~ by many private wells. These wells generally tap sandy intervals in the lower part of the formation for relatively small volumes of water.

#### 3.4.2.6 Santa Margarita Sandstone

The Miocene Santa Margarita Sandstone (Tsm on Figure 3-9) is a massive, fine- to coarse-grained, moderately sorted arkosic sandstone containing lenses of gravel and cobbles. It formed in a near-shore, high-energy environment as indicated by fossils of shallow marine organisms as well as fossils of terrestrial animals swept in by rivers (Clark, 1991). This poorly consolidated

and easily erodible formation can be observed in natural and quarried cliffs around Scotts Valley and forms the basis of the distinctive Sand Hills ecosystem. It is often referred to as "white sand" in drillers' logs. In areas where the Santa Margarita Sandstone directly overlies the Lompico Sandstone, the 2 sandstones can be difficult to distinguish from one other, although the Lompico Sandstone is typically finer grained and more cemented (Johnson, 2009).

The Santa Margarita Sandstone is thickest along the axis of the Scotts Valley Syncline between the community of Ben Lomond and City of Scotts Valley; it thins and becomes more fine-grained to the northeast (Clark, 1981). In the Quail Hollow and Olympia areas, it is as much as 450 feet thick, though much has been removed by quarrying (Johnson, 2009). In the Scotts Valley area, it is up to about 350 feet thick. The relatively easily eroded sandstone is incised, in some areas, through its entire thickness by overlying creeks, forming several isolated areas within the Basin. The Santa Margarita Sandstone is a principal aquifer in the Basin.

#### 3.4.2.7 Santa Cruz Mudstone

The Miocene Santa Cruz Mudstone lies conformably atop the Santa Margarita Sandstone, indicating a deepening of the marine depositional environment (Clark, 1991). The Santa Cruz Mudstone makes up the upper slope of the ridges between Zayante Creek and Carbonera Creek (Tsc in Figure 3-9) and can be up to 250 feet thick (Johnson, 2009). The medium- to thick-bedded, ~~and faintly laminated pale~~ siliceous mudstone restricts surface recharge where present.

#### 3.4.2.8 Purisima Formation

East of Zayante Creek, the shallow marine sediments of the Purisima Formation are discontinuously exposed along ridge tops separated by streams (Tp on Figure 3-9). It has a maximum thickness of about 200 feet within the Basin but thickens considerably west of Carbonera Creek and into the Santa Cruz Mid-County Basin where it is identified as one of the principal aquifers by this neighboring basin (Johnson, 2009).

#### 3.4.2.9 Coastal Terrace Deposits

There are small outcrops of marine coastal terrace deposits in the southernmost part of the ~~basin~~ Basin along Carbonera Creek and Powder Mill Creek (Qt on Figure 3-9). Present as isolated outcrops no thicker than 50 feet, these superficial deposits are not considered an aquifer and contain no known water supply wells.

#### 3.4.2.10 Alluvium

Quaternary alluvium consisting of unconsolidated sands and silts ~~associated with the Basin's rivers and creeks valleys occurs locally along the~~ occurs locally in river and creek valleys within the Basin, including along the San Lorenzo River, portions of Bean and Carbonera Creeks, ~~the length of the West Branch of Carbonera Creek,~~ and in an ancestral drainage near Camp Evers

(Qal on Figure 3-9). Ranging in thickness from less than 10 to 40 feet thick, these alluvial deposits are generally too thin to constitute a major aquifer; however, they may play a part in the connection between surface water in the river and creeks with underlying Santa Margarita and Lompico Sandstones (Johnson, 2009).

### 3.4.3 Geologic Structure

#### 3.4.3.1 Tectonic Setting

The geologic structure of the Basin is a reflection of its location along the boundary between the North American and Pacific tectonic plates. The Pacific plate is moving northward with respect to the North American plate an average of about 2 inches per year, with much of this motion distributed over a number of fault strands within the greater San Andreas fault zone. The Basin is bound on the north by one of these: the Zayante-Vergeles fault which has active seismicity.

Although the overall motion along the plate boundary is right-lateral, the local details are more complicated. There is a slight bend in the San Andreas fault east of the Santa Cruz Mountains. This bend interferes with the plates slipping past one another; this so-called restraining bend causes local compression in the rocks that causes them to fold or to break along high-angle fault planes in which one side of the fault moves up and over the rocks on the other side of the fault. The M7.1 1989 Loma Prieta earthquake occurred along the restraining bend and exhibited this type of behavior: there was 4.3 feet of vertical motion along the fault as well as 6.2 feet of right-lateral motion (Plafker and Galloway, 1989). Analysis of global positioning system data along with geochronological studies show that there is currently a component of compression along the San Andreas fault in the Santa Cruz Mountains, and that the contraction that causes folding and uplift along faults in an otherwise strike-slip setting (Burgmann *et al*., 2006; Gudmundsdottir *et al.*, 2008) are the cause of the complicated fault geometries in the region, including the Zayante-Vergeles and Ben Lomond Mountain fault zones.

This ~~transpressive~~ tectonic regime may have started when there was a reorganization of Pacific Plate motion about 5 million years ago (Engebretson *et al.*, 1985). Since that time, folding and faulting have resulted in the uplift that created the California Coast Range.

#### 3.4.3.2 Faults

Faults can be barriers to groundwater flow in 2 ways:

(1) As rocks on either side of a fault slide past each other, mineral grains along the fault are ground and transformed into a fine-grained, clay-rich, impermeable material referred to as gouge. Zones of gouge impede the lateral flow of groundwater, and may deflect the water upwards, where it can emerge at the surface as springs.

(2) Translation of rock layers along a fault can juxtapose a rock layer that is an aquifer against one that is an aquiclude, blocking groundwater flow.

The Basin is bounded by 2 regional faults, the Zayante-Vergeles fault zone to the north and the Ben Lomond Fault to the west. Figure 3-9 shows the location of these faults with respect to the Basin.

The Zayante-Vergeles fault zone, which forms the northern Basin boundary, is a major northwest-striking structural element of the Santa Cruz Mountains restraining bend of the larger San Andreas fault zone. It is a major right-lateral reverse-oblique-slip fault with late Pleistocene and possible Holocene displacement with an estimated vertical slip rate of 0.2 millimeters per year (Bryant, 2000). The easternmost end of the fault is currently seismically active; the section that is the northern boundary of the Basin is not.

Areas south of the Zayante-Vergeles fault zone are underlain primarily by granitic and metasedimentary basement rock, while in contrast, areas north of the fault zone are underlain by gabbroic basement rock and overlain by sedimentary formations not present within the Basin. The juxtaposition of these continental (90-million years ago) and oceanic (165-million years ago) crustal formations illustrates the significant displacement associated with the movement of the fault zone, reflects the long-term right-lateral translation of the Salinian block along the San Andreas fault system, and marks the fault zone as a major feature of this system.

In contrast, the Ben Lomond Fault, which is the western boundary of the Basin, has more limited, largely vertical motion. It extends from northwest of the community of Boulder Creek, where it merges with the Zayante-Vergeles fault zone, through the communities of Ben Lomond and Felton, and south to the coast, where it continues for a further 2.5 miles offshore (Johnson *et al*., 2016). The steep eastern face of Ben Lomond Mountain reflects the presence of the fault, as does the course of the San Lorenzo River, which exploited shattered, easily eroded rocks in the fault zone in making its way southward to the coast.

Movement along the near-vertical Ben Lomond fault has uplifted the basement rocks of Ben Lomond Mountain with respect to the sedimentary formations of the Basin by about 600 feet (Stanley and McCaffery, 1983). Evidence for lateral motion is lacking. This steep reverse fault is best interpreted as a minor fault in the complex fault geometry that results from the restraining bend in the San Andreas fault zone in the Santa Cruz Mountains.

The Ben Lomond fault is not currently seismically active. Stanley and McCaffery (1981) argued that most of the movement on the fault took place during the deposition of the Santa Margarita Sandstone, as this unit thickens against it. Small offsets of the Purisima Formation and uplift in marine terraces suggest that at least some slip occurred in Pleistocene time. A minor fault called the Bean Creek Fault is aligned along the lower reach of Bean Creek where the Monterey

Formation outcrops in the Bean Creek valley (Figure 3-9). It is unknown if this fault impacts the movement of groundwater in the Basin (Johnson, 2009).

#### 3.4.3.3 Folding and Geologic Structure

Caught between faults of the Santa Cruz Mountain restraining bend of the San Andreas fault zone, the sediments of the Santa Margarita Basin have been folded and uplifted several times, resulting in synclines and anticlines in and around the Basin. The dominant feature defining the Basin is the Scotts Valley syncline, a geologic trough whose northwest-southeast-trending axis roughly bisects the Basin (Figure 3-9). This folding of the sedimentary rocks is illustrated in 4 geologic cross sections (Figure 3-10 through Figure 3-13) constructed along lines of section shown on the geologic map (Figure 3-9). The cross sections were developed as part of SLVWD's water supply master plan (Johnson, 2009).

The southwest-northeast trending cross sections in section A-A' (Figure 3-10) and section B-B' (Figure 3-11) cross through the area of the Quail Hollow and Olympia well fields, respectively. Constructed approximately perpendicular to the axis of the Scotts Valley syncline, these cross sections illustrate the syncline and the location of the deepest part of the Basin beneath the wellfields, some 4,000 feet deep (Figure 3-11). They also show the prominent influence of the Ben Lomond fault as a boundary to the Basin, displacing the Lompico Sandstone by just under 400 feet, and juxtaposing aquicludes against aquifers. These cross sections also illustrate the steep dips of the Butano Sandstone, Lompico Sandstone, and Monterey Formation at the northern end of the basin, due to deformation near the Zayante-Vergeles fault zone. It is these steep dips that result in the relatively narrow strips of surface exposure of the Butano Sandstone and Lompico Sandstone (Figure 3-10 and Figure 3-11), the only places where they can receive direct recharge from infiltrating precipitation and percolation through creek beds, thereby limiting the amount of direct recharge these aquifers can receive.

The northwest-southeast-trending cross-section C-C' (Figure 3-12) is constructed approximately parallel to the axis of the Scotts Valley syncline. This cross section illustrates how the Basin's sedimentary rocks were folded against a basement highland forming the eastern margin of the Basin. Thus, the sedimentary rocks constitute a structural "bowl" across much of the Basin, making it hydrologically isolated from other basins. It also illustrates the shallowing of the granitic basement that forms the eastern margin of the Basin.

The southwest-northeast-trending cross section D-D' (Figure 3-13) is constructed to pass through the Mount Hermon, Pasatiempo, Camp Evers, and the southern and northern Scotts Valley well areas. The deepest wells in the Basin are shown on this section in the northern Scotts Valley area, where they tap down to the deepest aquifer, the Butano Sandstone.

The Monterey Formation is present widely in the Basin and in most places forms a thick aquitard between the Santa Margarita aquifer and the Lompico aquifer as shown in section A-A' (Figure

3-10). There is a narrow, southwest-northeast-trending area running from Pasatiempo to Scotts Valley (shown as a stipple pattern on the geologic map in Figure 3-9) in which the Monterey Formation is absent, so that the Santa Margarita Sandstone and the Lompico Sandstone are in direct contact. The cross section in Figure 3-13 illustrates ~~this well~~the Monterey Formation's absence near ~~in the~~ ~~area of~~ Camp Evers. The hydrogeologic connection between these 2 sandstone units in this area affects the quantity and quality of groundwater recharge to the Lompico Sandstone, and so is an important feature in the ~~hydrogeologic conceptual model~~HCM.

Most of the folding to form the Scotts Valley syncline must have occurred in the time between deposition of the Monterey Formation and the Santa Margarita Sandstone, as the Santa Margarita Sandstone and younger formations are only weakly affected by the folding, as can be seen in Figure 3-10, Figure 3-11, and Figure 3-13.

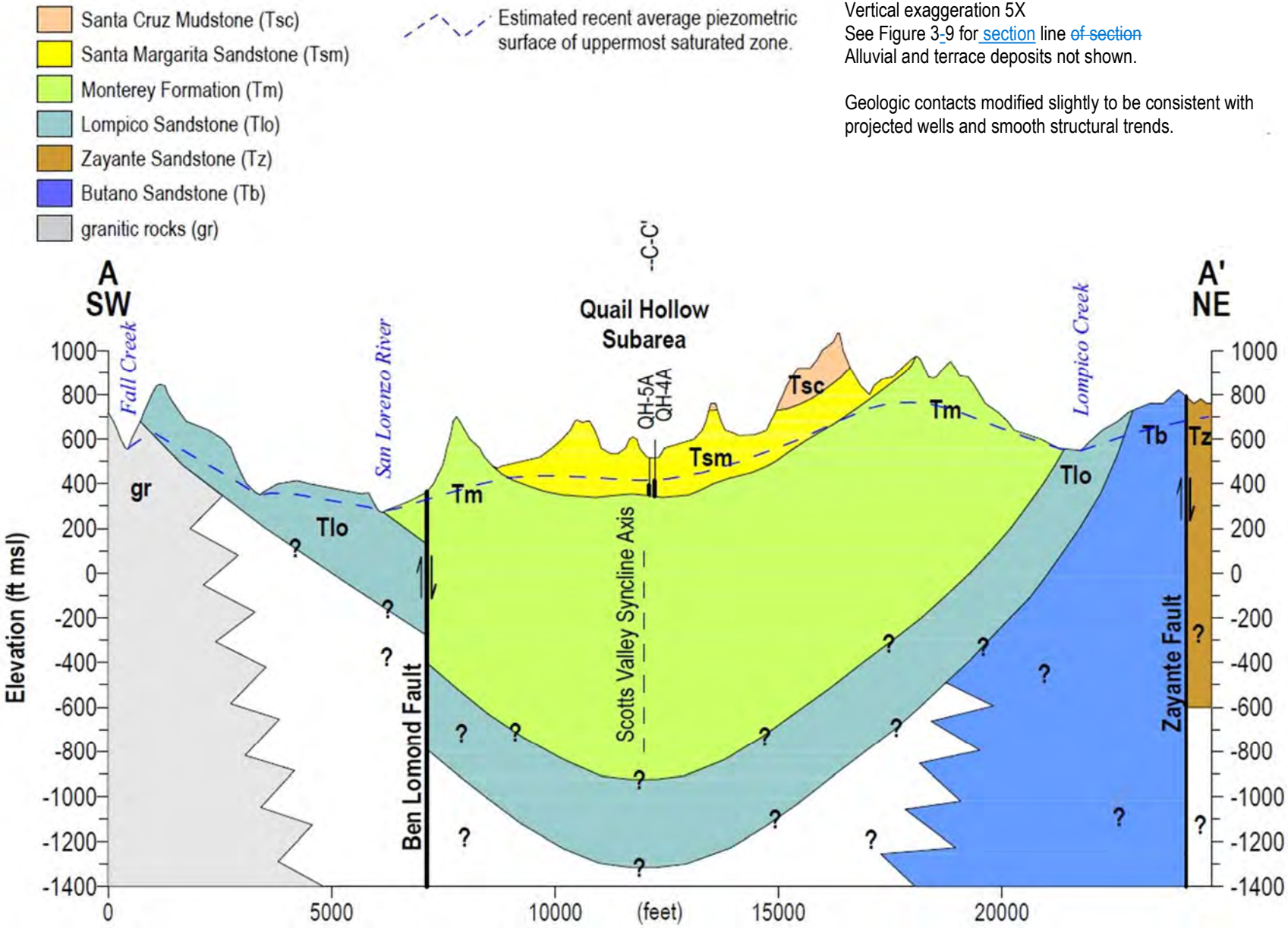



Figure 3-10~~3-10~~3-10. A-A' Geologic Cross-Section through the Santa Margarita Basin (Johnson, 2009)

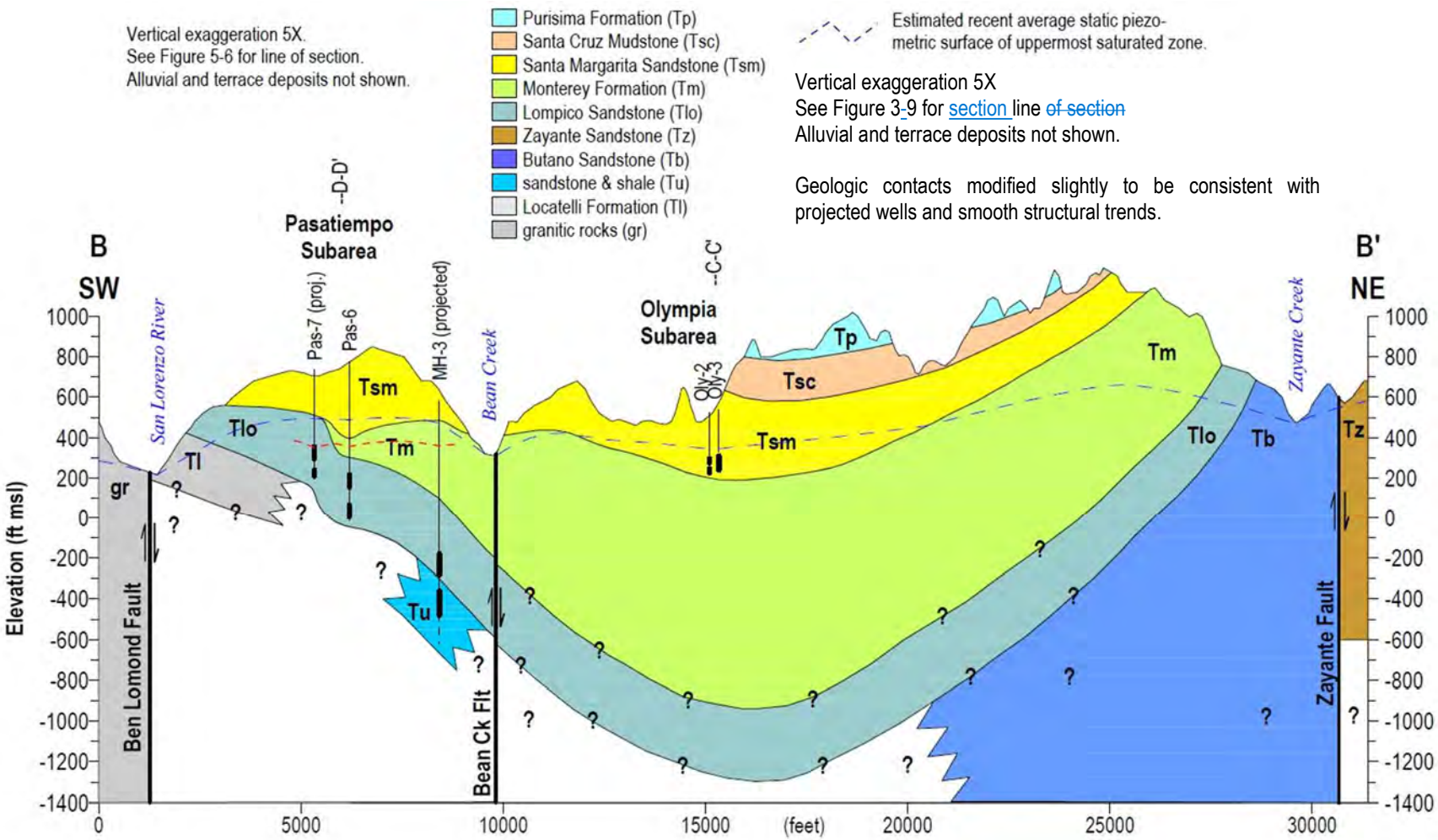



Figure 3-11~~3-113-3-11~~. B-B' Geologic Cross-Section through the Santa Margarita Basin (Johnson, 2009)

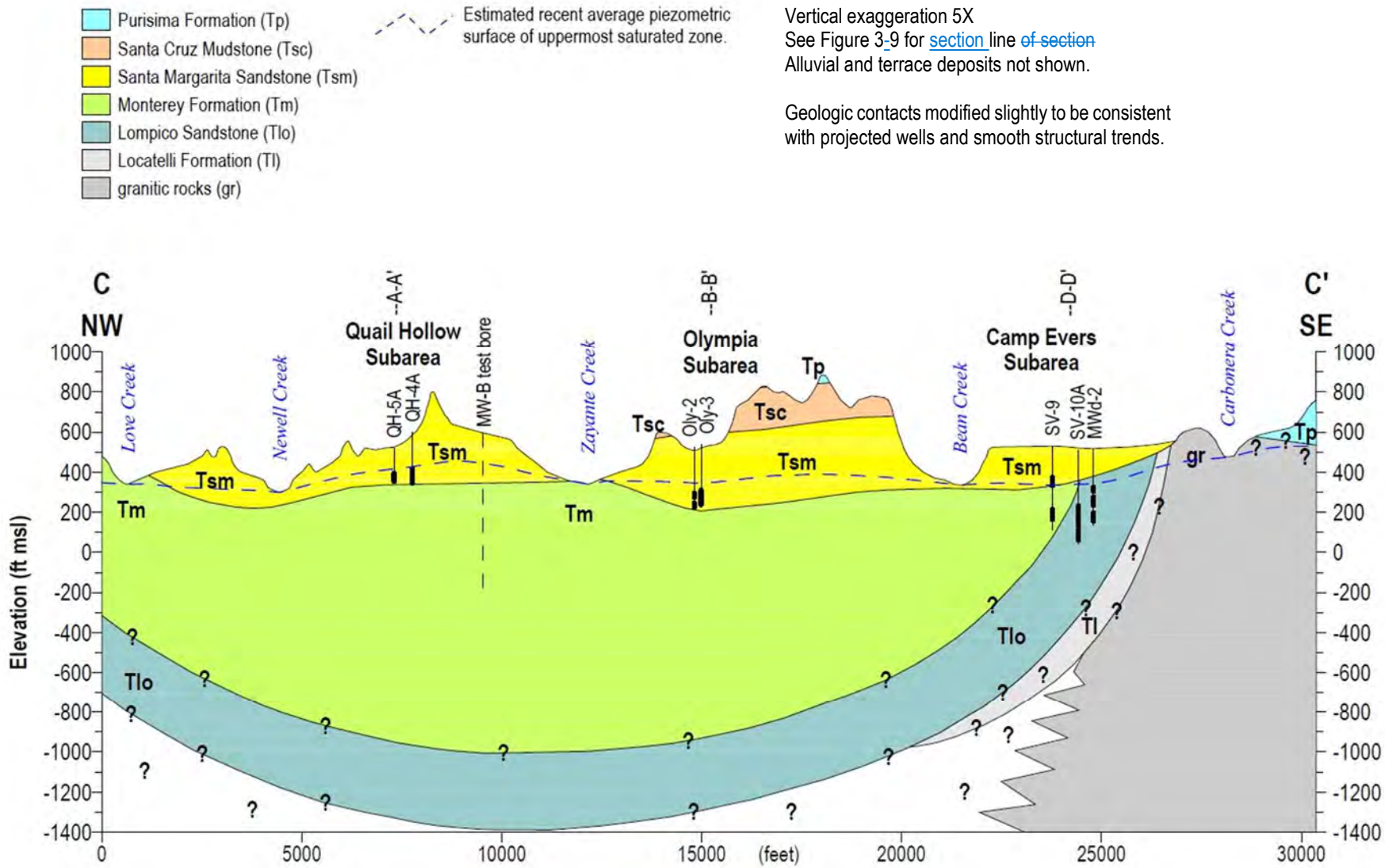



Figure 3-12~~3-12~~3-12. C-C' Geologic Cross-Section through the Santa Margarita Basin (Johnson, 2009)

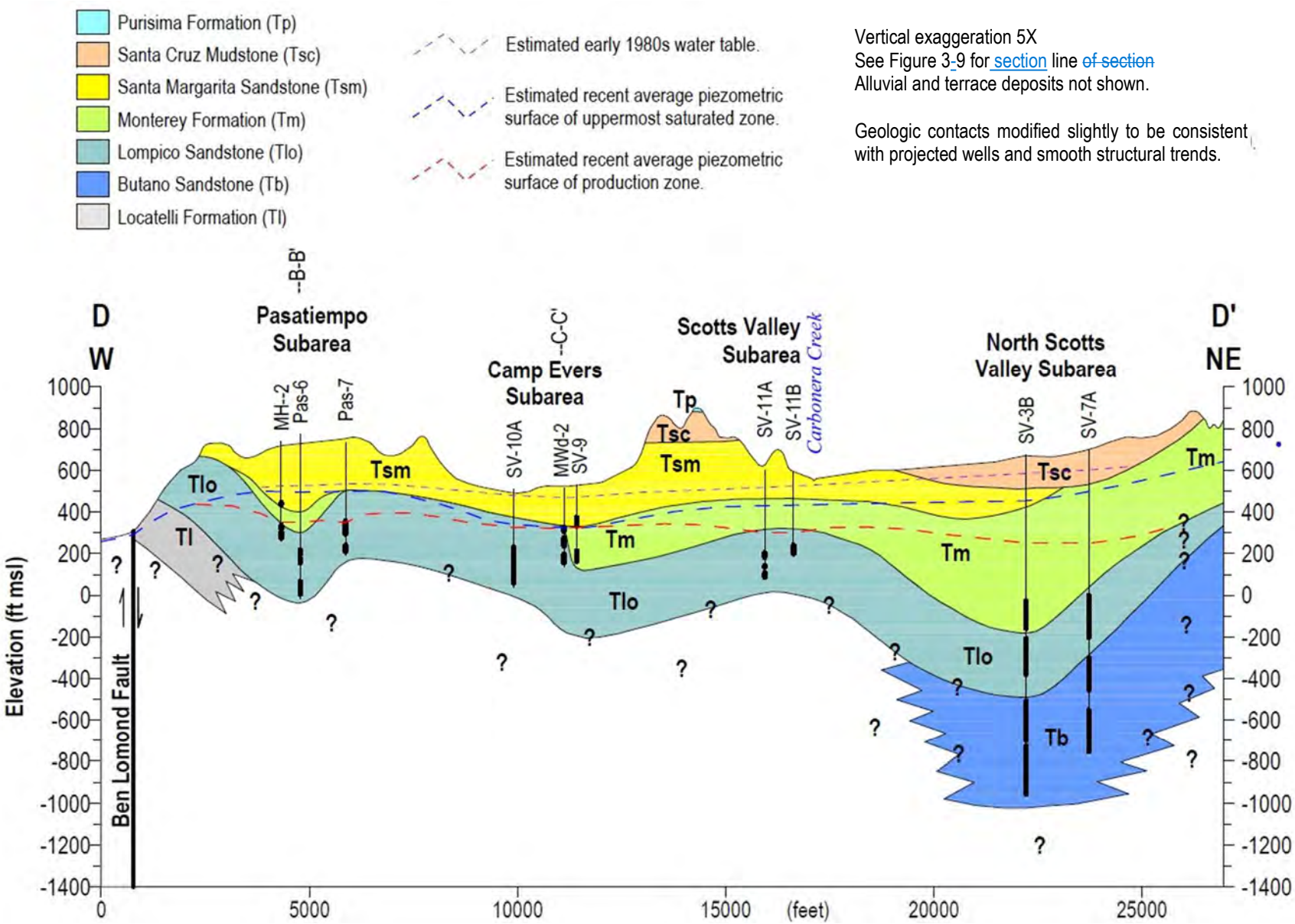



Figure 3-13~~3-13~~ ~~3-13~~. D-D' Geologic Cross-Section through the Santa Margarita Basin (Johnson, 2009)

### 3.4.4 Principal Hydrogeologic Units

Sandstone units within the sedimentary rocks of the Scotts Valley syncline supply nearly all the groundwater extracted in the Basin. The Santa Margarita, Lompico, and Butano Sandstones, are the principal aquifers utilized by municipal suppliers. Silty and sandy intervals within the otherwise fine-grained Monterey Formation provide smaller volumes of groundwater to domestic pumpers. More importantly, the Monterey Formation serves as a confining layer that separates the overlying unconfined Santa Margarita from the underlying generally confined Lompico and Butano aquifers in the central portion of the Basin. This has a bearing on the groundwater elevation subareas described in subsection 4.2 and the groundwater level and interconnected surface water monitoring networks described in subsections 6.2 and 6.5.

The Santa Margarita Sandstone, which is the shallowest of the 3 sandstone units, has a long history as a source of water in the Basin, with many water supply wells extracting groundwater from this unit. The Lompico and Butano Sandstones ~~is~~ are currently the principal groundwater producing units in the Scotts Valley area. SVWD is increasing reliance on the Butano Aquifer with inclusion of new Sucinto and Grace Way extraction wells screened across the Lompico and Butano aquifers. ~~Silty and sandy intervals within the otherwise fine-grained Monterey Formation provide smaller volumes of groundwater to domestic pumpers.~~ The subsections below describe these aquifers.

Table 3-2 summarizes representative aquifer hydraulic parameters for these units obtained from aquifer testing and included in reports by Johnson (2009) and Kennedy/Jenks Consultants (2015). Definitions of the aquifer parameter terminology used in this section are provided below.

**Hydraulic Conductivity:** Property of geologic materials that controls the ease with which groundwater flows through pore spaces or fractures. Higher hydraulic conductivity allows water to travel faster through geologic media. Units with very low hydraulic conductivity slow or may prevent groundwater flow. Hydraulic conductivity has units with dimensions of length per time (e.g., feet per day).

**Transmissivity:** A measure of how much water can be transmitted horizontally. It is derived from the hydraulic conductivity of an aquifer unit multiplied by its total thickness. High transmissivity units are very conducive to groundwater flow, very thick, or both. Transmissivity is usually expressed in units of length$^2$ per time, or occasionally as volume per length per time.

**Storativity (or storage coefficient):** The volume of water (e.g., cubic feet) released from aquifer storage per unit decline in hydraulic head in the aquifer (e.g., foot), per unit area of the aquifer (e.g., square feet). Storativity is a volumetric ratio and therefore unitless. A large value for storativity implies a highly productive aquifer. Storativity is applied only to aquifers under local or regional confinement; specific yield is a roughly equivalent measure of aquifer productivity in an unconfined aquifer.

**Specific Yield:** The volume of water released from storage by an unconfined aquifer per unit surface area of aquifer per unit decline of the water table. Specific yield is a volumetric ratio and therefore unitless. Specific yield is used to characterize unconfined aquifers; high specific yield indicates a productive aquifer unit.

Table 3-23~~-23-2~~. Principal Hydrogeologic Units Hydraulic Properties

| Principal Hydrogeologic Unit | Hydraulic Conductivity (feet/day) | Transmissivity (feet$^2$/day) | Storativity[1] | Specific Yield[2] |
|---|---|---|---|---|
| Santa Margarita Aquifer Entire Basin | 2 – 130 | 430-7,700 | 0.008 – 0.02 | 0.02 – 0.25 |
| Santa Margarita Aquifer Quail Hollow/ Olympia | 2 – 50 | 430 – 6,200 | 0.008 – 0.02 | 0.12 – 0.25 |
| Santa Margarita Aquifer Central Portion of Basin | 3 – 130 | 2,000 – 7,700 | NA | 0.02 – 0.13 |
| Santa Margarita Aquifer Scotts Valley Area | 12 – 35 | 1,000 – 1,700 | NA | 0.02 – 0.13 |
| Monterey Aquifer [3] | 0.05 – 6 | 170 – 1,000 | 0.00001 – 0.001 | 0.01 – 0.03 |
| Lompico Aquifer | 0.5 – 7 | 500 – 3,200 | 0.000001 – 0.001 | 0.02 – 0.07 |
| Butano Aquifer | 0.1 – 6 | 100 – 1,070 | 0.000001 – 0.0007 | |

Adapted from Kennedy/Jenks Consultants (2015); NA = non-applicable given unconfined conditions

[1] Storativity is the volume of water released from confined aquifer storage per unit decline in hydraulic head in the aquifer per unit area of the aquifer.

[2] Specific yield is the amount of water released from an unconfined aquifer if allowed to drain completely under force of gravity.

[3] The Monterey Formation is not a principal aquifer but is included here as there are aquifer test data available for it, and because its occurrence between 2 principal aquifers plays an important role in the hydrogeology of the Basin.

#### 3.4.4.1 Santa Margarita Aquifer

The Santa Margarita Sandstone or Santa Margarita aquifer is the shallowest principal aquifer in the Basin, with widespread surface exposures in the southern and central portions of the Basin. Due to its shallow depth and highly productive lithology, it was the first formation to be developed for municipal and private domestic use (Kennedy/Jenks Consultants, 2015). The Santa Margarita aquifer is capped in some areas by the Santa Cruz Mudstone and lies unconformably over the Monterey Formation in the north and northwest portions of the Basin. In the southeastern portion of the Basin, in the Pasatiempo and Camp Evers areas, the Monterey Formation has been completely removed by erosion so that the Santa Margarita Sandstone rests unconformably on the Lompico Sandstone, creating a direct groundwater connection between the 2 principal aquifers.

The Santa Margarita aquifer is unconfined, apart from areas in northern Scotts Valley, where it is confined by a few hundred feet of overlying Santa Cruz Mudstone. Due to its wide exposure and

high conductivity, the Santa Margarita aquifer responds rapidly to changes in precipitation and recharges quickly, but it also drains relatively rapidly to creeks such that it has little long-term groundwater storage (Kennedy/Jenks Consultants, 2015). The hydrogeologic properties of the Santa Margarita Sandstone as a highly transmissive unconfined aquifer reflect its coarse grain size and weak cementing. Estimated hydraulic conductivity ranges from 2 to more than 100 feet/day (Kennedy/Jenks Consultants, 2015) depending on location within the Basin and specific yield ranges from 0.02 to 0.25, and transmissivity ranges from 430 to 7,700 feet$^2$/day (Table 3-2; Kennedy/Jenks Consultants, 2015). Johnson (2009) and Kennedy/Jenks Consultants (2015) report variations in Santa Margarita aquifer parameters across the Basin that indicate the aquifer is spatially variable in its properties. ~~In particular, aquifer~~Aquifer test results from the Camp Evers area indicate the occurrence of highly conductive zones near the base of the aquifer where intervals of conglomerate (gravel-sized particles) occur (Johnson, 2009; Kennedy/Jenks Consultants, 2015).

#### 3.4.4.2 Lompico Aquifer

The Lompico Sandstone is a productive arkosic sandstone aquifer that provides a large proportion of the Basin's municipal supply (Johnson, 2009; Kennedy/Jenks Consultants, 2015). The Lompico Sandstone is generally uniform, although slightly more fine-grained and cemented towards its base. The restricted exposure of the Lompico Sandstone at the surface, at the northern and northeast margin of the Basin, limits the amount of surficial recharge by precipitation. The Lompico aquifer is primarily recharged via water that percolates through the highly transmissive Santa Margarita Sandstone, where the Santa Margarita and Lompico Sandstones are in direct contact due to the absence of intervening Monterey Formation. The limited exposure of the Lompico Sandstone at the surface and the confined to semi-confined nature of the aquifer makes it relatively slow to respond to rainfall-driven recharge events (Kennedy/Jenks Consultants, 2015). The Lompico aquifer discharges to the San Lorenzo River at several locations where it is exposed in the riverbed, ~~see~~ such as in cross section B-B' (Figure 3-11). The vertical gradient between the Lompico and Butano aquifers is not known; therefore, it is not known whether there is significant flow between these 2 deeper aquifers.

Available aquifer testing results in the Lompico aquifer reflect a moderately permeable, semi-confined to confined sandstone aquifer. Hydraulic conductivity ranges from 0.5 to 7 feet/day, transmissivity ranges from 500-3,200 feet$^2$/day, and storativity ranges from 0.000001 to 0.02 (Table 3-2; Kennedy/Jenks Consultants, 2015). Where the Lompico aquifer is unconfined, specific yield ranges from 0.04 to 0.08. Although generally less conductive than the Santa Margarita aquifer, the transmissivity of the Lompico aquifer, i.e., the amount of groundwater it can produce, is larger due to its much greater thickness (Johnson, 2009).

#### 3.4.4.3 Butano Aquifer

The Butano Sandstone or Butano aquifer is composed primarily of arkosic sandstone similar in consistency to the Lompico Sandstone, though with significant mudstone, shale, and siltstone interbeds. The Butano aquifer is recharged primarily by direct infiltration of precipitation and streamflow in the extreme northern portions of the Basin where it outcrops (Figure 3-9). Review of limited groundwater elevation data indicates that the Butano aquifer groundwater elevations recover more quickly than the Lompico aquifer, suggesting the Butano aquifer is a more actively recharged aquifer likely because of its greater surface exposure area (Kennedy/ Jenks Consultants, 2015). Since the available Butano groundwater elevation data is collected in wells installed close to where the formation outcrops, and the aquifer is not used extensively as a water supply in the Basin due to its greater depth and lower hydraulic conductivity than the other 2 aquifers, the more stable groundwater elevations in the Butano aquifer may also be related to the location of wells used to characterize the aquifer or a general lack of pumping influence on the aquifer.

Interpretation of limited aquifer tests in the Butano aquifer indicate confined or semi-confined aquifer conditions with moderate hydraulic conductivity. Estimated hydraulic conductivity ranges from 0.01 to 6 feet/day, transmissivity ranges from 100 to 1,070 feet$^2$/day, and storativity ranges from 0.000001 to 0.0007 (Table 3-2; Kennedy/Jenks Consultants, 2015).

### 3.4.5 Other Hydrogeologic Units

#### 3.4.5.1 Purisima Formation

The Purisima Formation comprises siltstone and sandstone up to 200 feet thick that forms the tops of some of the hills in the Scotts Valley area but is absent over most of the Basin. The more permeable units of the Purisima Formation are principal aquifers in the neighboring Santa Cruz Mid-County Basin to the east. However, in the Santa Margarita Basin, it is not considered a principal aquifer due to its limited thickness and occurrence on ridgetops. No hydraulic property data are available for this formation in the Basin.

#### 3.4.5.2 Santa Cruz Mudstone

The Santa Cruz Mudstone is an impermeable layer that locally caps the Santa Margarita Sandstone, limiting recharge to the underlying aquifers where it is present. Slightly higher than normal salinity in Santa Margarita Sandstone groundwater near the Santa Cruz Mudstone indicates that runoff from the mudstone may percolate and recharge adjacent exposures of Santa Margarita Sandstone. No hydraulic property data are available for this formation.

#### 3.4.5.3 Monterey Formation

The Monterey Formation is composed primarily of thick mudstone and siliceous shale that form a hydraulic barrier between the Santa Margarita Sandstone and Lompico Sandstone, except where it is missing in the southern portion of the Basin, as discussed above. The Monterey Formation contains sandstone interbeds, especially closer to the base of the formation, that are used for water supply. These interbeds are especially prominent in the southern Scotts Valley area (Kennedy/Jenks Consultants, 2015). In general, the sandstone interbeds of the Monterey Formation are more hydrogeologically connected to the underlying Lompico Sandstone than to the overlying Santa Margarita Sandstone (Kennedy/Jenks Consultants, 2015).

Although the Monterey Formation is generally considered an aquitard, the sandstone interbeds and fractured siliceous shales, along with the widespread surface exposure, make the Monterey Formation a locally important aquifer for shallow private domestic wells. Historically, municipal and small water systems pumped from the Monterey Formation, but those wells were not reliable because of low transmissivity.

Similar to the principal aquifers in the Basin, available aquifer test results in the Monterey Formation indicate a relatively large degree of heterogeneity. Reported hydraulic conductivity ranges from 0.05 to 6 feet/day, transmissivity ranges from 170 to 1,000 feet$^2$/day, storativity ranges from 0.00005 to 0.005, and specific yield ranges from 0.01 to 0.03 (Table 3-2; Kennedy/ Jenks Consultants, 2015).

#### 3.4.5.4 Locatelli Sandstone

The Locatelli Sandstone is primarily a sandy siltstone that acts as a local aquitard in the Scotts Valley area; however, it contains a thin basal sandstone that provides water for some wells in the Scotts Valley area. In the northern Scotts Valley area, the Locatelli Sandstone is overlain by 600 feet of Butano Sandstone, whereas in southern Scotts Valley it is unconformably overlain by the Lompico Sandstone. The Locatelli Sandstone is not exposed at the surface within the Basin, and only has a limited outcrop south of the Basin (Figure 3-9). Most recharge to this unit is likely from the overlying Lompico and Butano Sandstones. No hydraulic property data are available for this formation.

#### 3.4.5.5 Igneous and Metamorphic Basement Formations

The sedimentary rocks of the Santa Margarita Basin lie unconformably over a basement of igneous and metamorphic rocks. Exposed locally in the southern part of the Basin (e.g., along Carbonara Creek and the San Lorenzo River), the crystalline basement rocks have very low porosities and conductivities so typically behave as aquitards. Where sufficiently decomposed due to long surface weathering or fractured due to proximity to faults, granitic rocks can provide

limited volumes of groundwater suitable for private domestic wells (Kennedy/Jenks Consultants, 2015).

### 3.4.6 Soil Characteristics

The nature of soil and vegetation affect how much precipitation can infiltrate into the soil to recharge the regional groundwater aquifers. The ~~character of the soils of the basin~~ Basin's soils are derived from the exposed geologic formations ~~they are developed on, but is~~and also influenced by other factors such as climate, vegetation, and local relief.

The saturated hydraulic conductivity of surficial soils is a good indicator of its infiltration potential. The map on Figure 3-14 presents the distribution in the Basin of the 4 hydrologic groups defined in the USDA Natural Resources Conservation Service, Soil Survey Geographic Database (USDA, 2007). The soil hydrologic groups are characterized by the water-transmitting properties ~~of the soil~~, which include hydraulic conductivity and percentage of clay ~~in the soil~~ relative to sand and gravel. The groups are defined as:

- Group A – High Infiltration Rate: water is transmitted freely through the soil; soils typically less than 10% clay and more than 90% sand or gravel.
- Group B – Moderate Infiltration Rate: water transmission through the soil is unimpeded; soils typically have between 10 and 20% clay and 50 to 90% sand.
- Group C – Slow Infiltration Rate: water transmission through the soil is somewhat restricted; soils typically have between 20 and 40% clay and less than 50% sand.
- Group D – Very Slow Infiltration Rate: water movement through the soil is restricted or very restricted; soils typically have greater than 40% clay, less than 50% sand.

The soil hydrologic group ~~of the soil~~ generally correlates with the hydraulic conductivity of underlying geologic formations. Soil z~~Z~~ones ~~of~~ with greater ~~soil~~ hydraulic conductivity occur in areas where the Santa Margarita Sandstone outcrop~~s~~, and lower ~~soil~~ hydraulic conductivity ~~zones~~ are found where siltstones and mudstones outcrop ~~occur at the surface~~.

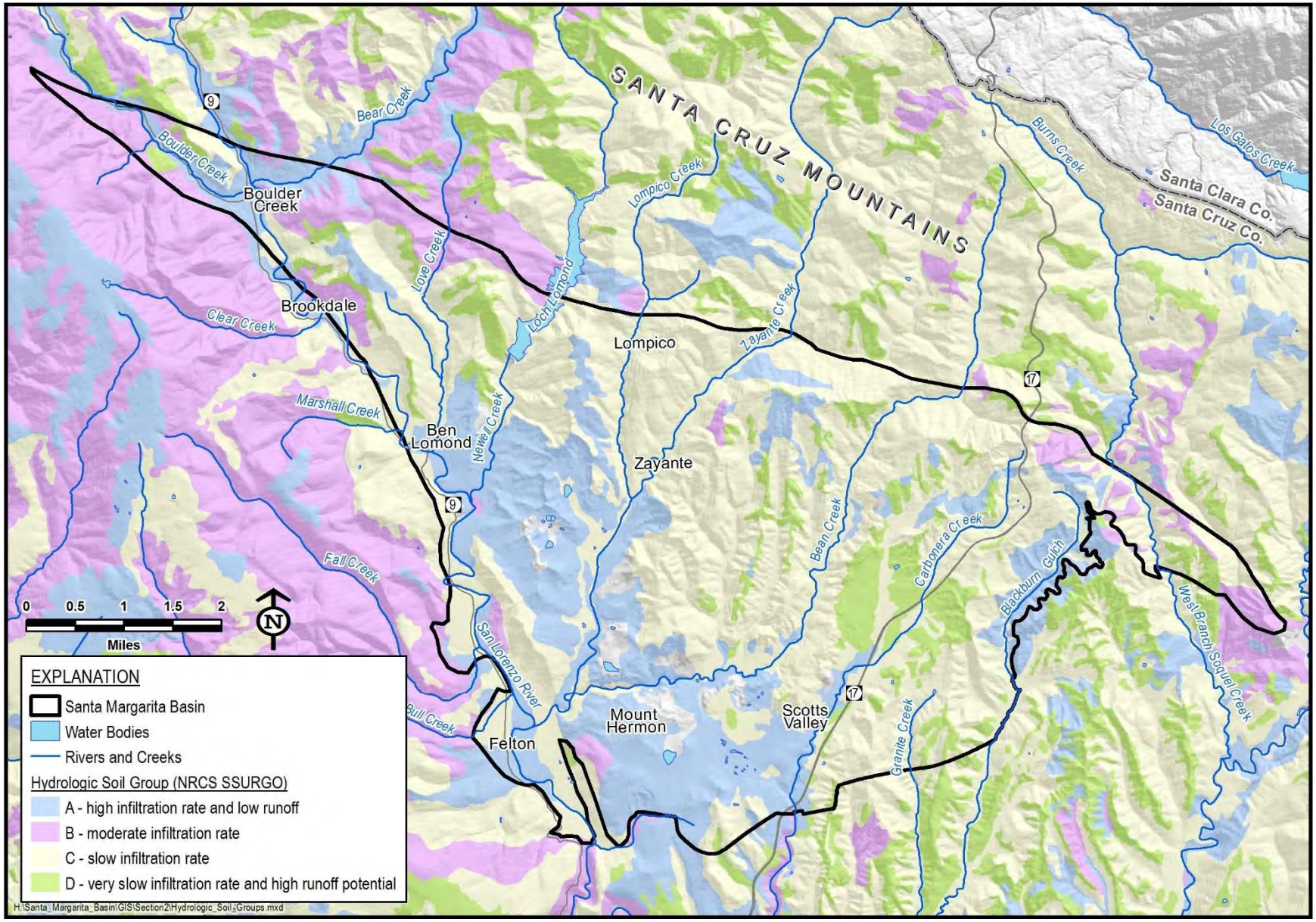



Figure 3-14~~3-14~~3-14. Soil Characteristics of the Santa Margarita Basin

### 3.4.7 Recharge Areas

Precipitation is the main source of natural groundwater recharge in the Basin. It enters shallow aquifers either directly by infiltration through the soil or indirectly from streamflow that infiltrates through stream and creek beds. As discussed in Section 3.4.9.1, most streams are fed by groundwater that is recharged by precipitation. Reductions in groundwater recharge can occur either naturally or anthropogenically. Natural reduction to groundwater recharge is caused by reduced precipitation or increased evapotranspiration due to changes in climate. Anthropogenic reduction to groundwater recharge is caused by land use changes such as increasing paved impermeable surfaces or changing vegetative cover that increase runoff and evapotranspiration.

Figure 3-15 shows County-mapped recharge areas (brown stipples). Most are areas with soils of high to moderate infiltration capacity developed on productive aquifer units. Areas of higher recharge capacity correspond closely with soils developed on the Santa Margarita Sandstone. Areas of lower recharge capacity are clay-rich soils with slower infiltration rates developed on geologic units with less productive potential: the Monterey Formation and the Santa Cruz Mudstone.

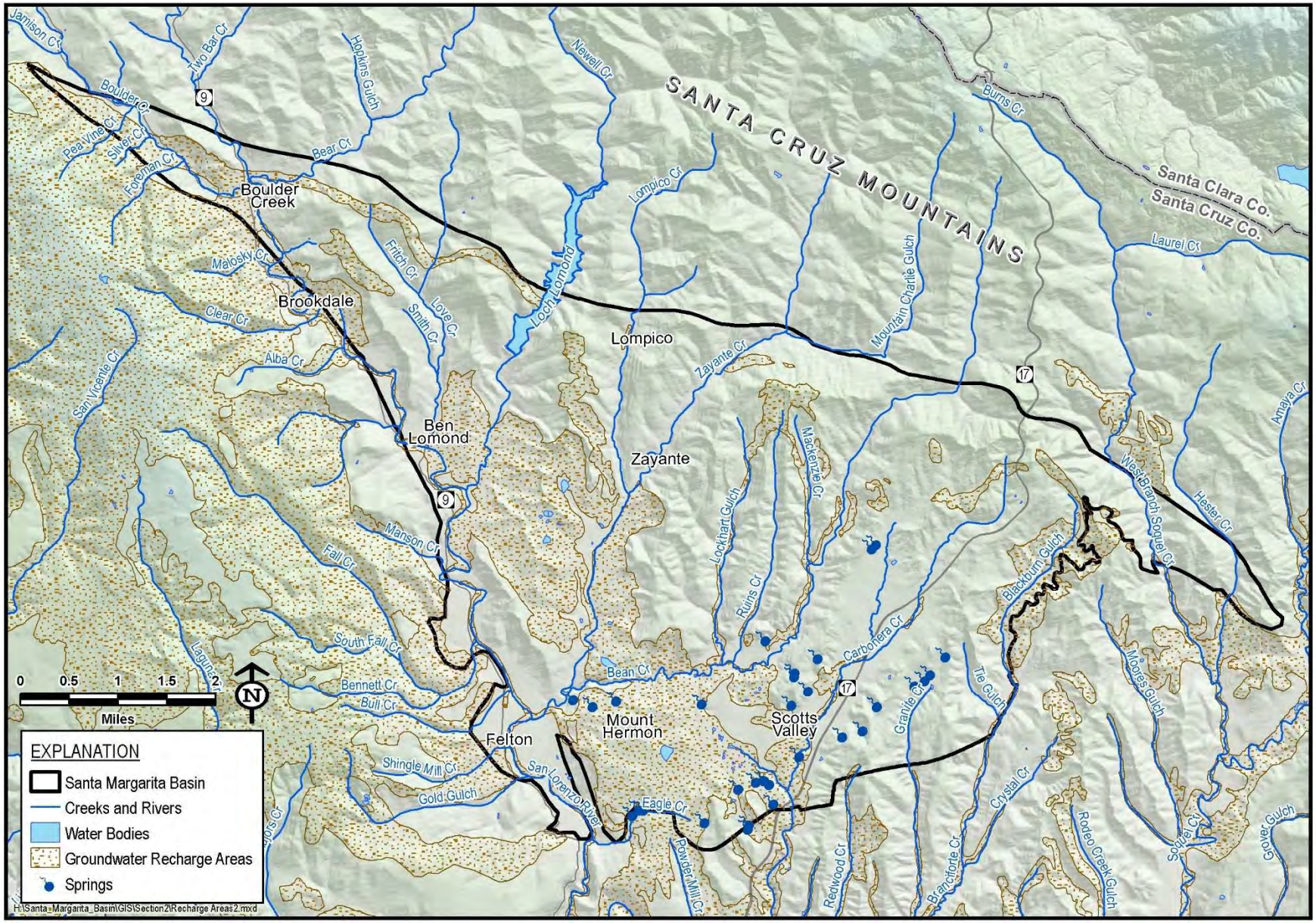



Figure 3-15~~3-15~~~~3-15~~. Recharge Areas in the Santa Margarita Basin

## 3.4.8 Surface Water

### 3.4.8.1 Rivers and Creeks

Figure 3-16 shows the location of rivers and creeks throughout the Basin. Significant rivers and creeks in the Basin include the San Lorenzo River, Boulder Creek, Love Creek, Newell Creek, Lompico Creek, Zayante Creek, Bean Creek, and Carbonera Creek. Many of these rivers and creeks are home to protected species such as coho salmon and steelhead, as described in Section 3.4.9.1.

Previous studies examining streamflow in the Basin concluded that ~~the portion of~~ streamflow ~~that is~~ is sustained by stormflow (i.e., stormwater runoff) and groundwater (i.e., ~~known as~~ baseflow). From November to May, streamflow ~~is from~~comprises both baseflow and stormflow. Streamflow peaks around April, at the tail end of the Basin's rainy season. The ~~amount of~~ contribution from baseflow increases through the wet season because of rising groundwater elevations. In the dry season, from roughly late May through October, essentially all water flowing in the Basin's streams and creeks is derived from groundwater (Johnson, 2009). This pattern is illustrated on Figure 3-17, originally presented by Johnson in 2009~~, where representative streamflow hydrographs show streamflow comprised entirely of baseflow from about June through October. From November to May, streamflow is from both baseflow and stormflow. The amount of contribution from baseflow increases through the wet season because of rising groundwater elevations.~~

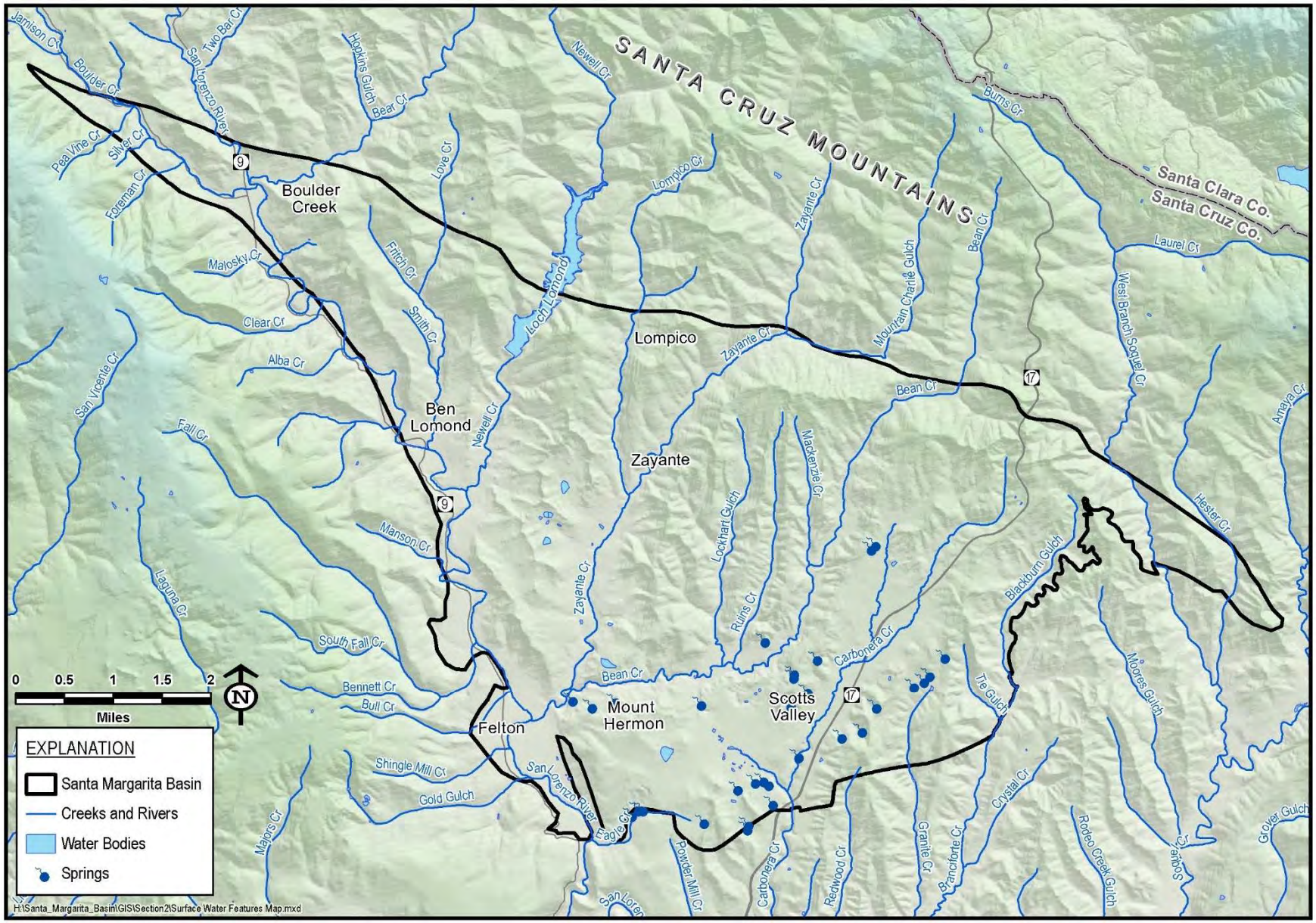



Figure 3-16~~3-163-3-16~~. Surface Water Features

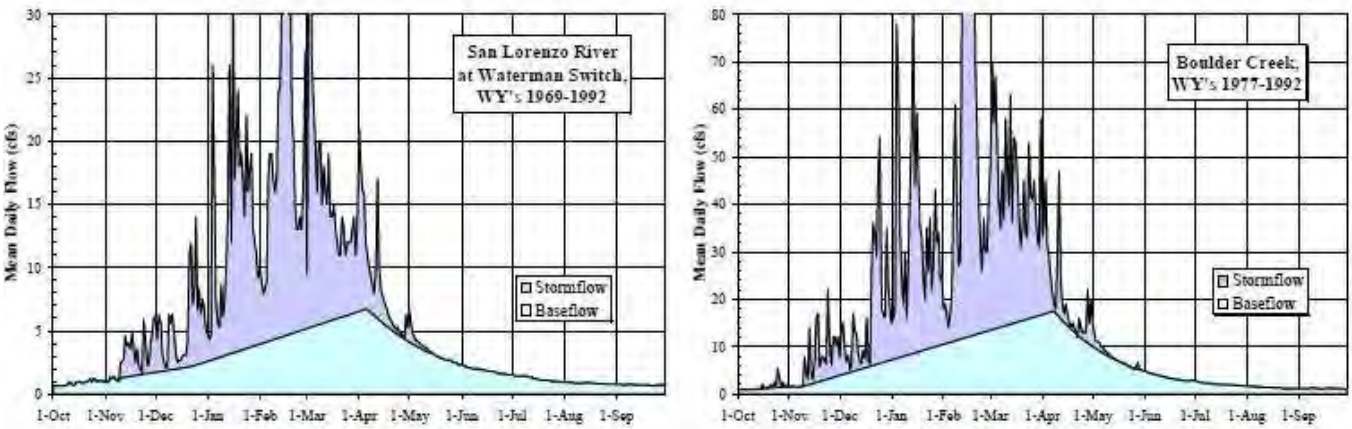



Figure 3-17~~3-173-3-17~~. Stormflow and Baseflow in San Lorenzo River and Boulder Creek (from Johnson, 2009)

### 3.4.8.2 Water Impoundments

There is 1 permanent surface water impoundment within the Basin operated by the City of Santa Cruz Water Department. The Newell Creek Dam constructed in the early 1960s impounded Newell Creek and formed the Loch Lomond Reservoir (Figure 3-16). The Loch Lomond Reservoir is 2.5 miles long, no more than 1,500 feet wide, and has a maximum storage capacity of approximately 8,600 AF. Water stored in the reservoir is a major supply source for the City of Santa Cruz in summer and during droughts when ~~flowing source~~ surface water availability declines.

There is 1 temporary surface water impoundment in the Basin that is operated rarely by the City of Santa Cruz Water Department. The diversion consists of an inflatable diversion dam on the San Lorenzo River in Felton that allows the City to impound and divert a portion of the streamflow by conveyance pipeline to the Loch Lomond Reservoir for storage. This dam can be inflated during the wet season as minimum bypass flow requirements, water rights, and storage capacity in Loch Lomond allow. If used, the dam is deflated in the dry season when stream flow is low.

### 3.4.8.3 Springs

Springs in the Basin are often important and reliable sources of cold water during summer, support adjacent wetlands, and by definition indicate groundwater levels are at the ground surface. There is a distinction between 'basal' and ~~other~~ "non-basal" springs in the Basin. Basal springs emanate from the base of the Santa Margarita Sandstone, where the underlying and much less permeable Monterey Formation ~~of~~ consolidated shales redirects water percolating ~~down~~ through the Santa Margarita Sandstone to the surface through springs, seeps, or other points of discharge.~~-~~ Non-basal springs are groundwater discharge features that are not controlled by lateral flow along an aquifer–aquitard contact, but instead result from local controls such as water table intersection, perched conditions, or structural features like faults.

#### 3.4.8.4 Open Water

Lakes and ponds in the Basin are typically man-made or are modifications of natural springs and seeps. Although not usually natural features in this Basin, lakes and ponds support unique wetland habitats and may be useful indicators of depth to groundwater and nearby rates of groundwater-to-surface water exchange. All open surface water features are included on Figure 3-16.

### 3.4.9 Groundwater Dependent Ecosystems

The GDE analysis in this GSP includes assessment of the extent of GDE indicator vegetation, groundwater elevations in shallow aquifers, and impacts of seasonal surface water and groundwater interaction or accretion. Where groundwater level data are unavailable, the groundwater model is used to identify where surface water and groundwater are likely connected.

Identification of GDEs in the Basin is based primarily on the database of mapping assembled by Natural Communities Commonly Associated with Groundwater (NCCAG) dataset [https://gis.water.ca.gov/app/NCDatasetViewer/#]. This database from sources such as the National Wetland Inventory, National Hydrography Dataset, and Classification and Assessment with Landsat of Visible Ecological Groupings includes GDE indicators such as mapped springs, wetlands, and ponds, as well as vegetation types that may rely on shallow groundwater. All of the GDEs from the NCCAG dataset were retained and considered GDEs in the Basin. In addition, several known springs, seeps, or other groundwater-dependent wetlands were identified as likely GDEs by local experts and were added to the GDE dataset.

Types of identified GDEs include springs, open water, riverine/riparian, and other groundwater-supported wetlands. Springs and open water were described in Sections 3.4.8.3 and 3.4.8.2, respectively. Riverine/riparian and other groundwater supported wetlands are discussed in more detail in the following subsections. Table 3-3 summarizes the 4 different GDE classifications in the Basin. Figure 3-18 through Figure 3-20 shows the locations of the Basin's mapped GDEs.

Table 3-3~~3 3~~3 ~~3~~. Santa Margarita Basin Groundwater Dependent Ecosystem Classification

| GDE Classification | GDE Types | Mapped GDEs |
|---|---|---|
| Springs | Basal springs, and non-basal springs | 42 sites |
| Open Water | Lakes and ponds | 35 sites |
| Riverine/ Riparian | Perennial and ephemeral streams, riparian corridors, on-channel ponds, palustrine wetlands | Sites throughout the basin |

| | | |
|---|---|---|
| Other Groundwater-Supported Wetlands | Seep, seep complex, quarry floor, willow vegetation, terrace | 5 sites: Quail Hollow, ~~Glenwood Preserve,~~ Lompico (also mapped as a pond), Graham Hill Rd (also mapped as pond), Olympia Quarry floor |

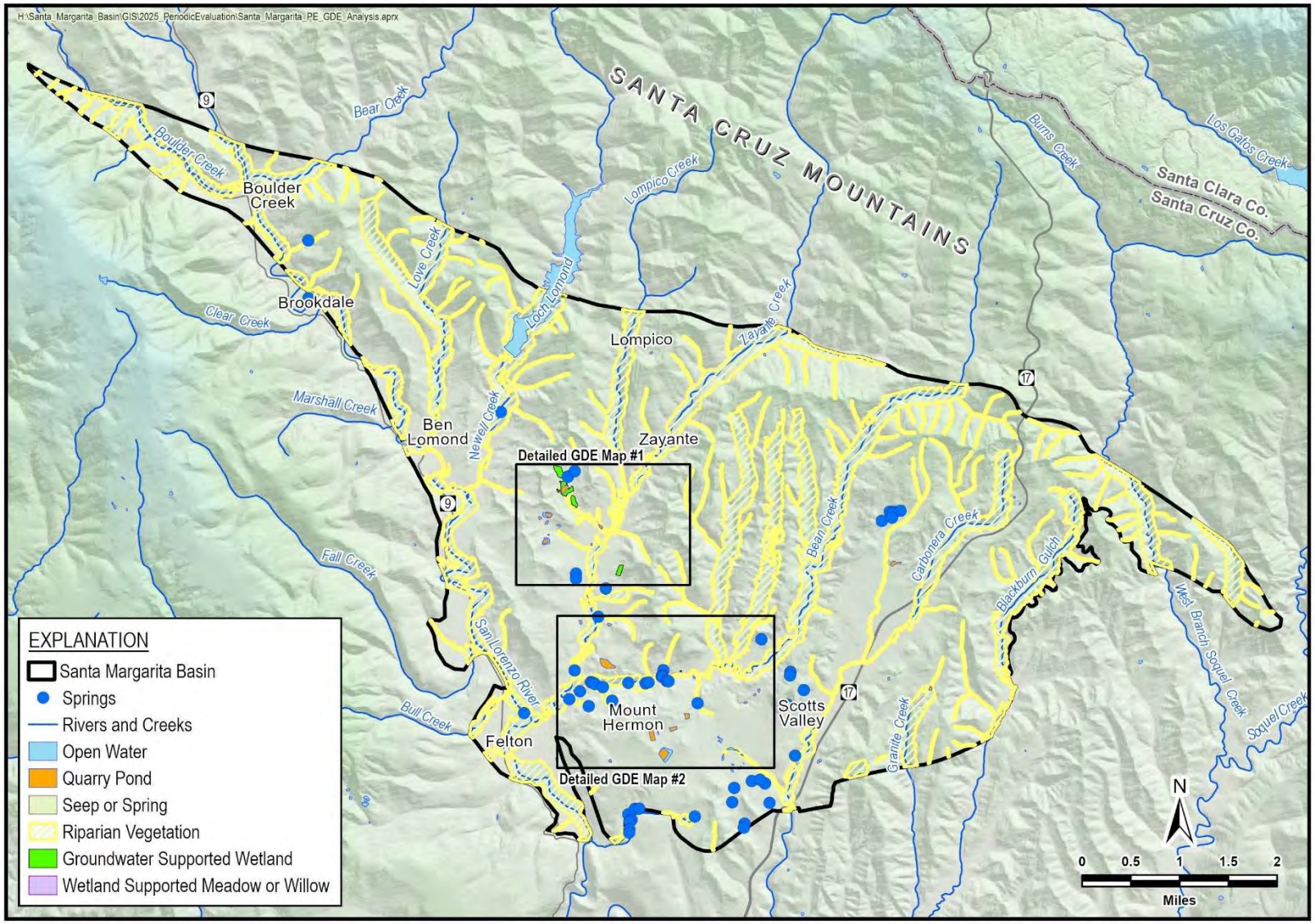



Figure 3-18~~3-183-3-18~~. Identified Groundwater Dependent Ecosystems in the Santa Margarita Basin

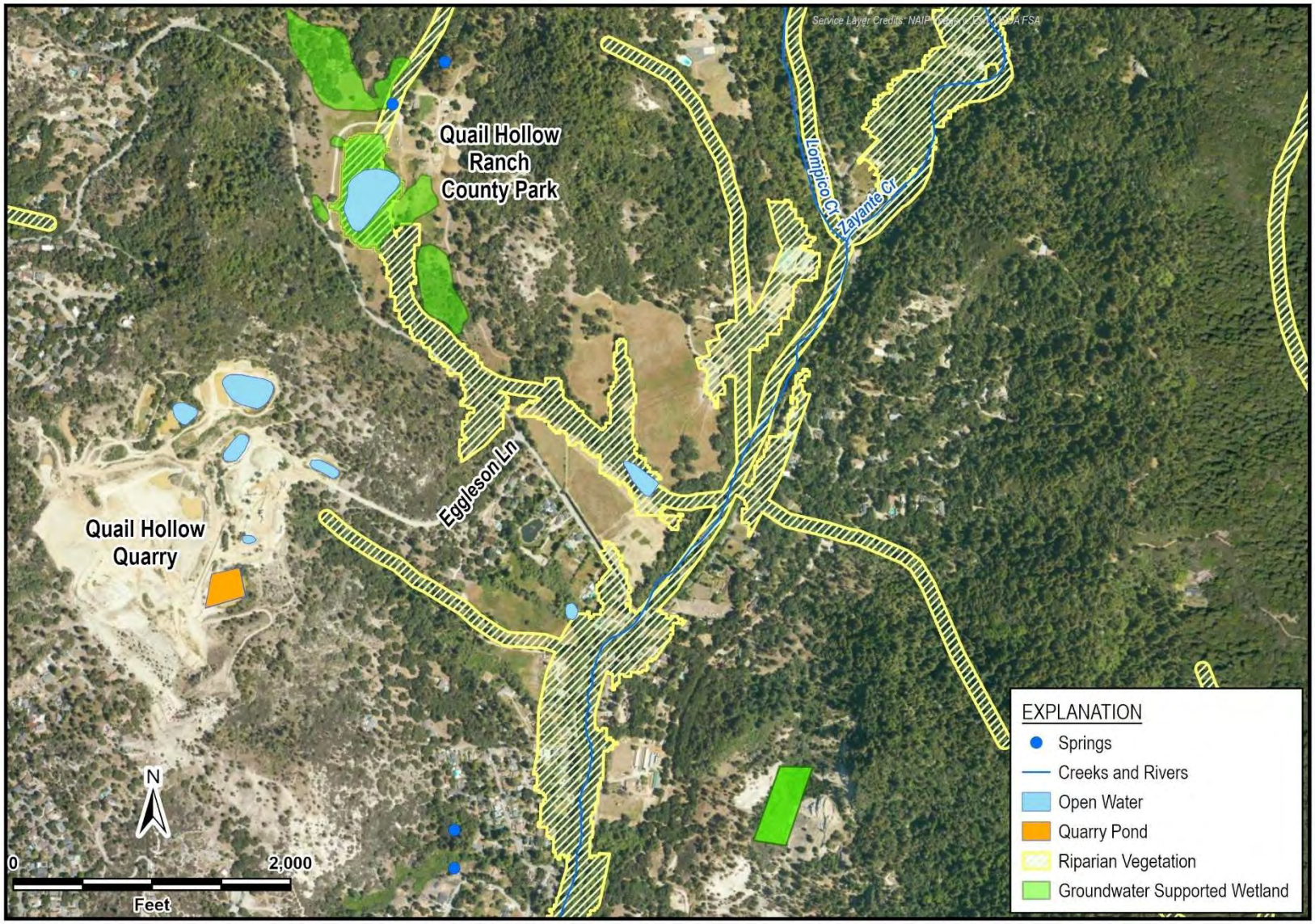



Figure 3-19~~3-193-3-19~~. Detailed Map #1 of Identified Groundwater Dependent Ecosystems

Figure 3-20~~3-20~~3-20. Detailed Map #2 of Identified Groundwater Dependent Ecosystems

#### 3.4.9.1 Riverine and Riparian GDEs

Riverine and riparian GDEs (including riverine wetlands, on-channel ponds, or other wetland types that occur within the riverine corridor) are distinguished from other GDE types because they have complex interactions with both surface water and groundwater. Riparian vegetation responds to changes in groundwater as well as streamflow, both of which can be influenced by fire, sudden oak death or other infestations, land use changes, and climate change. Further, riparian and watershed vegetation development stage can influence the water budget as older more mature plants have deeper root systems that might access groundwater more efficiently. These complicating factors make correlation of vegetation in riverine and riparian GDEs with groundwater management challenging.

#### 3.4.9.2 Other Groundwater-Supported Wetlands

Groundwater supported wetlands in the Basin are a variety of ecologically unique systems. These include spring/seep complexes and quarry floor sites where shallow or emerging groundwater support a variety of wetland vegetation types. Additional investigation is required, but several of these sites are likely supported by local shallow perched groundwater conditions on lower permeability sedimentary deposits as opposed to being supported wholly by baseflow from the high permeability Santa Margarita aquifer.

### 3.4.10 Sources and Points of Water Supply

Almost all water supply within the Basin is derived from local sources. Local water sources in the Basin include groundwater, surface water, and recycled water. Figure 3-21 shows the location of all municipal supply wells, points of surface water diversions, and current service areas of the public suppliers in the Basin. The communities of Forest Springs (128~~6~~ connections) and Bracken Brae (24~~25~~ connections) located in the northwesternmost part of the Basin are supplied water from sources within the Boulder Creek watershed but northwest of the Basin ~~through an intertie with Big Basin Water Company~~.

Figure 3-21 shows the rural areas of the Basin that have no municipal water supply and thus rely on private groundwater wells for domestic and non-domestic water supply. Figure 3-22 well density maps show the number of all water supply wells, including municipal, small water systems, private domestic, and industrial, within 1 square mile cells across the Basin.

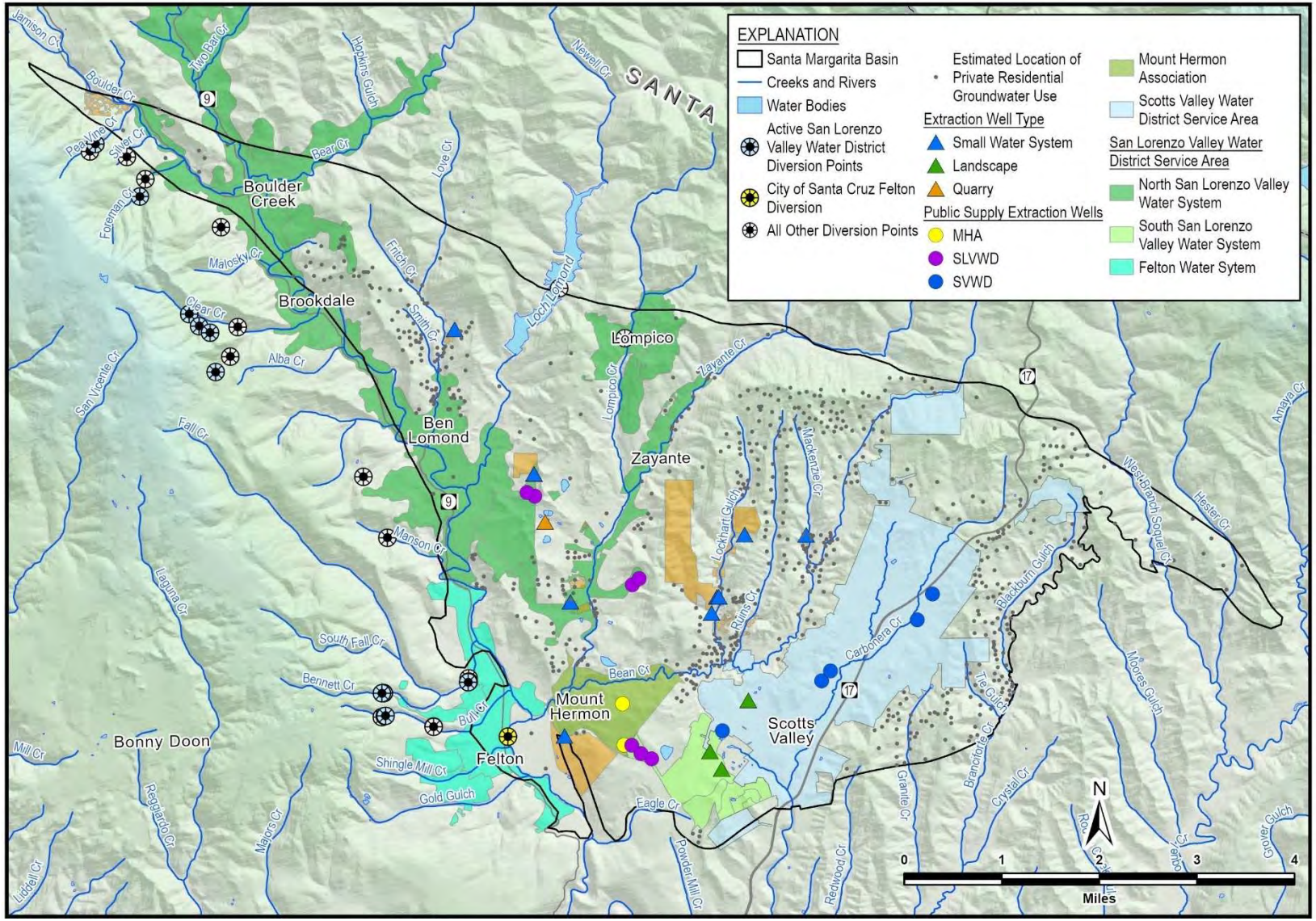



Figure 3-21~~3-213-3-21~~. Current Water Supply Sources and Service Areas

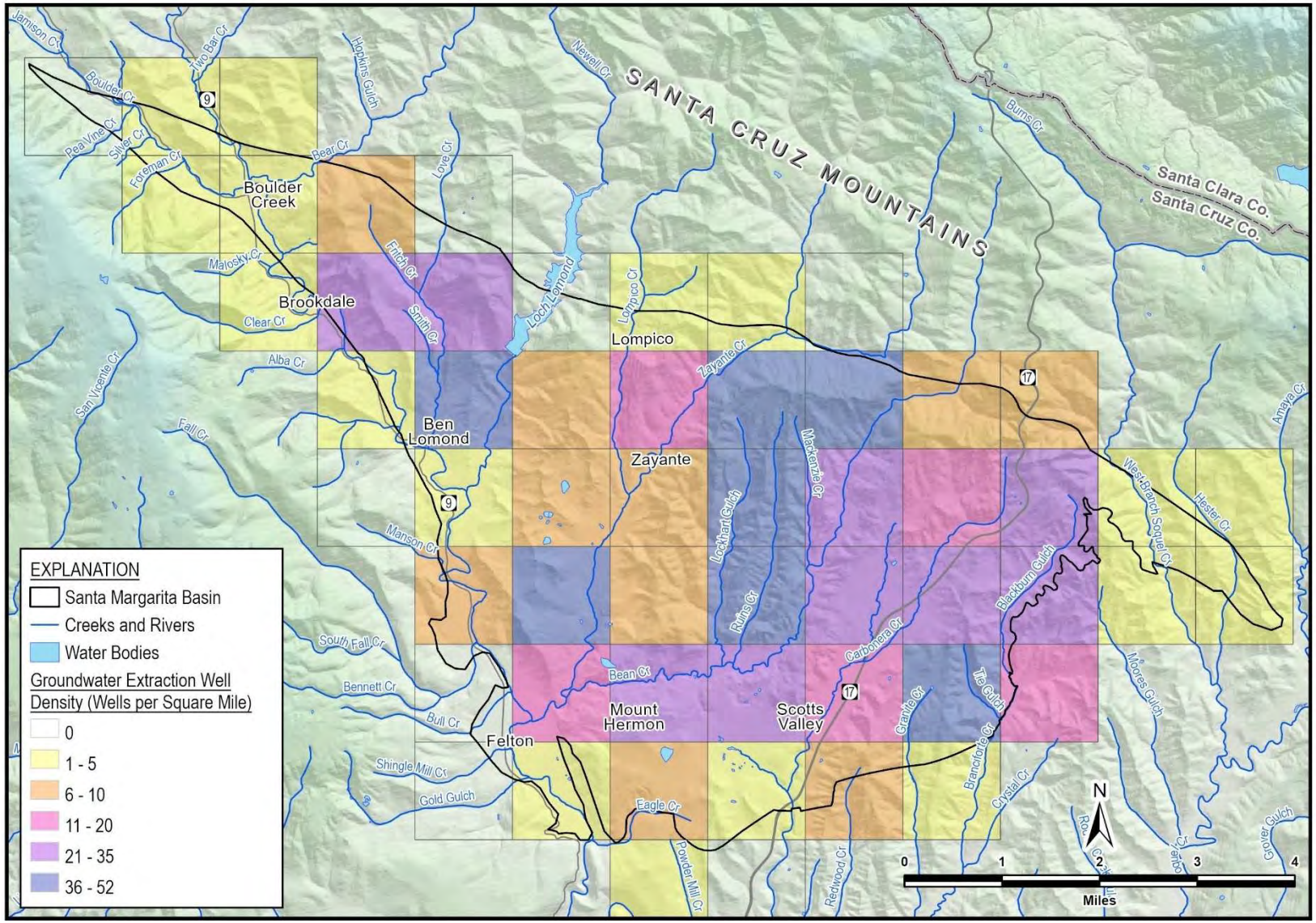



Figure 3-22~~3-223-3-22~~. ~~Groundwater Extraction~~Supply Well Density Map ~~for the Santa Margarita Basin~~

SLVWD uses both surface water and groundwater for its water supply. SLVWD operates~~'s~~ 9 surface water diversions — all located on tributaries of the San Lorenzo River outside of the Basin — which are shown on Figure 3-21 and listed in Table 3-4. Following the 2020 CZU Lightning Complex wildfire, which destroyed about 50% of SLVWD's facilities, the District has worked steadily to restore its water infrastructure; four of the nine diversion points remain unrestored. ~~4 of the 9 points of diversion are currently inactive due to damage sustained in the CZU Lightning Complex wildfire damage in the summer of 2020. It is anticipated that these will be repaired or replaced in 2022/2023. The diversions are all located on tributaries of the San Lorenzo River outside of the Basin. The watersheds of these creeks are also mostly outside of the Basin.~~ Water ~~that is~~ not diverted flows into the San Lorenzo River and is considered a Basin water source. SLVWD holds appropriative water rights, including pre-1914 ~~appropriative~~ rights, on all streams in the San Lorenzo Valley System, ~~are~~ exercised through ~~the~~ its active diversions.

Table 3-~~43~~ ~~43~~ 4. SLVWD Surface Water Diversions

| SLVWD System | Points of Diversion | Diversion Status |
|---|---|---|
| **San Lorenzo Valley System** | | |
| Peavine Creek | 1 | Temporarily inactive |
| Foreman Creek | 1 | Active |
| Clear Creek | 3 | Temporarily inactive |
| Sweetwater Creek | 1 | Temporarily inactive |
| **Felton System** | | |
| Fall Creek | 1 | Active |
| Bennett Spring | 1 | Active |
| Bull Creek | 1 | Active |

Note: gages that are temporarily inactive were damaged during the CZU Lightning Complex wildfire damage in the summer of 2020

Additionally, SLVWD holds entitlement to a portion of surface water storage in Loch Lomond Reservoir or an equivalent water transfer from the City Santa Cruz Water. SLVWD has not recently exercised its entitlement due mostly to the costly upgrade that would be needed to its Kirby WTP to address ~~the~~ relatively high concentrations of ~~total~~ organic carbon in Loch Lomond raw water.

SLVWD produces stored groundwater from 3 wellfields (Table 2-3 and Figure 3-21). The Quail Hollow and Olympia wellfields extract groundwater from the Santa Margarita aquifer, and the Pasatiempo wellfield extracts from the Lompico aquifer. The 7 active wells are grouped as shown in Table 2-3.

SVWD relies on ~~5~~ 6 active groundwater extraction wells for the entirety of its potable water supply (Figure 3-21). These wells extract from the Basin's confined ~~aquifers, namely the~~

Lompico and Butano aquifers. SVWD augments its water supply and offsets its groundwater extraction for non-potable uses with between 160 to 200 AFY of recycled water per year. This is less than the total available recycled water supply. The City of Scotts Valley's WRF treats around 2.9 AF of water daily (or about 1,060 AFY). Influent to the WRF is sourced entirely from within the City of Scotts Valley. Recycled water produced at a Scotts Valley WRF Tertiary Treatment Plant is used mainly within the city limits but is also available to bulk users outside of city limits such as the Pasatiempo Golf Club.

Groundwater is pumped by private pumpers within the Basin for residential use, and there are some private water rights holders for surface water diversions for non-potable uses. The approximate location of wells used for private use are shown on Figure 3-21.

Other water systems that use groundwater pumped from the Basin as a source of potable water include MHA and 9 small water systems. MHA used springs as their sole water source prior to 1991 (Johnson, 2009) but have since extracted groundwater to meet their full demand. Small water systems primarily use groundwater with several also diverting local surface water to supplement their demand. Section 2.4.1.3 provides more information on small water systems.

Table 3-5 summarizes WY2018 WY2025 water use within the Basin and Figure 3-23 provides annual water use in the Basin from WY1985 through 2018 2025 categorized by water source and user; water year type is shown on the chart (wet, normal, dry, and critically dry; the classification system is described in Section 3.3).

The City of Santa Cruz is included in Table 3-5 as it has rights to store and divert surface water in the Basin. The City of Santa Cruz operates the Loch Lomond storage reservoir that impounds water in the Newell Creek watershed that would naturally flow into the Basin. It also operates a diversion on the San Lorenzo River in Felton that conveys water upstream for storage in Loch Lomond. Water diverted and stored in the Basin by the City of Santa Cruz is conveyed out of the Basin by the Newell Creek Pipeline to the City of Santa Cruz WTP. The City of Santa Cruz's primary surface water diversion occurs on the San Lorenzo River at Tait Street, which is 5 miles downstream of the Basin in the City of Santa Cruz.

Table 3-5~~3-53~~. Water Year 2025~~18~~ Santa Margarita Basin Water Use by Source

| Water Supplier | Groundwater Use (Acre-Feet) | Surface Water Use (Acre-Feet) | Recycled Water Use (Acre-Feet) | Imported Water Use (Acre-Feet) | Total ~~2018~~ 2025 Water Use (Acre-Feet) |
|---|---|---|---|---|---|
| San Lorenzo Valley Water District (SLVWD)[1] | ~~993~~612 | ~~1,166~~1,155[54] | 0 | 0 | ~~2,159~~1,767 |
| Scotts Valley Water District (SVWD) | ~~1,211~~1,128 | 0 | ~~196~~169 | 0 | ~~1,407~~1,297 |
| Mount Hermon Association | ~~129~~167 | 0 | 0 | 0 | 167167 |
| City of Santa Cruz | 0 | ~~0~~[6]0[5]<br>5,307~~1,130~~[76] | 0 | 0 | ~~1,130~~5,307 |
| Private Domestic Wells[2] | 23~~43~~ | 0 | 0 | 0 | 234~~233~~ |
| Other Non-Domestic Private Groundwater Users[3] | ~~145~~122 | 0 | 0 | 0 | ~~145~~122 |
| Small Water Systems | ~~79~~88 | ~~6~~2 | 0 | 48 | ~~138~~138 |
| ~~Valley Gardens Golf Course[4]~~ | ~~113~~ | ~~0~~ | ~~0~~ | ~~0~~ | ~~113~~ |
| Quail Hollow Quarry | ~~25~~32 | 0 | 0 | 0 | ~~25~~32 |
| **Total** | **~~2,928~~2,383** | **~~2,302~~6,464** | **169~~196~~** | **2~~148~~** | **~~5,474~~9,016** |

Note: The City of Santa Cruz Water Department stores surface water diverted from both the San Lorenzo River and Newell Creek in Loch Lomond Reservoir which is partially within the Basin. Water from Loch Lomond is treated at the City's surface water treatment plant and served to its customers. While SLVWD has a right to a portion of Loch Lomond water to serve to customers within the Basin, this water is currently only delivered to City customers outside the Basin.

[1] includes springs
[2] estimated
[3] other private non-domestic uses include landscape irrigation and water for landscape ponds.
~~[4] Valley Golf Course closed on December 31, 2018~~
[54] SLVWD surface water is sourced outside of the Basin in tributaries to the San Lorenzo River
[65] City of Santa Cruz Valley's San Lorenzo River diversion from Felton to Loch Lomond
[76] City of Santa Cruz Valley's San Lorenzo River diversion at Tait Street (5 miles downstream of the Basin) to the City treatment plant

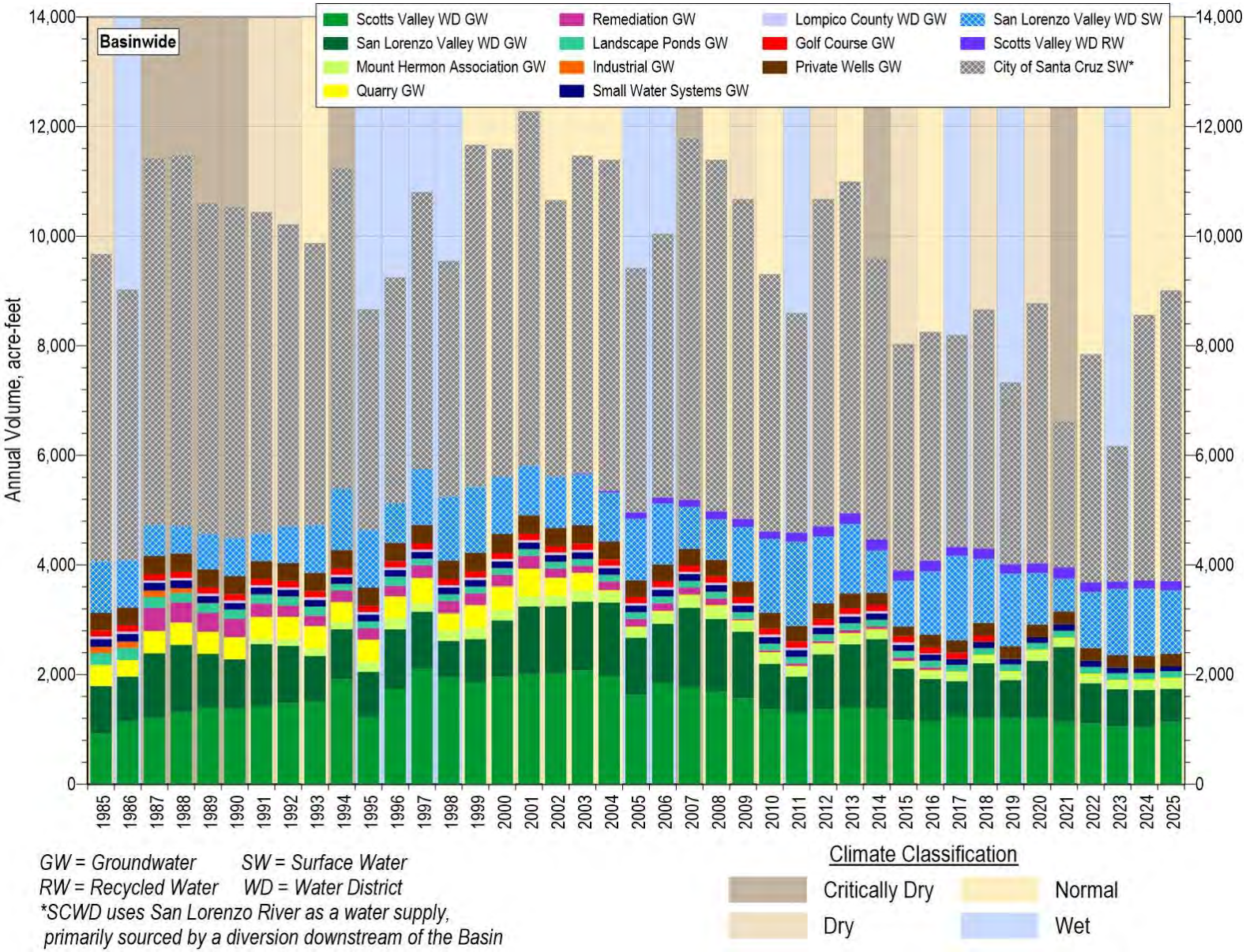



Figure 3-23~~3-233-3-23~~. Historical Annual Water Use in the Santa Margarita Basin by Source and User

### 3.4.11 Description of Surface Water Supply for Groundwater Recharge or In-Lieu Supply

Almost all water supply within the Basin is derived from surface water and groundwater, which is fed by precipitation in the Basin and the surrounding watershed. A very small amount (between 160 to 200 AFY) of recycled water is used by SVWD to supplement their water supply.

SLVWD has rights to divert water from tributaries of the San Lorenzo River located outside of the Basin. When surface water is available, SLVWD uses it in lieu of pumping its wells. This conjunctive use of surface water and groundwater is described ~~in more detail~~ in ~~the baseline projects in Section 4~~Section 2.3.4.1. If SLVWD's water rights and place of use restrictions are ~~revised per current requests to the SWRCB, in wet years~~amended in the future, there will be more surface water available for conjunctive use by SLVWD and potentially SVWD.

~~Currently, t~~The City of Santa Cruz has water rights to divert water from the San Lorenzo River. Between October 1 and May 31, the San Lorenzo River and its tributaries are not fully appropriated, and at times have streamflow in excess of minimum bypass flows; these excess flows could be used for groundwater recharge and conjunctive use projects. ~~Appendix 2E3A: Section 7.3.3 describes an estimated total of 540 AFY for excess flows within the water rights of SLVWD and City of Santa Cruz.~~ This potential source and volume of water is ~~used for an~~ potentially available for expanded conjunctive use projects~~ described in Section 8.3.14 on projects and management actions~~. ~~The 540 AFY estimate may change subject to applications by the City of Santa Cruz and SLVWD to change their water rights.~~

### ~~3.4.12 HYDROGEOLOGIC CONCEPTUAL MODEL DATA GAPS~~

~~THE HYDROGEOLOGY OF THE MOUNT HERMON/SOUTH SCOTTS VALLEY SUBAREA AND PORTIONS OF THE SANTA MARGARITA AQUIFER IN OLYMPIA AND QUAIL HOLLOW SUBAREAS ARE RELATIVELY WELL UNDERSTOOD BECAUSE OF THE WATER SUPPLY AND MONITORING WELLS THAT HAVE BEEN DRILLED, LOGGED, AND MONITORED BY SLVWD, SVWD, MHA, AND THROUGH ENVIRONMENTAL REMEDIATION PROGRAMS. AREAS OF THE BASIN THAT ARE LACKING THESE TYPES OF DATA ARE THOSE THAT ARE OUTSIDE OF THE JURISDICTION OF SLVWD, SVWD, AND MHA WHERE PRIVATE DOMESTIC GROUNDWATER EXTRACTION TAKES PLACE. ADDITIONALLY, THE DEEP BUTANO AQUIFER IS POORLY UNDERSTOOD BECAUSE IT ONLY HAS 2 DEDICATED MONITORING WELLS. IN ADDITION, WHILE RRECENT AERIAL ELECTROMAGNETIC (AEM) SURVEYS PERFORMED BY DWR DATA AND MONITORING IMPROVEMENTS HAVE REFINED THE UNDERSTANDING OF BASIN STRUCTURE AND AQUIFER EXTENT, THESE DATA AND GENERALLY CONFIRMS THE EXISTING CONCEPTUAL MODEL RATHER THAN ALTERING IT.~~

~~SINCE ADOPTION OF THEDURING GSP IMPLEMENTATION, SIGNIFICANT PROGRESS HAS BEEN MADE TOWARD ADDRESSING HCM DATA GAPS THROUGH 7 INSTALLATION OF NEW MONITORING WELLS INSTALLATIONS IN 2023AND INCORPORATION OF ADDITIONAL EXISTING WELLS. IN PARTICULAR, SEVEN NEW DEDICATED MONITORING WELLS WERE INSTALLED IN 2023 TOTHE NEW SHALLOW MONITORING WELLS IMPROVE SPATIAL COVERAGE IN THE SHALLOW SANTA MARGARITA AQUIFER AND MONTEREY FORMATION. DESPITE THESE IMPROVEMENTS, THE BUTANO AQUIFER CONTINUES TO BE POORLY CHARACTERIZED DUE TO LIMITED MONITORING, WITH ONLY TWO DEDICATED MONITORING WELLS CURRENTLY AVAILABLE IN THE NORTHERN SCOTTS VALLEY SUBAREA. INSTALLATIONTHE NEED FOR  OF AN DEDICATED ADDITIONAL DEEP MONITORING WELL TO MONITOR BETTER CHARACTERIZE BUTANO AQUIFER GROUNDWATER LEVELS CONDITIONS HAS BEEN IDENTIFIED BUT HAS NOT YET BEEN COMPLETED DUE TO FUNDING CONSTRAINTS. , AND THE SMGWA IS PURSUING DWR TECHNICAL SUPPORT SERVICES (TSS) ASSISTANCE TO ADDRESS THIS GAP.~~

~~THESE DATA GAPS HAVE LED TO SOME UNCERTAINTY ON HOW THE AQUIFERS INTERACT WITH EACH OTHER IN PARTS OF THE BASIN AND RESPOND TO CHANGE IN FLUXES, SUCH AS RECHARGE AND GROUNDWATER EXTRACTION. THE 9 NEW MONITORING WELLS IDENTIFIED AND DESCRIBED IN SECTION 3.3.4 WILL MINIMIZE THESE UNCERTAINTIES BY FILLING DATA GAPS IN THE BASIN'S HCM. THESE NEW MONITORING WELLS BECOME PART OF THE OVERALL MONITORING NETWORK, WHERE IMPLEMENTATION OF THE GSP WILL ENSURE ONGOING DATA COLLECTION AND MONITORING THAT WILL ALLOW CONTINUED REFINEMENT AND QUANTIFICATION OF THE HYDROGEOLOGIC SYSTEM. SECTION 5 INCLUDES ACTIVITIES TO ADDRESS THE IDENTIFIED DATA GAPS AND IMPROVE THE HCM.~~

# 4 GROUNDWATER CONDITIONS

Groundwater conditions in the Basin reflect more than a century of groundwater use together with the management and conservation measures implemented since the early 2000s. This section characterizes the current and historical groundwater conditions that provide the technical basis for the sustainable management criteria presented in Section 7~~3~~, drawing on data from the Basin's monitoring network and supporting technical analyses. Conditions are described for each sustainability indicator: groundwater elevations and the vertical hydraulic gradients between the principal aquifers, the change of groundwater in storage, groundwater quality, land subsidence, and the depletion of interconnected surface water. Each subsection summarizes historical trends, present-day conditions, and the data used to evaluate them.

## ~~3.5~~4.1 Historical Groundwater Demands ~~Elevations~~

Groundwater has been the primary source of water in the Basin for domestic, municipal, and sand mining users since the early part of the 20th century~~, which led to historical groundwater level declines~~. The rate of parcel development in the San Lorenzo River watershed between the 1950s and 1980s increased (Figure 4-1) to meet the housing, commercial, and industrial needs of a growing population (Figure 4-2). The parcel development led to increased groundwater demands. Much of the development in this timeframe was in the City of Scotts Valley and the communities of the San Lorenzo Valley (County of Santa Cruz, 2002). Since historical population estimates for all communities within the Basin are not available, Figure 4-2 shows County of Santa Cruz population estimates that can be used as an indication of population growth within the Basin.

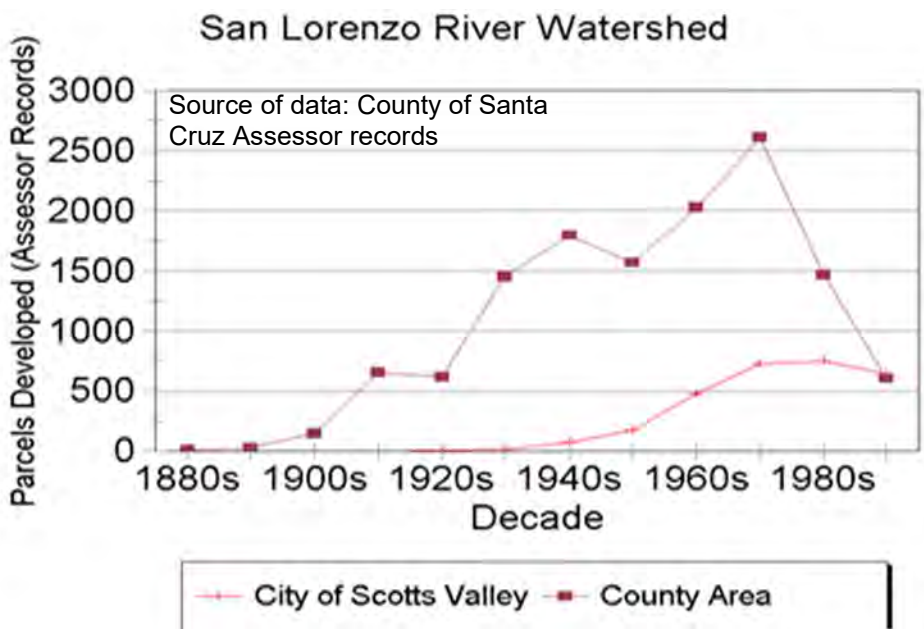



Figure 4-1~~4-14-4-1~~. County of Santa Cruz Parcel Development in the San Lorenzo River Watershed

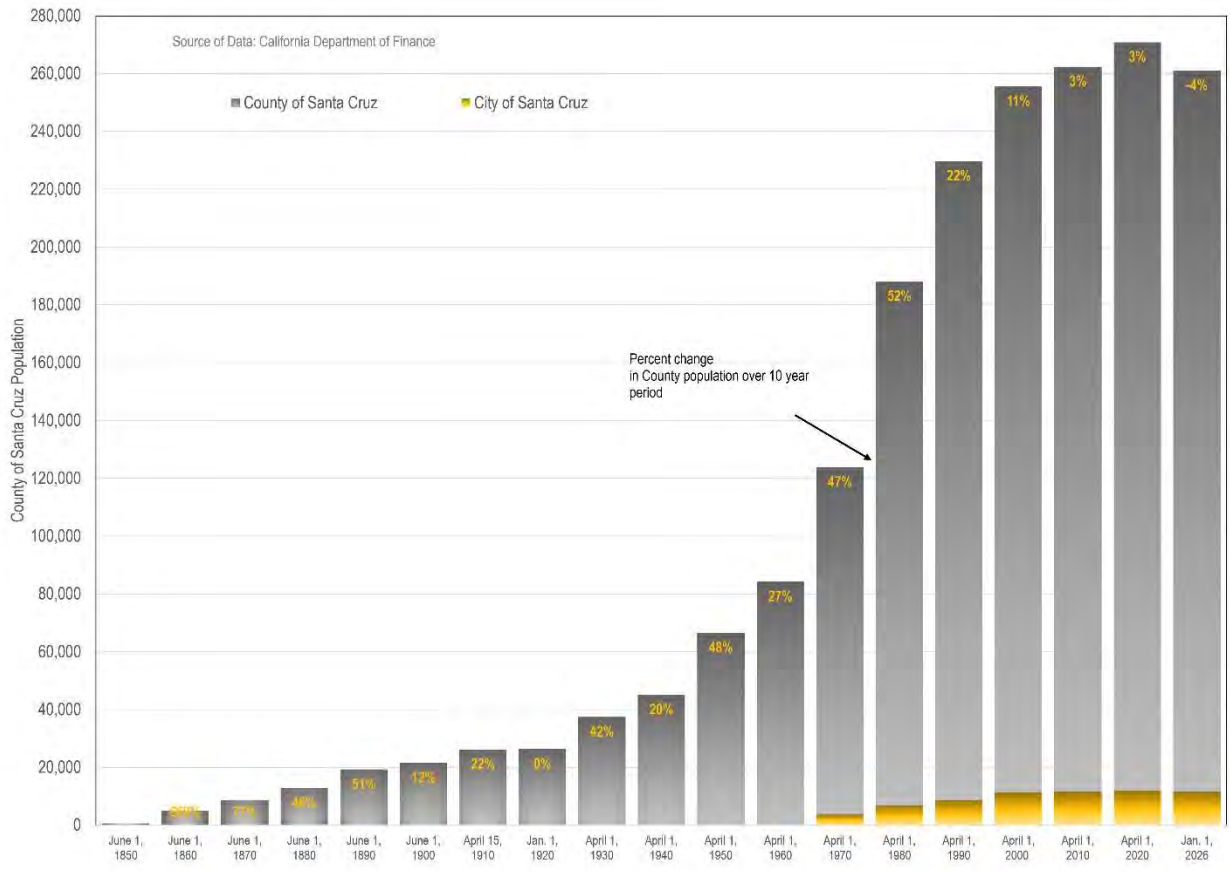



Figure 4-24 ~~24~~ 4-2. County of Santa Cruz Historical Population

~~The repercussions of historical drought periods, discussed in Section 2.2.6.2.1, and growth in the more developed areas of the Basin has been a decline in groundwater elevations in wells extracting groundwater from the Lompico aquifer.~~ Starting in the 2000s, focused groundwater management and conservation programs by the water districts, reduced environmental remediation pumping, decommissioning of the Hanson and Olympia ~~Quarries~~quarries, closure of the Valley Gardens Golf Course, and heightened water use efficiency practices. Water use within the Basin is discussed in detail in Section 3.4.10~~by the Basin's community have largely stabilized groundwater elevations by reducing~~ Reduced groundwater extraction in the Basin, particularly in the confined aquifers south of Bean Creek (Figure 4-3),~~to more sustainable volumes~~ helped stabilize declining groundwater levels in the Basin, as discussed in the sections below.~~(Figure 4-3).~~

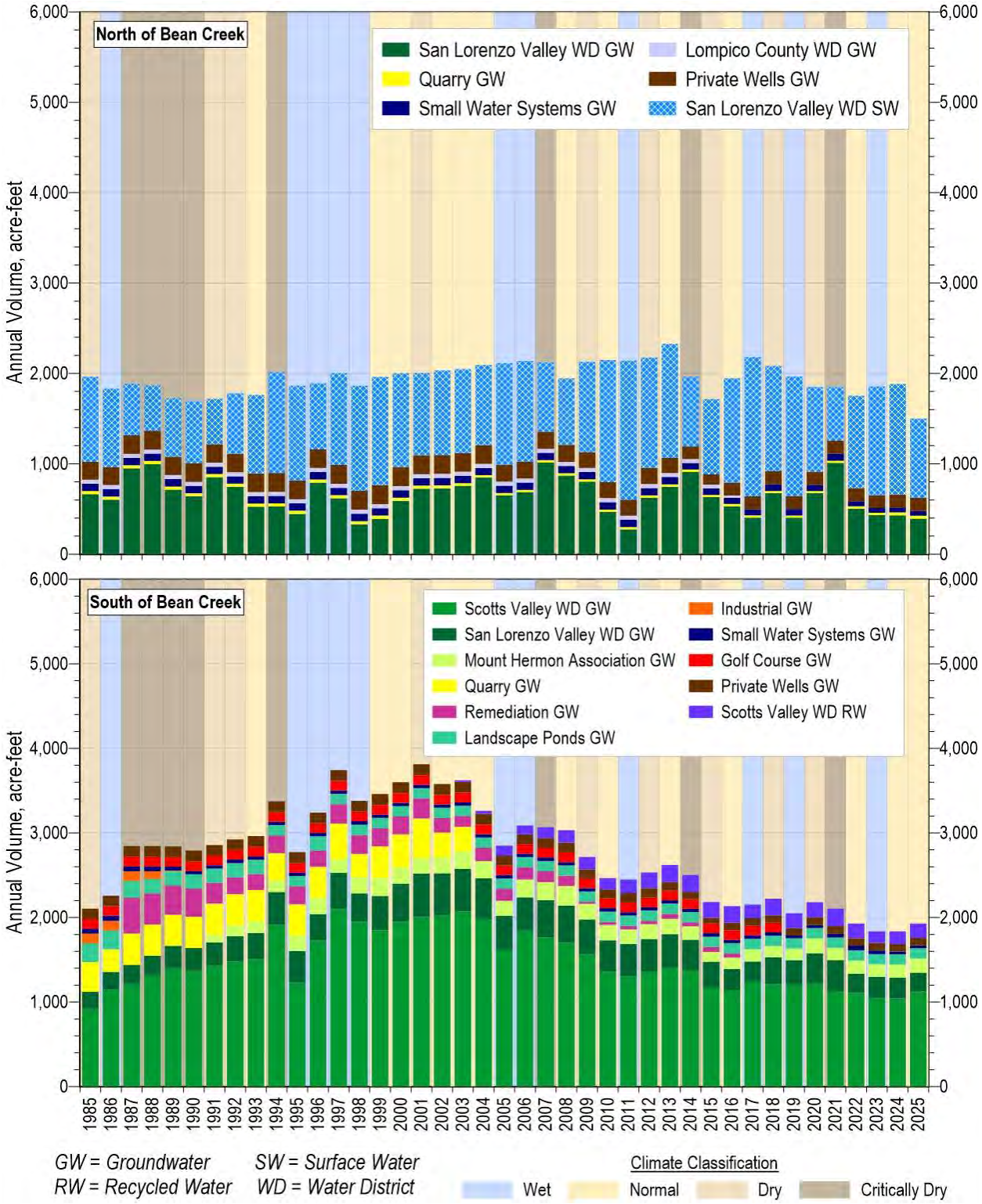



Figure 4-~~34~~ ~~34~~ ~~4~~ ~~3~~. Groundwater Extraction by User Type Relative to Bean Creek

## 4.2 Groundwater Elevations

Groundwater ~~condi~~elevations in the Basin ~~are generally sustainable~~have generally been stable to improving over the past 20 years. One notable area that exhibited unsustainable groundwater conditions is the~~, with the exception of the~~ Mount Hermon / South Scotts Valley area. Groundwater levels in both Santa Margarita and Lompico aquifers in the Mount Hermon / South Scotts Valley area started to decline as early as the 1970s when the area underwent extensive development. The groundwater level declines were exacerbated by a 10-year drought starting in 1984 eventually resulting in the dewatering of the Santa Margarita aquifer in that area. Groundwater levels have generally stabilized and are increasing in some areas since Basin-wide groundwater extraction peaked in the early 2000s, but the Santa Margarita aquifer remains dewatered in the area southeast of Mount Hermon.

### ~~3.5.1~~4.2.1 Groundwater Elevation Subareas and Monitoring Wells

The subsections below describe groundwater elevations and gradients by principal aquifers in the Basin. The Monterey Formation is generally an aquitard to flow between the Santa Margarita and Lompico aquifers so is not considered a principal aquifer. To guide discussion in the GSP, the principal aquifers and Monterey Formation are divided into subareas with distinct characteristics.

There are 4 Santa Margarita aquifer subareas shown on Figure 4-4:

1. Quail Hollow
2. Olympia/Mission Springs
3. Mount Hermon/South Scotts Valley
4. North Scotts Valley

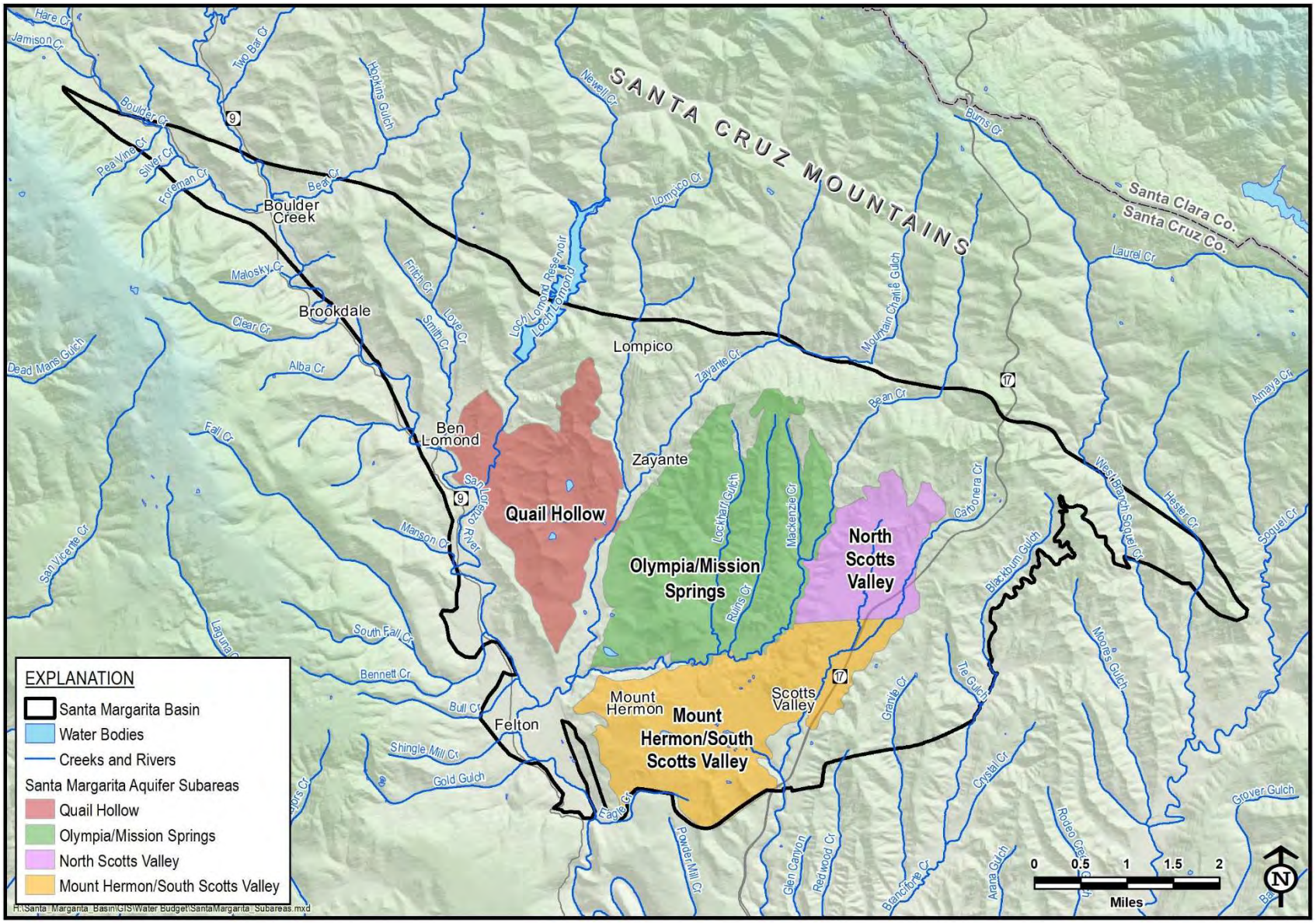



Figure 4-~~44~~-~~44~~-~~4~~-~~4~~. Santa Margarita Aquifer Subareas

The 2 Santa Margarita subareas are generally isolated from each other due to erosion by creeks through the entire thickness of the aquifer are therefore subject to different pumping and recharge regimes (Johnson, 2009). Kennedy/Jenks Consultants (2015) defined subareas in the Santa Margarita aquifer that are adopted with slight modification for the GSP.

The Quail Hollow area, a roughly 3 square mile hillslope area south of Loch Lomond is largely hydrogeologically separated from other areas of Santa Margarita Sandstone due to erosion and its position on the limb of the Scotts Valley syncline topographically above other outcrops (Johnson, 2009). The only major groundwater pathway between Quail Hollow and the greater Basin is through a narrow bridge of sandstone and stream alluvium beneath Zayante Creek (Figure 3-9). The isolated nature of the Quail Hollow area means that ~~projects and groundwater management actions~~PMAs undertaken in other parts of the Basin are unlikely to influence groundwater conditions in the Quail Hollow area. The other Santa Margarita aquifer subareas are connected more than Quail Hollow, but still demonstrate unique characteristics due to erosion by creeks.

Subareas are also identified for discussion in the GSP in each of the deeper, more laterally continuous geologic units used for water supply in the Basin. The 3 subareas for the Monterey Formation, Lompico aquifer, and Butano aquifer shown on Figure 4-5 are:

1. North of Bean Creek
2. Mount Hermon/South Scotts Valley
3. North Scotts Valley

The subareas are defined loosely based on the overlying Santa Margarita aquifer subareas, with the subareas south of Bean Creek having identical names and boundaries. Since ~~the majority~~nearly all of the Lompico and Butano aquifer extractions occur in the southern portions of the Basin, there are no monitoring wells in the aquifers and formations in the deeper geologic units in the North of Bean Creek subarea. MHA-MW1, the only Lompico aquifer well north of Bean Creek, is a pilot well that was not completed for extraction~~ and a new addition to the GSP water level monitoring network~~.

The sections below describe the groundwater conditions measured historically in monitoring wells in the Basin and simulated by the ~~groundwater m~~Basin Model. Well locations and the aquifer or formation they are screened in are shown on

Figure 4-6. The groundwater elevation contour maps are generated using groundwater level measurements supplemented with~~using~~ simulated groundwater model results. The Basin M~~m~~odel is calibrated to ~~the~~ measured groundwater levels in wells and ~~discharge~~ streamflow in creeks where data are ~~available, and~~available and is based on inferences where data are not available.

Appendix ~~2C~~ 4A contains hydrographs for all wells with current records in the Basin. Note that all hydrographs included in this GSP identify the climatic year type of each water year by different background colors on the graphs (wet, normal, dry, and critically dry)~~;~~ using the classification system ~~is~~ described in Section 3.3~~)~~.

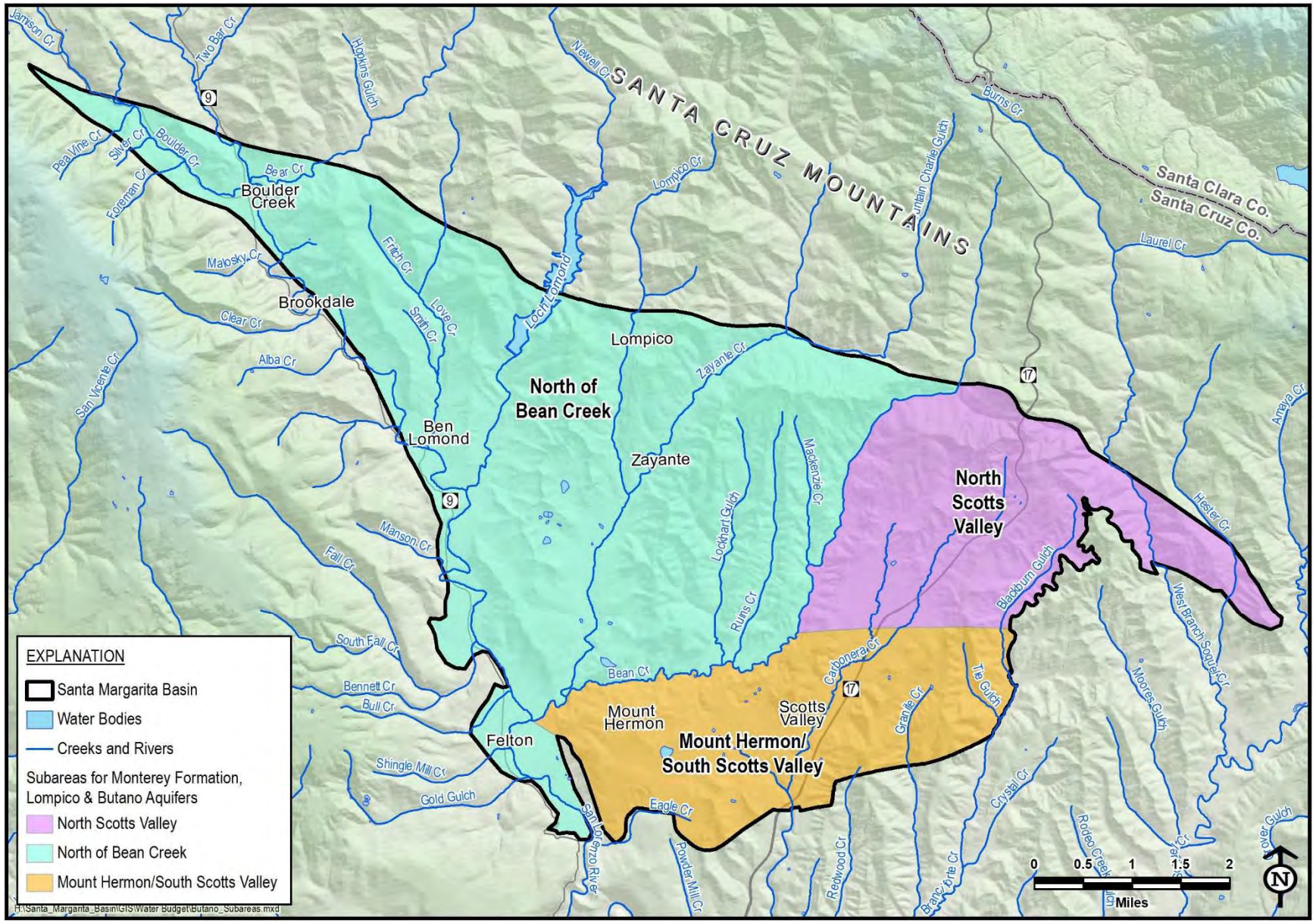



Figure 4-~~54~~-~~54~~-~~4-5~~. Monterey Formation, Lompico Aquifer and Butano Aquifer Subareas

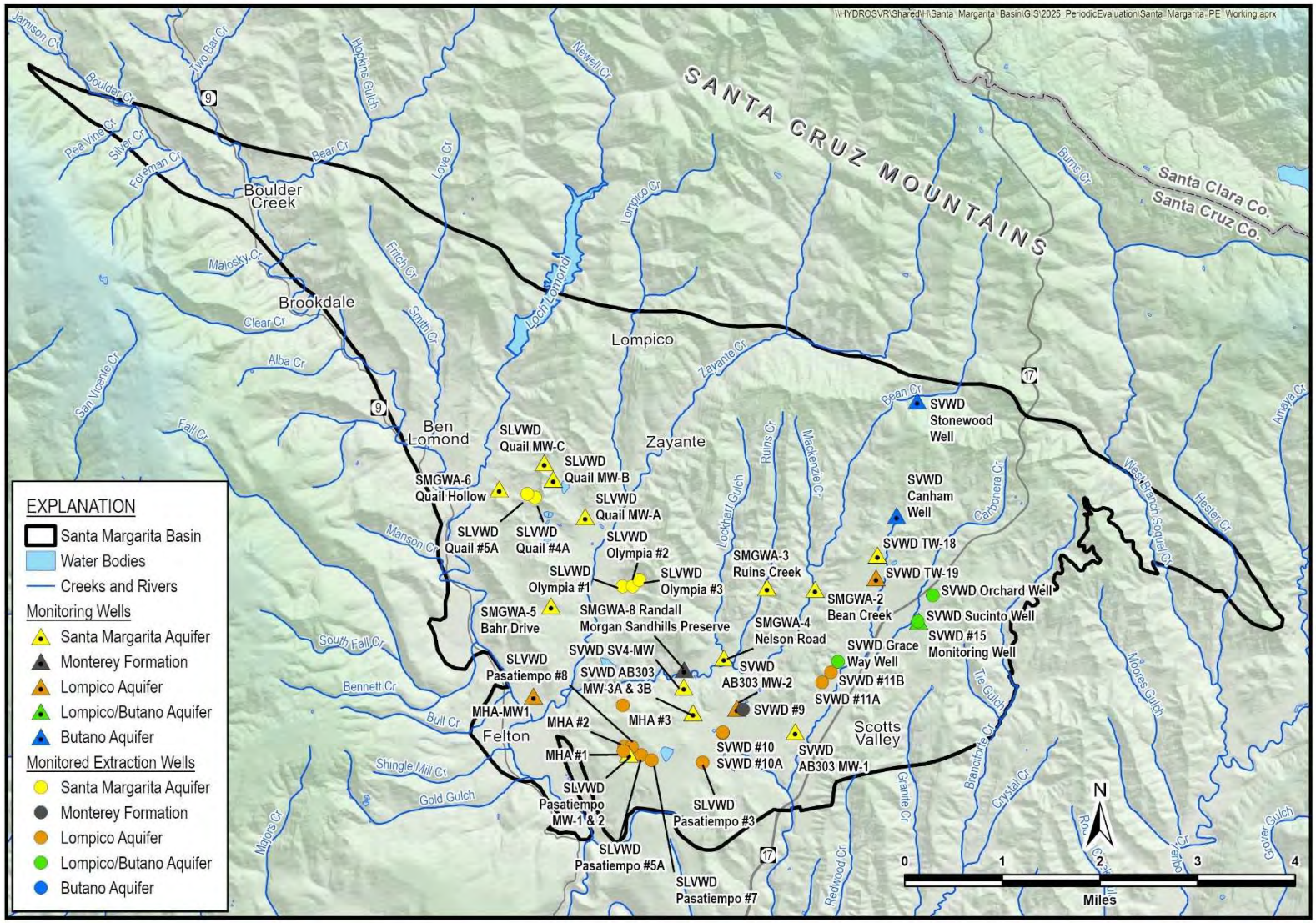



Figure 4-64-64-4-6. ~~Location of Wells Used for Monitoring~~ Groundwater Level Monitoring Locations~~s~~

## ~~3.5.2~~4.2.2 Santa Margarita Aquifer Groundwater Elevations

### ~~3.5.2.1~~4.2.2.1 Santa Margarita Aquifer Groundwater Elevations over Time

The Basin's primary unconfined aquifer is the Santa Margarita aquifer as described in Section 3.4.4.1. Relatively high hydraulic conductivities and widespread surface exposure result in the Santa Margarita aquifer being one of the most important hydrogeologic units within the Basin for water supply, recharge, and as a source of baseflow for creeks and rivers. The Santa Margarita aquifer's high hydraulic conductivity and extensive surface exposure allow it to recharge quickly after rainfall~~, but also become dewatered by overpumping in underlying formations~~ resulting in relatively stable long-term levels as demonstrated on hydrographs in Figure 4-7.

As discussed in Section 4.2, the Santa Margarita aquifer has isolated subareas with distinct groundwater level trends. The groundwater elevations in the Quail Hollow and Olympia/Mission Springs subareas north of Bean Creek demonstrate greater seasonal variability related to groundwater pumping. The Santa Margarita aquifer in the Mount Hermon/South Scotts Valley south of Bean Creek near Pasatiempo and Camp Evers was dewatered in the 1980s by overpumping in the Santa Margarita and underlying Lompico aquifer in an area where the Monterey Formation aquitard is absent. Groundwater elevations have not recovered and as a result, there is no longer groundwater pumping in most of the Santa Margarita aquifer in this portion of the subarea. There is very little pumping in the Santa Margarita aquifer in the North Scotts Valley subarea, resulting in long-term stable groundwater elevations.

This section describes groundwater level fluctuations in representative hydrographs in each subarea. The following section describes the overall groundwater elevations and flow directions for the aquifer in each subarea as simulated by the groundwater model in WY2018.

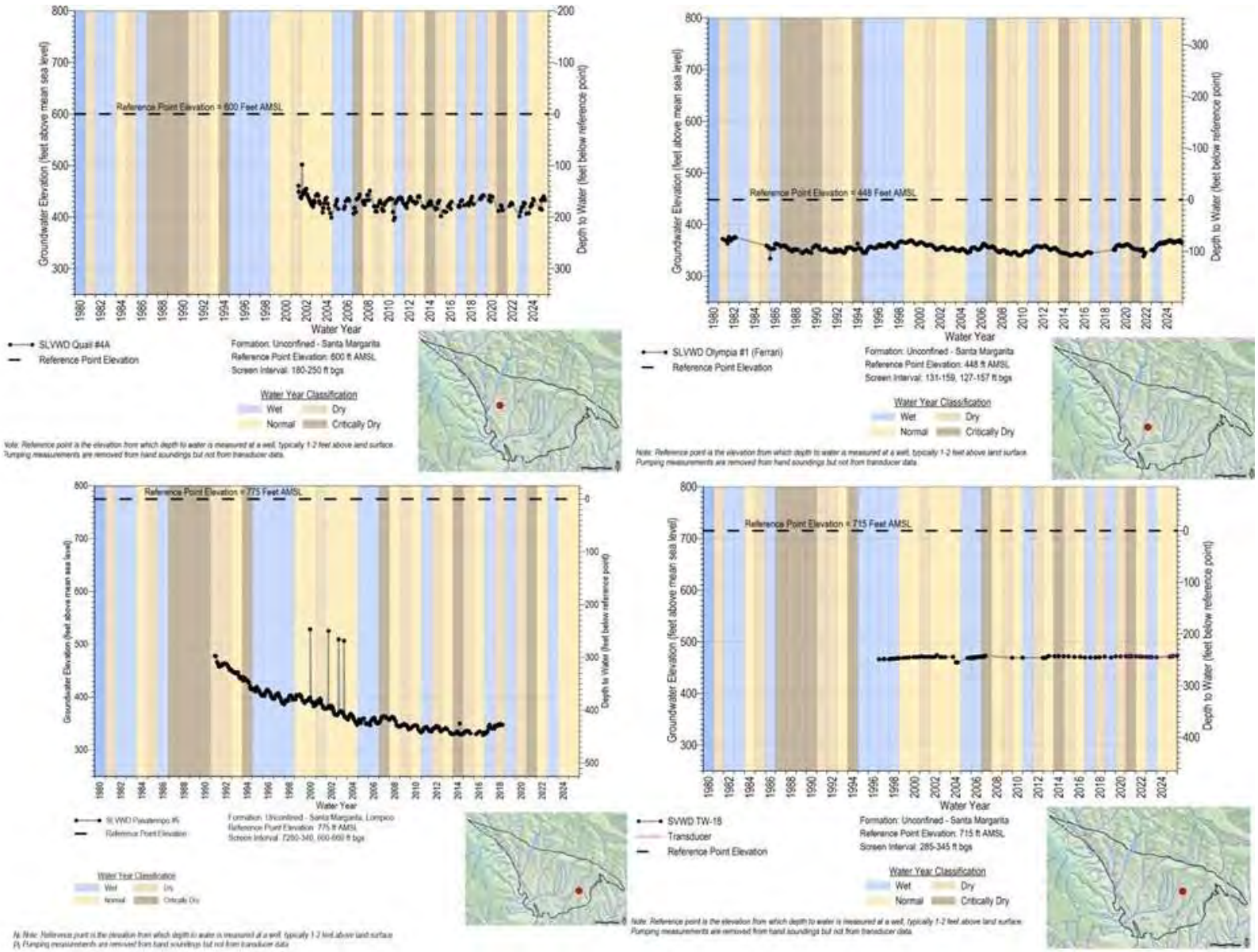



Figure 4-74-74-7. Santa Margarita Aquifer Hydrographs

### Quail Hollow and Olympia/Mission Springs Subareas

Groundwater elevations in the Santa Margarita aquifer in the Quail Hollow and Olympia/Mission Springs subareas are similar and have remained consistent over time. Groundwater elevations exhibit seasonal fluctuations from pumping and ~~decada~~annual responses to dry and wet periods (Figure 4-7).

The severity of the long-term groundwater level decline that took place in the Basin's deeper confined aquifers over the extended drought in the late 1980s through mid-1990s is not observed in the Santa Margarita aquifer in the Quail Hollow and Olympia areas. The hydrograph for SLVWD's Quail Hollow Well #4A on periods Figure 4-7 shows that, based on seasonal low elevations, there was a decline of only about 10 feet over that period. Groundwater elevations then recovered 40 feet above pre-drought levels by the end of 4 consecutive wet years that followed the drought. Rapid groundwater elevation recovery is observed during every wet period, as is typical in aquifers that have a high hydraulic conductivity and direct exposure to recharge from rainfall. The 30-foot decline in the Santa Margarita aquifer's Olympia area during the 1987 through 1994 drought was greater than in the Quail Hollow area, as shown on the SLVWD Olympia #~~2~~ 1 hydrograph on ~~periods~~ Figure 4-7. This is probably because there was more pumping from the Olympia well field during this time, especially towards the latter part of the drought.

### Mount Hermon South Scotts Valley Subarea

The Santa Margarita aquifer hydrograph for ~~SLVWD Old Probation and SLVWD~~SLVWD Pasatiempo ~~MW-2~~#6 in the Mount Hermon/South Scotts Valley subarea demonstrate greater groundwater level decline (Figure 4-7). In the Pasatiempo and Camp Evers area, dewatering of the Santa Margarita aquifer was induced by historical overpumping (Johnson, 2009). Dewatering took place because of unsustainable pumping by a combination of users: nearby sand quarry, environmental remediation to clean up contaminated groundwater, and municipal water suppliers. Declining groundwater elevations of up to 200 feet in the deeper Lompico aquifer caused the Santa Margarita aquifer to become unsaturated and eventually completely dewatered in the vicinity of where the Santa Margarita aquifer and Lompico aquifer are in direct contact (Figure 3-9). The ~~combined~~ hydrograph for ~~SLVWD Old Probation and~~ SLVWD Pasatiempo ~~MW-2~~ #6 on Figure 4-7 shows groundwater elevations declining in this well screened in the Lompico and ~~e~~ Santa Margarita aquifer ~~declining 60 feet from~~ to levels below the Santa Margarita screen interval (280-340 feet bgs) in the mid--1980s~~the early 1980s to 1989~~.

In the early 1990s, municipal water supply wells screened in the dewatered Santa Margarita aquifer in this subarea were replaced with deeper wells screened entirely in the Lompico aquifer. As a result of this change in groundwater source, along with reduced environmental remediation and quarry pumping in the Santa Margarita aquifer, by the end of 4 years of above average rainfall ending in 1998, groundwater elevations recovered approximately 25 feet (Figure 4-7).

Other than an almost 20-foot increase during the very wet year in 2017, groundwater elevations are stable since 1999. The Pasatiempo and Camp Evers areas currently remain mostly dewatered even though municipal water agencies no longer pump from the Santa Margarita aquifer.

Induced recharge through the aquifer is likely the main reason it has not completely recovered in dewatered areas. Induced recharge through the dewatered portions of the aquifer generally follows 1 of 2 pathways depending on the underlying formation: 1) infiltration to the top of the underlying low permeability Monterey Formation from where it flows until it emerges as seeps to Bean Creek, and 2) into the Lompico aquifer where it directly underlies the Santa Margarita aquifer. A secondary factor may be reduced local recharge. In the mid-1980s, most septic systems in the Scotts Valley area were converted to a sewer system. Moreover, development over time created increased impervious surfaces. These changes have resulted in less recharge and return flows to the Santa Margarita aquifer in the Scotts Valley area than prior to the 1980s.

**North Scotts Valley Subarea**

The Santa Margarita aquifer in the North Scotts Valley subarea is not pumped by SVWD. Because this part of the City of Scotts Valley is supplied water by SVWD, there are very few private wells. SVWD TW-18 is the only Santa Margarita monitoring well in the subarea and its groundwater elevations have fluctuated slightly since the start of the monitoring record in 1996 (Figure 4-7). Its trends are notably different than the Quail Hollow and Olympia/Mission Springs subareas, which demonstrate seasonal fluctuations related to groundwater pumping. Since the Monterey Formation underlies the aquifer in the North Scotts Valley subarea, groundwater levels are not influenced by pumping occurring in the deeper Butano and Lompico aquifers in the subarea.

#### ~~3.5.2.2~~4.2.2.2 Santa Margarita Aquifer Groundwater Elevation Contours and Flow Directions

Groundwater flow in the Santa Margarita aquifer generally mimics the surface topography. Groundwater flows from areas of higher elevation where the Santa Margarita aquifer is exposed at the surface and can be directly recharged, towards areas of lower elevations where groundwater is discharged. Groundwater discharge occurs in seeps at the contact between the Santa Margarita aquifer and underlying Monterey Formation, in springs, or as baseflow in Bean Creek, Zayante Creek, Newell Creek, and the San Lorenzo River in the Glen Arbor area.

As required per the GSP regulations, spring seasonal high and fall seasonal low contour maps are provided in this subsection. Figure 4-8 and Figure 4-9 show Santa Margarita aquifer groundwater elevations and flow directions for the spring ~~(seasonal high)~~ and fall ~~(seasonal low)~~ of WY~~2018~~2025, respectively. The groundwater elevations included on the Santa Margarita aquifer and all other aquifer contour maps are both a combination of interpreted contours from measured elevations at wells, and Basin M~~m~~odel-simulated elevations in areas where there are no measured data. The contour maps are produced for this and other following sections to show that

seasonal groundwater flow patterns are similar at the regional scale despite local groundwater elevation fluctuation during wet and dry seasons. The subsections below describe groundwater elevations and flow for each of the subareas.

