SANTA CRUZ MID-COUNTY GROUNDWATER SUSTAINABILITY PLAN

Advisory Committee Meeting #17

SANTA CRUZ MID-COUNTY GROUNDWATER AGENCY

Wednesday, March 27, 2018, 5:00 – 8:30 p.m.

Simpkins Family Swim Center, Santa Cruz

Welcome and Introductions

- Groundwater Sustainability Plan (GSP) Advisory Committee
- Staff
- Public

Meeting Objectives

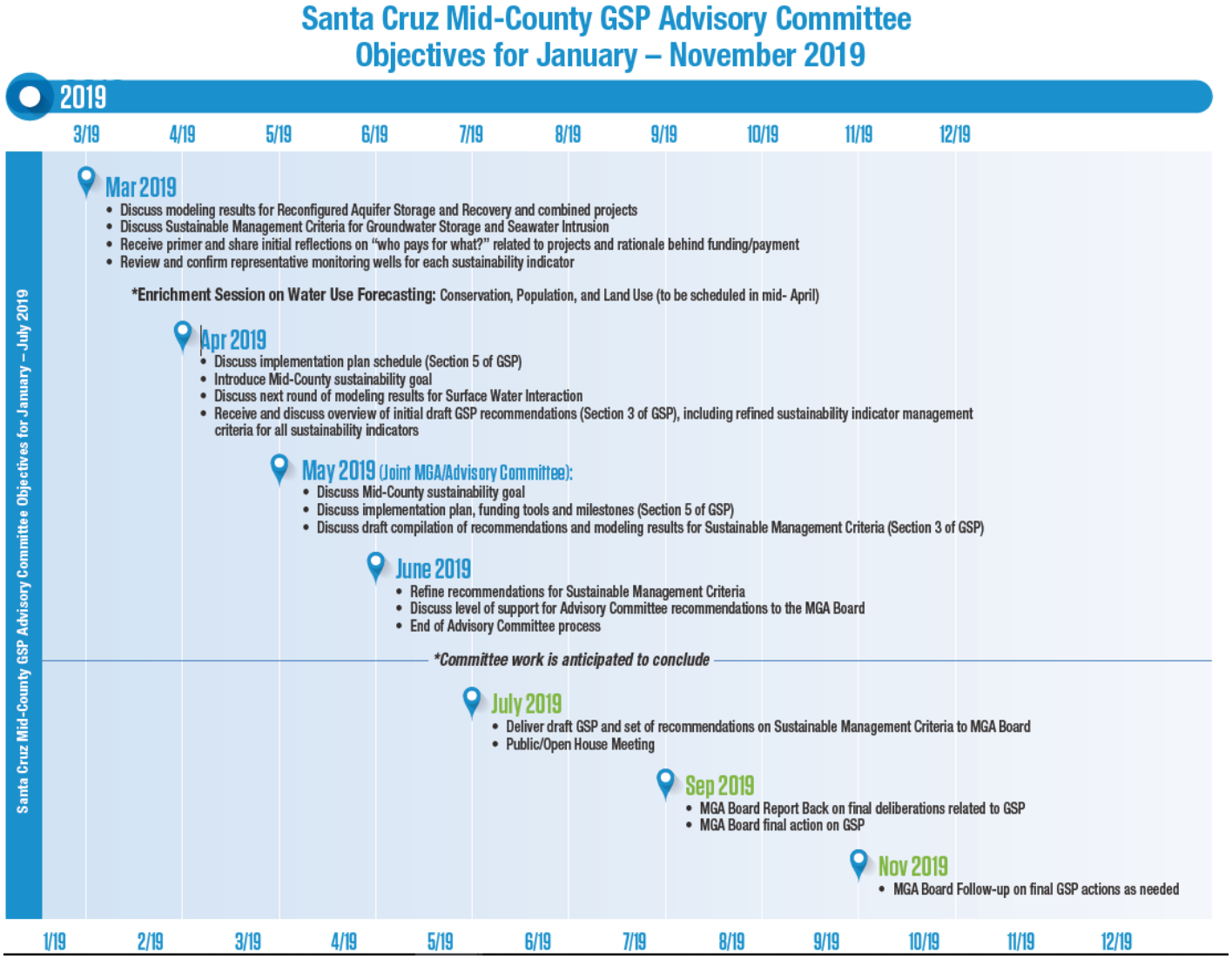
- Discuss groundwater modeling results for various sustainability strategies
  - Combined projects
- Discuss draft proposed Sustainable Management Criteria for "Groundwater Storage" Sustainability Indicator and updated Sustainable Management Criteria for "Sea Water Intrusion" Sustainability Indicator
- Receive primer and share initial reflections on the topic of "who pays for what?"
- Review and confirm representative monitoring wells for each sustainability indicator

Agenda

5:00	Welcome, Introductions, Objectives, Agenda, and GSP Project Timeline
5:10	Oral Communications
5:20	Project Updates
5:25	Groundwater Modeling Results for Combined Projects
6:15	Public Comment
6:25	*Break*
6:40	Proposed Draft Sustainable Management Criteria for Sea Water Intrusion and Groundwater Storage
7:30	Proposed Santa Cruz MGA Ongoing Funding Approach
8:00	Representative Monitoring Wells for Each Sustainability Indicator
8:10	Public Comment
8:20	Confirm February 27, 2019 Advisory Committee Meeting Summary
8:25	Recap and Next Steps
8:30	*Adjourn*

GSP Project Timeline

GSP 2019 Project Timeline



Oral Communications

Project Updates

- Upcoming GSP Advisory Committee meeting schedule
- March 21 DWR Groundwater Sustainability Agency (GSA) Forum
- Santa Margarita Basin informational meetings
- April 8 Surface Water working group meeting
- April 18 Land Use and Water Enrichment Session

SANTA CRUZ MID-COUNTY GROUNDWATER AGENCY

GROUNDWATER MODELING OF MGA SUSTAINABILITY STRATEGIES

GSP Advisory Committee – March 27, 2019

Item 4: Groundwater Modeling Results for MGA Sustainability Strategies

Modeling for Combination of Pure Water Soquel and City of Santa Cruz Aquifer Storage and Recovery

Modeled for GSP Advisory Committee using available information

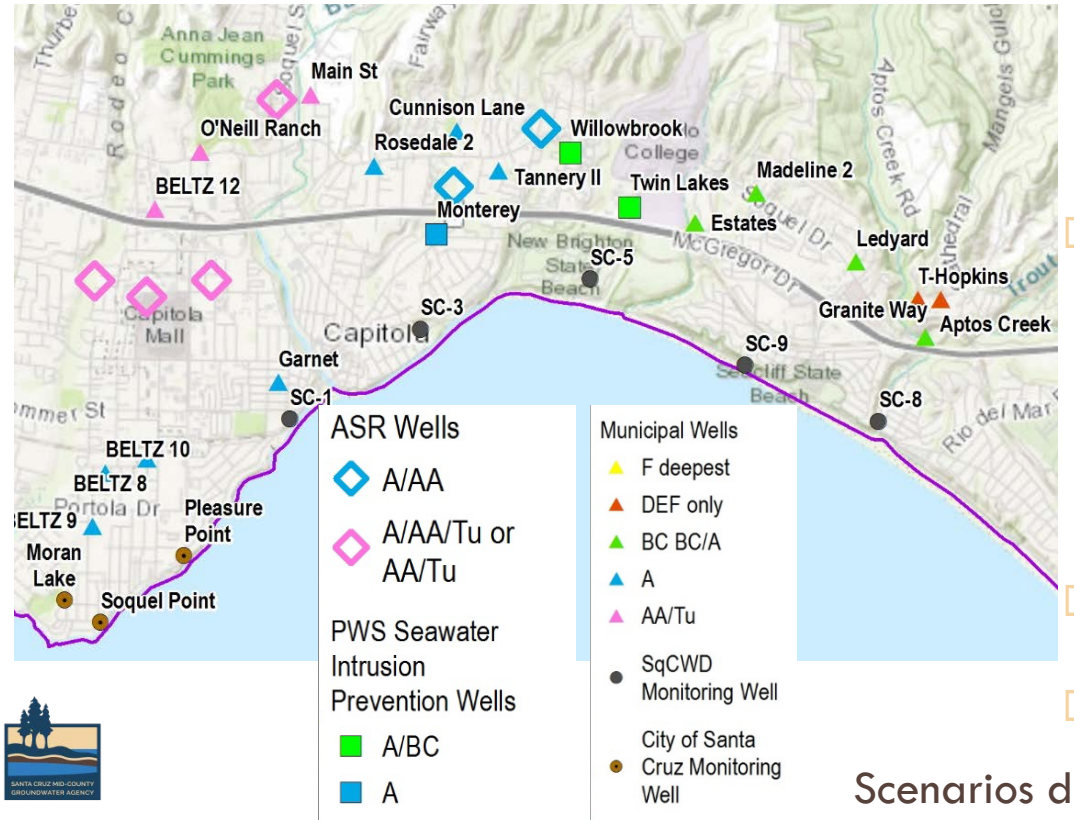
Member Agency Sustainability Strategies

- SqCWD Pure Water Soquel
  - Uses advanced water purification methods to purify recycled water for replenishing the groundwater basin and protecting against further seawater intrusion
  - Current Status: feasibility completed, project EIR certified, approved by lead agency (SqCWD)
  - Project with enhancements to pumping distribution modeled for GSP
- City of Santa Cruz Aquifer Storage and Recovery
  - Uses excess surface water supplies to store water to meet City water shortages
  - Initial iteration of configuration modeled for Phase I Technical Feasibility Investigation
  - City is pilot testing at Beltz 12 and performing ongoing groundwater modeling to inform next steps

City ASR Phase I Feasibility Scenarios

Scenarios for Phase I feasibility study

- Designed to meet City water shortage only
- **Initial iteration** of well configuration
- Modeling shows benefits for sustainability

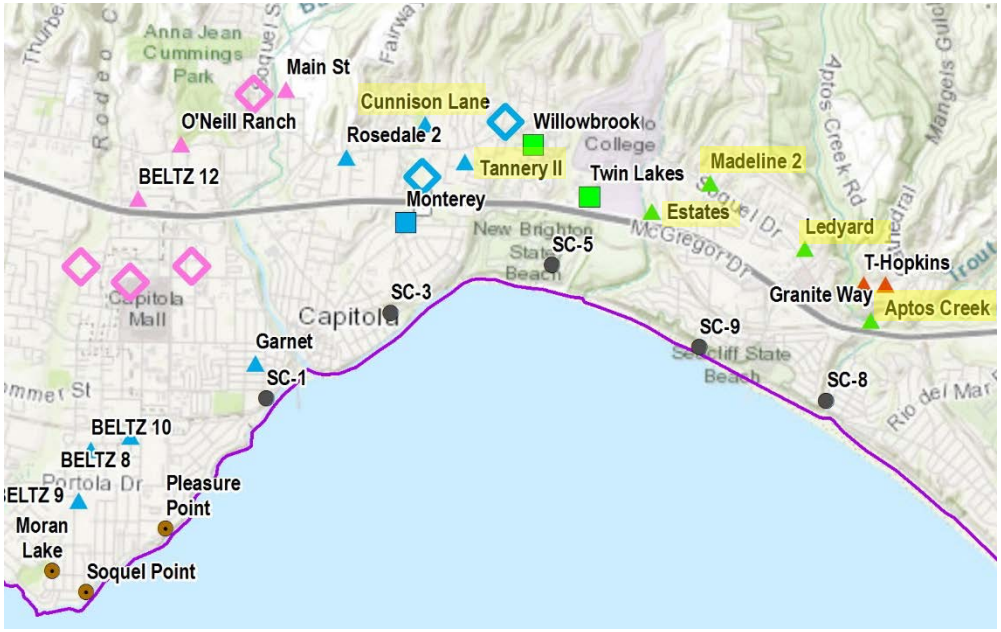


- In-lieu only
  - Reduced pumping at SqCWD Purisima wells
  - Recovery pumping at new City wells
- ASR only
  - Injection at new City wells
  - Recovery pumping at same wells as injection
- In-lieu + ASR
- Baseline (No Projects)

Scenarios developed by Pueblo Water Resources

Combination of City ASR & Pure Water Soquel Scenarios

Simulations of combination of City ASR & Pure Water Soquel to **inform future iteration** of City ASR well configuration

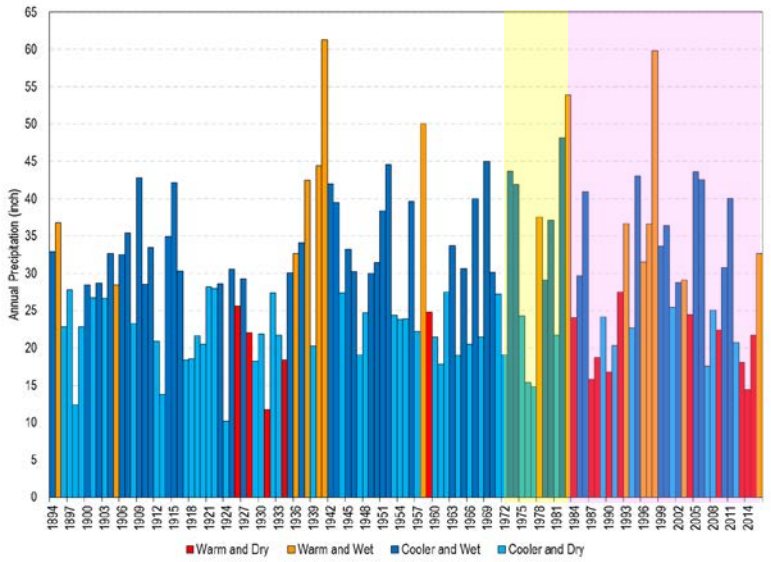


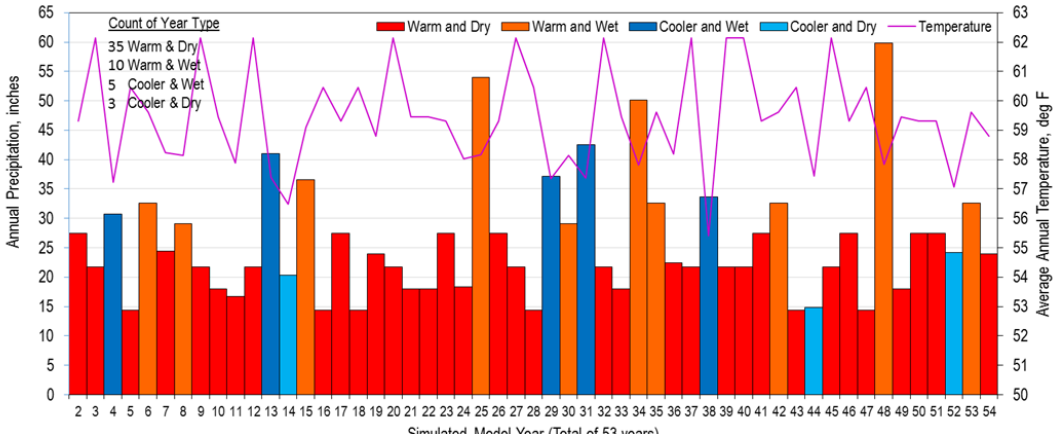
A and BC wells incompatible to simulate 1st iteration of in-lieu and Pure Water Soquel

- In-lieu + PWS
  - In-lieu reduced pumping at SqCWD Purisima wells
  - PWS increased pumping at some of the same wells
  - Not compatible to simulate; **would need to reconfigure**
- ASR only + PWS
  - Injection and recovery at new City wells
  - Injection at PWS wells and pumping at SqCWD wells
  - Compatible to simulate

Climate Scenarios for City ASR

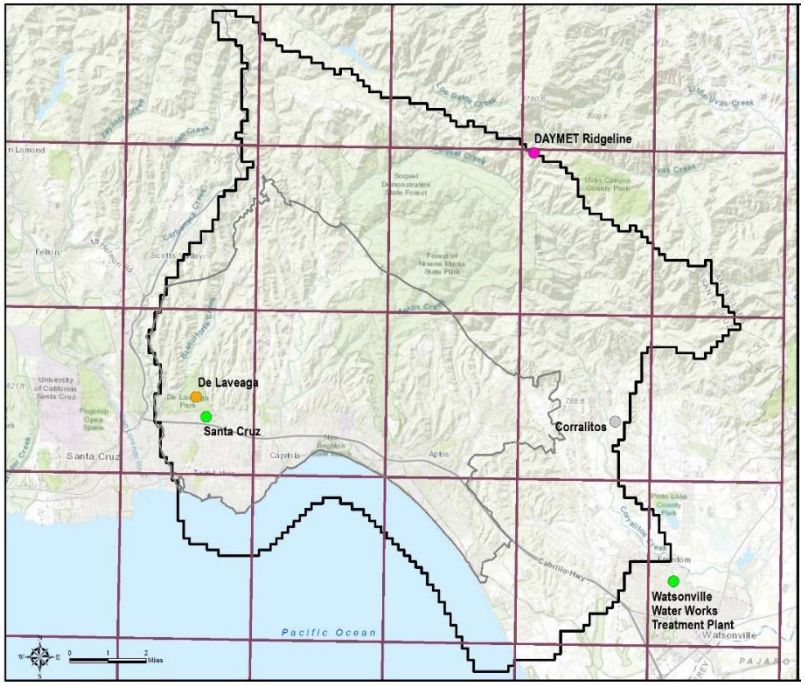
1. 1985-2015
2. 1973-1984
3. 2020-2069
   - Downscaled GCM: GFDL2.1-A2
4. 2020-2069
   - Catalog Climate
   - Under development: calculation of surface water availability





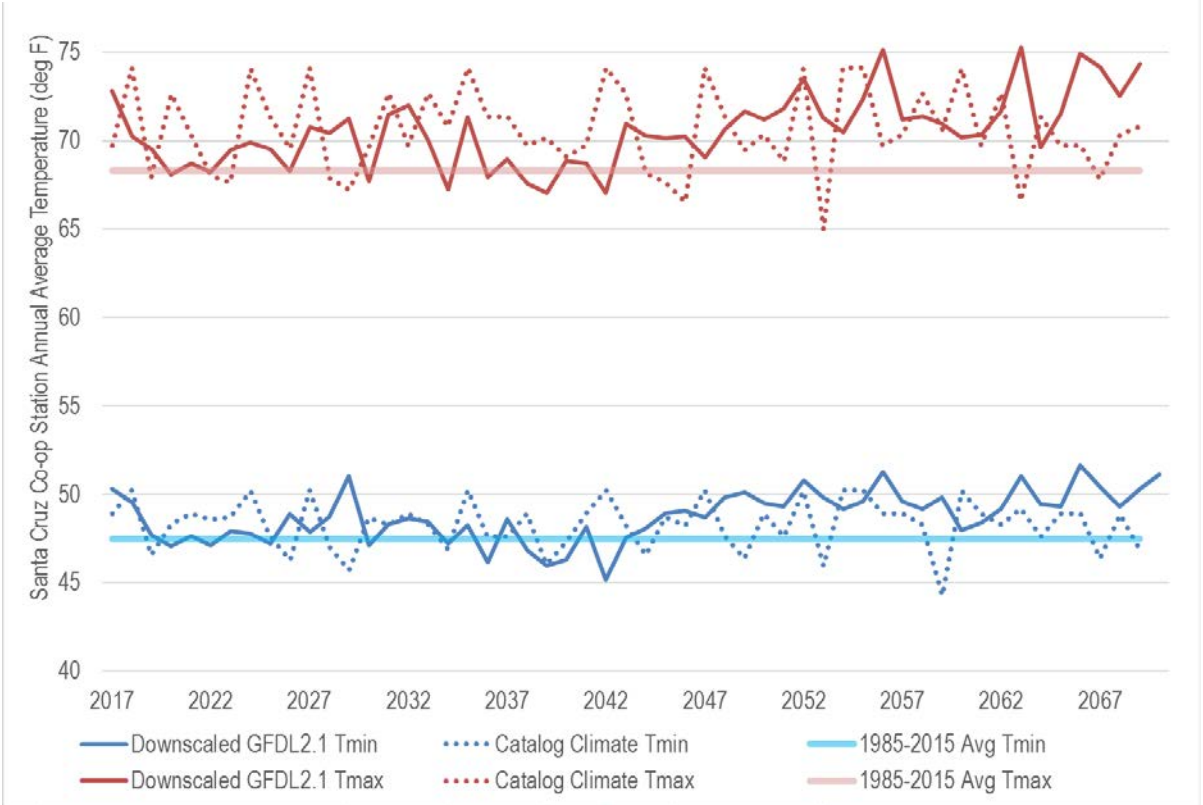
Downscaled Global Circulation Model (GCM)

- GFDL2.1-A2 used for City WSAC planning
  - CMIP3 released in 2010
- City calculated surface water available for ASR based on GFDL2.1
- Climate downscaled to stations for GSFLOW model input
- Can apply Pure Water Soquel pumping distribution based on GFDL2.1



Temperature: GFDL vs. Catalog

Santa Cruz Average (Degrees F)	Tmin	Tmax
1985-2015 (horizontal line)	47.4	68.3
Downscaled GFDL2.1 (solid line)	48.7	70.6
Catalog (dotted line)	48.2	70.6

