1 INTRODUCTION

A groundwater model (model) of the Santa Cruz Mid-County Groundwater Basin (Basin) has been developed and calibrated as described in the calibration report entitled*: Santa Cruz Mid-County Basin Model Integration and Calibration* (M&A, 2019b). The Santa Cruz Mid-County Groundwater Sustainability Plan (GSP) uses model simulations of future conditions to estimate future water budgets, evaluate the expected benefits of projects and management actions, and estimate sustainable yields. This report documents model simulations of future conditions.

Future water budgets are estimated from model simulation results for both assumed baseline conditions and projects included in the GSP to achieve sustainability. The modeled projects are the two planned projects included in the GSP: Pure Water Soquel (PWS) led by Soquel Creek Water District, and Aquifer Storage and Recovery (ASR) led by the City of Santa Cruz.

The expected benefits of these projects are based on a comparison of groundwater elevations simulated by the model with the projects versus the simulation of baseline conditions. Simulated groundwater elevations are also compared with groundwater elevation proxies for the GSP's sustainable management criteria (SMC) to evaluate whether the projects help prevent or eliminate undesirable results for seawater intrusion and depletion of interconnected surface water.

Sustainable yields by aquifer group are estimated based on testing combinations of pumping and injection rates with the projects that achieve minimum thresholds and therefore sustainability by not causing undesirable results.

2 BASELINE ASSUMPTIONS FOR FUTURE CONDITIONS

Baseline assumptions are implemented into the model simulations of future conditions. The baseline assumptions also represent management actions that Santa Cruz Mid-County Groundwater Agency (MGA) member agencies are already implementing. Except where otherwise noted, these assumptions are consistent for both the simulation of baseline conditions without projects and the simulations of projects.

2.1 Initial Conditions

Initial groundwater elevations for the model are based on simulated groundwater elevations at the end of September 2015 from the calibrated simulation of historical conditions documented in the calibration report. Simulation of Water Year 2016 is based on available data for October 2015 to September 2016. Available data used for Water Year 2016 includes climate data and municipal pumping. Non-municipal pumping and both non-municipal and municipal return flows are estimated following the approaches referenced in the calibration report (HydroMetrics WRI, 2017a and M&A, 2019a).

2.2 Catalog Climate Scenario

Climate for simulated water years representing Water Years 2017-2069 are generated from a catalog of historical climate data from warm years in the Basin's past to simulate warmer temperatures predicted by global climate change (HydroMetrics WRI, 2017b). Specifically, the Catalog Climate uses historical data from the Santa Cruz Co-op and Watsonville Waterworks climate stations as well as corresponding daily temperature values from the DAYMET database of gridded weather parameters (Thornton et al., 2014) for a location near the ridgeline (Figure 1). The model Technical Advisory Committee recommended this approach because it preserves the integrity of the climate data and ensures temperature and precipitation values are associated with real data. The Catalog Climate has an increase of 2.4 °F in temperature at the Santa Cruz Co-op station and decrease of 2.1 - 3.1 inches per year (approximately 10%) in precipitation over the 1985-2015 record at climate stations in Santa Cruz and Watsonville. There is a corresponding increase in potential evapotranspiration of about 6%. Figure 2 shows precipitation and average temperature used for the future simulations at the Santa Cruz Co-op and Figure 3 shows precipitation used at the Watsonville Waterworks climate station. Simulated water years 2-54 shown in these figures represent Water Years 2017-2069.

In comparison to the CMIP5 ensemble of 10 Global Circulation Models (CGM) often applied in California, the simulated Catalog Climate is slightly cooler and drier than most CMIP5 scenarios (M&A, 2018). California Department of Water Resources (DWR) released datasets for climate change projections to use in GSPs, but the use of the data and methods provided by DWR are optional and local data and methods may be more appropriate (DWR, 2018). The datasets provided by DWR result in a 5-8% increase in potential evapotranspiration and a 3-4% increase of precipitation at the closest grid cell to the Santa Cruz-Coop station (Figure 1). Therefore, the Catalog Climate has similar potential evapotranspiration, and has less precipitation than datasets provided by DWR for the Basin area.

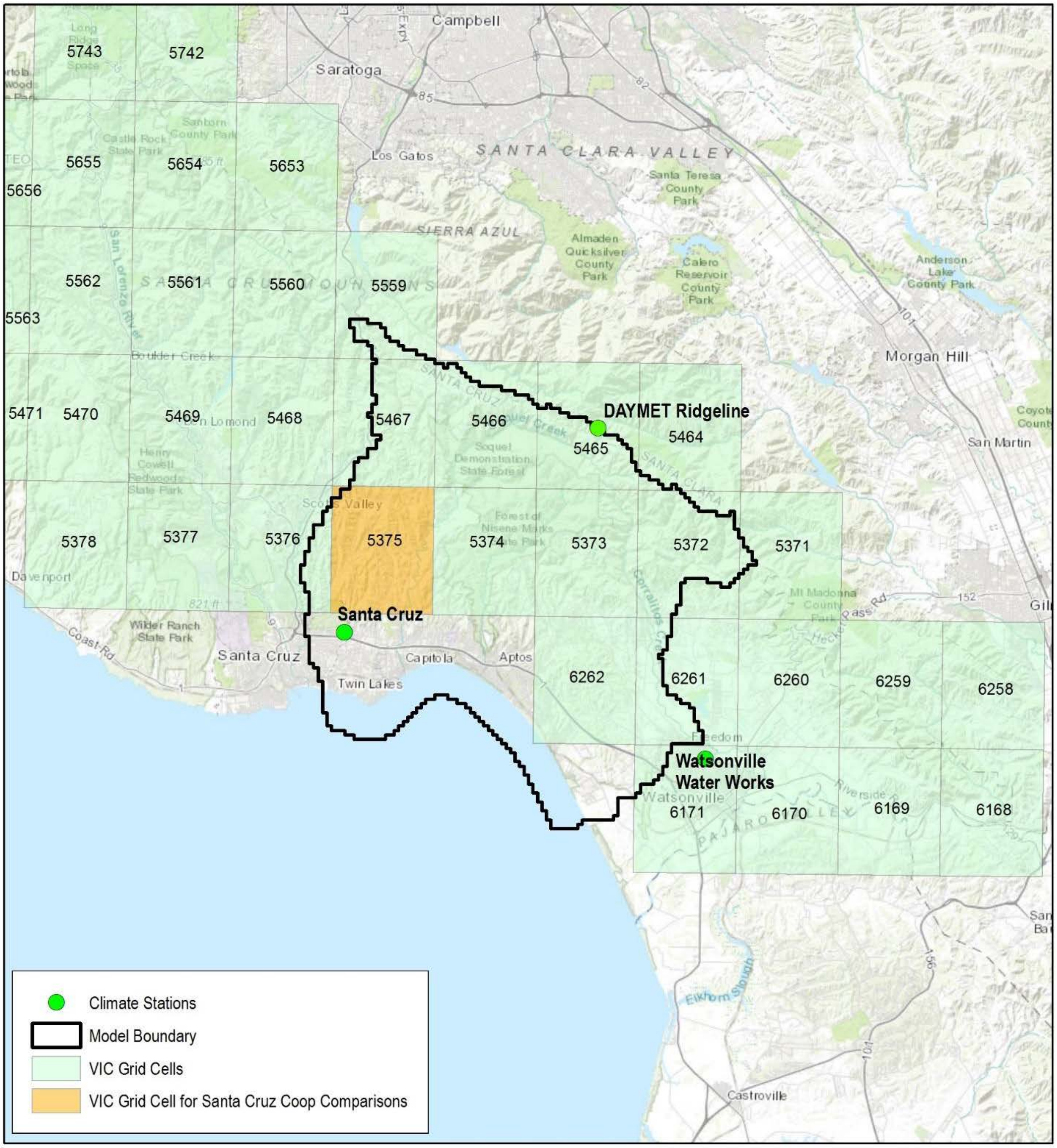

Figure 1. Climate Stations used in Model and Grid Cells for DWR Climate Datasets near Basin

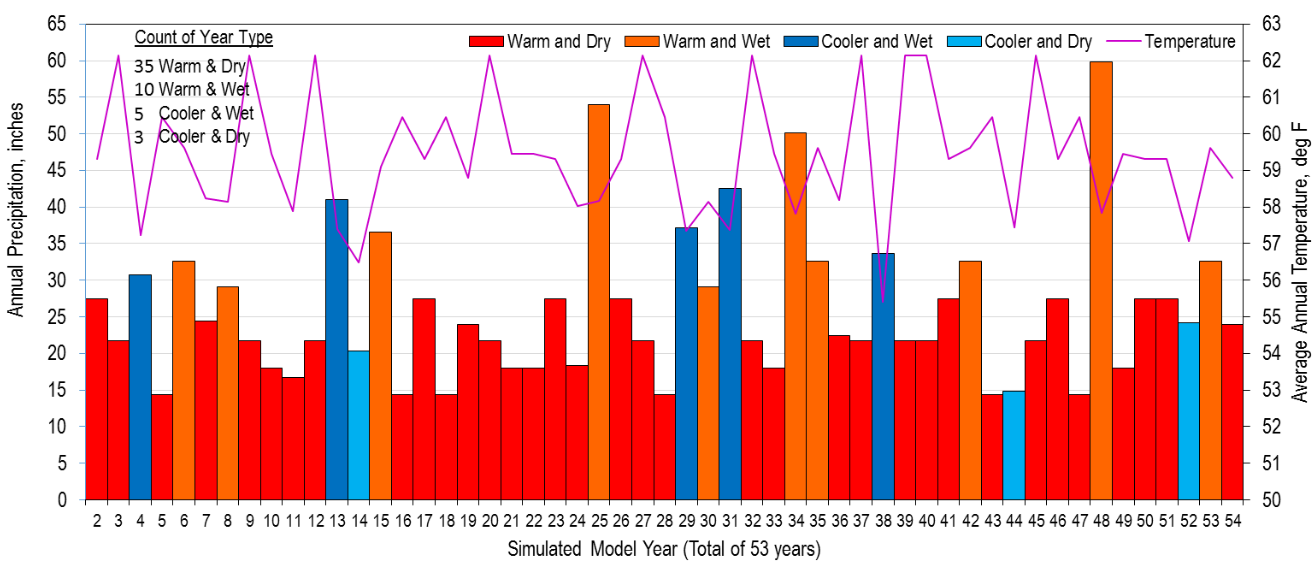

Figure 2. Simulated Future Precipitation and Temperature at Santa Cruz Co-op Station based on Catalog Climate

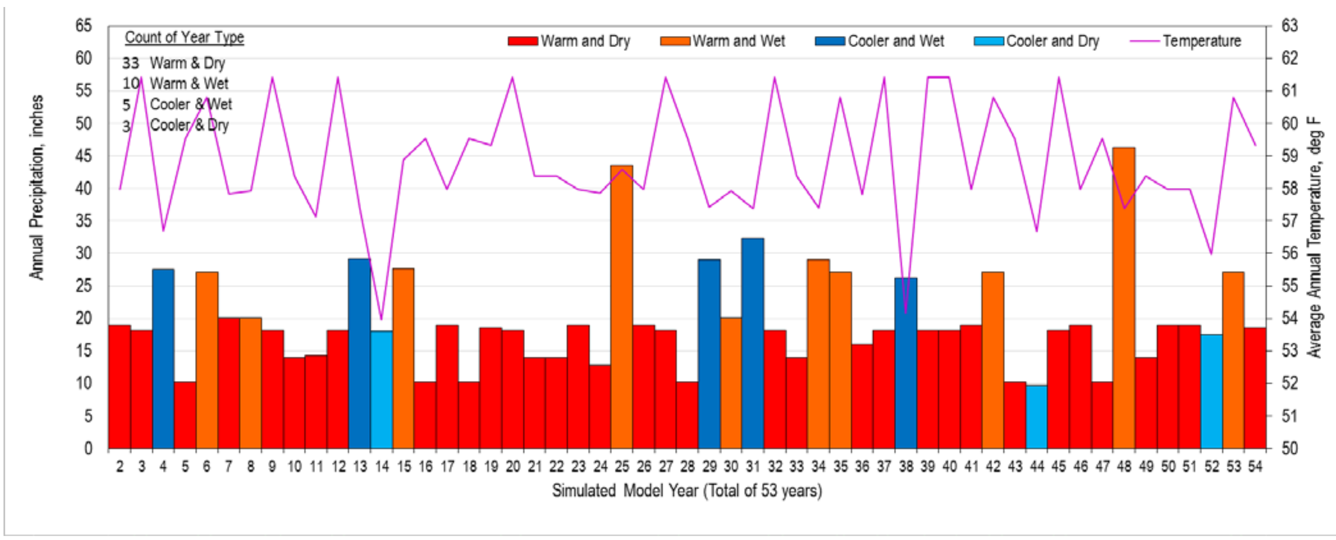

Figure 3. Simulated Future Precipitation at Watsonville Waterworks Station based on Catalog Clima

2.3 Sea Level Rise

Sea level rise is implemented in the model based on projections for Monterey provided by the 2018 update of the *State of California Sea-Level Rise Guidance* (California Natural Resources Agency and California Ocean Protection Council, 2018). The projections used are based on 5% exceedance probability under the high emissions scenario and rise to 2.3 feet by 2070 (Table 1). The increased sea level rise is applied to model general head boundaries with freshwater equivalent heads calculated from sea level.

Table 1. Sea Level Rise Projections Incorporated in Future Simulations

Year	Sea Level Rise (feet)
2030	0.6
2040	0.9
2050	1.3
2060	1.8
2070	2.3

2.4 Land Use

Land use assumed for future simulations are equivalent to land use simulated for historical conditions from Water Years 1985-2015, as documented in the calibration report. Therefore, the distribution of non-municipal pumping and return flows are consistent with the historical simulation. Also consistent are the areal distribution of vegetation type and density and impervious area percentages.

2.5 Baseline Demand

Baseline water demand is assumed to be the same for all future simulations and reflects management actions such as conservation already being implemented, but groundwater pumping to meet that demand changes with implementation of projects.

2.5.1 Municipal Demand

Municipal demand assumed for the future simulations is based on planning projections provided by the three municipal supply water agencies: Central Water District (CWD), City of Santa Cruz Water Department (SCWD), and Soquel Creek Water District (SqCWD).

Assumed future demand for CWD is based on demand from Water Years 2008-2011 prior to the most recent drought. These years are selected as there is anticipated bounce-back in demand from the conservation that occurred during the drought. Annual CWD water demand is assumed to be 550 acre-feet per year in all future simulations with monthly variation based on historical average pumping for Water Years 2005-2014.

Assumed future demand for SCWD is based on demand from 2016-2018 water demand. SCWD has not experienced a rebound in demand from 2014-2015 when SCWD rationed water during the drought (City of Santa Cruz, 2019). SCWD uses the 2016-2018 demand for planning purposes and to evaluate potential future water supply shortages. Therefore, model assumptions for SCWD include the 2016-2018 water demand for all future model simulations.

Assumed future water demand for SqCWD is based on projected demand in its Urban Water Management Plan (WSC, 2016). The SqCWD Urban Water Management Plan (UWMP) projects a demand bounce-back of approximately 65% from the low of Water Year 2016 (3,095 acre-feet per year relative to 2013 (4,279 acre-feet per year) when the drought started. The bounce back is projected in the UWMP to peak around 2020 at 3,900 acre-feet per year. The peak projected bounce-back is based on observed water demand of approximately 3,100 acre-feet per year in Water Year 2016 compared to approximately 3,350 acre-feet per year in Water Year 2018. The UWMP projects SqCWD demand to decline from 3,900 to 3,300 acre-feet per year by 2050 but future simulations do not include a decline in demand and maintain demand at 3,900 acre-feet per year. SqCWD has concluded that its UWMP's demand projections may be underestimated when considering effects such as statewide efforts to address the housing crisis including laws facilitating accessory dwelling uses and is therefore not assuming a long-term decline in demand for planning purposes. Monthly variation in future water demand is based on historical monthly variations in demand data.

2.5.2 Non-Municipal Demand

Non-municipal domestic demand is based on the water use factor used in the historical model simulation for Water Year 2013. Thus, the water use factor is assumed to be 0.35 acre-feet per year per residence in the Basin, the Santa Margarita Basin, and the Purisima Highlands and 0.59 acre-feet per year for the Pajaro Valley Subbasin (HydroMetrics WRI, 2017a). This assumed demand represents slight bounce-back in water demand experienced by small water systems during Water Years 2014 and 2015 during the drought.

Non-municipal domestic demand is assumed to increase over time by projections for population growth rates of 4.2% per year before 2035 and 2.1% per year after 2035. More recent projected growth rates of only 0.2% per year through 2040 as estimated by land use agencies, however, sensitivity runs provided in the calibration report showed a relatively small effect on sustainability by non-municipal pumpers.

Institutional demand and agricultural demand isare estimated based on the approach used for the historical simulation, assuming the same land use and crop type distribution (HydroMetrics WRI, 2017a). Irrigation demand varies with climatic conditions. Since the Catalog Climate is warmer and drier than the historical simulation, institutional and agricultural demand is simulated to be higher in the future simulations than during the historical period.

2.6 Baseline Pumping

Future baseline simulations include assumptions of how much groundwater pumping is needed to meet demand and where pumping occurs. Figure 4 shows the locations of existing and planned municipal pumping wells.

Baseline pumping is simulated in the model via the model's Multi-Node Well 2 (MNW2) MODFLOW package. The package defines the model cell location of the wells and either the screen elevations or model layers of the screens. Monthly time series of well flows for both pumping and injection are assigned to each well in the model.

2.6.1 Central Water District Baseline Pumping

Groundwater pumping at CWD's Rob Roy well field is assumed to meet all of CWD's demand of 550 acre-feet per year. Distribution of pumping between the three Rob Roy wells is based on the 2005-2014 distribution with CWD-12 as the primary pumper and CWD-4 and CWD-10 as secondary pumpers. Any historical pumping occurring at the now inactive Cox well field is assumed to occur at CWD-12 (Table 2). The first chart on Figure 5 shows the groundwater pumping distribution at CWD for future simulations. As CWD pumping is not assumed to change with implementation of projects, the third chart on Figure 5 for the projects simulation is identical to the first chart representing the baseline simulation.

Table 2. Central Water District Pumping Distribution by Wells for Future Simulations

Period	CWD-4	CWD-10	CWD-12	Total
	acre-feet per year			
2017-2069	48	92	410	550

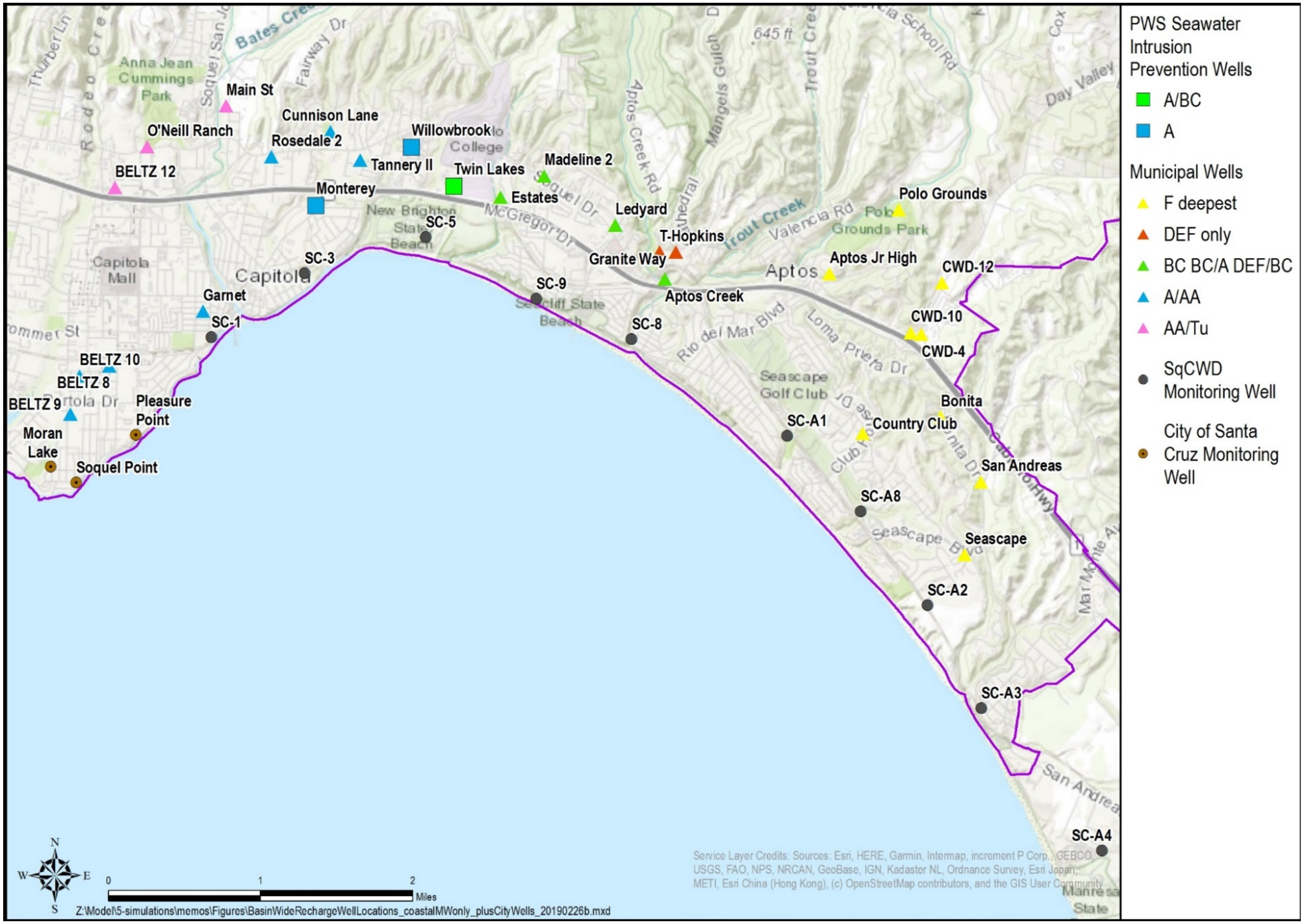

Figure 4. Locations of Existing and Planned Wells for Baseline and Projects Simulation

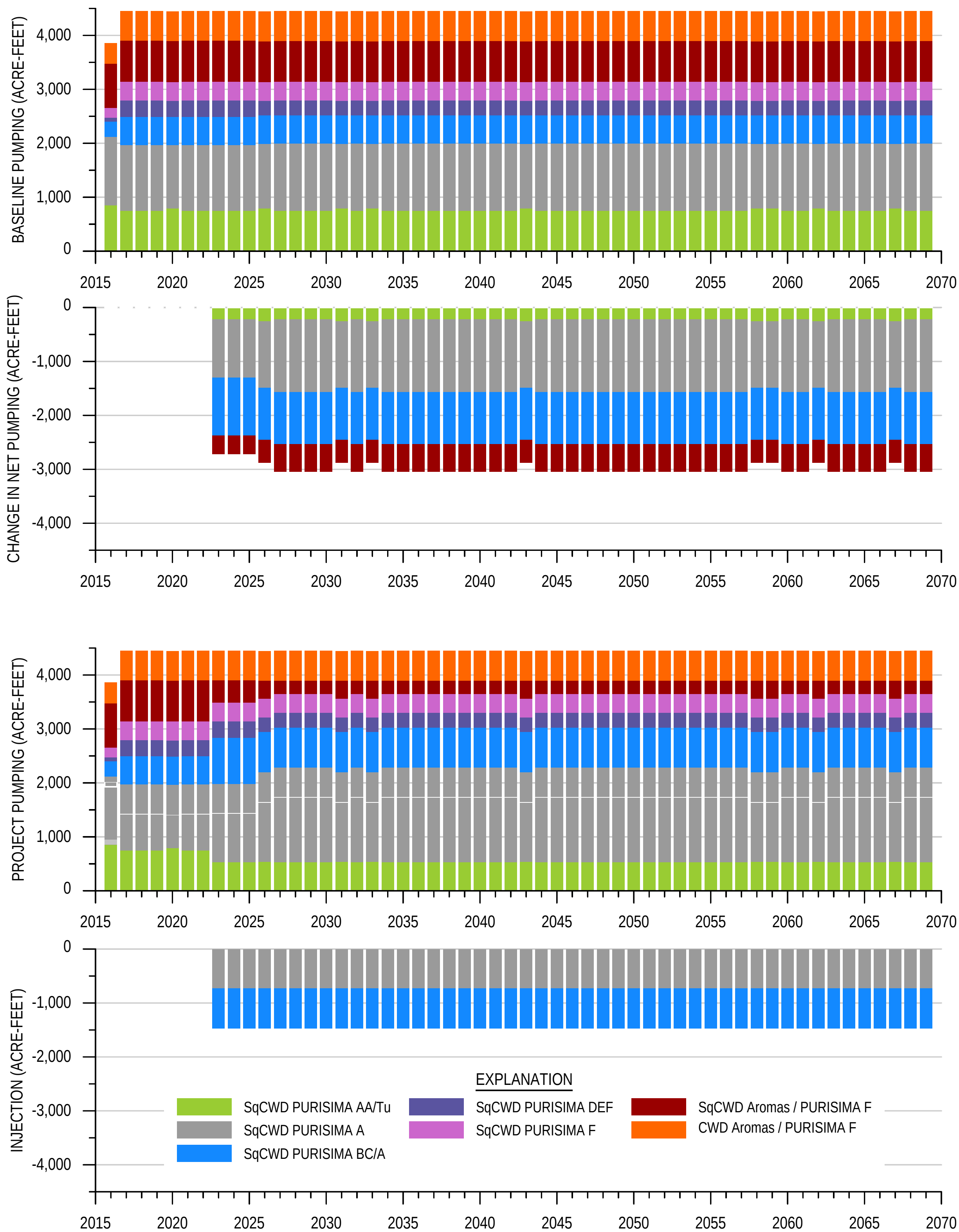

Figure 5. Central Water District and Soquel Creek Water District Pumping Distribution by Aquifer Unit for Baseline and Projects Simulation

2.6.2 City of Santa Cruz Baseline Pumping

Groundwater provides approximately 5% of the City of Santa Cruz's water supply. The City's groundwater pumping varies over time based on the availability of SCWD's surface water supplies. Total SCWD groundwater pumping by month was provided for the baseline simulation by Pueblo Water Resources Inc. based on availability of surface water under the Catalog Climate to meet WY 2016-2018 demands modeled by Gary Fiske & Associates. This work was supported by Balance Hydrologics as part of the SCWD's ASR feasibility evaluation. Groundwater pumping to the four existing Beltz wells was distributed based on historical pumping distributions in those wells during critically and non-critically dry years. Table 3 shows average pumping at the SCWD's Beltz wells for the baseline simulation over different time periods. The first plot of Figure 6 shows the pumping distribution used for the future baseline simulation. Total SCWD pumping averages approximately 350 acre-feet per year for the future baseline simulation.

Table 3. Average Pumping at Beltz Wells for the Baseline Simulation

Period	Beltz 8	Beltz 9	Beltz 10	Beltz 12	Total
	acre-feet per year				
2017-2019	49	127	100	74	350
2020-2025	99	129	96	40	364
2026-2039	100	131	96	42	369
2040-2069	90	119	88	39	337

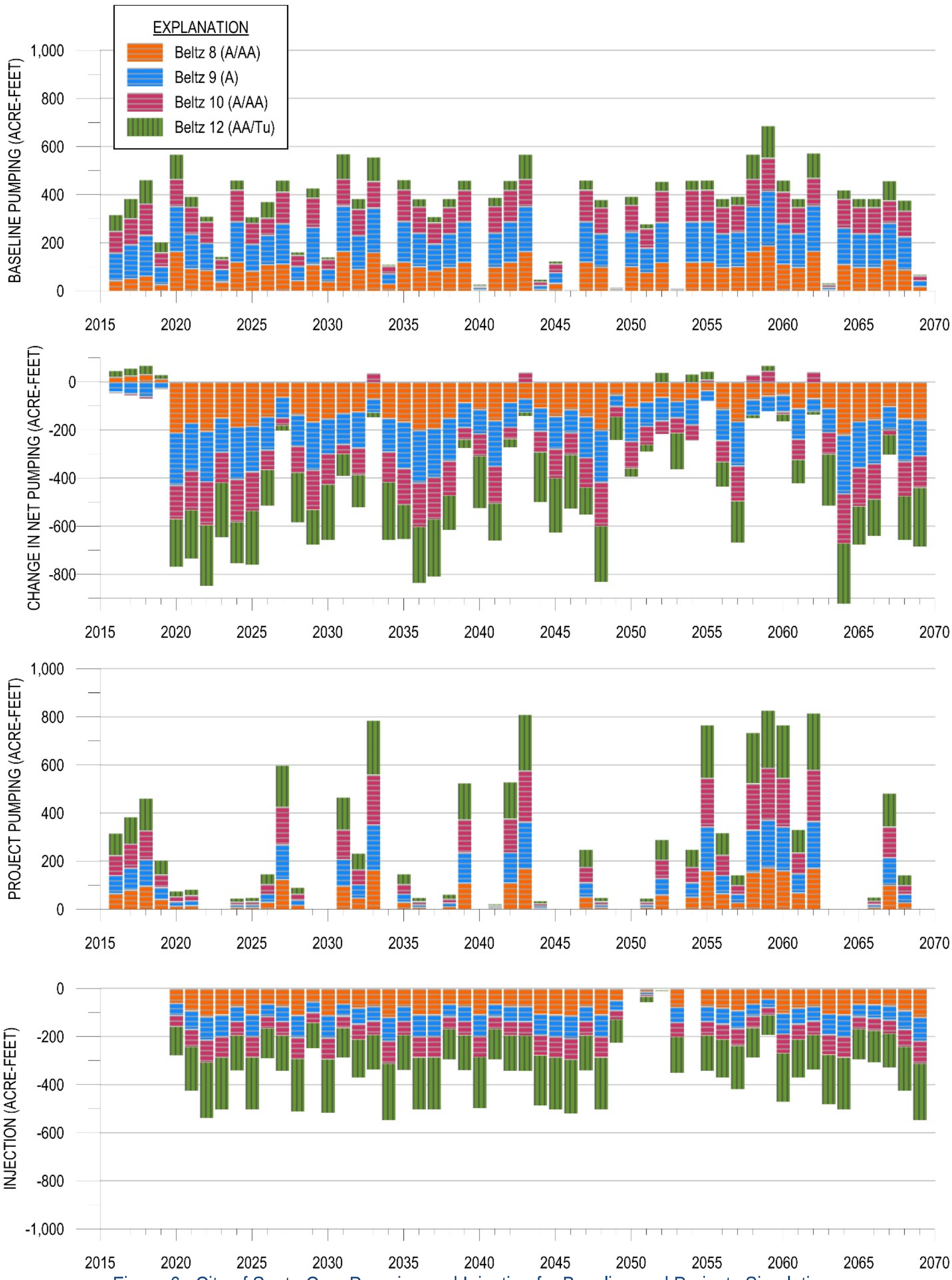

Figure 6. City of Santa Cruz Pumping and Injection for Baseline and Projects Simulations

2.6.3 Soquel Creek Water District Baseline Pumping

Groundwater pumping is assumed to supply 100% of Soquel Creek Water District's demand and thus, as described in Section 2.5.1, 3,900 acre-feet per year is pumped by Soquel Creek Water District in the future simulations. No surface water transfer is assumed and drought curtailment during critically dry years is also not assumed.

The baseline pumping distribution for SqCWD is based on implementing the management action of redistributing pumping to improve Basin sustainability without a project. Production wells used are the same as those included in the simulation of historical conditions, with the addition of the Granite Way well, which will come online in late 2019, and the Cunnison Way well, scheduled to come online in 2026. The pumping distribution is different in critically dry years versus non-critically dry years with the differences applied between April and September. Pumping is shifted inland from the Garnet well in critically dry years when City of Santa Cruz plans increased pumping near the Purisima A unit outcrop area as described in the cooperative monitoring and adaptive management agreement between SqCWD and SCWD. The distribution also changes when the Cunnison Way well comes online. Table 4 shows the pumping distribution. The first chart of Figure 5 shows the pumping distribution by aquifer unit used for the future baseline simulation.

Table 4. Pumping at SqCWD Wells for the Baseline Simulation

Well	Aquifer	2017-2025		2026-2069	
		Non-Critically Dry	Critically Dry	Non-Critically Dry	Critically Dry
		acre-feet per year			
O'Neill Ranch Well	Purisima AA/Tu	222	261	222	261
Main St Well	Purisima AA/Tu	528	532	528	532
Rosedale 2 Well	Purisima A/AA	544	553	544	553
Garnet Well	Purisima A	278	210	278	139
Cunnison Lane	Purisima A	0	0	230	230
Tannery Well II	Purisima A	399	408	196	277
Estates Well	Purisima BC/A	316	316	316	316
Madeline 2 Well	Purisima BC	98	98	98	98
Ledyard Well	Purisima BC	108	108	108	108
Aptos Creek Well	Purisima DEF/BC	0	0	0	0
T-Hopkins Well	Purisima DEF	156	156	137	137
Granite Way	Purisima DEF	145	145	135	135
Polo Grounds Well	Purisima F	100	100	100	100
Aptos Jr High Well	Purisima F	250	250	250	250
Country Club Well	Aromas / Purisima F	70	70	70	70
Bonita Well	Aromas / Purisima F	269	269	269	269
San Andreas Well	Aromas / Purisima F	371	371	371	371
Seascape Well	Aromas / Purisima F	46	46	46	46

Note: Totals do not equal 3,900 acre-feet per year due to rounding error

2.6.4 Non-Municipal Baseline Pumping

Groundwater pumping meets all of the non-municipal demand described in Section 2.5.2. The non-municipal demand averages approximately 1,600 acre-feet per year within the Basin. Figure 7 shows simulated non-municipal demand within the Basin and outside the Basin for categories of private/domestic, institutional, and agricultural. Since land use is not assumed to change, the locations of non-municipal pumping are the same as for simulation of historical conditions documented in the calibration report.

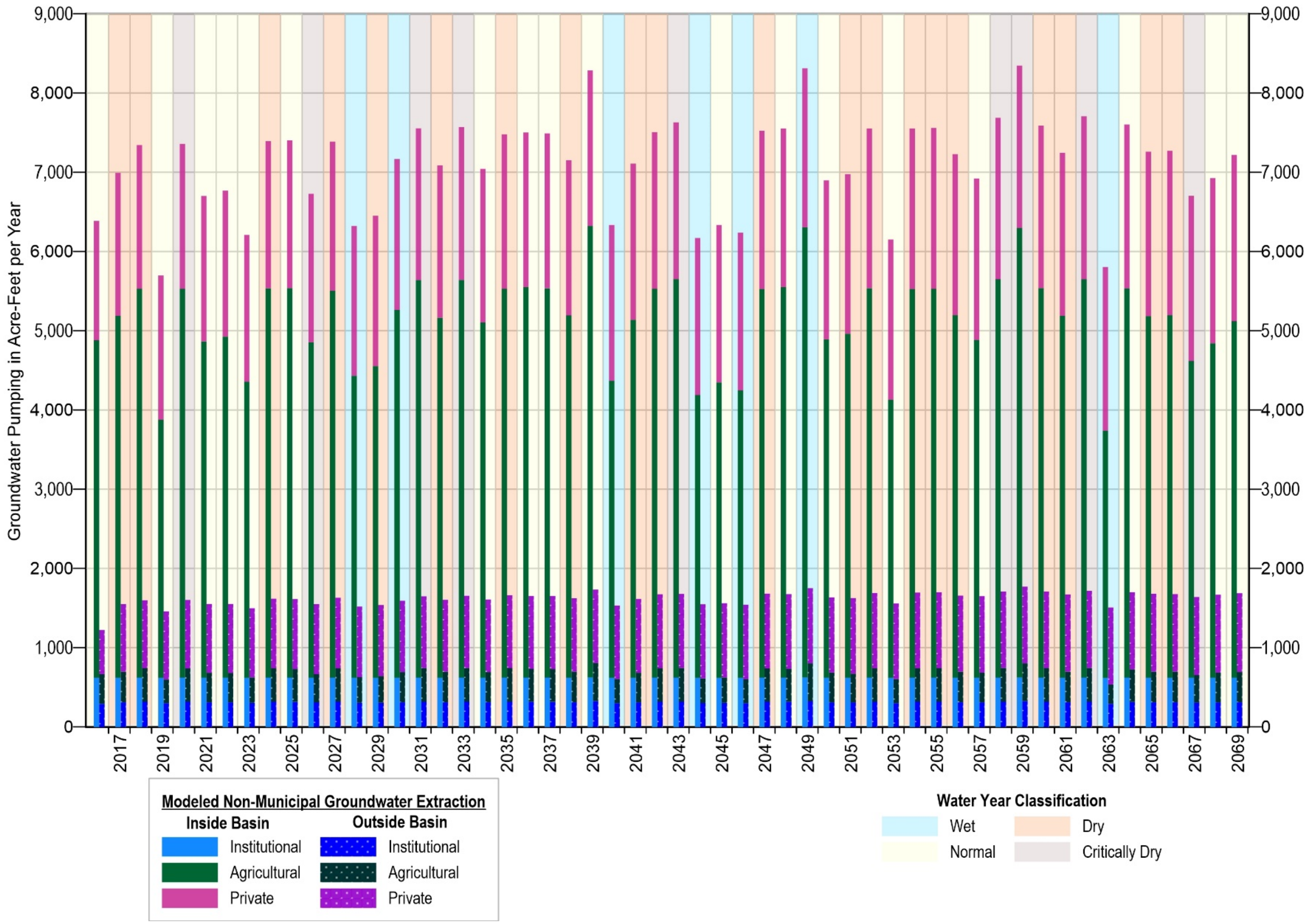

Figure 7. Non-Municipal Pumping for Baseline and Projects Simulation

3 PROJECT ASSUMPTIONS FOR FUTURE SIMULATIONS

The projects simulated by the model are SqCWD Pure Water Soquel (PWS) and the City of Santa Cruz Aquifer Storage and Recovery (ASR). These projects are included in the GSP as projects and management actions evaluated against the sustainable criteria. These are the projects included because they have been developed and thoroughly vetted by their respective proponent MGA member agency and are planned for near-term implementation by that agency.

The simulation of future conditions for the GSP includes both the PWS and ASR projects. This simulation provides information on whether the projects help achieve the sustainability goal and interim milestones. It is also used to estimate the future water budget with projects and management actions implemented as part of the GSP. In order to evaluate expected benefits of each project separately, a simulation of only PWS is performed. The expected benefits of PWS are evaluated by comparing the results of this simulation with the baseline simulation. The expected benefits of ASR are evaluated by comparing the results of the simulation of future conditions with both projects (PWS + ASR) to simulation of PWS only.

3.1 Description of Projects

3.1.1 Pure Water Soquel

SqCWD's Pure Water Soquel (PWS) would provide advanced water purification to existing secondary-treated wastewater that is currently disposed of in the Monterey Bay National Marine Sanctuary. The project would replenish 1,500 acre-feet per year of advanced purified water that meets or exceeds drinking water standards into aquifers within the Basin. Replenishment is currently planned at three locations in the central portion of SqCWD's service area. Purified water would mix with native groundwater and contribute to the restoration of the Basin, provide a barrier against seawater intrusion, and provide a drought proof and sustainable source of water supply. The conveyance infrastructure of PWS is being sized to accommodate the potential for future expansion of the Project's treatment system (if desired at a later time) and to convey up to approximately 3,000 acre-feet per year of purified water.

The PWS Environmental Impact Report (EIR) and project were approved by the lead agency in December 2018. The project is currently in the design and permitting phase and construction is anticipated to be completed in late 2022 with the project to come online in early 2023.

PWS injection is planned into the Basin's Purisima A and BC units. PWS also supports in-lieu recharge in aquifer units and areas where water is not directly injected. In-lieu recharge is facilitated in this simulation of PWS for the GSP by increasing SqCWD pumping from Purisima A and BC aquifer units where PWS injection takes place, which allows for reductions of

SqCWD pumping from the Tu aquifer unit in the western portion of the Basin and from the Purisima F and Aromas Red Sands in the eastern portion of the Basin. Figure 8 shows a map schematic of this strategy for the areas of injection (recharge, down arrows), increased pumping (plus signs), and decreased pumping (minus signs). Therefore, PWS is designed to provide benefits for sustainability throughout the portion of the Basin pumped by SqCWD.

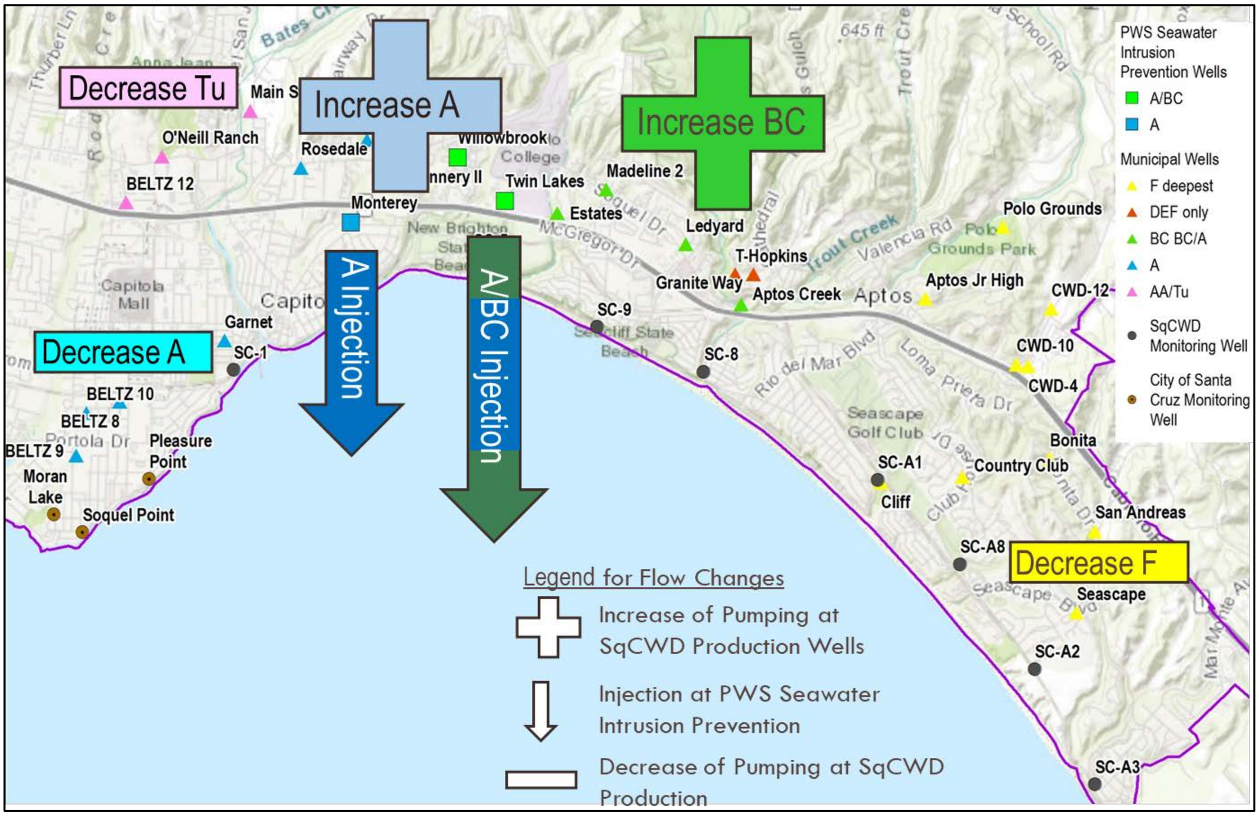

Figure 8 Map Schematic of Changes in Pumping Distribution from Pure Water Soquel Injection

3.1.2 City of Santa Cruz ASR

The ASR project would inject surface water from excess winter flows, treated to drinking water standards, into the natural structure of Basin aquifers which act as an underground storage reservoir. SCWD can treat excess surface water by improving the treatment process at its Graham Hill Water Treatment Plant. Surface water can only be considered excess if it is produced within SCWD's water rights, is above the volume of water required for SCWD operations, and after allowing for fish flows. The primary purpose of the ASR project is to store drinking water in the Basin to provide a drought supply for SCWD's service area. The ASR project is expected to also contribute to Basin sustainability but this may require additional capacity and changes to water rights.

As part of its efforts to update and align its water rights on the San Lorenzo River to incorporate fish flow requirements and provide additional operational flexibility including for ASR, the SCWD has initiated a water rights change process with the State Water Resources Control Board. Compliance with the California Environmental Quality Act (CEQA) for the water rights changes and the ASR project as well additional permitting will need to be completed before full scale ASR is implemented.

ASR pilot tests began at SCWD's Beltz 12 well in 2019. During the winter of 2019/2020, additional pilot testing at Beltz 12 may occur and an additional Beltz well is slated to be retrofitted for pilot testing. Assuming results from the initial pilot testing during 2019 continues to be positive and regulatory requirements are met, full scale phased implementation of ASR would occur beginning in 2021.

The ASR project modeled for the GSP optimizes existing SCWD infrastructure as a more efficient use of available resources to inject excess drinking water into Basin aquifers. However, since SCWD is in the process of developing its plans for the ASR project, eventual implementation of the ASR project may include different strategies and possibly new infrastructure. For evaluation in the GSP, simulations of the ASR project assume that injection and pumping recovery for ASR occurs at the existing Beltz wells: Beltz 8, Beltz 9, Beltz 10, and Beltz 12. These wells are screened in the Purisima A, Purisima AA, and Tu units. The simulation of ASR for the GSP also includes the possibility of in-lieu recharge that reduces groundwater pumping over some periods due to improved treatment and therefore delivers drinking water quality surface water to directly meet demand. Figure 9 shows a map schematic of the strategy for this simulation of ASR for the areas of injection (recharge, down arrows), increased average pumping (plus signs), and decreased average pumping (minus signs). The schematic shows average simulated changes from the assumed baseline, but injection and pumping compared to baseline varies over time based on surface water availability and demand.