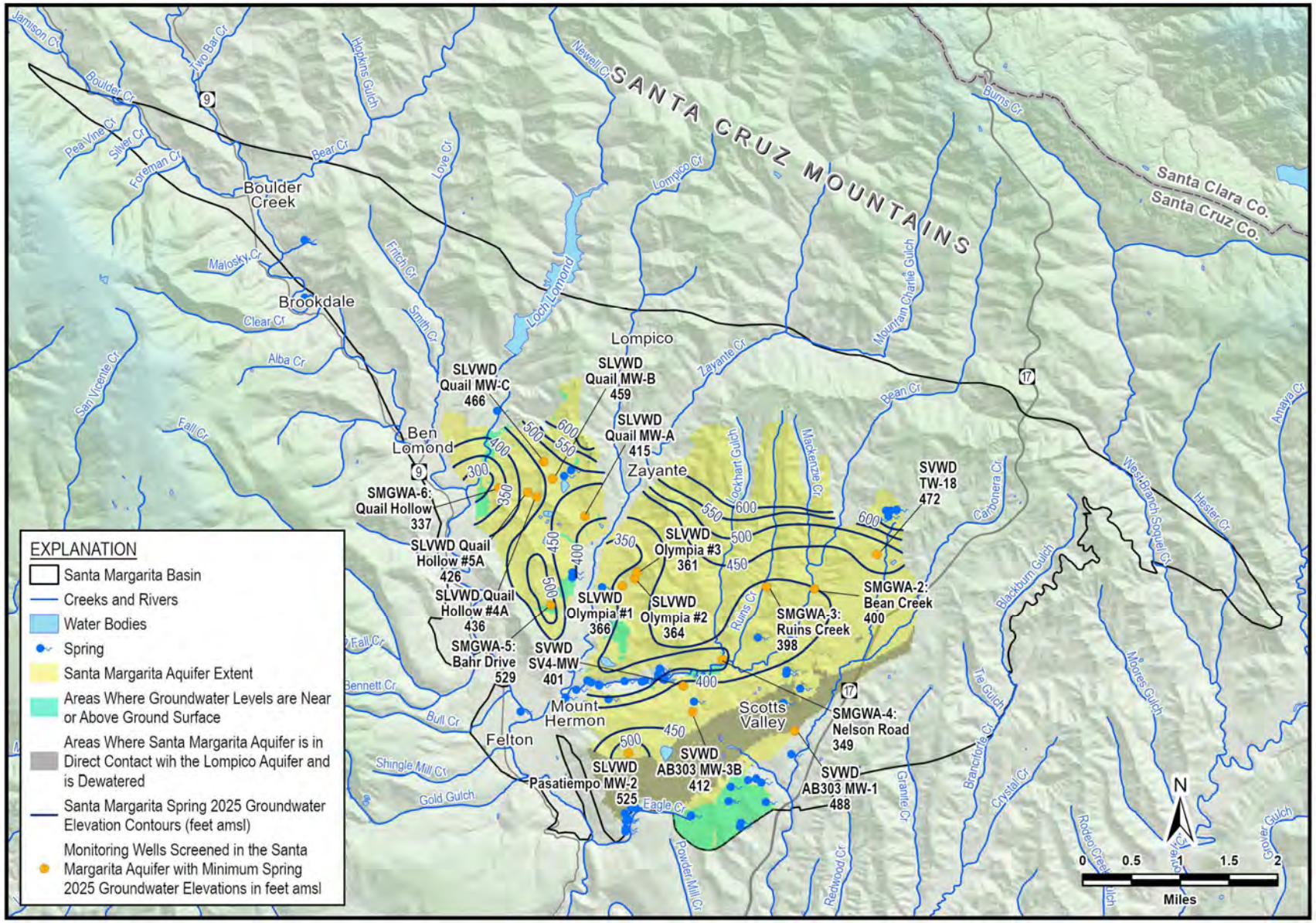

SANTA CRUZ MOUNTAINS
Santa Clara Co.
Santa Cruz Co.
Boulder Creek
Brookdale
Lompico
Ben Lomond
Zayante
Felton
Mount Hermon
Scotts Valley
SLVWD Quail MW-C 466
SLVWD Quail MW-B 459
SLVWD Quail MW-A 415
SMGWA-6: Quail Hollow 337
SLVWD Quail Hollow #5A 426
SLVWD Quail Hollow #4A 436
SMGWA-5: Bahr Drive 529
SLVWD Olympia #1 366
SLVWD Olympia #2 364
SLVWD Olympia #3 361
SVWD SV4-MW 401
SLVWD Pasatiempo MW-2 525
SVWD AB303 MW-3B 412
SVWD TW-18 472
SMGWA-2: Bean Creek 400
SMGWA-3: Ruins Creek 398
SMGWA-4: Nelson Road 349
SVWD AB303 MW-1 488
EXPLANATION
Santa Margarita Basin
Creeks and Rivers
Water Bodies
Spring
Santa Margarita Aquifer Extent
Areas Where Groundwater Levels are Near or Above Ground Surface
Areas Where Santa Margarita Aquifer is in Direct Contact wih the Lompico Aquifer and is Dewatered
Santa Margarita Spring 2025 Groundwater Elevation Contours (feet amsl)
Monitoring Wells Screened in the Santa Margarita Aquifer with Minimum Spring 2025 Groundwater Elevations in feet amsl
N
0 0.5 1 1.5 2
Miles

Figure 4-84-84-4-8. Santa Margarita Aquifer Groundwater Elevations and Contours, Spring 2025Spring (March) Water Year 20182025 Groundwater Elevations in the Santa Margarita Aquifer

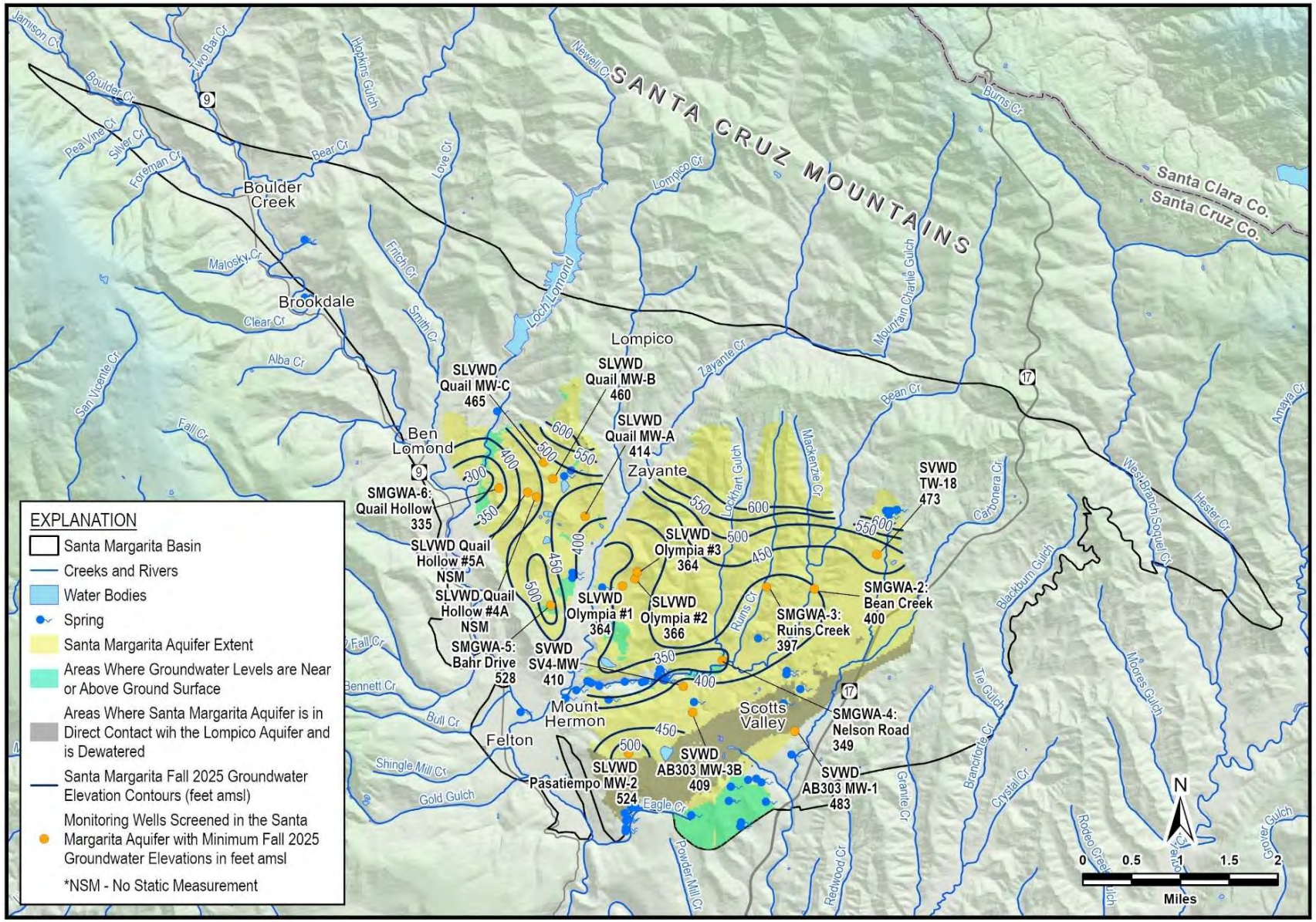



Figure 4-~~94~~ ~~94~~ 4-~~9~~. Santa Margarita Aquifer Groundwater Elevations and Contours, Fall 2025~~Fall (September) Water Year 2018 2025 Groundwater Elevations in~~

~~the Santa Margarita Aquifer~~

#### ~~3.5.2.2.1~~4.2.2.2.1 *QUAIL HOLLOW SUBAREA*

The Quail Hollow subarea is located in the central portion of the Basin, between the communities of Ben Lomond, Glen Arbor, Felton, Zayante, and Lompico (Figure 4-4). It lies between Love Creek and Lompico/Zayante Creek and is intersected by Newell Creek. Almost the entire subarea has Santa Margarita aquifer exposed at the surface. Groundwater in this subarea is pumped by SLVWD's Quail Hollow wellfield, the Quail Hollow sand quarry, and private domestic pumpers.

Johnson (2009) and Kennedy/Jenks Consultants (2015) describe the subarea groundwater elevations as generally mimicking the topography ~~in a subdued manor~~ as a result of mounded recharge beneath hills and ridges and groundwater discharge to ~~downcut~~ eroded stream channels. Perennial streams and springs are generally an expression of the groundwater table. Under high groundwater table conditions in wet years, the saturated thickness of the Santa Margarita sandstone reaches 130 feet thick. During drought conditions, the groundwater surface partially flattens but maintains a similar shape. Groundwater flows toward the center of Quail Hollow from the north and south, east toward Zayante Creek, west toward the Quail Hollow wellfield where there is a localized pumping depression and then toward Newell Creek. Under drought conditions, some groundwater flows west under Newell Creek toward the San Lorenzo River. Springs occur where the groundwater table intersects the ground surface. Most springs in the subarea occur on the northern flank of the lower Zayante Creek valley where the contact between Santa Margarita Sandstone and Monterey Formation outcrops at the surface, forcing groundwater perched above the Monterey Formation to emerge as springs and seeps.

#### ~~3.5.2.2.2~~4.2.2.2.2 *OLYMPIA/MISSION SPRINGS SUBAREA*

The Olympia/Mission Springs subarea is north of Bean Creek and lies between the communities of Mount Hermon, Zayante, and Scotts Valley (Figure 4-4). The subarea is a hillslope area where hilltop ridges are capped by Santa Cruz Mudstone and Purisima Formation, which limits recharge to the Santa Margarita aquifer below. Private domestic pumpers and small water systems provide the majority of water to the residents in the subarea. The only municipal pumping occurs in the western portion of the subarea where SLVWD has its Olympia wellfield.

The highest groundwater elevations are in upland areas in the northern portion of the subarea (Figure 4-8 and Figure 4-9) where recharge to the exposed portions of the aquifer occurs by direct percolation of precipitation and streambed percolation in the upper reaches of creeks. Groundwater flows from the upland areas to lower elevations discharging at: 1) Zayante Creek, west of the Olympia wellfield;~~,~~ 2) near the confluence of Lockhart Gulch and Ruins Creek with Bean Creek;~~,~~ and 3) in springs that occur at the contact of the Santa Margarita aquifer and Monterey Formation along the sides of Zayante and Bean ~~Creeks~~creeks. A localized pumping depression is associated with the Olympia wellfield.

The Olympia/Mission Springs subarea is separated from the Pasatiempo/Camp Evers/Scotts Valley subarea by Bean Creek, which is a groundwater discharge location in the Santa Margarita aquifer, as shown on the groundwater elevation contour maps (Figure 4-8 and Figure 4-9). Groundwater level declines north of Bean Creek are unlikely to influence groundwater elevations south of Bean Creek, and vice versa.

#### ~~3.5.2.2.3~~4.2.2.2.3 *North Scotts Valley and Mount Hermon/South Scotts Valley Subareas*

The Santa Margarita aquifer south of Bean Creek is divided into 2 subareas: North Scotts Valley and Mount Hermon/South Scotts Valley (Figure 4-4). Most of the Santa Margarita aquifer in the North Scotts Valley subarea is overlain by the Santa Cruz Mudstone. There has not been municipal pumping in the subarea, and there is limited private domestic pumping.

The Mount Hermon/South Scotts Valley subarea lies south of the lower to mid-reach of Bean Creek (Figure 4-4), both where it is exposed at the surface and locally overlain by the Santa Cruz Mudstone. It includes most of the City of Scotts Valley, the communities of Camp Evers and Mount Hermon, and the former Hanson Quarry (Figure 4-4). It is considered separately from the Northern Scotts Valley subarea because it contains the dewatered portion of the aquifer.

Most of the groundwater pumping in the Mount Hermon/South Scotts Valley subarea is by municipal suppliers, SVWD, SLVWD, and MHA, who pump from the deeper Lompico aquifer and not from the Santa Margarita aquifer. Historically, municipal, environmental remedial, and sand quarry pumping from the Santa Margarita aquifer took place in the subarea, but that use no longer occurs, as described in Section 4.2. There is also limited pumping by private domestic pumpers in the subarea.

The highest groundwater elevations are in the upland areas in the North Scotts Valley subarea (Figure 4-8 and Figure 4-9). Groundwater recharge is mostly from precipitation and streambed percolation where the Santa Margarita aquifer is exposed at the surface. Santa Cruz Mudstone overlying much of the Santa Margarita ~~Aquifer~~ aquifer limits the amount of precipitation and return flows reaching the aquifer. Groundwater recharge also occurs along Carbonera Creek where it flows in the Santa Margarita aquifer or the alluvium directly overlying the Santa Margarita aquifer (Kennedy/Jenks Consultants, 2015).

Groundwater flows south from the northern upland area and north from Mount Hermon to the central part of the subarea. Groundwater flow converges toward Bean Creek where the lowest groundwater elevations are found along the subarea's boundary with the Olympia/Mission Springs subarea. Bean Creek is the primary groundwater discharge area for groundwater in the subareas south of Bean Creek. In the western portion of the Mount Hermon/South Scotts Valley subarea, groundwater discharges at numerous springs along the Santa Margarita Sandstone outcrop areas bordering Bean, Eagle, and Camp Evers Creeks. Figure 4-8 and Figure 4-9 indicate areas where groundwater elevations simulated in the groundwater model lie above the land

surface. These areas correlate with known springs, which are indicated on the contour maps. Historically, some of MHA's water supply was from the Ferndell and Redwood springs. Water discharged by these springs is now sourced from the upland areas of the Santa Margarita aquifer adjacent to the springs.

In the past, when there was environmental remediation, quarry, and municipal pumping in the Santa Margarita aquifer, there were localized pumping depressions in the aquifer, but those have dissipated since that pumping ceased.

Figure 4-8 and Figure 4-9 show the location where the Santa Margarita aquifer is unsaturated or dewatered for its entire thickness. Even with portions of the aquifer dewatered, groundwater flow in this area is still toward Bean Creek.

### ~~3.5.3~~4.2.3 Monterey Formation Groundwater Elevations

As described in Section 3.4.5.3, the Monterey Formation is not a high yielding aquifer and is not considered a principal aquifer, but its groundwater is pumped by some Basin residents because there is no alternative water source. Groundwater elevation data for wells screened in the Monterey Formation in the Basin are very limited. The only long-term record is from SVWD Well #9 previously thought to be screened in the Santa Margarita aquifer (Kennedy/Jenks Consultants, 2015). The lack of monitoring data in the Monterey Formation ~~indicates a data gap that should be~~was addressed by adding ~~some~~ 1 private well~~s~~ to the County's private well monitoring network described in Section 2.2.4.1~~,~~ and ~~by~~ ~~or by~~ installing 2 new dedicated monitoring wells~~, as~~ described in Section 6.9.1.

The single hydrograph for the Monterey Formation on Figure 4-10 shows that groundwater elevations have a much more pronounced response to drought and increased water usage than the Santa Margarita aquifer, presumably because recharge to sandy layers tapped in the Monterey Formation is impeded by the low conductance of the surrounding mudstone and shale layers. A decline in groundwater elevations of about 150 feet corresponds with an extended dry period that started in the mid-1980s (Figure 4-10) and population growth in the Basin. It is notable that the SVWD Well #9 was pumped more between 1983 and 1988 than in the years before and after. Groundwater elevations stabilized in 1994 during a period of 4 consecutive wet years. ~~Since 1998, a~~A more typical rainfall pattern and ~~a~~ significantly ~~50%~~ reduced~~tion in~~ extraction from SVWD Well #9 has allowed groundwater elevations to recover by about ~~30~~75 feet (Figure 4-10). ~~SVWD Well #9 hwas rarely Itsbeen used for water supply since 2008, and the~~ pump was removed ~~pulled from the well~~ in early 2026 and the well ~~. It~~ is now only used for monitoring.

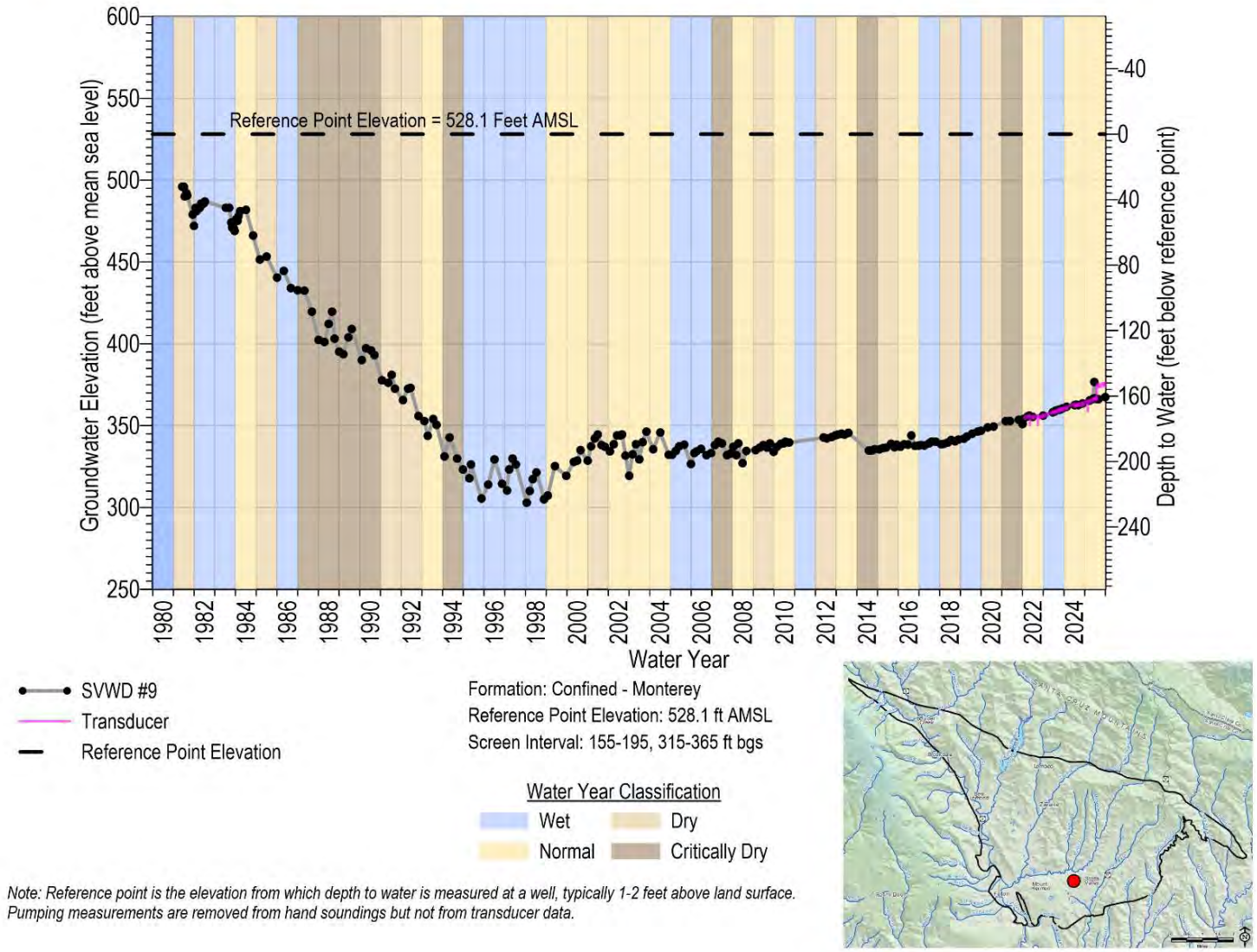



Figure 4-104~~-104-4-10~~. Monterey Formation Hydrograph

### ~~3.5.4~~4.2.4 Lompico Aquifer Groundwater Elevations

#### ~~3.5.4.1~~4.2.4.1 Lompico Aquifer Groundwater Elevations over Time

Most of the groundwater pumped from the Lompico aquifer in the Basin is extracted in the Scotts Valley area~~, because this area has the sole potable source available to SVWD~~ by SVWD. The Lompico aquifer is also pumped by the SLVWD Pasatiempo and MHA wellfields to the south of Scotts Valley. There is little to no Lompico aquifer pumping north of Bean Creek and therefore there has been no historical groundwater level monitoring conducted in the North of Bean Creek subarea (Figure 4-6).

In the Mount Hermon/South Scotts Valley subarea of the Basin, which includes central Scotts Valley south of Bean Creek, Camp Evers, and Pasatiempo, groundwater elevations in the Lompico aquifer declined as much as 200 feet in well SVWD #10 during the drought period between 1985 and 1994 (Figure 4-11). Other nearby wells have a shorter measurement record but display similar trends. The groundwater elevation declined more in this subarea than in other parts of the Basin during the drought due to population growth, remediation pumping at 2 cleanup sites, and pumping at the Hanson Quarry that led to overextraction of groundwater.

Subsequent groundwater management efforts and reduced pumping due to water conservation have slowed the decline in groundwater levels. Groundwater levels ~~, stabilizing~~ stabilized~~them~~ in the early 2000s and, ~~. S~~since 2017, ~~there has been a small but sustained increase in groundwater elevations~~ increased in the subarea by~~of~~ about ~~10~~ 25 to 50 feet ~~per year~~ (Figure 4-11). Part of this recovery is attributed to the emergency use of SLVWD interties for wildfire recovery, allowing for additional surface water diversion from the Felton System to offset groundwater pumping from the Pasatiempo wellfield.

~~The SVWD TW-19 monitoring well installed in t~~The North Scotts Valley subarea demonstrates similar overall trends, though the record only starts in 1996 and has a short-term groundwater level increase between 1996 and 2000 not observed in the other hydrographs. Groundwater elevations at SVWD TW-19 have also increased by about 50 feet since 2017 (Figure 4-11).

~~For the purposes of groundwater management in the Basin, it is important to highlight that~~ Groundwater elevation data for wells in the Lompico aquifer indicate that sometime around 2012, pumping volumes ceased to be unsustainable. Most wells exhibited more or less constant seasonal lows in groundwater elevation during the ~~recent drought of~~ 2012-2015 drought. Moreover, it appears that groundwater elevations have been recovering since 2017. These facts suggest that over-pumping is no longer occurring in the Lompico aquifer.

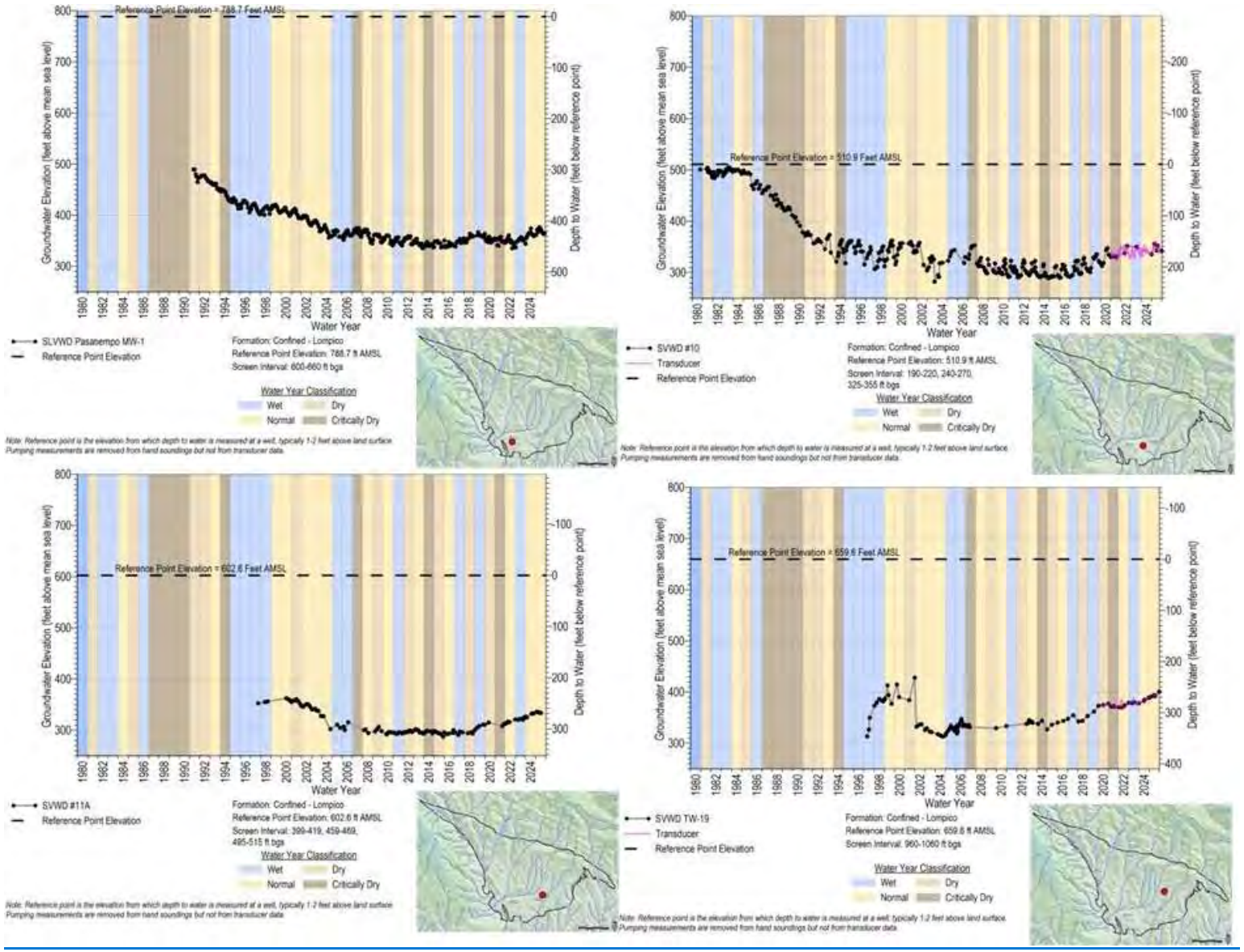



Figure 4-114~~-114-4-11~~. Lompico Aquifer Hydrographs

### ~~3.5.4.2~~4.2.4.2 Lompico Aquifer Groundwater Elevation Contours and Flow Directions

The highest groundwater elevations in the Lompico aquifer occur at the northern boundary of the Basin, where the Lompico Sandstone is exposed at the surface in a narrow strip parallel to the Zayante-Vergeles fault. This is the only area the Lompico aquifer can be recharged directly by percolation of precipitation or streamflow; elsewhere it is covered by younger geologic units that prevent direct recharge. Groundwater flow in the southern portion of the Lompico aquifer is primarily controlled by municipal pumping in the Scotts Valley area by SVWD and in the Pasatiempo area by SLVWD and MHA. Extraction of water causes depression of groundwater levels around the wells, such that groundwater flows down-gradient from the north and south toward the pumping wells. Groundwater elevation contours for Spring and Fall of ~~WY2018~~ WY2025 are shown on Figure 4-12 and Figure 4-13, respectively.

Measured groundwater elevation data are only available in the Pasatiempo, Camp Evers, and Scotts Valley areas. Consequently, the contour maps (Figure 4-12 and Figure 4-13) ~~include large areas that display model-simulated contours~~do not include contours north of Bean Creek. ~~The s~~Basin Model simulations identify~~imulated contours reveal~~ 3 primary discharge points along the San Lorenzo River where ~~there is outcrop of~~ the Lompico Sandstone outcrops. These ~~include~~ discharge points, ~~outcrops~~ shown in teal on the figures, are found on the west side of the Ben Lomond fault near Felton and further upstream near the communities of Ben Lomond and Boulder Creek. These locations are where the Lompico aquifer contributes to San Lorenzo River baseflow.

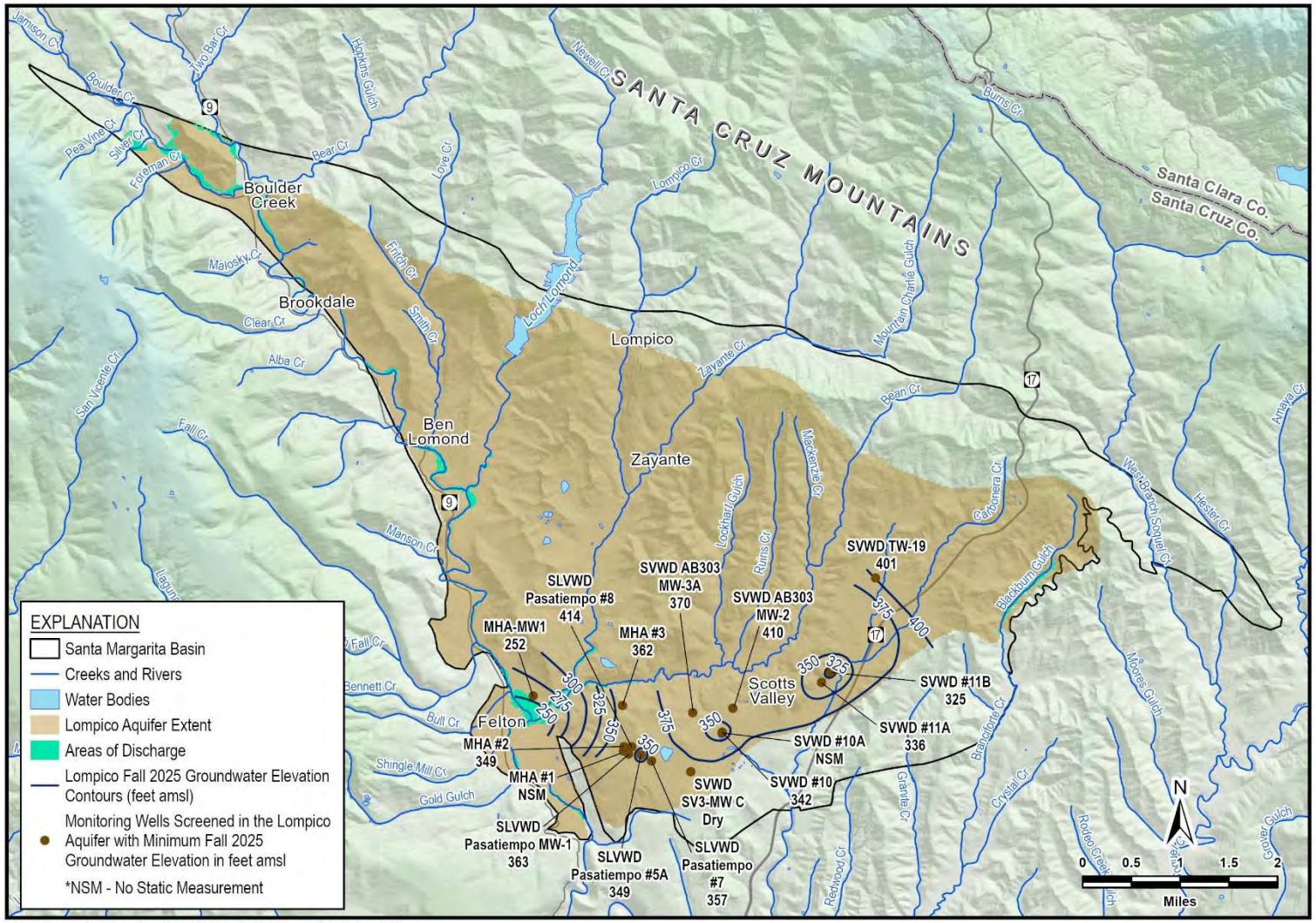



Figure 4-124~~-124~~-4-12. Lompico Aquifer Groundwater Elevations and Contours, Spring 2025~~Spring (March) Water Year 2018 Groundwater Elevations in the Lompico Aquifer~~

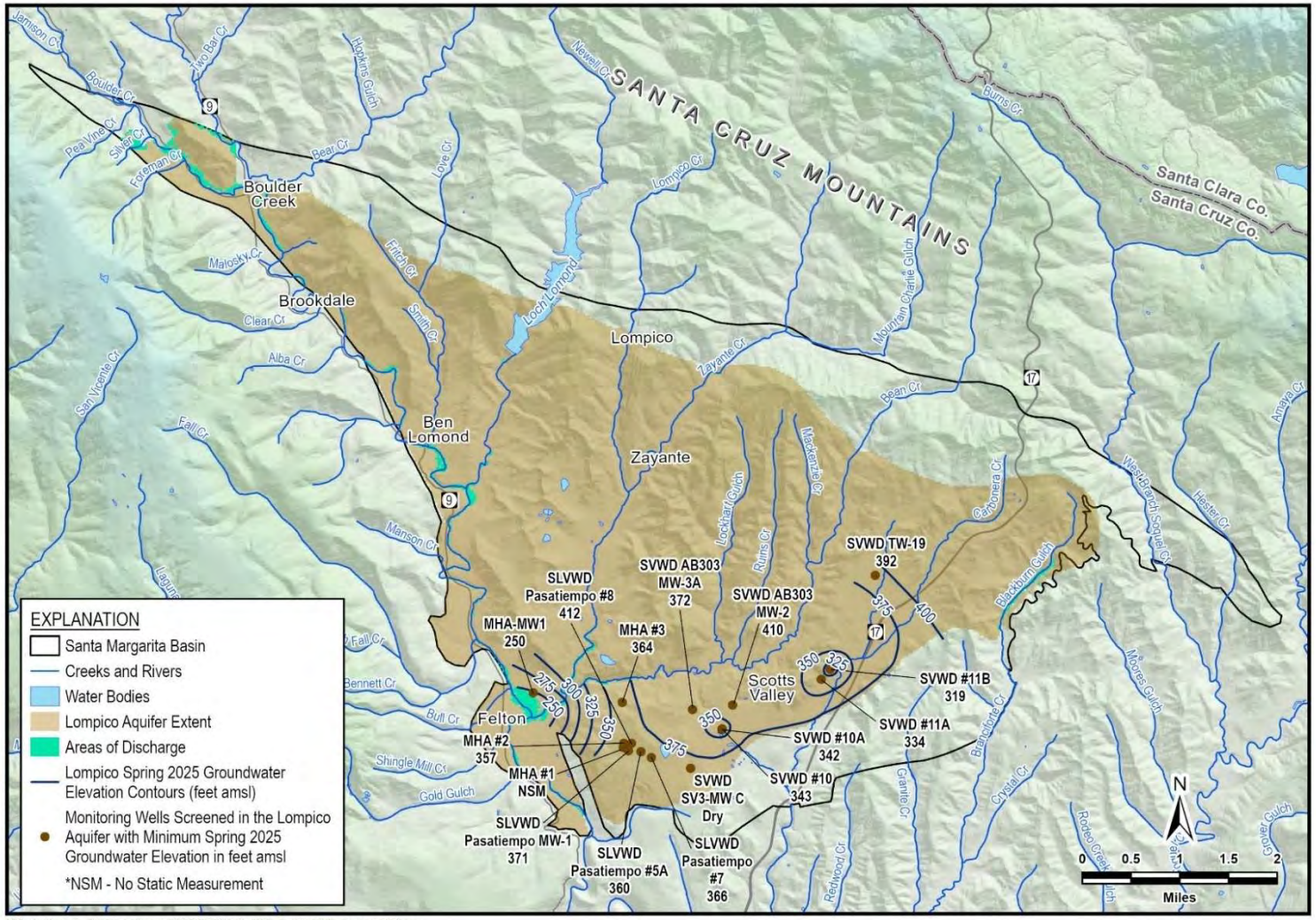

SANTA CRUZ MOUNTAINS
Santa Clara Co.
Santa Cruz Co.
Boulder Creek
Brookdale
Lompico
Ben Lomond
Zayante
Felton
Scotts Valley
EXPLANATION
Santa Margarita Basin
Creeks and Rivers
Water Bodies
Lompico Aquifer Extent
Areas of Discharge
Lompico Spring 2025 Groundwater Elevation Contours (feet amsl)
Monitoring Wells Screened in the Lompico Aquifer with Minimum Spring 2025 Groundwater Elevation in feet amsl
*NSM - No Static Measurement
SLVWD Pasatiempo #8 412
SVWD AB303 MW-3A 372
SVWD AB303 MW-2 410
SVWD TW-19 392
MHA-MW1 250
MHA #3 364
SVWD #11B 319
SVWD #11A 334
SVWD #10A 342
SVWD #10 343
MHA #2 357
MHA #1 NSM
SVWD SV3-MW C Dry
SLVWD Pasatiempo MW-1 371
SLVWD Pasatiempo #5A 360
SLVWD Pasatiempo #7 366
N
0 0.5 1 1.5 2
Miles
H:\Santa_Margarita_Basin\AnnualReports\WY 2025\GIS\ArcPro\GWL_Contours\GWL_Contours_2025.aprx

Figure 4-134-134-4-13. Lompico Aquifer Groundwater Elevations and Contours, Fall 2025Fall (September) Water Year 2018 Groundwater Elevations in the Lompico Aquifer

## ~~3.5.5~~4.2.5 Butano Aquifer Groundwater Elevations

### ~~3.5.5.1~~4.2.5.1 Butano Aquifer Groundwater Elevations over Time

The Butano aquifer is the deepest of the productive aquifers in the Basin. Due to its great depth, there are few wells completed in it, and limited groundwater elevation data available for analysis. SVWD's water supply wells in the aquifer are SVWD Sucinto (#3B replacement), Grace Way, ~~SVWD #3B~~ and ~~#7A/~~Orchard Well (#7A ~~was replaced~~replacement ~~in WY2018 by the similarly screened Orchard Well~~). The SVWD supply wells are screened in both the Butano Formation, at depths greater than 1,000 feet, and the overlying Lompico Formation; hence groundwater elevations measured in these supply wells are a composite elevation from both aquifers. As such, the groundwater elevations are not specific to the Butano aquifer making them difficult to interpret. The SVWD Canham and Stonewood monitoring wells are installed entirely within the Butano aquifer though not close to the SVWD supply wells (Figure 4-6).

Hydrographs shown on Figure 4-14 reflect long-term stable groundwater elevation trends since 1994, especially in the Butano-specific monitoring wells. The monitoring wells do not have seasonal groundwater elevation fluctuations. The supply wells show seasonal groundwater elevation fluctuations of greater than 50 feet, due to pumping during high-demand summer months, and the influence of flow to the supply wells from multiple aquifers.

~~For the long-term management of the Butano aquifer, a dedicated monitoring well in the Butano aquifer closer to the Lompico/Butano aquifer water supply wells will be drilled in 2022~~is ~~planned at Vine Hill School in Scotts Valley.~~

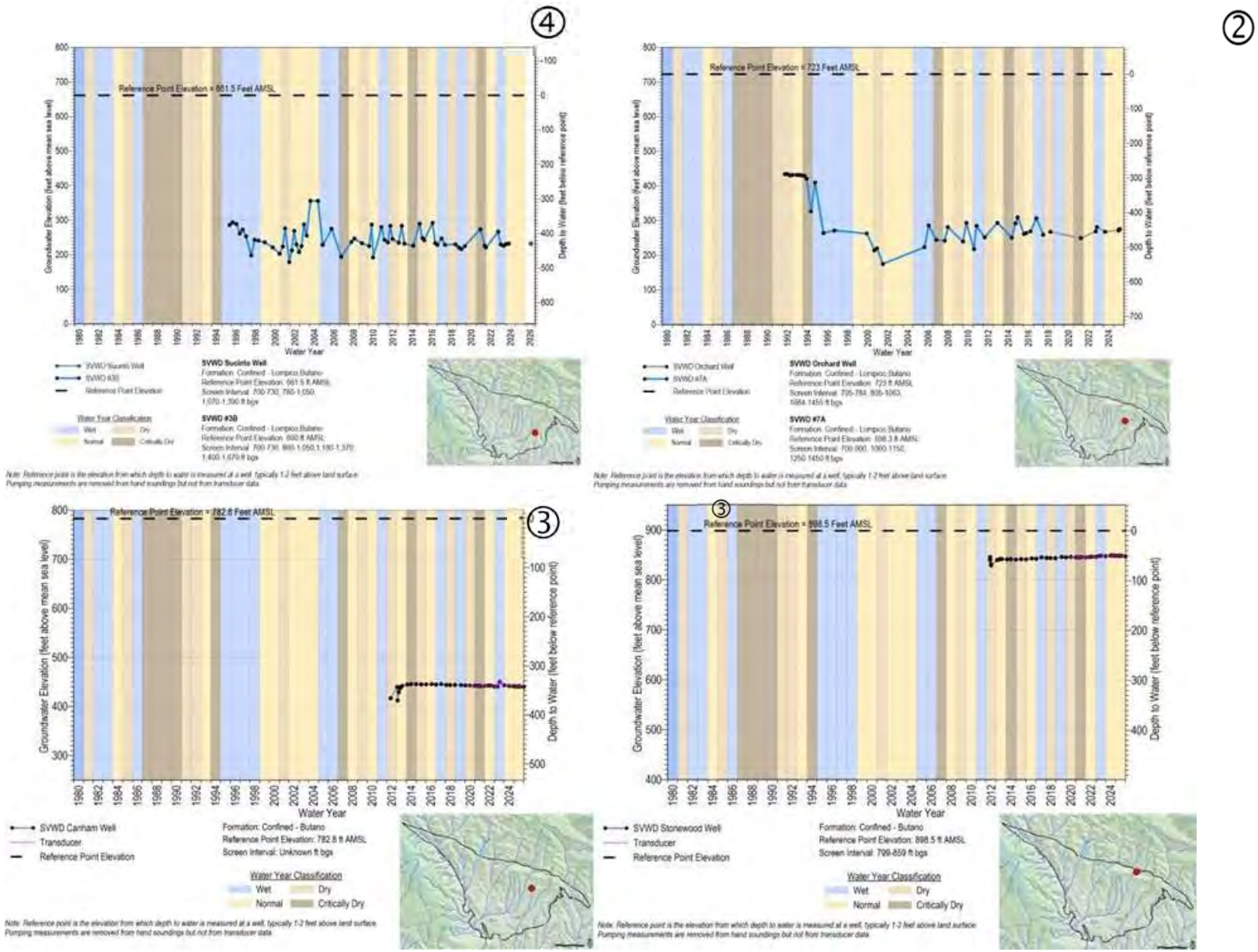



Figure 4-14~~4-14~~ ~~4-14~~. Butano Aquifer Hydrographs

### ~~3.5.5.24~~.2.5.2 Butano Aquifer Groundwater Elevation Contours and Flow Directions

The limited wells available to contour groundwater elevations in the Butano aquifer are shown on Figure 4-6:

- SVWD's Canham and Stonewood monitoring wells are screened solely in the Butano aquifer ~~(Figure 2-39),~~
- Monitoring well SVWD #15 ~~(Figure 2-39)~~ is screened roughly in equal lengths in the Lompico and Butano aquifers and is at times highly influenced by pumping at Orchard and Sucinto wells. It is still useful for groundwater elevation contour maps, but only with strict quality control of the data to ensure that only static groundwater levels are being used for analysis; ~~(Figure 2-39Figure 2-39), and~~
- SVWD's ~~2~~ active Butano aquifer supply wells, ~~#~~Grace Way, ~~3B~~Sucinto (#3B replacement), and Orchard (#7A replacement) ~~Well~~, are screened in the Lompico and Butano aquifers and are not suitable for ~~control points for~~ contouring because 1) they do n~~n~~ot consistently have static levels unless they are offline for an extended period of time, and 2) although in the past it has been assumed their groundwater levels are more representative of the Butano aquifer than the Lompico aquifer because a greater percentage of their screened interval is within the Butano aquifer (Kennedy/Jenks Consultants, 2015), this has not been confirmed with downhole flow surveys. Recent flow surveys for Sucinto and Grace Way well installations suggest that the aquifers contribute about equal volumes to the supply wells~~inclu~~. ~~Monitoring well SVWD #15 located very close to these 2 pumping wells is therefore a better control point for contouring.~~

Groundwater elevation contour maps for spring and fall of ~~WY2018~~WY2025~~, respectively~~, are shown on Figure 4-15 and Figure 4-16, respectively. The extent of the Butano aquifer contours is limited to just the area of available control points. Since these are the same points used for model calibration there is greater uncertainty in the simulated contours with distance from the control points. Also, complicating the simulated elevations is that each of the 3 Butano Sandstone members (upper, middle, and lower) are assigned their own model layers and thus each has its own simulated groundwater elevations which makes it difficult to produce a realistic combined contour map.

Like groundwater elevations in the Lompico aquifer, the Butano aquifer's highest groundwater elevations are where it is exposed at the surface along the Basin's northern boundary parallel to the Zayante-Vergeles fault. This is an important recharge area for the aquifer as it can only be recharged directly by percolation of precipitation and streamflow where it is exposed at the surface. The drawdown caused by pumping ~~the SVWD's Well #3B and Orchard~~ SVWD's Lompico/Butano extraction w~~W~~ells forms ~~a~~ local pumping depressions ~~around them~~. The Canham and Stonewood monitoring wells have higher groundwater elevations than the water

supply wells, which indicates that groundwater flow is mostly north to south towards the pumping center caused by the Lompico/Butano aquifer water supply wells. Model-simulated groundwater elevations indicate that south of the pumping depression there is south to north flow towards the depression.

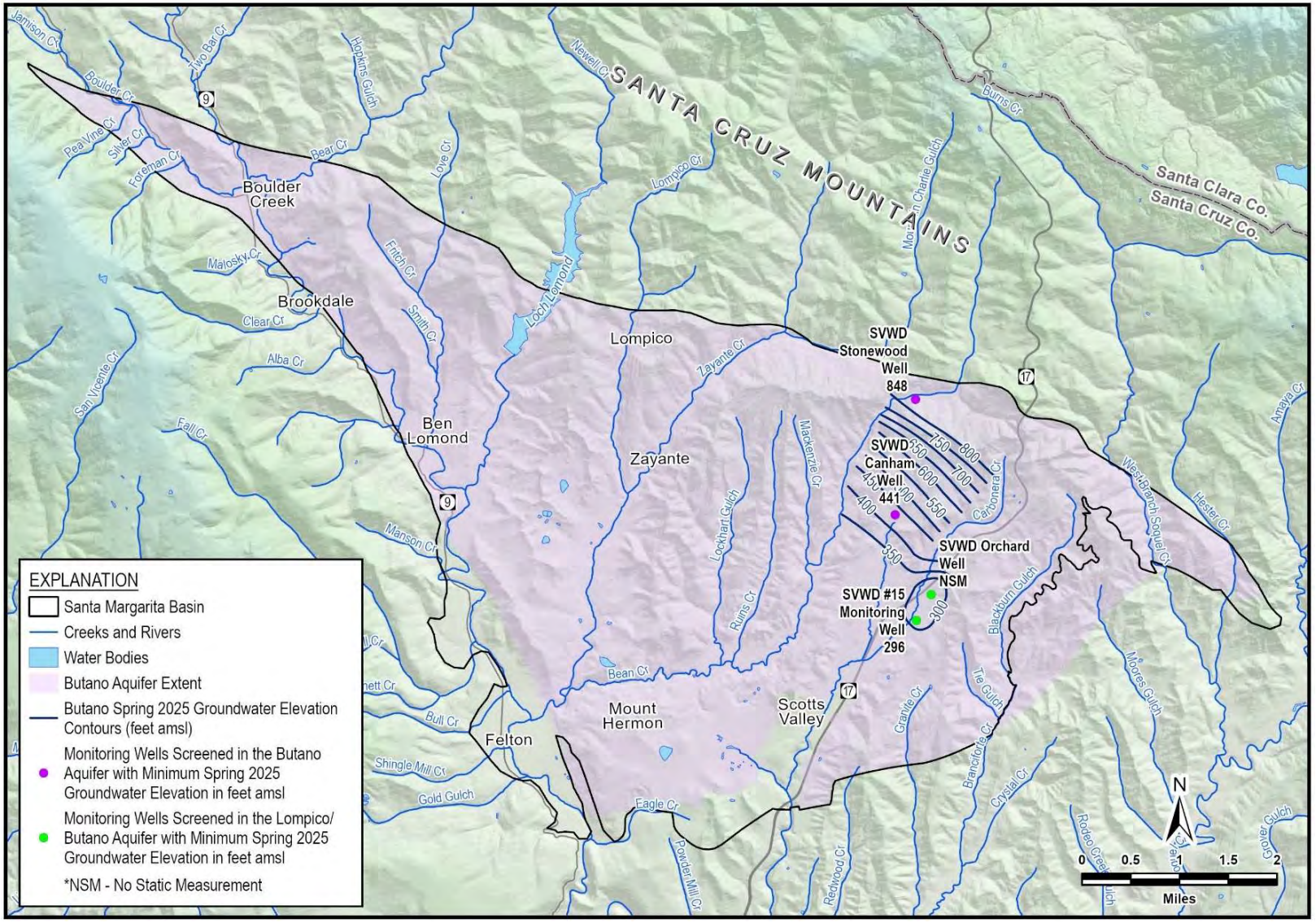



Figure 4-154~~-154-4-15~~. Butano Aquifer Groundwater Elevations and Contours, Spring 2025~~Spring (March) Water Year 2018~~2025 ~~Groundwater Elevations in the Butano Aquifer~~

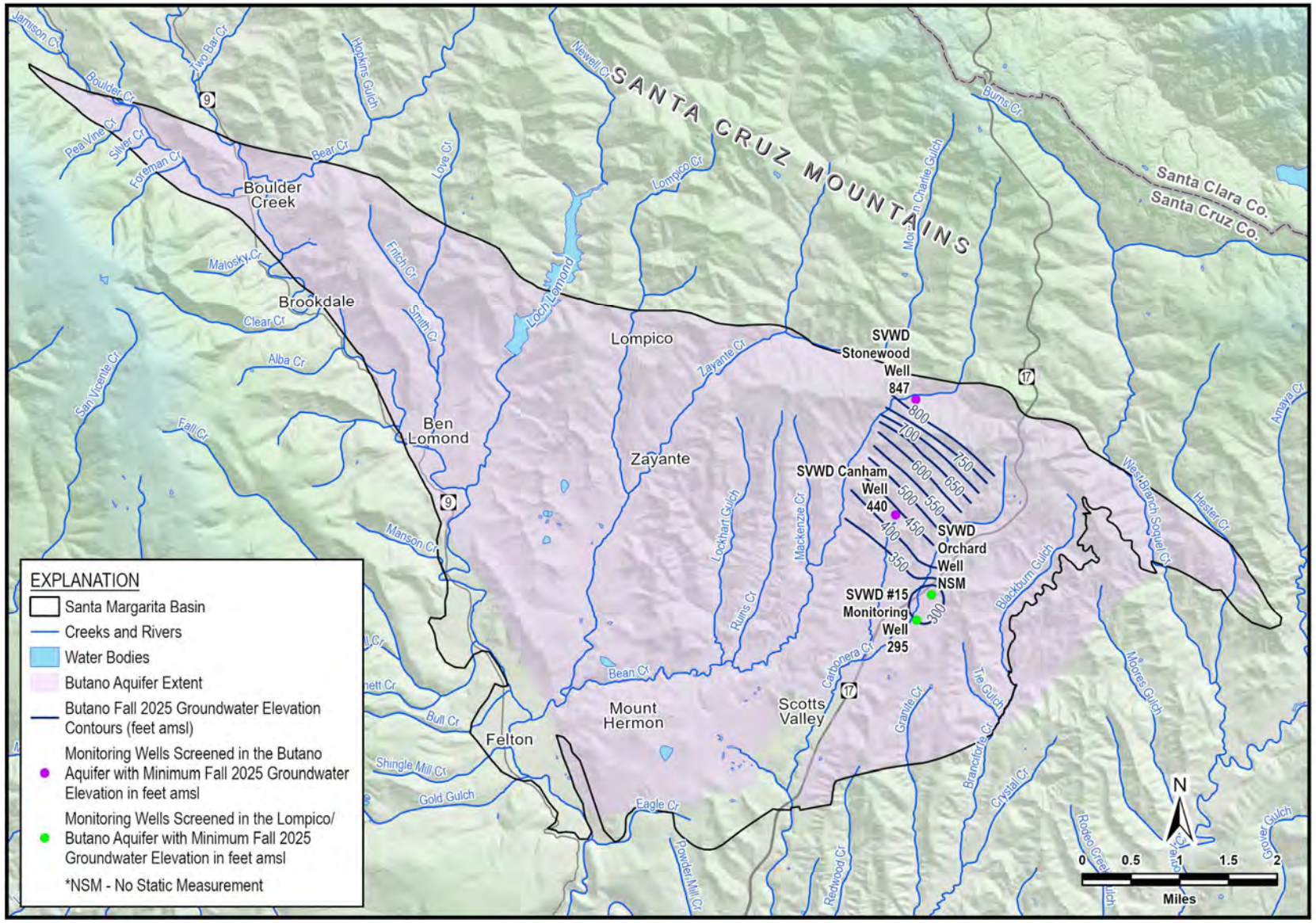

SANTA CRUZ MOUNTAINS
Santa Clara Co.
Santa Cruz Co.
Boulder Creek
Brookdale
Lompico
Ben Lomond
Zayante
Mount Hermon
Scotts Valley
Felton
Loch Lomond
SVWD Stonewood Well 847
SVWD Canham Well 440
SVWD Orchard Well NSM
SVWD #15 Monitoring Well 295
800
700
750
650
600
550
500
450
400
350
300
EXPLANATION
Santa Margarita Basin
Creeks and Rivers
Water Bodies
Butano Aquifer Extent
Butano Fall 2025 Groundwater Elevation Contours (feet amsl)
Monitoring Wells Screened in the Butano Aquifer with Minimum Fall 2025 Groundwater Elevation in feet amsl
Monitoring Wells Screened in the Lompico/ Butano Aquifer with Minimum Fall 2025 Groundwater Elevation in feet amsl
*NSM - No Static Measurement
N
0 0.5 1 1.5 2
Miles

Figure 4-164~~-164-4-16~~. Butano Aquifer Groundwater Elevations and Contours, Fall 2025~~Fall (September) Water Year 2018~~2025 ~~Groundwater Elevations in the Butano Aquifer~~

### ~~3.5.6~~4.2.6 Vertical Hydraulic Gradients

Differences in groundwater elevations between the Basin's aquifers and within some of the thicker aquifer units create vertical hydraulic gradients. Vertical gradients produce upward or downward flow within aquifers, or flow between overlying or underlying aquifers. Previous studies have identified substantial vertical gradients in the Pasatiempo, Camp Evers, and Scotts Valley areas, where overpumping in the Lompico aquifer has created local pumping depressions that cause groundwater to flow downward (Johnson, 2009; Kennedy/Jenks Consultants 2015).

In the relatively small area of the Basin where the Santa Margarita and Lompico aquifers are in direct contact with each other (Figure 3-9), the vertical hydraulic gradient induces recharge from the unconfined Santa Margarita aquifer into the deeper Lompico aquifer (Kennedy/Jenks Consultants 2015). For most of the Basin where the fine-grained Monterey Formation separates the Santa Margarita and Lompico aquifers, downward vertical flow is significantly reduced. Figure 4-17 and Figure 4-18 show groundwater elevation hydrographs for 2 sets of multi-level monitoring wells located in the Pasatiempo / Camp Evers area. Groundwater elevations in the Santa Margarita aquifer at these locations are currently at least 50 feet to 150 feet higher than in the confined Lompico aquifer that is separated from the Santa Margarita aquifer by the Monterey Formation. The hydrographs on Figure 4-18 for the Pasatiempo monitoring wells illustrate how continually lowered groundwater elevations in the Lompico aquifer progressively increased the downward vertical gradient over time. At the start of the hydrograph record, groundwater elevation differences are around 10 feet, and increase to roughly 150 feet. It is possible that prior to 1990, the vertical hydraulic gradient may have been upward, with the Lompico aquifer elevations being higher than those in the Santa Margarita aquifer.

Vertical hydraulic gradient information is only available in the Pasatiempo/Camp Evers/southern Scotts Valley area because this is the only area where groundwater elevation data from nested or multi-level monitoring wells are available. There is not enough information to assess vertical gradient between the Lompico and Butano aquifers.

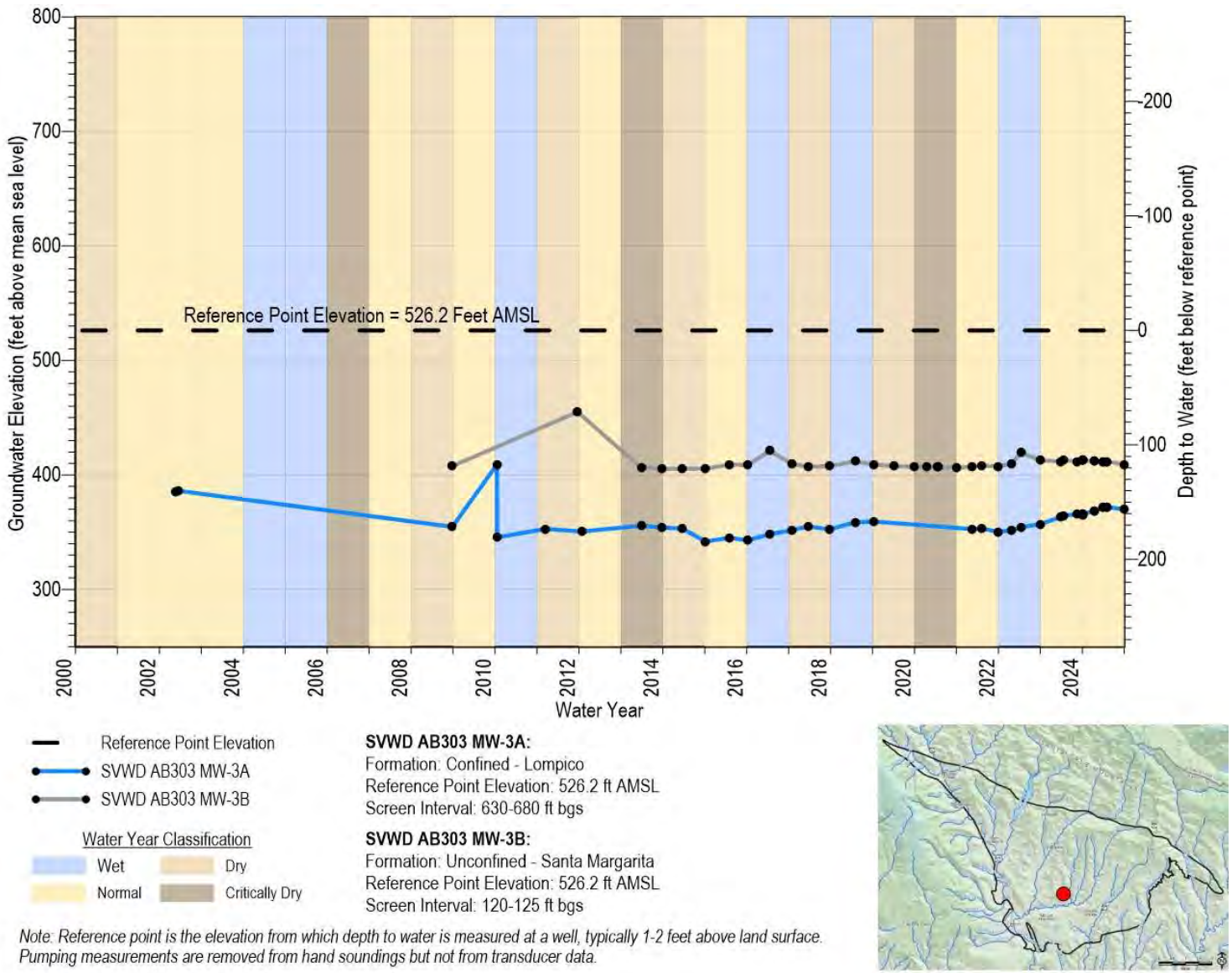



Figure 4-17~~4-17~~~~4-17~~. Monitoring Well AB303 MW-3A and AB303 MW-3B Hydrographs Illustrating Vertical Gradients Over Time

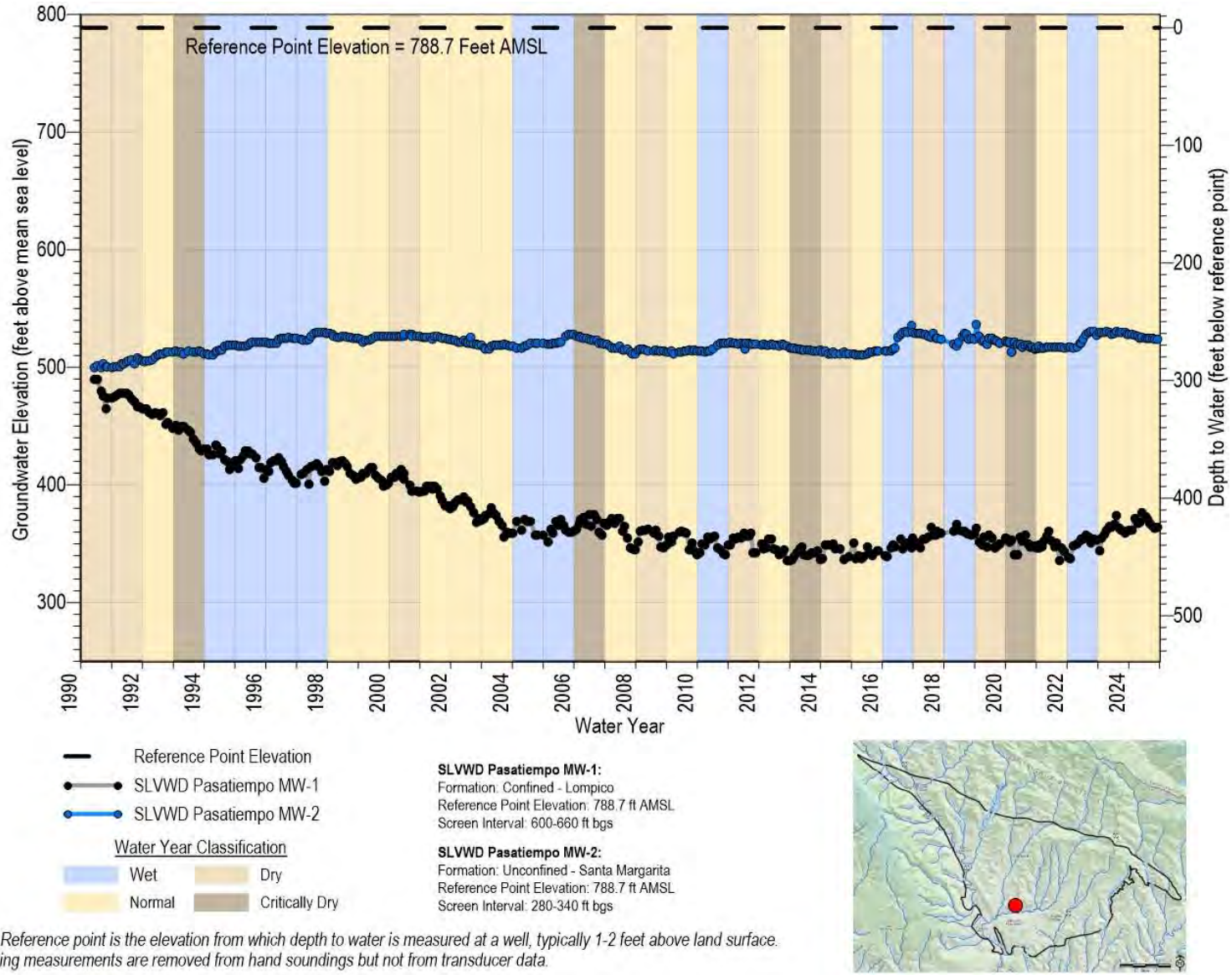



Figure 4-18~~4-184-4-18~~. Monitoring Well SLVWD Pasatiempo MW-1 and SLVWD Pasatiempo MW-2 Hydrographs Illustrating Vertical Gradients Over Time

## ~~3.6~~4.3 Change of Groundwater in Storage

Since the 1970s, and even possibly starting in the 1960s, there has been a consistent loss of groundwater stored in the Basin due primarily to over-pumping of the Lompico aquifer in the south Scotts Valley area. Figure 4-19 shows ~~groundwater m~~the Basin Model simulated annual change in storage with the color of the bars correlating with the water year type, and the solid line reflecting the cumulative change in storage.

Individual annual increases of groundwater stored in the Basin correlate with wet years and normal years if they precede a dry year. Historically, normal or drier water year types generally result in groundwater lost from storage. This is reflected on Figure 4-19 where cumulative storage change shows a consistent decline through about WY2014. After WY2014, cumulative change in storage ~~initially~~has stabilized with annual increases in wet years, little to no change in normal years, and decreases in dry years. ~~continued to decline through approximately WY2021. However more recent wetter and normal years (including a wet year in WY2023) have resulted in partial recovery and relative stabilization of groundwater storage, rather than the continued decline previously anticipated. appears to be leveling out but it is anticipated that the overall below average rainfall from 2018 to present will continue the trend of declining groundwater in storage.~~

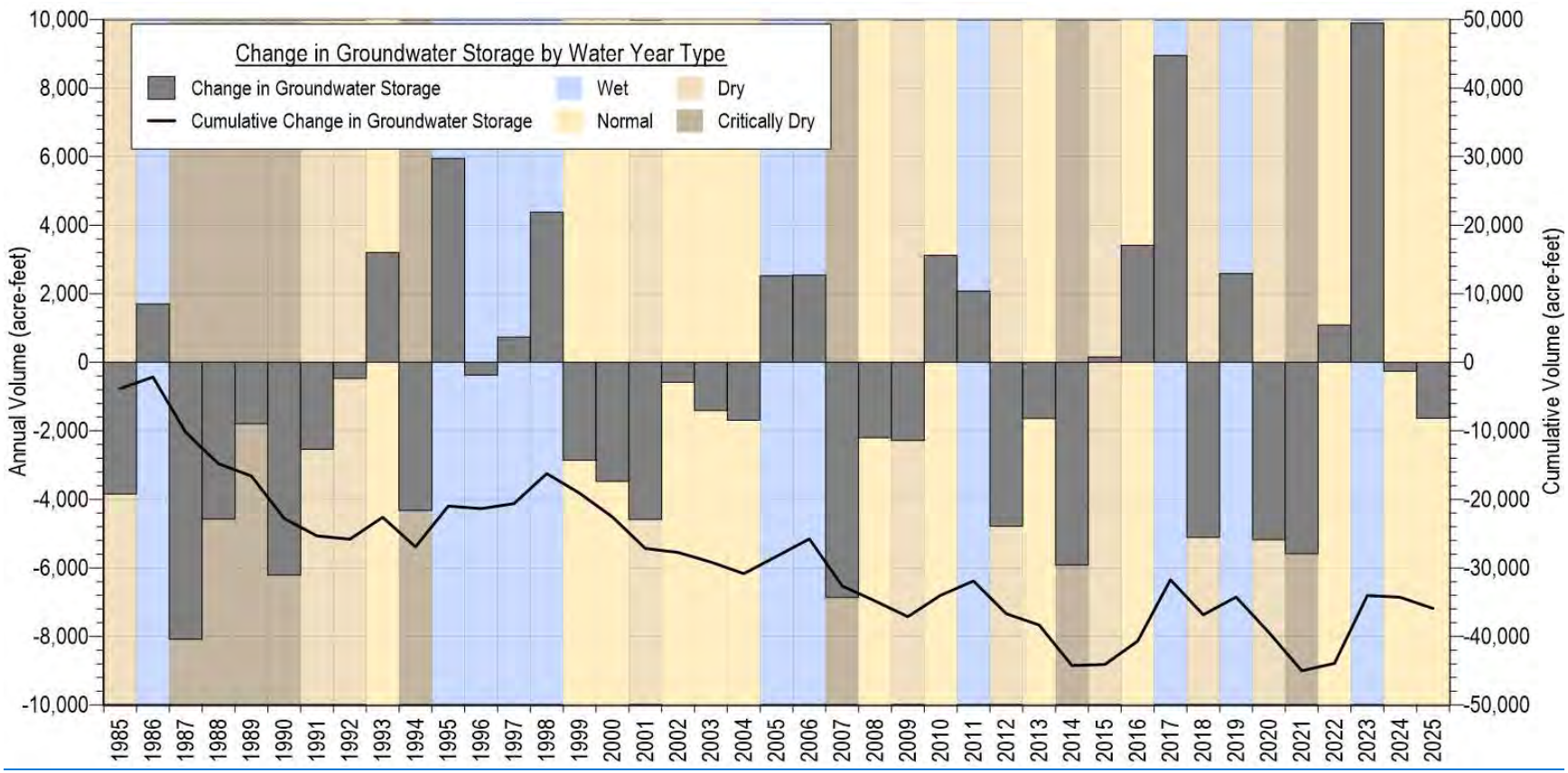



Figure 4-19~~4-194-4-19~~. Santa Margarita Basin Annual and Cumulative Change of Groundwater in Storage

## ~~3.7~~4.4 Groundwater Quality

Groundwater in the Basin is generally of good quality and ~~does not regularly exceed~~meets primary drinking water standards. However, both naturally occurring and anthropogenic groundwater quality concerns are present in some aquifers and areas. The following subsections discuss general groundwater quality with a focus on ~~chemical~~ constituents that have concentrations above state drinking water standards. The chemical constituents included in this section ~~are used as the basis for~~were considered and evaluated for inclusion in the Basin COC for which SMC are developed in Section 3. Appendix ~~2D~~ 4B contains chemographs for wells with ~~current~~ groundwater quality data in the Basin at the time of development of the 2022 GSP.

### ~~3.7.1~~4.4.1 Groundwater Quality Standards

As a relative measure of groundwater quality, this section compares groundwater quality in the Basin's different aquifers to primary and secondary drinking water standards. These standards are established by the USEPA and the California SWRCB DDW. Standards for contaminants in drinking water established by the USEPA represent the legal maximum allowable concentration for a constituent in public water systems. The maximum limits, referred to as MCLs, have been developed under the Safe Drinking Water Act. Some states, including California, have state laws or regulations ~~which~~ that set MCL values consistent with or lower than federal MCLs, or for chemicals for which no federal MCL has been established. For example, the federal MCL for benzene is 0.005 ~~milligrams per liter (~~mg/L~~)~~ but the state MCL is 0.001 mg/L. MTBE ~~, on the other hand,~~ does not have a federal MCL but California established an MCL of 0.013 mg/L.

California MCLs are in accordance with CCR, Title 22 ~~of the California Code of Regulations~~ and are categorized as either primary or secondary. Primary MCLs are those which address health concerns, whereas secondary MCLs address aesthetics such as taste and odor. Not all constituents with an established primary MCL have a secondary MCL, and not all constituents with a secondary MCL have a primary MCL. Using the example of MTBE above, the primary MCL is 0.013 mg/L whereas the secondary MCL is 0.005 mg/L. Manganese, on the other hand, ~~has no primary MCL yet~~ only has a secondary MCL of 0.05 mg/L. The California Office of Environmental Health Hazard Assessment establishes public health goals based on lifetime exposure risk for constituents with an established MCL or those for which an MCL will be established in the future, and MCL values may be revised based on the public health goal.

In addition to regulated constituents, California DDW has established notification levels and response levels for some constituents ~~which~~ that do not have an established MCL. Recommended actions for constituents exceeding these levels are established by DDW.

### ~~3.7.2~~4.4.2 Groundwater Quality Testing

Municipal water suppliers regularly sample and test both raw and treated water sources per state requirements contained in the ~~California Code of Regulations~~CCR, Title 22. Groundwater quality parameters typically tested for include general minerals, general physical parameters, and organic/inorganic compounds. All municipal water sources are treated to state drinking water standards.

The Code of Regulations requires that public water systems annually provide their customers with an annual water quality report called a Consumer Confidence Report ~~(CCR)~~. This includes information on source water, levels of any detected contaminants, and compliance with drinking water regulations (including monitoring requirements), along with some educational information. Consumer Confidence Reports~~CCRs~~ for SLVWD and SVWD are available at the following websites: https://www.slvwd.com/233/Consumer-Confidence-Reports~~https://www.slvwd.com/water-quality/pages/consumer-confidence-reports-ccrs~~ and https://www.svwd.org/water-quality~~https://www.svwd.org/resources-information/reports~~, respectively.

Groundwater quality is not regularly tested at SLVWD and SVWD monitoring wells. There have been some one-off samples collected and tested over the years, but there is no long-term groundwater quality record in any municipal monitoring well. There are longer groundwater quality records in monitoring wells associated with contamination cleanup sites. These only provide data for the period during active site assessment and remediation. Many of these monitoring wells are destroyed once clean up goals have been achieved.

Private domestic use wells are not subject to DDW drinking water regulations. However, before any newly constructed domestic well can be used the County requires ~~one-time~~ testing of nitrate ~~, TDS, chloride, iron, and manganese~~and bacteria (Total Coliform and E. Coli) to demonstrate the water is a safe drinking water source~~for any new private well~~. As of September 1, 2025, the County has specific testing requirements at property sale. This requires sellers of properties served by domestic wells to complete water quality testing and well flow testing before closing the sale. Results must be provided to the buyer and SCEH.

Small water systems that supply groundwater to 15 – 199 service connections also report water quality to the County. These water quality constituents include inorganics, nitrates, arsenic, perchlorate, chromium, radiation, synthetic organic compounds, VOCs, and fuel oxygenates, which include MTBE. The frequency of monitoring ranges between 1 year and 9 years depending on the constituents. Smaller water systems with between 5 and 14 service connections have limited one-time testing requirements for inorganics and report quarterly bacteriologic water quality to the County.

## ~~3.7.3~~4.4.3 Naturally Occurring Groundwater Quality

### ~~3.7.3.1~~4.4.3.1 Salinity

Elevated salinity in groundwater can occur from both natural geologic sources and as a result of anthropogenic groundwater contamination. Salinity in groundwater is often measured using TDS and chloride concentrations. There are no primary drinking water standards for TDS and chloride, but rather secondary drinking water standards that are set at 1,000 and 250 mg/L, respectively.

Natural waters contain some dissolved solids (salinity) from contact with soils, rocks, and other natural materials. Geologic formations can influence groundwater quality, and formations often have their own unique groundwater salinity signature. Surface activities by humans can artificially introduce salts into groundwater through the natural recharge process where infiltrating rainfall dissolves anthropogenic salts on the land surface allowing salts to enter the underlying aquifers. Slight differences in salinity occur across the Basin due to its geology. Improperly constructed wells can also allow salts to migrate from 1 aquifer to another.

#### *~~3.7.3.1.1~~4.4.3.1.1 TOTAL DISSOLVED SOLIDS*

The regulatory drinking water limit for TDS is a SWRCB secondary MCL, that differs from a primary MCL because it is based on aesthetics rather than health risk. Santa Cruz County enforces the 1,000 mg/L upper limit of the secondary MCL. TDS concentrations in portions of the Santa Margarita aquifer are generally low as a result of its high permeability, exposure at the surface, and associated high rate of aquifer "flushing" (Johnson, 2006; Johnson, 2009). In areas where wells pump from the Santa Margarita aquifer and data on TDS concentrations are available, the following observations on Santa Margarita aquifer TDS are made:

- Quail Hollow has relatively low TDS concentrations typically below 150 mg/L (Figure 4-20)
- The Olympia area has higher TDS concentrations typically ranging between 200 and ~~600~~800 mg/L (Figure 4-20)
- Historical TDS concentrations in Santa Margarita aquifer wells in the Pasatiempo/Camp Evers/southern Scotts Valley area were lower and more stable than TDS concentrations in the Olympia wells (Johnson, 2009). Since the Santa Margarita aquifer is no longer pumped by municipal suppliers in the Pasatiempo/Camp Evers/southern Scotts Valley area there is no current testing of groundwater quality to determine if this is still the case.

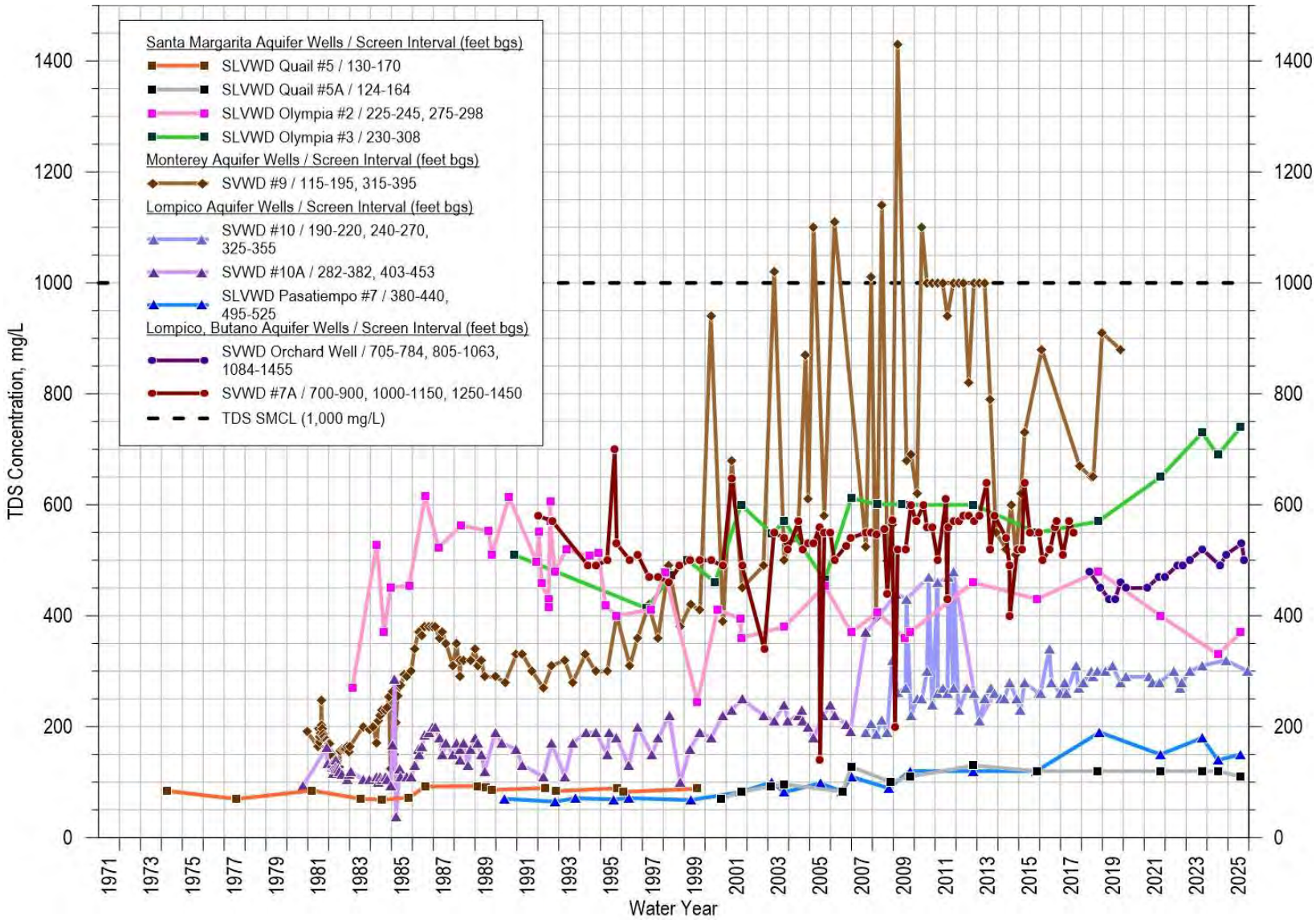



Figure 4-204 ~~204-4-20~~. Total Dissolved Solids Concentrations in Select Wells from 1970-2025~~19~~

There are very few wells screened in the Monterey Formation that have groundwater quality data. SVWD's Well #9, the only Monterey Formation well in the Basin with long-term and recent groundwater quality data, has TDS concentrations ranging from 300 to 1,430 mg/L (Figure 4-21). ~~Together with 2 Lompico aquifer wells (SVWD #10A and SLVWD Pasatiempo #7),~~ SVWD's Well #9 ~~has~~ had an increasing TDS trend while it was being used for extraction prior to 2008. It is thought its increased TDS concentration is linked to the dewatered Santa Margarita aquifer in the area that has caused reduced leakage of good quality water to the underlying aquifers (Johnson, 2009). High TDS concentrations appear to correspond to periods when the well was being pumped more and thereby extracting a greater proportion of its groundwater from deeper in the Monterey Formation which is known to have elevated TDS because of its marine origin and more limited flushing. This well is no longer used by SVWD for water supply because of its low yield and poor water quality. ~~Further supporting the occurrence of saline water in the Monterey Formation are reports of saline water received by Santa Cruz County from well drillers working in the lower Newell Creek and lower Zayante Creek areas~~ Elevated TDS concentrations were also reported for Monterey Formation monitoring wells SMGWA-7 (1,300 mg/L) and SMGWA-8 (1,000 mg/L) installed ~~in the Monterey Formation~~ in 2023 (M&A, 2023).

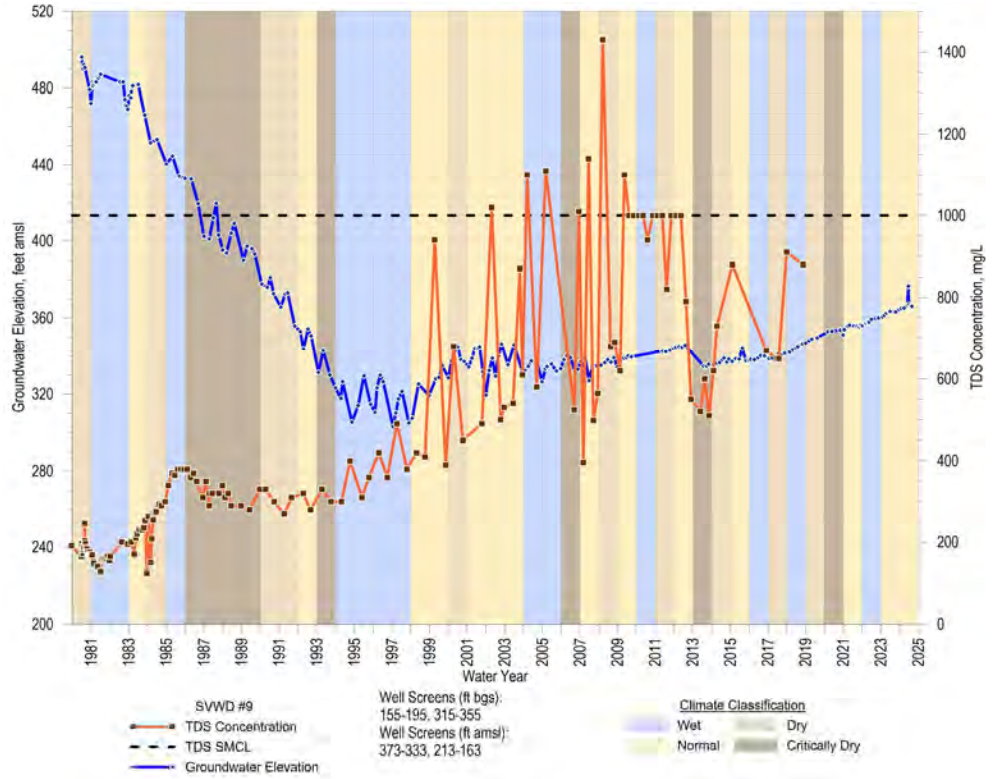
Wells screened in the Lompico ~~and Butano~~ aquifer ~~s~~ do not exceed the TDS secondary drinking water standard~~s~~ and concentrations typically range from 200 to 700 mg/L (Figure 4-20). Among municipal extraction wells, SVWD #10A and SLVWD Pasatiempo #7 show overall increasing TDS trends over the sampling record, whereas SVWD #11A/#11B remain stable~~Municipal extraction wells with overall increasing TDS trends as described above include~~~~are SVWD #10A and and SLVWD Pasatiempo #7 while other wells such as SVWD #11A/#11B have stable trends.~~. ~~However, r~~At~~Recent data for~~ SVWD #10, ~~shows that~~ TDS concentrations have generally stabilized in the ~200 to 300 mg/L range since the early 2010s, following earlier increases observed in the late 1990s through mid-2000s~~, indicating no continued upward trend in recent years.~~ ~~Similar to increased TDS concentrations in SVWD #9 in the Monterey Formation, i~~Increases in TDS generally correlate to declines in groundwater elevation (~~Increased TDS appears to correspond to~~ Figure 4-21). ~~This relationship is most evident during the historical period of groundwater level decline (approximately mid-1980s through mid-2000s); in contrast, more recent periods of groundwater level stability and recovery correspond to stable TDS concentrations at these wells.~~ This relationship does not hold uniformly across~~However, a corresponding TDS increase and groundwater elevation decrease in~~ the Lompico aquifer ~~does not always occur~~, however, as shown on Figure 4-22 where groundwater elevation declines at SVWD #11A and #11B ~~TDS does not increase despite groundwater elevation declines~~do not drive TDS increases ~~in the SVWD's El Pueblo wellfield (SVWD #11A and 11B)~~. TDS at~~Recent monitoring data for SVWD #11A and #11B (1997–2025)~~ these two wells has remained~~shows~~ relatively stable ~~TDS concentrations~~ over time, generally ranging from about 280 to 350 mg/L at

#11B and about 450 to 550 mg/L at #11A, with only minor variability and no persistent ~~increasing~~ trend~~s~~ despite groundwater level fluctuations. SVWD #11A and #11B are pumped less than #10A and SLVWD Pasatiempo #7, so perhaps concentration fluctuation is related to pumping more than groundwater levels in these wells. ~~This indicates that the increasing TDS trend associated with declining groundwater elevations in the Lompico aquifer may just be confined to the Pasatiempo/Camp Evers/southern Scotts Valley area.~~

Wells screened in the Butano aquifer appear to ~~be~~have higher TDS concentrations ~~naturally~~ than the Lompico aquifer. SVWD extraction wells screened across both aquifers in North Scotts Valley, #3B and its ~~(~~replacement~~d by~~ Sucinto~~)~~, #7A and its ~~(~~replacement~~d by~~ Orchard~~)~~, and Grace Way~~,~~, do not exceed TDS secondary drinking water standards, but concentrations are slightly higher than wells further south only installed in the Lompico aquifer. Concentrations in Lompico/Butano supply wells typically range from about 400 to 800 mg/L (Figure 4-20) and have slight increasing trends that do not appear to be related to groundwater level ~~fluctuation~~changes (Figure 4-23). Samples collected after installation of dedicated Butano aquifer exploration wells north of Scotts Valley exceeded the secondary MCL at SVWD Canham (1,500 mg/L) and approached the MCL at SVWD Stonewood (950 mg/L), as shown in chemographs in Appendix 4B.

Of interest, there is a known area of elevated salinity north of the Basin between Kings and Bear Creeks that is likely associated with connate water. Connate water is saltwater water trapped in the pore spaces of marine sediments when it was deposited and subsequently buried by younger sediments. A USGS water resource investigation in 1977 indicated that this area has some saline groundwater and surface water that may be degraded by connate water leaking upward from depth through improperly sealed, abandoned oil test wells (USGS, 1977). Although the source of saline water is outside of the Basin, higher salinity water does impact streams upgradient of the Basin which then flow into the Basin thereby slightly impacting surface water quality in the Basin.

Figure 4-24 summarizes the spatial distribution of TDS and chloride across the Basin by aquifer.


Groundwater Elevation, feet amsl
TDS Concentration, mg/L
Water Year
SVWD #9
TDS Concentration
TDS SMCL
Groundwater Elevation
Well Screens (ft bgs):
155-195, 315-355
Well Screens (ft amsl):
373-333, 213-163
Climate Classification
Wet
Dry
Normal
Critically Dry

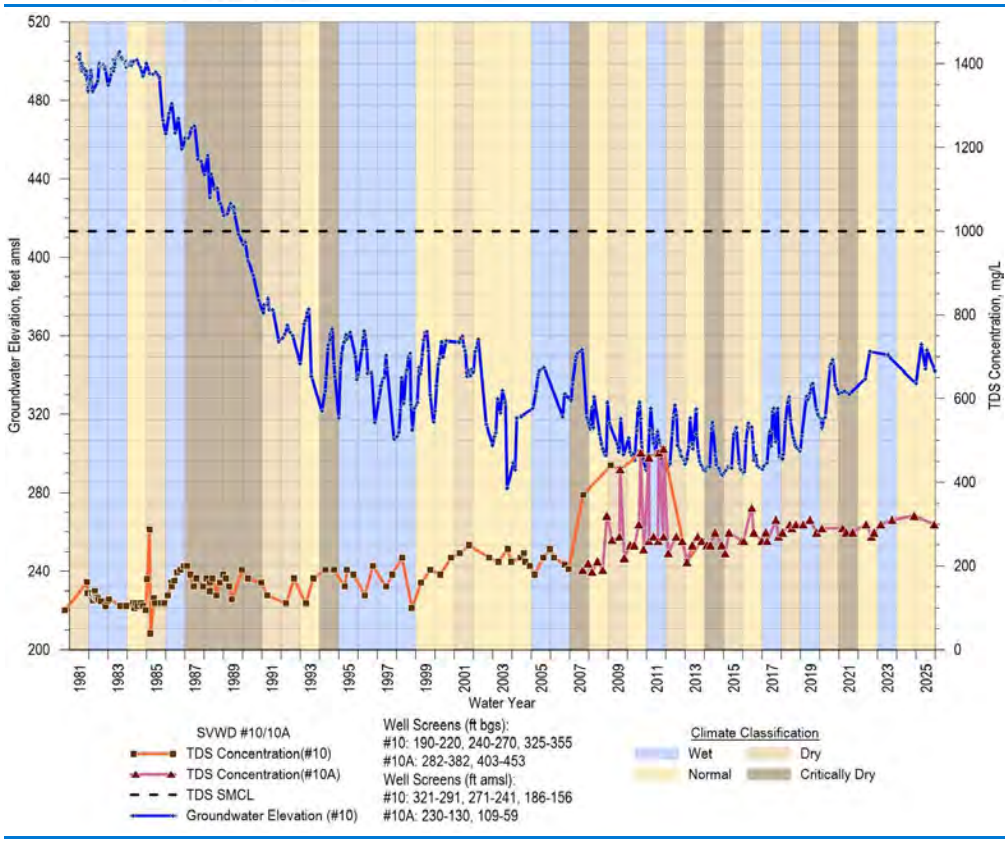

Groundwater Elevation, feet amsl
TDS Concentration, mg/L
Water Year
SVWD #10/10A
TDS Concentration(#10)
TDS Concentration(#10A)
TDS SMCL
Groundwater Elevation (#10)
Well Screens (ft bgs):
#10: 190-220, 240-270, 325-355
#10A: 282-382, 403-453
Well Screens (ft amsl):
#10: 321-291, 271-241, 186-156
#10A: 230-130, 109-59
Climate Classification
Wet
Dry
Normal
Critically Dry

Figure 4-214~~-214-4-21~~. Total Dissolved Solids Concentrations and Groundwater Elevations in SVWD Well #9 (Monterey Formation) and SVWD #10/10A (Lompico Aquifer)

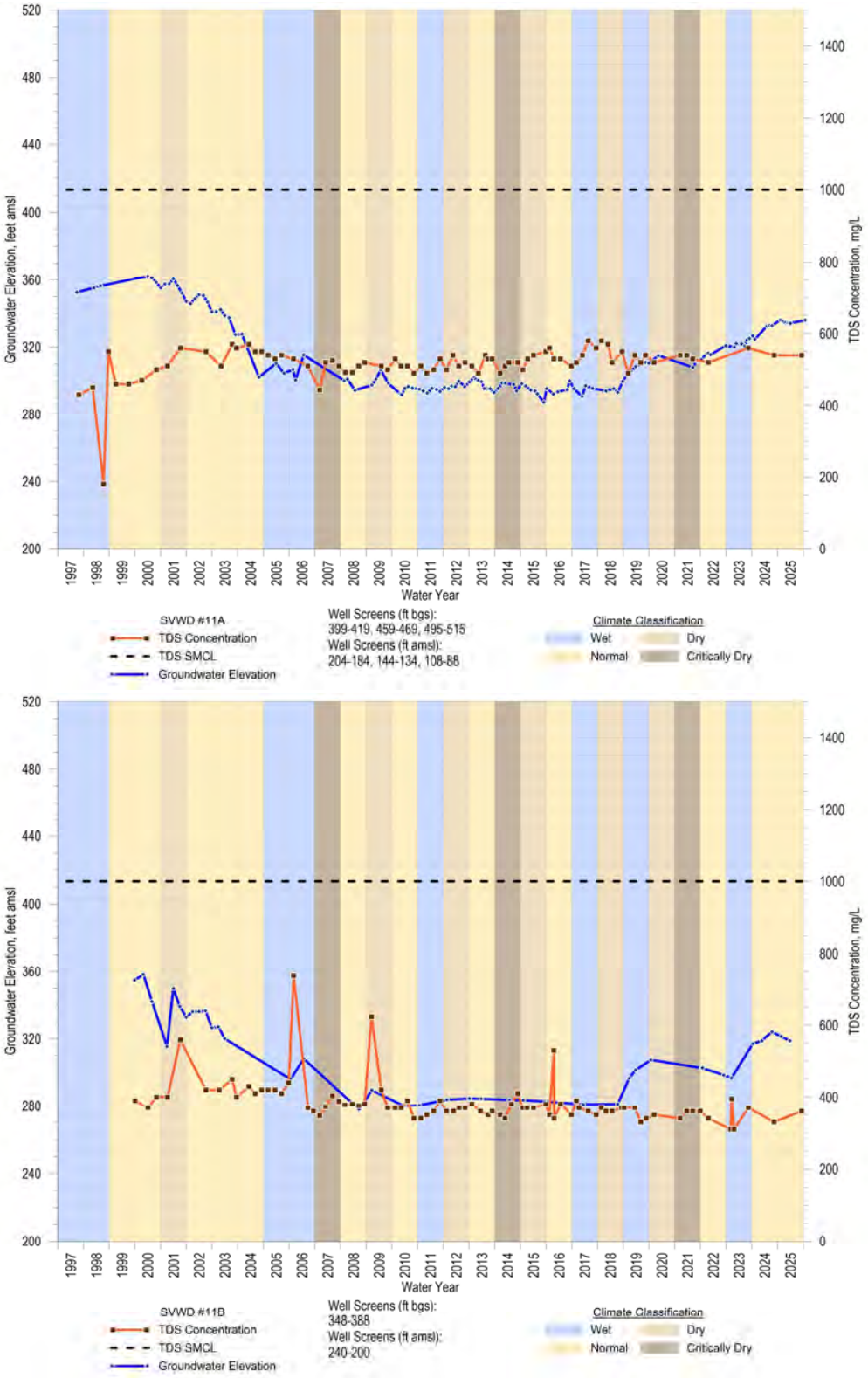
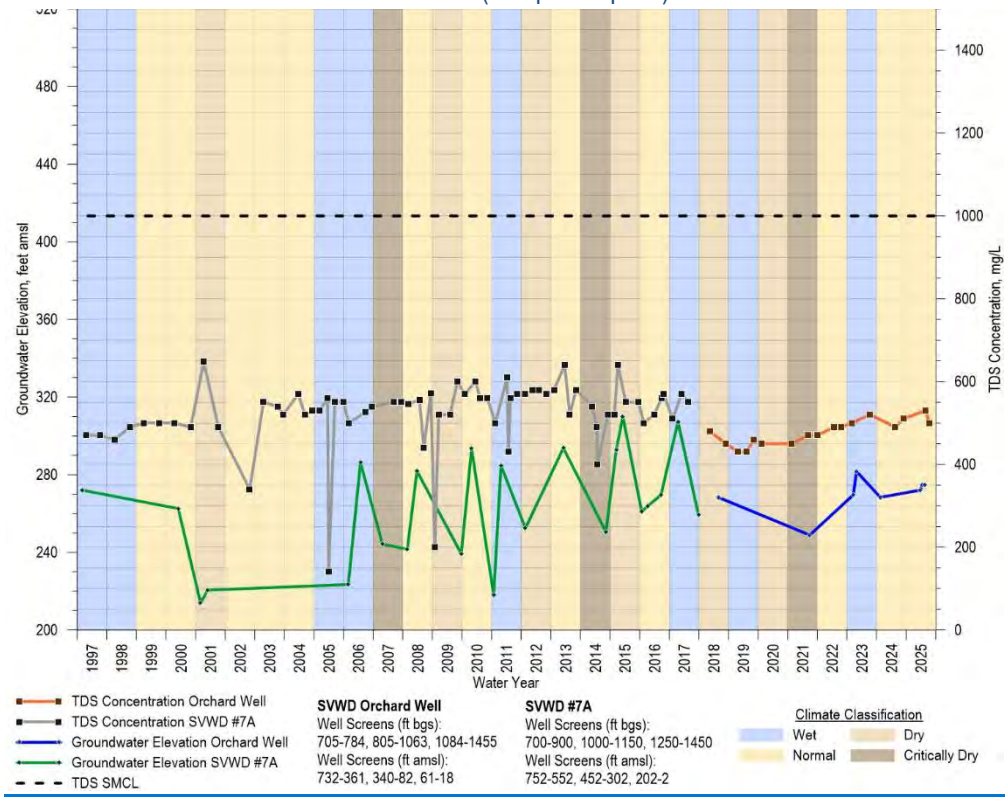


Figure 4-224-224-4-22. Total Dissolved Solids Concentrations and Groundwater Elevations in SVWD Well #11A and SVWD #11B (Lompico Aquifer)



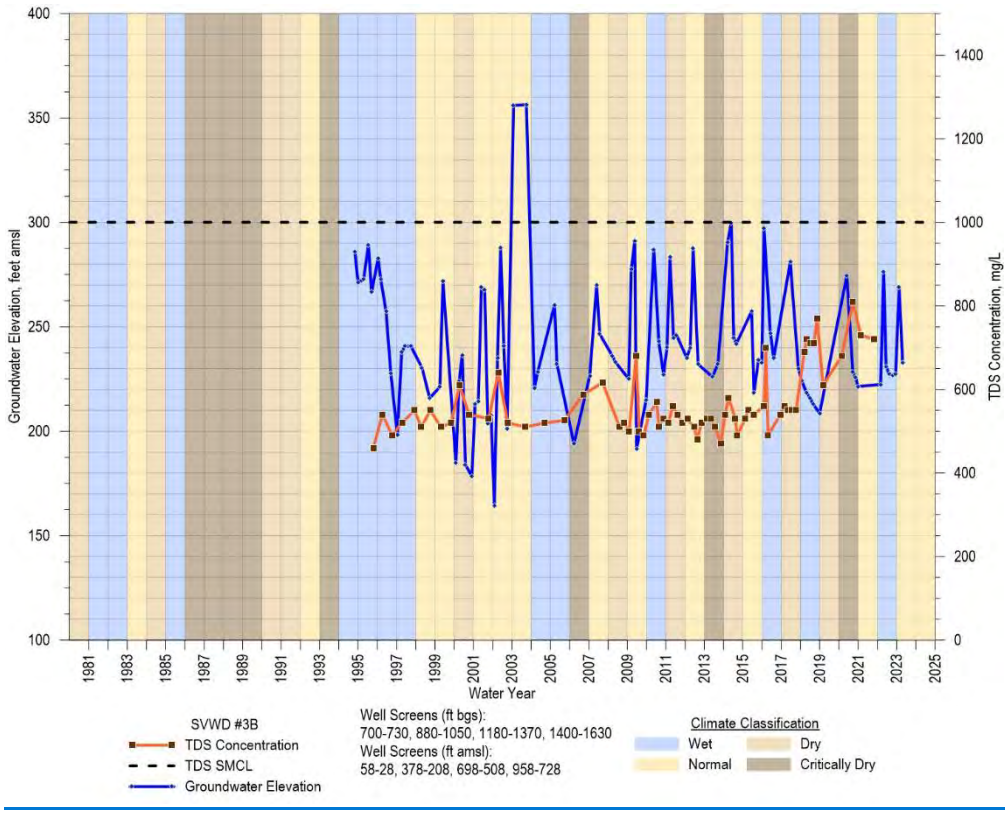



Figure 4-234~~-234-4-23~~. Total Dissolved Solids Concentrations and Groundwater Elevations in SVWD Wells #7A, Orchard, and #3B (Lompico/Butano Aquifer)

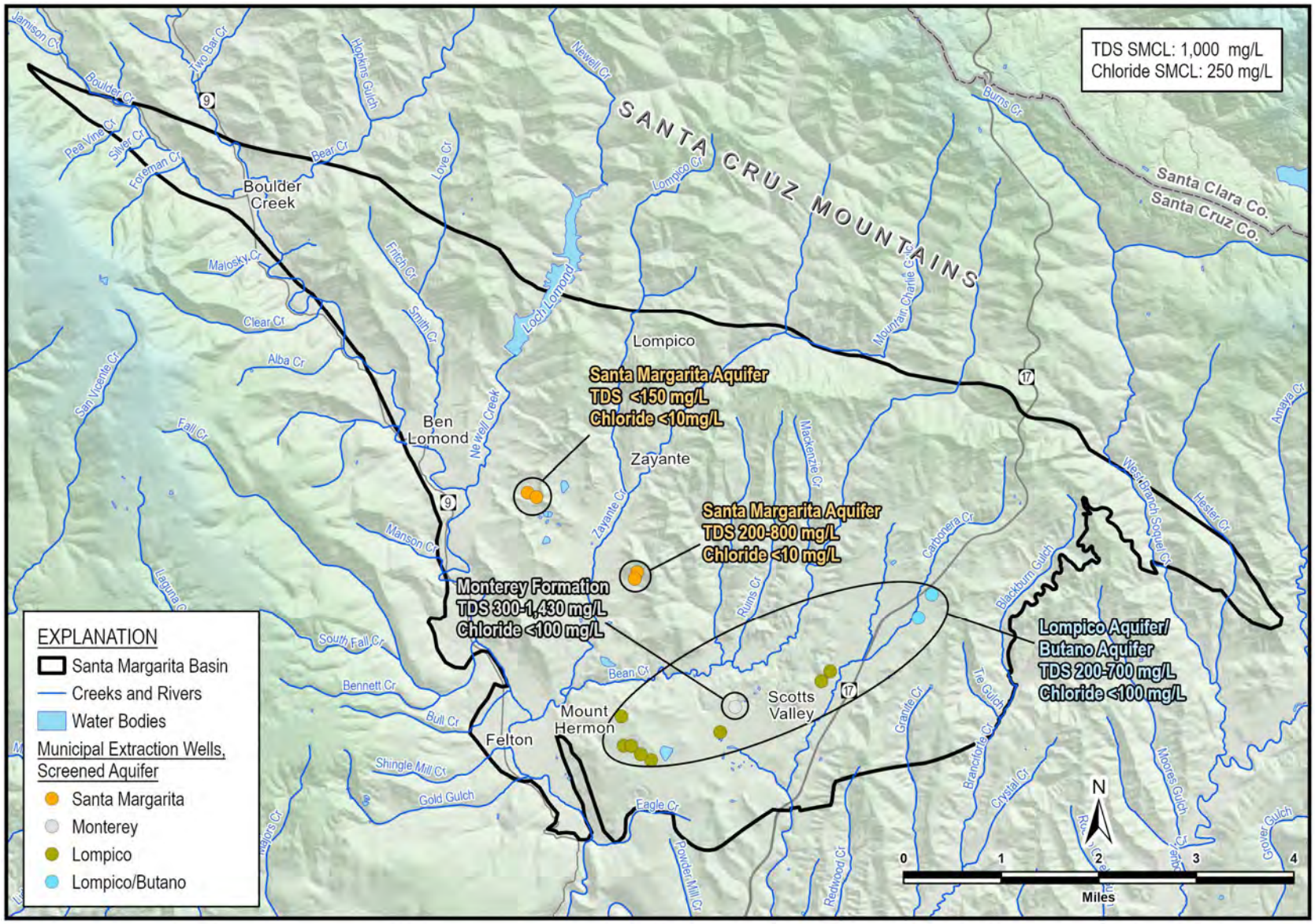

TDS SMCL: 1,000 mg/L
Chloride SMCL: 250 mg/L
SANTA CRUZ MOUNTAINS
Santa Clara Co.
Santa Cruz Co.
Boulder Creek
Ben Lomond
Lompico
Zayante
Felton
Mount Hermon
Scotts Valley
Loch Lomond
Santa Margarita Aquifer
TDS <150 mg/L
Chloride <10mg/L
Santa Margarita Aquifer
TDS 200-800 mg/L
Chloride <10 mg/L
Monterey Formation
TDS 300-1,430 mg/L
Chloride <100 mg/L
Lompico Aquifer/
Butano Aquifer
TDS 200-700 mg/L
Chloride <100 mg/L
EXPLANATION
Santa Margarita Basin
Creeks and Rivers
Water Bodies
Municipal Extraction Wells, Screened Aquifer
Santa Margarita
Monterey
Lompico
Lompico/Butano
N
0
1
2
3
4
Miles

Figure 4-24~~4-244-4-24~~. Distribution of Total Dissolved Solids and Chloride Across the Santa Margarita Basin

#### ~~3.7.3.1.2~~4.4.3.1.2 *CHLORIDE*

Chloride can be a major component of TDS and is used to determine salinity in groundwater. Chloride concentrations in the Basin are well below chloride's secondary MCL of 250 mg/L and are typically below 100 mg/L. Apart from increasing chloride in the Monterey Formation and Lompico aquifer in the Pasatiempo/Camp Evers/southern Scotts Valley area that mirror TDS trends, chloride concentrations do not have increasing (or decreasing) trends over time. Appendix ~~2D~~ 4B contains plots of chloride over time for wells with recent groundwater quality data.

#### ~~3.7.3.2~~4.4.3.2 Iron and Manganese

Although iron and manganese are required nutrients in the human diet, concentrations above secondary drinking water standards can create aesthetic problems including metallic taste, staining, accumulation of oxides in pipes, and eventually toxicity. Iron and manganese occur naturally in much of the world's groundwater and surface water but can also originate from anthropogenic sources including automobile exhaust and manufacturing (WHO, 2011). The state secondary MCLs for iron and manganese are 0.3 and 0.05 mg/L, respectively.

Iron and manganese concentrations are detected above state secondary MCL in all Basin aquifers, but not in all wells. The widespread occurrence of iron and manganese detections have a naturally occurring origin, associated with the dissolution of metals present in the Basin's geologic formations. There have been no trends in iron or manganese concentrations associated with contaminating activities. ~~Updated m~~Monitoring data through 2025 continue to show ~~that~~ elevated concentrations occur intermittently and are characterized by short-duration spikes rather than persistent increases, supporting a natural geochemical origin rather than anthropogenic influence. All groundwater extracted for municipal purposes with elevated iron and manganese is treated to reduce concentrations below secondary MCLs prior to distribution. Small water systems report iron and manganese concentrations to the County to ensure public health.

As with TDS, previous analysis has noted generally lower iron and manganese in some areas of the Santa Margarita aquifer ~~as a result of~~because of high rates of aquifer "flushing" (Johnson, 2009; Johnson, 2016). ~~Concentrations~~Areas where i~~I~~ron and manganese concentrations are higher in the Santa Margarita aquifer (i.e. the Olympic subarea) are found to be directly correlated with groundwater residence time, and therefore inversely correlated with the rate of aquifer flushing driven by rainfall ~~have lower flushing rates, like in the Olympia subarea~~(Johnson, 2009). Furthermore, the Santa Margarita aquifer interaction with ~~where Santa Margarita Sandstone contacts overlying~~ the ~~higher salinity geologic~~ overlying Santa Cruz Mudstone, where present, ~~-~~and underlying Monterey Formation, are related to ~~, increased~~ higher

iron and manganese concentrations in some areas ~~of the Santa Margarita aquifer can occur~~ (Johnson, 2009).

Iron and manganese ~~C~~concentrations ~~in these areas~~ are consistently below state secondary MCLs including frequent non-detects in the Quail Hollow subarea and are at higher concentrations and occasionally above the secondary MCLs in the Olympia subarea (Figure 4-25 and Figure 4-26). ~~However, iron and manganese concentrations above respective secondary MCLs do occur in other areas of the Santa Margarita aquifer, such as in the Olympia area, where c~~Concentrations of iron and manganese can be as high as 1.5 mg/L and 0.~~33~~ 2 mg/L, respectively in the Santa Margarita aquifer (Figure 4-25 and Figure 4-26). Basin-wide data also show occasional higher outliers, including iron concentrations exceeding 5 mg/L and manganese concentrations exceeding 0.6 mg/L at select wells, although these values are infrequent and not sustained (Figure 4-25 and Figure 4-26). Figure 4-27 shows variability in iron and manganese concentrations that do not appear to be closely tied to groundwater levels trends~~for extraction well SLVWD Olympia #2 versus its groundwater elevations~~. ~~Recent data (post-2015) indicate continued variability in manganese at Olympia #2, generally ranging from about 0.08 to 0.20 mg/L, with no consistent directional trend. Over the period of record, there have been both decreases and increases in manganese concentrations, none of which appear related to changing groundwater elevations. Iron concentrations do not follow the same trend as manganese and generally remain below the secondary MCL, but they do periodically and temporarily increase above the secondary MCL. Recent iron concentrations at Olympia #2 are typically below the secondary MCL, with occasional exceedances generally less than about 0.8 mg/L. For the most part, changes in iron concentrations do not appear to be influenced by changing groundwater elevations, although the historically low groundwater elevation for this well in WY2016 did correspond to 2 samples above the secondary MCL during that year (Figure 2-59Figure 2-59). Overall, updated data continue to indicate no consistent correlation between groundwater elevations and iron or manganese concentrations at this well.~~

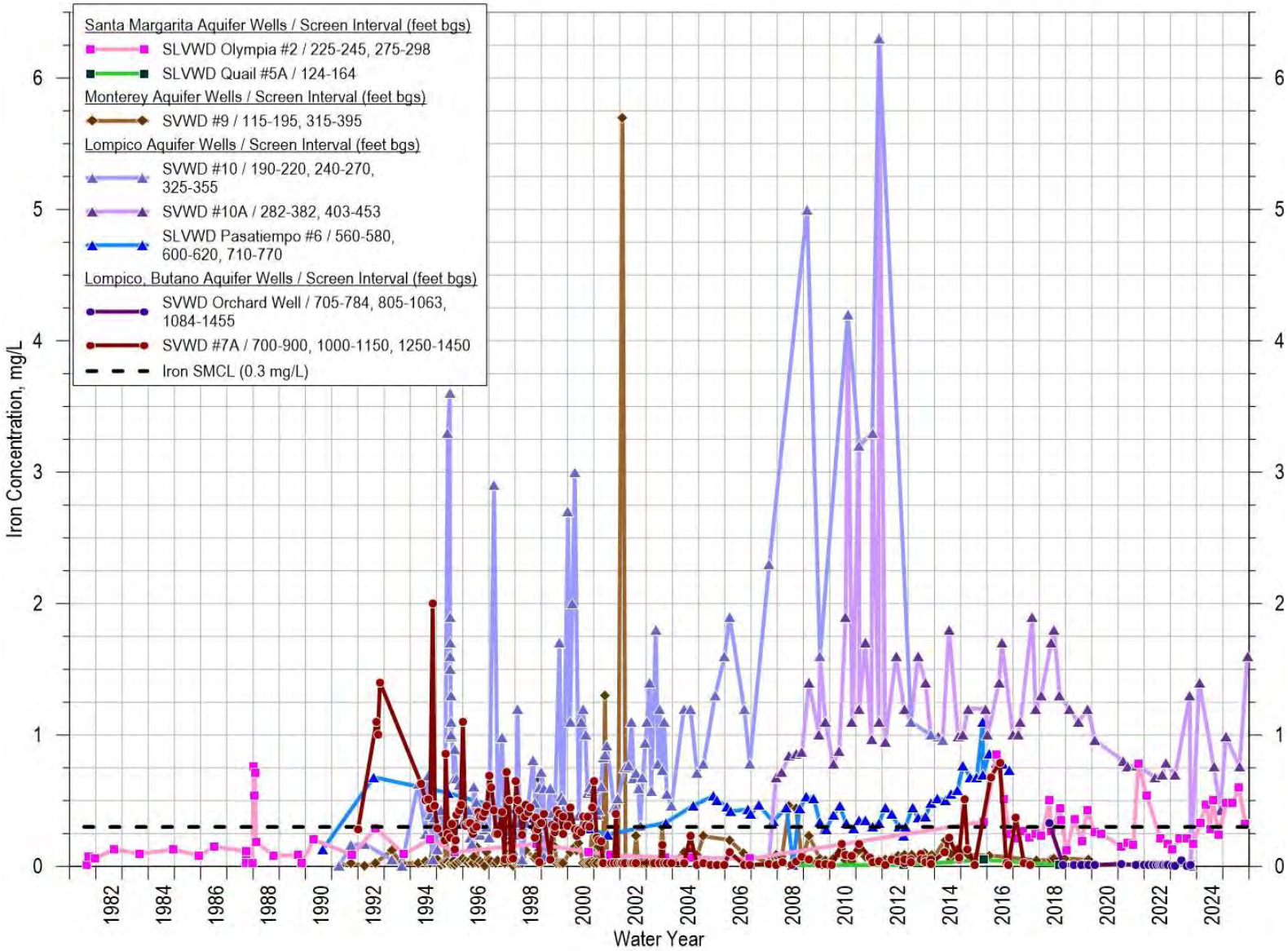



Figure 4-254~~-254~~-4-25. Iron Concentrations in Select Wells from 1980-~~2019~~2025

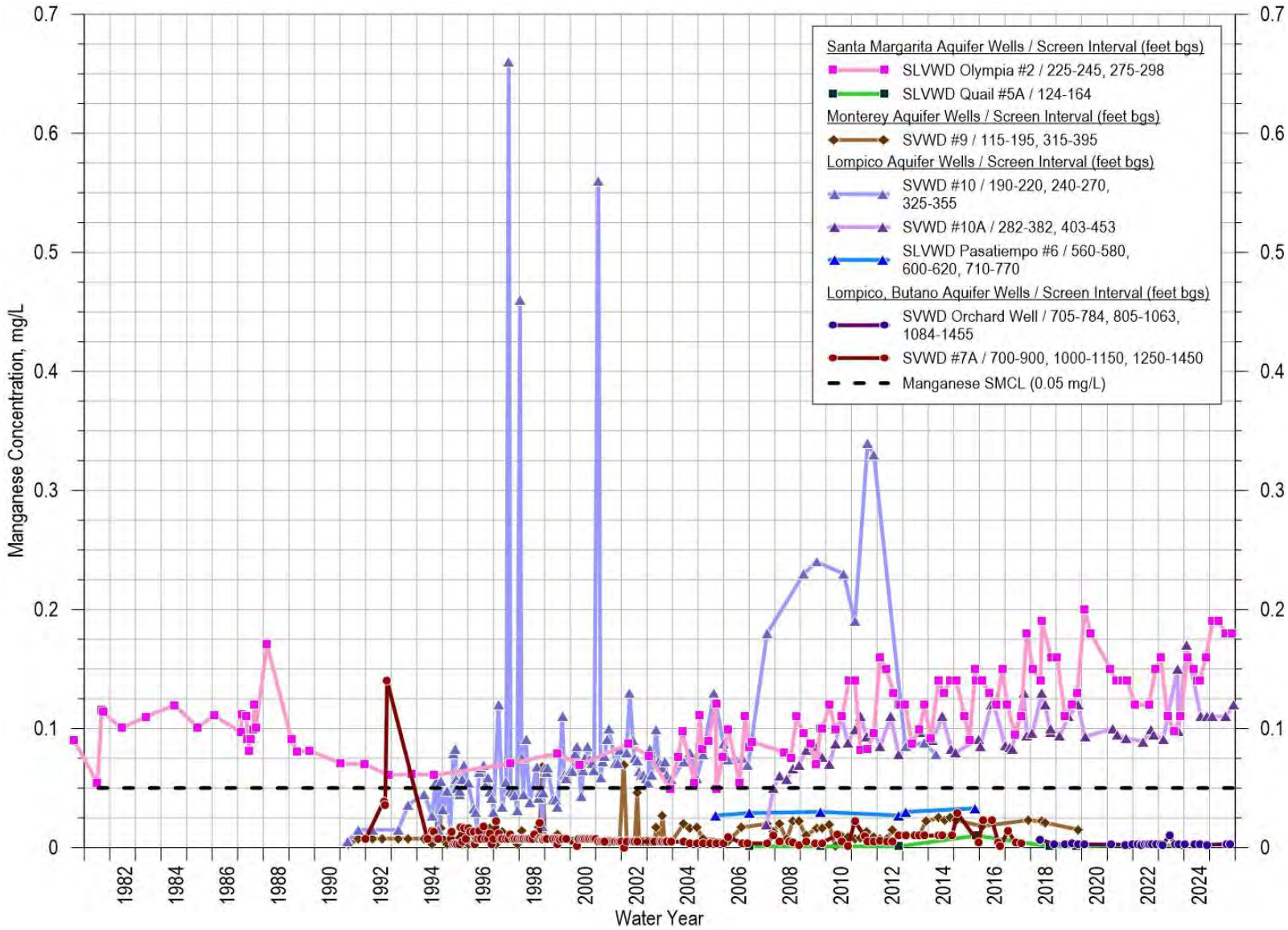
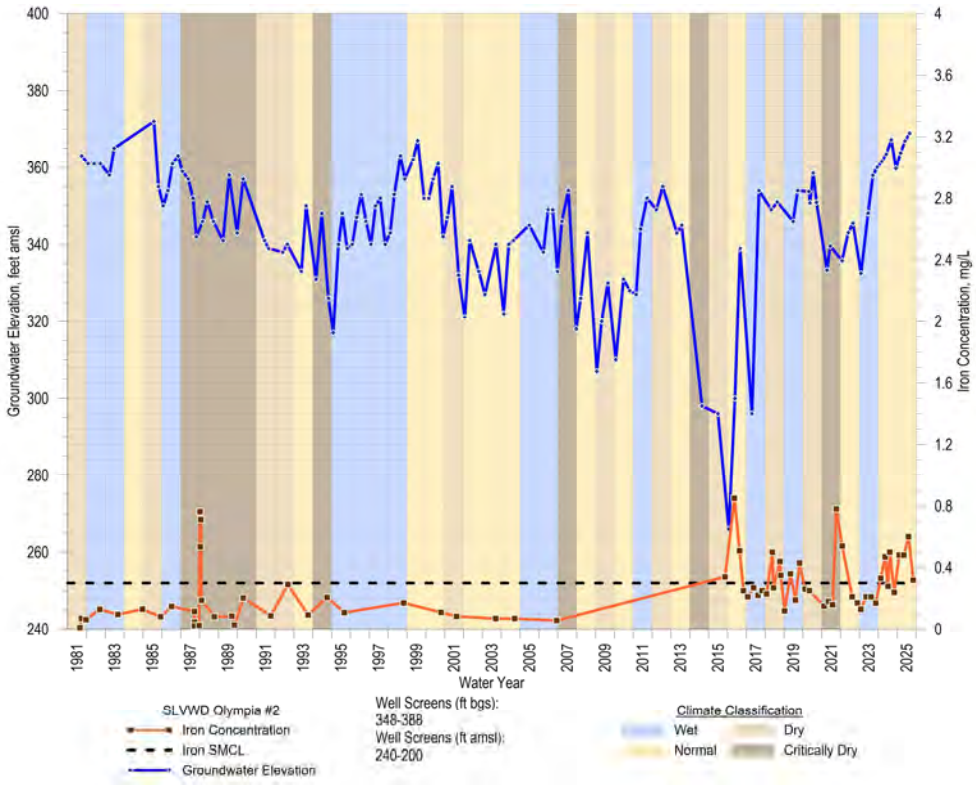



Figure 4-264~~-264-4-26~~. Manganese Concentrations in Select Wells from 1980-~~2019~~2025


Groundwater Elevation, feet amsl
Iron Concentration, mg/L
Water Year
SLVWD Olympia #2
Iron Concentration
Iron SMCL
Groundwater Elevation
Well Screens (ft bgs):
348-388
Well Screens (ft amsl):
240-200
Climate Classification
Wet
Dry
Normal
Critically Dry

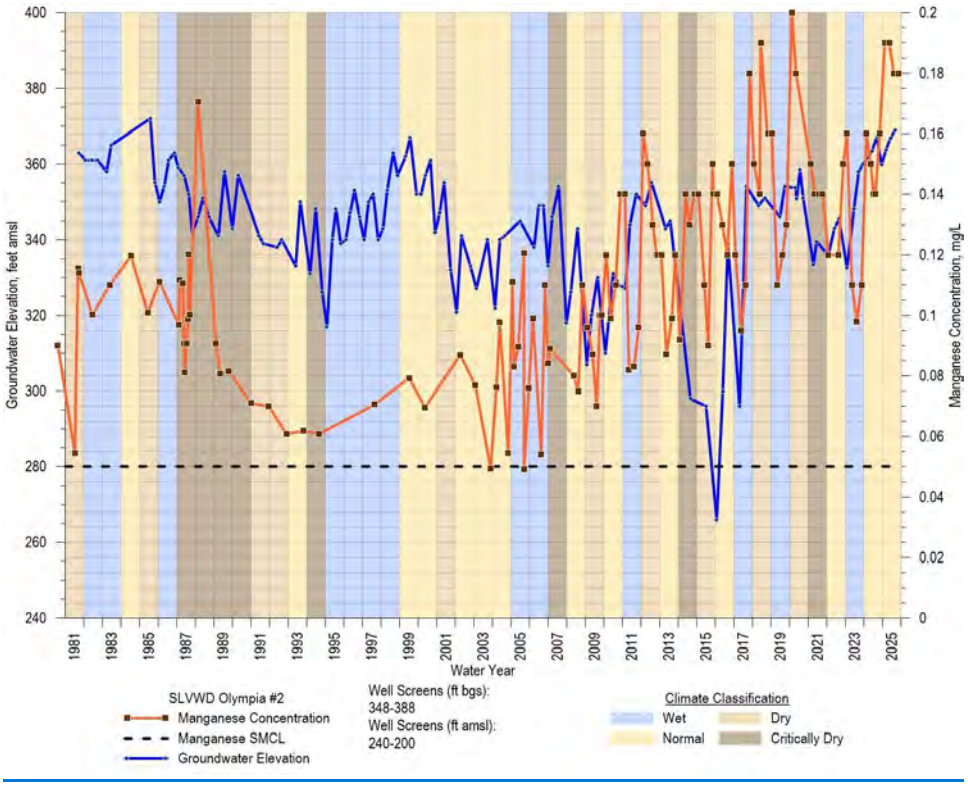

Groundwater Elevation, feet amsl
Manganese Concentration, mg/L
Water Year
SLVWD Olympia #2
Manganese Concentration
Manganese SMCL
Groundwater Elevation
Well Screens (ft bgs):
348-388
Well Screens (ft amsl):
240-200
Climate Classification
Wet
Dry
Normal
Critically Dry

Figure 4-274-274-4-27. Historical Iron and Manganese Concentrations and Groundwater Elevations in SLVWD Olympia #2 (Santa Margarita Aquifer)

~~Iron and manganese concentrations in the Santa Margarita aquifer are found to be directly correlated with groundwater residence time, and therefore inversely correlated with the rate of aquifer flushing driven by rainfall (Johnson, 2009). Furthermore, where Santa Margarita Sandstone contacts overlying Santa Cruz Mudstone and underlying Monterey Formation, increased iron and manganese concentrations in the Santa Margarita aquifer can occur (Johnson, 2009).~~

Groundwater in SVWD #9, which is screened in the Monterey Formation, generally has iron and manganese concentrations below secondary MCLs that occasionally spike higher (Figure 4-25 and Figure 4-26). There are no groundwater quality data for other Monterey Formation screened wells.

Iron and manganese concentrations in the Lompico aquifer are highly variable by well and ~~are~~ typically above state secondary MCLs, ~~and can reach~~with maximum concentrations of 6 mg/L and 0.66 mg/L, respectively (Figure 4-25 and Figure 4-26)~~, and are highly variable by well~~:

- ~~, respectively. However, updated monitoring data indicate that these elevated concentrations are primarily driven by episodic spikes and high variability rather than sustained long-term increases.~~ A historical~~n~~ increasing trend in iron and manganese ~~has been~~was observed in SVWD Well #10/10A ~~since samples were first analyzed in 1990~~corresponding to a period of groundwater level decline prior to 2014 (Figure 4-28). More recent data ~~(post-2000s)~~ indicate that concentrations ~~at SVWD #10/10A~~ have generally stabilized or declined from earlier peak values, ~~indicating no continued increasing trend. There is a possibility the increase corresponds with its declining~~as groundwater elevations recover (Figure 4-28).

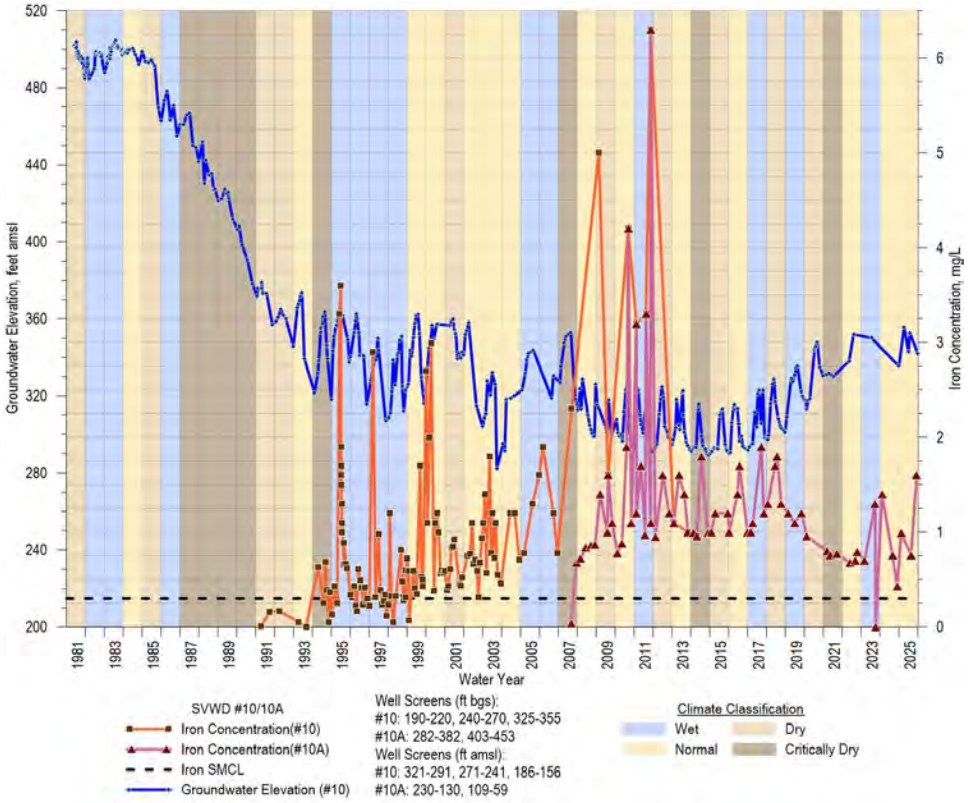
- ~~This relationship appears to be limited to the earlier period of groundwater level decline and is not evident under more recent conditions when groundwater levels stabilized or recovered. However, this is not conclusive as there are no iron and manganese data prior to 1990 for the period when most of the groundwater elevation decline occurred. Lompico aquifer screened~~E~~ e~~xtraction well SVWD #11B has different trends in iron and manganese even though it is only 1-mile northeast of SVWD Well #10/10A. ~~This well~~ It has ~~no trend~~highly variable ~~in~~ iron concentrations and declining manganese concentrations with declining groundwater elevations (Figure 4-29). ~~Updated data show that i~~Iron concentrations ~~at SVWD #11B are highly variable with~~have pronounced spikes in the late 1990s and early 2000s (up to approximately 9 mg/L), followed by a substantial decline to generally near or below the secondary

MCL in recent years; manganese concentrations show a modest decreasing trend with most recent values typically near or slightly above the secondary MCL.

- ~~No consistent relationship between iron or manganese concentrations and groundwater elevation is evident in the updated record. In contrast, e~~Extraction well SVWD #11A near SVWD #11B has a decreasing iron trend and no manganese trend (Figure 4-30). Recent data confirm that iron concentrations at SVWD #11A have declined from elevated values in the late 1990s and early 2000s to generally at or below the secondary MCL in recent years, while manganese concentrations remain relatively stable with moderate variability and no clear trend. SVWD #11A and 11B have not been pumped much in recent years so concentration trends could also be related to well inactivity.

These differences within the same aquifer suggest that differences in how each well is operated and from where in the Lompico aquifer it pumps has an influence on its iron and manganese concentrations.

SVWD wells screened within both the Lompico and Butano aquifers, such as extraction well SVWD Sucinto (Well #3B replacement) and~~,~~ SVWD Orchard (#7A replacement) generally have iron and manganese concentrations below secondary MCLs with occasional temporary spikes above their secondary MCLs (Figure 4-25 and Figure 4-26). ~~(Figure 2-63Figure 2-63). SVWD Well #3B was destroyed in summer 2024 and is no longer part of the active monitoring or supply network.~~ Historical data from thi~~s~~ese wells are consistent with the broader pattern of predominantly low concentrations with intermittent exceedances reflecting localized geochemical conditions (Figure 4-31 and Figure 4-32). ~~. T~~There does not appear to be any iron or manganese concentration correlation with water year type or groundwater elevation.