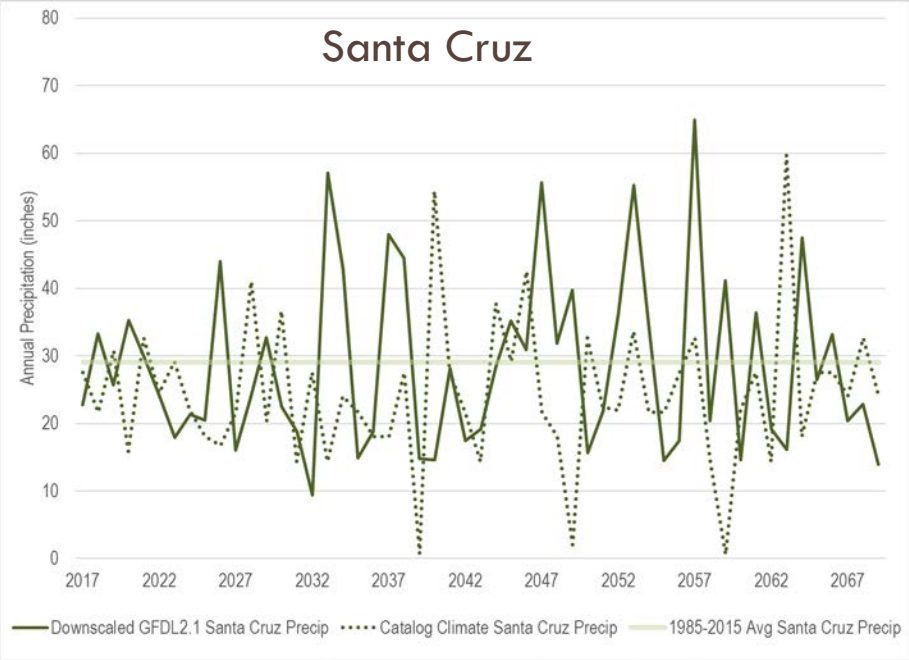


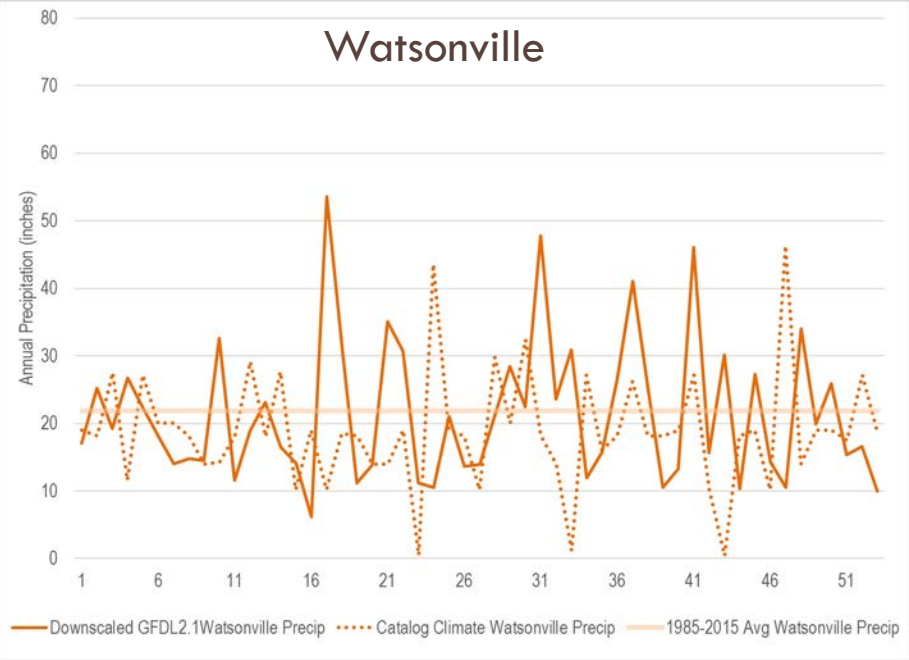
Tmax

Tmin

Rainfall: GFDL vs. Catalog

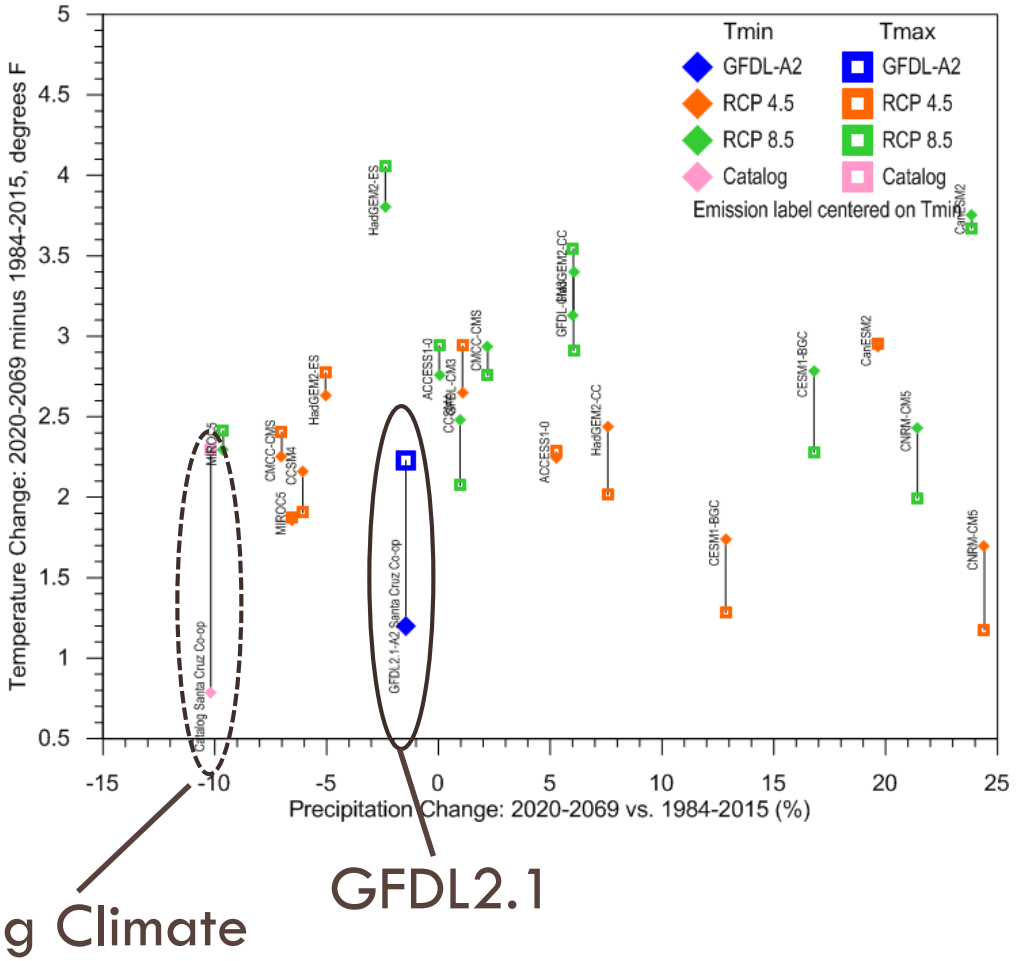
Annual Average (Inches)	Santa Cruz	Watsonville
1985-2015 (horizontal line)	29.0	21.5
Downscaled GFDL2.1 (solid line)	28.6	21.9
Catalog (dotted line)	26.0	19.8





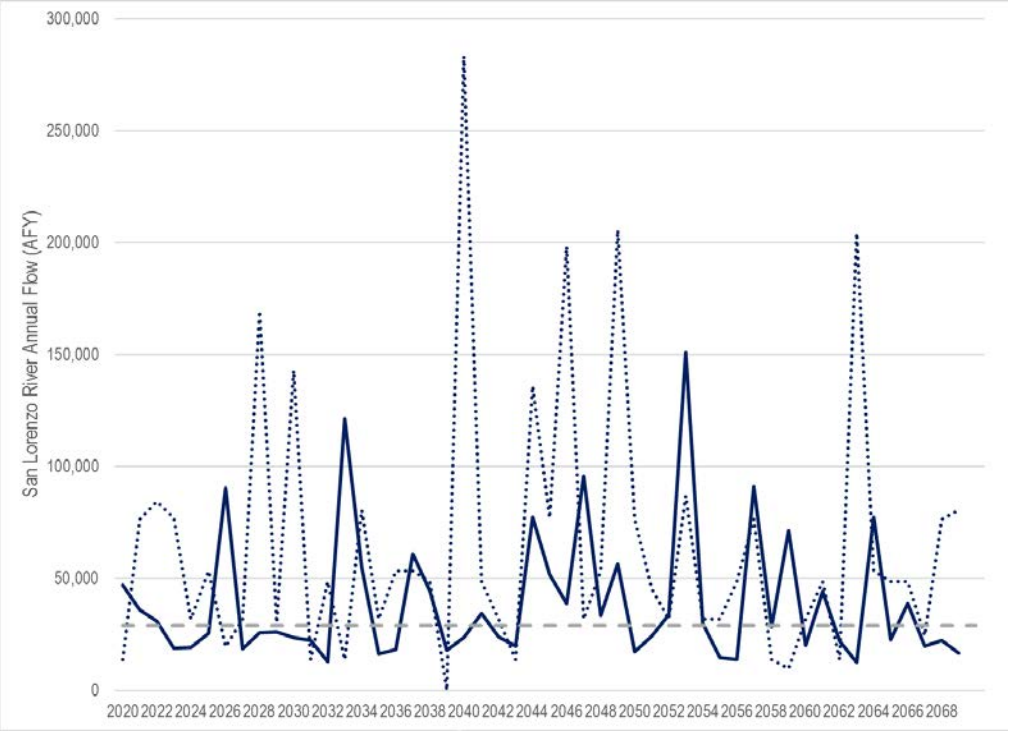
Comparison to CMIP5 Used by State

- Compared Catalog Climate and GFDL2.1 to 2013 ensemble used by state
- Drier than most CMIP5 models for Santa Cruz
- Not as hot as most CMIP5 models for Santa Cruz



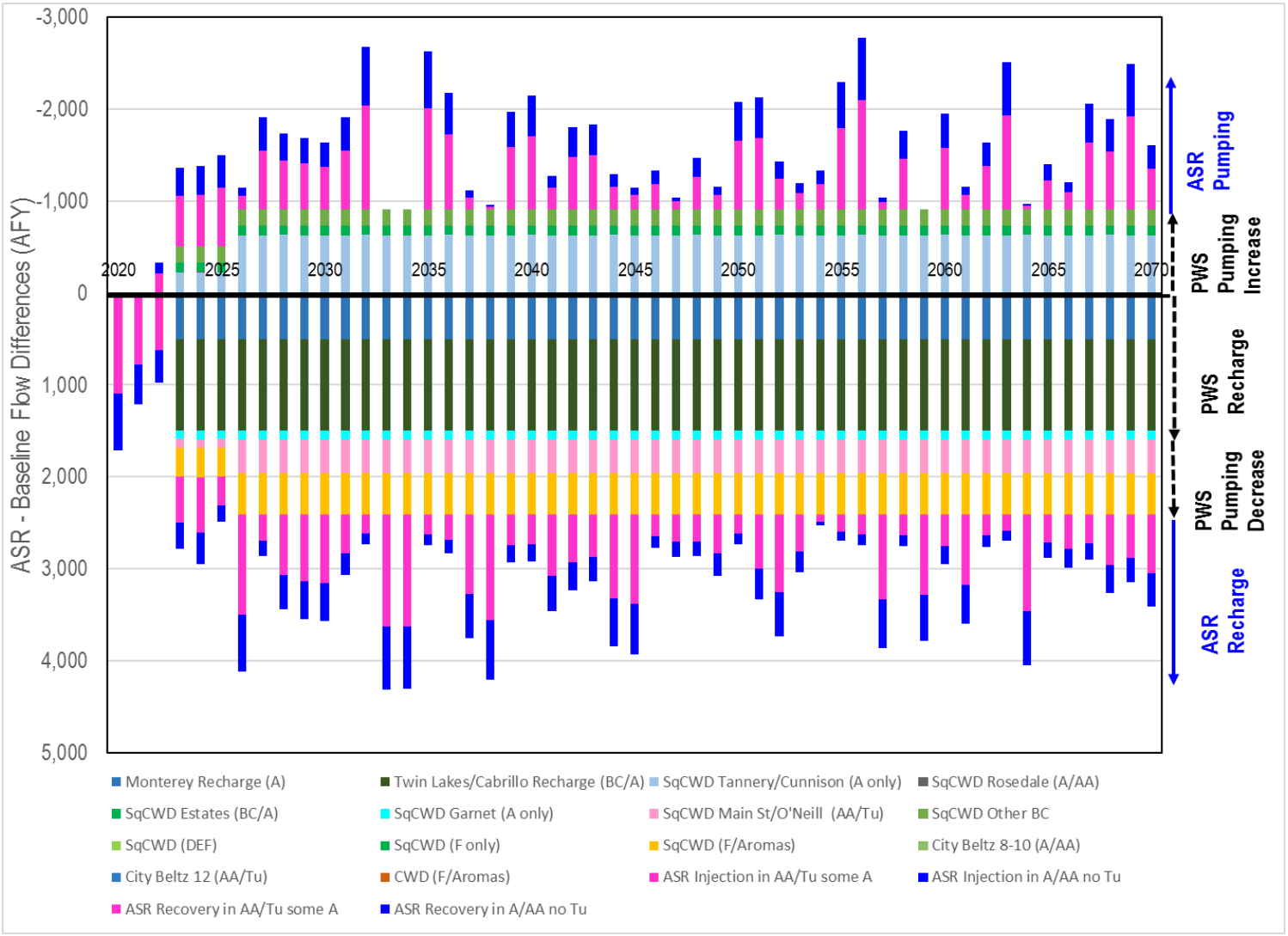
Streamflow: GFDL vs. Catalog

San Lorenzo River Flow	Annual Average	% Critically Dry Years (<29,000 AFY –dashed grey line)
1985-2015 (not graphed)	79,000	19%
Downscaled GFDL2.1 (solid line)	39,000	56%
Catalog (dotted line)	66,000	17%



Corrected table 3/28/2019

Recharge and Pumping Changes

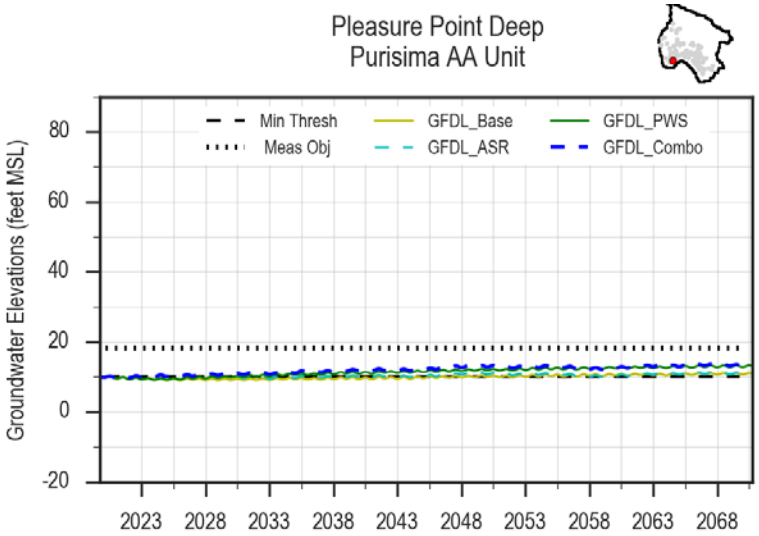


Up to 1,850 afy

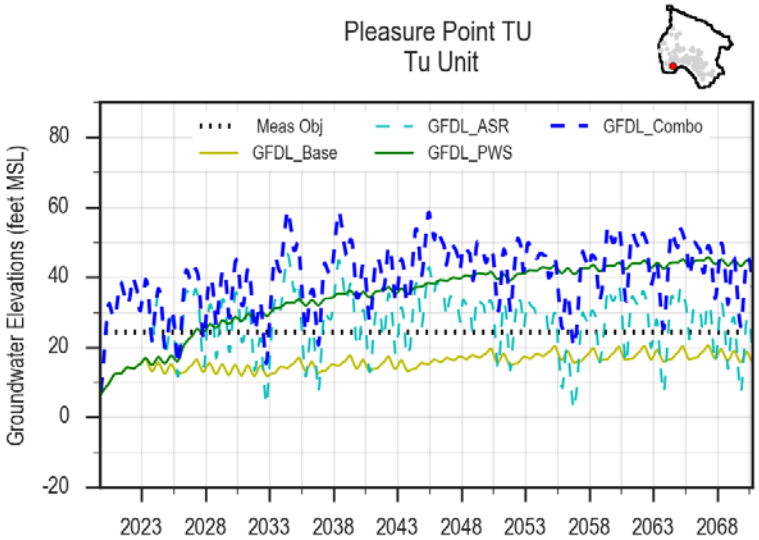
1,500 afy

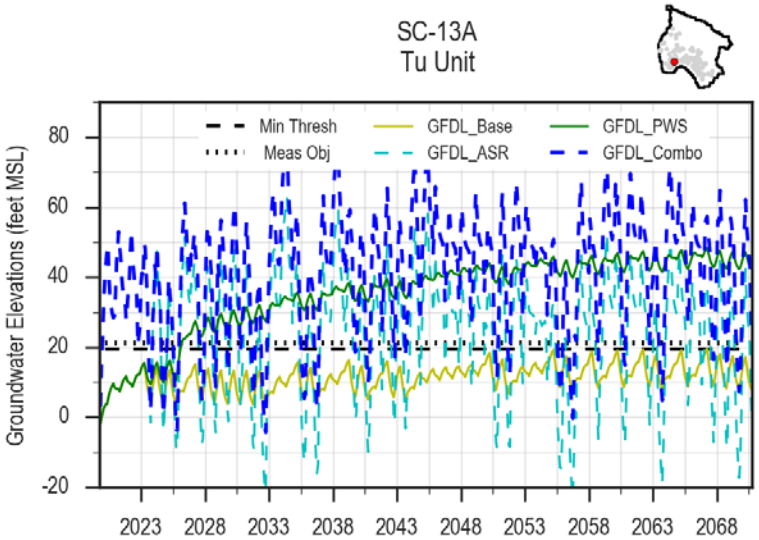
Up to 1,900 afy

Purisima AA and Tu Units



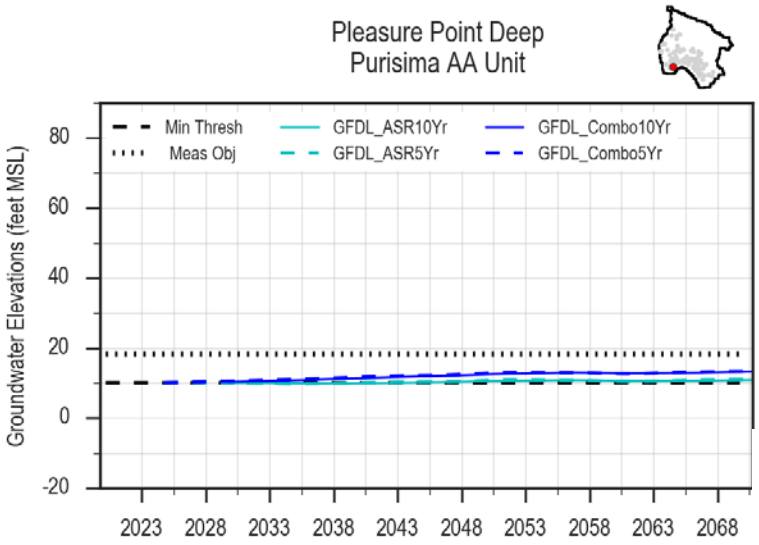
ASR transitions between injection and recovery based on City supply availability and demand

