# GSP Section 1 Contents

## 1. INTRODUCTION

1. **Purpose of the Groundwater Sustainability Plan**
2. **Sustainability Goal**
3. **Agency Information**
   - 1.3.1 Organization and Management of the Santa Cruz Mid-County Groundwater Agency
   - 1.3.2 Legal Authority of the Santa Cruz Mid-County Groundwater Agency
   - 1.3.3 Estimated Cost of Implementing the GSP and the MGA’s Approach to Meet Costs
4. **Member Agency Descriptions**
   - 1.4.1 Soquel Creek Water District
   - 1.4.2 City of Santa Cruz
   - 1.4.3 Central Water District
   - 1.4.4 Santa Cruz County
5. **Private Well Owner Representation**
6. **GSP Organization**
   - 1.6.1 Groundwater Sustainability Plan Organization
   - 1.6.2 Preparation Checklist for GSP Submittal

## Figures

- Figure 1-1. Basin Location Map
- Figure 1-2. Sustainability Indicators

## Appendices

- Appendix A1-A Santa Cruz Mid-County Groundwater Agency Joint Exercise of Powers Agreement
- Appendix A1-B. Example Preparation Checklist for GSP Submittal
GSP Section 2 Contents

2 PLAN AREA AND BASIN SETTING ................................................................. 2-9

2.1 Description of Plan Area ............................................................................ 2-9

2.1.1 Summary of Jurisdictional Area and Other Features ................................. 2-9

2.1.1.1 Area Covered by the Plan ........................................................................ 2-9

2.1.1.1.1 Santa Cruz Mid-County Basin ................................................................. 2-9

2.1.1.1.2 Neighboring Groundwater Basins ............................................................ 2-11

2.1.1.2 Adjudicated Areas, Other Agencies within the Basin, and Areas Covered by an Alternative Plan .................................................................................................................. 2-12

2.1.1.2.1 Adjudicated Areas ......................................................................................... 2-12

2.1.1.2.2 Other Agencies within the Basin ................................................................. 2-12

2.1.1.2.3 Areas Covered by an Alternative ............................................................... 2-12

2.1.1.3 Jurisdictional Boundaries within the Basin ............................................... 2-13

2.1.1.3.1 Federal or State Lands within the Basin ......................................................... 2-14

2.1.1.3.2 Tribal Lands ................................................................................................. 2-15

2.1.1.3.3 Cities ........................................................................................................... 2-15

2.1.1.3.4 County ....................................................................................................... 2-16

2.1.1.3.5 Water Agencies .......................................................................................... 2-16

2.1.1.4 Wastewater Management ...................................................................... 2-17

2.1.1.5 Existing Land Use Designations ............................................................... 2-17

2.1.1.5.1 Land Use Designations .............................................................................. 2-17

2.1.1.5.2 Water Use and Water Source Type ............................................................. 2-19

2.1.1.6 Well Density per Square Mile .................................................................... 2-20

2.1.2 Water Resources Monitoring and Management Programs .......................... 2-21

2.1.2.1 Description of Water Resources Monitoring and Management Programs ................................................................. 2-22

2.1.2.2 Incorporating Existing Monitoring Programs into the GSP ......................... 2-26

2.1.2.3 Description of how those Programs may Limit Operational Flexibility in the Basin .......................................................................................................................... 2-27

2.1.2.4 Description of Conjunctive Use Programs .................................................... 2-28

2.1.3 Land Use Elements or Topic Categories of Applicable General Plans .......... 2-29

2.1.3.1 Summary of General Plans and Other Land Use Plans Additional GSP Elements .......................................................................................................................... 2-29

2.1.3.1.1 Existing Land Use Designations ............................................................... 2-30

2.1.3.1.2 Agricultural Water Demand – Specialized Evaluation ................................ 2-31

2.1.3.1.3 Basin Water Demand .................................................................................. 2-32

2.1.3.1.4 Projected Water Demand ........................................................................... 2-34

2.1.3.2 Description of How Implementation of the GSP May Change Water Demands or Affect Achievement of Sustainability and How the GSP Addresses Those Effects ......................................................... 2-34

2.1.3.3 Description of How Implementation of the GSP May Affect the Water Supply Assumptions of Relevant Land Use Plans ........................................................................................................... 2-35

2.1.3.4 Summary of the Process for Permitting New or Replacement Wells in the Basin ... 2-35
2.1.3.5 Information Regarding the Implementation of Land Use Plans Outside the Basin that Could Affect the Ability of the Agency to Achieve Sustainable Groundwater Management

2.1.4 Additional GSP Elements

2.1.4.1 Control of Seawater Intrusion

2.1.4.2 Wellhead Protection Areas

2.1.4.3 Migration of Contaminated Groundwater

2.1.4.4 Well Abandonment and Well Destruction Program

2.1.4.5 Groundwater Recharge and Replenishment of Groundwater Extractions

2.1.4.6 Conjunctive Use and Underground Storage

2.1.4.7 Well Construction Policies

2.1.4.8 Groundwater Contamination Cleanup, Recharge, Diversions to Storage, Conservation, Water Recycling, Conveyance and Extraction Projects

2.1.4.9 Efficient Water Management Practices

2.1.4.10 Relationships with State and Federal Regulatory Agencies

2.1.4.11 Land Use Plans and Efforts to Coordinate with Land Use Planning Agencies to Assess Activities that Potentially Create Risks to Groundwater Quality or Quantity