Groundwater Elevation, feet amsl
Iron Concentration, mg/L
Water Year
SVWD #10/10A
Iron Concentration(#10)
Iron Concentration(#10A)
Iron SMCL
Groundwater Elevation (#10)
Well Screens (ft bgs):
#10: 190-220, 240-270, 325-355
#10A: 282-382, 403-453
Well Screens (ft amsl):
#10: 321-291, 271-241, 186-156
#10A: 230-130, 109-59
Climate Classification
Wet
Dry
Normal
Critically Dry

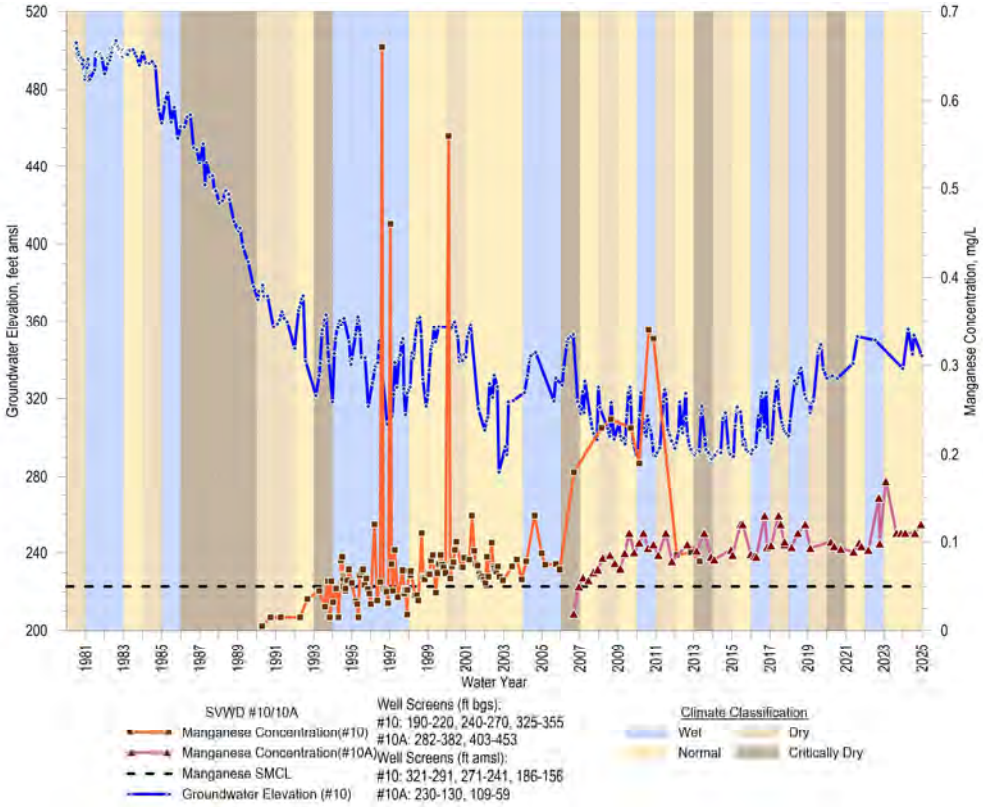
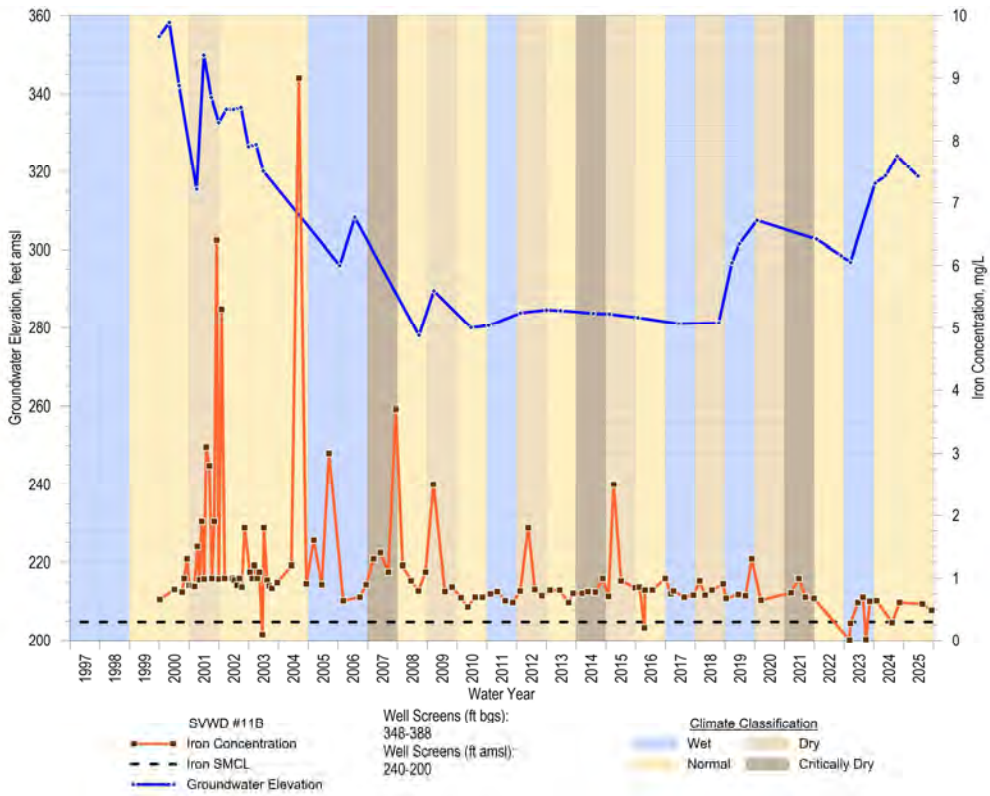

Groundwater Elevation, feet amsl
Manganese Concentration, mg/L
Water Year
SVWD #10/10A
Manganese Concentration(#10)
Manganese Concentration(#10A)
Manganese SMCL
Groundwater Elevation (#10)
Well Screens (ft bgs):
#10: 190-220, 240-270, 325-355
#10A: 282-382, 403-453
Well Screens (ft amsl):
#10: 321-291, 271-241, 186-156
#10A: 230-130, 109-59
Climate Classification
Wet
Dry
Normal
Critically Dry

Figure 4-284~~-284-4-28~~. Historical Iron and Manganese Concentrations and Groundwater Elevations in SVWD Well #10/10A (Lompico Aquifer)



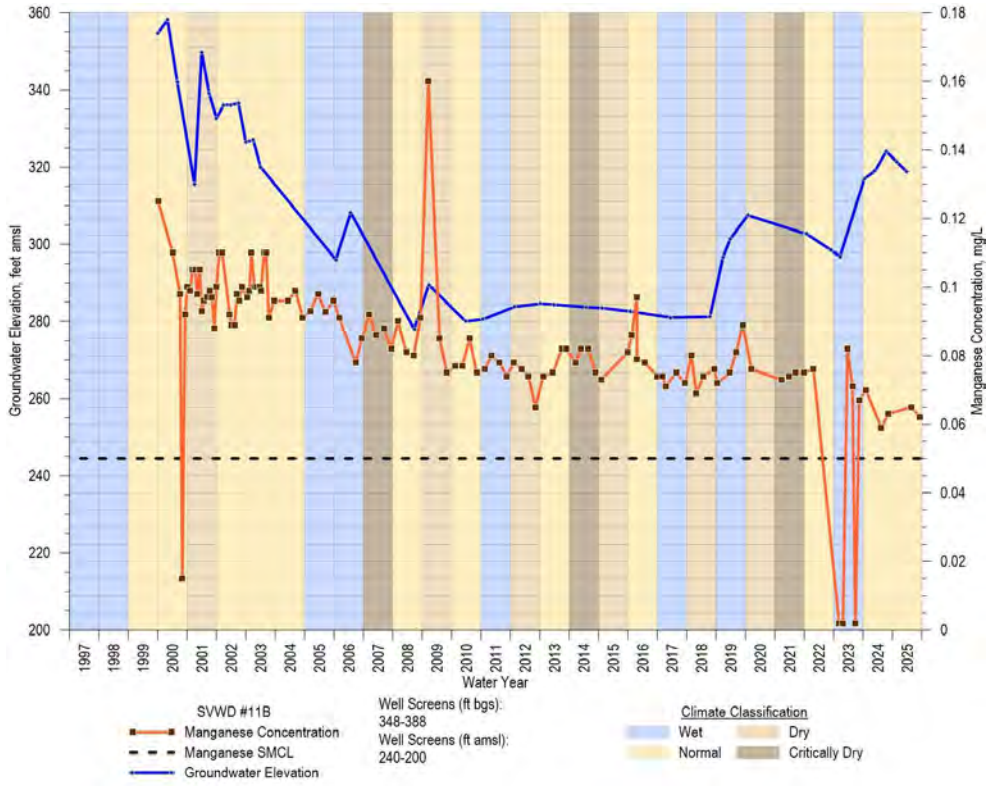
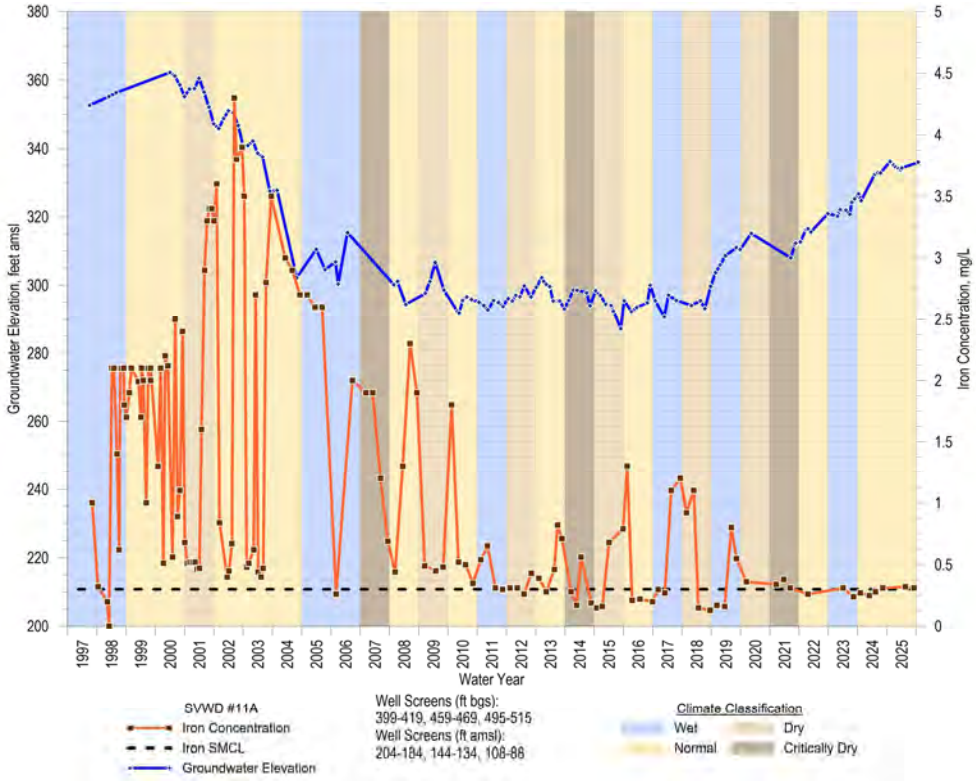



Figure 4-294-294-4-29. Historical Iron and Manganese Concentrations and Groundwater Elevations in SVWD Well #11B (Lompico Aquifer)



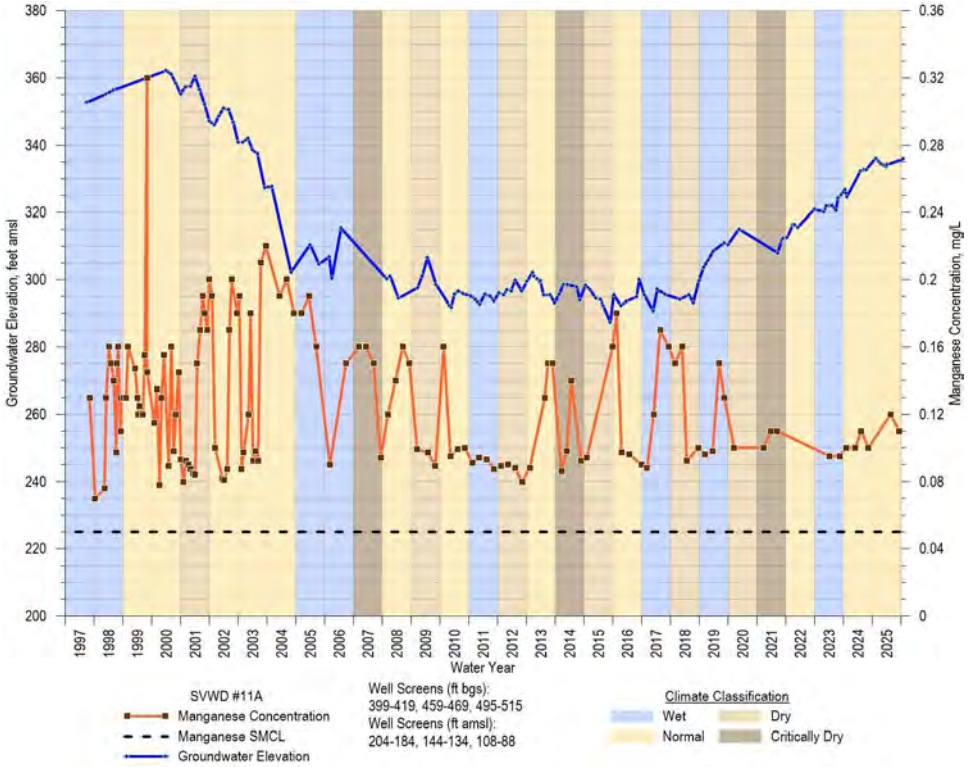
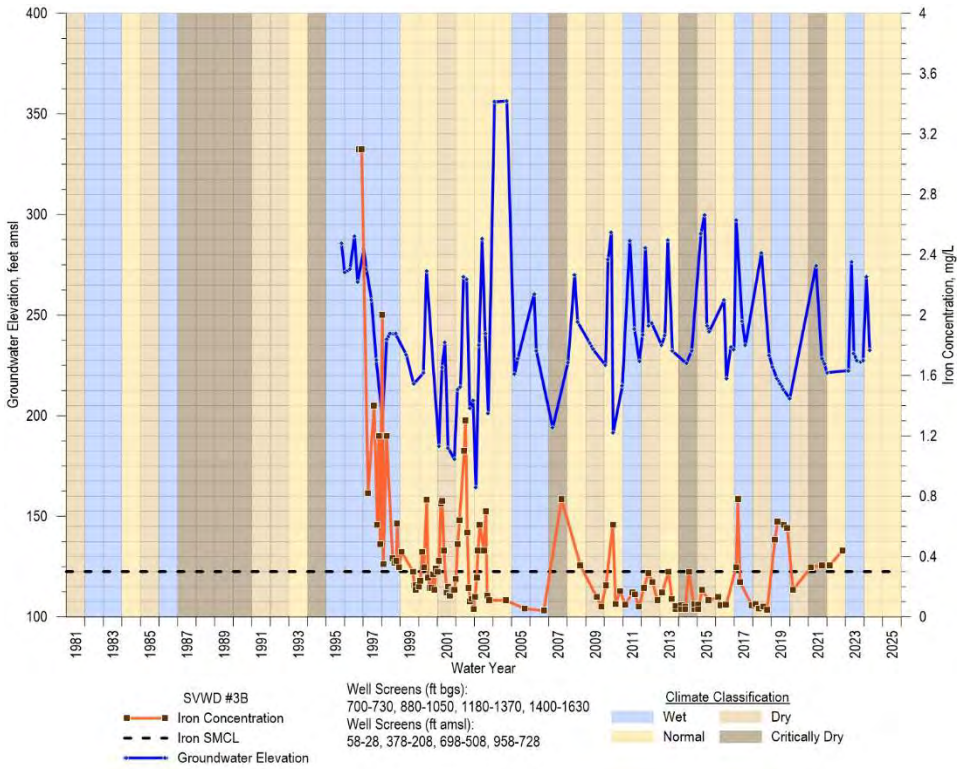



Figure 4-304~~-304-4-30~~. Historical Iron and Manganese Concentrations and Groundwater Elevations in SVWD Well #11A (Lompico Aquifer)



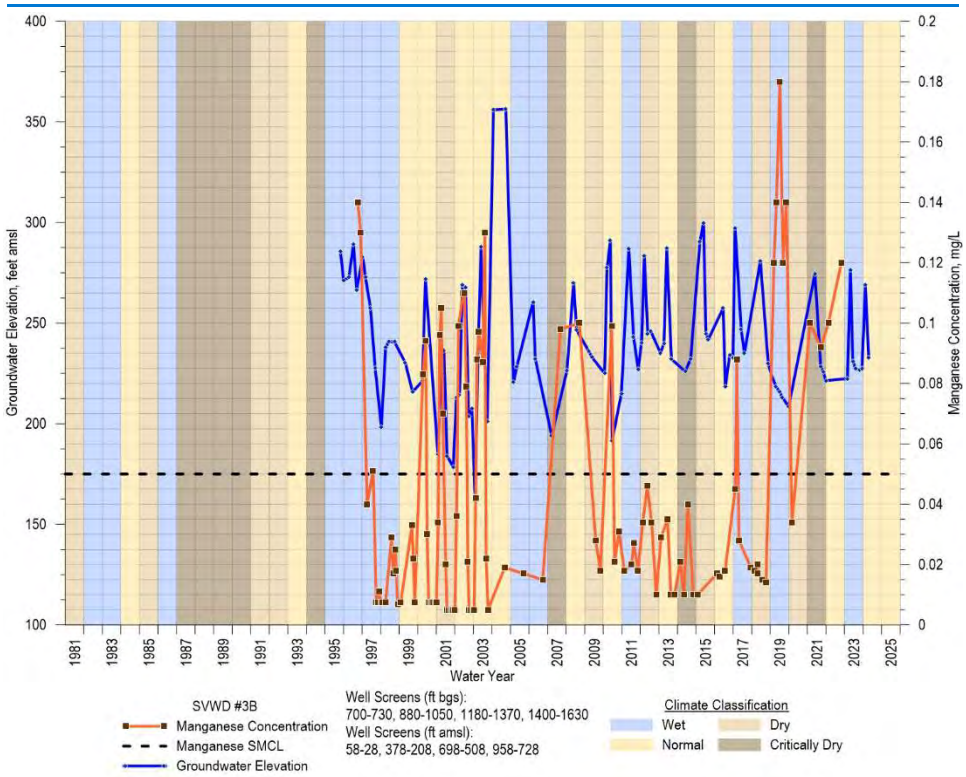
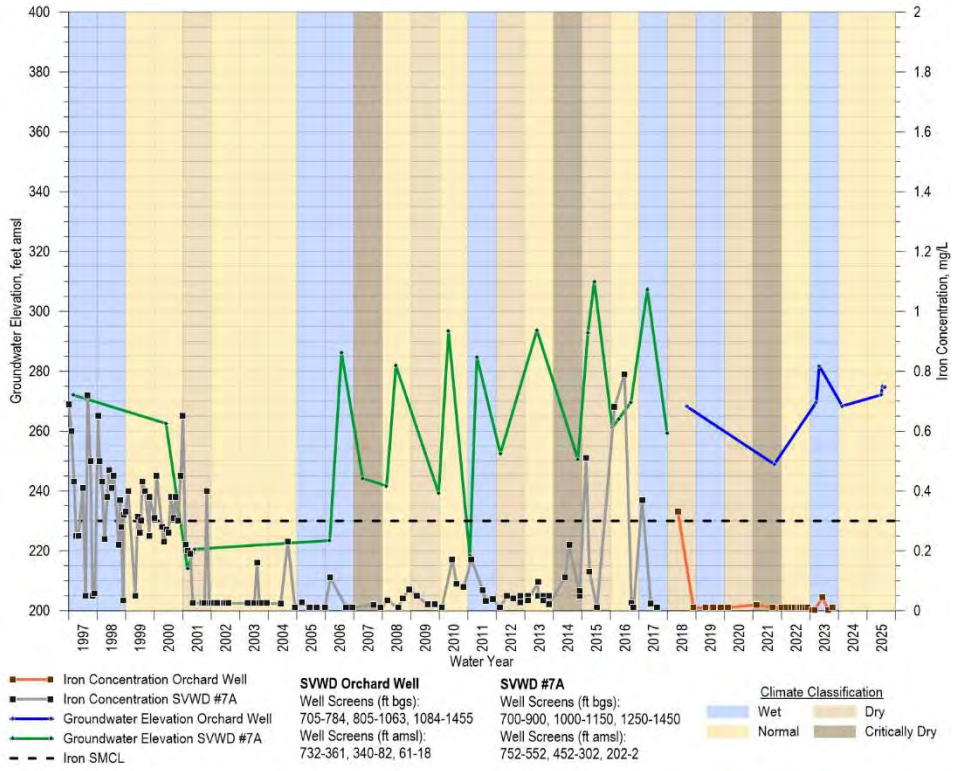



Figure 4-314~~-314-4-31~~. Historical Iron and Manganese Concentrations and Groundwater Elevations in SVWD Well #3B (Lompico/Butano Aquifer)



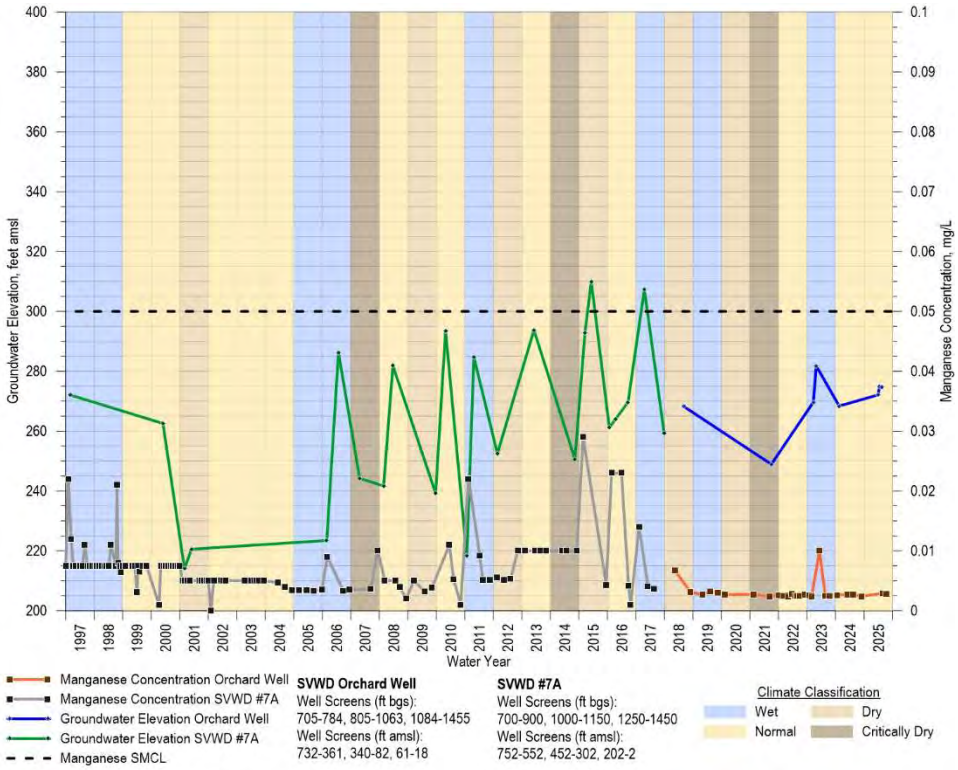




Figure 4-324~~-324-4-32~~. Historical Iron and Manganese Concentrations and Groundwater Elevations in SVWD Well #7A and Orchard (Lompico/Butano Aquifer)

### ~~3.7.3.3~~4.4.3.3 Arsenic

Arsenic is a trace element often naturally present in groundwater that can negatively impact human health when consumed. Arsenic occurs naturally and is ubiquitous in the environment. It is found in many drinking water sources in California and is commonly associated with deeper portions of sedimentary fill-basins throughout the western United States~~.~~ (Anning *et al*., 2012). The primary MCL for arsenic is 0.010 mg/L.

Arsenic concentrations ~~above~~ exceeding the MCL with a recent maximum of ~~(up to~~ 0.~~025~~ 016 mg/L,~~)~~ are found periodically in several ~~extraction~~ wells extracting from~~pumping from in~~ the Lompico aquifer (Figure 4-33). ~~Due to wells with groundwater quality data in the~~ Lompico aquifer ~~water~~groundwater quality monitoring is~~being~~ limited to wells in the Pasatiempo and Scotts Valley portions of the Basin (Figure 4-36), ~~there are no arsenic data for the Lompico aquifer~~so the extent of arsenic in the Lompico aquifer in other portions of the Basin is ~~not~~un known. Non-detect or low detections of arsenic in the Basin's other aquifers (~~all wells with data are included in~~ Appendix ~~2D~~4B), including the Butano aquifer, support the observation that naturally elevated arsenic is limited to the Lompico aquifer.

Arsenic is occasionally detected above its MCL in surface waters in the northern and western portions of the Basin, such as near Boulder Creek and south Felton where the Lompico aquifer is exposed at the surface in this area. The iron and manganese treatment and blending process used for ~~groundwater extracted for municipal purposes~~distributed public supply water coincidentally treats arsenic to below MCLs prior to distribution.

~~Except for the~~ Lompico aquifer extraction wells SVWD #11B and SLVWD Pasatiempo #8 are the only active extraction wells with arsenic concentrations greater than the MCL~~, there are no increasing arsenic concentration trends in wells with arsenic detections~~. ~~Increasing a~~Arsenic concentration increases in SVWD #11B appear to be correlated with groundwater elevation declines prior to 2018, and may reflect the well drawing groundwater from a different portion of the aquifer than nearby SVWD #11A, which has low to non-detectable arsenic concentrations (Figure 4-34). There ~~is~~are insufficient data to make conclusions about the arsenic concentration and groundwater level relationship at SLVWD Pasatiempo #8. This well, installed in 2019~~, and~~ has a maximum arsenic concentration of 0.011 mg/L which is just above the MCL (Figure 4-35)~~.Updated data indicate that arsenic concentrations at SVWD #11B are highly variable, with intermittent exceedances of the MCL primarily during the late 1990s through mid-2010s, followed by generally stable concentrations near or below the MCL in more recent years. SVWD #11A is only 725 feet from SVWD #11B but is screened deeper thereby extracting groundwater from deeper in the Lompico aquifer. Consistent with this, arsenic concentrations at SVWD #11A~~

~~remain low (typically at or near detection limits) with no exceedances of the MCL and no observable trend over the period of record.~~

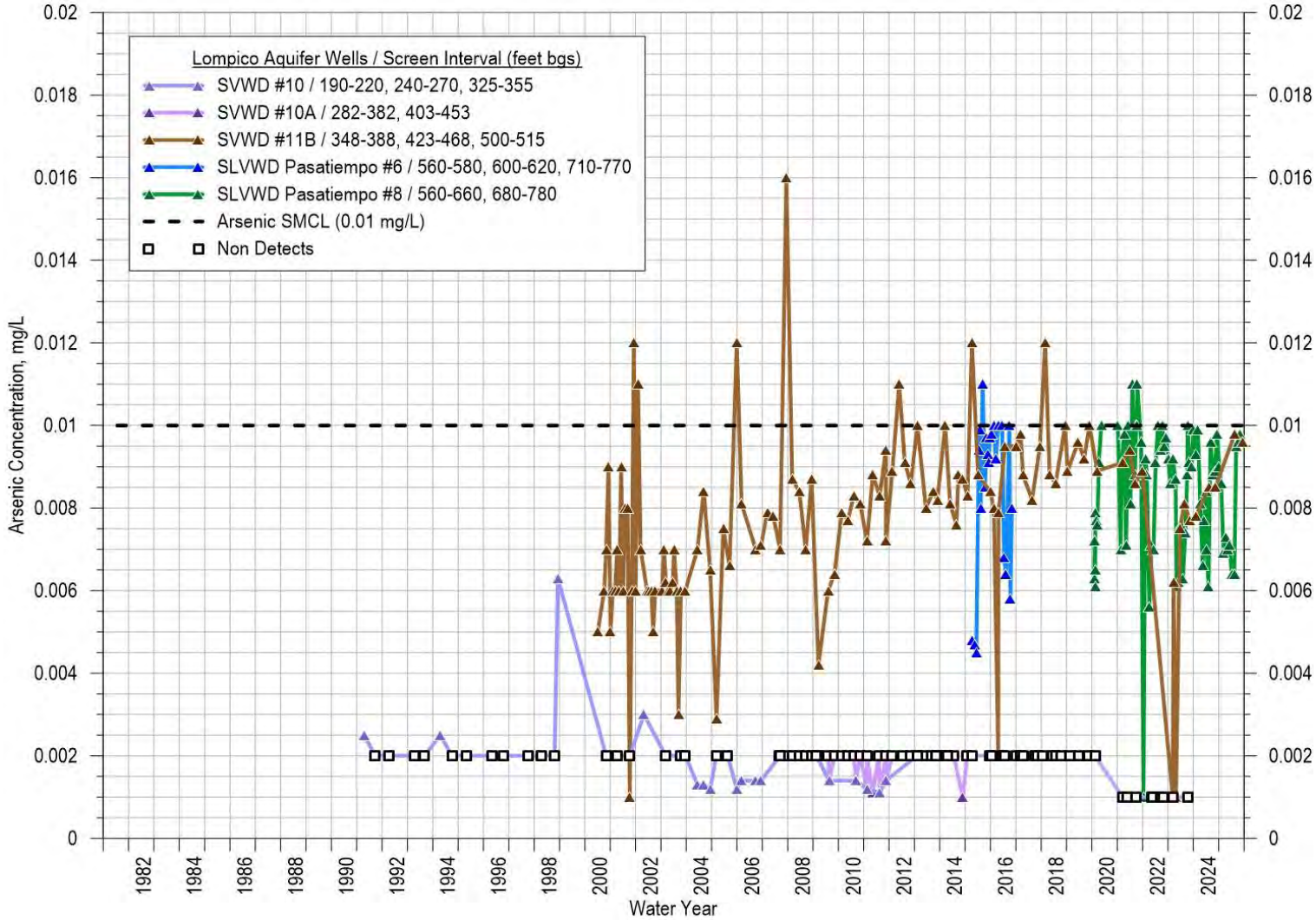
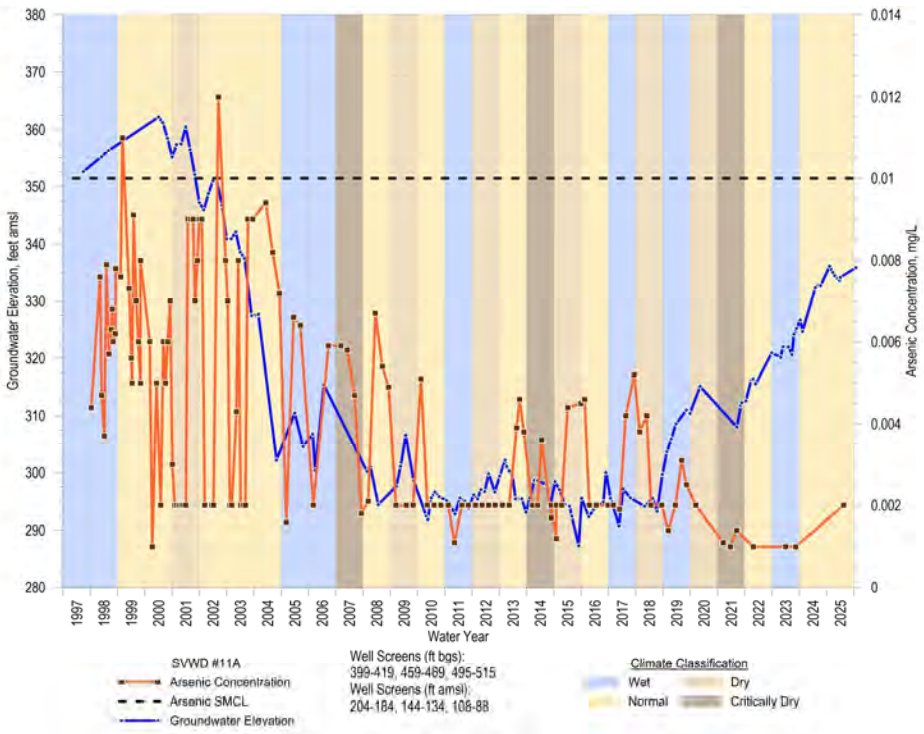

Lompico Aquifer Wells / Screen Interval (feet bgs)
SVWD #10 / 190-220, 240-270, 325-355
SVWD #10A / 282-382, 403-453
SVWD #11B / 348-388, 423-468, 500-515
SLVWD Pasatiempo #6 / 560-580, 600-620, 710-770
SLVWD Pasatiempo #8 / 560-660, 680-780
Arsenic SMCL (0.01 mg/L)
Non Detects
Arsenic Concentration, mg/L
Water Year
0.02
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024

Figure 4-334~~-334-4-33~~. Arsenic Concentrations in Select Lompico Aquifer Wells from 1990-~~2019~~2025



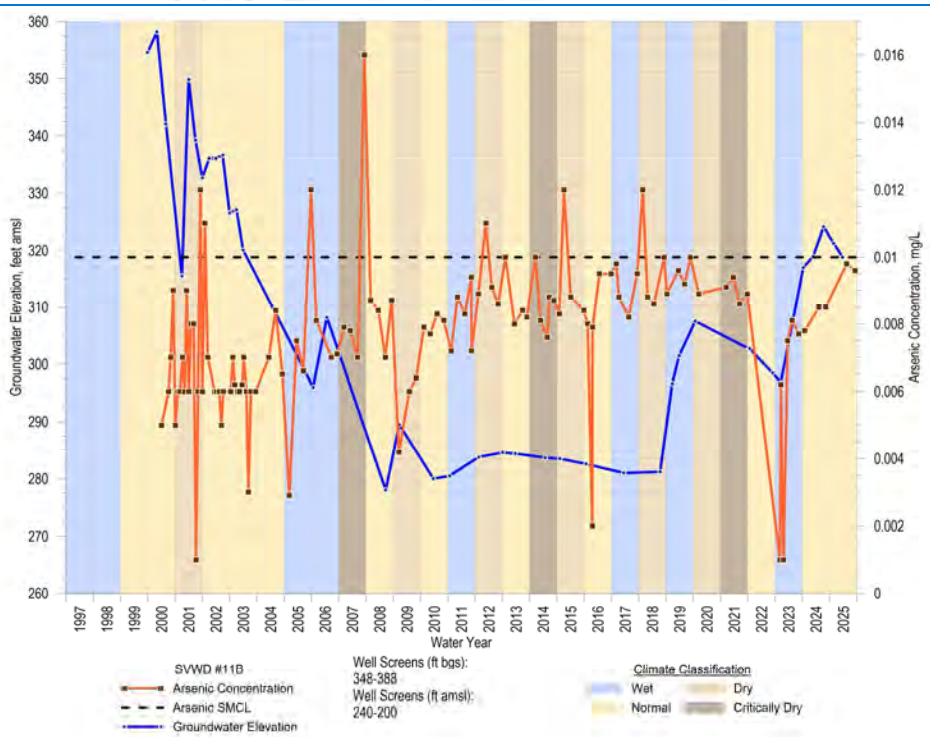




Figure 4-34~~4-344-4-34~~. Historical Arsenic Concentrations and Groundwater Elevations in SVWD #11A and SVWD #11B

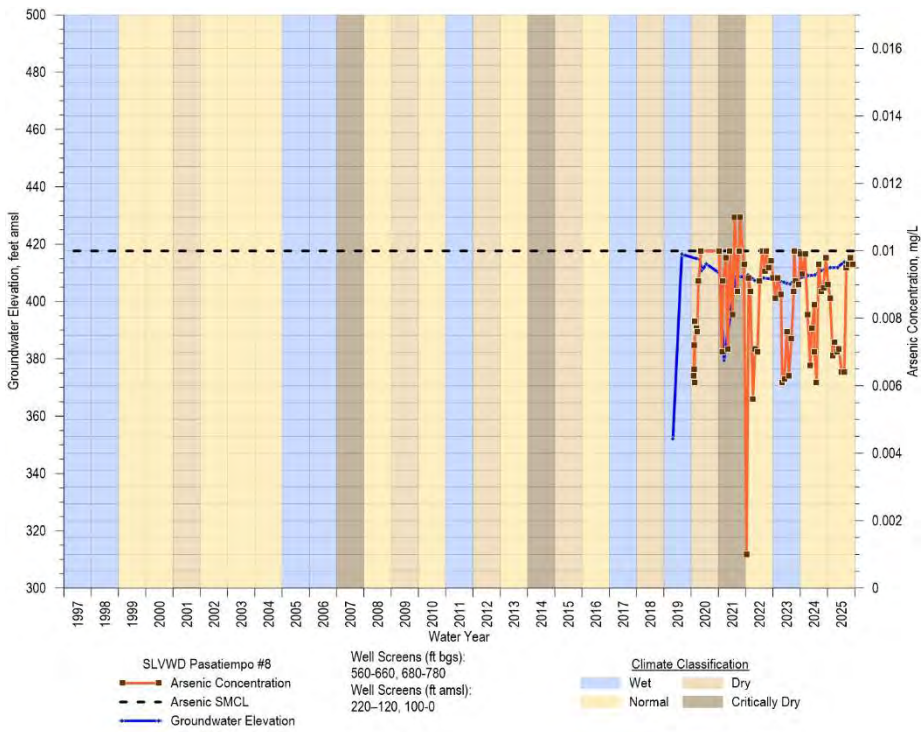



Figure 4-354-354-4-35. Historical Arsenic Concentrations and Groundwater Elevations in SLVWD Pasatiempo #8

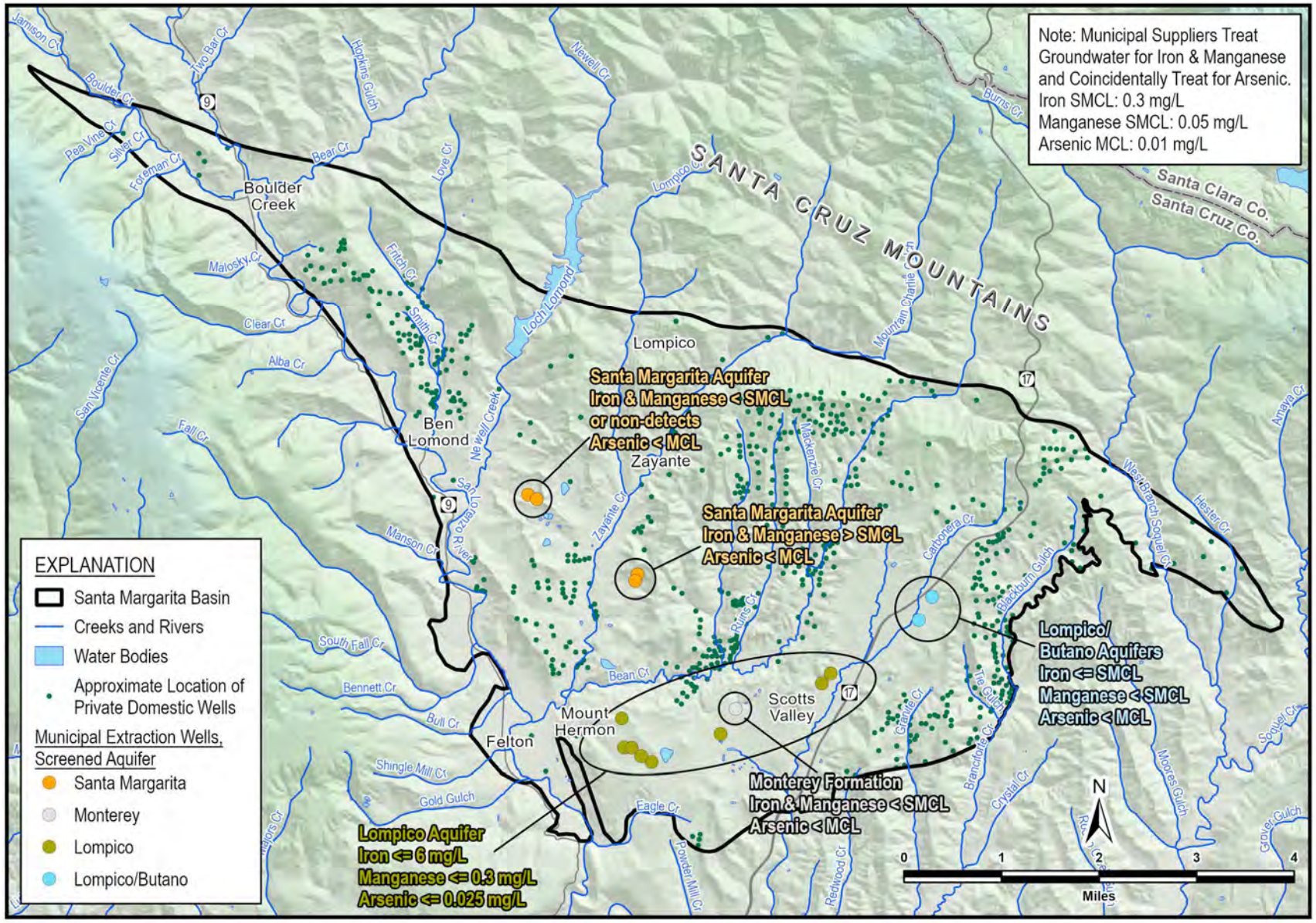



Figure 4-36~~4-36~~4-36. Areas of Elevated Naturally ~~Occuring~~Occurring Groundwater Quality

## ~~3.7.4~~4.4.4 Anthropogenic Constituents ~~of Concern~~ in Groundwater

### ~~3.7.4.1~~4.4.4.1 Nitrate

Nitrate is a regional water quality concern due to its prevalence in the environment and potential health impacts if ingested. Consumption of nitrates can cause methemoglobinemia (blue baby syndrome) in infants, which reduces the ability of the blood to carry oxygen. If left untreated, methemoglobinemia can be fatal for affected infants. Due to this health risk, a drinking water standard of 10 mg/L is set for nitrate measured as nitrogen (N) or 45 mg/L for nitrate as nitrate ($NO_3$).

#### *~~3.7.4.1.1~~4.4.4.1.1 NITRATE SOURCES*

Elevated nitrate in groundwater is typically derived from anthropogenic sources such as fertilizer applied to crops and turf, animal operations, such as livestock/stables, and human sources such as wastewater treatment plant effluent and septic tanks. In response to observed increased nitrate concentrations in the San Lorenzo River in the 1980s and 1990s, the County prepared a San Lorenzo Nitrate Management Plan to evaluate the impacts of nitrogen release from septic systems and other sources, and to develop recommendations for reduction of nitrate levels in groundwater and surface water (County of Santa Cruz, 1995). The 1995 Nitrate Management Plan found that 76% of the nitrate load in the San Lorenzo River originated from human waste including septic systems and sewer discharges. The remaining 24% was associated with natural (animal and plant) sources (16%), livestock and stables (6%), and fertilizer use (2%). The Nitrate Management Plan also found that the nitrate concentrations occurring in the San Lorenzo River at that time did not appear to have any adverse impacts on fishery resources, and that impacts on recreation were low.

Septic return flows and historical wastewater are the largest source of nitrate in the Basin. ~~Historically, the Hanson (also known as Kaiser) quarry in the Pasatiempo area was used to dispose of several thousand gallons per day of primary effluent from the Scotts Valley WRF constructed in 1964 (USGS, 1977).~~ The City of Scotts Valley is the only area of the Basin that is sewered although there are still approximately 445 operating septic systems (6% of systems in the Basin) within City limits (Figure 4-37). The vast majority of the Basin's residents, as shown on Figure 4-37, use septic systems to treat and dispose of sanitary waste. Using land use data and County septic system inspection records, it is estimated that there are approximately 7,789 septic systems in the Basin. Table 4-1 summarizes the estimated distribution of septic systems, with a major proportion of the Basin's septic systems in areas supplied water by SLVWD. Historically, primary effluent from the Scotts Valley WRF was discharged to the Hanson Quarry (USGS, 1977).

Table 4-14~~-14-1~~. Santa Margarita Basin Septic System Distribution

| Water Supplier | Estimated Number of Septic Systems (2018) | Percent |
|---|---|---|
| SLVWD | 5,275 | 68% |
| Private domestic wells | 784 | 10% |
| SVWD | 747 | 10% |
| Mount Hermon Association | 586 | 7% |
| Small Water Systems | 397 | 5% |
| **Total** | **7,789** | |

Nitrogen, primarily from urine, feces, food waste, and cleaning compounds, is present in sanitary wastewater. If sited or operated incorrectly, septic systems can be a significant source of groundwater contamination. Even properly functioning conventional septic systems may contribute nitrogen to groundwater exceeding this standard (USEPA, 2001).

~~The USEPA (2001) describes a typical household septic system as:~~

> ~~A septic tank, a distribution box, and a leachfield. Wastewater flows into the septic tank, where it is held for a period of time to allow suspended solids to separate out. The heavier solids collect in the bottom of the tank and are partially decomposed by microbial activity. Grease, oil, and fat, along with some digested solids, float to the surface to form a scum layer. The partially clarified wastewater that remains between the layers of scum and sludge flows to the distribution box, which distributes it evenly through the leachfield. The leachfield is a network of perforated pipes laid in gravel-filled trenches. Wastewater flows out of the pipes, through the gravel, and into the surrounding soil. As the wastewater effluent percolates down through the soil, chemical and biological processes remove some of the contaminants before they reach groundwater.~~

~~Nitrogen, primarily from urine, feces, food waste, and cleaning compounds, is present in sanitary wastewater. Consumption of nitrates can cause methemoglobinemia (blue baby syndrome) in infants, which reduces the ability of the blood to carry oxygen. If left untreated, methemoglobinemia can be fatal for affected infants. Due to this health risk, a drinking water standard of 10 mg/L is set for nitrate measured as nitrogen (N) or 45 mg/L for nitrate as nitrate ($NO_3$). Even properly functioning conventional septic systems may contribute nitrogen to groundwater exceeding this standard (USEPA, 2001).~~

The CCRWQCB has historically delegated authority to oversee and regulate the installation of septic systems to SCEH through a memorandum of understanding. The County must comply with the minimum standards contained in the Basin Plan in order to keep the authority to permit

septic systems. The County Board of Supervisors has adopted Section 7.38 of the County Code (the Sewage Disposal Ordinance) which specifies the standards for septic system installation in Santa Cruz County. The County's current ~~is currently in negotiations with the Regional Board for establishment of a~~ LAMP , ~~-~~which ~~will~~ is~~be~~ in compliance with the California Water Board's 2012 Water Quality Control Policy for Siting, Design, Operation and Maintenance of Onsite Wastewater Treatment Systems was adopted by the Santa Cruz County Board of Supervisors on August 23, 2022.

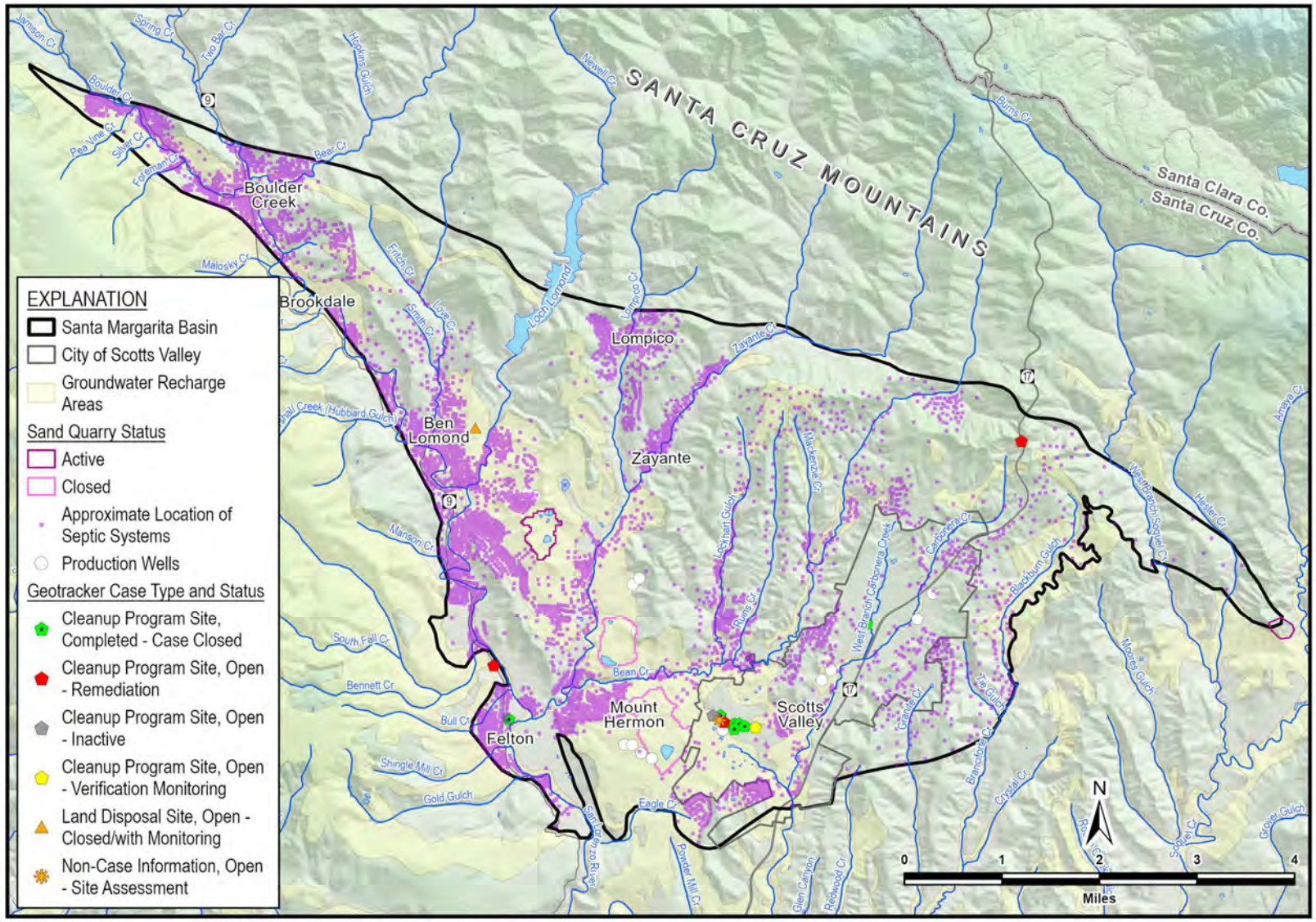



Figure 4-374~~-374-4-37~~. Potential Groundwater Contamination Sources

### ~~3.7.4.1.2~~4.4.4.1.2 *NITRATE CONCENTRATIONS IN GROUNDWATER*

Nitrate concentrations in the Santa Margarita and Lompico aquifers are well below the nitrate (as N) MCL of 10 mg/L Maximum nitrate (as N) detections in municipal wells from 2010 to 2025~~0~~ ~~were~~ are approximately 3.6 mg/L in the Santa Margarita aquifer, and -less than ~~0.7~~1 mg/L in the Lompico aquifer~~. These concentrations are well which are below the nitrate (as N) MCL of 10 mg/L~~. Nitrate ~~concentrations are generally higher~~ in the permeable Santa Margarita aquifer has relatively higher concentrations due to its widespread exposure at the surface and proximity to potential nitrate contamination sources such as septic tanks and livestock/stables. The description of nitrate concentrations below is limited to areas where groundwater quality data are available.

~~From the 1970s to the 1990s, d~~During the period of the County's greatest population growth, 1970s to the 1990s (Figure 4-2), nitrate concentrations increased in the Santa Margarita aquifer, particularly in the Quail Hollow area. Figure 4-38 plots nitrate (as N) concentrations in various wells screened at different depths ~~in the Basin SLVWD Quail Hollow extraction wells~~ from 1970-2025~~0~~. ~~The Quail Hollow~~~~These wells are screened in the Santa Margarita aquifer at different depths as noted on the chart.~~ Near-surface sources of nitrate have a greater impact on shallower wells (Quail Hollow #5 and #5A) compared to the deeper screened Quail Hollow #4 and #4A wells. There are also more septic systems potentially impacting Quail Hollow #5/5A than Quail Hollow #4/4A due to their different locations.

Historically n~~Figure 2-68Figure 2-68 shows that from the 1970s to the 1990s, during the County's greatest population growth (Figure 2-35Figure 2-35), nitrate concentrations increased in the Santa Margarita aquifer in the Quail Hollow area. N~~itrate concentrations ~~peaked~~peak in the impacted Santa Margarita aquifer wells during drought periods when groundwater levels are lower. Peak concentrations are observed at 3.5 mg/L in WY1987, which was during the 6-year statewide drought that extended from WY1986 through WY1991, and WY2016, which was at the end of the WY2012-2016 drought (Figure 4-38). Johnson (1988) demonstrated with a groundwater model that the nitrate peak at Quail Hollow was associated with late-season, drought-year pumping and the number of septic systems within the wells' capture zones.

Johnson forewarned that nitrate concentrations had the potential to increase again in the future as the source remained. ~~Thus far, only a temporary spike that remained below drinking water standards occurred during the WY2012 through WY2015 statewide drought in the Quail Hollow #5A well (Figure 2-69Figure 2-69). From Figure 2-69Figure 2-69.~~ Updated data through 2025 indicate that ~~this increaseese~~ nitrate concentration increases during droughts ~~were~~are ~~was~~ short-lived, with concentrations returning to typical levels (generally 2 to 3 mg/L or less) following the drought ~~period.periods~~. ~~From~~ Comparison of long-term groundwater level and nitrate concentration trends in Quail Hollow on Figure 4-39~~,, it~~ does not ~~appear that there is anyto~~ demonstrate ~~any~~ a significant correlation between nitrate concentrations~~, water year type,~~

and groundwater ~~elevation~~levels. It should be noted, however, that the nitrate data ~~plotted on Figure 2-69Figure 2-69Figure 2-69 is from groundwater quality samplesis~~are collected every 1 to 3 years per DDW requirements~~.~~, so may not be ~~. Comparing nitrate concentrations with water year type and groundwater elevations does not tell a complete story because the 3-year sampling frequency does not allow for comparisons at a seasonal level.~~ collected ~~frequentley~~frequently enough to fully analyze the interrelationship with seasonal groundwater level fluctuations~~does not allow for comparisons at a seasonal level~~.

~~Apart from the temporary increase in WY2015, concentrations in the Quail Hollow wells have been stable or slowly decreasing (Figure 2-68Figure 2-68), possibly in response to the County's efforts starting in 1986 toloading hasled to the observed in the Basin.work with property owners to reduce the occurrence of failing septic systems as well as instituting new requirements for the construction and performance of new and existing septic systems, including the requirement for enhanced treatment for effluent nitrogen reduction for new and replacement systems in sandy soils. Recent data (post-2015) continue to support stable to slightly decreasing nitrate concentrations in both shallow and deeper wells, with no evidence of renewed long-term increases.~~

Historically, the Santa Margarita aquifer in the Pasatiempo/southern Scotts Valley area was impacted by nitrate with concentrations (as N) up to 6 mg/L. The source of nitrate in this area is also ~~due to~~ septic and sewer waste disposal ~~described above in the section on nitrate sources~~ (Johnson, 2009). Recent nitrate concentration data are not available in this area since the Santa Margarita aquifer is no longer pumped for municipal use.

~~-~~Lompico aquifer wells in the area shown~~this area inIncluded~~ on Figure 4-38 ~~are public water supply wells screened in the Lompico aquifer. Groundwater in the Lompico aquifer~~ generally have ~~s~~ lower nitrate concentrations than the Santa Margarita aquifer because nitrate released at the ground surface undergoes~~of~~ greater attenuation before reaching~~to greater travel time nitrate has to reach~~ this ~~e~~ deeper aquifer ~~from the ground surface where nitrate is released~~. The extraction well, SVWD #10/10A, is screened in the Lompico aquifer below the Monterey Formation, which forms a barrier to downward recharge, and has mostly non-dete~~ct~~ctable ~~s of~~ nitrate concentrations. The SLVWD Pasatiempo wells, by contrast, are~~'s Pasatiempo wells, on the other hand, are~~ in an area where the Monterey Formation is absent or very thin. Without this ~~the~~ barrier between the Santa Margarita ~~aquifer~~ and Lompico aquifers ~~missing~~, nitrate concentrations there are slightly higher than in areas overlain by the fine-grained Monterey Formation, though still ~~but are~~ lower than in the Santa Margarita aquifer (Figure 4-38). The few public water supply wells screened in the Butano aquifer mostly have no detectable nitrate, reflecting the great depth of that ~~due to the very deep occurrence of the~~ aquifer.

The County's efforts starting in 1986 to manage nitrate loading from septic systems has likely contributed to stabilizing nitrate concentration trends observed in the Santa Margarita and Lompico aquifers. The County works with property owners to prevent failing septic systems, ~~institutes~~enforces new requirements for the construction and performance of new and existing septic systems, and requires enhanced treatment for effluent nitrogen reduction for new and replacement systems in sandy soils. ~~Recent g~~Groundwater monitoring since 2015 demonstrates that nitrate concentrations are stable to slightly decreasing in both shallow and deeper wells, with no evidence of wells with long-term concentration increases.

As described in Section 4.4.2, County well permitting code requires well owners of new private domestic wells to submit a single groundwater quality test result following well installation. Private domestic wells are more vulnerable to nitrate contamination than municipal wells because private wells are typically shallower and are closer to septic systems. The period from 2010 to 2019, only had 1 well with an elevated nitrate (as N) concentration of 4.9 mg/L and the remainder of the nitrate concentrations were less than 1 mg/L.

Figure 4-40 summarizes the Basin's spatial distribution of nitrate concentrations for different aquifers described above.

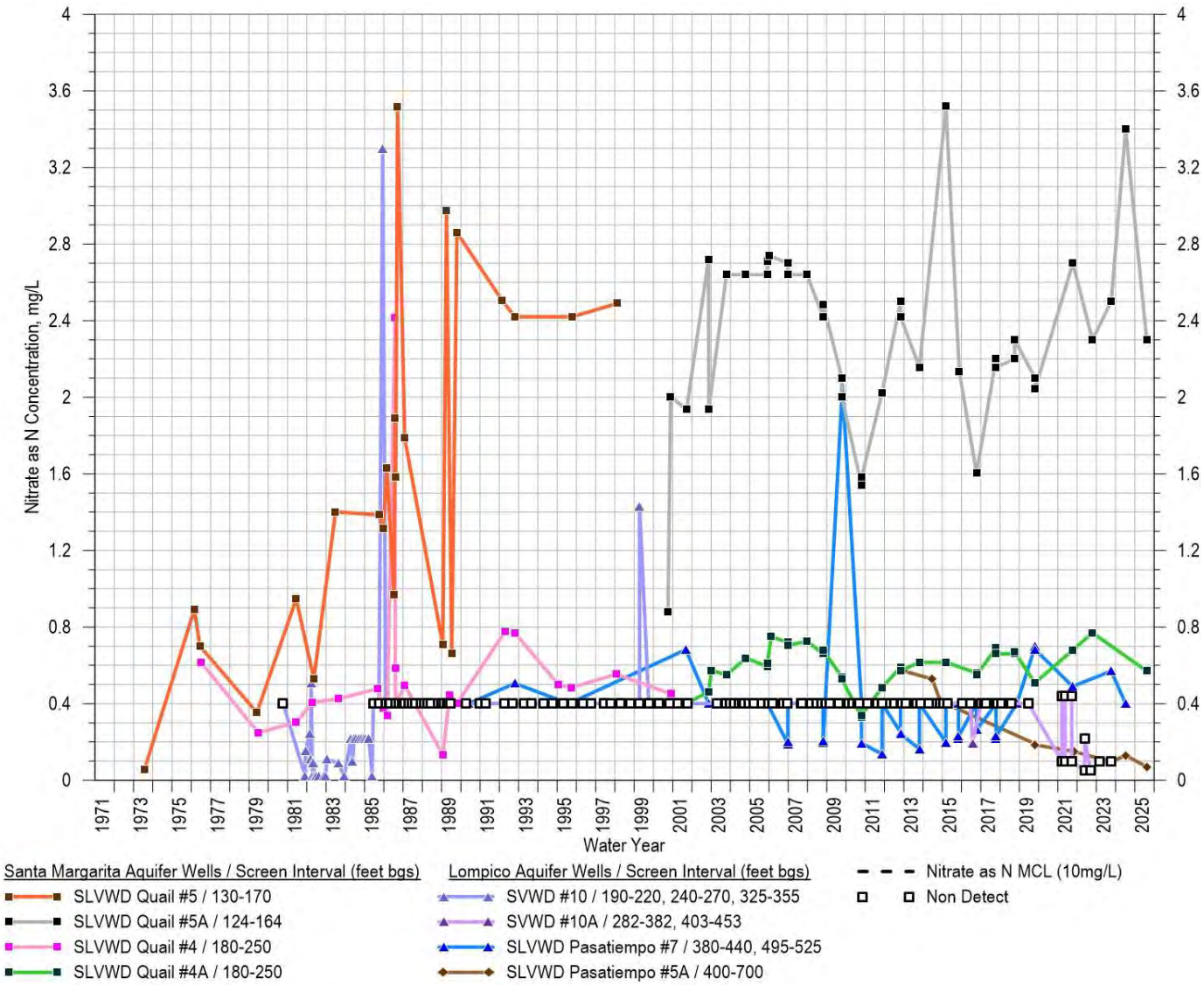
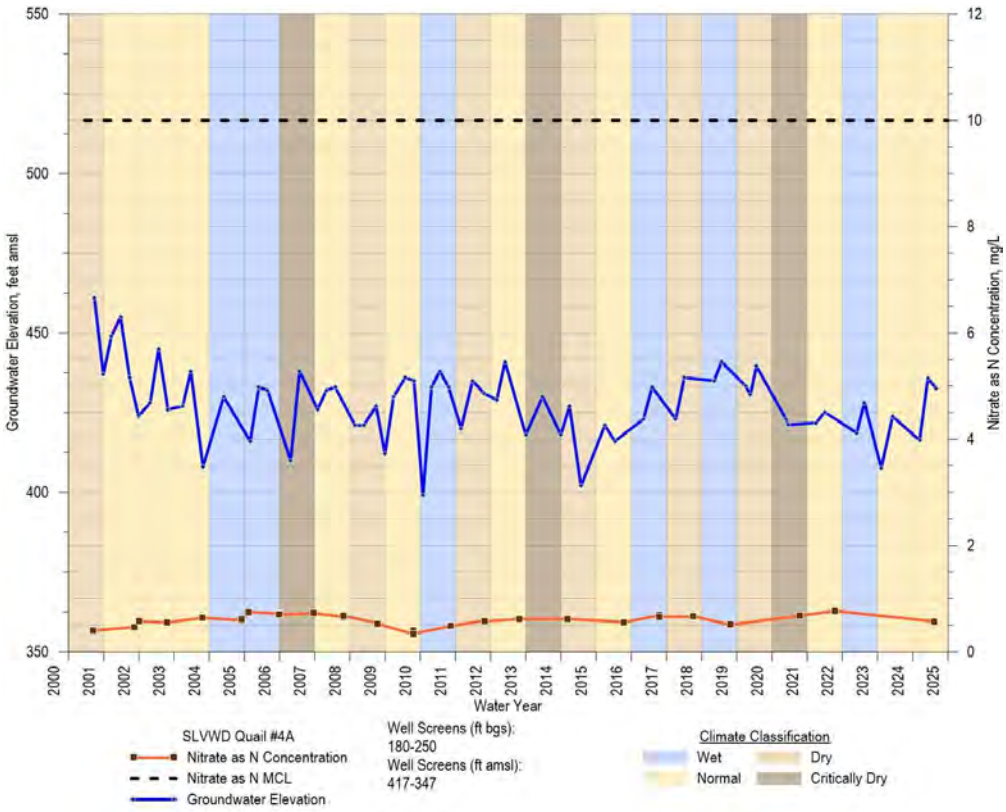



Figure 4-384-384-4-38. Historical Nitrate (as N) Concentrations, 1970-20202025



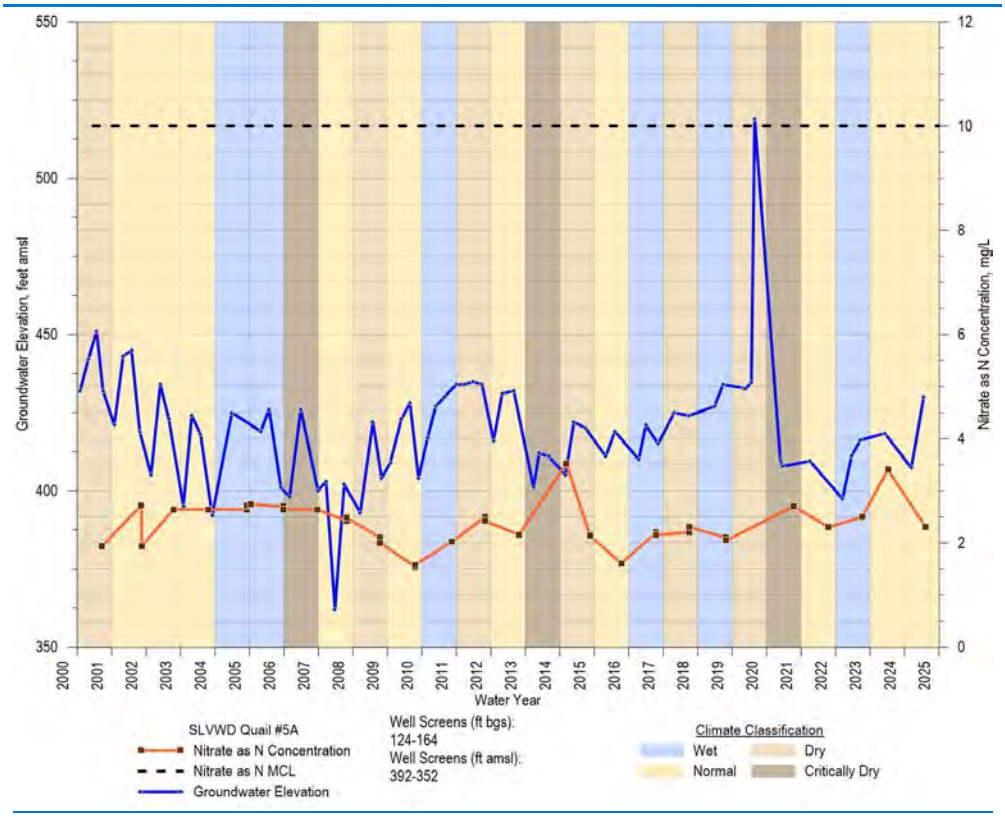




Figure 4-394-394-4-39. Historical Nitrate Concentrations and Groundwater Elevations in SLVWD Quail Hollow #4A and #5A (Santa Margarita Aquifer)

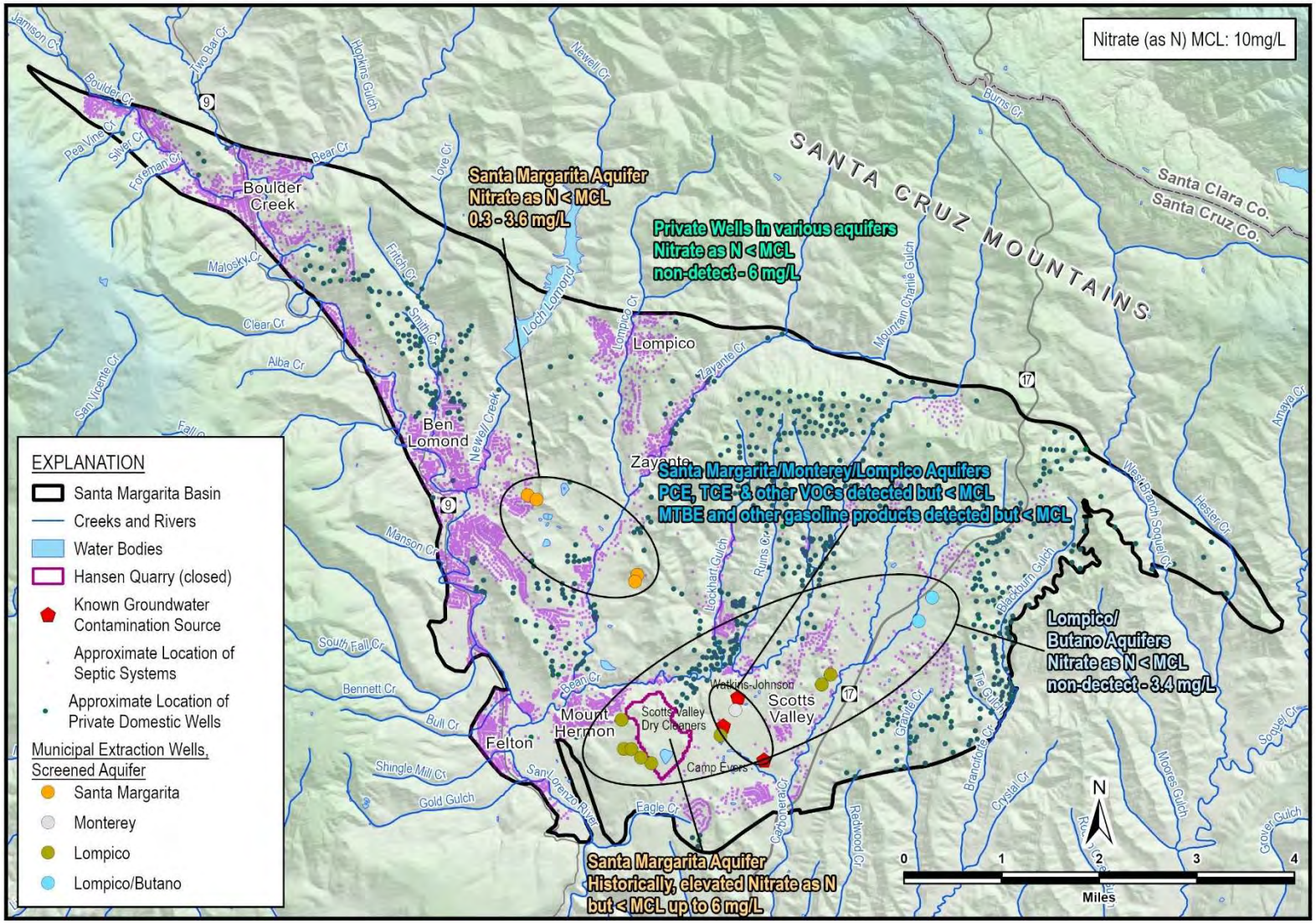



Figure 4-40~~4-404-4-40~~. Areas of Known Anthropogenic Groundwater Quality Impacts

#### ~~3.7.4.1.3~~4.4.4.1.3 *NITRATE CONCENTRATIONS IN THE SAN LORENZO RIVER*

Due to the great degree of groundwater and surface water interconnection, ground~~W~~water quality ~~in the Basin~~ has a strong influence on water quality in the San Lorenzo River. Nitrate released from septic systems, livestock, fertilizer use, and other sources passes readily through the sandy soil, into the basin groundwater and eventually into tributary streams and the San Lorenzo River. Summer average nitrate (as N) concentrations at the San Lorenzo River at Felton from 1976 to 1993 was 0.42 mg/L (County of Santa Cruz, 1995). More recently, nitrate (as N) concentrations at this same location averaged 0.47 mg/L between September 2011 and September 2018 (~~converted from nitrate (as $NO_3$) of 2.1 mg/L;~~ Trussell Technologies Inc., 2019). ~~Available data indicate that nitrate concentrations have remained relatively stable since that time, with values continuing to be well below the drinking water MCL.~~ This indicates that nitrate concentrations in the San Lorenzo River at Felton ~~have~~ increased approximately 11% over the ~~past~~ 30 year~~s~~ period.

The San Lorenzo River has been designated as impaired by the State and the USEPA due to elevated levels of nitrate, which stimulates increased algal growth and release of compounds that degrade the quality of drinking water and require increased cost for treatment. Increased nitrate and algal growth also causes impacts in the San Lorenzo lagoon, degrading salmonid habitat and potentially creating harmful algal blooms. Sixty-five percent of the nitrate load in the River originates from the Basin, the majority of which is from septic systems.

In order to reduce nitrate levels in the San Lorenzo River, the County developed the San Lorenzo Nitrate Management Plan in 1995, and the CCRWQCB adopted a Nitrate TMDL of 0.33 mg/L (as N). These plans call for various measures to prevent any increased nitrate discharge and to reduce existing sources, particularly requiring individual enhanced treatment systems as existing septic systems in sandy soils are replaced or upgraded. Additionally, the use of recycled water in the ~~basin~~ Basin requires additional treatment for denitrification before the water can be used.

### ~~3.7.4.2~~4.4.4.2 Constituents of Emerging Concern

Constituents of emerging concern (CECs), including pharmaceuticals and personal care products, are detected at low levels in the Basin's surface water and groundwater. CEC pathways to surface and groundwater resources are similar to nitrate since these constituents are typically found in wastewater. New and emerging contaminants are currently unregulated but may be subject to future regulation. Examples of new and emerging contaminants are N-Nitrosodimethylamine, and 1,4-dioxane, disinfection byproducts, and per- and polyfluoroalkyl substances (PFAS)~~perfluorinated substances~~.

The Unregulated Contaminant Monitoring Rule (UCMR) is part of the federal Safe Drinking Water Act Amendments of 1996 and administered by the U.S. Environmental Protection Agency

(USEPA). SVWD and SLVWD have had CECs tested in their source waters and treated water in 3 separate UCMR testing cycles: 2009/2010 (UCMR 2), 2014/2015 (UCMR 3), and 2018/2019 (UCMR 4). Apart from very low levels of brominated haloacetic acid disinfection byproducts in treated water, there ~~have been~~were no CECs detected in groundwater or surface water that are the 2 water districts' sources of water associated with those sampling events. More recently, SVWD and SLVWD were required to sample for 29 different PFAS in 2025/2026 as part of UCMR 5 released in 2021. While there were PFAS detections, no concentrations exceeded any notification levels associated with health-based concerns. UCMR data can be accessed from the USEPA (https://www.epa.gov/dwucmr/occurrence-data-unregulated-contaminant-monitoring-rule).

The San Lorenzo River which is a primary source of water for the City of Santa Cruz has detections of CECs at both the Tait and Felton diversions. The Tait diversion is south of the Basin and the Felton diversion is within the Basin. The City's CEC testing was initially undertaken to inform planning for upcoming improvements to the Graham Hill WTP (City of Santa Cruz, 2016~~b~~); it is now conducted annually and includes CEC testing of influent and effluent from the treatment plant. The most common CECs detected in raw San Lorenzo River water samples are 2 types of artificial sweeteners, Sucralose (i.e., Splenda) and Acesulfame-K, (i.e. Sunett and Sweet One). Sampling conducted over time and during different seasons found that the most diverse set of CECs were found in the first flush sample that reflects the influence of the first significant rainfall of the season on river flows and is intended to capture the impacts on water quality of both surface runoff and rewetting of the streambed.

Table 4-2 summarizes 1 year of monthly samples tested for CECs, including frequency of detections in either the raw source water blend and/or the treated drinking water at the Graham Hill WTP. In this 1-year WTP study, there were 59 total detections out of 2,304 CECs measured, which equals a 2.6% rate of CEC detection. Blending of the City's raw water sources prior to treatment was documented to decrease the higher CEC concentrations measured in the San Lorenzo River. Samples collected during the drier months of May through September measured lower concentrations of artificial ~~sugars~~ sweeteners (universal indictors of wastewater) and a dissimilar variety of CEC compounds compared to those CECs detected during the wetter periods. This occurs because of CECs entering the San Lorenzo River as either surface water runoff or septic system effluent through ~~saturated underground water flow~~groundwater baseflow, which are both less prevalent during dry-~~-~~season conditions. During these warmest months of the year, weekday, and weekend recreational activities in and around the San Lorenzo River are a probable source of human contamination from swimming and wading, as increased pharmaceutical and personal care products detections.

While there are few regulations for CECs at this time, it is expected there may be more in the future. There is a high likelihood that additional treatment techniques will be used to remove or

reduce CECs from the treated drinking water which will be more costly and likely require upgrades to existing WTPs.

Table 4-24-24-2. Summary of Constituents of Emerging Concern Detections in Raw Source Water Blend and/or Treated Drinking Water at the Graham Hill Water Treatment Plant (2016/2017)

| CEC Type | Chemical Type or Use with Common Name if Applicable | Number of CECs detected in the raw source water blend and/or treated drinking water in 2016/2017 | Number of Detections |
|---|---|---|---|
| Artificial sweeteners and caffeine | Artificial sweetener (Sunett and Sweet One) | Acesulfame- K (16) | 23 detections ranging from 6-320 ng/L, average detection of 70 ng/L |
| | Artificial sweetener (Splenda) | Sucralose (5) | |
| | Stimulant (coffee, tea, some energy drinks) | Caffeine (2) | |
| Pharmaceuticals | Antibiotic | Erythomycin (6) | 22 detections ranging from 6-130 ng/L, average detection of 34 ng/L |
| | Contrast media used for x-ray imaging | Iohexal (4) | |
| | Organic chemical used in the manufacture of a variety of other products such as dyes, some pharmaceuticals, and niacin (vitamin B3) | Quineline (3) | |
| | Pain relief medicine | Acetaminophen (2) | |
| | Veterinary drug for swine | Carbadox (2) | |
| | Antacid and antihistamine | Cimetidine (2) | |
| | Anti-inflammatory medicine | Meclofenamic acid (2) | |
| | High blood pressure medicine | Diltiazem (1) | |
| Herbicides and insecticides | Insect repellent | DEET (5) | 8 detections ranging from 5-60 ng/L, average detection of 23 ng/L |
| | Herbicide | Chloridazon (2) | |
| | Herbicide | Chlorotoluron (1) | |
| Personal care products | Alkylphenols used in manufacturing of antioxidants, lubricating oil additives, and laundry and dish detergents | 4-nonylphenol (4) | 5 detections ranging from 8-240 ng/L, average detection of 150 ng/L |
| | Paraben family of preservatives in personal care products found in cosmetics, pharmaceuticals and foods | Propylparaben (1) | |
| Flame retardant | Flame retardant | Tris(1,3-dichloro-2-propyl) phosphate (1) | 1 detection at 1,300 ng/L |

ng/L – nanograms per Liter

### 3.7.4.34.4.4.3 Organic Compounds

Organic compounds are those that include VOCs and pesticides. VOCs are chemicals that are carbon-containing and evaporate or vaporize easily into air at normal air temperatures. VOCs are found in a variety of commercial, industrial, and residential products, including gasoline, solvents, cleaners, and degreasers, paints, inks, and dyes, and pesticides. VOCs in the environment are typically the result of human activity, such as a spill or inappropriate disposal where the chemical has been allowed to infiltrate into the ground. Once released into the environment, VOCs may infiltrate into the ground and migrate into the underlying production aquifers.

Figure 4-37 shows the locations of all historical and current cleanup sites in the Basin sourced from the SWRCB GeoTracker database. GeoTracker is a database and geographic information system that provides online access to environmental data. It tracks regulatory data about leaking underground fuel tanks, Department of Defense, Spills-Leaks-Investigations-Cleanups, and landfill sites. Most the Basin's cleanup sites are in the Scotts Valley area and along the San Lorenzo Valley corridor ~~and~~ are impacted with VOCs. While closed-case cleanup sites (green) are present across a wide range of this area, current open-site cleanup cases are clustered near Felton and the Scotts Valley/Camp Evers area. These areas correspond with the Basin's developed areas and to detections of anthropogenic contaminants in wells (Figure 4-36 and Figure 4-40). ~~While closed-case cleanup sites (green) are present across a wide range of this area, current open-site cleanup cases are clustered near Felton and the Scotts Valley/Camp Evers area.~~ Section 2.2.9.1 summarizes the status of the Basin's groundwater cleanup cases based on information available from GeoTracker. The bullets below summarize cleanup sites not included in 2.2.9:

- To the southwest of the Watkin-Johnson site there are 2 open-case dry cleaner cleanup sites in the City of Scotts Valley: Scotts Valley Dry Cleaners (orange pentagon on Figure 4-37) and King's Cleaners (yellow pentagon on Figure 4-37). Both sites are located on Mt. Hermon Road between Scotts Valley Drive and Skypark Drive. The Scotts Valley Dry Cleaners site currently operates soil vapor extraction and air sparging systems to remediate PCE and TCE in the unsaturated soils above the groundwater table by extracting soil vapor. A groundwater remediation system was used from 1998-2015. The King's Dry Cleaners Site is operating soil vapor remediation to remove PCE and TCE contamination.
- The Ben Lomond Landfill (orange triangle on Figure 4-37) was closed in 2012 and is now operated as a transfer station. Groundwater monitoring has been ongoing at the now-closed landfill since 1980, as the site is associated with elevated levels of VOCs and heavy metals. Contamination associated with the site was detected in SLVWD's Quail Hollow wellfield in the late 1990s, but concentrations of VOCs have been non-detectable since 2007 ~~is not predicted to expand and is not thought to significantly impact 2 municipal wells operated by SLVWD east of Newell Creek~~ (Johnson, 2009).

In addition to the open-case sites discussed above, there have been many cleanup sites in the Basin which are now closed, indicated in green on Figure 4-37. These include numerous LUST sites, such as the now closed (since November 21, 2017) Camp Evers Combined Site associated with 4 current and former gasoline stations located at the intersection of Scotts Valley Drive and Mount Hermon Road. Although the Camp Evers site cleanup is complete as described in Section 2.2.9.1, there are remaining gasoline related chemicals in groundwater below their relevant MCLs.

Several SVWD municipal water supply wells have been impacted by organic compounds originating from some of the sites described above (Montgomery & Associates, 2020). SLVWD's Quail Hollow wells have historically been impacted by organics thought to have originated from spills or septic system disposal of cleaning products by 1 or more of the local residences (Johnson, 2009). Table 4-3 identifies those wells with detections. SVWD and SLVWD use onsite treatment plants to remove certain constituents that are above or approaching primary or secondary drinking water standards.

Table 4-34~~-34-3~~. Summary of Municipal Water Supply Wells Historical Detections of Organic Compounds

| Well | PCE MCL = 0.005 mg/L | TCE MCL = 0.005 mg/L | cis-1,2-DCE MCL = 0.07 mg/L | Chloro-benzene MCL = 0.1 mg/L | MTBE MCL = 0.013 mg/L |
|---|---|---|---|---|---|
| **Santa Margarita Aquifer** | | | | | |
| SLVWD Quail Hollow #4A | ND | ND | ND | ND | ND |
| SLVWD Quail Hollow #5A | ND | Below MCL | ND | ND | Below MCL |
| SLVWD Olympia #2 | ND | ND | ND | ND | ND |
| SLVWD Olympia #3 | ND | ND | ND | ND | ND |
| **Monterey Formation** | | | | | |
| SVWD #9* | ND | Below MCL | Below MCL | ND | Below MCL |
| **Lompico Aquifer** | | | | | |
| SLVWD Pasatiempo #5A | ND | ND | ND | ND | ND |
| SLVWD Pasatiempo #7 | ND | ND | ND | ND | ND |
| SLVWD Pasatiempo #8 | ND | ND | ND | ND | ND |
| SLVWD Mañana Woods #2* | ND | ND | ND | ND | Above MCL |
| SVWD #10A | ND | ND | ND | ND | ND |
| SVWD #11A | ND | ND | ND | Below MCL | ND |
| SVWD #11B | ND | ND | ND | ND | ND |
| **Lompico/Butano Aquifer** | | | | | |
| SVWD #3B* | ND | ND | ND | ND | ND |
| SVWD Orchard ~~Well~~ | ND | ND | ND | ND | ND |
| SVWD Sucinto | ND | ND | ND | ND | ND |
| SVWD Grace Way | ND | ND | ND | ND | ND |

MCL = maximum contaminant level or primary drinking water standard
* Well no longer used for water supply

Similar to the fate of nitrate, organic constituents readily migrate through the Santa Margarita Sandstone to the water table. The Lompico aquifer is more protected from contaminants

migrating downwards through the Santa Margarita aquifer by the Monterey Formation if it is present above the Lompico aquifer.

## ~~3.8~~4.5 Land Subsidence

Land subsidence is the gradual or sudden lowering of the land surface. Subsidence can be inelastic or elastic. Elastic subsidence includes short-term land surface elevation changes that are reversible; inelastic subsidence is irreversible. Only inelastic subsidence caused by groundwater pumping is subject to SGMA and GSP Regulations. Besides groundwater pumping, ~~I~~inelastic subsidence can also be caused by the following processes~~, however only aquifer-compaction related to groundwater pumping is subject to SGMA and GSP Regulations~~:

- Drainage and decomposition of organic soils
- Underground mining, oil and gas extraction, hydrocompaction, natural compaction, sinkholes, thawing permafrost
- Aquifer-system compaction
- Tectonic forces such as fault uplift and land sliding

There is no known evidence of land subsidence in the Basin. Potential evidence of land subsidence related to lowered groundwater elevations might include damage to roads, bridges, and ~~instances of protruding~~ well casings. None of these conditions have been prevalent ~~observed~~ in the Basin, nor attributed to subsidence.

~~The only potential cause of subsidence in the Basin subject to SGMA is aquifer-compaction caused by lowered groundwater levels from groundwater pumping. The Monterey Formation and Lompico aquifer have experienced up to 200 feet in groundwater decline in the Scotts Valley area but no known subsidence impacts have been observed.~~

Pumping-induced subsidence is generally restricted to unconsolidated deposits of clay and fine silt, in which extraction of pore water results in the grains of sediment no longer being subjected to the buoyant support of fluid-saturated pore space. The collapse is inelastic in that, even if pumping were to cease, the deposit ~~is~~ has less pore space to hold water and reduced conductivity.

Monterey Formation and Lompico aquifer have experienced up to 200 feet in groundwater decline in the Scotts Valley area but no known subsidence has been observed.

~~In contrast, t~~This is because the Basin's ~~3 principal~~ aquifers are sandstones that are, to varying degrees, consolidated and cemented. When groundwater is extracted from the pores, the pores do not collapse ~~(~~as they would in unconsolidated deposits or clay-rich rocks~~)~~ because the framework of sand and silt grains remains ~~due to grain-on-grain contact and~~ due to lithologic cement that holds the grains in place.

The Monterey Formation, though consisting mostly of siltstone and siliceous shale, has not undergone pumping-induced compaction because the formation is well consolidated and well-cemented. Moreover, the horizons tapped by the pumping are sandy interbeds that are coarser than the bulk of the formation.

As no reports or observations have been made regarding land subsidence due to lowered groundwater elevations in the basin, no local land-based -subsidence monitoring has taken place. There is a continuous global positioning station (CGPS) near Felton about 2.4 miles west of the Basin that is part of the University NAVSTAR Consortium Plate Boundary Observatory network; however, it is located outside the sedimentary basin on granitic basement rock, making it useful for tracking movement of the land surface due to tectonic deformation but of no use for monitoring pumping-induced subsidence in the nearby sedimentary rocks of the Basin.

DWR has made vertical displacement ~~spatial~~ data available as part of its SGMA technical assistance for GSP development and implementation. Vertical displacement estimates are derived from Interferometric Synthetic Aperture Radar (InSAR) data that are collected by the European Space Agency Sentinel-1A and 1B satellites and processed by TRE ALTAMIRA Inc. The InSAR dataset is available for public use and has ~~also~~ been calibrated to best available independent data prior to release by DWR. The statewide dataset starts in mid-~~January~~ June 2015.

InSAR monitoring ~~It is important to understand that the DWR InSAR data~~ is subject to potential errors of approximately 0.059 feet (0.7 inch) from discrepancies between InSAR data and CGPS data (Towill Inc., 2020) and measurement accuracy when converting from the raw InSAR data to the maps provided by DWR of 0.048 feet (personal communication with Benjamin Breezing at DWR, 2019). A land surface change of less than 0.1 foot (1.2 inches) which is less than the combined error of the dataset is within the noise of the data and is not dispositive of subsidence in the Basin. Additionally, InSAR data provided by DWR reflects both elastic and inelastic subsidence.

~~, derived from the dataset,~~ Figure 4-41 shows changes in total vertical ground surface displacement measured by InSAR between June 2015 and ~~June~~ April ~~2019~~2026. During this timeframe, the satellite data showed generally minimum vertical displacement, with most of the basin exhibiting between approximately –0.02 and 0.02 inches and limited localized areas showing up to slightly greater than 0.02 inches of uplift or subsidence within the basin. ~~up to 1.2 inches (0.1 feet) of subsidence within the Basin.~~ Most areas with estimated subsidence on Figure 4-41 are regional and not co-located with groundwater pumping. It is unlikely these relatively minor changes in ground surface elevation reflect ongoing ~~trends in~~ inelastic subsidence trends. Rather, they may be attributed to expected measurement error inherent in the methodology, seasonal fluctuations in soil and vadose zone moisture that cause swelling and recession of the ground surface, or tectonic forces. ~~A local area approximately 1 square mile to the east of Loch~~

~~Lomond Reservoir shows a slight rise in land surface of up to 0.035 inchesslightly greater than 0.02 inches (Figure 2-71Figure 2-71) that is also within the noise of the InSAR data.~~

The lack of land subsidence related to historical declines in groundwater levels combined with the consolidated nature of Basin sediments support the inapplicability of land subsidence as an indicator of sustainability.

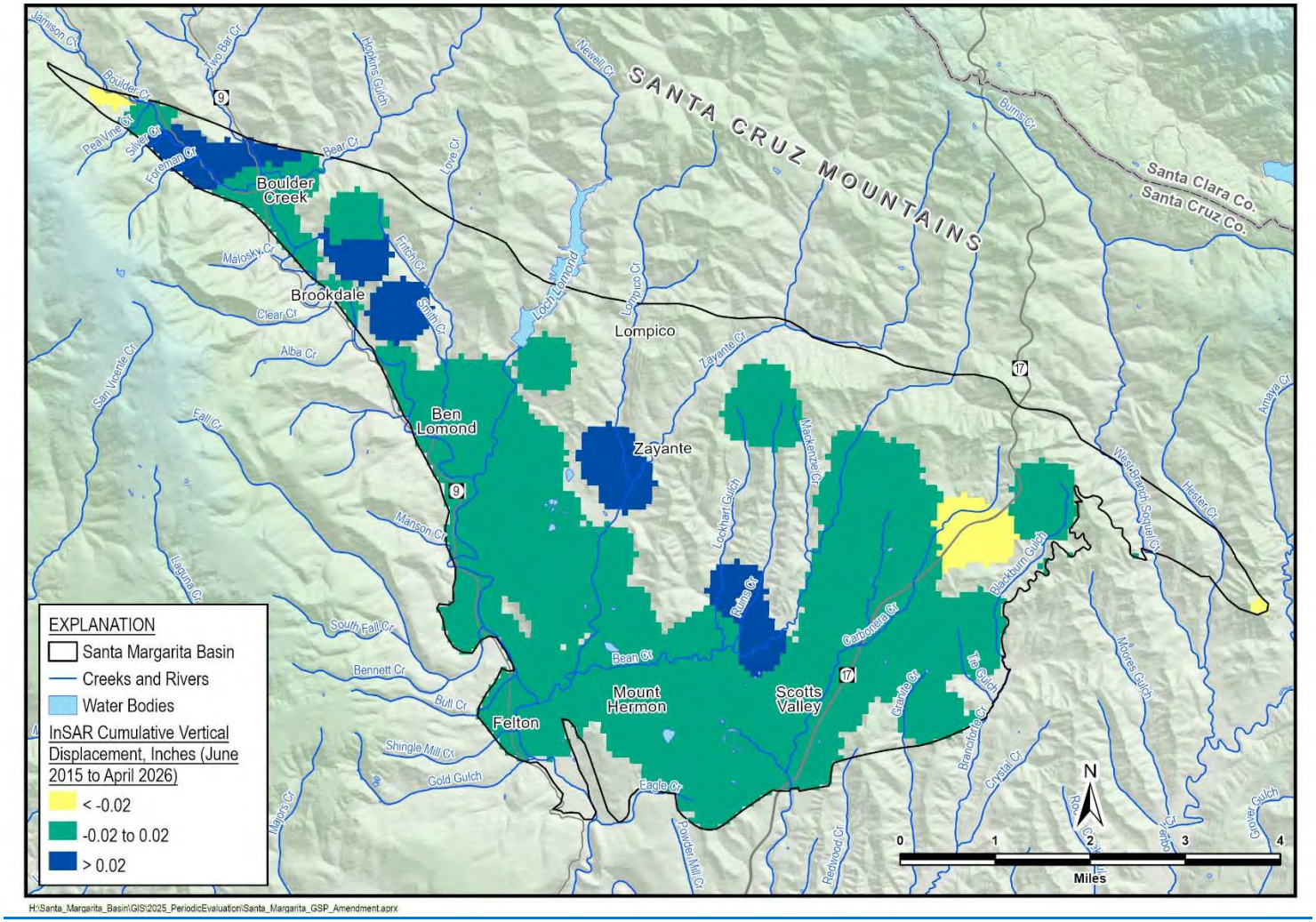



Figure 4-414-414-4-41. Total Vertical Land Surface Displacement in Santa Margarita Basin from June 2015 – June 20192026 (based on TRE ALTAMIRA Inc. InSAR)

## 4.6 Interconnected Surface Water

Surface water is largely connected to groundwater throughout the Basin. As discussed in Section 3.4.8, essentially all flow in the Basin's streams and creeks is derived from groundwater during the dry season from late May through October (Johnson, 2009). The SMGWA, member agencies, and local partners have collected a vast quantity of data to evaluate interconnection of surface water and groundwater, including stream gauging, accretion studies, groundwater level monitoring, stream topography surveys, field habitat reconnaissance, and groundwater modeling. This information helps inform the correlation between groundwater levels as a proxy for evaluating ~~streamflow~~ depletion ~~and the timing and rate of depletion due to groundwater extraction in the Basin~~of interconnected surface water.

### ~~3.8.1~~4.6.1 Locations of Interconnected Surface Water

The highly permeable nature of the Santa Margarita aquifer and its proximity to surface water features lends it to being ~~a~~ the primary source of baseflows to the Basin's creeks and the San Lorenzo River. Groundwater in other aquifers is also connected to surface water, but the Santa Margarita aquifer is the greatest overall contributor. The historical groundwater budget in Section 5.4.3 estimates that net groundwater contributions to surface water (i.e., groundwater discharge to creeks less groundwater recharge from creeks) ~~historically~~ averaged about ~~12,720~~12,600 AFY. The Santa Margarita aquifer contributes 40%, the Butano aquifer contributes 32%, and the other formations connected to creeks contributing a combined 28% of net groundwater discharge to creeks. The Butano aquifer contributes a relatively larger amount than expected because it is intersected by numerous creeks along the Basin's northern boundary where these interactions occur. The other formations and aquifers that discharge groundwater to creeks in the Basin include the small portion of alluvium near Felton, the Monterey Formation, and the Lompico aquifer.

Accretion studies provide field observations that demonstrate ~~indicate~~where ~~the aquifer~~groundwater is ~~adding~~contributing to stream-flow ~~to the stream,~~ and where ~~the~~ streams are ~~is~~ replenishing ~~the aquifer~~groundwater. In 2017, Balance Hydrologics began evaluating interconnected surface water by conducting annual late-season stream observation walks ("accretion runs"), where flow and specific conductance were measured with high precision at select locations along the San Lorenzo River and its tributaries[2]. The accretion runs also include habitat-oriented measurements of localized changes in water temperature, ~~whether~~ temperature stratification ~~of temperature may be present in deep pools~~, and the presence and height of recent high-water marks, all of which also inform assessments of surface/groundwater exchange. Additionally, measurements of nitrate and sometimes other

[2] This work grew out of detailed hydrologic studies conducted for the SLVWD during 2 very dry summers (2014 and 2015), coupled with the effects of a recovery year (2016), and the recommendations of the technical advisory committee reviewing that work.

major ions or forms or organic carbon (Richardson *et al*., 2020) are also included in many of the ~~'~~accretion runs~~.'~~. ~~Accretion studies tell where the aquifer is adding flow to the stream, and where the stream is replenishing the aquifer. Carefully conducted accretion studies are perhaps the best way of quantifying an understanding of aquifer dynamics and surface-groundwater exchange.~~ Sites along the San Lorenzo River are measured from upstream of downtown Boulder Creek to below the USGS at Big Trees gage (Section 6.6.1). Much of the emphasis is on areas within the outcrop of the Santa Margarita Sandstone, which contributes water to the river and its tributaries, most notably from below Love Creek to downstream of the USGS Big Trees gage, beneath the Henry Cowell State Park entrance road.

As part of ~~the on-going~~ GSP development and implementation~~processes~~, sites along Zayante, Lompico and Bean Creeks were added to the accretion runs in the summer of 2019 and 2020, with most of the additional sites along Bean Creek and its tributaries. During the summer and fall of 2019, 3 separate accretion runs (May, July, and September) were conducted on the San Lorenzo River, Lompico, Zayante, Bean, and Eagle Creeks, where measurements were collected at all sites over a period of 1 to 2 days for each run. During the summer and ~~Fall~~ fall of 2020, 2 separate accretion runs were conducted (July and September) at the same locations as in 2019.

~~The results of the~~ A~~a~~ccretion sampling results ~~have~~ show~~n~~ flow increases downstream along the San Lorenzo River, Bean, and Zayante Creeks, except for 1 dry reach along Bean Creek. The flow increases are independent of surface contributions from other small tributaries along the reaches. These findings suggest ~~s~~ that the creek baseflow ~~in these creeks~~ is supported by groundwater discharge (Parke and Hecht, 2020a; Neill and Hecht, 2020; Neill *e~~a~~t al.*, 2021). Previous studies have shown that streams flowing through the Santa Margarita ~~Sandstone~~ aquifer in the San Lorenzo Valley all share common characteristics of elevated baseflows, low solute loads (measured as specific conductance), very low chloride contributions and elevated nitrate loads (Ricker, 1979; Ricker *et al*., 1994; Sylvester and Covay, 1978; Hecht *et al*., 1991; Parke and Hecht, 2020a). These characteristics were observed in the accretion runs where streams pass through portions of the Basin influenced by the Santa Margarita aquifer.

Along Bean Creek, the findings of the accretion ~~study~~ runs are consistent with previous observations: the upper Bean Creek watershed and its tributaries are typically losing reaches that recharge the groundwater, whereas streamflow in the lower watershed is enhanced by groundwater discharge from the Santa Margarita aquifer (Kennedy/Jenks Consultants, 2015; Neill and Hecht, 2020). It has been noted that Bean Creek, beginning about ~~a~~ one-quarter mile downstream of Mackenzie Creek, typically goes dry in the summer and has done so since the 1960s, although the extents vary between years (Kennedy/Jenks Consultants, 2015; personal communication with John Ricker, March 2020). Balance Hydrologics conducted a stream walk along the dry reach to document the conditions and extent during October 2019 and July 2020 (Neill and Hecht, 2020, Neill *et al*., 2021). The greatest increases in flows were observed downstream of the confluence of Ruins Creek with Bean Creek. This reach, in particular, is the

primary gaining reach within the Basin and is characterized by areas where the stream has cut through the Santa Margarita sandstone and into the top of underlying Monterey shale, such that springs in the streambed and along the sides of the stream are contributing groundwater discharge (Figure 4-42). Balance Hydrologics conducted a stream walk along the lower Bean Creek reach in September of 2020 to document the numerous seeps and springs contributing groundwater from the Santa Margarita aquifer (Neill *et al*., 2021). Similar observations of seeps and springs contributing groundwater along streams within the Basin have been documented along the San Lorenzo River, Zayante Creek, and Eagle Creek (Parke and Hecht, 2020a; Parke and Hecht, 2020b).

In addition to accretion studies and field observations, ~~a comparison~~analysis of groundwater elevations in monitoring wells compared to nearby streambed elevations shows ~~static~~ groundwater levels consistently higher than the streambed, indicates~~ing~~ that groundwater is contributing to streamflow in these locations year-round. Additional details on this analysis ~~is~~are provided in Section 4.6.2.

Findings from the abovementioned studies and observations are combined with model-simulated groundwater elevations in relation to creeks and land surface to produce a map ~~of~~ showing where surface water and groundwater are connected (Figure 4-42). The map includes creek connections together with non-riparian areas where depth to groundwater is on average less than 30 feet. A depth of 30 feet is selected because it is generally accepted as the maximum rooting depth for most plants supported by groundwater that are mapped in the Natural Communities Commonly Associated

with Groundwater Dataset (TNC, 2019). The map shows that many of the creeks in the Basin are likely interconnected with groundwater most of the time.

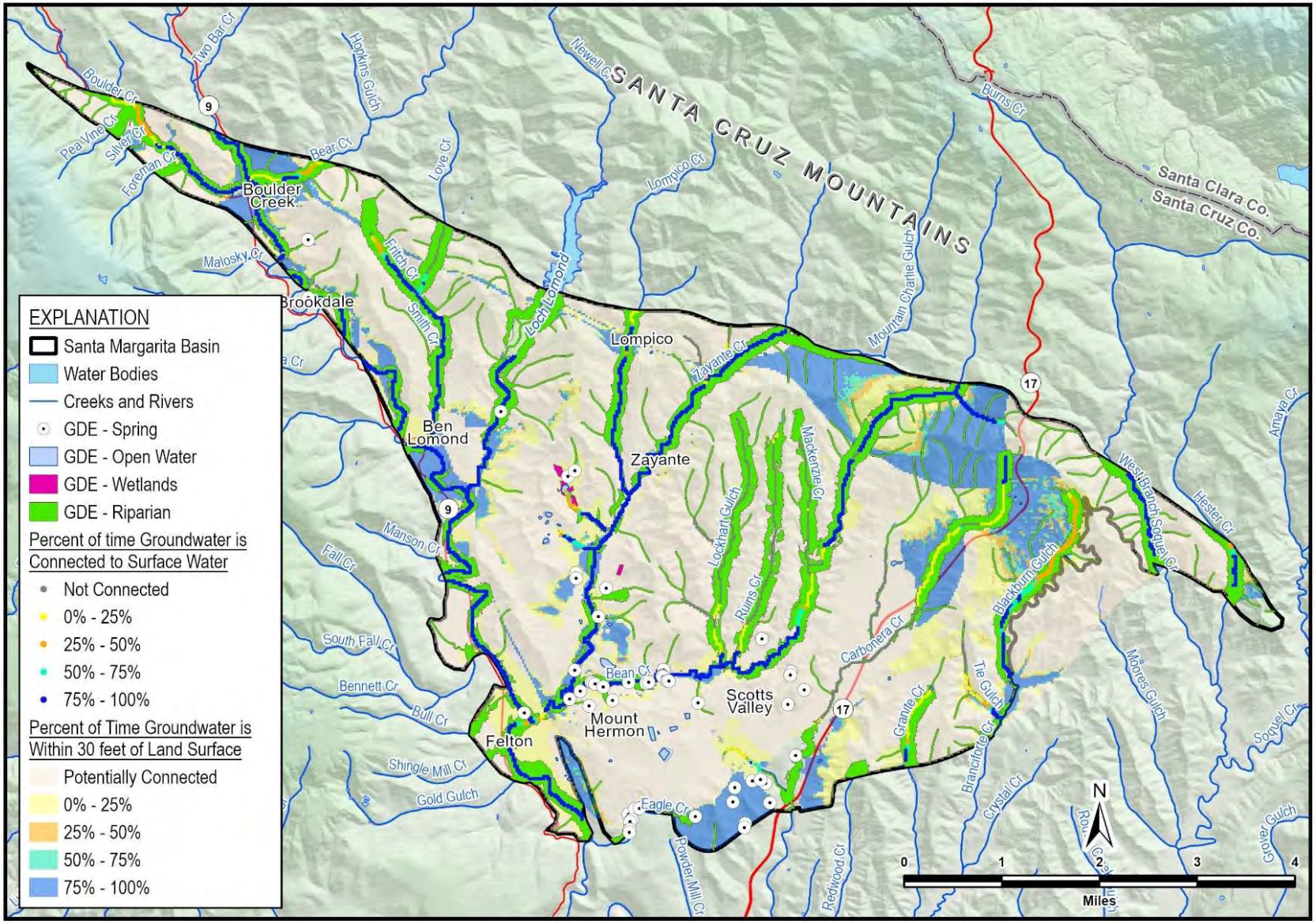



Figure 4-42. Interconnected Surface Water in the Santa Margarita Basin

### 4.6.2 Relationship of Interconnected Surface Water Baseflow to Groundwater Extraction and Precipitation

To assess the relationship between interconnected surface water, groundwater extraction, and water year precipitation, data for 25 water years (2001 through 2025) were compiled and reviewed. As described in Section 4.6.1 above, past accretion studies have established the relationship between surface water flow entering the Basin, tributaries from within and outside of the Basin, and the role of groundwater discharge to baseflow. The result of these relationships can be observed in daily flow as ~~measured~~gaged on the San Lorenzo River at Big Trees.

Figure 4-43 shows the daily flow in cfs plotted on a logarithmic scale throughout the water year averaged over 25 years. The flow data shows the high variability in mean daily flow that starts in mid-October and continues until mid-April associated with the wet season. After mid-April, flow becomes more consistent as it is dominated by groundwater discharge. The lowest flow of the season generally occurs throughout the month of September.

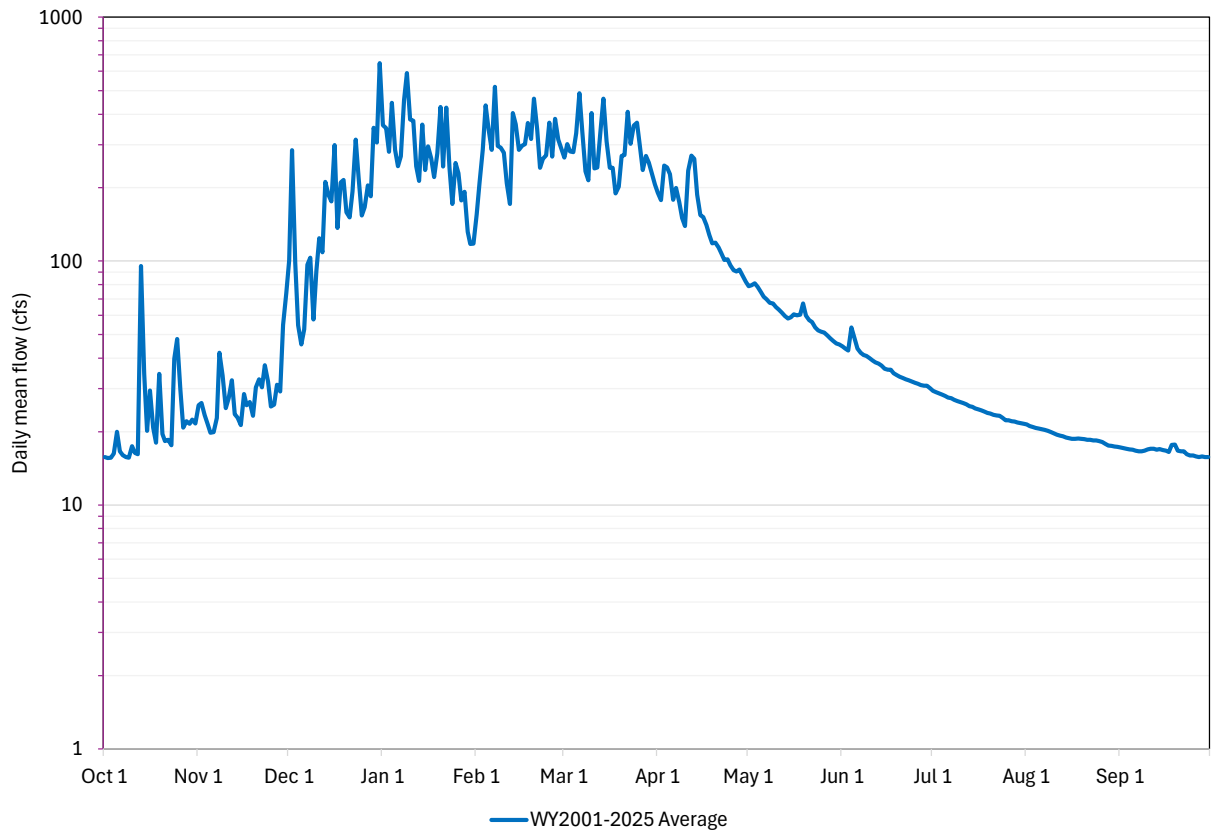



Figure 4-43. Daily Mean Flow on San Lorenzo River at Big Trees

As described in Sections 3.4.3, 3.4.4 and 4.2.2, the Basin has a unique geologic structure as a fault bounded syncline with the Santa Margarita Sandstone acting as a highly transmissive

unconfined aquifer that rapidly recharges and subsequently discharges baseflow to streams. ~~The d~~Discharge to streams is accentuated by the Santa Margarita Sandstone being situated above the Monterey Formation, which serves as a barrier to vertical groundwater flow (see Section 3.4.5.3). Figure 4-8 and Figure 4-9 show that the Santa Margarita Sandstone is present throughout much of the Basin with groundwater contours that largely mimic topography with groundwater elevations higher than adjacent streams that receive its discharge through baseflow and basal springs. Because this formation contributes so significantly to baseflow, a comparison of groundwater extraction from the Santa Margarita aquifer is appropriate to compare to the minimum daily flow measured in each year to evaluate the potential impact associated with groundwater extraction.

Figure 4-44 shows the low measured daily flow on the San Lorenzo River at the Big Trees ~~-~~gage in September ~~in cfs~~ from 2001 through 2025 compared to water year total groundwater extraction from the Santa Margarita aquifer ~~in AF~~. The data shows a relatively weak positive linear relationship, ~~. This~~ indicating~~es~~ that groundwater extraction has some influence on minimum flows at the end of the water year. However, ~~, but there are~~ some years combine ~~that have~~ very low groundwater extraction with lower than average flow, while other ~~and~~ years ~~that~~ have high extraction with above average flow.

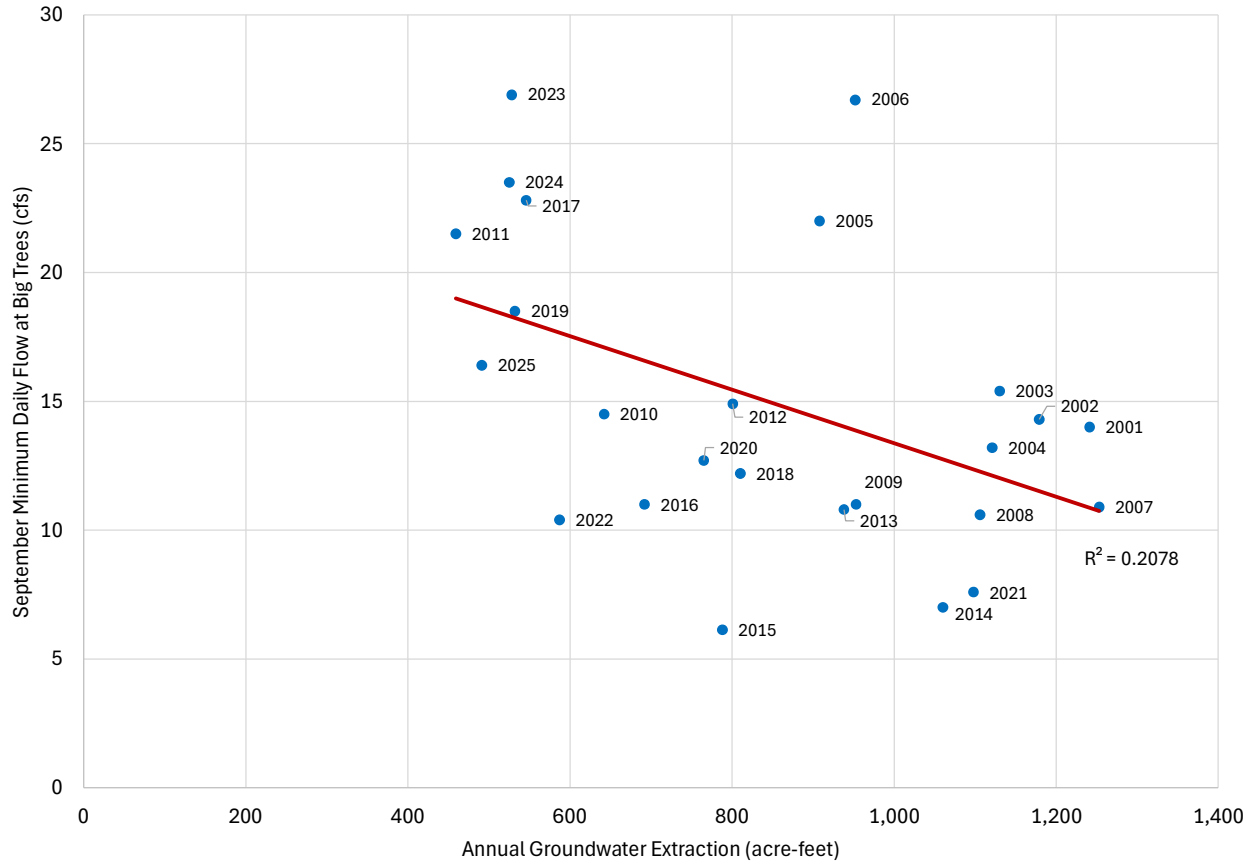


Figure 4-44. Relationship Between Minimum Flow at Big Trees Gage and Water Year Extraction in the Santa Margarita Aquifer

Figure 4-45 shows the low measured daily flow in September ~~in cfs~~ from 2001 through 2025 compared to water year total precipitation ~~in inches~~ as measured on the San Lorenzo River at the ~~Boulder Creek~~Big Trees gage. The data shows a relatively strong linear relationship, indicating that annual rainfall likely has a stronger influence on dry--season baseflow than groundwater extraction does.

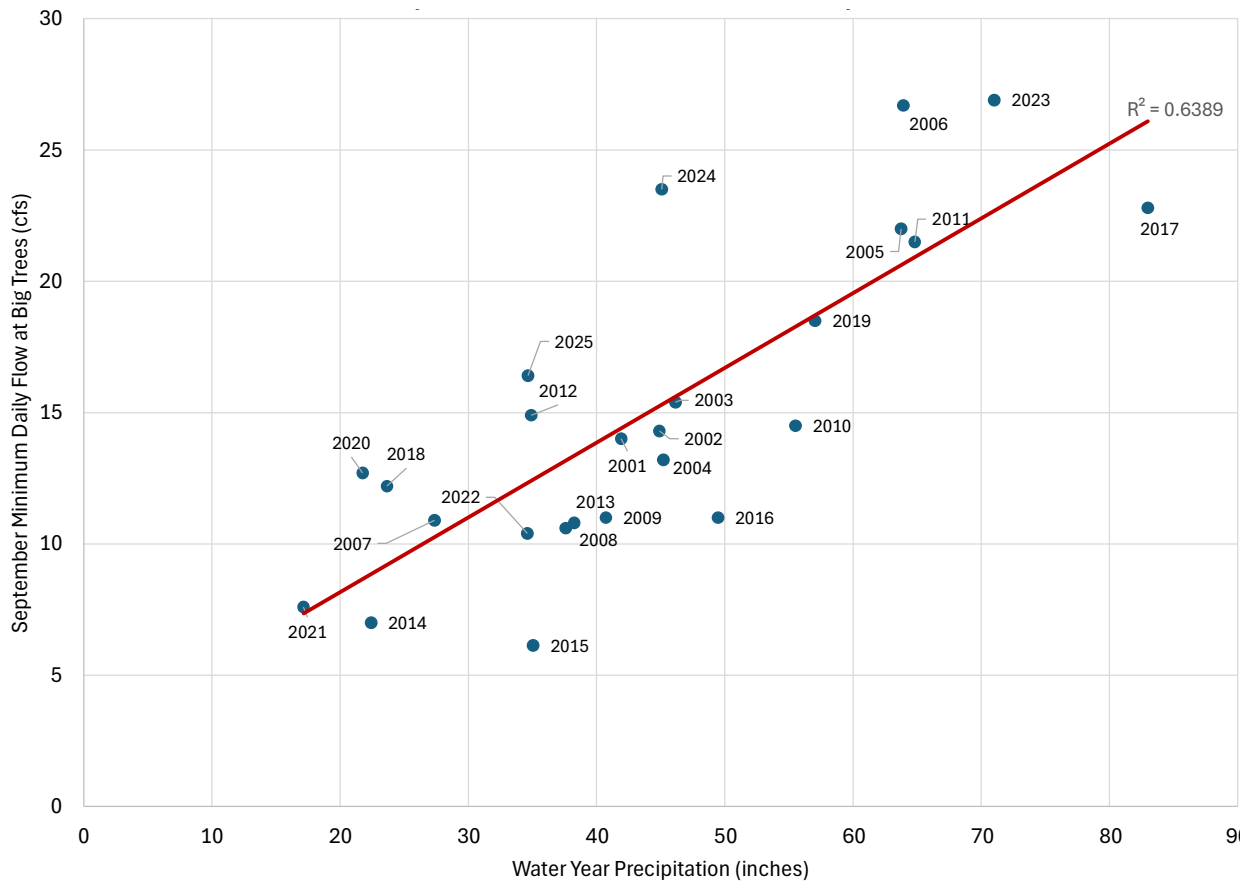



Figure 4-45. Relationship Between Minimum Flow at Big Trees Gage and Water Year Precipitation

### ~~3.8.2~~4.6.3 Relationship Between Depletion of Interconnected Surface Water and Groundwater Elevation Based on Measured Data

Section §354.28(c)(6) of the SGMA regulations requires that minimum thresholds for depletion of interconnected surface water be based on a rate or volume of surface water depletions. However, Section §354.28(d) allows the use of ~~A correlation must be established between groundwater elevation and depletion of interconnected surface water in order to use~~ groundwater ~~levels~~ elevations as a ~~a~~ proxy for multiple SMC ~~for monitoring interconnected surface water~~

~~depletion~~when supported by adequate evidence of a relationship ~~for this GSP~~. This section provides the rationale for the~~is~~ ~~correlation~~relationship. The data below indicates that despite a relatively weak correlation between groundwater extraction and ~~resulting~~ baseflow, groundwater elevations are still a good indicator of what baseflow to expect under varying hydrologic conditions.

#### 4.6.3.1 Comparison of Long-Term Water Groundwater Levels to Flow on the San Lorenzo River at Big Trees

To evaluate the relationship between groundwater elevations and streamflow, SMGWA identified 4 Santa Margarita aquifer representative monitoring points (RMPs) with fall (September to early October) groundwater level data collected between 2012 and 2025. Fall groundwater levels are used because they are at the end of the dry season, so they limit the effect of precipitation on streamflow while isolating groundwater's contribution to baseflow. The ~~four~~4 Santa Margarita aquifer RMPs (SLVWD Quail Hollow MW-B, SLVWD Olympia #1, SLVWD Pasatiempo MW-2, and SVWD SV4-MW) are broadly distributed ~~around~~across the Basin (Figure 4-46) in areas ~~that~~ where the Santa Margarita aquifer discharges groundwater to the San Lorenzo River or one of its tributaries. A~~To evaluate the relationship between groundwater elevation and streamflow, a~~nnual fall groundwater elevations at these 4 RMPs were averaged and compared to the lowest ~~measured~~ daily flow measured during ~~the month of~~ September ~~as measured~~ in the San Lorenzo River at Big Trees, which represents the cumulative outflow from the Basin and includes tributary contributions fed by groundwater within the Basin. Figure 4-47 shows that there is a strong correlation between annual average groundwater levels for the 4 ~~monitoring wells~~RMPs in the Santa Margarita aquifer and the resulting low daily flow in the San Lorenzo River.

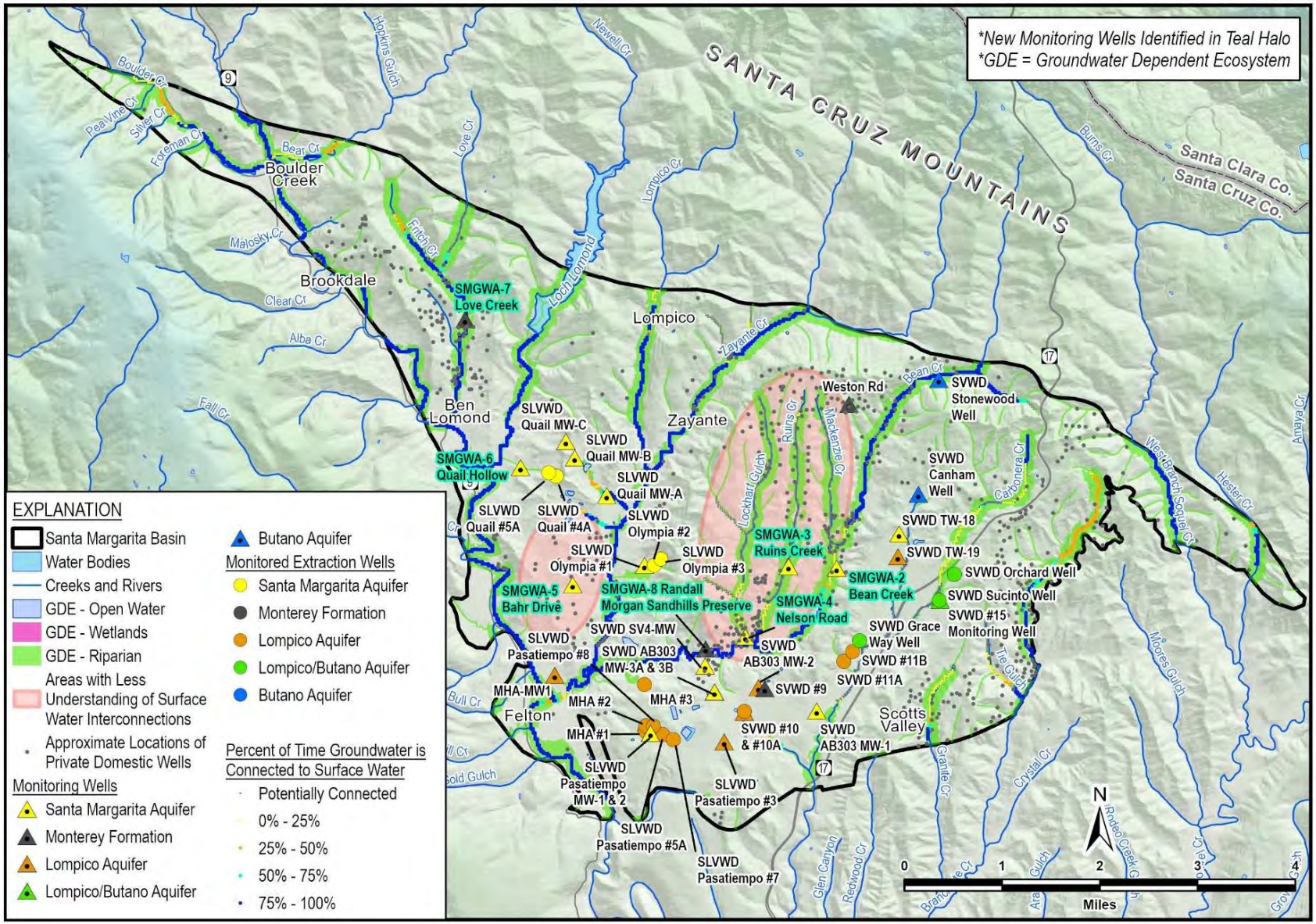

*New Monitoring Wells Identified in Teal Halo
*GDE = Groundwater Dependent Ecosystem
SANTA CRUZ MOUNTAINS
Santa Clara Co.
Santa Cruz Co.
Boulder Creek
Brookdale
Ben Lomond
Lompico
Zayante
Felton
Scotts Valley
SMGWA-7 Love Creek
SMGWA-6 Quail Hollow
SMGWA-5 Bahr Drive
SMGWA-8 Randall Morgan Sandhills Preserve
SMGWA-3 Ruins Creek
SMGWA-4 Nelson Road
SMGWA-2 Bean Creek
SLVWD Quail MW-C
SLVWD Quail MW-B
SLVWD Quail MW-A
SLVWD Quail #5A
SLVWD Quail #4A
SLVWD Olympia #2
SLVWD Olympia #1
SLVWD Olympia #3
SLVWD Pasatiempo #8
SLVWD Pasatiempo MW-1 & 2
SLVWD Pasatiempo #5A
SLVWD Pasatiempo #3
SLVWD Pasatiempo #7
SVWD SV4-MW
SVWD AB303 MW-3A & 3B
SVWD AB303 MW-2
SVWD AB303 MW-1
SVWD #9
SVWD #10 & #10A
SVWD #11A
SVWD #11B
SVWD Grace Way Well
SVWD #15 Monitoring Well
SVWD Sucinto Well
SVWD Orchard Well
SVWD TW-19
SVWD TW-18
SVWD Canham Well
SVWD Stonewood Well
Weston Rd
MHA-MW1
MHA #1
MHA #2
MHA #3
EXPLANATION
Santa Margarita Basin
Water Bodies
Creeks and Rivers
GDE - Open Water
GDE - Wetlands
GDE - Riparian
Areas with Less Understanding of Surface Water Interconnections
Approximate Locations of Private Domestic Wells
Monitoring Wells
Santa Margarita Aquifer
Monterey Formation
Lompico Aquifer
Lompico/Butano Aquifer
Butano Aquifer
Monitored Extraction Wells
Santa Margarita Aquifer
Monterey Formation
Lompico Aquifer
Lompico/Butano Aquifer
Butano Aquifer
Percent of Time Groundwater is Connected to Surface Water
Potentially Connected
0% - 25%
25% - 50%
50% - 75%
75% - 100%
N
0 1 2 3 4
Miles

Figure 4-46. Interconnected Surface Water Modeled Results, Monitoring Locations, and Data Gaps

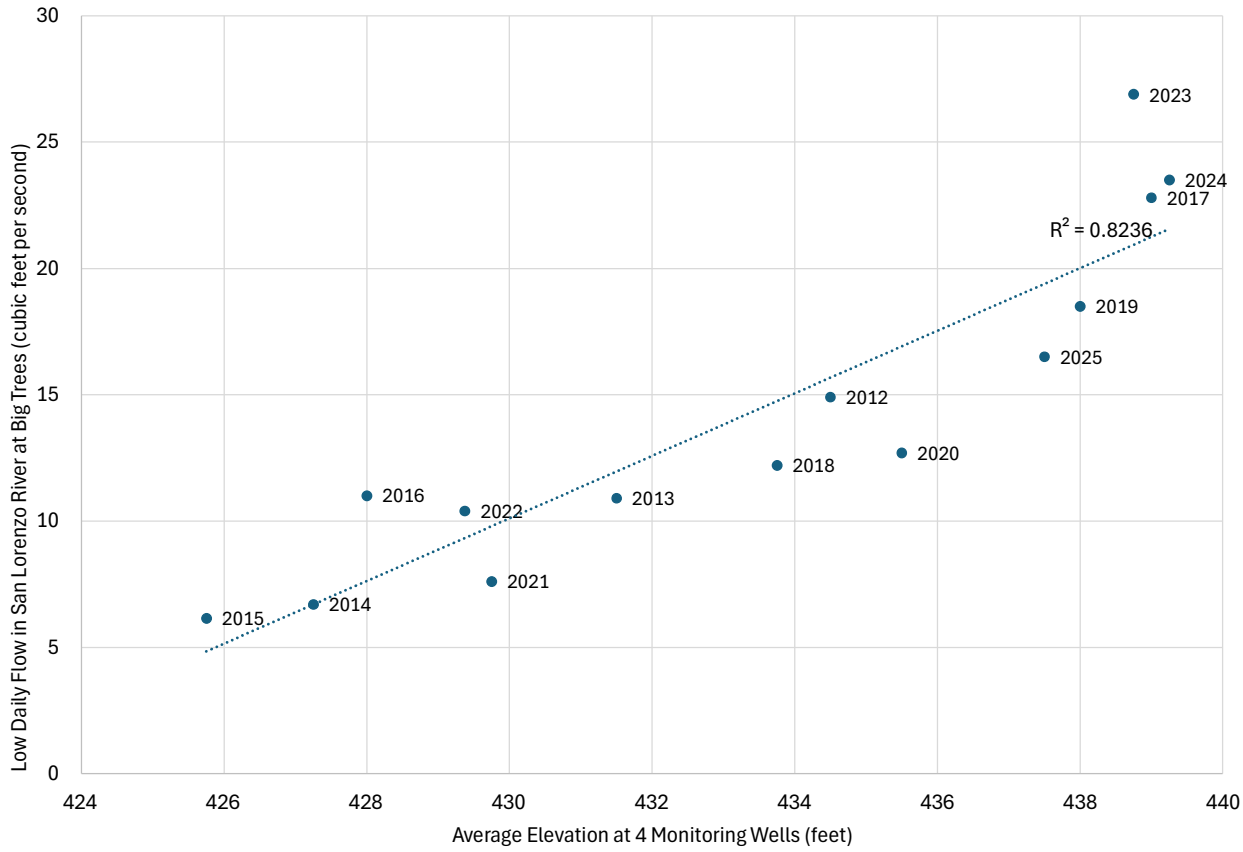



Figure 4-47. Average Annual Fall Santa Margarita Aquifer Groundwater Elevations Compared to Low Daily Flow, 2012 through 2025

#### 4.6.3.2 Comparison of Short-Term Groundwater Levels to Flow at Multiple Locations

A total of 7 new monitoring wells were installed in 2023 (labeled in teal on Figure 4-46**Error! Reference source not found.**), expanding the shallow monitoring network and improving spatial coverage near streams. Some of the new shallow wells are paired with nearby streamflow or stage monitoring gages to improve evaluation of groundwater-surface water interactions. The new monitoring wells are described in more detail in Section 6.9.1.

Figure 4-46**Error! Reference source not found.** shows the current understanding from the Basin Model of where interconnected surface water occurs in relation to GDE's, private domestic wells, all wells that have groundwater levels monitored as part of the GSP monitoring network, and the 7 monitoring wells installed in 2023 to improve monitoring coverage near streams. Figure 4-46**Error! Reference source not found.** also indicates areas where ~~there is~~ groundwater extraction occurs near creeks and where, prior to recent monitoring improvements~~, a lack of~~ groundwater level monitoring locations were insufficient to indicate whether ~~if~~ the creeks are gaining or losing.

As shown in Figure 4-46 much of the San Lorenzo River and its tributaries are connected to groundwater. ~~Within the Basin,~~ Love Creek, Newell Creek, Zayante Creek, and Bean Creek are the primary tributaries within the Basin from north to south along the San Lorenzo River. Above the confluence of Newell Creek as shown in Figure 2-8, ~~there is~~ only ~~one~~1 small water system serving 7 customers and an estimated 115 domestic wells ~~using an estimated~~ extract a combined 37 AFY of groundwater (less than 2% of total basin extraction). This nominal extraction does not appreciably influence surface water depletion. Evidence of this lack of depletion is the fact that Monterey Formation monitoring well SMGWA-7 installed in 2023 to monitor levels in that portion of the Basin has continued to exhibit artesian conditions since its installation. As the intent of SGMA is to manage the effects of groundwater extraction on depletions of interconnected surface water, SMGWA has excluded Love Creek from the analysis. ~~A c~~Comparisons of surface water flow and groundwater elevations ~~at locations in the Basin~~ are~~is~~ included below for Newell Creek, Zayante Creek, and Bean Creek. The analysis ~~provides~~uses 5 years of dry--season stream-flow data for each location and between 2 and 5 years of groundwater data for nearby wells that are equipped with year-round pressure transducers and dataloggers.

#### *4.6.3.2.1 NEWELL CREEK FLOWS COMPARED TO GROUNDWATER ELEVATIONS*

As shown in Figure 6-6, the Newell Creek gage is just above the confluence with the San Lorenzo River. Newell Creek flow is regulated ~~from the perspective that~~because Loch Lomond Reservoir is located on the creek near the northeastern boundary of the Basin. With limited exceptions, the City of Santa Cruz is required to maintain a year-round baseflow of 1.0 cfs below the reservoir to provide adequate depths for fish passage and spawning. In 2023, SMGWA constructed ~~a~~ monitoring well SMGWA-6 just under 0.25 miles east of the Newell Creek stream gage. The well was ~~outfitted~~equipped with a transducer and datalogger ~~on~~ in late September 2023. Figure 4-48 shows the relationship between dry--season flow on the creek and groundwater elevations in SMGWA-6.

~~While the relationship on Newell Creek is somewhat affected by~~Although managed releases from the reservoir for flow requirements~~, there is a clear relationship in~~somewhat affect the relationship on Newell Creek, declining groundwater levels ~~and~~correspond clearly with declining average flow over the period. Starting with the very wet year in 2023, 2024 and 2025 were successively drier. The September 30 groundwater level in SMGWA-6 ~~can be seen~~ declined~~ing~~ from 341.7 feet in 2023, to 338.7 feet in 2024, to 334.7 feet in ~~2023, 2024, and~~ 2025~~, respectively~~. ~~Also of note is that t~~Through much of that period, the City of Santa Cruz maintained a release of 1.0 cfs with minor exceptions. Measured flow above 1 cfs indicates that the stream is gaining baseflow as it travels from the reservoir to the confluence with the San Lorenzo River. Each successive year gained~~s~~ less baseflow, which is consistent with the declining groundwater elevations that are feeding the creek. ~~Finally, note the increasing s~~Streamflow also increased through the summer of 2023. This ~~is~~increase likely ~~resulting~~ reflects ~~from~~ a time lag in which ~~as ground~~water ~~that~~ recharged into the Santa Margarita aquifer during

the exceptionally wet winter ~~is~~ continued~~ing~~ to discharge into the creek over the summer. This behavior further supports the Basin HCM, in which ~~that~~ the Santa Margarita aquifer quickly accepts recharge and then ~~proceeds to~~ releases it from storage by discharging~~flowing~~ to ~~into~~ local creeks.

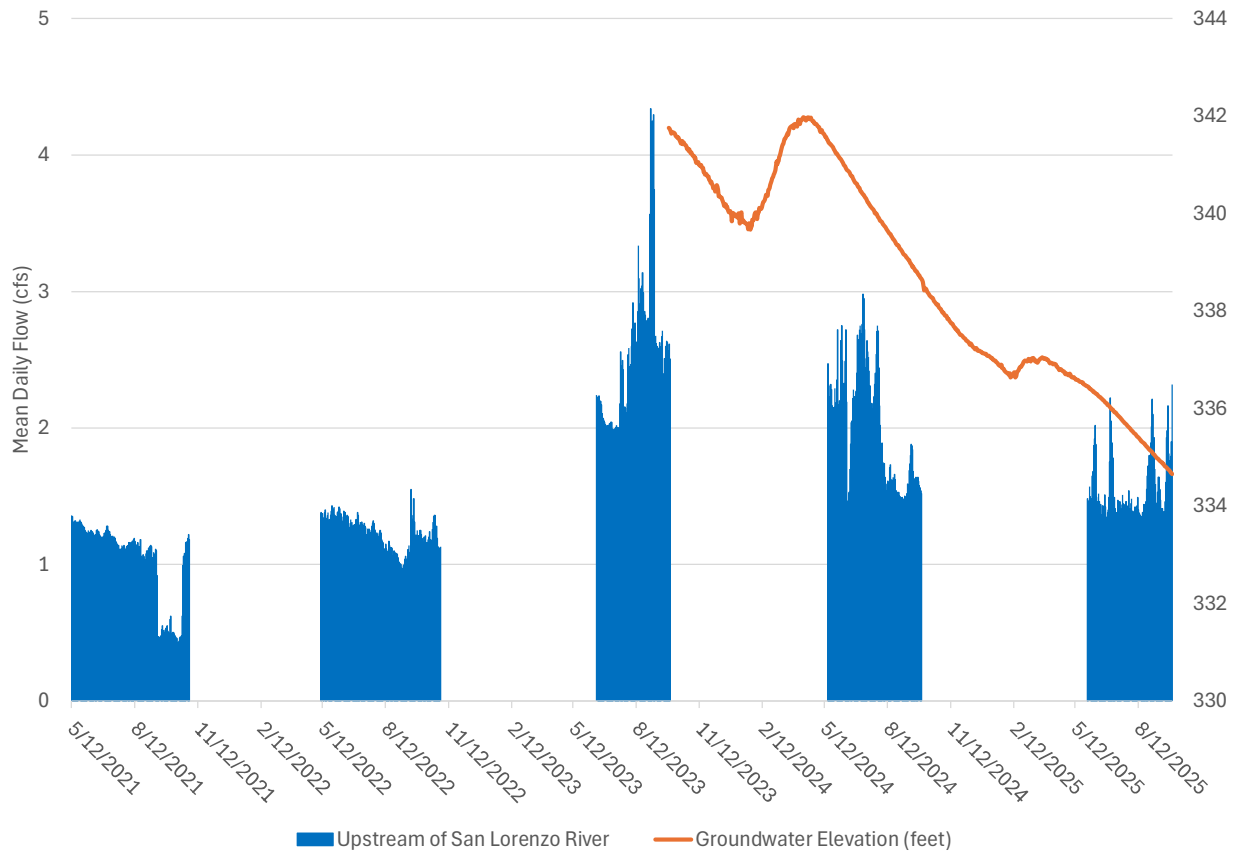



Figure 4-48. Dry-Season Flow on Newell Creek vs. Groundwater Elevations at SMGWA-6

#### *4.6.3.2.2 ZAYANTE CREEK FLOWS COMPARED TO GROUNDWATER ELEVATIONS*

As shown in Figure 6-6, the Zayante Creek gage at Woodwardia is just over 0.25 miles upstream from the confluence with Bean Creek. In May 2024, a pressure transducer and datalogger were installed in an existing monitoring well, SLVWD Olympia #1, which is located just over 1 mile northeast of the Zayante gage. Figure 4-49 shows the relationship between dry--season flow on the creek and groundwater elevations in Olympia #1. While the highs and lows measured in Olympia #1 are very subtle, the pattern of seasonality closely matches that of the creek during the dry--season.

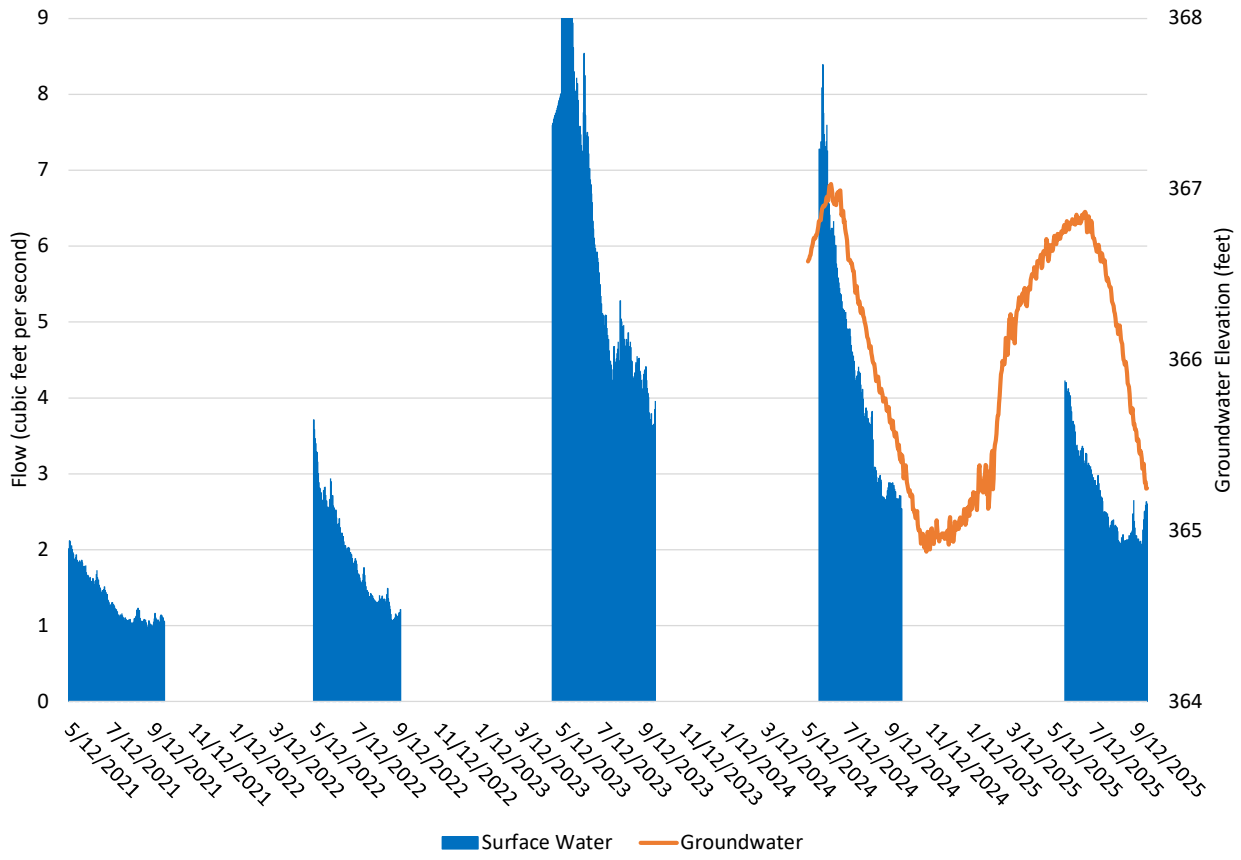



Figure 4-49. Dry-Season Flow on Zayante Creek vs. Groundwater Elevations at SLVWD Olympia #1

Also near Zayante Creek, SMGWA installed a monitoring well, SMGWA-5, about 0.75 miles north of the creek gage. A pressure transducer and datalogger were~~was~~ installed on the well in late September 2023. As shown in Figure 4-50, the data shows a unique, but clear, relationship ~~in that~~where the timing of ~~the~~ peak groundwater levels is in early spring as opposed to early summer. This behavior~~SMGWA~~ is expected because~~not surprised by this as~~ the well was drilled ~~in a location~~ where a highly permeable ~~less than 60-foot thick~~ section of Santa Margarita ~~Formation~~Sandstone less than 60 feet thick sits on top of impermeable Monterey Formation. Groundwater in this thin section~~This~~ was expected~~thought~~ to move relatively quickly into the creek at a lower elevation. The ~~behavior the~~ groundwater level behavior in this location indicates that~~would seem to indicate~~ groundwater moves~~is moving~~ through the aquifer as~~in the fashion of~~ a pulse earlier in the season. T~~Note that~~ the peak groundwater level declined~~declines from 2024 into 2025~~ by nearly 2 feet from 2024 to 2025, consistent with ~~the declining~~lower precipitation ~~over the winter months~~. The seasonal low, however, did not decline similarly, which supports the concept that the Monterey Formation serves~~Also note that the seasonal low does not have a similar decline, which is supportive of the concept that the Monterey Formation is serving~~ as a base of groundwater flow. This is consistent with SMGWA's understanding of the Basin's HCM.

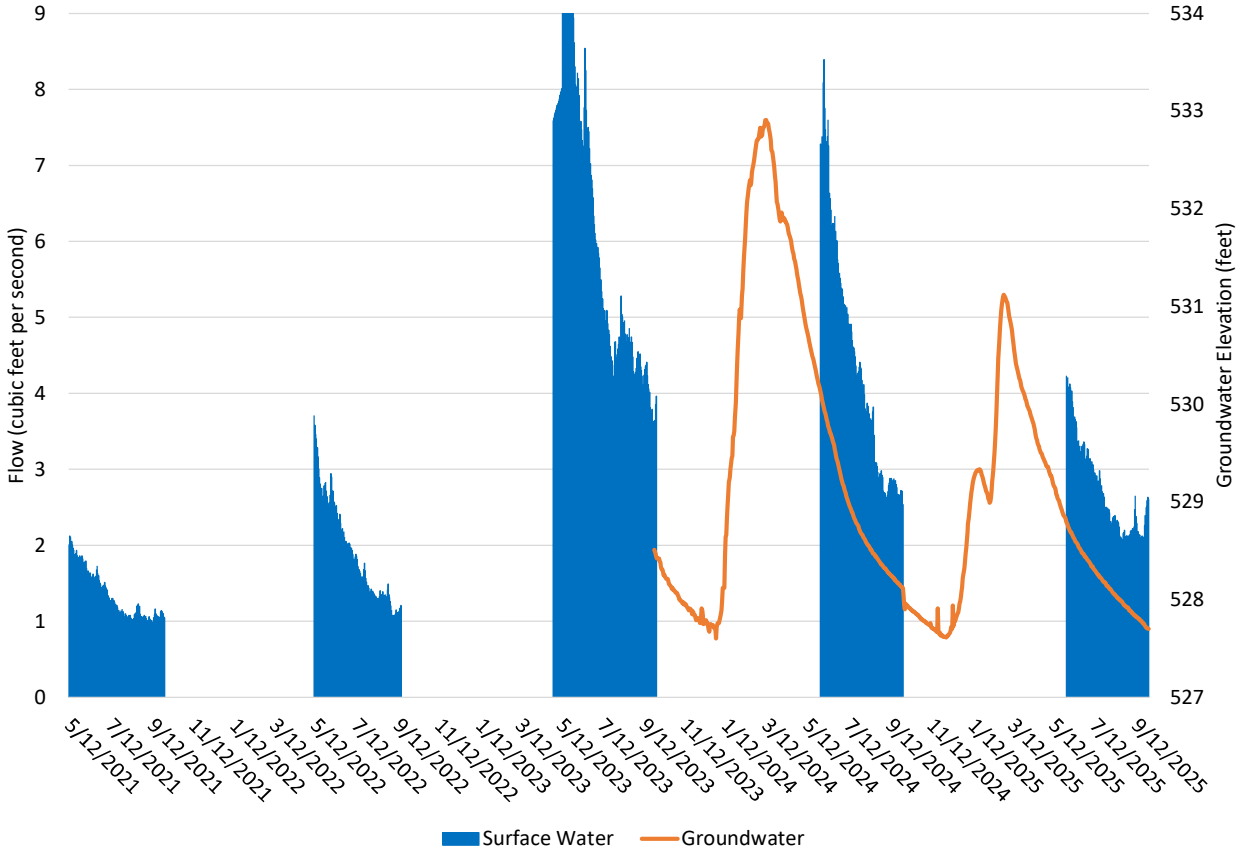



Figure 4-50. Dry-Season Flow on Zayante Creek vs. Groundwater Elevations at SMGWA-5

#### *4.6.3.2.3 Bean Creek Flows Compared to Groundwater Elevations*

As shown in Figure 6-6, the Bean Creek gage at Mount Hermon Camp is just under 0.2 miles upstream from the confluence with Zayante Creek. Since October 2020, a pressure transducer and datalogger have been installed in an existing monitoring well, SVWD SV4-MW, which is located just over 1 mile east of the Mount Hermon Camp gage. Figure 4-51 shows the relationship between dry--season flow on the creek and groundwater elevations in SVWD SV4-MW. Groundwater levels closely match the pattern of seasonality that the creek exhibits during the dry-season as well as the year-to-year creek flow trends (e.g., 2021 critically dry and 2023 wet).