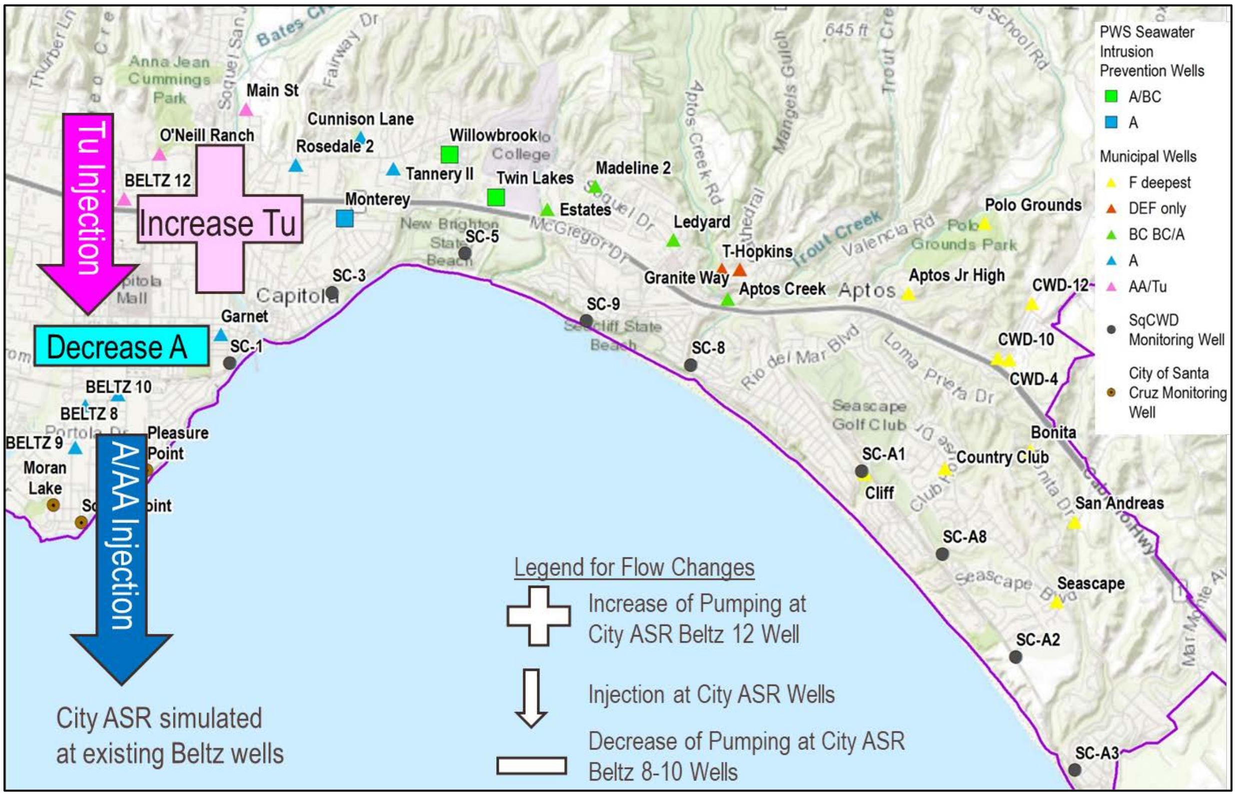

Figure 9 Map Schematic of Changes to ASR Injection and Pumping Distribution

3.2 Implementation of Projects in Model

Projects are simulated in the model by the Multi-Node Well 2 (MNW2) MODFLOW package. The package defines the model cell location of the wells and either the screen elevations or model layers of the screens. Monthly time series of well flows for both pumping and injection are assigned to each well in the model.

3.2.1 Pure Water Soquel

The PWS seawater intrusion prevention (SWIP) wells are added to the wells included in the baseline simulation. The SWIP wells are assigned to model cells based on their planned location and assigned specific model layers for injection. Injection rates are assigned based on estimated injection capacities for the wells and adjusted if model results show simulated groundwater elevations at the SWIP well rising above ground surface elevations. PWS injection at the SWIP wells is simulated to start October 2022 for Water Year 2023 and to continue for the remainder of the future conditions simulation (through Water Year 2069).

Table 5. Simulated SWIP Well Location and Injection Rates

Well	Aquifer	Injection (acre-feet per year) 2023-2069	Capacity Estimate Source	Notes
Monterey SWIP	Purisima A	500	Carollo, 2016	-
Willowbrook SWIP	Purisima A	233	Section 4.1	Screening Purisima BC also to be evaluated
Twin Lakes SWIP	Purisima BC/A	742	Preliminary Estimate from Pilot Testing	-

SqCWD pumping for PWS is redistributed from the baseline simulation to represent the strategy shown in Figure 8. Redistribution commences in Water Year 2023 with the commencement of PWS injection. Redistribution changes starting in Water Year 2026 when the Cunnison Lane well is simulated to come online. As with the baseline, redistributed pumping is different between critically and non-critically dry years. Monthly pumping is redistributed such that total monthly pumping is the same as the baseline simulations while pumping at any well does not exceed the well's monthly pumping capacity based on 50% runtime. The following summarizes the wells with pumping changes for PWS.

- Pumping increases at Tannery, Cunnison Lane (after it comes online in 2026), and Estates wells screened in the Purisima A unit where injection occurs from PWS SWIP wells.
- Pumping increases at the Estates, Madeline, Ledyard, and Aptos Creek wells screened in the Purisima BC unit where injection occurs from PWS SWIP wells.. The Estates well is screened in both the Purisima A and BC units.
- Pumping decreases at the Main Street and O'Neill Ranch wells in the Purisima AA and Tu units in the western portion of the Basin.
- Pumping decreases at the Garnet well in the Purisima A unit in the western portion of the Basin.
- Pumping decreases at the Bonita and San Andreas wells simulated to extract from the Purisima F unit in the eastern portion of the Basin.

Table 6 shows the pumping changes from baseline assumptions and redistributed pumping for simulations of PWS for critically and non-critically dry years. Figure 5 shows the change in pumping from baseline assumptions by aquifer unit over time and the redistributed pumping for the simulations of PWS under future conditions.

Table 6. Soquel Creek Water District Pumping Distribution by Well for Project Simulations in Critically and Non-Critically Dry Years

Well	Aquifer	Non-Critically Dry	Non-Critically Dry	Critically Dry	Average Change From Baseline
		acre-feet per year			
		2023-2025	2026-2069		
O'Neill Ranch Well	Purisima AA/Tu	182	182	181	-47
Main St Well	Purisima AA/Tu	348	348	352	-180
Rosedale 2 Well	Purisima A/AA	544	544	553	0
Garnet Well	Purisima A	222	222	123	-49
Cunnison Lane	Purisima A	0	426	426	184
Tannery Well II	Purisima A	689	563	563	348
Estates Well	Purisima BC/A	466	398	398	86
Madeline 2 Well	Purisima BC	122	122	122	24
Ledyard Well	Purisima BC	120	120	120	12
Aptos Creek Well	Purisima DEF/BC	144	102	102	105
T-Hopkins Well	Purisima DEF	156	137	137	0
Granite Way	Purisima DEF	145	135	135	0
Polo Grounds Well	Purisima F	100	100	100	0
Aptos Jr High Well	Purisima F	250	250	250	0
Country Club Well	Aromas / Purisima F	70	70	70	0
Bonita Well	Aromas / Purisima F	137	68	107	-190
San Andreas Well	Aromas / Purisima F	159	64	106	-293
Seascape Well	Aromas / Purisima F	46	46	46	0

Note: Totals do not equal 3,900 acre-feet per year due to rounding error

3.2.2 City of Santa Cruz ASR

The ASR project simulated for the GSP involves pumping and injection at existing SCWD wells also simulated in the baseline simulation: Beltz wells 8, 9, 10, and 12. Based on this configuration assumed for evaluation in the GSP, SCWD groundwater pumping and injection by month at each well was provided for the projects simulation by Pueblo Water Resources Inc. assuming a combined capacity for the four wells of 1.0 million gallons per day of injection and 1.5 million gallons per day of extraction. This time series input was based on availability of surface water under the Catalog Climate and WY 2016-2018 demands to meet ASR storage objectives as modeled by Gary Fiske & Associates as part of the SCWD's ASR feasibility evaluation. ASR is simulated to commence injection in Water Year 2020 and injection and pumping recovery continues through Water Year 2069 for the remainder of the simulation of future conditions.

The ASR pumping and injection distribution is based on estimated pumping and injection capacities for the wells and prioritization of Beltz 12 use due to less susceptibility to seawater intrusion. Beltz 12 is considered less susceptible to seawater intrusion based on its distance from coast and being screened in the Purisima AA and Tu units that do not outcrop offshore like the Purisima A unit where the other Beltz wells are screened. Therefore, the ASR pumping distribution is different than the pumping distribution assumed under the baseline simulation. As shown in Figure 9, ASR results in an increase in gross pumping from the Tu unit at the Beltz 12 well and a decrease in gross pumping from the Purisima A unit at the Beltz 8, 9, and 10 wells compared to the baseline simulation. Table 7 shows average assumed injection and pumping at the Beltz wells for ASR for different time periods.

Table 7. Average Pumping and Injection at Beltz Wells for Simulation of ASR

Period	Pumping (acre-feet per year)					Injection (acre-feet per year)				
	Beltz 8	Beltz 9	Beltz 10	Beltz 12	Total	Beltz 8	Beltz 9	Beltz 10	Beltz 12	Total
2017-2019	74	84	92	100	350	0	0	0	0	0
2020-2025	9	10	11	12	42	93	77	74	186	430
2026-2039	47	53	58	64	222	84	70	67	167	388
2040-2069	54	61	67	73	255	73	61	58	146	338

Based on the availability of the SCWD's surface water supply, injection and pumping with ASR varies over time as shown on Figure 6. The second chart of Figure 6 shows the annual change in net pumping with ASR compared to the baseline simulation. The third and fourth charts of Figure 6 shows annual pumping and injection respectively. The most significant shortage of surface water supply availability occurs in the two year period of Water Years 2058 and 2059 when pumping recovery is the greatest.

4 MODEL RESULTS

4.1 Evaluation of Well Capacities

The model is used to evaluate well capacities during injection by evaluating simulated heads at the well during injection in comparison to ground surface. Simulated heads substantially above ground surface indicate that the well capacity has been exceeded. Simulated heads at the wells are based on output from the model's MNW2 package that distinguish simulated heads in the well from groundwater elevations for the model grid cell representing aquifer conditions.

4.1.1 Pure Water Soquel

Simulated heads at the Monterey, Willowbrook, and Twin Lakes Church PWS SWIP wells are compared to ground surface elevations. The estimated injection rates of 500 acre-feet per year at the Monterey SWIP well and 742 acre-feet per year at the Twin Lakes Church SWIP well are not simulated to raise heads at the wells to ground surface. The injection rate of 233 acre-feet per year at the Willowbrook SWIP well is the estimated injection capacity based on simulated well heads rising near ground surface. Figure 10 shows the simulated heads at the three SWIP wells for the simulations of PWS with green line labeled PWS+ASR, and without (blue dashes labeled PWS) ASR compared to ground surface (black dashes). The difference between the simulations is negligible.

4.1.2 City of Santa Cruz ASR

Simulated heads at Beltz 8, 9, 10, and 12 wells planned for ASR are compared to ground surface elevations for the project simulation including ASR operations. The estimated total injection rate of 1.0 million gallons per day and distribution are based on groundwater levels at the wells rising to ground surface elevations but not substantially above ground surface. Figure 11 shows the simulated heads at the four Beltz ASR wells for the project's simulation, including ASR shown as a green line and labeled PWS+ASR compared to ground surface (black dashes). Also shown on Figure 11 are simulated heads for the baseline simulation (yellow line) and the simulation of PWS (blue dashes) without ASR. There is negligible effect of PWS at Beltz 8, 9, and 10. Reduction of Tu aquifer pumping planned with implementation of PWS does potentially limit injection capacity at Beltz 12.

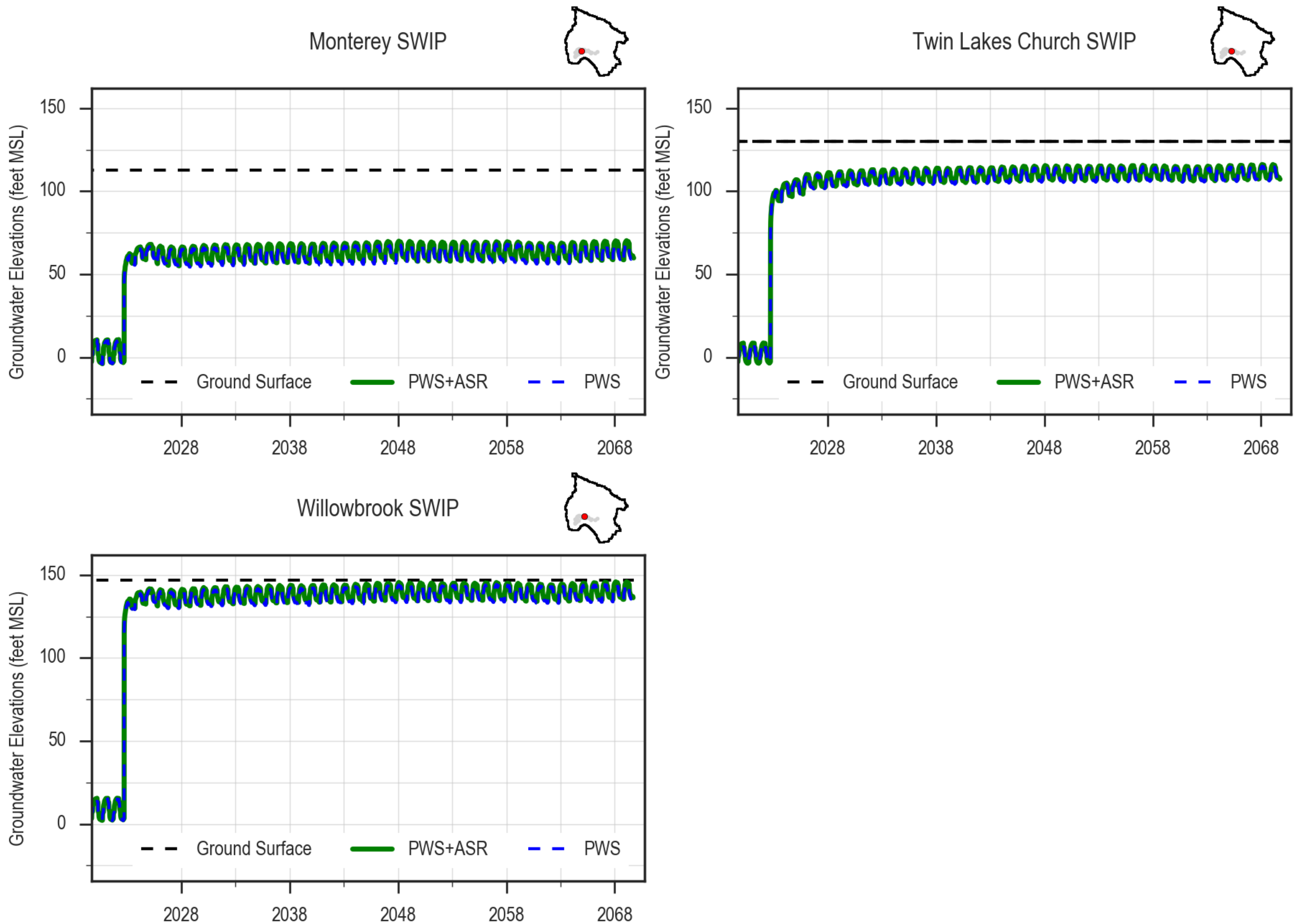

Figure 10. Simulated Well Heads at PWS Seawater Intrusion Prevention Wells versus Ground Surface

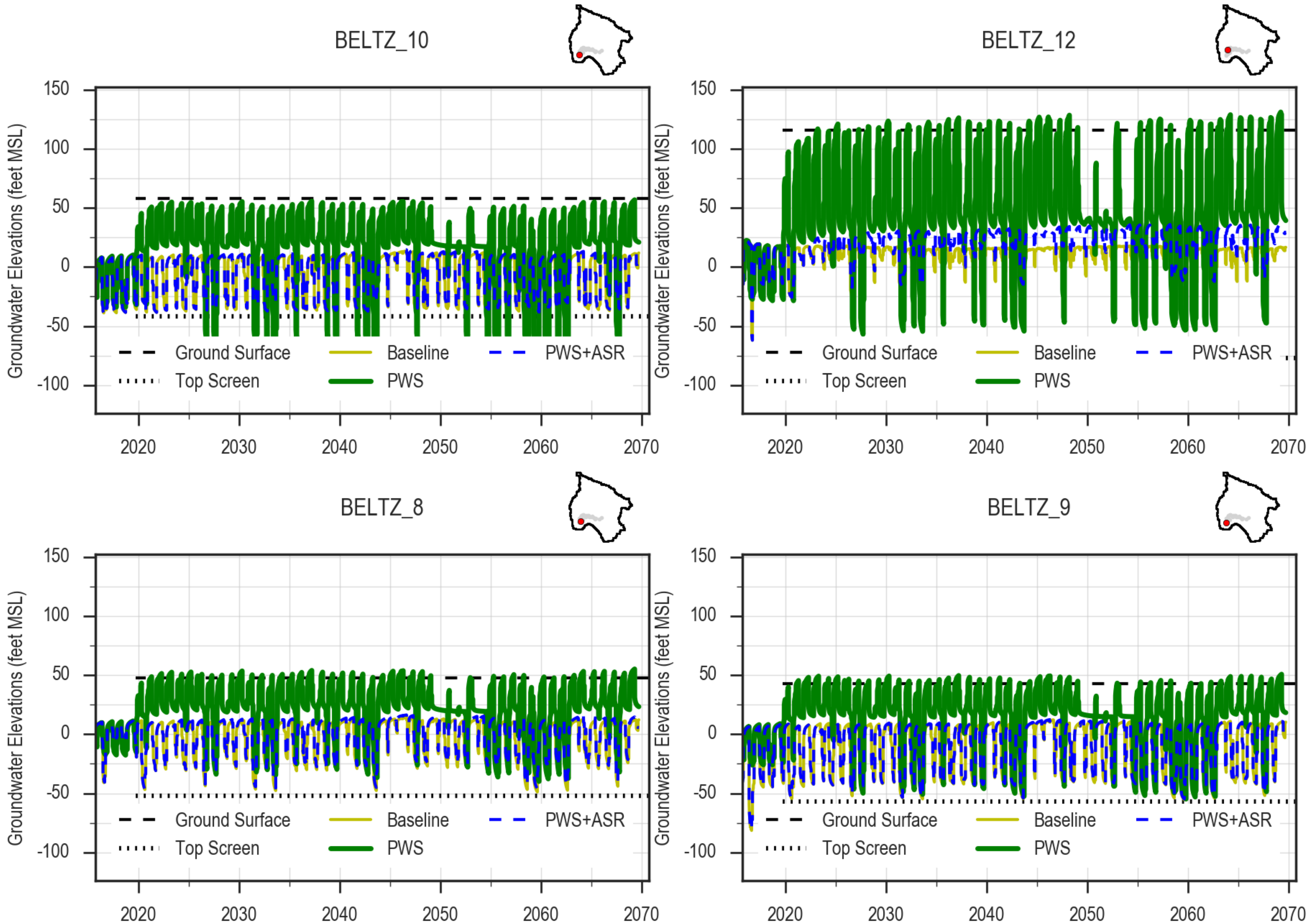

Figure 11. Simulated Well Heads at Beltz ASR Wells vs. Ground Surface

4.2 Expected Seawater Intrusion Benefits of Projects

Expected seawater intrusion benefits of projects are evaluated based on simulated groundwater elevations at the GSP's representative monitoring points with groundwater elevation proxies for protecting the Basin from seawater intrusion (Figure 12). The GSP defines the groundwater elevation proxies based on five-year averages so running five-year averages are calculated from the model's monthly output for comparison with minimum thresholds and measurable objectives. To avoid undesirable results, the running five-year average must achieve the groundwater elevation proxy for the minimum threshold at all of the representative monitoring points by 2040 and be maintained above the minimum threshold thereafter. The goal of the GSP is to achieve measurable objectives to provide operational flexibility, but five-year averages of groundwater elevations below measurable objectives are not considered undesirable results.

The effect of sea level rise is incorporated into the model evaluation of whether projects can raise and maintain groundwater elevations to meet and exceed the groundwater elevation proxies for minimum thresholds. As described in Section 2.3, the model incorporates projected sea level rise up to 2.3 feet in the offshore boundary condition for simulations of future conditions. Since the datum in the model is set at current sea level, simulated future groundwater levels were compared to the groundwater elevation proxies plus the total sea level rise of 2.3 feet. This allows evaluation of whether projects and management actions will raise and maintain groundwater elevations to meet groundwater elevation proxies relative to projections of higher sea levels.

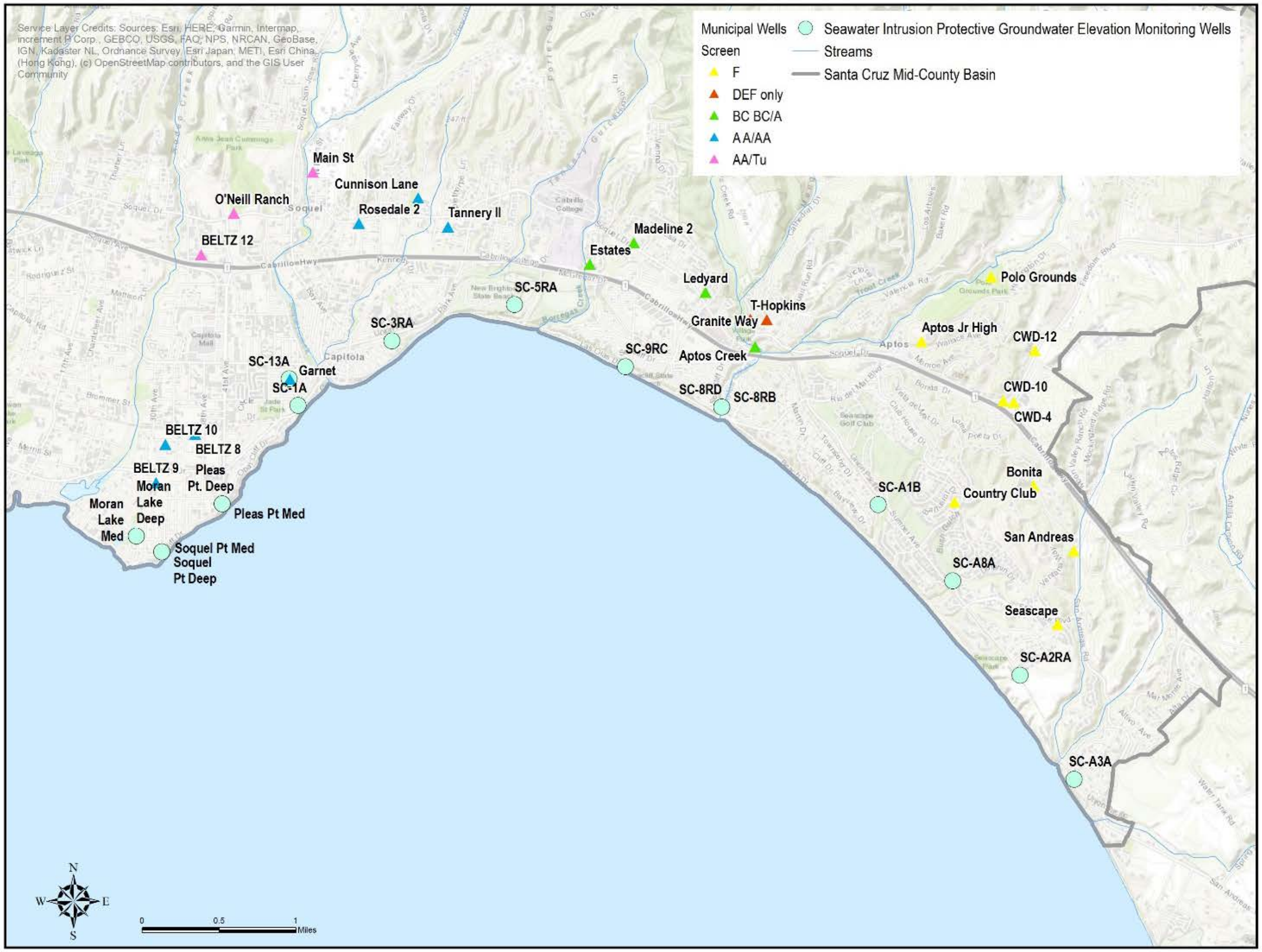

Figure 12. Locations of Representative Monitoring Points with Groundwater Elevation Proxies for Seawater Intrusion in Relation to Municipal Production Wells

4.2.1 Pure Water Soquel

A simulation of the PWS project under projected future climate conditions using the model demonstrates expected Basin sustainability benefits include raising running five-year average groundwater levels at coastal monitoring throughout SqCWD's service area to reduce the risk of seawater intrusion. The figures below show running five-year averages of simulated groundwater levels at representative monitoring points for seawater intrusion in the SqCWD's service area. The simulated groundwater levels are compared to groundwater elevation proxies for minimum thresholds (black dots) and measurable objectives (black dashes) adjusted for sea level rise.

Without the project (yellow line labeled Baseline), undesirable results for seawater intrusion are projected to occur in the Purisima A (Figure 13), Purisima BC (Figure 13), Purisima F (Figure 14) and Tu aquifer units (Figure 15). Running five-year average simulated groundwater levels are projected to be below the minimum threshold at representative monitoring points in these aquifer units pumped by SqCWD.

In the Purisima A and BC aquifer units where PWS injection occurs, groundwater levels are projected to rise to or above measurable objectives (blue dashes labeled PWS) even as pumping is increased from these aquifer units (Figure 13).

In the Purisima F and Aromas Red Sands aquifer units where pumping is reduced under PWS, groundwater levels (blue dashes labeled PWS overlying green line labeled PWS+ASR) are projected to rise above or near measurable objectives by 2040 and to be maintained above minimum thresholds thereafter so that undesirable results for seawater intrusion do not occur (Figure 14).

Figure 15 shows how pumping reduction from the Purisima AA and Tu units under PWS (blue dashes) also is projected to raise groundwater levels above minimum thresholds to prevent undesirable results for seawater intrusion.

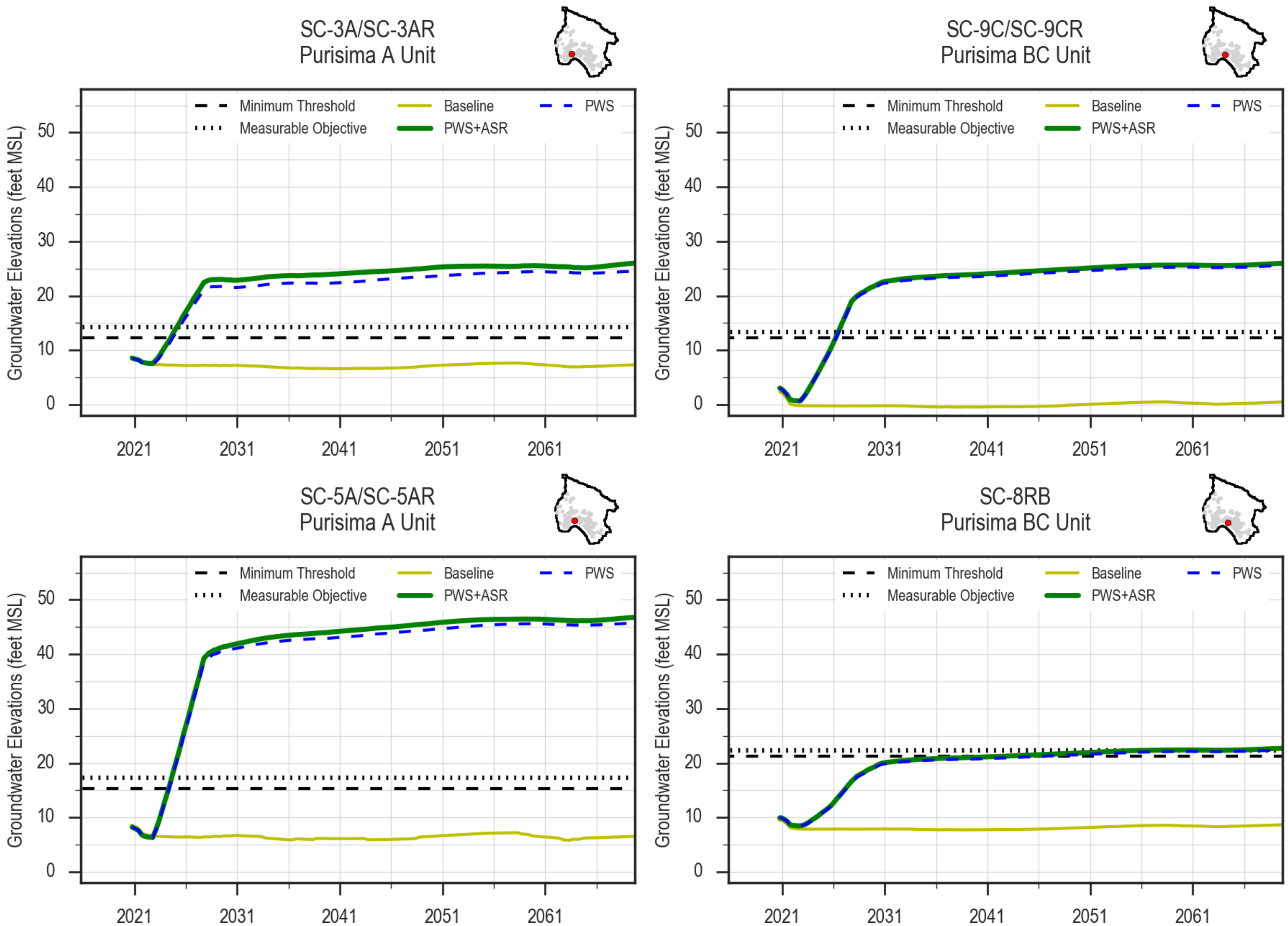

Figure 13. Running Five-Year Average Model Simulated Groundwater Elevations at Coastal Monitoring Wells in Purisima A and BC Units

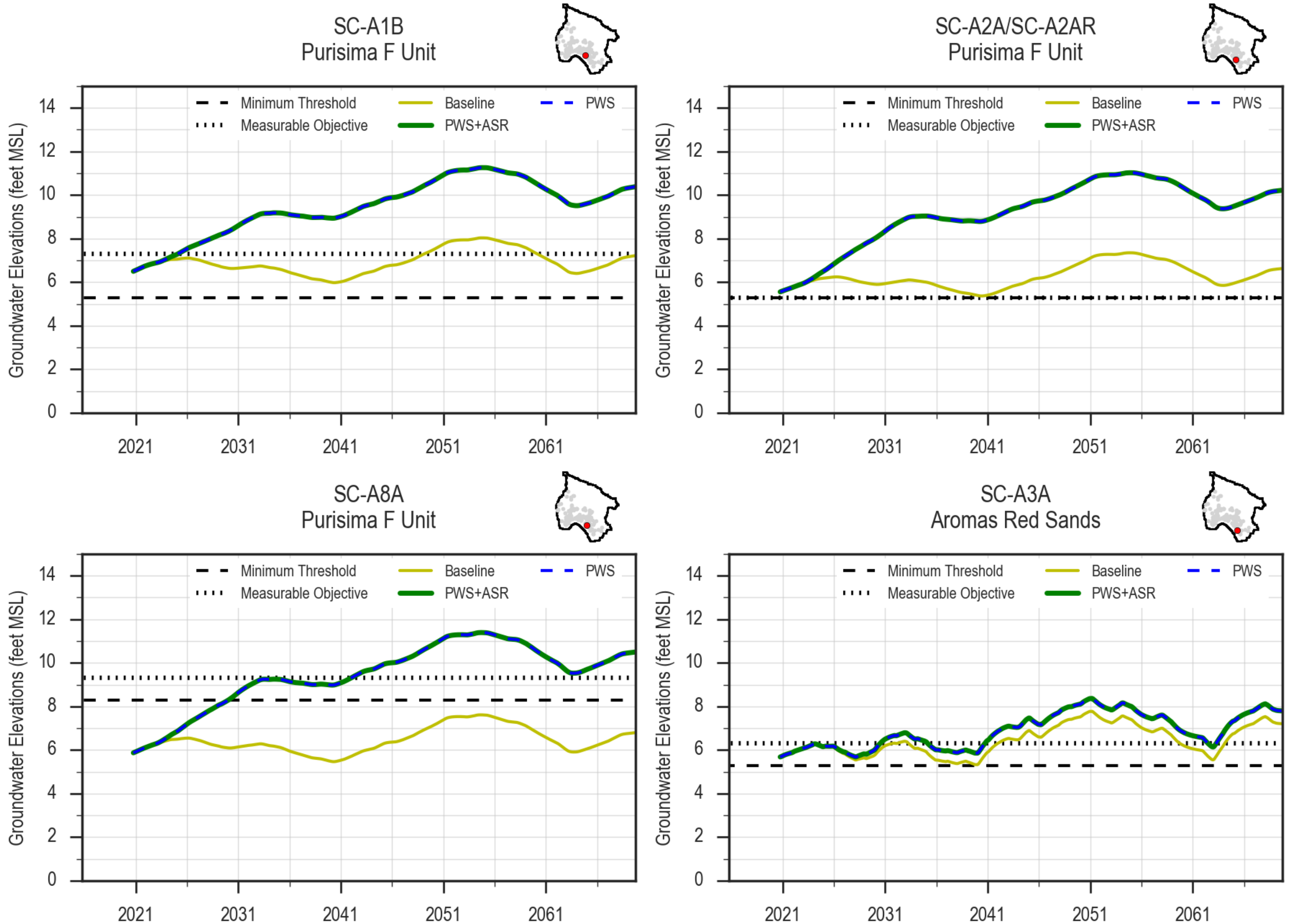

Figure 14. Running Five-Year Average Model Simulated Groundwater Elevations at Coastal Monitoring Wells in Purisima F and Aromas Red Sands Units

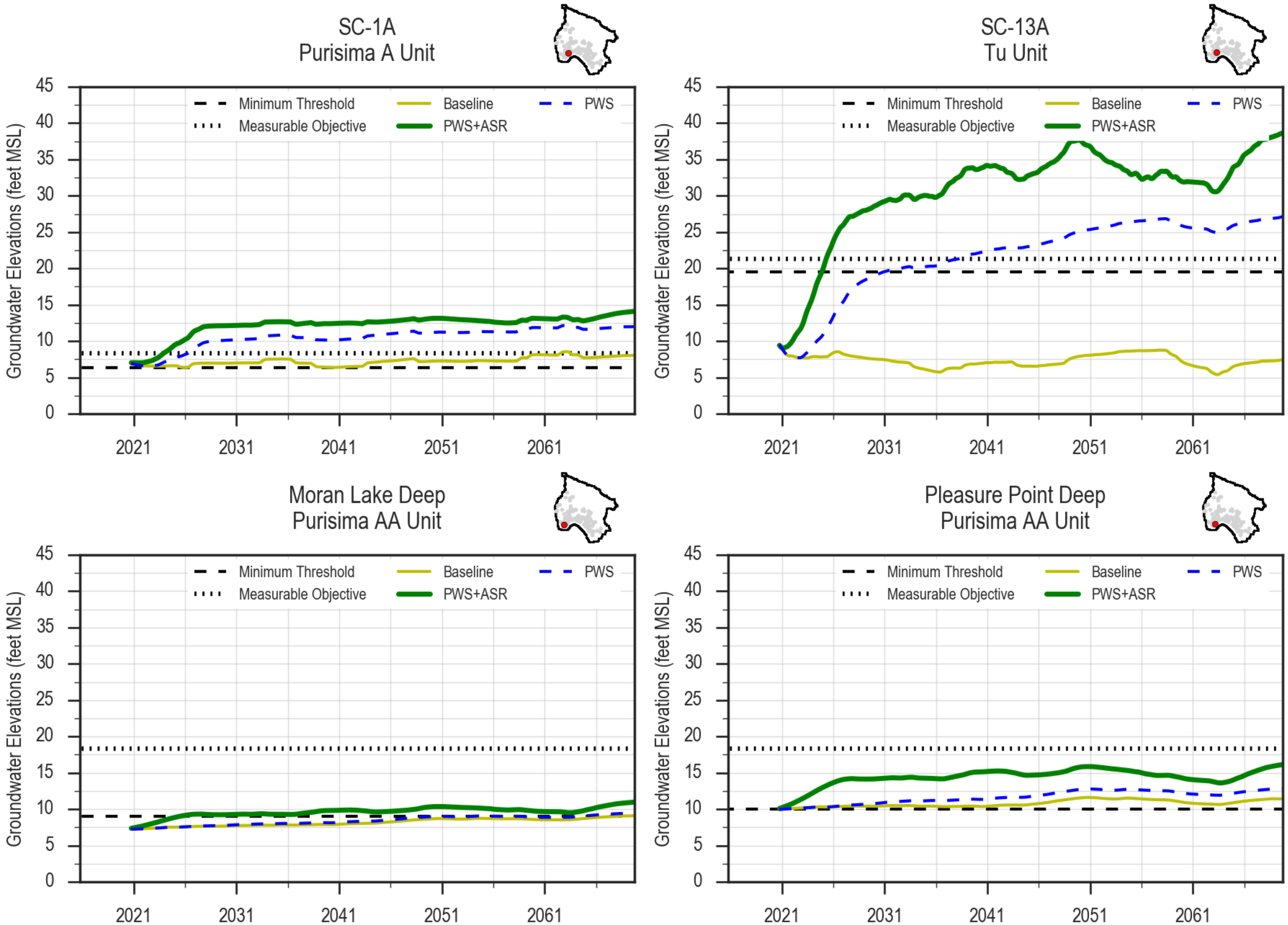

Figure 15. Running Five-Year Average Groundwater Elevations at Coastal Monitoring Wells in Tu and Purisima AA and A Units

4.2.2 City of Santa Cruz ASR

Expected benefits for seawater intrusion sustainability are to raise average groundwater levels at coastal monitoring in SCWD’s service area and reduce the risk of seawater intrusion. A simulation of ASR, in combination with the PWS, under projected future climate conditions using the model demonstrates these expected benefits. Figure 15 shows running five-year average simulated groundwater levels at Moran Lake, Soquel Point and Pleasure Point representative monitoring points for seawater intrusion (Figure 12) in SCWD’s service area. The simulated groundwater levels are compared to groundwater elevation proxies for minimum thresholds (black dots) and measurable objectives (black dashes) adjusted for sea level rise.

Without ASR, undesirable results are projected to occur as running five-year average simulated groundwater levels are projected to be below the minimum threshold in the Purisima AA unit under the baseline projection. The baseline projection also projects that measurable objectives at the representative monitoring points in the Purisima A unit will not be achieved or maintained. These conditions occur whether or not PWS is implemented (yellow line labeled Baseline vs. blue dashes labeled PWS) as PWS does not substantially raise groundwater levels in much of the SCWD service area.

With ASR that injects water at the existing SCWD Beltz wells and reduces pumping at the Beltz wells (green line labeled PWS+ASR), it is projected that measurable objectives will be achieved and maintained in the Purisima A unit that is the primary source of groundwater supply for SCWD, and minimum thresholds will be achieved and maintained in the Purisima AA unit such that undesirable results for seawater intrusion do not occur. ASR is projected to raise groundwater levels sufficiently such that sustainability is maintained even as SCWD increases recovery pumping to meet drought demand from the 2050s into the early 2060s.

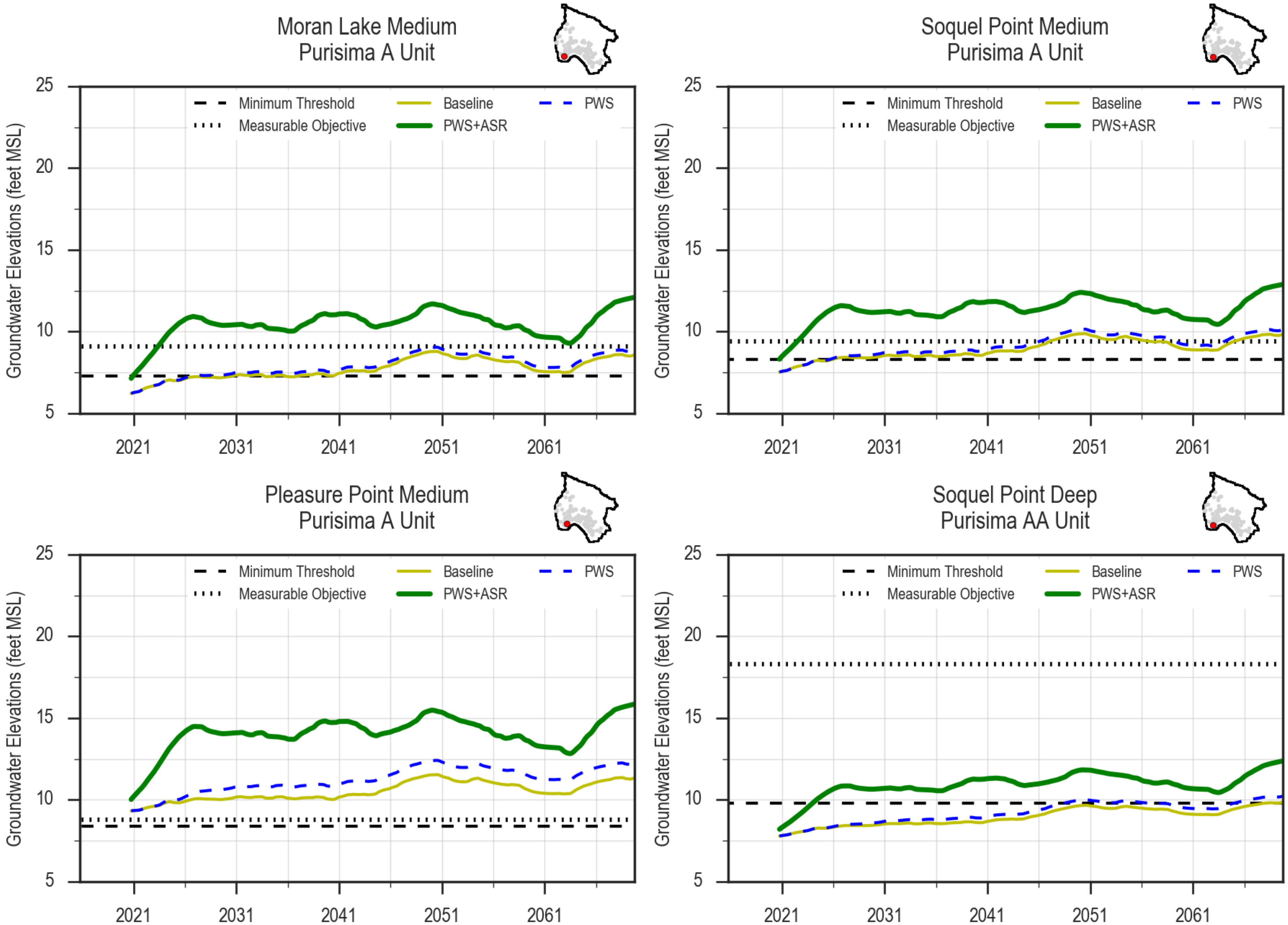

Figure 16. Running Five-Year Average Groundwater Elevations at Coastal Monitoring Wells in Purisima AA and A Units

4.3 Expected Streamflow Depletion Benefits of Projects

Expected streamflow depletion benefits of projects are evaluated based on simulated groundwater elevations at the GSP's representative monitoring points at shallow wells along Soquel Creek with groundwater elevation proxies for preventing increased surface water depletion (Figure 17). The GSP defines the groundwater elevation proxies based on minimum annual groundwater elevations so monthly results from the model are compared to groundwater elevation proxies. To avoid undesirable results, seasonal low groundwater elevations must be above the groundwater elevation proxy for the minimum threshold at all of the representative monitoring points starting in 2040. The goal of the projects is to achieve measurable objectives to provide operational flexibility, but groundwater elevations below measurable objectives are not considered undesirable results.

Figure 17. Locations of Monitoring Wells used as Representative Monitoring Points with Groundwater Elevation Proxies for Streamflow Depletion

4.3.1 Pure Water Soquel

Pure Water Soquel replenishment into the Purisima A unit is also expected to benefit the streamflow depletion sustainability indicator by raising shallow groundwater levels along Soquel Creek. Without PWS (yellow line labeled Baseline), simulated monthly groundwater levels are projected to be below the minimum threshold at most of the shallow wells. With the PWS project, shallow groundwater levels (blue dashes labeled PWS) are projected to rise to measurable objectives and be maintained above minimum thresholds to prevent undesirable results for surface water depletions (Figure 18 and Figure 19).

Figure 18. Simulated Groundwater Elevations at Purisima A Unit along Soquel Creek

4.3.2 City of Santa Cruz ASR

The hydrographs on Figure 19 show that expected benefits are maintained when combining SCWD’s ASR project to PWS (green line labeled PWS+ASR). In addition, shallow groundwater levels rise to measurable objectives at the representative monitoring points for surface water depletion.

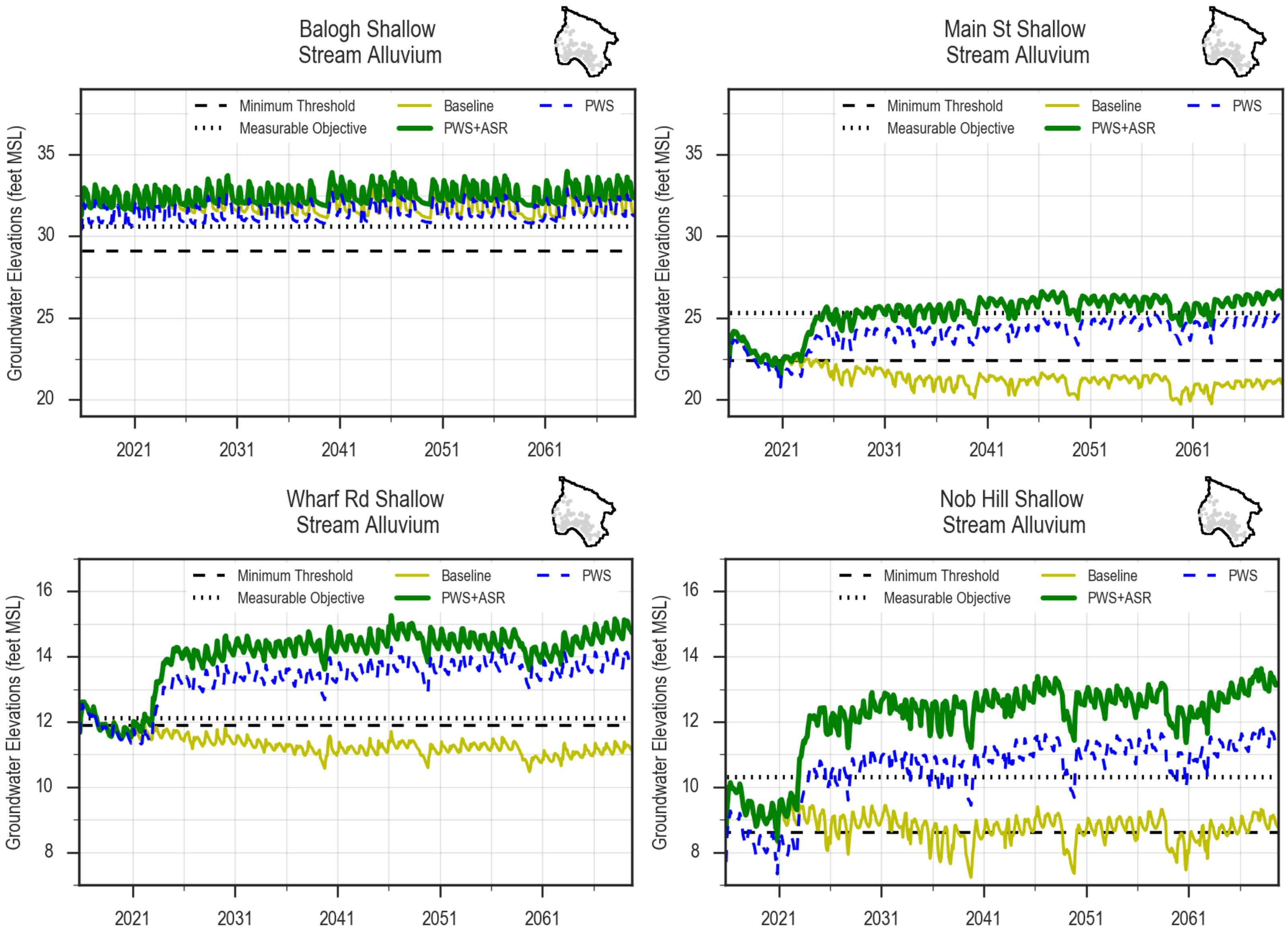

Figure 19. Simulated Groundwater Elevations at Shallow Monitoring Wells along Soquel Creek

4.4 Estimates of Interim Milestones

Interim milestones are interim measurable objectives set at five-year intervals and will be used to measure progress toward the minimum thresholds and measurable objective by 2040. The model is used to estimate groundwater elevation proxies for interim milestones based on the simulation of projects (PWS+ASR) under future conditions at representative monitoring points for seawater intrusion and surface water depletion. The interim milestones are based on modeled groundwater elevation results at representative monitoring points for 2025, 2030, and 2035.