2.1.4.12 Impacts on Groundwater Dependent Ecosystems

2.1.5 Notice and Communication

2.1.5.1 Description of Beneficial Uses and Beneficial Users of the Basin

2.1.5.1.1 Interest Groups Representation

2.1.5.1.2 GSP Advisory Committee Composition

2.1.5.2 Decision Making Process

2.1.5.2.1 MGA Board of Directors

2.1.5.2.2 GSP Advisory Committee

2.1.5.3 Public Engagement Opportunities

2.1.5.4 Encouraging Active Involvement

2.1.5.5 Informing the Public on GSP Implementation Progress

2.2 Basin Setting

2.2.1 Hydrogeologic Conceptual Model

2.2.1.1 Climate

2.2.1.2 Geology and Geologic Structures

2.2.1.2.1 Topography

2.2.1.2.2 Surficial Geology and Soil Characteristics

2.2.1.3 Principal Aquifers and Aquitards

2.2.1.4 Surface Water Bodies Significant to Basin Management

2.2.1.4.1 Surface Water Bodies that Impact Basin Water Quality

2.2.1.4.2 Surface Water Bodies that Supply Water to Basin Residents

2.2.1.4.3 Surface Water Bodies Connected to Basin Groundwater

2.2.1.4.4 Surface Water Supporting Basin Groundwater Dependent Ecosystems (GDE)
2.2.1.5 Recharge Areas and Water Deliveries ................................................................. 2-79
  2.2.1.5.1 Basin Recharge ............................................................................................. 2-79
  2.2.1.5.2 Water Deliveries ......................................................................................... 2-81
2.2.2 Current and Historical Groundwater Conditions ...................................................... 2-82
  2.2.2.1 Groundwater Elevation Data .......................................................................... 2-83
    2.2.2.1.1 Historical Groundwater Elevations ......................................................... 2-83
    2.2.2.1.2 Current Groundwater Elevations ............................................................... 2-87
    2.2.2.1.3 Groundwater Level Trends ...................................................................... 2-94
    2.2.2.1.4 Protective Elevations and How They Are Used to Evaluate Current Groundwater Levels 2-96
  2.2.2.2 Change in Groundwater in Storage .................................................................. 2-98
  2.2.2.3 Seawater Intrusion .......................................................................................... 2-99
  2.2.2.4 Groundwater Quality ....................................................................................... 2-102
    2.2.2.4.1 Natural Groundwater Quality .................................................................... 2-103
    2.2.2.4.2 Contaminated Groundwater Quality ......................................................... 2-105
  2.2.2.5 Land Subsidence Conditions ......................................................................... 2-109
    2.2.2.5.1 Land Subsidence Relationship to Groundwater Elevations ....................... 2-109
    2.2.2.5.2 Historical Land Subsidence Monitoring ..................................................... 2-110
    2.2.2.5.3 Inapplicability of Land Subsidence in the Basin ....................................... 2-110
  2.2.2.6 Identification of Interconnected Surface Water Systems .................................. 2-114
  2.2.2.7 Identification of Groundwater-Dependent Ecosystems .................................. 2-122
  2.2.3 Water Budget ...................................................................................................... 2-128
    2.2.3.1 Water Budget Data Sources .......................................................................... 2-128
    2.2.3.2 Model Assumptions and Uncertainty Related to the Water Budget ............... 2-131
    2.2.3.3 Water Budget Components .......................................................................... 2-132
      2.2.3.3.1 Groundwater Inflows .............................................................................. 2-133
      2.2.3.3.2 Surface Water Inflows ............................................................................ 2-134
      2.2.3.3.3 Groundwater Outflows ......................................................................... 2-134
      2.2.3.3.4 Surface Water Outflows ....................................................................... 2-134
      2.2.3.3.5 Change in Groundwater in Storage .......................................................... 2-134
    2.2.3.4 Historical Water Budget ................................................................................. 2-135
      2.2.3.4.1 Santa Cruz Mid-County Basin Historical Surface Water Budget ............... 2-135
      2.2.3.4.2 Santa Cruz Mid-County Basin Historical Groundwater Water Budget ........ 2-135
      2.2.3.4.3 North of Aptos Fault Historical Groundwater Budget ............................... 2-140
      2.2.3.4.4 South of Aptos Fault Historical Groundwater Budget ............................... 2-142
    2.2.3.5 Current Water Budget ..................................................................................... 2-145
      2.2.3.5.1 Santa Cruz Mid-County Basin Current Groundwater Budget ..................... 2-145
      2.2.3.5.2 North of Aptos Fault Current Groundwater Budget .................................. 2-150
      2.2.3.5.3 South of Aptos Fault Current Groundwater Budget .................................. 2-151
    2.2.3.6 Projected Water Budget ................................................................................... 2-153
      2.2.3.6.1 Assumptions Used in Projected Water Budget Development ...................... 2-153
      2.2.3.6.2 Santa Cruz Mid-County Basin Projected Groundwater Budget .................. 2-157
      2.2.3.6.3 North of Aptos Fault Projected Groundwater Budget ................................. 2-162
2.2.3.6.4 South of Aptos Fault Projected Groundwater Budget ........................................ 2-166
2.2.3.7 Projected Sustainable Yield ................................................................................... 2-170
2.2.4 Management Areas ................................................................................................. 2-171
2.2.5 References ............................................................................................................. 2-173

APPENDIX A2-A ................................................................................................................... 2-174
APPENDIX A2-B .................................................................................................................. 2-175
Tables

Table 2-1. Groundwater Dependent Species Identified for Priority Management ............................................... 2-50
Table 2. Summary of Public Outreach and Engagement Opportunities............................................................. 2-60
Table 2-3. Average Temperature and Precipitation .......................................................................................... 2-65
Table 2-4. 2011 PRMS Average Annual Water Budget Summary ................................................................. 2-80
Table 2-5. 2011 PRMS Average Deep Groundwater Recharge for Outcropping Aquifers .......................... 2-81
Table 2-6. Groundwater Level Averages Calculated from Logger Data at Coastal Monitoring Wells ........ 2-98
Table 2-7. Historic Groundwater Level Declines .......................................................................................... 2-109
Table 2-8. Non-salmonid Aquatic Species Identified in Mid-County Streams during Field Sampling Program, 1996-2017 .................................................................................................................................. 2-127
Table 2-9. Summary of Water Budget Component Data Sources .................................................................... 2-130
Table 2-10. Santa Cruz Mid-County Basin Historical Groundwater Budget Summary (1985 – 2015) .... 2-137
Table 2-11. Santa Cruz Mid-County Basin Historical Groundwater Budget by Aquifer Summary (1985 – 2015) ..................................................................................................................................... 2-139
Table 2-13. South of Aptos Fault Historical Groundwater Water Budget Summary (1985 – 2015) ...... 2-143
Table 2-14. Santa Cruz Mid-County Basin Current Groundwater Budget Summary (2010-2015) ........ 2-146
Table 2-15. Santa Cruz Mid-County Basin Current Groundwater Budget by Aquifer Summary (1985 – 2015) ..................................................................................................................................... 2-149
Table 2-17. South of Aptos Fault Current Groundwater Budget Summary (2010 – 2015) ..................... 2-152
Table 2-18. Santa Cruz Mid-County Basin Projected Groundwater Budget Summary (2016 – 2069) .... 2-159
Table 2-20. South of Aptos Fault Projected Groundwater Water Budget Summary (2016 – 2069) ...... 2-167
Table 2-21. Projected Sustainable Yield ......................................................................................................... 2-171
Figures