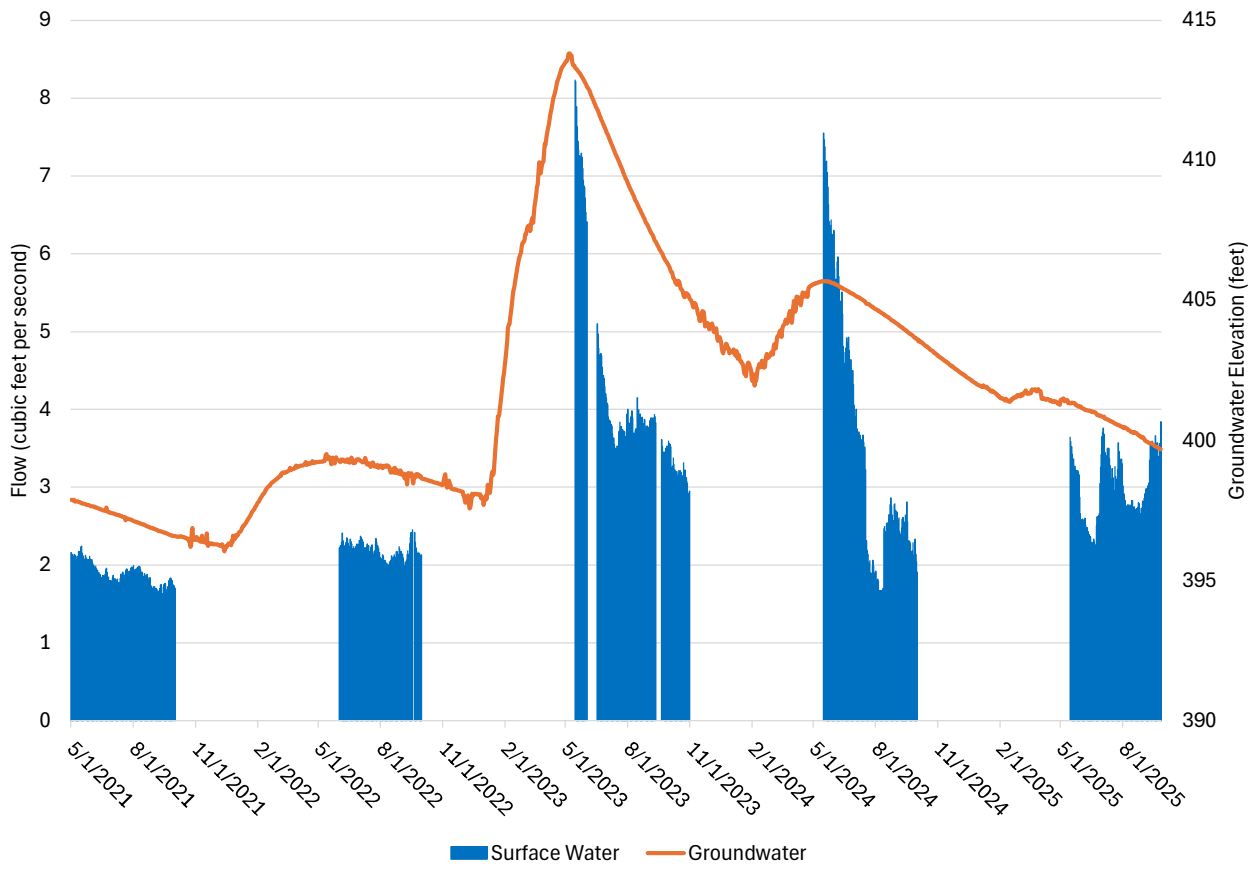



Figure 4-51. Dry-Season Flow on Bean Creek vs. Groundwater Elevations at SVWD MW-SV4

### 4.6.4 Modeled Information on Depletion of Interconnected Surface Water

For the 2022 GSP, ~~T~~the Basin M~~m~~odel was used to estimate the influence of groundwater extraction on stream depletion ~~in the 2022 GSP~~. Removing extraction from the Basin Model results in a 5.6% increase (about 1,200 AFY) of groundwater discharge to creeks ~~streams~~ (-Table 4-4~~(Figure 4-52~~). For context, this is about 5.3~~6~~% of the average ~~total~~ historical -annual groundwater discharge to streams (21,~~300~~300 AFY) and ~~1~~3.0% of the streamflow gained (40~~1~~,~~0~~600 AF) within the Basin (69,600 AFY entering Basin to 110,200 AFY exiting Basin). The Santa Margarita aquifer contributes more than half of the discharge.

Table 4-4. Annual Average Model Simulated Discharge to Creeks With and Without Groundwater Extraction, WY1985-2018

| Discharge to Creeks | Basin-Wide | Santa Margarita Aquifer |
|---|---|---|
| With Pumping, AFY | 21,300 | 6,780 |
| Without Pumping, AFY | 22,500 | 7,390 |
| Increase in Discharge to Creeks, AFY | 1,200 | 610 |

| | | |
|---|---|---|
| % Change | 5.6% | 9.0% |

On a smaller watershed scale, ~~E~~eliminating extraction in the Bean Creek watershed increases the groundwater contribution to ~~streams~~creeks by 0.33 to 0.55 cfs during low-~~in the Bean Creek watershed by approximately 0.5 cfs during low~~ flow periods (the difference between the 2 dashed lines on Figure 4-52). On average, this equates to 15% greater low flows without extraction. ~~The amount of g~~Groundwater ~~contribut~~discharge to creeks ~~ion in the~~during low-flow months contributes substantially to streamflow but is highly dependent on rainfall, ~~flow months is highly dependent on rainfall~~ represented by water year type on Figure 4-52. This result is consistent with the strong relationship between interconnected surface water baseflow and precipitation described in Section 4.6.2.

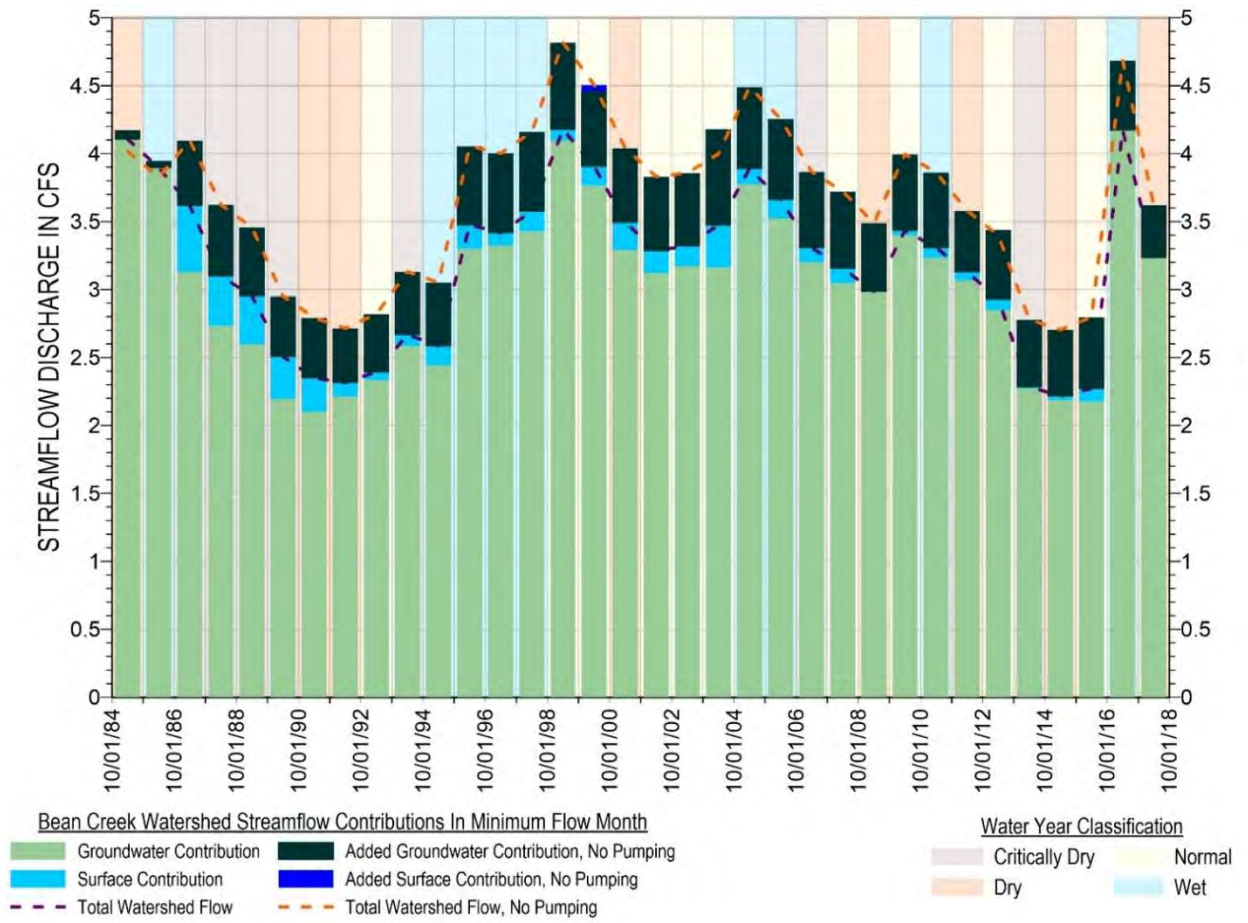



Figure 4-52. Model Simulated Effects of Groundwater Extractions on Groundwater Discharge to Bean Creek in Minimum Flow Month

### ~~3.8.3~~4.6.5 Sufficiency of Groundwater Elevation as a Proxy for Depletion of Interconnected Surface Water

Section §354.28(d) of the SGMA regulations allows groundwater elevation to serve as a proxy for other sustainability indicators where a GSP demonstrates a significant correlation between groundwater elevation and the indicator being represented. The preceding subsections present 5 independent lines of evidence supporting the use of Santa Margarita aquifer groundwater elevations as a proxy for the timing and rate of depletion of interconnected surface water in the Basin. This subsection summarizes those lines of evidence, states the quantitative relationship on which the proxy relies, and identifies the limitations of that relationship.

First, field observation establishes that the Basin's creeks and the San Lorenzo River are sustained by groundwater discharge during the dry season. Annual late-season accretion runs conducted since 2017 document downstream flow gains along the San Lorenzo River, Bean Creek, and Zayante Creek that are independent of tributary inflow, together with the seeps and springs that produce those gains where streams have incised the Santa Margarita Sandstone to the top of the Monterey Formation (Section 4.6.1). The elevated baseflow, low specific conductance, low chloride, and elevated nitrate measured along these reaches match the geochemical signature of Santa Margarita aquifer groundwater reported in earlier studies, which independently confirms groundwater as the source of dry-season flow.

Second, groundwater elevations measured at wells adjacent to interconnected reaches remain above the elevation of the adjacent streambed throughout the year, which is the defining condition for a gaining stream. Because the vertical gradient is directed from the aquifer toward the stream in all seasons, a change in groundwater elevation translates directly into a change in the head difference that drives groundwater discharge to the stream.

Third, the relationship between groundwater elevation and dry-season flow is significant at the Basin scale. Average fall groundwater elevation at the 4 Santa Margarita aquifer RMPs explains the variance in September low flow on the San Lorenzo River at Big Trees. Groundwater elevation correlates more closely with September low flow than groundwater extraction does because it is a measured state variable that integrates both drivers: it rises in response to recharge from precipitation and falls in response to extraction, and it therefore reflects the net aquifer condition that governs discharge to streams. This integration is the central basis for adopting groundwater elevations as the proxy.

Fourth, reach-scale monitoring demonstrates that groundwater elevation tracks streamflow in time as well as in magnitude. At Newell Creek, Zayante Creek, and Bean Creek, continuous groundwater elevation records from adjacent monitoring wells reproduce both the within-season recession and the year-to-year sequence of wet and dry conditions recorded at the corresponding stream gages (Sections 4.6.3.2.1 through 4.6.3.2.3). The Newell Creek record is particularly

informative because managed reservoir releases hold the upstream boundary condition near 1.0 cfs, so the progressive decline in flow gained between the reservoir and the confluence from 2023 through 2025 can be observed with the concurrent decline in groundwater elevation at SMGWA-6.

Fifth, numerical modeling corroborates the measured relationships. Simulations run with and without groundwater extraction indicate that extraction reduces groundwater discharge to streams by about 1,200 AFY Basin-wide, or 5.6% of average annual discharge. In the Bean Creek watershed, simulated discharge during low-flow periods is 0.33 to 0.55 cfs lower with extraction, with the magnitude dependent on water year precipitation (Section 4.6.4).

On the basis of the field observations, the measured relationships between groundwater elevation and streamflow, SMGWA concludes that Santa Margarita aquifer groundwater elevations are a reliable indicator of both the timing and the rate of depletion of interconnected surface water in the Basin, and are therefore appropriate for use as a proxy in establishing sustainable management criteria for the depletion of interconnected surface water sustainability indicator.

# 45 WATER BUDGET

A water budget is an accounting of the total annual volume of precipitation, surface water, and groundwater entering and leaving the Basin. This section provides an assessment of the historical, current, and projected Santa Margarita Basin water budgets in accordance with the GSP Regulations §354.18 and the Water Budget BMP (DWR, 2016a). Per the GSP Regulations, water budgets are presented in both graphical and tabular formats. Water budgets are developed using groundwater model inputs and outputs described in a groundwater model report (Appendix ~~2E~~3A).

## ~~4.1~~5.1 Water Budget Development

Water budgets are developed for the area and depth bounded by the lateral and vertical boundaries of the Basin. The lateral boundaries are the Basin boundaries described in Section 3.2. The water budgets were bounded vertically by the deepest principal aquifer, which in most places is the Butano aquifer. The lateral and vertical boundaries of the aquifers in the groundwater model are discussed in more detail in Appendix ~~2E~~3A: Section 5.2.1.

The water budgets are developed from an inventory of precipitation, surface water, and groundwater inflows (supplies) and outflows (demands) to and from the Basin. Some water budget components are measured, such as streamflow at a ga~~u~~ging station or municipal groundwater pumping from a metered well. Other components of the water budget are simulated by the model, such as recharge from precipitation and change in groundwater storage. The difference between groundwater inflows and outflows equals the change of groundwater in storage. The water budget inputs and outputs from the groundwater model are rounded to the nearest 100 for consistency across all summary tables and text. The larger values are not certain to this precision, but this approach helps summarize the data without introducing rounding errors into summation calculations such as total inflows, outflows, and change in storage.

The change over time in groundwater levels, groundwater and surface water interaction, and groundwater in storage derived from the water budgets will be used to assess Basin sustainability. Water movement in the Basin is driven by precipitation as surface runoff to creeks and groundwater recharge after accounting for evapotranspiration. Creeks flow into and out of the Basin, while interacting with groundwater. Water flows from creeks to groundwater and vice versa, depending on the gradient between creek stage and groundwater levels. Groundwater pumping removes groundwater from aquifers, though a small fraction of pumped water enters the groundwater system as return flows from septic systems, quarry usage, landscape irrigation, and sewer and water distribution system losses. Specific details on these components are described in the groundwater model report contained ~~in~~ in Appendix ~~2E~~3A: Section 5.1.4. Figure 5-1 presents a schematic hydrologic cycle that is included in the Water Budget BMP (DWR, 2016a). This is a generalized graphic and not all the components pictured apply to the Basin.

Although not required by GSP Regulations, the groundwater budgets of individual principal aquifers are analyzed to better understand and manage the various sources of groundwater in the Basin. The principal aquifers in the Basin are the Santa Margarita, Lompico, and Butano Sandstones. The Monterey Formation is not considered a principal aquifer but is included in the water budget because there are many private well owners that rely on it as their only source of water. The following describes the general characteristics of the aquifers relevant to water budgets:

- The Santa Margarita aquifer is the primary groundwater source for SLVWD and is also pumped by private well owners. It is the most significant aquifer in terms of groundwater's interactions with surface water.
- The Monterey Formation is primarily pumped to supply shallow private wells where more productive aquifers are not present at or near the surface. It is not currently pumped for municipal supply. Where it is present in the stratigraphic sequence, its low permeability retards recharge of the aquifers in the Lompico and Butano Sandstones below it. The Monterey Formation interacts with surface water where it outcrops in the streambed.
- The Lompico aquifer is pumped extensively for municipal supply in the Scotts Valley area where the formation is thickest. This aquifer has significantly less direct recharge from precipitation than the Santa Margarita aquifer as it outcrops over a much smaller area in the Basin. The area where the Monterey Formation is absent beneath the Santa Margarita aquifer is important for groundwater recharge of the Lompico aquifer in the south Scotts Valley area.
- The Butano aquifer is the deepest of the productive aquifers and is only pumped in northern Scotts Valley. It is recharged by surface water and precipitation where it outcrops along the northern margin of the Basin. In this area, private well owners also pump from it. SVWD pumps water from deep wells that are screened in both the Butano aquifer and the overlying Lompico aquifer.

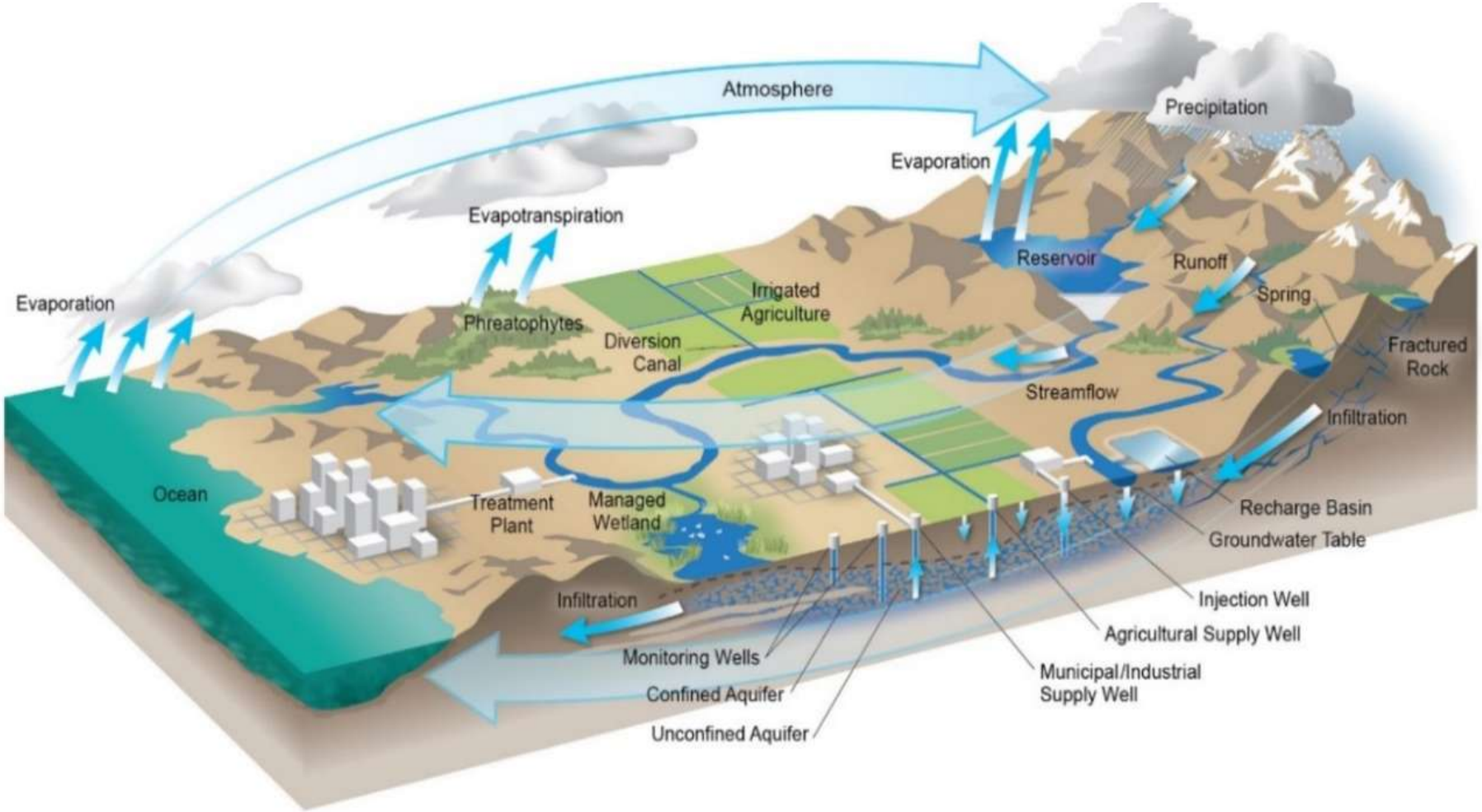



Figure 5-1~~5-15-5-1~~. Generalized Hydrologic Cycle from Water Budget BMP (DWR, 2016a)

- Other geologic formations having less of an impact on the water budget still contribute to overall inflows and outflows. The main formation not included in the water budget is the Quaternary alluvium, small deposits that occur widely throughout the Basin, but the most significant are deposits west of the Ben Lomond fault (Figure 3-9 and Figure 3-12).

Additional descriptions of hydrogeologic properties and extents of all aquifer units are provided in 3.4.4. The aquifer extents are shown in Appendix ~~2E~~3A: Figure 23 for the Santa Margarita aquifer, Monterey Formation, and Lompico aquifer and in Appendix ~~2E~~3A: Figure 24 for the Butano aquifer.

### ~~4.1.1~~5.1.1 Precipitation Budget Components

The precipitation budget is an accounting of how much rain falls on the Basin, and where it is eventually allocated. A simplified schematic showing the precipitation budget components is provided on Figure 5-2. Precipitation budget components and associated data sources and uncertainties are described in the bullets below and in Table 5-1.

**Precipitation Budget Inflow**

- **Precipitation:** Rain that falls within the Basin.

**Precipitation Budget Outflows**

- **Evapotranspiration:** Water that evaporates from the land surface and soil or is transpired by plants.

- **Runoff:** Flow that traverses over the land surface into surface water bodies. Also referred to as overland flow.

- **Groundwater Recharge**: Water that percolates through the unsaturated zone and passes through the water table into the saturated zone, becoming groundwater.

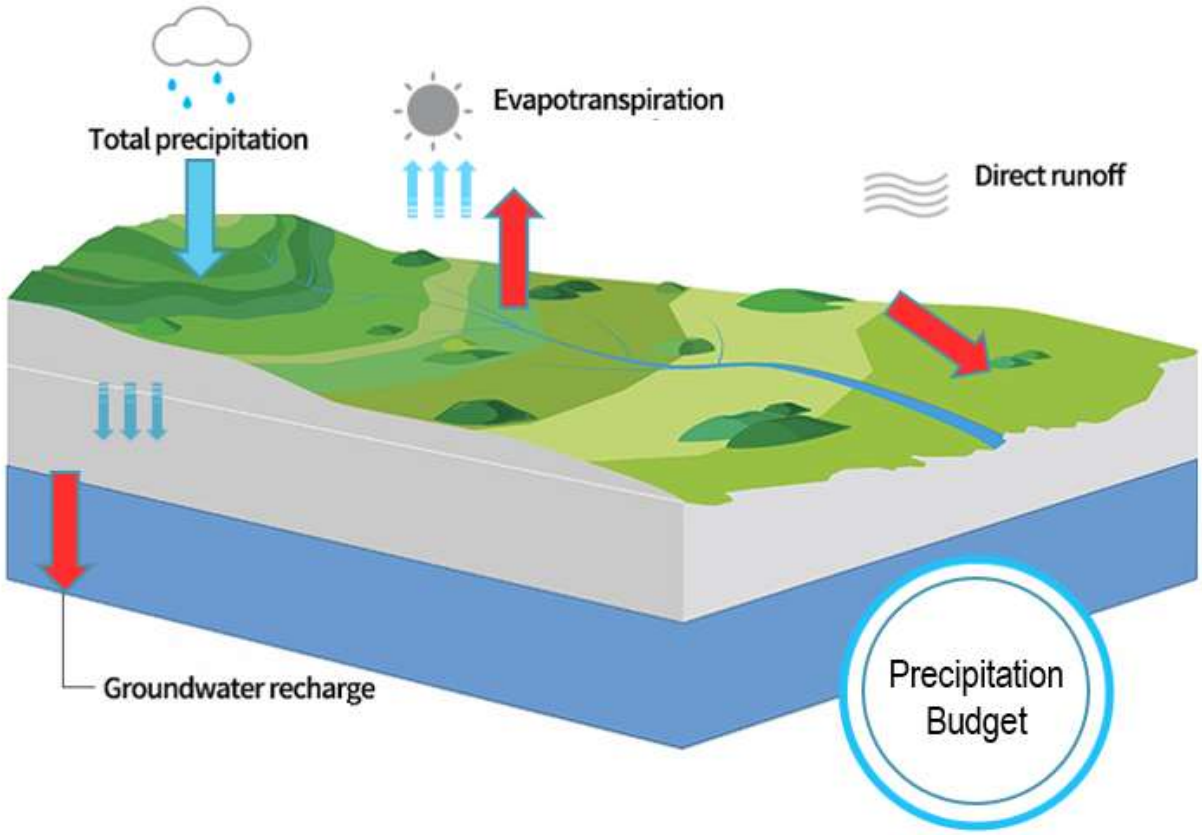



Figure 5-2~~5-25-5-2~~. Precipitation Budget Components

Table 5-1~~5-15-1~~. Precipitation Budget Components Data Sources and Uncertainty

| Budget Component | Source of Model Input Data | Limitations |
|---|---|---|
| **Inflows** | | |
| Precipitation | Monthly precipitation data from PRISM for historical model and Four-model Ensemble for future predictions ( ~~Figure 3-3~~Figure 3-3). | Regional precipitation model used to develop model input may not account for local variability |
| **Outflows** | | |
| Evapotranspiration | Calculated using the Blaney-Criddle (1962) method with adjusted factors from the Santa Cruz Water Balance Model. Temperature was sourced by PRISM for the historical and the Four-model Ensemble for future predictions. This is discussed in more detail in Appendix 2E: Section 5.1.3. | Regional temperature model used to calculate model input may not account for local variability in temperature |
| Direct Runoff | Calculated based on land use and geology which controls perviousness of land surface | Estimated, limited data for calibration. |
| Groundwater Recharge | Calculated from precipitation less evapotranspiration and runoff | Estimated, limited data for calibration. |

### ~~4.1.2~~5.1.2 Surface Water Budget Components

The surface water budget describes flows into and out of the Basin's surface water system. Evaluation of the surface water budget is important for understanding the groundwater-surface water connection, surface water use, and the responsiveness of the surface water system to historical climatic variation. A simplified schematic showing the surface water budget components is provided on Figure 5-3. Surface water budget components and associated data sources and uncertainties are described in the bullets below and in Table 5-2.

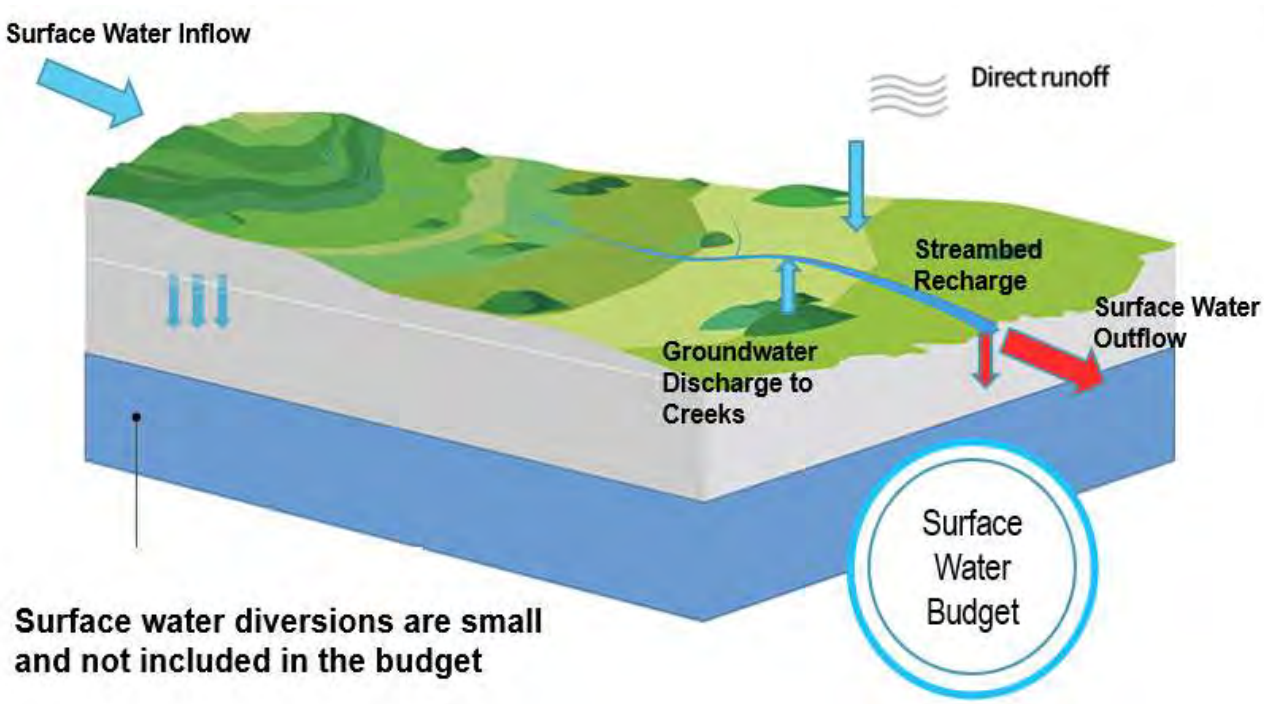



Figure 5-3~~5-35-5-3~~. Surface Water Budget Components

Surface water diversions within the Basin are small relative to other components of the surface water budget. The only surface water diversion within the Basin is the rarely used City of Santa Cruz San Lorenzo River diversion at Felton that is used to divert to storage at Loch Lomond. SLVWD diversions are all outside of the Basin on upstream tributaries of the San Lorenzo River. The City of Santa Cruz primary surface water diversion occurs on the San Lorenzo River at Tait Street, which is in Santa Cruz and about 5 miles downstream of the Basin.

Despite not being included in the groundwater model simulations, surface water diversions outside of the Basin by SLVWD and the City of Santa Cruz are an important component of the regional water supply system. These diversions made outside of the Basin totaled about 2,300 AF in WY2018 (Table 3-5). In WY2018, SLVWD surface water diversions upstream of the Basin to the west totaled about 1,170 AF, which is about 2.2% of the surface water flow into the Basin that year. That same year, the City of Santa Cruz diverted about 1,230 AF at Tait Street

and nothing at the Felton diversion, which is about 1.3% of the surface water budget flowing out of the Basin that year.

Table 5-25~~25~~ 2. Surface Water Budget Components Data Sources and Uncertainty

| Budget Component | Source of Model Input Data | Limitations |
|---|---|---|
| **Inflows** | | |
| Surface Water Inflow | Calculated from runoff in areas upstream of the basin | Estimated, limited data for calibration |
| Direct Runoff | Calculated based on land use and geology which control perviousness of land surface | Estimated, limited data for calibration. |
| Groundwater Discharge to Creeks | Simulated by model using stream stage and groundwater head. | Calibrated parameter using limited historical stream accretion data; data are not available for every time period or every creek and tributary in the Basin |
| **Outflows** | | |
| Surface Water Outflow | Simulated by model. | Calibrated parameter using available historical stream stage and discharge measurements; however, data are not available for every creek and tributary in the Basin. |
| Streambed Recharge | Simulated by model using stream stage and groundwater head. | Calibrated parameter using limited historical stream accretion data; data are not available for every time period or every creek and tributary in the Basin |

### Surface Water Budget Inflows

- **Surface Water Inflow:** Streamflow that enters the Basin's surface water system from areas upstream of the Basin. Surface water inflow includes inflow on the San Lorenzo River, Newell Creek (downstream of Loch Lomond Reservoir situated on the northern Basin boundary), Bean Creek, and other smaller tributaries of the San Lorenzo River.
- **Direct Runoff**: Water that runs off the land surface into surface water bodies.
- **Groundwater Discharge to Creeks**: Groundwater that discharges into creeks, also known as gaining stream conditions. This is the component of groundwater-surface water interactions where surface water stage is lower than nearby groundwater levels, allowing groundwater to discharge to surface water.

### Surface Water Budget Outflows

- **Surface Water Outflow:** Streamflow that leaves the Basin's surface water system to areas downstream of the Basin.

- **Streambed Recharge:** Water that percolates to groundwater from stream channels, also known as streambed seepage, or losing stream conditions. This is the component of groundwater-surface water interactions where surface water stage is higher than nearby groundwater levels, allowing surface water to recharge the groundwater system.

### ~~4.1.3~~5.1.3 Groundwater Budget Components

The groundwater budget describes flows into and out of the Basin's groundwater system. Evaluation of the groundwater budget is important for understanding trends in climate, groundwater use, and groundwater-surface water interaction. A simplified schematic showing the groundwater budget components is provided on Figure 5-4. Groundwater budget components and associated data sources and uncertainty are described in the bullets below and in Table 5-3. Change in storage is calculated from model inputs and outputs for all surface water and groundwater budget components. However, change in storage is discussed in the groundwater budget subsections as the majority of storage changes in the Basin occur in groundwater.

**Groundwater Budget Inflows**

- **Groundwater Recharge:** Water that infiltrates the land surface, percolates through the unsaturated zone, passes through the water table into the saturated zone, thereby becoming groundwater. The term "precipitation recharge" is used interchangeably with groundwater recharge in the water budget section of this GSP.
- **Subsurface Inflow**: Subsurface flow that enters the Basin's aquifers from neighboring areas.
- **Streambed Recharge**: Water that percolates to groundwater from stream channels, also known as streambed seepage, or losing stream conditions. This is the component of groundwater-surface water interactions where surface water stage is higher than nearby groundwater levels, allowing surface water to recharge the groundwater system.
- **Septic Return Flows**: Water originating in domestic septic systems that percolates to groundwater.
- **System Losses:** Water originating from leakage in sewer and water distribution systems that percolates to groundwater.
- **Quarry Return Flows**: Water that originates from usage at quarry sites that percolates to groundwater.
- **Irrigation Return Flows**: Water originating from the inefficient portion of landscape irrigation that percolates to groundwater.

**Groundwater Budget Outflows**

- **Subsurface Outflow:** Subsurface groundwater that flows out of the Basin's aquifers into adjacent basins or areas.
- **Groundwater Pumping:** Groundwater extracted by wells for municipal, agricultural, domestic, and industrial uses.
- **Discharge to Creeks:** Flow that discharges from groundwater into stream channels, also known as gaining stream conditions. This is the component of groundwater-surface water interactions where surface water stage is lower than nearby groundwater levels, allowing groundwater to discharge to surface water.

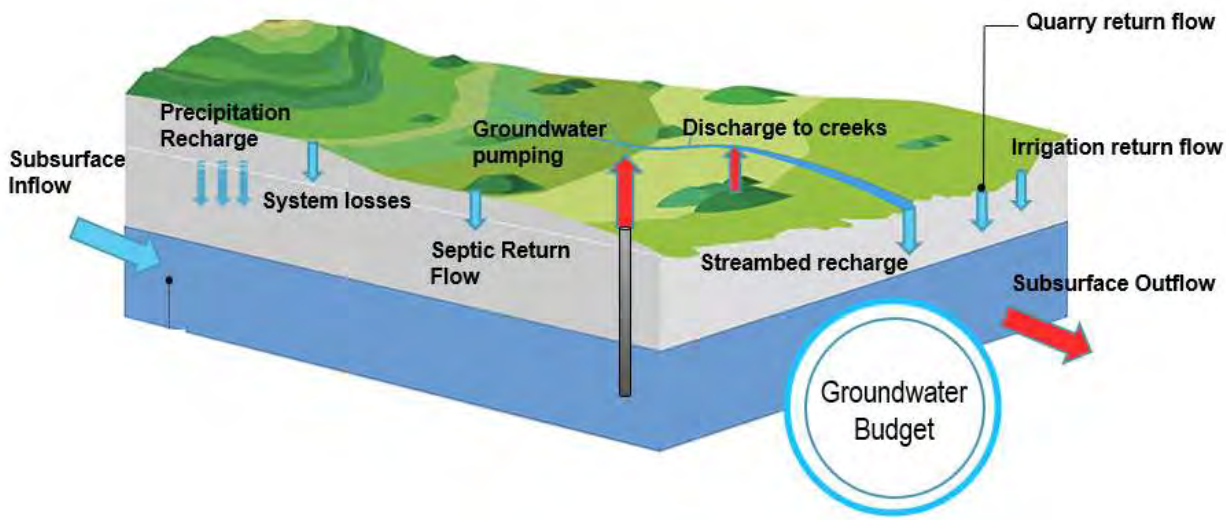



Figure 5-~~45~~ ~~45~~ ~~5~~ ~~4~~. Groundwater Budget Components

Table 5-3~~5-35-3~~. Groundwater Budget Components Data Sources and Uncertainty

| Budget Component | Source of Model Input Data | Limitations |
|---|---|---|
| **Inflows** | | |
| Precipitation (Groundwater) Recharge | Calculated from precipitation less evapotranspiration and runoff depending on land use and geology | Estimated, limited data for calibration. |
| Subsurface Inflow | Simulated by model. | Subject to uncertainty in simulated heads and aquifer hydraulic properties |
| Streambed Recharge | Simulated by model using stream stage and groundwater head. | Calibrated parameter using limited historical stream accretion data; data are not available for every time period or every creek and tributary in the Basin |
| System Losses | Estimated based on reported water demand or pumping and loss assumptions | Estimated, limited data for calibration. |
| Quarry Return Flows | Estimated based on reported pumping and loss assumptions | Estimated, limited data for calibration. |
| Irrigation Return Flows | Estimated based on assumed outdoor portion of reported water use for municipal users, and estimated for private domestic users and loss assumptions | Estimated, limited data for calibration. |
| **Outflows** | | |
| Subsurface Outflow | Simulated by model. | Estimated, limited data for calibration. |
| Groundwater Pumping | Reported by providers for public supply use. Estimated for private well owner domestic use using number of domestic parcels and local estimate of water use coefficients. Estimated for industrial, pond-filling, and landscape uses. | Unmetered data subject to estimation errors. |
| Discharge to Creeks | Simulated by model using stream stage and groundwater head. | Calibrated parameter using limited historical stream accretion data; data are not available for every time period or every creek and tributary in the Basin |

## ~~4.2~~5.2 Historical Water Budget

Per GSP Regulations (§ 354.18), the historical water budget is developed to show past water supplies and demands. The historical water budget time frame for this GSP starts in WY1985 and ends in WY2014 to coincide the end of the budget analysis with the passage of SGMA~~8~~. This period encompasses multiple droughts and wet periods to represent historical variation in water budget components. The model period starts in 1985 because groundwater pumping and level data are only available for the majority of the Basin starting around 1985.

### ~~4.2.1~~5.2.1 Historical Precipitation Budget

The historical precipitation budget provides an accounting of how much precipitation fell in the Basin and how much of it was lost to evapotranspiration, became surface water, or recharged groundwater. The historical precipitation budget is summarized in Table 5-4 and presented in a time series chart on Figure 5-5.

Table 5-4~~5~~ ~~4~~5 ~~4~~. Summary of Historical Precipitation Budget

| Water Budget Components | | Historical Water Budget WY1985-2014 | | Annual Average by Water Year Type (Acre-Feet) | | | |
|---|---|---|---|---|---|---|---|
| Average Total for Historical Water Budget (Acre-Feet) | | Annual Average (Acre-Feet) | Percent of Total Inflow or Outflow | Critically Dry | Dry | Normal | Wet |
| Inflows (81,600)* | Precipitation | 81,600 | 100% | 49,400 | 68,200 | 83,300 | 117,900 |
| Outflows 81,600)* | Evapotranspiration | 37,700 | 46% | 25,500 | 34,200 | 37,200 | 51,600 |
| | Direct Runoff | 30,400 | 37% | 16,600 | 24,100 | 31,500 | 46,000 |
| | Groundwater Recharge | 13,500 | 17% | 7,300 | 10,000 | 14,600 | 20,300 |

*Small discrepancies between total inflow and outflow may occur due to rounding.

On average, about 81,600 AFY of precipitation falls within the Basin boundaries, with critically dry years averaging about 49,400 AF and wet years averaging about 117,900 AF. On average, about 46% of precipitation is evaporated or transpired by plants, 37% runs off the land surface into creeks, and 17% percolates through the soil vadose zone and recharges groundwater.

Total outflow in the precipitation budget to evaporation, groundwater, and surface water is dependent on climate and land use/cover. As expected, evapotranspiration, runoff, and groundwater recharge are greater during wet years than dry years. In general, runoff and recharge are more responsive to climate variation than evapotranspiration because vegetation cover is relatively constant, dry soil in dry years absorbs soil moisture, and saturated soil moisture in wet years promotes runoff and infiltration. During critically dry years, a greater percentage of precipitation (about 52%) is lost from the system due to evapotranspiration than in wet years when only about 44% of precipitation is lost to evapotranspiration. As a result, a smaller percentage of precipitation enters the surface water and groundwater systems during critically dry years, and a greater percentage of precipitation enters the surface water and groundwater systems in wet years.

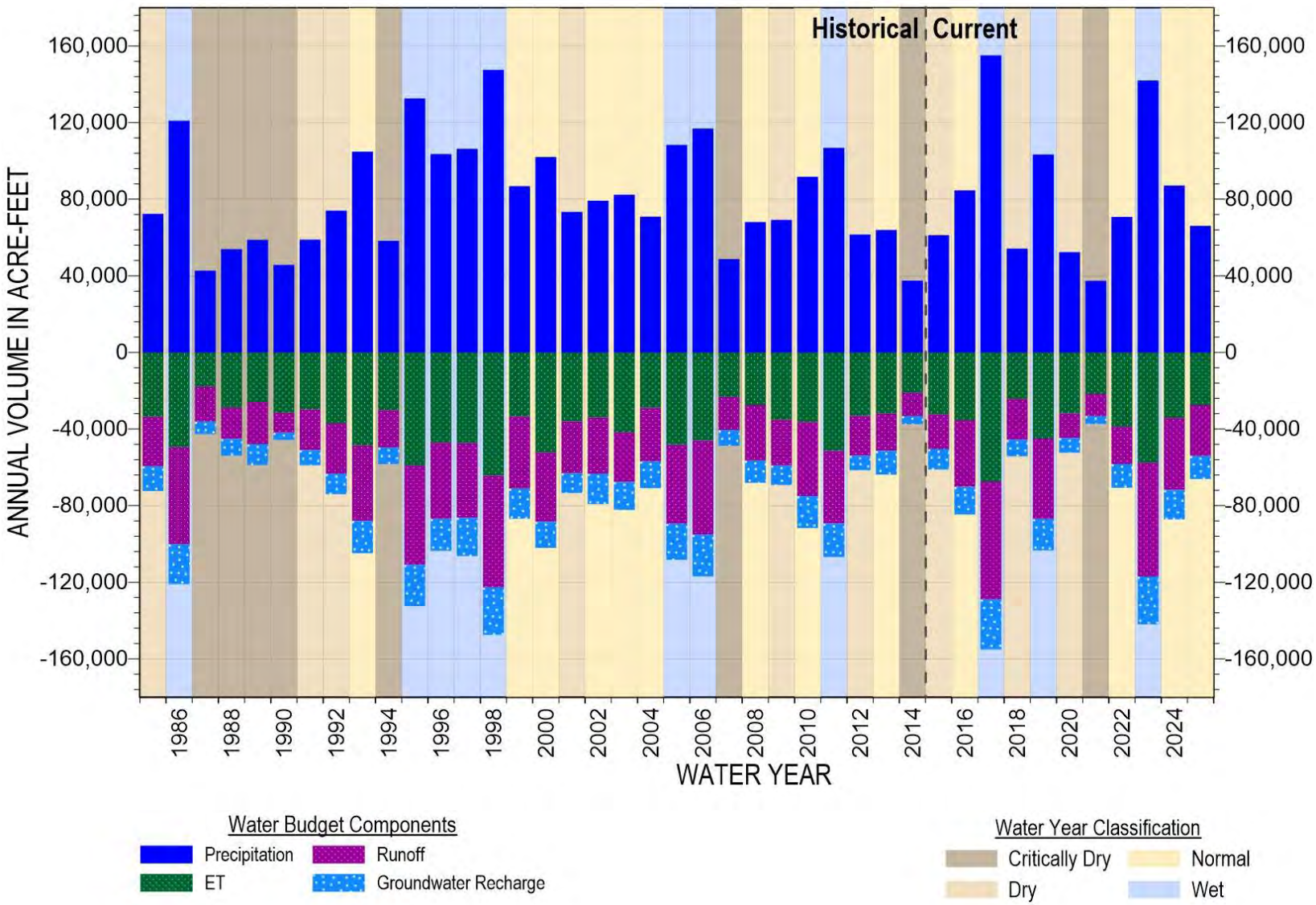



Figure 5-55 55. Historical and Current Precipitation Budget

### ~~4.2.2~~5.2.2 Historical Surface Water Budget

The historical surface water budget provides information on historical surface water and groundwater interactions, and how much surface water has flowed through the Basin. The historical surface water budget is summarized in Table 5-5, and is presented in a time series chart on Figure 5-6.

Table 5-5~~5~~ ~~5~~5 ~~5~~. Summary of Historical Surface Water Budget

| Water Budget Components | | Historical Water Budget WY1985-2014 | | Annual Average by Water Year Type (Acre-Feet) | | | |
|---|---|---|---|---|---|---|---|
| Average Total for Historical Water Budget (Acre-Feet) | | Annual Average (Acre-Feet) | Percent of Total Inflow or Outflow | Critically Dry | Dry | Normal | Wet |
| Inflows (118,800) | Surface Water Inflow | 69,600 | 59% | 37,900 | 56,800 | 71,300 | 104,900 |
| | Runoff | 27,900 | 23% | 15,200 | 22,100 | 28,900 | 42,200 |
| | Groundwater Discharge to Creeks | 21,300 | 18% | 17,800 | 19,600 | 21,700 | 25,300 |
| Outflows (118,900) | Surface Water Outflow | 110,200 | 93% | 63,400 | 90,300 | 113,300 | 162,600 |
| | Streambed Recharge | 8,700 | 7% | 7,700 | 8,500 | 8,700 | 9,600 |

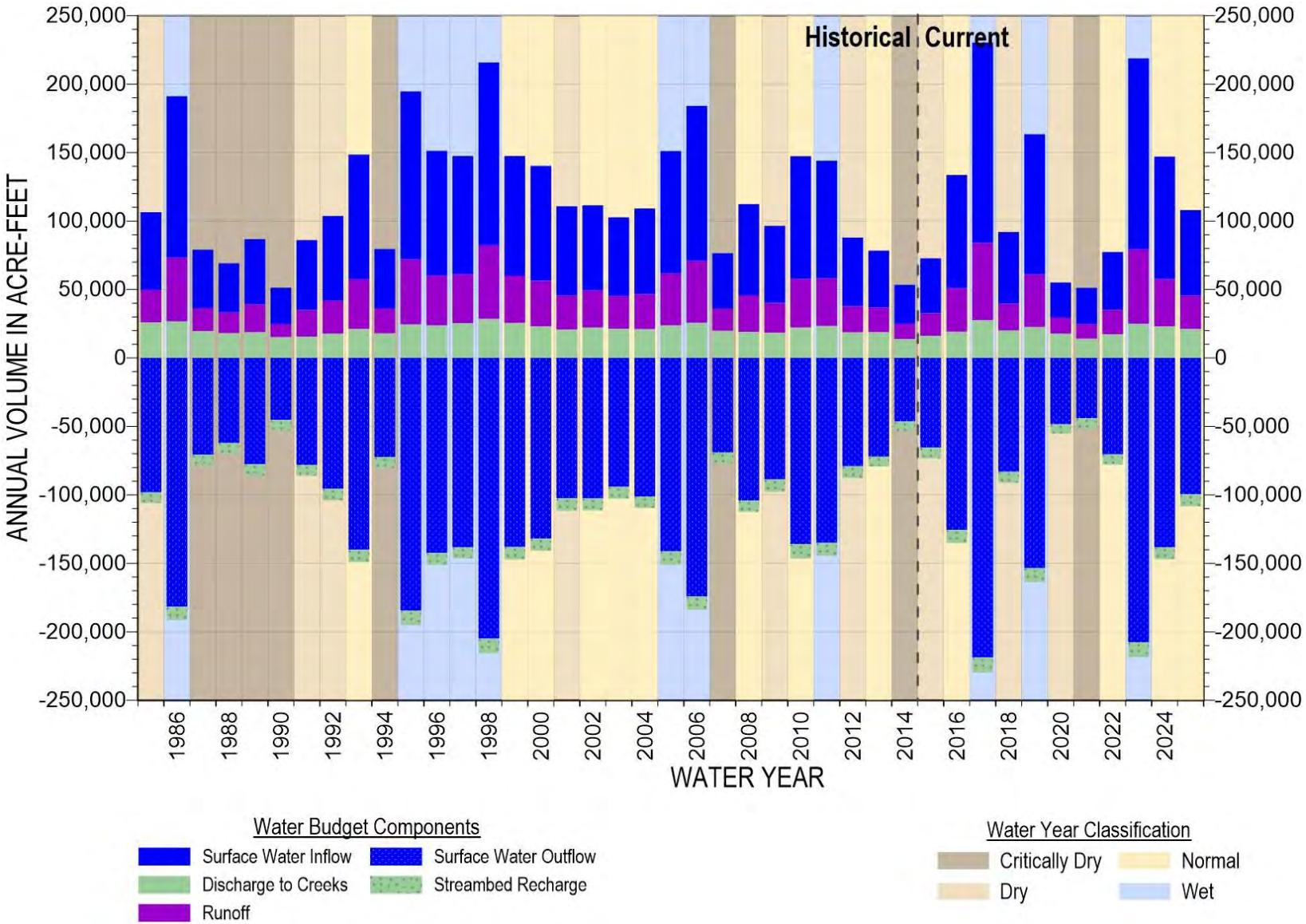



Figure 5-6~~5-65-~~. Historical and Current Surface Water Budget

Average historical surface water inflow in the Basin is about 118,800 AFY. Water year type strongly influences the surface water inflows, averaging about 70,900 AF in critically dry years and 172,400 AF in wet years. Surface water inflows are mostly from the San Lorenzo River, Newell Creek, Bean Creek, and a few other smaller streams and tributaries originating outside of the Basin. Creeks originating outside the Basin make up 59% of the surface water inflow to the Basin during an average year. Runoff from precipitation to surface water comprises 34% of total precipitation during an average year. Groundwater discharge to creeks makes the smallest contribution to surface water budget inflow, with an average of only 18% of the total inflow.

Outflow from the surface water system is approximately balanced with inflow over time across all water year types. Like inflow, surface water outflow is strongly correlated with water year type. Nearly all (93%) of surface water flows out of the Basin, mostly in the San Lorenzo River and Carbonera Creek. Recharge of aquifers underlying the surface water system accounts for only 7% of surface water outflow from the system.

Although groundwater discharge to creeks and streambed recharge to groundwater make up the smallest percentages of the surface water inflow and outflow budgets, surface water and groundwater interaction is important for maintaining volumes of surface water baseflows in the summer and fall months and for providing some groundwater recharge. Although there are months where there are losing reaches, creeks in the Basin consistently have a net annual gain from groundwater contributions regardless of water year type. Overall, there is about 2.5 times more groundwater discharge to creeks than creek recharge of groundwater. This results in widespread gaining stream conditions and contributes to greater surface water outflow than inflow. Annual precipitation and lowered groundwater levels influence groundwater and surface water interactions. Groundwater discharge to creeks during average wet years is about 7,500 AF more than in average critically dry years. Similarly, streambed groundwater recharge is about 1,900 AF more in average wet years than critically dry years. The impact of surface water interaction and precipitation on groundwater is discussed further in Sections 5.2.3 and 5.2.4.

### ~~4.2.3~~5.2.3 Historical Groundwater Budget

The historical groundwater budget provides information on how groundwater is replenished and used. Groundwater pumping, groundwater and surface water interaction, and changes of groundwater in storage are particularly relevant to groundwater management. The historical groundwater budget is summarized in Table 5-6 and presented in a time series chart on Figure 5-7.

Table 5-6~~5-6~~5-6. Historical Groundwater Budget

| Water Budget Components | | Historical Water Budget WY1985-2014 | | Annual Average by Water Year Type (Acre-Feet) | | | |
|---|---|---|---|---|---|---|---|
| Average Total for Historical Water Budget (Acre-Feet) | | Annual Average (Acre-Feet) | Percent of Total Inflow or Outflow | Critically Dry | Dry | Normal | Wet |
| Inflows (24,100)* | Precipitation Recharge | 13,600 | 56% | 7,400 | 10,400 | 14,700 | 20,100 |
| | Subsurface Inflow | 200 | 1% | 200 | 200 | 200 | 200 |
| | System Losses | 200 | 1% | 200 | 200 | 200 | 200 |
| | Septic Return Flow | 1,100 | 5% | 1,100 | 1,100 | 1,200 | 1,200 |
| | Quarry Return Flow | 200 | 1% | 300 | 300 | 200 | 200 |
| | Streambed Recharge | 8,700 | 36% | 7,700 | 8,500 | 8,700 | 9,600 |
| | Irrigation Return Flow | 100 | <1% | 100 | 100 | 100 | 100 |
| Outflows (25,300)* | Groundwater Pumping | 3,900 | 15% | 3,900 | 3,800 | 4,100 | 3,800 |
| | Subsurface Outflow | 100 | <1% | 100 | 100 | 100 | 100 |
| | Discharge to Creeks | 21,300 | 84% | 17,800 | 19,600 | 21,700 | 25,300 |
| Storage* | Average Annual Change in Storage | -1,300 | -- | -4,900 | -2,800 | -800 | 2,200 |
| | Cumulative Change in Storage | -40,300 | -- | -- | -- | -- | -- |

*Small discrepancies between total inflow and outflow may occur due to rounding.

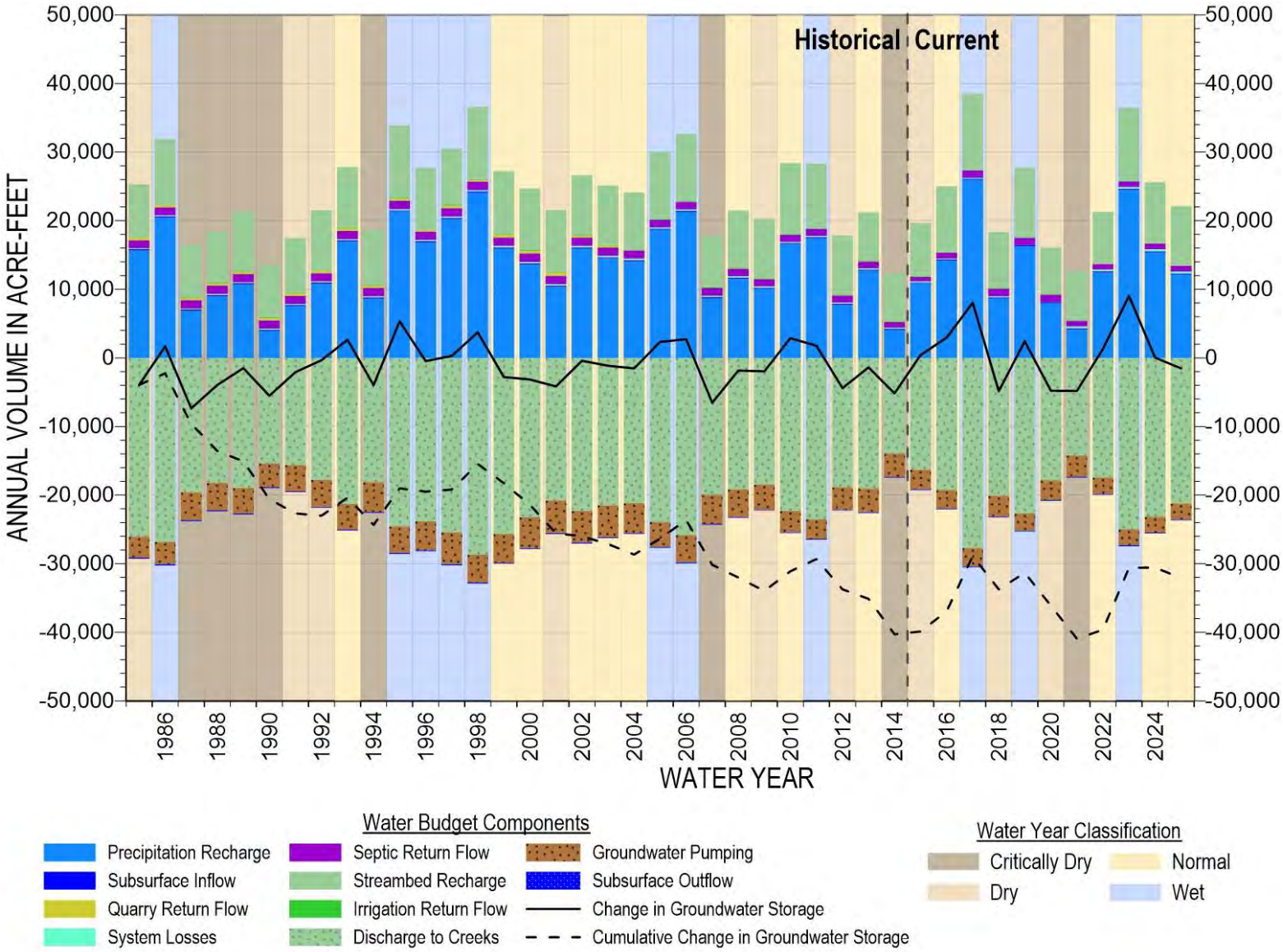



Figure 5-7~~5-75-7~~. Historical and Current Groundwater Budget

Groundwater inflow totals about 24,100 AFY on average and range from about 17,000 AF in average critically dry years to 31,600 AF in average wet years. Inflow to the groundwater system is dominated by precipitation and streambed recharge, which on average comprise 56% and 36% of total groundwater inflow, respectively. These 2 inflow components vary with climate, with significantly larger recharge volumes from both precipitation and creeks occurring during wet periods. Groundwater recharge from precipitation and streams combined ranges from about 15,100 AF in average critically dry years to 29,700 AF in average wet years.

Recharge to groundwater from septic systems, quarries, landscape irrigation, and other system losses make up only 8% of total annual inflow to groundwater. Groundwater return flows do not vary substantially with water year type but are correlated to population growth because more than half of the return flows are from septic systems. Septic return flows increased with population growth during the 1980s and early 1990s but decreased since the 2000s due to expansion of wastewater treatment systems, and replacement of older septic systems with systems that have less discharge in part to mitigate increasing nitrate concentrations due to septic impacts.

The Basin is hydrogeologically isolated by the bounding faults and relatively impermeable basement rock beneath the Basin; therefore, subsurface inflow and outflow constitute only a very small fraction of the total groundwater budget.

Total outflow from the Basin's groundwater system is approximately 25,300 AFY on average and ranges between 21,800 AF in average critically dry years to 29,200 AF in average wet years. Outflow is dominated by groundwater discharge to creeks and groundwater pumping, which comprise roughly 84% and 15% of total groundwater outflow, respectively.

As discussed in the historical surface water budget section, groundwater discharge to creeks is controlled by climate. Average groundwater discharge to creeks in critically dry years was 17,800 AF and average discharge in wet years was 25,300 AF. In contrast to predominantly agricultural groundwater basins in the state, groundwater pumping in the Basin does not increase greatly in dry years as groundwater is mainly for municipal and private domestic purposes, which have more consistent year-round demands than agriculture. Municipal pumping in the Basin reached a high during a period of relatively rapid population growth in the 1980s and 1990s. Groundwater management adjustments particularly from around 2010 on have reduced total groundwater pumping. More details on changes in groundwater pumping and its impact on groundwater levels are provided in Section 4.2.

Given that the Basin is a relatively closed groundwater system, groundwater discharge to creeks comprises a major component of groundwater outflow, and the Basin's creeks are dependent on groundwater discharge to maintain baseflows in the summer and early fall months. As discussed in the surface water budget section, creeks consistently gain more water from groundwater than

they lose to groundwater from streambed recharge, regardless of climate or anthropogenic factors.

The historical groundwater budget is indicative of a Basin not operating within its sustainable groundwater yield. Overall, historical groundwater outflow has been greater than inflow, resulting in a cumulative net decrease in groundwater in storage, which translates to falling groundwater levels. Between 1985 and 2014 the Basin cumulatively lost about 40,300 AF of groundwater in storage, or on average 1,300 AFY. While cumulative change in storage historically recovered during extended wet periods (notably WY1995 to WY1998 and WY2005 to WY2006), dry and normal years have historically resulted in large decreases in storage (notably WY1987 to WY1992 and the recent drought from WY2012 to WY2015). Improvements in groundwater supply management from 2010 onward appear to have slowed the decline in groundwater storage.

### ~~4.2.4~~5.2.4 Historical Groundwater Budget by Aquifer

The historical groundwater budget was analyzed by aquifer to demonstrate how groundwater was used and recharged in the various formations. The historical groundwater budget by aquifer is summarized in Table 5-7~~ and in more detailed tables in Appendix 5A~~.

In general, groundwater inflows are mostly into the Santa Margarita and Butano aquifers as they are conductive sandstones with large outcrop areas in the Basin. They are recharged by direct percolation of precipitation and streambed recharge. The Quaternary alluvium also receives substantial streambed recharge where it is thickest along the Basin's southern boundary, west of the Ben Lomond Fault near Felton. The alluvium is generally shallow across most of the Basin, but it is highly permeable and located in an area with relatively high streamflow where the San Lorenzo River flows out of the Basin.

In contrast to the other primary aquifers, the Lompico aquifer is recharged primarily from flow from overlying aquifers as it has limited surface outcrop in the Basin. It is readily recharged where Santa Margarita Sandstone directly overlies Lompico Formation in the Pasatiempo and Camp Evers areas. Elsewhere in the Basin, however, the presence of intervening Monterey Formation, an aquitard, limits the recharge of the Lompico aquifer.

Like the basin-wide groundwater inflow budget, groundwater outflow by aquifer is dominated by groundwater discharge to creeks, primarily from the Santa Margarita and Butano aquifers. There is also substantial flow between aquifers, with most of the flow being from the Santa Margarita aquifer to the deeper aquifers. The Lompico aquifer has smaller inflows than other aquifers, yet it supports almost half of the groundwater pumping in the Basin; the result is that about half the decline in storage in the Basin is in the Lompico aquifer.

Table 5-7~~5-75-7~~. Summary of Historical Groundwater Budget by Aquifer

| Groundwater Budget Components | | Historical Water Budget WY1985-2014 Annual Average (Acre-Feet) | | | | |
|---|---|---|---|---|---|---|
| | | Santa Margarita Aquifer | Monterey Formation | Lompico Aquifer | Butano Aquifer | Other Formations |
| Inflows | Precipitation Recharge | 6,400 | 1,500 | 1000 | 4,000 | 700 |
| | Subsurface Inflow | 0 | 0 | 0 | 100 | <100 |
| | Return Flows | 900 | 200 | 200 | 200 | 200 |
| | Streambed Recharge | 1,700 | 800 | 300 | 3,400 | 2,500 |
| | Flow from Other Aquifers | <100 | 400 | 1,900 | 700 | 200 |
| | ***Total Inflow**** | ***9,000*** | ***2,900*** | ***3,300*** | ***8,400*** | ***3,600*** |
| Outflows | Groundwater Pumping | 1,100 | 400 | 1,800 | 600 | <100 |
| | Subsurface Outflow | 0 | 0 | 0 | 100 | <100 |
| | Discharge to Creeks | 6,800 | 2,200 | 1,500 | 7,400 | 3,400 |
| | Flow to Other Aquifers | 1,300 | 400 | 700 | 600 | 200 |
| | ***Total Outflow**** | ***9,100*** | ***3,000*** | ***4,000*** | ***8,700*** | ***3,600*** |
| Storage | Average Annual Change in Storage* | -200 | -100 | -700 | -300 | -100 |
| | Cumulative Change in Storage* | -4,900 | -4,300 | -20,400 | -8,400 | -2,200 |

*Small discrepancies between total inflow and outflow may occur due to rounding

### ~~4.2.5~~5.2.5 Historical Groundwater Change in Storage by Subarea

To evaluate historical changes of groundwater in storage in different areas of the Basin and identify specific areas and aquifers that require ~~projects and management actions~~PMAs, the Basin is divided into subareas as depicted on Figure 4-4 and Figure 4-5. The subareas do not represent management areas and are only used in this GSP to describe aquifer conditions for different parts of the Basin.

Santa Margarita aquifer subareas are 1) Quail Hollow, 2) Olympia/Mission Springs, 3) Mount Hermon/South Scotts Valley, and 4) North Scotts Valley (Figure 4-4). These subareas are described in Section 4.2.2.2. Unlike the Santa Margarita aquifer, the Basin's confined aquifers are more continuous throughout the Basin. The Monterey Formation and Lompico and Butano aquifers share the same subareas: 1) North of Bean Creek, 2) Mount Hermon/South Scotts Valley, and 3) North Scotts Valley (Figure 4-5).

Plots of change in aquifer storage by subarea on Figure 5-8 through Figure 5-11 show that the largest loss of groundwater storage is in the Lompico aquifer in the Mount Hermon/South Scotts Valley subarea. The Monterey Formation and Butano aquifers in the Mount Hermon/South Scotts Valley subarea also have storage losses, but they are an order of magnitude smaller than in the Lompico aquifer. Losses of Lompico aquifer groundwater in storage in the in the Mount Hermon/South Scotts Valley subarea correspond to lowered groundwater levels measured in wells screened in the Monterey Formation and Lompico aquifer as described in Sections 4.2.3 and 4.2.4. The Butano aquifer has storage losses in subareas where it outcrops along the Basin's northern boundary in the North of Bean Creek and North Scotts Valley subareas. In comparison, the Lompico aquifer in those same subareas has smaller storage losses than the Butano aquifer. Storage losses in the Butano aquifer appear due to groundwater discharge to creeks since pumping is much smaller than creek discharges (Table 5-7). Conclusions regarding the Butano aquifer cannot be made with confidence because there are only 2 Butano aquifer specific monitoring wells in the Basin. The Butano aquifer is not as well-calibrated in the groundwater model as the shallower aquifers for which there are more data, as described in Section 3.4.11 on HCM data gaps.

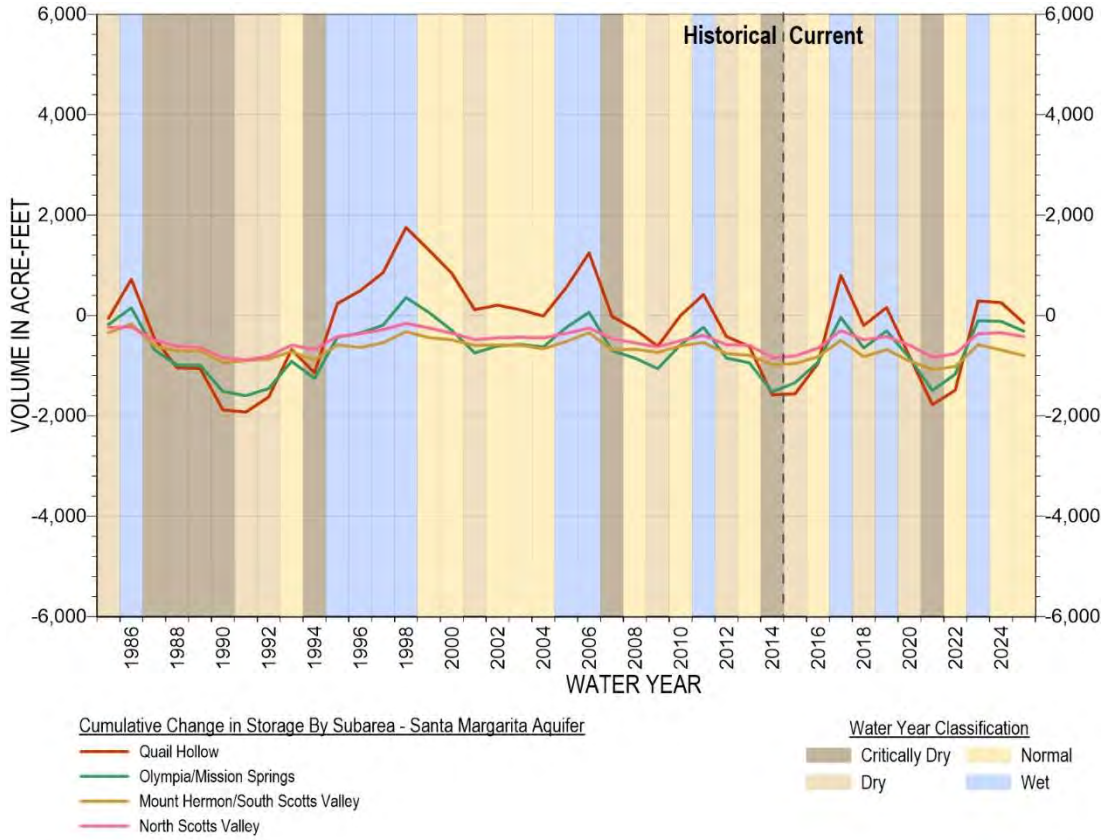



Figure 5-8~~5-85~~. Historical Cumulative Change of Groundwater in Storage in the Santa Margarita Aquifer

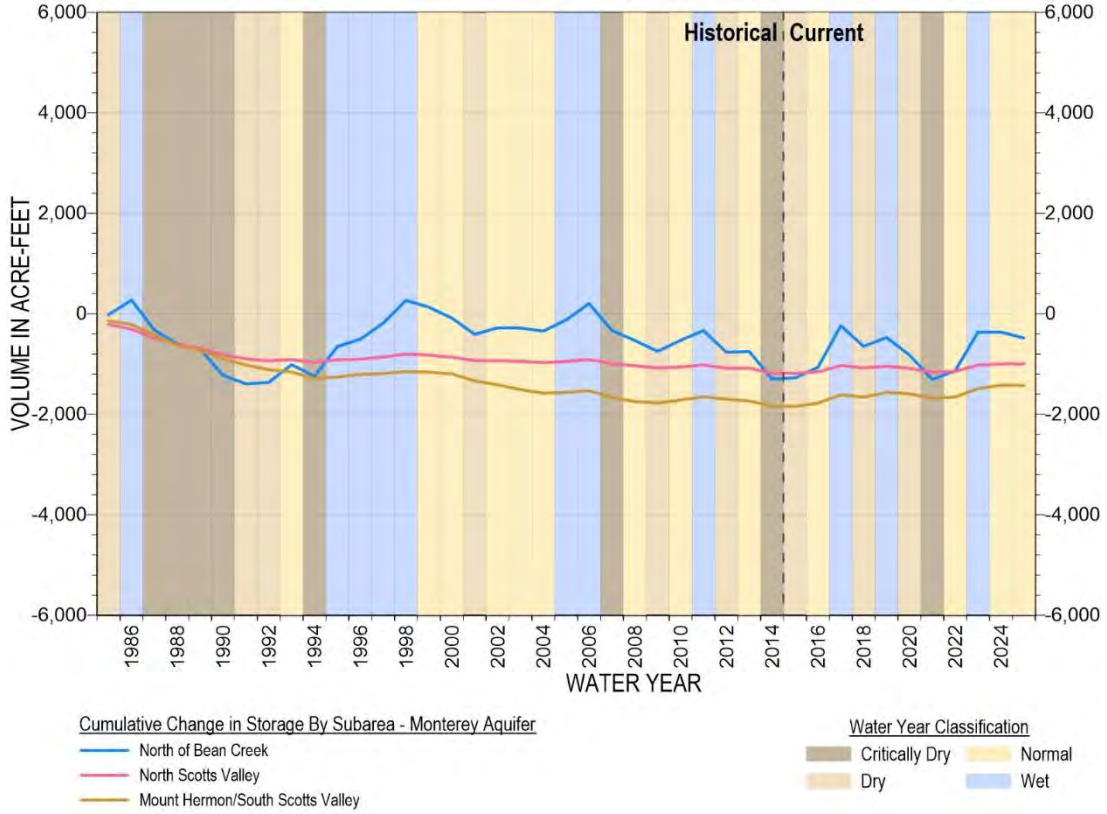



Figure 5-9~~5-95-9~~. Historical Cumulative Change of Groundwater in Storage in the Monterey Formation

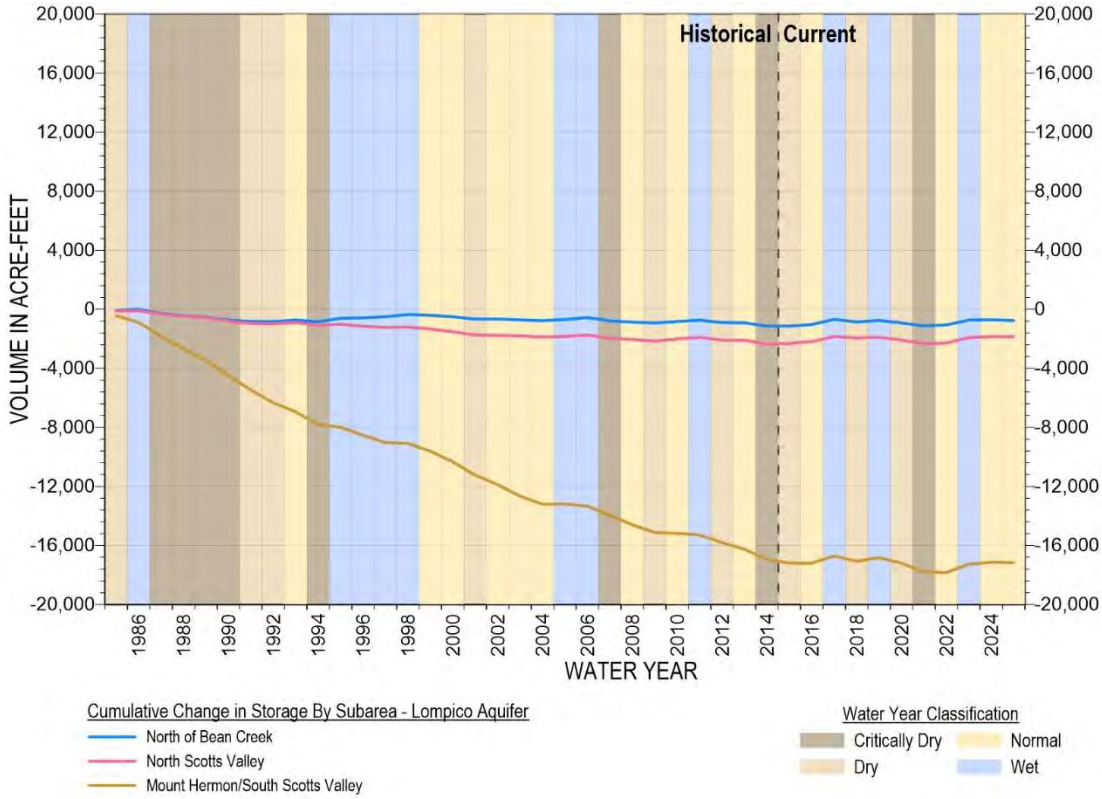



Figure 5-10~~5-105-10~~. Historical Cumulative Change of Groundwater in Storage in the Lompico Aquifer

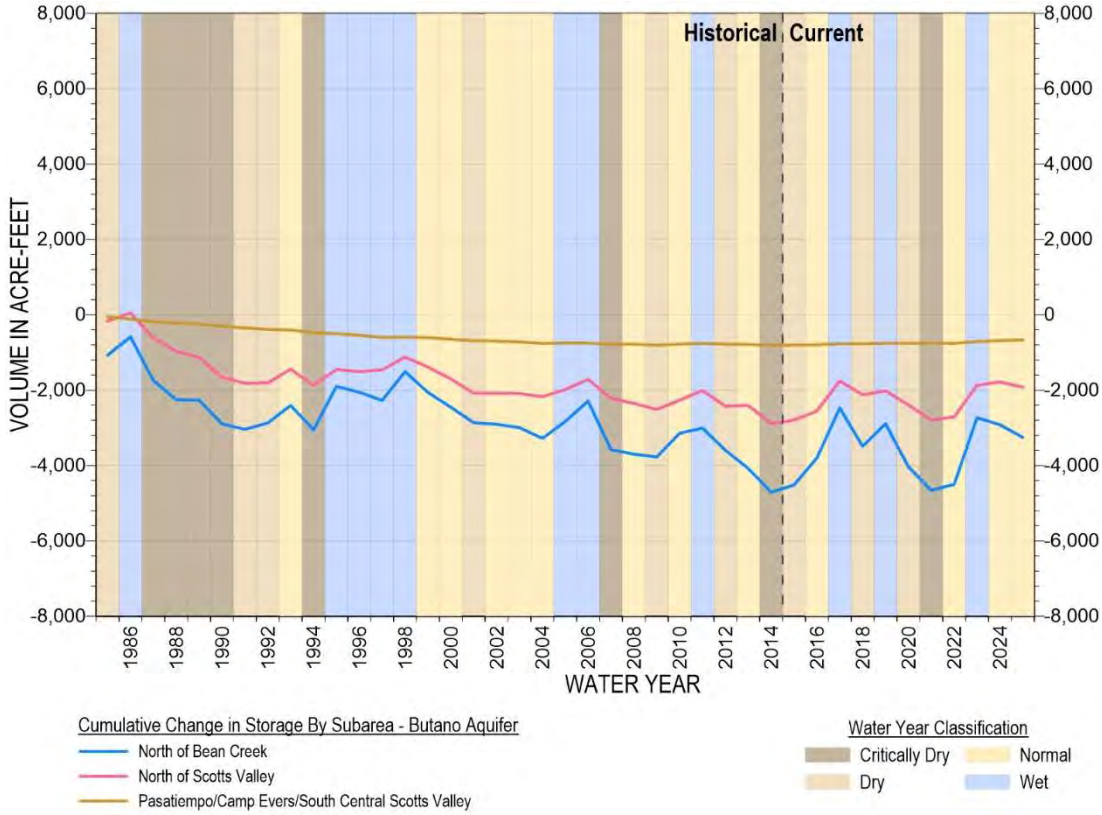



Figure 5-11~~5-115-11~~. Historical Cumulative Change of Groundwater in Storage in the Butano Aquifer~~r~~

## ~~4.3~~5.3 Current Water Budget

Per GSP Regulations (§ 354.18), a current water budget is developed for the Basin based on the most recent land use, water use, and hydrologic conditions. The current water budget allows the SMGWA to assess the most recent water supply, demand, groundwater and surface water interaction, and aquifer conditions for implementing the GSP. What constitutes current conditions is not prescribed by DWR in the GSP Regulations. For this Basin's GSP, the current water budget period from WY2015 to WY2025 is selected as it includes years after the passage of SGMA and encompasses some extreme climatic conditions that are anticipated to become more typical in the future due to climate change. The period includes extended dry conditions from WY2020 to WY2022, and historically wet conditions in WY2017 and WY2023.

### ~~4.3.1~~5.3.1 Current Precipitation Budget

The current precipitation budget provides a recent record of precipitation inflow and outflow in the Basin. The current precipitation budget is summarized in Table 5-8 and presented as part of the time series chart on Figure 5-5.

Table 5-8~~5-8~~ ~~5-8~~. Summary of Current Precipitation Budget

| Water Budget Components | | Current Water Budget WY2015-2025 | | Historical Water Budget WY1985-2014 | |
|---|---|---|---|---|---|
| Average Total for Current Water Budget (Acre-Feet) | | Annual Average (Acre-Feet) | Percent of Total Inflow or Outflow | Annual Average (Acre-Feet) | Percent of Total Inflow or Outflow |
| Inflows (83,100)* | Precipitation | 83,100 | 100% | 81,600 | 100% |
| Outflows (83,100)* | Evapotranspiration | 37,900 | 46% | 37,700 | 46% |
| | Direct Runoff | 31,300 | 38% | 30,400 | 37% |
| | Groundwater Recharge | 13,900 | 16% | 13,500 | 17% |

*Small discrepancies between total inflow and outflow may occur due to rounding

Overall, total precipitation during the current period is slightly more than during the historical period and is more variable. On average, approximately 83,100 AFY of precipitation fell in the Basin during the current timeframe, which is about 1,500 AF more per year than the historical period. During the current period, average evapotranspiration, runoff, and groundwater recharge has similar modest overall increases due to slightly higher precipitation and greater variability compared to the historical period. As with the historical period, evapotranspiration during the current period is relatively less responsive to extremes in climate than runoff and groundwater recharge. As a result, proportionally less precipitation enters the surface water and groundwater

systems during critically dry years, and proportionally more precipitation enters the surface water and groundwater systems in wet years.

### ~~4.3.2~~5.3.2 Current Surface Water Budget

The current surface water budget provides a recent record of surface water inflow and outflow in the Basin. The current surface water budget is summarized in Table 5-9 and presented as part of the time series chart on Figure 5-6.

Table 5-9~~5-9-9~~.Summary of Current Surface Water Budget

| Water Budget Components | | Current Water Budget WY2015-2025 | | Historical Water Budget WY1985-2014 | |
|---|---|---|---|---|---|
| Average Total for Current Water Budget (Acre-Feet) | | Annual Average (Acre-Feet) | Percent of Total Inflow or Outflow | Annual Average (Acre-Feet) | Percent of Total Inflow or Outflow |
| Inflows (122,800)* | Surface Water Inflow | 73,600 | 60% | 69,600 | 59% |
| | Runoff | 28,700 | 23% | 27,900 | 23% |
| | Groundwater Discharge to Creeks | 20,500 | 17% | 21,300 | 18% |
| Outflows (122,900)* | Surface Water Outflow | 114,100 | 93% | 110,200 | 93% |
| | Streambed Recharge | 8,800 | 7% | 8,700 | 7% |

*Small discrepancies between total inflow and outflow may occur due to rounding

During the current period, average overall inflow and outflow is approximately 122,800 AFY, which is about 4,000 AF more per year than the historical period. Overall wetter conditions during the current period compared to the historical period result in more surface water inflow and outflow. Groundwater discharge to creeks decreased and streambed recharge to groundwater increased compared to the historical period.

### ~~4.3.3~~5.3.3 Current Groundwater Budget

The current groundwater budget provides a recent record of groundwater inflow and outflow in the Basin. The current groundwater budget is summarized in Table 5-10 and presented as part of the time series chart on Figure 5-7.

The inflows and outflows to the groundwater budget are similar in the historical and current periods. The total inflow is about 24,000 AF, which is about 100 AFY less than the historical period. The total outflow is about 23,200 AF, which is about 2,100 AFY less than the historical period.

Table 5-10~~5-10-10~~. Current Groundwater Budget

| Water Budget Components | | Current Water Budget 2015-2025 | | Historical Water Budget 1985-2014 | |
|---|---|---|---|---|---|
| Average Total for Current Water Budget (Acre-Feet) | | Annual Average (Acre-Feet) | Percent of Total Inflow or Outflow | Annual Average (Acre-Feet) | Percent of Total Inflow or Outflow |
| Inflows (24,000)* | Precipitation Recharge | 13,900 | 58% | 13,600 | 56% |
| | Subsurface Inflow | 100 | 1% | 200 | 1% |
| | System Losses | 200 | 1% | 200 | 1% |
| | Septic Return Flow | 900 | 4% | 1,100 | 5% |
| | Quarry Return Flow | <100 | <1% | 200 | 1% |
| | Streambed Recharge | 8,800 | 37% | 8,700 | 36% |
| | Irrigation Return Flow | 100 | <1% | 100 | <1% |
| Outflows * (23,200) | Groundwater Pumping | 2,700 | 11% | 3,900 | 15% |
| | Subsurface Outflow | 100 | <1% | 100 | <1% |
| | Discharge to Creeks | 20,500 | 88% | 21,300 | 84% |
| Storage* | Average Annual Change in Storage | 700 | -- | -1,300 | -- |
| | Cumulative Change in Storage | 8,200 | -- | -40,300 | -- |

*Small discrepancies between total inflow and outflow may occur due to rounding

The main difference between the current and historical periods is that municipal pumping decreased. During the current period, outflow from groundwater pumping is 2,700 AFY on average, which is about 1,200 AF less than during the historical period. This reflects a reduction of average annual groundwater pumping of about 30% between the historical and current period.

During the current period, groundwater discharge to streams decreased by about 800 AFY from the historical period. Less net groundwater discharge to streams is likely related to lower groundwater levels in the Santa Margarita aquifer following the WY 2012-2015 drought and during WY 2020-2022 drought than in the early historical period, particularly in 4 consecutive wet years from WY 1995-1998.

Change of groundwater in storage fluctuated over the current period, from -4,800 AFY to 9,000 AFY, with a cumulative gain of 8,200 AF, and an average annual gain of 700 AF. The overall increase in storage during the current period indicates that groundwater inflow and outflow is balanced since 2015. This is an improvement from the historical period during which average annual storage losses are about 1,300 AF. Groundwater in storage declines in dry and critically dry water years suggest that net groundwater recharge of the Basin's aquifers only occurs in normal and wet years.

### ~~4.3.4~~5.3.4 Current Groundwater Budget by Aquifer/Formation

The current groundwater budget is analyzed by aquifer/formation to demonstrate changes in groundwater flows in the various aquifers relative to the historical period. The current groundwater budget by aquifer is summarized in Table 5-11 ~~and in more detailed tables in Appendix 5A~~.

Table 5-11~~5~~ ~~115~~ ~~11~~. Summary of Current Groundwater Budget by Aquifer

| Groundwater Budget Components | | Current Water Budget: WY2015-2025 Annual Average (Acre-Feet) | | | | |
|---|---|---|---|---|---|---|
| | | Santa Margarita Aquifer | Monterey Formation | Lompico Aquifer | Butano Aquifer | Other Formations |
| Inflows | Precipitation Recharge | 6,500 | 1,500 | 1,000 | 4,200 | 700 |
| | Subsurface Inflow | 0 | 0 | 0 | 100 | <100 |
| | Return Flows | 600 | 200 | 200 | 100 | 100 |
| | Streambed Recharge | 1,700 | 800 | 400 | 3,300 | 2,600 |
| | Flow from Other Aquifers | <100 | 300 | 1,700 | 600 | 100 |
| | Inflow* | **8,700** | **2,800** | **3,200** | **8,400** | **3,600** |
| Outflows | Groundwater Pumping | 700 | 200 | 1,200 | 500 | <100 |
| | Subsurface Outflow | 0 | 0 | 0 | 100 | <100 |
| | Discharge to Creeks | 6,500 | 2,100 | 1,300 | 7,200 | 3,300 |
| | Flow to Other Aquifers | 1,200 | 400 | 600 | 400 | 200 |
| | Total Outflow* | **8,400** | **2,700** | **3,100** | **8,200** | **3,500** |
| Storage | Average Annual Change in Storage* | 300 | 100 | 100 | 200 | <100 |
| | Cumulative Change in Storage* | 3,300 | 1,400 | 600 | 2,600 | 300 |

*Small discrepancies between total inflow and outflow may occur due to rounding

Groundwater inflows to each aquifer changed little between the historical and current periods. Precipitation recharge in the current period is within 200 AFY of its historical average in every aquifer, streambed recharge is within 100 AFY, and total inflow to each aquifer is within 300 AFY, indicating that the distribution of recharge among the aquifers is controlled by Basin geology rather than by changes in groundwater extraction. The one exception is flow into the Lompico aquifer from overlying aquifers, which decreased from 1,900 to 1,700 AFY, consistent with reduced vertical gradients as Lompico aquifer pumping declined and groundwater elevations recovered. Reduced pumping is the main difference between the 2 periods, and pumping decreased in every aquifer, from 1,800 to 1,200 AFY in the Lompico aquifer and from

1,100 to 700 AFY in the Santa Margarita aquifer, which together account for about 75% of the Basin-wide reduction.

The most substantial change between the historical and current periods is in groundwater storage, which shifted from losses to gains in all 5 hydrogeologic units. Average annual change in storage in the Lompico aquifer improved from a loss of 700 AFY in the historical period to a gain of 100 AFY in the current period. Current period cumulative storage gains are largest in the Santa Margarita aquifer, about 3,300 AF, and the Butano aquifer, about 2,600 AF. The reversal in the Lompico aquifer is the most notable of these changes because that aquifer accounted for about half of the historical Basin-wide storage loss.

### ~~4.3.5~~5.3.5 Current Groundwater Change in Storage by Subarea

The current groundwater change in storage is analyzed by aquifer and subarea to assess where storage changes have been occurring since WY 2015. Figure 5-8 through Figure 5-11 illustrate that cumulative change in storage is balanced overall in the current period.

Historical declines in groundwater in storage in the deeper, semi-confined, and confined aquifers stabilized after slight declining trends in the historical period. The Lompico aquifer in the Mount Hermon/South Scotts Valley subarea, which had the greatest storage losses during the historical timeframe, saw a slight average gain of 100 AFY over the current period (Figure 5-10).

## 5.4 Baseline Projected Water Budget

The GSP Regulations (CWC § 354.18) require the development of a projected water budget baseline to assess how water supply, surface water and groundwater interactions, and aquifer conditions will be impacted by future changes in climate and water demands if ~~projects and management actions~~PMAs are not implemented. The projected baseline water budgets presented in this and the next subsection fulfill those requirements of the GSP. The projected water budgets are developed for the period WY2026 to WY2072 per the GSP Regulations requirement that the projected period include a 50-year planning and implementation horizon over which the GSP and measures will be implemented to ensure that the Basin is operated within its sustainable yield.

The climate projections used by the groundwater model were designed to replicate historical climate conditions. The historical climate parameters from WY1985 to WY2025 are used as the projected climate parameters for WY2026 to WY2066, and the climate parameters from WY2007 to WY2012 (a period with variable climate but lower than average precipitation) are repeated again as the projected climate parameters for WY2067 to WY2072. A projected water budget under alternate climate conditions, developed to account for the potential impacts of climate change, is presented in Section 5.5.

In both climate scenarios, the projected simulation assumes a small increase in urban growth. Water demands are projected to increase 0.18% per year for SLVWD (SLVWD, 2026) and 0.14% per year for SVWD (SLVWD, 2026) through the projected model period from 2026 to 2072. Although it is not simulated in the projected groundwater model, the urban footprint in the service areas is projected to expand slightly, resulting in slightly more runoff and less recharge.

### 5.4.1 Baseline Projected Precipitation Budget

The projected precipitation budget provides a simulated outlook of precipitation inflow and outflow. The projected precipitation budget is summarized in Table 5-16 and presented on a time series chart on Figure 5-12.

Table 5-125-5-12. Summary of Baseline Projected Precipitation Budget

| Water Budget Components | | Baseline Projected WY2026-2072 | | Current WY2015-2025 | Historical WY1985-2014 |
|---|---|---|---|---|---|
| Average Total for Projected Water Budget (Acre-Feet) | | Annual Average (Acre-Feet) | Percent of Total Inflow or Outflow | Annual Average (Acre-Feet) | Annual Average (Acre-Feet) |
| Inflows (81,000)* | Precipitation | 81,000 | 100% | 83,100 | 81,600 |
| Outflows (81,000)* | Evapotranspiration | 37,300 | 46% | 37,900 | 37,700 |
| | Direct Runoff | 30,300 | 37% | 31,300 | 30,400 |
| | Groundwater Recharge | 13,400 | 15% | 13,900 | 13,500 |

*Small discrepancies between total inflow and outflow may occur due to rounding

Projected precipitation in the Basin is on average about 3% less than the current period and 1% less than the historical period. This discrepancy occurs because the climate conditions of 2007 to 2012, which collectively include below average precipitation, are repeated in the projected model period. Evapotranspiration over the projected period is also a repeat of historical conditions, and is also 1% lower than the historical period.

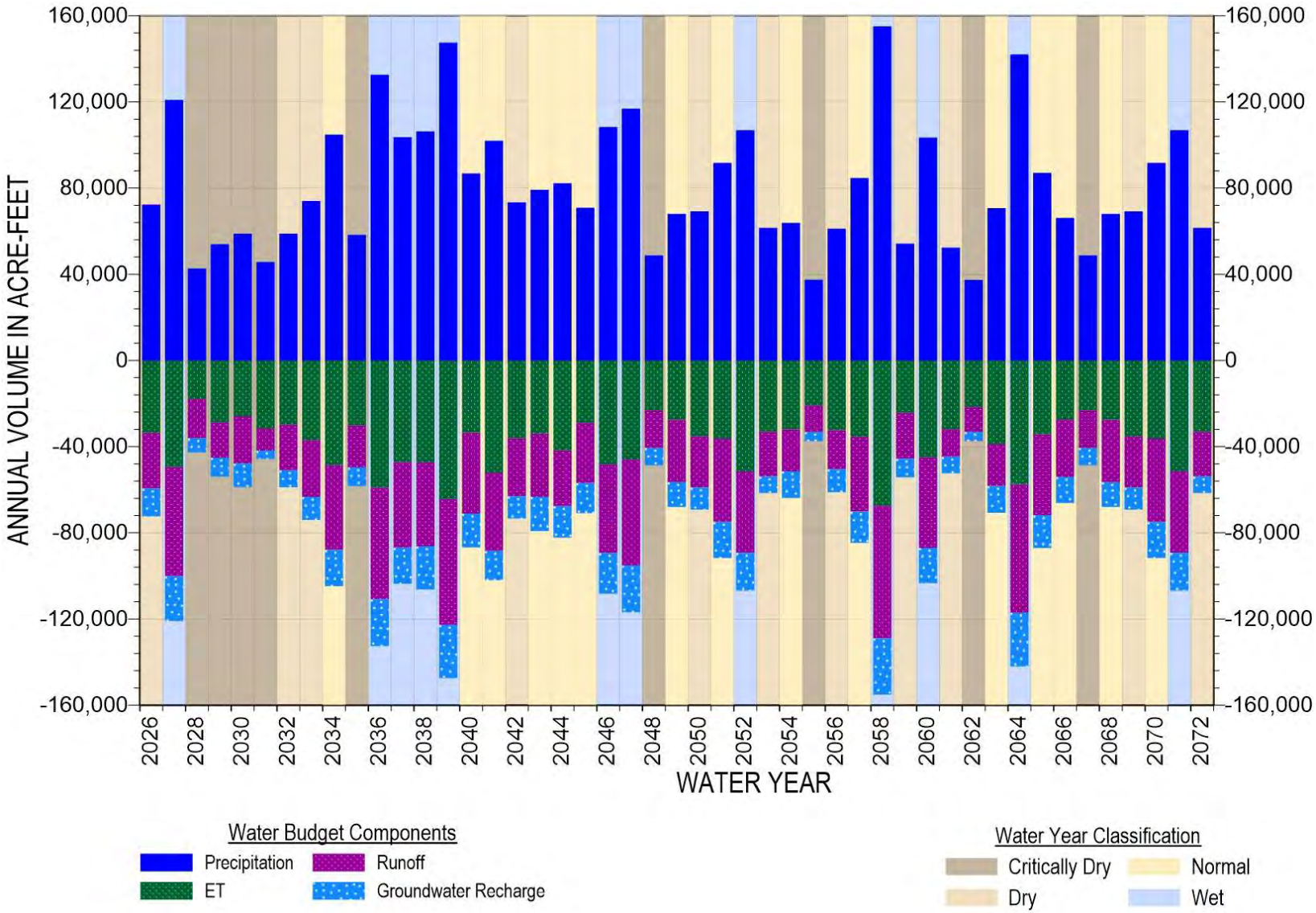



Figure 5-125~~-12~~. Baseline Projected Precipitation Budget

### 5.4.2 Baseline Projected Surface Water Budget

The projected surface water budget provides a simulated outlook for surface water inflow and outflow ~~in the Basin in the future~~. The projected surface water budget is summarized in Table 5-17 and presented in a time series chart on Figure 5-20.

Table 5-13~~5-5-13~~. Summary of Baseline Projected Surface Water Budget

| Water Budget Components | | Baseline Projected WY2026-2072 | | Current WY2015-2025 | Historical WY1985-2014 |
|---|---|---|---|---|---|
| Average Total for Projected Water Budget (Acre-Feet) | | Annual Average (Acre-Feet) | Percent of Total Inflow or Outflow | Annual Average (Acre-Feet) | Annual Average (Acre-Feet) |
| Inflows (118,500) | Surface Water Inflow | 69,600 | 59% | 73,600 | 69,600 |
| | Runoff | 27,800 | 23% | 28,700 | 27,900 |
| | Groundwater Discharge to Creeks | 20,800 | 18% | 20,500 | 21,300 |
| Outflows (118,600) | Surface Water Outflow | 109,900 | 93% | 114,100 | 110,200 |
| | Streambed Recharge | 8,700 | 7% | 8,800 | 8,700 |

During the baseline projected period, average groundwater total inflow and outflow ~~is~~are both approximately 118,600 AFY, which is about 3% less than the historical period. Surface water and groundwater interaction reflected as discharge to creeks and streambed recharge to groundwater fluctuates proportionally with precipitation and surface water inflow, especially during periods of extended drought. Consequently, the amount of surface water and groundwater interaction decreases slightly during the projected period.

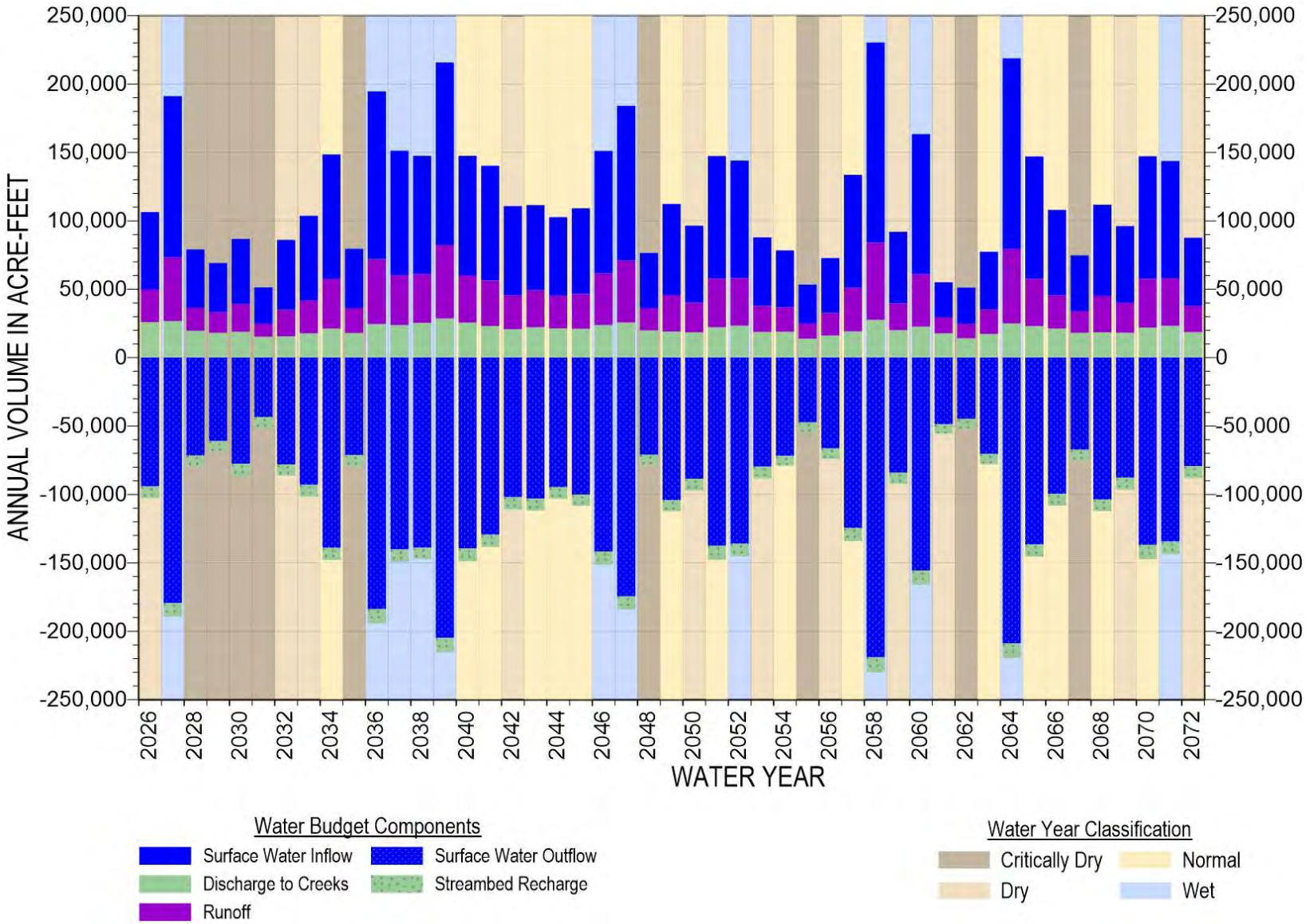



Figure 5-13~~5-13~~. Baseline Projected Surface Water Budget

### 5.4.3 Baseline Projected Groundwater Budget

The projected groundwater budget provides a simulated outlook for groundwater inflow and outflow. The projected groundwater budget is summarized in Table 5-18 and presented in a time series chart on Figure 5-21.

Table 5-14~~5-5-14~~. Summary of Baseline Projected Groundwater Budget

| Water Budget Components | | Baseline Projected WY2026-2072 | | Current WY2015-2025 | Historical WY1985-2014 |
|---|---|---|---|---|---|
| Average Total for Projected Water Budget (AF) | | Annual Average (AF) | Percent of Total Inflow or Outflow | Annual Average (AF) | Annual Average (AF) |
| Inflows (23,400)* | Precipitation Recharge | 13,400 | 57% | 13,900 | 13,600 |
| | Subsurface Inflow | 200 | <1% | 100 | 200 |
| | System Losses | 300 | 1% | 200 | 200 |
| | Septic Return Flow | 800 | 3% | 900 | 1,100 |
| | Quarry Return Flow | <100 | <1% | <100 | 200 |
| | Streambed Recharge | 8,700 | 37% | 8,800 | 8,700 |
| | Irrigation Return Flow | <100 | <1% | 100 | 100 |
| Outflows (23,500)* | Groundwater Pumping | 2,600 | 11% | 2,700 | 3,900 |
| | Subsurface Outflow | 100 | 1% | 100 | 100 |
| | Discharge to Creeks | 20,800 | 88% | 20,500 | 21,300 |
| Storage* | Average Annual Change in Storage | -100 | - | 700 | -1,300 |
| | Cumulative Change in Storage | -3,400 | - | 8,200 | -40,300 |

*Small discrepancies between total inflow and outflow may occur due to rounding

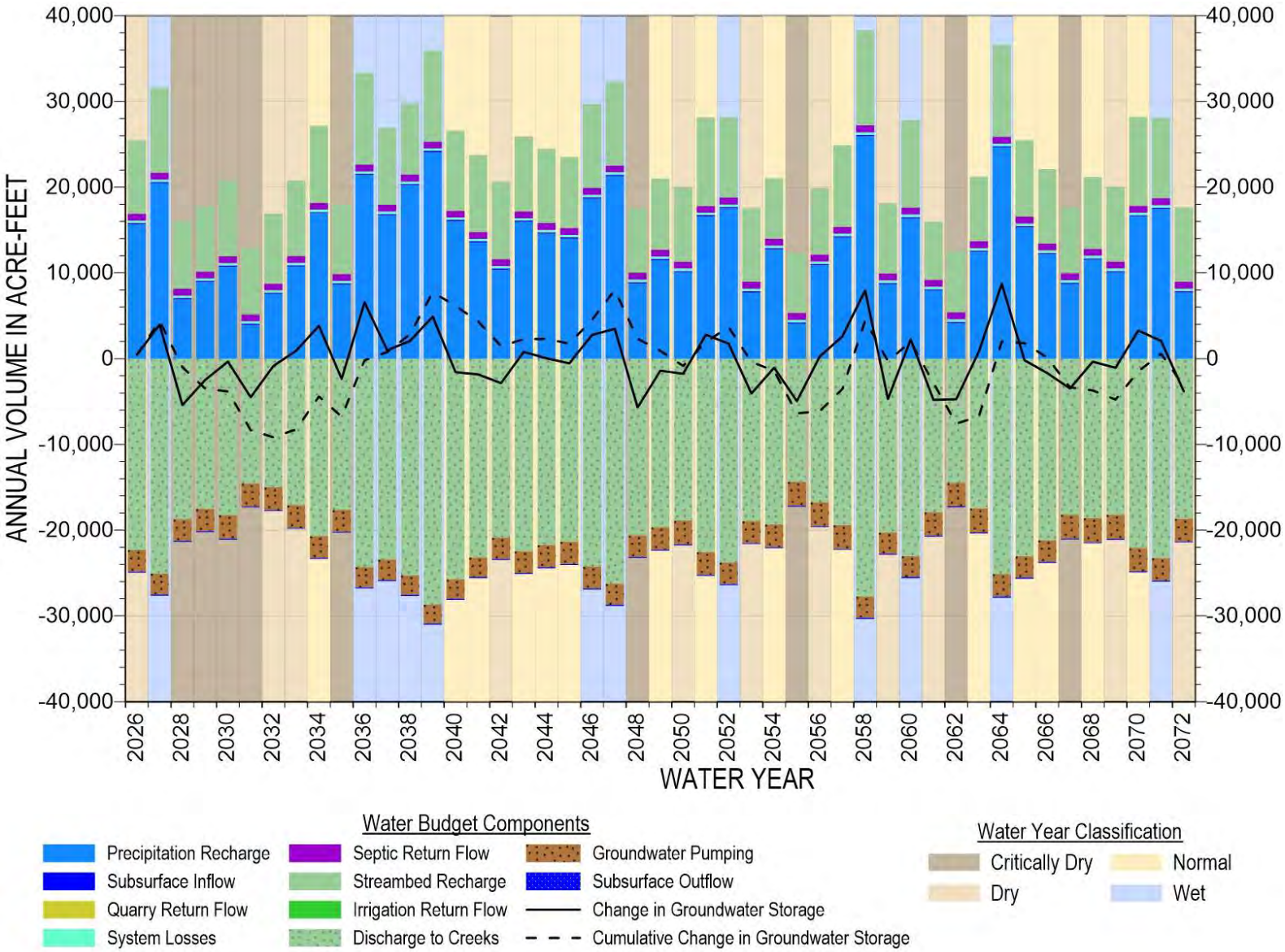



Figure 5-14~~5-14~~. Baseline Projected Groundwater Budget

Total inflows and outflows to the groundwater budget are both smaller in the projected period than in the historical and current periods. Compared to the historical period, predicted total inflows and outflows are approximately 700 AFY and 1,800 AFY less, respectively.

Direct groundwater recharge from precipitation is projected to be about 200 AF less per year than the historical period; in comparison, streambed recharge is predicted to be about 300 AF less. Septic return flows to groundwater are expected to decrease about 28% with improved water efficiency as water fixtures are replaced, resulting in about 800 AFY of septic return flows compared to about 1,100 AF per over the historical period. Other components of projected groundwater inflow are expected to be similar to historical inflows.

Reduced projected groundwater outflow is mostly a result of less groundwater pumping and groundwater discharge to creeks. In the projection, groundwater pumping is estimated to average about 2,600 AFY, which is 100 AFY less than average current conditions and about 1,300 AFY less than average historical conditions. Future population growth is expected to be small as described in Section **Error! Reference source not found.** and therefore the slight increase in water use is expected to be offset with continued water efficiency improvements. It is projected that groundwater discharge to creeks will be about 20,800 AFY on average, which is 500 AF less than the historical annual average and 300 AF more than the current annual average.

Under the repeated WY2007 to WY2012 climate projection, the Basin will experience slightly less precipitation and groundwater pumping compared to historical conditions. This results in a slightly negative, though nearly balanced, average change in groundwater in storage and groundwater levels. Periods of prolonged drought stress the water supply in the Basin and require greater groundwater recharge and/or conjunctive use strategies to increase groundwater in storage in wetter years when water is available. The projected baseline simulation without implementing new projects or management actions results in a cumulative loss of groundwater in storage of about 3,200 AF between 2026 and 2072. The annual average decline in storage in this timeframe is about 100 AFY, which is the rounding error for the simulated values.

Given these results, additional ~~projects and management actions~~PMAs will not be needed to achieve sustainability under a slightly drier climate than the past 50 years. It is, however, important to recognize that the model projections are highly dependent on estimates of future precipitation. To the degree that actual future precipitation deviates from that predicted by this projection, groundwater conditions could be better or worse than simulated. An alternate climate change projection water budget is provided in Section 5.5.

### 5.4.4 Baseline Projected Groundwater Budget by Aquifer

The projected groundwater budget is analyzed by aquifer to demonstrate changes in groundwater flows in the various aquifers if no additional projects or management actions are implemented.

The projected groundwater budget by aquifer is summarized in Table 5-19 ~~and in more detailed tables in Appendix 5A.~~

Table 5-15~~5-5-15~~. Baseline Projected Groundwater Budget by Aquifer

| Groundwater Budget Components | | Baseline Projected Water Budget: WY2026-2072 Annual Average (Acre-Feet) | | | | |
|---|---|---|---|---|---|---|
| | | Santa Margarita Aquifer | Monterey Formation | Lompico Aquifer | Butano Aquifer | Other Formations |
| Inflows | Precipitation Recharge | 6,300 | 1,400 | 900 | 4,000 | 700 |
| | Subsurface Inflow | 0 | 0 | 0 | 100 | <100 |
| | Return Flows | 500 | 200 | 200 | 100 | 100 |
| | Streambed Recharge | 1,700 | 800 | 400 | 3,400 | 2,500 |
| | Flow from Other Aquifers | <100 | 300 | 1,700 | 700 | 100 |
| | ***Total Inflow**** | ***8,500*** | ***2,700*** | ***3,100*** | ***8,300*** | ***3,400*** |
| Outflows | Groundwater Pumping | 700 | 100 | 1,200 | 600 | <100 |
| | Subsurface Outflow | 0 | 0 | 0 | 100 | <100 |
| | Discharge to Creeks | 6,700 | 2,200 | 1,400 | 7,200 | 3,300 |
| | Flow to Other Aquifers | 1,200 | 400 | 600 | 400 | 100 |
| | ***Total Outflow**** | ***8,600*** | ***2,700*** | ***3,200*** | ***8,300*** | ***3,040*** |
| Storage | Average Annual Change in Storage* | >-100 | >-100 | >-100 | >-100 | >-100 |
| | Cumulative Change in Storage* | -1,500 | -200 | -1,000 | -600 | -2,000 |

*Small discrepancies between total inflow and outflow may occur due to rounding

The baseline projected groundwater budget assumes pumping will be on average 100 AFY less than current pumping (Table 5-11). This is because in the projection's very wet years, there will be more surface water available for municipal water supply. A slight increase in pumping is projected in the Butano aquifer, while slight decreases in groundwater pumping are projected in the Monterey and Lompico aquifers in comparison to current pumping. The decrease in Lompico aquifer pumping is due to SVWD shifting pumping from Lompico aquifer wells (SVWD #10A, #11A, and #11B) to wells screened in both the Lompico and Butano aquifers (SVWD Grace Way, Orchard, and Sucinto).

The average long-term annual change in storage is projected to be slightly negative for each of the principal aquifers. The greatest amounts of storage loss are projected for the Santa Margarita aquifer. Storage is lost during dry periods and gained during wet periods. Since more dry and

critically dry years are projected than wet years, the result is a net overall loss of groundwater in storage.

### 5.4.5 Baseline Projected Groundwater Change in Storage by Subarea

Figure 5-22 through Figure 5-25 show each aquifer's baseline projected cumulative change of groundwater in storage. The Santa Margarita aquifer is the most sensitive to climatic changes and loses almost 2,800 AF from storage in the Quail Hollow subarea during the ~~longest~~5-year projected drought period from 2028 to 2032 (Figure 5-22). However, it recovers ~~very~~ quickly after several wet years. The same pattern of groundwater depletion and recovery occurs in ~~the~~ other subareas, but at a lesser scale. The Quail Hollow and Olympia/Mission Springs subareas have the greatest losses and gains in storage because they support municipal supply wells that pump most of the groundwater extracted from the Santa Margarita aquifer in the Basin.

Monterey Formation projected change of groundwater in storage is shown on Figure 5-23. The Monterey Formation has very limited ~~is not~~ extraction in the area south of Bean Creek (North Scotts Valley and Mount Hermon/South Scotts Valley subareas) and even in the driest years, little change in storage is predicted. Figure 5-23 shows there is more change in groundwater in storage in the subarea north of Bean Creek where only *de minimis* users pump from the Monterey Formation~~.~~.

Except in periods of consecutive dry or wet years, groundwater in storage in the Lompico aquifer is generally consistent (Figure 5-24). This indicates that pumping from the Lompico aquifer is roughly in balance with its recharge. The largest fluctuations in storage are seen in the Mount Hermon/South Scotts Valley subarea where the majority of Lompico aquifer extraction occurs by MHA, SLVWD, and SVWD. Section 8 describes potential projects targeting the Lompico aquifer to both provide for some recovery from past losses of storage and to provide regional water supply resiliency against prolonged future droughts.

The Butano aquifer is pumped only in the northern portions of the Basin, where it outcrops south of the Zayante-Vergeles fault and slightly farther south from the boundary where SVWD has ~~2~~3 water supply wells in Scotts Valley that are more than 1,000 feet deep. The projected modeled changes in storage depicted on Figure 5-25 reflect effects of recharge in wet years. This pattern is more like the Santa Margarita aquifer response to recharge events and less like the similarly confined Lompico aquifer response~~ds~~. The 2 Butano aquifer monitoring wells in northern Scotts Valley do not respond to wet years in the same way the model predicts (hydrographs are included on Figure 4-14. It is acknowledged in Section 0 that because of so few monitoring wells in the Butano aquifer, current understanding of it is limited and assumptions made in the model may not be correct. Existing plans to install a new Butano monitoring wells may increase hydrogeologic understanding, in turn informing the groundwater model.

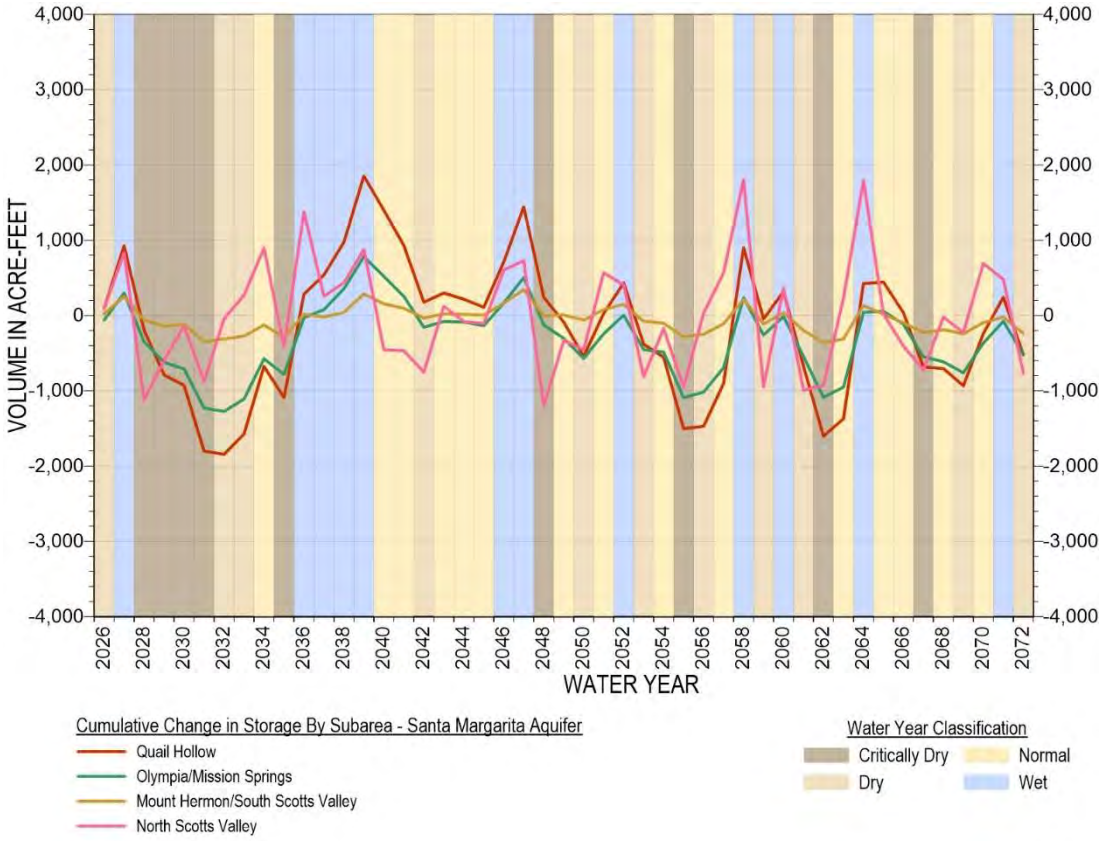



Figure 5-15~~5-15~~. Baseline Projected Cumulative Change of Groundwater in Storage in the Santa Margarita Aquifer

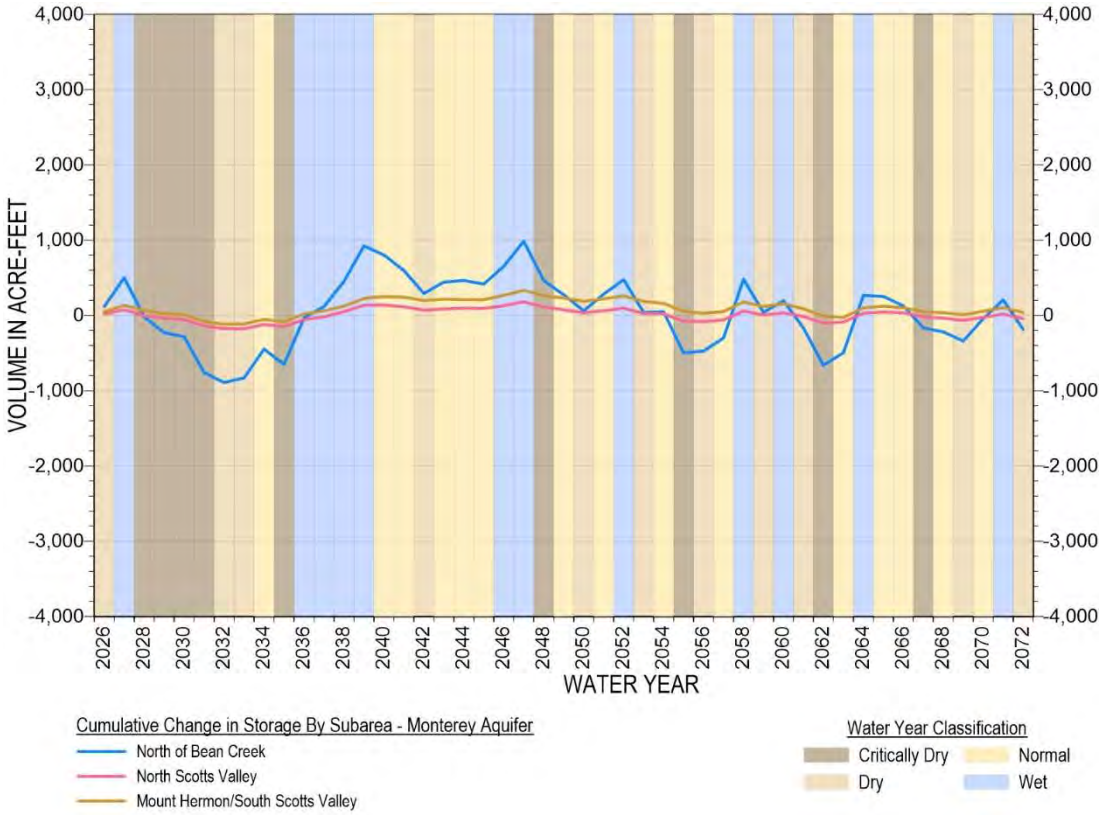



Figure 5-16~~5-16~~. Baseline Projected Cumulative Change of Groundwater in Storage in the Monterey Formation

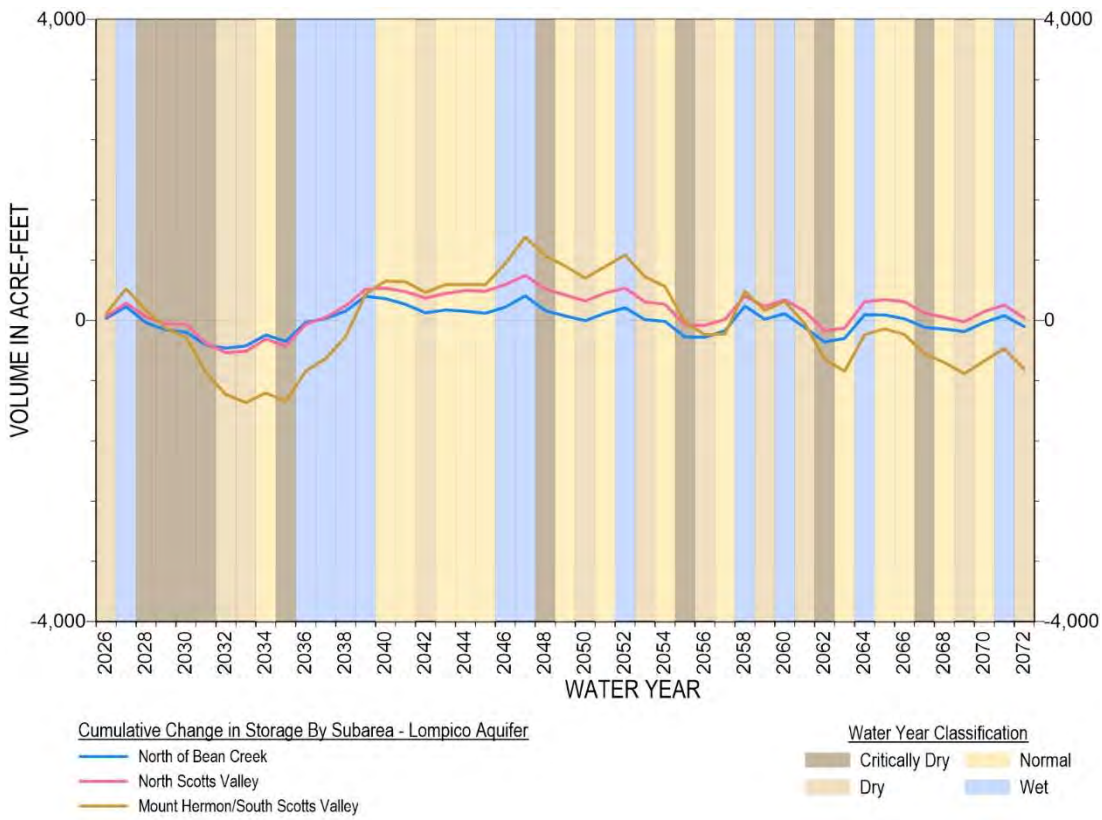



Figure 5-175 17. Baseline Projected Cumulative Change of Groundwater in Storage in the Lompico Aquifer

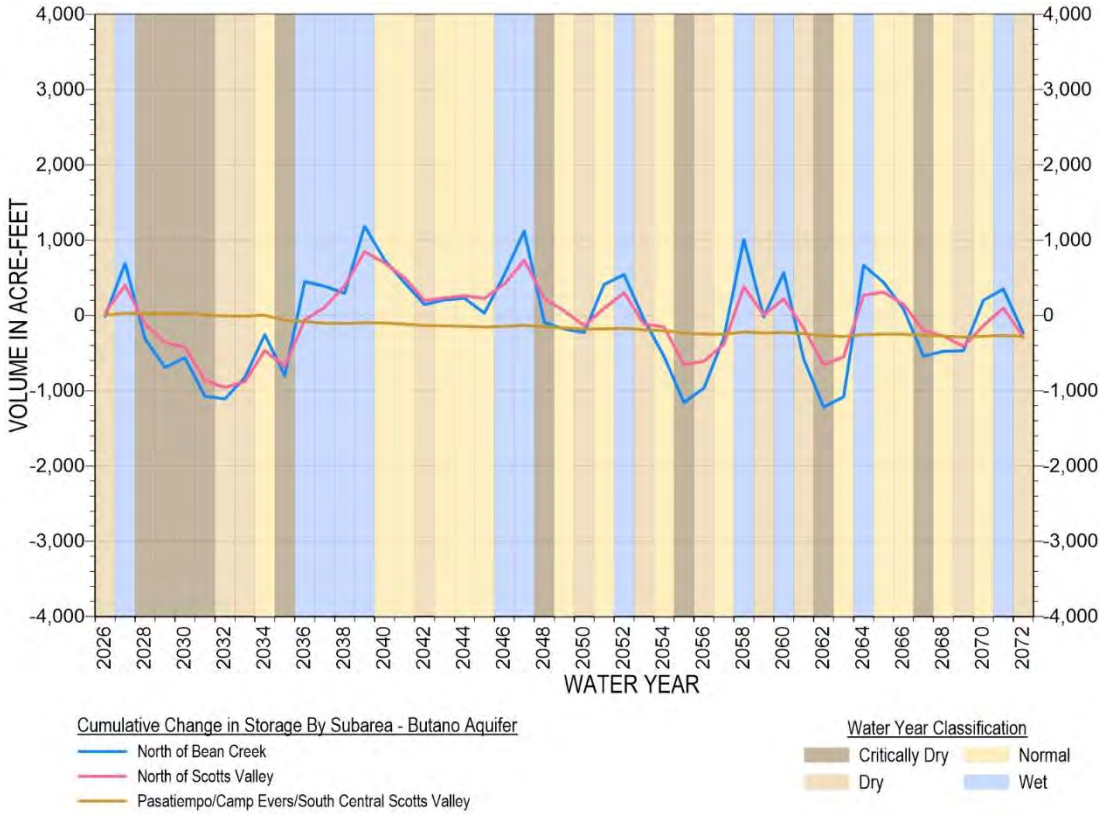



Figure 5-18~~5-18~~. Baseline Projected Cumulative Change of Groundwater in Storage in the Butano Aquifer

## 4.45.5 Projected Water Budget with Climate Change

The projected water budget presented in this subsection uses climate parameters described in Section 3.3.2 which account for potential impacts of climate change, including more extreme wet years and critically dry years, and overall less precipitation over the model period. All other model input parameters are the same as the baseline projected water budget in Section 5.4. Climate change is predicted to have a larger impact on the projected water budget than changes in water demand and runoff due to urban and residential development. Because all non-climate inputs are unchanged, the discussion below reports only the components that differ substantially from the baseline projected budget; components that are essentially unchanged are given in the summary tables and are not discussed again.

### 4.4.15.5.1 Projected Precipitation Budget with Climate Change

The projected precipitation budget with climate change is summarized in Table 5-16 and presented in a time series chart on Figure 5-19.

Table 5-165-165-16. Summary of Projected Precipitation Budget with Climate Change

| Water Budget Components | | Projected with Climate Change WY2026-2072 | | Current WY2015-2025 | Historical WY1985-2014 |
|---|---|---|---|---|---|
| Average Total for Projected Water Budget with Climate Change (Acre-Feet) | | Annual Average (Acre-Feet) | Percent of Total Inflow or Outflow | Annual Average (Acre-Feet) | Annual Average (Acre-Feet) |
| Inflows (76,500)* | Precipitation | 76,500 | 100% | 83,100 | 81,600 |
| Outflows (76,500)* | Evapotranspiration | 37,200 | 49% | 37,900 | 37,700 |
| | Direct Runoff | 27,300 | 36% | 31,300 | 30,400 |
| | Groundwater Recharge | 12,000 | 15% | 13,900 | 13,500 |

*Small discrepancies between total inflow and outflow may occur due to rounding

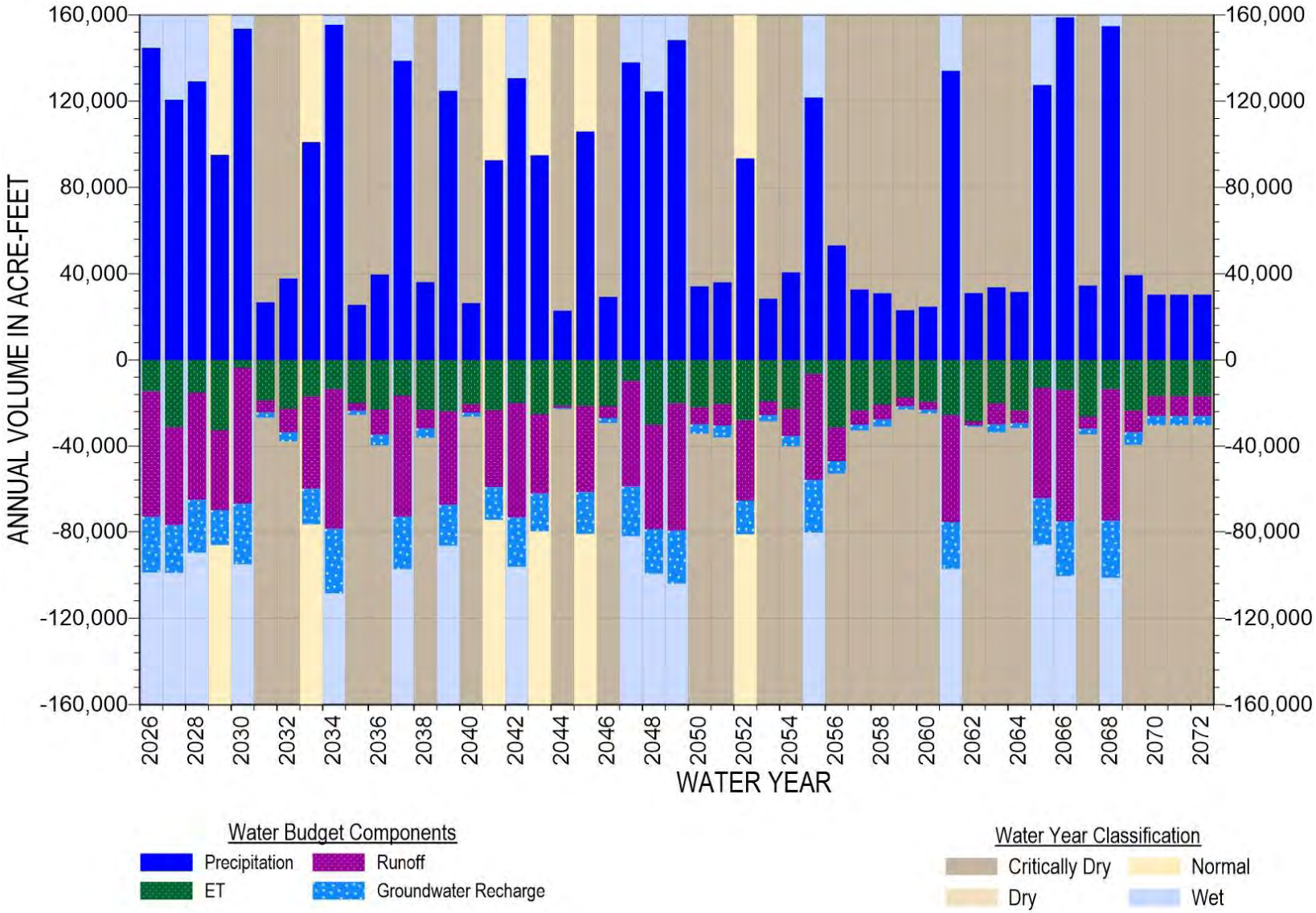



Figure 5-19~~5-195-19~~. Projected Precipitation Budget with Climate Change

Projected precipitation averages 76,500 AFY with climate change, about 4,500 AFY (6%) less than the baseline projected budget (Section 5.4.1), 8% less than the current period, and 6% less than the historical period. The more consequential difference is variability rather than volume: the 4-model ensemble classifies 53% of projected water years as critically dry, 34% as wet, and 13% as normal, with no dry years, compared with 17% critically dry and 30% wet historically.

Evapotranspiration is essentially unchanged from the baseline projected budget because higher projected temperatures sustain vegetative growth and evaporation despite lower precipitation. Constant evapotranspiration combined with less precipitation reduces groundwater recharge to 12,000 AFY, down from 13,400 AFY in the baseline projected budget and about 10% below the historical period.

### ~~4.4.2~~5.5.2 Projected Surface Water Budget with Climate Change

The projected surface water budget provides a simulated outlook for surface water inflow and outflow in the Basin in the future. The projected surface water budget with climate change is summarized in Table 5-17 and presented in a time series chart on Figure 5-20.

Table 5-17~~5-17~~ ~~5-17~~. Summary of Projected Surface Water Budget with Climate Change

| Water Budget Components | | Projected with Climate Change WY2026-2072 | | Current WY2015-2025 | Historical WY1985-2014 |
|---|---|---|---|---|---|
| Average Total for Projected Water Budget with Climate Change (Acre-Feet) | | Annual Average (Acre-Feet) | Percent of Total Inflow or Outflow | Annual Average (Acre-Feet) | Annual Average (Acre-Feet) |
| Inflows (106,200) | Surface Water Inflow | 62,400 | 59% | 73,600 | 69,600 |
| | Runoff | 24,500 | 23% | 28,700 | 27,900 |
| | Groundwater Discharge to Creeks | 19,300 | 18% | 20,500 | 21,300 |
| Outflows (106,100) | Surface Water Outflow | 97,900 | 92% | 114,000 | 110,200 |
| | Streambed Recharge | 8,200 | 8% | 8,800 | 8,700 |

During the projected period with climate change, total surface water inflow and outflow average about 106,200 AFY, roughly 12,400 AFY (10%) less than the 118,600 AFY baseline projected budget. Surface water inflow falls from 69,600 AFY to about 62,400 AFY and runoff from 27,800 to 24,500 AFY. Surface water and groundwater interaction reflected as discharge to creeks and streambed recharge to groundwater fluctuates proportionally with precipitation and surface water inflow, especially during periods of extended drought.

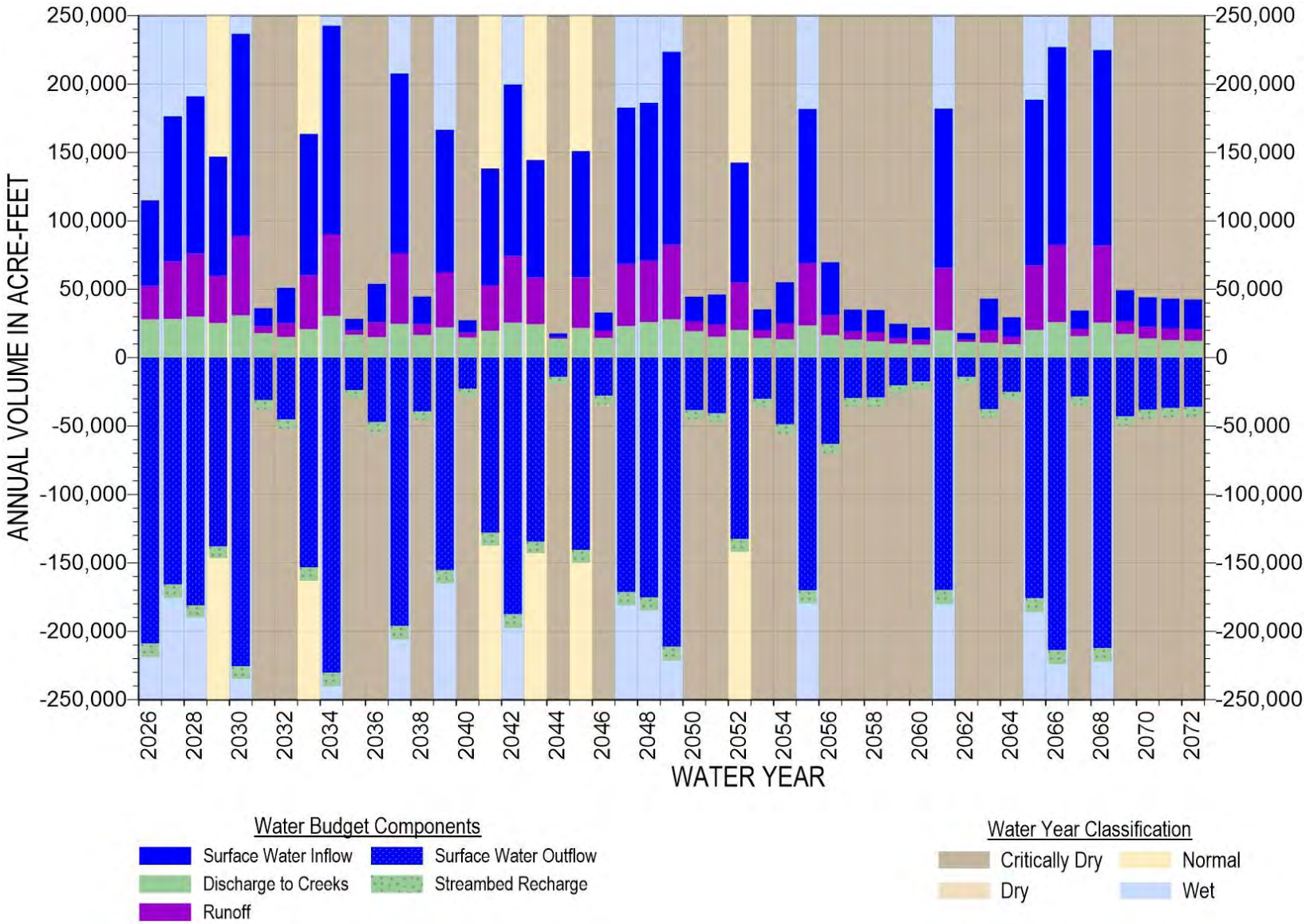



Figure 5-20~~5-20~~. Projected Surface Water Budget with Climate Change

### ~~4.4.3~~5.5.3 Projected Groundwater Budget with Climate Change

The projected groundwater budget provides a simulated outlook for groundwater inflow and outflow. The projected groundwater budget with climate change is summarized in Table 5-18 and presented in a time series chart on Figure 5-21.