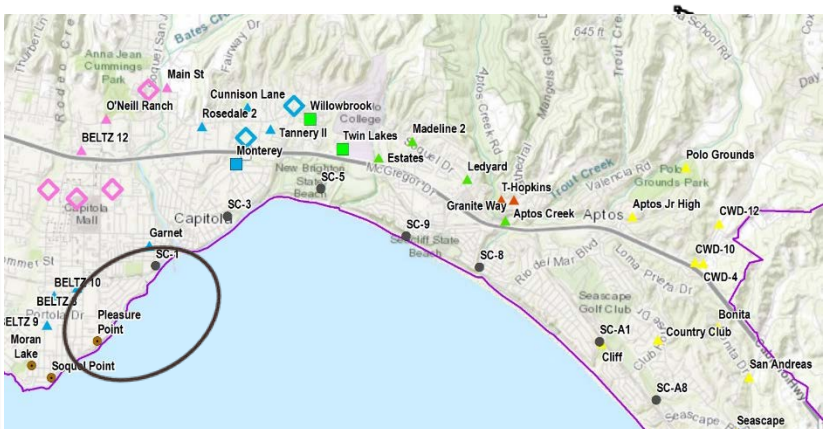




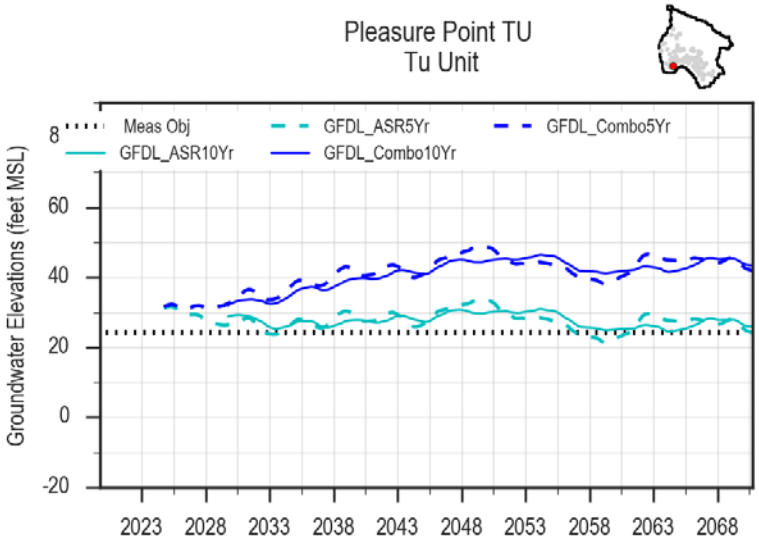
Combo
PWS
ASR
Baseline

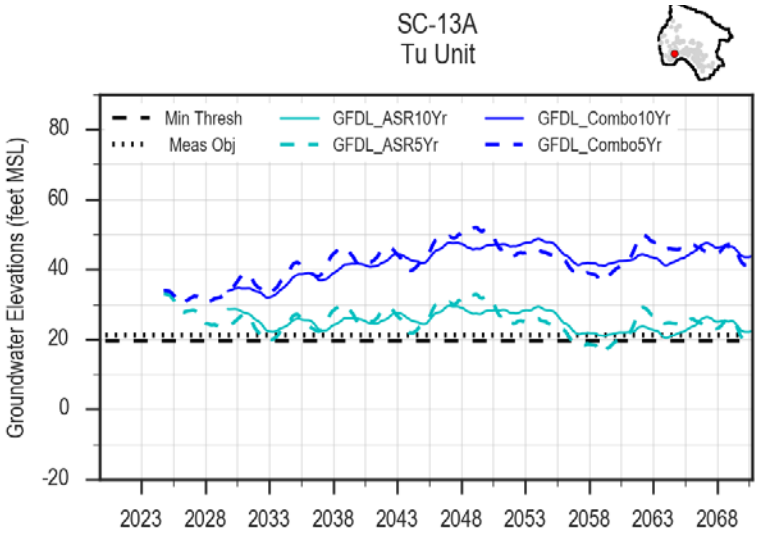
Purisima AA and Tu Units
5 Year vs 10 Year Average





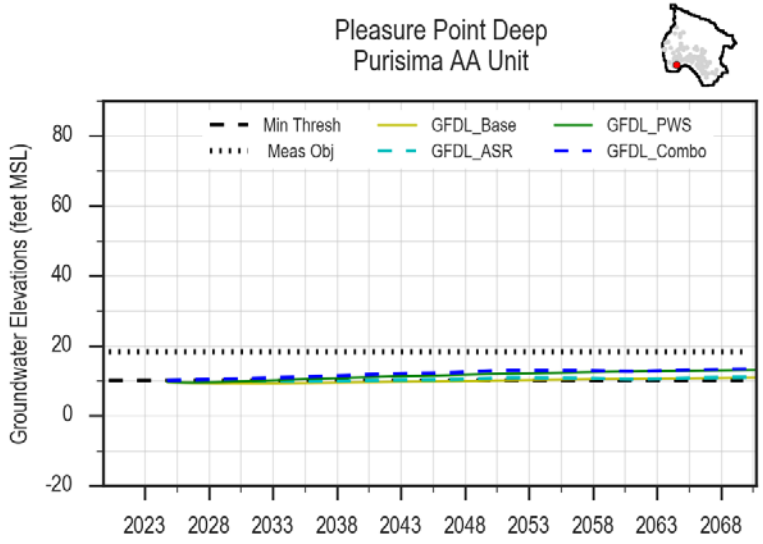
Multi-year averages help evaluate net effect of projects

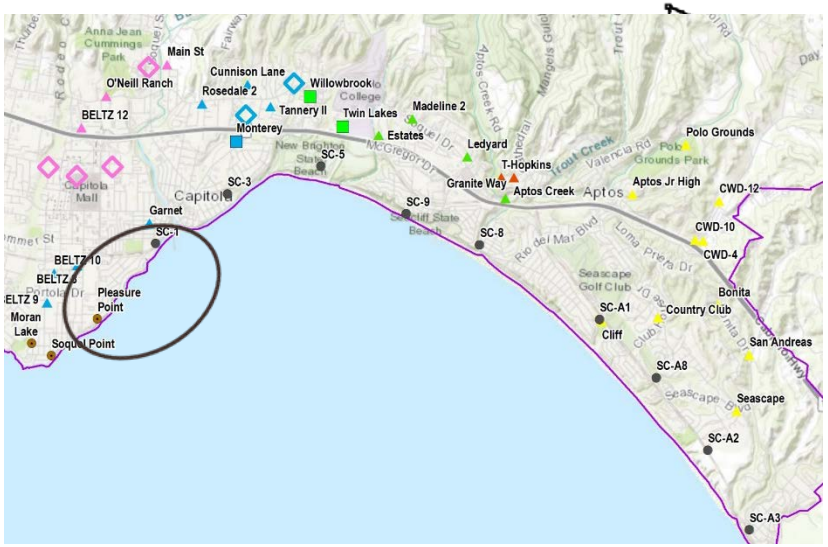


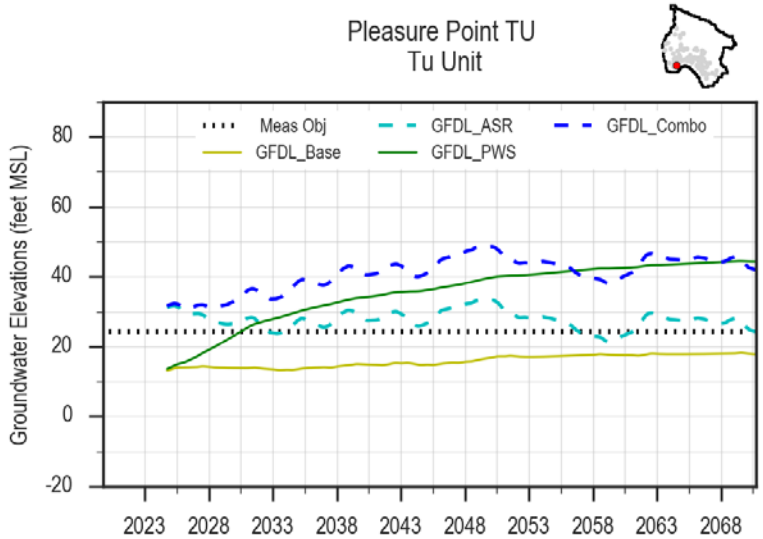


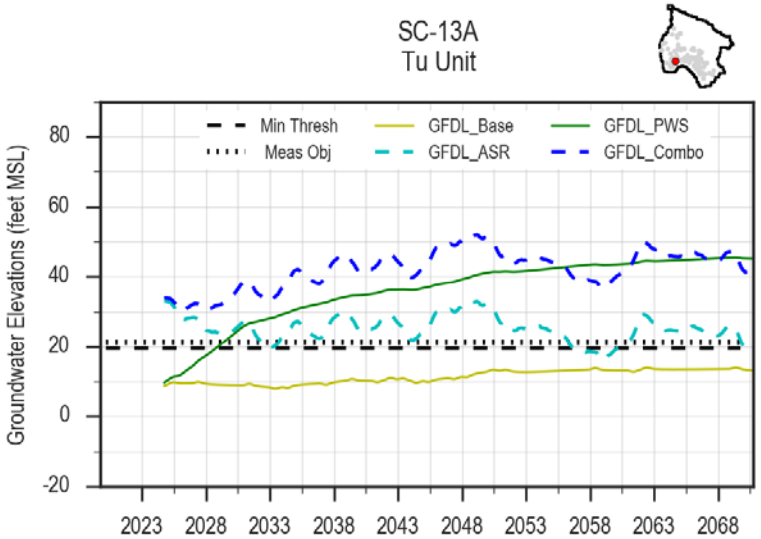
Combo
5 Year – Dashed
10 Year – Solid
ASR
5 Year – Dashed
10 Year – Solid

Purisima AA and Tu Units
5 Year Average









Combo
PWS
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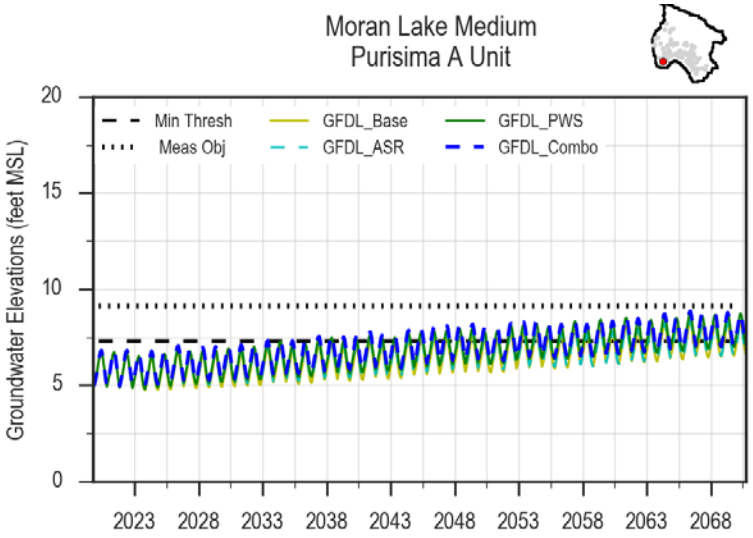
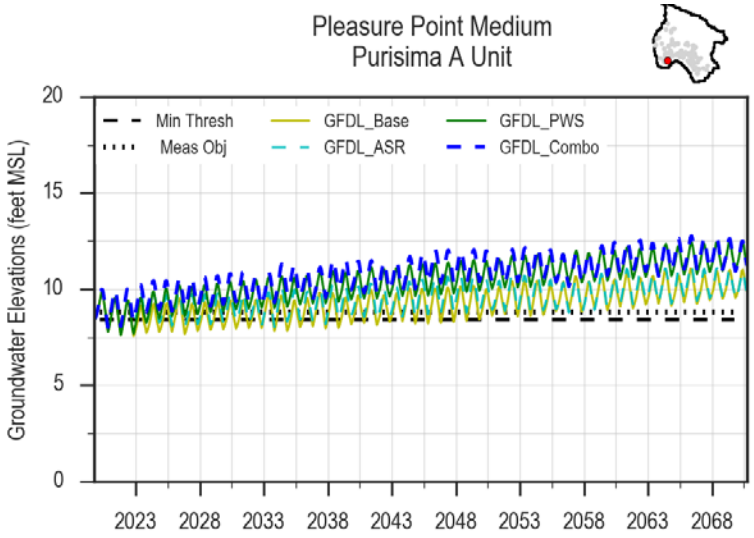
Purisima A Unit (City Wells)





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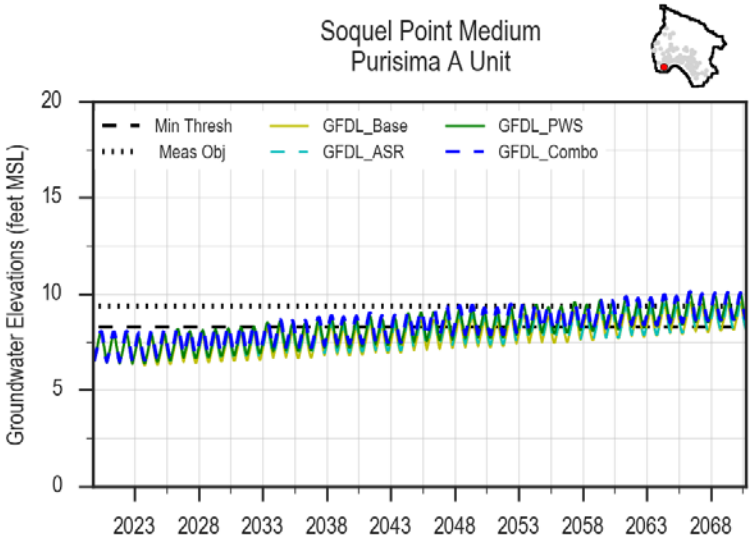
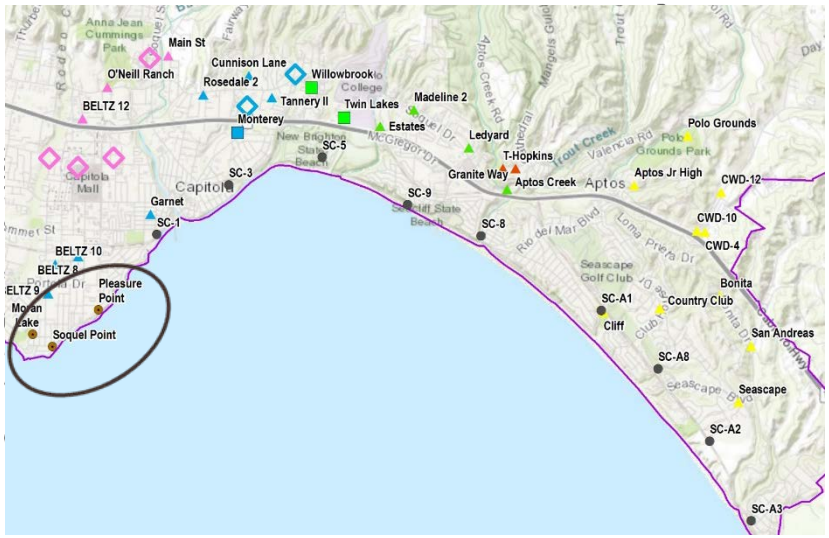
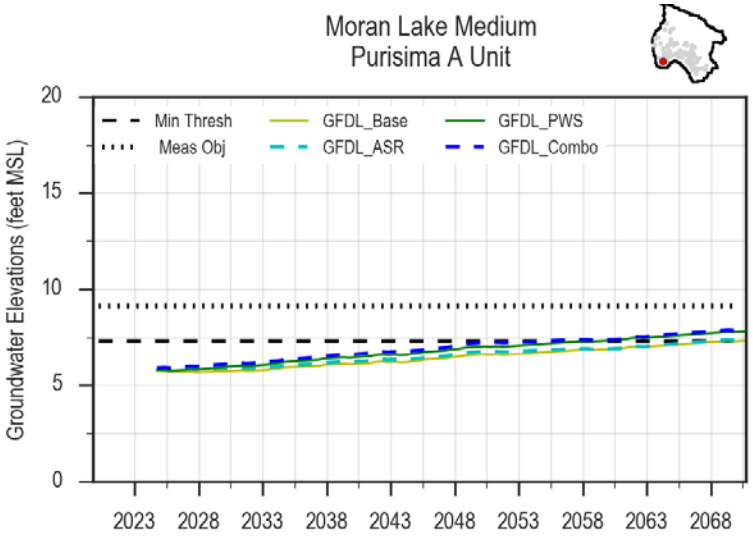
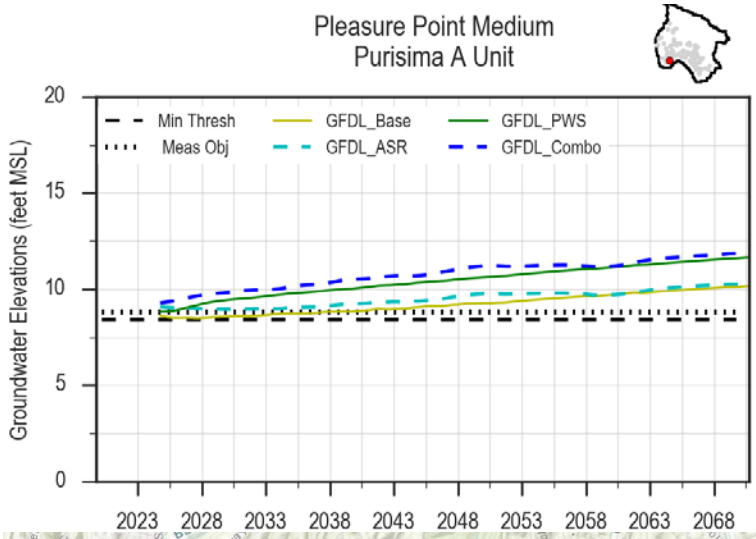




Purisima A Unit (City Wells)
5 Year Average





Combo
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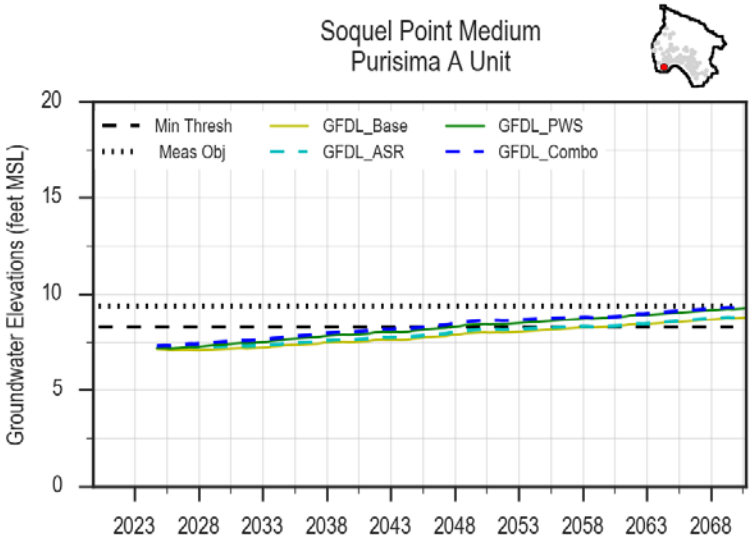
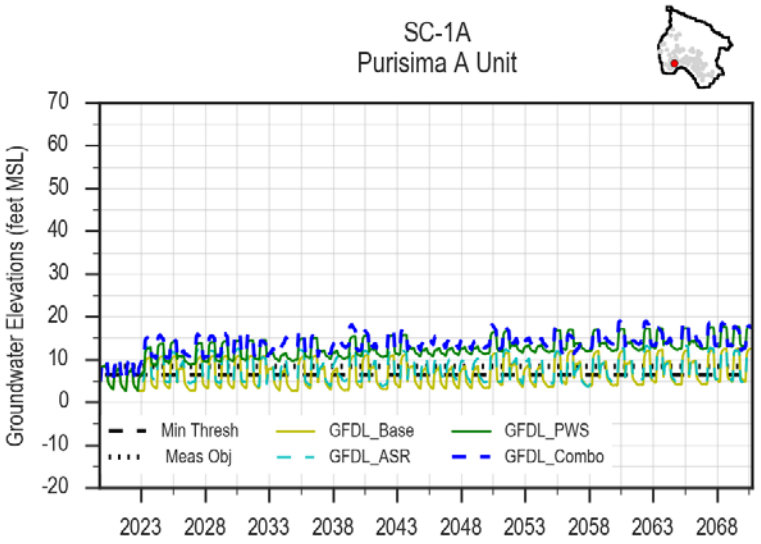
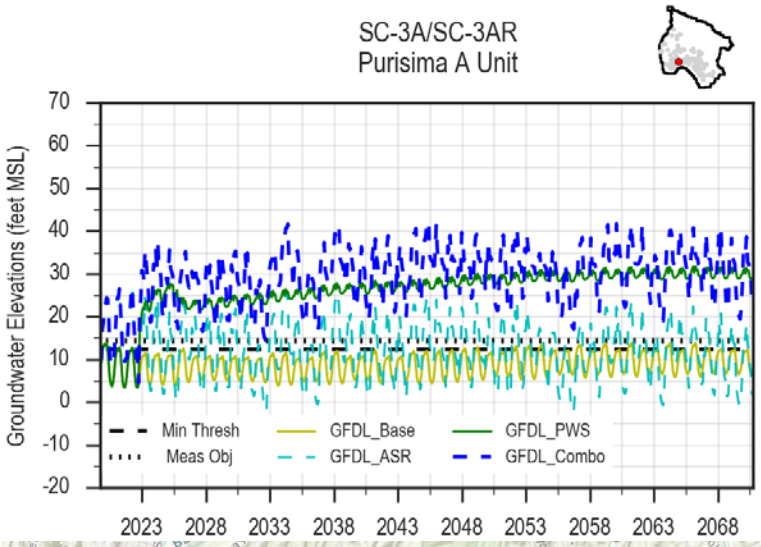


Iteration of ASR does not occur into A Unit Reconfiguration or separate action needed for sustainability

Purisima A Unit (SqCWD Wells)