Figure 2-1. Area Covered by the MGA’s Groundwater Sustainability Plan ................................................................. 2-10
Figure 2-2. Adjudicated Areas, Other Agencies within the Basin, and Areas Covered by an Alternative Plan ....................................................................................................................................... 2-13
Figure 2-3. Jurisdictional Boundaries ................................................................................................................................ 2-14
Figure 2-4. Existing Land Use Designations ........................................................................................................... 2-19
Figure 2-5. Private Well Concentration per Square Mile ............................................................................................. 2-21
Figure 2-6. Land Uses in the Basin .................................................................................................................................. 2-31
Figure 2-7. Agricultural Land Utilization .......................................................................................................................... 2-32
Figure 2-8. Average Annual Basin Groundwater Production by User Type ........................................................................... 2-33
Figure 2-9. Percent Time Surface Water and Groundwater are Connected (Water Years 1985-2015) .................. 2-50
Figure 2-10. Santa Cruz Mid-County Basin Conceptual Model ..................................................................................... 2-64
Figure 2-11. Basin Topography ........................................................................................................................................ 2-66
Figure 2-12. Basin Geology ............................................................................................................................................. 2-68
Figure 2-13. Aquifer and Aquitard Outcrops ..................................................................................................................... 2-69
Figure 2-14. Basin Soils .................................................................................................................................................... 2-70
Figure 2-15. Hydrostratigraphic Cross-Section, A – A’ ............................................................................................... 2-71
Figure 2-16. Hydrostratigraphic Cross-Section from Model Output, B – B’ (HydroMetrics WRI, 2015) ............... 2-72
Figure 2-17. Coastal Groundwater Elevations Compared with Historical Basin Pumping (1985-2015) ............ 2-74
Figure 2-18. Significant Surface Water Bodies ............................................................................................................... 2-77
Figure 2-19. Groundwater Recharge Zones .................................................................................................................... 2-79
Figure 2-20. Local and Imported Water .......................................................................................................................... 2-82
Figure 2-21. Groundwater Elevation Contours in Purisima A-Unit, Fall 2005 .............................................................. 2-84
Figure 2-22. Groundwater Elevation Contours in Purisima BC- Unit, Fall 2005 ........................................................... 2-85
Figure 2-23. Groundwater Elevation Contours in Aromas Red Sands and Pursima F-Unit, Fall 2005 .............. 2-86
Figure 2-24. Groundwater Elevations in Tu-Unit, Fall 2016 ......................................................................................... 2-88
Figure 2-25. Groundwater Elevation Countours in Purisima A and AA-Unit, Fall 2016 .............................................. 2-89
Figure 2-26. Groundwater Elevation Countours in Purisima BC-Unit, Fall 2016 ......................................................... 2-90
Figure 2-27. Groundwater Elevation Countours in Purisima DEF/F-Unit, Fall 2016 .................................................. 2-92
Figure 2-28. Groundwater Elevation Countours in the Aromas Area, Fall 2016 ........................................................ 2-93
Figure 2-29. 2012-2016 Groundwater Level Trends .................................................................................................... 2-95
Figure 2-30. Location of Coastal Monitoring Wells ...................................................................................................... 2-97
Figure 2-31. Cumulative Change in Groundwater in Storage ....................................................................................... 2-99
Figure 2-32. Water Year 2018 Chloride Concentrations ............................................................................................... 2-100
Figure 2-33. Hydrograph and Chemograph of Moran Lake Medium Well (Montgomery & Associates, 2019) Overlain by Hydrograph and Inset Chemograph of Beltz #2 Well (Johnson et al., 2004) .... 2-101
Figure 2-34. Water Year 2017 Risk of Seawater Intrusion into Pumped Aquifer Units Based on Groundwater Levels and SkyTEM Data on Shallowest Aquifer Unit with Salty Water Just Offshore .............................................................................................................................. 2-102

Figure 2-35. Known Contaminant Locations ......................................................................................................................... 2-106

Figure 2-36. Location of Continuous GPS STations near the Santa Cruz Mid-County Basin ......................................................... 2-110

Figure 2-37. P212 Larkin Valley CGSP Station Daily Position ..................................................................................................... 2-112

Figure 2-38. P214 Corralitos CGSP Station Daily Position ........................................................................................................... 2-113

Figure 2-39. Hydrologic Process Simulated by the Precipitation-Runoff Modeling Systems (PRMS)................................................. 2-115

Figure 2-40. Differences Between Purisima and Aromas Connection to Groundwater ................................................................. 2-116

Figure 2-41. Simulated Minimum Monthly Flows from Moores Gulch to Bates Creek ................................................................. 2-117

Figure 2-42. Simulated Minimum Monthly Flows Downstream from Bates Creek ................................................................. 2-118

Figure 2-43. Areas of Concentrated Groundwater Pumping along Soquel Creek ................................................................. 2-119

Figure 2-44. Conceptual Connections between Soquel Creek, Alluvium, and Underlying Aquifers ......................................................... 2-120

Figure 2-45. Hydrographs for Main Street Monitoring Wells Compared to Monthly Main Street Pumping, Creek Flow and Precipitation .............................................................................................................................. 2-121

Figure 2-46. Stream Habitat in the Sant Cruz Mid-County Basin ..................................................................................................... 2-122

Figure 2-47. Wetland and Vegetation Types according to the Natural Communities Commonly Associated with Groundwater Dataset .......................................................................................................................... 2-125

Figure 2-48. Distribution of Species throughout the Mid-County Basin according to the California Natural Diversity Database .............................................................................................................................. 2-126