If simulated groundwater elevations in 2025 are above minimum thresholds, the minimum thresholds are used as the interim milestone because there is some uncertainty about when projects would begin. This GSP sets as an interim milestone the elimination of undesirable results by 2025 at locations where model results show it is achievable with project implementation. If modeled groundwater levels in 2030 and 2035 are above measurable objectives, the measurable objectives are used as the interim milestones for those years.

4.4.1 Seawater Intrusion Interim Milestones

Groundwater elevation proxies for seawater intrusion are based on the five-year average of simulated groundwater elevations in Water Years 2025, 2030, and 2035. The simulated groundwater elevations are plotted as the green line labeled PWS+ASR in Figure 13 through Figure 16. Table 8 summarizes the interim milestones for seawater intrusion groundwater elevation proxies.

Table 8. . Interim MIlestones for Seawater Intrusion Groundwater Elevation Proxies

Representative Monitoring Well with Aquifer Unit in Parenthesis	Minimum Threshold	Measurable Objective	Interim Milestone 2025	Interim Milestone 2030	Interim Milestone 2035
	feet above mean sea level				
SC-A3A (Aromas)	3	7	3	3.7	3.7
SC-A1B (F)	3	5	3	5	5
SC-A8RA (F)	6	7	4.5	6.0	6.9
SC-A2RA (F)	3	4	3	4	4
SC-8RD (DEF)	10	11	10	10	10
SC-9RC (BC)	10	11	4.6	11	11
SC-8RB (BC)	19	20	8.4	16.6	18.1
SC-5RA (A)	13	15	13	15	15
SC-3RA (A)	10	12	10	12	12
SC-1A (A)	4	6	4	6	6
Moran Lake Medium (A)	5	6.8	5	6.8	6.8
Soquel Point Medium (A)	6	7.1	6	7.1	7.1
Pleasure Point Medium (A)	6.1	6.5	6.1	6.5	6.5
Moran Lake Deep (AA)	6.7	16	6.7	8.1	7.8
Soquel Point Deep (AA)	7.5	16	7.5	8.3	8.3
Pleasure Point Deep (AA)	7.7	16	7.7	11.8	11.9
SC-13A (Tu)	17.2	19	8.3	16.7	18.1

4.4.2 Surface Water Depletion Interim Milestones

Groundwater elevation proxies for seawater intrusion are based on the annual minimum of simulated groundwater elevations in Water Years 2025, 2030, and 2035. The simulated groundwater elevations are plotted as the green line labeled PWS+ASR in Figure 19. Table 9 summarizes the interim milestones for depletion of interconnected surface water groundwater elevation proxies.

Table 9. Interim Milestones for Deletion of Interconnected Surface Water Groundwater Elevation Proxies

Representative Monitoring Well with Aquifer Unit in Parenthesis	Minimum Threshold	Measurable Objective	Interim Milestone 2025	Interim Milestone 2030	Interim Milestone 2035
	feet above mean sea level				
Balogh	29.1	30.6	29.1	30.6	30.6
Main St. SW 1	22.4	25.3	20.7	22.9	23.2
Wharf Road SW	11.9	12.1	11.3	12.1	12.1
Nob Hill SW 2	8.6	10.3	7.3	9.5	9.9
SC-10RA	68	70	68	70	70

4.5 Basinwide Groundwater Elevation Effects of Projects

Projects are also evaluated based on the area where the projects affect groundwater elevations. Three maps are created for each aquifer unit to evaluate effects of PWS and ASR individually, and the projects in combination.

1. Pure Water Soquel: The effect of PWS is evaluated by mapping the groundwater elevation (head) difference between the PWS simulation and the baseline simulation in September 2039, the approximate seasonal low period before the January 2040 deadline to achieve sustainability.

2. City of Santa Cruz Aquifer Storage and Recovery: The effect of ASR is evaluated by mapping the groundwater elevation (head) difference between the PWS+ASR simulation and the PWS simulation in September 2039, the approximate seasonal low period before the January 2040 deadline to achieve sustainability.

3. Projects in Combination: The effect of the projects in combination is evaluated by mapping the groundwater elevation difference between the PWS+ASR simulation and the baseline simulation in October 2059 at the end of the two year drought over which ASR has its maximum pumping recovery. This will evaluate effects of combined projects when ASR pumping recovery to meet SCWD drought needs is causing groundwater elevations to drop.

The following subsections describe groundwater elevation effects by aquifer unit.

4.5.1 Purisima DEF/F Unit Groundwater Elevation Effects

The simulations of PWS redistribute pumping so that pumping is reduced at the San Andreas and Bonita wells in the Purisima F unit. The PWS and PWS+ASR simulations also increase pumping at the Aptos Creek well that is screened in both the Purisima DEF and BC units. The ASR project does not make any pumping or injection changes to the Purisima DEF or F units.

The upper map of Figure 20 shows the benefits of pumping redistribution with PWS that reduces pumping in the Purisima F unit. Pumping reductions facilitate in-lieu recharge to raise groundwater elevations (green areas) in the Aromas area (southeast portion of the Basin). Increases in groundwater elevations extend to the coastal boundary of the Basin and also across the Basin boundary into the Pajaro Valley Subbasin.

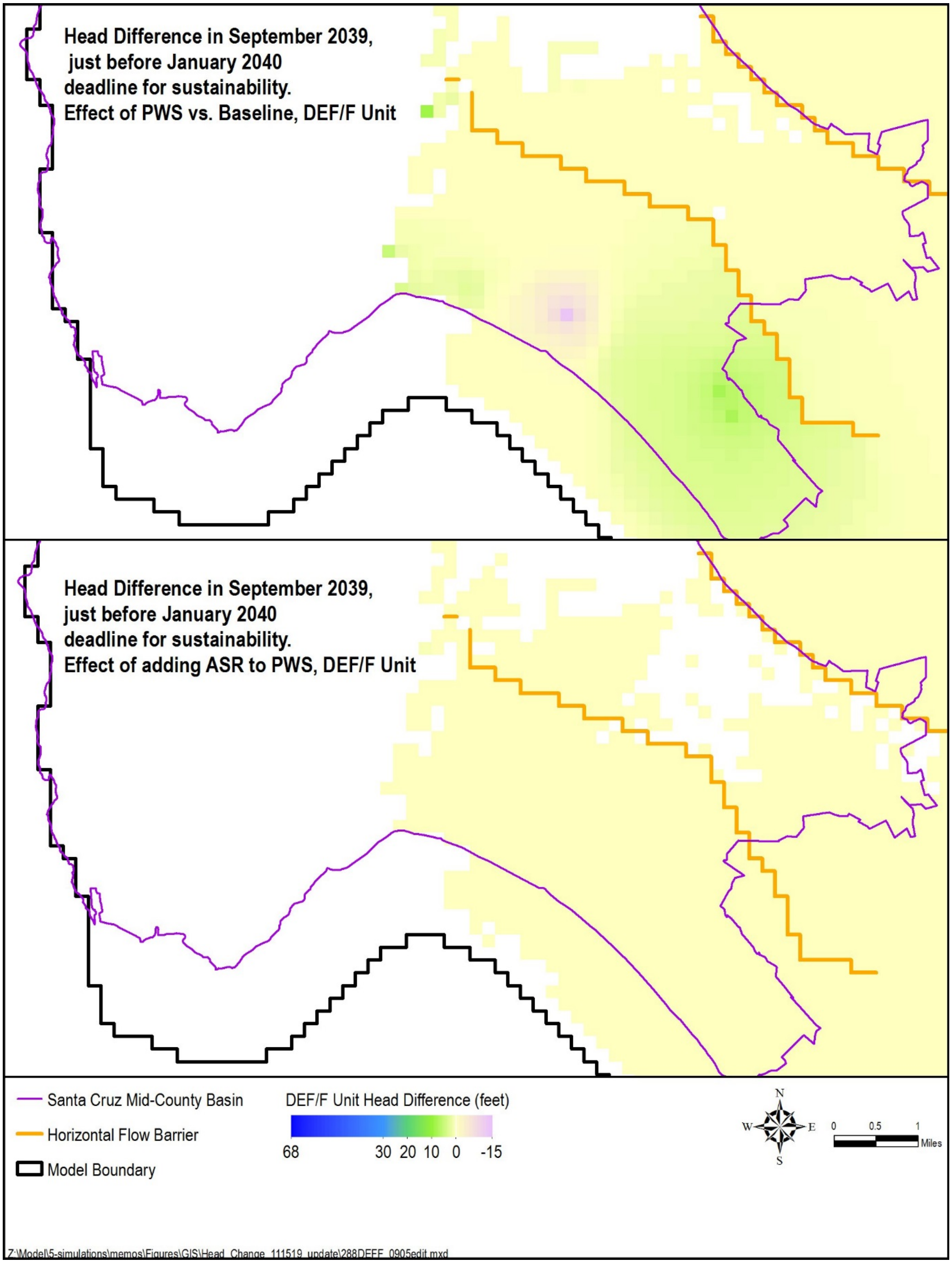

Figure 20. Simulated Effect of ASR and PWS on September 2039 Groundwater Elevations, DEF/F Unit

The upper map of Figure 20 shows decreases in groundwater elevations in the Purisima DEF unit (violet area) related to increased pumping at the Aptos Creek well. These simulation results show that the groundwater level decrease in the Purisima DEF unit does not extend to the coast, but the calibration report notes that the model is not calibrated to simulate the confined portion of the Purisima DEF unit. Adjustments to pumping from the Aptos Creek well and other Purisima DEF wells will likely be necessary during implementation to ensure groundwater elevations do not decline at the coast.

The ASR project does not have any effect in these aquifer units as shown on the lower map of Figure 20. Figure 21 that shows the effects of projects in combination is very similar to the upper map of Figure 20 because only PWS affects this area.

4.5.2 Purisima BC Unit Groundwater Elevation Effects

The simulations of PWS include injection into the Purisima BC unit at the Twin Lakes Church SWIP well. The PWS and PWS+ASR simulations also increase pumping at the Aptos Creek, Madeline, Ledyard, and Estates wells screened in the Purisima BC unit. The ASR project does not make any pumping or injection changes to the Purisima BC unit.

The upper map of Figure 22 shows the benefits of PWS injection into the Purisima BC unit. The largest increase (darkest blue area) is at the Twin Lakes Church SWIP well and increases extend to the coastal boundary of the Basin. Groundwater elevation increases are also simulated in the area of the Purisima BC unit where pumping from the unit is increased at SqCWD production wells.

The ASR project does not have any effect in this aquifer unit as shown on the lower map of Figure 22. Figure 23 that shows the effects of projects in combination is similar to the upper map of Figure 22 because only PWS affects this area. Figure 23 shows groundwater elevations are simulated to rise between 2040 and 2059 with nearly 20 years of additional injection into the Purisima BC unit.

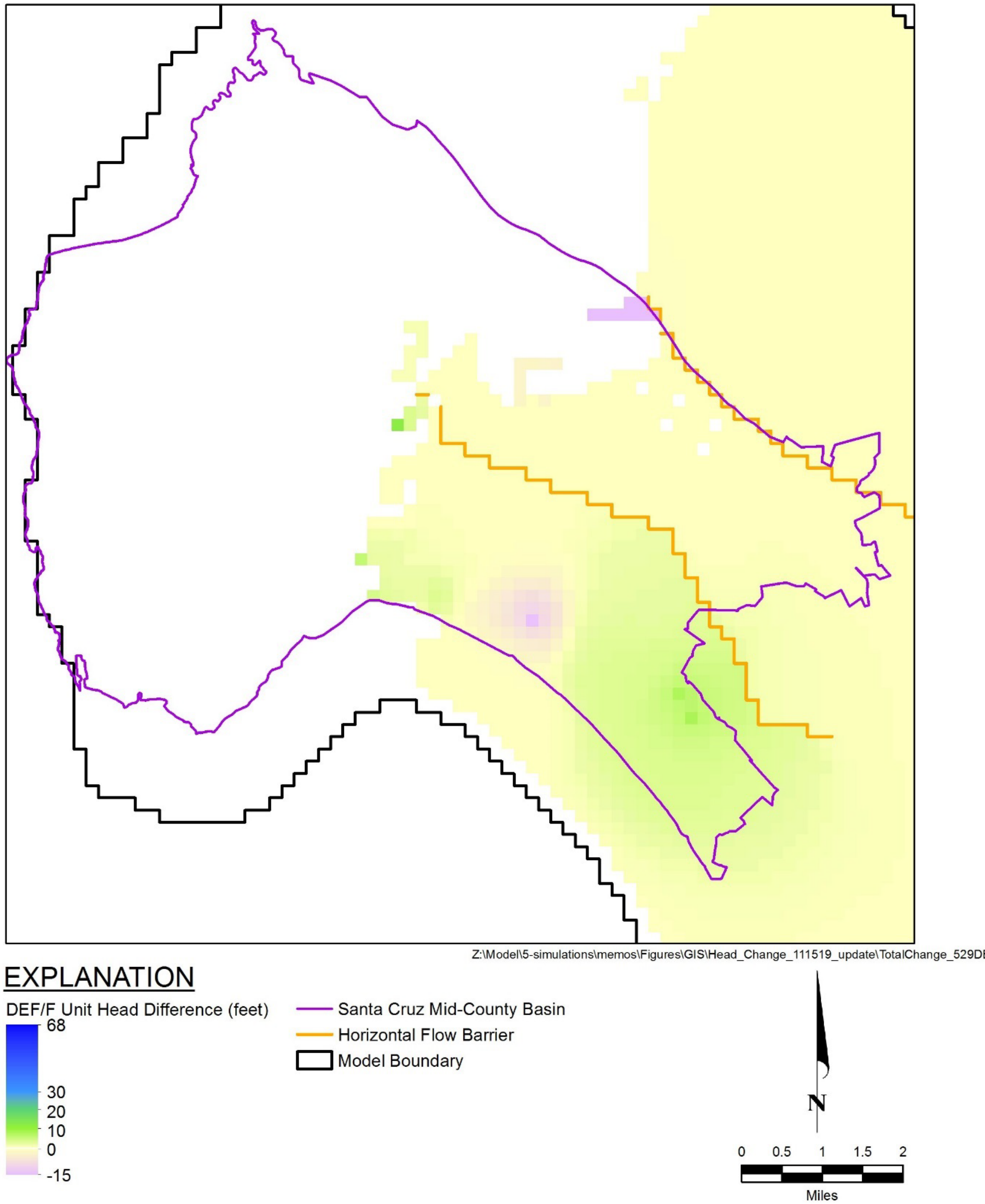

Figure 21. Simulated Effect of ASR and PWS on Groundwater Elevations on October 2059, DEF/F Unit

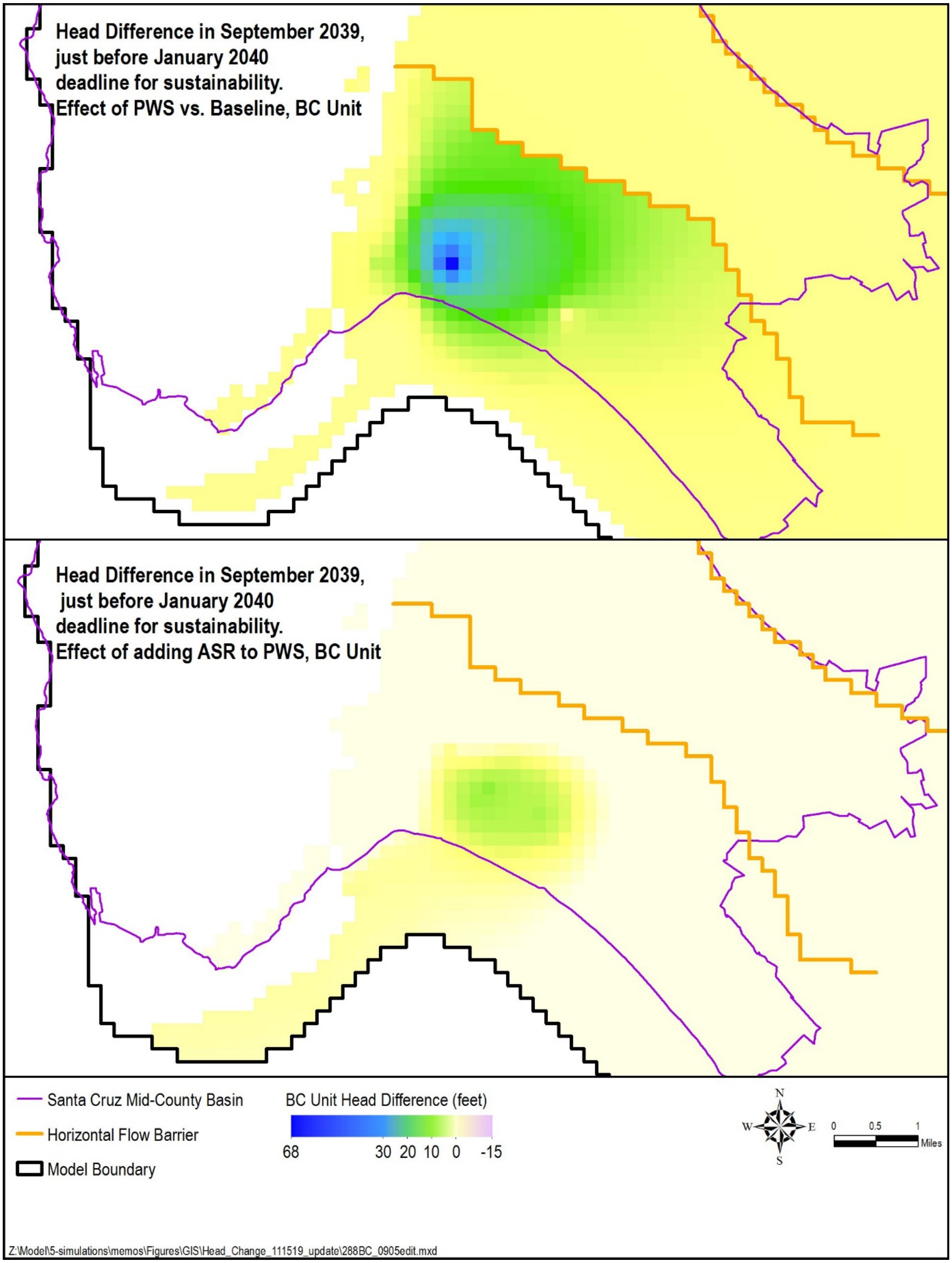

Figure 22. Simulated Effect of ASR and PWS on September 2039 Groundwater Elevations , BC Unit

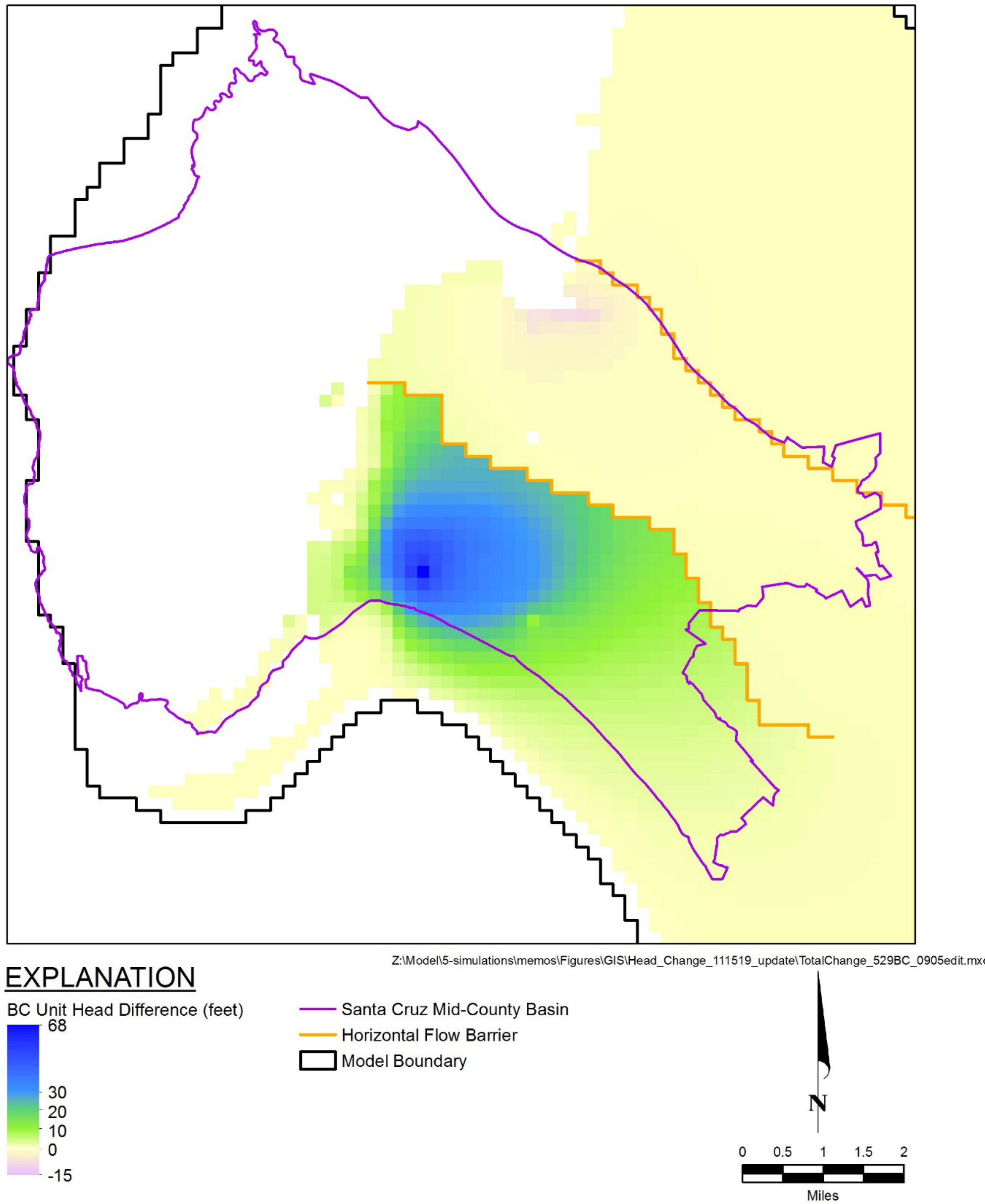

Figure 23. Simulated Effect of ASR and PWS on October 2059 Groundwater Elevations, BC Unit

4.5.3 Purisima A Unit Groundwater Elevation Effects

The simulations of PWS include injection into the Purisima A unit at the Twin Lakes Church, Willowbrook, and Monterey SWIP wells. The PWS and PWS+ASR simulations also increase pumping at the Estates, Tannery II, and Cunnison Lane wells screened in the Purisima A unit. Pumping is decreased at the Garnet well in the Purisima A unit and at the Main Street and O'Neill Ranch wells partially screened in the Purisima AA unit to the west. The simulation (PWS+ASR) incorporating the ASR project includes injection into the Purisima A and AA units at the Beltz 8, 9, and 10 wells. The ASR project also changes pumping at these Purisima A and AA unit wells compared to the baseline simulation. On average, pumping is reduced at the Beltz wells in the Purisima A and AA units, but there are a number of years with lower surface water availability when pumping is increased to meet projected SCWD demand.

The upper map of Figure 24 shows the benefits of PWS injection into the Purisima A unit. The largest increase (darkest blue area) is at the SWIP wells and increases extend to the coastal boundary of the Basin. Groundwater elevation increases are also simulated in the area of the Purisima A unit where pumping from the unit is increased at SqCWD production wells. Groundwater elevation increases are simulated to extend to the west where pumping is decreased in the Purisima A and AA units.

The lower map of Figure 24 shows the benefits of ASR injection and overall pumping reduction in the Purisima A and AA units where groundwater elevations increase (green areas) with the increases extend to the coastal Basin boundary. ASR increases groundwater elevations to the west of most of the groundwater elevation increases caused by PWS. The projects therefore have complementary benefits.

In areas where the PWS SWIP wells are located, groundwater elevation differences in Figure 25 are similar to the upper plot of Figure 24 as ASR has little effect in this area. Figure 21 shows effects of the maximum two-year pumping recovery period under ASR to the west. The model simulates small areas where groundwater elevations fall below baseline groundwater elevations at the Beltz wells (light violet areas) to the west but these declines do not extend to the coastal boundary of the Basin.

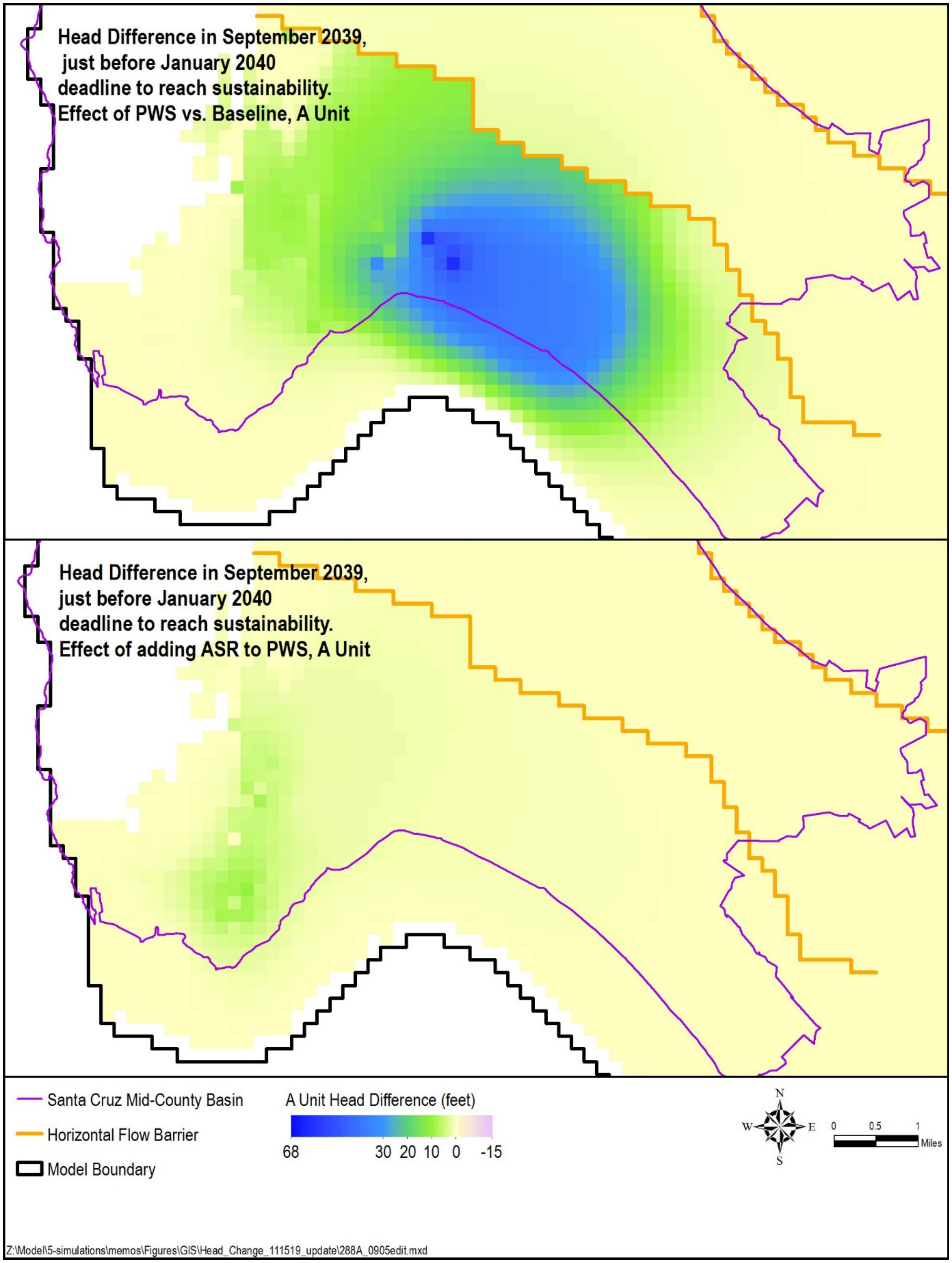

Figure 24. Simulated Effect of ASR and PWS on September 2039 Groundwater Elevations, A Unit

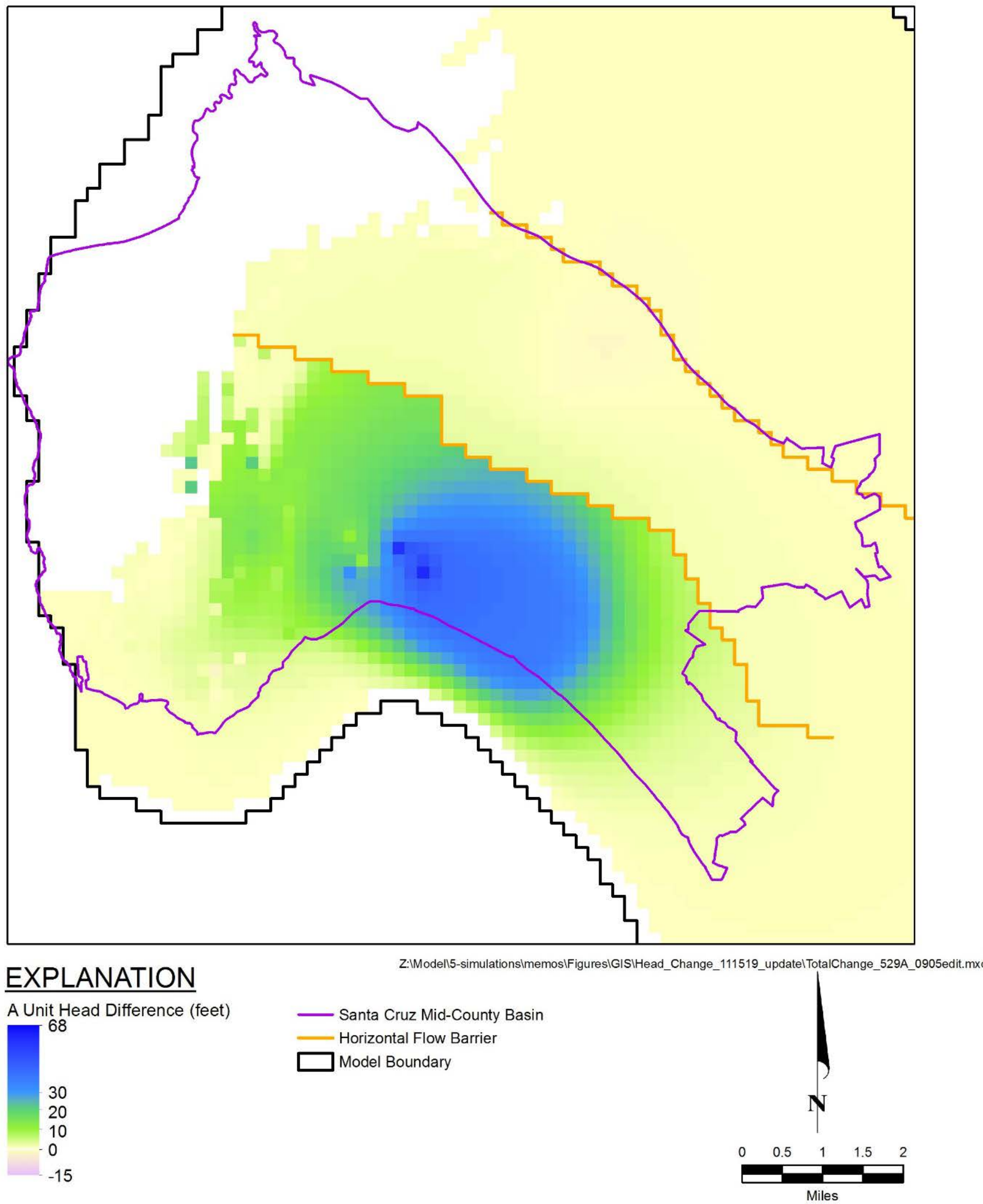

Figure 25. Simulated Effect of ASR and PWS on October 2059 Groundwater Elevations A Unit

4.5.4 Tu Unit Groundwater Elevation Effects

The simulations of PWS include reduction of pumping from the Tu unit at the Main Street and O'Neill Ranch wells. The simulation (PWS+ASR) with the ASR project includes injection into the Tu unit at the Beltz 12 well. The ASR project also changes pumping from the Beltz 12 well from the baseline simulation. On average, pumping is increased at the Beltz 12 well. Both injection and pumping with the ASR project varies over time based on surface water availability.

The upper map of Figure 26 shows the benefits of pumping reduction in the Tu unit that is part of the PWS project. The pumping reduction facilitates in-lieu recharge to raise groundwater elevations with the largest increase (blue area) at the O'Neill Ranch and Main Street wells. The increases extend to the coastal boundary of the Basin.

The lower map of Figure 26 shows a decline in groundwater elevations in the Tu unit at the Beltz 12 well after Water Year 2039 resulting from ASR. ASR has relatively high pumping and low injection in Water Year 2039 due to simulated reduced surface water supply. However, the lower map of Figure 26 shows increases in groundwater elevations resulting from ASR in the Tu unit at the coastal Basin boundary resulting from overall net injection by ASR over the previous twenty years.

Figure 27 shows the effects of projects in combination that raise groundwater elevations throughout the Tu unit compared to the baseline simulation even after ASR's maximum two-year pumping recovery period.

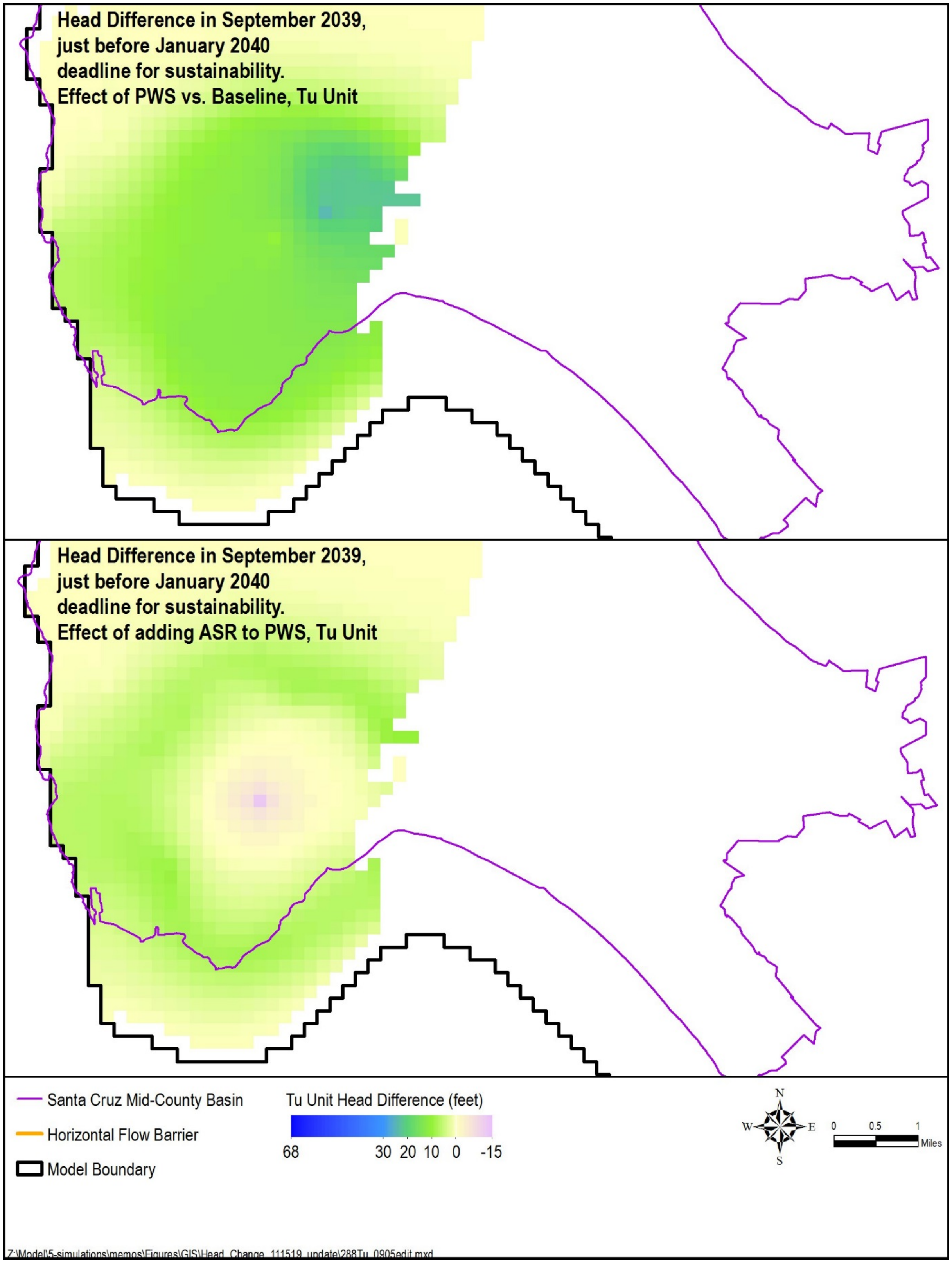

Figure 26. Simulated Effect of ASR and PWS on September 2039 Groundwater Elevations, Tu Unit

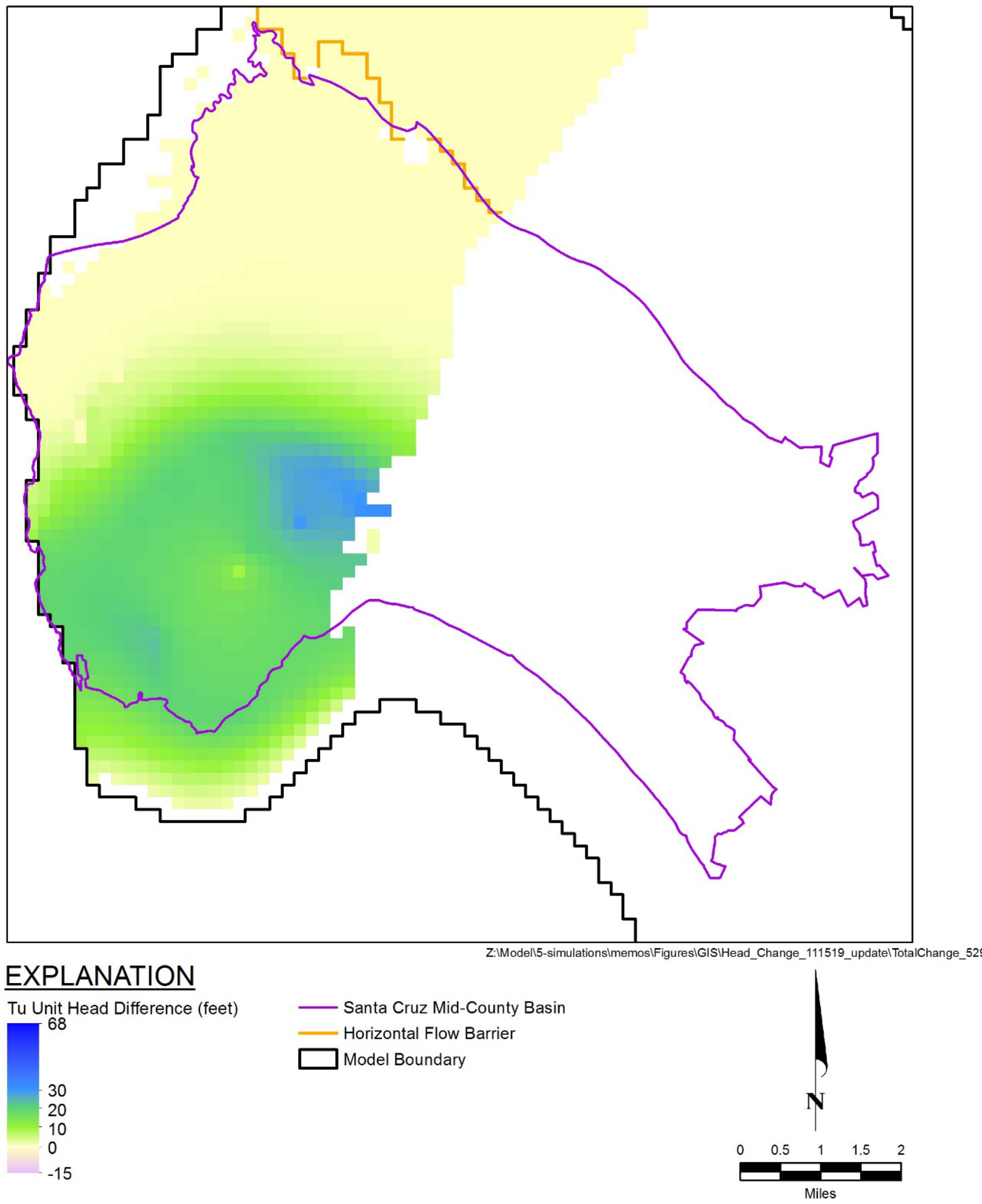

Figure 27. Simulated Effect of ASR and PWS on October 2059 Groundwater Elevations, Tu Unit

4.6 Effect of Projects on Groundwater Budget Components

The combination of PWS and ASR have significant effects on multiple water budget components when simulated over the future time period as shown by a comparison of the PWS+ASR simulation compared to the baseline simulation. The effects of the individual projects can also be evaluated by comparing the PWS simulation to the baseline simulation for the effects of PWS and the PWS+ASR simulation to the PWS simulation for the effects of ASR. These effects are tabulated and presented visually in Table 10 and Figure 28, respectively. The effect of ASR can be seen on Figure 28 starting in 2020, when the City of Santa Cruz begins injection at its Beltz wells. The effects of PWS begins in 2023, the planned start date for injection at the PWS SWIP wells.

Table 10. Groundwater Budget Components, Comparison Between Baseline and Project Scenarios

Groundwater Budget Components	Average (PWS)	Average (ASR)	Average (PWS + ASR)	Difference From Baseline (PWS + ASR)
Inflows	acre-feet per year			percent
UZF Recharge	0	0	0	0%
Net Recharge from Stream Alluvium	-260	-80	-330	- 33%
Recharge from Terrace Deposits	-30	-10	-50	- 3%
Subsurface Inflow from Purisima Highlands	0	0	0	0%
Outflows				
Pumping	-1,280	-460	-1,740	- 28%
Subsurface Outflow to Santa Margarita Basin	0	0	0	0%
Net Subsurface Outflow to Pajaro Valley Subbasin	250	0	250	+ 7%
Offshore	520	320	840	+ 73%
Change in Storage	220	50	280	400%

Note: Differences are normalized so that all decreases indicate a smaller volume of flow, and all increases indicate a greater volume of flow. All values rounded to nearest 10 acre-feet per year

The effects of both projects are most immediately visible in the groundwater pumping budget component, where PWS decreases annual average net pumping by 21%, and ASR causes a further decrease of 7%. Figure 28 shows the decrease in net pumping for PWS is constant while the decrease for ASR varies annually depending on surface water availability. The decreases in net pumping, which includes addition of injection, result in increases of groundwater in storage as plotted by the solid and dashed lines on Figure 28. Groundwater in storage increases an average of approximately 230% with PWS and 60% with ASR. The annual increases of groundwater in storage from PWS decline over the time corresponding with groundwater elevations stabilizing over time, and there are both increase and decreases of groundwater in storage from ASR.

Offshore flows are a key indication of project performance for achieving sustainability, as seawater intrusion is the critical sustainability indicator in the Basin. When compared to baseline, the PWS+ASR simulation displays a 76% higher volume of offshore flow, reflecting higher overall groundwater elevations within the Basin, and a general promotion of conditions that can prevent and possibly reverse seawater intrusion. In an average year, PWS is responsible for about 47% of this increase, while ASR contributes the remaining 29%. These effects are seen over the entire projected period, and are present during both wet and dry climatic conditions (Figure 29).

The PWS+ASR simulation displays a reduction in stream alluvium recharge when compared to baseline, indicating a greater flow of water from groundwater to streams and creeks within the Basin (groundwater flows). In an average year, the majority of the increase in groundwater flows to alluvium is due to PWS injection, while ASR contributes the remaining amount.

Figure 30 specifically examines this relationship in the Soquel Creek watershed, where results highlight the positive effect of both projects on groundwater flows to Soquel Creek during minimum flow months.. As discussed in the calibration report, the magnitude of groundwater flows to streams are not well calibrated so simulation results are only meant to demonstrate that there are expected benefits to streamflow from the projects as opposed to quantifying the benefit.

Higher groundwater elevations resulting from decreases in pumping from the Purisima F unit with PWS in the Aromas area result in a net increase of outflow (or net decrease of inflow) to Pajaro Valley Subbasin so the PWS project should have benefit for sustainability in that neighboring subbasin.