Combo
PWS
ASR
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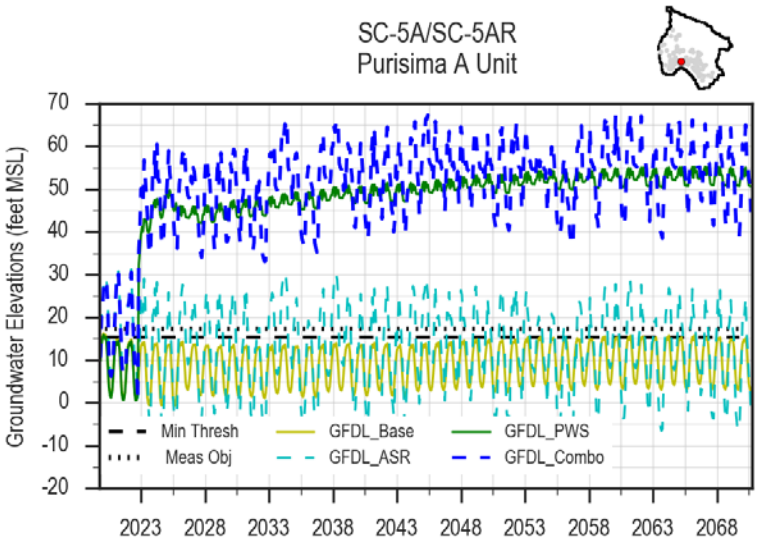
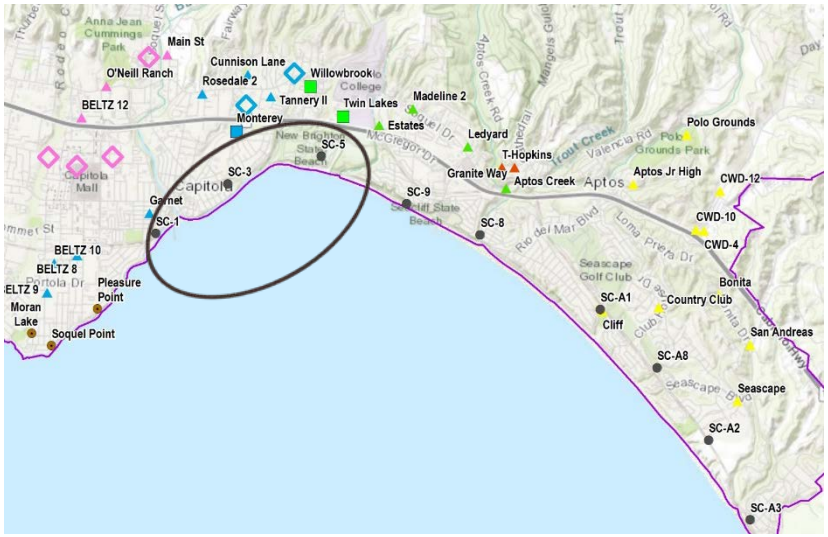
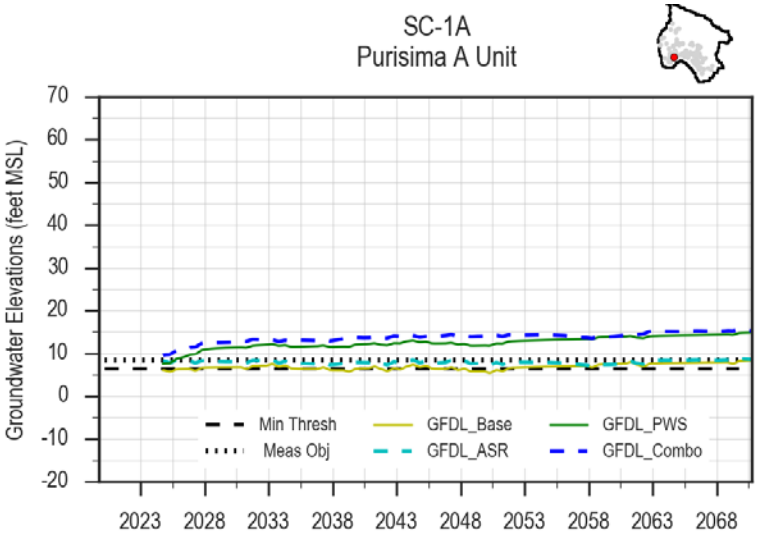
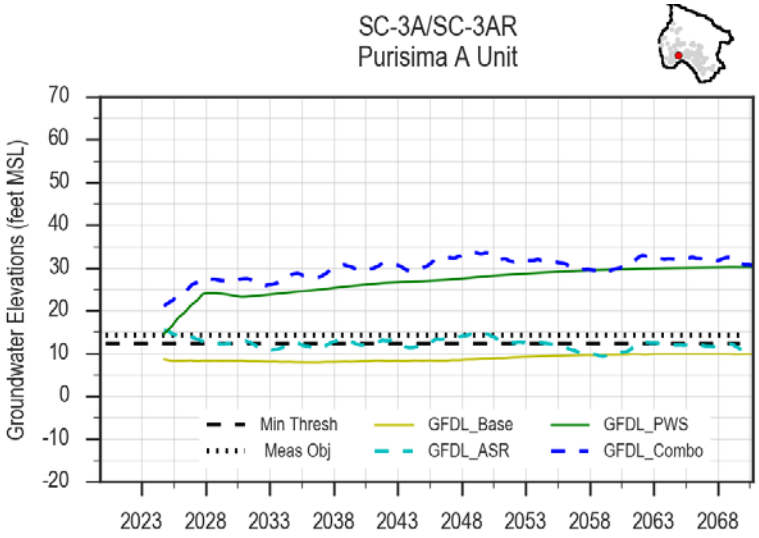


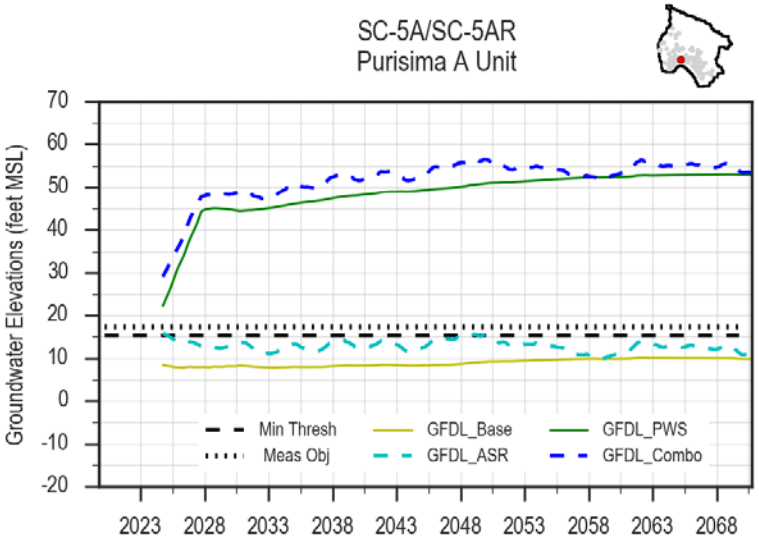


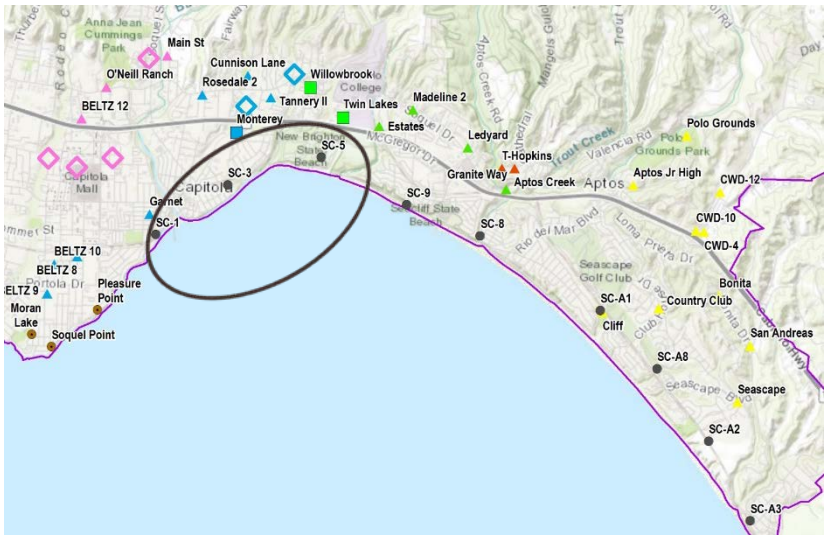
Purisima A Unit (SqCWD Wells) 5 Year Average



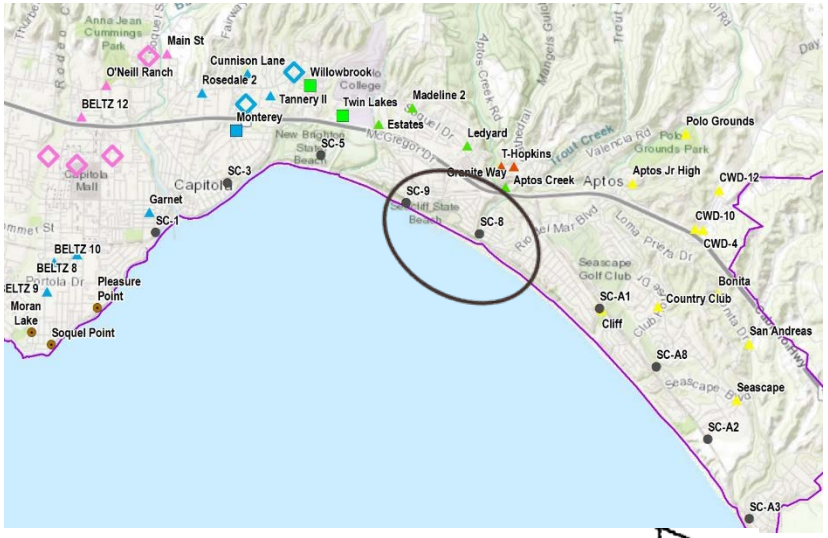


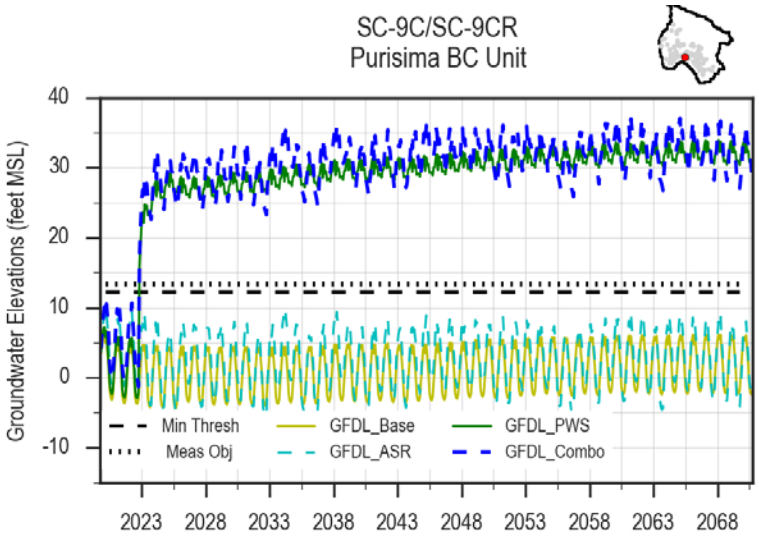
Combo
PWS
ASR
Baseline

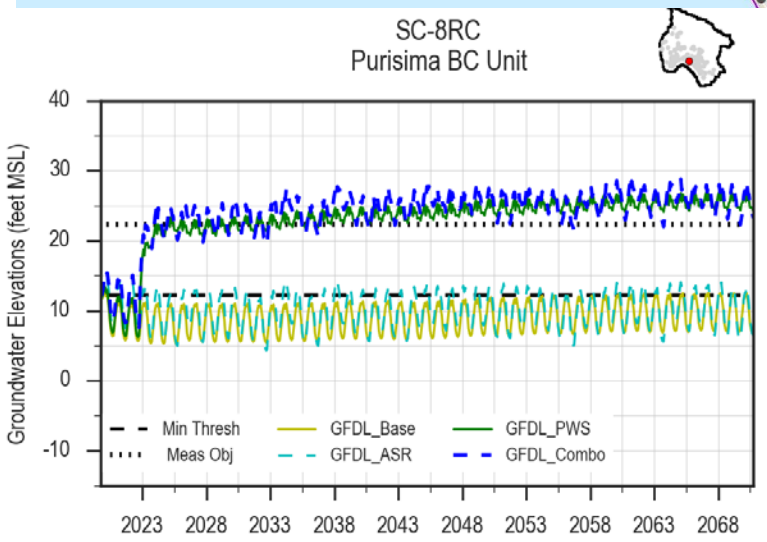




Purisima BC Unit







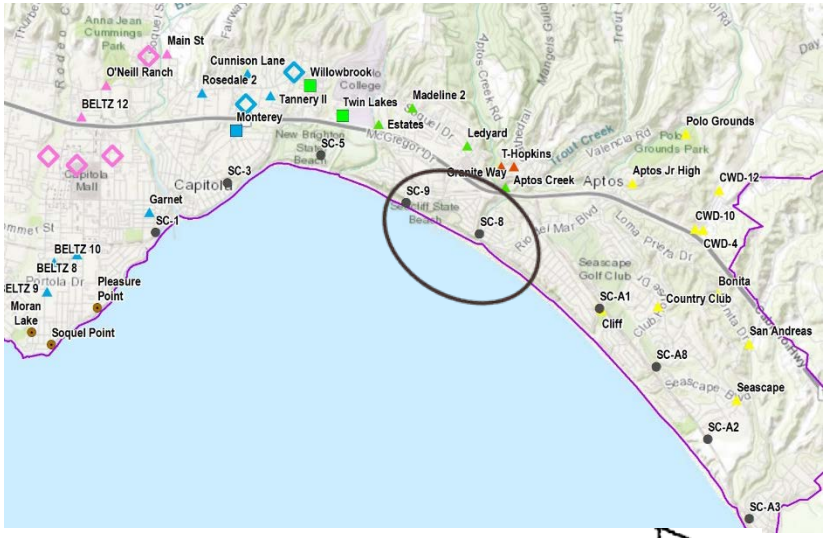
Combo

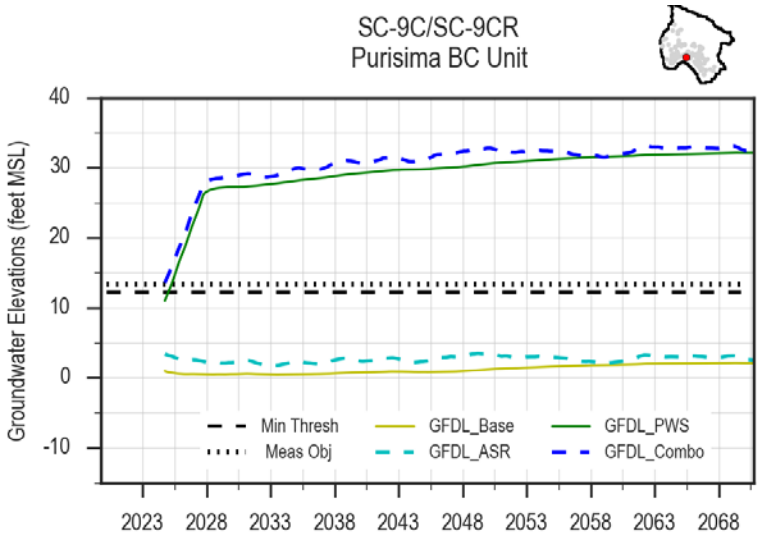
PWS

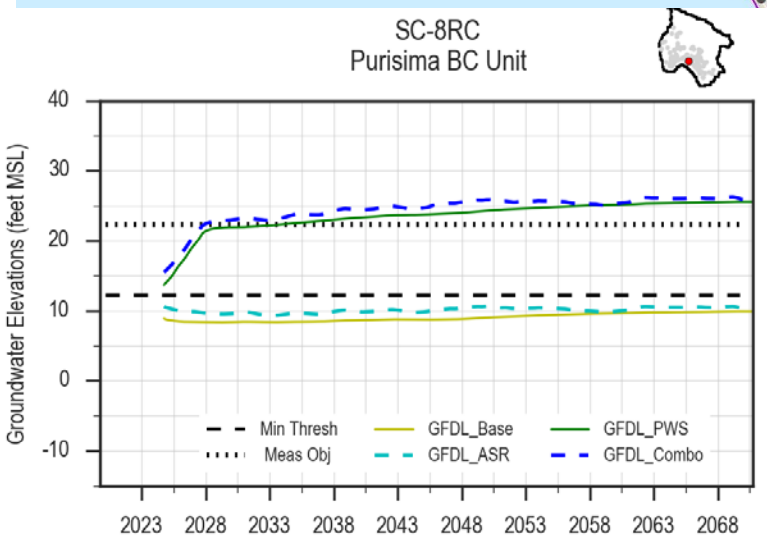
ASR

Baseline

Purisima BC Unit
5 Year Average



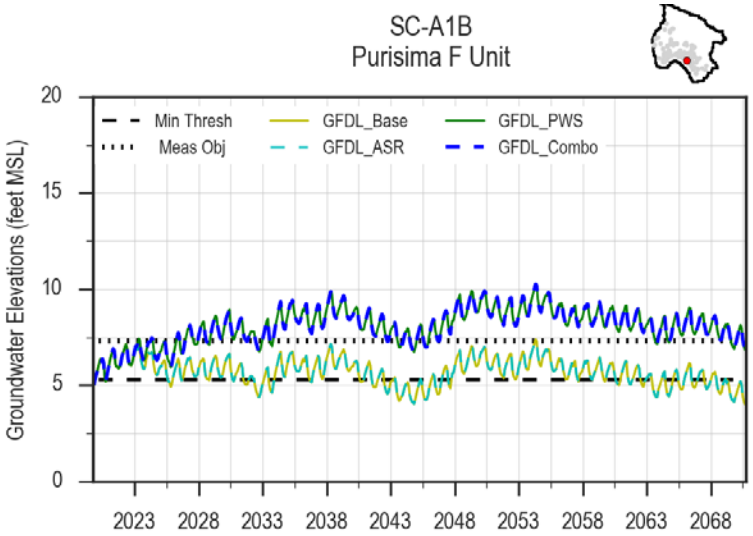


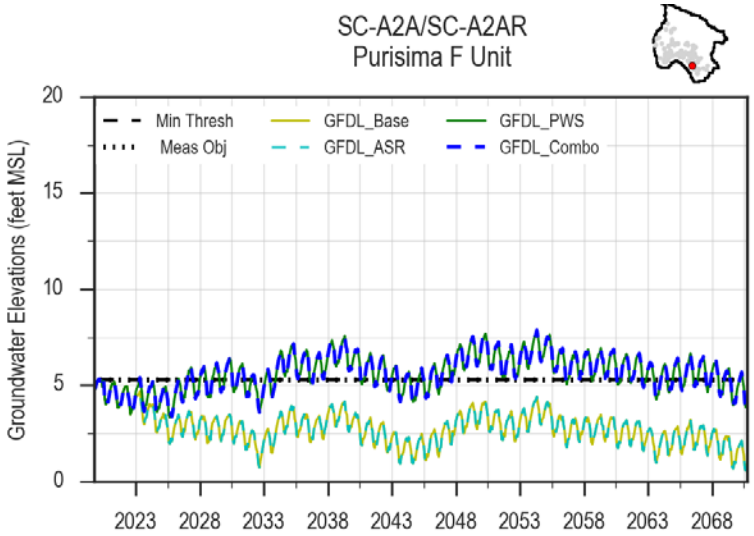


Combo
PWS

ASR
Baseline

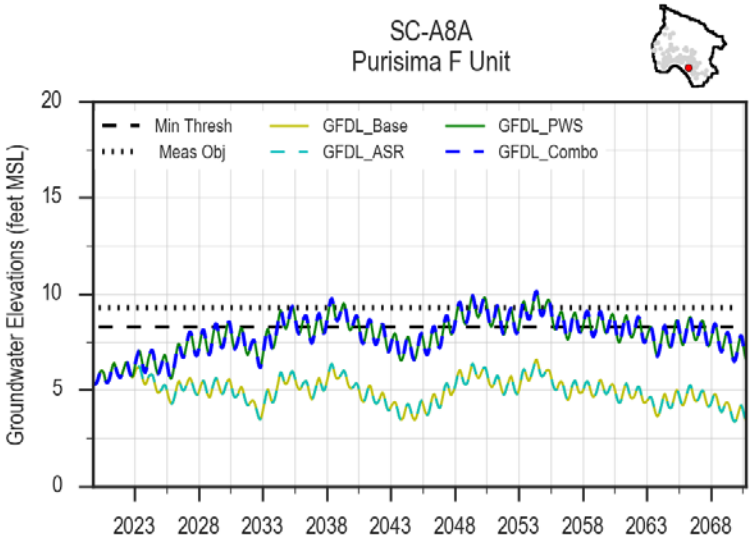
Aromas Area (Purisima F Unit)