Figure 2-49. GSFLOW Model Domain ..................................................................................................................................... 2-129

Figure 2-50. Groundwater Budget Subareas ............................................................................................................................. 2-133

Figure 2-51. Santa Cruz Mid-County Basin Historical Annual Groundwater Budget (1985 – 2015) ........................................................ 2-138

Figure 2-52. Offshore Groundwater Flow to Santa Cruz Mid-County Basin by Model Layer .......................................................... 2-140

Figure 2-53. North of Aptos Fault Historical Annual Groundwater Budget (1985 – 2015) .............................................................. 2-142

Figure 2-54. South of Aptos Fault Historical Annual Groundwater Budget (1985 – 2015) .............................................................. 2-144

Figure 2-55. Santa Cruz Mid-County Basin Current Annual Groundwater Budget (2010 – 2015) ......................................................... 2-147

Figure 2-56. Comparison of Historical, Current, and Projected GSP Groundwater Inflows and Outflows (acre-feet per year) .............................................................................................................................. 2-148

Figure 2-57. North of Aptos Fault Current Annual Groundwater Budget (2010 – 2015) ................................................................. 2-151

Figure 2-58. South of Aptos Fault Current Annual Groundwater Budget (2010 – 2015)................................................................. 2-153

Figure 2-59. Projected Baseline and with GSP Implementation Net Groundwater Pumping in the Santa Cruz Mid-County Basin (2016-2039) ..................................................................................................................................... 2-156

Figure 2-60. Projected Baseline and with GSP Implementation Net Groundwater Pumping in the Santa Cruz Mid-County Basin (2040-2069) ..................................................................................................................................... 2-157

Figure 2-61. Santa Cruz Mid-County Basin Projected Baseline Annual Groundwater Budget (2016 – 2069) ........................................................ 2-160

Figure 2-62. Santa Cruz Mid-County Basin Projected GSP Annual Groundwater Budget (2016 – 2069) ........................................................ 2-161

Figure 2-63. North of Aptos Fault Projected Baseline Annual Groundwater Budget (2016 – 2069) ........................................................ 2-164
Figure 2-64. North of Aptos Fault Projected GSP Annual Groundwater Budget (2016 – 2069) .................. 2-165
Figure 2-65. South of Aptos Fault Projected Baseline Annual Groundwater Budget (2016 – 2069) ...... 2-168
Figure 2-66. South of Aptos Fault Projected GSP Annual Groundwater Budget (2016 – 2069) ............... 2-169

Appendices

Appendix A2-A. Communication and Engagement Plan
Appendix A2-B. Groundwater Model Calibration Memorandum
GSP Contents