Table 5-18~~5-18~~5-18. Summary of Projected Groundwater Budget with Climate Change

| Water Budget Components | | Projected with Climate Change WY2026-2072 | | Current WY2015-2025 | Historical WY1985-2014 |
|---|---|---|---|---|---|
| Average Total for Projected Water Budget with Climate Change (AF) | | Annual Average (AF) | Percent of Total Inflow or Outflow | Annual Average (AF) | Annual Average (AF) |
| Inflows (21,400)* | Precipitation Recharge | 12,000 | 56% | 13,900 | 13,600 |
| | Subsurface Inflow | 100 | <1% | 100 | 200 |
| | System Losses | 300 | 1% | 200 | 200 |
| | Septic Return Flow | 800 | 4% | 900 | 1,100 |
| | Quarry Return Flow | <100 | <1% | <100 | 200 |
| | Streambed Recharge | 8,200 | 38% | 8,800 | 8,700 |
| | Irrigation Return Flow | <100 | <1% | 100 | 100 |
| Outflows (22,000)* | Groundwater Pumping | 2,600 | 12% | 2,700 | 3,900 |
| | Subsurface Outflow | 100 | 1% | 100 | 100 |
| | Discharge to Creeks | 19,300 | 88% | 20,500 | 21,300 |
| Storage* | Average Annual Change in Storage | -400 | - | 700 | -1,300 |
| | Cumulative Change in Storage | -19,500 | - | 8,200 | -40,300 |

*Small discrepancies between total inflow and outflow may occur due to rounding

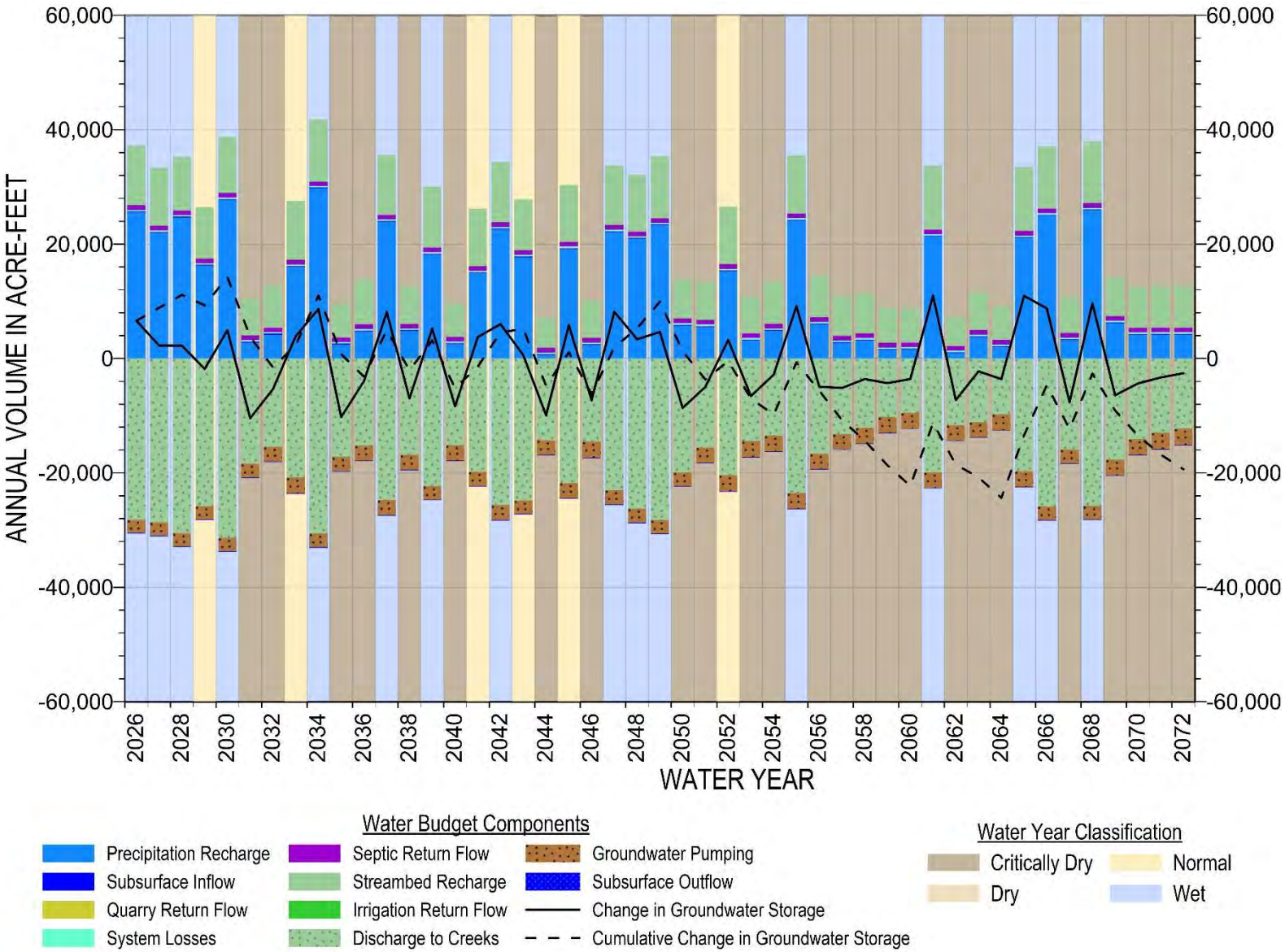



Figure 5-21~~5-215-21~~. Projected Groundwater Budget with Climate Change

Total projected groundwater inflow and outflow with climate change average about 21,400 AFY and 22,000 AFY, compared with 23,400 AFY and 23,500 AFY, respectively, in the baseline projected budget. Reduced precipitation recharge accounts for most of the difference, at 12,000 AFY against 13,400 AFY in the baseline projected budget. Direct groundwater recharge from precipitation is projected to be about 1,900 AFY and 1,600 AFY less than the current and historical periods, respectively. Streambed recharge is 8,200 AFY, about 500 AFY less than the baseline projection. Other components of projected groundwater inflow with climate change are expected to be similar to historical inflows.

Reduced projected groundwater outflow with climate change is almost entirely a result of less groundwater discharge to creeks. Groundwater pumping is a consistent model input for both projections at about 2,600 AFY and about 1,300 AFY less than average historical conditions. In the future, SLVWD and SVWD pumping is expected to increase very slightly, as described in Section 5.4, with all other pumping remaining consistent. Groundwater discharge to creeks with climate change averages about 19,300 AFY, roughly 1,500 AFY less than the baseline projected budget. The reduction reflects drier conditions, which reduce streamflow and lower groundwater levels.

The most substantial difference between the 2 projections is the loss of groundwater in storage. Less overall precipitation and greater variability result in longer droughts and lower groundwater levels. Prolonged drought stresses the water supply in the Basin and requires greater groundwater recharge and/or conjunctive use strategies to increase groundwater in storage in wetter years when water is available. The projected simulation under the climate change scenario, without new projects or management actions, results in a cumulative storage loss of about 19,500 AF between WY2026 and WY2072—which is 16,300 AF more storage loss than the baseline projected budget. The average annual decline is about 400 AFY, against about 100 AFY in the baseline projection. Cumulative storage remains balanced until WY2050, when a substantially drier climate begins, resulting in 17 critically dry years out of the 23 years to end the projected simulation (Figure 5-21).

Given these results, ~~projects and management actions~~PMAs may be needed to achieve groundwater sustainability, as discussed in Sections 7~~7~~ and 8 ~~8~~ — a conclusion the baseline projected budget does not support. Model projections depend heavily on estimates of future precipitation, however, so groundwater conditions could be better or worse than simulated if actual precipitation deviates from the 4-model ensemble.

### ~~4.4.4~~5.5.4 Projected Groundwater Budget by Aquifer with Climate Change

The projected groundwater budget with climate change is analyzed by aquifer to show how groundwater flows change if no additional projects or management actions are implemented. The groundwater budget by aquifer is summarized in Table 5-19~~ and in more detailed tables in Appendix 5A~~.

Table 5-19~~5-19~~~~5-19~~. Projected Groundwater Budget by Aquifer with Climate Change

| Groundwater Budget Components | | Projected Water Budget with Climate Change WY2026-2072 Annual Average (Acre-Feet) | | | | |
|---|---|---|---|---|---|---|
| | | Santa Margarita Aquifer | Monterey Formation | Lompico Aquifer | Butano Aquifer | Other Formations |
| Inflows | Precipitation Recharge | 5,700 | 1,300 | 800 | 3,600 | 600 |
| | Subsurface Inflow | 0 | 0 | 0 | 100 | <100 |
| | Return Flows | 500 | 200 | 200 | 100 | 100 |
| | Streambed Recharge | 1,500 | 800 | 400 | 3,300 | 2,200 |
| | Flow from Other Aquifers | <100 | 300 | 1,600 | 600 | Not calculated |
| | ***Total Inflow**** | ***7,700*** | ***2,600*** | ***3,000*** | ***7,700*** | ***3,100*** |
| Outflows | Groundwater Pumping | 700 | 100 | 1,200 | 600 | <100 |
| | Subsurface Outflow | 0 | 0 | 0 | 100 | <100 |
| | Discharge to Creeks | 6,100 | 2,100 | 1,300 | 6,800 | 3,000 |
| | Flow to Other Aquifers | 1,100 | 400 | 600 | 400 | Not calculated |
| | ***Total Outflow**** | ***7,900*** | ***2,600*** | ***3,100*** | ***7,800*** | ***3,100*** |
| Storage | Average Annual Change in Storage* | -100 | -100 | -100 | -100 | >-100 |
| | Cumulative Change in Storage* | -6,100 | -2,400 | -6,100 | -4,300 | -2,400 |

*Small discrepancies between total inflow and outflow may occur due to rounding

Groundwater in storage is projected to decrease with climate change in every principal aquifer and in the Monterey Formation, with a long-term average annual change in each aquifer of about -100 AFY, whereas the baseline projected budget shows only minor losses. Groundwater storage is in relative balance under projected climate change until WY2050, after which the concentration of critically dry years produces a net loss toward the end of the simulation. Cumulative losses over the projected period are about 6,100 AF each in the Santa Margarita and Lompico aquifers, 4,300 AF in the Butano aquifer, and 2,400 AF each in the Monterey Formation and other formations, compared with 1,500, 700, 800, 200, and 2,000 AF respectively in the baseline projected budget.

The Santa Margarita and Butano aquifers are the most sensitive to the drier climate because they are recharged directly by precipitation and streambeds, which together supply 7,200 AFY of the Santa Margarita aquifer's 7,700 AFY total inflow and 6,900 AFY of the Butano aquifer's 7,700 AFY total inflow. The Lompico aquifer response is muted because recharge must percolate through the overlying Santa Margarita aquifer, the Monterey Formation, or both, except in the

Camp Evers area of south Scotts Valley where Monterey Formation shale is absent between the permeable Santa Margarita and Lompico aquifers.

### ~~4.4.5~~5.5.5 Projected Groundwater Change in Storage by Subarea with Climate Change

In the climate change projection, all principal aquifers are affected by the drier climate simulated by the 4-model ensemble, particularly during the multiple critically dry years toward the end of the projected period. Figure 5-22 through Figure 5-25 show each aquifer's projected cumulative change of groundwater in storage within each of the 4 subareas.

The Santa Margarita aquifer is the most sensitive to climate, and the divergence between the 2 projections is pronounced there. During the longest projected drought period from WY2050 to 2064 (Figure 5-22), it loses about 8,400 AF from storage in the North of Bean Creek subareas (Quail Hollow and Olympia/Mission Springs) and about 2,800 AF from storage in the South of Bean Creek subareas (Mount Hermon/South Scotts Valley and North Scotts Valley). Storage still recovers quickly during and after wet years. The Quail Hollow and Olympia/Mission Springs subareas have the greatest losses and gains in storage because they contain SLVWD supply wells that extract the most groundwater from the Santa Margarita aquifer. These SLVWD supply wells are rested in wet years when surface water is available.

Monterey Formation projected change of groundwater in storage is shown on Figure 5-23. The Monterey Formation is not pumped by many wells in the area south of Bean Creek (North Scotts Valley and Mount Hermon/South Scotts Valley subareas) and even in the driest years, little change in storage is predicted. Figure 5-23 shows that there is more change in stored groundwater in the subarea north of Bean Creek where only *de minimis* users pump from the Monterey Formation. The very low rainfall predicted from WY2050 onward results in an overall loss of about 1,500 AF north of Bean Creek, where the baseline projected budget predicts little net change, by the end of the projected period.

Up until WY2050, groundwater in storage in the Lompico aquifer is generally consistent with about 2,300 AF of cumulative storage gain (Figure 5-24). This indicates that pumping from the Lompico aquifer is roughly in balance with its recharge. The extended drought projected after this period causes a cumulative loss of groundwater in storage of about 8,700 AF, mainly in the Mount Hermon/South Scotts Valley subarea where the majority of Lompico aquifer pumping occurs by MHA, SLVWD, and SVWD. Because of the aquifer's limited recharge area and confined nature, recovery from an extended drought may require projects or management actions. Section 8 describes potential projects that target the Lompico aquifer to both provide for some recovery from past storage losses and to provide resiliency against prolonged future droughts.

The Butano aquifer behaves similarly to the Lompico aquifer in the subareas south of Bean Creek and like the Santa Margarita aquifer north of Bean Creek. Most of the Butano groundwater pumping is from 3 deep SVWD extraction wells in North Scotts Valley subarea. North of Bean Creek, the Butano is shallower, outcropping and being recharged in the model simulations by interconnected streams and pumped by private well owners. The projected changes in storage depicted on Figure 5-25 reflect effects of recharge in wet years where it outcrops near interconnected streams. The 2 Butano aquifer monitoring wells in northern Scotts Valley do not appear to respond to wet years in the same way the model predicts (Figure 4-14~~Figure 4-14~~). It is acknowledged in Section 0~~3.4.11~~ that because of so few monitoring wells in the Butano aquifer, our current understanding of it is limited and assumptions made in the model may not be correct. Existing plans to install a new Butano monitoring well may increase hydrogeologic understanding, in turn informing the groundwater model.

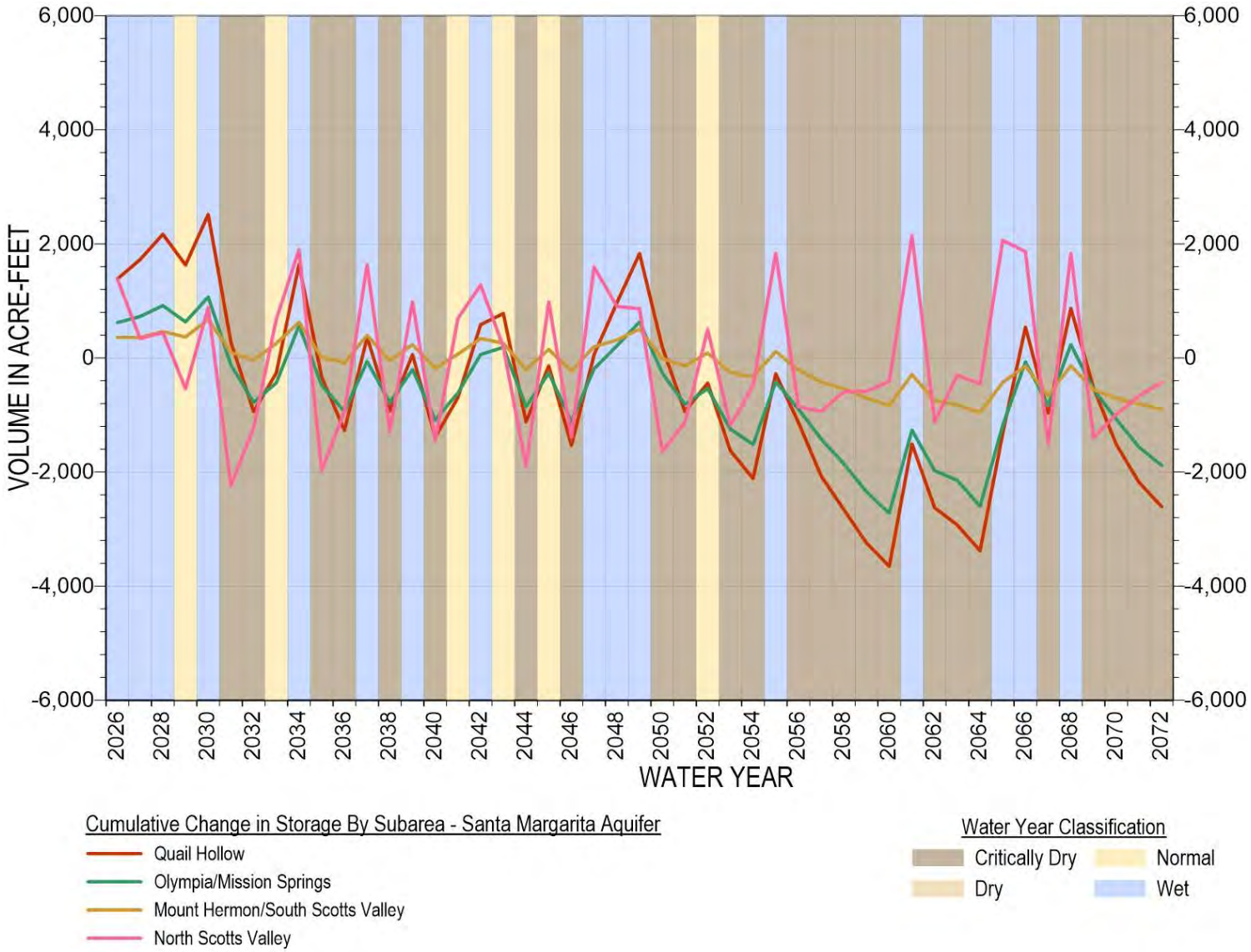



Figure 5-225-225-22. Projected Cumulative Change of Groundwater in Storage in the Santa Margarita Aquifer with Climate Change

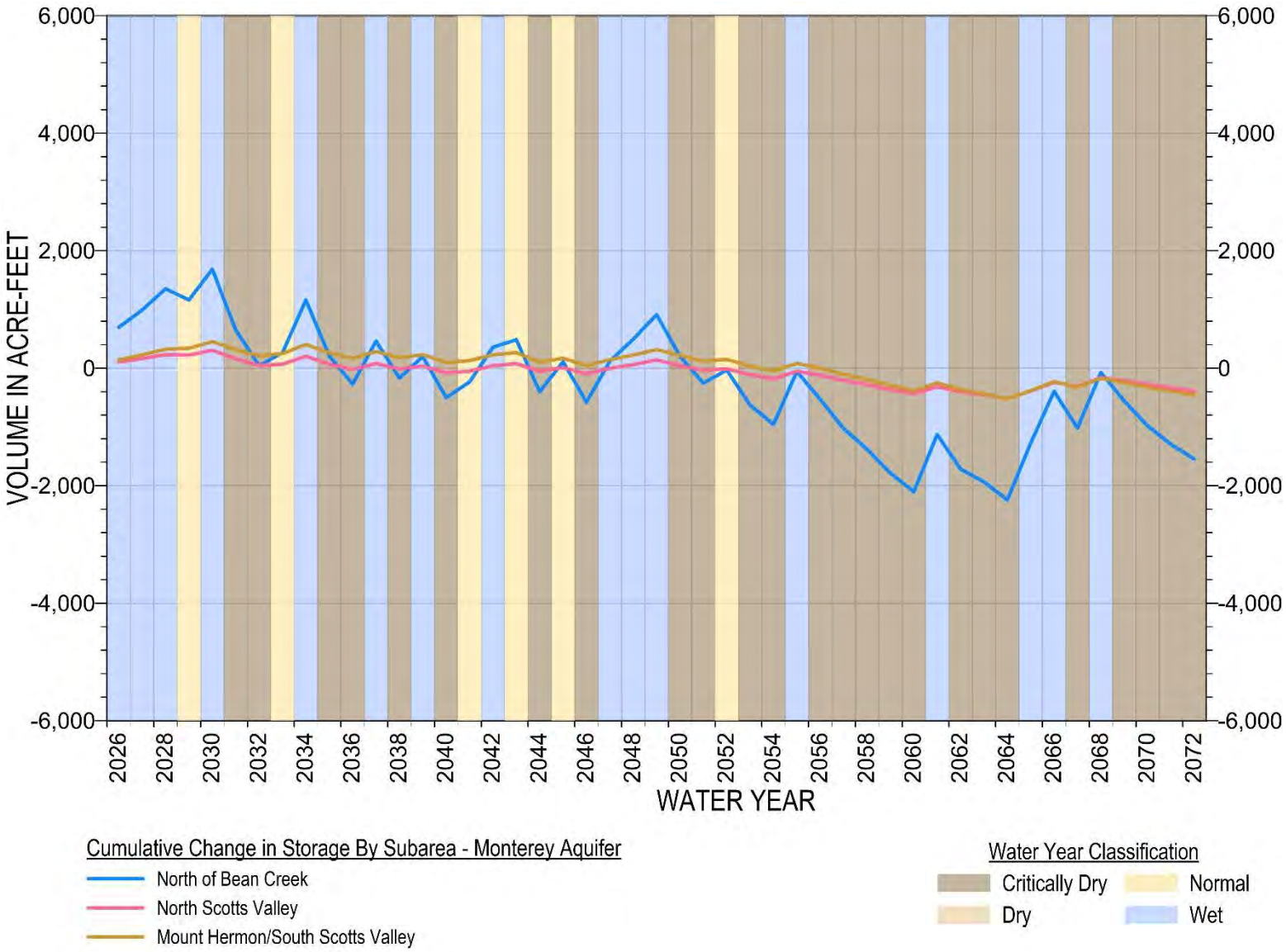



Figure 5-23~~5-235-23~~. Projected Cumulative Change of Groundwater in Storage in the Monterey Formation with Climate Change

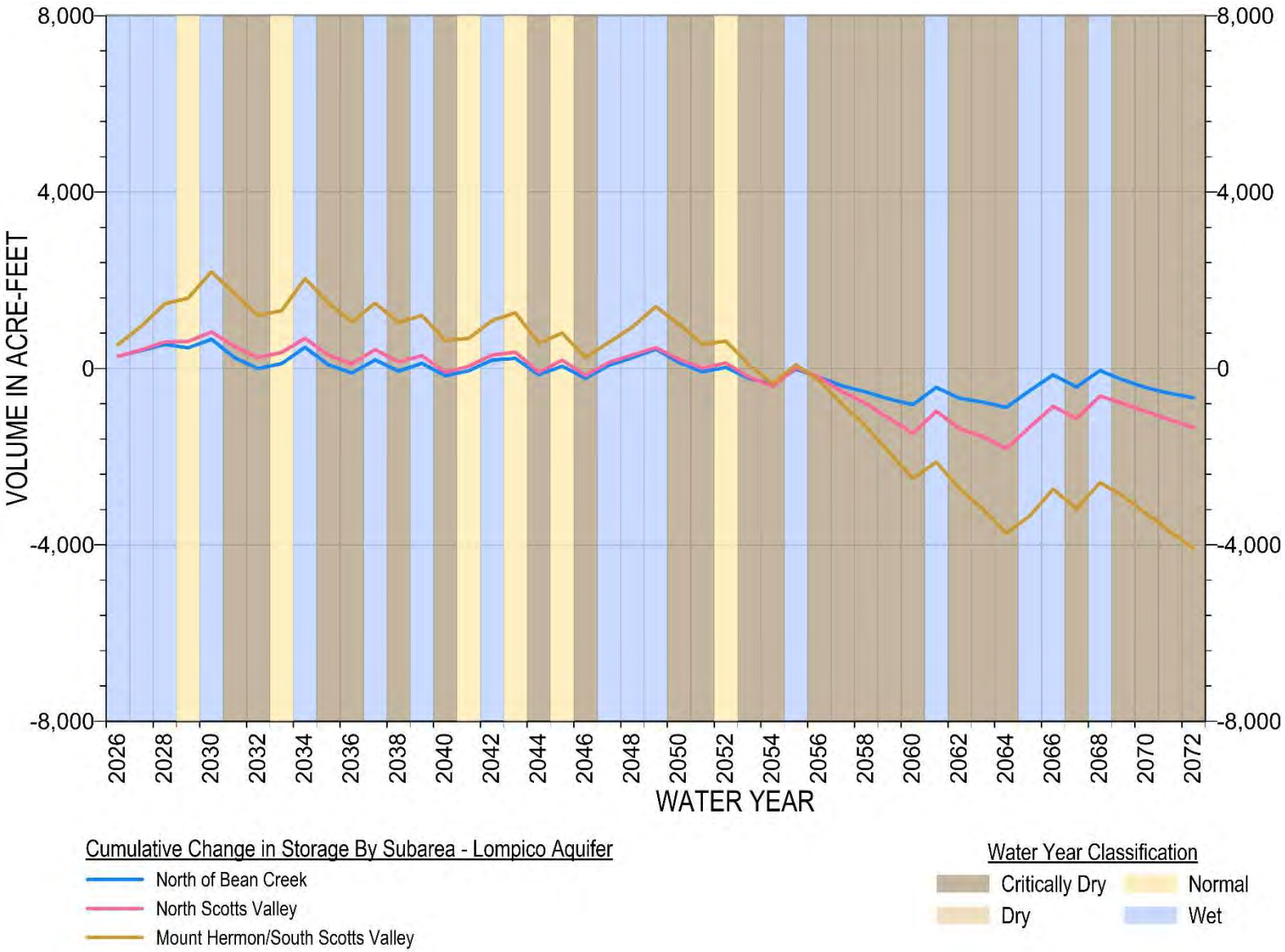



Figure 5-24~~5-245-24~~. Projected Cumulative Change of Groundwater in Storage in the Lompico Aquifer with Climate Change

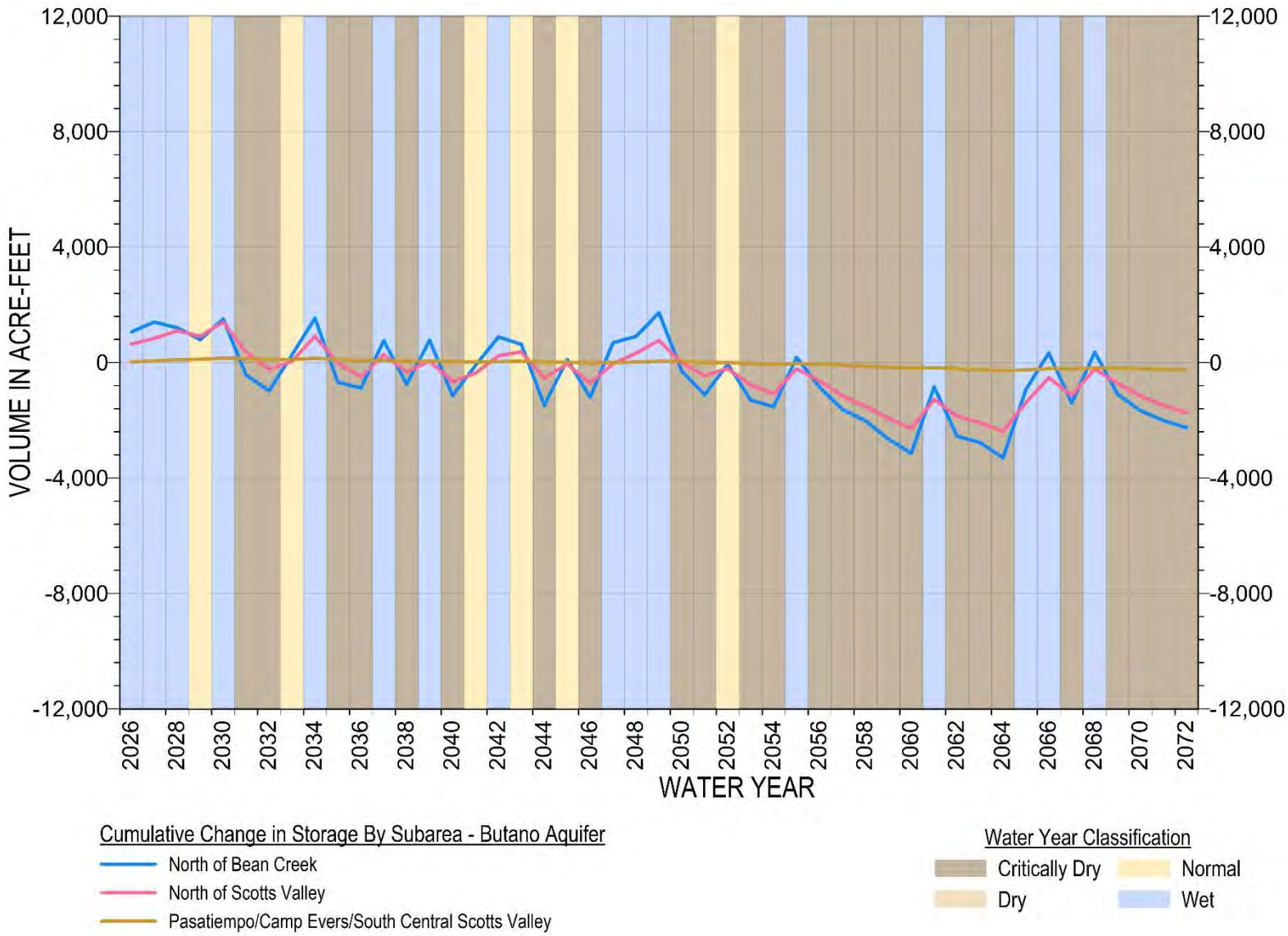



Figure 5-25~~5-25~~~~5-25~~. Projected Cumulative Change of Groundwater in Storage in the Butano Aquifer with Climate Change

## ~~4.5~~5.6 Sustainable Yield

The Basin's sustainable yield is an estimated volume of groundwater that can be ~~pumped~~ extracted on a long-term average annual basis without causing undesirable results. The role of sustainable yield estimates in SGMA as described in the SMC BMP (DWR, 2016a) are as follows:

> *"In general, the sustainable yield of a basin is the amount of groundwater that can be withdrawn annually without causing undesirable results. Sustainable yield is referenced in SGMA as part of the estimated basinwide water budget and as the outcome of avoiding undesirable results.*
>
> *Sustainable yield estimates are part of SGMA's required basinwide water budget. Section 354.18(b)(7) of the GSP Regulations requires that an estimate of the basin's sustainable yield be provided in the GSP (or in the coordination agreement for basins with multiple GSPs). A single value of sustainable yield must be calculated basinwide. This sustainable yield estimate can be helpful for estimating the projects and programs needed to achieve sustainability."*

Basin-wide groundwater ~~pumping~~ extraction within the sustainable yield does not constitute proof of sustainability. Sustainability under SGMA is only demonstrated by avoiding undesirable results for the sustainability indicators applicable to the Basin. Specific undesirable results for the chronic lowering of groundwater levels, reduction in groundwater storage, and depletion of interconnected surface water sustainability indicators are presented in Section 7~~3~~. ~~While GSP Regulations only require 1 sustainable yield volume for the entire basin, pumping within the sustainable yield may affect groundwater elevations in different aquifers and aquifer subareas differently depending on how pumping is distributed spatially. Therefore, sustainable yield volumes are estimated for each aquifer based on predictive model simulations that do not produce undesirable results.~~

~~The~~ Groundwater conditions in the Basin have been generally sustainable since SGMA was enacted in 2015, as reflected by stable to increasing groundwater level trends (Section 4.2) and balanced aquifer storage (Section 4.3), which create conditions that ~~prevent~~help limit groundwater quality degradation (Section 4.4) and maintain interconnected groundwater and surface water (Section 4.6). The Basin Model simulation results are generally aligned with observed conditions and also reflect a balanced current groundwater budget since SGMA was enacted in 2015 (Figure 5-7; Figure 5-14), except for an extreme drought in the climate change scenario simulated after WY2050 (Figure 5-21). Similarly, stable to increasing groundwater levels are observed and simulated at RMPs after 2015 in the projected baseline simulation (Appendix 5A) and until WY2050 in the projected simulation with climate change (Appendix

5B). SMGWA is prepared to adaptively manage the Basin with planned PMAs described in Section 8 to achieve or maintain sustainability during extreme future droughts should they occur.

Current and projected extraction volumes that prevent undesirable results are the estimated sustainable yield for the Basin. Current and projected future baseline model simulation scenarios incorporating climate change and projected water use predictshow that the average groundwater extraction volumes over the past 10 years are similar to projected average volumes between 2026 and 2072. s undesirable results will not occur within the modeled 50-year interval. The sustainable yield for the unconfined Santa Margarita aquifer is 700 AFY and confined aquifer is 1,900 AFY, totaling 2,600 AFY for the Basin, as summarized in Table 5-20. This means that groundwater pumping volumes used in the baseline simulation can be used to estimate sustainable yield. Given that groundwater pumping in the model is not specifically optimized to avoid undesirable results, it is possible that slightly more pumping than the estimated sustainable yield could avoid future undesirable results. Groundwater pumping in the projected baseline simulation, shown on Figure 5-26Figure 5-19, is generally consistent after WY2022 in the Monterey Formation, and Lompico and Butano aquifers. The estimates of sustainable yield for each aquifer are used as minimum thresholds for the reduction of groundwater storage sustainability indicator, described further in Section 3. The sustainable yield for those aquifers is therefore set as the average pumping after 2022 plus a 5% buffer to allow for pumping optimization during GSP implementation.

The amount of municipal groundwater pumped in the Santa Margarita aquifer is related to water year type and increases considerably during dry periods. When surface water supply is limited (Figure 2-89), SLVWD augments it with groundwater pumped from the Santa Margarita aquifer at the Quail Hollow and Olympia wellfields. For example, a substantial modeled increase in pumping during an extended simulated drought after WY2050 results in considerable loss of groundwater in storage in the Santa Margarita aquifer, and minimum thresholds to be exceeded (Figure 5-27Figure 5-20). These exceedances are not considered undesirable results because they occur during an extended drought. In contrast, from WY2030-2049 the simulation shows in a non-drought period that the Santa Margarita aquifer does not have undesirable results. During this relatively wetter period, the Santa Margarita aquifer experiences almost no cumulative groundwater in storage losses, indicating sustainable groundwater conditions. Therefore, the sustainable yield for the Santa Margarita aquifer is set as the average pumping from 2030-2049 plus a 5% buffer to allow for pumping optimization during GSP implementation.

Historical pumping and estimate of sustainable yield for each aquifer is presented in Table 5-20Table 5-16. The estimates of sustainable yield for each aquifer are used as minimum thresholds for the reduction of groundwater storage sustainability indicator, described further in Section 3.

~~Five-year averages of historical pumping are compared with sustainable yield values on Figure 5-28Figure 5-21. While pumping in all aquifers has declined over the historical period, current period pumping remains above sustainable yield in the Monterey and Lompico aquifers.~~

Table 5-20~~5-20~~5~~-16~~. Sustainable Yield by Aquifer Compared to Historical~~ and~~, Current ~~Pumping~~Extraction

| Aquifer | Historical Pumping 1985 – ~~2018~~2014 (~~Acre-Feet per Year~~AFY) | Current Pumping ~~2010~~ 2015 – ~~2018~~ 2025 (~~Acre-Feet per Year~~AFY) | Sustainable Yield Projected Pumping 2026-2072 ~~Sustainable Yield~~ (~~Acre-Feet per Year~~AFY) |
|---|---|---|---|
| **Santa Margarita (Unconfined Aquifer Total)** | **~~1,070~~1,100** | **~~770~~700** | **~~850~~700** |
| *Monterey* | *~~320~~400* | *200~~180~~* | *100~~140~~* |
| *Lompico* | *~~1,770~~1,800* | *1,200~~1,520~~* | *1,200~~1,290~~* |
| *Butano* | *~~530~~600* | *500~~480~~* | *600~~540~~* |
| **Confined Aquifer Total** | **2,800** | **1,900** | **1,900** |
| **Total Extraction** | **3,900** | **2,600** | **2,600** |

The projected confined aquifer extraction is similar every year, but the unconfined Santa Margarita aquifer extraction fluctuates with climate due to SLVWD's conjunctive use practices. Therefore, a 5-year running average extraction volume is appropriate to smooth out annual differences in volumes to understand the longer--term ~~affects~~effects that groundwater extraction has on groundwater conditions. Annual and 5-year running average groundwater extraction in the historical, current, and projected baseline model timeframes are shown on Figure 5-26 for the Santa Margarita / unconfined aquifer and Figure 5-27 for the confined aquifer. The 5-year running average extraction only exceeds the sustainable yield for the unconfined aquifer in a few drought years, which is offset by increased recharge and reduced extraction in wetter periods. The sustainable yield estimates are incorporated into the reduction of groundwater storage sustainability indicator evaluation, described further in Section 7.4.2.

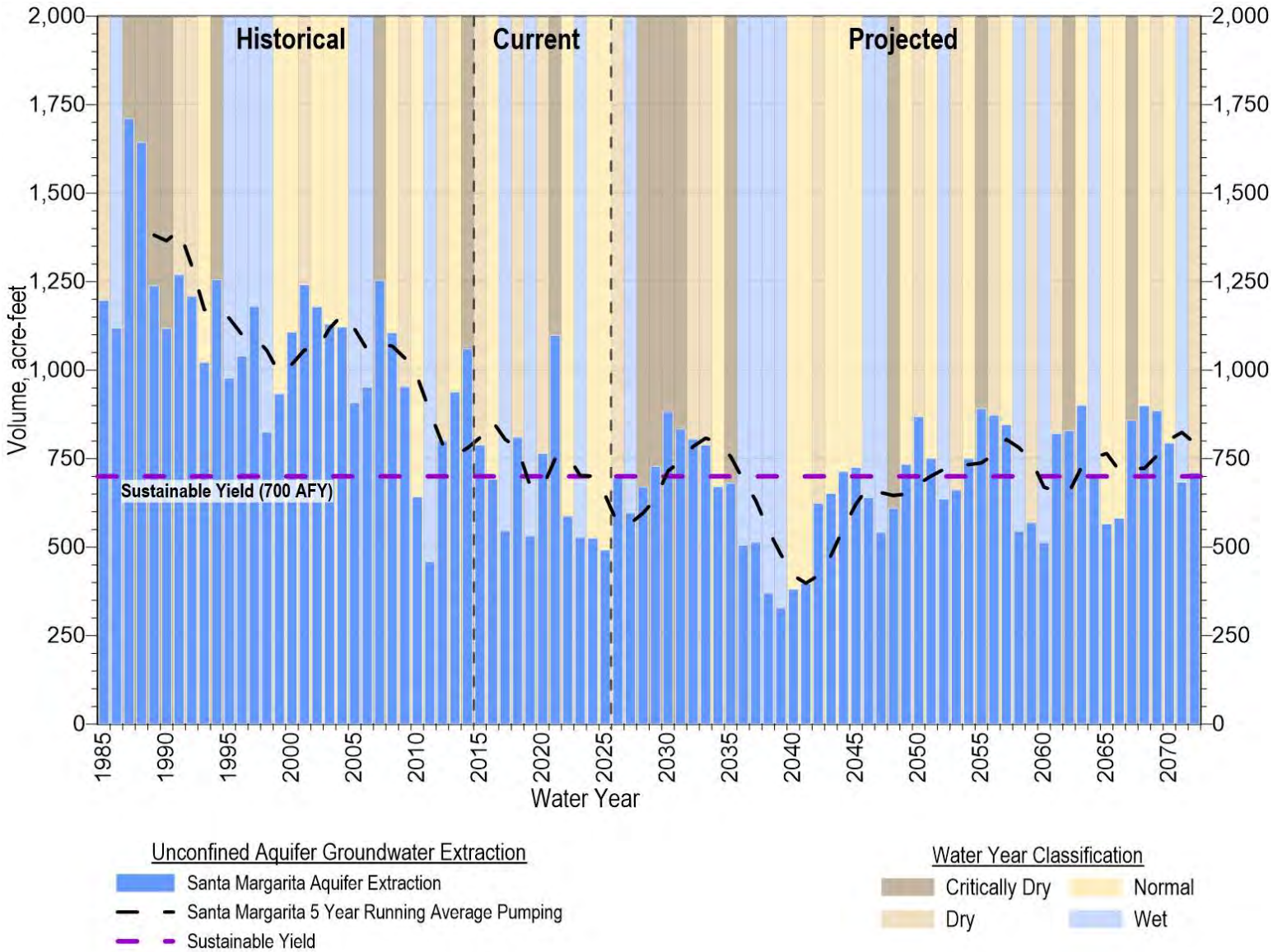



Figure 5-26~~5-265-195-19~~. Historical and Projected ~~Projected Baseline Simulation~~ Groundwater ~~Pumping~~ Extraction ~~by Aquifer~~in the Unconfined Aquifer

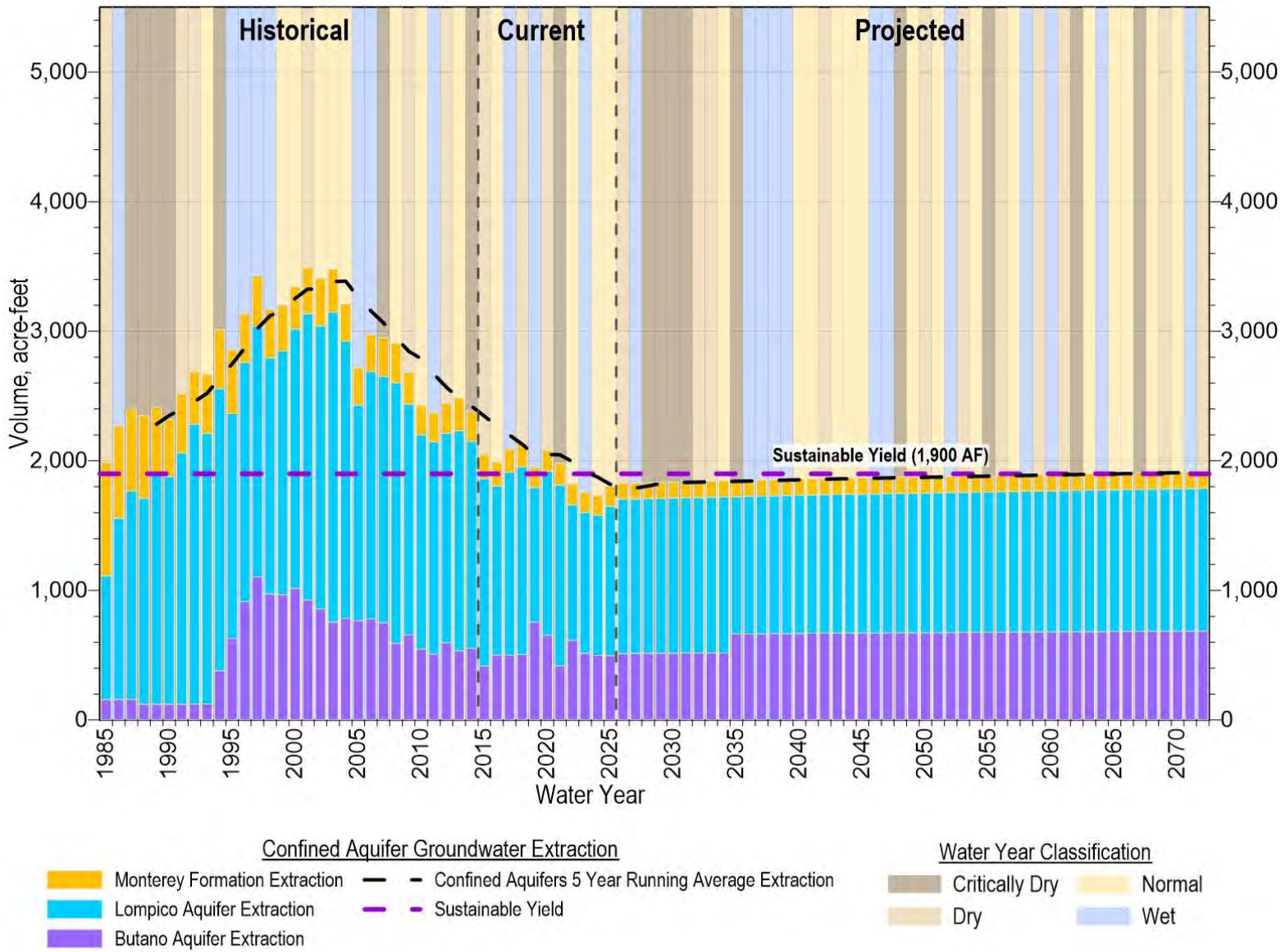



Figure 5-27~~5-275-205-20~~. Historical, Current, and Projected Groundwater Extraction in the Confined Aquifer ~~Projected Baseline Simulation Cumulative Change in~~

~~Groundwater in Storage by Aquifer~~

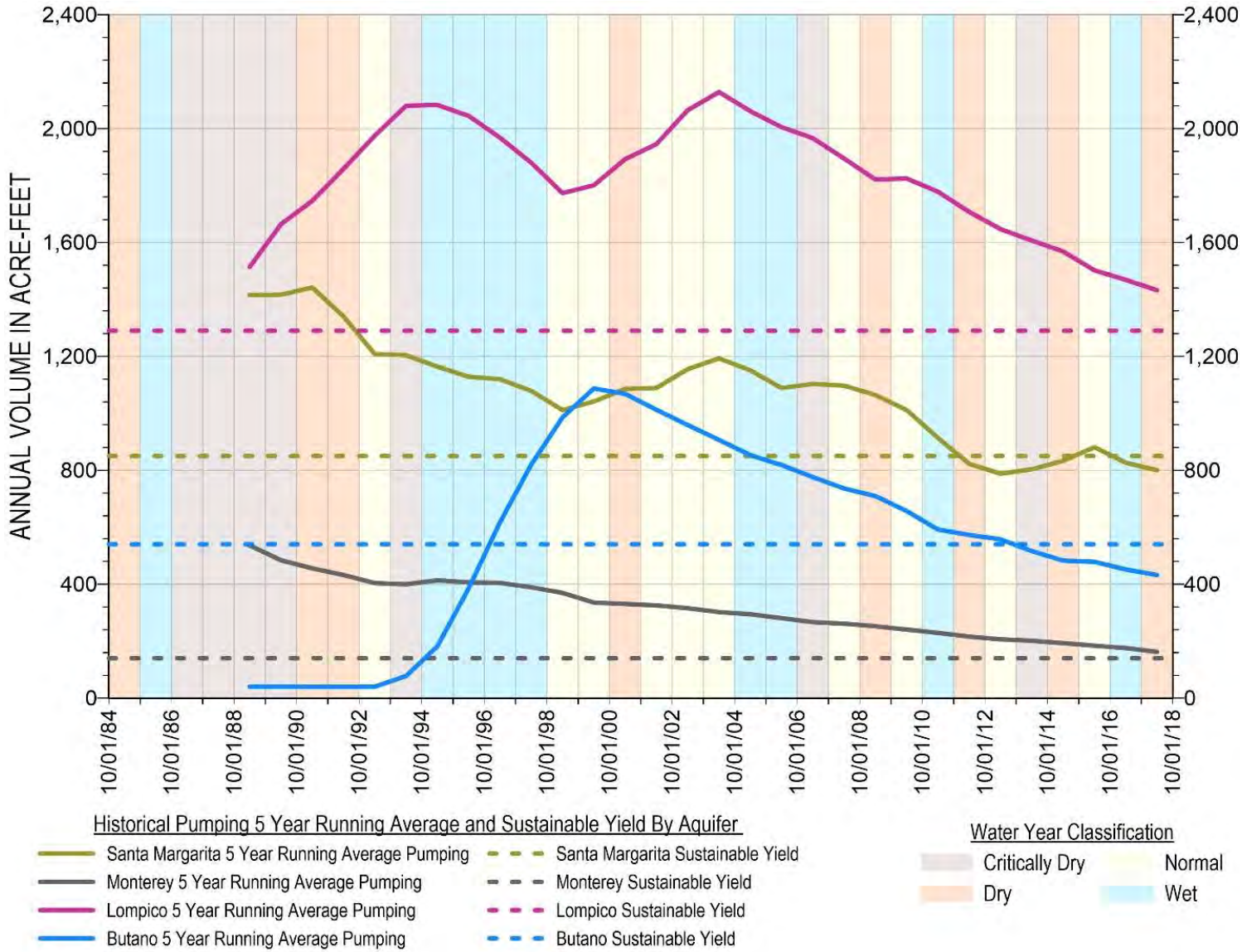



Figure 5-21. Historical Pumping 5-Year Running Average and Sustainable Yield by Aquifer

# ~~5~~6 MONITORING NETWORKS

This section describes the monitoring networks and protocols that the SMGWA will use to assess groundwater conditions and the Basin's sustainability during GSP implementation. The monitoring networks included in this subsection are based, to the extent possible, on existing monitoring networks described in Section 2.1.3~~Section 2.1.2: Water Resources Monitoring and Management Programs~~. The subsections below describe how the existing networks are adapted to meet the SGMA requirements for each applicable sustainability indicator. A subset of monitoring wells from the existing monitoring network are selected as ~~Representative Monitoring Points (~~RMPs~~)~~ ~~at which to establish SMC~~ for measuring progress towards sustainability metrics. Finally, this section identifies monitoring network data gaps and proposed improvements for networks that are insufficient for assessing current and future conditions.

## ~~5.1~~6.1 Purpose of Monitoring Networks

The SGMA regulations require that monitoring networks be developed to promote the collection of data of sufficient quality, frequency, and spatial distribution to characterize groundwater and related surface water conditions, and to evaluate changing conditions that occur during GSP implementation. Monitoring networks should accomplish the following:

- Demonstrate progress toward achieving ~~interim milestones and measurable objectives~~SMC described in the GSP
- Monitor impacts to beneficial uses and users of groundwater
  - ~~Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds~~
  - Quantify annual changes in water budget components

The Basin's existing monitoring networks have been used for ~~many~~ decades to collect information to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface water conditions. The existing networks ~~can be~~ are used to collect data relevant to the Basin's applicable groundwater sustainability indicators including chronic lowering of groundwater levels, depletion of interconnected surface water, reduction of groundwater in storage, and degraded groundwater quality (Table 6-1).

Representative monitoring points are a subset of the Basin's overall monitoring network where numeric values for SMC~~s~~, including minimum thresholds (~~minimum thresholds~~MTs), measurable objectives (~~measurable objectives~~MOs), and interim milestones (~~interim milestones~~IMs), are set. Per ~~the~~ GSP regulations, designation of RMPs is supported by adequate evidence demonstrating that the site reflects general aquifer conditions in the area. The depletion

of interconnected surface water sustainability indicator is monitored using groundwater levels and extraction volume as a proxy, because ~~significant~~they are correlated~~ion exists between these conditions and~~ to surface water depletion because of widespread interconnection between the ~~Basin's~~ principal aquifers and ~~interconnected~~ streams throughout the Basin.

Table 6-1~~6 16-1~~. Applicable Sustainability Indicators in the Santa Margarita Basin

| Sustainability Indicator | Metric | Proxy |
|---|---|---|
| Chronic Lowering of Groundwater Levels | Groundwater elevation | --- |
| Reduction of Groundwater in Storage | ~~Volume of gr~~Groundwater extraction volume~~ed~~ | --- |
| Degraded Groundwater Quality | Concentration | --- |
| Depletion of Interconnected Surface Water | Volume or rate of streamflow | Groundwater elevation and extraction volume |

## ~~5.2~~6.2 Groundwater Level Monitoring Network

Groundwater levels are ~~collected~~measured to evaluate the chronic lowering of groundwater levels SMC and as a proxy for monitoring depletion of interconnected surface water. ~~Each SMGWA member agency has its own network of dedicated monitoring wells and extraction wells that monitor groundwater elevations in their respective jurisdictions. These wells have been used for decades to evaluate short-term, seasonal, and long-term groundwater trends for groundwater management purposes, and will be incorporated into the GSP groundwater level monitoring network.~~

The groundwater level monitoring network ~~is made up of~~comprises municipal production wells, dedicated monitoring wells, and select private and small water system wells in each of the Basin's principal aquifers and the Monterey Formation. Table 6-2~~There are currently 35 wells used to monitor groundwater levels at least twice a year. Clusters of monitoring wells completed in different aquifers at the same location are used to understand changes in vertical gradients between aquifers.~~ **Error! Reference source not found.** summarizes the wells in the existing monitoring network by aquifer. Figure 6-1 shows the basin-wide distribution of groundwater level monitoring wells.

The monitoring network is grouped into 2 different hydrogeologic units for SMC evaluation – the ~~Shallow /~~ Unconfined Monitoring Network and ~~Deeper /~~ Confined Monitoring Network. The 2 consolidated network designations are used to evaluate groundwater level URs as described in Section 0. The Unconfined and Confined aquifer terminology is a generalization. The shallow Santa Margarita aquifer is unconfined throughout the Basin and the deeper ~~Monterey Formation and Lompico and Butano~~ aquifers group (Monterey, Lompico and Butano formations) are generally confined, particularly in the areas where they ~~are monitored and~~ used for water supply.

However, each of the "Confined" geologic units outcrop in a relatively thin band within the Basin at the margins where they represent the outer limbs of the syncline, so shallow zones in those locations could exhibit unconfined behavior~~and where the Santa Margarita aquifer is not present~~. ~~, and t~~There is also direct contact between the Lompico and Santa Margarita aquifers in the South Scotts Valley area where the Monterey Formation is not present, so the Lompico aquifer can exhibit semi-confined behavior. ~~Therefore, all the "Confined" hydrogeologic units can be unconfined or semi-confined in limited areas within the Basin.~~Regardless, groundwater tends to recharge and discharge more quickly in the Unconfined aquifer than it does in the Confined aquifer, so tracking these as 2 distinct aquifer systems is warranted.

A subset of the groundwater level monitoring network was designated as RMPs to assess conditions relative to SMC. Most of the ~~existing~~ groundwater level monitoring wells in the Basin are RMPs. Groundwater level monitoring locations that are not RMPs include wells also used as active extraction wells, monitoring wells highly influenced by extraction (i.e. SVWD #15 Monitoring Well), and a few monitoring locations that provide redundant data compared to other nearby locations (i.e., Quail MW-C, MHA-MW1, and AB303-MW-3B). RMPs are summarized in Table 6-2**Error! Reference source not found.** and shown on Figure 6-2. Summarized in **Error! Reference source not found.** and shown on Figure 6-2 ~~Data Logger~~

| ~~Aquifer Unit~~ | ~~Well Name~~ | ~~Well Type~~ | ~~Monitoring Agency~~ | ~~Sounding Frequency~~ | ~~Data Logger~~Datalogger |
|---|---|---|---|---|---|
| | ~~Mount Hermon #2~~ | ~~Extraction~~ | ~~MHA~~ | ~~Semi-annually~~ | ~~N~~ |
| | ~~Mount Hermon #3~~ | ~~Extraction~~ | ~~MHA~~ | ~~Semi-annually~~ | ~~N~~ |
| | ~~MHA-MW1~~ | ~~Monitoring~~ | ~~MHA~~ | ~~Semi-annually~~ | ~~N~~ |
| | ~~**SLVWD Pasatiempo MW-1**~~ | ~~**Monitoring**~~ | ~~**SLVWD**~~ | ~~**Monthly**~~ | ~~**N**~~ |
| | ~~SLVWD Pasatiempo #5A~~ | ~~Extraction~~ | ~~SLVWD~~ | ~~Monthly~~ | ~~N~~ |
| | ~~SLVWD Pasatiempo #7~~ | ~~Extraction~~ | ~~SLVWD~~ | ~~Monthly~~ | ~~N~~ |
| | ~~SLVWD Pasatiempo #8~~ | ~~Extraction~~ | ~~SLVWD~~ | ~~Monthly~~ | ~~N~~ |
| ~~Lompico Aquifer~~ | ~~**SVWD #10**~~ | ~~**Monitoring**~~ | ~~**SVWD**~~ | ~~**Monthly**~~ | ~~**N**~~ |
| | ~~SVWD #10A~~ | ~~Extraction~~ | ~~SVWD~~ | ~~Monthly~~ | ~~Y~~ |
| | ~~**SVWD #11A**~~ | ~~**Extraction**~~ | ~~**SVWD**~~ | ~~**Monthly**~~ | ~~**Y**~~ |
| | ~~SVWD #11B~~ | ~~Extraction~~ | ~~SVWD~~ | ~~Monthly~~ | ~~Y~~ |
| | ~~SVWD AB303 MW-3A~~ | ~~Monitoring~~ | ~~SVWD~~ | ~~Semi-annually~~ | ~~Y~~ |
| | ~~**SVWD TW-19**~~ | ~~**Monitoring**~~ | ~~**SVWD**~~ | ~~**Semi-annually**~~ | ~~**Y**~~ |
| | ~~SVWD SV3-MW-C~~ | ~~Monitoring~~ | ~~SVWD~~ | ~~Semi-annually~~ | ~~Y~~ |
| | ~~*Graham Hill Rd/Conference Drive*~~ | ~~*Monitoring*~~ | ~~*SLVWD*~~ | ~~*Semi-annually*~~ | ~~Y~~ |
| ~~Lompico/~~ | ~~SVWD #3B~~ | ~~Extraction~~ | ~~SVWD~~ | ~~Monthly~~ | ~~Y~~ |

| ~~Aquifer Unit~~ | ~~Well Name~~ | ~~Well Type~~ | ~~Monitoring Agency~~ | ~~Sounding Frequency~~ | ~~Data Logger~~Datalogger |
|---|---|---|---|---|---|
| ~~Butano Aquifer~~ | ~~SVWD Orchard Well~~ | ~~Extraction~~ | ~~SVWD~~ | ~~Monthly~~ | ~~Y~~ |
| | ~~**SVWD #15 Monitoring Well**~~ | ~~Monitoring~~ | ~~SVWD~~ | ~~Monthly~~ | ~~Y~~ |
| ~~Butano Aquifer~~ | ~~**SVWD Canham Well**~~ | ~~**Monitoring**~~ | ~~**SVWD**~~ | ~~**Semi-annually**~~ | ~~**Y**~~ |
| | ~~**SVWD Stonewood Well**~~ | ~~**Monitoring**~~ | ~~**SVWD**~~ | ~~**Semi-annually**~~ | ~~**Y**~~ |
| | ~~*Polo Ranch Road*~~ | ~~*Monitoring*~~ | ~~*SVWD*~~ | ~~*Daily*~~ | ~~*Y*~~ |

~~Notes: Wells in bold are Representative Monitoring Points; wells in italics are to be installed in 2022~~

~~The monitoring network contains wells within each principal aquifer in areas where municipal extraction takes place. Areas where groundwater is used but there is no groundwater level monitoring typically occur where there are a significant number of domestic supply wells or there are GDEs. Potential additions to the monitoring network that would be required to meet the goals of the GSP are discussed in Section 3.3.5.~~

Table 6-26 2. Summary of Groundwater Level Monitoring Network Wells

| Aquifer Type | Aquifer Unit | Well Name | Well Type | RMP |
|---|---|---|---|---|
| Unconfined | Santa Margarita | SLVWD Olympia #1 | Monitoring | X |
| | | SLVWD Olympia #2 | Extraction | |
| | | SLVWD Olympia #3 | Extraction | |
| | | SLVWD Pasatiempo MW-2 | Monitoring | X |
| | | SLVWD Quail #4A | Extraction | |
| | | SLVWD Quail #5A | Extraction | |
| | | SLVWD Quail MW-A | Monitoring | X |
| | | SLVWD Quail MW-B | Monitoring | X |
| | | SLVWD Quail MW-C | Monitoring | |
| | | SMGWA-2 Bean Creek | Monitoring | X |
| | | SMGWA-3 Ruins Creek | Monitoring | X |
| | | SMGWA-4 Nelson Road | Monitoring | X |
| | | SMGWA-5 Bahr Drive | Monitoring | X |
| | | SMGWA-6 Quail Hollow | Monitoring | X |
| | | SVWD AB303 MW-1 | Monitoring | X |
| | | SVWD AB303 MW-3B | Monitoring | |
| | | SVWD SV4-MW | Monitoring | X |
| | | SVWD TW-18 | Monitoring | X |
| Confined | Monterey | SMGWA-8 Sandhills Preserve | Monitoring | X |
| | | SVWD #9 | ~~Extraction~~Monitoring | X |
| | | Weston Rd | Extraction | |
| | Lompico | MHA #1 | Extraction | |
| | | MHA #2 | Extraction | |
| | | MHA #3 | Extraction | |
| | | MHA-MW1 | Monitoring | |
| | | SLVWD Pasatiempo #3 | Monitoring | X |
| | | SLVWD Pasatiempo #5A | Extraction | |
| | | SLVWD Pasatiempo #7 | Extraction | |
| | | SLVWD Pasatiempo #8 | Extraction | |
| | | SLVWD Pasatiempo MW-1 | Monitoring | X |
| | | SVWD #10 | Monitoring | X |
| | | SVWD #10A | Extraction | |
| | | SVWD #11A | Extraction | X |
| | | SVWD #11B | Extraction | |
| | | SVWD AB303 MW-2 | Monitoring | X |
| | | SVWD AB303 MW-3A | Monitoring | X |
| | | SVWD TW-19 | Monitoring | X |
| | Lompico, Butano | SVWD #15 Monitoring Well | Monitoring | |
| | | SVWD Grace Way | Extraction | |
| | | SVWD Orchard | Extraction | |
| | | SVWD Sucinto | Extraction | |
| | Butano | SVWD Canham | Monitoring | X |

| | | | | |
|---|---|---|---|---|
| | | SVWD Stonewood | Monitoring | X |

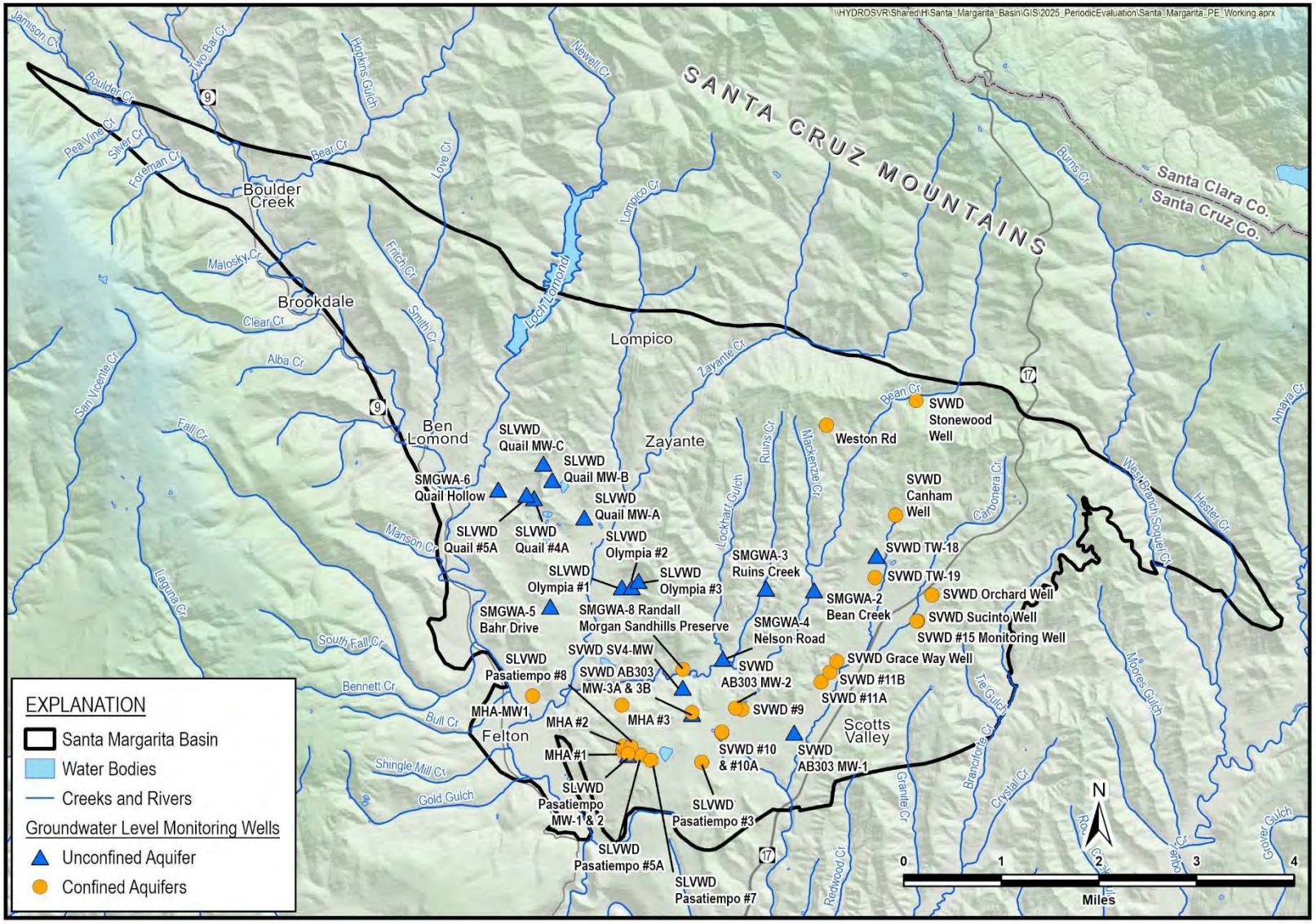



Figure 6-~~16~~ ~~16-6-1~~. ~~Location of Wells Used for~~ Groundwater Level Monitoring Network~~with Proposed New Wells Labeled in Teal~~

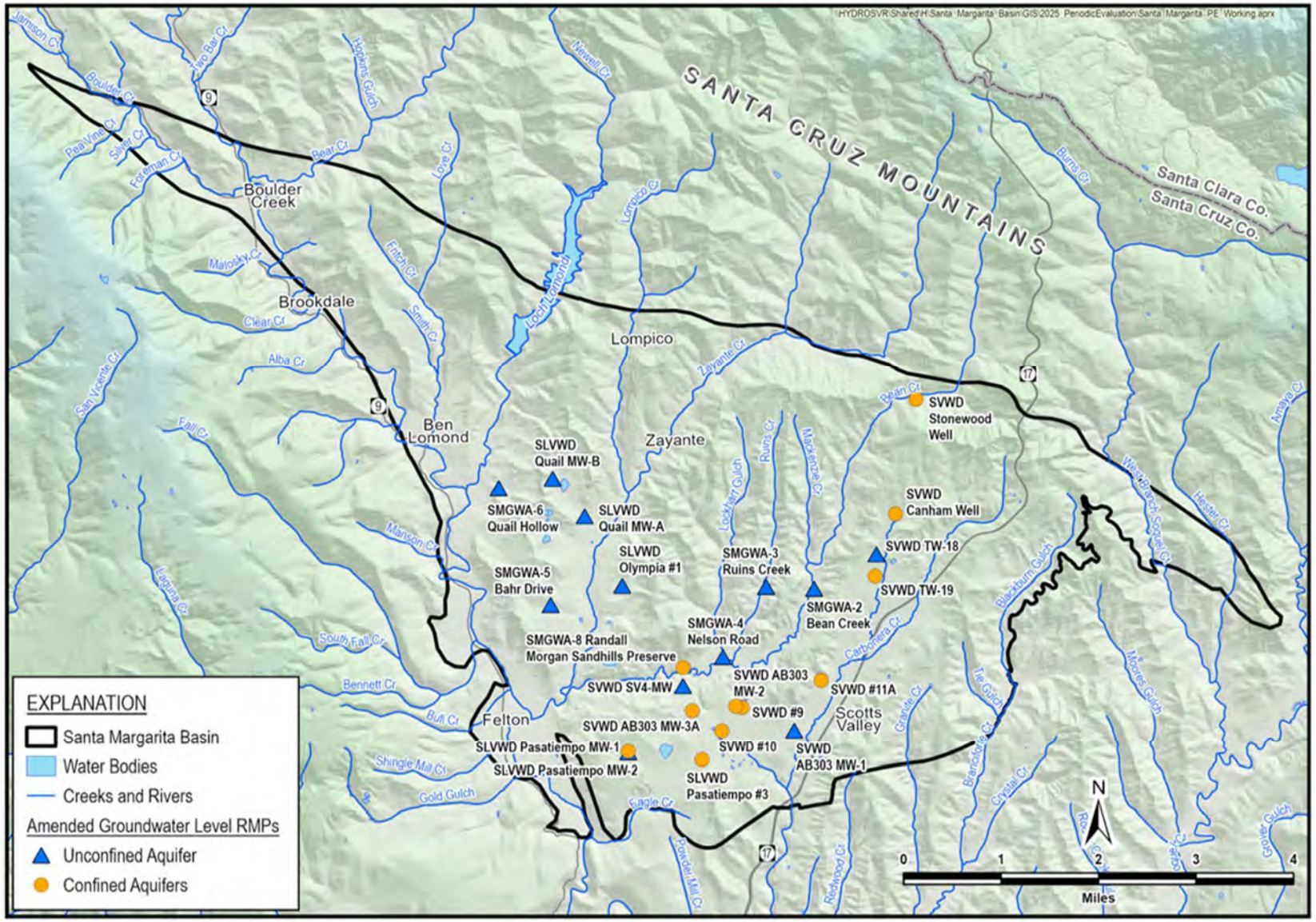



Figure 6-2~~6-26-6-2~~. Groundwater Level Representative Monitoring Network

~~Table 3-3. Summary of SMGWA Groundwater Level Monitoring Networks~~

| ~~Agency~~ | ~~Number of Wells~~ | | | |
|---|---|---|---|---|
| | ~~Monitoring~~ | ~~Extraction~~ | ~~Total~~ | ~~Representative Monitoring Points~~ |
| ~~San Lorenzo Valley Water District~~ | ~~5~~ | ~~7~~ | ~~12~~ | ~~5~~ |
| ~~Scotts Valley Water District~~ | ~~15~~ | ~~6~~ | ~~21~~ | ~~9~~ |
| ~~Mount Hermon Association~~ | ~~2~~ | ~~2~~ | ~~4~~ | ~~0~~ |
| ~~*Total*~~ | ~~*20*~~ | ~~*15*~~ | ~~*35*~~ | ~~*14*~~ |

~~**5.3** The proposed groundwater level monitoring network shown on Figure 3-1Figure 3-1 will be used to assess progress toward achieving interim milestones and measurable objectives with respect to chronic lowering of groundwater levels and will serve as a proxy in assessing the depletion of interconnected surface water described in the GSP.~~

~~The chronic lowering of groundwater levels sustainability indicator will be monitored using existing monitoring wells, focused in areas of municipal groundwater extraction: Quail Hollow, Olympia, and Scotts Valley. In addition to existing wells, Section 3.3.4.1: Groundwater Level Monitoring Improvements describes 4 new monitoring wells that will be installed to address identified data gaps using Proposition 68 and SMGWA member agency match funds.~~

~~**5.4** The depletion of interconnected surface water sustainability indicator will be monitored using 2 existing shallow monitoring wells: SVWD SV4-MW near Bean Creek and SLVWD Quail MW-A near an unnamed tributary of Zayante Creek. Recognizing that the Basin does not have enough shallow wells on the major creeks in the Basin to monitor and evaluate the effects of groundwater extractions on streamflow in interconnected surface waters, up to 5 new shallow monitoring wells will be installed using Proposition 68 and agency match funds to complete the monitoring network. The proposed new monitoring well general locations and intended use are described in more detail in Section 3.3.4.1.3.~~

~~**5.5** Each agency will continue to monitor existing and new wells as the GSP is implemented. All groundwater level data collected, both hand soundings and pressure transducer records, will be stored in a regional DMS to be managed by the County. All monitoring data uploaded to the DMS will be analyzed, compared to SMC, and included on hydrographs in the annual reports. The DMS is described in more detail in Section 3.3.2.5.~~

## ~~5.6~~6.3 Groundwater Extraction Monitoring

Per GSP regulations, the quantitative metric for reduction of groundwater in storage is an annual volume of groundwater extracted. The volume of groundwater extracted ~~will be~~ is measured using flow meters where available and estimated where direct measurements are not available.

~~For~~ Lower volume private and industrial extraction wells ~~that genrally~~generally do not have flow meters, so assumptions are made about water demand to estimate ~~a volume of~~ groundwater ~~extracted~~extraction. The SMC for ~~groundwater extraction~~reduction of groundwater in storage are an annual extraction volume and the RMPs are all metered and estimated supply wells in the Basin's principal aquifers. The location of the groundwater extraction well monitoring network is shown on Figure 6-3.

~~*5.6.1.1.1* Metered Groundwater Extraction~~

~~The SLVWD, SVWD, and MHA measure monthly extraction by individual well using totalizer readings. Public SWS with between 5 and 199 connections are required to measure and report monthly extraction data to SCEH. Table 3-4Table 3-4 lists the extraction wells that are metered. All metered monthly extraction data will be stored in the DMS.~~

~~Table 3-4. Metered Extraction Wells~~

| ~~Aquifer~~ | ~~Well Name~~ |
|---|---|
| ~~**Santa Margarita**~~ | ~~**SLVWD Quail Hollow #4A**~~ |
| | ~~**SLVWD Quail Hollow #5A**~~ |
| | ~~**SLVWD Olympia #2**~~ |
| | ~~**SLVWD Olympia #3**~~ |
| | ~~**Fernbrook Woods Mutual Water Company**~~ |
| | ~~**Fern Grove Water Club**~~ |
| | ~~**Hidden Meadows Mutual Water Company**~~ |
| | ~~**Karl's Dell**~~ |
| | ~~**Mission Springs Conference Center Well**~~ |
| | ~~**Vista Robles Association**~~ |
| | ~~**SVWD #9**~~ |

| ~~Aquifer~~ | ~~Well Name~~ |
|---|---|
| ~~**Monterey**~~ | ~~**Love Creek Heights Mutual Water Association**~~ |
| | ~~**Moon Meadows Water Company**~~ |
| ~~**Lompico**~~ | ~~**SLVWD Pasatiempo #5A**~~ |
| | ~~**SLVWD Pasatiempo #7**~~ |
| | ~~**SLVWD Pasatiempo #8**~~ |
| | ~~**SVWD #10A**~~ |
| | ~~**SVWD #11A**~~ |
| | ~~**SVWD #11B**~~ |
| | ~~**Mount Hermon #2**~~ |
| | ~~**Mount Hermon #3**~~ |
| | ~~**Roaring Camp**~~ |
| ~~**Lompico/Butano**~~ | ~~**SVWD #3B**~~ |
| | ~~**SVWD Orchard Well**~~ |

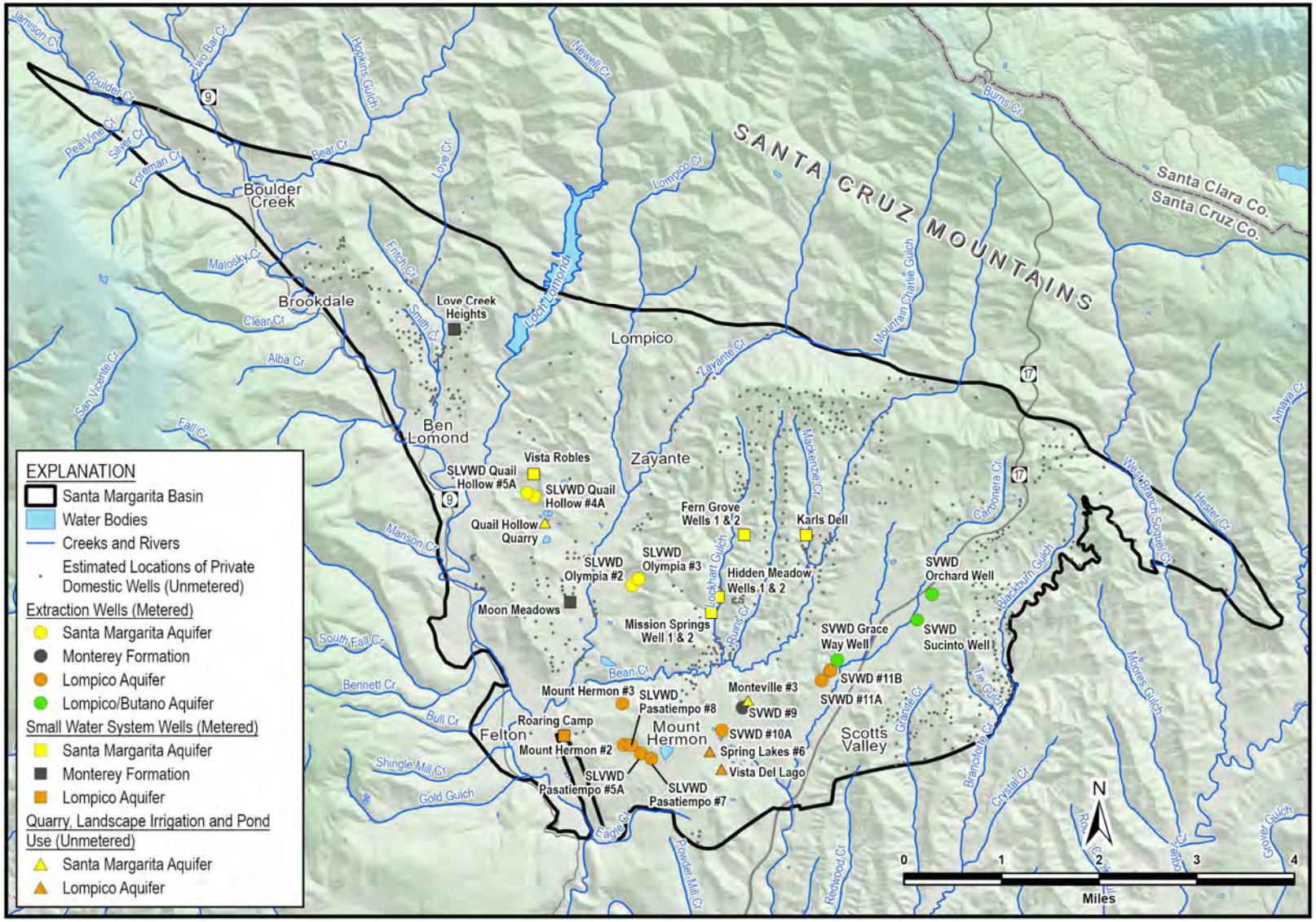



Figure 6-~~36~~-~~36~~-6-3. ~~Location of Wells Used for~~ Groundwater Extraction Wells in the Reduction in Storage Representative Monitoring Network ~~and RMPs~~

### 6.3.1 Metered Groundwater Extraction

The SLVWD, SVWD, and MHA measure monthly extraction by individual well using totalizer meter readings. Public SWS with between 5 and 199 connections are required to measure and report monthly extraction data to SCEH. Annual ~~M~~metered extraction is about 2,100 AF~~Y in~~between WY2021 and -2025. Table 6-3 lists the extraction wells that are metered. All ~~metered~~ monthly metered extraction data ~~will be~~is stored in the DMS.

Table 6-3~~6-3~~. Metered Extraction Wells

| Aquifer | Well Name |
|---|---|
| Santa Margarita | SLVWD Quail Hollow #4A |
| | SLVWD Quail Hollow #5A |
| | SLVWD Olympia #2 |
| | SLVWD Olympia #3 |
| | Fernbrook Woods Mutual Water Company |
| | Fern Grove Water Club |
| | Hidden Meadows Mutual Water Company |
| | Karl's Dell |
| | Mission Springs Conference Center Well |
| | Vista Robles Association |
| Monterey | Love Creek Heights Mutual Water Association |
| | Moon Meadows Water Company |
| Lompico | SLVWD Pasatiempo #5A |
| | SLVWD Pasatiempo #7 |
| | SLVWD Pasatiempo #8 |
| | SVWD #10A |
| | SVWD #11A |
| | SVWD #11B |
| | Mount Hermon #2 |
| | Mount Hermon #3 |
| | Roaring Camp |
| Lompico/Butano | SVWD Grace Way (added since 2022 GSP) |
| | SVWD Orchard Well |
| | SVWD Sucinto (added since 2022 GSP) |

### ~~5.6.2~~6.3.2 Unmetered Groundwater Extraction

Unmetered groundwater extraction includes ~~pumping for~~ private domestic ~~supply~~, irrigation, and landscaping, and industrial water uses. Estimated groundwater extraction volumes ~~will~~ are not ~~be~~ included in the DMS as the data are not measured. Instead, estimated extraction data ~~will be~~are

compiled and ~~stored~~ reported in ~~tabular format~~water use tables as part of ~~for GSP A~~annual ~~R~~reportings. ~~These data will be included in GSP 5-year updates and will be used to update the model. The frequency of future groundwater model updates during GSP implementation has not yet been determined~~

Private pumping is dispersed throughout the Basin in residential areas ~~that are~~ not served by public water systems. A~~There are a~~pproximately 777 residences in~~throughout~~ the Basin ~~that are not supplied by public water agencies, and where unmetered groundwater pumping for domestic use takes place. These users~~ that are considered *de minimis* users, a term~~which is defined by~~ the SGMA legislation defines as "a person who extracts, for domestic purposes, 2 AF or less per year." Under SGMA, *de minimis* groundwater pumping (less than 2 AFY) is exempt~~ed~~ from metering. This exemption, however, does not relieve~~exempt~~ *de minimis* pumpers of responsibility for~~from~~ addressing the impacts they may have on the Basin, including cumulative impacts. ~~Collective pumping from *de minimis* wells for domestic supply is estimated to be around 233 AFY based on an annual water use factor of 0.3 AFY, which is approximately 8% of extraction from the Basin. An update of the number of residential parcels that are not served by public water supply agencies will be updated for the GSP's 5-year updates. During GSP implementation, t~~The ~~amount~~ volume of water extracted for domestic use ~~will be~~is estimated based on the number of rural parcels with domestic wells, approximate population counts for people using domestic wells for water supply, and per connection water use estimates from small water systems and individual households that are metered. Collective pumping from *de minimis* wells for domestic supply is estimated to be around 233 AFY ~~based on an annual water use factor of 0.3 AFY~~, which is approximately 8% of extraction from the Basin.

Similar to domestic pumping, industrial groundwater extraction at Quail Hollow Quarry and irrigation by ~~other larger~~several non-*de minimis* private pumpers is currently unmetered and estimated based on SMGWA staff outreach and communication with well owners. Unmetered non-*de minimis* pumping is approximately 92 AFY. ~~As part of GSP implementation, the~~ SMGWA ~~will implement~~has not established a metering program ~~that will require~~ for non-*de minimis* users who pump more than 2 AFY ~~to meter their wells and provide records to the SMGWA~~. The number, ~~and~~ location, and volume of industrial, pond filling, agricultural, and landscape irrigation by non-*de minimis* pumpers ~~are~~is relatively well ~~known~~understood ~~based on land use maps~~.

~~Estimated groundwater extractions will not be included in the DMS as the data are not measured. Instead, estimated extraction data will be compiled and stored in tabular format. These data will be included in GSP 5-year updates and will be used to update the model. The frequency of future groundwater model updates during GSP implementation has not yet been determined.~~

## 5.76.4 Groundwater Quality Monitoring Network

Routine groundwater quality monitoring is almost entirely limited to performed by public water agencies and SWS with 15 or more connections to comply with drinking water regulations. Table 3-5Table 3-5 summarizes tThere are 21 GSP monitoring network 21 wells that are monitored most frequently in the Basin. Well locations are summarized in Table 6-4 and shown on Figure 6-4Figure 3-3Figure 3-3 and sampling frequency requirements for individual wells are summarized in Table 3-6Table 3-6. Groundwater quality RMPs are SLVWD and SVWD extraction wells, which extract about 75% of the groundwater in the Basin. These wells are representative as they are distributed throughout the Basin and principal aquifers where most groundwater is suppliedextracted and are routinely sampled for groundwater quality COCs to comply with state drinking water regulations. The 13 RMP wells are summarizedlisted in Table 6-5 and shown on Figure 6-5. SWS with 15 or more connections are not RMPs as they extract a relatively small volume of groundwater compared to SLVWD and SVWD wells and are not required to annually be monitored annually fortest drinking water quality. Available However ddata that is available from these SWS monitoring network wells isare publicly available and will be reviewed as part of Annual Reports and Periodic Evaluations to ensure that groundwater quality degradation is not occurring. There are no dedicated monitoring wells that are used for groundwater quality monitoring, therefore all wells shown on Figure 3-3Figure 3-3 are extraction wells.

Private domestic wells and SWS with 5 to 14 connections are not included in the GSP monitoring network because they are generally not sampled routinely so are not included in the GSP monitoring network, as described in Sections 2.1.2.4.2.1 and 2.1.2.4.2.2. For all newly constructed domestic wells, SCEH These wells are typically requires testing of nitrate and bacteria (Total Coliform and E. Coli) to demonstrate the water is a safe drinking water sourcerequired by SCEH to be sampled after installation and before , use as described in Sections 4.4.22.1.2.4.2.1 and 2.1.2.4.2.2. After initial sampling, there are no sampling requirements for domestic wells and limited and sporadic requirements for SWS with fewer than 15 connections. Data for domestic and SWS wells are reported to SCEH. Domestic wells and SWS with less fewer than 15 connections are not included in the GSP's groundwater quality monitoring network, though the SMGWA will evaluatehas options for incorporating these limited data, if available and needed to expand spatial coverage. For example, the , during future GSP updates. Should more water quality data be needed for GSP implementation, the SMGWA could partner with SCEH on the following two county domestic well County programs to obtain groundwater quality data:

- Free well water testing on a free or reduced cost groundwater quality testing program for private well owners

- Required point-of-sale well testing required -when a property relying on a domestic well is sold

Table 6-46-46-4. Summary of Groundwater Quality Monitoring Network Wells by System

| | Number of Wells | | | |
|---|---|---|---|---|
| Member Agency | Monitoring | Extraction | Total in Network | Representative Monitoring Points |

| Public Water Supply System | Extraction Wells | RMPs |
|---|---|---|
| San Lorenzo Valley Water District | **7** | 37 |
| Scotts Valley Water District | 6 | 6 |
| Mount Hermon Association | 2 | 0 |
| Fern Grove Club | 2 | 0 |
| Hidden Meadows Mutual Water Co. | 1 | 0 |
| Mission Springs Conference Center | 2 | 0 |
| Vista Robles Association | 1 | 0 |
| ***Total*** | ***21*** | ***913*** |

Table 6-56-5. Summary of Groundwater Quality Monitoring Network RMPs

| Aquifer Group | Aquifer | Well Name |
|---|---|---|
| Unconfined | Santa Margarita | SLVWD Quail #4A |
| | Santa Margarita | SLVWD Quail #5A |
| | Santa Margarita | SLVWD Olympia #2 |
| | Santa Margarita | SLVWD Olympia #3 |
| Confined | Lompico | SLVWD Pasatiempo #5A |
| | Lompico | SLVWD Pasatiempo #7 |
| | Lompico | SLVWD Pasatiempo #8 |
| | Lompico | SVWD #10A |
| | Lompico | SVWD #11A |
| | Lompico | SVWD #11B |
| | Lompico/ Butano | SVWD Orchard |
| | Lompico/ Butano | SVWD Sucinto |
| | Lompico/ Butano | SVWD Grace Way |

willing to share their data.

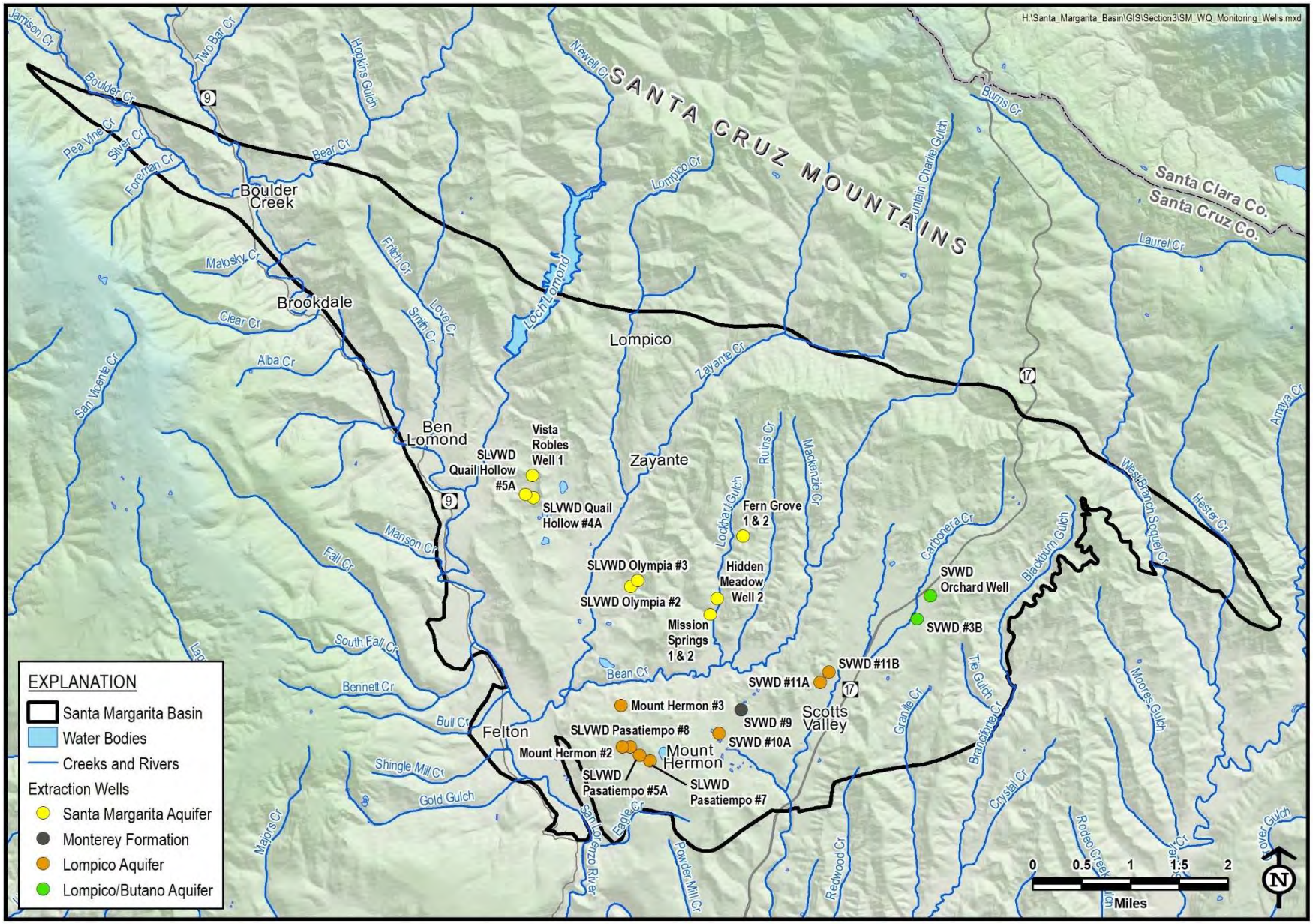



Figure 6-~~46~~-~~46~~-6-4. ~~Location of Wells Used to Monitor~~ Groundwater Quality Monitoring Network

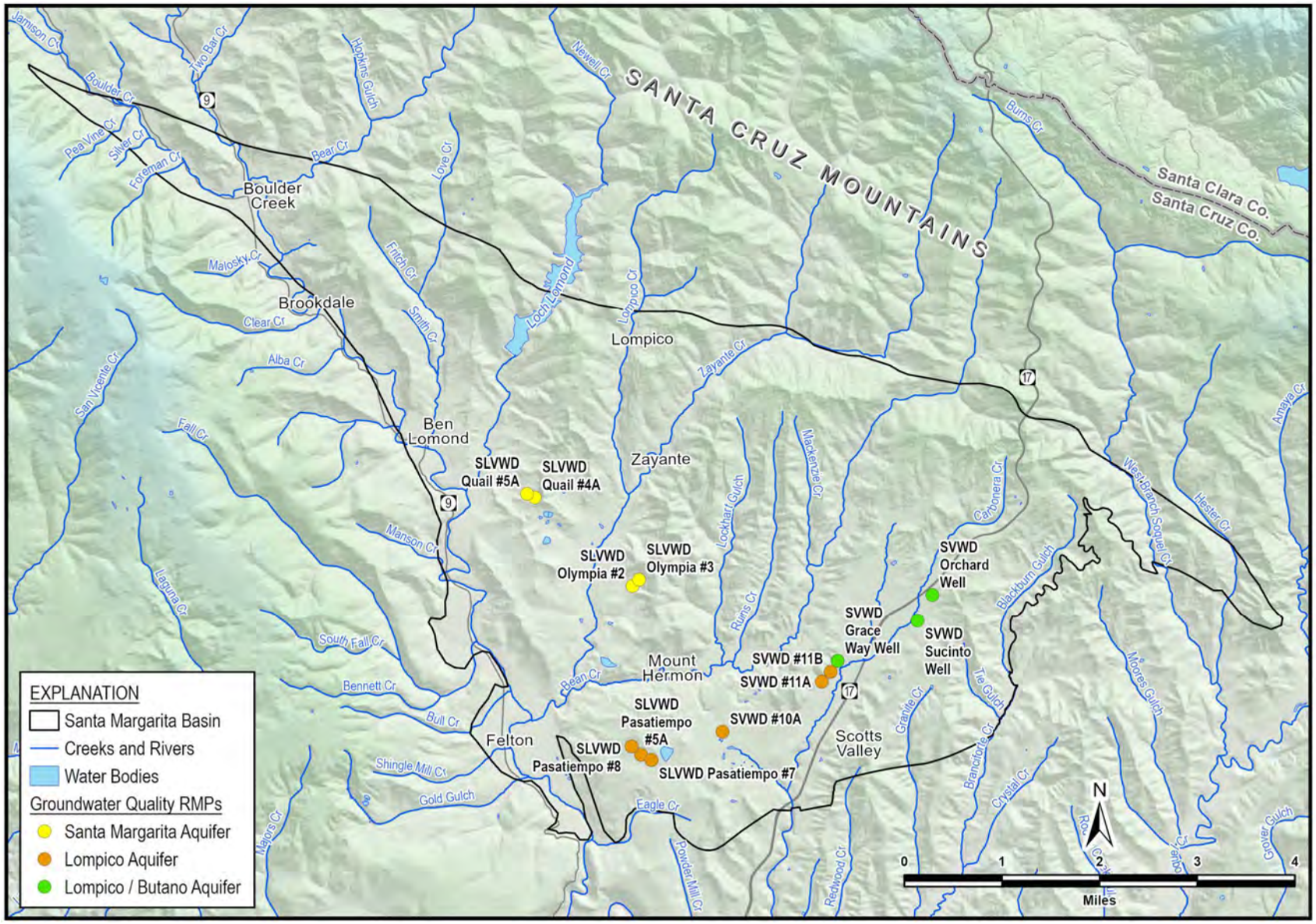



Figure 6-5~~6-56-6-5~~. Groundwater Quality Representative Monitoring Network ~~RMPs~~

~~Table 3-6. Current Sampling Frequency of Groundwater Quality Monitoring Wells~~

| ~~Aquifer~~ | ~~Extraction Well~~ | ~~Inorganics~~ | ~~Inorganics with More Frequent Sampling~~ | | | | ~~Volatile (VOC) & Synthetic (SOC) Organics~~ |
|---|---|---|---|---|---|---|---|
| | | | ~~Nitrate as N~~ | ~~Arsenic~~ | ~~Iron~~ | ~~Manganese~~ | |
| ~~Santa Margarita~~ | ~~SLVWD Olympia #2~~ | ~~Every 3 years~~ | ~~1 x year~~ | ~~Every 3 years~~ | ~~4 x year~~ | ~~4 x year~~ | ~~Every 3 years~~ |
| | ~~**SLVWD Olympia #3**~~ | ~~Every 3 years~~ | ~~1 x year~~ | ~~Every 3 years~~ | ~~4 x year~~ | ~~4 x year~~ | ~~Every 3 years~~ |
| | ~~SLVWD Quail Hollow #4A~~ | ~~Every 3 years~~ | ~~1 x year~~ | ~~Every 3 years~~ | ~~4 x year~~ | ~~4 x year~~ | ~~Every 3 years~~ |
| | ~~**SLVWD Quail Hollow #5A**~~ | ~~Every 3 years~~ | ~~1 x year~~ | ~~Every 3 years~~ | ~~4 x year~~ | ~~4 x year~~ | ~~Every 3 years~~ |
| | ~~Mission Springs Conference Center #1~~ | ~~Every 9 years~~ | ~~1 x year~~ | ~~Every 3 years~~ | ~~Every 3 years~~ | ~~Every 3 years~~ | ~~SOCs = 9 years VOCs = 6 years~~ |
| | ~~Mission Springs Conference Center #2~~ | ~~Every 9 years~~ | ~~1 x year~~ | ~~Every 3 years~~ | ~~Every 3 years~~ | ~~Every 3 years~~ | ~~SOCs = 9 years VOCs = 6 years~~ |
| | ~~Hidden Meadows Mutual Water Co #2~~ | ~~Every 9 years~~ | ~~1 x year~~ | ~~Every 3 years~~ | ~~Every 9 years~~ | ~~Every 9 years~~ | ~~SOCs = 3 years VOCs = 6 years~~ |
| | ~~Fern Grove #1~~ | ~~Every 3 years~~ | ~~1 x year~~ | ~~Every 3 years~~ | ~~Every 3 years~~ | ~~Every 3 years~~ | ~~SOCs = 3 years VOCs = 6 years~~ |
| | ~~Fern Grove #2~~ | ~~Every 3 years~~ | ~~1 x year~~ | ~~Every 3 years~~ | ~~Every 3 years~~ | ~~Every 3 years~~ | ~~SOCs = 3 years VOCs = 6 years~~ |
| | ~~Vista Robles Association #1~~ | ~~Every 3 years~~ | ~~1 x year~~ | ~~Every 3 years~~ | ~~Every 9 years~~ | ~~Every 9 years~~ | ~~SOCs = 9 years VOCs = 6 years~~ |
| ~~Monterey~~ | ~~**SVWD #9 (standby well)**~~ | ~~1 x year~~ | ~~1 x year~~ | ~~1 x year~~ | ~~1 x year~~ | ~~1 x year~~ | ~~1 x year~~ |
| ~~Lompico~~ | ~~MHA #2~~ | ~~Every 3 years~~ | ~~1 x year~~ | ~~Every 3 years~~ | ~~4 x year~~ | ~~Every 3 years~~ | ~~SOCs = 3 years VOCs = 6 years~~ |
| | ~~MHA #3~~ | ~~1 x year~~ | ~~1 x year~~ | ~~1 x year~~ | ~~1 x year~~ | ~~1 x year~~ | ~~SOCs = 3 years VOCs = 6 years~~ |
| | ~~SLVWD Pasatiempo #5A~~ | ~~Every 3 years~~ | ~~1 x year~~ | ~~12 x year~~ | ~~12 x year~~ | ~~12 x year~~ | ~~Every 3 years~~ |
| | ~~**SLVWD Pasatiempo #7**~~ | ~~Every 3 years~~ | ~~1 x year~~ | ~~12 x year~~ | ~~12 x year~~ | ~~12 x year~~ | ~~Every 3 years~~ |
| ~~Lompico (cont'd)~~ | ~~SLVWD Pasatiempo #8~~ | ~~Every 3 years~~ | ~~1 x year~~ | ~~12 x year~~ | ~~12 x year~~ | ~~12 x year~~ | ~~Every 3 years~~ |
| | ~~**SVWD #10A**~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ | ~~2 x year~~ |
| | ~~**SVWD #11A**~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ |
| | ~~**SVWD #11B**~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ |
| ~~Lompico/ Butano~~ | ~~**SVWD #3B**~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ |
| | ~~**SVWD Orchard Well**~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ | ~~4 x year~~ |

## ~~5.8 Notes: Wells in bold are Representative Monitoring Points~~

## 6.5 Depletion of Interconnected Surface Water Monitoring

Depletion of interconnected surface water is monitored using groundwater levels ~~and extraction~~ as a proxy, so the same RMP monitoring network described in Section 6.2~~6.2~~ above is being used. ~~Direct s~~Streamflow measurements cannot be used to directly monitor~~ing~~ depletion due to groundwater ~~pumping~~extraction because ~~groundwater pumping~~extraction accounts for ~~is~~ a fraction of ~~the~~all other factors influencing streamflow, such as precipitation, runoff, evapotranspiration, diversions, and other natural groundwater and surface water interactions that are unrelated to groundwater ~~pumping~~extraction. The GSP regulations allow for the use of groundwater elevations ~~and extraction~~ as a proxy for assessing the volume or rate of surface water depletion SMC ~~since~~if there is significant correlation between these conditions in the Basin. The~~is~~ correlation is demonstrated in Sections 4.6.2, ~~and~~ 4.6.3, and 4.6.5.

In addition to using groundwater levels as a proxy, SMGWA will use the groundwater extraction SMC network for monitoring of interconnected surface water. This will help isolate the potential effects from groundwater extraction on depletion of interconnected surface water despite the many other factors influencing streamflow described above. By maintaining groundwater extraction below what it was prior to SGMA, the effects on stream depletions would be less than in the pre-SGMA period.

## 6.6 Other~~Streamflow~~ Monitoring Network~~s~~

Other monitoring networks support groundwater conditions analysis and GSP reporting~~,~~ but are not directly tied to SMC. Monitoring networks that collect streamflow, vegetation health, land surface elevation, and climate data supplement the sustainability indicator representative monitoring networks used to evaluate sustainability.

### 6.6.1 Streamflow Monitoring Network

Stream stage and discharge monitoring ~~will be assessed~~supplements the depletion of interconnected surface water monitoring performed using groundwater levels and extraction as a proxy. Stream discharge data is also used to calibrate the Basin Model ~~in areas where groundwater pumping occurs in the vicinity of streams connected to groundwater~~. Streamflow monitoring gages are located throughout the Basin, especially in the southern portion, where tributaries consolidate into the larger stream reaches and groundwater and surface water interactions occur due to aquifers exposed at the ground surface. The stream gage network is summarized in Table 6-6 and shown on Figure 6-6. ~~A few of the r~~Recently inactivated gages ~~have also been~~are included on Figure 6-6 and Table 6-6 for reference.

The primary streamflow monitoring ~~location~~ point in the Basin is the Big Trees Gage on the San Lorenzo River (streamflow gage No. 11160500, San Lorenzo River at Big Trees). This gage is ~~There are 7 active stream gages within the Basin that will continue to be used as part of the GSP monitoring network. An additional eighth gage is planned for installation in late 2021. One of the existing gages is~~ maintained and operated by the USGS ~~(streamflow gage No. 11160500, San Lorenzo River at Big Trees)~~ with funding from the City of Santa Cruz. The gage measures San Lorenzo River stage and discharge leaving the Basin and thus captures surface water flow in the tributaries throughout the Basin that feed into the San Lorenzo River. ~~Streamflow at Big Trees Gage can be compared to downstream streamflow and diversion criteria for City of Santa Cruz water use under the City HCP.~~ Annual discharge at the gage is ~~also~~ used to ~~define~~classify the water year type for GSP reporting using ~~the City of Santa Cruz~~ a local water year classification system originally developed by the City of Santa Cruz. The classification system is no longer used by the city, but it is used in the GSP for consistency with past classification practices.

There are 7 other stream gages in the Basin that are funded and maintained by the City of Santa Cruz and the County. These gages measure stage and discharge on various tributaries ~~of~~ and upstream reaches ~~from~~of Big Trees on the San Lorenzo River. ~~. The other active stream gages are funded and maintained by the City of Santa Cruz and the County.~~ The USGS and City of Santa Cruz stream gages are measured ~~monthly~~ throughout the year and the County stream gages are typically operational during the seasonal baseflow period (approximately May to November) to record flow during the driest time of year. ~~The stream gage network is summarized in Table 3-7Table 3-7 and shown on Figure 3-4Figure 3-4. A few of the recently inactivated gages have also been included on Figure 3-4Figure 3-4 and Table 3-7Table 3-7 for reference.~~

~~Beginning in 2017, Balance Hydrologics conducted annual late-season stream observation walks called accretion runs to help determine where groundwater is contributing flow to the stream, and where the stream is replenishing groundwater. Accretion studies were performed at locations along the San Lorenzo River and its tributaries shown on Figure 6-6.~~ Past accretion studies were instrumental in understanding the surface water-groundwater relationship in the Basin. Beginning in 2017, Balance Hydrologics conducted annual late-season stream observation walks ("accretion runs"), where flow, nitrate, and specific conductance were measured at locations shown on Figure 6-6 along the San Lorenzo River and its tributaries. Measurements were collected along the reach from Felton up through Boulder Creek. The goal of the accretion study was to improve understanding of the surface water and groundwater interactions within the Basin. As part of the GSP process, sites along Zayante Creek, Lompico Creek, and Bean Creek were added to the accretion runs in the summer of 2019. Most of the added sites were focused along Bean Creek and its tributaries. During the summer and fall of 2019, 3 separate accretion runs (May, July, and September) were conducted on the San Lorenzo River, Lompico Creek, Zayante Creek, Bean Creek, and Eagle Creek. Measurements were collected at all sites over a period of 1 to 2 days for each run. The number of accretion runs was increased during 2019 to

capture the changes in flow during the dry-season recession and to aid in understanding the surface-water groundwater interactions within the Basin.

~~Results of accretion studies are described in Section 2.2.5.6.1. The SMGWA will evaluate whether further accretion studies would provide additional value based on changes observed in the groundwater levels, streamflow, and GDE health over the 5-year monitoring period before the first GSP update in January 2027.~~

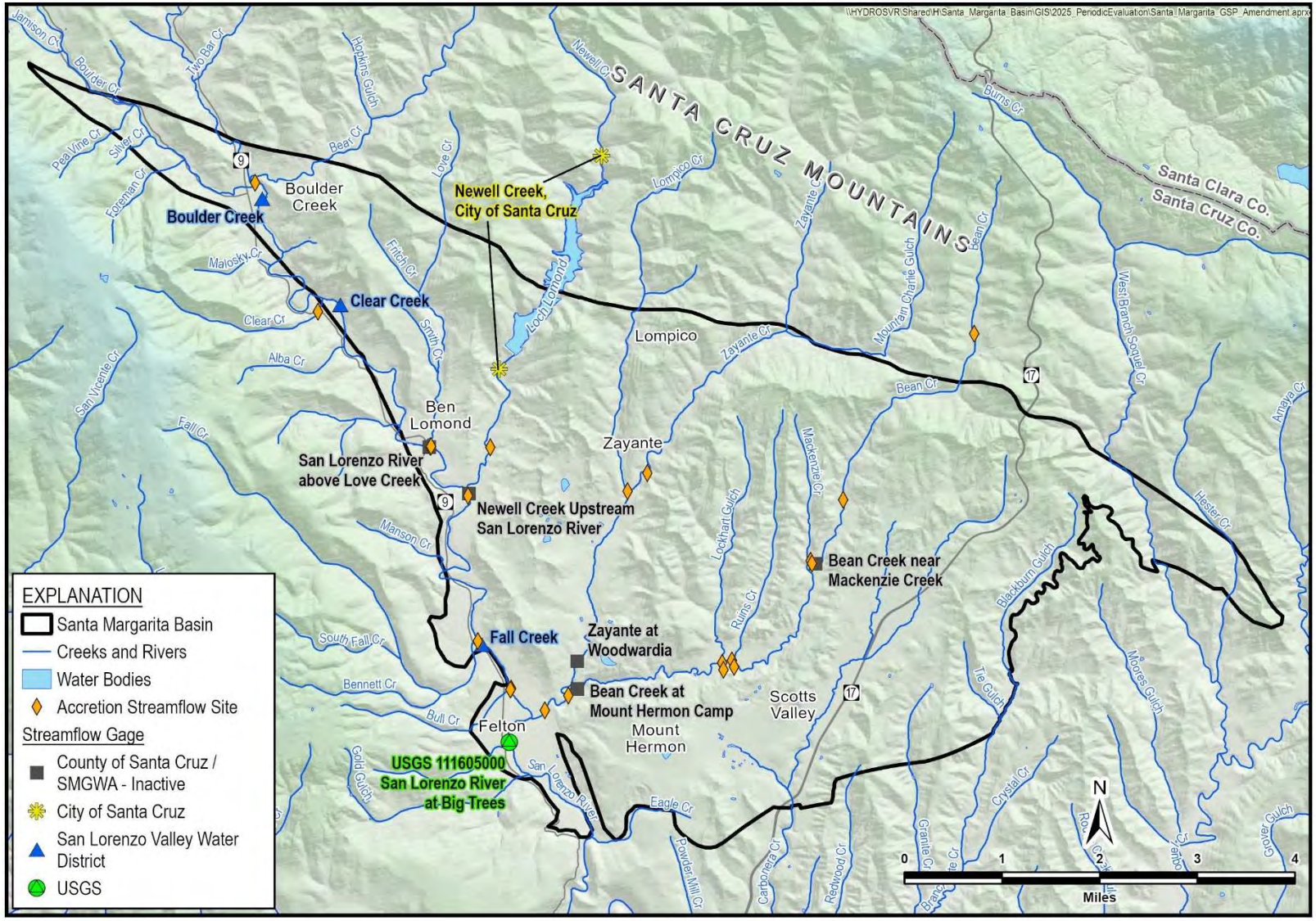



Figure 6-~~6~~6-~~66~~-6-~~6~~. Location of Streamflow Gages and Surface Water Quality Monitoring Sites

Table 6-~~6~~6 ~~6~~6 ~~6~~. ~~Summary of~~ Streamflow Gages, Status, and Use

| Monitoring Agency | Streamflow Gage Name | Status | Parameters Measured | Frequency Measured |
|---|---|---|---|---|
| USGS | USGS 11160500 San Lorenzo River at Big Trees | Active | Streamflow | ~~Approximately monthly~~15 minutes |
| City of Santa Cruz | Newell Creek below Loch Lomond | Active | Streamflow | ~~Approximately monthly~~Daily |
| | Newell Creek above Loch Lomond | Active | Streamflow | ~~Approximately monthly~~Daily |
| San Lorenzo Valley Water District | ~~San Lorenzo River Downstream of~~ Fall Creek | ~~Inactive~~Active | Streamflow, Temperature | Approximately monthly ~~during seasonal baseflow~~year-round |
| | ~~San Lorenzo River Downstream of Clear Creek~~Boulder Creek | ~~Inactive~~Active | Streamflow, Temperature | Approximately monthly during seasonal baseflow |
| | ~~San Lorenzo River Downstream of Boulder Creek~~Foreman Creek | A~~Ina~~ctive | Streamflow, Temperature | Approximately monthly during seasonal baseflow |
| County of Santa Cruz through 2021<br>SMGWA 2022 through 2025 | San Lorenzo River above Love Creek | Ina~~A~~ctive | Streamflow, Specific Conductance, Temperature | Approximately monthly during seasonal baseflow |
| | Newell Creek upstream of San Lorenzo River | Ina~~A~~ctive | Streamflow, Specific Conductance, Temperature | Approximately monthly during seasonal baseflow |
| | Zayante at Woodwardia | Ina~~A~~ctive | Streamflow, Specific Conductance, Temperature | Approximately monthly during seasonal baseflow |
| | Bean Creek at Mount Hermon Camp | Ina~~A~~ctive | Streamflow, Specific Conductance, Temperature | Approximately monthly during seasonal baseflow |
| | Bean Creek near Mackenzie Creek | ~~Planned in late 2021~~InaActive | Streamflow, Specific Conductance, Temperature | Approximately monthly during seasonal baseflow |
| | ~~Eagle Creek Gage~~ | ~~Inactive after October. 2020~~ | ~~Streamflow, Specific Conductance, Temperature~~ | ~~Approximately monthly during seasonal baseflow~~ |

### 5.8.16.6.2 Groundwater Dependent Ecosystem Monitoring

As part of GSP implementation, the SMGWA uses GDE monitoring to collect information on changes to GDE health during GSP implementationwill evaluate if potential impacts to GDEs fromdepletion of interconnected surface water is impacting environmental beneficial use of groundwatergroundwater use, projects, or management actions. The GDE health s will be is evaluated at least every five years using satellite-derived surface water measurements, field observations, and vegetation index mapping. GDEs in the Basin support many different species, some of which are listed as priority species by either the federal Endangered Species Act. Section 2.4.1.8 describes ecological beneficial users of groundwater including other priority species that may be found within the Basin. GDE health is evaluated alongside to supplement data collected by groundwater level, and interconnected surface water (ISW) depletion, streamflow, and climatesurface water monitoring networks described in Sections 6.2, 6.53.3.1.1, and 3.3.1.4, 6.6.1, and 6.6.4, respectively, to determine if groundwater use is impacting GDEs, will be an integral part of GDE monitoring.

As described in Section 2.2.4.9, GDEs in the Basin are classified into the following categories:

- Springs: basal and other springs
- Open water: lakes and ponds
- Riverine/riparian: perennial and ephemeral streams, riparian corridors, on-channel ponds, wetlands
  - Other groundwater-supported wetlands: seeps, quarry floor, willow, shrub, and scrub vegetation

GDE health is evaluated using . GDE monitoring protocols are described generally below; other routine GSP monitoring protocols are described in Section 3.3.2.

Work in the Basin over the past few decades indicates surface water characteristics are directly related to what is occurring in the aquifer underlying the surface water during the dry season. Surface water observations for GDE assessment will include visual inspection and water level, specific conductance, and temperature measurements at representative sites. Decades of monitoring by Santa Cruz County and other agencies have shown that these metrics vary seasonally with wet and dry periods and are resilient to most other watershed surface disturbances but are still susceptible to changes in conditions of the aquifers that control them. The timing of observations will be standardized, and field visits will occur twice a year, once in late spring/early summer (early May) and again in late summer/early fall (late September to early October). Timing may need to be adjusted slightly depending on the type of water year, and if there is late season rain, to capture the range of baseflow conditions. Measurements and observations will be documented in a standard format that will be uploaded to the DMS.

~~Qualitative metrics, such as photo monitoring and general site observations, will also be collected during site visits to further evaluate site conditions within the context of the direct measurements. This information will be provided in annual GSP updates.~~

~~Remote sensing tools, such as the Nature Conservancy's GDE Pulse or Google Earth Engine Vegetation vigor data is evaluated for areas with likely GDEs to assess potential impacts to GDEs due to lowering groundwater levels, reduction of storage, and ISW depletion. Within the Basin, the diversity in GDE types and the natural high NDVI values, make vegetation vigor a suitable long-term tool for analysis of vegetation impacts from changing groundwater levels. Remote sensing tools, such as the Nature Conservancy's GDE Pulse or Google Earth Engine will be used to qualitatively assess the health of vegetation surrounding lakes and ponds by evaluating changes in vegetation vigor indices, such as NDVI, EVI, and NDMI, over time. This information is available online and is free for the SMGWA to access. Vegetation vigor analysis by remote sensing methods will be conducted every 5 years using publicly available annual remote sensing data available over that 5-year period. Results of the analysis will be included in the GSP's 5-year updates.~~ Representative GDE monitoring sites are selected based on their proximity to pumping areas, the underlying geology, and inferred or modeled stream connectivity with groundwater (Table 6-7 and Figure 6-7)~~.The GDE data collected at representative sites will be supplemented by groundwater level and stream stage monitoring networks presented in Sections 3.3.1.1 and 3.3.1.4, respectively.~~

Table 6-7~~6~~ ~~76~~ ~~7~~. Groundwater Dependent Ecosystem Representative Monitoring Sites

| Site | GDE Types | Selection Rationale |
|---|---|---|
| ~~Glenwood Preserve and Canham Springs~~ | ~~Springs and Other Groundwater-Supported Wetlands~~ | ~~Near SVWD pumping, near contact between Santa Margarita aquifer and Santa Cruz Mudstone~~ |
| Quail Hollow | Springs, Open Water, and Other Groundwater-Supported Wetlands | Near SLVWD pumping in Santa Margarita aquifer |
| Zayante Creek south of Quail Hollow | Springs, Riverine and Riparian | Near SLVWD and private pumping, near contact between Santa Margarita aquifer and Monterey Formation |
| Redwood and Ferndell Springs | Springs | Near Mount Hermon Association pumping, springs are in the Santa Margarita aquifer |
| Eagle Creek Springs | Springs | At southern extent of Basin, springs are in the Santa Margarita aquifer |
| San Lorenzo River, Zayante Creek, and Bean Creek | Riverine and Riparian | Primary streams connected to groundwater, with nearby municipal and private pumping wells |

~~V~~vegetation vigor is ~~data collected using remote sensing methods.~~ The ~~analysis~~vegetation index mapping utilizes ~~affected by changes in groundwater, climate, and physical conditions (erosion,~~

~~sedimentation, mass wasting, wildfire, etc.). Vegetation vigor datasets are generated through processing satellite imagery. State agencies have made these~~ publicly available ~~vegetation vigor~~ datasets ~~publicly~~such as- The Nature Conservancy's GDE Pulse Webmap and open access processing tools such as Google Earth Engine, ~~available~~ thereby making ~~them~~ it a cost-effective indicator ~~of change in groundwater levels and GDE vegetation quality~~ to monitor. The common vegetation ~~vigor~~ health indices include Normalized Difference Vegetation Index (NDVI), Enhanced Vegetation Index (EVI), and Normalized Difference Moisture Index (NDMI)[3,4].

~~*5.8.1.1.1.1 Springs*~~

~~Monitoring of representative springs listed in Table 3-10Table 3-10 and shown on Figure 3-5Figure 3-5 will include measurements of flow, specific conductance, and temperature, along with general observations of the spring and surrounding vegetation. These physical measurements and records will be the clearest link between hydrologic support for GDEs and groundwater management. Monitoring will occur semi-annually during the first 10 years of the monitoring program to document the relationship between surface water flow, groundwater levels, and GDE health. Springs located near streamflow gages will additionally be monitored during regular streamflow gage calibration site visits.~~

~~*5.8.1.1.1.2 Open Water*~~

~~Monitoring of representative open water sites listed in Table 3-10Table 3-10 and shown on Figure 3-5Figure 3-5 will consist of evaluating vegetation vigor of fringe vegetation, photo monitoring, and measurements of surface water level. As previously discussed, remote sensing methods will be used to assess the changes in vegetation vigor surrounding open water GDEs during the period leading up to the GSP's 5-year update. To monitor the water surface level of the water body, a staff plate or measuring stick, will be installed at representative open water sites to document changes in water surface level at the site over time. Photos will be collected at established photo points, measurements of specific conductance and temperature will be taken, and observations of surface water stage and surrounding vegetation will be noted. Monitoring will occur semi-annually during the first 10 years of the monitoring program.~~

[3]https://www.usgs.gov/core-science-systems/nli/landsat/landsat-enhanced-vegetation-index?qt-science_support_page_related_con=0#qt-science_support_page_related_con
[4] https://gde.codefornature.org/#/methodology

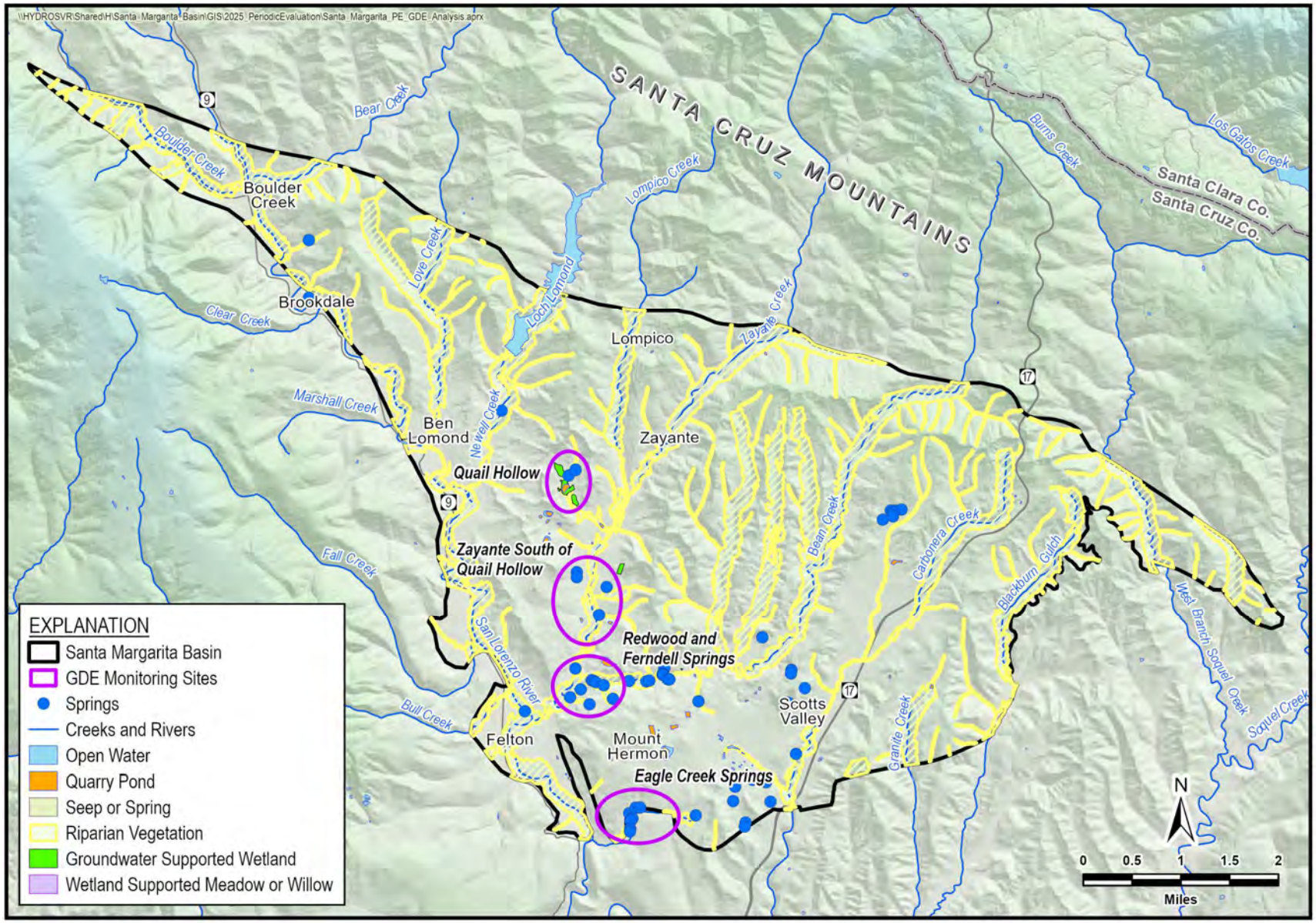



Figure 6-7~~6-7~~~~6-7~~. Location of Groundwater Dependent Ecosystem Monitoring Sites

*~~5.8.1.1.1.3 Riverine and Riparian~~*

~~Monitoring of representative riverine and riparian areas listed in Table 3-10Table 3-10 and shown on Figure 3-5Figure 3-5 will consist of seasonal streamflow monitoring to document changes in baseflow in selected streams during a given year and compared to other years (see Section 3.3.1.4). Riverine and riparian monitoring will include evaluation of vegetation vigor along riparian corridors. Field observations will be compared with remote sensing data to assess annual changes in vegetation vigor within the riparian corridor, which can be an indicator of shallow groundwater availability for plants. The evaluation of vegetation vigor using remote sensing data will occur during the period leading up to the GSP 5-year update.~~

*~~5.8.1.1.1.4 Other Groundwater-Supported Wetlands~~*

~~Monitoring of representative other groundwater-supported wetland sites listed in Table 3-10Table 3-10 and shown on Figure 3-5Figure 3-5 will consist of photo monitoring and evaluating vegetation vigor. As previously discussed, remote sensing methods will be used to assess the changes in vegetation vigor within representative other groundwater-supported wetlands during the period leading up to the GSP 5-year update. Semi-annual site visits during the first 10 years of the monitoring program will include collecting photos at photo monitoring locations, as well as general and qualitative site observations of the wetland and vegetation.~~

*~~5.8.1.1.1.5 Representative Groundwater Dependent Ecosystem Sites~~*

~~Specific sites are selected to be representative of the GDEs within the Basin (Table 3-10Table 3-10 and Figure 3-5Figure 3-5). These sites will be monitored to evaluate the impacts by groundwater use, projects, or management actions on GDEs. These sites were selected based on their proximity to pumping areas, the underlying geology, and inferred or modeled stream connectivity with groundwater. The GDE data collected at representative sites will be supplemented by groundwater level and stream stage monitoring networks presented in Sections 3.3.1.1 and 3.3.1.4, respectively.~~

***~~5.8.1.1.2 GROUNDWATER DEPENDENT ECOSYSTEMS AND PRIORITY SPECIES~~***

~~GDE monitoring will focus on areas most likely to support priority species habitat. For example, streamflow and temperature are critical components of habitat for many of the priority species within the Basin. Observations of changes in vegetation health, through monitoring vegetation vigor and photo monitoring, will indicate changes in groundwater availability for plants.~~

~~Table 3-11Table 3-11 lists priority species for the Basin selected for GDE management, the locations of those species, and the habitat components that will be measured through the GDE monitoring plan. Section 2.1.4.2.8 describes more broadly ecological beneficial users of groundwater including other priority species that may be found within the Basin. Other species of importance in the Basin not listed in Table 3-11Table 3-11 are believed to either not be dependent on groundwater or have similar needs as the priority species identified for GDE~~

~~monitoring. For example, multiple plant species are included in each GDE type but are not specifically considered priority species for GDE monitoring.~~

~~Table 3-11. Priority Species Monitoring~~

| ~~Priority Species common name~~ | ~~Type of species~~ | ~~Location(s)~~ | ~~Habitat Components Monitored through SMGWA~~ |
|---|---|---|---|
| ~~Steelhead~~ | ~~Fish~~ | ~~Bean Creek, Zayante Creek, Lompico, MacKenzie, San Lorenzo River, Newell Creek, Love Creek, Boulder Creek~~ | ~~Streamflow, temperature~~ |
| ~~Coho Salmon~~ | ~~Fish~~ | ~~Bean Creek, Zayante Creek, San Lorenzo River~~ | ~~Streamflow, temperature~~ |
| ~~Lamprey~~ | ~~Fish~~ | ~~Bean Creek, Zayante Creek, Newell Creek, San Lorenzo River~~ | ~~Streamflow, temperature~~ |
| ~~California Red-Legged Frog~~ | ~~Amphibian~~ | ~~Bean Creek, Mountain Charlie Gulch~~ | ~~Streamflow, temperature, water level in open water and seeps/springs~~ |
| ~~Western Pond Turtle~~ | ~~Reptile~~ | ~~Zayante Creek, Newell Creek, San Lorenzo River~~ | ~~Streamflow, temperature, water level in open water and seeps/springs~~ |
| ~~California Giant Salamander~~ | ~~Amphibian~~ | ~~Probably distributed widely in basin. Bean Creek, Lockhart Gulch, Ruins Creek, Zayante Creek, Lompico Creek, San Lorenzo River~~ | ~~Streamflow, temperature, water level in open water and seeps/springs~~ |

#### ~~*5.8.1.1.3 Biological Responses*~~

Ongoing habitat studies, conducted by the County, SLVWD, and the City of Santa Cruz, will assist in GDE data interpretation by providing additional information on the anticipated biological responses to surface water fluctuations and variability in GDE conditions. The Santa Cruz County Juvenile Steelhead and Stream Habitat Monitoring Program, a multi-agency partnership, has measured steelhead population density at more than 40 sites throughout the San Lorenzo, Soquel, Aptos, and Pajaro watersheds since 1989. Additionally, the County occasionally monitors riparian vegetation using the Riparian Rapid Assessment Method, a monitoring method developed by the Central Coast Wetlands Group to assess physical and biological complexity, and to infer ecological functioning and benefits (City of Santa Cruz Water Department *et al*., 2018). Data from these monitoring programs are anticipated to generally inform the SMGWA's ongoing consideration of potential groundwater management impacts to GDEs.

### ~~5.8.2~~6.6.3 ~~Land Elevation~~Subsidence Monitoring

Land subsidence is not an applicable indicator of sustainability in the Basin and land surface elevations within the Basin have not been historically monitored nor are there plans to conduct such monitoring in the future. The DWR-funded vertical displacement spatial data from InSAR,

described in Section 2.2.5.5, will be reviewed as part of each GSP ~~5-year update~~Periodic Evaluation to confirm that subsidence is not occurring. In the analysis of the InSAR dataset, it will be important to distinguish between land elevation changes resulting from tectonic deformation due to the proximity of active faults and land elevation changes from land subsidence caused by groundwater extraction. It will also be important to take into account small seasonal elevation changes that can result from changing moisture levels in expanding soils, and to acknowledge the intrinsic precision of the measurements can result in small calculated changes that do not reflect actual surface movement.

If inelastic or permanent land subsidence from groundwater extraction is found to be occurring, it will trigger the need for dedicated subsidence monitoring.

### ~~5.8.3~~6.6.4 Climate Monitoring

Precipitation and temperature data are collected by the Basin's 2 municipal water agencies using their own weather stations~~. The County of Santa Cruz has a county-wide rainfall sensor network (https://santacruz.onerain.com) with 1 sensor in the Basin at Ben Lomond. The collected data will be used to estimate precipitation and evapotranspiration which help refine estimates of groundwater recharge, runoff, and surface water and groundwater interactions~~. SLVWD has a weather station in Boulder Creek and SVWD has a weather station in Scotts Valley. Climate stations are summarized on Table 6-8 and their locations are provided on Figure 3-3.

Table 6-8~~6~~ ~~8~~6 ~~8~~. Climate Stations in the Santa Margarita Basin

| Monitoring Entity | Station Name | Parameters |
|---|---|---|
| San Lorenzo Valley Water District | Boulder Creek | Daily precipitation, daily minimum, maximum and average temperature |
| Scotts Valley Water District | El Pueblo Yard | Daily precipitation, daily minimum, maximum and average temperature |
| ~~Santa Cruz County~~ | ~~Ben Lomond~~ | ~~Daily precipitation~~ |

## ~~5.9~~6.7 Monitoring Protocols

County and SMGWA ~~Pursuant to the goals of SGMA,~~ member agency staff collect ~~ies monitoring~~ groundwater data in the Basin ~~endeavor to~~ using ~~e~~ reliable and effective data collection protocols ~~to monitor groundwater conditions~~. Use of ~~the~~ standard monitoring protocols ~~contained within this GSP~~ ensures data are consistently collected, thereby increasing the reliability of data used to evaluate GSP implementation. There are 5 types of data collected for GSP implementation: groundwater level, groundwater quality, streamflow, groundwater extraction volume, and climate conditions.

### ~~5.9.1~~6.7.1 Groundwater Level Measurement Protocols

Groundwater level monitoring is conducted to evaluate Basin conditions relative to the SMC for chronic lowering of groundwater levels and depletion of interconnected surface water, as shown in Table 6-1. ~~Each~~ SMGWA member agencies ~~y will continue to monitor existing and new wells as the GSP is implemented. All groundwater level data collected,~~collect both hand soundings and pressure transducer records, ~~will be~~ which are stored in a regional DMS ~~to be~~ managed by the County. All monitoring data uploaded to the DMS ~~will be~~is analyzed, compared to SMC, and included on hydrographs in the GSP A~~a~~nnual ~~r~~Reports. The DMS is described in more detail in Section 6.8~~3.3.2.5.~~ Groundwater levels in some wells are measured and recorded at least daily using pressure transducers with ~~data logger~~dataloggers. Groundwater level measurement in wells without ~~data logger~~dataloggers are collected monthly in most wells and at least semi-annually as required by GSP Regulations.

All groundwater level measurements are referenced to a consistent elevation datum, known as the Reference Point (RP). For monitoring wells, the RP is typically a mark on the top of the well casing. For extraction wells, the RP is typically the top of the well's concrete pedestal. Per GSP regulations, the elevation of the RP of each well is to be surveyed to the North American Vertical Datum of 1988 (NAVD 88). Currently, the elevation of the monitoring well RPs is accurate to at least 0.5 foot.

Groundwater level measurements are taken to the nearest 0.01 foot relative to the RP using procedures appropriate for the measuring device. Groundwater elevation is calculated using the following equation:

$$GWE = RPE - DTW$$

where:

GWE = groundwater elevation

RPE = reference point elevation

DTW = depth to water

In cases where the official RPE is a concrete pedestal, but the hand soundings are referenced off the top of a sounding tube, the measured DTW is adjusted by subtracting the sounding tube offset from the top of the pedestal.

All groundwater level measurements include a record of the date, well identifier, time (in 24-hour format), RPE, DTW, GWE, and comments regarding factors which may influence the recorded measurement such as nearby extraction wells pumping, weather, flooding, or well condition.

#### ~~5.9.1.1~~6.7.1.1 Manual Groundwater Level Measurement

All manual groundwater level measurements ~~will~~ are collected use~~e~~ing the following protocols:

- Measurements will be collected using an electronic sounder or steel tape. Electronic sounders consist of a graduated wire equipped with a weighted electric sensor. When the sensor is lowered into water, a circuit is completed and an audible beep is produced, at which point the sampler will record the depth to groundwater. This is the preferred method for monitoring groundwater levels, but other methods may be used. For instance, some extraction wells may have lubricating oil floating on top of the groundwater column; oil and groundwater levels in these wells will be gaged with an oil water interface probe or steel tape with oil and water indicator paste. Equipment usage will follow manufacturer specifications for procedure and maintenance.
- In wells that have been subject to recent pumping, a measurement will be taken after pumping has ceased and the water level has recovered to a stable level. If a well pump cannot be turned off during the scheduled monitoring event, then a measurement will be collected if possible, and accompanied by an explanatory note.
- For each well, multiple measurements will be collected to ensure the well has reached equilibrium such that no significant changes in groundwater level are observed.
- Equipment will be thoroughly cleaned after measurements at each well location in order to prevent cross-contamination among wells.
- The groundwater level measurement will be collected from a permanent reference mark. If a well is found to not have a permanent reference mark, one will be made on the north side of the casing to ensure subsequent measurements reference the same point.

#### ~~5.9.1.2~~6.7.1.2 Groundwater Level Measurement with Continuous Recording Devices

In addition to manual groundwater level measurements, some wells in the Basin are equipped with pressure transducers to collect more frequent data. These include SVWD extraction wells and most monitoring wells. Installation and use of pressure transducers abide by the following protocols:

- In order to calibrate the transducer data, the sampler will use a water level measurement device to measure the current groundwater level prior to installation of the probe. The groundwater level will be measured following the protocols listed above.
- All transducer installations will follow manufacturer specifications for installation and calibration. The time on the transducer internal clock will be synchronized with the computer satellite time.

- The well name, transducer name, transducer range, transducer accuracy, and cable serial number will be recorded in any log or datasheet used to document measurements.
- The sampler will note whether the pressure transducer uses a vented or non-vented cable for barometric compensation. If non-vented units are used, data will be corrected for natural barometric pressure changes using a barometric pressure logger or if unavailable, weather station data.
- All transducer cables will be secured to the well head with a well dock or another reliable method. This cable will be marked at the elevation of the reference point to allow estimates of future cable slippage (as needed).
- Transducer data will be periodically checked against manually measured groundwater levels to identify electronic drift, cable movement, and transducer failure. These checks will occur at least annually, typically during routine site visits.
- Transducer data will be downloaded when water levels are measured. Transducer data will be entered into the regional DMS as soon as possible. Once the transducer data has been successfully downloaded and stored, the data will be deleted or overwritten to ensure adequate ~~data logger~~datalogger memory.
- Desiccant for vented transducers will be replaced as needed, or at least annually, in order to prevent failure of the transducers. Non-vented transducers are preferred for this reason as they do not require routine maintenance.

### ~~5.9.2~~6.7.2 Groundwater Quality Monitoring Protocols

~~Monitoring of g~~Groundwater quality monitoring in the Basin ~~will rely~~relies on existing sampling programs. All public water supply agencies and SWS are responsible by California regulations for sampling and testing groundwater ~~from wells~~ used for drinking water supply.

~~For purposes of GSP implementation, groundwater quality monitoring is required to provide data to assess whether projects and/or management actions implemented to achieve sustainability are degrading groundwater quality (Table 3-1Table 3-1).~~ While specific groundwater sampling protocols vary depending on the constituent and the hydrogeologic context, the protocols contained herein provide guidance which is applied to all groundwater quality sampling:

- All groundwater quality analyses will be performed by laboratories certified under the State Environmental Laboratory Accreditation Program.
- Prior to sampling, the sampler will contact the laboratory(s) to schedule sample analysis, obtain appropriate sample containers, and clarify any sample holding times or sample preservation requirements. Laboratory(s) must be able to provide a calibration curve for the desired analyte and are instructed to use reporting limits equal to or less than the applicable data quality objectives, regional water quality objectives, or screening levels.