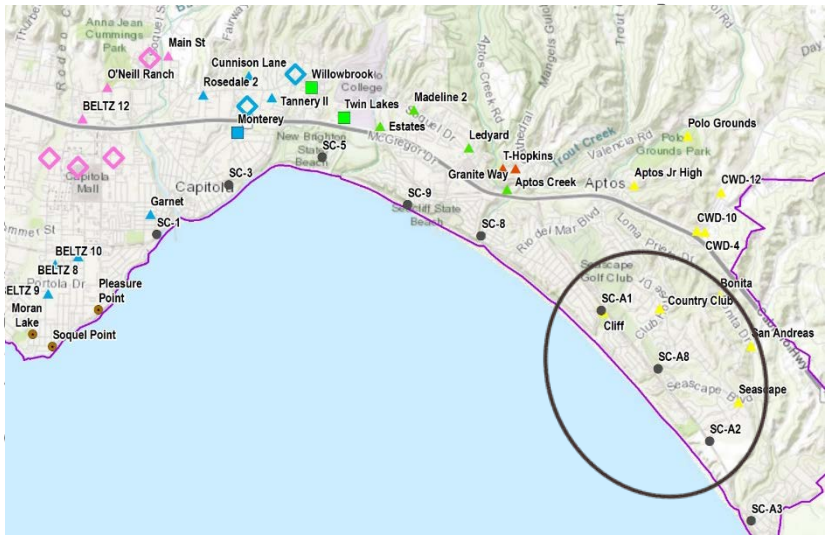




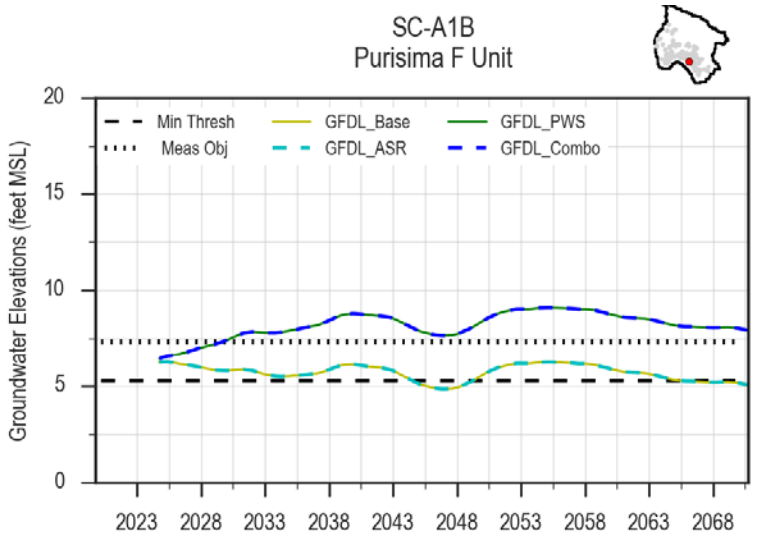
PWS Combo

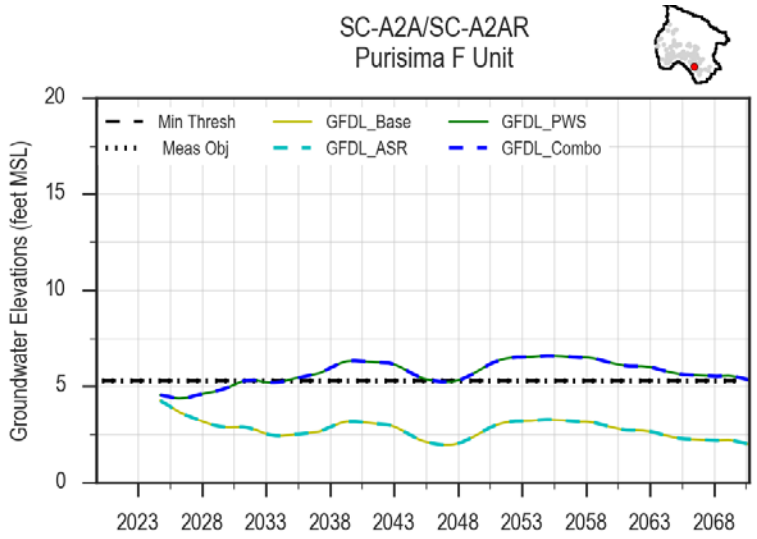
Baseline ASR





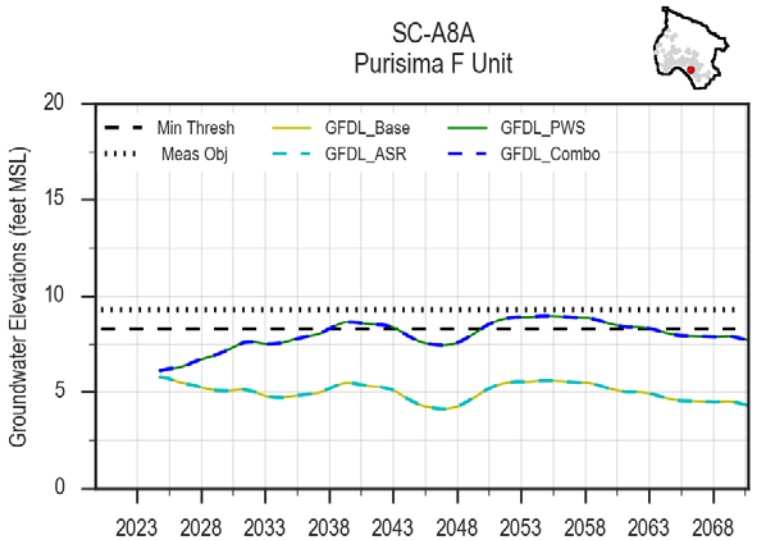
Aromas Area (Purisima F Unit) 5 Year Average

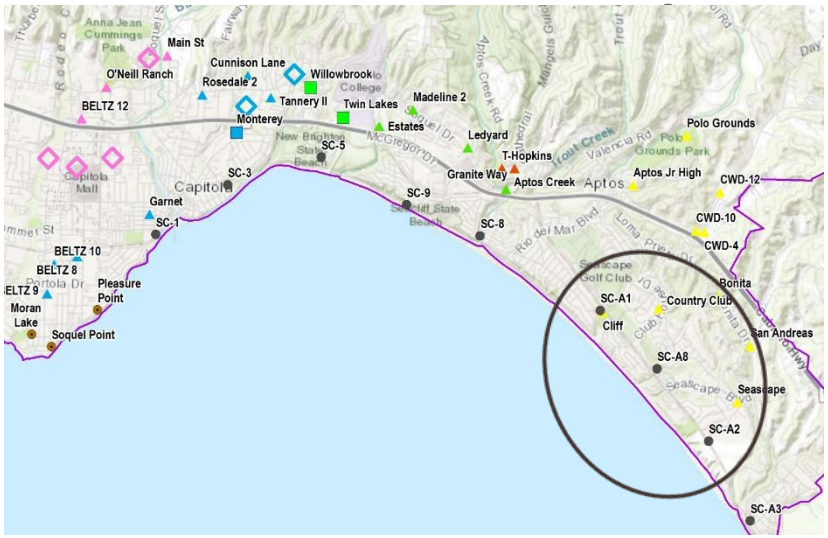




PWS Combo

Baseline ASR

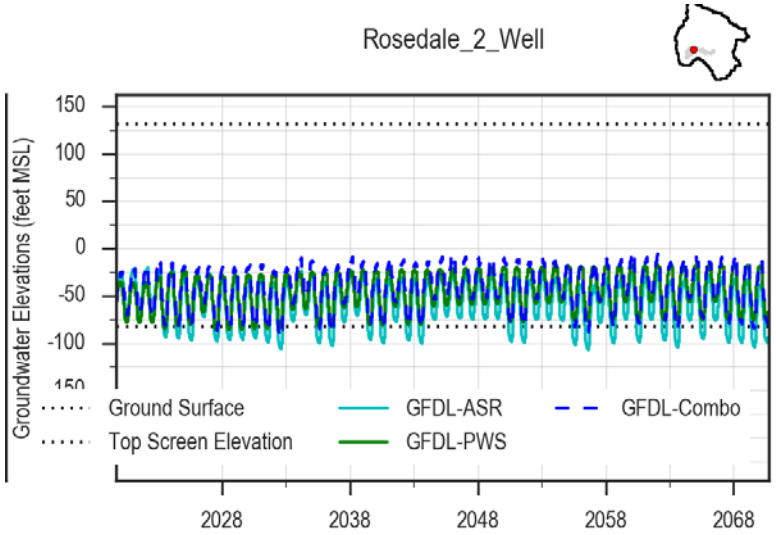




Pumping/Recharge Wells

- Evaluate pumping capacity
  - Keep groundwater levels above top of screen
- Evaluate recharge capacity
  - Keep groundwater levels below bottom of screen
- 3 Types of Wells
  - SqCWD production wells: pumping (existing and planned)
  - City ASR wells: pumping and recharge (6 evaluated)
  - SqCWD Pure Water Soquel wells: recharge (up to 3 planned)

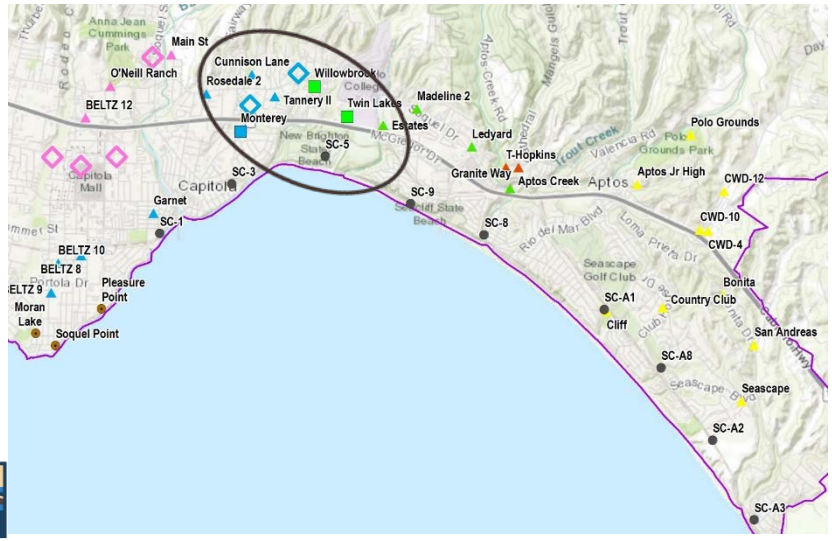
SqCWD Production Wells (AA/A/BC)



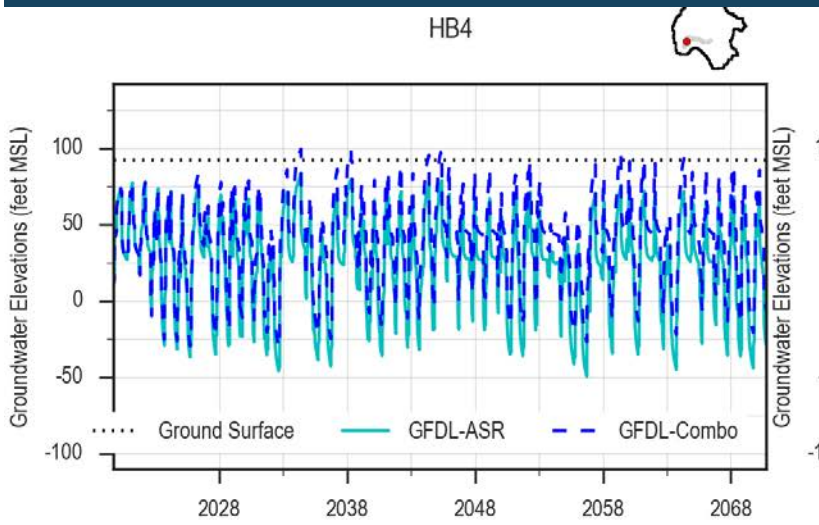
ASR

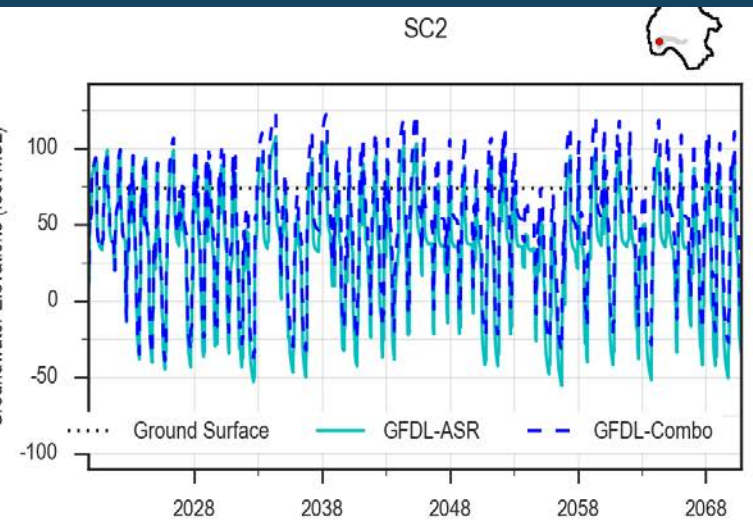
Combo

PWS



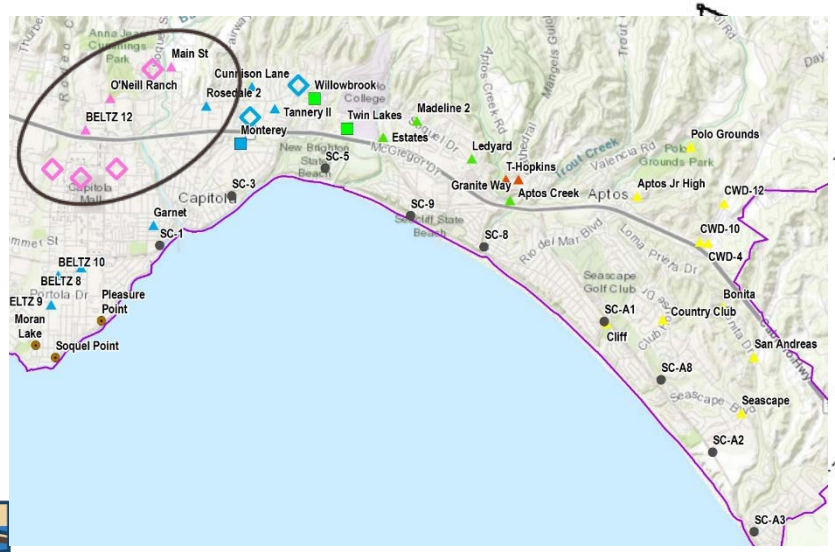
ASR Wells (Tu/AA/A)

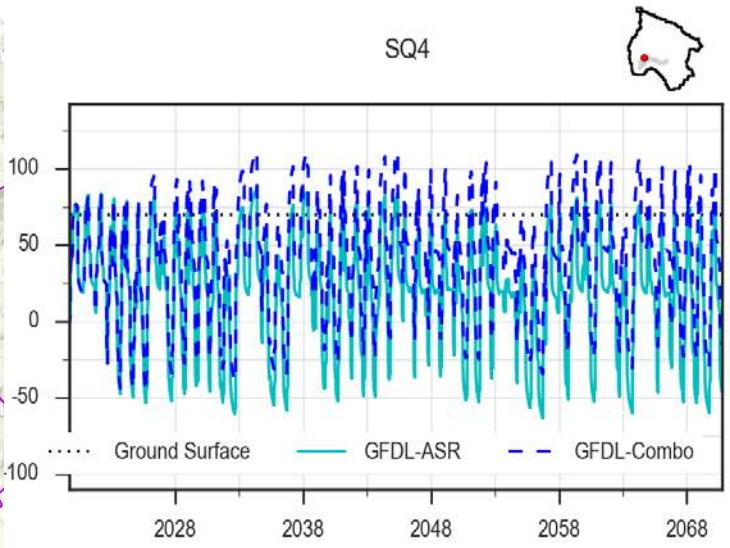




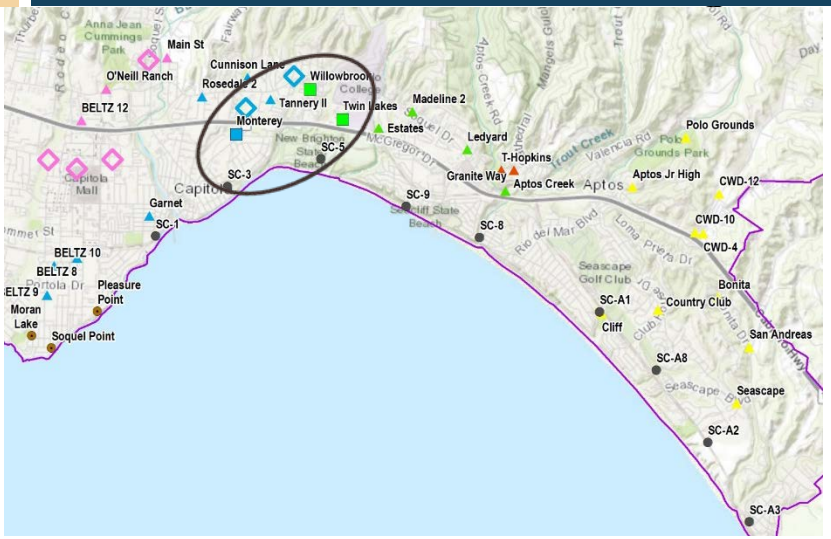
Combo

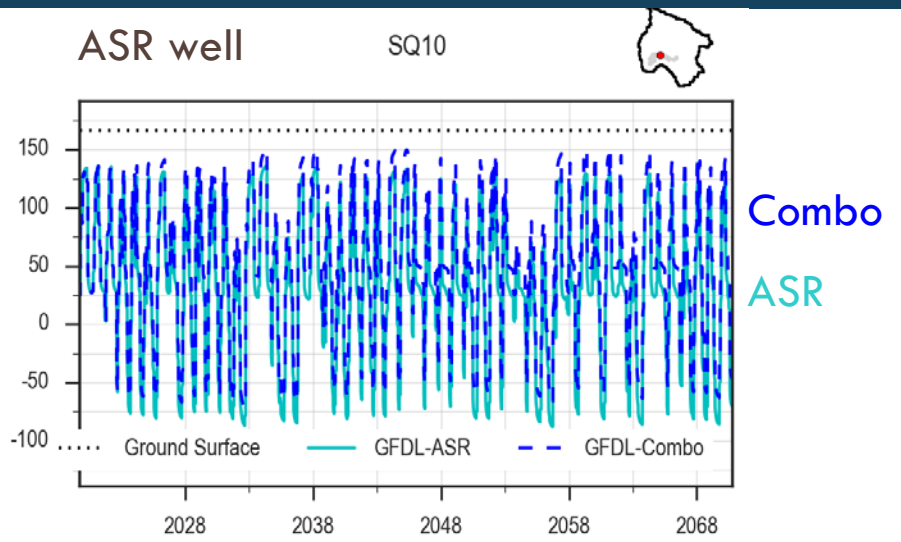
ASR





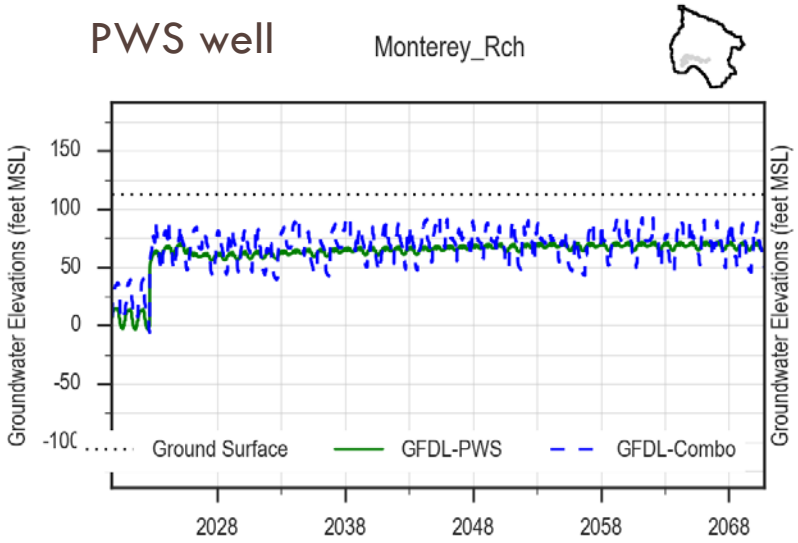
Recharge Wells (AA/A/BC)