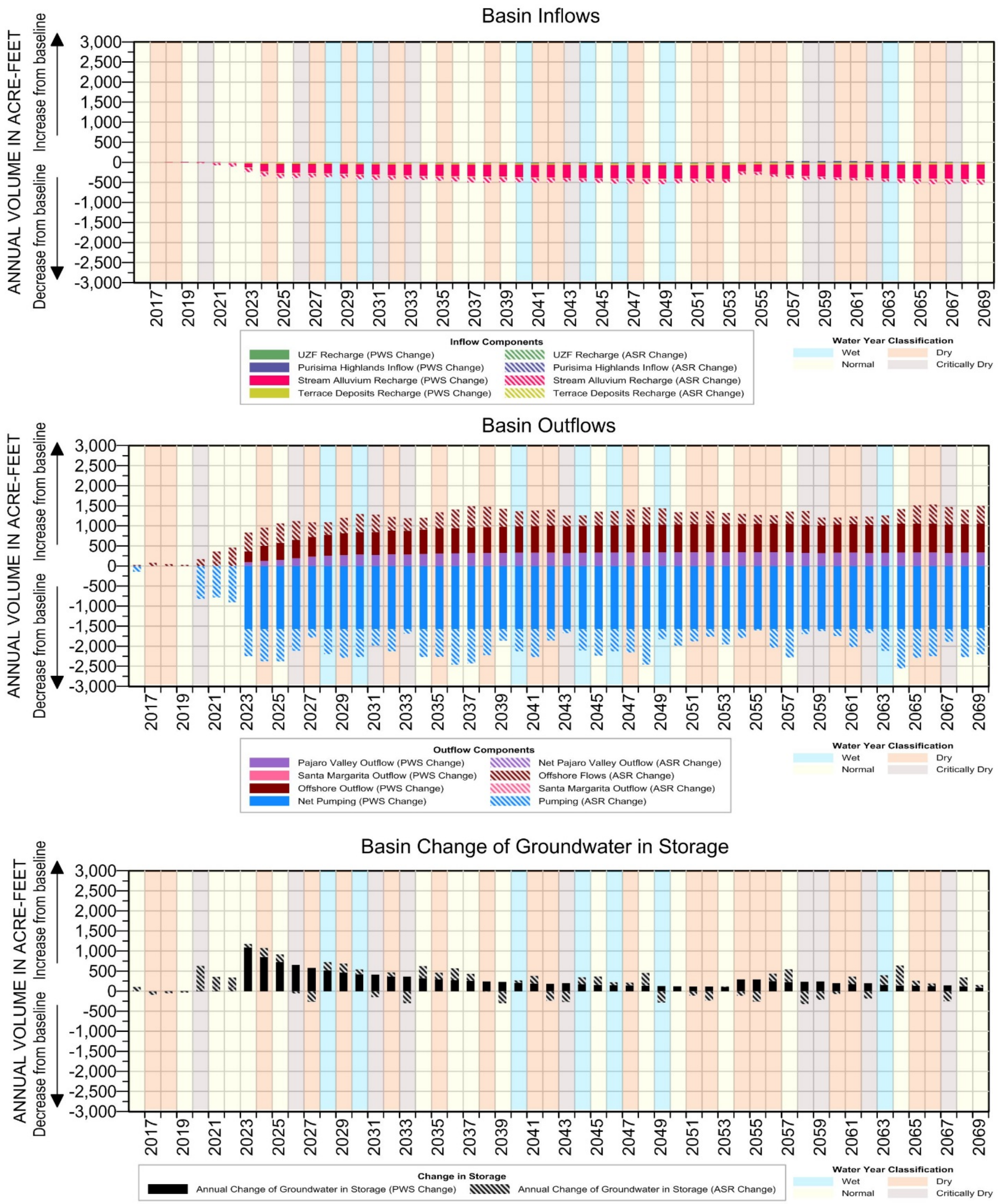

Figure 28. Overall Groundwater Budget, Comparison Between Baseline and Project Scenarios

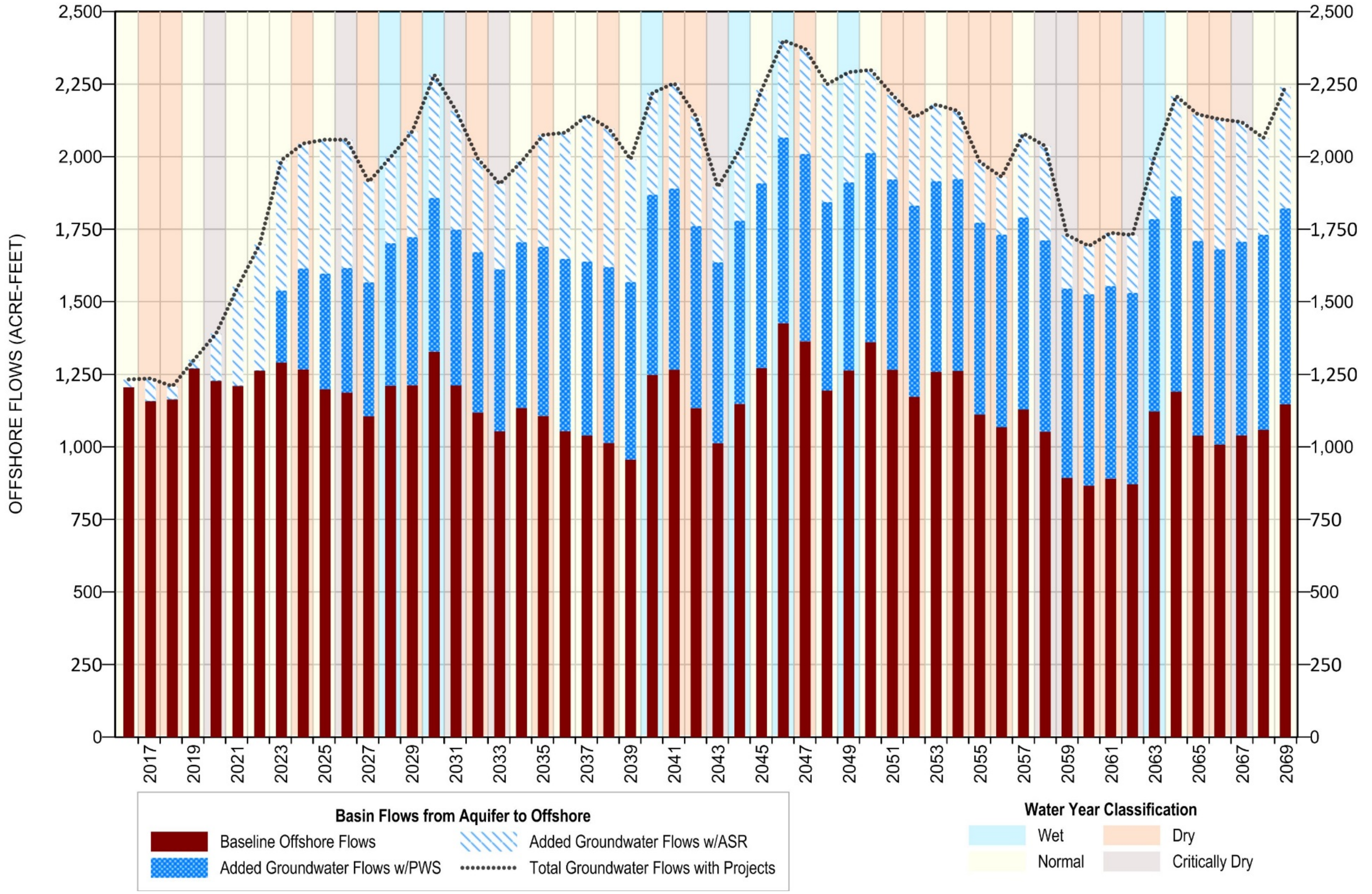

Figure 29. Offshore Flows, Comparison Between Baseline and Project Scenario

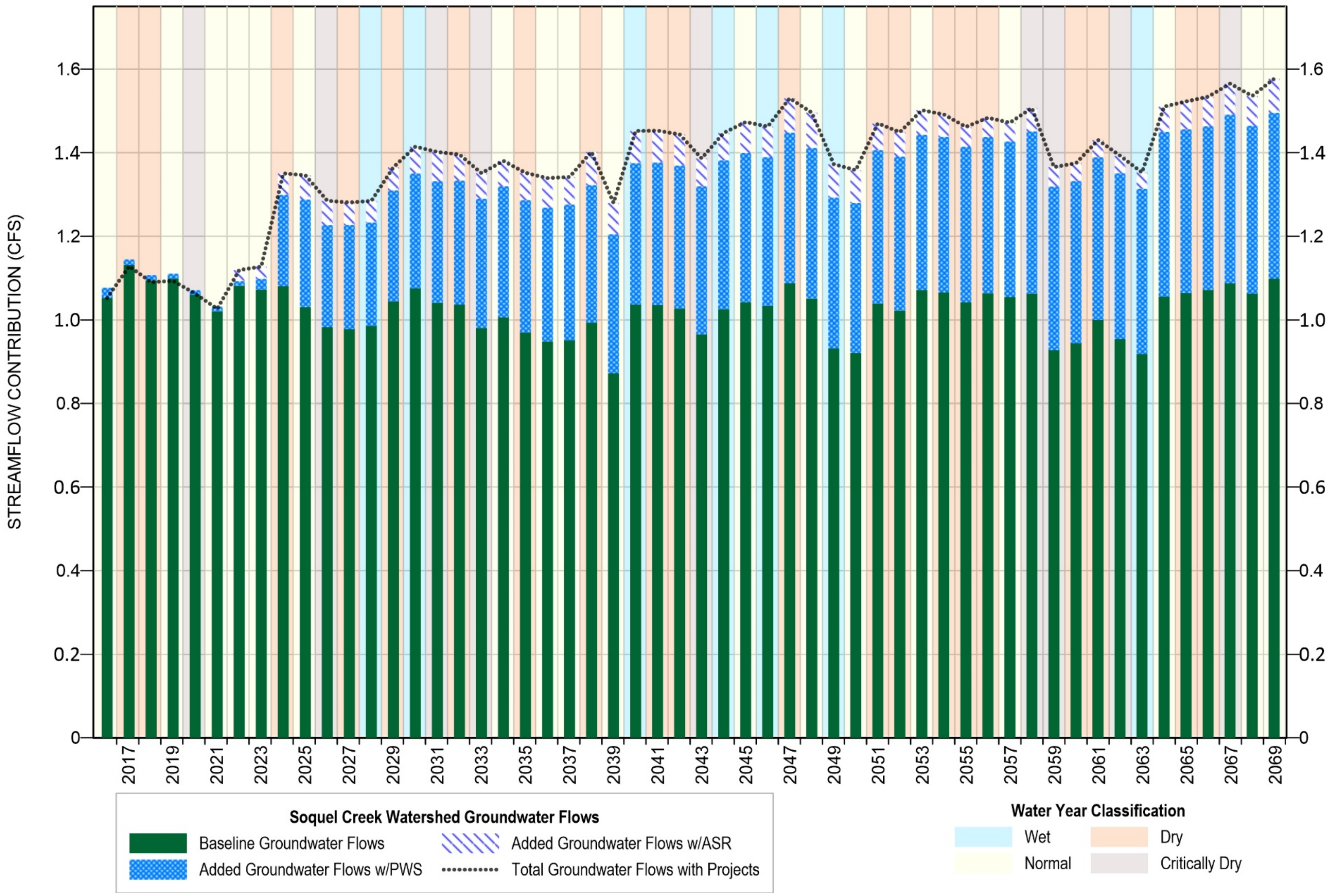

Figure 30. Soquel Creek Watershed Groundwater Flows during Minimum Flow Month Each Year, Comparison between Baseline and Project Scenarios

5 MODELING FOR SUSTAINABLE YIELD ESTIMATES

The GSP requires an estimate of Basin sustainable yield. For the Santa Cruz Mid-County Basin, sustainable yield is defined as the net pumping that avoids undesirable results in the Basin. Net pumping is pumping extraction minus managed recharge such as injection. Sustainable yield is also used as the minimum threshold for the reduction of groundwater in storage sustainability indicator. The Basin GSP sets separate sustainable yields for three aquifer unit groups: Aromas Red Sands/Purisima F, Purisima DEF/BC/A/AA, and Tu. The sustainable yields are based on simulations of future conditions because the Basin has experienced historical and current undesirable results.

5.1 Sustainable Yield Approach

The baseline simulation of future conditions shows undesirable results, but the simulation with projects shows that projects achieve sustainability by meeting minimum thresholds and therefore avoiding undesirable results. In general, projects show groundwater elevations rising higher than minimum thresholds and meeting measurable objectives. As sustainability is defined as avoiding undesirable results by meeting minimum thresholds, the sustainable yield is greater than the net pumping achieved by the projects. The approach for estimating sustainable yield is to use the configuration of the projects but increase net pumping while still meeting minimum thresholds. The estimates of sustainable yield are therefore specific to the configuration of PWS and ASR simulated under future conditions.

5.2 Groundwater Pumping Simulated

Different rates for pumping and injection were tested at SqCWD and SCWD wells included in the configuration of PWS and ASR to test whether minimum thresholds were met. Rates were revised beginning in Water Year 2026 when the final configuration of the projects were set with the Cunnison Lane well coming online. Project rates were used prior to Water Year 2026. CWD and non-municipal rates were not revised from baseline assumptions. Table 11 shows the distribution of pumping rates that achieve minimum thresholds to estimate sustainable yields for each aquifer unit group. There are likely other distributions of pumping rates within each aquifer unit group that also achieve sustainability.

Table 11. Groundwater Pumping and Injection 2026-2069 for Sustainability Estimate

Aquifer Group	Well Name	Average Net Pumping (for Sustainable Yield)	Average Net Pumping (Baseline)	Average Net Pumping (PWS+ASR)
		acre-feet per year		
Aromas Red Sands and Purisima F	Polo Grounds	100	100	100
	Aptos Jr High	250	250	250
	Country Club	0	70	70
	Bonita	75	269	79
	San Andreas	232	371	78
	Seascape	46	46	46
	CWD 4	48	48	48
	CWD 10	92	92	92
	CWD 12	410	410	410
	Domestic	84	84	84
	Institutional	199	199	199
	Agricultural	203	203	203
	Total	1,739	2,142	1,659
Purisima DEF, D, BC, A, and AA	Beltz 8	0	93	-29
	Beltz 9	58	123	-10
	Beltz 10	0	91	-1
	Monterey	-450	0	-500
	Willowbrook	-233	0	-233
	Twin Lakes Church	-742	0	-742
	Rosedale 2	546	545	545
	Garnet	253	254	205
	Cunnison	426	215	399
	Tannery 2	563	223	571
	Estates	398	316	402
	Madeline 2	122	98	122
	Ledyard	120	108	120
	Aptos Creek	102	0	105
	T-Hopkins	137	139	139
	Granite	135	135	135
	Domestic	579	579	579
	Institutional	109	109	109
	Agricultural	162	162	162
	Total	2,285	3,190	2,083

Aquifer Group	Well Name	Average Net Pumping (for Sustainable Yield)	Average Net Pumping (Baseline)	Average Net Pumping (PWS+ASR)
		acre-feet per year		
Tu	Beltz 12	40	39	66
	Main St	349	529	349
	O'Neill	229	229	182
	Domestic	278	278	278
	Institutional	7	7	7
	Agricultural	23	23	23
	Total	927	1,105	905
All Aquifers	Total	4,950	6,437	4,502

5.3 Comparison to Minimum Thresholds

Groundwater elevations for future conditions simulated with the pumping rates used to estimate sustainable yield are compared to groundwater elevation proxies at representative monitoring points for seawater intrusion and surface water depletion. Simulated groundwater elevations meeting minimum thresholds demonstrate that the aquifer unit group yields are sustainable.

The following summarizes where pumping rates at specific wells were revised substantially from the projects simulation and which representative monitoring points for seawater intrusion controlled the change.

For the Aromas Red Sands/Purisima F sustainability yield estimate:

- Country Club well pumping is removed to achieve minimum thresholds at SC-A1B and SC-A8A while pumping is increased by greater amounts farther to the east.
- San Andreas well pumping is increased and minimum thresholds are still met at SC-A2A and SC-A3A.

For the Purisima DEF/BC/A/AA sustainability yield estimate:

- The full project net pumping including injection at SWIP wells are needed to achieve minimum thresholds in the Purisima BC unit at representative monitoring points SC-8B and SC-9C.
- Net pumping from Purisima A unit can be increased in SqCWD wells, including increased pumping from the Tannery II, Cunnison Lane, and Garnet wells together with a

decrease in injection at the Monterey SWIP well can still achieve minimum thresholds at representative monitoring points SC-5A, SC-3A, and SC-1A.

- ASR includes net injection on average, but net pumping at the Beltz wells without injection can still achieve minimum thresholds at the Medium (A) and Deep (AA) completions of the Pleasure Point, Soquel Point, and Moran Lake well representative monitoring point.

For the Tu sustainability yield estimate:

- Net pumping from the Tu unit can still achieve minimum thresholds at representative monitoring point SC-13 without ASR injection. The distribution simulated includes no injection, baseline pumping at Beltz 12 and O'Neill Ranch wells, and assumed pumping at the Main Street well under PWS. The simulated distribution achieves sustainability, but other sustainable distributions amongst the three municipal wells in the Tu unit likely also exist.

Figure 34 and

Figure 35 also show that the simulation of net pumping shown in Table 11 also meets minimum thresholds for groundwater elevation proxies for surface water depletion preventing undesirable results for that indicator.

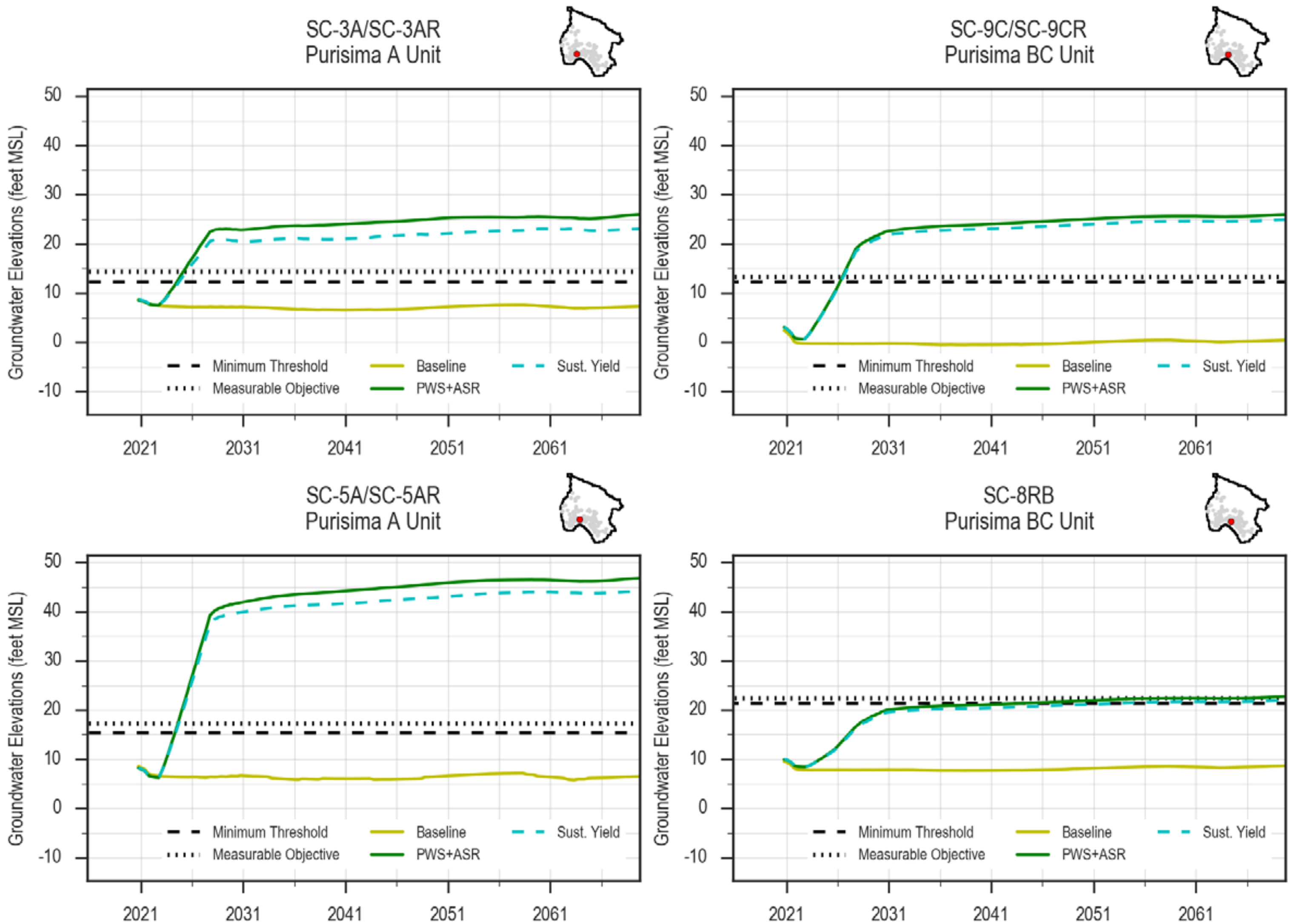

Figure 31. Running Five-Year Average Model Simulated Groundwater Elevations at Coastal Monitoring Wells in Purisima A and BC Units for Sustainable Yield Estimate

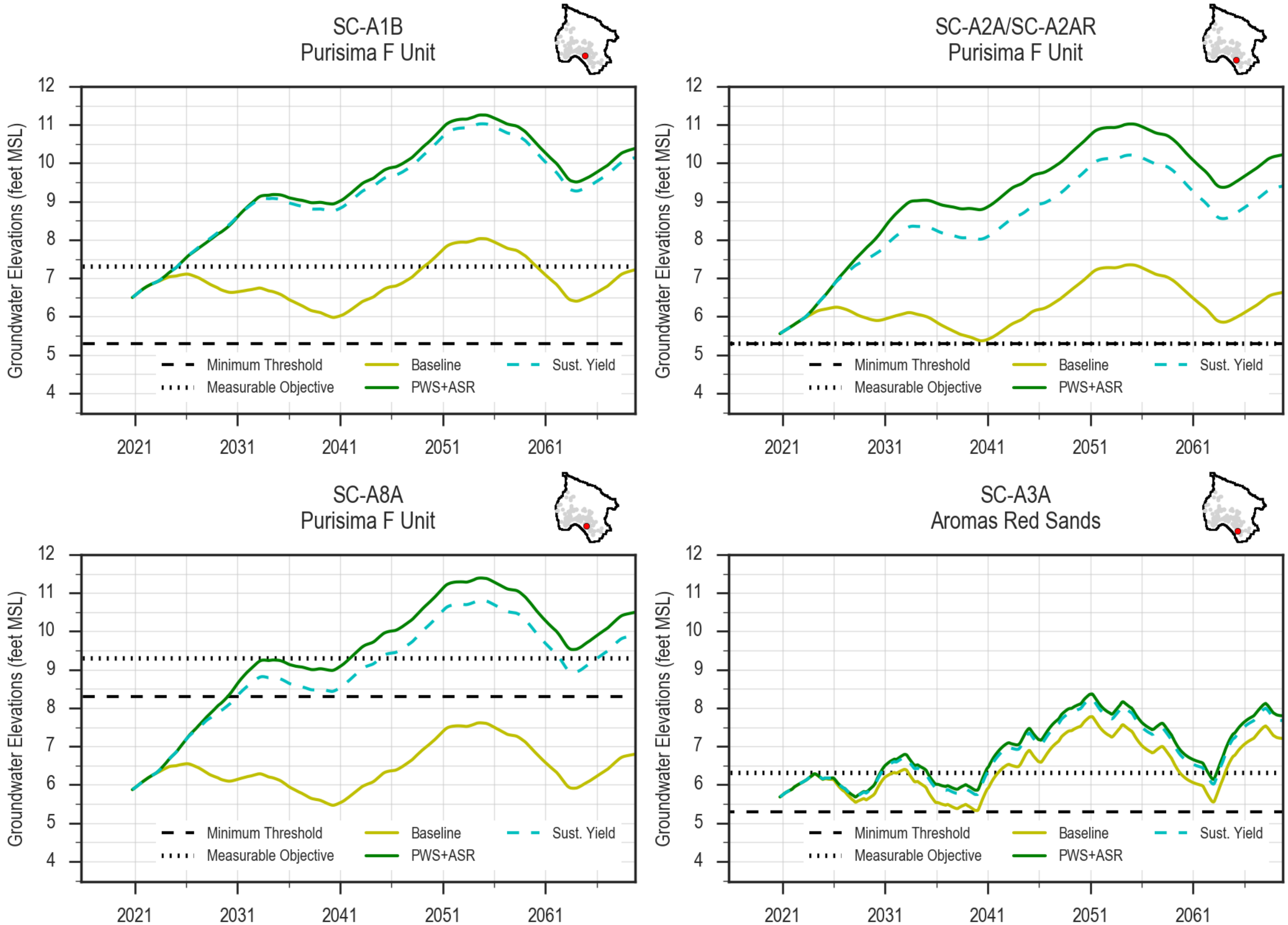

Figure 32. Running Five-Year Average Model Simulated Groundwater Elevations at Coastal Monitoring Wells in Purisima F and Aromas Red Sands Units for Sustainable Yield Estimate

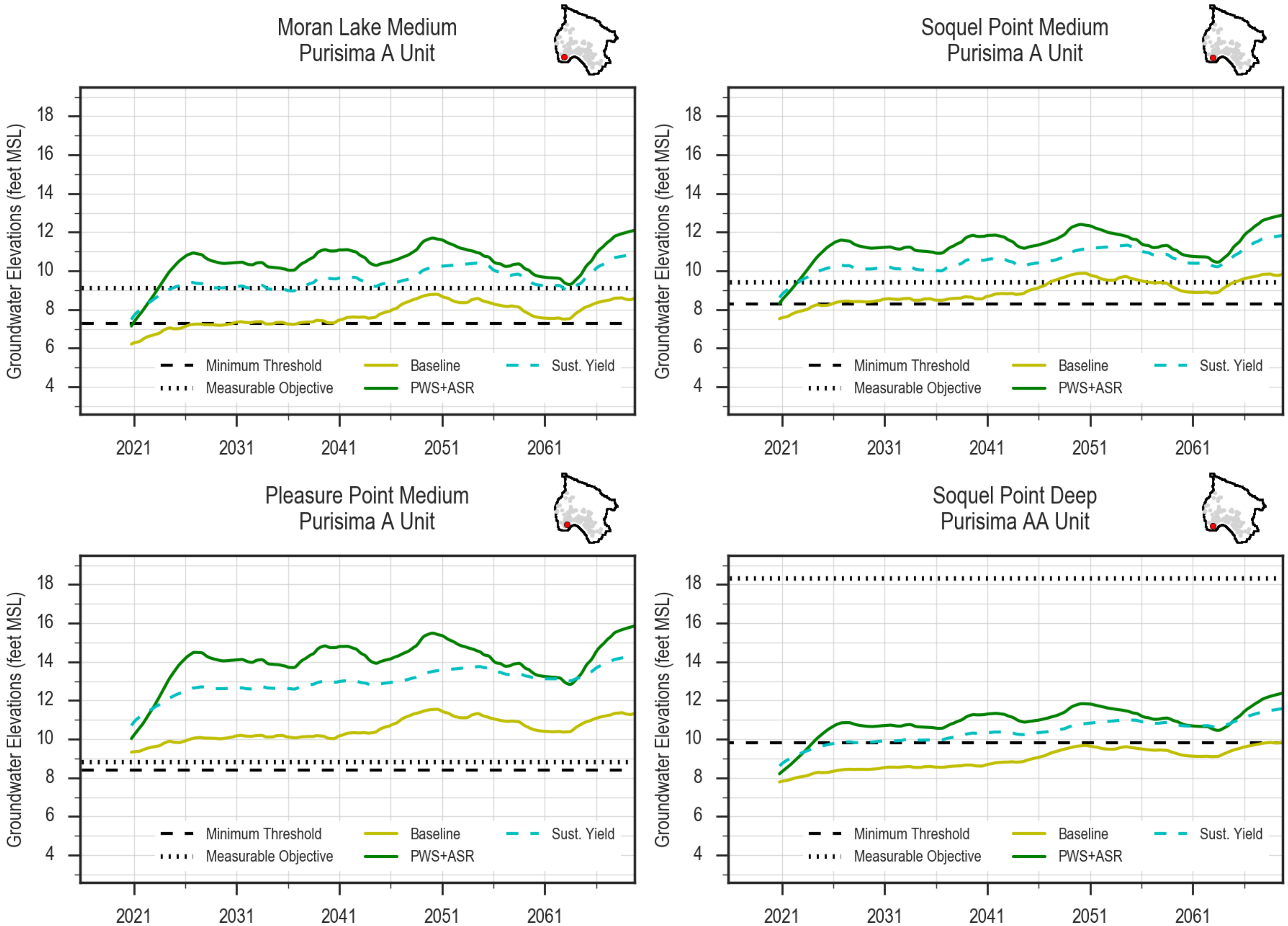

Figure 33. Running Five-Year Average Model Simulated Groundwater Elevations at Coastal Monitoring Wells in Tu and Purisima AA and A Units for Sustainable Yield Estimate

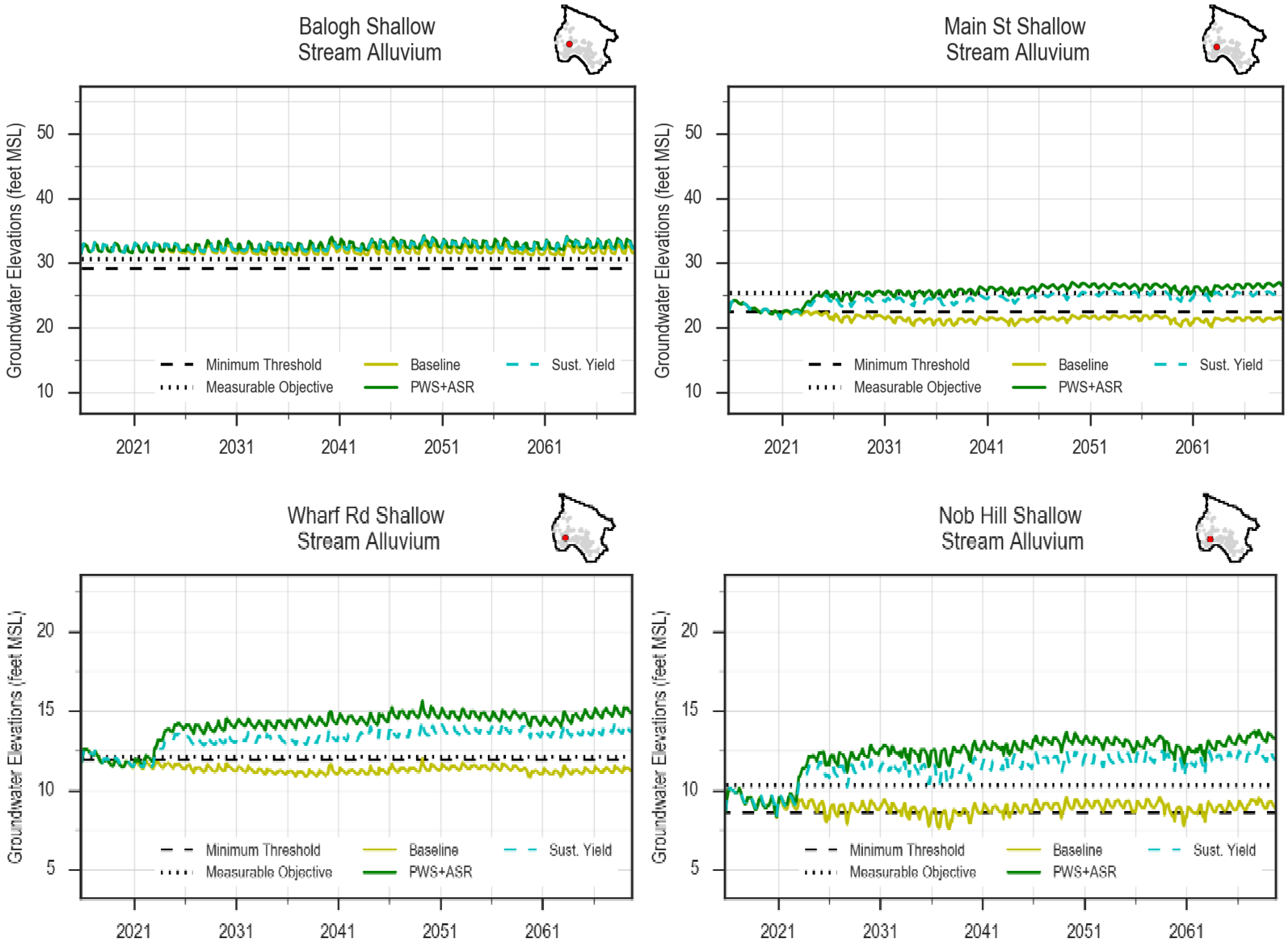

Figure 34. Simulated Groundwater Elevations at Shallow Wells along Soquel Creek for Sustainable Yield Estimate

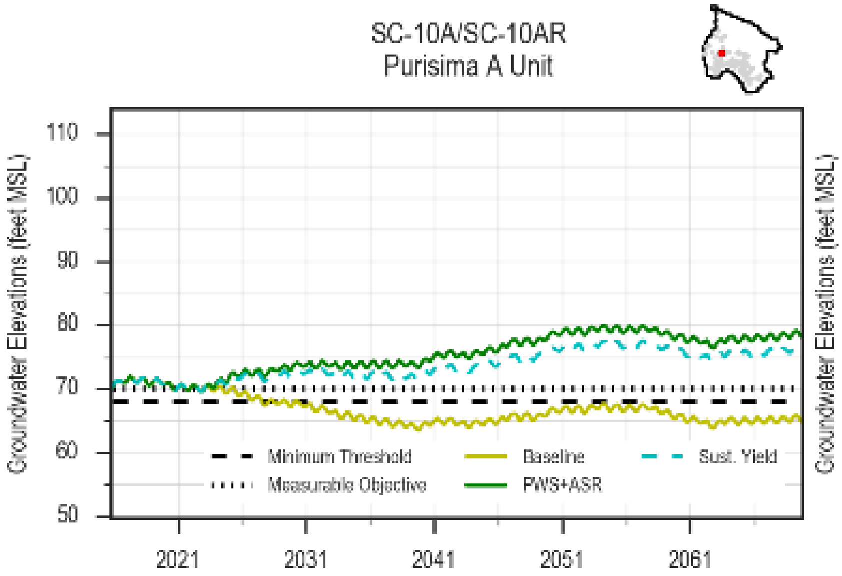

Figure 35. Simulated Groundwater Elevations at Purisima A Unit Well along Soquel Creek for Sustainable Yield Estimate

5.4 Sustainable Yield Estimates

As the simulation of net pumping to estimate sustainable yield shows that minimum thresholds are achieved and undesirable results are eliminated and avoided, Table 12 provides estimates of sustainable yield based on ASR and PWS configuration.

Table 12. Estimates of Sustainable Yield Based on Configuration of Pure Water Soquel and City of Santa Cruz ASR

Aquifer Group	Sustainable Yield (acre-feet per year)
Aromas Red Sands and Purisima F	1,740
Purisima DEF, BC, A, and AA	2,280
Tu	930
Total	4,950

6 CONCLUSIONS

The simulations of future conditions show that implementation of the PWS and ASR projects help the Basin achieve sustainability while the simulation of baseline conditions show continued undesirable results. The simulations show that both PWS and ASR contribute to achieving basin sustainability and are largely complementary in benefiting different areas of the Basin. The model is also used to provide an estimate of sustainable yield based on the configuration of the PWS and ASR projects.

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8 ACRONYMS & ABBREVIATIONS

ASR................Aquifer Storage and Recovery
CWD..............Central Water District
DWR..............California Department of Water Resources
EIR.................Environmental Impact Report
GCM..............Global Circulation Model
GSP ....Groundwater Sustainability Plan
MGA..............Santa Cruz Mid-County Groundwater Agency
MNW2...........Multi-Node Well 2
PWS...............Pure Water Soquel
SCWD............City of Santa Cruz Water Department
SMC...............sustainable management criteria
SqCWD..........Soquel Creek Water District
SWIP..............seawater intrusion prevention
UWMP...........Urban Water Management Plan

APPENDIX 3-A

TECHNICAL APPROACH FOR DETERMINING GROUNDWATER ELEVATION MINIMUM THRESHOLD FOR CHRONIC LOWERING OF GROUNDWATER LEVELS IN REPRESENTATIVE MONITORING WELLS

Technical Approach for Determining Groundwater Elevation Minimum Threshold for Chronic Lowering of Groundwater Levels in Representative Monitoring Wells

The general premise for determining Minimum Thresholds for chronic lowering of groundwater levels is that groundwater levels cannot go below a level which prevents overlying groundwater users from meeting their typical water demand. Overlying water demand is determined from land use and by the well use indicated on well driller logs in the vicinity of the RMP.

The saturated thickness of an aquifer is an important factor that can limit well yields. When groundwater levels decline, the saturated thickness of the aquifer decreases. The saturated thickness may decrease to a point at which the aquifer can no longer produce water to the well at the minimum rate of pumping needed to meet typical demands.

The pump rate and aquifer properties control how much saturated aquifer thickness (distance between the bottom of the well and the groundwater level) is needed to meet water demands. Water demands by municipal wells are known as municipal agencies have detailed records of each well's pump capacity and volumes pumped. Private domestic and agricultural well users generally do not have this information, and therefore assumptions are made to estimate their water usage. For domestic use, average rates of 10 gpm were provided by a local pump contractor. For purposes of estimating the minimum saturated thickness (MST) needed, a more conservative rate of 15 gpm was used as this needs more saturated thickness than a well pumping at 10 gpm (i.e. the groundwater level needs to be higher for 15 gpm). For agricultural wells, the estimated capacity provided on the well driller's logs available indicated 250 gpm is typical.

A theoretical MST for each RMP is estimated using a spreadsheet tool developed by the Kansas Geological Survey based on the overlying water demand (Brookfield, 2016). The tool considers well efficiency, nearby pumping wells, and drawdown in the well due to pumping at a given rate. To consider uncertainties in the MST estimation, a 20% safety factor is added to the MST obtained from the spreadsheet tool. It is also assumed that a well pump can be placed no deeper than 20 feet from the bottom of the well to prevent the pump from being damaged by settled sediment in the bottom of the well. This is the typical depth well pumps are set in domestic wells according to a local pump installer. To account for this, a further 20 feet is added to the estimated MST. Figure 1 provides a generalized schematic that illustrates the method described above. The resultant adjusted MST is the minimum thickness of saturated aquifer that is needed for overlying groundwater users to meet their typical demand. In some areas, there may be two overlying uses, such as agricultural and domestic, or municipal and domestic. For these cases, the adjusted MST of the use type that results in the shallowest groundwater level is used.

As a conservative measure, the approach assumes the RMP has a depth equal to the shallowest nearby well screened in the same aquifer as the RMP. This results in a shallower groundwater elevation than if the actual depth of the RMP is used (if it is deeper than nearby wells).

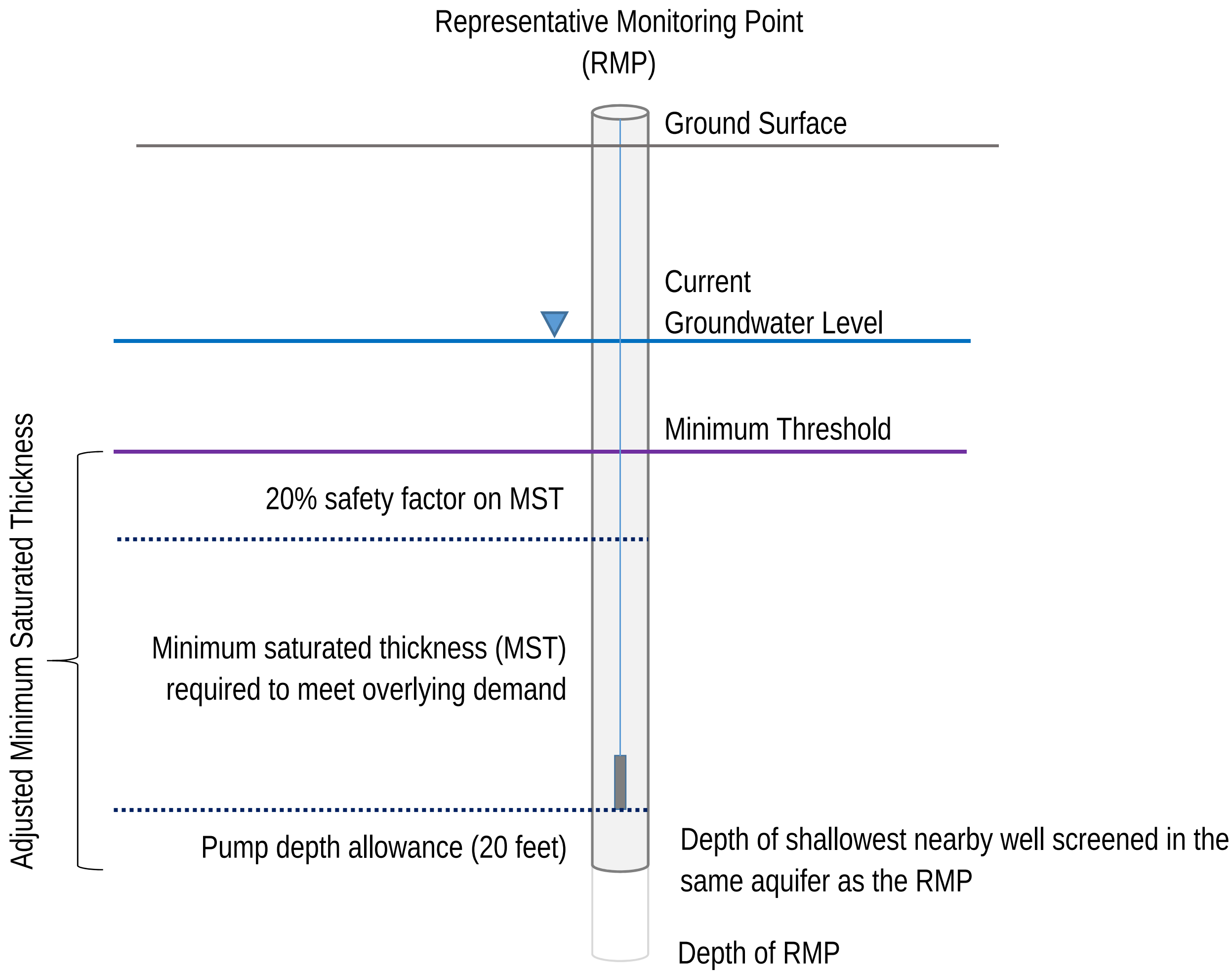

Figure 1. Schematic of Minimum Saturated Thickness Approach

Table 1 summarizes the minimum thresholds for 17 RMPs selected as representative across the Basin. There are five RMPs that had adjusted MSTs that are greater than 30 feet below historic low groundwater levels. For these RMPs, the minimum threshold was raised to 30 feet below historic low groundwater levels. This was done because, although the wells could meet their demand with a much lower groundwater level, having groundwater levels drop to these depths may influence other sustainability indicators. The rationale for selecting a maximum of 30 feet below historic low is that the majority of the RMPs have adjusted MSTs less than 30 feet below historic low levels as shown on Figure 2.

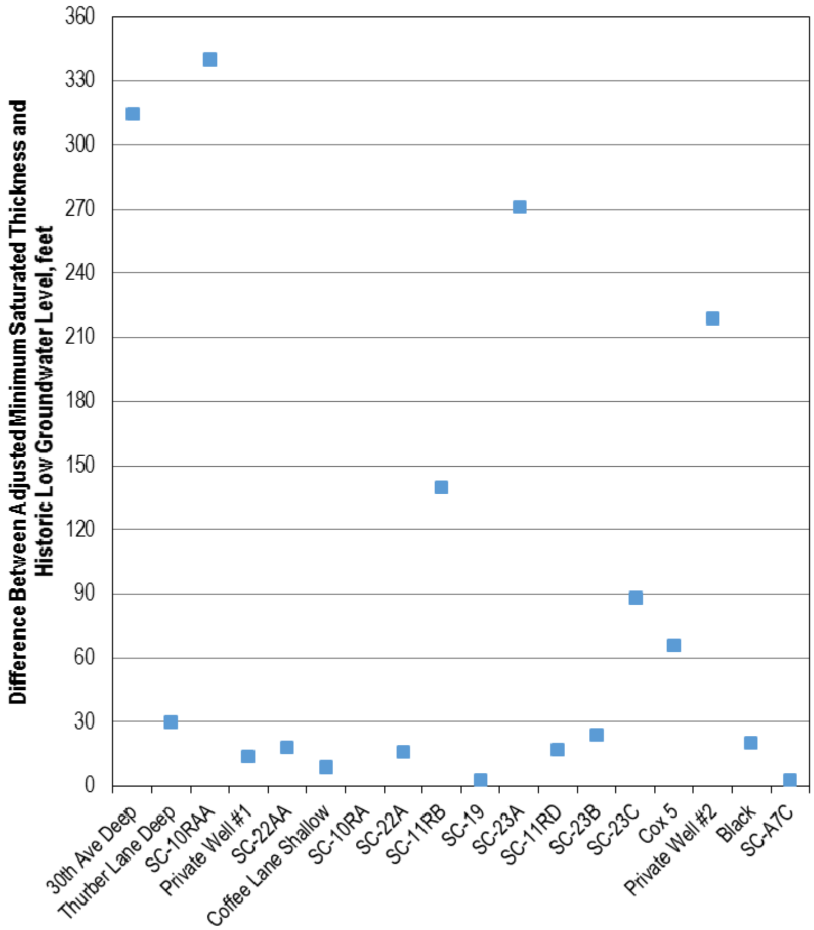

Figure 2. Representative Monitoring Points Difference between Adjusted Minimum Saturated Thickness and Historic Low Groundwater Level

There are four wells where the minimum thresholds were raised to sea level as these are close to protective elevation coastal monitoring wells and having groundwater levels below sea level will make it difficult to achieve protective elevations at the coast. Other reasons for raising elevations from the MST levels are provided in Table 1.

References

Brookfield, A. 2016. Minimum Saturated Thickness Calculator, Method Overview and Spreadseet Description. Kansas Geological Survey Open---File Report 2016---3, pp 6.

Table 1. Summary of Representative Monitoring Points with Minimum Threshold Groundwater Elevations

RMP Name	Overlying Demand Type	Aquifer	Minimum Threshold Elevation (feet amsl)	Minimum Saturated Thickness (MST) Assumptions and Adjustments made to Minimum Thresholds (MT)
30th Ave Deep	Municipal	Tu	0	No private wells screened in this very deep aquifer. There are some municipal wells screened in this aquifer > 0.8 mile to the north. Shallowest municipal well depth results in a minimum elevation of -324 ft amsl based on the MST. However, well screens are typically at 200 ft below ground so the MT is adjusted upwards to sea level which is typically above well screens.
Thurber Lane Deep	Private Domestic	Purisima AA/Tu	-10 Upward	Shallowest domestic well depth results in a minimum elevation of -33 ft amsl that still meets demands. Increase the elevation to -10 ft amsl so that there is not such a steep gradient between this RMP and the coast where there are higher protective groundwater elevations.
SC-10RAA	Private Domestic	Purisima AA/Tu	35 30 ft below low	There are no deep domestic wells in the area of this RMP that are screened in the Pur AA/Tu similar to the RMP. They are screened shallower in Pur A/AA and in the alluvium. Even using the shallowest domestic well depth (not screened in the same aquifer), adjusted MST is at -275 ft amsl, MT is therefore set to 30 ft below historic low levels.
Private Well #1	Private Domestic	Purisima AA/Tu	362	Shallowest domestic well depth in same aquifer as RMP.
SC-22AA	Municipal	Purisima AA	0	Shallowest municipal well depth and municipal well MST. The adjusted MST is --3 ft amsl, MT is therefore increased to sea level.
Coffee Lane Shallow	Municipal	Purisima A/AA	27	Shallowest domestic well depth in same aquifer as RMP.
SC-22A	Municipal/Private Domestic	Purisima A	2	Shallowest domestic well depth, adjusted MST at muni well MST is -3 ft amsl. MT set at 2 ft above SC-22AA MT because groundwater levels in SC-22A are typically 2 ft higher than SC-22AA levels, which has a minimum threshold of 0 ft amsl.
SC-11RB	Private Domestic	Purisima BC	120	Not many domestic wells are deep enough in this location to go down through the Purisima DEF and D units into the underlying Purisima BC unit. Shallowest domestic well depth in same aquifer as RMP (555 ft). MT set to 30 ft below historic low because adjusted MST results in > 30 ft below historic low level.
SC-19	Municipal/Private Domestic	Purisima BC	56	Not many private wells nearby. Municipal wells are shallower than private wells with County records. Used shallowest municipal well depth

RMP Name	Overlying Demand Type	Aquifer	Minimum Threshold Elevation (feet amsl)	Minimum Saturated Thickness (MST) Assumptions and Adjustments made to Minimum Thresholds (MT)
				in same aquifer as RMP.
SC-23A	Municipal	Purisima BC	0	No domestic wells at this depth in the area. Shallowest municipal well depth, adjusted MST >30 ft below historic low. Raise MT to sea level 0 ft amsl which is 21 ft below historic low.
SC-11RD	Private Domestic	Purisima DEF	295	Shallowest domestic well depth in same aquifer as RMP.
SC-23B	Small Water System/ Private	Purisima DEF	50	Shallowest domestic well depth results in a minimum elevation of -137 ft amsl that still meets demands. Increase the elevation to 50 ft amsl. Difference in groundwater levels between SC-23B and SC-23A is 50 ft during historic low levels on hydrograph.
SC-23C	Municipal	Purisima F	15	Shallowest domestic well depth results in a minimum elevation of -14 ft amsl that still meets demands. Increase the elevation to 15 ft amsl. This is both 30 ft lower than historic low and equal to the average depth below SC-23B elevation.
CWD-5	Private Domestic	Purisima F	133	Shallowest domestic well depth results in a minimum elevation of 97 ft amsl that still meets demands. Increase the MT elevation to 30 ft below average historic lows.
Private Well #2	Private Domestic	Purisima F	562	Shallowest domestic well depth results in a minimum elevation of 433 ft amsl that still meets demands. Increase the elevation to 562 ft amsl, which is 30 ft below historic lows.
Black	Private Domestic	Purisima F	21	Other domestic wells in the area are screened in both the Aromas and Purisima F, while this RMP is screened in only the Purisima F. The MT is set at a level less than 30 ft below the historic low.
SC-A7C	Ag/Municipal	Aromas	0	Shallowest Ag well depth results in a minimum elevation of --20 ft amsl that still meets demands. MT is therefore set at sea level.