- Each well used for groundwater quality monitoring will have a unique identifier (ID). This ID will be written on the well housing or the well casing (if not there already) to avoid confusion.
- Sample containers will be labeled prior to sample collection if possible. The sample label will include the sample ID, sample date and time, sample personnel, sample location, preservative used, analyte, and analytical method.
- Prior to any sampling, the sampler will clean the sampling port and/or sampling equipment so that it is free of any contaminants and also decontaminate sampling equipment between sampling locations to avoid cross-contamination between samples. Cleaning should be conducted using a phosphate-free detergent, such as Alconox® or Liquinox®, followed by a rinse with distilled, deionized, or purified water.
- In the case of wells with dedicated pumps, samples will be collected at or near the wellhead. Samples will not be collected from storage tanks, at the end of long pipe runs, or after any water treatment. Samples from active extraction wells that are continuously purging may be collected after flushing the sample tap.
- Should monitoring well or inactive extraction well sampling be required, sampling should follow either low-flow or 3 well casing volume sampling methods. Low-flow sampling consists of purging at a low rate less than 0.13 gallons per minute and measuring water quality parameters until they stabilize within a specific range. Low-flow sampling is best suited for wells with short well screens less than 20 feet in length. Three well casing volume sampling will consist of purging 3 standing volumes of water from the well to ensure that the groundwater sample is representative of ambient groundwater and not stagnant water in the well casing. If pumping causes a well to go dry, the condition will be documented, and the well will be allowed to recover to within 90% of the original level prior to sampling. For deep and large casing diameter wells, purging 3 well volumes may not always be applicable, so professional judgment will be practiced for purging and sampling.
- For low-flow and 3 well casing volume sampling protocols, field parameters including dissolved oxygen, electrical conductivity, temperature, oxidation reduction potential and pH may be collected during well purging. Samples should not be collected until these parameters stabilize. Parameters will be considered stabilized at the following ranges for 10 to 15 minutes: dissolved oxygen and oxidation reduction potential, ±10%; temperature and electrical conductivity, ±3%; and pH ±0.2%.
- All field instruments will be calibrated each day of use, cleaned between samples, and evaluated for drift throughout the day of use.
- Samples will be collected under laminar flow conditions if possible (i.e., without turbulence and bubbles). This may require reducing pumping rates prior to sample collection. For

extraction wells, purging at laminar flow rates is not always an option, so professional judgment will be practiced.

- All samples requiring preservation will be preserved as soon as practically possible and filtered appropriately as recommended for the specific constituent.
- Samples will be chilled and maintained at 4 °C to prevent degradation of the sample prior to analysis.
- Samples must be promptly shipped or delivered in person to the appropriate laboratory to avoid exceeding holding times. The sampler will be responsible for providing proper chain of custody documentation for sample delivery.

### ~~5.9.3~~6.7.3 Groundwater Extraction Measurement Protocols

Groundwater extraction volumes are collected to provide data for water demand operations, wellfield management, and estimate extraction relative to the groundwater in storage ~~the GSP water budget~~SMC. ~~Additionally, the volume of groundwater extracted is the metric for the reduction of groundwater in storage sustainability indicator.~~ Municipal SMGWA member agencies measure discharge from their individual extraction wells with calibrated flow meters and totalizers. SVWD and SLVWD also use SCADA systems to monitor and control extraction from individual wells in close to real time. Small water systems report monthly extractions to the County of Santa Cruz on an annual basis. ~~t~~The ~~amount~~ volume of water extracted for private ~~domestic~~ use ~~will be~~ is estimated ~~based on the number of rural parcels with domestic wells, approximate population counts for people using domestic wells for water supply, and per connection water use estimates from small water systems that are metered~~as discussed in Section 6.3.1.

### 6.7.4 Other~~Streamflow~~ Monitoring Protocols

Other monitoring protocols only apply to streamflow measurements, as monitoring of GDEs and subsidence are satellite-based methods and the climate monitoring is performed by SVWD and SLVWD using established weather stations.

#### ~~5.9.3.1~~6.7.4.1 Stream Gage Measurements

Stream stage and discharge measurements are collected by SMGWA cooperating agencies to monitor streamflow interaction related to groundwater extractions, monitor stream conditions related to fish habitat, and help preserve other beneficial uses of surface water. The Big Trees gage on the San Lorenzo is operated and monitored by the USGS according to procedures outlined by USGS (1982).

Surface water is most easily measured using a stream gage and stilling well system, which requires development of a ratings curve between stream stage and total discharge. Several

measurements of discharge at a variety of stream stages are taken to develop an accurate ratings curve. This relationship is sometimes developed with assistance from Acoustic Doppler Current Profilers. Following development of an accurate ratings curve, streamflow is evaluated on a frequent basis using a stilling well and pressure transducer.

The following stream gage monitoring protocols will be followed:

- Streamflow gages within the basin are equipped with a staff plate and pressure transducer(s), housed in a stilling well.
- Most of the gages are equipped with non-vented pressure transducers, which measure pressure, temperature, and specific conductance and are usually set to log at 15-minute intervals. All transducer installations follow manufacturer specifications for installation, calibration, data logging intervals, battery life, and anticipated life expectancy. Non-vented pressure transducers are properly corrected for natural barometric pressure changes. See Section 6.7.1.2 for pressure transducer installation protocol.
- Streamflow measurements are regularly made at ga~~u~~ging locations following the methods established by the Federal Interagency Sedimentation Program. All field measurements are documented by date in station observers' logs, which are included with data submittals.
- Streamflow velocities are measured using a bucket-wheel meter, either a full-size Type AA ("Price"), bucket-wheel current meters, or a 60% scale smaller meter ("pygmy meter"). Flow meters must meet and exceed the required calibration test of that type of meter prior to measuring flow.
  - Measurements of streamflow are taken at a variety of stream stages to develop an accurate rating curve, which establishes the relationship between stream stage and total discharge. The rating curve is used to create a continuous record of flow from the record of water depth collected by the pressure transducers.

#### ~~5.9.3.2~~6.7.4.2 Stream Accretion

Additional stream accretion monitoring is not currently planned in the Basin; however ~~T~~to ensure consistency with previous accretion studies, any ~~additional~~ future studies will follow the general protocol described below:

- Streamflow measurements and velocities will be collected per the protocols described in the Section above. To increase accuracy for the accretion studies, 30 or more "verticals," or discrete velocity measurements are typically collected across each stream transect.
- Streamflow velocities are measured using a bucket-wheel meter, either a full-size Type AA ("Price"), bucket-wheel current meters, or a 60% scale smaller meter ("pygmy meter"). For low flow stream discharge (less than 50 gallons per minute), measurements

are taken using a bag with graduated cylinder or bucket. Flow from seeps is measured with a bucket and stopwatch or Ziploc bag and graduated cylinder where appropriate.

- Specific Conductance is measured with a calibrated specific conductance meter at field temperature and at 25 °C. Specific conductance is measured in the center of flow in the stream profile.

- Water quality samples, such as nitrate and phosphate, are collected in Polyethylene bottles. Each bottle and cap are triple rinsed at the site before sample collection. Each sampling team will collect at least 1 field duplicate per day. Samples are stored in a cooler with ice and kept at or below 4° C. Samples and the chain-of-custody forms are delivered to a state-certified laboratory at the end of the sampling day.

- All field measurements are documented by date in station observers' logs, which are included with data submittals.

## ~~5.10 Climate Monitoring Protocols~~

## ~~5.11 The SLVWD and SVWD both use weather stations manufactured by Davis Instruments. Instrument models include Vantage Pro and Vantage Pro2. The rain sensor is a self-emptying tipping bucket, with each tip occurring after 0.01 inches of rain. District staff operate and maintain the stations according to the user manual: https://www.davisinstruments.com/product_documents/weather/manuals/07395-333_IM-6322C-6334.pdf~~

## ~~5.12~~6.8 Data Management System

A regional DMS ~~is~~has been developed ~~used~~ to compile and manage the large quantities of data required ~~by the GSP~~collected by the SMGWA. ~~A~~The regional DMS ~~has been~~was ~~developed~~is used jointly by the member agencies of the SMGWA and Santa Cruz Mid-County Groundwater Agency (MGA). The DMS platform is WISKI (Water Information Systems by Kisters) developed by KISTERS North America. ~~WISKI is also the DMS used by Soquel Creek Water District and the City of Santa Cruz Water Department for their own monitoring and operational purposes.~~

~~The DMS has been developed specifically to support water resource management that meets requirements outlined by the DWR for GSAs and can act as a regional platform for data management and access to data. It includes the following elements:~~

- ~~Data repository and storage~~
- ~~Data uploading using file importers~~
- ~~Data quality assurance (QA) and control (QC) measures and features~~
- ~~Management of multiple levels of user access with accessibility controls to ensure confidential data entered by one agency is not available to other agencies unless it relates to one of the GSAs~~
- ~~Analytical and customizable reporting tools for time series and tabular data~~
- ~~Capacity to accommodate system modifications and expansion to incorporate additional geographic areas or additional datasets~~
- ~~Conformity with and enforcement of metadata standards~~
- ~~Audit tracking options for particular data sets (i.e., a record of changes to a data set by a named user, when changes were made and what was changed)~~
- ~~Potential for web portal options~~
- ~~Migration of historical data into DMS~~

~~Complete end-user and technical support staff training is provided by Kisters. Under an annual support and maintenance agreement, ongoing support services and training are accessible to all end-users and IT staff.~~

The costs for development of the DMS ~~is~~ were funded with assistance from a ~~83% by the~~ Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Sustainable Groundwater Planning Grant Program), administered by DWR. ~~, and 27% by the member agencies of both GSAs.~~ Ongoing maintenance costs will be shared by ~~the member agencies of~~ both GSAs. ~~Details on estimated cost to the SMGWA member agencies over the next 5 years are provided in Section 5 on Plan Implementation.~~

Cooperating agencies ~~will be~~are required to upload groundwater level data to the DMS twice a year ~~quarter~~ using ~~simple~~ tools developed by KISTERS for that purpose. These data are required for reporting to the SGMA portal and are also used to report on basin conditions for the Annual Reports required to be submitted to DWR by April 1 of each year following the SMGWA's adoption of the GSP. Each of the submitting agencies are responsible for QA/QC of their data, and barometric compensation and correction of ~~data logger~~datalogger records prior to upload to the DMS.

~~**5.13** Apart from groundwater level data, other data stored in the DMS include groundwater quality, streamflow stage and flow rate, GDE observations, rainfall, and groundwater extraction data. These data will also be uploaded by cooperating agencies twice a year prior to the SGMA required uploads to the SGMA portal before January 1 and July 1 of each year.~~

## 5.146.9 Assessment and Improvement of Monitoring Network

The monitoring networks will continue to be evaluated and refined as conditions change during GSP implementation. The following sections describe recent monitoring network improvements, the current remaining data gaps, and how they networks may be improved in the future during GSP implementation.

### 5.14.16.9.1 Groundwater Level Monitoring Improvements

There are areas of the Basin where groundwater is being used, but there are no historical or current groundwater level data. These are areas where monitoring network improvements are needed as soon as possible. Data gap areas identified include: 1) communities where there are many private domestic wells pumping from either the Santa Margarita Sandstone or Monterey Formation; 2) deep Butano aquifer; and 3) areas where shallow groundwater is connected to surface water and groundwater pumping may be causing depletion of surface water. Nine new monitoring wells are scheduled to be installed in 2022. The exact locations of new monitoring wells have not been finalized yet, but locations will be in the general vicinity described in Table 3-13Table 3-13 and depicted on Figure 3-6Figure 3-6. Installation of the new monitoring wells is funded using Proposition 68 and SMGWA member agency match funds.The 2022 GSP identified 9 groundwater level monitoring data gap areas in 9 areas within the basin. Eight locations were identified in the Santa Margarita aquifer and Monterey Formation were identified that either support private domestic wells or potential interconnected streams. The 2022 GSP noted that improved monitoring in these locations would help evaluate impacts to beneficial users in areas where little historical monitoring has been performed historically. In addition, because there are only two dedicated Butano monitoring wells in the Basin, a ninth well location to be drilled more than 1,000 feet down to the Butano aquifer was identified.

There are also few dedicated Butano monitoring wells near SVWD extraction wells screened in the Lompico and Butano aquifers. The need for a deep Butano aquifer monitoring location needs to be balanced with the cost of installing a monitoring well in the deep confined aquifer.

SMGWA received Proposition 68 funding from DWR to address these data gaps. Sites for 9Nine new monitoring wellssites were selectedchosen in WY2021, shortly after the 2022 GSP was submitted. In WY2022, SMGWA secured site access and permits for 8 of the sites.In WY2022, SMGWA acquired site access, developed technical specifications for well construction, prepared public bid documents, and coordinated well permits for 8 of the sites. SMGWA was unable to find a suitable location for a Monterey Formation monitoring well on Weston Road in the northern concentrated domestic well use portion of the Basin where there is concentrated private well use. A Butano aquifer monitoring site was selected but the well could not be drilled due to the cost of drilling to that depth.

In WY2023, SMGWA installed 7 monitoring wells in the Santa Margarita aquifer and Monterey Formation (i.e., SMGWA-2 through -8 shown on **Error! Reference source not found.**; M&A, 2023). The wells ~~were~~are equipped with dataloggers for frequent groundwater level measurement.

In WY2024, the County of Santa Cruz identified a private domestic well owner in the Weston Road area that will allow County staff to collect semi-annual groundwater level measurements to fill that data gap. ~~This well filled the data gap identified in the GSP where a well installation was not feasible.~~

Additional existing monitoring ~~locations~~wells were ~~also~~ incorporated into the RMP ~~existing~~monitoring networks that were either not identified or ~~were being~~ underutilized in the 2022 GSP. ~~Several groundwater level monitoring wells , including~~ SLVWD Pasatiempo #3, SVWD AB303 MW-2 and SVWD AB303 MW-3A ~~,~~ were ~~not identified as~~promoted to RMPs ~~in the GSP.~~because ~~These wells~~they are completed in principal aquifers, ~~and~~ have long-term, reliable groundwater level records, and are representative of Basin groundwater conditions. ~~These existing wells were added to the RMP network to improve groundwater level monitoring coverage without the need to install new wells.~~

The RMP network was also updated to reduce ~~potential~~ influences from extraction well operations on groundwater level measurements. SLVWD Olympia #3, which was identified as an RMP in the GSP, is an active municipal supply well. ~~SLVWD Olympia #3~~ and is replaced as an RMP with nearby inactive SLVWD Olympia #11~~1 as an RMP. Olympia #1 is an inactive supply well located near Olympia #3 and~~, ~~is~~ screened in the same aquifer. The Lompico/Butano SVWD #15 monitoring well is too close to two SVWD supply wells: the new SVWD Sucinto supply well on the same property and ~~monitoring well is located on the same property as the new SVWD Sucinto supply well and also~~ nearby SVWD Orchard well~~responds to pumping at nearby SVWD Orchard~~. Th~~is~~e monitoring well is no longer an RMP because it cannot provide static groundwater data ~~because~~as the nearby supply wells are almost always in service~~no longer provides useful data for monitoring static groundwater conditions as these wells are almost always in service~~.

SMGWA and/or SVWD still plans to install a deeper Butano aquifer monitoring well to address a data gap identified in the 2022 GSP. On September 26, 2023, SMGWA requested direct assistance from the DWR's TSS program to install this well, but has yet to receive a response on ~~hear~~ whether this request will be fulfilled.

~~Table 3-13. Rationale for Proposed New Monitoring Well Locations~~

| ~~Location Type~~ | ~~Aquifer~~ | ~~General Location~~ | ~~Purpose~~ |
|---|---|---|---|
| ~~Monitoring in Areas of Concentrated Private Domestic Pumping~~ | ~~Santa Margarita~~ | ~~Near Ruins Creek (Ruins Creek on Figure 3-6Figure 3-6)~~ | ~~Address a data gap in the aquifer where there is no historical groundwater level data~~ |
| | ~~Monterey~~ | ~~At the headwaters of Mackenzie Creek (Weston Road on Figure 3-6Figure 3-6)~~ | ~~Collect data from an area with a high concentration of private domestic pumping and no records of historical groundwater levels~~ |
| | ~~Monterey~~ | ~~Northwest of Basin, near Love Creek (Smith Creek on Figure 3-6Figure 3-6)~~ | ~~Collect data from an area with a high concentration of private domestic pumping and no records of historical groundwater levels~~ |
| ~~Deep Butano Sandstone~~ | ~~Butano~~ | ~~In the vicinity of SVWD Orchard and #3B extraction wells which are screened in both the Lompico and Butano aquifers (Polo Ranch Road on Figure 3-6Figure 3-6)~~ | ~~Establish a monitoring well screened only in the Butano aquifer near SVWD extraction wells~~ |
| ~~Shallow wells to Monitor Surface Water / Groundwater Interactions~~ | ~~Santa Margarita~~ | ~~Bean Creek, downstream of Mackenzie Creek~~ | ~~Collect groundwater data near a portion of Bean Creek that periodically runs dry in summer months~~ |
| | ~~Santa Margarita~~ | ~~Bean Creek, near its confluence with Ruins/ Lockhart Creek (Nelson Road/Lockhart Gulch on Figure 3-6Figure 3-6)~~ | ~~Monitor an area that has a high concentration of private domestic pumping and is the location where Bean Creek flow resurfaces when the upgradient reach is dry~~ |
| | ~~Santa Margarita~~ | ~~Zayante Creek, above confluence with Bean Creek (Bahr Drive on Figure 3-6Figure 3-6)~~ | ~~Monitor an area where groundwater seeps out of the valley side and into Zayante Creek~~ |
| | ~~Santa Margarita~~ | ~~Newell Creek, between SLVWD Quail Hollow #8 extraction well and lower Newell Creek (Glen Arbor Road on Figure 3-6Figure 3-6)~~ | ~~Monitor groundwater levels in the Quail Hollow subarea~~ |
| | ~~Monterey~~ | ~~Bean Creek, next to an existing stream gage and slightly downstream of the Lockhart Gulch confluence (near SV4-MW on Figure 3-6Figure 3-6)~~ | ~~Establish a correlation between groundwater and surface water levels in an area downgradient to a high concentration of private domestic users~~ |

#### ~~*5.14.1.1.1* Monitoring in Areas of Concentrated Private Domestic Pumping~~

~~**5.14.2 A large proportion of private well owners pump from either the very productive Santa Margarita aquifer or the considerably less productive Monterey Formation. Monitoring both aquifers is critical to understanding the collective impact of individual private wells on GDEs, as well as the vulnerability of private well owners to groundwater level declines.**~~

~~**5.14.3 Relative to the Monterey Formation, the Santa Margarita Sandstone is less**~~

~~extensive across Basin, so only a single new monitoring well in the Santa Margarita is proposed, near Ruins Creek in an area with no historical groundwater level data (Table 3-13Table 3-13 and Figure 3-6Figure 3-6). There are an additional 4 new Santa Margarita aquifer shallow monitoring wells proposed near private domestic wells to evaluate surface water/groundwater interactions as described in Section 3.3.4.1.3.~~

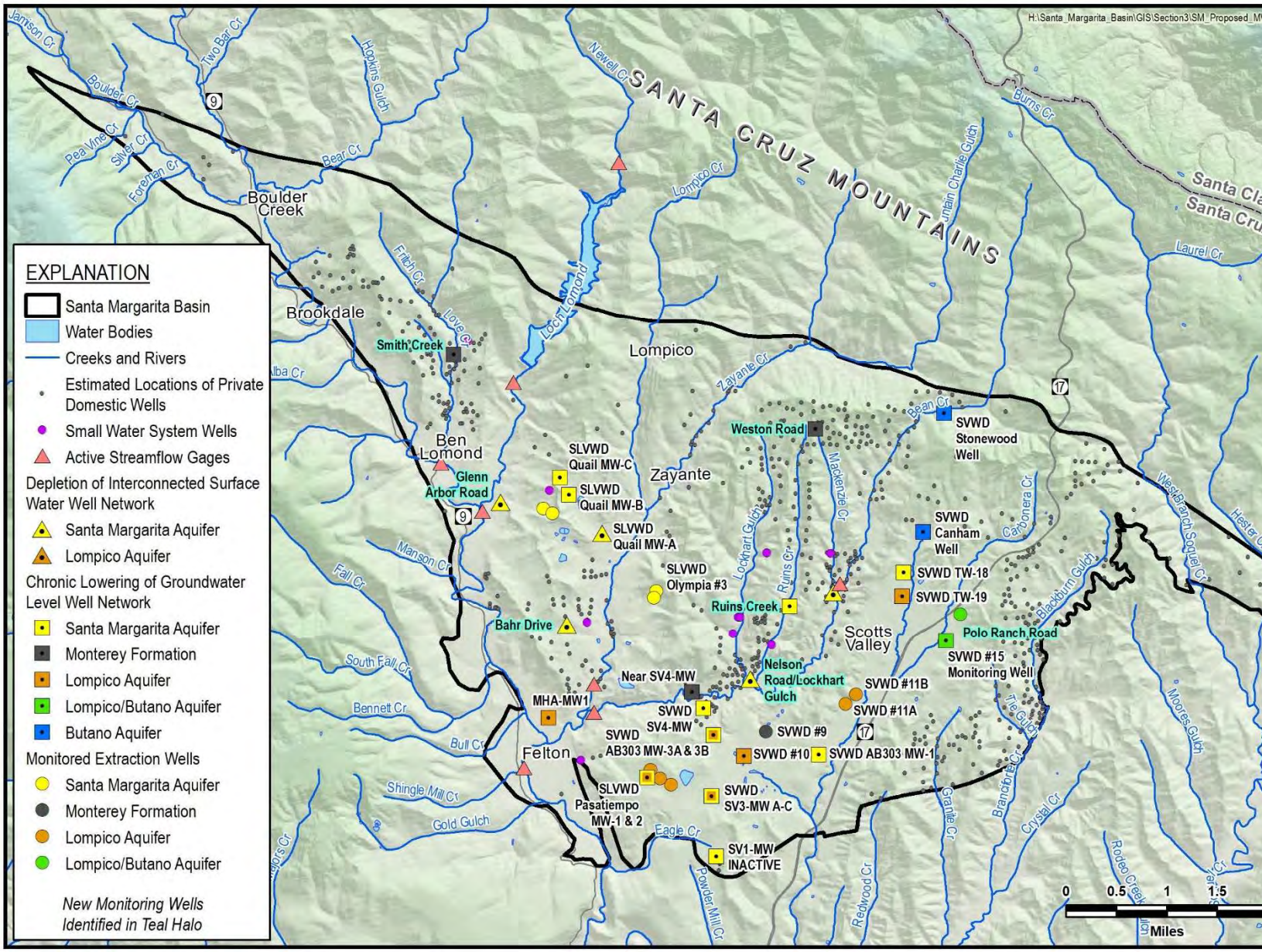



Figure 3-6. New Monitoring Wells (Teal Label) in Relation to Existing Monitoring Features and Private Wells

~~5.14.4 There is only a single groundwater level monitoring well located in the Monterey Formation within the Basin. Although not a principal aquifer, many private domestic wells extract their supply from the Monterey Formation because it is the only aquifer available to them. The largest concentrations of private domestic wells in the Monterey Formation are located where it crops out in the northwestern and northern parts of the Basin. Given that there are no long-term records of the groundwater levels in these areas, it is proposed to install 2 new monitoring wells. One well is near Love Creek and a second near the headwaters of Mackenzie Creek (Table 3-13Table 3-13 and Figure 3-6Figure 3-6) in order to better understand how pumping and direct recharge effect groundwater levels.~~

~~*5.14.4.1.1* Groundwater Levels in the Butano Aquifer~~

~~5.14.5 Groundwater level data from the Butano aquifer is limited because there are currently only 2 monitoring wells screened exclusively in the aquifer. Two municipal extraction wells and 1 monitoring well screened the Butano aquifer, are also screened in the Lompico aquifer. The 2 monitoring wells (Canham and Stonewood) screened exclusively in the Butano aquifer are located in northern Scotts Valley fairly distant from the municipal pumping center at SVWD's #3B and Orchard wells (Figure 3-1Figure 3-1). A well dedicated to monitoring groundwater elevation in the Butano aquifer near these municipal wells (Figure 3-6Figure 3-6) is necessary to further understand groundwater level responses to pumping and recharge in this poorly understood aquifer.~~

~~*5.14.5.1.1* Shallow Monitoring Wells to Evaluate Surface Water/Groundwater Interactions~~

~~5.14.6 As the existing distribution of monitoring wells is largely limited to monitoring wells close to municipal pumping, additional shallow monitoring wells are required to 1) better understand the interactions between groundwater and surface water, 2) become RMPs for the depletion of interconnected surface water sustainability indicator, and 3) provide measured groundwater level data to improve simulation of groundwater and surface water interactions in the groundwater model. The 2 existing monitoring wells used as RMPs for the~~

~~depletion of interconnected surface water sustainability indicator are inadequate to represent the entire Basin and it is expected that new shallow monitoring wells will become RMPs after several years of data collection.~~

~~5.14.7 Areas where the existing network should be improved by installation of shallow groundwater monitoring wells are listed in Table 3-13Table 3-13 and locations shown on Figure 3-6Figure 3-6. There are a total of 5 proposed shallow wells: 4 monitoring wells in the Santa Margarita aquifer which contributes the greatest amount of groundwater to surface water in the Basin and 1 in the Lompico Sandstone near where the Lompico aquifer discharges to the San Lorenzo River. The locations of these new monitoring locations, although not yet finalized, are selected specifically to be paired with either existing or soon-to-be installed streamflow gages. The intent is that data from the paired monitoring features will be used to quantify surface water depletions from groundwater pumping.~~

### ~~5.14.8~~6.9.2 Groundwater Extraction Monitoring Improvements

During GSP implementation, the ~~There are no significant monitoring data gaps for groundwater extraction.~~ SMGWA ~~has~~ performed targeted outreach to estimate annual pumping volumes for non-metered non-*de minimis* pumpers, filling a data gap identified in the 2022 GSP. New SVWD water supply wells Grace Way and Sucinto were added for groundwater extraction monitoring. No other improvements were made. ~~Where groundwater extraction is unmetered, assumptions on water usage are used in this GSP to estimate the volume of extractions by private *de minimis* (2 AFY or less) or non-*de minimis* pumpers (more than 2 AFY). SGMA does not authorize GSAs to require metering of *de minimis* extractions, however, non-*de minimis* may be required to be metered by the SMGWA.~~

~~As part of GSP implementation, the SMGWA will initiate a new well metering program requiring measurement and reporting of all non-*de minimis* groundwater extraction greater than 2 AF annually. Groundwater pumpers using more than 2 AFY include the Quail Hollow Quarry, those that pump groundwater for large scale irrigation or to fill landscape ponds, environmental remediation pump and treat operations, and SWS with more than 5 connections. The SWS with more than 5 connections have been metered since 2015. A planned non-*de minimis* metering program is described in more detail in Section 5 on Plan Implementation.~~

### 5.14.96.9.3 Groundwater Quality Monitoring Improvements

Groundwater quality monitoring only includes sampling is conducted routinely in public drinking water supply wells that are routinely sampled to comply with state regulations; therefore., t There are no spatial data gaps New SVWD water supply wells Grace Way and Sucinto were added for groundwater quality monitoring. No other improvements were made. in this network. However, the sampling frequency in some municipal extraction wells is insufficient because specific analytes are only sampled once every 4 years per DDW requirements. Increasing the frequency of groundwater quality sampling will generate current water quality information that can be used to detect degradation of groundwater quality from projects and management actions implemented to achieve the Basin's sustainability goals. SLVWD intends to increase the sampling frequency on the groundwater quality RMP wells for COCs identified in Section 2.2.5.4.

### 5.14.106.9.4 Streamflow Other Monitoring Improvements

As shown on Figure 3-4Figure 3-4 there are currently no active surface water monitoring sites on Carbonera Creek within the Basin. As GDEs have been identified on Carbonera Creek within the Basin (Figure 2-30), streamflow monitoring should be established for potential correlation with nearby groundwater elevations. A new gage on Carbonera Creek will bewas installed to fill a data gap identified in the 2022 GSP. This area was identified as likely GDE habitat due to a cluster of springs and wetland habitat. Through additional data collection, SMGWA determined that this area is not likely groundwater dependent as the saturated groundwater level is deep below the root zone in the closest monitoring wells. The springs on this reach of Carbonera Creek are likely supported by the stream as recharge pools and daylights on the surface of the impermeable Monterey Formation. There are nNo other streamflow monitoring improvements were made or needed in the Basin.

### ~~5.14.11 Representative Monitoring Points~~

~~Representative monitoring points are a subset of the Basin's overall monitoring network where numeric values for SMCs, including minimum thresholds, measurable objectives, and interim milestones, are set. Per the GSP regulations, designation of an RMP must be supported by adequate evidence demonstrating that the site reflects general aquifer conditions in the area.~~

~~Groundwater levels may be used as a proxy for sustainability indicators if the following can be demonstrated:~~

1. ~~Significant correlation exists between groundwater elevations and the sustainability indicators for which groundwater elevation measurements serve as a proxy.~~
2. ~~Measurable objectives established for groundwater elevation include a reasonable margin of operational flexibility taking into consideration the basin setting to avoid undesirable results for the sustainability indicators for which groundwater elevation measurements serve as a proxy.~~

~~Table 3-1Table 3-1 lists the metrics for each of the Basin's applicable sustainability indicators. The SMC for depletion of interconnected surface water sustainability indicator were developed using groundwater levels as a proxy.~~

#### ~~5.14.11.1 Chronic Lowering of Groundwater Level Representative Monitoring Points~~

~~The selection of RMPs used to evaluate compliance with chronic lowering of groundwater level SMC are based on considerations that they:~~

- ~~Have a relatively long-term historical record~~
- ~~Are representative of the aquifer in which they are screened~~
- ~~Are preferably not an extraction well~~

~~Based on an evaluation of spatial well distributions, proximity to groundwater use (both municipal and private use), GDEs, available measured groundwater level data, and groundwater level trends, RMPs listed in Table 3-14Table 3-14 are selected as points for assessment of chronic lowering of groundwater sustainability indicator. These wells will be used for long-term monitoring and to compare against SMC established in this GSP. The rationale for selecting each RMP is provided in Table 3-14Table 3-14 and well locations are shown on Figure 3-7Figure 3-7.~~

~~Some or all 9 of the additional monitoring wells being installed in 2022 will be added to the RMP network once several years of data are collected. It is anticipated that the 1st 5-year update~~

~~to the GSP in 2027 will include analysis of the new monitoring well data and recommendations for inclusion as RMPs and associated SMC. Figure 3-7Figure 3-7 includes the location of these potential RMPs in relation to current RMPs, GDEs, DACs, and private domestic wells to show how they fill monitoring data gaps.~~

~~Table 3-14. Representative Monitoring Points for Chronic Lowering of Groundwater Levels~~

| ~~Aquifer~~ | ~~Well Name~~ | ~~Screen Interval (feet below ground)~~ | ~~Rationale~~ |
|---|---|---|---|
| ~~Santa Margarita~~ | ~~SLVWD Quail MW-A~~ | ~~38 – 88~~ | ~~Upgradient of Quail Hollow municipal wells, 1,600 feet from Zayante Creek, in an wells. Also, a depletion of interconnected surface water RMP due to shallow scre creek.~~ |
| | ~~SLVWD Quail MW-B~~ | ~~95 – 195~~ | ~~24-year record that is representative of nearby pumping wells SLVWD Quail Holl overlaps with Quail Hollow #4A and just above Quail Hollow #5A (Figure 3-8Figu~~ |
| | ~~*SLVWD Olympia #3*~~ | ~~230 – 300~~ | ~~No dedicated monitoring wells in this area so an extraction well is the only option screened shallower than Olympia #2 and for a greater thickness of the aquifer~~ |
| | ~~SLVWD Pasatiempo MW-2~~ | ~~280 – 340~~ | ~~30-year record in an area with historical Santa Margarita aquifer pumping. Weste monitoring well south of Bean Creek.~~ |
| | ~~SVWD TW-18~~ | ~~285 – 345~~ | ~~Northernmost monitoring well screened in the Santa Margarita aquifer~~ |
| | ~~SVWD SV4-MW~~ | ~~50 – 60~~ | ~~Also, a depletion of interconnected surface water RMP due to shallow screen inte Representative of AB303 MW-3B (Figure 3-9Figure 3-9).~~ |
| ~~Monterey~~ | ~~SVWD #9~~ | ~~155 – 195, 315 – 365~~ | ~~Only well screened in Monterey Formation with a long-term record that has a dee that has not gone dry~~ |
| ~~Lompico~~ | ~~SLVWD Pasatiempo MW-1~~ | ~~600 – 660~~ | ~~Representative of aquifer from which nearby extraction wells pump: Mount Herm Pasatiempo #5A, #7 and #8 (**Figure 3-10**Figure 3-10).~~ |
| | ~~SVWD #10~~ | ~~190 – 220~~ | ~~Representative of AB303 MW-2 and AB303 MW-3A (Figure 3-11Figure 3-11).~~ |
| | ~~*SVWD #11A*~~ | ~~399 – 419, 459 – 469, 495 – 515~~ | ~~No dedicated monitoring wells in this area so an extraction well is the only option screened similarly (Figure 3-12Figure 3-12).~~ |
| | ~~SVWD TW-19~~ | ~~960 – 1,050~~ | ~~Northernmost Lompico monitoring well~~ |
| ~~Lompico/ Butano~~ | ~~SVWD #15 Monitoring Well~~ | ~~700 – 1,100~~ | ~~Possibly convert to Butano only monitoring well. On the same site as pumping we **influenced by pumping**~~ |
| ~~Butano~~ | ~~SVWD Stonewood Well~~ | ~~799 – 859~~ | ~~Northernmost Butano aquifer monitoring well in an area with private domestic pu~~ |
| | ~~SVWD Canham Well~~ | ~~1,281 – 1,381~~ | ~~Closest Butano monitoring well to SVWD pumping in the Butano aquifer~~ |

~~Well names in italics are active extraction wells~~

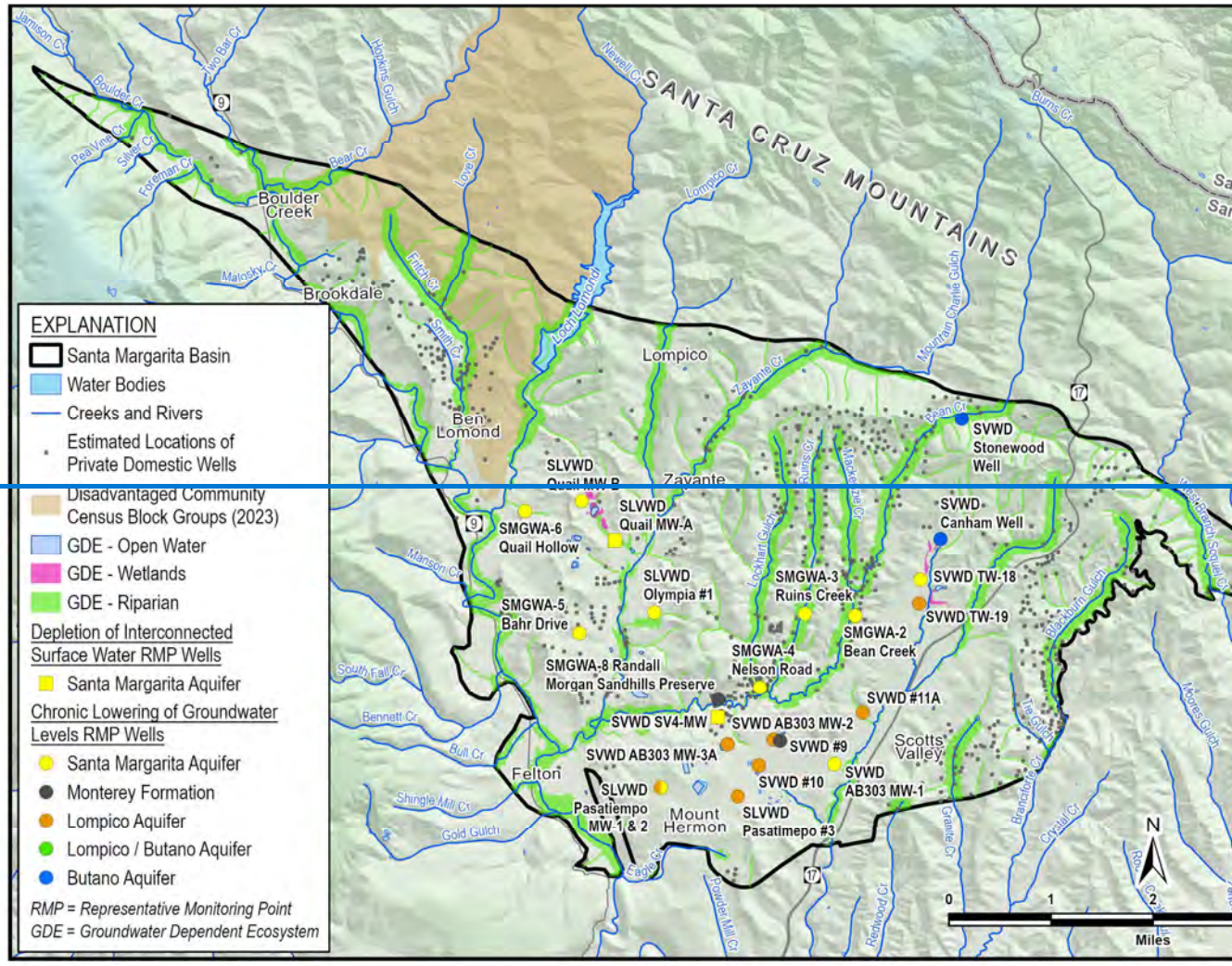
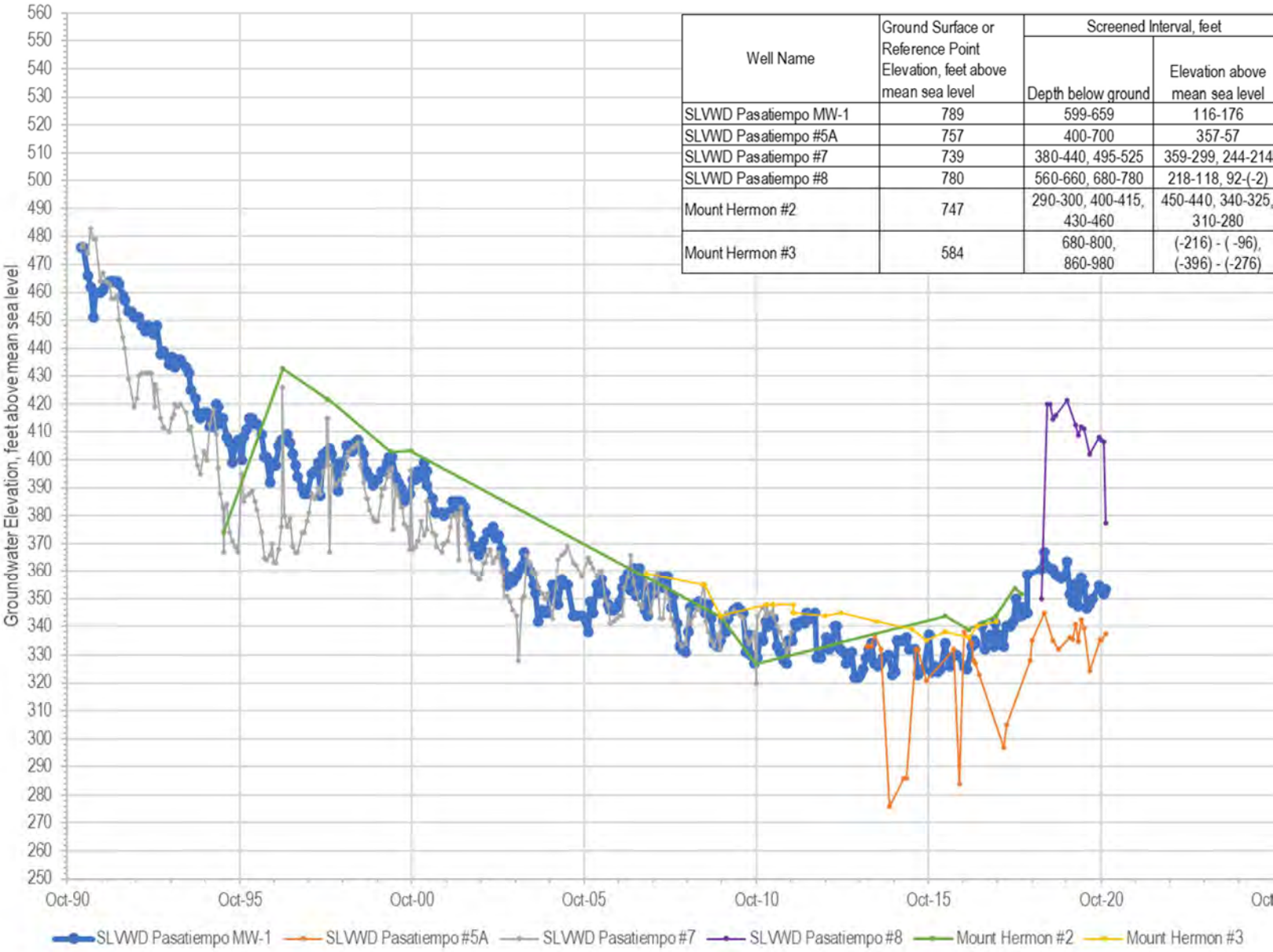



Figure 3-7. Representative Monitoring Points for Groundwater Levels

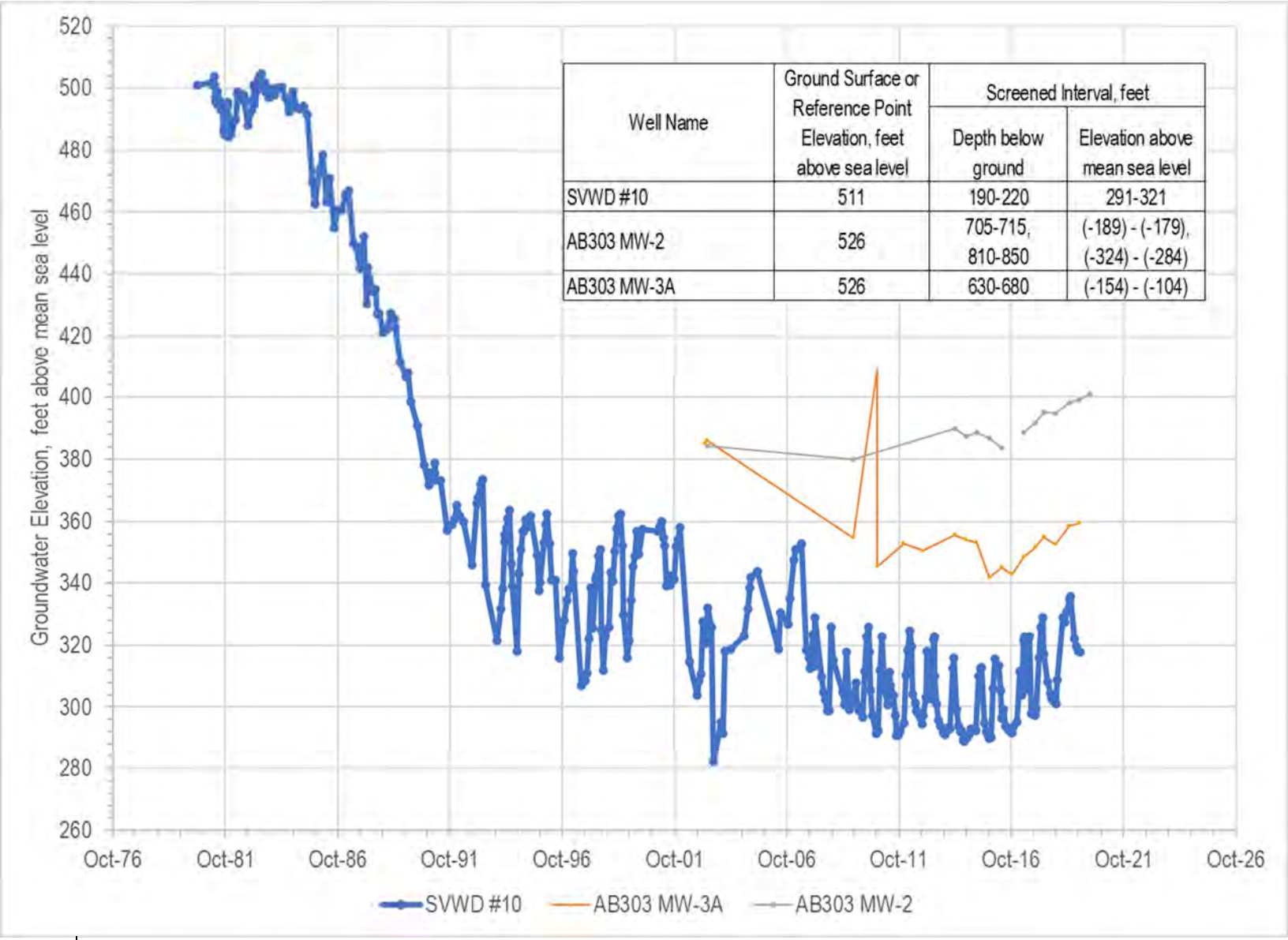



| Well Name | Ground Surface or Reference Point Elevation, feet above mean sea level | Screened Interval, feet | |
|---|---|---|---|
| | | Depth below ground | Elevation above mean sea level |
| SLVWD Pasatiempo MW-1 | 789 | 599-659 | 116-176 |
| SLVWD Pasatiempo #5A | 757 | 400-700 | 357-57 |
| SLVWD Pasatiempo #7 | 739 | 380-440, 495-525 | 359-299, 244-214 |
| SLVWD Pasatiempo #8 | 780 | 560-660, 680-780 | 218-118, 92-(-2) |
| Mount Hermon #2 | 747 | 290-300, 400-415, 430-460 | 450-440, 340-325, 310-280 |
| Mount Hermon #3 | 584 | 680-800, 860-980 | (-216) - ( -96), (-396) - (-276) |

~~Figure 3-8. Hydrographs Showing Groundwater Elevations in Nearby Wells Relative to Representative Monitoring Point SLVWD Quail MW-B~~

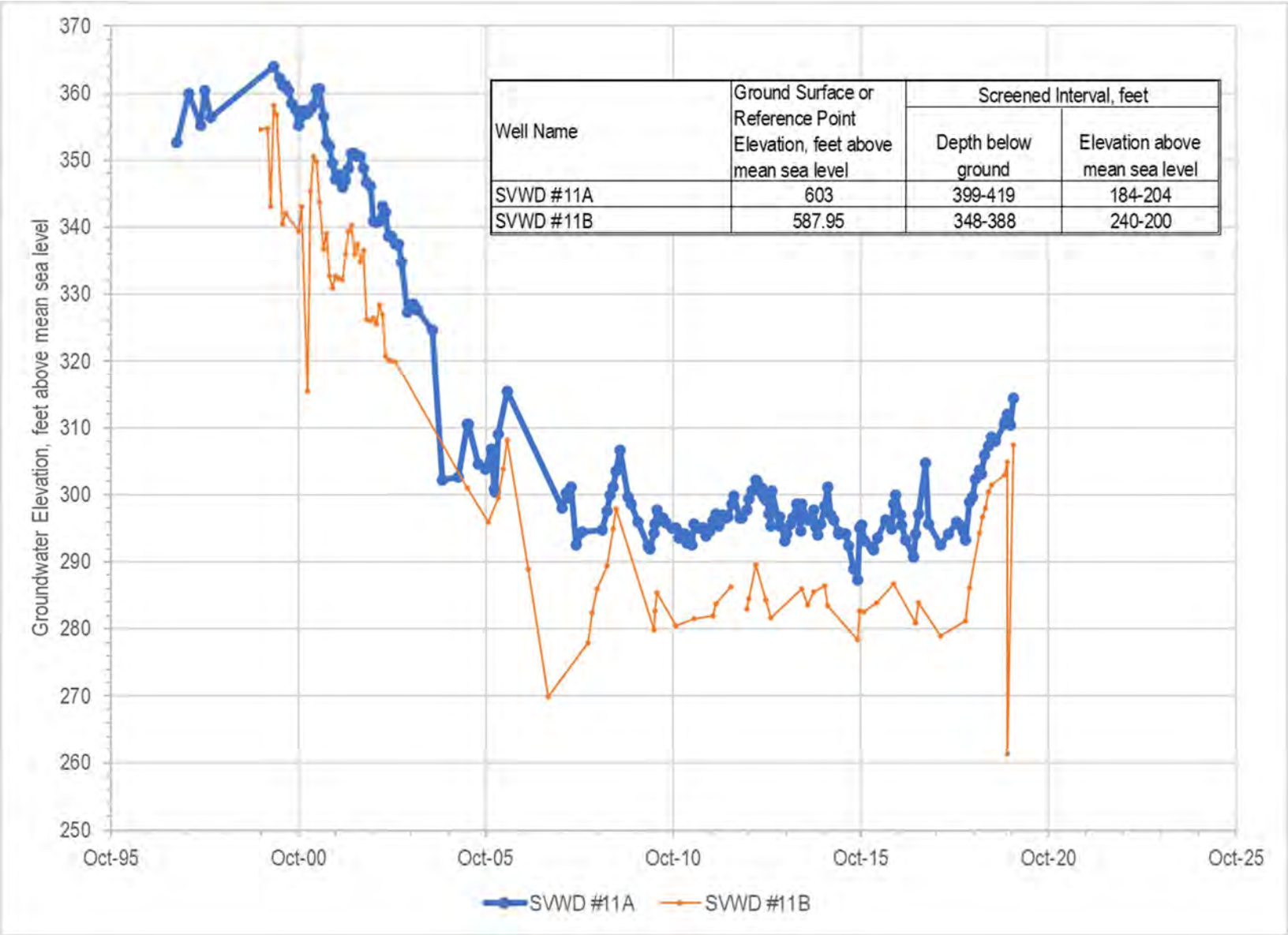
~~Figure 3-9. Hydrographs Showing Groundwater Elevation in Nearby Well Relative to Representative Monitoring Point SVWD SV4-MW~~

~~Figure 3-10. Hydrographs Showing Groundwater Elevations in Nearby Wells Relative to Representative Monitoring Point SLVWD Pasatiempo MW-1~~




| Well Name | Ground Surface or Reference Point Elevation, feet above sea level | Screened Interval, feet | |
|---|---|---|---|
| | | Depth below ground | Elevation above mean sea level |
| SVWD #10 | 511 | 190-220 | 291-321 |
| AB303 MW-2 | 526 | 705-715, 810-850 | (-189) - (-179), (-324) - (-284) |
| AB303 MW-3A | 526 | 630-680 | (-154) - (-104) |

~~Figure 3-11. Hydrographs Showing Nearby Groundwater Elevations in Nearby Wells Relative to Representative Monitoring Point SVWD #10~~




| Well Name | Ground Surface or Reference Point Elevation, feet above mean sea level | Screened Interval, feet | |
|---|---|---|---|
| | | Depth below ground | Elevation above mean sea level |
| SVWD #11A | 603 | 399-419 | 184-204 |
| SVWD #11B | 587.95 | 348-388 | 240-200 |

~~Figure 3-12. Hydrographs Showing Groundwater Elevation in Nearby Well Relative to Representative Monitoring Point SVWD #11A~~

#### ~~5.14.11.2 Reduction of Groundwater in Storage Representative Monitoring Points~~

~~The RMPs for reduction in groundwater storage consist of all municipal and private extraction wells where groundwater extraction is measured or estimated. These include metered public water supply and SWS wells and unmetered private uses such as domestic, quarry operations, pond filling, and landscape irrigation. The metered RMP wells for reduction in groundwater storage are summarized in Table 3-4Table 3-4 and shown on Figure 3-2Figure 3-2.~~

#### ~~5.14.11.3 Degraded Groundwater Quality Representative Monitoring Points~~

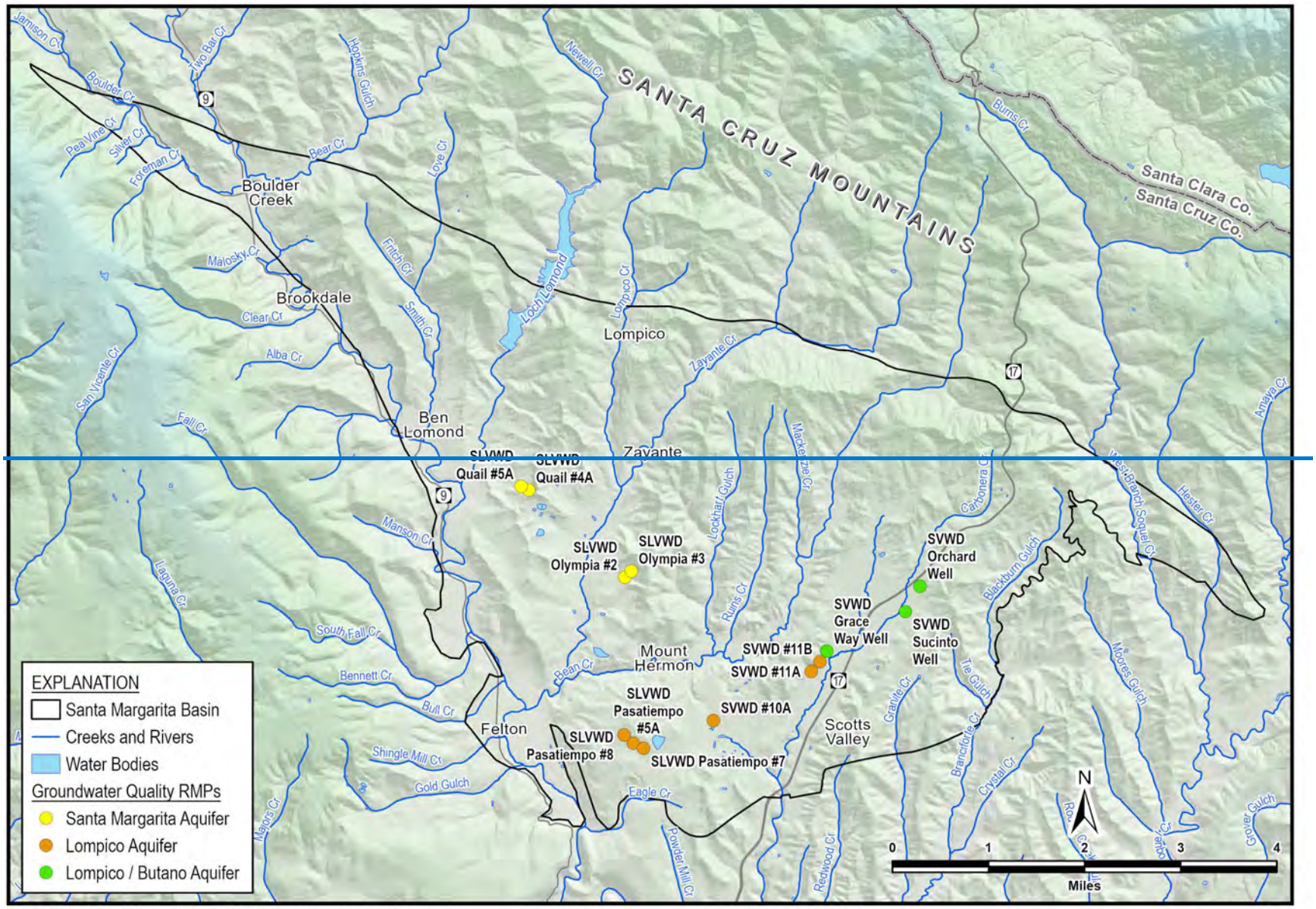
~~The RMPs used to evaluate groundwater quality compared to degraded groundwater quality SMC are based on the criteria that they are:~~

- ~~Regularly sampled at least annually~~
- ~~Representative of the aquifer in which they are screened~~
- ~~Located in areas where GSP related projects and management actions are likely to influence groundwater conditions~~

~~The above criteria were used to narrow the water quality RMPs to the active municipal extraction wells listed in Table 3-15Table 3-15 and shown on Figure 3-13Figure 3-13.~~

~~Table 3-15. Representative Monitoring Points for Degraded Groundwater Quality~~

| ~~Aquifer~~ | ~~Well Name~~ | ~~Screen Interval (feet below ground)~~ |
|---|---|---|
| ~~Santa Margarita~~ | ~~SLVWD Quail Hollow #5A~~ | ~~124-164~~ |
| | ~~SLVWD Olympia #3~~ | ~~230-300~~ |
| ~~Monterey~~ | ~~SVWD #9~~ | ~~155-195, 315-355~~ |
| ~~Lompico~~ | ~~SLVWD Pasatiempo #7~~ | ~~380-440, 495-525~~ |
| | ~~SVWD #10A~~ | ~~280-380, 400-450~~ |
| | ~~SVWD #11A~~ | ~~399-419, 459-469, 495-515~~ |
| | ~~SVWD #11B~~ | ~~348-388, 423-468, 500-515~~ |
| ~~Lompico/Butano~~ | ~~SVWD #3B~~ | ~~700-720, 880-1,050, 1,180-1,370, 1,400-1,670~~ |
| | ~~SVWD Orchard Well~~ | ~~705-784, 805-1,063, 1,084-1,455~~ |


SANTA CRUZ MOUNTAINS
Santa Clara Co.
Santa Cruz Co.
Boulder Creek
Brookdale
Lompico
Ben Lomond
Zayante
Felton
Mount Hermon
Scotts Valley
SLVWD Quail #5A
SLVWD Quail #4A
SLVWD Olympia #2
SLVWD Olympia #3
SVWD Orchard Well
SVWD Grace Way Well
SVWD Sucinto Well
SVWD #11B
SVWD #11A
SVWD #10A
SLVWD Pasatiempo #5A
SLVWD Pasatiempo #8
SLVWD Pasatiempo #7
EXPLANATION
Santa Margarita Basin
Creeks and Rivers
Water Bodies
Groundwater Quality RMPs
Santa Margarita Aquifer
Lompico Aquifer
Lompico / Butano Aquifer
N
0
1
2
3
4
Miles

~~Figure 3-13. Representative Monitoring Points for Groundwater Quality~~

~~SLVWD is required to sample their extraction wells less frequent than annually for some COCs (Table 3-6Table 3-6); therefore, a single RMP for each of the 3 clusters of extraction wells in the Quail Hollow, Olympia, and Pasatiempo areas was selected for future increased sampling frequency on an annual basis for the COCs listed in the GSP. SLVWD extraction well water quality RMPs are Quail Hollow #5A, Olympia #3, and Pasatiempo #7. These specific wells are representative of aquifer conditions in nearby extraction wells as they are screened in the same aquifer and show similar groundwater quality trends. The wells selected either had the highest concentration in the well cluster of the COCs identified in Section 2.2.5.4, or if data were similar, had the longest sampling record in the well cluster.~~

#### ~~5.14.11.4 Depletion of Interconnected Surface Water Monitoring Representative Monitoring Points~~

~~Direct streamflow measurements cannot be used because depletion of surface water by groundwater pumping is a fraction of the other factors influencing streamflow, such as precipitation and runoff, evapotranspiration, diversions, and natural groundwater / surface water interactions creeks. The GSP regulations allow for the use of groundwater elevations as a proxy for assessing the volume or rate of surface water depletion SMC. To use groundwater elevation as a proxy, there must be significant correlation between groundwater elevations and depletion of surface water. This correlation is demonstrated in Section 3.7.2.1.~~

~~The only existing shallow monitoring wells in the Basin that can be used for depletion of interconnected surface water RMPs are SLVWD Quail MW-A and SVWD SV4 MW (Figure 3-7Figure 3-7). Historically, groundwater levels are measured monthly at SLVWD Quail MW-A and semi-annually at SVWD SV4-MW. SVWD SV4-MW was recently equipped with a datalogger, and SLVWD Quail MW-A will be equipped with a datalogger as part of Proposition 68 grant funds received by the SMGWA. The dataloggers will measure groundwater levels continuously. As a result, SMGWA will have a record of daily groundwater level in these wells.~~

~~Two shallow monitoring wells are not enough locations to represent the Basin's major creeks where there is interconnected surface water and groundwater pumping. Additional shallow monitoring wells are needed to monitor and evaluate the effects of groundwater levels on streamflow where it is connected to surface water. The additional monitoring wells are described in more detail in Section 3.3.4.4~~

# ~~6~~7 SUSTAINABLE MANAGEMENT CRITERIA

This section defines the groundwater conditions that constitute sustainable groundwater management, discusses the process by which the SMGWA characterizes undesirable results (URs), identifies the monitoring networks used to assess conditions, and establishes ~~minimum thresholds and measurable objectives~~MTs and MOs for each applicable sustainability indicator. ~~Undesirable results, minimum thresholds, and measurable objectives together define the SMC and commit the SMGWA to actions that will achieve those conditions. These SGMA specific terms and others are defined in the Glossary.~~

Defining SMC requires significant analysis and scrutiny. This section presents the data and methods used to develop SMC and demonstrates how they influence beneficial uses and users. The SMC are based on currently available data and the application of best available science. As noted in ~~this~~ the 2022 GSP, data gaps existed in the HCM related to ~~the~~ interconnected~~ion~~ ~~of~~ surface water ~~and groundwater,~~ that have been partially addressed and are incorporated in the 2027 GSP Amendment~~. Uncertainty caused by these data gaps was considered when developing the SMC. Due to uncertainty in the HCM, the SMC are considered initial criteria that will be reevaluated and potentially modified in the future as new data becomes available~~.

This section is organized to address all the SGMA regulations regarding SMC. The Sustainability Goal guides development of the SMC and the monitoring networks identified in Section 6 describe~~s~~ the monitoring features used to track progress toward meeting ~~interim milestones and measurable objectives~~MOs and IMs~~ and what data gaps still exist~~. To retain an organized approach, the description of the ~~Monitoring Network and~~ SMCs are grouped by each individual sustainability indicator. Each subsection follows a consistent format that contains the information required by Section §354.22 *et. seq* of the SGMA regulations and outlined in the SMC BMP (DWR, 2017). Each SMC subsection includes a description of how the following SMC were developed:

- Qualitative, locally defined significant and unreasonable conditions
- Quantitative description of undesirable results, including:
    - The criteria defining when and where the effects of the groundwater conditions cause undesirable results based on a quantitative description of the combination of minimum threshold exceedances (§354.26 (b)(2))
    - The potential causes of undesirable results (§354.26 (b)(1))
    - The effects of these undesirable results on the beneficial users and uses (§354.26 (b)(3))
- Quantitative minimum thresholds, including:

- The information and methodology used to develop minimum thresholds (§354.28 (b)(1))
- The relationship between minimum thresholds and the relationship of these minimum thresholds to other sustainability indicators (§354.28 (b)(2))
- The effect of minimum thresholds on neighboring basins (§354.28 (b)(3))
- The effect of minimum thresholds on beneficial uses and users (§354.28 (b)(4))
- How minimum thresholds relate to relevant Federal, State, or local standards (§354.28 (b)(5))
- The method for quantitatively measuring minimum thresholds (§354.28 (b)(6))

- Quantitative measurable objectives, including:
  - The methodology for setting measurable objectives (§354.30)
  - Interim milestones (§354.30 (a), §354.30 (e), §354.34 (g)(3))

## ~~6.1~~7.1 Sustainability Goal

~~Per Section 1 of this GSP, the SMGWA's sustainability goals are to:~~

~~the Basin~~SMGWA's sustainability goal is to achieve and maintain groundwater conditions that support beneficial uses and users and sustain the long-term health of the Basin's community, economy, and environment.

The sustainability goal will be achieved by:

- Monitoring and managing groundwater conditions to meet established sustainable management criteria and striving to achieve measurable objectives to enhance Basin conditions.
  - Maintaining groundwater levels sufficient to protect domestic, municipal, agricultural, and industrial supply wells.
- Maintaining groundwater levels that support streamflow and groundwater dependent ecosystems, where applicable.
- Maintaining groundwater quality for current and future beneficial uses.
- Implementing cost-effective adaptive management strategies, including expanding conjunctive use and drought response measures, to enhance drought resilience and long-term supply reliability.

- ~~Implement the SGMA, which requires the management and use of groundwater in the Basin in a manner that can be maintained during the planning and implementation horizon without causing undesirable results.~~

- ~~Provide a safe and reliable groundwater supply that meets the current and future needs of beneficial users.~~

- ~~Support groundwater sustainability measures and projects that enhance a sustainable and reliable groundwater supply in the Basin, utilizing integrated water management principles by:~~

    - ~~Safeguarding water supply availability for public health and welfare~~

    - ~~Maintaining and enhancing groundwater availability for municipal, private, and industrial users and uses~~

    - ~~Maintaining and enhancing groundwater contributions to streamflow, where beneficial users are dependent upon such contributions (fish, frogs, salamanders, dragonflies etc.)~~

    - ~~Maintaining and enhancing groundwater levels that support groundwater dependent ecosystems~~

    - ~~Maintaining and enhancing groundwater quality for existing and future beneficial uses~~

- ~~Provide for operational flexibility within the Basin by supporting a drought supply reserve that takes into account future climate change.~~

- ~~Plan and implement projects and activities to achieve sustainability that are cost effective and do not place undue financial hardship on the SMGWA, its cooperating agencies, or basin stakeholders. A cost-benefit analysis, taking into consideration financial, social, environmental, and adverse consequences, may be conducted to evaluate whether a project or activity results in undue financial hardship.~~

~~Measures that SMGWA cooperating agencies will take to achieve Basin sustainability are primarily focused on increasing Lompico aquifer groundwater levels in the Mount Hermon / South Scotts Valley area. The most immediate action is to reduce the Basin's water demand through continued water use efficiency programs. If reduced water demand cannot be achieved or is not sufficient to raise groundwater levels, will be to expanded conjunctive use of surface water and groundwater using existing infrastructure is the next option followed . It is likely that this measure will be followed by development construction of new infrastructure to gain access to San Lorenzo Valley Water District's (SLVWD) entitlement of 313 AFY of Loch Lomond water for further conjunctive use opportunities. Combining the 2 projects would potentially provide for a long-term average of 540 AFY of in-lieu recharge by SLVWD and SVWD resting their extraction wells during the wet seasons when surface water is available for conjunctive use.~~

~~Groundwater modeling has demonstrated the combined projects will raise Mount Hermon / South Scotts Valley area Lompico aquifer groundwater levels by 20 to 50 feet and Monterey Formation levels by 20 feet. Additionally, resting SVWD wells extracting from the Butano aquifer may raise Butano aquifer groundwater levels by 20 to 50 feet in the central to northern Scotts Valley areas. The anticipated increases in groundwater levels from 540 AFY of conjunctive use enables the SMGWA to meet its long-term measurable objectives for chronic lowering of groundwater levels, depletion of interconnected surface water, and reduction of groundwater in storage, while having no impact on groundwater quality.~~

~~Larger, more costly projects using either treated surface water or purified wastewater imported from outside the Basin, as described in Section 4, will be evaluated during the first 5 years of GSP implementation. The larger projects will provide the SMGWA cooperating agencies additional water supply resiliency and drought protection, beyond the level likely needed for sustainable management of groundwater in the Basin.~~

## 7.2 Process of Developing Sustainable Management Criteria

To evaluate progress toward sustainability, SMC were established for each sustainability indicator in accordance with SGMA requirements. The SMC were selected and approved by the SMGWA Board through an iterative and public process, starting with the 2022 GSP and being ~~revisited~~reevaluated for the 2027 GSP Amendment. The SMC consist of ~~representative monitoring points (~~RMPs~~)~~, minimum thresholds (MTs), measurable objectives (MOs), interim milestones (IMs), and undesirable results (URs):

- Minimum Threshold (MT): Condition at which significant and unreasonable impacts may occur
- Measurable Objective (MO): Desired condition that provides operational flexibility above the MT
- Interim Milestones (IM): Incremental targets to achieve the MO by the sustainability horizon
    - Undesirable Results (UR): Significant and unreasonable adverse impacts, defined qualitatively and quantified through exceedance of MTs

SMC refinements included in the 2027 GSP Amendment address ~~several shortcomings~~recommended improvements identified by DWR and/~~or~~ SMGWA ~~board and technical consultants~~ through implementation of the 2022 GSP. The amended SMC address data gaps, improve representative monitoring ~~representativeness~~, and align indicators within an integrated SMC framework. The integrated SMC framework establishes fall 2013, pre-SGMA conditions, as a benchmark for basin management. This is a period with historical low groundwater levels in some wells, higher groundwater extraction than post-SGMA timeframe, and therefore likely higher volumes of ISW depletion. Using 2013 as a benchmark is conservative since annual pumping volumes were higher than 2013 in the late 1990s and early 2000s and groundwater levels have been lower pre-2013 in different wells and areas of the Basin.

With the 2027 GSP Amendment, groundwater levels continue to serve as a primary indicator of aquifer response to pumping and recharge, groundwater extraction and storage conditions provide a basin-scale constraint on water use, and ISW depletion is evaluated as a function of broader groundwater conditions rather than localized measurements alone. This integrated framework reflects the conceptual understanding that changes in groundwater levels and storage ultimately control the magnitude and timing of groundwater contributions to surface water systems in the Basin.

### ~~6.1.1 SMGWA Board Involvement~~

~~SMC were developed for the Basin based on historical data and desired future conditions. The SMC decision making process involved guidance by SMGWA staff, stakeholder outreach, and discussion and refinement over multiple SMGWA Board meetings. Prior to discussing SMC for a particular sustainability indicator with the SMGWA Board, Directors were provided background information describing the sustainability indicator including the past and present groundwater conditions associated with it. Discussion during the meeting was facilitated by David Ceppos from Consensus and Collaboration Program at the College of Continuing Education, Sacramento State. Facilitation focused on information sharing, topic understanding, and public participation.~~

~~Once there was comfort in understanding Basin conditions related to the sustainability indicator, the technical consultant described potential options for SMC. First, a statement that identified significant and unreasonable, or unsustainable conditions, was drafted. The statement was revisited multiple times in subsequent Board meetings until the Board was satisfied with the definition.~~

~~The significant and unreasonable conditions statement for each sustainability indicator guided development of the other SMCs, including undesirable results, minimum thresholds, and measurable objectives. Options for each SMC were provided to the SMGWA Board for consideration. This approach was taken so that the Board could understand the relative levels of protectiveness for each indicator before making decisions. Interim milestones were developed based on current conditions, measurable objectives, and future groundwater conditions predicted by the groundwater model and did not have direct SMGWA Board input.~~

~~Meeting summaries and video recordings posted on the SMGWA website reflect the discussions that took place for each sustainability indicator. The SMC were developed over several meetings of the SMGWA Board, which allowed for continual improvements to the criteria. Additionally, opportunities for public comment on the topics being discussed at the SMGWA Board meetings were provided and taken into consideration during development of the SMC.~~

### ~~6.1.2 Surface Water Technical Advisory Group~~

~~Representatives from the following organizations and agencies participated in 2 technical Surface Water TAG meetings to provide their perspectives on the approach for development of depletion of interconnected surface water SMC and identification of GDEs:~~

- ~~Balance Hydrologics (consultant to the SMGWA)~~
- ~~California Department of Fish and Wildlife~~
- ~~California Department of Water Resources~~

- ~~City of Santa Cruz Water Department~~
- ~~County of Santa Cruz Environmental Health~~
- ~~Environmental Defense Fund~~
- ~~Land Trust of Santa Cruz County~~
- ~~Montgomery & Associates (consultant to the SMGWA)~~
- ~~National Marine Fisheries Service (NMFS, formerly NOAA Fisheries)~~
- ~~The Nature Conservancy~~
- ~~Resource Conservation District of Santa Cruz County~~
- ~~San Lorenzo Valley Water District staff~~
- ~~Santa Margarita Groundwater Agency Board (2 directors)~~
- ~~Scotts Valley Water District staff~~
    - ~~U.S. Fish and Wildlife Service~~

~~The 2 meetings, held on August 14, 2020, and February 24, 2021, provided the TAG background information on the hydrogeological setting of the Basin, City of Santa Cruz habitat conservation planning, Santa Cruz County fish monitoring, potential conjunctive use opportunities for SLVWD, water budget, and current understanding of the relationship between surface water and groundwater. Based on the background information available, the technical team shared potential approaches for developing SMC for the depletion of interconnected surface water and plans for GDE monitoring. The TAG was asked to provide specific input on the SMGWA Board's statement of significant and unreasonable, potential SMC approaches, and GDE monitoring plan. Their expert input was considered in the development of SMC and the GDE monitoring plan.~~

## ~~6.2~~7.3 Chronic Lowering of Groundwater Levels Sustainable Management Criteria

Groundwater levels in the Basin fluctuate seasonally and over the long-term. Groundwater level change in the U~~u~~nconfined ~~Santa Margarita~~ aquifer (Santa Margarita Formation) is driven mainly by variations in precipitation, as the aquifer drains quickly during extended dry periods, but is able to ~~fill up~~recover during a wet year. The ~~principal~~ C~~c~~onfined aquifers (Monterey, Lompico, and Butano formations) in the Basin also respond to changes in climate, but the response is muted and slower in comparison to the unconfined Santa Margarita aquifer. These aquifer groups are further described in Section 6.2~~6.2~~.

### 7.3.1 Undesirable Results - Chronic Lowering of Groundwater Levels

Chronic lowering of groundwater levels is considered significant and unreasonable when:

- Fall groundwater elevations in 3 or more RMPs are below the MT for 2 consecutive years in the Unconfined aquifer.
- Fall groundwater elevations in 3 or more RMPs are below the MT for 2 consecutive years in the Confined aquifers.

~~The primary groundwater condition in the Basin that is considered unsustainable to beneficial users is lowered groundwater levels in 2 of the Basin's principal aquifers, the Lompico and Santa Margarita aquifers in the Mount Hermon / South Scotts Valley area. There is a portion of this area where the entire depth of the Santa Margarita aquifer is dewatered due to groundwater level declines of 30 to 40 feet and where there has been a 150- to 200-foot decline in groundwater levels in the Lompico aquifer. Groundwater levels in both Santa Margarita and Lompico aquifers in the Mount Hermon / South Scotts Valley area started to decline as early as the 1970s when the area underwent extensive development. The groundwater level declines were exacerbated by a 10-year drought starting in 1984. During this drought, the Scotts Valley area experienced an average rainfall deficit of 8.6 inches relative to the long-term average annual rainfall of 41.7 inches. Coinciding with climate-driven reduced natural aquifer recharge, water demand in the Basin peaked further exacerbating groundwater conditions.~~

~~Groundwater levels in the Mount Hermon / South Scotts Valley area have stabilized over the past 10 years and even experienced a small amount of recovery due to water use efficiency measures and recycled water use to offset potable demand from the aquifers. The sustainability goal strives to improve groundwater levels in this portion of the Basin and the SMC reflect that.~~

### ~~6.2.1 Significant and Unreasonable Chronic Lowering of Groundwater Levels~~

~~Significant and unreasonable chronic lowering of groundwater levels occurs if lowered levels materially impair groundwater supply, negatively impact beneficial uses, or cause undue financial burden to a significant number of beneficial users.~~

~~In this context, undue financial burden means a cost or financial impact resulting from an action or inaction of the SMGWA or groundwater users in the Basin, that is unwarranted, inappropriate, or excessive and/or rising to a level that is more than necessary, acceptable, or reasonable.~~

### ~~6.2.2 Undesirable Results - Chronic Lowering of Groundwater Levels~~

### ~~6.2.2.1~~7.3.1.1 Criteria for Defining Chronic Lowering of Groundwater Levels Undesirable Results

~~The description of undesirable results from c~~Chronic lowering of groundwater levels undesirable results are quantified as a number and length of time for MT exceedances ~~is based on a quantitative description of a combination of minimum threshold exceedances that~~that would likely ~~-~~cause significant and unreasonable effects in the Basin.

Undesirable results ~~include~~are developed using the following criteria and information~~d~~:

- Knowledge of impacts to groundwater beneficial users during periods when groundwater levels were lowest in the Basin~~.~~
- Understanding ~~H~~how the Basin's aquifers respond to ~~climatic change~~hydrologic conditions in any given year and over multiple years~~s.~~
- Understanding the relationship between groundwater levels and surface water baseflow
    - Maintaining ~~Some level of f~~flexibility for adaptive management ~~avoiding undesirable results that gives the SMGWA and its member agencies an opportunity to implement management actions if there are short-term declines in to raise~~of groundwater levels should impacts occur in a single year~~.~~

When Santa Margarita and Lompico aquifer groundwater levels declined in the Mount Hermon/South Scotts Valley subareas from 1985 through 1994 due to a combination of a 10-year extended drought and increased groundwater use in the area, there were known impacts to human groundwater beneficial users. In the early 1990s, municipal water supply wells screened in the dewatered Santa Margarita aquifer were replaced with wells screened deeper in the Lompico aquifer. Since the South Scotts Valley is supplied municipal water, there were no known significant impacts to individual domestic users of groundwater in this portion of the Basin. Chronically lowered groundwater levels have not occurred in any other areas of the Basin.

The County has records that many shallow private wells less than 100 feet in depth outside of the Scotts Valley area were deepened or replaced in response to declining groundwater levels towards the end of the WY 1987-1994 drought. Since that extended drought there have not been many wells deepened or replaced with deeper wells, including during the WY2012-2015 and WY2020-2022 droughts.

~~Lowering of groundwater levels in the Santa Margarita aquifer in years of drought, although not ideal, are not considered significant and unreasonable if levels can recover (either naturally, by managed recharge, or by reducing pumping). It is anticipated that climate change will cause wetter wet years and drier dry years. Multiple consecutive dry years may lead to groundwater levels falling below historical measured lows (i.e., minimum threshold~~MTs~~).~~

~~The Basin's susceptibility to drought impacts is a challenge that SMGWA and its member agencies continue to address. SLVWD and SVWD routinelycontinually work towards raising groundwater levels to build a drought water supplyreserve in wetter years through conservation, conjunctive use, and other PMAs discussed in Section 8. Maintaining a drought reserve helps ensure groundwater is available to sustain the Basin's water demands through , so that groundwater supply is available to sustain the Basin's water demands in future droughts. SinceAs groundwater levels in the unconfined Santa Margarita aquifer groundwater levels are strongly influenced driven mainly by variations in precipitation, they conditions are expected to can fluctuate significantly between during wet and dry yearsperiods, making the aquifer especially sensitive it particularly susceptible to future drought impacts. Groundwater model simulations under projected climate conditions demonstrate the effects of climate extremes on groundwater levels, including that during wet years, the Santa Margarita aquifer fills up relatively quickly because of its high recharge rate.~~

~~The Basin's confined aquifers, Lompico and Butano, together with the Monterey Formation, do not respond as rapidly to changing climatic conditions as the Santa Margarita aquifer. , so groundwater levels can be managed more effectively by shifting pumping locations, reducing groundwater extraction, or increasing groundwater recharge should isolated lowering of groundwater levels occur.~~

#### ~~6.2.2.2 Numerical Description of Undesirable Results~~

~~Qualitatively, the Basin will be experiencing an UR if groundwater elevations fall below MTs in multiple locations for multiple years. Temporary groundwater levels dropping below the MT, or single locations with MT exceedances, can be managed by shifting operations to reduce pumping in affected areas. Quantitatively, an UR will occur if either of the following conditions are observed:~~

- ~~Unconfined aquifer: Fall groundwater elevations in 3 or more RMPs are below the minimum thresholdMT infor 2 consecutive years.~~
- ~~Confined aquifer: Fall groundwater elevations in 3 or more RMPs are below the minimum thresholdMT infor 2 consecutive yearsSpecific groundwater level conditions that constitute undesirable results for chronic lowering of groundwater levels occur if the groundwater elevation in any RMP falls below the minimum threshold in 2 or more consecutive non-drought years. If an RMP groundwater elevation below its minimum threshold is caused by emergency operational issues or extended droughts, it is not considered an undesirable result.~~
- ~~Per DWR's draft SMC Best Management Practices (DWR, 2017), chronic lowering of groundwater levels due to prolonged drought will not be considered undesirable results:~~

- ~~"Undesirable results are one or more of the following effects: Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods".~~

#### ~~6.2.2.3~~7.3.1.2 Potential Causes of Undesirable Results

Undesirable results may be caused by unsustainable groundwater use resulting in chronic lowering of groundwater levels~~. Temporary lowering of groundwater levels during extended drought are exempted from this. Undesirable results may occur under~~ such as the following conditions:

1. **Changes to Basin Pumping.** If the location and rates of groundwater pumping change as a result of new high-capacity wells, or ~~projects and management actions~~PMAs implemented to improve sustainability and water supply reliability, these changes could result in localized lowering of groundwater levels and changes in groundwater flow directions. Average t~~T~~otal Basin extraction more than the sustainable yield is another potential cause of undesirable results for groundwater levels. ~~Total extractions include those for municipal, small water systems, industrial, private domestic and landscaping, and agricultural uses.~~
2. **Drought.** Groundwater levels could exceed the ~~minimum threshold~~MT for extended periods of time during a prolonged drought. The Santa Margarita aquifer is particularly sensitive to climate and most at risk ~~to~~of experiencing undesirable results during drought. However, the historical groundwater level records show that this unconfined and highly permeable aquifer typically recovers in wet years to pre-drought conditions.

~~2. **Groundwater Recharge**. Capture and transfer of stormwater runoff as part of a project that relies on stormwater to recharge groundwater may potentially result in localized lowered groundwater levels due to loss of recharge.~~

3. **Surface Water Diversions**. Diversion of surface water may result in reduced recharge to groundwater in the upper reaches of the Basin's creeks where losing creek conditions occur. Most creeks in the Basin are currently gaining year-round and surface water diversions are currently small, making this a highly unlikely cause of undesirable results if current groundwater conditions and management practices continue.

#### ~~6.2.2.4~~7.3.1.3 Effects on Beneficial Users and Land Use

Currently, there are no undesirable results ~~to~~ for human beneficial users of groundwater occurring due to chronic lowering of groundwater levels. As described earlier, deeper wells

replaced impacted shallow wells in the 1990's. Those municipal, industrial, agricultural, and domestic users of groundwater have adjusted to the lowered groundwater levels during pre-2012 droughts. Impacts of historical chronic lowering of groundwater levels on environmental groundwater users, such as GDEs and aquatic species is less understood.

If undesirable results from chronic lowering of groundwater levels occur in the future, it will impact beneficial users of groundwater as described in the bullets below. Lowering of groundwater levels will reduce the thickness of saturated aquifer from which wells can pump and may prevent a significant number of water supply wells from pumping the amount of groundwater they have typically used to meet their water needs.

Undesirable results from chronic lowering of groundwater levels can have the following general impacts on beneficial users and land uses:

- **Urban land uses and users**. If groundwater levels fall below municipal supply well pumps, the pump can only be lowered to the point where it reaches the bottom of the well, and then a deeper replacement well needs to be drilled. Lowering the pump or drilling a deeper well in the same location is not a solution as the levels will only continue to drop. Another solution is to move pumping to an unimpacted part of the Basin to meet demands. It is possible that changing extraction to a different ~~groundwater supply source~~location may ~~add~~ stress ~~to those~~ unimpacted parts of the Basin ~~groundwater~~. Other effects on municipal users from lowered groundwater levels is the increased pumping costs due to greater lift required to bring the water to the surface.

- Lowered groundwater levels in both Santa Margarita and Lompico aquifers result in reduced contributions to streamflow and can impact the San Lorenzo Valley Water District, which has flow requirements for surface water diversions on its Felton system. Reduced streamflow could also impact the City of Santa Cruz, a downstream surface water user, especially in light of their efforts to support enhanced streamflow to protect and restore runs of endangered coho salmon and threatened steelhead trout though an HCP adopted in 2025. ~~One result of the City's commitments to providing instream flows for fisheries is that it is working to develop a supplemental water supply to replace supply dedicated to fisheries. Continued loss of baseflows due to lowered groundwater levels in the Santa Margarita and Lompico aquifers incurs significant costs, borne by the City because it increases the amount of supplemental supply that the City needs to develop, so that adequate flows are left in the river to comply with the provisions of the City's HCP.~~

- **Rural residential land uses and users**. Typically, rural residential users have the shallowest wells which makes them more vulnerable to lowered groundwater levels. If groundwater levels decline below the top of well screens or below pump intakes,

landowners may lose access to groundwater and be forced to lower their pumps or drill their well deeper. Additionally, when groundwater levels fall below the top of well screens, this has the potential to cause cascading water in the well. Cascading or falling water is water flowing through preferential pathways above the groundwater table that falls into the well. As it pours into the well it introduces air into the water being pumped thereby causing pump cavitation. This condition may increase the cost to pump, cause physical damage to the well and pump, and potentially degrade groundwater quality within the well due to microbial biofouling. Property values may decline if low groundwater levels cause undesirable results that require residential pumping restrictions, deepening of wells, or connection to a public water system. Some small water systems rely on springs and lowered groundwater levels may dry the springs out.

- **Industrial land uses and users**. Industrial use of groundwater in the Basin is limited to process and dust suppression water at a single remaining sand quarry at Quail Hollow. Chronic lowering of groundwater elevations has the potential to increase pumping costs or reduce access to groundwater for similar reasons listed above for rural residential users.
- **Agricultural land uses and users**. For the very limited agriculture in the Basin, chronic lowering of groundwater elevations has the potential to increase irrigation costs or reduce access to groundwater for similar reasons listed above for rural residential users.

- **Ecological land uses and users**. GDEs have the potential to be impacted directly if groundwater depths decrease below the accessible level for GDE vegetation. Surface water bodies connected to groundwater may also incur reductions in baseflow caused by lowering of groundwater levels. Reduced baseflow may negatively impact portions of the lifecycle of aquatic species. Potential impacts to GDEs and priority species from decreased groundwater levels and interconnected surface water are further described in Section 7.6.1.3.

## ~~6.2.3~~7.3.2 Minimum Thresholds - Chronic Lowering of Groundwater Levels

Section §354.28(c)(1) of the GSP Regulations states that "The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results."

### ~~6.2.3.1~~7.3.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

The ~~minimum thresholds and measurable objectives~~MTs and MOs were established based on evaluation of historical groundwater elevation data ~~collected at~~from the 2022 GSP RMP wells

and ~~projected~~ estimated groundwater levels based on nearby well data or model simulations ~~during the GSP planning and implementation horizon~~for more recently completed RMP wells. Additional information considered included baseflow to support beneficial uses and users given the very positive correlation between groundwater elevations and surface water discussed in Section 4.6.3~~4.6.3~~. Baseflow was represented by the mean daily flow measured on the San Lorenzo River at Big Trees; this was reviewed over a 25-year period from 2001 through 2025. Finally, the restrictions related to the beneficial uses and users described above were considered, including whether diversion restrictions would be triggered based on surface water flows. ~~. Appendix 3A 4A includes hydrographs with historical measured and projected groundwater elevations for all RMP wells.~~

The information reviewed revealed that the month of September is on average the lowest flow month and the most restrictive requirement is that SLVWD cannot divert surface water in its Felton system under Permit #20123 if flows at Big Trees are less than 10 cfs in the month of September. Based on the review of 25 years of baseflow, WY 2013 was identified as a relatively dry year that supported a minimum baseflow greater than 10 cfs through the month of September. Because the diversion restriction below 10 cfs impacts a beneficial user of surface water in the Basin, groundwater elevations from fall 2013, which supported more than the minimum baseflow, were used as the basis for establishing the MT values described below.~~Board discussion on whether historical chronic lowering of groundwater levels during the recent or prior droughts had resulted in diminished supply or impacts to beneficial users. The Board generally agreed in the past lead to general agreement that municipal, industrial, agricultural, and domestic, and ecological users of groundwater either adjusted or were not impacted by to the lowered groundwater levels during past droughts. However, the SMGWA Board expressed that they did not want groundwater levels to fall below historical low levels as this would could cause impacts and undue financial burden to some beneficial groundwater users.~~

### ~~6.2.3.2~~7.3.2.2 Chronic Lowering of Groundwater Level Minimum Thresholds

~~As the SMGWA Board direction on chronic lowering of groundwater levels was that levels should not be allowed to fall below historical low levels, minimum groundwater elevations on record were considered to represent the minimum threshold. The absolute minimum elevation was not used for minimum thresholds because for some RMPs that value appeared anomalous. To treat each well's data consistently without the need to discard seemingly anomalous data, an average of the 5 lowest measured elevations are used to calculate a minimum elevation to use as a minimum threshold. Using this methodology, minimum thresholds for chronic lowering of groundwater levels are the average of the 5 lowest measured groundwater elevations at each RMP.~~The amended MT is the ~~measured~~ fall 2013 groundwater level at each RMP. ~~, which is a~~

~~recent low groundwater levelelevation in many areas of the Basin that still allowed adequate streamflow to meet San Lorenzo River in-stream flow requirements. There are other years in the 1990s and 2000s when Basin extraction was greater that had lower groundwater levels in various aquifers and areas of the Basin.~~ If a measured value is not available for an RMP in 2013, then the level is selected based on a similar nearby well or from the historical Basin Model simulation ~~which also indicates that fall 2013 was a recent low level for many locations~~. ~~Establishing MTs at the recent low levelselevations generally observed across the Basin provides a consistent management target to prevent significant and unreasonable impacts from occurring since the passage of SGMA.~~

MTs for each RMP are summarized in Table 7-1. Hydrographs showing ~~minimum thresholds~~MTs and ~~measurable objectives~~MOs for each RMP are included in Appendix 7A. ~~determineddifferenthistorical elevationselevations from7-1 iinterconnected This is 12 feet higher than t as SMGWA-6 Quail Hollow (7-2)7-3~~

~~Minimum thresholds for each RMP are summarized in Table 3-16Table 3-16. Hydrographs showing minimum thresholds and measurable objectives for each RMP are included in Appendix 3A. Examples from a RMP in the Santa Margarita aquifer and a RMP Lompico aquifer are shown on Figure 3-14Figure 3-14 and Figure 3-15Figure 3-15, respectively.~~

7-1Comparative sUsed 7-2Comparative sUsed 7-3Comparative sUsed Table 7-17-17-1. Minimum Thresholds, Measurable Objectives, and Interim Milestones for Chronic Lowering of Groundwater Levels

| Aquifer Group | Aquifer | Well Name | MT (ft amsl) | MO (ft amsl) | Spring 2025 & 2027 IM (ft amsl) | 2032 IM (ft amsl) | 2037 IM (ft amsl) |
|---|---|---|---|---|---|---|---|
| Unconfined | Santa Margarita | SLVWD Olympia #1 | 349 | 359 | -- | -- | -- |
| | Santa Margarita | SLVWD Pasatiempo MW-2 | 516 | 528 | -- | -- | -- |
| | Santa Margarita | SLVWD Quail MW-A | 413 | 417 | -- | -- | -- |
| | Santa Margarita | SLVWD Quail MW-B | 457 | 470 | 459 | 464 | 468 |
| | Santa Margarita | SMGWA-2 Bean Creek | 392 | 396 | -- | -- | -- |
| | Santa Margarita | SMGWA-3 Ruins Creek | 387 | 393 | -- | -- | -- |
| | Santa Margarita | SMGWA-4 Nelson Road | 345 | 349 | -- | -- | -- |
| | Santa Margarita | SMGWA-5 Bahr Drive | 515 | 528 | -- | -- | -- |
| | Santa Margarita | SMGWA-6 Quail Hollow | 325 | 360 | 338 | 345 | 352 |
| | Santa Margarita | SVWD AB303 MW-1 | 478 | 488 | -- | -- | -- |
| | Santa Margarita | SVWD SV4-MW | 399 | 408 | -- | -- | -- |
| | Santa Margarita | SVWD TW-18 | 469 | 474 | -- | -- | -- |
| Confined | Monterey | SMGWA-8 Randall Morgan Sandhills Preserve | 320 | 325 | -- | -- | -- |
| | Monterey | SVWD #9 | 340 | 346 | -- | -- | -- |
| | Lompico | SLVWD Pasatiempo #3 | 337 | 359 | -- | -- | -- |
| | Lompico | SLVWD Pasatiempo MW-1 | 337 | 372 | -- | -- | -- |
| | Lompico | SVWD #10 | 286 | 335 | -- | -- | -- |
| | Lompico | SVWD #11A | 294 | 317 | -- | -- | -- |
| | Lompico | SVWD AB303 MW-2 | 387 | 400 | -- | -- | -- |
| | Lompico | SVWD AB303 MW-3A | 354 | 361 | -- | -- | -- |
| | Lompico | SVWD TW-19 | 337 | 348 | -- | -- | -- |
| | Butano | SVWD Canham Well | 433 | 451 | 442 | 445 | 448 |
| | Butano | SVWD Stonewood Well | 841 | 845 | -- | -- | -- |

Groundwater Elevation (feet above mean sea level)

| ~~Aquifer~~ | ~~Well Name~~ | ~~Minimum Threshold~~ | ~~Interim Milestone #1 (2027)~~ | ~~Interim Milestone #2 (2032)~~ | ~~Interim Milestone #3 (2037)~~ | ~~Measurable Objective~~ |
|---|---|---|---|---|---|---|
| ~~Santa Margarita~~ | ~~SLVWD Quail MW-B~~ | ~~449~~ | ~~472~~ | ~~472~~ | ~~472~~ | ~~472~~ |
| | ~~SLVWD Olympia #3~~ | ~~302~~ | ~~307~~ | ~~307~~ | ~~307~~ | ~~307~~ |
| | ~~SLVWD Pasatiempo MW-2~~ | ~~498~~ | ~~514~~ | ~~514~~ | ~~514~~ | ~~514~~ |
| | ~~SVWD TW-18~~ | ~~462~~ | ~~471~~ | ~~471~~ | ~~471~~ | ~~471~~ |
| ~~Monterey~~ | ~~SVWD #9~~ | ~~301~~ | ~~340~~ | ~~351~~ | ~~354~~ | ~~358~~ |
| ~~Lompico~~ | ~~SLVWD Pasatiempo MW-1~~ | ~~334~~ | ~~339~~ | ~~353~~ | ~~357~~ | ~~372~~ |
| | ~~SVWD #10~~ | ~~286~~ | ~~302~~ | ~~314~~ | ~~316~~ | ~~322~~ |
| | ~~SVWD #11A~~ | ~~288~~ | ~~299~~ | ~~312~~ | ~~314~~ | ~~317~~ |
| | ~~SVWD TW-19~~ | ~~314~~ | ~~357~~ | ~~371~~ | ~~373~~ | ~~376~~ |
| ~~Lompico/Butano~~ | ~~SVWD #15 Monitoring Well~~ | ~~291~~ | ~~310~~ | ~~328~~ | ~~330~~ | ~~333~~ |
| ~~Butano~~ | ~~SVWD Stonewood Well~~ | ~~836~~ | ~~844~~ | ~~844~~ | ~~844~~ | ~~844~~ |
| | ~~SVWD Canham Well~~ | ~~427~~ | ~~447~~ | ~~461~~ | ~~464~~ | ~~467~~ |

--: Interim milestones are the same as the MO

### ~~6.2.3.3~~7.3.2.3 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

Groundwater level ~~minimum thresholds~~MTs are unique to every RMP. As they are based on historical data or simulation of historical data in newer constructed monitoring wells, they represent actual achievable conditions that will not conflict other RMP ~~minimum thresholds~~MTs.

~~Minimum thresholds for c~~Chronic lowering of groundwater level MTs are ~~selected to~~ integrated with and avoid undesirable results for other sustainability indicators, as described below.

- **Reduction of groundwater in storage**. ~~Minimum thresholds for c~~Chronic lowering of groundwater level MTs~~s~~ do not promote pumping more than the sustainable yield or cause long-term declines of groundwater in storage because they are not lower than historical groundwater elevations. Therefore, ~~minimum thresholds for the~~ chronic lowering of groundwater level MTs~~s sustainability indicator~~ will not result in an exceedance of the reduction of groundwater in storage ~~minimum threshold~~MT.
- **Degraded groundwater quality**. Declines in groundwater elevation may cause wells to draw from different aquifers or hydrogeologic subunits, potentially impacting groundwater quality. ~~Because the minimum threshold is set at the average of 5 lowest historical groundwater elevations, groundwater elevations should not be lower than historical levels. Historical groundwater levels are not believed to have caused d~~Degradation of groundwater quality was not apparent at the ~~F~~fall 2013 groundwater level, and thus chronic lowering of groundwater level ~~minimum threshold~~MTs should not result in exceedances of groundwater quality ~~minimum thresholds~~MTs.
- **Depletion of interconnected surface water**. ~~Minimum thresholds for c~~Chronic lowering of groundwater level MTs do not promote additional pumping or lower groundwater elevations adjacent to interconnected surface water than has historically occurred. Therefore, the chronic lowering of groundwater elevation MTs ~~minimum thresholds~~ will not result in a significant or unreasonable depletion of interconnected surface water.
- **Seawater intrusion**. Not applicable.
    - **Subsidence**. Not applicable.

### ~~6.2.3.4~~7.3.2.4 Effect of Minimum Thresholds on Neighboring Basins

The anticipated effect ~~of minimum thresholds for the~~ chronic lowering of groundwater level MTs ~~sustainability indicator~~ on each of the neighboring basins is addressed below.

**Santa Cruz Mid-County Basin** (critically-overdrafted). There is a relatively impermeable geologic basement high that separates the 2 basins and very limited areas where the Purisima Formation, the largest supply aquifer for Santa Cruz Mid-County Basin, is in direct contact with the principal aquifers of the Santa Margarita Basin. As a result, it is very unlikely that changes in groundwater levels due to ~~projects and management actions~~PMAs in either basin could change hydraulic gradients near the shared basin boundary or affect groundwater level ~~minimum thresholds~~MTs in the neighboring basin.

**Purisima Highlands Subbasin of the Corralitos Basin** (very low priority). The Santa Margarita Basin is hydraulically downgradient from the Purisima Highlands Subbasin, but is separated from it by the Zayante-Vergeles fault zone, which acts as a barrier to groundwater flow. Hence, it is unlikely that groundwater elevations in the Santa Margarita Basin can have an influence on groundwater in the Purisima Highlands Subbasin.

**West Santa Cruz Terrace Basin** (very low priority). The boundary between the Santa Margarita Basin and West Santa Cruz Terrace Basin is located where Tertiary sedimentary rocks that are the principal aquifers in Santa Margarita Basin thin abruptly against basement rocks that are exposed at the surface or are at shallow depth in the subsurface. Groundwater pumping in West Santa Cruz Terrace Basin is mostly from private wells tapping low-yielding Quaternary alluvium and terrace deposits. These Quaternary deposits are not hydrologically connected to similar deposits scattered in small patches in Santa Margarita Basin. The lack of continuity in the Quaternary deposits and thinning of the Santa Margarita Basin aquifers makes it unlikely that groundwater elevations in the Santa Margarita Basin at ~~minimum thresholds~~MTs would cause chronic lowering of groundwater levels in the West Santa Cruz Terrace Basin.

### ~~6.2.3.5~~7.3.2.5 Effects of Minimum Thresholds on Beneficial Users and Land Uses

~~Minimum thresholds for c~~Chronic lowering of groundwater level MTs ~~s~~ are set at the ~~average of the 5 lowest historical minimum elevations~~fall 2013 groundwater ~~level~~elevation~~, which was the recent low level in manymost areas of the Basin~~ in each RMP. Figure 4-47~~Figure 4-47~~ shows that average groundwater levels were higher than the average levels in WY 2014, 2015, and 2016. Because ~~historical~~ lower groundwater levels have not appeared to cause significant and unreasonable conditions when they were lowest late in~~in during~~ the 2012-2015 drought~~the past~~, these levels should continue to support similar beneficial use of groundwater users in the future. The ~~minimum thresholds~~MTs generally benefit beneficial users and land uses in the Basin as outlined in the bullets below.

- **Urban land uses and users**[5]. Maintaining groundwater elevations at or above historical levels will benefit municipal groundwater pumpers by protecting their ability to pump groundwater from existing municipal wells to meet public water supply demands. These elevations support the ability of SLVWD to divert surface water for its Felton system. Additionally, t~~T~~hese elevations support a baseflow that will allow the City of Santa Cruz to divert some surface water from its Tait Street diversion outside the Basin under its 2025 HCP as~~as a user of Basin surface water and implementor of habitat conservation in the San Lorenzo River watershed relies on baseflows to help achieve the Agreed Flows~~ described in Section 2.2.8. ~~If groundwater levels in the Basin do not fall below historical lows, baseflows should remain within the historical range of flows used to determine the Agreed Flows.~~

- **Rural residential land uses and users**[6]. Maintaining groundwater elevations at or above historical levels ~~that for the most part represent low levels~~ during the 2012-2015 drought will benefit most domestic users of groundwater by protecting their ability to pump groundwater from their wells. There were very few reports of dry wells during the 2012-2015 drought and so not allowing levels to fall below those historical low levels will protect a vast majority of private domestic wells. ~~Although most existing domestic wells are deeper than the minimum thresholds, new wells drilled near the RMPs should not have their pumps set at an elevation shallower than the minimum threshold elevation.~~ If groundwater levels fall below ~~minimum thresholds~~MTs in RMPs, shallow private domestic wells ~~near those RMPs shallower than 250 feet~~ may be at risk of being dewatered.

  - **Industrial land uses and users**. Maintaining groundwater elevations at or above historical low levels should benefit industrial land uses and beneficial users by protecting their ability to pump groundwater from industrial wells.

  - **Agricultural land uses and users**. For the very limited agriculture in the Basin, maintaining groundwater elevations at or above historical low levels will benefit agricultural users and land use by protecting their ability to pump groundwater from irrigation wells.

  - **Ecological land uses and users**. Maintaining groundwater elevations at or above ~~historical low levels~~fall 2013 will maintain the very connected nature of groundwater and surface water in parts of the Basin. Baseflows associated with the fall 2013 groundwater elevations would support greater than 10 cfs flow in September. ~~This will protect GDE habitat used by~~This is greater than the 8 cfs minimum flow required on the San Lorenzo River (measured at Santa Cruz) for rearing of priority species in

[5] Urban land users include a small area of a DAC supplied water by SLVWD.

[6] Rural land users include an estimated fewer than 10 DAC residents who depend on private wells for domestic use.

the City of Santa Cruz 2025 HCP. , and generally benefit ecological land uses and users.

#### 6.2.3.67.3.2.6 Relevant Federal, State, or Local Standards

No federal, state, or currently enforced local standards exist for chronic lowering of groundwater elevations.

#### 6.2.3.77.3.2.7 Method for Quantitative Measurement of Minimum Thresholds

Fall Depth to ggroundwater elevations at each RMP will be are compared to directly measured at the RMPs identified in Section 3.3.5.1 for comparison to minimum thresholdsMTs in GSP Annual Reports to evaluate progress towards achieving sustainability. The groundwater level data will be collected in accordance with the monitoring protocols outlined in Section 3.3.2.1 and converted to groundwater elevation by subtracting the measured depth to water from the reference point elevation used to take the depth to water measurement. During GSP implementation, individual groundwater level measurements collected manually and by data loggerdataloggers will be reviewed for quality control and analyzed for minimum threshold exceedances during compilation of GSP annual and 5-year update reports.

### 6.2.47.3.3 Measurable Objectives - Chronic Lowering of Groundwater Levels

MOs are set for each RMP at groundwater elevations that allow for operational flexibility to manage drought or other operational changes and keep groundwater levels above the MTs.

#### 6.2.4.17.3.3.1 Measurable Objectives

Measurable objectives are set for each RMPs at groundwater elevations that reflect where the SMGWA would like groundwater elevations to be in 20 years while considering realistic project implementation and allowing for operational flexibility. The MOs are established at the fall 2006 groundwater levelelevations at each RMP during the spring of 2005 and 2006of and . Fall 2006 was the second of two consecutive wet years, which followed three consecutive normal water years. following a relatively wet decade. Groundwater elevations were at a relatively high level similar to recent wet years like WY 2017, 2018, and 2023. In 2006, San Lorenzo River streamflow supported downstream diversions and met the current City of Santa Cruz HCP in-stream flow requirements for a very wet year of 13.3 cfs, further making this year a good target for Basin groundwater level management. Some MOs are establishedestimated using measured fall groundwater levelselevations infrom a similar year and if the 2006 measured values were not taken or the GSP Model did not provide reasonable or effectiveestimated targets this yearfor that year. To be consistent with minimum thresholds that are mostly based on annual minimum groundwater elevations, measurable objectives are also based on annual minimum groundwater elevations. Hydrographs showing measurable objectives for a Santa Margarita aquifer

~~monitoring well and Lompico aquifer monitoring well are shown on Figure 3-14Figure 3-14 and Figure 3-15Figure 3-15, respectively.~~The MOs are summarized in Table 7-1 and shown on ~~H~~hydrographs for each RMP ~~are included~~ in Appendix ~~3~~7A.

~~Measurable objectives are defined as follows:~~

- ~~The measurable objectives for the Santa Margarita aquifer RMPs are the annual minimum groundwater levels in each well in WY2004.~~
- ~~RMPs located in the Monterey Formation and the Lompico and Butano aquifers are the average annual minimum groundwater elevation measured from 2016 to 2020 plus the projected groundwater elevation increase in annual minimum groundwater elevations simulated to result from implementing a 540 AFY conjunctive use project in the Mount Hermon / South Scotts Valley area.~~

~~Measurable objectives are defined differently in the Santa Margarita aquifer than in the underlying aquifers because of the rapid response of its groundwater levels to changes in precipitation. Absent current undesirable results, with no significant projected improvement in levels from potential projects that target the Lompico aquifer (see Section 4), the measurable objectives are based on groundwater levels observed in a typical year. WY2004 was selected because WY2004 and the 5 prior years (4 normal and 1 dry water year) had an average of 41 inches of precipitation per year, which is similar to the average of 41.7 inches for the period 1947-2020 measured at the El Pueblo Yard in Scotts Valley. Hence, the measurable objective for each RMP in the Santa Margarita aquifer is defined as the annual minimum groundwater elevation measured in WY2004.~~

#### ~~6.2.4.2~~7.3.3.2 Interim Milestones

~~Interim milestones in the Santa Margarita aquifer RMPs are all set equivalent to the measurable objective for the aquifer being the annual minimum WY2004 groundwater elevation because projects and management actions are not predicted to increase groundwater elevations significantly.~~

~~Interim milestones for the confined aquifers are estimated using the expected benefit (positive change in groundwater elevations) from the conjunctive use simulations compared to the baseline. Expected benefits from 2022-2027, 2028-2032, and 2033-2037 are added to the average annual minimum groundwater elevations from 2016-2020. Estimation of interim milestones for the confined aquifers are consistent with the definition of measurable objectives described above that reflects projected rise in groundwater elevations with the implementation of a 540 AFY conjunctive use project~~IMs provide a managed trajectory from current conditions to sustainability at each RMP. If the spring 2025 groundwater level is above the MO, the IMs are

set equal to the MO. If the spring 2025 groundwater level is below the MO the following IMs are calculated:

- 2027 IM is the ~~Spring~~fall 2025 groundwater level
- 2032 IM is 1/3 of the difference between the 2027 IM and the MO
- 2037 IM is 2/3 of the difference between the 2027 IM and MO.
- The~~All~~ ~~interim milestones~~IMs are included in Table 7-1.

## ~~6.3~~7.4 Reduction of Groundwater in Storage Sustainable Management Criteria

~~Since the 1980s, and even possibly starting in the 1960s,~~ Historically, there ~~has~~ was~~been~~ a consistent loss of groundwater stored in the Basin primarily due to overpumping of the Lompico aquifer in the South Scotts Valley area prior to SGMA. However, since SGMA passed in 2015, groundwater in storage has been balanced~~Individual annual increases of groundwater stored in the Basin correlate with either wet years or normal years if the normal year follows a dry year. Historical normal or drier water year types generally result in groundwater lost from storage. After WY2014, cumulative change in storage appears to level out but it is anticipated that below average rainfall from 2018 through 2021 will continue the trend of declining groundwater in storage~~ with losses in dry years offset by gains in wet years (Section 5.3.3).

### ~~6.3.1 Significant and Unreasonable Reduction of Groundwater in Storage~~

~~Based on SMGWA Board input, a significant and unreasonable reduction of groundwater in storage impacts occur for this sustainability indicator s when there is a long-term decline of groundwater in storage, or the volume of groundwater extracted causes undesirable results for any other sustainability indicator.~~

### 7.4.1 Undesirable Results - Reduction of Groundwater in Storage

The reduction of groundwater in storage is considered significant and unreasonable when either of the following occurs:

- Groundwater extraction volumes exceed the MT in the Unconfined aquifer.
- Groundwater extraction volumes exceed the MT in the Confined aquifers.

#### ~~6.3.1.1~~7.4.1.1 Criteria for Defining Undesirable Results

Per GSP Regulations ~~T~~the reduction in storage sustainability indicator is ~~not measured by a change of groundwater in storage. Rather, per the GSP Regulations, the reduction of~~

~~groundwater in storage sustainability indicator is~~ measured by "a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results." (§354.28 (c)(2)). This definition intersects with the definition of sustainable yield described in Section 5.6~~2.2.6.5~~. As described there, Basin-wide groundwater pumping within the sustainable yield does not constitute proof of sustainability. Sustainability under SGMA is only demonstrated by avoiding undesirable results for all sustainability indicators applicable to the Basin. ~~Therefore, undesirable results for reduction of groundwater in storage is total pumping that causes undesirable results in any other indicator. These total pumping amounts for each aquifer representing u~~Undesirable results for the storage indicator are based on predictive model simulations that demonstrate undesirable results for applicable sustainability indicators are avoided. For example, the projected groundwater extraction in specific aquifers does not cause MT exceedances that would ~~result~~ create an undesirable result for chronic lowering of groundwater levels.

#### ~~6.3.1.2 Numerical Description of Undesirable Results~~

~~Undesirable results for reduction of groundwater in storage~~~~this sustainability indicator are defined numerically as groundwater extraction volumes that exceed the reduction in groundwater storage MTs for the unconfined and/or confined aquifers system for 2 consecutive years minimum thresholds in one or more principal aquifers.~~

#### ~~6.3.1.3~~7.4.1.2 Potential Causes of Undesirable Results

~~Undesirable results for reduction of groundwater in storage may occur due to sustained extraction volumes exceeding the MT in the confined or unconfined aquifer system pumping more than the sustainable yield in one or more of the Basin's principal aquifers. Potentially, i~~Increased groundwater extraction may result from urban or agricultural land use expansion or a failure to implement ~~projects and management actions~~PMAs that supplement ~~native groundwater extraction~~ groundwater supply through ~~such as~~ conjunctive use with surface water~~, recycled water, or managed aquifer recharge projects~~. ~~Reduction of groundwater in storage due to~~GSP implementation will improve resiliency by storing groundwater supply in wet years to offset increased groundwater demands in dry years when surface water availability is limited. ~~extended dry conditions is not considered undesirable if extractions and groundwater recharge are managed as necessary to ensure reductions during a period of drought are offset by increased groundwater levels or storage during other periods.~~

#### ~~6.3.1.4~~7.4.1.3 Effects on Beneficial Users and Land Use

~~Undesirable results of reduced~~A reduction of groundwater in storage would impact ~~s~~ beneficial users of groundwater by ~~inducing~~ causing undesirable results for one or more applicable sustainability indicators. Undesirable results ~~can~~ may have the following general impacts on beneficial users and land uses:

- **Urban land uses and users**. Continual reduction of groundwater in storage leads to groundwater elevation decline which may reduce well efficiency, increase associated pumping costs, cause mechanical damage to the well by cavitation, and may lead to groundwater levels falling ~~s~~ below pump intakes or even the bottom of wells. Reduced groundwater in storage decreases contributions to streamflow which may impact~~s~~ GDEs and surface water users, including SLVWD as an in-basin user of surface water and the City of Santa Cruz ~~which is~~as a downstream user of surface water.
- **Rural residential land uses and users**. Groundwater elevation declines associated with reduction of groundwater in storage ~~have the potential to~~may ~~reduce or eliminate~~prevent rural residential access to groundwater~~. Problems associated with declining groundwater elevations below well screens include reduced pump efficiency, mechanical damage to the well (cavitation), and microbial growth~~ due to the same urban impacts described above. Losing access to groundwater would have ~~. These problems have~~ cost ramifications for the individual property owner who may need to repair their pump or drill their well deeper, and to the community at large which may see a decline in property value or require connecting to public water service.
- **Industrial land uses and users**. Industrial use of groundwater in the Basin is limited to process and dust suppression water at 1 remaining sand quarry at Quail Hollow. Groundwater elevation declines associated with reduction of groundwater in storage have the potential to increase pumping costs or reduce access to groundwater for similar reasons listed above for urban and rural residential users.

- **Agricultural land uses and users**. Groundwater elevation declines associated with reduction of groundwater in storage have the potential to increase irrigation costs or reduce access to groundwater for similar reasons listed above for urban and rural residential users.
- **Ecological land uses and users**. GDEs have the potential to be impacted directly if extraction causes groundwater depths to fall below the accessible level for GDE vegetation. Surface water bodies connected to groundwater may also incur reductions in baseflow caused by falling groundwater levels ~~expressing~~ due to reduced groundwater in storage. This may negatively impact portions of aquatic species lifecycles.

### ~~6.3.2~~7.4.2 Minimum Thresholds - Reduction of Groundwater in Storage

The reduction of storage sustainability indicator is not measured by a change in groundwater in storage. Rather, per the GSP Regulations, the reduction in groundwater in storage sustainability indicator is measured by "a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results." (§354.28 (c)(2)).

### 6.3.2.17.4.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

Information used in establishing Minimum thresholds and measurable objectivesMTs and MOs for the reduction of groundwater in storage indicator are included: review of results fromestablished to maintain long term extraction volumes at or below the sustainable yield estimated using the Basin Model and discussed in Section 5.6; review of water year types encountered in the region from WY 1985 through WY 2025; review of actual groundwater extraction and trends in the Basin; and consideration of conjunction use expansion from implementing PMAs.. Based on the review of water years types, aA five-year rolling average will be used to evaluate extraction relative to the MT and MO to allow for annual variability in extraction to allow for 5-year drought periods that have been experienced and support. implementation of ongoing and planned conjunctive use practices.

using a simulation from the Basin Model that projects pumping and climate change through WY2072. Minimum thresholds are developed based on pumping in the baseline model simulation (no projects or management actions implemented), while measurable objectives are based on projected pumping that corresponds with implementing a 540 AFY conjunctive use project to reduce November through April pumping by SLVWD and SVWD in an effort to recover groundwater levels in the Mount Hermon / South Scotts Valley area. The conjunctive use project is described in Sections 4.3.1.2 and 4.3.1.3 and assumptions made in developing the projected model simulation are provided in Appendix 2E.

### 6.3.2.27.4.2.2 Reduction of Groundwater in Storage Minimum Thresholds

The MT for reduction of groundwater in storage is set as a 5-year rolling average not-to-exceed of 750 AFY in the Unconfined aquifer and 2,250 AFY in the Confined aquifers. In the Unconfined aquifer, this value is consistent with current use in the Unconfined aquifer and existing conjunctive use practices. Conjunctive use is not expected to change significantly in the Unconfined aquifer, so the average 5-year extraction of 750 AFY is consistent with current and projected eoperations that result in recent average annual extraction of 700 AFY. The MT of 750 allows for additional extraction over a prolonged period of 5 years that can be offset by reduced extraction in wet and normal years.

In the Confined aquifers, conjunctive use programs will be defined as part of GSP implementation, so the maximum amount of groundwater usage in dry years is yet to be determined. As an estimate for high groundwater usage under future conjunctive use operations, SMGWA reviewed groundwater usage in the last 5 years, which resulted in. The average extraction from the Confined aquifers is of approximately 1,750 AFY. Based on an estimate of the scale of implementing expanded conjunctive use by SLVWD (Section 8.2.1) and SVWD/City of Santa Cruz (Section 8.3.1) groundwater extraction in dry years could increase by about 500 AF. That would result in an MT of 2,250 to accommodate these projects in the future.

As these projects are developed, project proponents ~~would be to~~ will demonstrate how reductions in groundwater extraction in non-dry years would allow the Confined aquifers to operate within their sustainable yield estimate of 1,900 AFY. ~~leading up to the passage of SGMA (WY2010 through 2014). This period represents a greater than 28% decrease from the Basin's peak groundwater extraction in the 5-year period from WY 2001 through 2005 (3,210 AFY compared to 4,492 AFY at peak extraction). The proposed MT values are consistent with the extraction values observed in WY2010 through 2014; these values are supportive of the target baseflows in the 2025 City of Santa Cruz HCP, so SMGWA believes that these MTs are protective of beneficial uses and users Minimum thresholds for the reduction of groundwater in storage indicator are equivalent to aquifer-specific sustainable yield volumes described in Section 2.2.6.5 on sustainable yield. The minimum thresholds are derived from a projected baseline model simulation incorporating climate change and projected pumping that predicts undesirable results will not occur over the GSP planning and implementation horizon of 50 years.~~

~~Groundwater pumping volumes from the baseline simulation are used to estimate sustainable yield and represent minimum thresholds. For all aquifers apart from the Santa Margarita aquifer the long-term period from WY2022-2072 produces relatively constant groundwater in storage, therefore the long-term average pumping over this period is used for the minimum threshold calculation. While change of groundwater in storage in the Santa Margarita aquifer is more variable, groundwater pumping in this aquifer produces near zero cumulative groundwater in storage loss from WY2030-2049, therefore this period is used for the minimum threshold calculation. Given that groundwater pumping in the model is not specifically optimized to avoid undesirable results, it is possible that slightly more pumping than the estimated sustainable yield could avoid future undesirable results. A 5 percent buffer to account for this is added to all minimum threshold calculations to allow for pumping optimization during GSP implementation.~~ Reduction of groundwater in storage ~~minimum thresholds and their relationships to~~ historical, ~~and~~ current, and projected groundwater ~~pumping~~ extraction from the Basin Model, MT, and MO are summarized in Table 5-20, Figure 7-1, and Figure 7-2.

Table 7-2. Reduction of Groundwater in Storage Minimum Thresholds by Aquifer Compared to Historical and Current Pumping

| | ~~Historical Pumping 1985 - 2018~~ | ~~Current Pumping 2010 - 2018~~ | ~~Minimum Threshold~~ | |
|---|---|---|---|---|
| ~~Aquifer~~ | ~~Acre-Feet per Year~~ | | | ~~Minimum Threshold Calculation Based On~~ |

| Aquifer | Extraction Volume (AFY) | | | | |
|---|---|---|---|---|---|
| | Historical (1985 to 2014) | Current (2015 to 2025) | Projected (2026 to 2072) | Minimum Threshold | Measurable Objective |
| ~~Santa Margarita~~Unconfined | 1,100 ~~070~~ | 7~~7~~00 | 700 | ~~850~~750 | 700 |

| | | | | | |
|---|---|---|---|---|---|
| **Aquifer System Total (Santa Margarita Aquifer))** | | | | | |
| *Monterey* | *~~320~~400* | *~~180~~200* | *100* | *~~140~~ --* | *--* |
| *Lompico* | *1,~~770~~800* | *~~1,520~~1,200* | *1,200* | *--~~1,290~~* | *--* |
| *Butano* | *~~530~~600* | *~~480~~500* | *600* | *--~~540~~* | *--* |
| **Confined Aquifer System Total** | **2,800** | **1,900** | **1,900** | **2,250** | **1,900** |
| **Combined Total** | **3,900** | **2,600** | **2,600** | **3,000** | **2,600** |

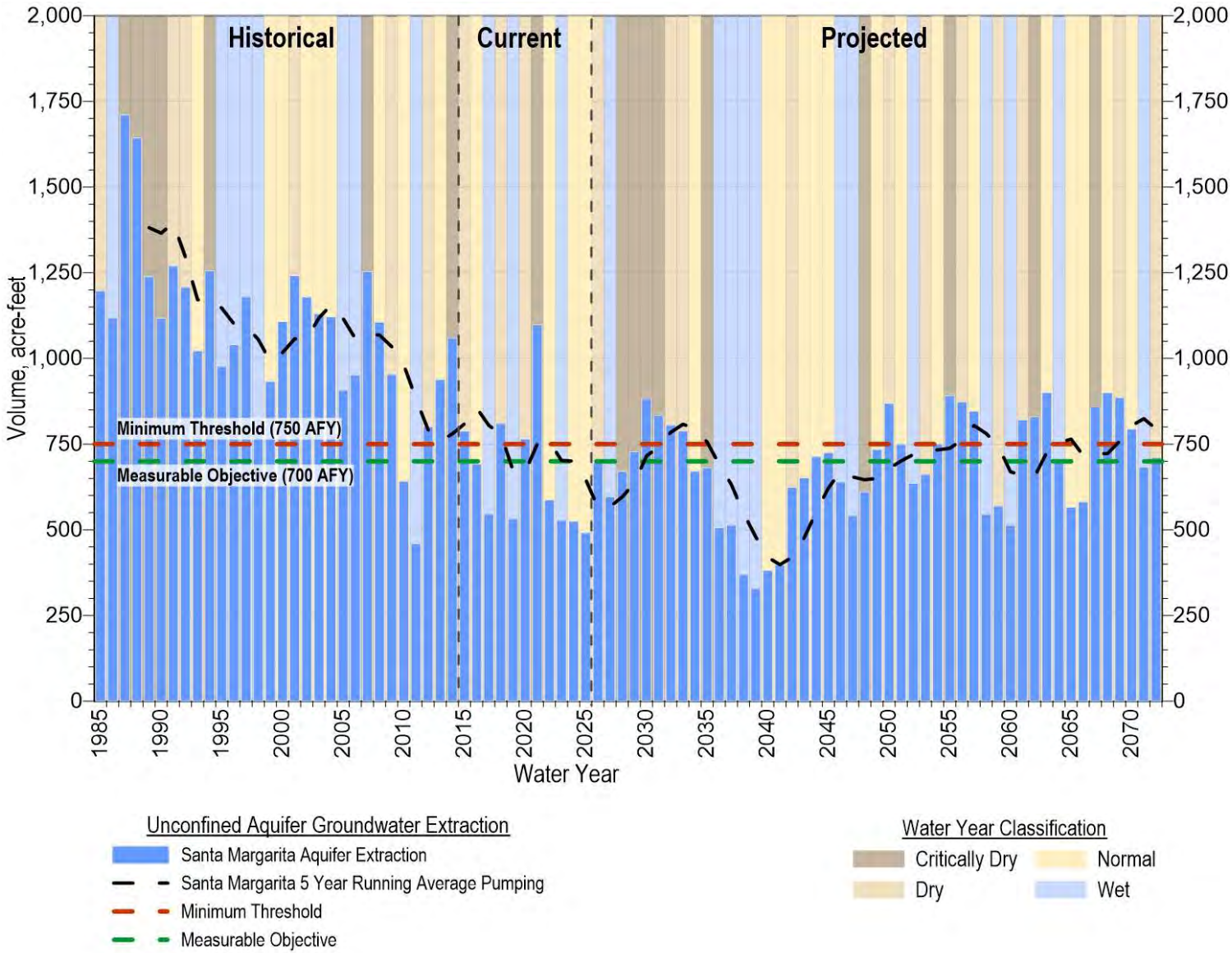

Historical
Current
Projected
Volume, acre-feet
Minimum Threshold (750 AFY)
Measurable Objective (700 AFY)
Water Year
Unconfined Aquifer Groundwater Extraction
Santa Margarita Aquifer Extraction
Santa Margarita 5 Year Running Average Pumping
Minimum Threshold
Measurable Objective
Water Year Classification
Critically Dry
Normal
Dry
Wet

Figure 7-1~~7 17~~. Unconfined Aquifer Historical and Projected Extraction, Minimum Threshold, and Measurable Objective

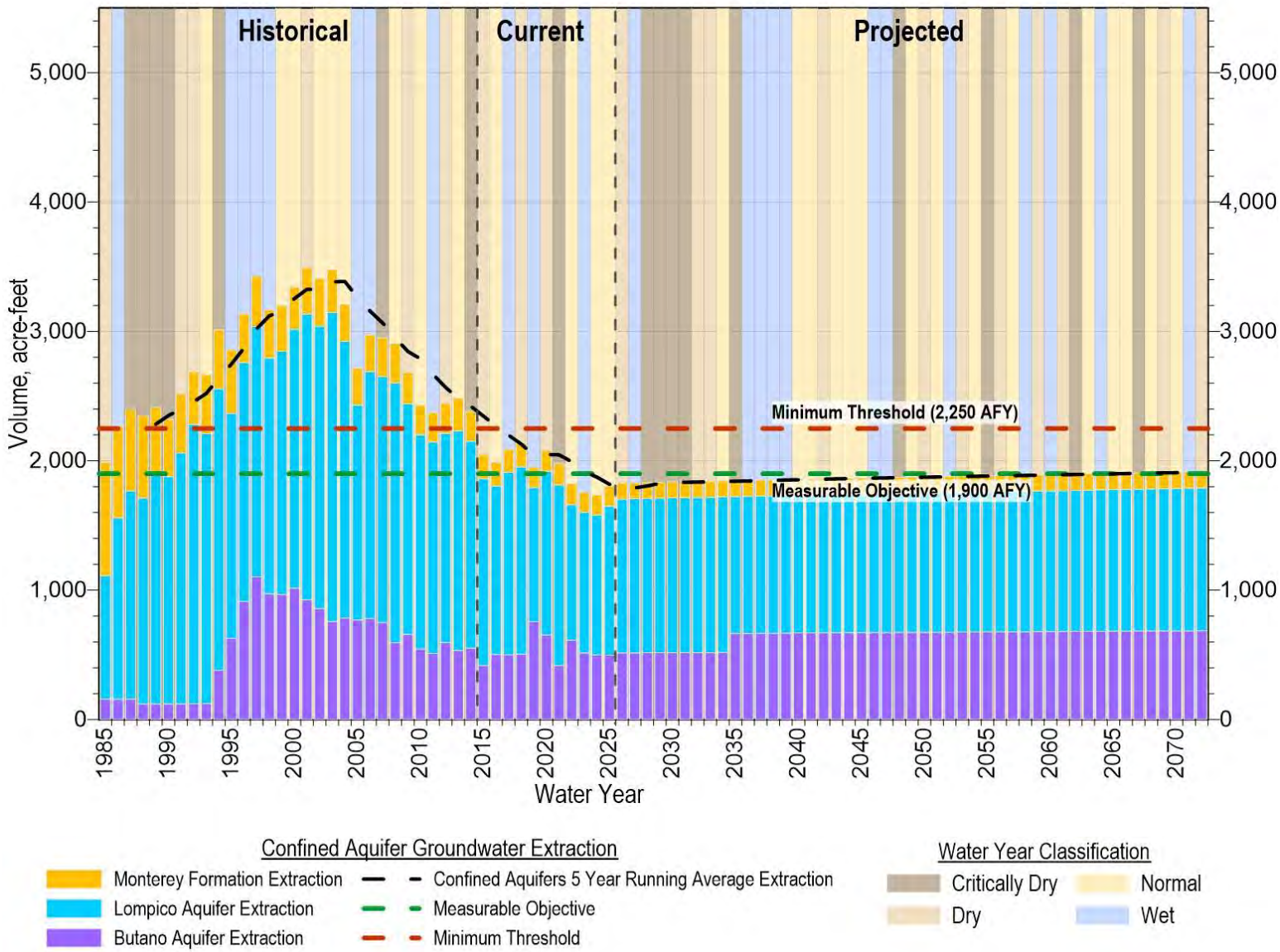

Historical
Current
Projected
Volume, acre-feet
5,000
4,000
3,000
2,000
1,000
0
Minimum Threshold (2,250 AFY)
Measurable Objective (1,900 AFY)
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
Water Year
Confined Aquifer Groundwater Extraction
Monterey Formation Extraction
Lompico Aquifer Extraction
Butano Aquifer Extraction
Confined Aquifers 5 Year Running Average Extraction
Measurable Objective
Minimum Threshold
Water Year Classification
Critically Dry
Normal
Dry
Wet

Figure 7-27 ~~27~~. Confined Aquifer Historical and Projected Extraction, Minimum Threshold, and Measurable Objective

#### ~~6.3.2.3~~7.4.2.3 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

Reduction of groundwater in storage ~~minimum threshold~~MTs can influence other sustainability indicators. However, by design (see Section 7.4.1.1 above), ~~minimum thresholds~~MTs for reduction of groundwater in storage avoid occurrence of undesirable results in other sustainability indicators.

- **Chronic Lowering of Groundwater Levels**. Reduction of groundwater in storage ~~minimum thresholds~~MTs, by definition, prevent pumping in excess of the sustainable yield that would cause chronic lowering of groundwater level undesirable results. Therefore, the reduction of groundwater in storage ~~minimum thresholds~~MTs will not result in an exceedance of the chronic lowering of groundwater levels ~~minimum threshold~~MTs ~~unless the exceedances are short-term conditions in dry conjunctive use recovery periods or pumping distribution in the Basin changes significantly~~.
- **Degraded groundwater quality**. Rising or falling groundwater elevations may cause wells to draw from different aquifers or hydrogeologic subunits, potentially impacting groundwater quality. Historical groundwater levels are not believed to have caused degradation of groundwater quality. Because ~~minimum thresholds~~MTs are set at volumes that avoid undesirable results and should maintain groundwater levels above historical minimum levels, reduction o~~r~~f groundwater in storage ~~minimum thresholds~~MTs should not result in exceedances of groundwater quality ~~minimum thresholds~~MTs.
- **Depletion of interconnected surface water**. Reduction of groundwater in storage ~~minimum thresholds~~MTs do not promote additional pumping or lowering of groundwater elevations adjacent to interconnected surface water and ~~. T~~therefore, ~~the chronic lowering of groundwater elevations minimum thresholds~~ will not result in ~~a~~ significant or unreasonable depletion of interconnected surface water.
  - **Seawater intrusion**. Not applicable.
  - **Subsidence**. Not applicable.

#### ~~6.3.2.4~~7.4.2.4 Effect of Minimum Thresholds on Neighboring Basins

The anticipated effect of the ~~minimum thresholds~~MTs for reduction in groundwater storage on each of the neighboring basins is addressed below.

**Santa Cruz Mid-County Basin** (critically-overdrafted). There is a relatively impermeable basement high that separates the 2 basins and very limited areas where the Purisima Formation, the largest supply aquifer for Santa Cruz Mid-County Basin, is in direct contact with the principal aquifers of the Santa Margarita Basin. As a result, it is very unlikely that changes of groundwater in storage due to ~~projects and management actions~~PMAs in either basin could

change hydraulic gradients near the shared basin boundary or affect ~~minimum thresholds~~MT for the reduction of groundwater in storage in the neighboring basin.

**Purisima Highlands Subbasin of the Corralitos Basin** (very low priority). The Santa Margarita Basin is hydraulically downgradient from the Purisima Highlands Subbasin but is separated from it by the Zayante-Vergeles fault zone, which acts as a barrier to groundwater flow. With a flow barrier between the two basins and a ~~minimum threshold~~MT based on sustainable yield less than historical pumping, it is highly unlikely Santa Margarita Basin pumping ~~at~~ will have a negative influence on groundwater in storage in the Purisima Highlands Subbasin.

**West Santa Cruz Terrace Basin** (very low priority). The boundary between the Santa Margarita Basin and West Santa Cruz Terrace Basin is located where Tertiary sedimentary rocks that ~~are~~ form the principal aquifers in the Santa Margarita Basin thin abruptly against basement rocks that are exposed at the surface or are at shallow depth in the subsurface. Groundwater pumping in West Santa Cruz Terrace Basin is mostly from private wells tapping low-yielding Quaternary alluvium and terrace deposits. These Quaternary deposits are not hydrologically connected to similar deposits scattered in small patches in Santa Margarita Basin. The lack of continuity in the Quaternary deposits and thinning of the Santa Margarita Basin aquifers makes it unlikely that groundwater extraction at ~~minimum thresholds~~MTs in the Santa Margarita Basin would cause a reduction of groundwater in storage in the West Santa Cruz Terrace Basin.

#### ~~6.3.2.5~~7.4.2.5 Effects of Minimum Thresholds on Beneficial Users and Land Uses

The reduction ~~in~~ of groundwater in storage ~~minimum thresholds~~MTs are set at volumes that avoid undesirable results in the other sustainability ~~indicators, and~~indicators and therefore maintain groundwater elevations above ~~historical lows~~their MTs. Since ~~historical~~ groundwater level MTs~~s~~ ~~have not appeared to cause~~are intended to avoid undesirable conditions in the Basin, ~~levels no lower than the historical low~~extraction MTs should continue to support similar beneficial use in the future:

- **Urban land uses and users**. Maintaining available groundwater in storage will benefit municipal groundwater pumpers by protecting their ability to pump groundwater from municipal wells and meet public water supply demands.
- **Rural residential land uses and users**. Maintaining available groundwater in storage will benefit all domestic users of groundwater by protecting their ability to pump groundwater from their wells.
- **Industrial land uses and users**. Maintaining available groundwater in storage will benefit industrial land uses and beneficial users by protecting their ability to pump groundwater from their wells.

- **Agricultural land uses and users**. For the very limited agriculture in the Basin, maintaining available groundwater in storage will benefit those beneficial users and land uses by protecting their ability to pump groundwater from irrigation wells.
- **Ecological land uses and users**. Maintaining groundwater ~~in storage above~~ extraction historical ~~low groundwater~~ levels will preserve groundwater elevation and their respective~~'s~~ connection to surface water in the Basin thereby protecting GDE habitat used by priority species and generally benefit ecological land uses and users.

#### ~~6.3.2.6~~7.4.2.6 Relevant Federal, State, or Local Standards

No federal, state, or currently enforced local standards exist for reduction of groundwater in storage.

#### ~~6.3.2.7~~7.4.2.7 Method for Quantitative Measurement of Minimum Thresholds

Exceedance of ~~minimum thresholds~~MTs for reduction of groundwater in storage will be quantified using metered and estimated groundwater extractions within the Basin. Municipal and small water systems have metered pumping data, while *de minimis* and limited private non-*de minimis* ~~pumping~~ extraction will be estimated.

### ~~6.3.3~~7.4.3 Measurable Objectives - Reduction of Groundwater in Storage

The MO for reduction of groundwater in storage is set as a 5-year rolling average not-to-exceed of 700 AFY in the Unconfined aquifer and 1,900 AFY in the Confined aquifers. ~~Measurable objective~~MO~~s for reduction of groundwater in storage provide quantitative and obtainable goals for volumes of groundwater extracted from each aquifer. Measurable objective~~MOs are equivalent to the sustainable yield, discussed in Section 5.6. Reduction of groundwater in storage historical, current, and projected groundwater extraction relative to the MT and MO are summarized in Table 7-2. ~~.~~Current extraction in the Basin is less than the MO (Figure 7-1; Figure 7-2), therefore interim milestones are not needed to achieve the MO. ~~determined using groundwater pumping projected in a model simulation incorporating a 540 AFY conjunctive use project in the South Scotts Valley area consistent with the calculation of measurable objectives for groundwater levels. Calculations for the measurable objective are consistent with the periods used to calculate minimum thresholds described in 7.4.3.2 above. The measurable objective for the Santa Margarita aquifer uses average conjunctive use simulation pumping from 2030-2049, while the other aquifers use the long-term average from 2022-2072. Table 3-3 summarizes the measurable objectives in comparison to historical and current pumping.~~

~~Table 3-3. Reduction of Groundwater in Storage Measurable Objectives by Aquifer Compared to Historical and Current Pumping~~

| | ~~Historical Pumping~~<br><br>~~1985 – 2018~~ | ~~Current Pumping~~<br><br>~~2010 – 2018~~ | ~~Measurable Objective~~ | |
|---|---|---|---|---|

| ~~Aquifer~~ | ~~Acre-Feet per Year~~ | | | ~~Measurable Objective Calculation Based On~~ |
|---|---|---|---|---|
| ~~Santa Margarita~~ | ~~1,070~~ | ~~770~~ | ~~615~~ | ~~Average conjunctive use simulation pumping between 2030-2049~~ |
| ~~Monterey~~ | ~~320~~ | ~~180~~ | ~~130~~ | ~~Average conjunctive use simulation pumping after 2022~~ |
| ~~Lompico~~ | ~~1,770~~ | ~~1,520~~ | ~~1,000~~ | ~~Average conjunctive use simulation pumping after 2022~~ |
| ~~Butano~~ | ~~530~~ | ~~480~~ | ~~380~~ | ~~Average conjunctive use simulation pumping after 2022~~ |

#### ~~6.3.3.1 Interim Milestones~~

~~Like the measurable objectives for this indicator, interim milestones are derived from pumping included in the projected conjunctive use model simulation. Simulation of conjunctive use begins in WY2025. Therefore, the interim milestones for reduction of groundwater in storage are equivalent to minimum thresholds prior to 2027 and equivalent to measurable objectives from 2027 onward. Interim milestones are summarized in Table 3-4.~~

~~Table 3-4. Reduction of Groundwater in Storage Interim Milestones by Aquifer~~

| | ~~Interim Milestone~~<br><br>~~Prior to 2027~~ | ~~Interim Milestone~~<br><br>~~from 2027 Onward~~ |
|---|---|---|

| ~~Aquifer~~ | ~~Acre-Feet per Year~~ |
|---|---|

| | | |
|---|---|---|
| ~~Santa Margarita~~ | ~~850~~ | ~~615~~ |
| ~~Monterey~~ | ~~140~~ | ~~130~~ |
| ~~Lompico~~ | ~~1,290~~ | ~~1,000~~ |
| ~~Butano~~ | ~~540~~ | ~~380~~ |

## ~~6.4~~7.5 Degraded Water Quality Sustainable Management Criteria

Groundwater in the Basin is generally of good quality and meets primary drinking water standards. However, both naturally occurring and anthropogenic groundwater quality COCs are present in some aquifers and areas, based on local land use and hydrogeologic conditions. The COCs that present the greatest risk to groundwater viability for beneficial use are naturally occurring arsenic and TDS, which are found in both the unconfined and confined aquifers and anthropogenic nitrate from septic system leaching, typically found in the unconfined aquifer. Other constituents that are public health concerns but are only detected sporadically at low concentrations below drinking water standards (~~i.~~e.g., VOCs)~~,~~ or are naturally occurring and managed by water providers prior to distribution (~~i.~~e.g., iron and~~,~~ manganese~~, and others~~) are not considered COCs. These other constituents will be evaluated annually through ~~coordination with SCEH and~~ review of public water supply monitoring results and coordination with SCEH, as discussed in Section 8.2.2. ~~Groundwater in the Basin is generally of good quality and does not regularly exceed primary drinking water standards. However, both naturally occurring and anthropogenic groundwater quality concerns are present in some aquifers and areas. Municipal water suppliers regularly sample and test both raw and treated water sources per state requirements.~~

~~Insert discussion on excluding other COCs here and new PMA.~~

### ~~6.4.1 Significant and Unreasonable Degraded Water Quality~~

~~Significant and unreasonable water quality conditions occur if projects or management actions in support of SGMA degrade groundwater quality is degraded such that it leads to diminished supply, adverse impacts on beneficial uses, or undue financial burden for mitigating such negative impacts. Widespread exceedances of groundwater quality MTs would be significant and unreasonable impactsto many beneficial users and uses.~~

~~In this context, undue financial burden means a cost or financial impact resulting from an action or inaction of the SMGWA or groundwater users in the Basin, that is unwarranted, inappropriate, or excessive and/or rising to a level that is more than is necessary, acceptable, or reasonable.~~

## 7.5.1 Undesirable Results - Degraded Water Quality

~~6.4.2~~ Degraded water quality is considered significant and unreasonable when 3 or more RMPs experience an MT exceedance for the same constituent for 2 consecutive years.