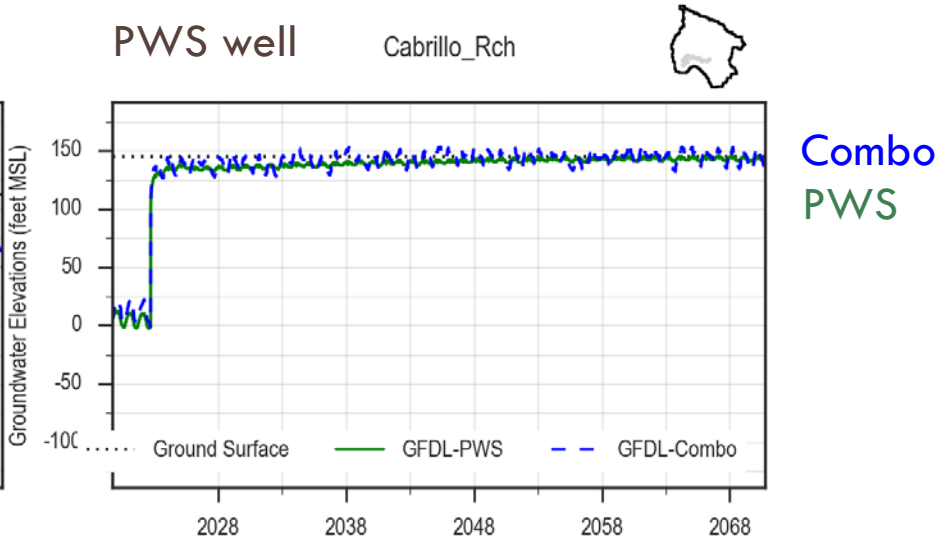




Combo

ASR

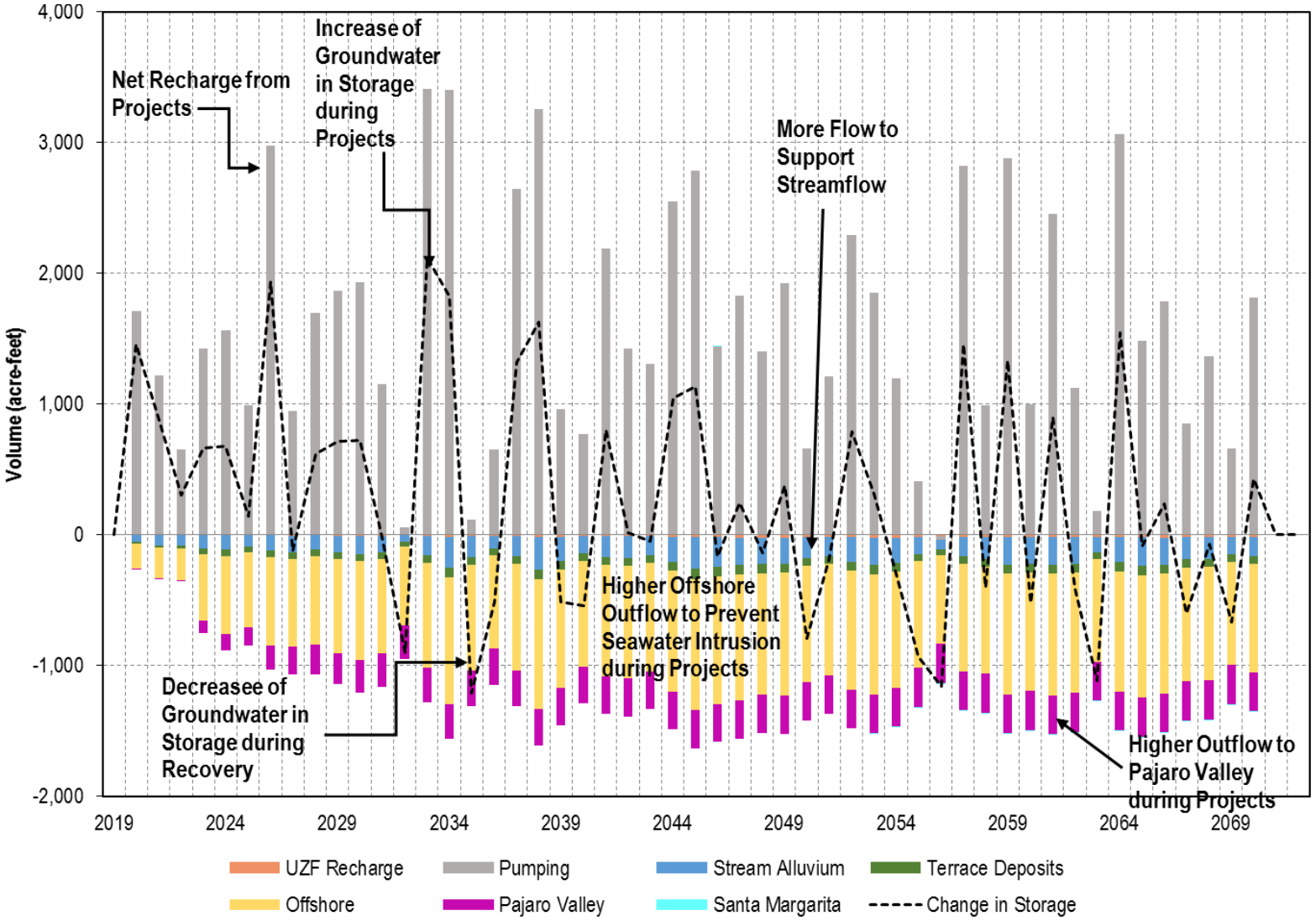




Combo

PWS

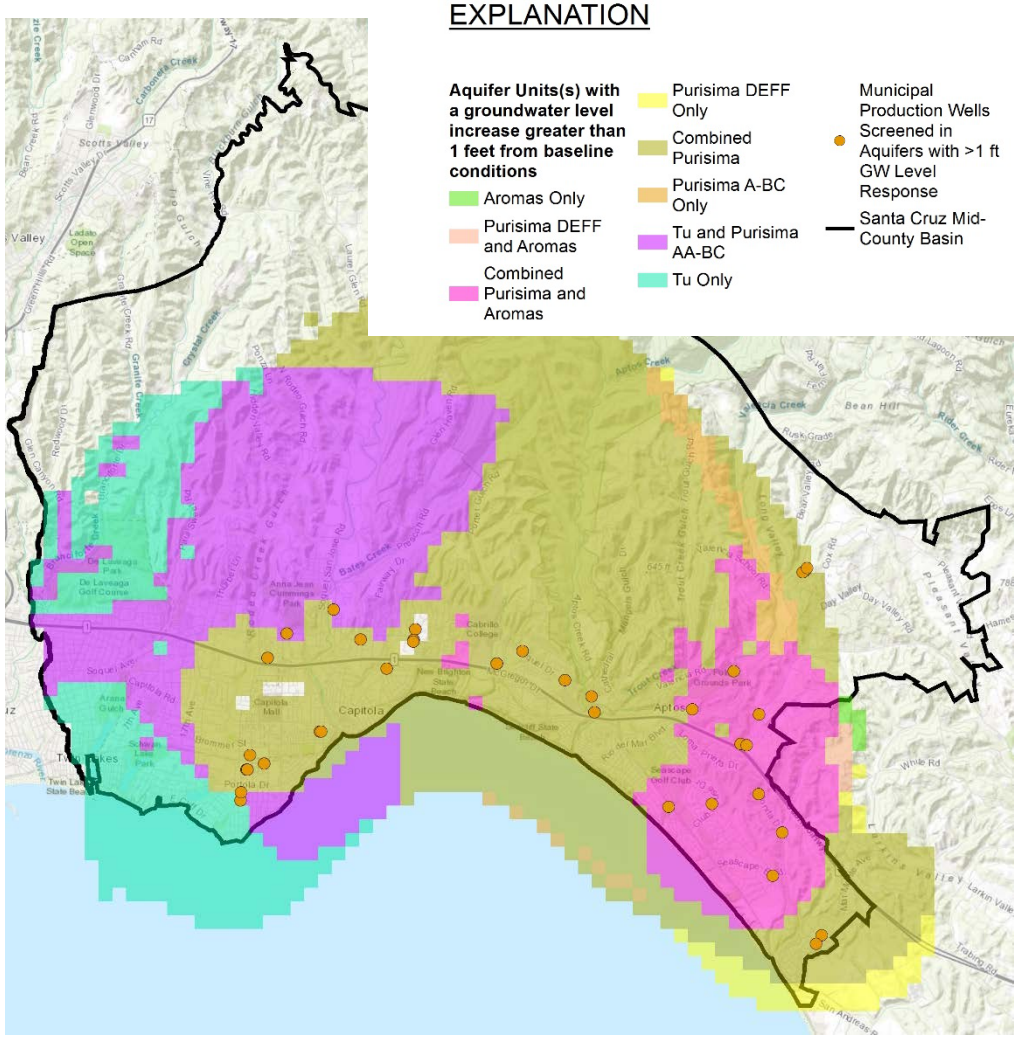
Water Budget Change from Combination of Projects



Area Groundwater Levels Increased by Combination of Projects

Areas and aquifer units where <u>combination</u> of recharge at ASR and seawater intrusion prevention wells and pumping redistribution raise groundwater levels even after ASR recovery

NOTE: Areas where groundwater levels increase are much larger than areas where water travels

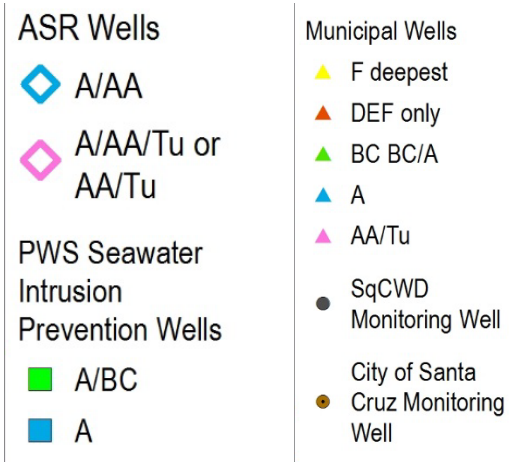


Summary of Modeling Results

- Adding City ASR to Pure Water Soquel generally improves sustainability (based on 5 Year Avg)
  - Consistent improvement in SqCWD Purisima A and BC
  - Minor improvement in City Purisima A
  - Improvement for majority of time in Tu
  - No effect in Purisima F/Aromas
- Recharge well interference
  - Groundwater levels rise above ground surface in 3 ASR wells and one PWS well
- Informs City's iterative process for designing ASR
  - Reconfigure ASR well locations and ASR quantity distribution

Possible Iterations to Model

- Reconfigured ASR
  - Add ASR into Purisima A near/at City's Beltz well field
  - Redistribute ASR away from Pure Water Soquel wells
- Incorporate in-lieu compatible with Pure Water Soquel
- Further redistribution of Pure Water Soquel pumping
- Evaluate City ASR and Combined Projects using Catalog Climate



Questions and Discussion

Public Comment

Break

SANTA CRUZ MID-COUNTY GROUNDWATER SUSTAINABILITY PLANNING

GSP Advisory Committee – March 27, 2019

Item 3
Surface Water Interactions Update

Depletion of Interconnected Surface Water Update

- Need to link the groundwater elevation proxy with depletion of interconnected surface water
  - Modeling will be done to determine:
    - What changes to streamflow result from changes in pumping (private and municipal wells)
    - What changes to shallow groundwater levels result from changes in pumping (private and municipal wells)

Item 7.1. Updated Seawater Intrusion Sustainable Management Criteria

Staff Proposal

Significant & Unreasonable Conditions

Seawater moving farther inland than has been observed in the past five years

Undesirable Results

- Intruded Coastal Monitoring Wells

  Any coastal monitoring well with current intrusion has a chloride concentration above its past five year maximum chloride concentration. This concentration must be exceeded in 2 or more of the last 4 consecutive quarterly samples

Undesirable Results

- Unintruded Coastal Monitoring Wells, and Inland Monitoring and Production Wells
  - Any Unintruded Coastal Monitoring Well has a chloride concentration above 250 mg/L. This concentration must be exceeded in 2 or more of the last 4 consecutive quarterly samples
  - Any Unintruded Inland Monitoring Well (municipal production wells closest to the coast & other non-coastal monitoring wells) has a chloride concentration above 150 mg/L. This concentration must be exceeded in 2 or more of the last 4 consecutive quarterly samples

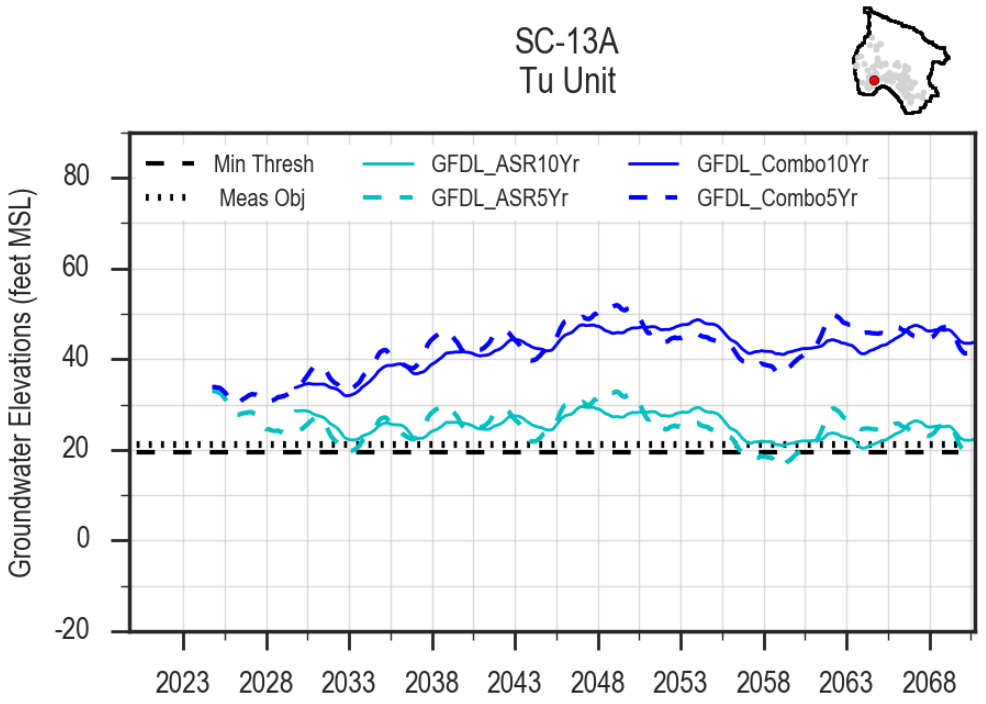
    Semi-annual sampling until exceedance occurs which triggers quarterly sampling

Undesirable Results for Protective Groundwater Elevations

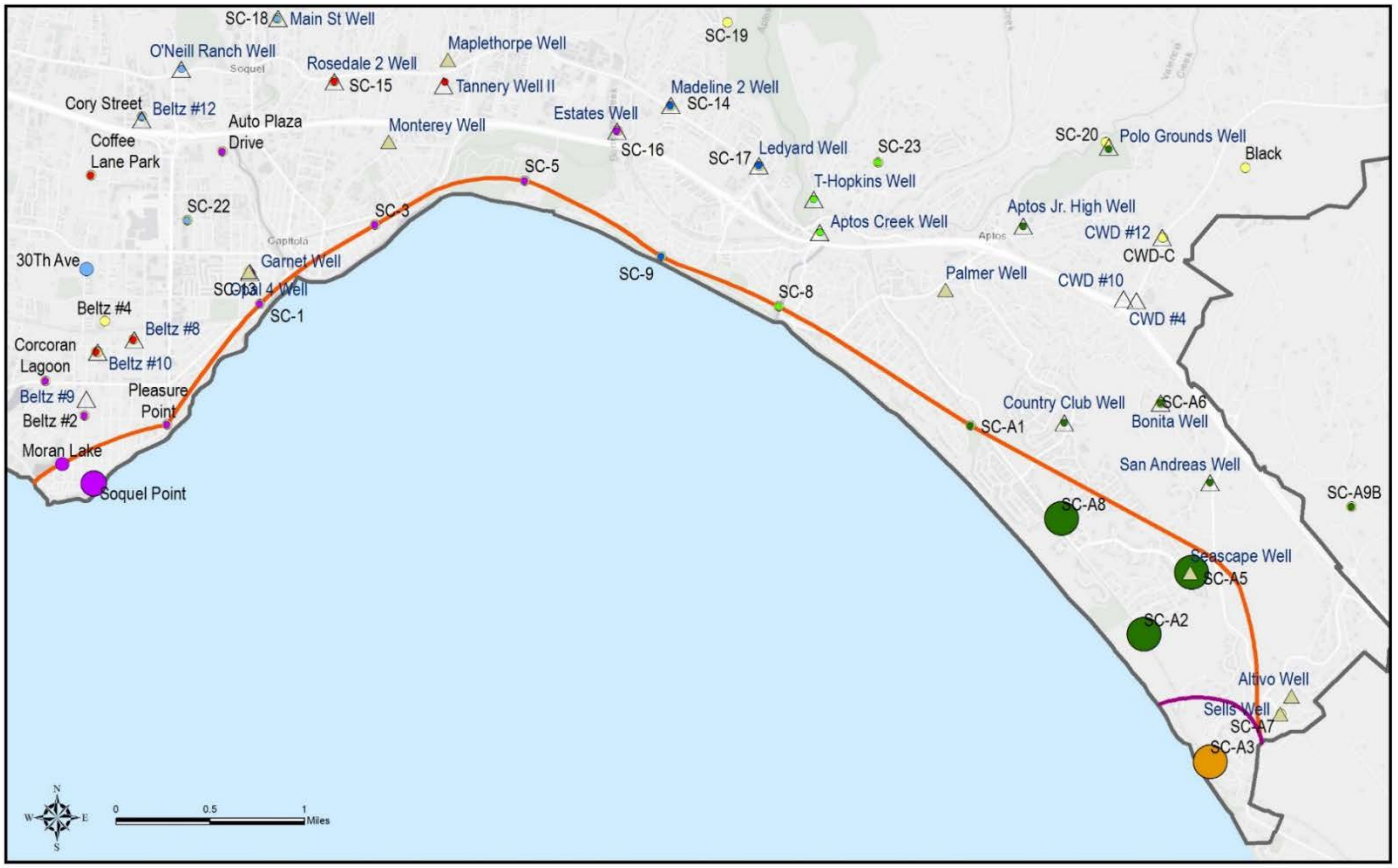
- <Five- or Ten-year> average groundwater elevations below protective groundwater elevations in Coastal Monitoring Wells for any Coastal Monitoring Well

Recommend 5-Year Average

- Less smoothed out, and shows highs and lows better then 10-year average
- Less flexibility in avoiding undesirable results
- Identify short-term issues quicker
- Coincides with 5-year GSP updates

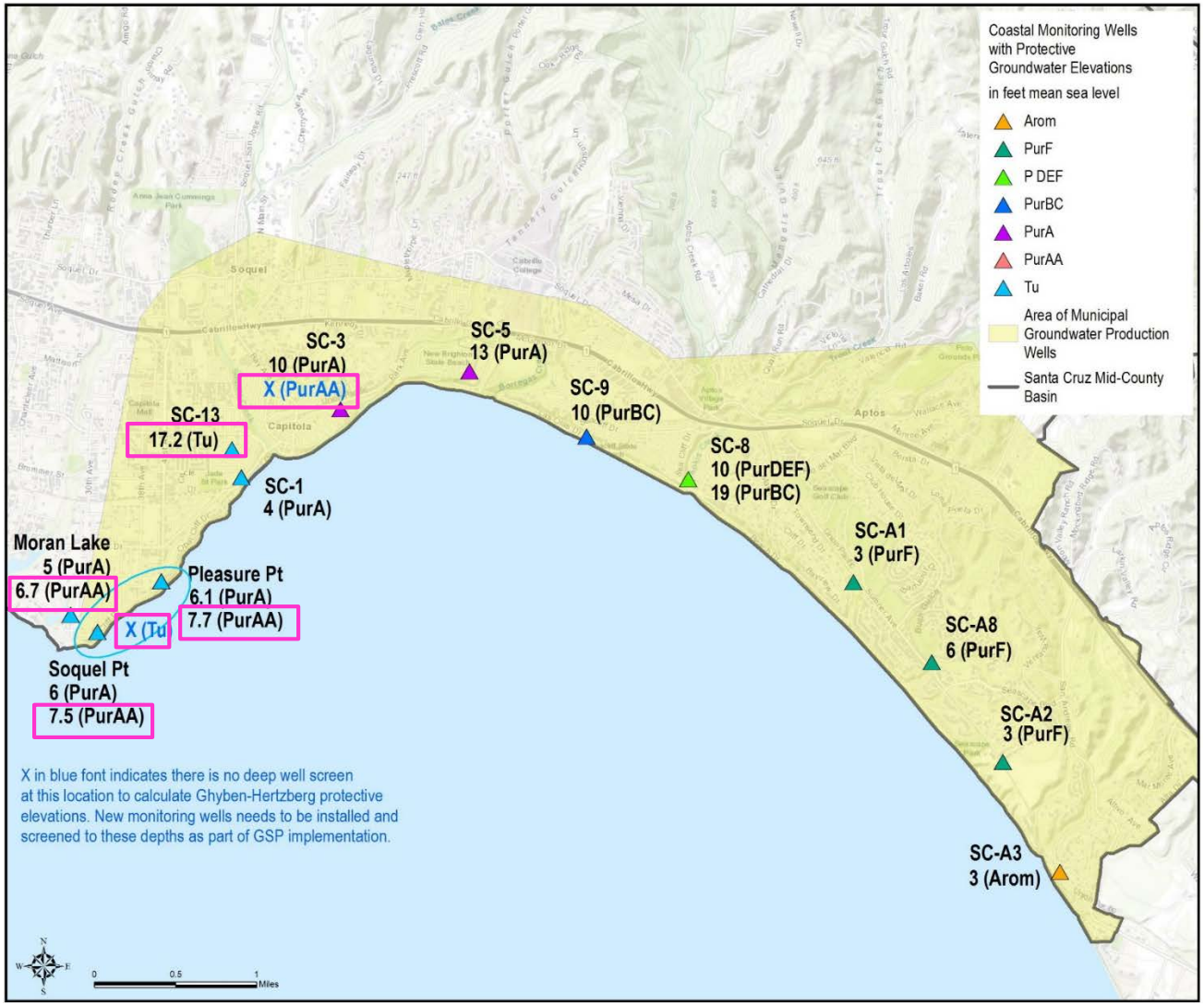


Minimum Threshold
250 mg/L chloride isocontour



Minimum Thresholds
Protective Groundwater Elevations

- Added deeper existing wells, plus 2 new monitoring wells needed
- Minimum Threshold in area covered by cross-sectional model is elevation protective of seawater intrusion in 70% of 100 model runs
- Minimum Threshold in areas not covered by cross-sectional model use Ghyben-Herzberg method to protect to bottom screen of well