3      SUSTAINABILITY MANAGEMENT CRITERIA ........................................................... 3-1
3.1  Sustainability Goal ........................................................................................................ 3-1
3.2  Sustainable Management Criteria ................................................................................. 3-1
      3.2.1 Sustainable Management Criteria Definitions .................................................. 3-3
      3.2.2 Process of Developing Sustainable Management Criteria .............................. 3-3
3.3  Monitoring Network ........................................................................................................ 3-4
      3.3.1 Description of Monitoring Networks .................................................................... 3-4
      3.3.1.1 Groundwater Level Monitoring Network ..................................................... 3-5
      3.3.1.2 Groundwater Quality Monitoring Network .................................................. 3-13
      3.3.1.3 Groundwater Extraction Monitoring ............................................................. 3-19
      3.3.1.3.1 Metered Groundwater Extraction ............................................................. 3-19
      3.3.1.3.2 Unmetered Groundwater Extraction ......................................................... 3-19
      3.3.1.4 Streamflow Monitoring ................................................................................. 3-20
      3.3.1.5 Land Elevation Monitoring .......................................................................... 3-21
      3.3.2 Monitoring Protocols for Data Collection and Monitoring .............................. 3-23
      3.3.2.1 Groundwater Elevation Monitoring Protocols ............................................. 3-23
      3.3.2.1.1 Manual Groundwater Level Measurement .................................................. 3-24
      3.3.2.1.2 Groundwater Level Measurement with Continuous Recording Devices ........ 3-25
      3.3.2.2 Groundwater Quality Monitoring Protocols ................................................. 3-26
      3.3.2.3 Streamflow Monitoring Protocols .................................................................. 3-27
      3.3.2.4 Measuring Groundwater Extraction Protocols .............................................. 3-28
      3.3.2.5 Climate Monitoring Protocols ...................................................................... 3-22
      3.3.3 Representative Monitoring Points ...................................................................... 3-28
      3.3.3.1 Chronic Lowering of Groundwater Level Representative Monitoring Points .......... 3-28
      3.3.3.2 Reduction of Groundwater in Storage Representative Monitoring Points .............. 3-30
      3.3.3.3 Seawater Intrusion Representative Monitoring Points ..................................... 3-31
      3.3.3.4 Degraded Groundwater Quality Representative Monitoring Points ............... 3-36
      3.3.3.5 Depletion of Interconnected Surface Water Monitoring Representative Monitoring Points 3-39
      3.3.4 Assessment and Improvement of Monitoring Network ....................................... 3-41
      3.3.4.1 Groundwater Level Monitoring Data Gaps ................................................... 3-41
      3.3.4.2 Streamflow Monitoring Data Gaps ................................................................ 3-41
      3.3.4.3 Groundwater Extraction Monitoring Data Gaps .............................................. 3-42
3.4  Chronic Lowering of Groundwater Levels Sustainable Management Criteria ...... 3-43
      3.4.1 Undesirable Results - Chronic Lowering of Groundwater Levels ....................... 3-43
      3.4.1.1 Criteria for Defining Chronic Lowering of Groundwater Levels Undesirable Results 3-43
      3.4.1.2 Potential Causes of Undesirable Results ......................................................... 3-43
      3.4.1.3 Effects on Beneficial Users and Land Use ....................................................... 3-44
      3.4.2 Minimum Thresholds - Chronic Lowering of Groundwater Levels ...................... 3-44
      3.4.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives 3-44
      3.4.2.2 Chronic Lowering of Groundwater Level Minimum Thresholds .............................. 3-44
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.4.2.3</td>
<td>Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators</td>
<td>3-45</td>
</tr>
<tr>
<td>3.4.2.4</td>
<td>Effect of Minimum Thresholds on Neighboring Basins</td>
<td>3-48</td>
</tr>
<tr>
<td>3.4.2.5</td>
<td>Effects of Minimum Thresholds on Beneficial Users and Land Uses</td>
<td>3-49</td>
</tr>
<tr>
<td>3.4.2.6</td>
<td>Relevant Federal, State, or Local Standards</td>
<td>3-50</td>
</tr>
<tr>
<td>3.4.2.7</td>
<td>Method for Quantitative Measurement of Minimum Thresholds</td>
<td>3-50</td>
</tr>
<tr>
<td>3.4.3.1</td>
<td>Measurable Objectives - Chronic Lowering of Groundwater Levels</td>
<td>3-50</td>
</tr>
<tr>
<td>3.4.3.2</td>
<td>Interim Milestones</td>
<td>3-51</td>
</tr>
<tr>
<td>3.5</td>
<td>Reduction of Groundwater in Storage Sustainable Management Criteria</td>
<td>3-51</td>
</tr>
<tr>
<td>3.5.1</td>
<td>Undesirable Results - Reduction of Groundwater in Storage</td>
<td>3-51</td>
</tr>
<tr>
<td>3.5.1.1</td>
<td>Criteria for Defining Reduction of Groundwater in Storage Undesirable Results</td>
<td>3-51</td>
</tr>
<tr>
<td>3.5.1.2</td>
<td>Potential Causes of Undesirable Results</td>
<td>3-52</td>
</tr>
<tr>
<td>3.5.1.3</td>
<td>Effects on Beneficial Users and Land Use</td>
<td>3-52</td>
</tr>
<tr>
<td>3.5.2</td>
<td>Minimum Thresholds - Reduction of Groundwater in Storage</td>
<td>3-53</td>
</tr>
<tr>
<td>3.5.2.1</td>
<td>Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives</td>
<td>3-53</td>
</tr>
<tr>
<td>3.5.2.2</td>
<td>Reduction of Groundwater in Storage Minimum Thresholds</td>
<td>3-54</td>
</tr>
<tr>
<td>3.5.2.3</td>
<td>Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators</td>
<td>3-54</td>
</tr>
<tr>
<td>3.5.2.4</td>
<td>Effect of Minimum Thresholds on Neighboring Basins</td>
<td>3-54</td>
</tr>
<tr>
<td>3.5.2.5</td>
<td>Effects of Minimum Thresholds on Beneficial Users and Land Uses</td>
<td>3-55</td>
</tr>
<tr>
<td>3.5.2.6</td>
<td>Relevant Federal, State, or Local Standards</td>
<td>3-56</td>
</tr>
<tr>
<td>3.5.2.7</td>
<td>Method for Quantitative Measurement of Minimum Thresholds</td>
<td>3-56</td>
</tr>
<tr>
<td>3.5.3</td>
<td>Measurable Objectives - Reduction of Groundwater Storage</td>
<td>3-56</td>
</tr>
<tr>
<td>3.5.3.1</td>
<td>Measurable Objectives</td>
<td>3-56</td>
</tr>
<tr>
<td>3.5.3.2</td>
<td>Interim Milestones</td>
<td>3-57</td>
</tr>
<tr>
<td>3.6</td>
<td>Seawater Intrusion Sustainable Management Criteria</td>
<td>3-57</td>
</tr>
<tr>
<td>3.6.1</td>
<td>Undesirable Results - Seawater Intrusion</td>
<td>3-58</td>
</tr>
<tr>
<td>3.6.1.1</td>
<td>Criteria for Defining Seawater Intrusion Undesirable Results</td>
<td>3-59</td>
</tr>
<tr>
<td>3.6.1.2</td>
<td>Potential Causes of Undesirable Results</td>
<td>3-62</td>
</tr>
<tr>
<td>3.6.1.3</td>
<td>Effects on Beneficial Users and Land Use</td>
<td>3-62</td>
</tr>
<tr>
<td>3.6.2</td>
<td>Minimum Thresholds - Seawater Intrusion</td>
<td>3-62</td>
</tr>
<tr>
<td>3.6.2.1</td>
<td>Information Used and Methodology for Establishing Seawater Intrusion Minimum Thresholds</td>
<td>3-63</td>
</tr>
<tr>
<td>3.6.2.1.1</td>
<td>Chloride Isocontours</td>
<td>3-63</td>
</tr>
<tr>
<td>3.1.1.1.1</td>
<td>Groundwater Elevations as a Proxy</td>
<td>3-63</td>
</tr>
<tr>
<td>3.6.2.1.2</td>
<td>Consideration of Sea-Level Rise</td>
<td>3-64</td>
</tr>
<tr>
<td>3.6.2.2</td>
<td>Chloride Isocontour Minimum Threshold</td>
<td>3-65</td>
</tr>
<tr>
<td>3.6.2.3</td>
<td>Groundwater Elevations as a Proxy for Seawater Intrusion Minimum Thresholds</td>
<td>3-68</td>
</tr>
<tr>
<td>3.6.2.4</td>
<td>Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators</td>
<td>3-68</td>
</tr>
<tr>
<td>3.6.2.5</td>
<td>Effect of Minimum Thresholds on Neighboring Basins</td>
<td>3-70</td>
</tr>
<tr>
<td>3.6.2.6</td>
<td>Effects of Minimum Thresholds on Beneficial Users and Land Uses</td>
<td>3-71</td>
</tr>
<tr>
<td>3.6.2.7</td>
<td>Relevant Federal, State, or Local Standards</td>
<td>3-73</td>
</tr>
<tr>
<td>3.6.2.8</td>
<td>Method for Quantitative Measurement of Minimum Thresholds</td>
<td>3-73</td>
</tr>
<tr>
<td>3.6.3</td>
<td>Measurable Objectives - Seawater Intrusion</td>
<td>3-73</td>
</tr>
</tbody>
</table>
3.6.3.1 Chloride Isocontour Measurable Objective ................................................. 3-73
3.6.3.1.1 Measurable Objectives ................................................................. 3-73
3.6.3.1.2 Chloride Concentration Triggers ............................................... 3-74
3.6.3.1.3 Interim Milestones for Chloride .................................................. 3-75
3.6.3.2 Groundwater Elevations as a Proxy Measurable Objectives ............. 3-75
3.6.3.2.1 Measurable Objectives ................................................................. 3-75
3.6.3.2.2 Protective Groundwater Elevation Triggers ............................... 3-75
3.6.3.2.3 Interim Milestones for Groundwater Elevation Proxies ............... 3-76