### ~~6.4.2.1~~7.5.1.1 Criteria for Defining Degraded Water Quality Undesirable Results

~~U~~Primary criteria for undesirable results for groundwater quality are the exceedance of drinking water standards or degradation of existing water quality that impacts safe and affordable access to groundwater for beneficial use. An additional criteria for defining degraded water quality for nitrate is the presence of a TMDL for nitrate in the San Lorenzo River of 0.33 mg/L, which is well below the drinking water standard of 10 mg/L. ~~There are s~~~~Several criteria are considered for defining undesirable results for degraded groundwater quality:~~

Some areas of the Basin have naturally high concentrations of constituents ~~pre-dating SGMA~~. In those circumstances, undesirable results are focused on limiting increases from existing concentrations~~There are also some contaminant releases that impact groundwater in isolated areas of the Basin that are being addressed by responsible parties under regulatory program oversight. SMGWA is not responsible for improving groundwater quality, particularly for constituents like iron and manganese that exceed taste and odor thresholds used for secondary drinking standards in numerous wells in the Basin. SMGWA can only be responsible for managing groundwater quality degradation that did not exist prior to SGMA.~~

~~1. Ground~~~~There must be confirmation sampling to prove that a concentration above its minimum threshold is not sampling or laboratory error.~~

~~W~~~~water quality degradation must be caused by groundwater extraction or SMGWA approved projects or management actions implemented as part of this GSP to achieve and maintain sustainability.~~

~~1. There must be confirmation sampling to prove that a concentration above its MT is not sampling or laboratory error.~~

~~Qualitatively, the Basin will be experiencing an undesirable result if the concentrations of TDS, arsenic, or nitrate exceed the MT in multiple locations for multiple years. Groundwater quality exceeding the MT in a single location or year, should be manageable by shifting operations to reduce pumping or modify PMAs being implemented by SMGWA or member agencies.~~

~~2.~~

~~The following conditions do not cause undesirable results as defined in this GSP:~~

2. ~~It is not considered an undesirable result if activities by private individuals or companies mobilize poor quality groundwater or introduce poor quality water or contaminants into the Basin. This is because the undesirable result was not caused by the SMGWA. Although such groundwater quality degradation needs to be addressed, it does not fall under the responsibility of the SMGWA. Per the GSP Regulations, SMGWA is only responsible for its own actions and consequences of implementing the GSP. There are local and state regulatory agencies responsible for enforcing various Acts and policies protecting water resources in the Basin as described in Section 2.1.3.4.6.1 on groundwater contamination cleanup.~~

3. ~~Naturally elevated concentrations already exceeding minimum thresholds are not considered an undesirable result because it was not caused by the SMGWA member or cooperating agencies. Examples of elevated naturally occurring chemical constituents in the Basin are iron, manganese, sulfate, and arsenic. These constituents are discussed in more detail in Section 2.2.5.4.3. Although naturally occurring elevated concentrations are undesirable to users of the water and require treatment to make the water either safe for human health or aesthetically acceptable depending on the constituent, those elevated concentrations are not an undesirable result caused by implementation of the GSP.~~

4. ~~Nitrates introduced into the Santa Margarita aquifer and surface water through wastewater disposal, livestock, fertilizer use, and other sources have been occurring since the lands within the Basin were first developed. County of Santa Cruz Environmental Health is responsible for improving septic tank standards and has been implementing the San Lorenzo Nitrate Management Plan since 1995 to reduce nitrate impacts in the Basin. Since nitrate impacts have been occurring for decades, SMGWA is not responsible for causing them nor mitigating them.~~

#### ~~6.4.2.2 Numerical Description of Undesirable Results~~

~~Undesirable results occur if any of the degraded groundwater quality minimum thresholds are exceeded at RMPs where:~~

- ~~Minimum thresholds have not been exceeded prior to SMGWA approved project(s) or management action(s)~~
- ~~An immediate resampling confirms the exceedance~~

~~The exceedance is caused by SMGWA approved project(s) or management action(s)Quantitatively, an undesirable result will occur if 3 or more RMPs experience a MT exceedance for the same constituent for 2 consecutive years.~~

### ~~6.4.2.3~~7.5.1.2 Potential Causes of Undesirable Results

Groundwater extraction and SMGWA approved projects and management activities may potentially degrade groundwater quality under the following conditions:

- **Changes to Basin Pumping.** If the location and rates of groundwater pumping change as a result of projects implemented or management actions taken under the GSP, these changes could alter hydraulic gradients and cause movement of existing poor-quality groundwater towards a supply well at concentrations that exceed ~~minimum threshold~~MTs.
- **Groundwater Recharge**. Active groundwater recharge through injection wells, Aquifer ~~s~~Storage and~~&~~ Recovery (ASR), ~~-~~or surface spreading could potentially modify groundwater gradients and move existing poor-quality groundwater towards a supply well in concentrations that exceed ~~minimum thresholds~~MTs. Another potential cause of groundwater degradation from recharge by injecting water into the aquifer is mobilization of metals. Introducing surface water ~~or purified wastewater~~ into an aquifer may change the ~~eH or pH~~geochemistry of groundwater in such a way that minerals in the aquifer such as pyrite break down or trace elements are desorbed from clays, thereby releasing iron, manganese, or arsenic into the groundwater. Pilot testing can help understand geochemical impacts an injection or ~~Aquifer storage & Recovery (ASR)~~ ASR project may or may not have before a decision can be made on its feasibility.
- **Recharge of Poor-Quality Water.** Although highly unlikely because of the state's antidegradation policy that requires the project proponent to demonstrate a project will not cause surface water or groundwater degradation, a recharge project could potentially introduce poor quality water or contaminants into the Basin. Recharge of stormwater from an urban area and recharge of wastewater are examples of sources with potential poor-quality water. Recharge water needs to be treated to concentrations that will not cause undesirable results by degrading groundwater or surface water. Using wastewater as a recharge source requires advanced treatment that may include ozonation, membrane filtration, reverse osmosis, and ultraviolet advanced oxidation. Nitrate concentrations introduced by poor-quality recharge water is a concern because increased nitrate concentrations in groundwater may result in increased nitrate in surface water through groundwater's contribution to baseflows. Elevated nitrate in surface water may ~~cause bio~~stimulate biological growth ~~ion~~ in the aquatic ecosystem, depressing dissolved oxygen levels and adversely impacting aquatic biota. It may also result in increased production of organic compounds that can cause taste and odor problems and disinfection byproducts adversely affecting municipal water supply and costs for surface water treatment.

~~SMGWA approved projects and management activities may potentially degrade surface water quality under the following conditions:~~

- **Degraded Groundwater Impacts to Surface Water**: Groundwater in the Basin is highly connected to surface water which means the quality of groundwater influences the quality of surface water. This is evident in the elevated nitrate concentrations in the San Lorenzo River influenced in large part by septic system leaching to groundwater. Users of surface water within the Basin are primarily SLVWD, and to a lesser extent a few private users and small water systems who have water rights. Surface water from the Basin is also used outside of the Basin by the City of Santa Cruz that has appropriative rights to San Lorenzo River water via licenses. These licenses allow the withdrawal of water at the San Lorenzo River Intake in Santa Cruz for delivery to the Graham Hill WTP and the Felton diversion for storage at Loch Lomond Reservoir. Surface water is always treated before being used by the City of Santa Cruz for potable water. ~~If SMGWA approved projects and management activities degrade surface water quality, a~~Additional treatment may be needed depending on the chemical constituents and concentrations.
- **Degraded Groundwater Impacts to Soil Vapor**: ~~If SMGWA approved projects or management actions~~~~IF~~f Groundwater extraction ~~-~~moves~~S~~ existing plumes with vapor-forming chemicals, a potential impact on urban land use could be the~~is~~ formation of soil vapor plumes that may impact health. Vapor intrusion occurs when vapor-forming chemicals in contaminated soils or groundwater migrate into overlying buildings. Vapor-forming chemicals may include VOCs, such as TCE and benzene, select semi-volatile organic compounds, such as naphthalene, elemental mercury, and some polychlorinated biphenyls and pesticides (USEPA, 2020).

#### ~~6.4.2.4~~7.5.1.3 Effects on Beneficial Users and Land Use

Undesirable results from degradation of groundwater quality can have the following general impacts on beneficial users and land uses:

- **Urban land uses and users**. If municipal supply wells cannot be pumped anymore because of contamination, an alternative water source will need to be used or the groundwater will need to be treated to drinking water standards. New wells or increased pumping in existing wells may change the groundwater pumping regime, which could promote migration of degraded groundwater. If surface water or soil vapor impacts are caused by groundwater degradation, then water or soil vapor treatment may be needed to ensure public safety. With groundwater and surface water closely connected, degraded groundwater quality can degrade surface water quality. The only urban user impacted would be the City of Santa Cruz which is a downstream user of surface water. Elevated nitrate in surface water may result in increased production of organic compounds that can

cause taste and odor problems and disinfection byproducts adversely affecting municipal water supply and costs for surface water treatment. SLVWD surface water sources are outside of and upgradient of the Basin and will not be impacted.

- **Rural residential land uses and users**. Since private well owners do not routinely test groundwater pumped by their wells, there is a strong possibility that they could unknowingly drink groundwater exceeding drinking water standards and experience potential health effects. In addition, not having access to groundwater as a water source because of known undesirable results will significantly devalue properties that have no alternative water source or cannot be connected to a municipal water system. Finally, costly treatment systems may need to be installed depending on the concentration and chemical found in rural water supplies.
- **Industrial land uses and users**. Industrial use of groundwater in the Basin is limited to process and dust suppression water at 1 remaining sand quarry at Quail Hollow. Degraded groundwater quality will have limited negative effect on the use of water used at the quarry. Impacts on groundwater quality by sand mining have a greater potential negative effect than projects or management actions implemented to achieve sustainability.
- **Agricultural land uses and users**. For the very limited agriculture in the Basin, degraded groundwater quality has the potential to damage crops. It is unlikely that the agricultural land use will be impacted by degraded water quality caused by SMGWA approved projects or management actions since those land uses are many miles away from the urban settings that have known contaminant plumes.
- **Ecological land uses and users**. GDEs have the potential to be directly impacted if baseflows ~~become~~ contaminated by degraded groundwater ~~enters or is~~enter their root zone ~~utilized by root zone of GDEs~~. Each species has differing tolerance to groundwater quality, but in general, groundwater quality degradation may cause nuisance or toxicity for some riparian, aquatic, or terrestrial species. Elevated nitrate in surface water may ~~cause~~ stimulate biologic growth~~stimulation~~ in the aquatic ecosystem, depressing dissolved oxygen levels and adversely impacting aquatic biota.

### ~~6.4.3~~7.5.2 Minimum Thresholds - Degraded Water Quality

The GSP Regulations allow 3 options for setting degraded water quality ~~minimum thresholds~~MTs. Section §354.28(c)(2) of the GSP Regulations states that "The minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin" (CCR, 2016). In this Basin, ~~minimum thresholds~~ TDS, arsenic, and nitrate MTs ~~are based on specified~~~~specific concentrations~~will be monitored at supply wells ~~of constituents determined to be of concern~~these COCs. ~~This metric is similar to the location of an~~

~~isocontour approach in the GSP Regulations.~~ Unique MTs and MOs are established for each ~~Currently available~~ RMP ~~wells monitored annually for COCs are~~ public supply well based on ~~the~~ historical data collected since 2011 and relevant drinking water standards~~s~~. Several guidance documents were used to develop the SMC approach for the degraded water quality sustainability indicator (DWR, 2017; Moran and Belin, 2019; Community Water Center, 2019).

#### ~~6.4.3.1~~7.5.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

~~• The primary information used to develop m~~MTs and MOs~~inimum thresholds and measurable objectives~~ are developed relative to the maximum historical groundwater quality ~~data~~concentrations ~~from public supply wells~~ from each well and primary and secondary drinking water standards or MCLs. The metrics are established at progressively higher concentrations above the historical maximum. The MO will alert SMGWA ~~staff~~ that degradation is starting to occur by establishing the objective at a marginally higher concentration than the historical maximum concentration in the well. The MT is set at a higher concentration than the MO and below the drinking water standard in most RMPs to allow for SMGWA and member agencies to adjust operations if MTs are exceeded prior to exceeding drinking water standards. ~~The MCLs, and secondary . Other sources of information used to develop minimum thresholds and measurable objectives are state primary and secondary drinking water standards or MCLs, and various guidance documents (DWR, 2017; Moran and Belin, 2019; Community Water Center, 2019).~~

#### ~~6.4.3.2~~7.5.2.2 Degraded Water Quality Minimum Thresholds

~~Minimum thresholds for COCs in degraded groundwater quality RMPs are state drinking water standards, except for nitrate (as N).~~ Using ~~state~~ drinking water standards, or MCLs, to ~~define~~ guide ~~minimum thresholds~~ MT selection is consistent with the SMGWA defined significant and unreasonable water quality degradation that results in adverse impacts including materially diminished water supplies or undue costs for mitigating such negative impacts. ~~Federal, state, or local regulatory requirements are established after careful scientific study, legal review and procedural steps mandated by law. They~~MCLs are designed to protect public health and welfare, and they provide the clearest indication of the point beyond which there is a real risk of an undesirable result (Moran and Belin, 2019).

Nitrate (as N) concentrations in groundwater are typically less than 5 mg/L, which is half the MCL of 10 mg/L. Because nitrate in groundwater influences nitrate concentrations in the San Lorenzo River (described in Section 2.1.2.3), allowing nitrate concentrations in groundwater to increase above 5 mg/L will make it challenging to meet the San Lorenzo River's 0.33 mg/L nitrate TMDL enforced by the CCRWQCB.

An ~~minimum threshold~~MT of 5 mg/L is established for nitrate (as N) because:

1. Concentrations in RMPs are historically below this threshold
2. The groundwater quality goal is to prevent concentrations from worsening and concentrations above 5 mg/L are currently uncommon throughout the Basin
3. Nitrate concentrations in ~~SMGWA~~ SMGWA-approved project source waters close to 10 mg/L would increase the challenge of meeting the nitrate TMDL in the San Lorenzo River. Feasibility for future projects will need to demonstrate the Basin's good quality groundwater will not be degraded above 5 mg/L before the SMGWA can approve its implementation.

The 3 highest historical concentrations since 2011, MTs, and MOs are summarized in tables for TDS (Table 7-3), nitrate (Table 7-4), and arsenic (Table 7-5). Appendix 7B includes chemographs for COCs at each RMP showing historical data, MTs, and MOs.~~Table 3-20Table 3-20 lists the Basin's COCs together with why it is of concern, basis for the minimum threshold, and the minimum threshold value. Appendix 3B includes chemographs for COCs at each RMP showing historical data, minimum thresholds, and measurable objectives.~~

RMPs that have MTs at concentrations greater than or equal to the MCL, are summarized below:

- TDS ~~minimum threshold~~MTs are set below the secondary MCL of ~~1,0~~500 mg/L at all but two RMPs. The ~~minimum threshold~~MT is set at the ~~secondary~~primary MCL for SVWD Orchard and SLVWD Olympia #3 of 1,000 mg/L, which have historical maximum concentrations of 660 and 740 mg/L, respectively. Several wells have MTs that fall between the primary and secondary MCL based on their historic high concentrations.
- Arsenic MTs are less than the primary MCL of 0.01 mg/L, except for 2 RMPs with historical concentrations slightly above the MCL. The historical maximum concentration is 0.011 mg/L at SLVWD Pasatiempo #8; the MO is 0.013 mg/L and MT is 0.015 mg/L. SVWD #11B has a historical maximum concentration of 0.012 mg/L; the MO is 0.014 mg/L and MT is 0.016 mg/L. SLVWD and SVWD treat or blend raw water before distributing to customers, so having concentrations marginally above the MCL is not desirable, but also does not prevent beneficial use of groundwater from these wells.

Table 7-3~~7-3~~. TDS Minimum Thresholds and ~~Measureable~~Measurable Objectives

| Aquifer Group | Aquifer | Representative Monitoring Point~~Well Name~~ | TDS Concentrations, mg/L | | | | |
|---|---|---|---|---|---|---|---|
| | | | Highest TDS Concentrations Since 2011 | | | Measurable Objective~~Amended MO~~ | Minimum Threshold~~Amended MT~~ |
| | | | Maximum TDS | 2nd Highest | 3rd Highest | | |
| Unconfined | Santa Margarita | SLVWD Quail #4A | 150 | 130 | 130 | 250 | 500 |
| | Santa Margarita | SLVWD Quail #5A | 130 | 130 | 120 | 250 | 500 |
| | Santa Margarita | SLVWD Olympia #2 | 480 | 460 | 430 | 600 | 800 |
| | Santa Margarita | SLVWD Olympia #3 | 740 | 730 | 690 | 900 | 1,000 |
| Confined | Lompico | SLVWD Pasatiempo #5A | 180 | 180 | 160 | 250 | 500 |
| | Lompico | SLVWD Pasatiempo #7 | 190 | 180 | 150 | 250 | 500 |
| | Lompico | SLVWD Pasatiempo #8 | 170 | 160 | 140 | 250 | 500 |
| | Lompico | SVWD #10A | 340 | 330 | 320 | 400 | 600 |
| | Lompico | SVWD #11A | 580 | 580 | 570 | 700 | 800 |
| | Lompico | SVWD #11B | 410 | 400 | 390 | 500 | 700 |
| | Lompico/ Butano | SVWD Orchard Well | 660 | 520 | 510 | 800 | 1,000 |
| | Lompico/ Butano | SVWD Sucinto Well | 534 | 500 | NA | NA | NA |
| | Lompico/ Butano | SVWD Grace Way Well | 324 | NA | NA | NA | NA |

~~ND – not detected at the laboratory reporting limit~~

NA – not applicable as there is not enough historical data. MTs and MOs will be established after 3 years of data are available.

Table 7-4~~7-4~~. Nitrate (as N) Minimum Thresholds and ~~Measureable~~Measurable Objectives

| Aquifer Group | Aquifer | ~~Well Name~~Representative Monitoring Point | Nitrate (as N) Concentrations, mg/L | | | | |
|---|---|---|---|---|---|---|---|
| | | | Highest Nitrate Concentrations Since 2011 | | | Measurable Objective | Minimum Threshold |
| | | | Maximum Nitrate~~TDS~~ | 2nd Highest | 3rd Highest | | |
| Unconfined | Santa Margarita | SLVWD Quail #4A | 0.77 | 0.69 | 0.68 | 2 | 5 |
| | Santa Margarita | SLVWD Quail #5A | 3.4 | 2.7 | 2.6 | 4 | 5 |
| | Santa Margarita | SLVWD Olympia #2 | ND | ND | ND | 2 | 5 |
| | Santa Margarita | SLVWD Olympia #3 | ND | ND | ND | 2 | 5 |
| Confined | Lompico | SLVWD Pasatiempo #5A | 0.15 | 0.07 | ND | 2 | 5 |
| | Lompico | SLVWD Pasatiempo #7 | 0.7 | 0.6 | 0.57 | 2 | 5 |
| | Lompico | SLVWD Pasatiempo #8 | ND | ND | ND | 2 | 5 |
| | Lompico | SVWD #10A | ND | ND | ND | 2 | 5 |
| | Lompico | SVWD #11A | ND | ND | ND | 2 | 5 |
| | Lompico | SVWD #11B | ND | ND | ND | 2 | 5 |
| | Lompico/ Butano | SVWD Orchard Well | ND | ND | ND | 2 | 5 |
| | Lompico/ Butano | SVWD Sucinto Well | ND | ND | NA | NA | NA |
| | Lompico/ Butano | SVWD Grace Way Well | ND | NA | NA | NA | NA |

ND – not detected at the laboratory reporting limit

NA – not applicable as there is not enough historical data. MTs and MOs will be established after 3 years of data are available.

Table 7-5~~7-57-7~~. Arsenic Groundwater Quality Minimum Thresholds and ~~Measureable~~Measurable Objectives

| Aquifer Group | Aquifer | Representative Monitoring Point | Arsenic Concentrations, mg/L | | | | |
|---|---|---|---|---|---|---|---|
| | | | ~~Historical~~ Highest Arsenic Concentrations Since 2011 | | | Measurable Objective | Minimum Threshold |
| | | | Maximum Arsenic | 2nd Highest | 3rd Highest | | |
| Unconfined | Santa Margarita | SLVWD Quail #4A | 0.0032 | 0.0029 | 0.0028 | 0.005 | 0.008 |
| | Santa Margarita | SLVWD Quail #5A | 0.0027 | 0.0022 | 0.0015 | 0.005 | 0.008 |
| | Santa Margarita | SLVWD Olympia #2 | ND | ND | ND | 0.002 | 0.005 |
| | Santa Margarita | SLVWD Olympia #3 | ND | ND | ND | 0.002 | 0.005 |
| Confined | Lompico | SLVWD Pasatiempo #5A | 0.0035 | 0.0035 | 0.0034 | 0.005 | 0.008 |
| | Lompico | SLVWD Pasatiempo #7 | 0.0028 | 0.0025 | 0.002 | 0.005 | 0.008 |
| | Lompico | SLVWD Pasatiempo #8 | 0.011 | 0.011 | 0.011 | 0.013 | 0.015 |
| | Lompico | SVWD #10A | ND | ND | ND | 0.002 | 0.005 |
| | Lompico | SVWD #11A | 0.0052 | 0.0046 | 0.0046 | 0.006 | 0.008 |
| | Lompico | SVWD #11B | 0.012 | 0.012 | 0.011 | 0.014 | 0.016 |
| | Lompico/ Butano | SVWD Orchard Well | ND | ND | ND | 0.002 | 0.005 |
| | Lompico/ Butano | SVWD Sucinto Well | 0.0013 | ND | NA | NA~~0.002NA~~ | NA~~0.005NA~~ |
| | Lompico/ Butano | SVWD Grace Way Well | 0.0026 | NA | NA | NA~~0.005NA~~ | NA~~0.008NA~~ |

ND – not detected at the laboratory reporting limit

NA – not applicable as there is not enough historical data. MTs and MOs will be established after 3 years of data are available.

| ~~Total dissolved solids~~ | ~~basic health of basin~~ | ~~Upper recommended limit of State secondary MCL used county-wide~~ | ~~1,000~~ |
|---|---|---|---|
| ~~Chloride~~ | ~~basic health of basin~~ | ~~State secondary MCL~~ | ~~250~~ |
| ~~Iron~~ | ~~naturally elevated~~ | ~~State secondary MCL~~ | ~~0.30~~ |

| | | | |
|---|---|---|---|
| ~~Manganese~~ | ~~naturally elevated~~ | ~~State secondary MCL~~ | ~~0.05~~ |
| ~~Arsenic~~ | ~~naturally elevated~~ | ~~State primary MCL~~ | ~~0.01~~ |
| ~~Nitrate as Nitrogen~~ | ~~septic systems~~ | ~~Consideration of the State TMDL for San Lorenzo River~~ | ~~5~~ |
| ~~Methyl-tert-butyl-ether (MTBE)~~ | ~~Introduced into groundwater~~ | ~~State primary MCL~~ | ~~0.013~~ |
| ~~Chlorobenzene~~ | ~~by leaking gasoline tanks~~ | ~~State primary MCL~~ | ~~0.07~~ |
| ~~Trichloroethylene (TCE)~~ | ~~Introduced into groundwater~~ | ~~State primary MCL~~ | ~~0.005~~ |
| ~~Tetrachloroethylene (PCE)~~ | ~~by Watkins-Johnson and~~ | ~~State primary MCL~~ | ~~0.005~~ |
| ~~1,2-Dichloroethylene (1,2-DCE)~~ | ~~Scotts Valley Dry Cleaners~~ | ~~State primary MCL~~ | ~~0.07~~ |

~~MCL = maximum contaminant level~~

~~Each future SMGWA approved project implemented as part of the GSP will have a set of COC that apply to monitoring and extraction wells included in their use permits granted by the SWRCB DDW. For example, projects injecting purified recycled water into the Basin are classified as groundwater replenishment reuse projects and permits from SWRCB DDW are required. A compendium of groundwater replenishment reuse regulations (GRRR) (Title 22, Division 4, Chapter 3) was issued by the SWRCB in 2014 (SWRCB, 2018). Specific monitoring wells and a list of chemical constituents to monitor are part of specific permit conditions. The GRRR Section 60320.200 (c) requires at least 4 quarters of background groundwater quality data to characterize groundwater quality in each aquifer that will be receiving recycled water before injection of purified recycled water starts. Constituents of concern for implemented projects will be added to the list of COC for this GSP, and some of the monitoring wells specified in the permit will be added as RMPs.~~

~~For ASR projects, the SWRCB has adopted general waste discharge requirements for ASR projects that inject water of drinking water quality into groundwater (Order No. 2012-0010-DWQ or ASR General Order). The ASR General Order provides a consistent statewide regulatory framework for authorizing both pilot ASR testing and permanent ASR projects. Oversight of these regulations is through the CCRWQCB and obtaining coverage under the General ASR Order requires the preparation and submission of a Notice of Intent (NOI) application package. The NOI includes a technical report that, amongst other things, identifies and describes target aquifers, delineates the Areas of Hydrologic Influence, identifies all land uses within the delineated Areas of Hydrologic Influence, identifies known areas of contamination within the Areas of Hydrologic Influence, identifies project-specific constituents of concern, and groundwater degradation assessment.~~

#### ~~6.4.3.3~~7.5.2.3 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

SGMA regulations do not require projects or management actions to improve existing groundwater quality, although the GSA may undertake such a goal. Since the Basin's groundwater quality is generally suitable for all beneficial users and uses ~~below minimum thresholds~~, the SMGWA's objective is to keep it at current concentrations and will not be taking any actions to improve it other than maintaining groundwater levels above historical low levels. Keeping groundwater quality at current concentrations, therefore, poses no threat to other sustainability indicators. However, preventing migration of poor-quality groundwater may limit projects or management actions needed to achieve ~~minimum thresholds~~MTs for other sustainability indicators.

- **Chronic lowering of groundwater levels**. Degraded groundwater quality ~~minimum thresholds~~MTs could negatively ~~influence~~ impact groundwater level ~~minimum~~

~~thresholds~~MTs by limiting the types of water that can be used for recharge to increase groundwater levels if groundwater levels started to approach ~~minimum threshold~~MTs.

- **Change in groundwater storage**. Degraded groundwater quality ~~minimum threshold~~MTs do not promote pumping in excess of the sustainable yield that is needed to ensure change in groundwater storage does not cause undesirable results. Therefore, the degraded groundwater quality ~~minimum threshold~~MTs will not result in an exceedance of the groundwater storage ~~minimum threshold~~MT.
- **Seawater intrusion**. Not applicable.
- **Subsidence**. Not applicable.
- **Depletion of interconnected surface water**. Degraded groundwater quality ~~minimum threshold~~MTs do not promote additional pumping or lower groundwater elevations adjacent to interconnected surface water. Therefore, the degraded groundwater quality ~~minimum threshold~~MTs will not result in a significant or unreasonable depletion of interconnected surface water.
- ~~Minimum thresholds for specific COCs are the same for each RMP throughout the Basin, thus there is no conflict between individual RMP minimum thresholds.~~

#### ~~6.4.3.4~~7.5.2.4 Effect of Minimum Thresholds on Neighboring Basins

The anticipated effect of the ~~minimum threshold~~MTs for degraded groundwater quality on each of the neighboring basins is addressed below.

**Santa Cruz Mid-County Basin** (critically overdrafted). Limited groundwater flows from the Santa Cruz Mid-County Basin into the Santa Margarita Basin. Groundwater quality in the vicinity of the basins' boundary is generally good except for naturally occurring elevated iron, manganese, and occasionally arsenic. No GSP projects or management actions, for either basin, that might change hydraulic gradients or directions are ~~likely in~~being considered in the vicinity of the basins' shared boundary. The Santa Cruz Mid-County Basin's ~~minimum threshold~~MTs for groundwater quality are drinking water standards and therefore, it is unlikely that the degraded groundwater quality ~~minimum threshold~~MTs established for the Basin will prevent the Santa Cruz Mid-County Basin from achieving sustainability. Even though the Santa Cruz Mid-County Basin's ~~minimum threshold~~MT for nitrate (as N) of 10 mg/L is higher than the Santa Margarita Basin's ~~minimum threshold~~MT of 5 mg/L, the lack of connection between the Santa Cruz Mid-County Basin's primary aquifer (Purisima Formation) and the Santa Margarita Basin's primary aquifers (Santa Margarita, Lompico and Butano aquifers) will not prevent the Santa Margarita Basin from achieving its nitrate (as N) ~~minimum threshold~~MT.

**Purisima Highlands Subbasin of the Corralitos Basin** (very low priority). The Santa Margarita Basin is hydraulically downgradient from the Purisima Highlands Subbasin, but is

separated from it by the Zayante-Vergeles fault zone, which acts as a barrier to groundwater flow. Furthermore, with ~~minimum threshold~~MTs in the Santa Margarita Basin- generally set ~~at~~ below drinking water standards, groundwater quality at those concentrations or better will remain safe for Purisima Highlands Subbasin beneficial users.

**West Santa Cruz Terrace Basin** (very low priority). The boundary between the Santa Margarita Basin and West Santa Cruz Terrace Basin is located where Tertiary sedimentary rocks that are the principal aquifers in Santa Margarita Basin thin abruptly against basement rocks that are exposed at the surface or are at shallow depth in the subsurface. Groundwater pumping in West Santa Cruz Terrace Basin is mostly from private wells tapping low-yielding Quaternary alluvium and terrace deposits. These Quaternary deposits are not hydrologically connected to similar deposits scattered in small patches in Santa Margarita Basin. Even if the sediments in the 2 basins were highly connected, groundwater quality at drinking water standards would not adversely impact rural residential or GDE groundwater users in the West Santa Cruz Terrace Basin.

#### ~~6.4.3.5~~7.5.2.5 Effects of Minimum Thresholds on Beneficial Users and Land Uses

In general, groundwater quality concentrations at or less than the ~~minimum threshold~~MTs will not impact beneficial users and land uses in the Basin. The selected ~~minimum threshold~~MTs generally benefit beneficial users and land uses in the Basin:

- **Urban land uses and users**[7]. The degraded groundwater quality ~~minimum threshold~~MTs benefit ~~the~~ urban water users in the Basin. Preventing groundwater for drinking water supply from exceeding state drinking water standards ensures an adequate supply of groundwater for municipal use.
- **Rural residential land uses and users**[8]. The degraded groundwater quality ~~minimum threshold~~MTs benefit domestic water users in the Basin. Ensuring constituents of concern in water supply wells remain below state drinking water standards also ~~to~~ protects groundwater quality for private domestic use.
- **Industrial land uses and users.** The degraded groundwater quality ~~minimum threshold~~MTs generally benefit industrial water users in the Basin. Ensuring constituents of concern in water supply wells remain below state drinking water standards is more protective than is needed for industrial use.

[7] Urban land users include a small area of a DAC supplied water by SLVWD.

[8] Rural land users include an estimated fewer than 10 DAC residents who depend on private wells for domestic use.

- **Agricultural land uses and users.** The degraded groundwater quality ~~minimum threshold~~MTs generally benefit the limited agricultural water use in the Basin by preventing impacts to crop health from degraded groundwater.
- **Ecological land uses and users**. Although the groundwater quality ~~minimum threshold~~MTs do not directly benefit ecological uses, it can be inferred that the degraded groundwater quality ~~minimum threshold~~MTs generally benefit the environmental water uses in the Basin. Preventing poor-quality groundwater from migrating to GDEs and surface water bodies will limit ecosystem impacts.

#### ~~6.4.3.6~~7.5.2.6 Relevant Federal, State, or Local Standards

The degraded groundwater quality ~~minimum threshold~~MTs are defined at concentrations below the ~~as the~~ state drinking water standards in most RMPs, except for a couple of RMPs with TDS MTs at the secondary MCL and a couple of RMPs with arsenic MTs slightly greater than the primary MCL. The wells with arsenic MTs at higher concentration than the MCL occasionally have detections that marginally exceed the MCL and are managed by the water providers before public distribution. ~~with the exception of the nitrate minimum threshold, which is less than the state drinking water standard.~~

#### ~~6.4.3.7~~7.5.2.7 Method for Quantitative Measurement of Minimum Thresholds

Groundwater quality in RMPs will be directly measured by collecting and testing groundwater samples in accordance with the monitoring protocols outlined in Section 6.7. ~~Chemical~~ COC concentrations reported by the laboratory will be ~~used to compare chemical COC concentrations in relation~~compared to their respective ~~minimum threshold~~MTs. Should a ~~minimum threshold~~MT be exceeded, follow-up sampling and analysis will be conducted to confirm that exceedances are not due to sample collection or laboratory errors.

### ~~6.4.4~~7.5.3 Measurable Objectives - Degraded Water Quality

#### ~~6.4.4.1~~7.5.3.1 Measurable Objectives

All ~~measurable objective~~MOs set for degraded groundwater quality strive to ~~keep~~ prevent groundwater quality ~~at current~~ degradation from historical maximum concentrations. ~~Measurable objective~~MOs ~~for each RMP are the average concentration between January 2010 and December 2019 concentrations for each COC. The measurable objectives~~will alert SMGWA that degradation is starting to occur. The historical maximum concentrations, MTs, and MOs are summarized in tables for TDS (Table 7-3), nitrate (Table 7-4), and arsenic (Table 7-5). Appendix 7B includes chemographs for COCs at each RMP showing historical data, MTs, and MOs.

~~for RMPs are as shown in Table 3-21Table 3-21 and included on chemographs in Appendix 3B.~~

#### ~~6.4.4.2~~7.5.3.2 Interim Milestones

Groundwater in the Basin is currently of better quality than ~~minimum threshold~~MTs for all RMPs with no changes in quality expected from ~~projects and management actions~~PMAs implemented to achieve sustainability. Since the ~~measurable objective~~MOs effectively represent marginal degradation from current conditions, interim milestones are set at the same concentration as ~~measurable objective~~MOs ~~(see Table 3-21Table 3-21)~~.

~~Table 3-21. Minimum Thresholds and Measurable Objectives for Degradation of Groundwater Quality~~

| ~~Aquifer Unit~~ | ~~Well Name~~ | ~~Total Dissolved Solids~~ | ~~Chloride~~ | ~~Iron~~ | ~~Manganese~~ | ~~Arsenic~~ | ~~Nitrate as Nitrogen~~ | ~~Methyl-tert-butyl-ether (MTBE)~~ | ~~Chlorobenzene~~ | ~~Trichloroethylene (TCE)~~ | ~~Tetrachloroethylene (PCE)~~ | ~~1,2-Dichloroethylene (1,2-DCE)~~ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ~~All units in mg/L~~ | ~~Minimum Threshold~~ | ~~1,000~~ | ~~250~~ | ~~0.3~~ | ~~0.05~~ | ~~0.01~~ | ~~5~~ | ~~0.013~~ | ~~0.07~~ | ~~0.005~~ | ~~0.005~~ | ~~0.07~~ |
| ~~Santa Margarita~~ | ~~SLVWD Quail Hollow #5A~~ | ~~123~~ | ~~8.00~~ | ~~0.020~~ | ~~0.003~~ | ~~0.002~~ | ~~2.13~~ | ~~0.003~~ | ~~0.001~~ | ~~0.0005~~ | ~~0.0005~~ | ~~0.0005~~ |
| | ~~SLVWD Olympia #3~~ | ~~573~~ | ~~8.85~~ | ~~0.502~~ | ~~0.157~~ | ~~0.002~~ | ~~0.400~~ | ~~0.003~~ | ~~0.001~~ | ~~0.0005~~ | ~~0.0005~~ | ~~0.0005~~ |
| ~~Monterey~~ | ~~SVWD Well #9~~ | ~~839~~ | ~~44.7~~ | ~~0.082~~ | ~~0.015~~ | ~~0.002~~ | ~~0.400~~ | ~~0.003~~ | ~~0.001~~ | ~~0.0008~~ | ~~0.0005~~ | ~~0.0005~~ |
| ~~Lompico~~ | ~~SLVWD Pasatiempo #7~~ | ~~143~~ | ~~7.40~~ | ~~0.539~~ | ~~0.099~~ | ~~0.002~~ | ~~0.330~~ | ~~0.003~~ | ~~0.001~~ | ~~0.0005~~ | ~~0.0005~~ | ~~0.0005~~ |
| | ~~SVWD #10A~~ | ~~290~~ | ~~30.6~~ | ~~1.51~~ | ~~0.099~~ | ~~0.002~~ | ~~0.390~~ | ~~0.003~~ | ~~0.001~~ | ~~0.0005~~ | ~~0.0005~~ | ~~0.0005~~ |
| | ~~SVWD #11A~~ | ~~525~~ | ~~27.1~~ | ~~0.459~~ | ~~0.112~~ | ~~0.003~~ | ~~0.400~~ | ~~0.003~~ | ~~0.001~~ | ~~0.0005~~ | ~~0.0005~~ | ~~0.0005~~ |
| | ~~SVWD #11B~~ | ~~367~~ | ~~21.3~~ | ~~0.826~~ | ~~0.077~~ | ~~0.009~~ | ~~0.400~~ | ~~0.003~~ | ~~0.001~~ | ~~0.0005~~ | ~~0.0005~~ | ~~0.0005~~ |
| ~~Lompico/ Butano~~ | ~~SVWD #3B~~ | ~~563~~ | ~~31.6~~ | ~~0.380~~ | ~~0.042~~ | ~~0.002~~ | ~~0.400~~ | ~~0.003~~ | ~~0.001~~ | ~~0.0005~~ | ~~0.0005~~ | ~~0.0005~~ |
| | ~~SVWD Orchard Well~~ | ~~450~~ | ~~26.3~~ | ~~0.063~~ | ~~0.004~~ | ~~0.002~~ | ~~0.400~~ | ~~0.003~~ | ~~0.001~~ | ~~0.0005~~ | ~~0.0005~~ | ~~0.0005~~ |

## 6.57.6 Depletion of Interconnected Surface Water Sustainable Management Criteria

The GSP Regulations developed by DWR staff require identifying the location of interconnected surface water and the estimating~~ed~~ timing and quantity of depletions. Locations of interconnected surface water are identified in Section 4.6.1. ~~Stream gauging, accretion studies, groundwater level monitoring, stream and GDE field reconnaissance, and groundwater modeling have all been used to show that s~~Surface water is hydraulically connected to groundwater ~~throughout most~~ in most areas of the Basin. Stream gage monitoring, accretion studies, groundwater level monitoring, stream and GDE field reconnaissance, and groundwater modeling show that ~~As discussed in Section 2.2.5.6.1,~~ during the dry-~~-~~season from ~~late~~ May through October, almost all the water flowing in the Basin's streams and creeks is derived from groundwater. ~~In the historical groundwater model simulation, there is about 2.5 times more groundwater discharge to creeks than creeks recharge of groundwater. The result of net groundwater discharge to surface water is widespread gaining stream conditions that contribute to more surface water flowing out of the Basin than flowing into the Basin.~~

The direct measurement of streamflow depletion is not feasible given the Basin's geology and topography. Rather, it is more ~~appropriately~~effectively measured in the form of the amount of baseflow contribution from groundwater (accretion) to the San Lorenzo River and its tributaries within the Basin. SMGWA ~~member agencies ve~~has reviewed the needs of beneficial uses and users in comparison to mean daily flows in the San Lorenzo River at Big Trees over 25 years~~the~~. SMGWA has also evaluated the relationship between baseflow compared to both groundwater extraction and groundwater elevations and has found a stronger correlation between groundwater elevations and baseflow (Sections 4.6.2 and 4.6.3). SMGWA believes that this analysis, summarized in Section 4.6.5, provides justification for the sufficiency ~~use~~ of groundwater elevations as a proxy ~~(also see Section for a summary)~~ for direct ~~ISW~~interconnected surface water measurements.

A relevant concern associated with the timing and quantity of depletion (or reduced accretion in this Basin) from groundwater is whether this is resulting in significant and unreasonable impacts to beneficial uses and users. The baseflow analysis strongly supports that September is the most common period of low streamflow in the Basin that also corresponds with potential impacts associated with public supply diversion requirements and minimum flows needed to support spawning of sensitive fish species. This issue of timing, locations, and quantity was considered in establishing the MTs and MOs discussed further below.~~Since measuring the volume of streamflow depletion is not practical with the volumes of pumping, streamflow, and natural groundwater and surface water interactions in the Basin,~~

~~Tthe depletion of interconnected surface water SMC is developed usingare evaluated with groundwater levels and reduction in storage SMC as a proxyproxies as discussed in Section~~

~~3.7.2.1 below. Recognizing that the Basin does not have enough shallow wells to monitor and evaluate the effects of groundwater extractions on streamflow depletion in interconnected surface waters, up to 5 new shallow monitoring wells will be installed in 2022 to complete the monitoring network. This section details the SMC for the 2 existing monitoring wells near creeks that will be used as RMP. SMC will be defined for new monitoring wells once several years of groundwater level data have been collected and a relationship between groundwater levels, groundwater extractions, rainfall, and other factors can be established. Any new RMPs and SMC developed with input from and approved by the SMGWA Board will be included in future updates to the GSP. In 2024, DWR released a series of technical papers describing approaches for identifying interconnected surface water, estimating the location, timing, and magnitude of depletion, and supporting development of SMC. The Basin's management approach is amended in the 2027 GSP to better integrate groundwater levels, changes in storage, and ISW depletion, such that these indicators are evaluated collectively to meet common sustainability objectives.~~

### ~~6.5.1 Significant and Unreasonable Depletion of Interconnected Surface Water~~

~~Significant and unreasonable depletion of interconnected surface water occurs if groundwater use, or projects or management actions in support of SGMA adversely impact the sustainability of GDEs or selected priority species or cause undue financial burden to beneficial users of surface water.~~

~~In this context, undue financial burden means a cost or financial impact resulting from an action or inaction of the SMGWA or groundwater users in the Basin, that is unwarranted, inappropriate, or excessive and/or rising to a level that is more than is necessary, acceptable, or reasonable.~~

### ~~6.5.2~~7.6.1 Undesirable Results - Depletion of Interconnected Surface Water

~~6.5.3~~ Depletion of interconnected surface water is considered significant and unreasonable under the following conditions:

- Groundwater elevations in 3 or more RMPs fall below the MT in 2 consecutive years in the Unconfined aquifer; or.
- Groundwater elevations in 3 or more RMPs fall below the MT in 2 consecutive years in the Confined aquifers; or
- Groundwater extraction volumes exceed the MT in the Unconfined aquifer; or

~~6.5.4~~• Groundwater extraction volumes exceed the MT in the Confined aquifers.

#### ~~6.5.4.1 Groundwater Elevation as a Proxy for Depletion of Interconnected Surface Water Minimum Thresholds~~

~~The recommended metric for depletion of interconnected surface water SMC identified in the GSP Regulations is a volume or rate of surface water depletion caused by groundwater pumping. Limited data collected to dateManaging surface water depletion in this Basin is not feasible with this metric because does not allow for measurement or estimation of a volume or rate of historical depletion of interconnected surface water due specifically from groundwater extractions. Data limitations include streamflow gages not paired with shallow monitoring wells and having to rely on estimates of extraction for unmetered groundwater usage by *de minimis* pumpers and some non-*de minimis* pumpers. Although there have been multiple accretion studies to understand where groundwater and surface water are interconnected, and what the groundwater contributions are to baseflow (as described in Section 2.2.5.6.1), there have been no studies conducted in the Basin to understand the effects of groundwater use on streamflow or the GDEs that rely on streamflow for supporting flora and fauna.~~

~~Even though streamflow depletion from groundwater extractions cannot be directly measuredaccurately decoupled from other factors affecting streamflow, as discussed in Section 4.6. at a streamflow gage because it is only one component of many oDepletion of interconnected surface water is ther components that make up streamflow, changes in groundwater contributions to streamflow can be evaluated most effectively in this Basin simulated with a groundwater model and using chronic lowering of groundwater levels and reduction of groundwater in storage SMC as a proxy. TheAn integrated approach for managing groundwater levels and extraction to prevent depletion of interconnected surface water allows SMGWA to improve groundwater conditions prior to SGMA and prevent undesirable results.~~

~~Sensitivity runs using the calibrated Basin model to simulate groundwater conditions and water budget with and without groundwater pumping and associated return flows shows, on average over the WY1985-2018 historical model period, there is around 1,000 AFY (approximately 1.4 cfs) of year-round surface water depletion due to groundwater extraction (Figure 3-16Figure 3-16). The negative values on Figure 3-16Figure 3-16 indicate the volume of pumping and return flows removed from the model in the "without pumping" simulation, while the positive values for discharge to creeks indicate the increase in discharge in response to pumping being removed.~~

~~Analysis of the model simulated water budget for the Bean Creek watershed reveals that on average from WY1985 through 2018 groundwater extractions reduce groundwater contributions to Bean Creek during low flow periods by approximately 0.5 cfs (Figure 3-17Figure 3-17). The amount of groundwater contribution in the low flow months is highly dependent on rainfall depicted as water year type on Figure 3-17Figure 3-17.~~

~~(Difference between Simulations Without Pumping and With Pumping)~~

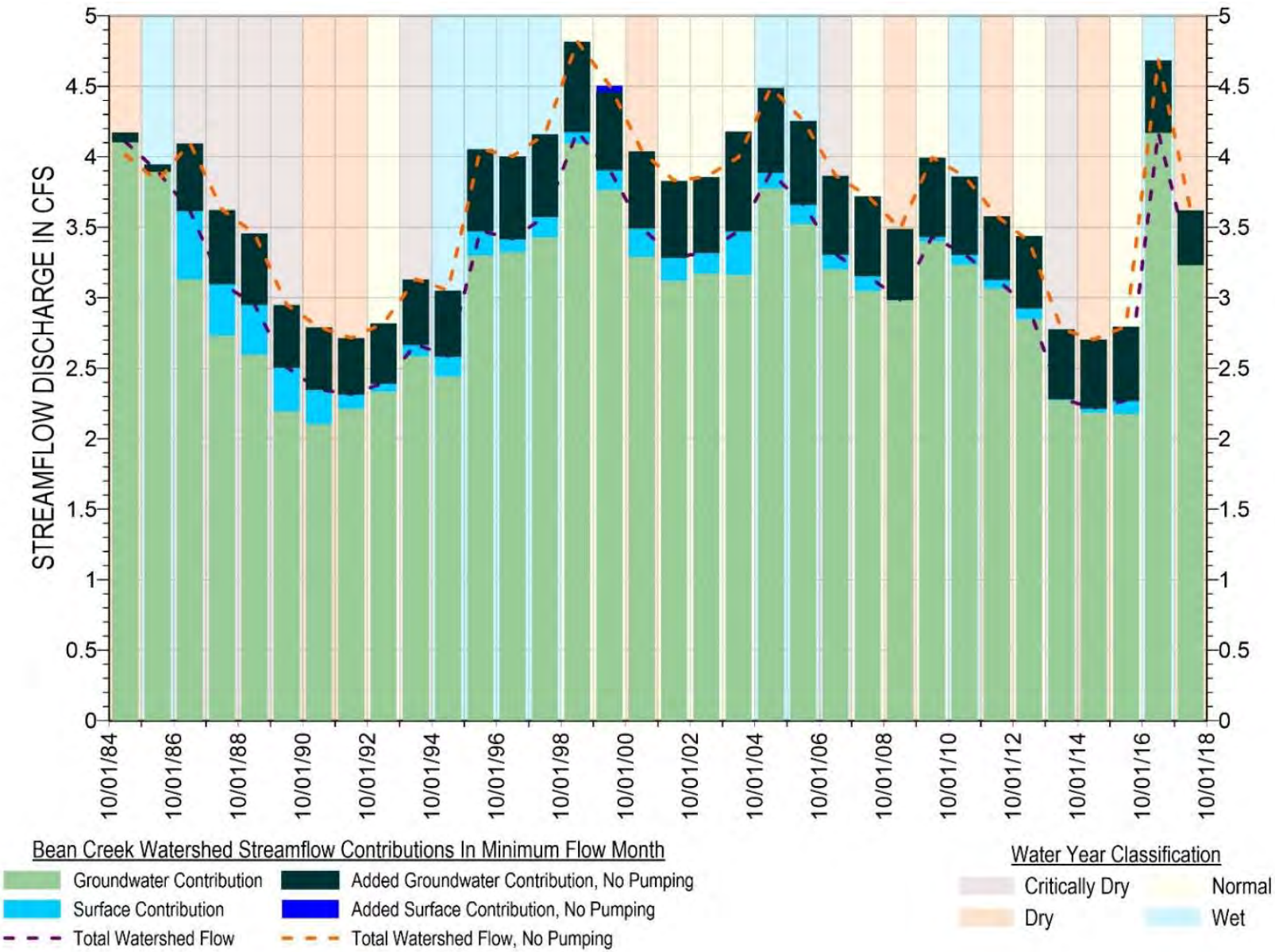



Figure 3-17. Model Simulated Effects of Groundwater Extractions on Groundwater Discharge to Bean Creek in Minimum Flow Month

~~There are only 2 monitoring wells from the existing monitoring network adjacent to creeks and screened in the aquifer connected to the creek that can be used as RMPs for the depletion of interconnected surface water. Each of these wells has some limitations:~~

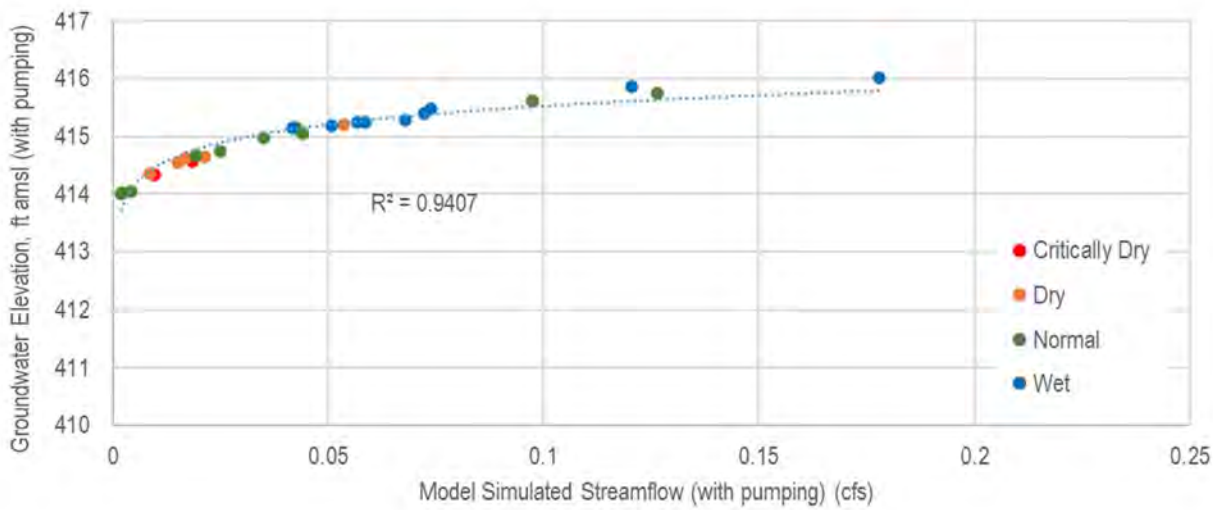
- ~~SLVWD's Quail MW-A is screened in the Santa Margarita aquifer and is closer to an unnamed non-perennial tributary of Zayante Creek than Zayante Creek. This well is included as an RMP even though its location is not ideal because it more likely represents flow in the unnamed tributary rather than Zayante Creek.~~

- ~~SVWD's SV4-MW is screened in the Santa Margarita aquifer and is located south of Bean Creek in an area of known groundwater contribution to baseflows. This location is more suitable for an RMP however, it only has semi-annual historical groundwater level measurements which is not a suitable frequency for monitoring interconnected surface water. To improve data from this well, it was recently equipped with a pressure transducer to monitor groundwater levels continuously.~~

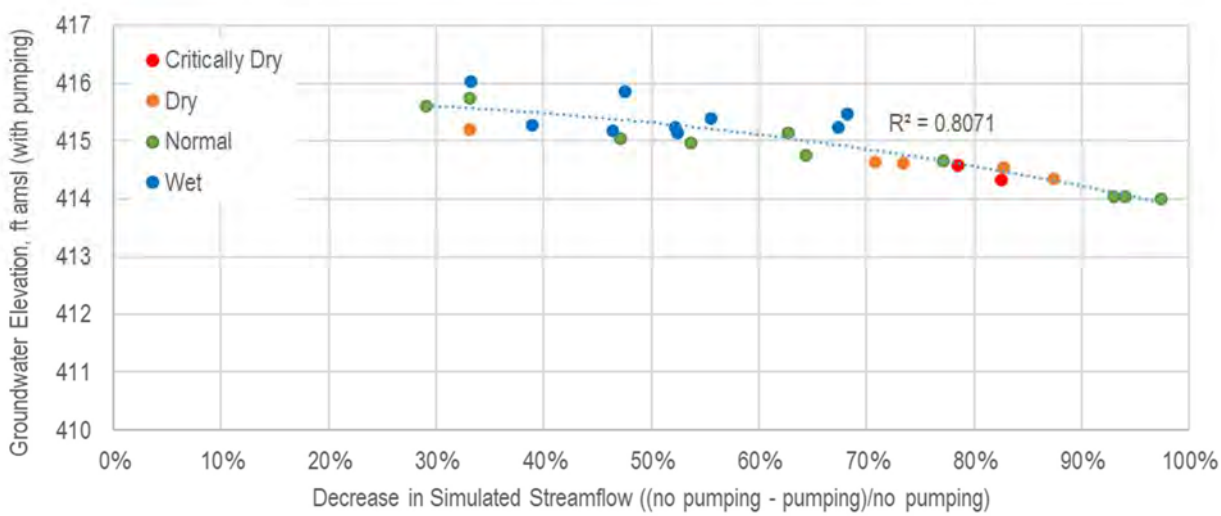
~~In 2022, up to 5 shallow monitoring wells in areas with groundwater extraction and interconnected surface water will be installed, as described in Section 3.3.4.1.3. These additional shallow wells are needed to better understand the relationship between groundwater conditions and baseflow in creeks, to improve the simulation of groundwater and surface water interactions in the groundwater model, and to add to the depletion of interconnected surface water RMP network. Some of the new shallow wells will be paired with nearby streamflow gages. Streamflow and groundwater level data from the new monitoring wells along with more frequent groundwater levels from the 2 RMPs will be used to establish a relationship between streamflow, nearby groundwater use, and other relevant components of streamflow. Until those relationships can be established and because of no other direct means to estimate depletions of interconnected surface water in streamflow records, groundwater levels in the 2 RMPs will be used in the interim to monitor groundwater levels adjacent to creeks. This approach is justified because both RMPs have had groundwater elevations well above adjacent streambed elevations over their respective periods of record (greater than 24 years). If groundwater elevations connected to creeks are kept at or above historical elevations, there will be no more depletion of surface water than experienced over the past 24 years. These historical groundwater levels are not thought to have caused significant and unreasonable impacts to GDEs or selected priority species or cause undue financial burden to beneficial users of surface water.~~

#### ~~6.5.4.1.1 Correlation between Groundwater Elevation and Streamflow Depletion in SLVWD Quail MW-A~~

~~Model simulated streamflow adjacent to SLVWD Quail MW-A for "with pumping" and "without pumping" simulations are used to evaluate the relationship between measured groundwater elevation and baseflow in the adjacent unnamed tributary to Zayante Creek (Figure 3-7Figure 3-7). The results plotted on Figure 3-18Figure 3-18 and Figure 3-19Figure 3-19 show data from September of every year of the calibrated model period (WY1985—2018). Data from September represent baseflow during the driest time of year.~~




~~Figure 3-18. SLVWD Quail MW-A September Model Simulated Streamflow Compared to Groundwater Elevations~~




~~Figure 3-19. SLVWD Quail MW-A September Simulated Streamflow Depletion Compared to Groundwater Elevation~~

~~Figure 3-18Figure 3-18 shows the relationship between simulated streamflow and measured groundwater elevations during historical Septembers with pumping. There are 8 dry and critically dry years during the interval WY1985-2018 for which there is no simulated streamflow in the unnamed tributary in September and measured groundwater elevations are lower than 414 feet amsl. Those points are not included on the chart. Figure 3-18Figure 3-18 shows a strong relationship between September streamflow and groundwater levels at SLVWD Quail MW-A. The relationship indicates with wetter years there is more groundwater recharge and higher groundwater levels leading to greater groundwater discharge to creeks.~~

~~Figure 3-19Figure 3-19 shows simulated streamflow depletion compared to historical measured groundwater elevations. Simulated streamflow depletion is calculated as the difference between baseflow with and without pumping. Years with no baseflow are not included. Figure 3-19Figure 3-19 shows a good correlation between simulated streamflow depletion in the unnamed tributary from pumping compared to measured groundwater elevation. Streamflow depletion at this location is sensitive to changes in groundwater elevation, with 50% reduction in streamflow occurring from a 1-foot decline in groundwater level.~~

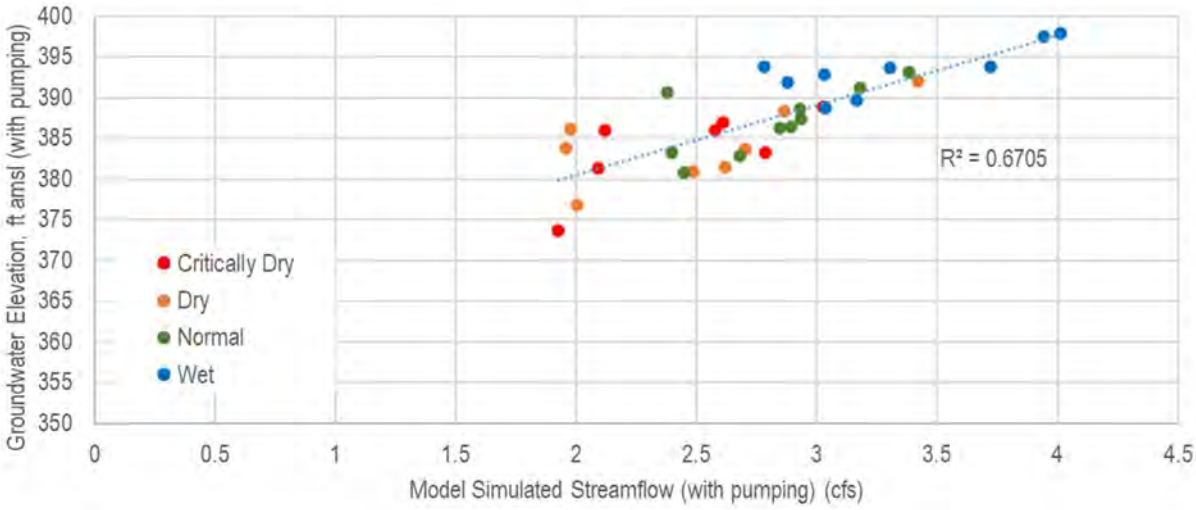
#### ~~*6.5.4.1.2 Correlation between Groundwater Elevation and Streamflow Depletion in SVWD SV4-MW*~~

~~The results of the same analysis performed on simulated streamflow and measured groundwater level data for SLVWD Quail MW-A above is shown on Figure 3-20Figure 3-20 and Figure 3-21Figure 3-21 for SVWD SV4-MW just south of Bean Creek. Well location is shown on Figure 3-7Figure 3-7.~~

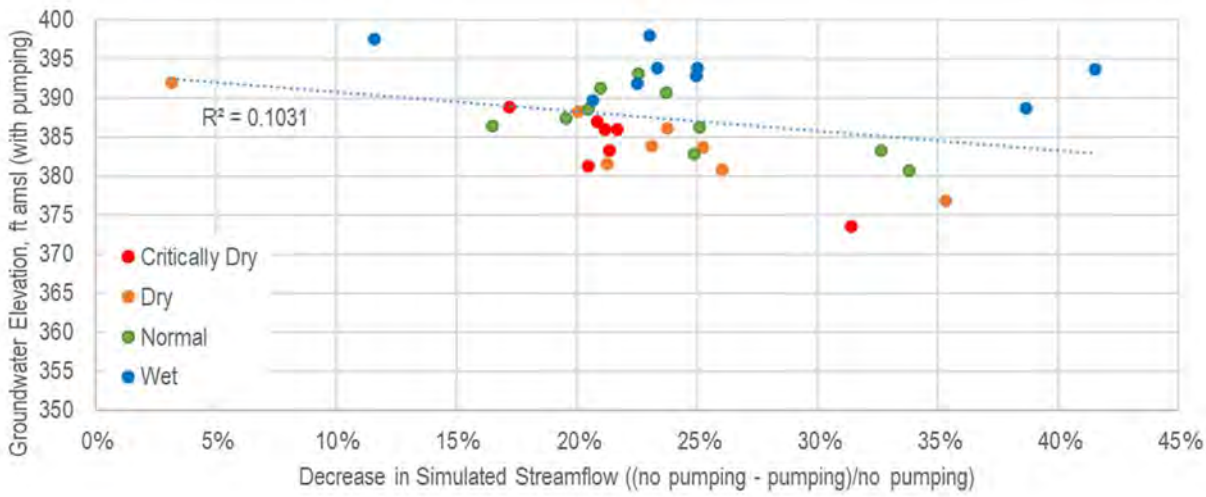
~~Figure 3-20Figure 3-20 shows the relationship between simulated streamflow in Bean Creek close to the monitoring well and measured groundwater elevations in the monitoring well during historical Septembers with pumping. The relationship between streamflow and groundwater levels at this location is not as good as at SLVWD Quail MW-A, likely because of other factors that influence streamflow, one of which may be the discharge of treated water from the Watkins-Johnson Superfund site remediation efforts from October 1986 to July 2016 (described in Section 2.1.3.4.6.1).~~

~~Figure 3-21Figure 3-21 shows simulated streamflow depletion compared to historical groundwater elevations. Streamflow depletion is calculated as the difference between baseflow with and without pumping. Unlike at SLVWD Quail MW-A, at this monitoring well there is not a good long-term relationship between simulated streamflow depletion from pumping compared to groundwater elevations potentially because of the effects of discharge of treated water from the Watkins-Johnson Superfund site. Since discharges from the Watkins-Johnson Superfund site have now stopped, groundwater levels monitored in SVWD SV4-MW over the next 5 years will be used to determine whether the relationship between groundwater elevations and modeled~~

~~surface water depletions is improved and the groundwater elevations can be more confidently used as a proxy for surface water depletion.~~




~~Figure 3-20. SVWD SV4-MW September Model Simulated Streamflow Compared to Groundwater Elevations~~




~~Figure 3-21. SVWD SV4-MW September Simulated Streamflow Depletion Compared to Groundwater Elevation~~

#### ~~*6.5.4.1.3 Future Evaluation of Depletion of Interconnected Surface Water from Groundwater Extraction*~~

~~Development of this GSP relies on best available data and science. Until there are data collected that can inform specific studies to quantify groundwater extraction's impact on surface water, the data currently available to the SMGWA are being used to monitor groundwater's contribution to surface water. The SGMA regulations allow for the use of groundwater elevations as a proxy for volume or rate of surface water depletion. To use a groundwater elevation proxy there must be~~

~~significant correlation between groundwater elevations and the sustainability indicator for which groundwater elevation measurements are to serve as a proxy.~~

~~Correlation based on the data from the 2 monitoring wells collected to date is not sufficient to establish that correlation. With a total of 8 monitoring wells collecting daily data near creeks plus stream gauging data, it is anticipated that by the first GSP 5-year update in 2027, there will sufficient data to better quantify depletions from groundwater extraction and establish whether groundwater elevations as a proxy are still applicable or not. Supplementing field measurements, there will be some component of analysis of depletion of surface water that relies on model simulation since depletion of surface water by groundwater extraction is only one component of streamflow and is not directly measurable in streamflow.~~

#### ~~6.5.4.2~~7.6.1.1 Criteria for Defining Depletion of Interconnected Surface Water Undesirable Results

~~The depletion of interconnected surface water undesirable result is defined~~ based on~~using chronic lowering of groundwater~~ levels~~elevation~~ and reduction of groundwater in storage SMC extraction~~ as a proxy. Per the GSP Regulations, the description of undesirable results was based on~~is~~ a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the Basin.~~

~~Criteria that were considered by t~~The SMGWA Board in defining~~defines~~ ~~undesirable results~~ for ~~depletion of interconnected surface water as~~ include avoiding ~~conditions worse than historical conditions.~~The criteria used to define significant and unreasonable impacts and ~~undesireable~~undesirable results for depletion of interconnected surface water are focused on the protection of beneficial uses and users. To protect these uses and users, maintaining groundwater elevations that result in sufficient surface water baseflow, in conjunction with maintaining groundwater extraction at levels below their historical highs that occurred prior to SGMA, are intended to result in avoiding impacts to surface water users within and outside the Basin, riparian and aquatic habitat and species, and GDEs adjacent to interconnected surface water. ~~Having recently had water infrastructure destroyed by wildfires, the Board believes that emergency operational issues or extended droughts are not cause for undesirable results. Fortunately, the Santa Margarita aquifer that contributes the majority of the Basin's baseflow quickly recharges in above-average water years, thereby naturally recovering after drought years and does not have a long-term effect on baseflow.~~

While the information reviewed by SMGWA indicates that groundwater elevations and extraction from the Unconfined aquifer have a more immediate impact on baseflow in any given year, groundwater elevations and extraction from the deeper, Confined aquifers are also considered as criteria. This is in recognition that declining water levels in the Confined aquifers could introduce vertical gradients that result in baseflow depletion over a multi-year timeframe.

#### ~~6.5.4.3 Numerical Description of Undesirable Results~~

~~Quantitatively, an undesirable result occurs when either:~~

- ~~Groundwater extraction from 1 or more aquifers exceeds itsthe reduction of groundwater in storage MT for 2 consecutive years; or~~
- ~~Groundwater elevations in 3 or more RMPs fall below the MT in 2 consecutive years in the shallow/unconfined aquifer system; or.~~
- ~~Groundwater elevations in 3 or more RMPs fall below the MT in 2 consecutive years in the deeper/confined aquifer system chronic lowering of groundwater levelsforGroundwater level conditions that constitute undesirable results for depletion of interconnected surface water occur if the groundwater level in any RMP falls below the minimum threshold in 2 or more consecutive non-drought years. If a RMP groundwater level below its minimum threshold is caused by emergency operational issues or extended droughts, it is not considered an undesirable result.~~

#### ~~6.5.4.4~~7.6.1.2 Potential Causes of Undesirable Results

~~As described in~~ Section 4.6.2 identifies~~4.6.2,~~ there is a relatively weak correlation between s~~S~~urface water flow ~~is more strongly correlated with precipitation than~~and groundwater extraction. However, undesirable results ~~for depletion of interconnected surface water in the context of the GSP must be related to the extraction of groundwater or other project and management actions implemented for groundwater sustainability, and not due to lack of precipitation during periods of prolonged drought. Undesirable results~~ may occur ~~in the future to GDEs~~ if groundwater pumping ~~near creeks~~ causes declines in shallow groundwater levels that support GDEs and baseflow to creeks. Given the strong correlation between precipitation and surface water flow, a likely cause of undesirable results would be an extended dry period of ~~two~~2 or more years (e.g., 2014 and 2015) or an extremely dry single year (e.g., 2021)~~, or if increased diversion of runoff results in reduced recharge in the aquifers, particular the Santa Margarita aquifer~~.

#### ~~6.5.4.5~~7.6.1.3 Effects on Beneficial Users and Land Use

Undesirable results from depletion of surface water can have the following general impacts on beneficial users and land uses:

- **Urban land uses and users**. If municipal supply wells cannot be pumped due to depletion of interconnected surface water SMC, an alternative water source will need to be used. This will likely add stress on municipal water systems which will result in installation of new wells or increased pumping in wells ~~distal~~ away from the impacted area, which increases the potential for further depletions of interconnected surface

water in other portions of the Basin. Depletion of interconnected surface water may reduce the availability of surface water for the City of Santa Cruz which is a downstream user of surface water that can only divert when there are flows greater than the Agreed Flows described in Section 2.2.8.

- **Rural residential land uses and users**. Depletion of interconnected surface water may limit the amount of available groundwater for residential groundwater supply due to reduced recharge from streams. Property values may decline if lowering of groundwater levels causes undesirable results that require residential pumping restrictions, deepening of wells, or connection to a public water system.
- **Industrial land uses and users**. Industrial use of groundwater in the Basin is limited to process and dust suppression water at 1 remaining sand quarry at Quail Hollow. Depletion of interconnected surface water has the potential to reduce access to groundwater for similar reasons listed above for rural residential users.
- **Agricultural land uses and users**. For the very limited agriculture in the Basin, depletion of interconnected surface water may reduce access to groundwater for similar reasons listed above for rural residential users.
- **Ecological land uses and users**. GDEs have the potential to be impacted directly if the depth to groundwater exceeds ~~depths accessed by the roots of groundwater dependent vegetation~~GDE rooting depth. Surface water bodies connected to groundwater may also incur reductions in baseflow. Under late summer low flow conditions, there is a direct relationship between streamflow and the amount of suitable GDE habitat. Reduction of flow directly reduces the amount of suitable rearing habitat for steelhead, by reducing the amount of wetted area, stream depth, flow velocity, cover, and dissolved oxygen. Reduced flow can also result in increased water temperature. In extreme conditions, dewatering of stream reaches eliminates the ability of fish to move to more suitable areas and can cause mortality. In even more extreme conditions, lowering of groundwater levels below the root zone of riparian vegetation can result in the loss of vegetation, impacting terrestrial GDE habitat. Section 2.4.1.8 includes a detailed discussion of the ecological users in the basin, including: a list of priority species and co-beneficiaries of priority species, resources and methods available to evaluate instream flows for priority species, steelhead and coho minimum passage and spawning criteria, and a summary of on-going programs to evaluate the biological response of priority species within the basin.

### 7.6.2 Minimum Thresholds - Depletion of Interconnected Surface Water

SMGWA and its partners have studied the relationship between groundwater and ISW throughout the Basin. Based on our understanding, direct measurement of depletion of ISW is infeasible and is not the most important information related to beneficial uses and users. Instead,

SMGWA believes the following framework for location, quantity, and timing of depletion of ISW addresses the intent of the regulation:

**Location:** T-he San Lorenzo River at Big Trees is an appropriate measuring point to account for the effect of depletion throughout the Basin. Accretion studies and dry-season streamflow monitoring indicate that the measurement of flow taken at this location ~~is~~are representative of Bassin conditions.

**Quantity:** The flow volume at Big Trees is appropriate for measuring depletion of ISW. This quantity can be related to the ability of both in-Basin and out-of-Basin surface water users to divert for public supply needs and the need of environmental uses to support critical fish species.

**Timing:** September flow is the best indicator for evaluating depletion of ISW. It coincides with when flows are most critical for both diverters and fish. It also comes at the end of the dry-season when the effects of groundwater levels are most prominent on baseflow.

~~6.5.5~~ Specifics of how these factors are tied to MTs are ~~given~~provided below.

#### ~~6.5.5.1~~7.6.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

The i~~I~~nformation and methodology used to establish the depletion of interconnected surface water ~~minimum threshold~~MTs and ~~measurable objective~~MOs ~~include:~~are the same as those used for chronic lowering of groundwater levels and reduction of groundwater in storage.

- ~~Definitions of significant and unreasonable conditions and desired groundwater elevations discussed during 2022 GSP development by Surface Water TAG and SMGWA Board meetings during 2022 GSP development~~

- ~~Depths, locations, and logged lithology of existing monitoring wells throughout the Basin~~

  - ~~Historical groundwater elevation data from monitoring wells~~
  - ~~Groundwater extraction measurements and estimates~~
  - ~~Streamflow and stream stage data collected by the USGS, SLVWD, and County of Santa Cruz~~
  - ~~Input from the Surface Water TAG (described in Section 1.1.1)~~
  - ~~Past hydrologic reports and accretion studies~~

Groundwater levels serve as a proxy for depletion of interconnected surface water due to their demonstrated relationship to contributions to baseflow as described in Section 4.6.3. ~~ISW Management Papers from DWR (DWR, 2024a, b, and c)~~WY 2013 was identified as a relatively

dry year that supported a minimum baseflow greater than 10 cfs through the month of September. Because the diversion restriction below 10 cfs impacts SLVWD as a beneficial user of surface water in the Basin, groundwater elevations from fall 2013, which supported more than the minimum baseflow, ~~were~~are used as the basis for establishing ~~the~~ MTs ~~values~~. This flow ~~also exceeds~~is greater than the minimum flow of 8 cfs identified in the 2025 City of Santa Cruz HCP for rearing of sensitive fish species.

The MOs are established at the fall 2006 groundwater elevations at each RMP. Fall 2006 was the second of two consecutive wet years, which followed three consecutive normal water years. Groundwater elevations were at a relatively high level similar to recent wet years like ~~WY~~water years 2017, 2018, and 2023. In 2006, San Lorenzo River ~~streamflow~~flow supported downstream diversions and met the 2025 City of Santa Cruz HCP in-stream flow requirements for a very wet year of 13.3 cfs, further making this an achievable ~~good~~ target year for Basin groundwater level management.

Figure 7-3 shows mean daily flow for ~~the~~ water years 2013 and 2006. Flow in WY2013 ~~stayed~~remained above the September Flow Minimum of 10 cfs, Groundwater levels ~~from~~in 2013 ~~that~~ supporting~~ed~~ this baseflow ~~became~~are the basis for the MTs. Flow in WY2006 stayed well above the Wet Year September Flow Minimum of 13.3 cfs. Groundwater levels from 2006 that supported this baseflow ~~became~~are the basis for the MOs.

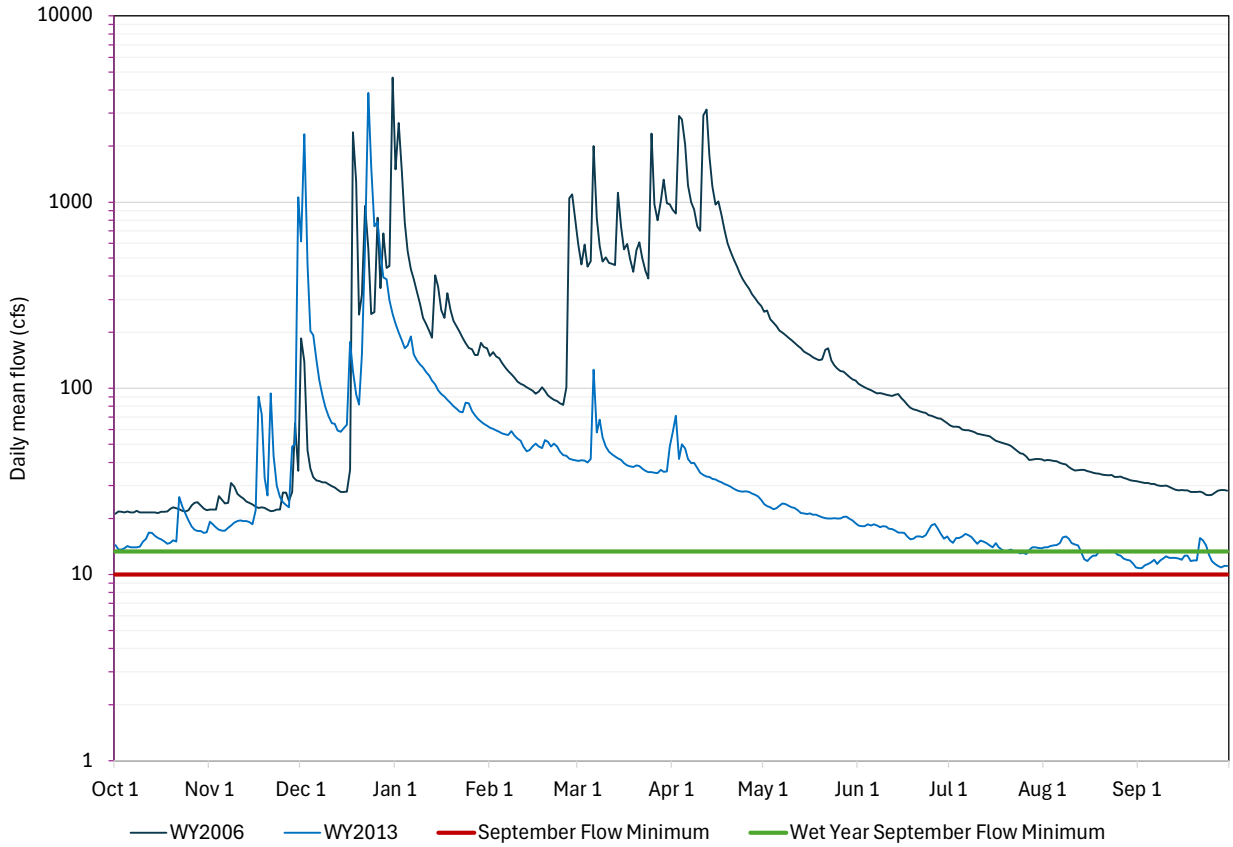



Figure 7-3. Daily Mean Flow at Big Trees for WY 2006 and 2013 and HCP Minimum Flow Requirements

- Groundwater extraction is used as an additional SMC indicator for depletion of ~~interconnected surface water~~ISW. As discussed in Section 7.4 above, the MO is established as the model-determined sustainable yield of the Basin and the MT is associated with allowing additional extraction during dry conditions to develop future conjunctive use programs while operating within the sustainable yield over the long-term.

~~Since groundwater level is used as a proxy to define the minimum thresholds for the depletion of interconnected surface water, the approach for this sustainability indicator is consistent with the approach for defining minimum thresholds for chronic lowering of groundwater levels, described in Section 3.4.3.1.~~

~~Consistent with the approach used for chronic lowering of groundwater level minimum threshold, historical data from the 2 existing surface water depletion RMPs, SLVWD Quail MW-A and SVWD SV4-MW, is used to develop surface water depletion minimum thresholds. These RMPs are both screened in the Santa Margarita aquifer in locations close to interconnected creeks. Historical groundwater level records at SLVWD Quail MW-A have been consistent; the absolute minimum is less than 1 ft lower than the average of the 5 lowest measurements. However, at monitoring well SVWD SV4-MW there is more variation in measured groundwater levels. The absolute minimum, recorded in 2009, is approximately 12 feet lower than the average of the 5 lowest measurements. This point was the only measurement over a 7-year span and was approximately 11 feet lower than any other recorded point. The average of the 5 lowest groundwater levels is approximately 1 foot higher than the second lowest recorded groundwater level in 1999. As more data are collected, the validity of this outlying measurement at SVWD SV4-MW will be assessed. The surface water depletion RMP network will be refined with new data and monitoring wells during the GSP 5-year update.~~

#### ~~6.5.5.2~~7.6.2.2 Depletion of Interconnected Surface Water Minimum Thresholds

Identical MTs are used for this sustainability indicator and the chronic lowering of groundwater levels and reduction of groundwater in storage indicators described in Sections 7.3 and 7.4.

~~Since g~~Chronic lowering of groundwater levels ~~and reduction of groundwater in storage SMC are~~is used as a proxy ~~to define the minimum thresholds~~ for the depletion of interconnected surface water~~,~~. MTs for each RMP are summarized in Table 7-1. Hydrographs showing MTs and MOs for each RMP are included in Appendix 7A. ~~Minimum thresholdsMTs for Bboth of these indicators are based on conditions observed use minimum thresholds framed around the time passage of SGMA was enacted, which coincidedcorresponds with the lowest minimum groundwater levels and the end of conclusion of the Basin's period of the peak extraction period in the Basin. SGMA code specifically states that "The plan may, but is not required to, address undesirable results that occurred before, and have not been corrected by, January 1, 2015" [CWC §10727.2(b)(4)]. Accordingly,; therefore, groundwater managing the Basin ement to maintain groundwater levels above avoid fall 2013 groundwater levels and WYYYYY-~~

~~YYYYgroundwater extraction below peak historical ratesin the 5 years prior to SGMA (WY 2010-2014) is consistent with SGMA and enables allows SMGWA to establish manage the Basin to MTs that avoid undesirable results. Furthermore, using identical MTs and MOs across multiple sustainability indicators creates an integrated approach to manage the Basin wholisticallythe approach for this sustainability indicator is consistent with the approach for defining minimum thresholds for chronic lowering of groundwater levels, described in Section 3.4.3.1.~~

The cross-sections

~~Minimum thresholds for depletion of interconnected surface water RMPs are summarized in Table 3-22Table 3-22. Hydrographs showing historical groundwater elevation data compared to the minimum threshold and streambed elevation are provided~~ on Figure 7-4 and Figure 7-5~~Figure 7-4Figure 7-4~~ show ~~the~~ MTs and MOs near the downstream reaches of the interconnected stream reaches on the San Lorenzo River/Newell Creek, Bean Creek, and Zayante Creek. The MTs and MOs are at a higher elevation than nearby interconnected stream reaches on the San Lorenzo River, Newell Creek, Zayante Creek, and Bean Creek and thus continue to support baseflow of groundwater to streams. The figures also show groundwater levels measured in fall 2025 for an example of how current conditions compare to the SMC.

Groundwater extraction SMC are shown in Table 7-2. Figures 7-1 and 7-2 show the SMC graphically with respect to historical, current, and projected conditions based on modeling.

~~.~~

~~Table 3-22. Minimum Thresholds, Measurable Objectives, and Interim Milestones for Depletion of Interconnected Surface Water~~

| | ~~Groundwater Elevation (feet above mean sea level)~~ | | | | |
|---|---|---|---|---|---|
| ~~Well Name~~ | ~~Minimum Threshold~~ | ~~Interim Milestone #1 (2027)~~ | ~~Interim Milestone #2 (2032)~~ | ~~Interim Milestone #3 (2037)~~ | ~~Measurable Objective~~ |
| ~~SLVWD Quail MW-A~~ | ~~413~~ | ~~416~~ | ~~416~~ | ~~416~~ | ~~416~~ |

| | | | | | |
|---|---|---|---|---|---|
| ~~SVWD SV4 MW~~ | ~~381~~ | ~~387~~ | ~~387~~ | ~~387~~ | ~~387~~ |

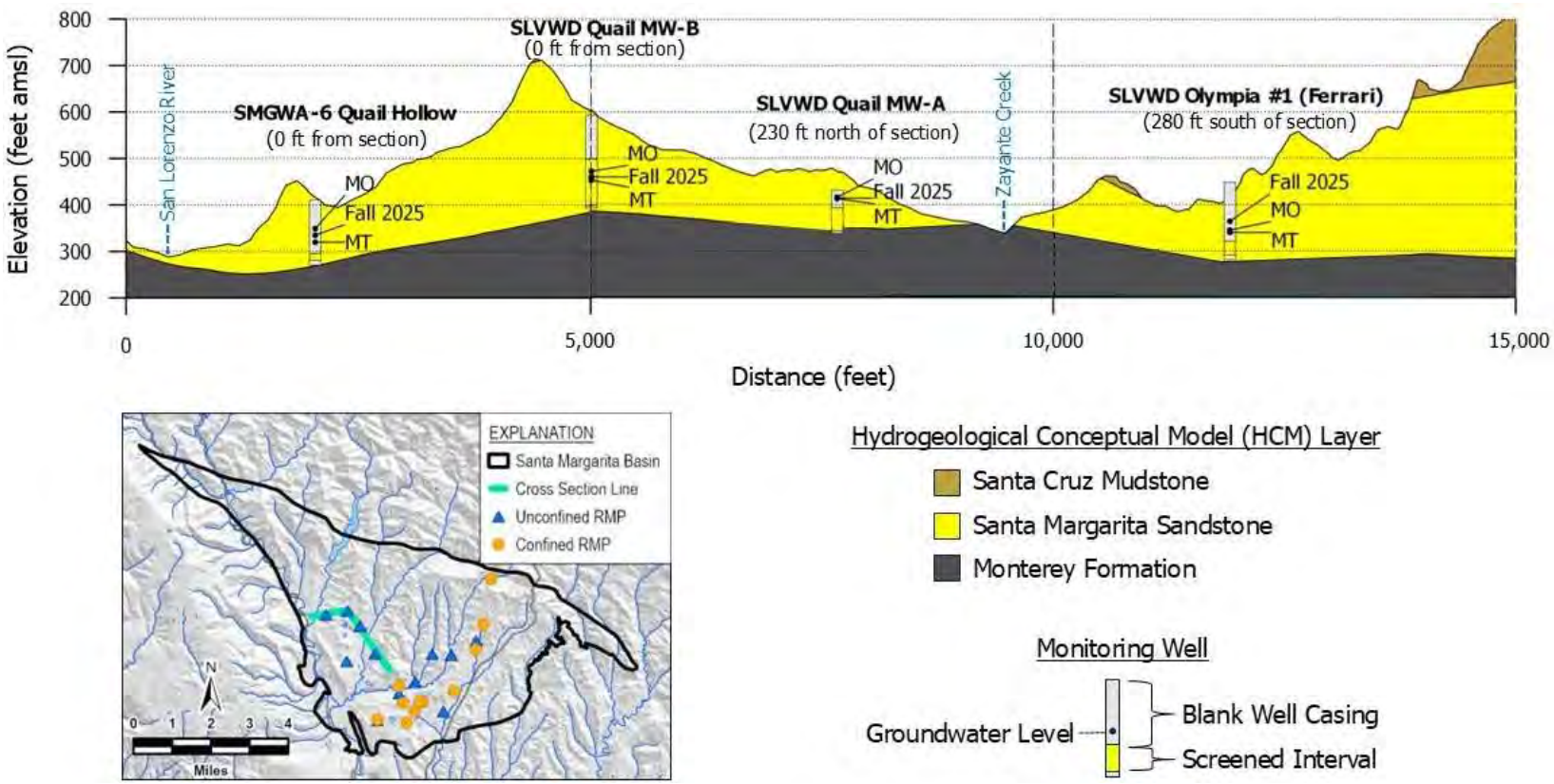



Figure 7-~~47~~ ~~37~~ ~~27~~ ~~1~~: Cross-Section of Groundwater Level Minimum Thresholds~~Ts, MOs~~Measurable Objectives~~.~~, and WY2025 Groundwater ~~Levels~~Elevations Relative to Interconnected Streams in the Quail Hollow and Olympia/Mission Springs Subareas ~~Hydrograph for SLVWD Quail MW-A in the Santa Margarita Aquifer Showing Minimum Threshold and Measurable Objective Relative to Measured Groundwater and Streambed Elevations~~

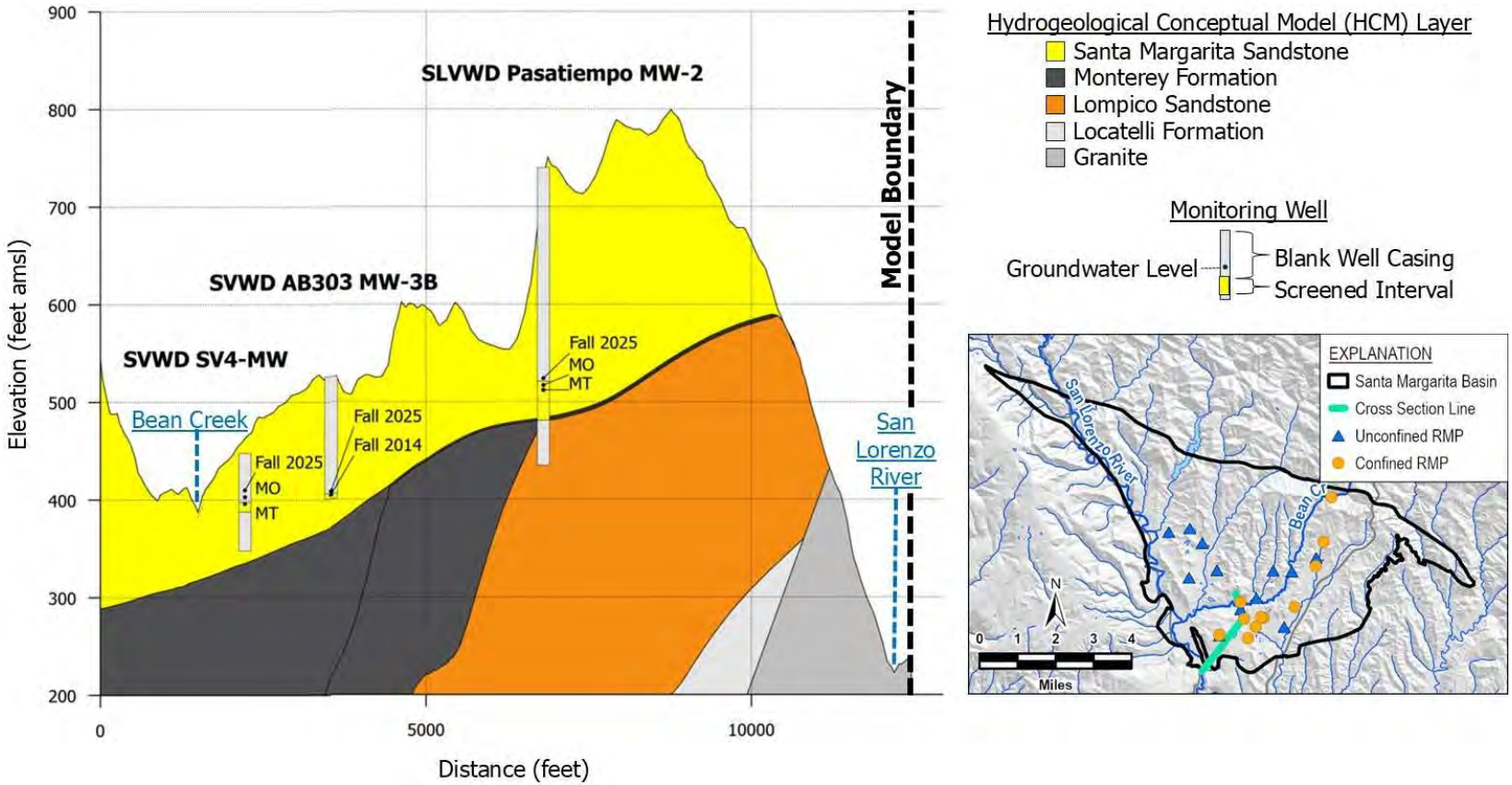



Figure 7-~~5~~7-~~4~~7-~~3~~7-~~2~~. Cross-Section of 2027 GSP Amendment Groundwater Level Minimum Thresholds, Measurable Objectives, and WY2025 Groundwater Elevations ~~MTs, MOs. and WY2025 Groundwater Levels~~ Relative to Interconnected Streams in the Olympia/Mission Springs and Mount Hermon / South Scotts Valley Subareas

~~: Hydrograph for SLWD SV4-MW in the Santa Margarita Aquifer Showing Minimum Threshold and Measurable Objective Relative to Measured Groundwater and Streambed Elevations~~

### ~~6.5.5.3~~7.6.2.3 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

~~Since the groundwater elevations are based on historical conditions and are considered an achievable condition, the individual minimum thresholds at RMPs do not conflict with each other.~~

Using ~~The surface water depletion minimum thresholds have the potential to influence other sustainability indicators.~~ chronic lowering of groundwater levels and reduction of groundwater in storage SMC proxy ~~The groundwater level minimum thresholds are selected to a~~should avoid undesirable results for other sustainability indicators, as described below:

- **Chronic lowering of groundwater levels**. ~~Groundwater levels are used as a proxy for monitoring the depletion of interconnected surface water minimum thresholds.~~ The ~~methodology~~ SMC ~~for establishing minimum thresholds for both sustainability indicators~~ are ~~the same~~identical for the unconfined aquifer and confined aquifers for both sustainability indicators. ~~The confined aquifer groundwater levels are not sensitive to streamflow in the areas where it used for water supply.~~. ~~If groundwater levels for chronic lowering of groundwater level RMPs are lower than their minimum thresholds, groundwater levels for streamflow depletion are also likely to be lower than their minimum thresholds.~~
- **Reduction of groundwater in storage**. The SMC are identical for the unconfined aquifer and confined aquifers subject to stream depletion in this Basin. ~~Confined aquifer extraction has a marginal influence on streamflow depletion in the Basin. Minimum thresholds for depletion of interconnected surface water do not promote pumping in excess of the sustainable yield that is needed to ensure change of groundwater in storage does not cause undesirable results. Therefore, the minimum threshold for depletion of interconnected surface water minimum thresholds will not result in an exceedance of the groundwater storage minimum threshold.~~
- **Degraded groundwater quality**. ~~Minimum threshold~~MTs for depletion of interconnected surface water ~~are set just above the~~ are intended to maintain groundwater levels above 2013 and extraction ~~below 203 levels~~operating within the sustainable yield~~historical minimum groundwater elevation~~. Since ~~historical groundwater levels are not thought to cause existing degradation of~~ groundwater quality degradation was not occurring ~~inunder~~ under these conditions, ~~, depletion of interconnected surface water~~ the ~~minimum thresholds~~MTs are ~~should is~~ not expected to~~not~~ ~~result~~ cause future~~in~~ exceedances of groundwater quality ~~minimum threshold~~MTs ~~in the future~~.
- **Seawater intrusion**. Not applicable.
- **Subsidence**. Not applicable.

### ~~6.5.5.4~~7.6.2.4 Effect of Minimum Thresholds on Neighboring Basins

The anticipated effect of the depletion of interconnected surface water ~~minimum threshold~~MTs on each of the neighboring basins is addressed below.

**Santa Cruz Mid-County Basin** (critically-overdrafted). The Santa Margarita Basin is upstream of the Santa Cruz Mid-County Basin. The San Lorenzo River does not run through the Santa Cruz Mid-County Basin, but the West Branch of Soquel Creek and Blackburn Gulch/Branciforte Creek do. Only a very small portion of the West Branch of Soquel Creek runs through the Santa Margarita Basin (Figure 2-1). By maintaining groundwater levels above ~~historical~~ 2013 levels in areas near interconnected streams, the ~~minimum threshold~~MTs do not prevent the Santa Cruz Mid-County Basin from meeting their respective surface water depletion ~~minimum threshold~~MTs which are based on groundwater elevations slightly higher than historical lows. Groundwater flow between the Santa Cruz Mid-County Basin and the Santa Margarita Basin is limited, and there are no GSP projects or management actions planned for either basin that might change hydraulic gradients near the basins' shared boundary. The lack of connection between the Santa Cruz Mid-County Basin's primary aquifer (Purisima Formation) and the Santa Margarita Basin's primary aquifers (Santa Margarita, Lompico and Butano aquifers) further reduces the likelihood of either basin affecting depletion of interconnected surface water ~~minimum threshold~~MTs in the neighboring basin.

**Purisima Highlands Subbasin of the Corralitos Basin** (very low priority). The Purisima Highlands Subbasin is hydraulically upgradient from the Santa Margarita Basin and separated by the Zayante-Vergeles fault zone which acts as a barrier to groundwater flow. This hydrogeologic disconnect provides little opportunity for depletion of interconnected surface water in the Santa Margarita Basin to influence groundwater in the Purisima Highlands Subbasin.

**West Santa Cruz Terrace Basin** (very low priority). Most private domestic wells in the West Santa Cruz Terrace Basin pump from low yielding Quaternary alluvium and terrace deposits (DWR, 2003). These deposits are not principal aquifers in the Santa Margarita Basin nor are they hydraulically downgradient of the Santa Margarita Basin. Therefore, it is unlikely that the depletion of interconnected surface water ~~minimum threshold~~MTs in the Santa Margarita Basin would influence the West Santa Cruz Terrace Basin.

### ~~6.5.5.5~~7.6.2.5 Effects of Minimum Thresholds on Beneficial Users and Land Uses

The ~~minimum threshold~~MTs for depletion of ~~interconnected surface water~~ISW measured using chronic lowering of groundwater levels and reduction of groundwater in storage SMC proxy ~~groundwater levels as a proxy~~ assumes that maintaining groundwater levels at or above ~~historical low levels in the Basin~~fall 2013 conditions, will maintain groundwater's contribution to creeks thus supporting beneficial users in the Basin. ~~historical levels of surface water depletion. Maintaining surface water depletion at levels greater below~~than historical conditions will provide

~~a benefit to beneficial users and land uses that rely on interconnected surface water.~~ The following specifically describes how managing to ~~minimum thresholds~~ these MT proxies will benefit land use and beneficial water use in the Basin:

- **Urban land uses and users**. Municipal groundwater pumpers will still be able to meet their typical water demands if surface water's ~~inter~~connection with groundwater ~~levels~~ remains similar to the historical degree of connection ~~levels~~. The City of Santa Cruz, as a user of Basin surface water and implementor of habitat conservation in the San Lorenzo River watershed, relies on baseflows to help achieve the Agreed Flows described in Section 2.2.8. If groundwater levels adjacent to creeks are no lower than ~~historical levels~~fall 2013 levels, baseflows should remain within the historical range of flows used to determine the Agreed Flows.
- **Rural residential land uses and users**. Maintaining surface water interconnection with groundwater at or above ~~historical levels~~ fall 2013 levels will protect the ability of residential beneficial users ~~of groundwater by keeping groundwater levels at or above historical low levels. This protects their ability~~ to pump from domestic wells ~~in the vicinity of creeks~~.
- **Industrial land uses and users**. Maintaining surface water interconnection with groundwater should benefit industrial land uses and beneficial users by supporting similar groundwater pumping to historical levels.
- **Agricultural land uses and users**. For the very limited agriculture in the Basin, maintaining interconnection of surface water and groundwater at historical levels should not impact irrigation water supply.
- **Ecological land uses and users**. ~~The main benefit of the surface water depletion minimum thresholds is to GDEs for priority species.~~ Meeting ~~minimum threshold~~MTs ~~for depletion of surface water allows for continuing gaining surface water in the vicinity of the RMPs. Based on historical conditions, these groundwater levels are considered sufficient to~~will support GDEs ~~for~~ and priority species by maintaining sufficient in-stream flows.

#### ~~6.5.5.6~~7.6.2.6 Relevant Federal, State, or Local Standards

No explicit federal, state, or local standards exist for depletion of interconnected surface water. However, both the CCRWQCB and state and federal endangered species provisions call for the protection and restoration of conditions necessary for steelhead and coho salmon habitat in San Lorenzo River. These provisions were considered in development of the ~~surface water depletion minimum thresholds~~MTs for ISW~~surface water~~ depletion.

### ~~6.5.5.7~~7.6.2.7 Method for Quantitative Measurement of Minimum Thresholds

Identical metrics are used for this sustainability indicator and the chronic lowering of groundwater levels and reduction of groundwater in storage indicators ~~proxies,~~ described in prior sections~~chronic lowering of Groundwater elevations~~s ~~reduction of change in storage~~ ~~will be measured in RMPs used to monitor surface water depletion as a proxy. Groundwater level monitoring will be conducted in accordance with the monitoring protocol outlined in Section 3.3.2.1.~~

~~In addition to the direct measurement of groundwater levels, GDE monitoring described in Section 3.3.1.5.1 will be compared to proxy groundwater levels in an effort to correlate vegetation vigor with groundwater levels~~.

## ~~6.5.6~~7.6.3 Measurable Objectives - Depletion of Interconnected Surface Water

### ~~6.5.6.1 Measurable Objectives~~

Identical MOs and interim milestones are used for this sustainability indicator and the chronic lowering of groundwater levels and reduction of groundwater in storage indicators ~~proxies,~~ described in ~~prior s~~Sections 7.3 and 7.4~~Measurable objectives are established to define an achievable average groundwater level in the depletion of interconnected surface water RMPs. The measurable objectives for the Santa Margarita aquifer surface water depletion RMPs are the annual minimum groundwater levels in each RMP from the fall of WY 2004.~~

~~Measurable objectives are based on groundwater levels that occurred in a historical average year. The average year selected is WY2004 because WY2004 and the 5 prior years cumulatively average 41 inches per year, which is similar to the average precipitation of 41.7 inches between 1947 and 2020 measured at the El Pueblo Yard in Scotts Valley. The prior 5 years comprise 4 normal and 1 dry water year.~~

~~Measurable objectives for depletion of interconnected surface water RMPs are summarized in Table 3-22Table 3-22 and hydrographs showing historical groundwater elevation data compared to the measurable objective are provided in Appendix 3A~~.

### ~~6.5.6.2 Interim Milestones~~

~~Recent groundwater levels are close to the measurable objective at both depletion of interconnected surface water RMPs. Because the 540 AFY expanded conjunctive use project used to develop the measurable objectives targets the Lompico aquifer, the RMPs in the Santa Margarita aquifer are predicted to have very small increases in groundwater levels. Interim milestones are therefore set at the same elevations as measurable objectives shown in Table 3-22Table 3-22.~~

## 6.67.7 Land Subsidence Sustainable Management Criteria

The lLand subsidence sustainability indicator is not applicable is highly unlikely in this consolidated bedrock e Basin as an indicator of groundwater sustainability and therefore no SMC are setestablished for this sustainability indicator. Section 4.5: Land Subsidence provides substantiating evidence for subsidence's inapplicability as an indicator of groundwater sustainability. Even though the indicator is not applicable, the SMGWA Board agreed that any land subsidence caused by lowering of groundwater levels occurring in the Basin would be considered significant and unreasonable.

If, during GSP implementation, the Basin experiences conditions of inelastic subsidence specifically due to groundwater use, the SMGWA would develop land subsidence SMC in an update to the GSP.

# ~~7~~8 PROJECTS AND MANAGEMENT ACTIONS

This chapter describes a range of potential ~~projects and management actions~~ PMAs that will allow the Basin to ~~attain~~ achieve sustainability in accordance with §354.42 and §354.44 of the ~~SGMA~~ GSP ~~r~~Regulations.

As a Joint Powers Authority, the SMGWA is comprised of 3 member agencies: SLVWD, SVWD, and the County. The SMGWA Board consists of representatives from the 3 member agencies and from other public agencies and private groups that rely directly or indirectly on groundwater from the Basin: City of Scotts Valley, City of Santa Cruz, MHA, and private well owners. ~~Projects and management actions~~PMAs presented herein may provide benefits to just a single agency, to multiple agencies, and/or other groundwater or surface water users within the Basin. The term *cooperating agencies* is used throughout this section to represent the diverse water supply and land use planning agencies, organizations, and other operations that have a role in developing or implementing projects and/or management actions within the Basin. It includes SMGWA member agencies, other public agencies, and private parties.

~~Projects and management actions~~PMAs discussed in this section are in varying stages of development. They are proposed to achieve one or more of the following outcomes:

- Achieve groundwater sustainability in the Basin by meeting SMC by 2042
- Meet the water supply goals of the cooperating agencies
- Provide a framework for future collaboration and cost sharing for cooperating agencies

~~Groundwater is a primary source of drinking water for residents and businesses within the Basin. Groundwater supports important creek baseflows for municipal agencies and aquatic species throughout the year, but most importantly, in the summer and fall. The City of Santa Cruz indirectly uses groundwater from the Basin because the surface water it diverts from the San Lorenzo River for municipal use partially comprises baseflows supported by Basin groundwater discharge to creeks.~~

~~Projects introduced within this section focus on achieving high return on investment using existing supply and infrastructure resources within the Basin, transferring surface water sources from outside the Basin, or recharging the Basin with purified wastewater. Several projects have the benefit of creating supplemental supply to improve water supply reliability for the City of Santa Cruz, SLVWD, and SVWD. Some projects benefit areas pumped by *de minimis* groundwater users.~~

The Santa Margarita Basin is not currently experiencing undesirable results based on the SMC in this GSP. Additionally, modeling of projected conditions with future demands (Section 5.4~~5.3~~)

indicates that the Basin is generally in balance and will likely be sustainable with limited ~~projects and management actions~~PMAs. This current and projected status ~~status~~ has been achieved ~~by projects and management actions thought~~through a combination of ~~projects and management actions~~PMAs implemented over the past 2 decades that are ~~ongoing todaypermanent due to the~~already providing significant benefits to the Basin. These~~se~~ ongoing~~include implementing P~~PMAs~~rojects and management actions~~ are:

- ~~Water Use Efficiency Programs as described in Section 2.1.3.4.6.5~~
- ~~Stormwater Recharge Projects as described in Section 2.1.3.4.6.3~~
- ~~Recycled Water Program as described in Section 2.1.3.4.6.6~~
- Conjunctive ~~U~~use of groundwater and surface water ~~as described in~~( Section 2.3.4.1);~~2.1.3.4.5~~
  - Stormwater recharge (Section 2.3.4.2);
  - Water use efficiency programs (Section 2.3.4.4); and
  - Recycled water use (Section 2.3.4.5)

~~The primary groundwater condition in the Santa Margarita Basin that projects and management actions aim to improve is lowered groundwater levels in one of the Basin's primary aquifers. The affected aquifer is the Lompico aquifer in the Mount Hermon / South Scotts Valley area where there has been a 150 to 200-foot historical decline in groundwater levels as described in Section 2.2.4.1. The long-term decline has been halted by successful water use efficiency programs and supplying recycled water for non-potable uses. Increasing groundwater levels to meet the SMGWA's sustainability goal will require additional projects and management actions to achieve sustainability under the assumed future climate conditions.~~

Additional ~~P~~PMAs~~rojects and management actions~~ that have yet to be implemented are presented below in ~~3~~ 2 groups,~~ that provide distinction of the general status of projects and management actions representing a range of scale, cost, and state of planning and implementation, and timeframe which they may be implemented.~~are classified as primary and ~~and~~ supplemental PMAs:~~.~~

> ~~**Group 1 - Baseline Projects and Management Actions:** Activities in Group 1 are considered existing commitments by cooperating agencies. These include projects and management actions that are currently being implemented and are expected to continue to be implemented, as needed, to assist in achieving the sustainability goal throughout the GSP implementation period. Group 1 projects and management actions are incorporated into baseline conditions in the groundwater model used to evaluate projected~~

~~groundwater conditions. Group 1 projects and management actions, by themselves, are not sufficient to achieve groundwater sustainability.~~

- **~~Group 2~~ Primary ~~Projects and Management Actions~~PMAs ~~in Planning Process~~:** Primary ~~projects~~PMAs ~~in Group 2~~ are considered the Basin's ~~best~~ most immediate options for ~~reaching sustainability~~the continued avoidance of undesirable results in the SGMA implementation horizon. ~~Many Group 2~~Primary projects require detailed feasibility and environmental review. Management actions can be implemented at the discretion of the GSA. Continuation of ~~Group 1~~ongoing projects listed above, ~~along with the select Group 2primary projects,~~ supplemented by the primary PMAs is anticipated to ~~bring~~ allow the Basin to ~~into~~ achieve long-term sustainability. ~~It is anticipated that the continuation of Group 1 projects along with a subset of Group 2 projects should allow the Basin to reach sustainability.~~ If this combination of PMAs ~~is not~~cannot ~~able to~~ meet the SMGWA's sustainability goals, additional ~~Group 2~~supplemental projects ~~and even Group 3 projects~~ may need to be~~ further~~ evaluat~~implement~~ed.

~~Group 2 projects are further organized into tiers based on their source of water:~~

- ~~Tier 1 – Projects that rely on existing water sources within the Basin~~
- ~~Tier 2 – Projects that rely on water from existing surface water sources outside the Basin~~
- ~~Tier 3 – Projects that rely on purified wastewater~~

- **~~Group 3~~ Supplemental ~~Projects and Management Actions~~PMAs ~~Requiring Future Evaluation~~:** If groundwater model projections and assumptions of future supply availability change or if ~~Group~~ primary ~~2~~ projects do not ~~end up having~~achieve the expected results further ~~projects and/or management actions~~PMAs will be required to achieve sustainability. Similarly, if ~~Group 2~~primary projects fail to become feasible either due to costs, environmental requirements, or any other reason, SMGWA may need to look to additional projects. In either case, appropriate supplemental projects may be ~~chosen from those listed under Group 3~~explored. As work continues on water supply and resource management efforts, it may be prudent to incorporate additional projects into future GSP ~~updates~~amendments.

Primary and supplemental projects included here are generally the result of work and ideas emanating from a 2017 Memorandum of Agreement between SLVWD, SVWD, City of Santa Cruz, and County of Santa Cruz (City of Santa Cruz *et al.*, 2017) to explore and evaluate potential projects for the conjunctive use of surface and groundwater resources in the Basin and San Lorenzo River watershed.

## ~~7.1~~8.1 How Projects will be Accomplished

~~Projects and management actions~~PMAs included in Sections 8.2 and 8.3 provide a framework for achieving the outcomes described above. However, project feasibility analysis must be completed, funding secured, and necessary cooperation agreements negotiated before any of the ~~projects and management actions~~PMAs proceed with design, permitting, water rights, environmental review, and ultimately implementation. Costs for implementing projects are in addition to the costs for operation of the SMGWA described in the GSP's implementation plan in Section 9.

~~Group 2 and 3 p~~Projects are not sufficiently developed ~~enough~~ for cooperating agencies to ~~fully~~ commit to them before~~any projects prior to submission of~~ the SMGWA submits the GSP Amendment to DWR in January ~~2022~~2027. C~~Project implementation will ultimately be led by c~~ooperating agencies, rather than~~not~~ the SMGWA, lead project implementation and coordinate~~working in coordination~~ with one another on~~for~~ projects with multi-stakeholder benefits. ~~Many~~ Some projects may ultimately carry substantial costs, and their~~have significant costs and their viability for~~ implementation depends on obtaining grants and~~/or~~ low-interest loans to supplement local revenue streams.

Through project feasibility analysis, cooperating agencies will need to demonstrate to the SMGWA that their projects meet SMGWA's groundwater sustainability goals, water supply goals of the individual cooperating agencies without causing undesirable effects to other groundwater beneficial uses or users.

Feasibility and analysis of projects will require additional information, technical and financial analysis, modeling, and potentially, pilot scale testing. Findings and results of such feasibility and analysis will be provided to the SMGWA Board for final evaluation and approval. SMGWA Board involvement in project evaluation is likely limited to determining if projects interfere with achieving the Basin's sustainability goals or have negative impacts on other GSP-related ~~projects or management actions~~PMAs. Cooperating agencies are encouraged to coordinate with one another on projects to ensure multi-stakeholder benefits, thereby decreasing the likelihood of project interference. ~~The process described herein is shown in Figure 8-1.~~

~~Figure 8-. Project Feasibility Process~~

Aside from feasibility and analysis, each SMGWA member and cooperating agency ~~will be~~is responsible for permitting and other specific implementation oversite for its own projects.

Inclusion in this GSP does not forego any obligations under local, state, or federal regulatory programs.

~~Most of the projects presented within Groups 2 and 3 are conceptual and still within the development phase shown on Figure 8-1. Very few projects within these groupings have had any feasibility analysis performed. For those where feasibility analysis has been performed, additional analysis is likely needed to update project scopes, benefits, limitations, and costs.~~ A complete summary table of PMAs is included in Appendix 8A.

## ~~7.2 Baseline Projects and Management Actions (Group 1)~~

~~Projects and management actions in Group 1 are existing commitments by cooperating agencies and are currently being implemented. These baseline projects and management actions are expected to continue, as needed, throughout the GSP implementation period. As mentioned previously, these projects and management actions alone do not achieve basin sustainability on their own.~~

### ~~7.2.1 Existing Water Use Efficiency~~

~~SLVWD and SVWD are already implementing a number of water use efficiency and conservation activities. These successful programs have been in place for some time and have contributed to significant demand reduction. These programs are regularly updated to continue to incentivize conservation and promote efficient use of water. The programs are supported by extensive public outreach and education measures.~~

~~SLVWD, SVWD, the County, and City of Santa Cruz are members of the Water Conservation Coalition of Santa Cruz County, which serves as a regional information source for countywide water reduction measures, rebates, and resources. The Water Conservation Coalition provides water saving tips, information on countywide rebate programs, and educational materials (e.g., drought-tolerant plants suitable for local conditions). The organization works collaboratively to produce press releases, newspaper ads, radio ads, and informational booths at local events.~~

~~SLVWD, SVWD, the County, and the City of Santa Cruz have adopted water waste ordinances (incorporating State of California Executive Order B-37-16), which allow agencies to address incidents of water waste by investigating, recommending corrective action, providing follow-up documentation of resolution, and administering penalties, fines, and water service disconnection commensurate with the excessiveness of the action.~~

~~SLVWD promotes public awareness and education through a variety of water use efficiency programs. SLVWD provides information to customers regarding the water supply sources, the~~

~~San Lorenzo River watershed, and the public's role in conserving water and protecting shared resources. The SLVWD website provides seasonal water use efficiency tips, informs customers when the drought contingency plan is in effect, posts restrictions or prohibitions for outdoor water use, provides rebate and landscape waterwise assistance and provides contacts for other partner organizations supporting water conservation. As mentioned previously SLVWD is part of the Water Conservation Coalition of Santa Cruz County.~~

~~SVWD, like SLVWD, also promotes public awareness and education through a variety of water efficiency programs. SVWD established the Think Twice Water Use Efficiency program which prescribes a set of activities to support SVWD's long-term sustainable water supply planning efforts. The program outlines a multi-pronged approach that increases awareness about indoor and outdoor water use efficiencies, promotes water efficient behaviors, and continuously reduces water waste. A key Think Twice program component is education and outreach. SVWD promotes public awareness and education of SVWD water supply sources, the San Lorenzo River watershed, and the public's role in conserving water and protecting shared resources. The SVWD website provides water use efficiency tips, informs customers when the drought contingency plan is in effect, posts restrictions or prohibitions for outdoor water use, provides rebate and landscape waterwise assistance and provides contacts for other resources that support water conservation. As mentioned previously, SVWD is part of the Water Conservation Coalition of Santa Cruz County.~~

~~Although the City of Santa Cruz is not in the Basin, it does divert water from the San Lorenzo River in the Basin. Consequently, conservation measures implemented by the city lessen the need for surface water diversions in the Basin. The City of Santa Cruz actively values and promotes public awareness and education about its water resources and the importance of water conservation. In 2017, the City of Santa Cruz initiated a Water Conservation Master Plan to define the next generation of water conservation activities and serve as a road map to help the community achieve maximum, practical water use efficiency. The City of Santa Cruz disseminates information to the public in different forms including media, workshops and community events, billing and customer service, and school education programs. In addition to education and outreach the City of Santa Cruz implements the following conservation programs: metering infrastructure improvements to monitor water losses, large landscape budget-based water rates, residential leak assistance, high efficiency plumbing fixture rebates, turf removal and lawn rebates, sprinkler nozzle rebates, gray water retrofits and rain barrels, and overall system water loss reductions.~~

~~These management actions will continue to evolve with technological advances and future legislative requirements. Existing water use efficiency activities lower water demand and consequently reduce groundwater pumping and surface water diversions. Depending on where~~

~~pumping and diversion reductions occur, groundwater levels may increase, and surface water depletions may be reduced.~~

~~There is currently no plan to end these successful water use efficiency activities. SVWD's peak water usage was in 2003 and they have since reduced consumption by 45% (data from 1995 to 2020 water years, WSC AND M&A, 2021). SLVWD's peak water usage was in 2002 and they have since reduced consumption by 26% (data from 1995 to 2020 water years, WSC AND M&A, 2021). City of Santa Cruz's peak water usage was in 2000 and they have since reduced consumption by 45% (data from 1951 to 2015 water years, City of Santa Cruz, 2016). Costs of conservation and demand management programs are built into respective agency's budgets and are not anticipated to be passed on to the SMGWA. As existing water use efficiency activities within the Basin continue to evolve over time, any significant changes will be publicly noticed as necessary by each implementing agency's governing bodies. Existing California state law gives water districts the authority to implement water conservation programs. Local land use jurisdictions have police powers to develop similar permitting programs to conserve water. SGMA grants the SMGWA legal authority to pass regulations necessary to achieve sustainability. Cooperating agencies are committed to successful implementation of their conservation programs.~~

### ~~7.2.2 SVWD Low Impact Development~~

~~SVWD has implemented 3 LID projects, largely with grant funds that apply stormwater BMPs—such as infiltration basins, vegetated swales, bio-retention and/or tree box filters—to retain and infiltrate stormwater that is currently being diverted into the storm drain system. SVWD has installed monitoring equipment to assess the performance of the facilities. The total amount of stormwater captured at the 3 LID facilities in the SVWD service area in 2019 was 40.38 AF and in 2020 was 19.42 AF (Montgomery & Associates, 2021). The location of the LID facilities is described in Section 2.1.3.4.6.3 and shown on Figure 2-7. The 3 LID projects are:~~

- ~~Transit Center LID: SVWD obtained grant funding through a Santa Cruz County Proposition 84 grant from the SWRCB for the planning, design, and construction of a LID retrofit at the Scotts Valley Transit Center site. The design included construction of a vegetated swale, a below-ground infiltration basin, and pervious pavement. Construction began in October 2016 and was completed in May 2017. In 2020, SVWD recorded a total of 1.5 AF of infiltrated stormwater at this location (Montgomery & Associates, 2021).~~
- ~~Woodside Homeowner's Association LID: As part of the Proposition 84 grant match, SVWD worked with a local developer to install a stormwater recharge facility at the Woodside Homeowner's Association along Scotts Valley Drive. This facility includes a large below-ground infiltration basin. Stormwater is routed from the development to the basin where it can percolate down into the groundwater. Initial hydrology reports estimate~~

~~recharge on the order of 20 to 40 AFY (Ruggeri, Jensen, and Azar, 2010). In 2020, SVWD recorded, a total of 14.97 AF of infiltrated stormwater at this location (Montgomery & Associates, 2021).~~

- ~~Scotts Valley Library LID: An earlier grant-funded project installed a below-ground infiltration basin at the Scotts Valley Library. In 2020 SVWD recorded, a total of 2.94 AF of infiltrated stormwater at this location (Montgomery & Associates, 2021).~~

~~In addition to the 3 LID projects described above, SVWD was part of the Strategic and Technical Resources Advisory Groups for Ecology Action's regional sponsorship of the Proposition 84 LID Incentives Grant. SVWD staff provided input on rating criteria for the landscape certification program and the structure of grant reporting. Through 2018, 32 SVWD customers were awarded grant incentives for making stormwater management improvements to their properties, with strategies such as rainwater harvesting, lawn and hardscape removal, and stormwater retention methods, such as swales and rain gardens. According to SVWD staff records, the program provided 31,733 square-feet of permeable recharge area.~~

~~The infiltrated stormwater recharges the shallow aquifers in a manner similar to natural processes. The infiltration helps augment groundwater levels and sustains groundwater contributions to stream baseflow that supports local fishery habitats. In the case of the existing LID facilities, all 3 overlie and percolate stormwater into the Santa Margarita Sandstone in areas where the underlying Monterey Formation restricts recharge of that water into the Lompico aquifer beneath the Monterey Formation. Because of this geological sequence there is limited potential of the LID facilities recharging the Lompico aquifer which has the greatest need for recovery and is the source of most of SVWD's water supply. A complicating factor in implementing LID projects in the Scotts Valley area is that there is no centralized stormwater collection system. This limits the ability to do large scale projects to direct groundwater augmentation to the most beneficial areas. Costs of existing projects have been offset by grant funding. SVWD will continue to evaluate additional LID projects in the future and look for opportunities to gain additional funding as needed.~~

### ~~7.2.3 SLVWD Conjunctive Use~~

~~SLVWD owns, operates, and maintains 2 permitted water systems: San Lorenzo Valley System (comprising 2 connected distribution systems: North System and South System) and Felton System (Figure 2-3), which supply separate areas from independent water sources. A conjunctive use program is already implemented in the North System, as this water system relies on surface water when available and groundwater when surface water diversion is not possible.~~

~~The North System is approximately 57 square miles and includes the unincorporated communities of Boulder Creek, Brookdale, and Ben Lomond. The North System is supplied by~~

~~both stream diversions and groundwater wells. Six active points of diversion are located on Peavine, Foremen, Clear, and Sweetwater creeks. Two active groundwater wells draw from the Santa Margarita aquifer in each of the Quail Hollow and Olympia areas. On average, the North System obtains 56% of its water supply from stream diversions and 44% from groundwater pumping (Exponent, 2019).~~

~~Conjunctive use in this sense refers to the optimized, sustainable use of multiple water sources throughout repeated climatic cycles under physical, legal, and environmental constraints. As practiced in the North System, conjunctive use requires water production from stream diversions whenever possible. This allows a significant portion of unused and recharging groundwater to remain essentially stored for use during dry periods. The conjunctive use of these sources has met annual production demands since 1984, without a substantial decline in groundwater levels.~~

~~This successful conjunctive use program has allowed SLVWD to optimize the use of surface water and groundwater in the North System by utilizing stream flows while they are high and groundwater during low flow times. The resulting impacts are reduced groundwater pumping, increased groundwater levels around the wells that are resting, and increased creek baseflow.~~

~~The existing conjunctive use program uses operational changes to increase surface diversions when there is enough flow available that results in reduced groundwater pumping. The conjunctive use program can only be operated when there is available surface water. When surface water is not available due to sustained drought, groundwater pumping will increase. SLVWD currently has no plan to end the conjunctive use strategy it has been applying toward its 2 water sources, and instead has plans to expand the diversions in the North System to offset additional groundwater pumping (see Section 4.3.1.2). Costs of implementing additional diversions are built into ongoing SLVWD budgetary commitments and are not anticipated to be passed on to the SMGWA.~~

### ~~7.2.4 SVWD Recycled Water Program~~

~~The Recycled Water Program is a cooperative effort between SVWD and the City of Scotts Valley. Recycled water has been used by SVWD since 2002 in lieu of groundwater for non-potable uses. This augments the water supply and helps to meet water use efficiency goals. Recycled water is produced at the City of Scotts Valley Tertiary Treatment Plant, where it undergoes treatment including nitrate removal, ultra-violet disinfection, and chlorination. Recycled water is then distributed by SVWD to customers through a dedicated recycled water system. Recycled water is mostly used for landscape irrigation and dust control to a lesser extent.~~

~~The following specific recycled water programs are implemented by SVWD:~~

- ~~The City of Scotts Valley has an order mandating use of recycled water for irrigation for new construction when permissible and economically feasible.~~
- ~~Recycled Water Fill Station was activated in 2016-2018 and 2021 to offer free recycled water to District customers and City residents for permitted uses.~~
- ~~In 2016, the City of Scotts Valley and Pasatiempo Golf Club, located outside of the Basin, reached an agreement for the City of Scotts Valley to provide treated wastewater to the golf course for irrigation. This allows Pasatiempo Golf Club to reduce its reliance on potable water from the City of Santa Cruz during peak-use months when irrigation demand is high. In support of this regional effort, SVWD released 10% of its total recycled water allocation in exchange for compensation that can be applied toward funding future projects. SVWD did not have a current identified use for the amount of recycled water that it supplied to the golf course.~~

~~Recycled water use within the Basin represents an equivalent reduction in groundwater pumping. Groundwater not pumped from the basin is assumed to be available for future beneficial use. Therefore, recycled water use results in a reduction in groundwater pumping and an increase in groundwater levels in the Basin.~~

~~SVWD continues using recycled water use in lieu of groundwater pumping and is exploring options to maximizing the beneficial use of recycled water in the future (see Section 4.6.7). Costs of operating the recycled water system are built into SVWD and City of Scotts Valley budgets and are not anticipated to be passed on to the SMGWA.~~

## 8.2 Primary Projects and Management Actions ~~Using Existing Water Sources Within the Basin (Group 2, Tier 1)~~

The main groundwater condition ~~in the Santa Margarita Basin~~ that ~~projects and management actions~~PMAs in the Santa Margarita Basin aim to improve is lowered groundwater levels in ~~one of~~ the Basin's ~~primary~~ confined aquifers. ~~The Specifically, affected aquifer is t~~The Lompico aquifer in the Mount Hermon / South Scotts Valley area ~~where there~~ has experienced ~~been~~ a ~~150 to 200-foot~~ historical decline of about 150 to 200-foot, ~~in groundwater levels~~ as described in Section 4.2.4~~2.2.4.1~~. This~~e~~ long-term decline has been stabilized largely ~~halted primarily~~ through ~~by~~ successful water use efficiency programs and use of supplying recycled water for non-potable ~~uses~~demands. However, maintaining ~~Increasing~~ groundwater level recovery~~s~~ will likely require additional ~~projects and management actions~~PMAs to maintain sustainability ~~under~~ with ~~the projected assumed future~~ climate ~~conditions~~change (Section 5.5).

### ~~7.2.5 Project Descriptions, Objectives, and Circumstances for Implementation~~

~~Group 2 projects represent current thinking regarding the Basin's best option for reaching sustainability. Projects and management actions presented in this section have been designated under Group 2, Tier 1 and comprise projects that rely on existing water sources within the Basin, often cases within each agencies' own systems. Tier 1 projects and management actions also include expansion of some of the baseline, Group 1 projects presented in the previous section. These projects and management actions describe strategies for additional water use efficiency and conjunctive use of existing water sources in the Basin. Some of the potential projects in Tier 1 are the result of work and ideas emanating from a 2017 Memorandum of Agreement between SLVWD, SVWD, City of Santa Cruz, and County of Santa Cruz (City of Santa Cruz *et al.*, 2017) to explore and evaluate potential projects for the conjunctive use of surface and groundwater resources in the Basin and San Lorenzo River watershed.~~

The following subsection~~s~~ provides a ~~detailed~~ project description~~s~~ followed by a summary of objectives and discussion of circumstances for implementation, and other aspects of the Basin's primary sustainability project. This is followed by a description of the Basin's primary management action related to groundwater quality sustainability.

#### ~~7.2.5.1 SLVWD, SVWD, and Santa Cruz County Additional Water Use Efficiency~~

### ~~7.2.6 Project Description~~

### ~~7.2.7 As discussed in Section 4.2.1, SLVWD and SVWD have a long history of implementing successful water use efficiency activities resulting in significant demand reduction. Further expansion of these programs will allow SLVWD and SVWD to reach more customers and expand the awareness. This management action establishes a set of activities to support the SLVWD and SVWD's long-term sustainable water supply planning efforts. The management action outlines a multi-pronged approach that increases awareness about indoor and outdoor water use efficiencies, promotes water efficient behaviors, and continuously reduces water waste. The program components include additional education and outreach measures such as free house calls to provide consultation and devices for efficient water use, continued participation in countywide conservation coalition activities, continued public speaking and local media placements, irrigation scheduling guidelines, commercial kitchen pre-rinse spray valve project repeating in 5 years (2023), and community outreach at Scotts Valley and Felton Farmers Market and other~~

~~events. SLVWD and SVWD will continue to provide rebates on a variety of activities and equipment and free devices, which enhance water use efficiencies. Both SLVWD and SVWD will continue implementation and enforcement of the water waste policies (SLVWD Ordinance 106 and SVWD P500-15-1). In addition, SVWD will evaluate feasibility and effectiveness of a program that sets water targets for landscape customers.~~

~~7.2.8 While education and outreach programs increase awareness and efficiency on the customer side, both SLWVD and SVWD will look to continue to increase efficiencies within their respective distribution systems through improvements to the metering infrastructure, evaluation and remediation of non-revenue water, and system pressure reduction. New metering infrastructures allow for increased accuracy, leak detection, and customer involvement and awareness. In 2016, SLVWD began deployment of new meters in its Lompico service area, and a multi-year system wide meter change out program that has upgraded 27% of meters system wide at the time of writing this GSP. In 2016, SVWD began system-wide deployment of AMI and achieved 100% completion in spring 2021.~~

~~7.2.9 As part of regular capital improvements, SLVWD is planning to begin replacement of older storage tanks and pipelines. Many of these facilities are parts of older distribution systems that have been acquired by SLVWD. Several storage tanks within SLVWD are made of redwood and known sources of water loss. Systemically addressing water losses increases overall efficiency and reduces non-revenue loss thereby decreasing consumption and groundwater pumping.~~

~~7.2.10 Santa Cruz County can facilitate improved water use efficiency for non-municipal groundwater users, many of whom rely on the climate-vulnerable Santa Margarita aquifer. To achieve this, the County would provide small water systems and private well owners education, outreach and support for water~~

~~conservation practices and opportunities.~~

~~Project Objectives~~

~~7.2.11 Management actions to reduce water demand have been implemented at various times depending on the agency and are continued to this day. Benefits from already implemented water use efficiency programs have resulted in overall reduction of pumping and halting the long-term decline in Lompico aquifer and Monterey Formation groundwater levels in the Scotts Valley area. Expected project benefits from expanding water use efficiency projects include further reductions in groundwater pumping that results in increased groundwater levels, and the ancillary benefits such as increased groundwater storage and reduction in surface water depletion. Additional water use efficiency on its own is not expected to increase groundwater levels to meet measurable objectives for chronic lowering of groundwater levels and depletion of interconnected surface water, but it is expected to contribute to keeping water demand flat while population increases slightly.~~

~~Circumstances for Implementation~~

~~7.2.12 Most water use efficiency measures are already in place and covered in existing budgets of the respective agencies. Since existing water use efficiency programs are well received and successful, expansion of these programs where viable is not expected to face any significant setbacks.~~

### ~~7.2.13~~8.2.1 ~~SLVWD Existing Infrastructure~~ Project 1: SLVWD Expanded Conjunctive Use ~~(Phase 1)~~

**Project Description**

As discussed in Section 2.3.4.1, SLVWD has been practicing conjunctive use in their North System for decades, however, SLVWD has an opportunity to expand conjunctive use in their South System. The South System is supplied groundwater pumped from the Lompico aquifer by SLVWD's Pasatiempo wellfield. Expanding conjunctive use will allow SLVWD to optimize use of currently available treated surface water sources in their North System and Felton System by using existing system interties and potential capacity enhancements to offset groundwater pumping in their South System where lowered groundwater levels have occurred. ~~The South~~

~~System is supplied groundwater pumped from the Lompico aquifer by SLVWD's Pasatiempo wellfield.~~ SLVWD would achieve reductions in groundwater pumping in ~~this~~ the South System~~area~~ by substituting Pasatiempo pumping with excess surface water from the North System and/or Felton System. In very wet years when there is more surface water available than needed to meet SLVWD's South System ~~and SVWD~~ demands, the Santa Margarita aquifer will benefit by resting SLVWD's Quail Hollow and Olympia wellfields in the North System. ~~This project is the first of 2 phases to increase surface water use in an effort to reduce groundwater pumping in areas with depressed groundwater levels. A second phase requiring additional infrastructure is described in Section 8.3.1.~~

Details on the climate projection and water availability analysis are described in the 2022 GSP groundwater model report included as Appendix 3A. Estimated available excess surface water is 227 AFY, including ~~from the North System is~~ approximately 99 AFY from the North System and ~~the Felton System may have~~ up to 128 AFY the Felton System. Available excess surface water is based primarily on runoff simulated to occur in response to the future climate projection developed for the GSP.

In general, availability of excess surface water is constrained by several factors, including drinking water treatment capacity, water rights place of use restrictions, required minimum fish flows, and availability of adequate surface water supplies to serve SLVWD customers in the North System. SLVWD's Fall Creek diversion that supplies the Felton System is currently limited by the water right place of use to the town of Felton. The following constraints are considered in the analysis of availability:

- Minimum Fall Creek winter (November 1 through March 31) bypass flow of 0.75 cfs for dry years, and 1.5 cfs for otherwise. Dry years are defined based on cumulative flow volume in the San Lorenzo River at Big Trees from the beginning of the water year, and it should be noted that the administrative definition of dry year used to constrain Felton System diversions differs from the definition of dry year used for the GSP.
- SLVWD's permitted appropriative right to divert at a maximum total diversion rate of 1.7 cfs from Fall and Bull Creeks, and Bennett S~~s~~pring, with a maximum total annual diversion volume of 1,059 AF.
  - Diversions from streams serving SLVWD's Felton System are permitted only if streamflow in the San Lorenzo River at Big Trees is at least 20 cfs.

~~Details on the climate projection and water availability analysis are~~is ~~described in the groundwater model report included as Appendix 2E. Excess surface water in the North and Felton Systems would be transferred to the South System in lieu of pumping groundwater from the Pasatiempo wellfield during the winter/springs months. This would allow the unpumped~~

~~groundwater to remain stored for use during dry periods. On average, an estimated 227 AFY of excess surface water from SLVWD's North and Felton Systems is potentially available for expanded conjunctive use (Appendix 2E).~~

~~In general, availability of excess surface water is constrained by a number of~~several ~~factors, including drinking water treatment capacity, water rights place of use restrictions, required minimum fish flows, and availability of adequate surface water supplies to serve SLVWD customers in the North System. SLVWD's Fall Creek diversion that supplies the Felton System is currently limited by the water right place of use to the town of Felton.~~

As of August 2026, SLVWD ~~has been studying expanded conjunctive use for several years. Currently, SLVWD is completing a California Environmental Quality Act (CEQA) analysis and a final Conjunctive Use Plan, which has been funded with grant funds. The following supporting studies have been completed:~~

- ~~Fisheries Resource Considerations for the San Lorenzo River Watershed Conjunctive Use Plan (Podlech, 2019)~~

~~Water Availability Assessment for San Lorenzo River Watershed Conjunctive Use Plan (Exponent, 2019)~~is working on mapping out the process for the project, which would likely include developing a conjunctive use plan, followed by developing a project description for an environmental review and subsequently applying for a permit amendment.

**Project Objectives**

The project objective is to use existing infrastructure to expand conjunctive use to passively recharge groundwater in SLVWD's Quail Hollow, Olympia, and Pasatiempo wellfield areas by resting those wells when excess North and Felton Systems surface water is available while also increasing stream baseflows. Groundwater stored by in-lieu recharge can be pumped in years when surface water flows are less available. As a result of expanding conjunctive use in the Basin, it is expected that there will be increased groundwater levels, increased stored groundwater, and increased baseflows.

**Circumstances for Implementation**

SLVWD~~'s~~ is committed to this expanded conjunctive use project, which is already in the early planning stages and is likely to be implemented in the next few years~~ or 2~~. ~~As presented in Section 90, it is the lowest capital cost of the projects and management actions included in this GSP to implement assuming future excess surface water is available.~~

**Public Noticing**

~~Public notice for all aspects of the conjunctive use will be carried out by member agencies prior to the start of the project.~~ Public noticing is anticipated to occur through compliance with CEQA for any ~~facilities or~~ plans associated with the project. Specific actions related to the project

~~Projects~~ will be approved through regular ~~member agency~~SLVWD public board ~~or council~~ meetings in which public discussions or comments will occur. ~~Future notification of the public for any additional pilot testing or long-term implementation will be carried out prior to initiation of any project.~~

**Overdraft Mitigation and Management Actions**

The water budget described in Section 5~~2.2.5~~ identifies there have been historical losses of groundwater in storage in the Basin. ~~and those losses will could continue in the future with hotter temperatures and more variable precipitation without projects and management actions.~~ The historical declines in groundwater levels in the Mount Hermon / S~~s~~outh Scotts Valley started to lessen in the mid-2000s due to water use efficiency efforts by SLVWD and SVWD as well as elimination of pumping by the former Hanson Quarry and the former Valley Gardens Golf Course to the point that groundwater levels are no longer declining.

While the stabilization of groundwater levels in recent years is promising, model projections with future climate change (Section 5.5) indicate that declines could resume in the future with hotter temperatures and more variable precipitation without the project. ~~cooperating agencies will need to implement projects that recharge the areas of the Basin that have lowered groundwater levels. Projects and management actions presented within this section offer existing sources of water to offset groundwater pumping to raise groundwater levels through increased water use efficiency (reducing demand) or conjunctive use (in-lieu recharge). If existing sources and groundwater pumping are managed prudently, groundwater levels will increase resulting in basin sustainability.~~

**Permitting and Regulatory Process**

~~No permitting is required for water use efficiency and public education programs. However, the c~~The project~~onjunctive use projects~~ will require compliance with CEQA. ~~An Initial Study—Mitigated Negative Declaration is currently being prepared for the expanded conjunctive use project with Loch Lomond water. Upon completion of the CEQA process, the SMGWA member and cooperating agency boards must take actions to certify the CEQA work and approve projects.~~ No new water rights are being requested as part ~~of any of~~ the project.~~s~~ ~~presented under this section, h~~However, change of water rights place of use will be needed for excess surface water available from the Fall Creek diversion in the Felton System.

**Timetable for Implementation**

~~Additional water use efficiency programs are expected to start being implemented in 2022. Of the conjunctive use and replenishment projects relying on similar water sources, expanded conjunctive use (Phase 1) and addition of Loch Lomond water (Phase 2) are those most likely to be implemented first.~~

SLVWD is in the planning stage for ~~Phase 1 of~~ expanded conjunctive use ~~and is currently preparing CEQA documentation for routine use of existing emergency interties which would be required as part of both the conjunctive use and replenishment projects (SLVWD, 2020). As such, the expanded conjunctive use and replenishment projects are not included in SLVWD's or SVWD's most recent capital improvement plans or fiscal planning budgets.~~. It is anticipated that expanded conjunctive use ~~(Phase 1)~~ will be ~~fully~~ implemented within the next 5 years, with the majority of the time needed for approval of the water rights place of use modification through the SWRCB~~, while planning, environmental documentation, and construction of the infrastructure required to access Loch Lomond water will be completed before 2032~~.