APPENDIX 3-B

HYDROGRAPHS OF REPRESENTATIVE MONITORING POINTS FOR CHRONIC LOWERING OF GROUNDWATER LEVELS

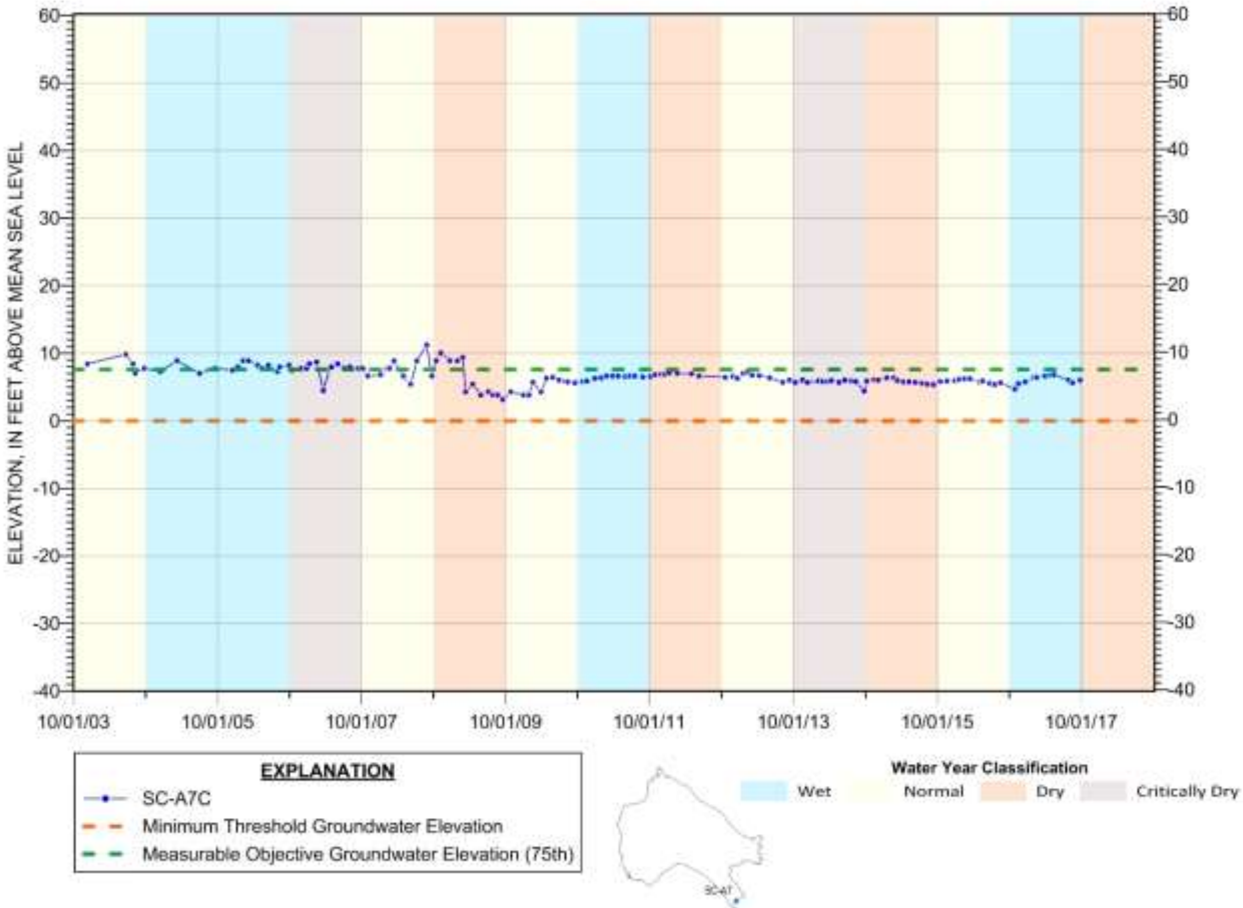

Figure 3-B.1. SC-A7C Hydrograph with Minimum Threshold and Measureable Objective

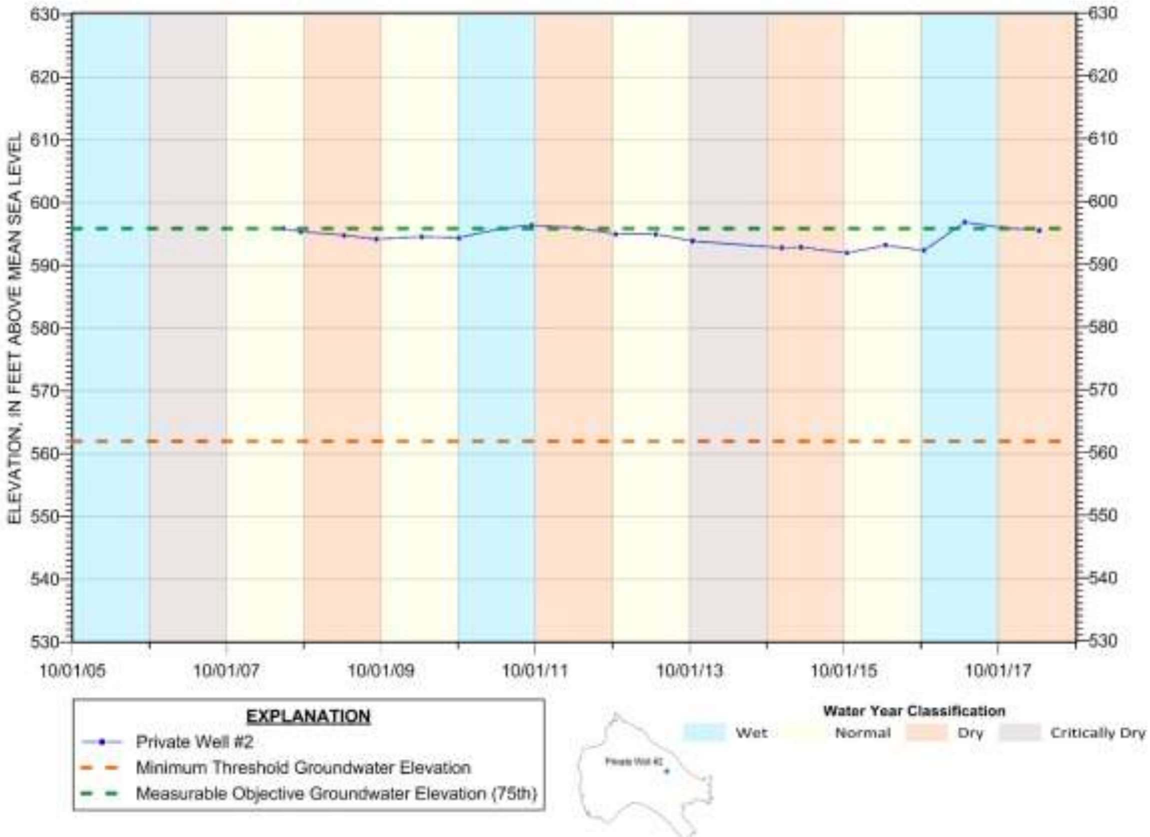

Figure 3-B.2. Private Well #2 Hydrograph with Minimum Threshold and Measureable Objective

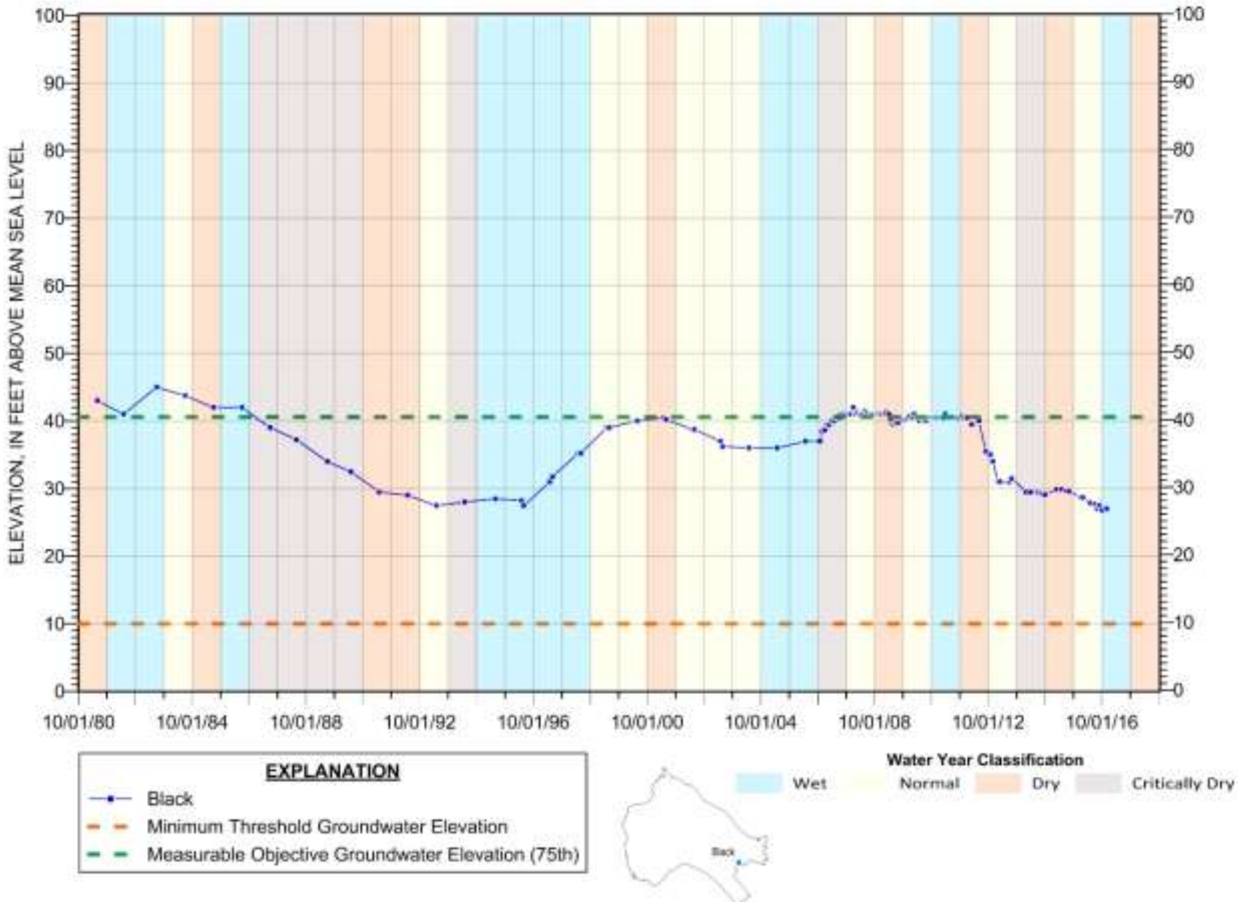

Figure 3-B.3. Black Hydrograph with Minimum Threshold and Measureable Objective

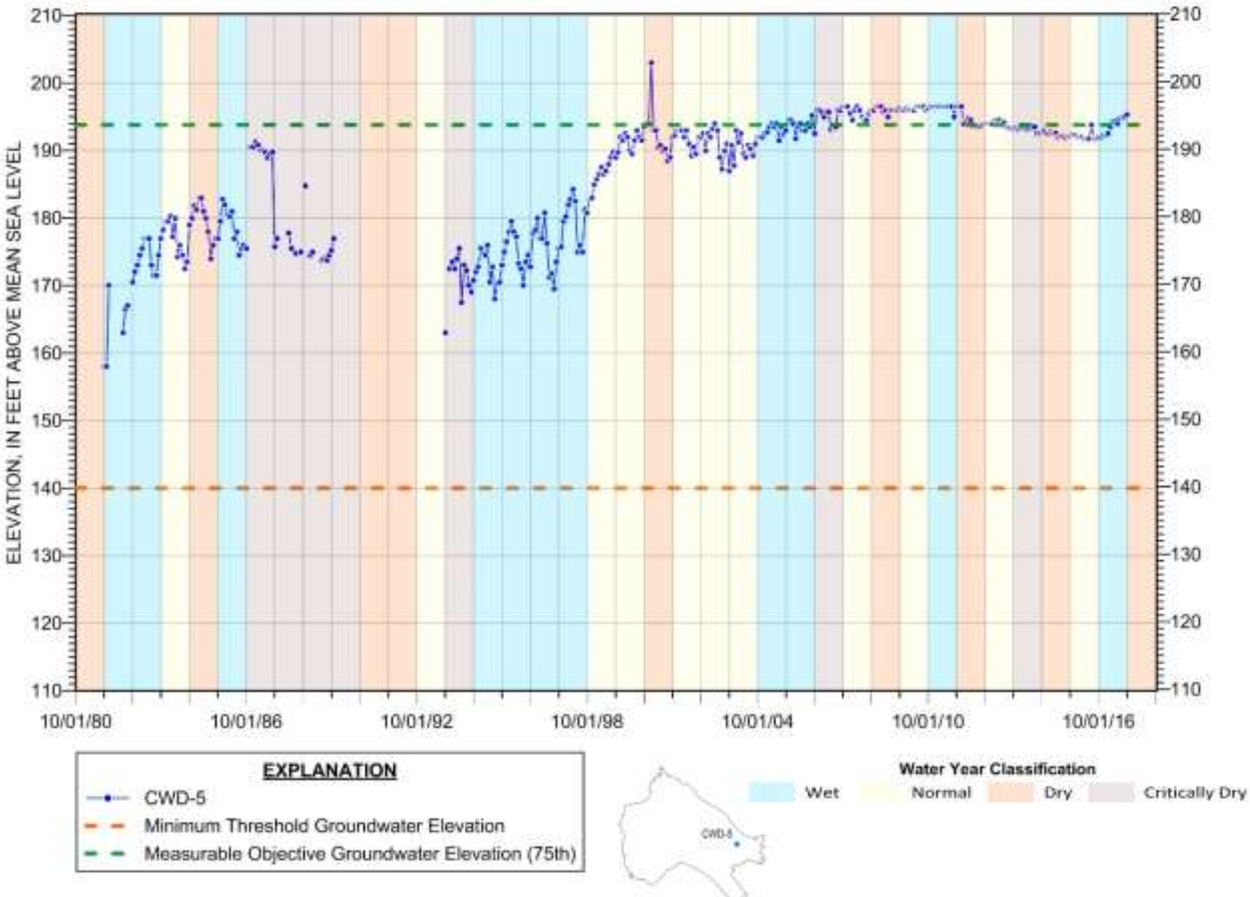

Figure 3-B.4. CWD-5 Hydrograph with Minimum Threshold and Measureable Objective

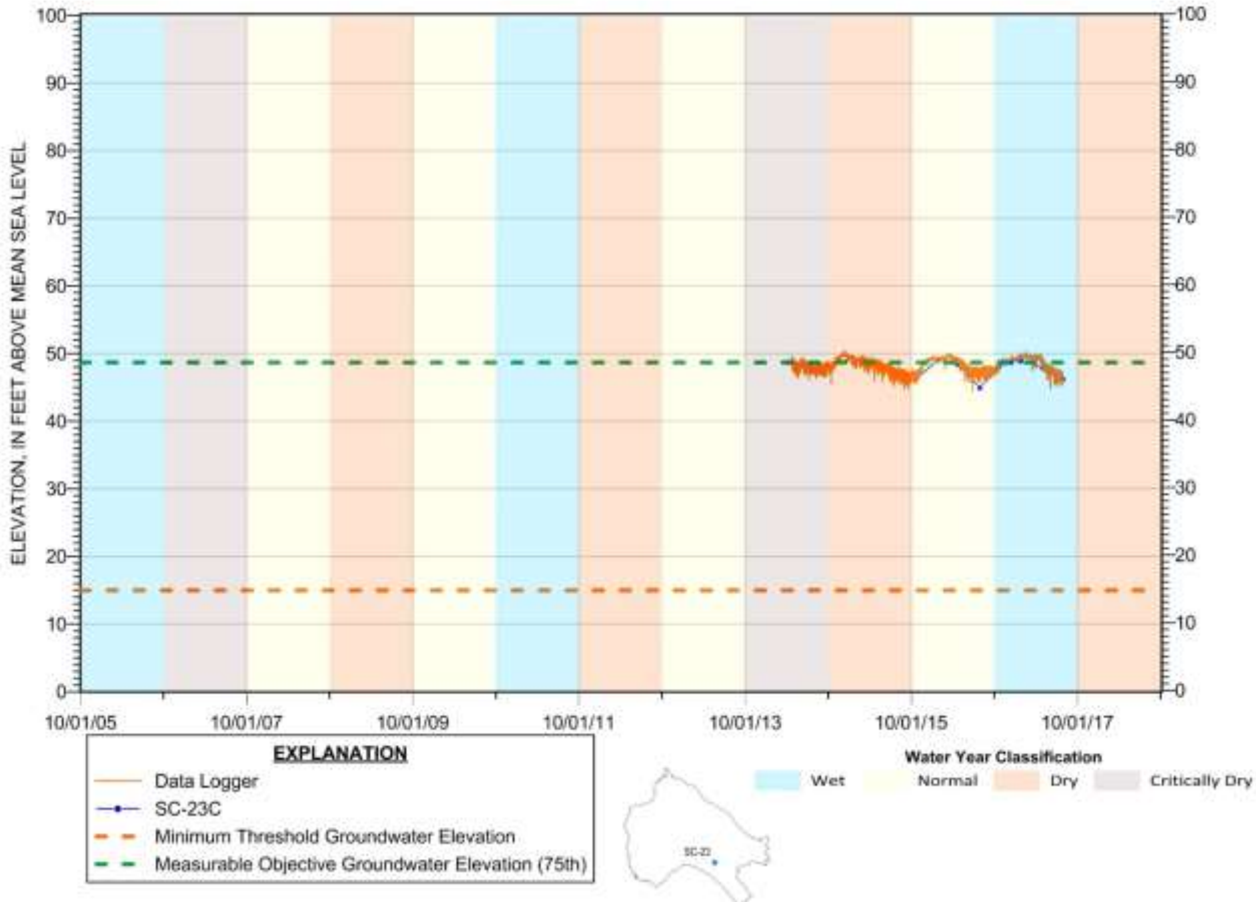

Figure 3-B.5. SC-23C Hydrograph with Minimum Threshold and Measureable Objective

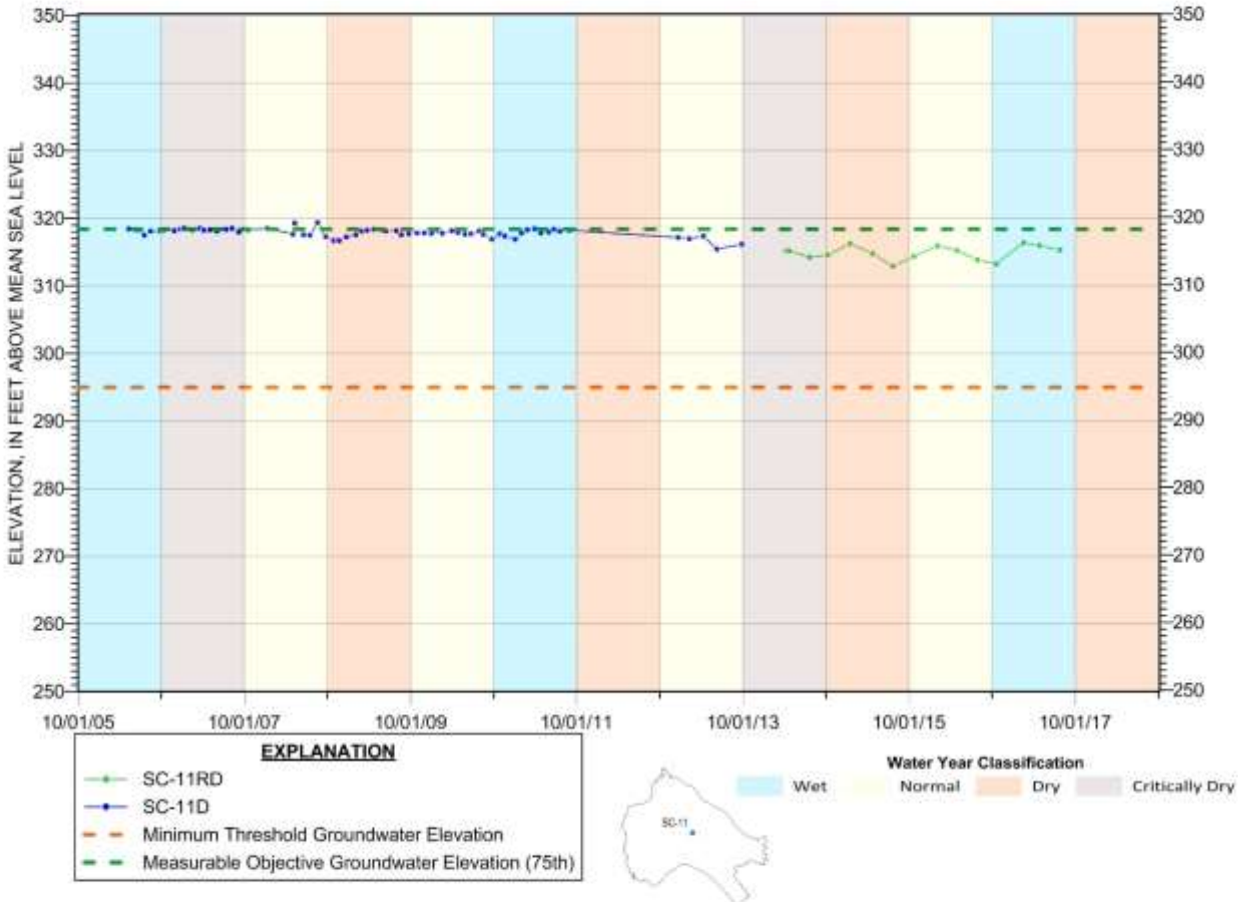

Figure 3-B.6. SC-11RD Hydrograph with Minimum Threshold and Measureable Objective

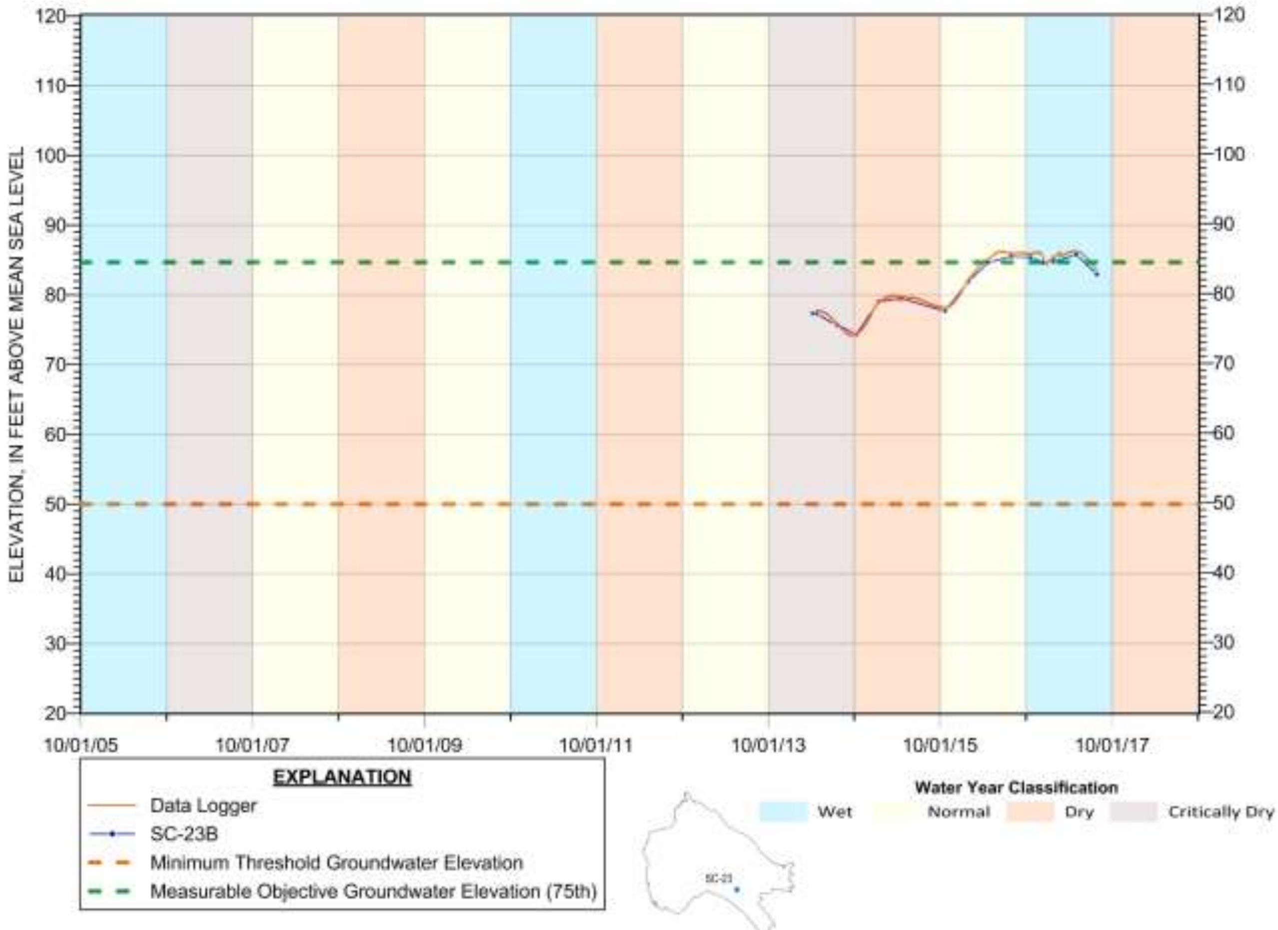

Figure 3-B.7. SC-23B Hydrograph with Minimum Threshold and Measurable Objective

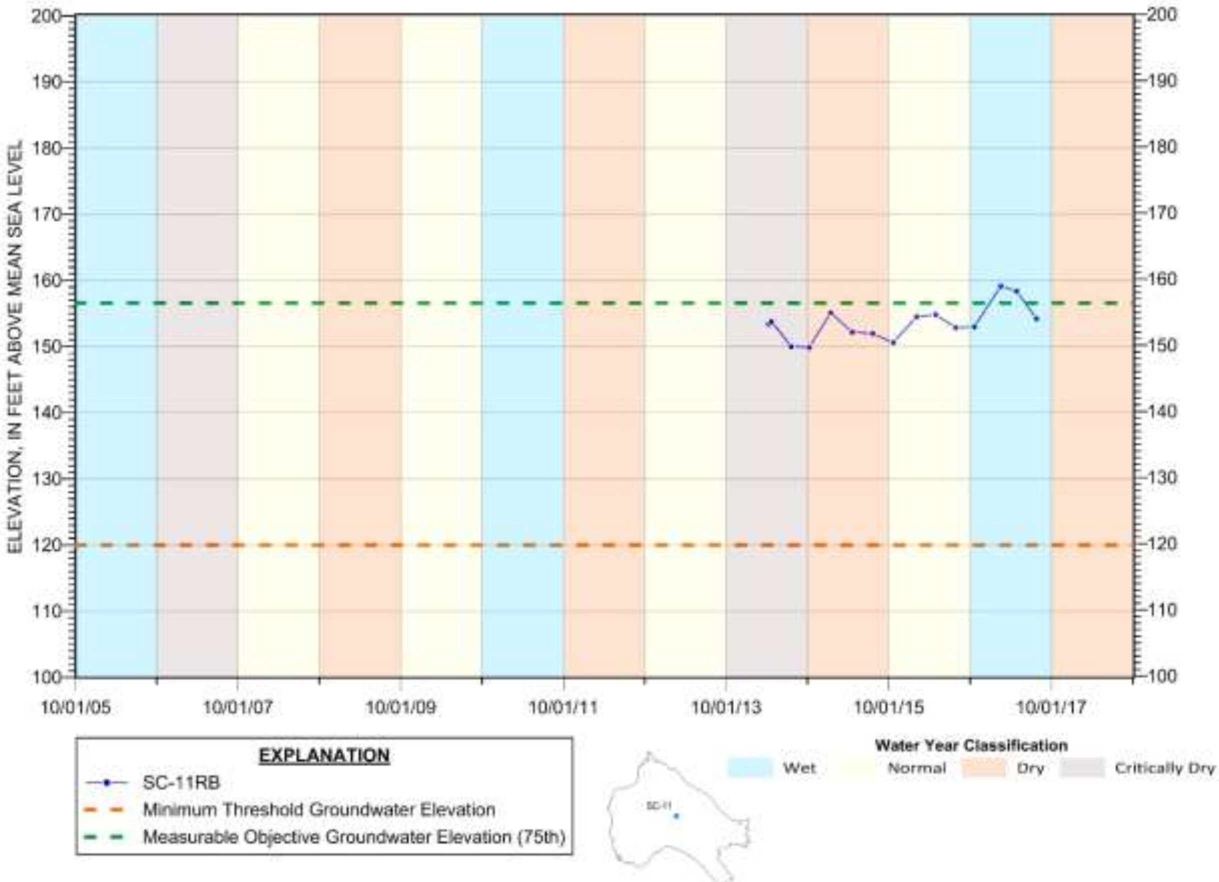

Figure 3-B.8. SC-11RB Hydrograph with Minimum Threshold and Measureable Objective

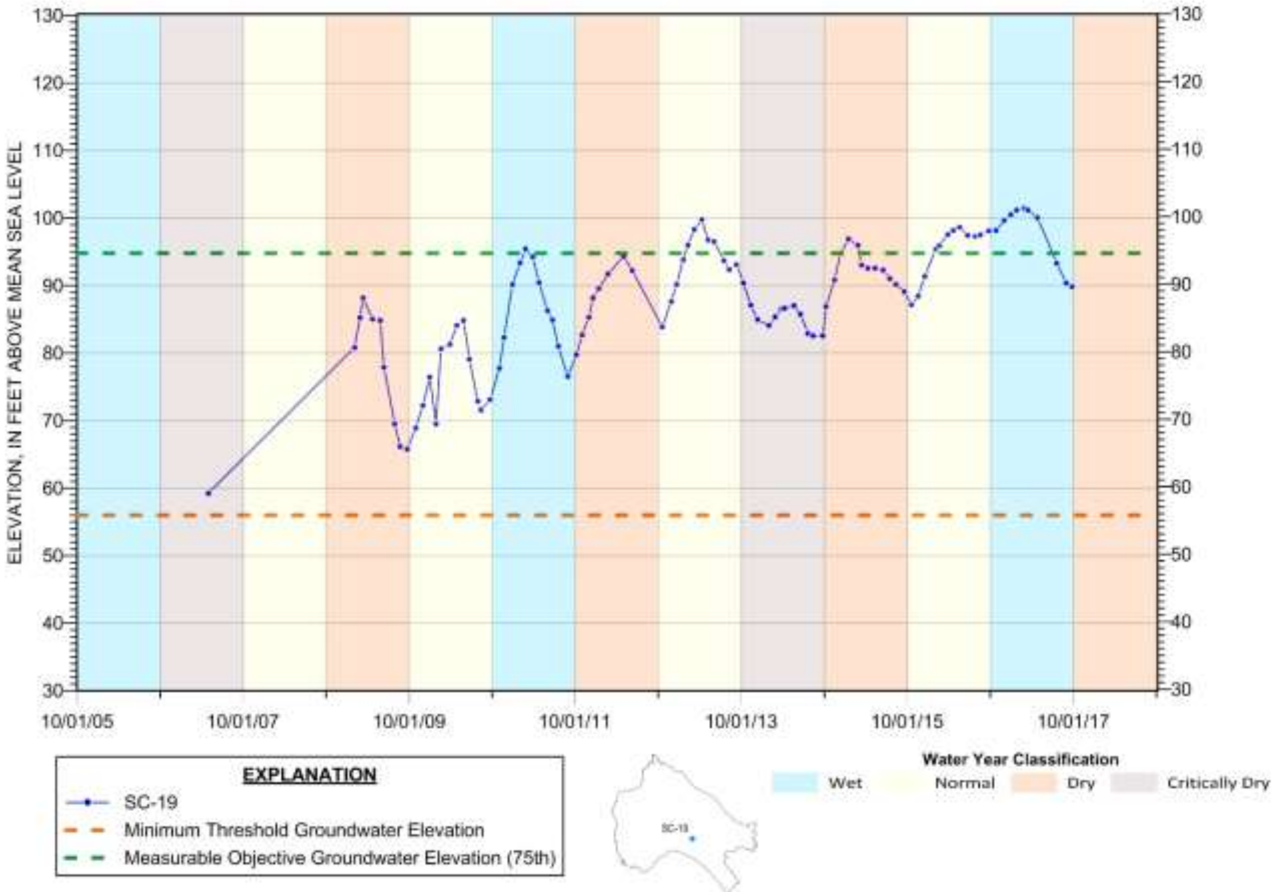

Figure 3-B.9. SC-19 Hydrograph with Minimum Threshold and Measureable Objective

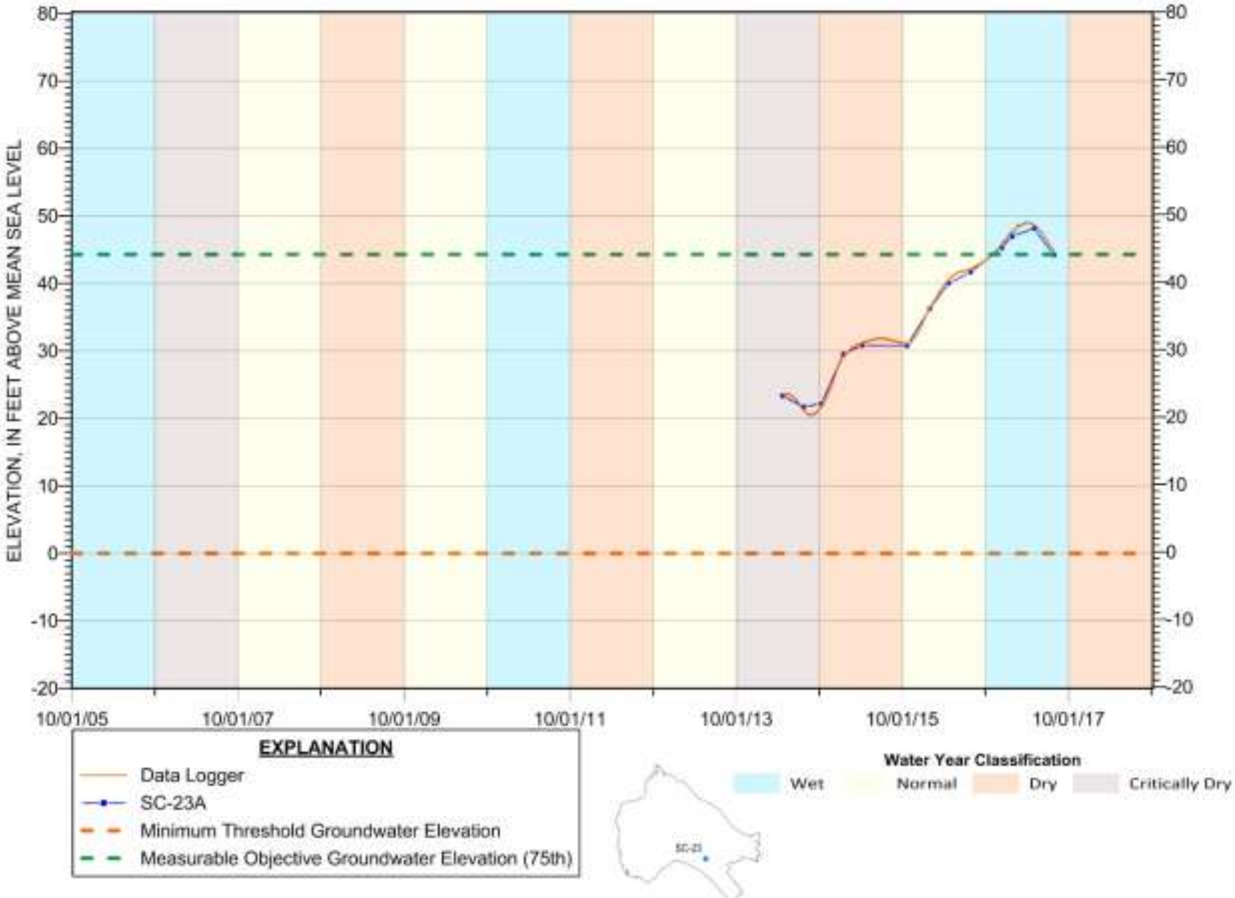

Figure 3-B.10. SC-23A Hydrograph with Minimum Threshold and Measureable Objective

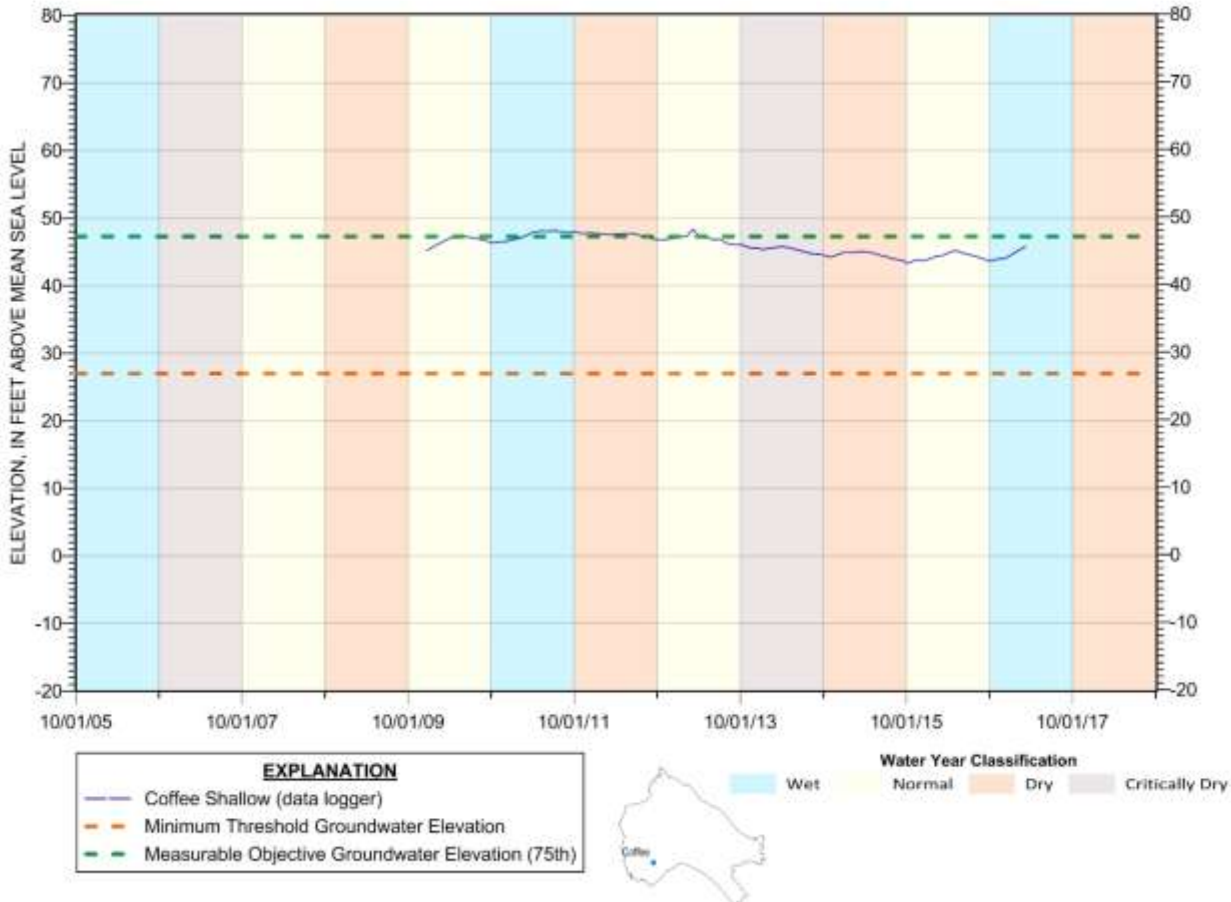

Figure 3-B.11. Coffee Lane Shallow Hydrograph with Minimum Threshold and Measureable Objective

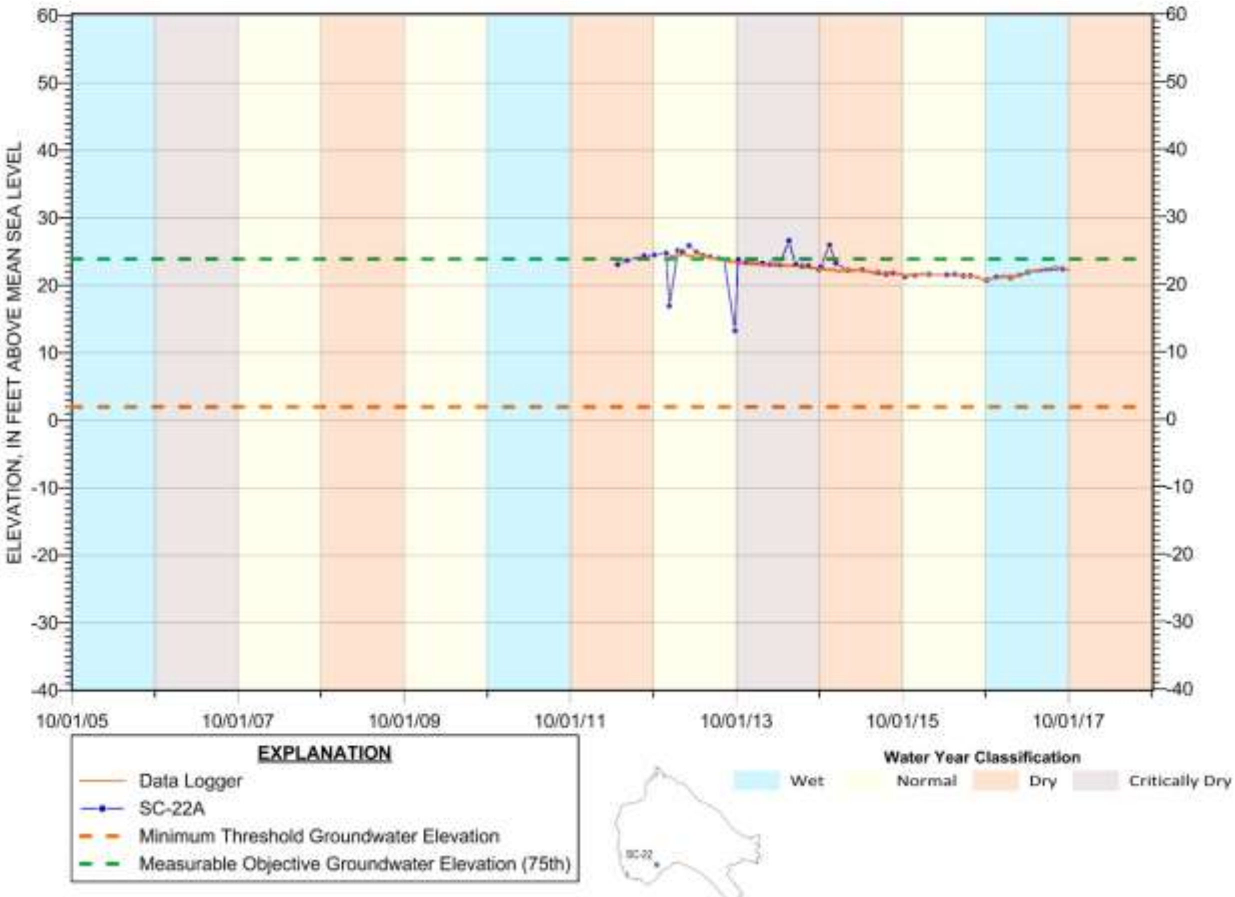

Figure 3-B.12. SC-22A Hydrograph with Minimum Threshold and Measureable Objective

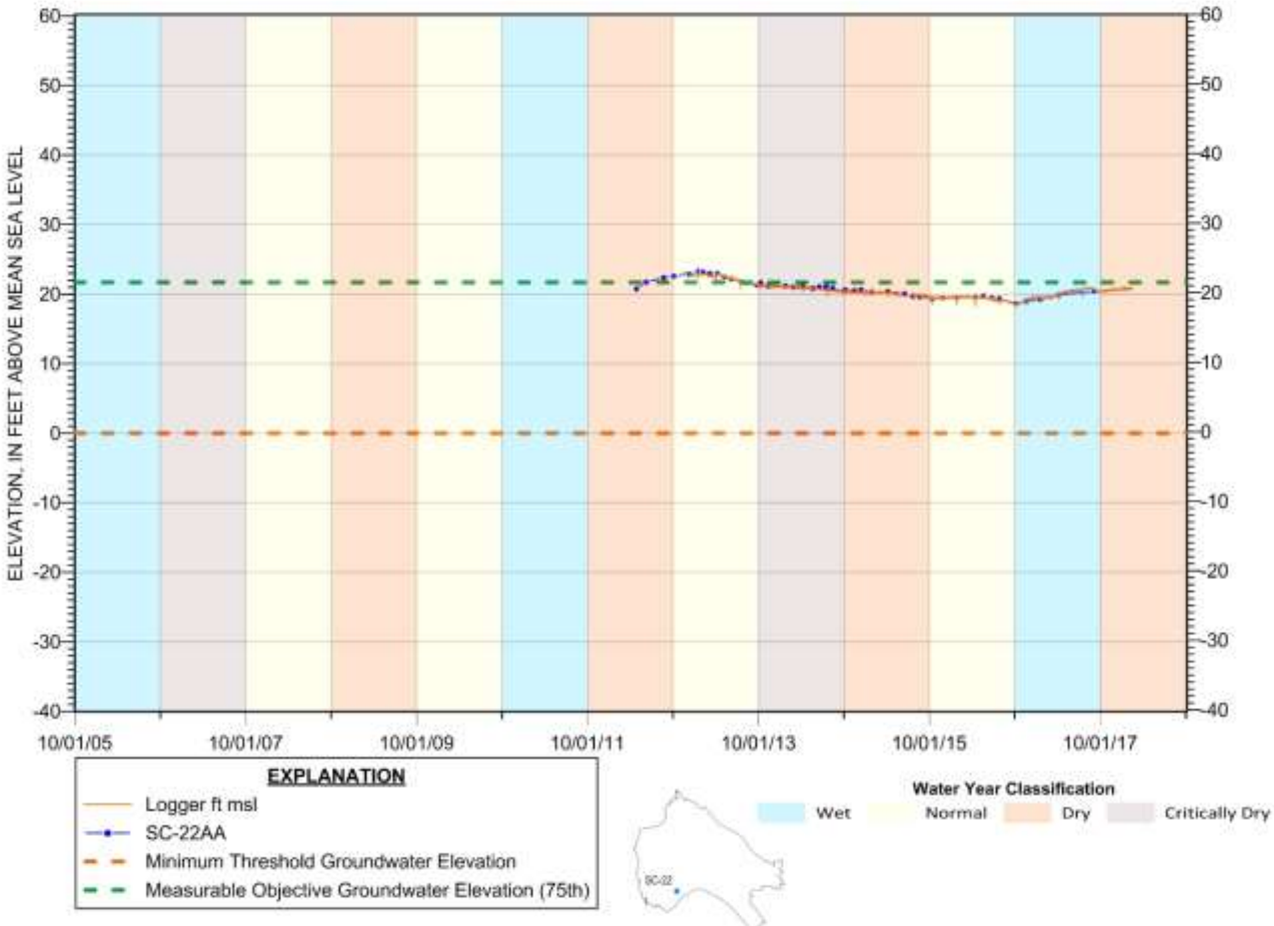

Figure 3-B.13. SC-22AA Hydrograph with Minimum Threshold and Measureable Objective