3.7 Degraded Groundwater Quality Sustainable Management Criteria ........ 3-78
3.7.1 Undesirable Results - Degraded Groundwater Quality .................. 3-78
3.7.1.1 Criteria for Defining Degraded Groundwater Quality Undesirable Results 3-78
3.7.1.2 Potential Causes of Undesirable Results ......................................... 3-79
3.7.1.3 Effects on Beneficial Users and Land Use ....................................... 3-79
3.7.2 Minimum Thresholds - Degraded Groundwater Quality .............. 3-80
3.7.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives 3-80
3.7.2.2 Degraded Groundwater Quality Minimum Thresholds ....................... 3-80
3.7.2.3 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators ..................................................... 3-81
3.7.2.4 Effect of Minimum Thresholds on Neighboring Basins .................. 3-82
3.7.2.5 Effects of Minimum Thresholds on Beneficial Users and Land Uses 3-83
3.7.2.6 Relevant Federal, State, or Local Standards .................................... 3-83
3.7.2.7 Method for Quantitative Measurement of Minimum Thresholds ....... 3-83
3.7.3 Measurable Objectives - Degraded Groundwater Quality .............. 3-84
3.7.3.1 Measurable Objectives ................................................................. 3-84
3.7.3.2 Interim Milestones ................................................................. 3-84

3.8 Land Subsidence Sustainable Management Criteria ............................... 3-89
3.8.1 Undesirable Results - Land Subsidence .............................................. 3-89
3.8.2 Minimum Thresholds - Land Subsidence ........................................... 3-89
3.8.3 Measurable Objectives - Land Subsidence ........................................ 3-89

3.9 Depletion of Interconnected Surface Water Sustainable Management Criteria .... 3-89
3.9.1 Undesirable Results - Depletion of Interconnected Surface Water .......... 3-90
3.9.1.1 Groundwater Elevations as a Proxy for Depletion of Interconnected Surface Water Minimum Thresholds .................................................. 3-90
3.9.1.2 Criteria for Defining Depletion of Interconnected Surface Water Undesirable Results 3-91
3.9.1.3 Potential Causes of Undesirable Results ......................................... 3-91
3.9.1.4 Effects on Beneficial Users and Land Use ....................................... 3-92
3.9.2 Minimum Thresholds - Depletion of Interconnected Surface Water ........ 3-92
3.9.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives 3-92
3.9.2.2 Depletion of Interconnected Surface Water Minimum Thresholds ............ 3-93
3.9.2.3 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators ..................................................... 3-94
3.9.2.4 Effect of Minimum Thresholds on Neighboring Basins .................. 3-95
3.9.2.5 Effects of Minimum Thresholds on Beneficial Users and Land Uses 3-95
3.9.2.6 Relevant Federal, State, or Local Standards .................................... 3-95
3.9.2.7  Method for Quantitative Measurement of Minimum Thresholds...........................................3-95
3.9.3  Measurable Objectives - Depletion of Interconnected Surface Water.................................3-96
3.9.3.1  Measurable Objectives .....................................................................................................3-96
3.9.3.2  Interim Milestones.............................................................................................................3-96

4  REFERENCES AND TECHNICAL STUDIES ...........................................................................3-98

5  ACRONYMS & ABBREVIATIONS ....................................................................................ERROR! BOOKMARK NOT DEFINED.

APPENDIX 3-A ............................................................................................................................3-1
APPENDIX 3-B ............................................................................................................................1
APPENDIX 3-C ............................................................................................................................1
APPENDIX 3-D ............................................................................................................................1
Tables

Table 3-1. Applicable Sustainability Indicators in the Santa Cruz Mid-County Basin ........................................ 3-5
Table 3-2. Summary of MGA Member Agency Monitoring Well Network for Groundwater Levels .............. 3-6
Table 3-3. Monitoring Wells for Groundwater Levels in the Santa Cruz Mid-County Basin .......................... 3-8
Table 3-4. Summary of MGA Member Agency Monitoring Well Network for Groundwater Quality ............. 3-14
Table 3-5. Monitoring Wells for Groundwater Quality in the Santa Cruz Mid-County Basin ........................ 3-15
Table 3-6. Streamflow Gauges in the Santa Cruz Mid-County Basin ............................................................. 3-20
Table 3-7. Representative Monitoring Points for Chronic Lowering of Groundwater Levels .......................... 3-29
Table 3-8. Seawater Intrusion Representative Monitoring Network ............................................................... 3-33
Table 3-9. Representative Monitoring Points for Seawater Intrusion ........................................................... 3-33
Table 3-10. Representative Monitoring Points for Degraded Groundwater Quality .................................. 3-37
Table 3-11. Representative Monitoring Points for Depletion of Interconnected Surface Water .................... 3-40
Table 3-12. Minimum Thresholds and Measurable Objectives for Chronic Lowering of Groundwater Level .......................... 3-45
Table 3-13. Minimum Thresholds and Measurable Objectives for Reduction of Groundwater of Storage 3-54
Table 3-14. Interim Milestones for Reduction of Groundwater of Storage .................................................. 3-57
Table 3-15. Summary of Chloride Concentrations in Monitoring and Production Wells at the Coast .......... 3-58
Table 3-16. Chloride Minimum Thresholds and Measurable Objectives for Coastal and Inland Wells .......... 3-67
Table 3-17. Minimum Thresholds and Measurable Objectives for Groundwater Elevations Used as Proxies at Seawater Intrusion Representative Monitoring Points ................................................................. 3-68
Table 3-18. Interim Milestones for Seawater Intrusion Groundwater Elevation Proxies .............................. 3-77
Table 3-19. Constituents of Concern with Minimum Thresholds ................................................................. 3-80
Table 3-20. Measurable Objectives for Degradation of Groundwater Quality ............................................. 3-85
Table 3-21. Minimum Thresholds and Measurable Objectives for Representative Monitoring Points for Depletion of Interconnected Surface Water ......................................................... 3-93
Table 3-22. Interim Milestones for Deletion of Interconnected Surface Water Groundwater Elevation Proxies ................................................................................................................................. 3-97