**Expected Benefits**

~~While Basin groundwater levels have stabilized in the last few decades and even increased in places, it is anticipated that further water use efficiency efforts will not be able to increase groundwater levels on their own.~~ Additional conjunctive use ~~and/or groundwater replenishment will~~is expected to help increase ~~Basin~~ groundwater levels in areas where wells are rested.~~-~~ The past several years have already seen a preview of the benefit to the Pasatiempo area. SLVWD has been able to operate under an emergency authorization to deliver surface water to offset groundwater use in its wells since the CZU Lightning Complex Wild~~F~~fire. Groundwater levels in the Pasatiempo MW-1 monitoring well in the Lompico ~~Formation~~aquifer have seen some of their highest elevations in the past 20 years during this period~~Current projections indicate that the combined projects of expanded conjunctive use (Phase 1) and addition of Loch Lomond water (Phase 2) will meet the SMC described in Section 3~~7~~. The severity of climate change over the next 20 years will determine whether supplemental projects are needed to achieve groundwater sustainability.~~

~~The Basin groundwater model described in Appendix 2E~~ 3A ~~was used to simulate groundwater conditions in the Basin in response to implementing the combined projects of expanded conjunctive use (Phase 1) and addition of Loch Lomond water (Phase 2) for a total of 540 AFY in-lieu recharge in the areas where SLVWD and SVWD extract groundwater. The Basin groundwater budget and groundwater levels for the project simulation are compared against a baseline "no project" simulation. Both the project and baseline simulations account for projected climate change described in Appendix 2E.~~3A. ~~It is important to note that the simulations used to evaluate benefits are based on an assumed climate projection that will not reflect the year-to-year~~

climate that transpires. The climate projection was selected to allow for a drier future to conservatively guide sustainability planning. Actual projects and management actions benefits will be understood by monitoring groundwater responses to their implementation. Recognizing the impossibility of predicting future climate and how much groundwater is pumped and where it is pumped, some of the smaller volumes in the water budgets are smaller less than the noise or statistical uncertainty of those simulated volumes.

Table 8-1Table 8-1Table 5-14 compares baseline "no project" conditions to 540 AFY Phase 1 and 2 conjunctive use water budgets. An average 510 AFY reduction in pumping due to conjunctive use has the following benefits, on average, over the 50-year simulation:

- 100 AFY more groundwater is left in storage
- 400 AFY more net groundwater discharge[9] to creeks as baseflow

The baseline and conjunctive use simulations both have cumulative losses of groundwater in storage (Table 8-1Table 8-1Table 5-14). This is predominantly because the climate change projection in those simulations has 940 AFY less precipitation than WY2010 through WY2018 average precipitation. Storage losses are mostly in the Santa Margarita aquifer which is the most vulnerable to drought because it is directly recharged by rainfall and loses much of its recharge to creeks (Table 8-2Table 8-2). The projected average of all critically dry water years, when there is only 27% of average projected rainfall, results in storage losses of up to 6,500 AF regardless of whether there is a conjunctive use project or not (Table 5-18Table 5-14). This is because there will be less available surface water for conjunctive use and so groundwater will be pumped more. Note that even in critically dry years there is still 313 AF of Loch Lomond and a small amount of Felton system surface water available for the conjunctive use project. Wet years may result in gains in storage of up to 7,600 AFY (Table 5-18Table 5-14).

The groundwater model is used to simulate benefits to groundwater levels from the expanded conjunctive use project (magenta line on Figure 8-2Figure 8-2 through Figure 8-5Figure 8-5) in the areas where SLWVD and SVWD extraction wells are rested during the wet season months. In the Olympia wellfield area (Figure 8-2Figure 8-2) extracting from the Santa Margarita aquifer, there is little increase in groundwater levels because the simulation assumes that to improve groundwater levels in the Lompico aquifer, excess surface water is used to first offset SLVWD Pasatiempo pumping, followed by SVWD pumping. Any remaining surface water is used to offset SLVWD pumping from its Olympia and Quail Hollow wellfields, which only occurs in a few very wet years. The projected baseline and expanded conjunctive use lines on Figure 8-2Figure 8-2 are very similar and as a result the baseline is obscured.

[9] Net groundwater discharge to creeks is groundwater discharge to creeks less streambed recharge.

~~Figure 8-3Figure 8-3 and Figure 8-4Figure 8-4 show simulated groundwater levels for Lompico aquifer wells in the vicinity of SLVWD and SVWD extraction wells that are rested in the wet season months. A conjunctive use project of 540 AFY is simulated to recover groundwater levels around the Pasatiempo wellfield (Figure 8-3Figure 8-3) by an average of 25 feet and in south Scotts Valley (Figure 8-4Figure 8-4) by an average of 20 feet. Monitoring well SVWD #15 screened in both the Lompico and Butano aquifers is simulated to have a benefit of around 50 feet of groundwater level recovery (Figure 8-5Figure 8-5).~~

Table 8-18-1. Baseline and 540 AFY Conjunctive Use Project Groundwater Budget

| Water Budget Components | | Projected Baseline 2020-2072 | | | | 540 AFY Conjunctive Use 2020-2072 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Average Total for Water Budget Period in parenthesis (Acre-Feet) | | Wet Water Year Average | Critically Dry Water Year Average | Annual Average (Acre-Feet) | Average Percent of Total Inflow or Outflow | Wet Water Year Average | Critically Dry Water Year Average | Annual Average (Acre-Feet) | Average Percent of Total Inflow or Outflow |
| Inflows | Precipitation Recharge | 23,700 | 3,300 | 12,100 | 56% | 23,700 | 3,300 | 12,100 | 56% |
| | Subsurface Inflow | 100 | 100 | 100 | <1% | 100 | 100 | 100 | <1% |
| | Return flows (System Losses, Septic Systems, Quarry, Irrigation) | 1,100 | 1,100 | 1,200 | 5% | 1,100 | 1,100 | 1,100 | 5% |
| | Streambed Recharge | 10,700 | 6,600 | 8,400 | 39% | 10,600 | 6,500 | 8,300 | 38% |
| | *Total Inflow* | ***35,600*** | ***11,100*** | ***21,800*** | | ***35,500*** | ***11,000*** | ***21,600*** | |
| Outflows | Groundwater Pumping | 2,600 | 2,900 | 2,800 | 12% | 1,900 | 2,500 | 2,300 | 10% |
| | Subsurface Outflow | 100 | 100 | 100 | 1% | 100 | 100 | 100 | 1% |
| | Discharge to Creeks | 25,600 | 14,600 | 19,400 | 87% | 25,900 | 15,000 | 19,700 | 89% |
| | *Total Outflow* | ***28,300*** | ***17,600*** | ***22,300*** | | ***27,900*** | ***17,600*** | ***22,100*** | |
| Storage | Average Annual Change in Storage | 7,400 | -6,400 | -500 | - | 7,600 | -6,500 | -400 | - |
| | Cumulative Change in Storage | - | - | -24,000 | - | | | -19,700 | - |

*Small discrepancies between total inflow and outflow may occur due to rounding

Table 8-28-2. 540 AFY Conjunctive Use Project Groundwater Budget by Aquifer

| Water Budget Components | | 540 AFY Conjunctive Use 2020-2072 | | | |
|---|---|---|---|---|---|
| Average Total for Water Budget Period in parenthesis (Acre-Feet) | | Santa Margarita Aquifer | Monterey Formation | Lompico Aquifer | Butano Aquifer |
| Inflows | Precipitation Recharge | 5,700 | 1,300 | 900 | 3,600 |
| | Subsurface Inflow | 0 | 0 | 0 | 100 |
| | Return flows (System Losses, Septic Systems, Quarry, Irrigation) | 500 | 200 | 200 | 200 |
| | Streambed Recharge | 1,600 | 800 | 400 | 3,300 |
| | Flow from Other Aquifers | 0 | 300 | 1,600 | 600 |
| | *Inflow Totals* | ***7,800*** | ***2,600*** | ***3,000*** | ***7,700*** |
| Outflows | Groundwater Pumping | 700 | 100 | 1,000 | 400 |
| | Subsurface Outflow | 0 | 0 | 0 | 100 |
| | Discharge to Creeks | 6,300 | 2,120 | 1,400 | 6,900 |
| | Flow to Other Aquifers | 1,100 | 400 | 600 | 400 |
| | *Outflow Totals* | ***8,000*** | ***2,600*** | ***3,000*** | ***7,800*** |
| Storage | Average Annual Change in Storage | -200 | 0 | 0 | -100 |
| | Cumulative Change in Storage | -9,600 | -2,400 | -2,700 | -4,500 |

*Small discrepancies between total inflow and outflow may occur due to rounding

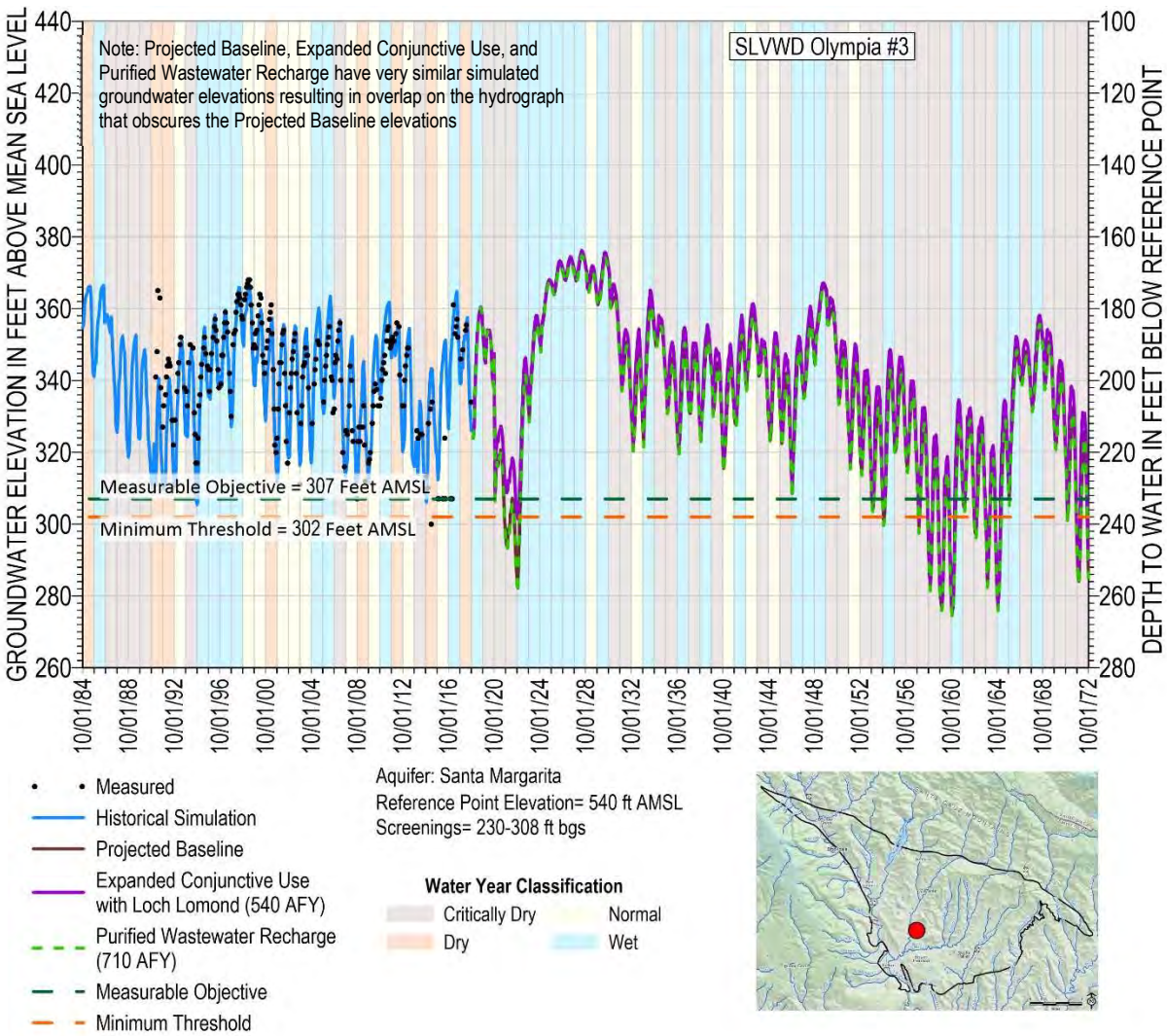
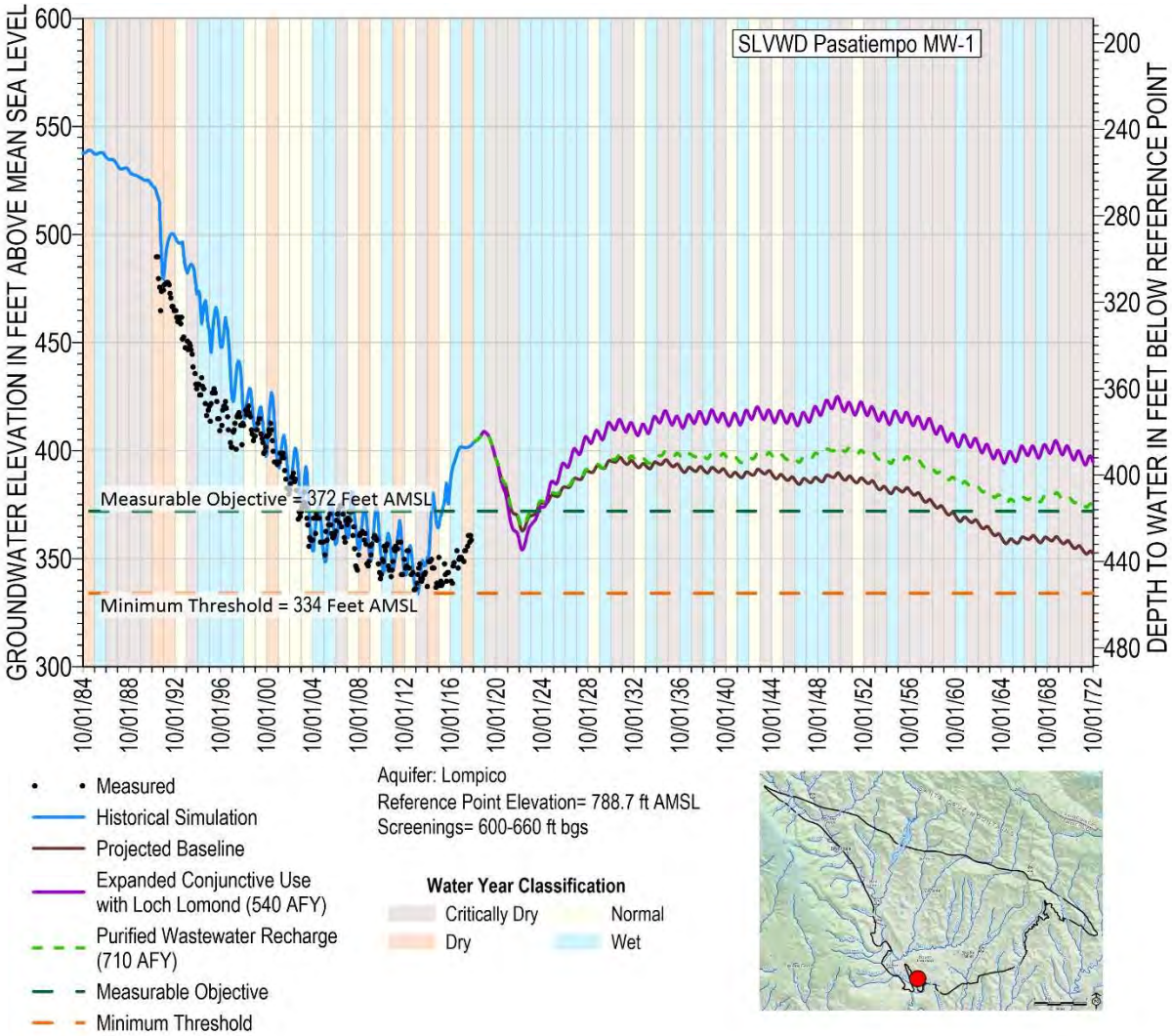
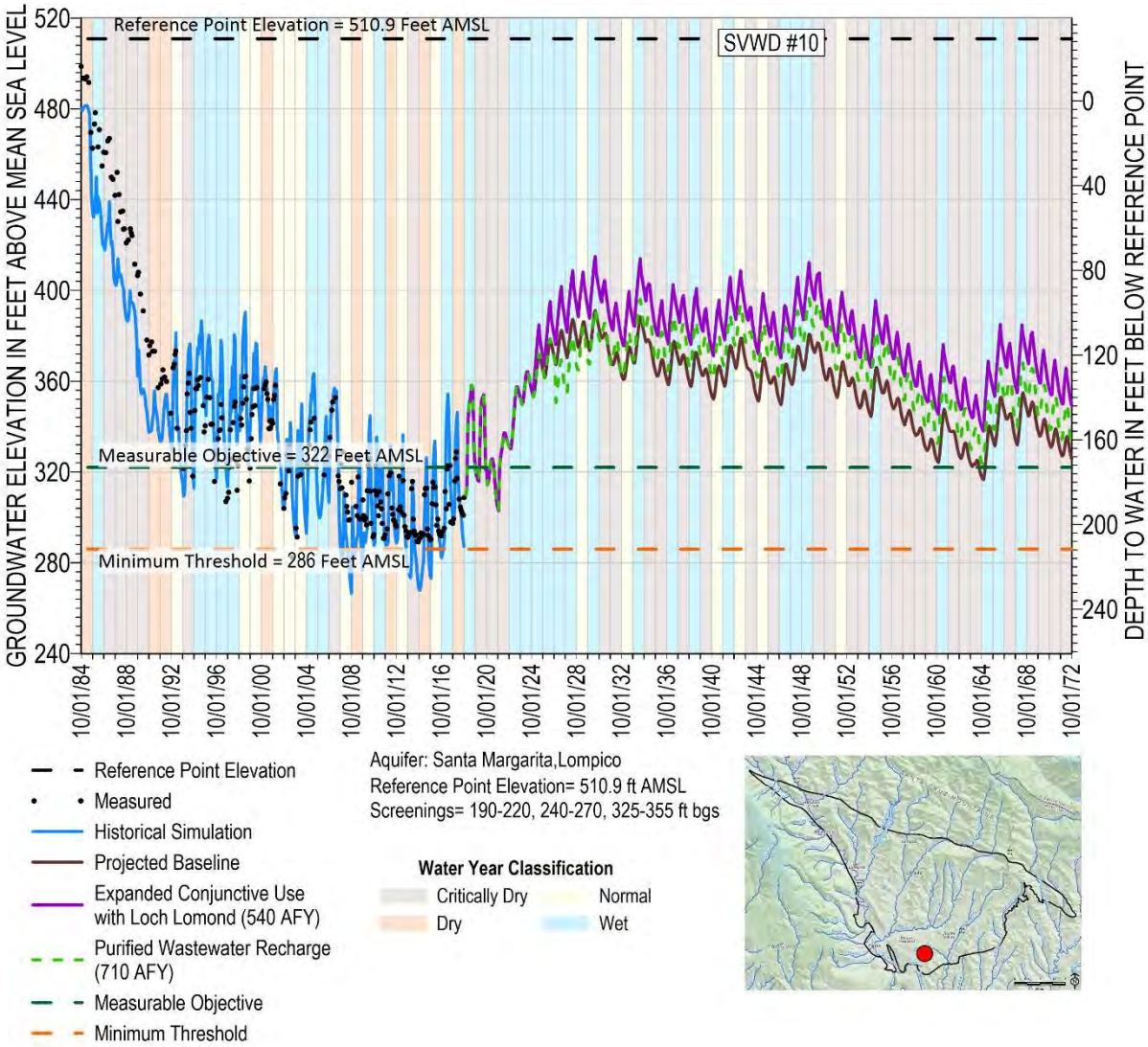


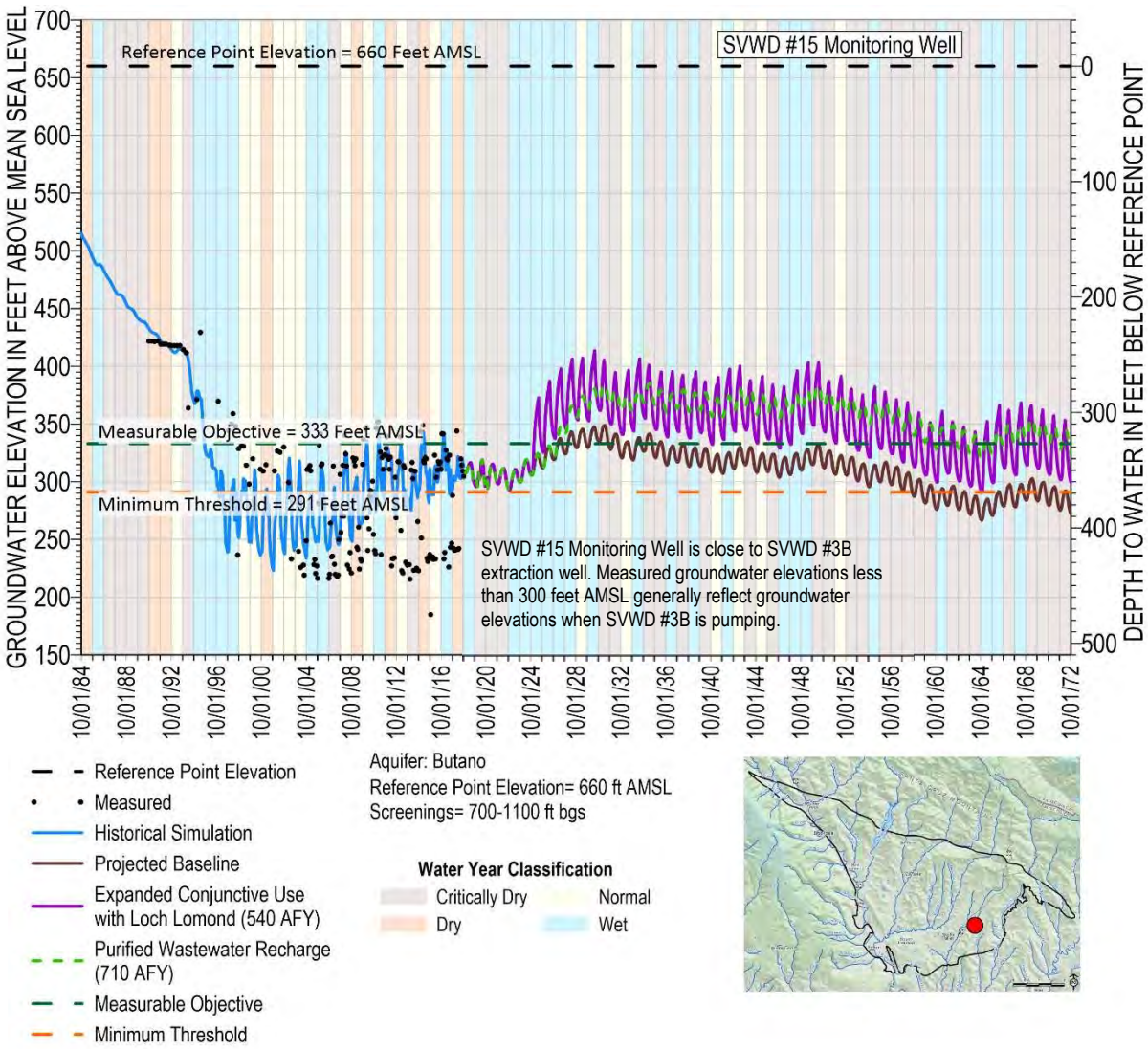

Figure 8-28-2. SLVWD Olympia #3 Simulated Groundwater Levels (Santa Margarita Aquifer)




~~Figure 8-38-3. SLVWD Pasatiempo MW-1 Simulated Groundwater Levels (Lompico Aquifer)~~




~~Figure 8-48-4. SVWD #10 Simulated Groundwater Levels (Lompico Aquifer)~~




~~Figure 8-58-5. SVWD #15 Monitor Simulated Groundwater Levels (Butano Aquifer)~~

### Legal Authority

California state law gives ~~water districts~~SLVWD the authority to take actions necessary to supply sufficient water for present or future beneficial use. ~~Land use jurisdictions have police powers to develop similar programs. The SGMA grants SMGWA legal authority to adopt rules, regulations, ordinances, and resolutions necessary to achieve sustainability. Water use efficiency and conjunctive use projects make use of preserving existing water resources already within each member agency's system to which each agency already has access. Water transfers and purchases between agencies will comply with all legal requirements.~~

### Estimated Costs and Funding Plan

~~Projects and management actions within this section will rely on a significant amount of existing infrastructure and in the case of additional water use efficiency will expand currently implemented programs. Additional infrastructure such as pipelines, pump stations, interties, injection wells and treatment capacity expansions will be required as part of the expanded conjunctive use with Loch Lomond and groundwater replenishment projects. Costs associated with these projects will be funded through a combination of increased operating revenue and outside funding sources. SLVWD has already received Proposition 50 grant funds for CEQA permitting required to expand conjunctive use within their system. Potential outside funding sources include IRWM, Sustainable Groundwater Management Grant Program, State Revolving Fund low interest loans, USDA grants and/or low interest loans, or USBR Drought Resiliency and/or Title XVI Recycled Water grants. For the more costly projects, securing outside funding will be needed for the projects to be affordable~~Cost estimates are currently unknown, although no capital facility improvements and expenses are assumed to be needed. SLVWD is expected to fund the project through its rates, although it may pursue grant funding opportunities should they come available.

~~A summary of estimated costs is included in Table 8-3Table 8-3. Other project related costs presented below include engineering, permitting, land acquisition, environmental, special studies, legal, water rights, and other indirect costs. Cost estimates were prepared to Advancement of Cost Engineering (AACE) Estimate Class 5 intended for conceptual and planning level uses.~~

~~Table 8-38-3. Group 2, Tier 1 Estimated Project Costs~~

| ~~Project~~ | ~~Capital Construction Cost~~ | ~~Other Project Related Cost~~ | ~~Total Capital Cost~~ | ~~Annual O&M Costs~~ |
|---|---|---|---|---|
| ~~SLVWD, SVWD and County Additional Water Use Efficiency~~ | ~~$0.9 M~~ | ~~$1.0 M~~ | ~~$1.9 M~~ | ~~$0.9 M~~ |
| ~~SLVWD Existing Infrastructure Expanded Conjunctive Use (Phase 1)~~ | ~~$0.5 M~~ | ~~$2.8 M~~ | ~~$3.3 M~~ | ~~$0.2 M~~ |
| ~~SLVWD and SVWD Inter-District Conjunctive Use with Loch Lomond (Phase 2)~~ | ~~$25.1 M~~ | ~~$26.7 M~~ | ~~$51.7 M~~ | ~~$2.0 M~~ |

**Management of Groundwater Extractions and Recharge**

This project is not intended to limit groundwater extraction. ~~The Additional Water Use Efficiency activities and Expanded Conjunctive Use with Loch Lomond projects target to reduce groundwater pumping by SLVWD and SVWD. Reductions in groundwater pumping allow aquifers to passively recharge around the extraction wells being pumped less. Reduced pumping will contribute to increased groundwater levels and groundwater in storage. Increased groundwater extractions in dry years when surface water is less available will need to be managed such that minimum thresholds are not exceeded. Management actions are described in the 2020 Water Shortage Contingency Plan included in SVWD and SLVWD's joint 2020 UWMP. These actions are developed to address supply shortages that consider groundwater levels approaching minimum thresholds and extraction averages compared to projected long-term average baseline pumping (WSC and M&A, 2021).~~

The GSP monitoring networks will be used to track groundwater levels, groundwater extraction, ~~and~~ groundwater quality, and interconnected surface water SMC ~~by cooperating agencies~~ to evaluate ~~pumping impacts, measures of~~ sustainability ~~, and effects of implemented GSP projects and management actions on beneficial groundwater users and uses~~associated with project implementation. SLVWD would be expected to coordinate with SMGWA should sustainability concerns arise.

### 8.2.2 Management Action 1~~.~~: Groundwater Quality Coordination with Santa Cruz County Environmental Health Division

**Project Description**

This management action will include SMGWA reviewing all publicly available water quality data compiled by ~~for~~ the State Division of Drinking Water for public water supply wells in the

Basin. The review will include looking for any ~~volatile organic compound~~VOC detections or any constituent exceeding an MCL. SMGWA will complete this review by December 31st each year. SMGWA will share any water quality items of interest in an annual coordination meeting with SCEH Site Mitigation Program representatives. SCEH is the local agency authorized by the CCRWQCB and California Department of Toxic Substances Control (DTSC) to oversee investigation and cleanup of waste releases in Santa Cruz County. At the meeting, SCEH and SMGWA will also discuss active site investigations or remediation activities as they could relate to sampling results or future recommended sampling.

**Project Objectives**

The ~~project~~ management action objective is to proactively track and identify issues of emerging concern with respect to contaminants. Coordination is intended to assist SCEH in its oversight role in working with responsible parties to protect the beneficial uses of groundwater.

**Circumstances for Implementation**

SMGWA is committed to implementing this management action. The level of effort will vary in any given year depending on the results of groundwater quality review and coordination with SCEH.

**Public Noticing**

Public noticing of emerging issues would occur through regular public meetings of the SMGWA Board.

**Overdraft Mitigation and Management Actions**

This management action does not involve overdraft mitigation. It will directly address the degradation of groundwater quality SMC.

**Permitting and Regulatory Process**

Coordination does not require permitting and does not affect the regulatory process of the SCEH in its oversight role.

**Timetable for Implementation**

The management action will take effect immediately and be an ongoing process. SMGWA has already met with SCEH in November 2025 to get their concurrence with this coordination.

**Expected Benefits**

The expected benefit is to increase the effectiveness of the GSA and the County in their respective roles. Consistent review by the GSA of all water quality monitoring in the Basin could help the SCEH in identifying potential sources of contamination and information from the SCEH on active sites or investigations could help local water suppliers with targeting sampling for specific water quality parameters in addition to those required for drinking water regulatory programs.

**Legal Authority**

Legal authority is not required for this coordination.

**Estimated Costs and Funding Plan**

The management action is not expected to add significant expense to the baseline activities of SMGWA. The level of effort would equate to approximately $2,500 to 5,000 per year, depending on the level of activity. SMGWA would fund the activity through its annual budget process.

**Management of Groundwater Extractions and Recharge**

The management action does not require the management of groundwater extractions or recharge. However, it is expected that SMGWA would coordinate with water suppliers potentially impacted by future contaminants to identify ~~potential~~ feasible operational changes to limit or mitigate impacts.

### ~~7.2.14 Project 2. SLVWD and SVWD Inter-District Conjunctive Use with Loch Lomond (Phase 2)~~

~~As a second phase to the expanded conjunctive use project presented in Section 8.2.1.1, the Inter-District Conjunctive Use project with Loch Lomond would provide an additional 313 AF of treated surface water from Loch Lomond each year to offset wet season demand in SLVWD's South System and, once that need is satisfied, in SVWD's service area. Combined with Phase 1, there would be on average 540 AFY to offset all or almost all wet season groundwater demand. Through this demand offset SLVWD and SVWD could recover groundwater resources by reducing or eliminating pumping during the wet part of the year. Water transfers through existing and to be constructed system interties will allow the transfer and purchase of surface water from City of Santa Cruz to SLVWD and SVWD.~~

~~SLVWD has entitlements to a portion of Loch Lomond yield. In 1958, SLVWD sold 2,500 acres encompassing a portion of the Newell Creek watershed to the City of Santa Cruz with the agreement that SLVWD would be entitled to purchase 500 AFY, which was12.5% of the annual~~

~~safe yield from a future Newell Creek reservoir planned by the City of Santa Cruz. In 1960, the City completed the Newell Creek Dam which created Loch Lomond Reservoir. The reservoir has a drainage area of 8.3 square miles and a reservoir capacity of approximately 9,000 AF. The City of Santa Cruz's appropriative right allows a maximum direct diversion of 3,200 AFY and a maximum use of 5,600 AFY.~~

~~SLVWD began receiving a portion of the reservoir yield in 1963. In 1965 SLVWD constructed the Glen Arbor Treatment Plant for treating its Loch Lomond deliveries. Toward the end of the 1976-77 drought, the City of Santa Cruz stipulated that SLVWD was not entitled to an allocation of 500 AFY, merely 12.5% of the safe yield. This decision, based on a reduction to the estimated annual safe from the Newell Creek Reservoir, reduced SLVWD's contractual allocation. This determination led to several years of water disputes between the City of Santa Cruz and SLVWD. In June 1977, SLVWD filed a Complaint for Declaratory Relief, which requested the Court to make a judicial determination of the respective parties' duties and rights. In June 1980, a court order fixed the estimated annual safe yield from Newell Creek Reservoir at reduced quantity, which resulted in a reduction to SLVWD's contractual allocation. SLVWD can currently purchase up to 313 AFY. Since implementation of the Surface Water Treatment Rule, SLVWD has not had the means to adequately treat diversions from Loch Lomond. For that reason, SLVWD has not exercised its contractual allotment of 313 AFY of raw Loch Lomond water. In 2010, the City of Santa Cruz and SLVWD discussed an option that would allow SLVWD to purchase up to 313 AFY (102 million gallons) of treated City of Santa Cruz water. During the discussion, however, the City indicated that the treated water allocation would be reduced or interruptible during declared water-shortage emergencies. This was unacceptable to SLVWD, so the discussion did not lead to an agreement.~~

~~SLVWD commissioned a study to evaluate the feasibility and cost of utilizing its allotment of Loch Lomond (SPH Associates Consulting Engineers, 2010). The 2010 study presented costs of a project to upgrade the Kirby WTP and interconnect the Felton and San Lorenzo North and South Systems at a cost of approximately $6.4 million. This cost estimate is now outdated and would need to be updated, and the project scope and assumptions revisited.~~

~~An alternative would be purchasing treated water from the City of Santa Cruz. This would require conveyance lines, upgrades to the Graham Hill WTP, a booster pump from the Graham Hill WTP, and additional interties to route treated water to SLVWD's South System and SVWD. In previous discussions, the City of Santa Cruz indicated that the availability of treated water sales would carry drought restrictions. During drought is exactly when SLVWD would most need the water. Upgrading the Kirby WTP, on the other hand, would allow SLVWD unrestricted use of its Loch Lomond entitlement during all seasons and water quality conditions.~~

~~**Project Objectives**~~

~~The project objective is to use both existing and new infrastructure to expand conjunctive use beyond Phase 1 to passively recharge groundwater in SLVWD's Quail Hollow, Olympia, and Pasatiempo wellfield areas and in Scotts Valley where SVWD's extraction wells are located by resting those wells when Loch Lomond and excess North and Felton System surface water is available. Groundwater stored by in-lieu recharge can be pumped in years when surface water flows are less available. As a result of expanding conjunctive use in the Basin, it is expected that there will be increased groundwater levels, increased stored groundwater, and increased baseflows.~~

~~**Circumstances for Implementation**~~

~~Adding the Loch Lomond component (Phase 2) to the Expanded Conjunctive Use project (Phase 1) is currently a conceptual project. Apart from the constraints outlined for the Phase 1 project above, the major factor constraining use of Loch Lomond water is adequate water treatment. Additionally, a study will be required to determine if there are water quality issues from mixing surface and groundwater across interties between SLVWD and SVWD.~~

~~It is expected that Phase 1 (227 AFY of in-lieu recharge) will not be able to achieve the increases in groundwater levels required to reach measurable objectives for chronic lowering of groundwater levels on its own. SMC developed for this GSP are based on the model results of combined 313 AFY of Loch Lomond and 227 AFY of North System and Felton System surface water being used in lieu of groundwater pumping in the winter and spring months (totaling an average of 540 AFY). Work to complete Phase 2 will likely follow completion of Phase 1.~~

## 8.3 Supplemental Projects and Management Actions

If the primary expanded conjunctive use project is deemed infeasible or anticipated outcomes change, SMGWA may look to supplemental projects to meet SMGWA sustainability goals. Because these are supplemental projects, the level of detail provided for them is significantly less detailed than the primary ~~projects and management actions~~PMAs. Note that despite these being classified as supplemental projects, they may still proceed based on the interests of the cooperating agencies.

### ~~7.2.15~~ Project 2: ~~Expanded In-Lieu Conjunctive Use~~

~~further expansion of cuwater available from (Section 8.2.1), there would be on average 540 AFY to offset all or almost all wet season groundwater demand. Through this demand offset SLVWD and SVWD could recover groundwater resources by reducing or eliminating pumping~~

~~during the wet part of the year. Water transfers through existing and to be constructed system interties will allow the transfer and purchase of surface water from City of Santa Cruz to SLVWD and SVWD.~~

~~SLVWD has entitlements to a portion of Loch Lomond yield. In 1958, SLVWD sold 2,500 acres encompassing a portion of the Newell Creek watershed to the City of Santa Cruz with the agreement that SLVWD would be entitled to purchase 500 AFY, which was12.5% of the annual safe yield from a future Newell Creek reservoir planned by the City of Santa Cruz. In 1960, the City completed the Newell Creek Dam which created Loch Lomond Reservoir. The reservoir has a drainage area of 8.3 square miles and a reservoir capacity of approximately 9,000 AF. The City of Santa Cruz's appropriative right allows a maximum direct diversion of 3,200 AFY and a maximum use of 5,600 AFY.~~

~~SLVWD began receiving a portion of the reservoir yield in 1963. In 1965 SLVWD constructed the Glen Arbor Treatment Plant for treating its Loch Lomond deliveries. Toward the end of the 1976-77 drought, the City of Santa Cruz stipulated that SLVWD was not entitled to an allocation of 500 AFY, merely 12.5% of the safe yield. This decision, based on a reduction to the estimated annual safe yield from the Newell Creek Reservoir, reduced SLVWD's contractual allocation. This determination led to several years of water disputes between the City of Santa Cruz and SLVWD. In June 1977, SLVWD filed a Complaint for Declaratory Relief, which requested the Court to make a judicial determination of the respective parties' duties and rights. In June 1980, a court order fixed the estimated annual safe yield from Newell Creek Reservoir at reduced quantity, which resulted in a reduction to SLVWD's contractual allocation. SLVWD can currently purchase up to 313 AFY. Since implementation of the Surface Water Treatment Rule, SLVWD has not had the means to adequately treat diversions from Loch Lomond. For that reason, SLVWD has not exercised its contractual allotment of 313 AFY of raw Loch Lomond water. In 2010, the City of Santa Cruz and SLVWD discussed an option that would allow SLVWD to purchase up to 313 AFY (102 million gallons) of treated City of Santa Cruz water. During the discussion, however, the City indicated that the treated water allocation would be reduced or interruptible during declared water-shortage emergencies. This was unacceptable to SLVWD, so the discussion did not lead to an agreement.~~

~~SLVWD commissioned a study to evaluate the feasibility and cost of utilizing its allotment of Loch Lomond (SPH Associates Consulting Engineers, 2010). The 2010 study presented costs of a project to upgrade the Kirby WTP and interconnect the Felton and San Lorenzo North and South Systems at a cost of approximately $6.4 million. This cost estimate is now outdated and would need to be updated, and the project scope and assumptions revisited.~~

~~An alternative would be purchasing treated water from the City of Santa Cruz. This would require conveyance lines, upgrades to the Graham Hill WTP, a booster pump from the Graham Hill WTP, and additional interties to route treated water to SLVWD's South System and SVWD. In previous discussions, the City of Santa Cruz indicated that the availability of treated water sales would carry drought restrictions. During drought is exactly when SLVWD would most need the water. Upgrading the Kirby WTP, on the other hand, would allow SLVWD unrestricted use of its Loch Lomond entitlement during all seasons and water quality conditions.~~

**~~Project Objectives~~**

~~The project objective is to use both existing and new infrastructure to expand conjunctive use beyond Phase 1 to passively recharge groundwater in SLVWD's Quail Hollow, Olympia, and Pasatiempo wellfield areas and in Scotts Valley where SVWD's extraction wells are located by resting those wells when Loch Lomond and excess North and Felton System surface water is available. Groundwater stored by in-lieu recharge can be pumped in years when surface water flows are less available. As a result of expanding conjunctive use in the Basin, it is expected that there will be increased groundwater levels, increased stored groundwater, and increased baseflows.~~

**~~Circumstances for Implementation~~**

~~Adding the Loch Lomond component (Phase 2) to the Expanded Conjunctive Use project (Phase 1) is currently a conceptual project. Apart from the constraints outlined for the Phase 1 project above, the major factor constraining use of Loch Lomond water is adequate water treatment. Additionally, a study will be required to determine if there are water quality issues from mixing surface and groundwater across interties between SLVWD and SVWD.~~

~~It is expected that Phase 1 (227 AFY of in-lieu recharge) will not be able to achieve the increases in groundwater levels required to reach measurable objectives for chronic lowering of groundwater levels on its own. SMC developed for this GSP are based on the model results of combined 313 AFY of Loch Lomond and 227 AFY of North System and Felton System surface water being used in lieu of groundwater pumping in the winter and spring months (totaling an average of 540 AFY). Work to complete Phase 2 will likely follow completion of Phase 1.~~

~~All other aspects of Phase 2 are described with Phase 1 above. These include: public noticing; overdraft mitigation and management actions; permitting and regulatory process; timetable for implementation; expected benefits; legal authority; estimated costs and funding plan; and management of groundwater extractions and recharge.~~

### 8.3.1 ~~Transfer for Inter-District~~ Project ~~32~~: SVWD/City of Santa Cruz Conjunctive Use

~~Project Description~~

Similar to the expanded conjunctive use project presented in Section 8.2.1, this is a conjunctive use project, but it relies on treated surface water from outside of the Basin to offset some or all SVWD groundwater pumping during the wet season months and for active banking. Treated surface water would be provided by the City when excess water is available. To facilitate the transfer of treated surface water to the Basin, Intertie-1, comprising a new 2-mile pipeline and a 12-inch-diameter, bi-directional, 1 million gallon per day intertie and pump station between the City of Santa Cruz and SVWD has been constructed. The project also includes a new extraction well in SVWD to replace aging wells, increase extraction capacity, strengthen SVWD's ability to provide redundancy and meet potential increased demand, and to supply water to neighboring agencies in drought conditions. The project is funded through a 2021 Urban and Multibenefit Drought Relief grant for $9.5 million to implement a Regional Drought Resiliency Project awarded to SVWD.

In addition to providing benefits during drought of other emergency conditions, the intertie and increased extraction capacity enables conjunctive use of the 2 systems. The City can convey surplus surface water to SVWD for active and passive recharge of the Basin, banking water during wet years for use during dry years.

The City of Santa Cruz and SVWD are currently evaluating what infrastructure and capacities are needed to store water in the Basin for drought supply. The Basin Model is being used to evaluate the potential benefits and impacts of storage to the Basin's aquifers and ISW, and to determine how the project can be operated in conformance with the Basin's SMC.

As a means of further expanding conjunctive use capacities, both agencies are interested in studying the use of ASR wells. Substantial analysis and investigation would be needed before advancing this concept, including, but not limited to: hydraulic modeling of the SVWD system; water quality modeling to identify potential water quality impacts; drilling exploratory boreholes to confirm suitable geology; identifying potential ASR well sites; constructing or converting wells with ASR capability and conducting ASR pilot testing to determine injection and extraction capacities and potential water quality impacts; upgrading water treatment plant capacity; and constructing additional conveyance to and from the ASR wells~~Similar to the expanded conjunctive use projects presented in Sections 8.2.1 and 8.2.1.2, this is a conjunctive use project, but it relies on treated surface water from outside of the Basin to offset some or all SLVWD and SVWD groundwater pumping during the wet season months and for active banking. Treated source surface water would be provided by the City of Santa Cruz of Santa Cruz from its San Lorenzo River and North Coast sources when excess water is available. To~~

~~facilitate the transfer of treated surface water to the Basin, Intertie-1, comprising a new 2-mile pipeline and an accompanying pump station, between the City of Santa Cruz and SVWD has been constructed will be completed in 2026. (SVWD Grace Way)The intertie is funded through a $6.5 million grant from DWR, with costs shared between the City and SVWD, as part of the state's Climate Resilient Santa Cruz initiative.~~

~~A majority of the City of Santa Cruz water system relies on local surface water supplies, which include the North Coast sources, the San Lorenzo River, and Loch Lomond. The North Coast sources consist of surface diversions from 3 coastal streams and a natural spring. The San Lorenzo River is the City's largest source of water supply through their primary surface water diversion, Tait Diversion, and is supplemented by shallow, auxiliary wells located directly across the river. The City of Santa Cruz's Felton Diversion is a secondary diversion on the San Lorenzo River within the Basin. The diversion is an inflatable dam and intake structure about 6 miles upstream from the Tait Diversion. Water is pumped from this diversion to Loch Lomond to augment storage in the reservoir during dry years when natural inflow from Newell Creek, which feeds Loch Lomond, is low.~~

**~~Project Objectives~~ ~~and Circumstance for Implementation~~**

~~The City of Santa Cruz and SVWD are constructing Intertie-1 to facilitate conjunctive use to address several converging supply reliability, regulatory, and ecological drivers affecting both agencies.~~

~~The City's water system relies heavily on surface water diversions from the San Lorenzo River and Loch Lomond Reservoir, and the City has not substantially expanded its storage capacity since Loch Lomond was constructed in the early 1960s, even as the system now serves approximately 100,000 people. Intertie-1 allows the City to draw on water stored in the Basin during dry periods, providing each agency an alternative source during a shortage rather than depending solely on its own supply portfolio.~~

~~rThe intertie also enables conjunctive use of the 2 systems. The City of Santa Cruz can convey surplus surface water to SVWD for active and passive recharge of the Basin, banking water during wet years for use during dry years. This capability was not previously available to the City under its prior water rights. The City's 2021 Water Rights Project modified those rights~~

~~specifically to permit water sharing and underground storage arrangements with neighboring districts.~~

~~Conjunctive use through the intertie also supports instream flow protection for anadromous fisheries. By relying on banked groundwater rather than direct river diversion during low-flow periods, the City can leave more water in the San Lorenzo River system for steelhead and coho salmon, consistent with the conservation strategy of the City's HCP.~~

~~Intertie-1 further improves fire protection by increasing fire-response flows along the pipeline alignment, and it responds to a 2022 Santa Cruz County Civil Grand Jury report recommending greater cooperation among the county's water districts, including a coordinated regional approach to drought response.~~

~~The City of Santa Cruz Transfer for Inter-District Conjunctive Use project has the primary objective of helping recover groundwater levels in the Lompico aquifer in the Scotts Valley area. It would allow for passive groundwater recharge in the areas where the SLVWD and SVWD extract groundwater by using treated surface water supply from City of Santa Cruz in lieu of groundwater pumping. Conjunctive use projects could increase groundwater levels and add groundwater to storagehave the potential to increase groundwater levels and create additional groundwater in storage if adequate amounts of treated surface water are available and some of the stored water is left in the aquifers to support groundwater sustainability.~~

**~~Circumstances for Implementation~~Project Status**

~~The City of Santa Cruz and SVWD are currently evaluating what infrastructure and capacities are needed to store water in the Basin for drought supply. The Basin Model is being used to evaluate the potential benefits and impacts of storage to the Basin's aquifers and ISW, and to determine how the project can be operated without causing undesirable results.~~

~~parties areSubstantial work remains, including hydraulic modeling of the SVWD system, drilling exploratory boreholes to confirm suitable geology, selecting ASR well sites, constructing ASR wells and, conducting ASR pilot testing to determine injection and extraction capacities and potential water quality impacts, upgrading water treatment plant capacity, and constructing additional conveyance to and from the ASR wells.Transfer for Inter-District Conjunctive Use is currently a conceptual project. In general, availability of excess surface water is constrained by a number of factors, including drinking water treatment capacity, water rights place of use restrictions, required minimum fish flows, and availability of adequate surface water supplies to serve SLVWD's and SVWD's demands. Some of the City of Santa Cruz's surface water is~~

~~currently limited by water right place of use restrictions and the City has prepared a draft EIR evaluating the potential for significant environmental impacts from improved flexibility for operation of the City's water system while enhancing stream flows for local anadromous fisheries. The draft EIR public review period is from June 10 to July 26, 2021. To improve operational flexibility of the water system, the City of Santa Cruz is proposing water rights modifications to its existing rights, permits, and licenses to expand the authorized place of use, to better utilize existing diversions, and to extend the City's time to put water to full beneficial use. A purchase water agreement would need to be established between inter-SMGB agencies (i.e., SLVWD and SVWD) and the City of Santa Cruz.~~

~~If a conjunctive use project using sources from within the Basin is implemented, it is unlikely a conjunctive use project using water from outside of the Basin would also be implemented (and vice versa) because there is not enough wet season demand for both conjunctive use projects at the same time.~~

### ~~7.2.16 Expanded Conjunctive Use through Aquifer Storage & Recovery WellsProject in Scotts Valley Area of the Basin~~

~~Over the past few years, the City of Santa Cruz has explored the possibility of an ASR project in the Scotts Valley area of the Basin. The potential project would use treated surface water from the City of Santa Cruz's San Lorenzo River and North Coast sources to create an underground reservoir in the Basin for drought supply. The project would be located in the area of Scotts Valley where Lompico aquifer groundwater levels are lowered and there is the most storage capacity.~~

~~The City of Santa Cruz has used the Basin groundwater model to simulate some preliminary ASR options for different ASR configurations and operations. However, its ASR feasibility study in the Basin has generally been deferred while this GSP is developed to ensure an ASR project is designed and operated in a manner that does not prevent the Basin from achieving sustainability. The City of Santa Cruz is also evaluating and pilot testing ASR in the neighboring Santa Cruz Mid-County Basin.~~

#### ~~Project Objectives~~

~~The potential ASR project water storage options. The objective is to store treated surface water in the Lompico aquifer for use in drought years. For the SMGWA to support a storage project such as this, there must be benefits to the Basin that would likely need to include a reduction in depletion of interconnected surface water and increased groundwater levels. To achieve this, the project will need to leave an agreed amount of water in the aquifer to provide a benefit to the Basin.~~

~~The ASR project feasibility study will need to include an evaluation of potential adverse impacts, such as property damage from high groundwater levels, groundwater quality degradation, reduction in groundwater baseflows to creeks, and groundwater levels falling below minimum thresholds when the City of Santa Cruz needs to use their drought storage.~~

**~~Circumstances for Implementation~~**

~~The potential ASR project is a drought storage project for the City of Santa Cruz, however, for it to be supported by the SMGWA it needs to operate within the GSP's SMC. If a feasibility study shows an ASR project to be technically feasible, it will also need to demonstrate that it has benefits to groundwater beneficial users and uses, such as GDEs, municipal users, and private domestic users.~~

### ~~7.2.17 Public Noticing~~

~~Public notice for all aspects of an ASR project will be carried out by the City of Santa Cruz prior to the start of the project. Public noticing is anticipated to occur through compliance with CEQA for any facilities or plans associated with the project.~~

~~Projects will be approved through regular member agency public board or council meetings in which public discussions or comments will occur. Future notification of the public for pilot testing or long-term implementation will be done prior to initiation of the project.~~

### ~~7.2.18 Overdraft Mitigation and Management Actions~~

~~An ASR project will not permanently stop overdraft of the Basin on its own. It is not designed for that purpose, although if combined with another potential project(s) included in this GSP it may cumulatively increase groundwater in storage.~~

### ~~7.2.19 Permitting and Regulatory Process~~

~~The conjunctive use and ASR projects presented under this section will require an EIR to be developed in compliance with CEQA. Upon completion of the CEQA process, the cooperating agencies' boards and/or councils shall take actions to certify the CEQA work and approve projects. At this early stage of planning, it is unknown if any modifications to existing water rights would be required for these projects, or if a storage supplement could be filed through an administrative process.~~

### ~~7.2.20 Timetable for Implementation~~

~~The ASR project is only in the preliminary planning stages. Key next steps are to fully determine project feasibility and Basin benefits. The ASR project will continue to be evaluated over the next year or 2.~~

~~The Transfer for Inter-District Conjunctive Use project is purely conceptual at this stage with no plan to conduct a feasibility study. If Phase 2 of the Expanded Conjunctive Use project is completed with treated Loch Lomond water being treated by the City of Santa Cruz and piped back up to south Scotts Valley in lieu of pumping groundwater by SLVWD and SVWD, the infrastructure will then be in place to supply the treated water needed for both ASR and transfer of surface water to the Basin for inter-district conjunctive use.~~

### ~~7.2.21 Expected Benefits~~

~~The transfer of treated surface water from outside the Basin for inter-district conjunctive use would have similar benefits as described in Section 0, if the volume transferred averages at least 540 AFY over the long-term. Benefit will be proportional to the volume of water available for conjunctive use and resulting in-lieu recharge.~~

~~Expected benefits from ASR are temporary increased groundwater levels and groundwater in storage. The benefits are temporary until a drought period when the stored water is needed and groundwater levels and storage decline until more drought storage can be injected into the aquifer. How the ASR project can be configured and operated so it does not negatively impact the Basin is still being evaluated. To provide a benefit to the Basin, the project will need to leave an agreed amount of water in the aquifer to improve groundwater levels and groundwater discharge to creeks.~~

### ~~7.2.22 Legal Authority~~

~~California state law gives water districts the authority to take actions necessary to supply sufficient water for present or future beneficial use. Land use jurisdictions have police powers to develop similar programs. The SGMA grants SMGWA legal authority to adopt rules, regulations, ordinances, and resolutions necessary to achieve sustainability. Water use efficiency and conjunctive use projects make use of preserving existing water resources already within each member agency's system to which each agency already has access. Water transfers and purchases between agencies will comply with all legal requirements.~~

### ~~7.2.23 Estimated Costs and Funding Plan~~

~~Projects included in this section will require additional new infrastructure such as pipelines, interties, pump stations and treatment capacity expansions and costs associated with these would~~

~~be funded through a combination of increased operating revenue and outside funding sources. Potential outside funding sources could include IRWM Grant Programs, Sustainable Groundwater Management Grant Program, State Revolving Fund low interest loans, USDA grants and/or low interest loans, or USBR Drought Resiliency and/or Title XVI Recycled Water grants. Without outside funding, these projects are very likely not financially feasible.~~

~~A summary of estimated costs is presented in Table 8-4. Other project related costs presented below include engineering, permitting, land acquisition, environmental, special studies, legal, water rights, and other in-direct costs. Cost estimates were prepared to AACE Estimate Class 5, intended for conceptual and planning level uses.~~

~~Table 8-8-4. Group 2, Tier 2 Estimated Project Costs~~

| ~~Project~~ | ~~Capital Construction Cost~~ | ~~Other Project Related Cost~~ | ~~Total Capital Cost~~ | ~~Annual O&M Costs~~ |
|---|---|---|---|---|
| ~~Inter-District Transfer for Conjunctive Use~~ | ~~$15 M~~ | ~~$16 M~~ | ~~$31 M~~ | ~~$2.5 M~~ |
| ~~Aquifer Storage & Recovery Project in Scotts Valley Area of the Basin~~ | ~~$25 M~~ | ~~$26.6 M~~ | ~~$51.6 M~~ | ~~$2.5 M~~ |

### ~~7.2.24 Management of Groundwater Extractions and Recharge~~

~~The Transfer for Inter-District Conjunctive Use project intends to reduce groundwater pumping by SLVWD and SVWD. Reductions in groundwater pumping allow aquifers to passively recharge around the extraction wells being pumped less. Reduced pumping will contribute to increased groundwater levels and groundwater in storage. Increased groundwater extractions in dry years when surface water is less available will need to be managed such that minimum thresholds are not exceeded. Management actions are described in the 2020 Water Shortage Contingency Plan included in SVWD and SLVWD's joint 2020 UWMP. These actions are developed to address supply shortages that consider groundwater levels approaching minimum thresholds and extraction averages in comparison with projected long-term average baseline pumping (WSC and M&A., 2021).~~

~~The ASR project will need to be designed to operate such that it does not draw groundwater levels down below minimum thresholds for extended periods of time without the means to recharge the aquifers again before significant and unreasonable conditions occur.~~

~~The GSP monitoring network will be used to track groundwater levels, groundwater extraction, and groundwater quality by cooperating agencies to evaluate pumping impacts, measures of~~

~~sustainability, and effects of implemented GSP projects and management actions on beneficial groundwater users and uses.~~

~~Of the potential projects included in Tier 2 of Group 2, ASR using treated surface water from the City of Santa Cruz's San Lorenzo River and North Coast sources is the only project with a potential to change groundwater quality. A project feasibility study for ASR would include, amongst other things, an evaluation of the potential for groundwater quality degradation. Two potential causes of degradation are 1) dissolution of metals, such as arsenic, from the geologic formation into groundwater because of changes in geochemistry caused by mixing surface water and groundwater, and 2) mobilization of an existing contaminant plume that causes the plume to contaminate previously unimpacted wells or surface water.~~

~~Furthermore, a feasibility study needs to identify if beneficial groundwater users may be impacted by the project and whether groundwater quality minimum thresholds (drinking water standards) may be exceeded at RMPs. With ASR targeting the Lompico aquifer in Scotts Valley, only municipal beneficial users of groundwater may be directly impacted by degraded groundwater quality in the Lompico aquifer. There are very few private domestic wells in the area with a potential to be impacted by degraded groundwater quality because residents of the City of Scotts Valley and Mount Hermon are supplied municipal water by SLVWD, SVWD, and the MHA. Private wells outside of the City limits and the DAC (8 miles from Scotts Valley) will not be impacted because they are hydraulically upgradient of where projects may take place.~~

~~Santa Margarita aquifer quality has a the potential to be impacted by raising groundwater levels in the Lompico aquifer. Model simulations show increasing Lompico aquifer groundwater levels raise Santa Margarita aquifer groundwater levels because induced recharge is reduced through the Santa Margarita aquifer. Higher Santa Margarita aquifer groundwater levels have a potential to mobilize existing south Scotts Valley VOC contaminant plumes. Beneficial uses that may be impacted if groundwater is degraded by mobilized plumes in the Santa Margarita aquifer include baseflows to Bean Creek and groundwater extraction from wells screened in the Santa Margarita aquifer located between the plumes and Bean Creek.~~

## ~~7.3 Projects and Management Actions Using Purified Wastewater Sources (Group 2, Tier 3)~~

### ~~7.3.1 Project Descriptions, Objectives, and Circumstances for Implementation~~

~~Projects and management actions presented in this section have been designated under Group 2, Tier 3 and represent projects that obtain their source water from purified wastewater supplies.~~

~~The following subsections provide a detailed project description followed by a summary of objectives and discussion of any circumstances for implementation.~~

#### ~~7.3.1.1 Purified Wastewater Recharge in Scotts Valley Area of the Basin (710 – 1,500 AFY Treated at Existing Facility Outside of the Basin)~~

~~A purified wastewater recharge project in the Scotts Valley area would use advanced water purification technology to treat existing secondary-treated effluent source water from the City of Santa Cruz Wastewater Treatment Facility (WWTF). Advanced treated wastewater would be injected into the Lompico aquifer in the Scotts Valley area. The project could use the expanded capacity of SqCWD's Chanticleer Advanced Water Purification Facility (AWPF) that is scheduled to begin construction in 2021 as part of the Pure Water Soquel project.~~

~~SVWD is in the process of assessing the feasibility and benefit to the Basin of using purified wastewater to replenish the Lompico aquifer. In 2020, SVWD performed an alternatives analysis to assess alternative purified wastewater projects ranging between 250 to 2,600 AFY (Kennedy/Jenks, 2020). Modeling performed in preparation of this GSP shows 710 AFY of replenishment would be enough to raise groundwater levels in the Lompico aquifer by 20 to 80 feet (see Section 4.5.6 for results) and meet measurable objectives. Preliminary modeling results indicate that if the expanded conjunctive use project with Loch Lomond (Phase 1 and 2) is not implemented, recharge of purified wastewater in excess of 710 AFY will create drought storage that can be used while still meeting measurable objectives.~~

~~To generate 710 AFY of purified wastewater, Pure Water Soquel Chanticleer AWPF would require a partial expansion, while full expansion of the Pure Water Soquel Chanticleer AWPF would generate 1,500 AFY of purified wastewater. In both the 710 and 1,500 AFY alternatives, secondary-treated effluent would be conveyed to the Chanticleer AWPF via planned infrastructure as part of the Pure Water Soquel project. Secondary-treated effluent would be treated using micro-filtration, reverse osmosis, and ultraviolet light and advanced oxidation process. Purified wastewater would be conveyed to the SVWD's El Pueblo yard for final conditioning and injected into wells near El Pueblo yard to recharge the Lompico aquifer. Brine is intended to be discharged via the Santa Cruz outfall.~~

~~A purified wastewater project is a high-cost option, but with regional participation it could provide greater water availability as well as the benefit of shared infrastructure and costs.~~

**~~Project Objectives~~**

~~The 710 AFY alternative's objective is to recharge the Lompico aquifer in the Scotts Valley area to increase groundwater levels and groundwater discharge to creeks. For alternatives recharging more than 710 AFY, the excess water recharged may be used as drought supply.~~

**~~Circumstances for Implementation~~**

~~The expanded conjunctive use with Loch Lomond (Phase 1 and 2) projects are a cheaper option for raising groundwater levels in the Lompico aquifer than a purified wastewater recharge project. However, the advantage of using purified wastewater is that it is a drought resilient source, while conjunctive use is reliant on having excess surface water. With concerns that changing climate is altering the timing and intensity of rainfall events that impact surface water runoff, conjunctive use may not solely provide the benefits needed to achieve sustainability.~~

~~As a backup option for achieving sustainability, and as a source of drought supply storage that can have multi-agency benefits, purified wastewater recharge is a potential project that the cooperating agencies are now considering.~~

~~Technical feasibility of the project is still largely unknown and further investigation is required. Several key factors that will determine feasibility are:~~

- ~~Public perception related to perceived public health issues associated with using purified wastewater as a source~~
- ~~Groundwater modeling required to assess available capacity in the groundwater basin and ability to meet regulatory travel times~~
- ~~Pilot testing of Lompico aquifer injection capacity~~
- ~~Water quality testing is required to assess potential impacts to the Basin and to meet regulatory and GSP requirements~~
- ~~Dependability on other agencies to supply the source wastewater and treatment at the Chanticleer AWPF (i.e., City of Santa Cruz and SqCWD)~~
- ~~Concept for Pure Water Soquel expansion capacity was initially intended for the Santa Cruz Mid-County Basin and not for the Santa Margarita Basin~~
- ~~Complex multi-agency partnerships and institutional agreements would be required (i.e., cost sharing, operational agreements, etc.)~~
- ~~Lack of conveyance network with other agencies to sell excess recharged water and considerable capital and operations and maintenance (O&M) cost for treatment of purified water and conveyance to Scotts Valley~~

#### ~~7.3.1.2 Purified Wastewater Recharge in Scotts Valley Area of the Basin (3,500 AFY Treated at New Facility inside the Basin)~~

~~Similar to the purified wastewater recharge project presented in the previous subsection, this larger project utilizes advanced water purification technology to treat existing secondary-treated effluent source water from the City of Santa Cruz WWTF for injection into the Lompico aquifer. The difference between this 3,500 AFY project and the previous project with a 710 to 1,500 AFY capacity is that this project requires a new AWPF site in or near Scotts Valley. A project of this capacity would need to be a regional project with separate infrastructure from that used by Pure Water Soquel. Cooperating agencies are still in early discussions amongst themselves to determine if this project has potential regional support before assessing its feasibility.~~

~~Under this project 4 million gallons per day (MGD) of secondary-treated effluent would be conveyed to a new Scotts Valley based AWPF via new conveyance infrastructure. Secondary-treated effluent would be put through a rigorous advance treatment using technology that meets regulatory requirements and industry best practices for similar sites throughout California. Purified wastewater would be conveyed and injected into injection wells near SVWD's El Pueblo yard and at several other suitable location in Scotts Valley. Brine discharge will need new infrastructure to connect to the Santa Cruz outfall.~~

**~~Project Objectives~~**

~~The 3,500 AFY purified wastewater recharge alternative's objective is to recharge the Lompico aquifer through active injection in the Scotts Valley area to increase groundwater levels, groundwater in storage, and groundwater discharge to creeks. Recharged purified wastewater in excess of 710 AFY may be used by multiple cooperating agencies as drought supply.~~

**~~Circumstances for Implementation~~**

~~A project of this size and cost can only be implemented if there is regional multi-agency benefit to the cooperating agencies. Longer drought periods and the threat of wildfires are considerations that need to be weighed against the costs and benefits of a drought resilient supply. This is a long-range project that needs to be studied together with the lesser capacity alternatives described in Section 4.5.1.1. The different project sizes will have different cost-benefits and operational strategies to maximize storage potential and control losses to creeks that may dictate which project size is the most beneficial to the Basin and its users.~~

#### ~~7.3.1.3 Purified Wastewater Augmentation at Loch Lomond~~

~~This project involves augmenting Loch Lomond storage with purified wastewater. Advanced treatment would occur via an Advanced Wastewater Treatment Facility (AWTF) located at or near City of Santa Cruz WWTF employing full advanced treatment technology that meets regulatory requirements and industry best practices. The project would convey purified wastewater from the AWFT to Loch Lomond where it would be blended with raw water in the reservoir, a source of municipal drinking water supply for the City of Santa Cruz. Brine discharge would be via connection to the existing City of Santa Cruz ocean outfall. Other infrastructure would include a pump station near the treatment facility, conveyance pipelines and diffuser discharge facility at Loch Lomond (Kennedy/Jenks, 2018).~~

~~The available supply for a surface water augmentation project would depend on the amount of secondary effluent available for reuse, the dilution ratio and the retention time in the reservoir needed to meet regulation. Monthly wastewater flows are generally their lowest during summer months thereby limiting the size of the surface water augmentation project. This also happens to correspond with the time in which there is more available capacity in Loch Lomond. The ability to augment Loch Lomond may be limited to when there is available capacity in the reservoir to accept advanced treated flows. Reservoir augmentation would take place about half of each year and be sized to produce 3.2 MGD of advanced treated water when the reservoir is being drawn down to meet demands. Production would scale down in the winter months when the reservoir is filled naturally by rainfall and runoff. The project could be sized larger to draw the reservoir down in the summer as source of water for conjunctive use or ASR type projects (Kennedy/Jenks, 2018).~~

**~~Project Objectives~~**

~~A purified wastewater augmentation project at Loch Lomond would maximize the beneficial reuse of wastewater in summer months, and potentially provide more operational flexibility for reservoir operations. Instead of preserving storage to assure sufficient water supply for the City of Santa Cruz in the dry months, in all seasons Loch Lomond could be used as a climate independent resource for the region. If sized appropriately, the project could offset groundwater pumping by the City of Santa Cruz in the Santa Cruz Mid-County Basin, or if sold to SLVWD or SVWD offset pumping in the Santa Margarita Basin thereby raising groundwater levels in the locations where pumping is offset.~~

**~~Circumstances for Implementation~~**

~~The project provides an alternative means of utilizing drought resilient purified wastewater to augment Loch Lomond instead of for aquifer recharge and use as drought supply. Technical~~

~~feasibility of the project is still largely unknown and further investigation is required. Several key factors that will determine feasibility are:~~

- ~~There is a regulatory pathway for reservoir water augmentation projects, and though no projects are currently permitted in California, there are 3 projects in various stages of planning, design, and construction~~
- ~~Requires meeting reservoir retention and dilution times~~
- ~~Facility operation would be limited when the reservoir is full due to natural runoff~~
- ~~Climate change and resiliency study by the City of Santa Cruz is in progress to understand true benefit of supply in dry years~~
- ~~Project may require the City of Santa Cruz to operate Loch Lomond differently in the future~~
- ~~Public perception related to perceived public health issues associated with using wastewater as a source supply for drinking water~~

### ~~7.3.2 Public Noticing~~

~~Public notice for all aspects of the project will be carried out by member agencies prior to the start of the project. Public noticing is anticipated to occur through compliance with CEQA for any facilities or plans associated with the project.~~

~~Projects will be approved through regular member agency public board or council meetings in which public discussions or comments will occur. Future notification of the public for any additional pilot testing or long-term implementation would be done prior to initiation of the project.~~

### ~~7.3.3 Overdraft Mitigation and Management Actions~~

~~The purified wastewater recharge projects presented within this section use outside purified wastewater sources to recharge the Lompico aquifer and increase groundwater levels in the Scotts Valley area, thereby eliminating overdraft conditions. Where recharge capacity of the project exceeds 710 AFY, recharge provides for drought supply through indirect potable reuse.~~

~~The purified wastewater augmentation at Loch Lomond project will only help address lowered groundwater levels in the Lompico aquifer if a portion of the water can be used by SLVWD and/or SVWD in lieu of pumping groundwater from the Lompico aquifer in the Scotts Valley area.~~

### ~~7.3.4 Permitting and Regulatory Process~~

~~The projects presented under this section will require an EIR to be developed in compliance with CEQA. Upon completion of the CEQA process, cooperating agencies' boards and/or councils shall take actions to certify the CEQA work and approve projects. No new water rights are being requested as part of any of the projects presented under this section.~~

~~Any project involving recycled water is required to comply with the State's Water Quality Control Policy for Recycled Water. This policy includes the need for an antidegradation analysis demonstrating that the existing projects, reasonably near future projects, and other sources of loading to the basin included within the plan will, cumulatively, satisfy the requirements of State Water Board Resolution No. 68-16, Statement of Policy with Respect to Maintaining High Quality of Waters in California (Antidegradation Policy).~~

### ~~7.3.5 Timetable for Implementation~~

~~The projects presented herein are only in the conceptual planning stages. Project scopes and benefits are subject to change based on further analysis. Key next steps are properly determining feasibility of the projects and defining key benefits.~~

### ~~7.3.6 Expected Benefits~~

~~While basin groundwater levels have stabilized in the last few decades, supplemental sources of water from outside the Basin may be needed to increase Lompico aquifer groundwater levels and meet Basin sustainability objectives. After recharging enough purified wastewater to increase groundwater levels to measurable objectives, any additional water stored in the aquifer may be used to augment groundwater or surface water providing a drought resilient supply that will increase the cooperating agencies' water supply resiliency.~~

~~The groundwater model was used to simulate groundwater conditions in the Basin in response to injecting 710 AFY in the central and northern Scotts Valley area. The Basin groundwater budget and groundwater levels for the project simulation are compared against a baseline "no project" simulation. Both the project and baseline simulations account for projected climate change described in Appendix 2E. A project of greater capacity was not modeled.~~

~~Table 4-5 compares the Basin groundwater budgets for baseline conditions with injecting 710 AFY of purified wastewater into the Lompico aquifer. The project is simulated to, on average, have the following benefits to the Basin:~~

- ~~200 AFY more groundwater is left in storage~~

- ~~300 AFY more net groundwater discharge to creeks as baseflow~~

~~Compared to 540 AFY conjunctive use (Section 4.3.6, Table 2-34), the amount of groundwater discharge to creeks from 710 AFY purified wastewater recharge (Table 4-5) is very similar, but there is 75% more groundwater in storage because of direct injection into the Lompico aquifer.~~

~~Like the expanded conjunctive use with Loch Lomond project, groundwater storage losses for the 710 AFY purified wastewater injection simulation is mostly in the Santa Margarita aquifer due to reduced precipitation in the climate change projection used in the simulations (Table 4-6). With injection, storage losses in critically dry water years are simulated to be half of that if there were no project because of the cumulative benefits of leaving 710 AFY in storage each year (Table 4-5).~~

~~The groundwater model is used to simulate benefits to groundwater levels from injection of 710 AFY of purified wastewater (green dashed line on Figure 4-2 through Figure 4-6). In the Olympia wellfield area (Figure 4-2), there is no increase in groundwater levels because all injection takes place into the Lompico aquifer south of Bean Creek and there is no direct connection to the Santa Margarita aquifer north of Bean Creek. The most distant monitoring well from where injection takes place is SLVWD Pasatiempo MW-1. The hydrograph for this well shown on Figure 4-3 simulates around 20 feet of recovery which is a smaller groundwater level improvement than expanded conjunctive use. The difference in benefit is because resting the Pasatiempo wellfield through conjunctive use is more impactful than injection some 2 miles to the northeast. SVWD #10 (Figure 4-4), in the south Scotts Valley area, also has a smaller groundwater level increase than expanded conjunctive use because injection is about 1 mile away.~~

~~At a location close to injection, SVWD #11A (Figure 4-6), groundwater levels are simulated to increase up to 80 feet, well above those predicted for expanded conjunctive use at this location. SVWD #15 Monitor (Figure 4-5) is a monitoring well screened in the Lompico and Butano aquifers. It has a 50-foot groundwater level benefit, which is similar to the expanded conjunctive use but without the seasonal fluctuations that occur in the expanded conjunctive use simulation. Its resultant groundwater levels do not have seasonal fluctuations since injection occurs uniformly throughout the year.~~

~~The purified wastewater augmentation at Loch Lomond project has unknown benefits to the Basin at this early stage of the City of Santa Cruz's recycled water planning efforts.~~

~~Table 4-5. Baseline and 710 AFY Purified Wastewater Recharge Project Groundwater Budget~~

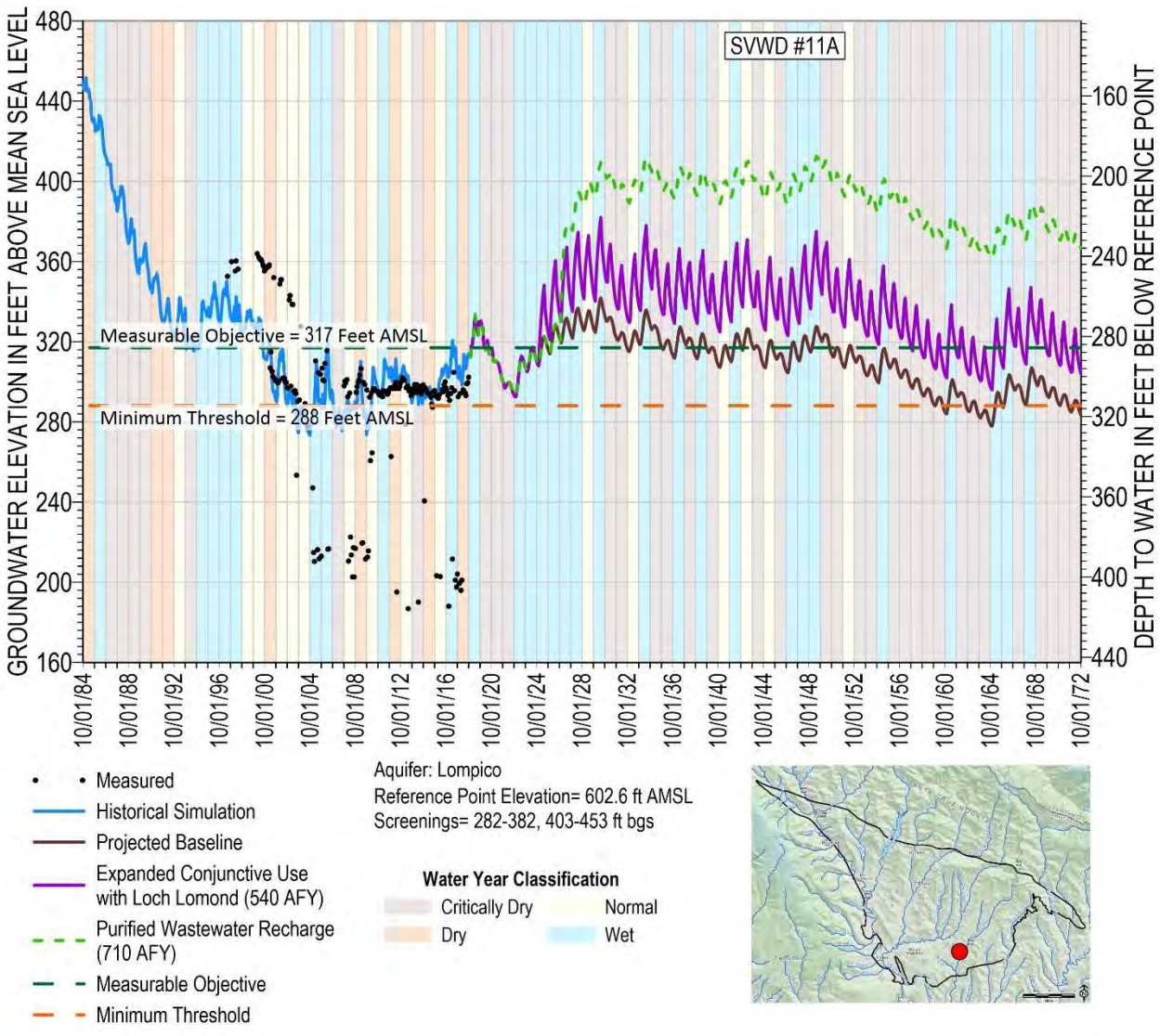
| ~~Water Budget Components~~ | | ~~Projected Baseline 2020-2072~~ | | | | ~~710 AFY Injection 2020-2072~~ | | | |
|---|---|---|---|---|---|---|---|---|---|
| ~~Average Total for Water Budget Period in parenthesis (Acre-Feet)~~ | | ~~Wet Water Year Average~~ | ~~Critically Dry Water Year Average~~ | ~~Annual Average (Acre-Feet)~~ | ~~Average Percent of Total Inflow or Outflow~~ | ~~Wet Water Year Average~~ | ~~Critically Dry Water Year Average~~ | ~~Annual Average (Acre-Feet)~~ | ~~Average Percent of Total Inflow or Outflow~~ |
| ~~Inflows~~ | ~~Precipitation Recharge~~ | ~~23,700~~ | ~~3,300~~ | ~~12,100~~ | ~~56%~~ | ~~23,700~~ | ~~3,300~~ | ~~12,100~~ | ~~54%~~ |
| | ~~Subsurface Inflow~~ | ~~100~~ | ~~100~~ | ~~100~~ | ~~<1%~~ | ~~100~~ | ~~100~~ | ~~100~~ | ~~<1%~~ |
| | ~~Return flows (System Losses, Septic Systems, Quarry, Irrigation)~~ | ~~1,100~~ | ~~1,100~~ | ~~1,200~~ | ~~5%~~ | ~~1,100~~ | ~~1,100~~ | ~~1,100~~ | ~~5%~~ |
| | ~~Streambed Recharge~~ | ~~10,700~~ | ~~6,600~~ | ~~8,400~~ | ~~39%~~ | ~~10,700~~ | ~~6,500~~ | ~~8,400~~ | ~~37%~~ |
| | ~~Injection~~ | ~~0~~ | ~~0~~ | ~~0~~ | ~~0%~~ | ~~600~~ | ~~600~~ | ~~620~~ | ~~3%~~ |
| | ~~*Inflow Totals*~~ | ~~***35,600***~~ | ~~***11,100***~~ | ~~***21,800***~~ | | ~~***36,200***~~ | ~~***11,600***~~ | ~~***22,400***~~ | |
| ~~Outflows~~ | ~~Groundwater Pumping~~ | ~~2,600~~ | ~~2,900~~ | ~~2,800~~ | ~~12%~~ | ~~2,600~~ | ~~3,100~~ | ~~2,900~~ | ~~13%~~ |
| | ~~Subsurface Outflow~~ | ~~100~~ | ~~100~~ | ~~100~~ | ~~1%~~ | ~~100~~ | ~~100~~ | ~~100~~ | ~~<1%~~ |
| | ~~Discharge to Creeks~~ | ~~25,600~~ | ~~14,600~~ | ~~19,400~~ | ~~87%~~ | ~~25,800~~ | ~~15,000~~ | ~~19,700~~ | ~~87%~~ |
| | ~~*Outflow Totals*~~ | ~~***28,300***~~ | ~~***17,600***~~ | ~~***22,300***~~ | | ~~-2,600~~ | ~~-3,100~~ | ~~***22,700***~~ | |
| ~~Storage~~ | ~~Average Annual Change in Storage~~ | ~~7,400~~ | ~~-6,400~~ | ~~-500~~ | ~~-~~ | ~~2,600~~ | ~~-3,100~~ | ~~-300~~ | ~~-~~ |
| | ~~Cumulative Change in Storage~~ | ~~-~~ | ~~-~~ | ~~-24,000~~ | ~~-~~ | | | ~~-16,300~~ | ~~-~~ |

~~*Small discrepancies between total inflow and outflow may occur due to rounding~~

~~Table 4-6. 710 AFY Purified Wastewater Recharge Project Groundwater Budget by Aquifer~~

| ~~Water Budget Components~~ | | ~~710 AFY Injection 2020-2072~~ | | | |
|---|---|---|---|---|---|
| ~~Average Total for Water Budget Period in parenthesis (Acre-Feet)~~ | | ~~Santa Margarita Aquifer~~ | ~~Monterey Formation~~ | ~~Lompico Aquifer~~ | ~~Butano Aquifer~~ |
| ~~Inflows~~ | ~~Precipitation Recharge~~ | ~~5,700~~ | ~~1,300~~ | ~~900~~ | ~~3,600~~ |
| | ~~Subsurface Inflow~~ | ~~0~~ | ~~0~~ | ~~0~~ | ~~90~~ |
| | ~~Return flows (System Losses, Septic Systems, Quarry, Irrigation)~~ | ~~500~~ | ~~200~~ | ~~200~~ | ~~150~~ |
| | ~~Streambed Recharge~~ | ~~1,600~~ | ~~800~~ | ~~400~~ | ~~3,330~~ |
| | ~~Flow from Other Aquifers~~ | ~~3,300~~ | ~~600~~ | ~~2,300~~ | ~~1,160~~ |
| | ~~*Inflow Totals*~~ | ~~*7,800*~~ | ~~*2,500*~~ | ~~*2,800*~~ | ~~*7,800*~~ |
| ~~Outflows~~ | ~~Groundwater Pumping~~ | ~~900~~ | ~~100~~ | ~~1,400~~ | ~~520~~ |
| | ~~Subsurface Outflow~~ | ~~0~~ | ~~0~~ | ~~0~~ | ~~100~~ |
| | ~~Discharge to Creeks~~ | ~~6,100~~ | ~~2,100~~ | ~~1,500~~ | ~~6,920~~ |
| | ~~Flow to Other Aquifers~~ | ~~4,400~~ | ~~700~~ | ~~1,500~~ | ~~860~~ |
| | ~~*Outflow Totals*~~ | ~~*8,000*~~ | ~~*2,500*~~ | ~~*3,500*~~ | ~~*7,900*~~ |
| ~~Storage~~ | ~~Average Annual Change in Storage~~ | ~~-200~~ | ~~0~~ | ~~-700~~ | ~~-100~~ |
| | ~~Cumulative Change in Storage~~ | ~~-9,300~~ | ~~-1,600~~ | ~~-3,000~~ | ~~-3,400~~ |

~~*Small discrepancies between total inflow and outflow may occur due to rounding~~




~~Figure 4-6. SVWD #11A Simulated Groundwater Levels (Lompico Aquifer)~~

### ~~7.3.7 Legal Authority~~

~~California state law gives water districts the authority to take actions necessary to supply sufficient water for present or future beneficial use. Land use jurisdictions have police powers to develop similar programs. The Sustainable Groundwater Management Act of 2014 grants SMGWA legal authority to pass regulations necessary to achieve sustainability. Water use efficiency projects make use of preserving existing sources already within each member agency's specific system to which each agency already has rights.~~

### ~~7.3.8 Estimated Costs and Funding Plan~~

~~Projects included in this subsection require new infrastructure such as pipelines, interties, pump stations, injection wells, and new treatment facilities. Costs associated with the new infrastructure would be funded through a combination of increased operating revenue and outside funding sources. Potential outside funding sources could include IRWM Grant Programs, Sustainable Groundwater Management Grant Program, State Revolving Fund low interest loans, USDA grants and/or low interest loans, or USBR Drought Resiliency and/or Title XVI Recycled Water. The significant cost of the projects in this tier will require multi-agency collaboration, plus substantial outside funding to make them financially feasible.~~

~~A summary of costs is presented in Table 4-7. Other project related costs presented below include engineering, permitting, land acquisition, environmental, special studies, legal, water use rights, and other in-direct costs. Cost estimates were prepared to AACE Estimate Class 5 intended for conceptual and planning level uses.~~

~~Table 4-7. Group 2, Tier 3 Estimated Project Costs~~

| ~~Project~~ | ~~Capital Construction Cost~~ | ~~Other Project Related Cost~~ | ~~Total Capital Cost~~ | ~~Annual O&M Costs~~ |
|---|---|---|---|---|
| ~~Purified Wastewater Recharge in Scotts Valley Area of the Basin (710 – 1,500 AFY Treated at an Existing Facility Outside of the Basin)[1]~~ | ~~$61.4 M~~ | ~~$46.1 M~~ | ~~$107.5 M~~ | ~~$2.6 M~~ |
| ~~Purified Wastewater Recharge in Scotts Valley Area of the Basin (3,500 AFY Treated at a New Facility inside the Basin)~~ | ~~$167.9 M~~ | ~~$126 M~~ | ~~$293.9 M~~ | ~~$5.9 M~~ |
| ~~Purified Wastewater Augmentation at Loch Lomond~~ | ~~$117.2 M~~ | ~~$76.1 M~~ | ~~$193.3 M~~ | ~~$7.5 M~~ |

~~[1] Costs are shown for the larger 1,500 AFY project. The smaller 710 AFY project is estimated at $97.9 million in total costs with $2.1 million in annual O&M.~~

### ~~7.3.9 Management of Groundwater Extractions and Recharge~~

~~Two potential projects included in Tier 3 of Group 2 have the potential to impact groundwater quality by recharging purified wastewater into groundwater. To ensure a project does not degrade groundwater quality, the project proponent of a groundwater recharge project using purified wastewater must submit an antidegradation analysis to the CCRWQCB with the report~~

~~of waste discharge to demonstrate compliance with the State's Antidegradation Policy. The antidegradation study needs to consider project impacts on the fate and transport of existing contaminant plumes causing contamination of previously unimpacted wells or surface water, and changes to the geochemistry of an aquifer thereby causing the dissolution of metals from the geologic formation into groundwater.~~

~~SWRCB approved projects are required to meet the following criteria (SWRCB, 2018):~~

- ~~Compliance with regulations related to purified wastewater for groundwater recharge projects, including monitoring requirements for priority pollutants contained in CCR, title Title 17 and California Code of RegulationsCCR, title Title 22 (including subsequent revisions), and recommendations by the SWRCB for the protection of public health pursuant to CWC§Water Code section 13523.~~

- ~~Implementation of a monitoring program for CECs that is consistent with the SWRCB's Water Quality Control Policy for Recycled Water and any additional recommendations from the SWRCB.~~

~~Furthermore, a feasibility study needs to identify if beneficial groundwater users may be impacted by the project and whether groundwater quality minimum thresholds (drinking water standards) may be exceeded at RMPs. With potential projects targeting the Lompico aquifer in Scotts Valley, only municipal beneficial users of groundwater may be directly impacted by degraded groundwater quality in the Lompico aquifer. There are very few private domestic wells in the area with a potential to be impacted by degraded groundwater quality because residents of the City of Scotts Valley and Mount Hermon are supplied municipal water by SLVWD, SVWD, and the MHA. Private wells outside of the City limits and the DAC (8 miles from Scotts Valley) will not be impacted because they are hydraulically upgradient of where projects may take place.~~

~~Santa Margarita aquifer quality has a potential to be impacted by raising groundwater levels in the Lompico aquifer. Model simulations show increasing Lompico aquifer groundwater levels raise Santa Margarita aquifer groundwater levels because induced recharge is reduced through the Santa Margarita aquifer. Higher Santa Margarita aquifer groundwater levels have a potential to mobilize existing south Scotts Valley VOC contaminant plumes. Beneficial uses that may be impacted if groundwater is degraded by mobilized plumes in the Santa Margarita aquifer include baseflows to Bean Creek and groundwater extraction from wells screened in the Santa Margarita aquifer located between the plumes and Bean Creek.~~

~~All water injected will be metered and subject to reporting to the CCRWQCB, as well as to the SMGWA to be included in the GSP's Annual Reports. Monitoring wells associated with the project proponent's permit requirements will monitor groundwater quality changes from the~~

~~project. Some of the monitoring wells may be included as RMPs in future updates to the GSP. Extractions to recover water stored for drought supply will be metered and accounted for separately from native groundwater extractions. Data collected as part of recharge operations will create a record of changes in groundwater levels and quality by the project and will be used to evaluate project impacts on all beneficial users of groundwater and its contribution to achieving sustainability.~~

## ~~7.4 Identified Projects and Management Actions Requiring Future Evaluation (Group 3)~~

~~If Group 2 projects are deemed infeasible or anticipated outcomes change, SMGWA may look to Group 3 projects to meet SMGWA sustainability goals. The level of detail provided for Group 3 is significantly less detailed than Groups 1 and 2 because the activities listed have not yet been seriously considered for implementation.~~

### ~~7.4.1 SLVWD Olympia Groundwater Replenishment~~

~~The Olympia groundwater replenishment project is a potential aquifer replenishment project in SLVWD's North System. Injection wells at the Olympia wellfield would be used to replenish the Santa Margarita aquifer with treated surface water from available winter flows. The winter surface water flows available for replenishment would be those greater than ongoing operations, water rights, and fish flows.~~

~~Since the Olympia area Santa Margarita aquifer is a major contributor to baseflow in Zayante Creek, the project could only provide for operational storage for one season rather than as a drought reserve. It is unknown currently what the losses to baseflow would be as groundwater modeling of the project has not been undertaken.~~

~~Replenishment of the Santa Margarita aquifer in this area may be needed in the future if groundwater extraction in the area caused significant and unreasonable surface water depletions or chronic lowering of groundwater levels. Currently, there is some slight long-term declines in groundwater levels in the Olympia area.~~

~~Similar to the projects presented in the previous Sections 4.3.1.2 and 4.3.1.3, replenishing the Olympia wellfield area would be sourced by excess surface water in the North System and Felton System. If the Expanded Conjunctive Use project (Phase 1) and Inter-District Conjunctive Use project with Loch Lomond (Phase 2) are implemented and all available excess surface water is used by those projects, the Olympia Groundwater Replenishment project would not have source water. It is therefore considered an alternative project that would only be needed if~~

~~groundwater extraction in the area caused significant and unreasonable surface water depletions or chronic lowering of groundwater levels.~~

~~Use of excess surface water for replenishment would directly recharge groundwater and increase groundwater levels instead of indirect or in-lieu passive recharge from conjunctive use presented in Sections 8.2.1.1 and 8.2.1.2. In addition to increasing groundwater storage in the Santa Margarita aquifer through direct recharge, a portion of the replenished water will discharge to creeks as baseflow.~~

### ~~7.4.2~~8.3.2 ~~Public/Private~~Project 43: Expanded Stormwater Recharge ~~and Low Impact Development~~

**~~Project Description~~**

This project includes, where feasible, installation of small to medium scale, 10 AFY to 1,~~0~~00 AFY per site, facilities to capture stormwater to recharge the Santa Margarita aquifer through surface spreading, linear infiltration galleries ~~and/~~or constructed dry wells. Preliminary siting of such facilities could be within the Lockhart Gulch area where stormwater runoff is currently diverted, near an existing detention basin on Marion Avenue, or one of several previously disturbed sites in public ownership or on property owned by the Santa Cruz Land Trust. Benefits would be location dependent but would likely ~~locally~~ increase groundwater levels locally around the recharge site and increase Santa Margarita aquifer baseflows to creeks. If stormwater recharge locations can be found in the Camp Evers area where the Monterey Formation is absent, ~~it will~~recharge could also benefit the Lompico aquifer underlying the Santa Margarita aquifer. ~~While low-impact development projects do have positive impacts on basin recharge their individual flow contributions are typically small due to their limited footprints.~~

### ~~7.4.3 Enhanced Santa Margarita Aquifer Conjunctive Use~~

~~This conceptual conjunctive use operational strategy builds on Phase 1 and 2 Expanded Conjunctive use projects described in Section 4.3.1.2. and 4.3.1.3. Its objective is to maximize the conjunctive use of the Santa Margarita and Lompico aquifers based on wet and dry years.~~

~~It is proposed that SLVWD extract from the Santa Margarita aquifer (Olympia and Quail Hollow wellfields) instead of its Pasatiempo wells extracting from the Lompico aquifer in years when the Santa Margarita aquifer has high groundwater levels. This allows the SLVWD Pasatiempo wellfield to provide for in-lieu recharge of the Lompico aquifer. In dry years, when Santa Margarita aquifer groundwater are lowered in response to reduced recharge from rainfall and impacting baseflows to creeks, SLVWD's Santa Margarita aquifer wells are rested by extracting instead Lompico aquifer groundwater recharged in the wet years.~~

~~The anticipated benefits of operating Santa Margarita and Lompico aquifer extractions in this way are that it maximizes the storage capacity of the Santa Margarita aquifer, operating it much like a surface reservoir. The expectation is that Santa Margarita aquifer groundwater will be available in the critical high water demand late summer and fall months when surface water is less available thereby maximizing conjunctive of the Lompico aquifer. By eliminating or reducing pumping from the SLVWD's Santa Margarita aquifer wellfields in drought years, groundwater that would have been pumped can remain in the aquifer to support creek baseflows. It also provides SLVWD with drought storage in the Lompico aquifer when groundwater levels in its Santa Margarita aquifer wells are too low to pump. There are also potential benefits to SVWD and the City of Santa Cruz.~~

~~Groundwater modeling of this operational concept will be needed to determine if it is feasible given climate change is expected to result in more dry years than wet years, and that the wet years will be wetter than historically experienced. Understanding potential impacts on the Santa Margarita aquifers contribution to creek baseflow and fate of the groundwater stored in the Lompico aquifer will also be important factors in determining its feasibility.~~

### ~~7.4.4 SLVWD Quail Hollow Pumping Redistribution~~

~~This project would add a new well within the SLVWD's system in order to redistribute pumping at the Quail Hollow area. SLVWD operates and maintains 2 active groundwater extraction wells in the Quail Hollow area which were constructed in the early 2000s. Prior to 1995, SLVWD operated wells at 3 additional locations in the Quail Hollow area. SLVWD plans to construct a third Quail Hollow extraction well to provide needed redundancy, additional capacity, and redistribute pumping in the area. Redistribution will help address drawdown impacts that may negatively affect some GDEs.~~

~~Wells sites in the vicinity of Quail Hollow Ranch are being considered to minimize potential interference with the 2 active Quail Hollow extraction wells with the intent of widening and reducing the depth of the pumping cone of depression caused by the existing wells.~~

### ~~7.4.5 Santa Margarita Aquifer Private Pumpers Connect to Public Water System~~

~~Public water systems operated by SMGWA member agencies could be expanded to incorporate parcels or developments dependent on private wells extracting from the Santa Margarita aquifer. A project of this nature would only be considered if it were found that private pumping was impacting surface water sources, if there was concern about shallower private wells going dry, or if there are climate change impacts not accounted for in current models. If this were the case, some parcels or developments could choose to be connected to the nearest public water system.~~

~~Preliminary analysis undertaken as part of GSP development using the groundwater model indicates that private pumping is not causing significant depletion of interconnected surface water and so this is not a necessary project. Additionally, connecting rural parcels to a water system will require significant additional infrastructure for minimal benefit given the size and relatively low population density of the region.~~

### ~~7.4.6 Direct Potable Reuse~~

~~Current California regulations do not allow direct potable reuse (DPR). DPR is the purposeful introduction of advanced treated wastewater into a drinking water supply, typically upstream of a drinking WTP or directly into the potable water supply distribution system downstream of a WTP. Unlike indirect potable reuse projects, there is no environmental buffer that limits the capacity of a DPR project.~~

~~The report entitled "A Proposed Framework for Regulating Direct Potable Reuse in California" was released by the SWRCB in April 2018 and identifies key research areas to fill the identified knowledge gaps prior to the adoption of water recycling criteria for DPR through raw water augmentation by December 2023 (per AB 574). Given the outcome of the framework and interest in potable reuse statewide, raw water blending should continue to be tracked as a potential long-term strategy to maximize reuse and reduce ocean discharge. In general, future feasibility of the technology will be tied to overcoming the perception that there are public health issues associated with using wastewater as a source water for drinking water supplies.~~

### ~~7.4.7 Groundwater Use Restrictions~~

~~SGMA grants the SMGWA the authority to restrict pumping if the need or situation arises. At the time of submission of this GSP, pumping curtailment or restrictions are not currently being considered. However, should a future extreme scenario arise where the SMGWA fails to reach sustainability, the SWRCB will most likely enforce pumping restrictions as a management action to achieve sustainability.~~

~~For the purpose of the GSP, pumping restrictions are defined as reductions or limitations in the amount of water a current or future groundwater user can pump from the Basin. This would be applied in the case of a situation where implemented projects and management actions are insufficient to reach and/or maintain sustainability and one or more sustainability indicator is forecast to fall below minimum thresholds by 2042. Under such a curtailment scenario, the SMGWA would determine the amount of water that affected groundwater beneficial users could pump sustainably, and the pumpers would be required to reduce their groundwater extraction to that allocation. All pumpers subject to allocations and restriction would be required to be metered.~~

~~Should this dire option need to be considered at some point in the future, considerable technical work, discussion, and stakeholder input would be needed for the SMGWA to define the policies and procedures required to implement groundwater pumping restrictions.~~

### ~~7.4.8 Scotts Valley Non-Potable Reuse~~

~~Recycled water has been available for use in the City of Scotts Valley since 2002. Its availability increased steadily through expansion of the distribution system and the addition of service connections.~~

~~In 2021, the City of Scotts Valley is planning to conduct a study of potential upgrades or replacement projects for its existing Wastewater Recovery Facility. The full range of options has yet to be identified at the time of writing this GSP, however, it is anticipated to include looking at alternatives such as refurbishment of the existing treatment plant technology, upgrading to new technology such as membrane bioreactors, or other opportunities. Part of this study will be to review other reuse and system expansion opportunities for adjacent water agencies such as the City of Santa Cruz or Soquel Creek Water District. Recycled water demand for irrigation primarily occurs in the summer months. SVWD provides recycled water for use by irrigation at parks, schools, homeowners associations, landscaped medians, and businesses. Recycled water use has tapered off in the last decade and has historically been climate dependent with higher usage during periods of reduced rainfall. While additional customers have been connected to the recycled water distribution system, overall demand has not increased significantly. Expansion of the system is currently limited by the economics of large capital costs required to connect a limited number of additional customers.~~

# ~~8~~9 GROUNDWATER SUSTAINABILITY PLAN IMPLEMENTATION

This section describes ~~how~~ the agency's funding and ~~SMGWA's GSP will be implemented~~ an estimate of the cost to implement the GSP over the next 5 years. ~~()~~. It includes a schedule for implementation that serves as ~~an initial~~a roadmap for ~~addressing~~ GSP implementation activities between ~~2022~~ 2027 and 2042 but focuses on implementation activities ~~to be completed~~ between ~~2022~~ 2027 and ~~2026~~2032~~, prior to the GSP's first second 5-year update~~. ~~It also provides an estimate of the cost to implement the GSP over the next 5 years (Table 9-1Table 9-1) and how the SMGWA plans to meet those costs.~~

~~In Table 9-1Table 9-1 annual costs are multiplied by 5 to arrive at the 5-year cost that is included in the total. Annual costs are directly related to work that needs to be done consistently to meet the requirements of SGMA. Items listed as lump sum are one-time costs that are not multiplied and are carried forward to the total 5-year cost. Annualized costs over the 5-year period are also provided in Table 9-1Table 9-1. It is important to note that not all lump sum costs will be required in the first year of the 5-year implementation period, but for cost estimating purposes, are anticipated before the first GSP 5-year update.~~

~~This implementation plan is based on the current understanding of Basin conditions described in Section 2 and the monitoring networks summarized in Section 3, and conceptual nature of Group 2 and 3 potential projects and management actions for achieving groundwater sustainability described in Section 4. Understanding of groundwater conditions and the specific details of projects and management actions will evolve over time based on future data collection, model analysis, and stakeholder input. New understanding about the Basin and how it responds to implemented projects and management actions may change the course of SMGWA activities, which is the reason this section focuses on the next 5 years.~~

~~Each of the line items in Table 9-1Table 9-1 correspond to the 8 GSP implementation activities described in the subsections that follow. Appendix 5A 9A contains a more detailed explanation of how the costs are estimated, which activities are currently being performed by the SMGWA and cooperating agencies, and which are new activities required under SGMA and the contents of the GSP. More accurate costs will be brought to the Board in the form of the annual budget for approval.~~

Table 9-19-1. Santa Margarita Groundwater Agency 5-Year Estimated Costs Forfor GSP Implementation

| Activity | Categories and Tasks | Annual Cost | Lump Sum Items | 5-year Total | Annualized Cost (5 years) |
|---|---|---|---|---|---|
| 1 | **Agency Membership and Funding Structure Evaluation** | To be accomplished in Fiscal Year 2022 and included in Fiscal Year 2022 budget | | | |
| 2 | **Administrative and Business Operations** | | | | |
| | Administrative and Planning Coordination | $100,000 | $0 | $500,000 | $100,000 |
| | Treasurer Services | $10,000 | $0 | $50,000 | $10,000 |
| | Legal Services | $12,000 | $0 | $60,000 | $12,000 |
| | Communication and Outreach | $20,000 | $0 | $100,000 | $20,000 |
| | Audit Services | $9,000 | $0 | $45,000 | $9,000 |
| | Software and Licenses | $2,500 | $0 | $12,500 | $2,500 |
| | Memberships | $2,100 | $0 | $10,500 | $2,100 |
| | Meetings and Travel | $5,000 | $0 | $25,000 | $5,000 |
| | Insurance | $1,200 | $0 | $6,000 | $1,200 |
| | Supplies and Equipment | $1,000 | $0 | $5,000 | $1,000 |
| 3 | **Technical Support and Consultation** | | | | |
| | Groundwater Model Simulations and Updates | $15,000 | $0 | $75,000 | $15,000 |
| | Consultants As-Needed Technical Support | $15,000 | $0 | $75,000 | $15,000 |
| 4 | **Monitoring & Reporting** | | | | |
| | Groundwater Level Monitoring | $8,000 | $0 | $40,000 | $8,000 |
| | Interconnected Surface Water Monitoring: Streamflow | $40,000 | $0 | $200,000 | $40,000 |
| | Interconnected Surface Water Monitoring: 5-Year Vegetation Vigor | $0 | $5,000 | $5,000 | $1,000 |
| | Interconnected Surface Water Monitoring: GDEs | $5,000 | 0 | $25,000 | $5,000 |
| | Annual Reports | $45,000 | $0 | $225,000 | $45,000 |
| | GSP 5-year Update | $0 | $100,000 | $100,000 | $20,000 |
| 5 | **Non-De Minimis Metering Program** | $2,000 | $5,000 | $15,000 | $3,000 |
| 6 | **Address Data Gaps in the Hydrogeological Conceptual Model, Understanding of Groundwater Conditions, and the Monitoring Network** | | | | |
| | Streamflow Gage on Carbonera Creek | $0 | $15,000 | $15,000 | $3,000 |
| 7 | **Data Management System** | $40,000 | $0 | $200,000 | $40,000 |
| 8 | **Evaluate, Prioritize, and Refine Projects and Management Actions** | Funded by individual agencies sponsoring specific projects and management actions | | | |
| | **Contingency (10%)** | $33,280 | $12,500 | $178,900 | $35,780 |
| | **TOTAL** | **$366,080** | **$137,500** | **$1,967,900** | **$393,580** |

## 8.19.1 Implementation Activity 1: Agency Membership and Funding Structure Evaluation

The SMGWA is organized as a JPA by and between 3 public agencies: SLVWD, SVWD and the County. The water districts are the Basin's principal water purveyors, while the County oversees the well permitting process and represents non-municipal pumpers. -The SMGWA is funded by its 3 member agencies and other agencies represented on the SMGWA Board through annual contributions. The cost allocation is currently established at: 46.4% to SVWD; 31.7% to SLVWD; 12.5% County of Santa Cruz; 5.0%; City of Santa Cruz; and 4.5% Mount Hermon Association. Future contribution amounts may be reassessed based upon SMGWA's annual budgetary requirements and equitable cost share rationale between the member and other represented agencies. The SMGWA will continue to pursue funding opportunities from state and federal sources to support GSP implementation activities.

The SMGWA member agencies agreed to jointly develop this GSP and fund the required activities during the GSP development period. However, it is appropriate and prudent for the SMGWA to evaluate expanding the agency's membership and funding structure. This activity will determine the most effective and equitable approach going forward with GSP implementation starting after the GSP is submitted to DWR by January 31, 2022. No cost estimate is included in Table 9-1Table 9-1 for reviewing and making appropriate changes to agency membership and funding structure because it is anticipated that the activity will be completed in Fiscal Year 2022 and funded under the approved Fiscal Year 2022 budget.As authorized under Chapter 8 of the SGMA, a GSA may impose fees, including, but not limited to, permit fees and fees on groundwater extraction or other regulated activity, to fund the costs including groundwater sustainability planning and program activities and administration. While the SMGWA has elected to not assess other private users of groundwater in the Basin, SMGWA reserves the right to evaluate assessing fees on other private users of groundwater should they be determined to either cause impacts to Basin sustainability or substantially benefit from SMGWA's management activities. There are no current plans to impose a fee on private users of groundwater in the Basin.

## 8.29.2 Estimate of GSP Implementation Costs Implementation Activity 2: Administrative and Business Operations

This section provides an estimate of the cost to implement the GSP and a general description of activities. Implementation costs are presented in two principal categories: 1) Governance,

Administration and Business Operations and 2) SGMA Compliance and GSP Implementation. Table 9-1 presents the estimated costs by budget category and major tasks. Each of the line items correspond to the GSP implementation activities described in the subsections that follow.

Since formation in 2017, the SMGWA has used a collaborative staffing model whereby cooperating agencies participating in Basin management through the SMGWA do so as part of their internal budgets and not that of the SMGWA. Executive Staff from the 3 member agencies provide leadership and management while member agency professional and technical staff support Basin monitoring/data collection activities. Except for the agency's Treasurer, the collaborative staff support is provided as "in kind" services that are not funded by the SMGWA.

Consultants and service providers are retained to support governance, administration and business operations and to perform specialized activities such as technical work, legal counsel, financial audit, facilitation, public outreach, and grant administration. Staffing needs will be assessed ~~from time to time~~periodically to ensure the collaborative staffing model and consultant support meets the agency's needs as SGMA compliance and GSP implementation proceeds.

~~In annual costs are multiplied by 5 to arrive at the 5-year cost that is included in the total. Annual costs are directly related to work that needs to be done consistently to meet the requirements of SGMA. Items listed as lump sum are one-time costs that are not multiplied and are carried forward to the total 5-year cost. Annualized~~ A cost estimate ~~s over~~ for the ~~the~~ 5-year period between WY2027-2032 is~~are also~~ provided in Table 9-1. ~~It is important to note that not all lump sum costs will be required in the first year of the 5-year implementation period, but for cost estimating purposes, are anticipated before the next GSP 5-year update.~~ More accurate costs will be brought to the Board annually through the annual budget review and approval process.

Table 9-1~~9-19-1~~. Santa Margarita Groundwater Agency 5-Year Estimated Costs for GSP Implementation

| Categories and Tasks | Annual Cost | Lump Sum Items | 5-Year Total | Annualized Cost (5 Years) |
|---|---|---|---|---|
| **Governance, Administration and Business Operations** | | | | |
| Governance and Administrative Services | $153,000 | $0 | $765,000 | $153,000 |
| Administrative General Expenses | $17,000 | $0 | $85,000 | $17,000 |
| Treasurer Services | $10,000 | $0 | $50,000 | $10,000 |
| Annual Financial Audit | $10,000 | $0 | $50,000 | $10,000 |
| Legal Counsel | $12,000 | $0 | $60,000 | $10,000 |
| **SGMA Compliance and GSP Implementation** | | | | |
| GSP Planning and Implementation Services | $105,000 | $0 | $525,000 | $105,000 |
| Basin Monitoring | Individual agencies will conduct monitoring | | | |
| Basin Monitoring – SMGWA specific expenses | $5,000 | $0 | $25,000 | $25,000 |
| Technical Services (as needed) | $10,000 | $0 | $50,000 | $10,000 |
| Data Management System | $15,000 | $0 | $75,000 | $75,000 |
| GSP Annual Report | $35,000 | $0 | $175,000 | $35,000 |
| GSP Periodic Evaluations (5-year) | $0 | $60,000 | $60,000 | $12,000 |
| Community Outreach and Engagement | $15,000 | $0 | $75,000 | $15,000 |
| **TOTAL** | **$387,000** | **$60,000** | **$1,995,000** | **$397,000** |

## 9.2.1 Governance, Administration and Business Operations

~~This category includes g~~Governance, administration, and business operations are necessary for the ~~Agency~~ SMGWA to function. Estimated costs to cover these tasks are presented in Table 9-1.

### 9.2.1.1 Governance and Administrative Services

This category encompasses the services necessary for the governance and operations of the agency. Activities include Board and committee support, meeting coordination, agenda and

packet preparation, policy implementation, public noticing, records management, regulatory compliance, financial management, budgeting, invoicing, contract procurement and administration, and organizational administration.~~includes~~ It includes coordination among member agencies, consultants, and the public to ensure efficient day-to-day operations. The agency currently utilizes a non-profit organization to provide these services. It is anticipated that the approach of utilizing a service provider/consultant to support these services will continue in the next 5-year period.

#### 9.2.1.2 Administrative General Expenses

These expenses include the day-to-day business operations of the Agency, including insurance, office and meeting expenses, memberships, software subscriptions, supplies, document management, communications, and other organizational costs required to maintain Agency operations.

#### 9.2.1.3 Treasurer Services

The SVWD Finance Manager serves as SMGWA Treasurer and is responsible for the financial and accounting activities of the SMGWA. The Treasurer provides financial management services including accounts payable, financial reporting, budget monitoring, cash and reserve management, preparation of financial statements, annual budgeting activities, and support for Board financial oversight. SMGWA compensates SVWD annually for the Treasurer's services. While SVWD Finance Manager currently serves in this role, SLVWD Finance Manager previously served in this role.

#### 9.2.1.4 Annual Financial Audit

An accounting firm coordinates and conducts the Agency's independent annual financial audit, including preparation of financial records, auditor support, review of findings, and presentation of audited financial statements to the Board of Directors.

#### 9.2.1.5 Legal Counsel

The agency contracts with legal counsel for advice and representation related to Agency governance, SGMA compliance, contracts, Brown Act requirements, public records matters, regulatory issues, and other legal matters necessary to support Agency operations.

~~**various activities in support of the SMGWA, including administrative and planning coordination, Board support, legal and audit services, communication and outreach, and miscellaneous services and supplies.**~~

~~Estimated costs to cover these expenses are provided in Table 9-1Table 9-1.~~

~~This category broadly includes various management, planning and programmatic support tasks to the SMGWA for ongoing GSP and SGMA related requirements. The SMGWA has used a collaborative staffing model since it was formed in 2017 whereby cooperating agencies participating in Basin management through the SMGWA do so as part of their internal budgets and not that of the SMGWA. Staff from cooperating agencies provide management, administrative and support services to the agency. For the SMGWA to fund agency staff time, the SMGWA bylaws would need to be revised.~~

~~Outside vendors and consultants are retained to perform specialized activities such as technical work, legal counsel, financial audit, facilitation, public outreach, and grant administration. As the SMGWA shifts from GSP development into implementation starting in 2022, administrative support needs will be evaluated to determine the appropriate level of service and structure. It is anticipated staffing needs will be assessed annually during the early years of GSP implementation as a better understanding of the agency's needs is developed.~~

~~The SVWD Finance Manager serves as SMGWA Treasurer and is responsible for the financial and accounting activities of the SMGWA. The SVWD has been providing administrative staff support to SMGWA with a half-time employee position designated for this purpose. Considering that in the future, the scope and frequency of activities for the agency will change notably, the appropriate level and method of providing administrative services will need to be assessed.~~

~~Community outreach activities will also transition from awareness building and education about SGMA, SMGWA, and the Basin, to providing more routine updates on the implementation efforts of the GSP and communication on Basin conditions. Some of the activities can be achieved under the~~

~~administration function while others require subject matter expert services.~~

### ~~8.3~~9.2.2 ~~Implementation Activity 3: Technical Support and Consultation~~SGMA Compliance and GSP Implementation

This category includes activities necessary to comply with SGMA including GSP planning, implementation, and reporting. ~~by technical consultants in support of implementing the GSP. It includes ongoing improvements and use of the groundwater model to evaluate impacts from projects and management actions~~PMAs ~~on groundwater conditions, and as needed technical support not related to the groundwater model.~~ Estimated costs to cover these tasks are presented in Table 9-1.

#### 9.2.2.1 GSP Planning and Implementation Services

This broadly encompasses the range of activities to manage and coordinate implementation of the Basin's GSP, including Basin project planning, regulatory coordination, coordination with the member and cooperating agencies, coordination with technical consultants, implementation tracking, and technical studies. These services are to ensure the overall implementation efforts are proceeding consistently with the GSP and to achieve the Basin sustainability objectives under SGMA. These services are currently supported by a service provider/consultants. It is anticipated that this approach will continue in the next 5-year period.

#### 9.2.2.2 Basin Monitoring

The SMGWA's monitoring program is described in Section 6. Individual member agencies will continue to collect data from their monitoring networks as they have been doing to inform management and operation of their respective water supplies. One of the primary ongoing functions of GSP implementation is data collection and its evaluation, comparison of data against SMC, and reporting of groundwater conditions. Cooperating agencies will provide the monitoring data they collect from their existing monitoring networks as part of their ongoing operations.

Groundwater level, groundwater quality, extraction, streamflow, and rainfall data collected by cooperating agencies will be uploaded semi-annually to the DMS described in Section 6.8~~0~~. Data stored in the DMS will be downloaded by the consultant or SMGWA staff preparing the annual report and summarized in the required tables and figures to demonstrate that progress is being made toward sustainability in the Basin. Cooperating agenc~~y~~ies will upload~~s~~ seasonal high and low groundwater elevation data, at a minimum, to the to the DMS, so the data can be uploaded to DWR's SGMA portal by January 1 and July 1 of each year ~~to the DMS will be coordinated with the requirement under~~to comply with SGMA requirements.~~for SMGWA to upload, at a~~

~~minimum, seasonal high and low groundwater elevation data to the SGMA portal by January 1 and July 1 of each year.~~

#### 9.2.2.3 Basin Monitoring – SMGWA Specific Expenses

Basin monitoring expenses due to activities conducted specifically at the request of SMGWA will be funded by SMGWA. Examples include the costs to install and maintain monitoring equipment, monitoring station improvements, and associated technical support. These are intended for activities and expenses that the member agencies would not otherwise be incurring in the routine monitoring of their respective water system operations.

#### 9.2.2.4 Technical Services – As Needed

It is anticipated the SMGWA will have a need for technical support to inform Basin management. This includes specialized technical services assistance to support GSP implementation and to address emerging Basin management needs.

#### 9.2.2.5 Data Management System

As described in Section 6.8, the SMGWA, MGA, and County of Santa Cruz have established a regional DMS to upload, store, and review data collected by the GSP monitoring networks for the Santa Margarita and Santa Cruz Mid-County Basins. Having all groundwater related data in the DMS will streamline data collation while preparing GSP annual reports and 5-year periodic evaluations. Ongoing costs to SMGWA, shared with the MGA, include fees for hosting, maintenance, user support, and licensing of the WISKI DMS. Cooperating agencies that collect relevant data within the Basin will be responsible for semi-annual uploads to the DMS.

#### 9.2.2.6 GSP Annual Report

SGMA regulations require that the SMGWA submit annual reports to DWR documenting Basin conditions and progress toward sustainability. In accordance with SGMA Regulation §356.2, GSP annual reports are due to DWR prior to April 1. The purpose of the report is to provide monitoring and total groundwater use data to DWR, compare monitoring data to SMC, and adaptively implement ~~actions and projects~~ PMAs to achieve sustainability.

Preparation of the GSP Annual Report is currently led by consultants in coordination with member agency staff and a Board ad hoc committee. It is anticipated that this approach will continue in the next 5-year period.

#### 9.2.2.7 GSP Periodic Evaluations (5-Year)

The SMGWA will conduct a Periodic Evaluation of the GSP at least every 5 years to assess whether it is achieving its sustainability goals. The evaluation will include a description of significant new information that has been made available since GSP adoption, amendment, or the prior evaluation, and whether the new information or understanding warrants changes to any aspect of the plan. The initial Periodic Evaluation will be submitted to DWR in January 2027. The next GSP Periodic Evaluation will be submitted prior to January 2032.

Preparation of the GSP Periodic Evaluation is currently led by consultants in coordination with member agency staff and a Board ad hoc committee. It is anticipated that this approach will continue in the next 5-year period.

#### 9.2.2.8 Community Outreach and Engagement

The agency will continue to implement public outreach and stakeholder engagement activities that increase awareness of groundwater sustainability efforts, communicate agency programs and decisions, support public participation, maintain website and communication materials, and engage groundwater users, private well owners, and other Basin stakeholders.

### 9.2.3 Items Not Included in Estimate of Implementation Cost

The following activities are not included in  as GSP implementation costs because they are not directly funded by SMGWA (e.g., project implementation) or the activity is not anticipated in the next 5-year period (e.g., groundwater model updates) or is anticipated to only proceed in the next 5-year period if outside funding is obtained (e.g., Butano aquifer groundwater monitoring well). These activities are summarized below.

#### 9.2.3.1 ~~Project(s) to achieve sustainability~~Projects and Management Actions

The GSP implementation cost estimate does not include the cost of evaluating, planning, designing, and constructing a project(s) to achieve groundwater sustainability. As discussed in Section~~s~~ 8~~4 and 5~~, cooperating agencies will cover their respective costs of these activities because the SMGWA will not serve as the lead agency for implementing PMAs. Project costs may be shared between multiple agencies if the project provides greater water supply reliability and resiliency benefit to multiple agencies. Regional collaboration to achieve both B~~b~~asin sustainability and increase regional water supply reliability and resiliency is encouraged by the SMGWA.

Costs associated with implementing new projects would be funded through a combination of increased operating revenue and outside funding sources. ~~For many projects included in the GSP,~~

sSecuring outside funding to supplement local revenue streams will be critical to implementing some of the PMAs. Considering the size of the population and scale of the projects required to achieve sustainability, it is important to ensure financial feasibility and long-term affordability.

#### 8.3.1.1 Groundwater Model Simulations and UpdatesGroundwater Model Simulations and Updates

#### 9.2.3.2

The Basin groundwater model helps inform development of projects and managementPMAs activities, and ongoing performance assessment of the GSP's SMC. Periodic updates to the groundwater model are required to continue to refine and improve its capabilities and maintain ongoing functionality. This includes incorporating new model tools and features, aquifer parameters, refining of climate change projections, and related work to support ongoing simulations of projects and management actionsPMAs. The estimated cost of this task is provided in Table 9-1Table 9-1.

A comprehensive update to the groundwater model is not anticipated in the next 5 years. The agency will continue to conduct groundwater model simulations of Basin conditions as part of the GSP annual reports as well as part of the Periodic Evaluation. The cost estimate (Table 9-1Table 9-1) includes the cost to conduct the model simulations necessary to complete the required SGMA annual and periodic reporting.

#### 9.2.3.3 GSP Amendment

Although not required by SGMA regulations, the SMGWA may prepare amendment(s) to the GSP if the implementation approach needs to change significantly to adaptively manage the Basin. With the completion of this 2027 GSP Amendment, the need to further amend the GSP in the next 5-years is not anticipated at this time and therefore not included as a cost in Table 9-1.

#### 9.2.3.4 Address Monitoring Network Data Gaps

There is a single monitoring data gap identified in the 2027 GSP Amendment. As described in Section 0 6.9.1, the SMGWA has requested TSS support to install a dedicated Butano aquifer well and is waiting for confirmation from DWR. SMGWA and SVWD will continue to evaluate other funding mechanisms if TSS funding is not available.

### 8.3.2 Consultants As-Needed Technical Support

**It is anticipated the SMGWA will have a need for technical support to inform Basin management. The estimated $15,000 per year for this**

~~activity included in Table 9-1Table 9-1 covers general as-needed costs that are not project specific. Examples of as-needed support include assistance with the DMS, collate and upload seasonal high and low (at a minimum) groundwater elevation data to the online SGMA portal as required by the SGMA, periodic SMGWA requests for information, attending SMGWA Board meetings when requested, and providing ongoing updates on SGMA related activities by the DWR and others.~~

~~There may be times when a defined project requires consultant support. Specific needs beyond what is included in the 5-year cost estimate provided in Table 9-1Table 9-1 are yet to be identified and are not included in the estimate. Examples of technical consultant support for potential future projects are hydrogeologic technical support (not groundwater model specific), economic (e.g., cost-benefit analysis), programmatic assessment of funding mechanisms, supplemental studies to address data gaps, vulnerability assessments for climate change, and additional assessment of managed aquifer recharge opportunities.~~

## ~~8.4 Implementation Activity 4: Monitoring and Reporting~~

~~One of the primary ongoing functions of GSP implementation is data collection and its evaluation, comparison of data against SMC, and reporting of groundwater conditions. The SMGWA will either contract consultants, negotiate agreements with agencies, and/or hire staff to implement the GSP's monitoring and reporting tasks. Cooperating agencies will provide the monitoring data they collect from their existing monitoring networks as part of their ongoing operations. Costs for monitoring and reporting are included in Table 9-1Table 9-1.~~

### ~~8.4.1 Monitoring~~

The SMGWA's monitoring program is described in Section 3.36. Individual member agencies will continue to collect the same data from their monitoring networks as they have prior to the GSP to inform management and operation of their respective water supplies. It likelyis likely that costs resulting from improvements to or expansion of existing monitoring networks necessary to evaluate progress towards sustainability, or otherwise added at the request of the SMGWA, will be funded by the SMGWA.

Groundwater level, groundwater quality, extraction, streamflow, and rainfall data collected by cooperating agencies will be uploaded semi-annually to the DMS described in Section 9.6. Data stored in the DMS will be downloaded by the consultant or SMGWA staff preparing the annual report and summarized in the required tables and figures to demonstrate that progress is being made toward sustainability in the Basin, as defined in Section 3. Cooperating agency uploads to the DMS will be coordinated with the requirement under SGMA for SMGWA to upload, at a minimum, seasonal high and low groundwater elevation data to the SGMA portal by January 1 and July 1 of each year.

### 8.4.2 Reporting

SGMA regulations require that the SMGWA submit regular reports to DWR documenting Basin conditions and progress toward sustainability. The costs to prepare the required reports are included in Table 9-1Table 9-1 and described below.

- Annual Reports. In accordance with SGMA Regulation §356.2, annual reports will be submitted to DWR starting on April 1, 2022. The purpose of the report is to provide monitoring and total groundwater

use data to DWR, compare monitoring data to SMC, and adaptively implement actions and projects to achieve sustainability.

- 5-Year GSP Update ReportsPeriodic Evaluations. Five-year GSP update reportsevaluations will be provided to DWR starting in JanuaryApril 1, 2027. The SMGWA will evaluate the GSP at least every 5 years to assess whether it is achieving its sustainability goals. The evaluation will include a description of significant new information that has been made available since GSP adoption, or amendment, or the prior evaluation, and whether the new information or understanding warrants changes to any aspect of the plan.

- GSP Amendments. Although not required by SGMA regulations, the SMGWA may prepare amendment(s) to the GSP if the implementation approach needs to change significantly to adaptively manage the Basin. as the monitoring networks are refined and understanding of basin conditions are improved over time. The amendment does not need to correspond to the GSP's 5-year update if there is an urgent need to make a change to the GSP.

## 8.5 Implementation Activity 5: Implement Groundwater Extraction Metering for Non-*De Minimis* Extractors

The SMGWA will initiate a well metering program to collect volumes of non-*de minimis* groundwater extraction. These data will be used to assess and refine the sustainable yield calculation, which is used to define undesirable results related to the reduction of groundwater in storage sustainability indicator. The metering program will apply to all non-*de minimis* private pumping extracting more than 2 AFY and will be led by the County of Santa Cruz. Under the SGMA, private well owners who extract less than 2 AFY for domestic purposes (also

~~called *de minimis* users), including individual water systems serving fewer than 5 connections, may not be required to meter their wells by the SMGWA. The SMGWA has no current plans to regulate or to charge a fee on either *de minimis* or non-*de minimis* private users. The SMGWA may evaluate these options as funding mechanisms in the future, with any fees that may be proposed being commensurate to the benefit received by *de minimis* and non-*de minimis* private users. Private users shall be engaged in this process.~~

~~Costs to implement the metering program are summarized in Table 9-1. The costs include program development including timeline, guidance documents, and outreach; coordination of program set-up and implementation; participant tracking; and coordination of annual reporting by the participants. The SMGWA will initiate planning to develop the program in 2022 and aim to implement it within 2 years. It is anticipated the non-*de minimis* users will be responsible for all costs related to the purchase, installation, calibration, and operation of the meters as well as annual reporting to the SMGWA.~~

## ~~8.6 Implementation Activity 6: Address Monitoring Network Data Gaps in the Hydrogeological Conceptual Model, Understanding of Groundwater Conditions, and the Monitoring Network~~

~~There is a single monitoring data gap identified in the 2027 GSP Amendment. As described in Section 3.4.12, the SMGWA has requested TSS support to install a dedicated Butano aquifer well and is waiting for confirmation from DWR. SMGWA and SVWD will continue to evaluate other funding mechanisms if TSS funding is not available.~~

~~Section 2 identifies several data gaps related to the HCM and groundwater conditions. There are areas of the Basin with limited to no data available to develop the HCM and calibrate the groundwater model. Data collection during GSP implementation will be used to refine the HCM for better groundwater management in the following areas:~~

1. ~~Communities where there are higher concentrations of private domestic *de minimis* wells pumping from either the Santa Margarita aquifer or Monterey Formation~~
2. ~~The Butano aquifer where it is pumped at depths more than 1,000 feet by SVWD~~
3. ~~Areas where shallow groundwater is connected to surface water and groundwater pumping may be causing depletion of surface water~~

~~In 2020, the SMGWA was awarded a Round 3 Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Sustainable Groundwater Planning Grant Program) grant, administered by the California Department of Water Resources. In July 2021, a project funded by this grant will commence to expand the Basin's monitoring network through the installation of 8 new monitoring wells to fill the data gaps described above and described in more detail in Section 3.3.4.1.~~

~~Collection of additional hydrogeologic data during well installation of the 9 new monitoring wells, as well as their ongoing monitoring during GSP implementation will help the SMGWA improve Basin characterization. During drilling activities, groundwater level and water chemistry data will be collected, and drill cuttings will be examined to determine depths to the top of various geologic~~

~~formations and the presence of sandy layers most suitable for aquifers. Gathering more lithologic and hydrostratigraphic data will help map the lateral and vertical extent, and aquifer characteristics of the principal aquifers and other formations with greater resolution. New information will further inform understanding of groundwater levels in parts of the Basin where no historical data exist and can be used to improve model calibration in those areas.~~

- ~~Groundwater Level Spatial Data Gaps Near Groundwater Pumping: Spatial data gaps are identified in areas pumped exclusively by *de minimis* and small water systems that lack historical groundwater level monitoring and hydrogeologic data. These data gaps will be addressed by installation of 4 new monitoring wells screened in targeted aquifers to collect groundwater levels: 1 well in the Santa Margarita aquifer, 2 wells in the Monterey Formation, and 1 well in the deep Butano aquifer.~~

- ~~Groundwater Level Spatial Data Gaps Near Interconnected Creeks: Spatial data gaps are identified in areas that have interconnected surface waters supported by aquifers pumped by municipal and private extractors, and with limited aquifer-specific groundwater level monitoring. In order to address these data gaps, 5 new monitoring wells will be installed with screen intervals in the aquifers underlying interconnected creeks. These wells will supplement the 2 existing shallow monitoring wells near creeks that are included as RMPs for the depletion of interconnected surface water SMC. The new monitoring wells will include 4 wells in the Santa Margarita aquifer and 1 well in the Monterey formation.~~

~~Localized Streamflow Monitoring Data Gaps: During GSP development, streamflow monitoring data gaps were identified. To address the data gaps, 3 streamflow gages were upgraded, and 2 new gages were installed and calibrated early in 2021. The gages are being monitored by the SMGWA and where possible will be paired with new monitoring wells to be constructed in 2022. There is one streamflow monitoring data gap of lower priority identified near Carbonera Creek which is not as connected to groundwater as most other creeks in the Basin and is therefore a lower priority to be addressed as funding becomes available.~~

## ~~8.7 Implementation Activity 7: Data Management System~~

~~As described in Section 6.83.3.3, the SMGWA, Santa Cruz Mid-County Groundwater Agency (MGA)MGA, and County of Santa Cruz have established a regional DMS to upload, store, and review data collected by the GSP monitoring networks for the Santa Margarita and Santa Cruz Mid-County Basins. Having all groundwater related data in the DMS will streamline data collation while preparing GSP annual reports and 5-year updatesperiodic evaluations. Ongoing costs to SMGWA, shared with the MGA, include fees for hosting, maintenance, and licensing of the WISKI DMS. Cooperating agencies that collect relevant data within the Basin will be responsible for semi-annual uploads to the DMS.~~

### ~~8.7.1 Implementation Plans for Addressing Data Gaps~~

#### ~~8.7.1.1 Groundwater Level Monitoring Network~~

~~The planning and construction of 9 new groundwater level monitoring wells will commence in July 2021. Estimated costs for the next 5 years~~

are not included in Table 5-1 because the SMGWA has already been awarded DWR grant funding and has budgeted the required match. Given the need for landowner negotiations, and potential limitations on well construction during winter months, this project will be completed in 2022, after GSP adoption.

#### 8.7.1.2 Groundwater Storage Monitoring Network

In 2022, the SMGWA plans to implement a non-*de minimis* groundwater extraction metering program as described in Section 9.5 above. The more accurate groundwater pumping volumes generated from this program will be used to compile groundwater extraction data needed to assess whether the 5-year moving average Basin extraction is less than the sustainable yield which is used to determine reduction of groundwater storage undesirable results.

#### 8.7.1.3 Interconnected Surface Water Monitoring Network

Four new monitoring wells, as part of the 9 new wells described in Section 9.7.1.1, will be completed in 2022 to improve understanding of surface water and groundwater interactions, to improve the groundwater model simulations of and surface water interactions, and to become RMPs for the depletion of interconnected surface water indicator. A cost estimate for the new wells is not included in Table 5-1 because the SMGWA has already been awarded a DWR grant and has budgeted the required match. The first GSP 5-year update will include analyses on the new well groundwater level data recorded by data loggerdataloggers adjacent to gaged streamflow, accretion studies, and GDE monitoring. Based on findings in that first GSP 5-year update, additional monitoring locations may be identified.

~~In addition, either a new stream gage will be installed, or an old gage will be reestablished on Carbonera Creek within the first 5 years of GSP implementation. The SMGWA's estimated costs to install, calibrate and maintain 1 streamflow gage are presented in Table 5-1. This estimate includes one-time costs related to the initial establishment of the new station. The cost estimate includes planning, site selection, design specifications, and related pre-installation tasks. It includes the cost to install monitoring instrumentation, conduct surveys and related work to establish each monitoring site, develop rating curves to establish a stream stage-discharge relationship, routine data collection, and station maintenance. The assignment of roles and responsibilities (consultants and agency staff) will be evaluated as GSP implementation proceeds.~~

## ~~8.8~~9.3 Financial Reserves and Contingencies

Prudent financial management prescribes that the SMGWA carry a general reserve in order to manage cash flow and mitigate the risk of expense overruns due to unanticipated expenditures. General reserves have no restrictions on the types of expenses they can be used to fund. In May 2024, the Board approved a reserves policy that established maintaining general reserves at 20% of the annual operating expenses budget. ~~and~~ T~~t~~he ending balance in ~~cash~~ total reserves becomes the beginning reserves balance for the next fiscal year.

The SMGWA Treasurer, responsible for overseeing the financial health of the agency, will advise the Board on the appropriate reserves and request a contingency amount as part of the budget adoption process. ~~An initial contingency of 10% of the annual total cost is included in Table 9-1Table 9-1.~~

## 8.99.4 GSP Implementation Schedule

A general schedule showing the major GSP implementation activities and their estimated timelines during the first next 5 years of GSP implementation is provided on SEQ Figure * ARABIC \s 1 . Project and management actionsPMAs summarized in Section 84 will have their own implementation timelines that would be determined after the project is deemed feasibleility and funding is secured.

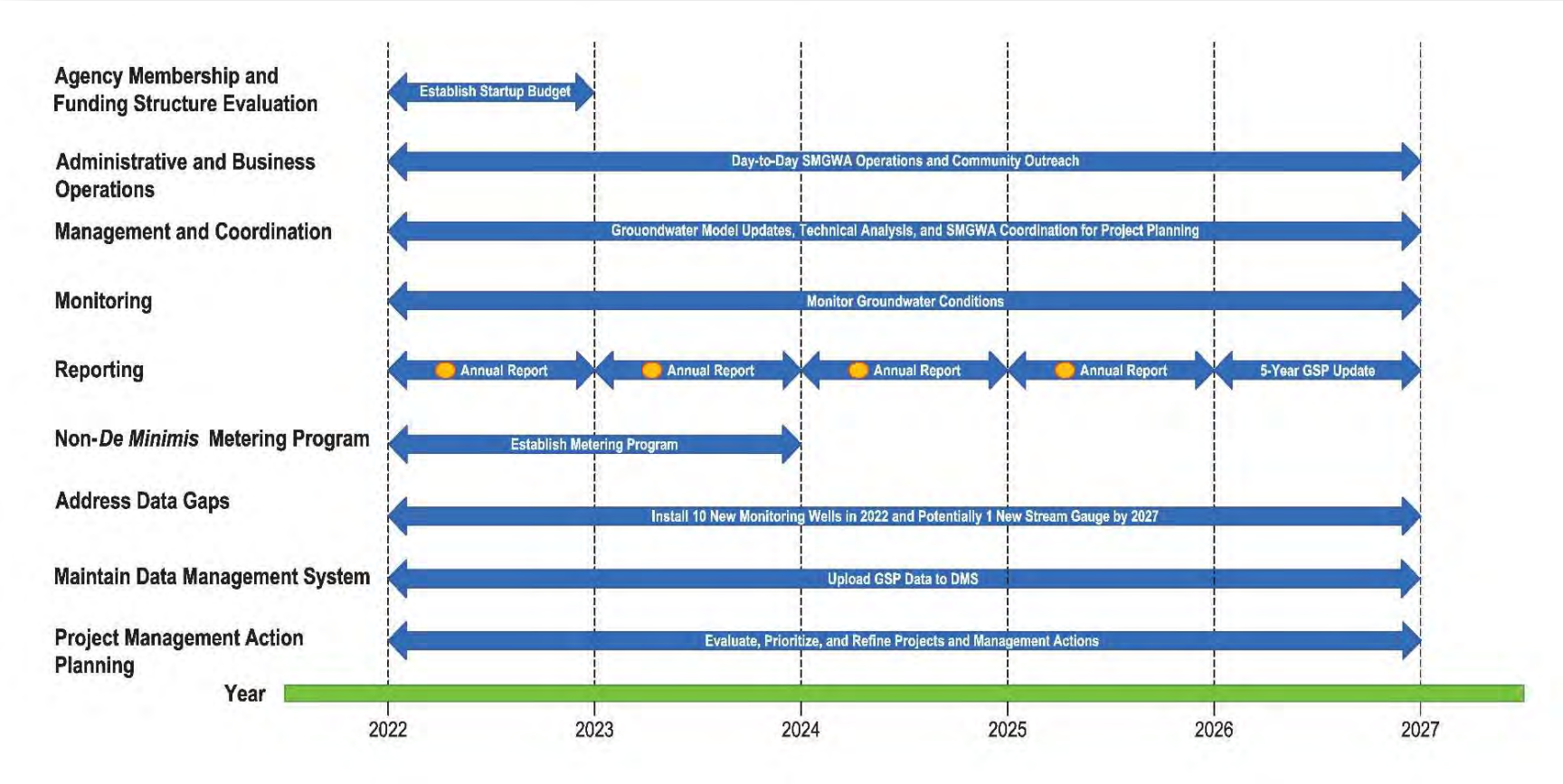
The amended GSP will be presented to the Board for adoption in fall 2026 and will be submitted to DWR by January 13, 2027. Table 9-2Table 9.X2 provides an overview of the schedule for the agency administration and GSP implementation. Many of these categories consist of ongoing tasks and efforts that will continue throughout GSP implementation.

GSP reporting will occur on an annual and a 5-year basis as required under SGMA. Annual reports will be submitted to DWR by April 1 of each year. Periodic reports will be submitted to DWR at least every 5 years or sooner following a formal GSP amendment.

Table 9-2. Implementation Schedule 2026 - 2032

| Description | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|
| **GSP Amendment** | | | | | | | |
| GSP Amendment – Board Adoption | ● | | | | | | |
| GSP Amendment – Submittal to DWR | | ● | | | | | |
| **Governance, Administration and Operations** | | | | | | | |
| Agency Administration & Operations | → | → | → | → | → | → | → |
| **SGMA Compliance and GSP Implementation** | | | | | | | |
| GSP Planning and Implementation Services | → | → | → | → | → | → | → |
| Basin Monitoring | → | → | → | → | → | → | → |
| Data Management System | → | → | → | → | → | → | → |
| Projects and Management Actions | → | → | → | → | → | → | → |
| Community Outreach and Engagement | → | → | → | → | → | → | → |
| GSP Annual Report | ● | ● | ● | ● | ● | ● | ● |
| GSP Periodic Evaluations | | ● | | | | | ● |

Key: ● denotes a submittal/event
→ denotes an ongoing activity




~~Figure 9-19-2. General Schedule of 5-year Implementation Plan~~

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