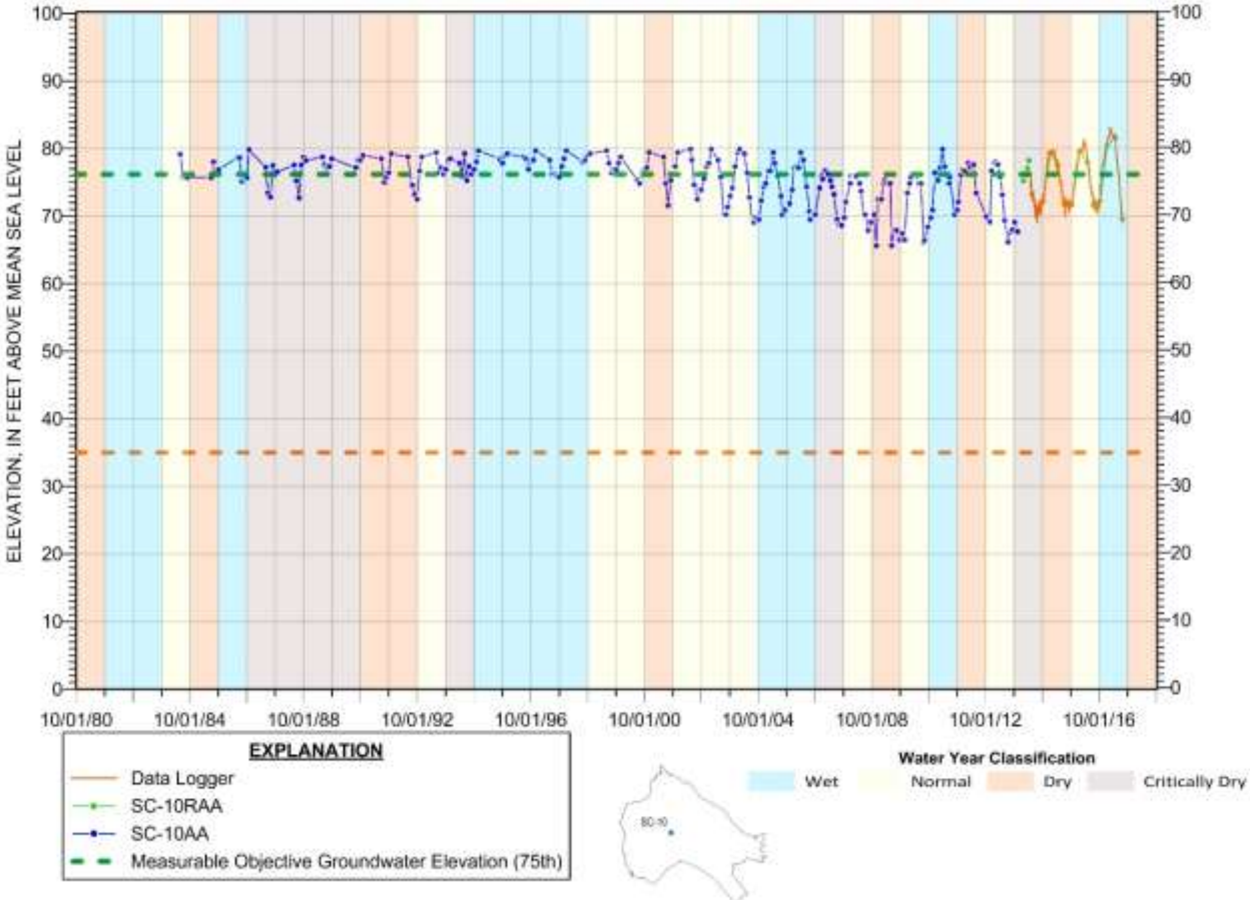

Figure 3-B.14. SC-10RAA Hydrograph with Minimum Threshold and Measureable Objective

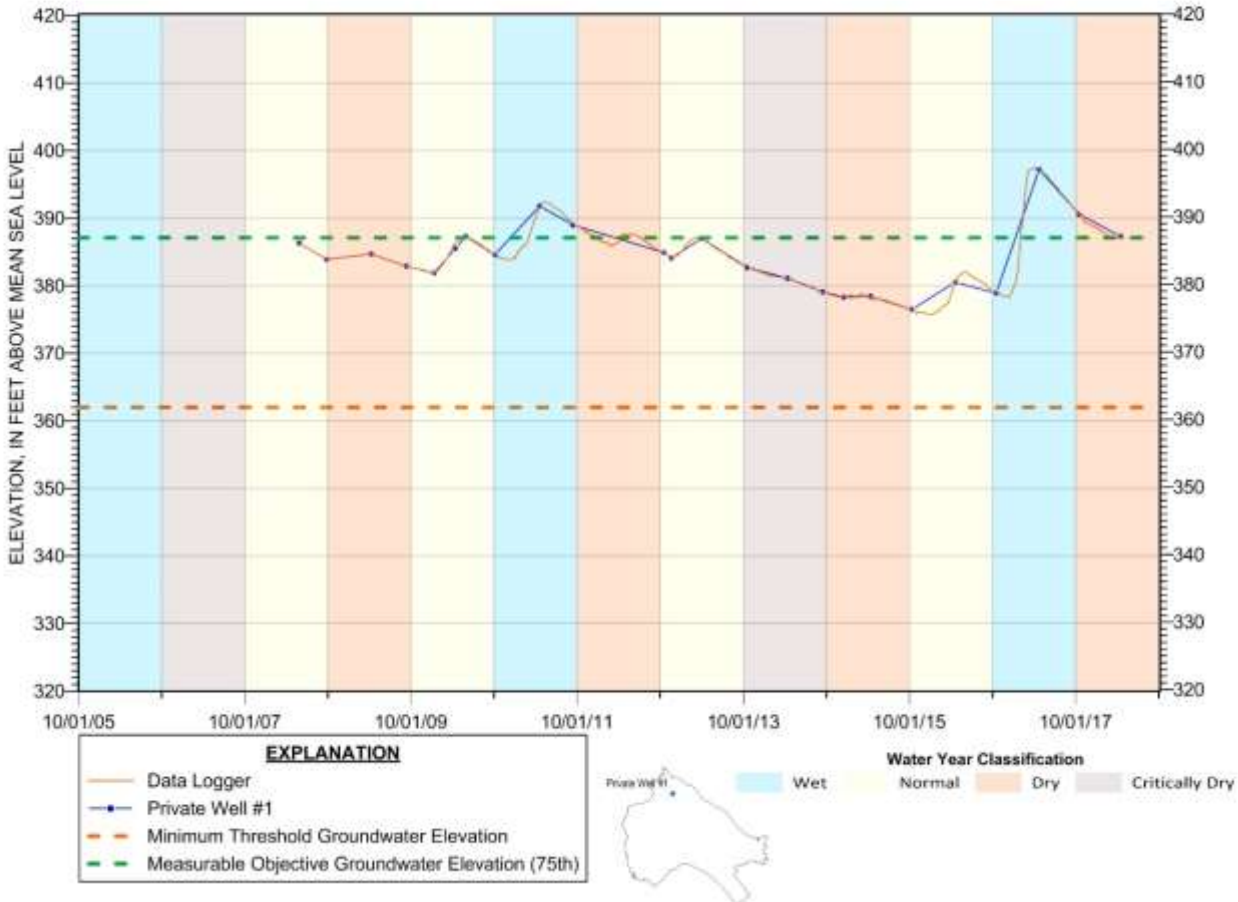

Figure 3-B.15. Private Well #1 Hydrograph with Minimum Threshold and Measureable Objective

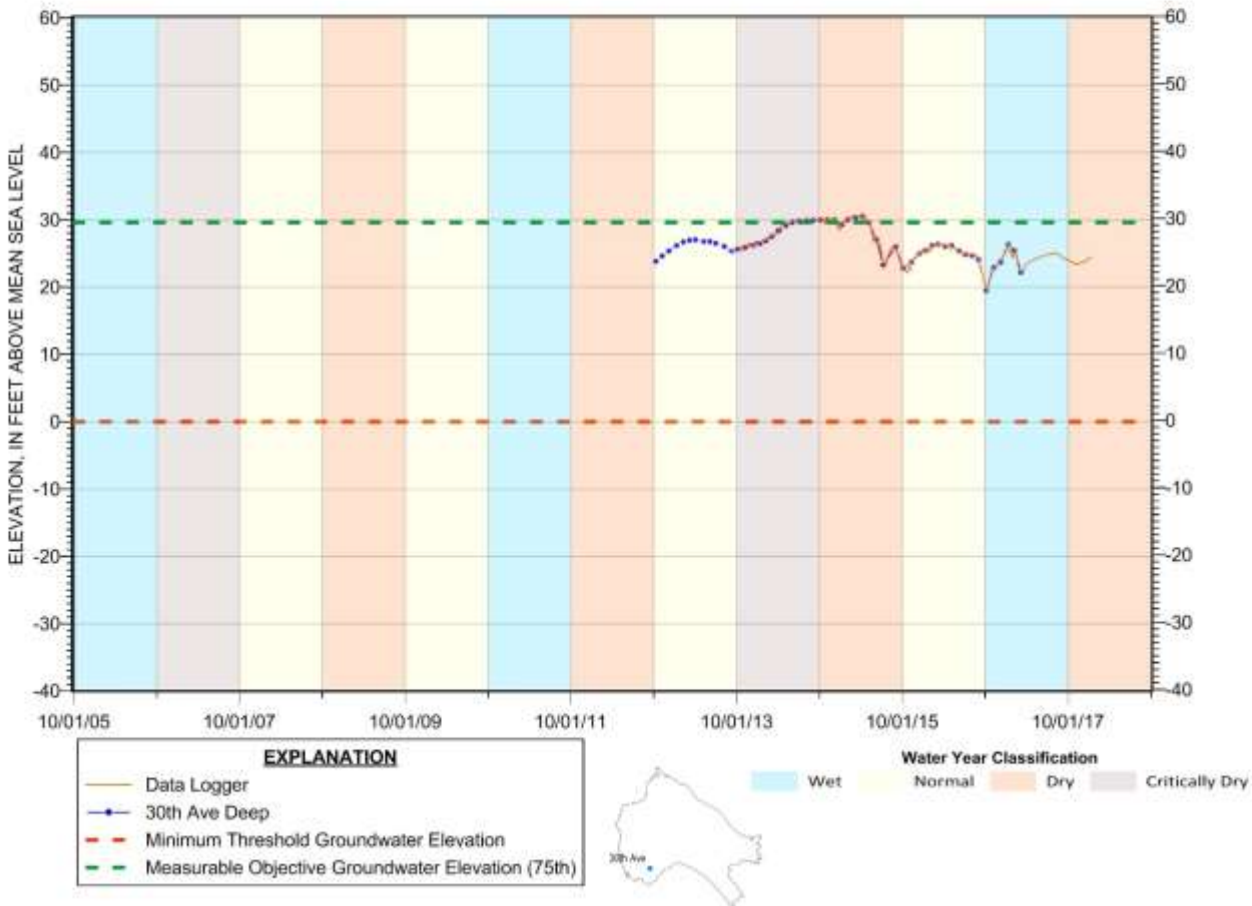

Figure 3-B.16. 30th Ave Deep Hydrograph with Minimum Threshold and Measureable Objective

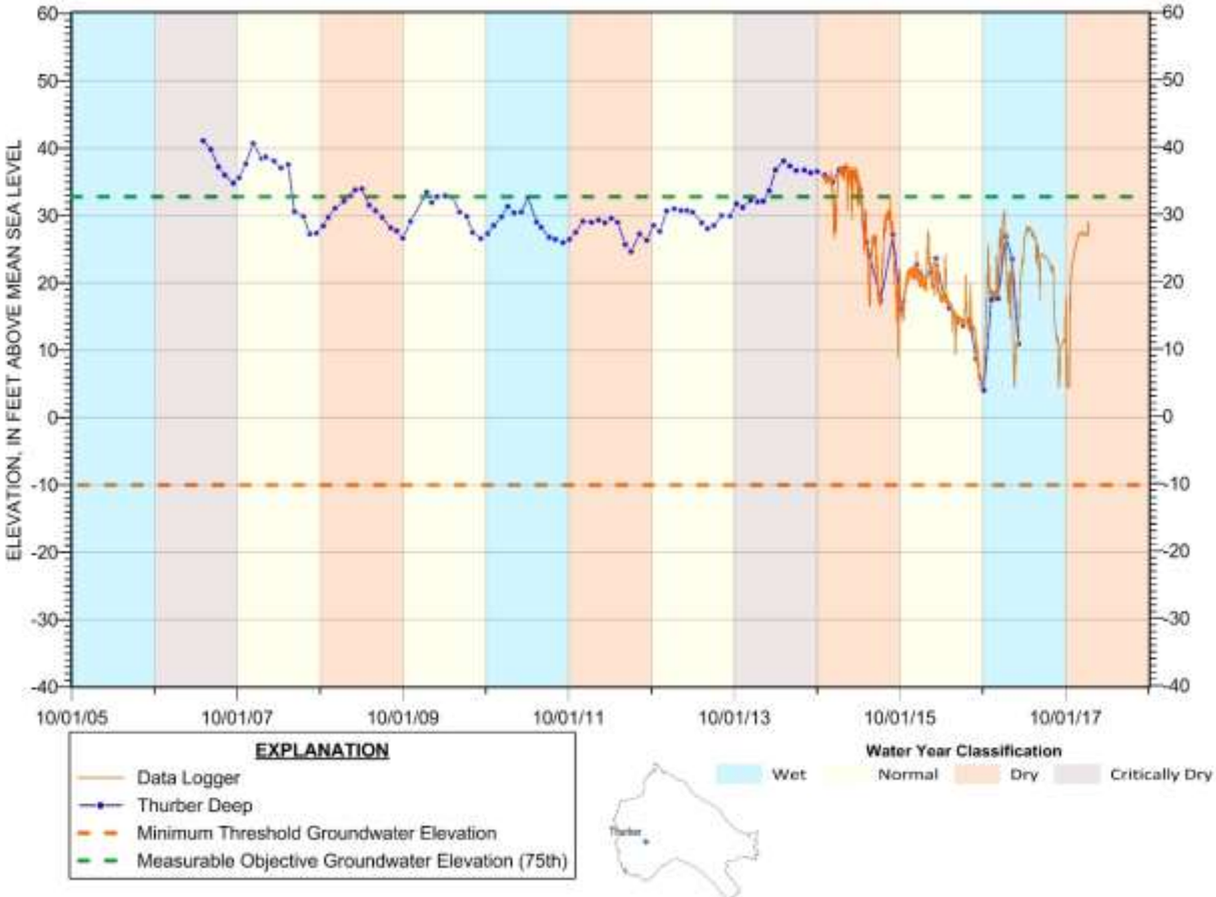

Figure 3-B.17. Thurber Lane Deep Hydrograph with Minimum Threshold and Measureable Objective

APPENDIX 3-C

SUMMARY OF FEDERAL, STATE, AND LOCAL WATER QUALITY REGULATIONS

Existing Regulatory Policies Related to Groundwater

This appendix provides an overview of federal, state, and local environmental laws, policies, plans, regulations, and guidelines (referred to generally as "regulatory requirements") relevant to groundwater resources and applicable to the MGA member agencies. The text is almost entirely from Pure Water Soquel's Draft Environmental Impact Report (EIR). The full Draft EIR document can be found at: https://www.soquelcreekwater.org/PWS-CEQA.

Federal and State Regulations

CLEAN WATER ACT (1972)

The federal Clean Water Act (CWA) of 1972's primary objective is to restore and maintain the integrity of the nation's waters. The objective translates into two fundamental national goals:

- to eliminate the discharge of pollutants into the nation's waters, and
- to achieve water quality levels that are fishable and swimmable.

To achieve the second objective, Designated Uses have been established for individual water bodies (e.g., lake, stream, creek, river) with typical designated uses including:

- Protection and propagation of fish, shellfish and wildlife;
- Recreation;
- Public drinking water supply; and
- Agricultural, industrial, navigational and other purposes.

The Clean Water Act includes an Antidegradation Policy (40 CFR 131.12).

Federal Antidegradation Policy

Section 303 of the Clean Water Act (CWA) (33 U.S.C. § 1313) requires that states adopt water quality standards for waters of the United States within their applicable jurisdiction. Such water quality standards must include, at a minimum, (1) designated uses for all waterbodies within their jurisdiction, (2) water quality criteria necessary to protect the most sensitive of the uses, and (3) antidegradation provisions. Antidegradation policies and implementing procedures must be consistent with the regulations in 40 C.F.R. § 131.12. Antidegradation is an important tool that states use in meeting the CWA requirement that water quality standards protect public health and welfare, enhance water quality, and meet the objective of the Act to "restore and maintain the chemical, physical and biological integrity" of the nation's waters. The CWA requires that states adopt antidegradation policies and identify implementation methods to provide three levels of water quality protection to maintain and protect (1) existing water uses and the level of water quality, (2) high quality waters, and (3) outstanding national resource waters.

SAFE DRINKING WATER ACT (1972)

The Safe Drinking Water Act (SDWA) is the federal law that is intended to protect public drinking water supplies throughout the nation (see: https://www.epa.gov/sdwa). Under the SDWA, EPA sets standards for drinking water quality and, with its partners (e.g., states), implements various technical and financial programs to ensure drinking water safety.

State agencies accepting primacy[1] authority from EPA implement drinking water regulations that are no less stringent than federal standards. Federal regulations and standards also apply to underground injections including Aquifer Storage and Recovery wells (see: https://www.epa.gov/uic/class-v-wells-injection-non-hazardous-fluids-or-above-underground-sources-drinking-water).

STATE WATER RESOURCES CONTROL BOARD RESOLUTION 68-16 ANTI-DEGRADATION POLICY

In 1968, the State Water Resources Control Board (SWRCB) adopted an anti-degradation policy (policy) aimed at maintaining the high quality of waters in California through the issuance of Resolution No. 68-16 ("Statement of Policy with Respect to Maintaining High Quality Waters in California"). They apply to both surface waters and groundwaters (and thus groundwater replenishment projects), protect both existing and potential beneficial uses of surface water and groundwater, and are incorporated into Regional Water Quality Control Board (RWQCB) Water Quality Control Plans (e.g., Basin Plans).

The policy requires that existing high water quality be maintained to the maximum extent possible, but allows lowering of water quality if the change is "consistent with maximum benefit to the people of the state, will not unreasonably affect present and anticipated use of such water (including drinking), and will not result in water quality less than prescribed in policies." The policy also stipulates that any discharge to existing high quality waters will be required to "meet waste discharge requirements which will result

[1] States accepting primacy are delegated authority by EPA to implement the regulation for which they have accepted primacy. The SDWA and CWA programs are typically delegated to states via primacy agreements.

in the best practicable treatment or control of the discharge to ensure that (a) pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained."

The policy prohibits actions that tend to degrade the quality of surface and groundwater. The RWQCBs oversee this policy (SWRCB, 1968). The anti-degradation policy states that:

- Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water, and will not result in water quality less than that prescribed in the policies.

- Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters must meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

SWRCB has interpreted Resolution No. 68-16 to incorporate the federal anti-degradation policy, which applies if a discharge that began after November 28, 1975 would lower existing surface and groundwater quality. This policy would apply to any project that brings in supplemental sources of water into the Basin because the projects would be required to comply with the state resolution maintaining the existing water quality.

Furthermore, one of the requirements for any recycled water project is that it must be compatible with State Board Resolution 68-16 and the Recycled Water Policy (see below). This can be evaluated on a project-specific localized impacts basis or can be evaluated in terms of the utilization of basin-wide groundwater assimilative capacity. Utilization of more than 10% of basin-wide assimilative capacity for compliance with anti-degradation policy has typically required a Salt and Nutrient Management Plan for the basin or a similar level of evaluation (Brown and Caldwell, 2018).

PORTER-COLOGNE WATER QUALITY CONTROL ACT

The Porter-Cologne Water Quality Control Act (Division 7 of the California Water Code) provides the basis for water quality regulation within California and defines water quality objectives as the limits or levels of water constituents established for the reasonable protection of beneficial uses. The SWRCB administers water rights, water pollution control, and water quality functions throughout California, while the Central Coast RWQCB (CCRWQCB) conducts planning, permitting, and enforcement activities. The Porter-Cologne Act requires the RWQCB to establish a regional Basin Plan with water quality objectives, while acknowledging that water quality may be changed to some degree without unreasonably affecting beneficial uses. Beneficial uses, together with the corresponding water quality objectives, are defined as standards, per federal regulations. Therefore, the regional basin plans form the regulatory references for meeting state and federal requirements for water quality control. Changes in water quality are allowed if the change is consistent with the maximum beneficial use of the State waters, it does not unreasonably affect the present or anticipated beneficial uses, and it does not result in water quality less than that prescribed in the water quality control plans. The basin plan regulations also apply to groundwater. The Basin Plan for this location is discussed below in the local regulations subsection.

This Act would apply to any project where any supplemental sources of water are brought into the Basin because they would have potential to affect water quality and beneficial uses in the Basin. Thus, it is likely that most supplemental water supply projects would be required to comply with the Basin Plan water quality objectives established by the CCRWQCB to protect the beneficial uses of groundwater. This is discussed in the Local Regulations subsection below.

STATE WATER RESOURCES CONTROL BOARD POLICIES RELATED TO GROUNDWATER

Sources of Drinking Water Policy

The Sources of Drinking Water Policy (adopted as Resolution 88-63) designates the municipal and domestic supply (MUN) beneficial use for all surface waters and groundwater except for those waters: (1) with total dissolved solids exceeding 3,000 mg/L, (2) with contamination that cannot reasonably be treated for domestic use, (3) where there is insufficient water supply, (4) in systems designed for wastewater collection or conveying or holding agricultural drainage, or (5) regulated as a geothermal energy producing source. Resolution 88-63 addresses only designation of water as drinking water source; it does not establish objectives for constituents that threaten source waters designated as MUN.

Recycled Water Policy

The Recycled Water Policy, adopted by the SWRCB in February 2009, and amended in 2013 to include monitoring for CECs (discussed below) for groundwater replenishment projects. The Recycled Water Policy was a critical step in creating uniformity in how RWQCBs were individually interpreting and implementing the Anti-degradation Policy in Resolution 68-16 for water recycling projects, including groundwater replenishment projects. The critical provisions in the Policy related to groundwater replenishment projects are discussed in the following subsections.

Constituents of Emerging Concern

As defined in the SWRCB Recycled Water Policy, CECs are chemicals in personal care products, pharmaceuticals including antibiotics, antimicrobials, agricultural and household chemicals, hormones, food additives, transformation products and inorganic constituents. These chemicals have been detected in trace amounts in surface water, wastewater, recycled water, and groundwater. The Recycled Water Policy includes monitoring requirements for six CECs for subsurface application groundwater replenishment projects using recycled water, four of which are used as health-based indicators and others serving as performance-based indicators. In addition to the Recycled Water Policy CECs, as part of the SWRCB regulations for groundwater replenishment projects with recycled water, a project sponsor must recommend CECs for monitoring in recycled water and potentially in groundwater in the project's Engineering Report. For recharge projects that use recycled water that has been treated using reverse osmosis (RO) and an advanced oxidation process (AOP), the monitoring requirements in the Recycled Water Policy only apply to recycled water prior to and after RO/AOP treatment (i.e., no groundwater sampling). None of the CECs currently have regulatory limits. The Recycled Water Policy includes monitoring trigger levels (MTLs) for the four health-based CEC indicators and response actions to be taken by groundwater replenishment project sponsors based on monitoring results compared to the MTLs. The MTLs were based on Drinking Water Equivalent Levels. A Drinking Water Equivalent Level represents the amount of a CEC in drinking water that can be ingested daily over a lifetime without appreciable risk (MRWPCA and MPWMD, 2016). The following CECs from the Recycled Water Policy are those with health-based indicators, treatment/performance- based indicators, or both as indicated below in parentheses.

- 17-β-estradiol - steroid hormone (health-based indicator)
- Caffeine – stimulant (health-based and performance-based indicator)
- N-nitrosodimethylamine (NDMA) – disinfection byproduct (health-based and performance- based indicator) [Note: NDMA's current California NL is 0.01μg/L]
- Triclosan – antimicrobial (health-based indicator)
- N,N-diethyl-metatoluamide (DEET) – ingredient in personal care products (performance- based indicator)
- Sucralose – food additive (performance-based indicator)

Salt and Nutrient Management Plans

In recognition that some groundwater basins in the state contain salts and nutrients that exceed or threaten to exceed Basin Plan groundwater objectives, and that some Basin Plans do not have adequate implementation measures to achieve compliance, the Recycled Water Policy includes provisions for managing salts and nutrients on a regional or watershed basis through development of Salt and Nutrient Management Plans (SNMP) rather than imposing requirements on individual recycled water projects (which had been the practice prior to adoption of the Recycled Water Policy). Unfavorable groundwater salt and nutrient conditions can be caused by natural soils, discharges of waste, irrigation using surface water, groundwater, or recycled water, and water supply augmentation using surface or recycled water (although treating the recycled water through RO prior to application would typically prevent this from occurring). The Recycled Water Policy recognizes that regulation of recycled water alone will not address these conditions. SNMPs are to be developed for every groundwater basin/sub-basin by May 2014 (May 2016 with a RWQCB-approved extension). SNMPs were not prepared for the Santa Cruz Mid-County Basin because it does not contain salts and nutrients in excess of Basin Plan objectives. If a SNMP is not prepared for a basin underlying a project or a project is using a limited amount of be available assimilative capacity (described below), the recycled water policy requires the preparation of a dedicated anti-degradation evaluation.

Antidegradation and Assimilative Capacity

Assimilative capacity is the ability for groundwater to receive contaminants without detrimental effects to human health or other beneficial uses. It is typically derived by comparing background ambient chemical concentrations in groundwater to the concentrations of the applicable Basin Plan groundwater quality objectives. The difference between the ambient concentration and groundwater quality objective is the available assimilative capacity.

The Recycled Water Policy establishes two assimilative capacity thresholds in the absence of an adopted SNMP. A groundwater replenishment project that utilizes less than 10% of the available assimilative capacity in a groundwater basin/sub-basin (or multiple projects utilizing less than 20% of the available assimilative capacity in a groundwater basin/subbasin) are only required to conduct an anti-degradation analysis verifying the use of the assimilative capacity. In the event a project or multiple projects utilize more than the designated fraction of the assimilative capacity (e.g., 10% for a single project or 20% for multiple projects), the project proponent must conduct a RWQCB-deemed acceptable (and more elaborate) anti-degradation analysis.

A RWQCB has the discretionary authority to allocate assimilative capacity to groundwater replenishment projects. There is a presumed assumption that allocations greater than the Recycled Water Policy thresholds would not be granted without concomitant mitigation or an amendment to the Basin Plan groundwater quality objective to create more assimilative capacity for allocation. Groundwater replenishment projects that utilize advanced treated recycled water will use very little to essentially none of the available assimilative capacity because of the high quality of the water.

Regional Water Quality Control Board Groundwater Requirements

The Recycled Water Policy does not limit the authority of a RWQCB to impose more stringent requirements for groundwater replenishment projects to protect designated beneficial uses of groundwater, provided that any proposed limitations for the protection of public health may only be imposed following regular consultation with the California SWRCB Division of Drinking Water (DDW). The Recycled Water Policy also does not limit the authority of a RWQCB to impose additional requirements for a proposed groundwater replenishment project that has a substantial adverse effect on the fate and transport of a contaminant plume (for example those caused by industrial contamination or gas stations), or changes the geochemistry of an aquifer thereby causing the dissolution of naturally occurring constituents, such as arsenic, from the geologic formation into groundwater. These provisions require additional assessment of the impacts of groundwater replenishment projects on areas of contamination in a basin and/or if the quality of the water used for replenishment causes constituents, such as naturally occurring arsenic, to become mobile and impact groundwater.

SWRCB DIVISION OF DRINKING WATER (DDW)

California's drinking water program was originally created in 1915, when the California State Board of Health established the Bureau of Sanitary Engineering. In 1976, two years after the Safe Drinking Water Act was passed, California adopted its own safe drinking water act (contained in the Health and Safety Code) and adopted implementing regulations (contained in Title 22 California Code of Regulation). The state's act had two main goals: (1) to continue the state's drinking water program, and (2) to be the delegated authority (referred to as the "primacy") by the EPA for enforcement of the federal Safe Drinking Water Act. As required by the federal act, California's program must set drinking water standards that are at least as stringent as the EPA's standards. Each public water system also must monitor for a specified list of contaminants, and the findings must be reported to the state.

The DDW regulates public water systems, oversees water recycling projects, permits water treatment devices, supports and promotes water system security, and performs a number of other functions. DDW has adopted enforceable primary and secondary maximum contaminant levels (MCLs). The MCLs are either based on the federal MCLs or as part of DDW's own regulatory process. For example, California has an MCL for perchlorate while there is no federal MCL. The MCLs account for not only chemicals' health risks, but also factors such as their detectability and treatability, as well as costs of treatment. Health and Safety Code Section116365(a) requires a contaminant's MCL to be established at a level as close to its Public Health Goal (PHG) as is technologically and economically feasible, placing primary emphasis on the protection of public health. The Office of Environmental Health Hazard Assessment (OEHHA) established PHGs. They are concentrations of drinking water contaminants that pose no significant health risk if consumed for a lifetime, based on current risk assessment principles, practices, and methods. OEHHA establishes PHGs pursuant to Health and Safety Code Section116365(c) for contaminants with MCLs, and for those for which MCLs will be adopted. Public water systems use PHGs to provide information about drinking water contaminants in their annual Consumer Confidence Reports. Certain public water systems must provide a report to their customers about health risks from a contaminant that exceeds its PHG and about the cost of treatment to meet the PHG, and hold a public hearing on the report. Action levels (AL) are included in CCRs for certain constituents where no MCLs have been established, i.e., under the lead and copper rule. If a constituent exceeds its AL, this triggers treatment or other requirements.

There are also a variety of chemicals of health concern whose occurrence is too infrequent in conventional drinking water sources to justify the establishment of national standards, but are addressed using advisory levels. The DDW, with the assistance of OEHHA, has established notification levels (NL) and Response Levels (RL) for that purpose. If a chemical is present in drinking water that is provided to consumers at concentrations greater than the RL (10 to 100 times greater than the NL depending on the toxicological endpoint of the constituent), DDW recommends that the source be taken out of service. If the source is not taken offline and a chemical concentration is greater than its NL in drinking water that is provided to consumers, DDW recommends that the utility inform its customers and consumers about the presence of the chemical, and about health concerns associated with exposure to it.

Final Groundwater Replenishment with Recycled Water Regulations hereafter, referred to as "Groundwater Replenishment Regulations," went into effect June 18, 2014 (SWRCB, 2014). The overarching principles taken into consideration by DDW in developing the Groundwater Replenishment Regulations were:

- Groundwater replenishment projects are replenishing groundwater basins that are used as sources of drinking water.
- Control of pathogenic microorganisms should be based on a low tolerable risk that was defined as an annual risk of infection from pathogen microorganisms in drinking water of one in 10,000 (10-4). This risk level is the same as that used for the federal Surface Water Treatment Rule for drinking water.
- Compliance with drinking water standards for regulated chemicals.
- Controls for unregulated chemicals.
- No degradation of an existing groundwater basin used as a drinking water source.
- Use of multiple barriers to protect water quality and human health.
- Projects should be designed to identify and respond to a treatment failure. A component of this design acknowledges that groundwater replenishment projects inherently will include storage in a groundwater aquifer and include some natural treatment.

CENTRAL COAST REGIONAL WATER QUALITY CONTROL PLAN (BASIN PLAN)

The CCRWQCB, under the authority of the California Water Code, is responsible for authorizing and regulating activities that may discharge wastes to surface water or groundwater resources.

This authority includes adoption of Basin Plans (Section 13240) with beneficial uses and water quality objectives (both narrative and numeric) to reasonably protect those uses (Section 13050). The Basin Plan also establishes guidelines for water used for irrigation. The Basin Plan for the Central Coast was originally adopted in 1971 and was last amended in 2011.

Groundwater beneficial uses for the Basin are listed as agricultural water supply (AGR), municipal and domestic water (MUN). The Basin Plan has:

- For MUN beneficial uses – groundwater criteria for bacteria and DDW primary and secondary MCLs.
- For AGR beneficial uses – objectives to protect soil productivity, irrigation, and livestock watering and guidelines to interpret a general narrative objective to prevent adverse effects on the beneficial use.

Permit limits for groundwater replenishment projects are set to ensure that groundwater does not contain concentrations of chemicals in amounts that adversely affect beneficial uses or degrade water quality. For some specific groundwater sub-basins, the Basin Plan establishes specific mineral water quality objectives for total dissolved solids, chloride, sulfate, boron, sodium, and nitrogen.

WATER WELL STANDARDS

Under California Water Code Section 231, enacted in 1949, California Department of Water Resources (DWR) is responsible for developing standards for the protection of well water quality. Authority for enforcing the standards as they apply to the construction, destruction, and modification of water wells rests with the Santa Cruz County Environmental Health Services, which also implements additional local requirements. The California Water Code requires contractors that construct or destruct water wells to have a C-57 Water Well Contractor's License, follow DWR well standards, and file a completion report with DWR (Water Code Sections 13750.5 et seq.).

WELL COMPLETION REPORTS

DWR is responsible for maintaining a file of well completion reports (DWR Form 188), which must be submitted whenever a driller works on a water well. Well completion reports must be filed with DWR within 60 days from the date of the work and must also be filed with the County. Well completion reports may be used by public agencies conducting groundwater studies, and may also be made available to the public as long as the owner's name is not made public (Water Code Sections 13751 and 13752).

GROUNDWATER RIGHTS

In California, water rights involve the right to use water, not the right to own water. While the Water Code implies the existence of groundwater rights, their doctrinal bases and characteristics are essentially the product of the decisions of the courts. There are three types of groundwater rights:

Overlying Rights. All property owners above a common aquifer possess a mutual right to the reasonable and beneficial use of a groundwater resource on land overlying the aquifer from which the water is taken. Overlying rights are correlative (related to each other) and overlying users of a common water source must share the resource on a pro rata basis in times of shortage. A property overlying use takes precedence over all non-overlying uses.

Appropriative Rights. Non-overlying uses and public uses, such as municipal uses, are called appropriative uses. Among groundwater appropriators, the "first in time, first in right" priority system applies. Appropriative users are entitled to use the surplus water available after the overlying user's rights are satisfied.

Prescriptive Rights. Prescriptive rights are gained by trespass or unauthorized taking that can yield a title because it was allowed to continue longer than the five year statute of limitations. Claim of a prescriptive water right to non-surplus water by an appropriator must be supported by many specific conditions, including a showing that the pumpage occurred in an open manner, was continuous and uninterrupted for five years, and was under a claim of right.

From a water law standpoint, rights of public agencies to store water via in-lieu recharge and to recapture water in the Santa Cruz Mid-County Basin can be summarized by the following general rules:

- The agencies have the right to recapture water that has been added to the groundwater supply as a result of in-lieu recharge;
- The agencies have the right to prevent other groundwater producers from extracting the replenished supply, although this could require litigation, and in some cases, adjudication of all rights to the groundwater basin may be necessary to determine rights to the total supply; and
- The underground storage and recovery of the groundwater basin cannot substantially interfere with the basin's native or natural groundwater supply.

Material Injury. Groundwater case law has generally adopted the threshold that "…material injury… turns on the existence of an appreciable diminution in the quantity or quality of water…" (District, 2010) A reasonable definition of "appreciable" would render a nearby well incapable of meeting its:

1. Historically measured maximum daily production level;
2. Historically measured dry-season production levels; or
3. Historically measured annual production levels under drought conditions.

Local Regulations

California Government Code Section 53091 (d) and (e) provides that facilities for the production, generation, storage, treatment, or transmission of water supplies are exempt from local (i.e. city and county) building and zoning ordinances. However, they would not be exempt from the requirements of Local Coastal Programs.

COASTAL ZONE MANAGEMENT ACT FEDERAL CONSISTENCY REVIEW

The federal consistency requirement set forth in Section 307 of the Coastal Zone Management Act (CZMA) requires that activities approved or funded by the federal government (e.g., the federally-funded California Clean Water State Revolving Fund Program) that affect any land or water use or natural resource of a state's coastal zone, must be consistent with the enforceable policies of the state's federally approved coastal management program.

California's federally approved coastal management program consists of the California Coastal Act, the McAteer-Petris Act, and the Suisun Marsh Protection Act. The California Coastal Commission implements the California Coastal Act and the federal consistency provisions of the CZMA for activities affecting coastal resources outside of San Francisco Bay. Subparts D and F of the federal consistency regulations govern consistency review for activities involving a federal permit and federal funding, respectively. These sections generally require the applicant to provide the subject state agency (e.g., the Coastal Commission) with a brief assessment of potential coastal resources impact and project conformity with the enforceable policies of the management program.

The Coastal Commission considers an application for a coastal development permit to satisfy the Subpart D and F conformity assessment requirements. Typically, the Coastal Commission will provide its response (concurrence, conditional concurrence, or objection) in its staff report for the coastal development permit. In cases where the coastal development permit is issued by a local government with a certified local coastal program (LCP), the Coastal Commission will typically provide its response in a letter, following the permit issuance and the completion of any appeals process.

California Coastal Act

The California Coastal Act (Public Resources Code Section 30000 et seq.) provides for the long-term management of lands within California's coastal zone boundary. The Coastal Act includes specific policies for management of natural resources and public access within the coastal zone. Of primary relevance to groundwater and water quality are Coastal Act policies concerning protection of the biological productivity and quality of coastal waters. For example, Article 4 of the Act details policies related to the marine environment, such as biological productivity and water quality. Specifically, and relevant to groundwater hydrology and water quality, the Act requires the quality of coastal waters, streams, wetlands, estuaries appropriate to maintain optimum populations of marine organisms and for the protection of human health, to be maintained and, where feasible, restored through, among other means, preventing depletion of groundwater supplies (Cal. Pub. Res. Code §§ 30231).

SANTA CRUZ COUNTY ENVIRONMENTAL HEALTH SERVICES

At the local level, the Santa Cruz County Environmental Health Services enforces the well drilling and reporting requirements of the California Water Code (Sections 13750.5 et seq.) through enforcement of Title 7, Chapter 7.70, Water Wells, of the Santa Cruz County Code. The Santa Cruz County Environmental Health Services well program provides permitting for the construction, destruction, and repair/modification of all wells, including geothermal heat exchange wells, cathodic protection wells, test wells, and monitoring wells.

Summary of Key Points

1. There are strong federal and state statutes and regulations governing water quality that will apply to implementation of management actions and/or projects that become part of the GSP;
2. Federal and state anti-degradation policies are particularly important in considering how projects and/or management actions might be used to support basin sustainability; and
3. Federal and state policy and regulations are not static but are continuously evolving based on new information and experience.

APPENDIX 3-D

HYDROGRAPHS OF REPRESENTATIVE MONITORING POINTS FOR DEPLETION OF INTERCONNECTED SURFACE WATER

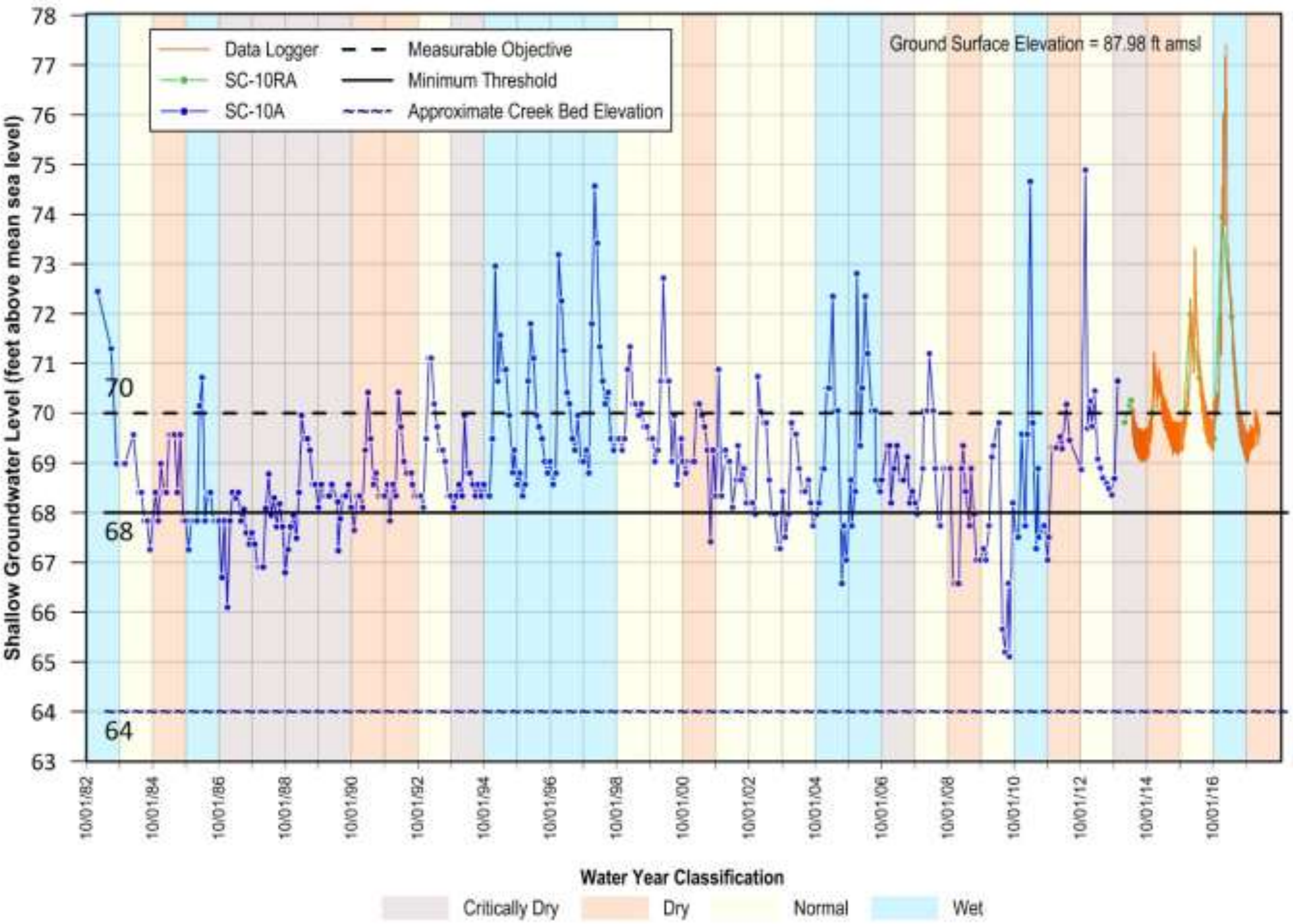

Figure 3-C.1. SC-10RA Hydrograph with Minimum Threshold and Measureable Objective

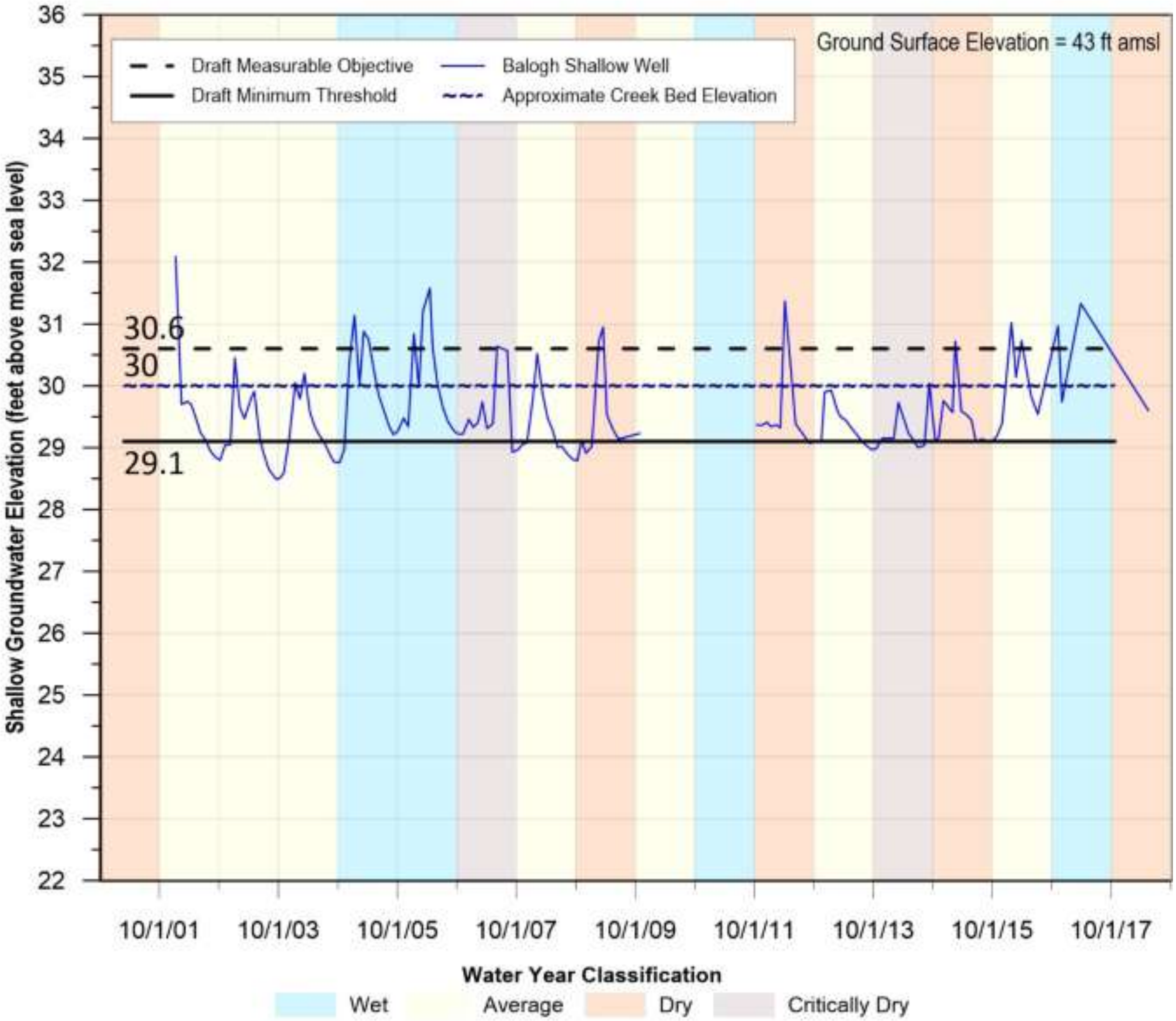

Figure 3-C.2. Balogh Shallow Monitoring Well Hydrograph with Minimum Threshold and Measureable Objective