Measurable Objective
Chloride Isocontour

- 100 mg/L chloride isocontour in the same location as the 250 mg/L Minimum Threshold chloride isocontour

Measurable Objective
Protective Groundwater Elevation

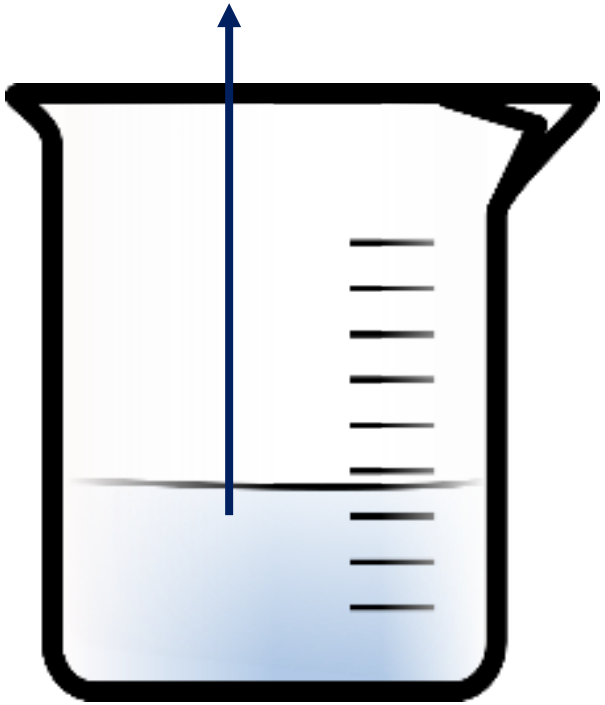
- If cross-sectional model available
  - Measurable Objectives are the groundwater elevations that represents >99% of 100 cross-sectional model simulations being protective against seawater intrusion for each monitoring well with a protective elevation
- If cross-sectional model not available
  - Measurable Objectives are the groundwater elevations that represent protective groundwater elevation estimated by using the Ghyben-Herzberg method to protect the entire depth of the aquifer unit

Item 7.2. Depletion of Groundwater in Storage Sustainable Management Criteria

Staff Proposal

Reduction in Storage Sustainability Indicator

- A total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results



Indicator NOT measured by change in groundwater in storage

Reduction in Storage Metrics

- Supported by the Sustainable Yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin
- Sustainable Yield is the net amount that can be pumped from the Basin without causing undesirable results
- Only required to provide one volume number for the basin but MGA can separate volumes by aquifer, if needed

Proposed Significant & Unreasonable Conditions

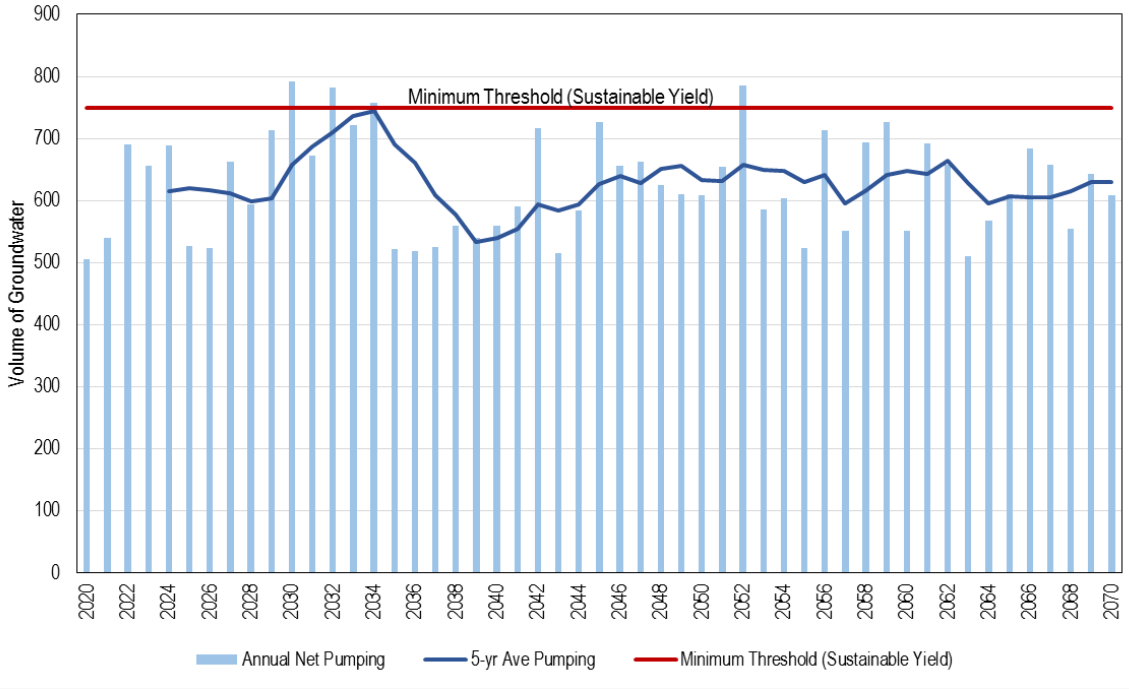
A significant and unreasonable reduction of groundwater in storage would be a net volume of groundwater extracted that will likely cause other sustainability indicators to have undesirable results

Net volume extracted from the Basin = Volume of groundwater pumped – Volume of managed aquifer recharge

Proposed Undesirable Results

- Five-year average net extractions exceeding the Sustainable Yield (Minimum Threshold) for the:
  - Aromas aquifer and Purisima F unit,
  - Purisima DEF, BC, A, and AA aquifers, or
  - Tu aquifer

- Sustainable Yield is a long-term volume of extraction, so we should not use annual values to compare against Minimum Threshold
- Consistent with Seawater Intrusion



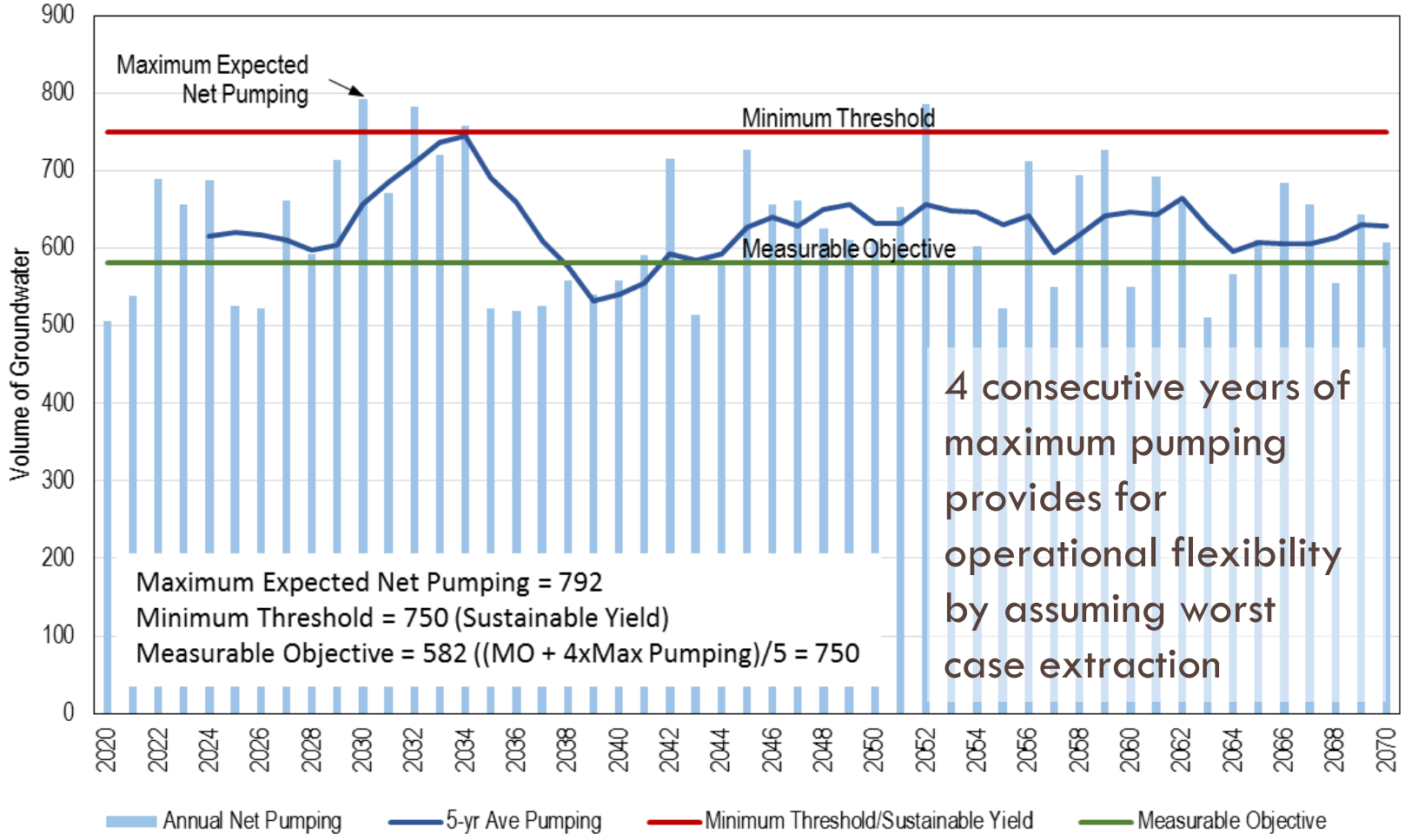
Proposed Minimum Thresholds

- Sustainable Yield representing the net annual volume of groundwater extracted (pumping minus annual volume of managed aquifer recharge) for each of the aquifers groups:
  - Aromas aquifer and Purisima F aquifer (still to be estimated)
  - Purisima DEF, BC, A, and AA aquifer (still to be estimated)
  - Tu aquifer (still to be estimated)

Proposed Measurable Objectives

- The net annual groundwater that needs to be extracted to ensure that if there were four subsequent years of maximum projected net groundwater extraction, net annual groundwater extractions greater than the Minimum Threshold will not occur for each of the aquifer groups:
  - Aromas and Purisima F aquifers
  - Purisima DEF, BC, A, and AA aquifers
  - Tu aquifer

Hypothetical Example for Hypothetical Aquifer



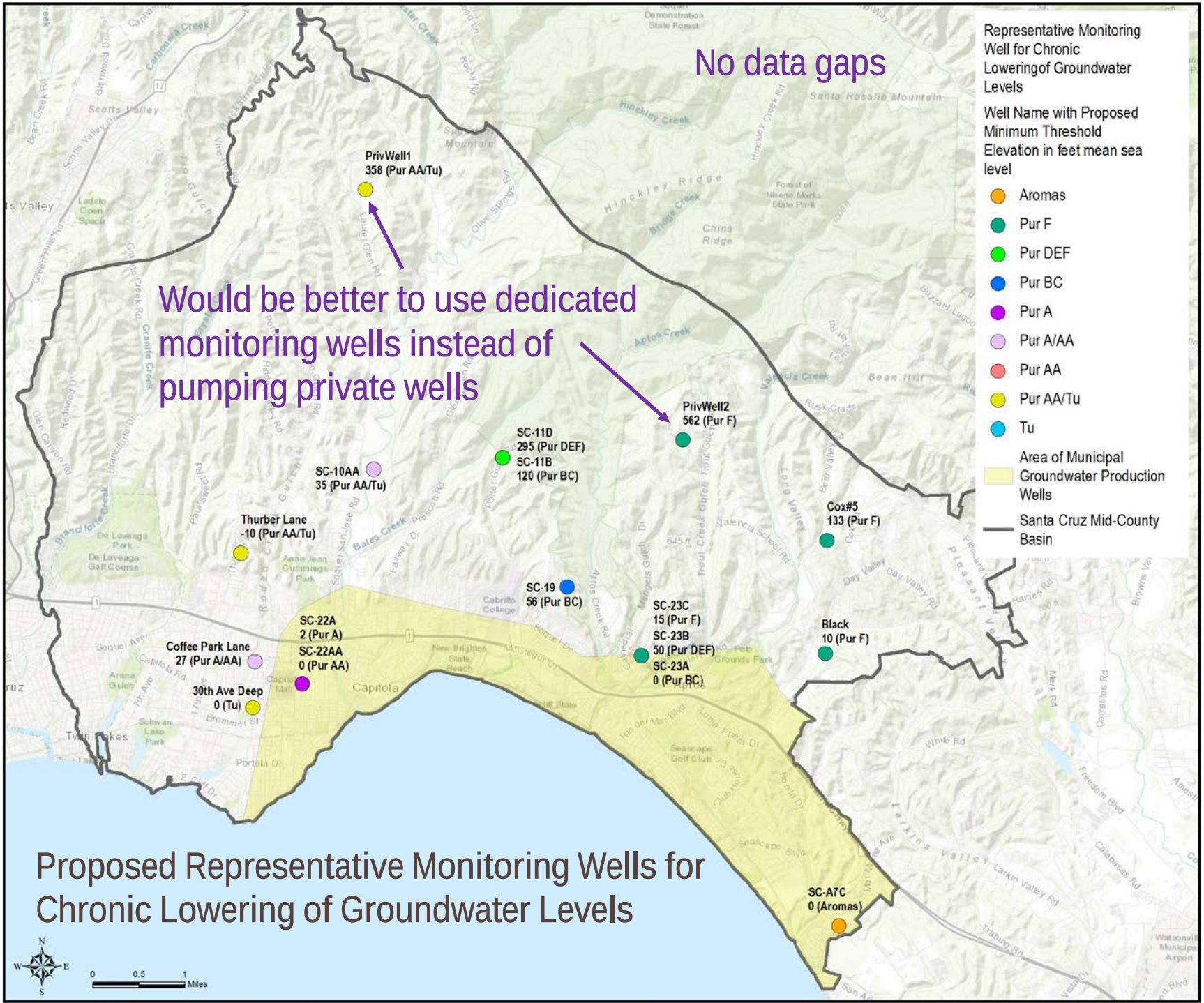
Proposed Representative Monitoring

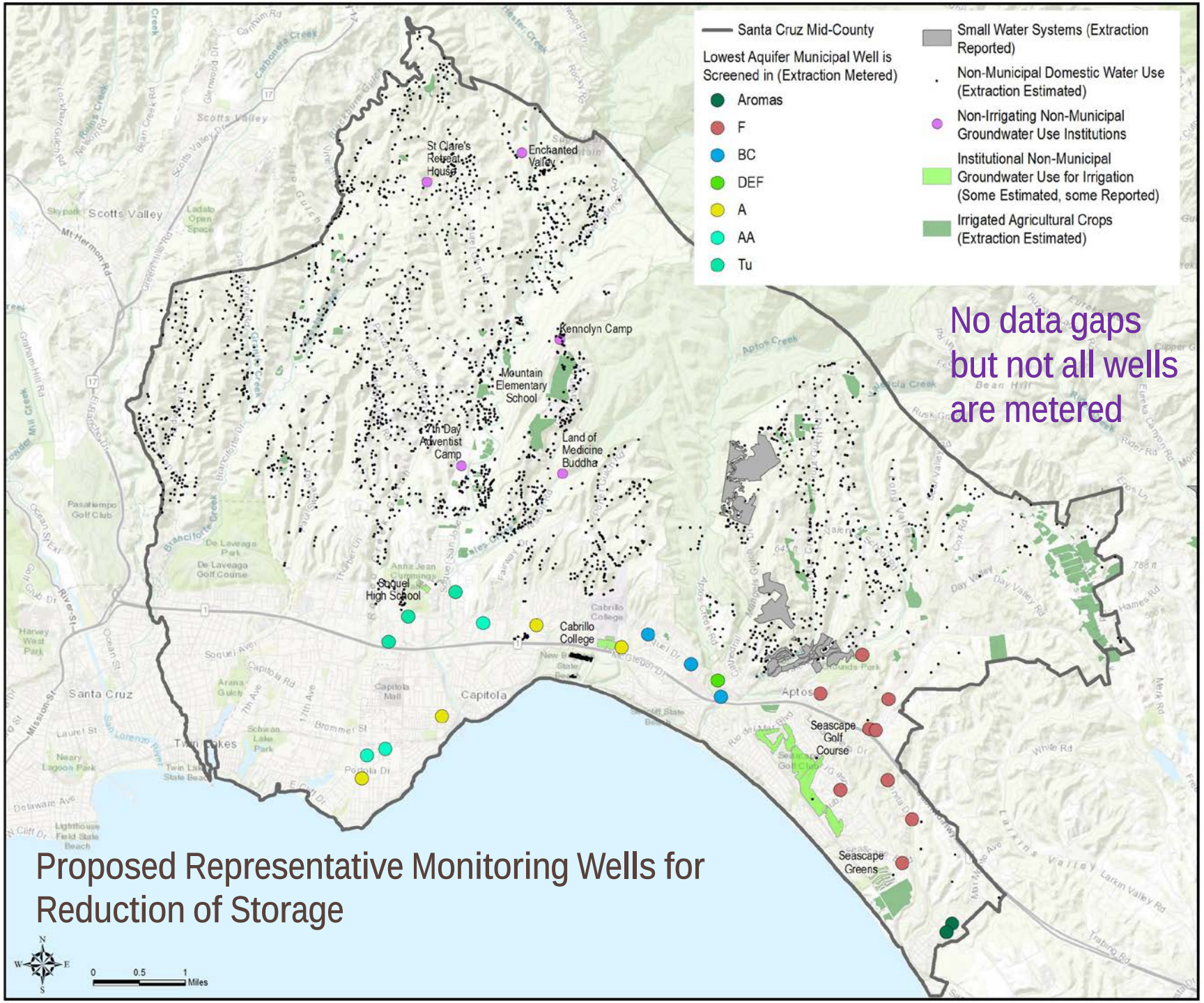
Needs to include all wells extracting groundwater from the Basin:

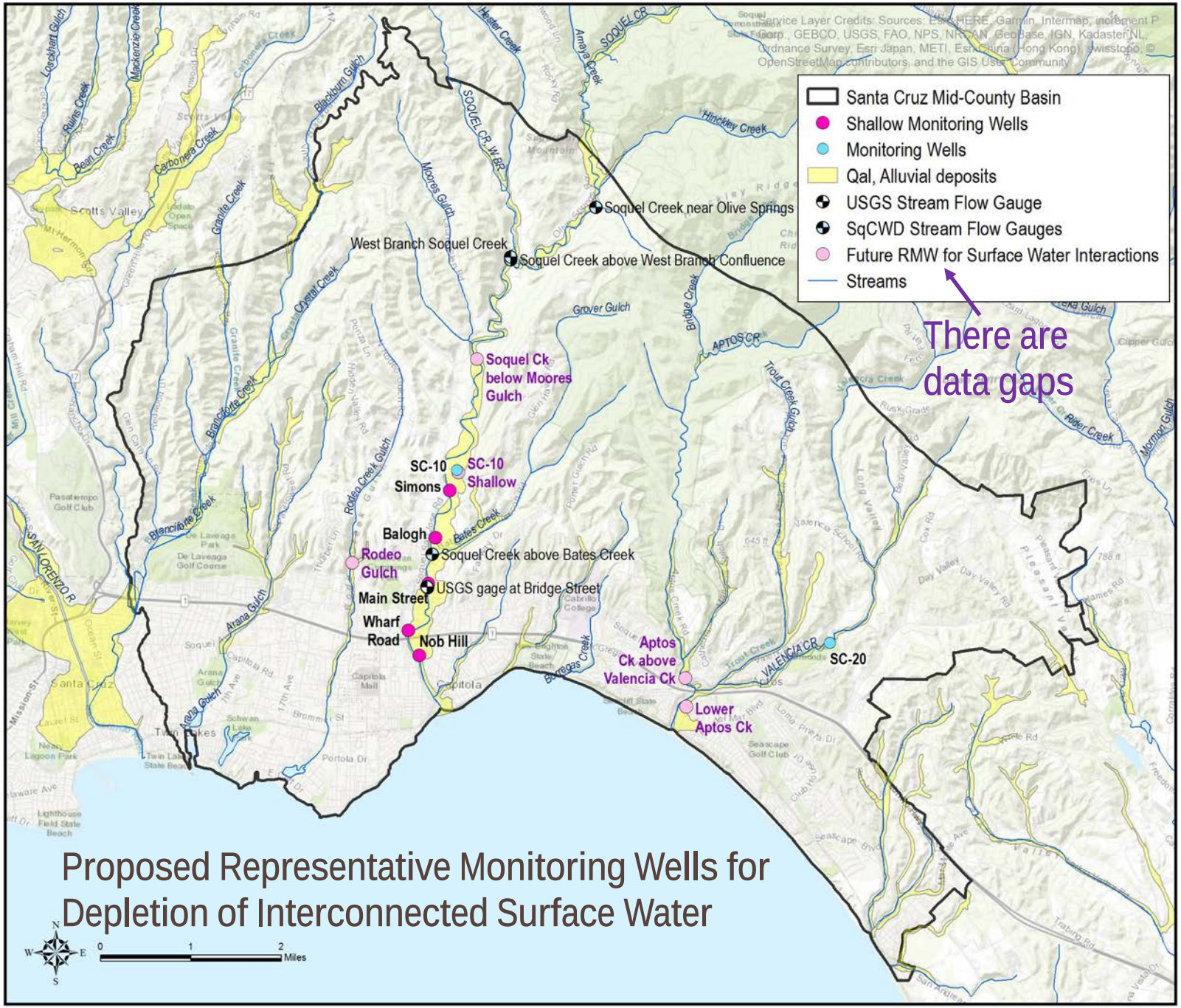
- All metered municipal wells
- All metered managed recharge facilities (injection wells or surface recharge features)
- Unmetered non-municipal extractions (private domestic and agricultural users) will be estimated using water use factors
- Small water systems report extractions to the County