Figures

Figure 3-1. Location of Existing Basin-Wide Wells Used for Groundwater Level Monitoring ......................... 3-8
Figure 3-2. Location of Basin-Wide Wells Used for Groundwater Quality Monitoring .................................... 3-14
Figure 3-3. Location of Basin Streamflow Gauges ....................................................................................... 3-21
Figure 3-4. Location of Continuous GPS Stations near the Santa Cruz Mid-County Basin .......................... 3-23
Figure 3-5. Chronic Lowering of Groundwater Level Representative Monitoring Network ......................... 3-30
Figure 3-6. Reduction of Groundwater in Storage Representative Monitoring Network .......................... 3-31
Figure 3-7. Degraded Groundwater Quality Representative Monitoring Network ................................. 3-36
Figure 3-8. Depletion of Interconnected Surface Water Existing Representative Monitoring Network...... 3-40
Figure 3-9. Groundwater Level and Streamflow Monitoring Data Gaps.................................................... 3-42
Figure 3-10. Minimum Thresholds for All Sustainability Indicators with Groundwater Elevation Minimum Thresholds ............................................................................................3-48
Figure 3-11. 250 mg/L Chloride Isocontour for the Aromas and Pursima Aquifers ................................3-66
Figure 3-12. Protective Groundwater Elevations at Coastal Monitoring Wells ........................................3-70
Figure 3-13. Seawater Intrusion within the Pajaro Valley (Source: PVWMA) ..........................................3-72
Figure 3-14. Simulated Contributions to Streamflow for Soquel Creek Watershed with and without Historical Pumping ...........................................................................................................3-91
Figure 3-15. Main Street Shallow Monitoring Well Hydrograph with Minimum Threshold and Measureable Objective ..................................................................................................................3-94

Appendices

Appendix 3-A. Technical Approach for Determining Groundwater Elevation Minimum Threshold for Chronic Lowering of Groundwater Levels in Representative Monitoring Wells
Appendix 3-B. Hydrographs of Representative Monitoring Points for Chronic Lowering of Groundwater Levels
Appendix 3-C. Summary of Federal, State, and Local Water Quality Regulations
Appendix 3-D. Hydrographs of Representative Monitoring Points for Depletion of Interconnected Surface Water
# GSP Section 4 Contents

4 PROJECTS AND MANAGEMENT ACTIONS ................................................................. 4-1

4.1 Baseline Projects and Management Actions (Group 1) ........................................... 4-4

4.1.1 Water Conservation and Demand Management .................................................... 4-4
4.1.2 Planning and Redistribution of Municipal Groundwater Pumping ...................... 4-6

4.2 Projects and Management Actions Planned to Reach Sustainability (Group 2) ....... 4-7

4.2.1 Pure Water Soquel ............................................................................................... 4-7
4.2.1.1 Project Description ......................................................................................... 4-7
4.2.1.2 Measurable Objective ................................................................................... 4-7
4.2.1.3 Circumstances for Implementation .............................................................. 4-8
4.2.1.4 Public Noticing ............................................................................................. 4-8
4.2.1.5 Overdraft Mitigation and Management Actions .............................................. 4-8
4.2.1.6 Permitting and Regulatory Process ............................................................... 4-9
4.2.1.7 Time-table for Implementation .................................................................... 4-9
4.2.1.8 Expected Benefits ....................................................................................... 4-9
4.2.1.9 How the Project will be Accomplished ......................................................... 4-13
4.2.1.10 Legal authority ............................................................................................ 4-13
4.2.1.11 Estimated Costs and Funding Plan ............................................................. 4-13
4.2.1.12 Management of groundwater extractions and recharge ......................... 4-13
4.2.1.13 Relationship to Additional GSP Elements ............................................... 4-14

4.2.2 Aquifer Storage and Recovery ............................................................................. 4-14
4.2.2.1 Project Description ....................................................................................... 4-14
4.2.2.2 Measurable Objective ................................................................................... 4-14
4.2.2.3 Circumstances for Implementation .............................................................. 4-15
4.2.2.4 Public Noticing ............................................................................................. 4-15
4.2.2.5 Overdraft Mitigation and Management Actions .............................................. 4-15
4.2.2.6 Permitting and Regulatory Process ............................................................... 4-16
4.2.2.7 Time-table for Implementation .................................................................... 4-16
4.2.2.8 Expected Benefits ....................................................................................... 4-16
4.2.2.9 How the Project will be Accomplished ......................................................... 4-18
4.2.2.10 Legal Authority ............................................................................................ 4-19
4.2.2.11 Estimated Costs and Funding Plan ............................................................. 4-19
4.2.2.12 Management of Groundwater Extractions and Recharge ......................... 4-19
4.2.2.13 Relationship to Additional GSP Elements ............................................... 4-20
4.2.3 Water Transfers / In Lieu Groundwater Recharge ................................................. 4-20
4.2.3.1 Project Description ......................................................................................... 4-20
4.2.3.2 Measurable Objective ................................................................................... 4-21
4.2.3.3 Circumstances for Implementation ................................................................. 4-21
4.2.3.4 Public Noticing ............................................................................................. 4-21
4.2.3.5 Overdraft Mitigation and Management Actions .............................................. 4-21
4.2.3.6 Permitting and Regulatory Process ................................................................. 4-22
4.2.3.7 Time-table for Implementation ...................................................................... 4-22
4.2.3.8 Expected Benefits ......................................................................................... 4-23
4.2.3.9 How the Project will be Accomplished .......................................................... 4-24
4.2.3.10 Legal authority ............................................................................................ 4-25
4.2.3.11 Estimated Costs and Funding Plan ................................................................. 4-25
4.2.3.12 Management of groundwater extractions and recharge ............................ 4-25
4.2.3.13 Relationship to Additional GSP Elements .................................................... 4-25