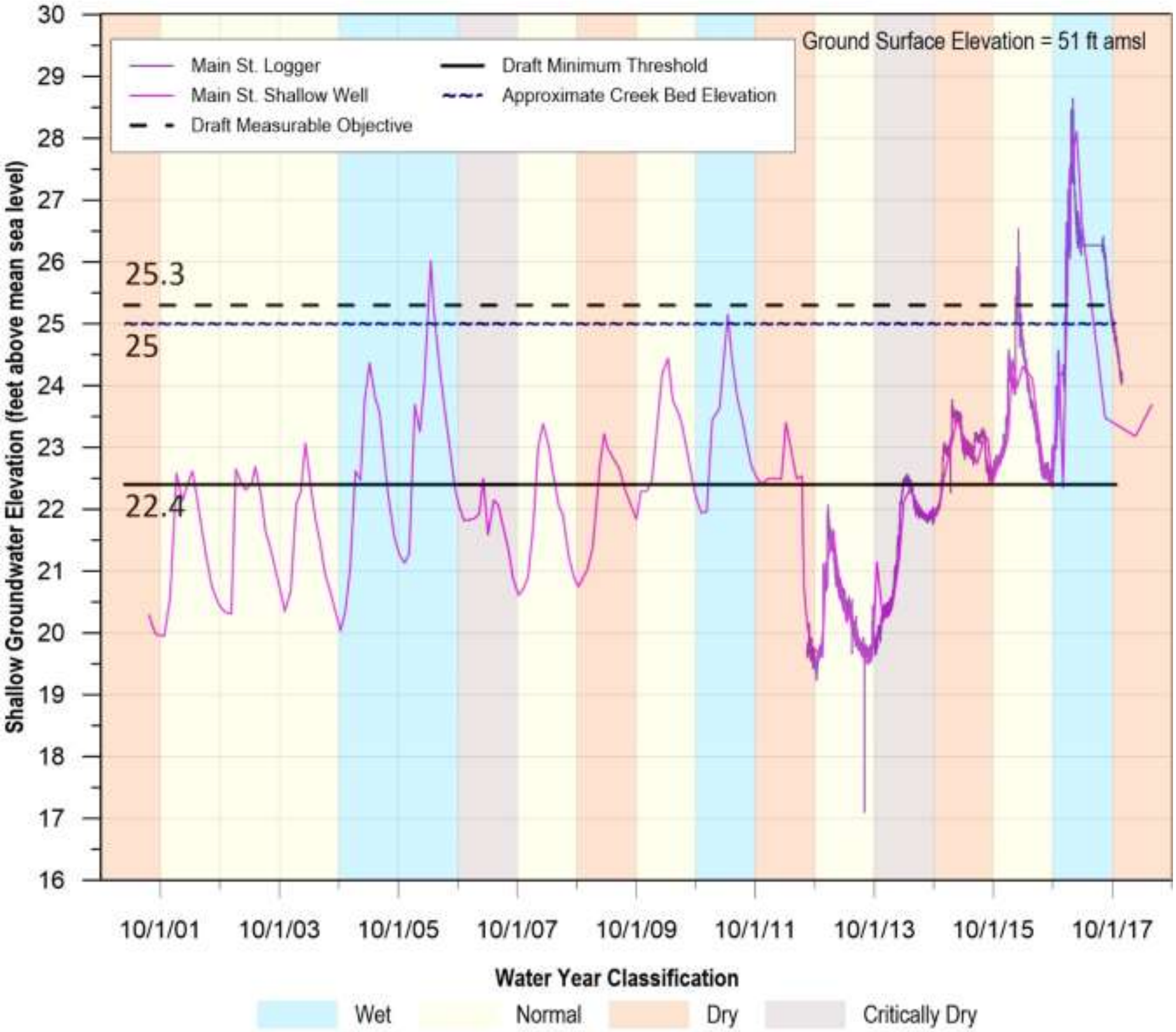

Figure 3-C.3. Main Street SW 1 Shallow Monitoring Well Hydrograph with Minimum Threshold and Measureable Objective

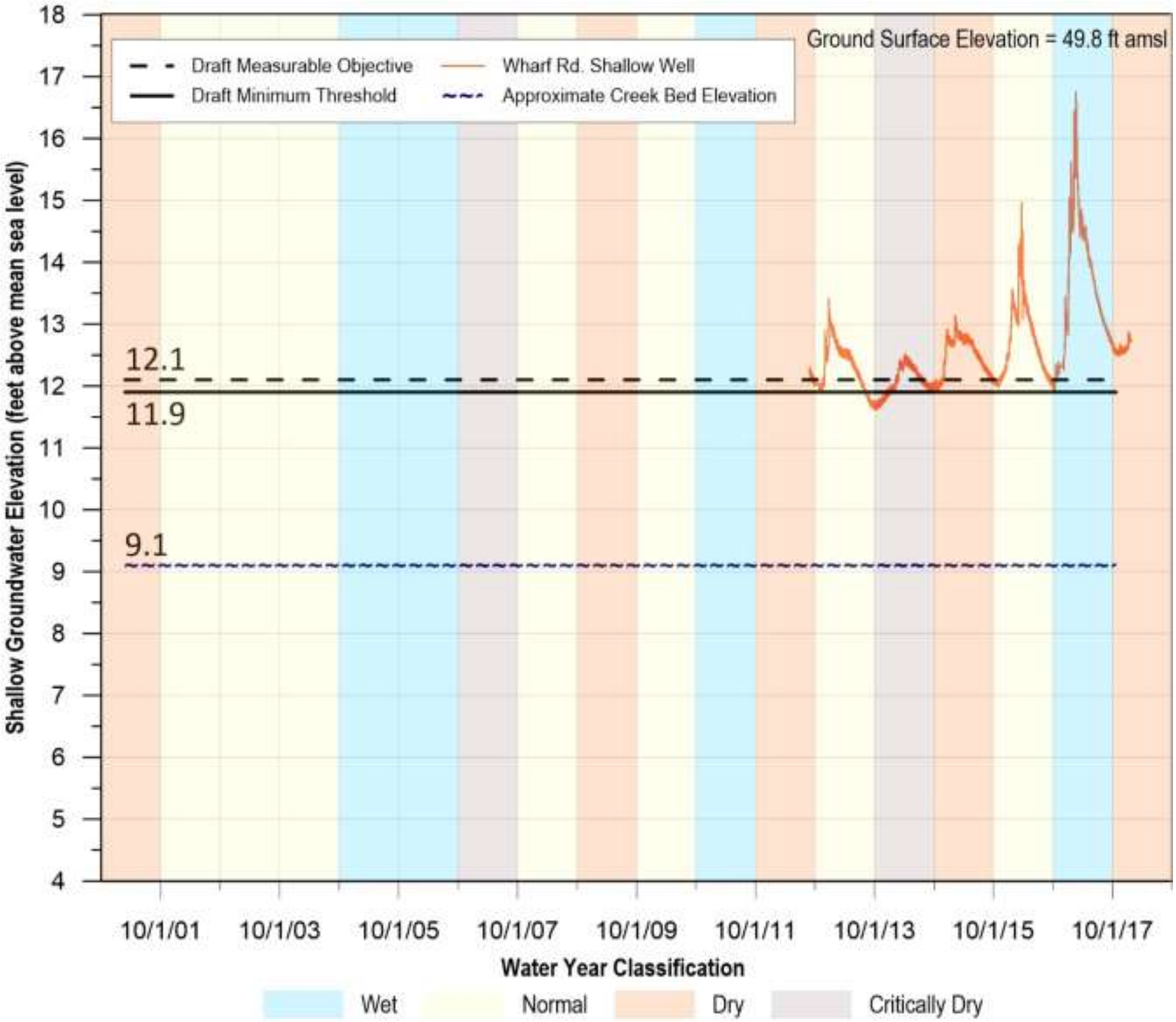

Figure 3-C.4. Wharf Road SW Shallow Monitoring Well Hydrograph with Minimum Threshold and Measureable Objective

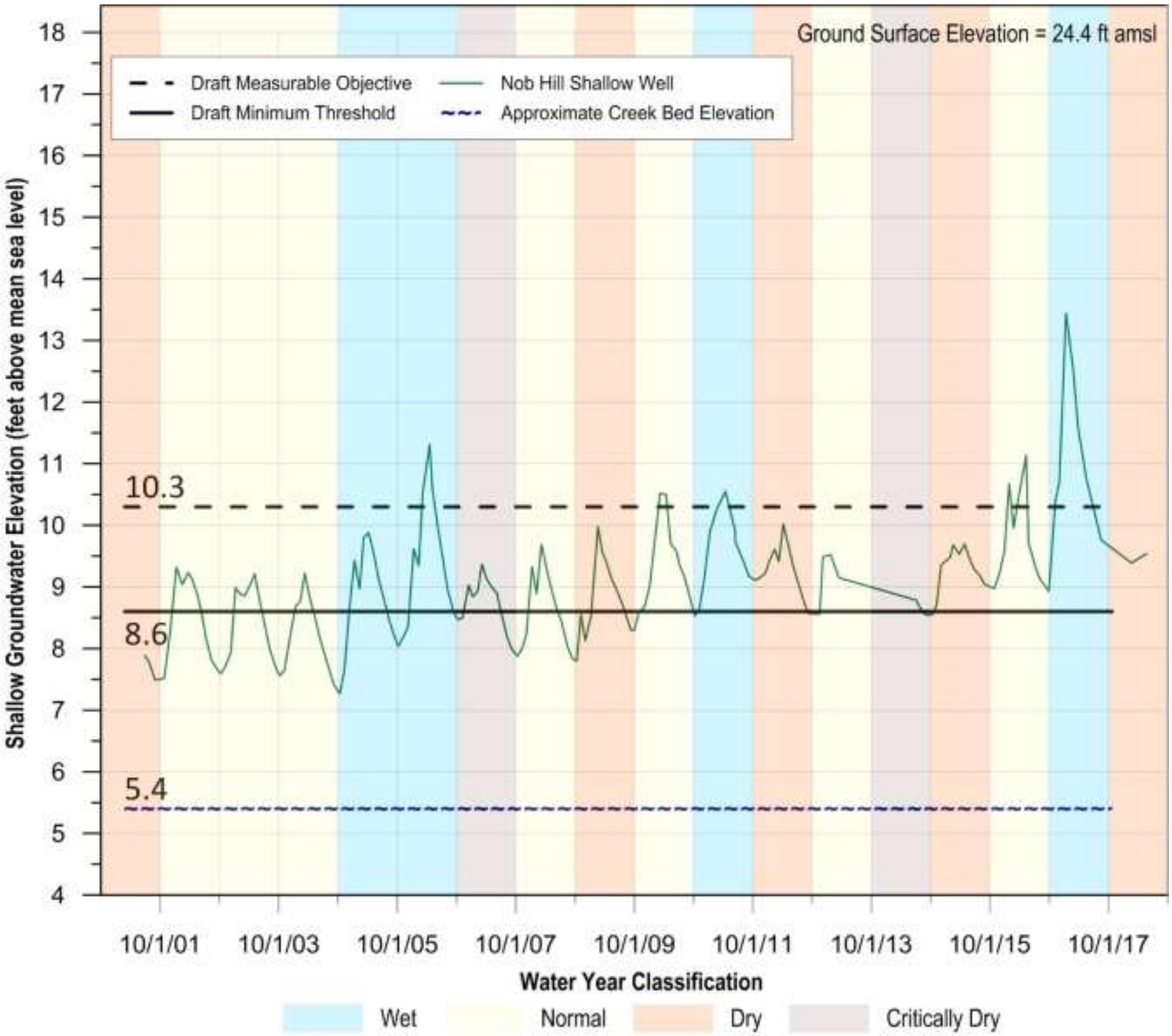

Figure 3-C.5. Nob Hill SW 2 Shallow Monitoring Well Hydrograph with Minimum Threshold and Measureable Objective

APPENDIX 5-A

SANTA CRUZ MID-COUNTY GROUNDWATER AGENCY EVALUATION OF PRIVATE PUMPER FUNDING MECHANISMS AND FEE CRITERIA, RAFTELIS, MAY 2019

SANTA CRUZ

MID-COUNTY GROUNDWATER AGENCY

Evaluation of Private Pumper Funding Mechanisms and Fee Criteria

May 2019

RAFTELIS

May 3, 2019

John Ricker
Water Resources Division Director
County of Santa Cruz
701 Ocean Street, Room 312
Santa Cruz, CA 95060

Subject: Private Non-de minimis Funding Options and Fee Criteria

Dear Mr. Ricker:

This memorandum identifies opportunities for the Santa Cruz Mid-County Groundwater Agency (MGA) to recover costs of Groundwater Sustainability Plan (GSP) administration and management. The criteria, necessary policies, and data required for charging non-de minimis pumpers are explained in detail as well as estimated charges based on preliminary cost estimates and groundwater user data. Development of a funding mechanism is critical to facilitate successful implementation of the GSP consistent with the requirements of the Sustainable Groundwater Management Act (SGMA). A key success factor is preparing a cost allocation that is equitable to GSA members and basin users.

This White Paper includes discussion on the following items:

- Preliminary GSA Budget
- Fee basis options
- Criteria for including/excluding users from cost recovery
- Calculation of hypothetical non-de minimis private pumper charges
- Costs and benefits of various types of charges
- Proposition 218 and 26 requirements in the context of SGMA

The tasks identified to prepare the White Paper include:

1. Determine the suite of options to recovery GSA costs from non-de minimis pumpers based on geographic location, proximity to surface water and the coast, volume of water pumped, and other criteria
2. Calculate fees using preliminary data based on parcels, acreage, and volumetric production of water
3. Assess the costs and benefits of each fee structure and mechanism for implementing each fee
4. Relate the implications of each fee type to the requirements of Proposition 218 and Proposition 26
5. Describe the conditions, if any, whereby de minimis users can be charged for a fair share of MGA costs

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1. Introduction and Study Background

1.1 Santa Cruz Mid-County Groundwater Agency

The Santa Cruz Mid-County Groundwater Agency (MGA) is a Joint Powers Authority (JPA)[1] formed by the Central Water District, the City of Santa Cruz, the Soquel Creek Water District, and the County of Santa Cruz to oversee groundwater management activities in the Mid-County Basin of Santa Cruz County. The MGA is governed by an eleven-member board consisting of two officials each from the agencies named in the JPA as well as three private well owner representatives. The MGA is charged with implementing the requirements of the Sustainable Groundwater Management Act (SGMA) of 2014 which consists of developing a Groundwater Sustainability Plan (GSP) and implementation of the adopted GSP over a long horizon.

Due to chronic over-pumping and impending seawater intrusion into the aquifer, the Mid-County Basin has been designated a critically overdrafted basin by the Department of Water Resources (DWR) in Bulletin 118. Basins designated as "critical" must submit sustainability plans to DWR by January 2020 and achieve "sustainability" over a 20-year period. Sustainability is defined as mitigation of the following six undesirable results[2]:

- 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.
- Significant and unreasonable reduction of groundwater storage.
- Significant and unreasonable seawater intrusion.
- Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.
- Significant and unreasonable land subsidence that substantially interferes with surface land uses.
- Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

1.2 Study Purpose

The MGA has acquired grant funds to develop and submit the GSP. This paper concerns the long-term costs of managing, administering, and regulating the basin after GSP adoption, otherwise referred to as GSP implementation. More specifically, this paper addresses options in regulating and recovering plan implementation costs from private groundwater users not affiliated with the three municipal water agencies who are party to the JPA. Plan implementation costs include regulatory activities associated with groundwater monitoring, administration of the GSP, periodic reporting, outreach, and fee collection, among other activities. The following sections detail the estimated plan implementation costs (budget), identify several fee setting mechanisms for

[1] Joint Exercise Powers Agreement signed March 17, 2016
[2] Water Code §10721(x)

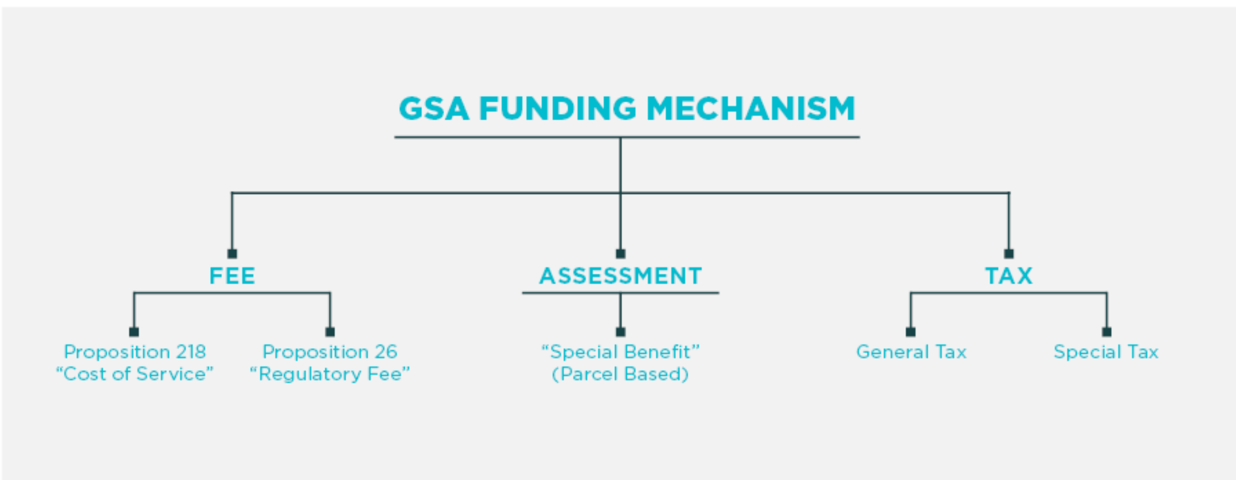
evaluation, discuss different measurement options for determining a regulatory fee, and considers the MGA's authority to charge non-de minimis[3] private groundwater users for groundwater management activities.

[3] SGMA defines de minimis users as those that are residential *and* extract less than two acre-feet of water per year. All other extractors are considered non-de minimis.

2. Funding Mechanisms

Due to Constitutional limitations imposed through California's Propositions 13, 218, and 26, there are strict distinctions between, and regulations associated with, fees and taxes. Taxes and assessments require voter approval. Water rates passed under Proposition 218 are subject to mandatory noticing and a potential majority protest. Regulatory fees are identified as an exemption from taxes under Proposition 26 and can be passed by majority vote of the governing body of the Agency imposing the fee[4]. An example is a dollar per acre foot ($/AF) pumping charge levied by a groundwater management agency. Other fees require protest proceedings for individuals who are paying the fees, for example water rates of a public utility. Figure 1 is a graphical illustration of the broad options available to MGA. What follows in this section is a primer on the various funding mechanisms available for exploration and considerations for the use of each as they relate to future MGA charges.

Figure 1- Funding Options



Raftelis is not a law firm and does not purport to give legal advice or make any recommendation on the legality of individual options in the context of SGMA. The aim is to illustrate the universe of funding mechanisms that may be available to the MGA. The legality of various funding options in the context of GSA fees and charges is fluid. The most recent meaningful case for MGA to consider is the *City of San Buenaventura versus United Water Conservation District* decision (Cal. Supreme Court Case No. S226036). Ultimately the GSA Counsel must opine on the legality of the funding mechanisms and MGA must choose what it believes to be most appropriate for the basin and its groundwater users. The following section introduces four potential funding mechanisms, including the statutory authorization and adoption procedures of each.

2.1 Regulatory Fee (Proposition 26)

The Agency can assess regulatory fees governed by Proposition 26 (Prop 26). This Proposition, passed in 2010, states that everything is a tax under the California Constitution Article XIII C, section 1(e), except:

[4] Proposition 26 and 218 Implementation Guide, League of California Cities, Sacramento, California, 2017

- **A charge imposed for a specific benefit** conferred or privilege granted directly to the payor that is not provided to those not charged, and which does not exceed the reasonable costs to the local government of conferring the benefit or granting the privilege.
- **A charge imposed for a specific government service** or product provided directly to the payor that is not provided to those not charged, and which does not exceed the reasonable costs to the local government of providing the service or product.
- **A charge imposed for the reasonable regulatory costs** to a local government for issuing licenses and permits, performing investigations, inspections, and audits, enforcing agricultural marketing orders, and the administrative enforcement and adjudication thereof.
- **A charge imposed for entrance to or use of local government property**, or the purchase, rental, or lease of local government property.
- **A fine, penalty, or other monetary charge** imposed by the judicial branch of government or a local government, as a result of a violation of law.
- **A charge imposed as a condition of property development**.
- **Assessments and property-related fees** imposed in accordance with the provisions of Article XIII D.

Property-related fees and special benefit assessments levied under Article XIII D are an exemption (number 7) from the requirements of Proposition 26. Additionally, every exaction must bear a fair or reasonable relationship to the payer's burden on, or benefits received from, the governmental activity.

Example: City of San Buenaventura (Ventura) Decision, 2017[5]
United Water Conservation District (District) imposes groundwater pumping fees. The District charges non-agricultural users three times that of agricultural uses. The City of Ventura challenged that the difference in pumping charges represented an illegal subsidy to agricultural users and violated Article XIII D, section 6(b) (Proposition 218) because the fees exceeded the cost of service. The appellate court held that the charges are not property related fees because they are based on the pumping activity and not property ownership (Ventura Water customers do not have their own wells). The court determined that the pumping charges are regulatory fees meeting the first two exceptions of Article XIII C, section 1(e): fee imposed for a specific benefit and does not exceed the reasonable cost of the service. Further the court stated that the reasonableness of costs is not to be measured on an individual basis, but on a collective basis. Since the total cost recovery across all users is reasonable, so is the fee.

MGA may argue that the fee imposed on users is for the reasonable regulatory costs related to managing the groundwater basin. This would presumably comply with Section 1(e)(3) *"A charge imposed for the reasonable regulatory costs…"* The calculated fees charged by MGA should not exceed the reasonable costs of administering and managing the GSP and the basin, and the fees should be proportional to the benefits.

[5] City of San Buenaventura v. United Water Conservation Dist. (2017) 3 Cal.5th 1191, 1198 (City of San Buenaventura)

Key Considerations
Cost to develop: Low
Cost to implement: Low
Collected by: Direct billing or County Assessor
Limitations on use of funds: Reasonable costs of managing the basin
Ease of protest: Not applicable

2.2 Rate/Fee for Service (Proposition 218)

Proposition 218 (Prop 218), passed by the voters in 1996, governs property related fees including water, wastewater, and solid waste. The measure created an amendment to the California Constitution: Article XIII D, Section 6. Proposition 218 was enacted to ensure in part that fees and charges imposed for ongoing delivery of a service to a property are proportional to, and do not exceed, the cost of providing service. Proposition 218 defines property related fees for service and the criteria for achieving the amendment's requirements. The principal requirements, as they relate to public water service fees and charges are as follows:

- Revenues derived from the fee or charge shall not exceed the costs required to provide the property-related service.
- Revenues derived by the fee or charge shall not be used for any purpose other than that for which the fee or charge was imposed.
- The amount of the fee or charge imposed upon any parcel shall not exceed the proportional cost of service attributable to the parcel.
- No fee or charge may be imposed for a service unless that service is actually used or immediately available to the owner of property.
- A written notice of the proposed fee or charge shall be mailed to the record owner of each parcel not less than 45 days prior to a public hearing, when the Agency considers all written protests against the charge.

Procedurally, Prop 218 requires noticing of all affected properties with each property allowed to protest the proposed rates. Absent a majority protest, rates can be adopted by majority vote of the governing body at a public hearing. SGMA makes explicit that fees imposed on the extraction of groundwater "shall be adopted in accordance with subdivisions (a) and (b) of Section 6 of Article XIII D of the California Constitution" (Water Code 10730.2(c)). This section is commonly referred to as Proposition 218.

As it exists, the section of the Water Code created by SGMA requires that fees charged by a GSA comply with Proposition 218 as a water service fee. It is Raftelis' understanding that there may be attempts to amend Water Code Section 10730.2(c) and adopt a lower standard. It is also our understanding that water law practitioners have varying opinions of the requirements of Section 10730.2 as it relates to fee adoption and "extraction of groundwater from the basin." The language in the Water Code is clear, however, and the issue will surely be litigated in the courts in the years to come.

The noticing and majority protest requirements of Proposition 218 presents challenges and questions in the context of GSA fees. If only private non-de minimis pumpers are noticed, it would be easy to foresee a majority protest as the groups are generally few and organized. Including de minimis users in the noticing may reduce the likelihood of a protest, however, it is unclear to Raftelis if such noticing would be considered legal since users classified as de minimis would receive a notice but no charge for service. More, if only private users are noticed it is unclear if the substantive requirements of Proposition 218 would be met. Consider for example that all residential, commercial, and irrigation users within a municipal agency boundary are also users of groundwater, albeit with service from municipal wells. Is it legally defensible to exclude these users from noticing even if their water service provider is paying their proportional share of MGA management costs? Inclusion of municipal users to notice the entirety of the management area would almost certainly guarantee no majority protest of the fee, but again if these users were not assessed a fee in the notice it is unknown if this action would be legal. More, if municipal users are de-minimis in their water use (residential with annual consumption below two-acre feet per year (AFY)) is it lawful to charge these parcels if MGA is not "regulating" them at the time of fee adoption? These questions require further exploration by MGA's legal team.

Key Considerations
Cost to develop: Low-Moderate – Cost of Service Study Report
Cost to implement: Low
Collected by: Direct billing or County Assessor
Limitations on use of funds: Only for those costs identified in the Cost of Service Study
Ease of protest: Moderate to high

2.3 Assessment (Special Benefit Nexus)

Special assessments have been redefined over the years. Assessments for special benefit are also governed by Proposition 218 and are exempted from Prop 26; nor are they subject to a 2/3 vote like a special tax. Property owners can be assessed to pay for a public improvement or service if it provides a special benefit to the property. To assess, local government bodies must:

- Develop a Special Benefit methodology to determine each parcel's assessment
- Ensure that each owner's assessment does not exceed its proportional share of total costs when compared to total project costs
- Ensure only special benefits are assessable
- Ensure all parcels which benefit are assessable (with no government property exemptions)
- Prepare an engineer's report that determines the amount of special benefit to each property
- Notify all affected property owners by mail with mail-in protest ballot form

The Agency must then hold a Public Hearing to determine if a majority protest exists. Protest ballots are tabulated and weighted based on the *amount* of each assessment. Assessments have a similar implementation timeline to utility rates and the Agency has complete control over the timeline (unlike taxes). Once the Engineer's Report is approved, notices must be mailed at least 45 days prior to the public hearing. The notice must include the affected parcel's protest ballot. An average project timeline from start to finish is six months.

Like a possible majority protest under Proposition 218, the Agency runs the risk of protest by assessment if a few large users exercise their disproportionate power to protest the special assessment, and if only private non-de minimis pumpers are included. MGA could consider a special assessment for all users basin-wide to reduce the chance of protest, however, the lawfulness of assessing fees to de minimis users who are not "regulated" at the time of adoption is unclear. Further, an assessment may be challenged post-formation by any property owner under the premise that the special benefit is invalid.

Key Considerations
Cost to develop: Moderate – Outreach and special benefit nexus report
Cost to implement: Low
Collected by: County Assessor
Limitations on use of funds: Only for those costs identified in the Engineer's Report
Ease of protest: Moderate to high

2.4 General and Special Taxes (approval from electorate)

Everything that does not meet the exceptions defined in Proposition 26, and is not a special assessment, is considered a tax and must be approved by the voters. The Agency is still required to develop a reasonable relationship between the tax and affected parcels. The tax could potentially be spread based on acreage, parcel, or by estimated pumping. These are not the only options but are the most likely given data availability. General taxes require a simple majority vote; however, the charges required to manage the basin and administer the GSP would most likely be considered a special tax. Article XIII D, Section 2(a) states that "Special purpose districts or agencies, including school districts, shall have no power to levy general taxes." Special taxes require a two-thirds (2/3) approval from the electorate (i.e. registered voters); and with a special tax, government properties are exempt from the tax.

A special tax would need to be placed on a ballot for either a general election or special election. There are specific tasks and a firm timeline that must be followed to include a tax measure on an election ballot. The minimum time required prior to election day to fulfill the requirements is approximately 90 days. A special tax is the option with the highest risk of failure as unlike Proposition 218 fees and assessments that require majority protest, a special tax would fail with any less than a 2/3 majority.

Key Considerations
Cost to develop: Low-Moderate
Cost to implement: High compared to other options
Collected by: County Assessor
Limitations on use of funds: None
Ease of protest: Moderate for General Tax; High (super-majority threshold failure) for Special Tax

2.5 Contract

A novel approach in recovering costs and charging non-de minimis extractors is to sign contracts with each based on individual pumping. Depending on the number of extractors and their agreeability, or lack thereof, negotiation costs may be high. Individual contracts may help to avoid political landmines related to the protest of fees and assessments or the high threshold of a special tax, however, it is Raftelis' recommendation that all non-de minimis users (any residential extractor greater than two AFY or any non-residential extractor) have a contract with MGA.

The Agency could face legal challenge if it was determined that low volume extractors were excluded from a contract because it was cost effective and politically expedient to do so.

Key Considerations

Cost to develop: Unknown

Cost to implement: depends on number of extractors and timeliness of negotiations

Collected by: Direct billing by MGA

Limitations on use of funds: Unknown

Ease of protest: Not applicable

Table 1 - Funding Mechanism Matrix

Basis	Development Cost	Implementation Cost	Collection	Funds Limitation	Ease of Protest
Prop 26 Regulatory Fee	Low	Low	Direct or Assessor Billing	Reasonable Costs	N/A
Prop 218 Fee for Service	Low-Moderate	Low	Direct or Assessor Billing	Cost of Service	Moderate to High
Special Assessment	Moderate	Low	Assessor Billing	Special Benefit Parcels	Moderate to High
Special Tax	Low-Moderate	High	Assessor Billing	None	High
Contract	Unknown	Unknown	Direct	Unknown	N/A

3. GSA Charges

3.1 GSA Budget

The GSA will incur costs in implementing the GSP. These include administrative costs, monitoring costs, and other interim costs. MGA has estimated a preliminary annual and five-year budget (annualized) for these activities including administration and personnel, data management, monitoring and management, and reporting. These costs are summarized in Table 2. The estimated annualized budget in 2019 dollars is $350,000.

3.1.1 ADMINISTRATIVE COSTS

These costs include dedicated MGA staff support, internal reporting, managing Agency information, public outreach, legal retainer, and program coordination.

3.1.2 MONITORING COSTS

There are several costs associated with monitoring groundwater in the basin. These are discussed in further detail below.

1. **Water Quality**

   Includes collection, testing, and analysis of groundwater samples from designated monitoring wells on a semi-annual basis. A trained professional will visit designated wells, perform field testing of select water quality parameters, collect samples, and send samples to a laboratory for water quality testing. Test results will be tabulated and reported per the GSP guidelines. Management of data, as well as annual preparation of a water quality monitoring summary.

   The water budget and numeric groundwater model will be updated and calibrated to incorporate the previous 5 years of applicable data.

2. **Stream Flow Monitoring**

   Inspection and monitoring of streams within the basin on a semi-annual basis. Tasks may include measuring flow rates, visual inspection of streams, noting changes in geomorphology, and preparation of a stream monitoring summary.

3. **Groundwater Monitoring and Shallow Groundwater Elevation**

   Monitoring of groundwater levels conducted semi-annually throughout the well network within the Basin. This may consist of multiple days of field monitoring annually in which a trained professional will manually measure depth to water, or, collect data from transducer data loggers. Management of data, as well as annual preparation of groundwater level monitoring summary.

4. **SkyTEM Offshore Surveys**

Monitoring of the change in the saltwater interface offshore is vital to the assessment of ongoing risk to the basin of saltwater intrusion. The SkyTEM geotechnical survey will be conducted approximately every 5 years.

5. Model Updates

As needed, the numeric groundwater model will be updated and calibrated with the data collected through the monitoring, and will in-turn inform additional data collection gaps.

6. Data Management System

Collected monitoring data will be included in a data management system.

3.1.3 FIVE YEAR ADDITIONAL SCOPE OF WORK

Every 5th year of GSP implementation and whenever the GSP is amended, the GSA is required to prepare and submit an Agency Evaluation and Assessment Report to the Department of Water Resources together with the annual report for that year. The assessment and report will be prepared as described in CWC § 356.10. Five-year costs are annualized to determine the amount of revenue required to fund Five Year activities on an annual basis.

1. Updated Water Budget and Sustainable Yield Value

The water budget will be updated and calibrated to incorporate the previous 5 years of applicable data. Using the updated model, MGA will generate a refined estimate of the sustainable yield of the basin.

2. Five Year Plan Evaluation and Assessment Report

Every 5th year of GSP implementation and whenever the GSP is amended, the GSA is required to prepare and submit an Agency Evaluation and Assessment Report to the Department together with the annual report for that year. The assessment and report will be prepared as described in California Water Commission (CWC) § 356.10.

3.1.4 COST CONTINGENCY

MGA is a new entity and is budgeting from the ground up. The cost estimate should account for a contingency between estimated and actual expenses. Cost contingencies provide a buffer for the variance in costs, particularly in the early years. Most frequently contingencies are estimated as a percentage of the total budget, or with better information, an expected dollar value. Comparable agencies budget for a contingency of 10 to 20 percent of expenditures. As the budgets in Sections 3.1.1, 3.1.2, and 3.1.3 are rough estimates using staff and consultant judgment and best available data, the cost estimate accounts for a $25,000 contingency.

3.1.5 RESERVES

In addition to covering the operations budget, the GSA should consider adoption of a reserves policy which is expressly authorized by SGMA (Section 10730(a) and 10730.2(a)(1)). Reasonable and achievable reserves are a prudent financial tool to aid in cash flow timing and unforeseen expenditures. Generally, a reserve for operations targets a specific percentage of annual operating costs or days of cash on hand. The reserve target is influenced by several factors including the frequency of billing and the recurrence of expenses. Comparable reserve percentage is 50% of operating budget if billing semi-annually and less if billing more frequently (monthly, bi-monthly, or quarterly). For this evaluation no reserve funding is assumed in the first year.

3.1.6 TOTAL REVENUE REQUIRED

The estimated Administrative, Monitoring, Five-year Update, and Contingency is combined to determine the annual revenue required to fund MGA. The total annual budget in 2019 dollars is $350,000 per year. This total includes the annualized amount of Five-year Update costs and does not account for any reserve funds.

Table 2 – MGA Budget Estimate

Task	Expense Items	Cost ($)
Administration	Personnel, Outreach, Program Coordination, Legal, Finance	$200,000
Monitoring and modeling	Water Quality, Stream Flow, Groundwater Elevation, SkyTEM. Model updates, Data Management System	$85,000
Reporting (annual and 5-year)	Updated Water Budget, , Reports	$40,000
Contingency		$25,000
Reserves		$0
Total		**$350,000**

3.2 Unit of Service/Measure Options

The GSA budget discussed in the previous section represents the numerator in developing GSA charges and recovering costs. The denominator must be determined from a suite of options. Each option to define the "unit" has certain advantages and disadvantages, data requirements, and policy and legal considerations. Additionally, specific options relate to possible funding mechanisms in different ways. Raftelis has identified eight preliminary unit options, with certain options having multiple variations. This list is not necessarily exhaustive and is provided to present potential units of measurement for the basin. From a data availability and data quality standpoint, the six main options rank as follows, with those listed earlier having fewer data requirements: well count, parcel count (total parcels and total non-de minimis parcels[6]), acreage, well capacity, irrigated acreage, and pumping (gross extraction). The data requirements of the contract option are unknown.

[6] SGMA defines de minimis use in Section 10721(e) as extraction for domestic use of less than 2 AFY. Non-de minimis use is for any water use greater than 2 AFY. The GSA has evaluated groundwater extractions by de minimis users and determined that they represent approximately 10 percent of total basin withdrawals.

3.2.1 WELL COUNT (TOTAL NON-DE MINIMIS WELLS)

Advantages: Simple to understand and to administer. Data available to MGA.

Disadvantages: Complete dataset may not be available at the start of the GSP. Uncertainty regarding timing of data availability. Not related to actual extraction amount and burden on the basin.

Data requirements: Basin-wide count of non-de minimis wells subject to the GSP.

Other/Policy Requirements: None identified.

Internally Raftelis discussed active versus total (active and non-active) wells and determined that total is appropriate given the non-de minimis threshold of 2 AFY. Additionally, GSA action would be required to clearly define active, non-active, and abandoned wells.

3.2.2 WELL CAPACITY (NON-DE MINIMIS WELLS)

Advantages: All wells are not equal, they have different capacities and ability to extract water.

Disadvantages: More data is required than simple well count.

Data requirements: Need well head/well meter size for all active wells or wells subject to the GSP.

Other/Policy Requirements: Requires adoption of a metering plan, or similar way to validate well head size.

3.2.3 PARCEL COUNT (TOTAL PARCELS)

Advantages: Parcel based approaches are generally simple to understand and to administer. Few data requirements with the data from the County Assessor readily available.

Disadvantages: Approach assumes a broad benefit of groundwater, or a "general benefit logic." Requires a voter approval process to put on an election ballot.

Data requirements: County Assessor's parcel database.

Other/Policy Requirements: None identified.

3.2.4 PARCELS COUNT (NON-DE MINIMIS)

Advantages: Generally simple to understand and to administer. Few data requirements. Requires a good data set of parcel owners and non-de diminish classification.

Disadvantages: Inequitable among non-de minimis users. No relation to groundwater extraction.

Data requirements: Basin-wide count of non-de minimis parcels.

Other/Policy Requirements: None identified.

3.2.5 ACREAGE (TOTAL)

Advantages: Simple to understand and to administer. Minimal data requirements. Data is readily available. Acts as a proxy for potential extraction.

Disadvantages: Assumes a general benefit but with a stronger nexus than parcel count. Not related to actual water extraction.

Data requirements: County Assessor's parcel database.

Other/Policy Requirements: None identified.

3.2.6 ACREAGE (IRRIGATED)

Advantages: Absent another source of supply, irrigated usage is directly tied to groundwater extraction. More equitable than parcel or acreage. Proxy for actual water extraction by land area and land cover data.

Disadvantages: Data intensive. Will require regular updates. May be prone to challenges and manual surveys for confirmation. Will require plant/crop type being irrigated.
Data requirements: Accurate geospatial land cover data and independent estimation.
Other/Policy Requirements: None identified.

3.2.7 PUMPING (GROSS EXTRACTION)

Advantages: Greatest equity since fee based on actual extraction. Easy to understand. Easy to administer provided metering plan adoption.
Disadvantages: Requires flow meter installation to implement. If not, more time, effort, and cost than other options (i.e., wells, parcels, or acreage options).
Data requirements: Validated metered data.
Other/Policy Requirements: Requires adoption of metering plan.

3.2.8 CONTRACT

Advantages: Simple, potentially cost effective, avoids adoption and implementation hurdles and limits legal risk associated with Prop 218/26, taxes, and assessments. Based on negotiation of parties.
Disadvantages: Not necessarily related to past, present, or future extraction. Potential inequity.
Data requirements: None identified.
Other/Policy Requirements: Requires formal agreement/signed contract between basin non-de minimis extractors and MGA.

3.2.9 MEASUREMENT OPTION SELECTION

Raftelis makes no recommendation with regards to the unit of service. Rather, it should be the decision of the MGA Board to select the unit of service approach that is most appropriate for the Agency given the policy objectives, basin characteristics, data availability, and types of costs incurred. There are varying degrees of equity, user flexibility, and ease of administration with each option. These decisions will require input from MGA staff, the Advisory Committee, and the MGA Board.

While Raftelis makes no single recommendation, given the characteristics of the basin's non-de minimis private users and data available at this time, we recommend narrowing down the options to the following three: parcels (non-de minimis), acreage, and estimated gross pumping. Narrowing the options allows a deeper dive into each and an easier comparison across options. In the following sub-section, we have calculated preliminary charges based on these three options and the estimated annual costs of MGA identified in Section 3.1.

3.3 GSA Charge Calculations

Raftelis calculated preliminary charges using the cost estimates in the prior sub-sections and the following units of service: irrigated acreage, estimated pumping volume, and parcel count. Charges are shown in both dollars per year and dollars per month. All rates are rounded up to the nearest whole penny.

The first step is to allocate the total costs (revenue requirement) of MGA between the municipal users and the non-de minimis users based on pumping estimates. The table below shows the class, specific user, estimated pumping, and share of total pumping. Charges developed in this section for non-de minimis users include Small Water

Systems, Institutional, and Agriculture. In total this class accounts for roughly 18 percent of total basin pumping and approximately 20 percent of regulated basin pumping (exclusive of de-minimis pumping which is not included in the cost allocation).

Table 3 – MGA Cost Allocation

Class	Water pumper	2016 Estimate (AF)	Percent of Total GW	2016 Estimate - Regulated (AF)	Percent of Regulated GW	Share of MGA Costs
Municipal	Santa Cruz	480	8.74%	480	9.71%	$34,001
Municipal	Soquel Creek	3,090	56.25%	3090	62.54%	$218,883
Municipal	Central	381	6.94%	381	7.71%	$26,988
Non-de Minimis	Small Water Systems	85	1.55%	85	1.72%	$6,021
Non-de Minimis	Institutional	190	3.46%	190	3.85%	$13,459
de Minimis	Private wells	552	10.05%	0	0.00%	$0
Non-de Minimis	Agriculture	715	13.02%	715	14.47%	$50,648
Total		**5,493**	**100%**	**4,941**	**100%**	**$350,000**

The summation of costs allocated to the three Non-de minimis user classifications - Small Water Systems, Institutional, and Agriculture – yields the total costs required to be recovered from non-de minimis users. The total revenue recovery required from non-de minimis users is $70,128.

Table 4 – Non-de Minimis Cost Allocation to User Classes

Class	Share of MGA Costs
Municipal	$279,872
Non-de Minimis	$70,128
De Minimis	$0
Total Costs Recovered	**$350,000**

3.3.1 PARCEL FEE

Table 5 shows the total count of parcels subject to a fee and Table 6 shows the calculated fee based on the count of non-de minimis parcels. Total costs are divided by the number of parcels to derive the fee. The estimated fee is shown both on an annual and monthly basis. The estimated fee for small water systems does not include the number of parcels served by each system. Therefore, each system is treated as one parcel. Depending upon the actual number of parcels served by small water systems it is possible that there could be a large variance in the calculated parcel fee. Any addition of parcels will reduce the fee as the costs allocable to the class (non-de minimis users) remains fixed.

Table 5 – Non-de Minimis Parcel Count

User Type	Parcel Count
Private Non-de Minimis Users	135
Small Water Systems	22
Total Parcels	**157**

Table 6 – Parcel Fee

Costs	Parcel Count	$ Per Parcel Per Year	$ Per Parcel Per Month
$70,128	157	$446.67	$37.23

3.3.2 IRRIGATED ACREAGE FEE

Table 7 shows the sum of acres subject to the fee and Table 8 shows the calculated fee based on non-de minimis irrigated acreage. Total costs are divided by each class's irrigated acreage to derive the fee per acre. The estimated fee is shown both on an annual and monthly basis. The estimated acreage fee is high as the data for small water systems considers all acreage, not just the total number of irrigated acres served by each system. To be more conservative, Raftelis accounted for the small water systems' total pumping in the acreage estimate, effectively assuming water use at a rate of one acre foot per acre per year. Depending upon the actual acreage of small water systems it is possible there will be a significant variance in the calculated acreage fee. Any additional acreage above what is assumed in the calculation will reduce the fee as the costs allocable to the class remain fixed.

Table 7 – Non-de Minimis Irrigated Acreage

User Type	Acreage
Private Non-de Minimis Users	838.5
Small Water Systems	275.1
Total Parcels	**1,114**

Table 8 – Irrigated Acreage Fee

Costs	Acreage	$ Acre Per Year	$ Per Acre Per Month
$70,128	1,114	$62.97	$5.25

3.3.3 VOLUMETRIC FEE

As previously discussed, MGA may choose to assess charges on all non-de minimis pumpers or at a minimum threshold, yet to be determined. Raftelis calculated fees at the following minimum extraction thresholds: 0 AFY, 2 AFY, 5 AFY, and 10 AFY. For reference 0 AFY represents all 135 identified private non-de minimis users and 100 percent of private non-de minimis pumping (exclusive of small water systems); 2 AFY represents 58 private non-de minimis users and 93 percent of private pumping; 5 AFY represents 31 users and 80 percent of private pumping; 10 AFY represents 15 users and 62 percent of private pumping. The top nine private users pump half of the water in the class. Table 9 summarizes the volume of pumping among private non-de minimis users at these various thresholds. In all scenarios small water systems are charged for all their pumping.

Table 9 – Volumetric Fee Thresholds

User Type	AFY
Private Non-de Minimis User (0 AFY Minimum)	659.74
Private Non-de Minimis User (2 AFY Minimum)	611.05
Private Non-de Minimis User (5 AFY Minimum)	523.64
Private Non-de Minimis User (10 AFY Minimum)	408.86
Small Water System	275.1
Total Acre Feet	**1,113.6**

The following four tables show the calculated volumetric pump charge at each threshold of 0 AFY, 2 AFY, 5 AFY, and 10 AFY. Fees are presented in dollars per acre foot and range from a low of $75.02 per acre foot to a high of $102.53 per acre foot.

Table 10 – 0 AFY Threshold

Costs	Acre Feet per Year	$ acre foot
$70,128	935	$75.02

Table 11 – 2 AFY Threshold

Costs	Acre Feet per Year	$ Per Acre Foot
$70,128	886	$79.14

Table 12 – 5 AFY Threshold

Costs	Acre Feet per Year	$ acre foot
$70,128	799	$87.80

Table 13 – 10 AFY Threshold

Costs	Acre Feet per Year	$ acre foot
$70,128	684	$102.53

3.4 Other GSA Charges

In addition to fees and charges imposed to recover the costs of implementing the GSP and operating MGA, the Agency will assess other charges in cases of pumping over allocations (should allocations be adopted), non-compliance charges, and/or penalties. Non-extraction and over-pumping charges are outlined in the following subsections.

3.4.1 PUMPING OVERAGE CHARGES

Groundwater extractions exceeding the amount that a groundwater user is authorized to pump under regulations adopted by the Agency may be subject to fines or penalties under Water Code section 10732(a). The fine may not exceed $500 per acre-foot extracted in excess of their authorized amount (Water Code §10732 (a)(1)). Implementation of fines or penalties assumes that MGA will adopt a metering plan and develop individual pumping allocations for each non-de minimis user in the basin. Given the nature of the Sub-basin, the Water Code maximum fine of $500/AF appears warranted. Justification for this value is as follows:

- Supplemental water costs (Indirect Potable Reuse (IPR)) – Soquel Creek Water District is designing and constructing a supplemental supply project using tertiary treated wastewater, advanced purification, and groundwater injection. While the project will be wholly owned and funded by an MGA member agency, it will assist in achieving Mid-County Basin sustainability goals. The estimated cost of finished water (operating and capital costs included) will far exceed $500 per AF so it is appropriate for the Agency to charge the maximum fine defined in the Water Code.

- Supplemental water costs (Water Transfers) – High flow events may be captured on the San Lorenzo River and transferred for consumption by municipal users or groundwater recharge within the Mid-County Basin. The costs of water transfers have been estimated to exceed $500 per AF so it is appropriate for the Agency to charge the maximum fine defined in the Water Code.

An argument may be made that the requirements of Article XIII D, section 6(b) (Proposition 218) supersede the maximums presented in the Water Code. Simply, the cost of service based on supplemental supplies through IPR and water transfers trumps the Water Code maximum of $500/AF. Additional legal review by MGA counsel would be required to explore this argument.

Overage Charges (Surcharge Rates) Example – Fox Canyon Groundwater Management Agency

Tier I: One to 25.000 AF = $1,461.00 per AF
Tier II: 25.001 AF to 99.999 AF = $1,711.00 per AF
Tier III: 100 AF or more = $1,961.00 per AF

From the Fox Canyon Ordinance: *Extraction surcharges are necessary to achieve safe yield from the groundwater basins within the Agency and shall be assessed annually when annual extractions exceed the historical and/or baseline allocation for a given extraction facility or the combined sum of historical allocation and baseline allocation for combined facilities. The extraction surcharge shall be fixed by the Board and shall be based upon (1) the cost to import potable water from the Metropolitan Water District of Southern California, or other equivalent water sources that can or do provide non-native water within the Agency jurisdiction; and (2) the current groundwater conditions within the Agency jurisdiction. The Board shall fix the surcharge by Resolution at a cost sufficiently high to discourage extraction of groundwater in excess of the approved allocation when that extraction will adversely affect achieving safe yield of any basin within the Agency. In circumstances where an individual or entity extracts groundwater from* *a facility(s) having no valid extraction allocation, the extraction surcharge shall be applied to the entire quantity of water extracted. Surcharges are assessed annually.*

Deficit Accounting - GSAs can allow unused groundwater extraction allocations to be carried over and transferred only "if the total quantity of groundwater extracted in any five-year period is consistent with the provisions of the [GSP]." § 10726.4(a)(4). If the GSA adopts a carryover policy then deficit pumping may be allowable with sufficient carryover water. However, the policy should be specific and should not allow borrowing from future allocations.

3.4.2 NON-COMPLIANCE CHARGES

If the fine or penalty is for non-compliance with regulations adopted by the GSA (e.g., failing to install a meter), then it is subject to the limitations in Water Code section 10732(b) and the fine or penalty may not exceed $1,000 plus $100 per day additional charges if the violation continues for longer than 30 days after the notice of the violation has been provided. A list of anticipated non-compliance charges is below, including examples identified by Raftelis:

Non-metered use (non-de minimis): The fee is equal to double the current groundwater extraction charge for all estimated water used (Fox Canyon GMA 2013).

Failure to provide access: No known guidance on reasonable costs but may be tied to reasonable staff labor costs.

Failure to report: No known guidance on reasonable costs but may be tied to reasonable staff labor costs.

State Non-Compliance Charges: In the event that a GSA is unwilling or unable to manage the groundwater basin the State will intervene with a schedule of fees set by the State Water Resources Control Board. Fees would be imposed on all users of the "probationary" basin and extractors would be required to file a groundwater extraction report. In probationary basins non-de minimis users may be required to file an extraction report, due by December 15 of each year for the prior water year. For reference, the table below shows the 2017 fee schedule for unmanaged and probationary basins.

Table 14 – SWRCB Non-Compliance Charges

Fee Category	Fee Amount	Applicable Parties
Base Filing Fee	$300 per well	All extractors required to report
Unmanaged Area Rate (metered)	$10/AF	Extractors in unmanaged areas
Unmanaged Area Rate (unmetered)	$25/AF	Extractors in unmanaged areas
Probationary Plan Rate	$40/AF	Extractors in probationary basins
Interim Plan Rate	$55/AF	Extractors in probationary basins where the Board determines an interim plan is required
De minimis Fee	$100 per well	Parties that extract, for domestic purposes, two acre-feet or less per year from a probationary basin, If the Board decides the extractions will likely be significant.
Late Fee	25% of total fee per month late	Extractors that do not file reports by the due date

3.4.3 PENALTIES

If the GSA has adopted an ordinance, it may levy an administrative civil fine or penalty (Government Code §53069.4). The fine or penalty may not exceed $100 for the first violation, $200 for the second violation, and $500 for each additional violation within 12 months of the first (§25132(b) and §36900(b)).

Section 10730.6(a) outlines the authority of a GSA to collect management fees and the remedies available to the Agency for failure to pay. These remedies include collection of interest on late payments at a maximum of one percent per month[7]; assessing penalties "in the same manner as it would be applicable to the collection of delinquent assessments, water charges, or tolls[8]"; or even the cessation of pumping[9] until the outstanding fees are paid and the user is no longer delinquent on payments.

Alternatively, and only if MGA was to adopt individual pumping allocations, in place of monetary penalties the GSA could impose a penalty that results in a percent of volume loss of a following year pumping allocation, or similar allocation reduction penalty.

A series of examples follows from Fox Canyon Groundwater Management Agency (MGA):

Late Statements

Statements submitted after the due date incur a Civil Penalty of $50 per day.

Late fee on extraction

An Extraction Interest Charge of 1.5% is charged for every month the statement and/or payment is overdue. (Extraction charge x 1.5% x month(s) overdue).

Late fee on overage/surcharge[10]

A Surcharge Late Penalty of 1.5% is charged for every month the statement and/or payment is overdue. (Surcharge x 1.5% x month(s) overdue).

Late fee on non-metered water use

Any delinquent Non-Metered Water Use Fee obligations shall also be charged interest at the rate of 1.5% per month on any unpaid balances.

3.5 Other Considerations

3.5.1 METERING PLAN

[7] Water Code Section 10730.6(b)
[8] Water Code Section 10730.6(d)
[9] Water Code Section 10730.6(e) requires a public hearing with at least 15 days' notice to the owner of operator of the well
[10] Greater than an extractors pumping allocation

Aerial survey for landcover data is an accurate method of estimating the irrigation demands of a parcel. However, challenges arise due to timing and frequency of updated crop cover, validating parcel boundaries, and identifying the parcel(s) served by an individual well, among other challenges. A remedy is to require installation of meters on individual non-de minimis wells for precise pumping volumes rather than estimations. However, there are tradeoffs for precision. It is costly to install meters on wells and the cost is greater for small volume users, particularly if the fee amount is low. Consequently, MGA may impose a significant financial burden on the pumper and increase the effort on MGA staff for a relatively small benefit. Conversely, large users have a greater impact on the basin and the cost of meter compliance is low relative to their fee. Additionally, if the fee is based on actual pumping, and a metering plan is not adopted by the MGA Board, a larger user will have an incentive to report lower pumping to reduce the fee. If actual gross pumping is selected as the method of fee-setting, metering should be required along with regular reporting and verification.

3.5.2 PUMPING ALLOCATIONS

MGA may choose to adopt individual pumping allocations for all non-de minimis users. These allocations would be based, at least initially, on estimated pumping from aerial survey and land cover/crop type data. Each extractor will know their allocation which would could become the basis for their pumping fee. MGA should determine if individual allocations are prudent if no pumping reductions are required by individual non-de minimis pumpers. Further, if estimated pumping (and therefore allocation) is greater than actual extraction the private pumper would have an incentive to pump *more* so that their pumping is in line with their allocation.

3.5.3 PUMPING REDUCTIONS AND NON-DE MINIMIS USER FEE THRESHOLD:

The sustainable yield of the Mid-County Basin will be achieved predominantly by using supplemental supply projects from the MGA's Municipal entities. Still, approximately 18 percent of total basin pumping (20% of non-de minimis pumping) comes from non-de minimis private pumpers. Approximately 15 of these users extract greater than 10 AFY. Given the significant pumping of the largest private users, MGA should consider developing pumping reductions for these individuals by identifying the costs and benefits of curtailment. They would effectively be treated as a separate sub-class of private pumper, unique from the de-minimis users and small non-de minimis users.

3.5.4 EXTRACTION THRESHOLD FOR FEE ASSESSMENT

Given that the majority of non-residential, non-de minimis users are estimated to use less than 2 AFY, the question of extraction threshold should be considered. What should the threshold for assessing charges on these users be and why? SGMA and the Water Code give MGA the authority to assess these users however minimal their extraction; however, the burden on staff and administrative costs may not cover the literal dollars, in some cases, of assessing an annual volumetric fee on a user extracting one-tenth of an acre foot per year. Still, MGA would require a sound argument as to why a specific threshold was selected. While a statistical analysis, or some other analytical assessment, could be used to determine an appropriate threshold we would recommend MGA use 2 AFY as the threshold. This volume corresponds to the definition of a de minimis user, were they a residential user. Further a review of MGA's data on non-de minimis users shows that 77 of 135 identified extract less than 2 AFY. In total these 77 extractors amount to 49 AF of pumping relative to 660 AF for the class in total. In other words, the remaining 58 users account for 93 percent of pumping among the user group. Removing the 77 users from the charge calculation has an immaterial effect on the resulting fees to other users (in fee recovery by acreage or pumping volume). Additionally, it reduces the demands on MGA staff and potential for contentious public meetings. Raftelis reviewed our work in the Sonoma GSAs and Borrego GSA, as well as the draft report in the neighboring

SVBGSA, and found no mention of minimum thresholds for non-de minimis users at which they will or will not be assessed management charges. The Borrego Valley GSA is considering a de-minimis threshold of 5 AFY because after long term reductions these users would approach 2 AFY in 2040.

2 AFY identified as de minimis in SGMA seems appropriate even when the user is not Residential in nature. The cost-benefit of charging a private irrigator who uses less than 2 AFY versus a private residential pumper who uses less than 2 AFY may not pan out.

3.5.5 ACTIONS IN OTHER BASINS

Borrego Valley GSA plans to adopt a metering a plan and are currently identifying individual allocations which will then need to be reduced over time (interim and final reductions) to achieve the long-term sustainable yield. The Borrego basin requires a greater than 70 percent reduction in pumping and no supplemental/alternative water supply projects are feasible. Achieving sustainable yield will be achieved with reduced pumping, fallowing of agricultural lands, and conservation. In Sonoma County GSAs there is no plan for metering or reductions for large private pumpers. Groundwater users will be assessed a volumetric charge per acre foot of water based on estimated extractions from the basin (using spatial data analysis). The Salinas Valley Basin GSA (SVBGSA) has released a draft report with non-de minimis users (which are almost exclusively commercial agricultural users) assessed charges based on estimated irrigated acreage (estimates from spatial data analysis). It should be noted that Borrego GSA actions are for GSA fees (GSP implementation) while the Sonoma GSAs and SVBGSA actions are to fund GSP development activities prior to implementation.

4. Fee Recovery Methods

Below are two bill collection options for MGA groundwater users.

4.1 Direct Billing

Direct billing requires more staff, has higher administrative costs (printing, postage, customer service, collections), and has a higher rate of late payments and delinquencies. It requires the Agency maintain its own customer information system and internal accounting. If the existing County system or member agency system is not readily available for use there may be significant one-time costs to purchase, configure, integrate, and train staff on the software. Direct billing results in greater cash flow assuming regular monthly or bi-monthly billing. This results in lower cash reserve requirements.

4.2 Property Tax Roll

Billing users through the County Assessor results in less overhead, lower billing and customer service costs, and a lower rate of late payments and delinquencies. Setup costs should be lower as the Agency relies on the County Assessor. The Agency is still required to maintain accurate parcel data and associated data for charges that may be based on volumetric pumping, well count, or well capacity. Revenue is only received twice per year, so cash flow may be a concern depending on timing. Property Tax Roll billing requires greater cash reserves than direct billing. Additional fees will be incurred by the County to place a charge on the property tax roll.

As it relates to the available funding mechanisms presented in Section 2, assessments and special taxes are always recovered on a parcel's property tax bill. Fees for service are more likely to be directly billed but many agencies find it advantageous to collect fees on the property tax roll. As previously mentioned, the collection rate is frequently higher, and the collected revenue is then transferred to the charging agency twice per year.

5. Management Area Designation

If MGA determines it to be beneficial to differentiate the basin into Management Areas, Raftelis recommends the Agency identify and document the rationale for doing so. In traditional rate and fee setting, costs should be matched to benefits to ensure equity among and between different users, as well as to ensure each user group pays its fair share. In utility rate setting costs are allocated to classes of customers commensurate with their service requirements. In fee setting costs are allocated proportional to the benefits gained through the fee.

Considering that any capital project costs will be borne by the three municipal water service partner agencies, the costs recovered by MGA are for management only. In a certain sense, management zones have unintentionally been derived between coastal municipal users and all other non-de minimis users. Coastal zone users will pay fees, additional to the MGA management fees, through their water rates and charges as customers of Soquel Creek Water District, the City of Santa Cruz, or Central Water District; all other non-de minimis users within the Basin in County areas will only pay the management fee.

If MGA wishes to further designate management zones it may be appropriate to different impact zones using long term monitoring costs. If monitoring costs in coastal zones versus inland zones, or stream adjacent zones versus non-adjacent zones, or high elevation zones versus low elevation zones, can be demarcated with a sound rationale it may be justifiable. However, consider the following analogy: Property A is inland and adjacent to a creek. Property B is near the coast but not creek adjacent. The two properties pay different management fees due to long term monitoring costs with Property A paying a higher fee. However, Property B, the coastal parcel, benefits from the monitoring taking place inland. The exercise leads back to the fact that the fees derived to fund MGA are for basin-wide management, which is an implicit objective of SGMA: all current, future, or potential users benefit from basin management and the benefit of management is general to all.

If MGA decides to differentiate management areas it will need to ensure that specific benefits are identified for users in different areas. Initial questions that arise when hypothesizing include:

- Can we identify all non-de minimis users inside and outside a proposed impact zone?
- Is the “impact” just seawater intrusion, or is it also basin elevation, basin storage reduction, etc?
- What about connectivity with surface water?
- Can we identify and differentiate management, monitoring, and other costs between two or more impact zones?
- What other information would be required to develop separate fees for coastal and creek impact zones that would be *additional to* general basin management fee?
- Would MGA adopt a metering plan for non-de minimis users? This would be beneficial so that charges could be related to impact based on water extraction, and recovered proportionally
- Can creek monitoring costs be used to differentiate? For example, an instream flow fee and a coastal impact fee, etc. Again, a specific benefit would need to be identified for those having the fee imposed.

6. De Minimis Users

SGMA defines a "de minimis extractor" as "a person who extracts, for domestic purposes, two acre-feet or less per year[11]." De minimis "extractors" or de minimis groundwater users cannot be charged fees "unless the agency has regulated the users pursuant to this part[12]." The key operating phrase is "has regulated" and unfortunately the term *regulated* is undefined leaving the meaning up to legal interpretation. Does *has regulated* imply past regulation and management? Or can the new sustainability agency "regulate" de minimis users prior to fee adoption to be able to charge them for basin management over the long-term? At least one GSA that Raftelis consults for is considering the act of noticing de minimis groundwater extractors as "regulating" them. By corresponding with a de minimis user and requesting basic information, the agency *has regulated* the de minimis user and can legally impose a fee.

Beyond the legal gray area and semantics of the Water Code language, a GSA should consider the cost-benefit analysis of recovering management costs from de minimis users. For example, consider a hypothetical groundwater basin experiencing critical overdraft where greater than 95 percent of extraction is from large non-de minimis agricultural interests and a single municipal entity. Are the real costs of management, and the potential costs of litigation, worth the benefit of revenues deriving from users responsible for five percent of water extraction? Or, should the Agency instead focus resources on the 95 percent of extraction which is almost certainly responsible for the required mitigation of the six undesirable results? Conversely, consider a basin experiencing critical overdraft where 75 percent of extraction is from de minimis extractors and the remainder from three municipal agencies. It may be considered unreasonable to expect 100 percent of funding required to mitigate impacts to come from three agencies (and their customers) when they are responsible for only 25 of extraction. In this situation the risk may be in *not* regulating and imposing a fee on de minimis users.

MGA should consider their own cost-benefit analysis with the Advisory Committee and GSA Board. Considerations should include the gross and net extraction by de minimis extractors, their geographical and hydrological location within the basin, and the likely amount of total cost recovery from the group, relative to the whole. Raftelis has developed a Pricing and Policy Objectives exercise for the Board to use to evaluate the decision to regulate and charge de minimis extractors, or not. The Raftelis exercise is attached as an appendix to this paper.

[11] Water Code Section 10721(e)
[12] Water Code Section 10730(a)

7. Appendices

7.1 Comparative Agency Administrative and Management Budgets

Raftelis has researched management and administrative costs of five similar agencies, which represent three GSAs, a groundwater management agency, and a Watermaster in an adjudicated basin. Details of each comparative agency are presented in the subsequent sub-sections. The table below presents a comparison of the five agencies with measurements that may be useful to MGA in identifying long-term management and administrative costs. Where available, the first fiscal year of GSP implementation costs are used; otherwise the most recently available values are used.

	Borrego Valley GSA	Mojave Watermaster	Fox Canyon GMA	North Fork Kings GSA[2]	Kings River East GSA[4]	Southwest Kings GSA
Personnel Costs		$634,955	$735,831	$75,400	$45,000	$50,000
Legal Costs				$27,400	$10,000	$11,139-20,000
Total Admin Budget	$574,566	$759,855	$1,431,744	$156,750	$68,400	$85,884-99,000
Staff Level (FTEs)	2	4	6.5[1]			Time and Materials
Staff Hours			11,700[1]	458[3]		
Management	Borrego Water District	Mojave Water Agency	Ventura County Public Works	Kings River Conservation District	Alta Irrigation District	Provost & Pritchard Consulting
Basin	Borrego	Mojave	Oxnard Plain, etc.	Kings	Kings	Tulare
Water Production (AFY)	20,000	120,000	134,000	TBD	TBD	TBD
Predominant User Groups	Single Municipal & Agriculture	Private Pumpers & Single Municipal	Municipal & Agriculture	Municipal	Municipal	Municipal

[1]Staff levels and hours assume contracted labor from the County of Ventura using 1,800 annual hours per FTE
[2]Estimates based on fiscal year 2020-2021, the first full year of GSP implementation
[3]Extrapolated using January through June 2018 costs
[4]Administrative budget for GSP Development and not GSP implementation

7.1.1 MOJAVE BASIN AREA WATERMASTER

The Mojave Basin Area Watermaster (Mojave Watermaster) is administered as a unit of the Mojave Water Agency (MWA). As Watermaster, the agency's main responsibilities include monitoring, reporting, and verification of water extraction for all parties of the adjudication, collection of assessments, production of annual reports, and facilitating water transfers between parties. In many respects the watermaster of an adjudicated basin and the GSA for a basin subject to SGMA are similar in duties and commitments.

The Budget Summary for the Mojave Watermaster from FY 2015-16 through budget year FY 2019-2020 is presented below. The overwhelming majority of expenses relate to wages and benefits, expected to cost $653,884 in FY 2019-2020. Secondary costs relate to engineering services of $93,500 in FY 2019-2020. The remaining costs of approximately $34,000 relate to travel, training, supplies, and other miscellaneous expenses.

The Mojave Watermaster consists of four staff including two technicians, a database administrator, and a services manager. Assuming four full-time employees (FTEs) and the wages and benefits in the FY 2019-2020 budget, the cost per FTE is approximately $163,500 per year.

Watermaster (WM) – Dept #90

Department Budget Summary

	ADMINISTRATIVE EXPENSES:	FY 15/16 Actual	FY 16/17 Actual	FY 17/18 Budget	Actual YTD as of 03/31/2018	FY 17/18 Projected	FY 18/19 Budget	FY 19/20 Budget
5600	Dept Wages	374,484	409,735	408,253	300,111	409,764	427,645	440,474
5612	Dept Overtime	5,646	3,936	4,000	2,257	859	4,000	4,000
5613	Health Insurance - Medical	54,609	48,960	48,960	36,249	48,960	55,455	57,119
5614	Payroll Taxes	12,048	12,659	13,259	9,667	13,439	14,010	14,430
5615	Misc Benefit	-	-	-	-	-	-	-
5616	Workers Compensation Expense	2,149	2,005	2,602	2,116	2,804	2,554	2,631
5618	Health Insurance - Dental/Vision	9,576	9,524	9,675	5,684	7,979	8,525	8,781
5620	Health Ins Reimb - FSA	6,879	5,949	10,400	4,386	6,000	10,600	10,918
5621	Deferred Comp Contributions	-	-	-	-	-	21,382	22,023
5623	PERS Retirement	67,897	72,908	98,679	81,214	105,656	90,784	93,508
	TOTAL WAGES & BENEFITS	**533,288**	**565,676**	**595,828**	**441,684**	**595,461**	**634,955**	**653,884**
5702	Safety Supplies	-	-	500	-	-	500	500
5710	Small Tools	-	-	100	-	-	250	250
5711	Books & Subscriptions	-	37	50	-	-	50	50
5713	Printing	-	-	500	-	-	500	500
5725	Auto Expenses	2,842	368	500	228	400	500	500
5726	Travel Expenses	-	-	500	-	1,850	8,800	9,000
5728	Education & Training	-	-	1,500	-	1,000	5,800	8,000
5736	Engineering, General	144,370	72,981	73,500	43,930	73,500	93,500	93,500
5741	Aerial Photos	19,750	10,875	12,500	10,875	12,500	15,000	15,000
	NON-LABOR EXP	**166,962**	**84,261**	**89,650**	**55,033**	**89,250**	**124,900**	**127,300**
	TOTAL DEPT EXPENSES	**700,250**	**649,937**	**685,478**	**496,717**	**684,711**	**759,855**	**781,184**
5610	Labor & Benefits from Watermaster	(350,125)	(276,286)	(297,914)	(152,750)	(297,731)	(317,478)	(326,942)
	Total Capital Labor & OH Out	**(350,125)**	**(276,286)**	**(297,914)**	**(152,750)**	**(297,731)**	**(317,478)**	**(326,942)**
	TOTAL NET DEPT EXPENSES:	**350,125**	**373,651**	**387,564**	**343,967**	**386,980**	**442,377**	**454,242**

7.1.2 FOX CANYON GROUNDWATER MANAGEMENT AGENCY (FCGMA)

FCGMA is a special district which governs the extraction of water in southern Ventura County and serves five municipalities and agricultural users in unincorporated areas of the county. While a special district since 1982 FCGMA will also be the GSA for the local groundwater basins including Arroyo Santa Rosa, Oxnard Plain, Pleasant Valley, and Las Posas Valley. The agency is staffed by contract with Ventura County Public Works overseeing technical, legal, financial, and administrative services. Total expenses in FY 2014-2015 were $1,088,951 with 60 percent of expenses ($645,975) towards County staff charges. Another 14 percent was spent on Groundwater Supply Enhancement Assistance Program (GSEAP) funding to assist local agencies with local groundwater projects that increases groundwater supply. 21 percent of costs were associated with professional services.

Per communications with Fox Canyon management, the County of Ventura utilizes 6.5 FTEs at assumed annual hours of 1,800 hours per FTE for a total of 11,700 hours. The fully burdened labor rate is approximately $115 per hour for an average annual cost of $1,345,500.

FOX CANYON GROUNDWATER MANAGEMENT AGENCY
Statements of Revenues, Expenses, and Changes in Net Position
For the Years Ending
June 30, 2016 and 2015

	2016	2015
OPERATING REVENUES		
Extraction charges and surcharges	$ 2,129,739	$1,373,904
Groundwater sustainability fee	274,544	-
Interest and penalties on delinquent accounts	75,969	33,946
Total Operating Revenues	2,480,252	1,407,850
OPERATING EXPENSES		
Ventura County Public Works Agency charges	735,831	645,975
Professional specialty services	603,816	227,410
Management and administrative services	19,580	7,197
Supplies and minor equipment	300	600
Liability insurance	4,707	4,498
Depreciation expense	51,908	51,908
GSEAP spending	-	148,269
Miscellaneous	15,602	3,094
Total Operating Expenses	1,431,744	1,088,951

7.1.3 NORTH FORK KINGS GSA

Located in the Central San Joaquin Valley, North Fork Kings GSA consists of 15 member agencies in the Kings Subbasin. Kings River Conservation District (KRCD) will administer the GSA including data collection and reporting, financial and accounting services, engineering services, and public outreach and education. The cost for administrative services by KRCD in FY 2020-2021 (the first full year of GSP implementation) is estimated at $75,400.

Table 3-2. Projected 5-Year Annual Budget

Category	Prior to 6/30/17	FY[a] 2017-2018	FY[a] 2018-2019	FY[a] 2019-2020	FY[a] 2020-2021	FY[a] 2021-2022	FY[a] 2022-2023	TOTAL
GSA Administration								
KRCD Staffing / Public Outreach		$ 69,000	$ 71,100	$ 73,200	$ 75,400	$ 77,700	$ 80,000	$ 377,400
Office Supplies / Postage / Outreach Materials		$ 6,000	$ 6,200	$ 6,400	$ 6,600	$ 2,000	$ 2,100	$ 23,300
Insurance		$ 2,000	$ 2,100	$ 2,200	$ 2,300	$ 2,400	$ 2,500	$ 11,500
Annual Audit		$ -	$ 4,000	$ 4,100	$ 4,200	$ 4,300	$ 4,400	$ 21,000
Miscellaneous Overhead		$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 7,500
Start-up Costs	$ 188,628		$ -	$ -	$ -	$ -	$ -	$ -
SUBTOTAL	$ 188,628	$ 78,500	$ 84,900	$ 87,400	$ 90,000	$ 87,900	$ 90,500	$ 440,700
Professional Services								
Project Management		$ 20,000	$ 20,600	$ 21,200	$ 21,800	$ 22,500	$ 23,200	$ 109,300
Funding Mechanism Assessment		$ 8,000	$ -	$ -	$ -	$ -	$ -	$ -
Prop 218 Engineer's Report/Elections		$ 30,000	$ 2,000	$ -	$ -	$ -	$ -	$ 2,000
Groundwater Sustainability Plan Preparation[b]		$ 150,000	$ 285,770	$ 80,000	$ -	$ -	$ -	$ 365,770
Legal, Litigation Reserve		$ 25,000	$ 25,800	$ 26,600	$ 27,400	$ 28,200	$ 29,000	$ 137,000
Lobbyist		$ 3,000	$ 3,100	$ 3,200	$ 3,300	$ 3,400	$ 3,500	$ 16,500
Grant Writing		$ 7,000	$ -	$ -	$ -	$ -	$ -	$ -
SUBTOTAL	$ -	$ 243,000	$ 337,270	$ 131,000	$ 52,500	$ 54,100	$ 55,700	$ 630,570
~10% Contingency/Reserve		$ 19,296	$ 42,220	$ 21,840	$ 14,250	$ 14,200	$ 14,620	$ 107,130
Reimbursement to Member Agencies			$ 264,712	$ 264,712	$ -	$ -	$ -	$ 529,424
Total Estimated GSA Administration & Professional Services Cost	$ 188,628	$ 340,796	$ 729,102	$ 504,952	$ 156,750	$ 156,200	$ 160,820	$ 1,707,824
Enterprise Fund for GSP Implementation - Project Development / Groundwater Monitoring			$ 907,435	$ 1,131,585	$ 1,479,787	$ 1,480,337	$ 1,475,717	$ 6,474,861
Total Estimated Cost			**$ 1,636,537**	**$ 1,636,537**	**$ 1,636,537**	**$ 1,636,537**	**$ 1,636,537**	**$ 8,182,685**

Raftelis contacted KRCD which provided a detail of staff hours by function. It is estimated that KRCD will spend approximately 458 staff hours across all functions on GSA administration in calendar year 2018 in support of GSP development. KRCD disclosed that May 2018 hours were higher than normal due to a special assessment hearing.

Employee Description	January-June 2018	Calendar Year 2018 (extrapolated)
Coordinator	72.5	145
Public Relations	50.5	101
Assistant	2	4
Finance	35	70
GIS	22.75	45.5
Accounting	0	0
Minutes	20.25	40.5
Admin	16	32
General Labor	10	20
Total	**229**	**458**

7.1.4 KINGS RIVER EAST GSA

Kings River East GSA is southeast of Fresno and west of the Sierra foothills. The GSA is a MOU between 14 municipalities and special districts in the basin. The total three-year budget is presented below. The administrative budget in each year is $68,400. The budget presented is only for GSP development and not GSP implementation and ongoing administration and management of the GSA. Administrative services are provided by contract with Alta Irrigation District, a party to the MOU. Staff time is billed hourly for costs incurred in servicing the GSA with an estimate of $45,000 per year.

Table 3: Projected Budget
Kings River East Groundwater Sustainability Agency
Groundwater Fee Study

Budget Item	Year 1	Year 2	Year 3	Total
Administration	**$68,400**	**$68,400**	**$68,400**	**$205,200**
Board Members (Per Diem)	$8,400	$8,400	$8,400	$25,200
Insurance	$5,000	$5,000	$5,000	$15,000
Legal	$10,000	$10,000	$10,000	$30,000
Administration Services	$45,000	$45,000	$45,000	$135,000
Grants/Outreach	**$3,500**	**$28,500**	**$3,500**	**$35,500**
Grant Application	$0	$25,000	$0	$25,000
Grower/Landowner Outreach	$3,500	$3,500	$3,500	$10,500
Groundwater Sustainability Plan	**$206,800**	**$235,350**	**$214,350**	**$656,500**
Sub-basin Coordination	$64,600	$64,600	$64,600	$193,800
Coordination Agreement	$0	$7,550	$7,550	$15,100
Data Management System	$0	$21,000	$0	$21,000
Hydrogeology	$75,000	$75,000	$75,000	$225,000
Legal Assistance	$7,800	$7,800	$7,800	$23,400
Monitoring Network	$14,600	$14,600	$14,600	$43,800
Projects & Management Actions	$17,800	$17,800	$17,800	$53,400
Sustainable Management Criteria	$18,700	$18,700	$18,700	$56,100
Report Compilation	$8,300	$8,300	$8,300	$24,900
Other	**$5,000**	**$5,000**	**$5,000**	**$15,000**
Miscellaneous Costs	$5,000	$5,000	$5,000	$15,000
Subtotal	**$283,700**	**$337,250**	**$291,250**	**$912,200**
Contingency (15%)	$42,600	$50,600	$43,700	$136,900
Total	**$326,300**	**$387,850**	**$334,950**	**$1,049,100**

7.1.5 SOUTHWEST KINGS GSA

Located in the Tulare Lake Subbasin, GSA day-to-day management will be provided by a consultant including financial management, reporting to the Board of Directors, and legal functions among others. The proposed five-year budget for on-going management is $85,884 in FY 2018-2019 and is presented below. The budget is drawn from the GSA's Engineer's Report dated June, 2017.

Description	2017	2018	2019	2020	2021
ON-GOING MANAGEMENT					
On-Going Management					
Communications, general administration	$ 12,000	$ 12,360	$ 12,731	$ 13,113	$ 13,506
Insurance	3,000	3,090	3,183	3,278	3,377
Website maintenance	5,000	5,150	5,305	5,464	5,628
Financial management	6,000	6,180	6,365	6,556	6,753
Administrative support	6,000	6,180	6,365	6,556	6,753
Assessments, collections	4,000	4,120	4,244	4,371	4,502
Printing, supplies, travel	12,000	12,360	12,731	13,113	13,506
Audit	0	5,000	5,150	5,305	5,464
	$ 48,000	$ 54,440	$ 56,073	$ 57,755	$ 59,488
SWKGSA board meetings (4)					
Board packages, attend, minutes	$ 8,000	$ 8,240	$ 8,487	$ 8,742	$ 9,004
Legal: attend, resolutions, agreements	8,000	8,240	8,487	8,742	9,004
	$ 16,000	$ 16,480	$ 16,974	$ 17,484	$ 18,008
Subbasin meetings (Monthly)					
Management: attend (12)	$ 9,600	$ 9,888	$ 10,185	$ 10,490	$ 10,805
Legal: attend (2)	2,500	2,575	2,652	2,732	2,814
	$ 12,100	$ 12,463	$ 12,837	$ 13,222	$ 13,619
Total On-Going Management	**$ 76,100**	**$ 83,383**	**$ 85,884**	**$ 88,461**	**$ 91,115**

A more recent FY 2018 Budget presented at the Southwest Kings GSA Board Meeting on May 9, 2018 shows a slightly different amount for management and legal costs. The FY 2018 Budget total for on-going management is $79,000 with $50,000 in management and $20,000 in legal representing the overwhelming majority of costs.

SWKGSA
2018 Budget

Description	Proposed 2018 Budget
Management	50,000
Legal	20,000
Clerical	6,000
Insurance	-
Website	2,000
Audit	1,000
GSP	115,000
Contingency	20,000
Total Expenses	214,000
Projected Income	
Assessments	455,906
Reimbursements	(97,939)
Delinquent Assessments	-
Interest	-
Total Income	357,967

7.2 Pricing Objectives Exercise

1. OVERVIEW

Fee structures are best designed when formulated to collect the appropriate amount of revenue while addressing unique characteristics of the Agency and the needs of its locale, basin users, and other stakeholders. Policy objectives for pricing are specifics that support broad policies, such as equity and conservation, and serve as discussion points when designing a fee structure.

Raftelis developed a list of policy objectives, and sub-objectives, according to the specific characteristics of the Santa Cruz Mid-County Groundwater Agency (MGA) and the suite of possible fee structures identified to implement the Groundwater Sustainability Plan (GSP) as part of the Sustainable Groundwater Management Act (SGMA) of 2014. Each pricing objective is defined herein.

2. BACKGROUND

The policy objectives in Table 1 – Administration, Equity, Rate and Revenue Stability, Affordability, and Conservation – were developed by Raftelis and will help guide the selection of an appropriate fee structure and fee recovery mechanism. Each policy objective includes several sub-objectives.

To inform the Board, each policy objective includes a policy statement, discussion notes and advantages and disadvantages of the policies. The seventeen pricing objectives were determined as most relevant to the possible fee structures identified and the characteristics of the groundwater basin.
The ranking of these policy objectives by the GSA Board will be used to develop a framework for the most appropriate fee structure(s) and fee recovery mechanism for the MGA. Recommended fee structure(s) may include a hybrid approach based on management and extraction and/or may include fixed and variable components.

Table 15: Policy Objectives and Associated Sub-Objectives for Fee Structure Evaluation

Administration	Equity	Rate and Revenue Stability	Affordability	Conservation
•Ease of Understanding •Easy of Implementation and Administration (Simplicity) •Defensibility	•Equitable among property owners •Equitable among pumpers •Equity across all basin users (beneficiaries) •Equity across management areas •Inter-generational equity	•Revenue Stability •Rate Stability •Minimize financial impacts	•Shared burden •Affordability for Essential Use	•Rewards past conservation •Tool for GSP implementation •Promotes future conservation •Scientific

Policy Objective 1 –Administration

Policy Statement: Recognizes the advantages of designating a structure and fee recovery mechanism that is easily understood by fee-payers, is simple to implement and administer by staff, and which is most defensible under applicable laws including the water code and the State Constitution.

Discussion: This objective highlights the importance of keeping structures and the process of administering them simple. Basin user education and clarity of bills should be considered as part of this principle.

Advantages of the Policy Objective: Creating structures that are easy for fee payers to understand will minimize fee-related user related administrative issues. If basin users understand the basis of their bills, they will have a greater ability to comprehend their calculated charges and conclude that it is fair.

Disadvantage of the Policy Objective: Simplifying the rate structure does not generally provide a maximum degree of fairness and equity across user groups and may limit conservation and affordable outcomes.

Sub-Objectives:

- **Ease of Understanding** – The ability for the fee structure to be explained in a manner that can be understood by basin users and other stakeholders that will have a positive impact on the ability to build acceptance of fees.
- **Ease of Implementation and Administration (Simplicity)** – Implementing a new fee structure merits careful consideration as fee structure implementation requires upfront (one-time) costs such as data gathering or billing system changes. An easy-to-administer structure does not negatively impact the ongoing costs of administration, which are predominately staffing costs.
- **Defensibility** – Producing a fee structure perceived to be fair, well documented, and well explained reduces the likelihood of legal challenge. This leads to more efficient and less costly administration.

Policy Objective 2 –Equity

Policy Statement: In compliance with the State Constitution (Article XIII D) and governing statutes of State Law (including Water Code §10720-10737.8 (SGMA)), fees should be cost-based, fairly apportioned among basin users, and account for the substantive provisions of law through a sound, technically defensible methodology.

Discussion: This principle highlights the importance of basin users' perception of fairness and equity, while also recognizing that an absolute equity among all basin users and user classes may not be achieved. Rates should generally be perceived as fair, reasonable, and equitable for all basin users.

Advantages of the Policy Objective: This principle reinforces the priority of treating all basin users fairly. Also, it acknowledges the practical obstacles that may prevent perfect equity, such as, excessive administrative costs or technical costs incurred solely to achieve additional equity.

Disadvantages of the Policy Objective: "fairness" and "equity" can be subjective and requires the Board to apply its discretion and judgment. More, equity can be interpreted at the basin-wide level or among and between different user groups or stakeholders.

Sub-Objectives:

- **Equity Among Property Owners** – States that a fee structure achieves equity by allocating costs fairly and proportionally across property owners whose parcels overlay the basin.
    - Example argument for: An impaired groundwater basin may diminish property values while an improved basin may increase land values

- **Equity Among Pumpers -** States that a fee structure achieves equity by allocating costs fairly and proportionally across well owners who extract from the basin.
  - Example argument for: Pumpers, or those owning wells, should pay because they are the actual extractors of groundwater from the basin
- **Equity Across All Basin Users (Beneficiaries) -** States that a fee structure achieves equity by allocating costs fairly and proportionally across all water users in the basin. Considers basin groundwater a general benefit across all users of groundwater.
  - Example argument for: Access to local groundwater benefits all and therefore all should pay
- **Equity Across Management Areas** - Considers specific regions within the basin boundaries that contribute to groundwater replenishment and specific regions which contribute to intrusion, depletion, and/or impairment.
  - Example argument for: It is fair and appropriate for MGA to incorporate natural sub-basin characteristics across the groundwater basin into a fee structure
- **Inter-Generation Equity –**States that a fee structure achieves equity by matching the costs of existing basin impacts to those who have caused the impacts. The objective aims to protect current and future users from disproportionately bearing costs related to groundwater management due to past activities.
  - Example argument for: It is fair and appropriate to recoup mitigation and restoration costs based on past users and their uses

Policy Objective 3 –Rate and Revenue Stability

Policy Statement: There are advantages to an agency in increasing revenue certainty and stabile rates to users. These policies are achieved by selecting specific funding mechanisms or incorporating specific cost components into a fee structure.

Discussion: This principle highlights the importance of ensuring adequate revenue generation for maintaining a self-sustaining agency. Revenues must be adequate to fund technical, personnel, and other operational costs. Revenue generation, and the rates charges to users, should be predictable.

Advantages of the Policy Objective: The practice of ensuring revenue sufficiency and stability generates additional gains in financial health.

Disadvantages of the Policy Objective: While pursuing a rate structure that promotes revenue stability is advantageous, setting user charges in a fashion that fixes a user's bill may be perceived as unfair and inequitable. In addition, the public may perceive the need as unnecessary and that the agency has little incentive to be judicious with operating and management costs.

Sub-Objectives:

- **Revenue Stability** – The ability of the fee structure to generate stable and predictable revenues from month to month or year to year. Specific types of fee structures are more effective at maintaining revenue stability than others. Adequate revenues ensure, for example, that technical studies can be conducted, qualified personnel can be retained, and that operational costs of the agency are covered.
- **Rate Stability** – To reasonably ensure that user fees are predictable from over billing cycles and without sharp fluctuations in magnitude or structure year over year. Similar to the revenue stability objective, certain fee structures are more effective at guarding against fee spikes and highly fluctuating user bills.
- **Minimize Financial Impacts** – Fees imposed by MGA on basin users will be the first of its kind. This objective aims to minimize the financial burden on users to the greatest extent possible. The objective overlaps with the shared burden objective in Policy Objective 4.

Policy Objective 4 –Affordability

Policy Statement: It is important to establish rates that generate adequate revenues from year to year, regardless of climate cycles or variation in basin extractions. Large and unexpected rate changes may impose financial hardships on users large and small. This may negatively affect public opinion of the MGA in terms of revenue management, fiscal responsibility, and rate equity.

Discussion: Affordable fees require a balance between generating stable and sufficient revenue for operations and providing flexibility in user charges. Any new fee structure may result in different impacts to different basin users.

Advantages of the Policy Objective: Flexibility in bills allows users a degree of choice and control over their charges. More, lower income and/or those facing financial hardship are more likely to stay current on their charges with fees deemed affordable by the community.

Disadvantages of the Policy Objective: Affordability is relative to each individual fee payer and can be difficult to define. What may be affordable for one user is unaffordable to another. Additionally, affordability efforts generally present a tradeoff with revenue stability to the agency.

Sub-Objectives:

- **Shared Burden** – Recognizes that the Mid-County Basin benefits all current, future, and potential users of groundwater. In essence, each overlying property benefits from a sustainable groundwater basin and the burden of ensuring basin health should be distributed as broadly as possible.
- **Affordability for Essential Use** – This objective addresses the importance of maintaining the price - i.e. that which is used for health and safety – at the lowest cost possible while considering the needs of the Agency and regulatory conditions.

Policy Objective 5 – Conservation

Policy Statement: The critical condition of the groundwater basin, and the mandate of sustainability as defined by SGMA, should be reflected in the fees and charges. The fee structure should encourage a reduction in basin-wide use and empower necessary water management efforts by the GSA.

Discussion: This principle recognizes the limited water availability of the basin, as well as the environmental and financial impact of mitigation activities. The fees should encourage reduced use of a limited resource to the greatest extent under the law.

Advantages of the Policy Objective: This policy attempts to align the costs of reducing basin extraction with the users causing basin overdraft and seawater intrusion. The fee structure assigns a tangible value on the costs of critical overdraft.

Disadvantages of the Policy Objective: Typically, fee structures emphasizing efficiency, conservation, and reduced water use pose increased costs in implementation, administration, technical services, and outreach.

Sub-Objectives:

- **Reward Past Conservation Efforts** –Recognizes the value either of rewarding individuals for reduced and efficient use according to their needs, or at minimum, not penalizing those users for their conservation efforts prior to SGMA.
- **Tool for Implementing the Groundwater Sustainability Plan (GSP)** –Aims to develop a fee structure that is most likely to achieve the goals of the GSP over the long term. Advocates for a mechanism to allocate costs and incentivize activities to avoid or mitigate undesirable results as defined by SGMA.

- **Promotes Future Conservation** –Aims to reduce total water use through a focus on reduced pumping. The objective may include increased efficiency of basin water use to include development of benchmark standards associated with the appropriate amount of water use based on local characteristics.
- **Scientific Method** – Use of best available science, models, and empirical data-based standards and guidelines should be employed to develop the fee structure. The scientific method is applied to pumping for indoor and outdoor water use, such as the specific amount of water estimated for outdoor requirements given parcel land cover as well as the estimated return of water to the basin based on geology and other hyper-local characteristics.

3. Pricing objectives Exercise

Santa Cruz Mid-County Groundwater Agency
Pricing Objectives Exercise

Please rank each of the objectives from 1 to 17 with
1 being most important and 17 being least important
See Appendix A for the definitions of each Objective

	Objectives	Ranking
Administration	Ease of Understanding	
	Easy of Implementation and Administration	
	Defensibility	
Equity	Equity Among Property Owners	
	Equity Among Pumpers	
	Equity Across All Basin Users (Beneficiaries)	
	Equity Across Geographic Areas	
	Inter-Generational Equity	
Rate and Revenue Stability	Revenue Stability	
	Rate Stability	
	Minimize Financial Impacts	
Affordability	Shared Burden	
	Affordability for Essential Use	
Conservation	Rewards Past Conservation Effort	
	Tool for Implementing the GSP	
	Promotes Future Conservation	
	Scientific Method	

Participant's name ____

4. Sub-Objective Definitions

Affordability for Essential Use: This objective addresses the importance of maintaining the price - i.e. that which is used for health and safety – at the lowest cost possible while considering the needs of the Agency and regulatory conditions.

Defensibility: Producing a fee structure perceived to be fair, well documented, and well explained reduces the likelihood of legal challenge. This leads to more efficient and less costly administration.

Ease of Implementation and Administration (Simplicity): Implementing a new fee structure merits careful consideration, as rate structure implementation requires upfront (one-time) costs such as data gathering or billing system changes. An easy-to-administer structure does not negatively impact the ongoing costs of administration, which are predominately additional staffing costs.

Ease of Understanding: The ability for the fee structure to be explained in a manner that can be understood by basin users and other stakeholders will have a positive impact on the ability to build acceptance of fees.

Equity Across All Basin Users (beneficiaries): This objective states that a fee structure achieves equity by allocating costs fairly and proportionally across all water users in the basin. Considers basin groundwater a general benefit across all users of groundwater.

Equity Across Management Areas: Considers specific regions within the basin boundaries that contribute to groundwater replenishment and specific regions which contribute to intrusion, depletion, and/or impairment.

Equity Among Property Owners: This objective states that a fee structure achieves equity by allocating costs fairly and proportionally across property owners whose parcels overlay the basin.

Equity Among Pumpers: This objective states that a fee structure achieves equity by allocating costs fairly and proportionally across well owners whose parcels overlay the basin.

Inter-Generational Equity: This objective states that a fee structure achieves equity by matching the costs of existing impacts to the basin to those who have caused the impacts. The objective aims to protect current and future users from bearing all costs related to groundwater management due to past activities.

Minimize Financial Impacts: Fees imposed on basin users will be the first of its kind. This objective aims to minimize the financial burden on users to the greatest extent possible. The objective overlaps with the shared burden objective.

Promotes Future Conservation: The objective aims to reduce total water use through a focus on reduced pumping. The objective may include increased efficiency of basin water use to include development of benchmark standards associated with the appropriate amount of water use based on local characteristics.

Rate Stability: The objective is to reasonably ensure that user fees are predictable from billing cycle to billing cycle and without sharp fluctuations in magnitude or structure year over year. Similar to the revenue stability objective, certain fee structures are more effective at guarding against fee spikes and highly fluctuating user bills.

Revenue Stability: The ability of the fee structure to generate stable and predictable revenues from month to month or year to year. Specific types of fee structures are more effective at maintaining revenue stability than others. Adequate revenues ensure, for example, that technical studies can be conducted, qualified personnel can be retained, and that operational costs of the agency are covered.

Reward Past Conservation Efforts: This objective recognizes the value either of rewarding individuals for efficient use according to their needs, or at minimum, not penalizing those users for their conservation efforts prior to SGMA.

Scientific Method: Use of best available science, models, and empirical data-based standards and guidelines should be employed to develop the fee structure. The scientific method is applied to pumping for indoor and outdoor water use, such as the specific amount of water estimated for outdoor requirements given parcel land cover, as well as the estimated return of water to the basin based on geology and other hyper-local characteristics.

Shared Burden: This objective recognizes that the Mid-County Basin benefits all current, future, and potential users of groundwater. In essence each overlying property benefits from a sustainable groundwater basin and the burden of ensuring basin health should be distributed as broadly as possible.

Tool for Implementing the Groundwater Sustainability Plan (GSP): This objective aims to develop a fee structure that is most likely to achieve the goals of the GSP over the long term. Advocates for a mechanism to allocate costs and incentivize activities to avoid or mitigate undesirable results as defined by SGMA.

Appendix B

Part 2.74 of Division 6 of the Water Code contains 12 chapters on Sustainable Groundwater Management. Below are five important sub-sections of Chapter 8: Financial Authority that are pertinent to MGA's ability to develop a fee structure that is most appropriate for the basin and the authority and technical requirements to charge fees. The language that follows is direct from the sub-sections in Chapter 8 of Part 2.74 of the Water Code. Bolded font is emphasis added by Raftelis.

10730.2(d): Fees imposed pursuant to this section may include **fixed fees** and **fees charged on a volumetric basis**, including, but not limited to, fees that increase based on the quantity of groundwater produced annually, the year in which the production of groundwater commenced from a groundwater extraction facility, and impacts to the basin.
10730.8(a): Nothing in this chapter shall affect or interfere with the authority of a groundwater sustainability agency to levy and collect **taxes, assessments, charges**, and tolls as otherwise provided by law.
10730.2(c): Fees imposed pursuant to this section shall be adopted in accordance with subdivisions (a) and (b) of **Section 6 of Article XIII D** of the California Constitution. (*Proposition 218*)
10730(a): A groundwater sustainability agency may impose fees, including, but not limited to, **permit fees** and **fees on groundwater extraction** or other regulated activity, to fund the costs of a groundwater sustainability program, including, but not limited to, preparation, adoption, and amendment of a groundwater sustainability plan, and investigations, inspections, compliance assistance, enforcement, and program administration, including a prudent reserve.
10730.2(a): …may impose fees on the extraction of groundwater from the basin to fund costs of groundwater management, including:

- Administration, operation, and maintenance, including a prudent reserve.
- Acquisition of lands or other property, facilities, and services.
- Supply, production, treatment, or distribution of water.
- Other activities necessary or convenient to implement the plan.