4.2.4 Distributed Storm Water Managed Aquifer Recharge (DSWMAR) .................... 4-26
4.2.4.1 Project Description ......................................................................................... 4-26
4.2.4.2 Measurable Objective ................................................................................... 4-26
4.2.4.3 Circumstances for Implementation ................................................................. 4-26
4.2.4.4 Public Noticing ............................................................................................. 4-26
4.2.4.5 Overdraft Mitigation and Management Actions .............................................. 4-27
4.2.4.6 Permitting and Regulatory Process ................................................................. 4-27
4.2.4.7 Time-table for Implementation ...................................................................... 4-27
4.2.4.8 Expected Benefits ......................................................................................... 4-27
4.2.4.9 How the Project will be Accomplished .......................................................... 4-28
4.2.4.10 Legal authority ............................................................................................ 4-28
4.2.4.11 Estimated Costs and Funding Plan ................................................................. 4-28
4.2.4.12 Management of groundwater extractions and recharge ............................ 4-29
4.2.4.13 Relationship to Additional GSP Elements .................................................... 4-29

4.3 Identified Projects and Management Actions That May Be Evaluated in the Future
(Group 3) .................................................................................................................. 4-29

4.3.1 Recycled Water - Groundwater Replenishment and Reuse ............................... 4-29
4.3.2 Recycled Water – Surface Water (Reservoir) Augmentation ............................. 4-31
4.3.3 Recycled Water – Direct Potable Reuse ............................................................. 4-32
4.3.4 Groundwater Pumping Curtailment and/or Restrictions ................................... 4-33
4.3.5 Local Desalination ........................................................................................... 4-34
4.3.6 Regional Desalination ..................................................................................... 4-35
Tables

Table 4-1. Projects and Management Actions (Groups 1 and 2) ................................................................. 4-2
Table 4-2. Identified Potential Future Projects and Management Actions (Group 3) ................................. 4-3

Figures

Figure 4-1. Five Year Averages of Model Simulated Groundwater Elevations at Coastal Monitoring Wells in Purisima A and BC Units ........................................................................................................ 4-10
Figure 4-2. Five Year Averages of Model Simulated Groundwater Elevations at Coastal Monitoring Wells in Purisima F and Aromas Red Sands Units ........................................................................... 4-11
Figure 4-3. Monthly Model Simulated Groundwater Elevations in Shallow Wells along Soquel Creek..... 4-12
Figure 4-4. Five Year Averages of Groundwater Elevations at Purisima AA and A Units ................. 4-18
Figure 4-5. Five Year Averages of Groundwater Elevations at Coastal Monitoring Wells in Tu and Purisima AA and A Units ........................................................................................................... 4-24
GSP Section 5 Contents

5 PLAN IMPLEMENTATION .............................................................................................................. 5-1
5.1 Estimate of GSP Implementation Costs .................................................................................. 5-1
  5.1.1 Estimate of Ongoing Costs by Major Category ................................................................. 5-1
  5.1.1.1 Agency Administration and Operations ........................................................................ 5-1
  5.1.1.2 Legal Services .............................................................................................................. 5-3
  5.1.1.3 Management and Coordination ................................................................................... 5-3
    5.1.1.3.1 Technical Work: Groundwater Model Simulations and Updates ...................... 5-3
    5.1.1.3.2 Technical Work: Consultants ............................................................................. 5-3
    5.1.1.3.3 Planning/Program Staff Support ..................................................................... 5-3
  5.1.1.4 Data Collection, Analysis, and Reporting ................................................................. 5-4
    5.1.1.4.1 Monitoring: Groundwater Elevation ................................................................. 5-4
    5.1.1.4.2 Monitoring: Groundwater Quality ........................................................................ 5-5
    5.1.1.4.3 Groundwater Extraction Monitoring ................................................................. 5-5
    5.1.1.4.4 Monitoring: Streamflow .................................................................................... 5-6
    5.1.1.4.5 Data Collection: Offshore Airborne Electromagnetics Geophysical Surveys .... 5-6
    5.1.1.4.6 Data Collection: Other ..................................................................................... 5-6
    5.1.1.4.7 Data Management ............................................................................................ 5-6
  5.1.1.5 GSP Reporting to DWR ............................................................................................... 5-7
    5.1.1.5.1 Annual Reports ................................................................................................. 5-7
    5.1.1.5.2 Periodic (5-year) Evaluations ......................................................................... 5-7
  5.1.1.6 Community Outreach & Education ............................................................................. 5-7
  5.1.1.7 Financial Reserves and Contingencies ...................................................................... 5-7
  5.1.2 Activities of the MGA Member Agencies ......................................................................... 5-8
    5.1.2.1 Monitoring Activities ............................................................................................ 5-8
    5.1.2.2 Member Agency Projects .................................................................................... 5-9
  5.1.3 Total Estimated Implementation Costs Through 2040 .................................................. 5-9
  5.1.4 Funding sources and mechanisms .................................................................................. 5-10
5.2 Schedule for Implementation ............................................................................................... 5-11
  5.2.1 Projects and Management Actions .................................................................................. 5-12
5.3 Annual Reporting ..................................................................................................................... 5-13
5.4 Periodic (5-Year) Evaluations .............................................................................................. 5-14
Tables

Table 5-1. Estimated Agency Costs by Major Category ................................................................. 5-2
Table 5-2. Member Agency Groundwater Elevation and Quality Monitoring Annual Costs in Basin........ 5-8
Table 5-3. Member Agency Streamflow, Precipitation, and Fish Monitoring Annual Costs in Basin........ 5-8
Table 5-4. Member Agency Projects ............................................................................................. 5-9
Table 5-5. Groundwater Sustainability Plan Estimated Implementation Cost Through 2040 ............... 5-10

Figures

Figure 5-1. GSP Implementation Schedule ..................................................................................... 5-12
Figure 5-2. Member Agency Projects and Management Actions Estimated Timeline ....................... 5-12

Appendices

Appendix A5-A. Santa Cruz Mid-County Groundwater Agency Evaluation of Private Pumper Funding
Mechanisms and Fee Criteria, Raftelis, May 2019