Item 9. Representative Monitoring

- Monitors Sustainability Indicators
- Quantitative Values for Minimum Threshold, Measurable Objectives & Interim Milestones
- For each site needs to be supported by adequate evidence demonstrating site reflects general conditions of the area

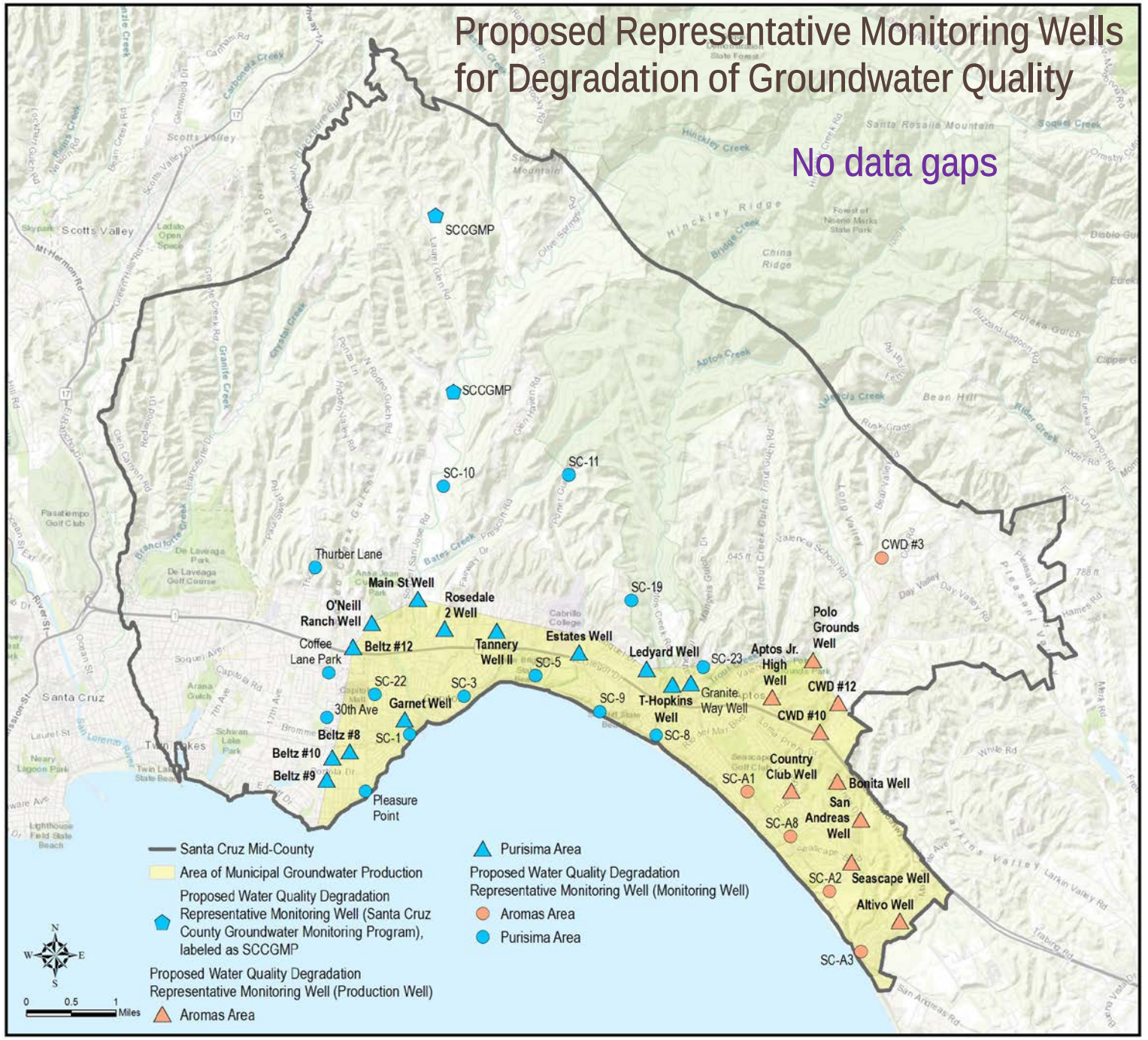

No data gaps
Would be better to use dedicated monitoring wells instead of pumping private wells
Proposed Representative Monitoring Wells for Chronic Lowering of Groundwater Levels
Representative Monitoring Well for Chronic Loweringof Groundwater Levels
Well Name with Proposed Minimum Threshold Elevation in feet mean sea level
Aromas
Pur F
Pur DEF
Pur BC
Pur A
Pur A/AA
Pur AA
Pur AA/Tu
Tu
Area of Municipal Groundwater Production Wells
Santa Cruz Mid-County Basin
PrivWell1
358 (Pur AA/Tu)
PrivWell2
562 (Pur F)
SC-11D
295 (Pur DEF)
SC-11B
120 (Pur BC)
SC-10AA
35 (Pur AA/Tu)
Thurber Lane
-10 (Pur AA/Tu)
Cox#5
133 (Pur F)
SC-19
56 (Pur BC)
SC-23C
15 (Pur F)
SC-23B
50 (Pur DEF)
SC-23A
0 (Pur BC)
Black
10 (Pur F)
SC-22A
2 (Pur A)
SC-22AA
0 (Pur AA)
Coffee Park Lane
27 (Pur A/AA)
30th Ave Deep
0 (Tu)
SC-A7C
0 (Aromas)
Capitola
Santa Rosalia Mountain
Hinckley Creek
Scotts Valley
China Ridge
Aptos Creek
Valencia Creek
Bates Creek
Soquel Creek
Cabrillo College
Seascape Golf Club
Larkins Valley
0 0.5 1 Miles

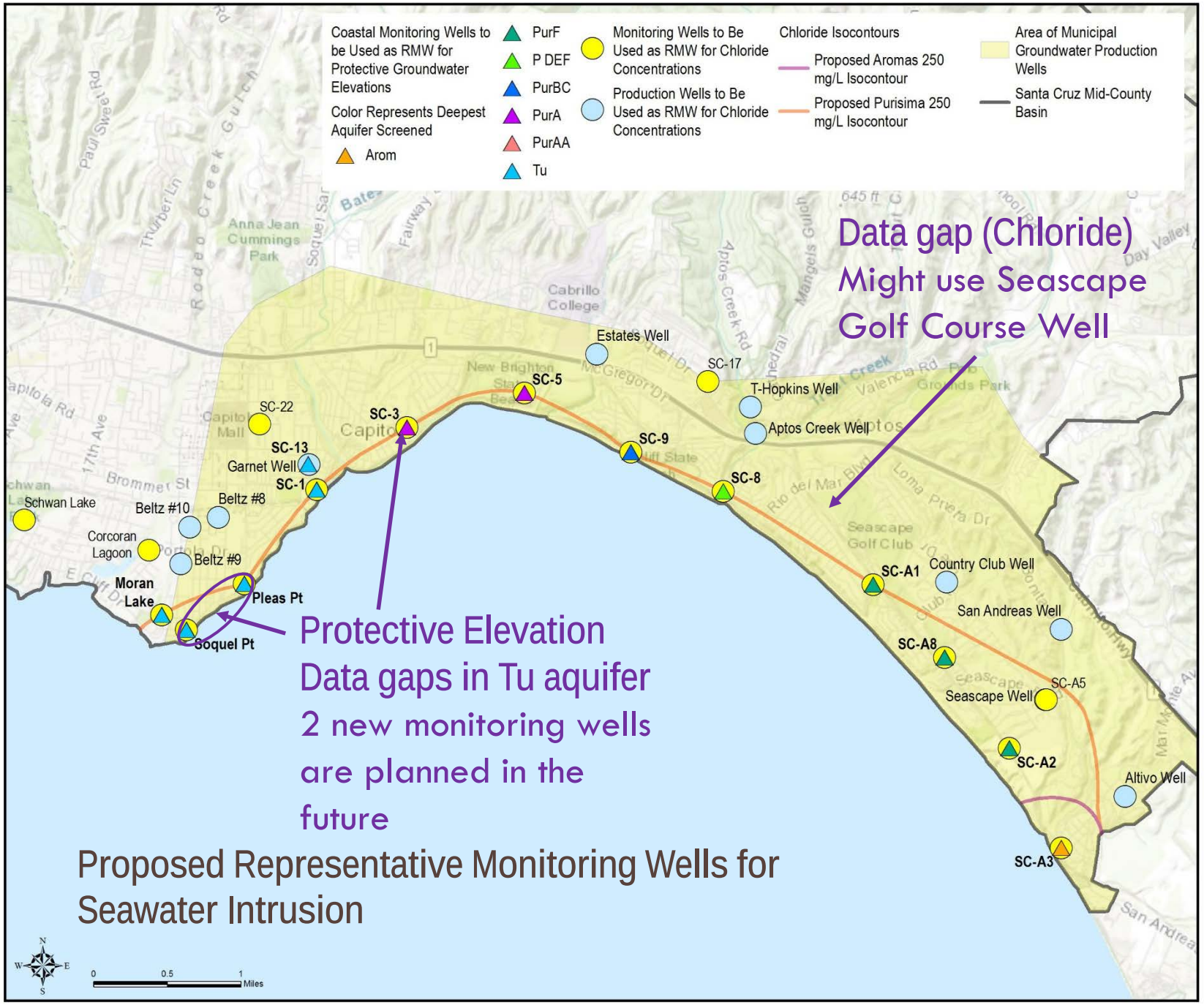

Santa Cruz Mid-County
Lowest Aquifer Municipal Well is Screened in (Extraction Metered)
Aromas
F
BC
DEF
A
AA
Tu
Small Water Systems (Extraction Reported)
Non-Municipal Domestic Water Use (Extraction Estimated)
Non-Irrigating Non-Municipal Groundwater Use Institutions
Institutional Non-Municipal Groundwater Use for Irrigation (Some Estimated, some Reported)
Irrigated Agricultural Crops (Extraction Estimated)
No data gaps but not all wells are metered
St Clare's Retreat House
Enchanted Valley
Kennolyn Camp
Mountain Elementary School
7th Day Adventist Camp
Land of Medicine Buddha
Soquel High School
Cabrillo College
Seascape Golf Course
Seascape Greens
Scotts Valley
Santa Cruz
Capitola
Aptos
Proposed Representative Monitoring Wells for Reduction of Storage
0 0.5 1 Miles


Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), Swisstopo, © OpenStreetMap contributors, and the GIS User Community
Santa Cruz Mid-County Basin
Shallow Monitoring Wells
Monitoring Wells
Qal, Alluvial deposits
USGS Stream Flow Gauge
SqCWD Stream Flow Gauges
Future RMW for Surface Water Interactions
Streams
There are data gaps
Soquel Creek near Olive Springs
West Branch Soquel Creek
Soquel Creek above West Branch Confluence
Soquel Ck below Moores Gulch
SC-10
SC-10 Shallow
Simons
Balogh
Soquel Creek above Bates Creek
Rodeo Gulch
USGS gage at Bridge Street
Main Street
Wharf
Road
Nob Hill
Aptos Ck above Valencia Ck
SC-20
Lower Aptos Ck
Proposed Representative Monitoring Wells for Depletion of Interconnected Surface Water
N
W
E
S
0
1
2
Miles

Proposed Representative Monitoring Wells for Degradation of Groundwater Quality

No data gaps

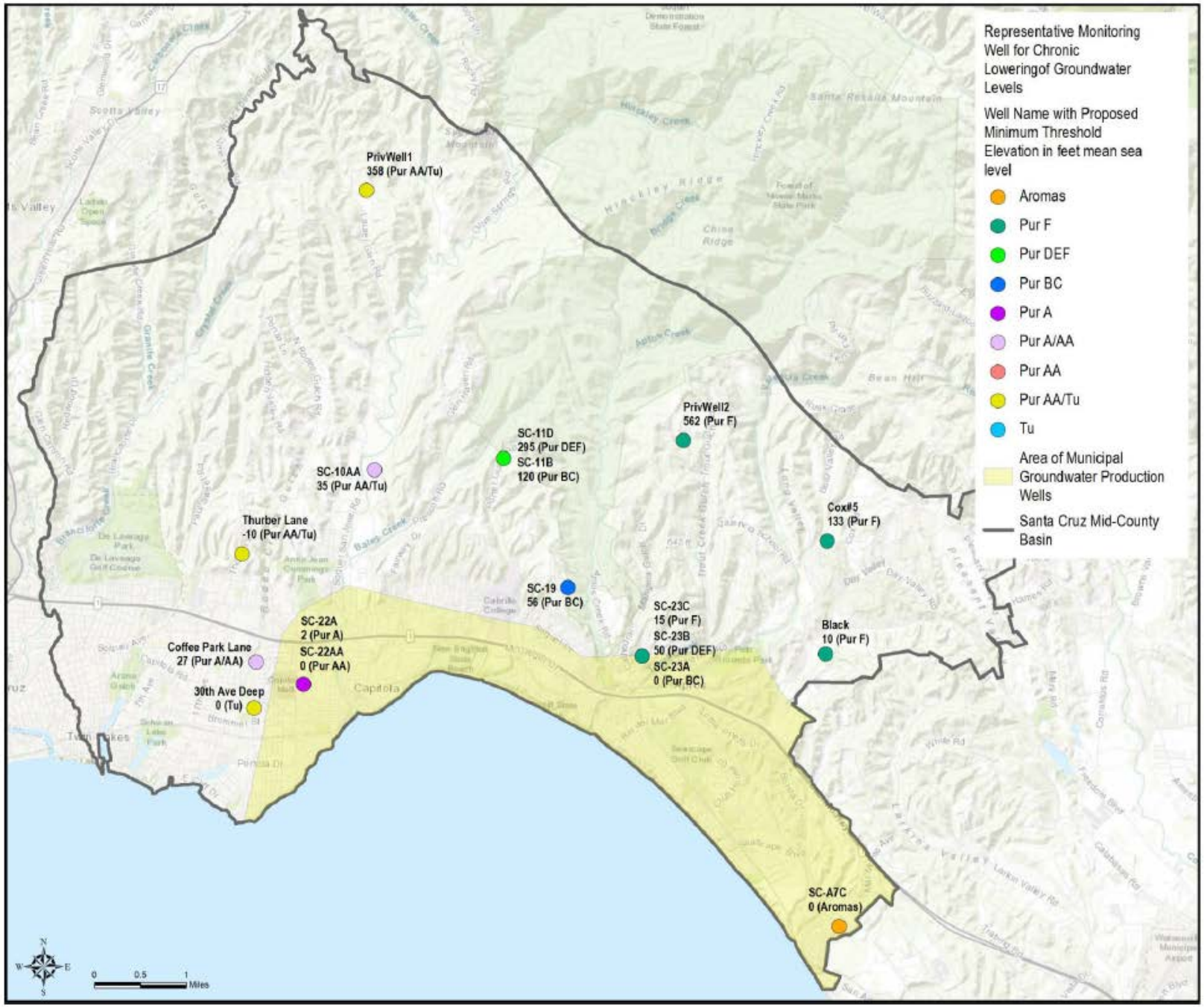



Coastal Monitoring Wells to be Used as RMW for Protective Groundwater Elevations
Color Represents Deepest Aquifer Screened
Arom
PurF
P DEF
PurBC
PurA
PurAA
Tu
Monitoring Wells to Be Used as RMW for Chloride Concentrations
Production Wells to Be Used as RMW for Chloride Concentrations
Chloride Isocontours
Proposed Aromas 250 mg/L Isocontour
Proposed Purisima 250 mg/L Isocontour
Area of Municipal Groundwater Production Wells
Santa Cruz Mid-County Basin
Data gap (Chloride)
Might use Seascape Golf Course Well
Protective Elevation
Data gaps in Tu aquifer
2 new monitoring wells are planned in the future
Proposed Representative Monitoring Wells for Seawater Intrusion
Estates Well
SC-17
T-Hopkins Well
SC-5
SC-3
SC-22
SC-13
Garnet Well
SC-1
Aptos Creek Well
SC-9
SC-8
Schwan Lake
Beltz #10
Beltz #8
Corcoran Lagoon
Beltz #9
Moran Lake
Pleas Pt
Soquel Pt
SC-A1
Country Club Well
San Andreas Well
SC-A8
SC-A5
Seascape Well
SC-A2
Altivo Well
SC-A3
Cabrillo College
Anna Jean Cummings Park
Capitola Mall
Seascape Golf Club
0
0.5
1
Miles

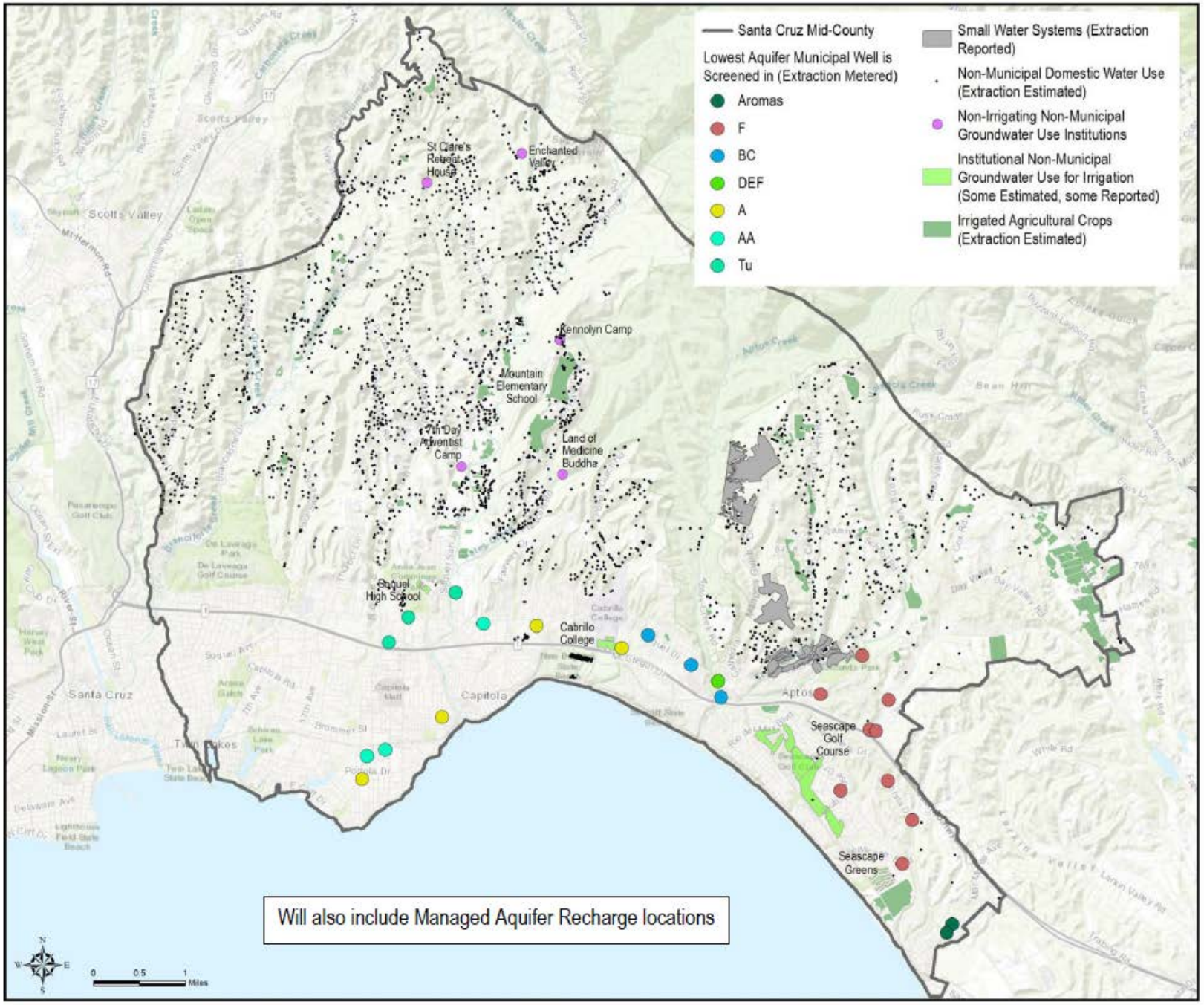
Proposed Santa Cruz MGA Ongoing Funding Approach

Primer on "who pays for what?"

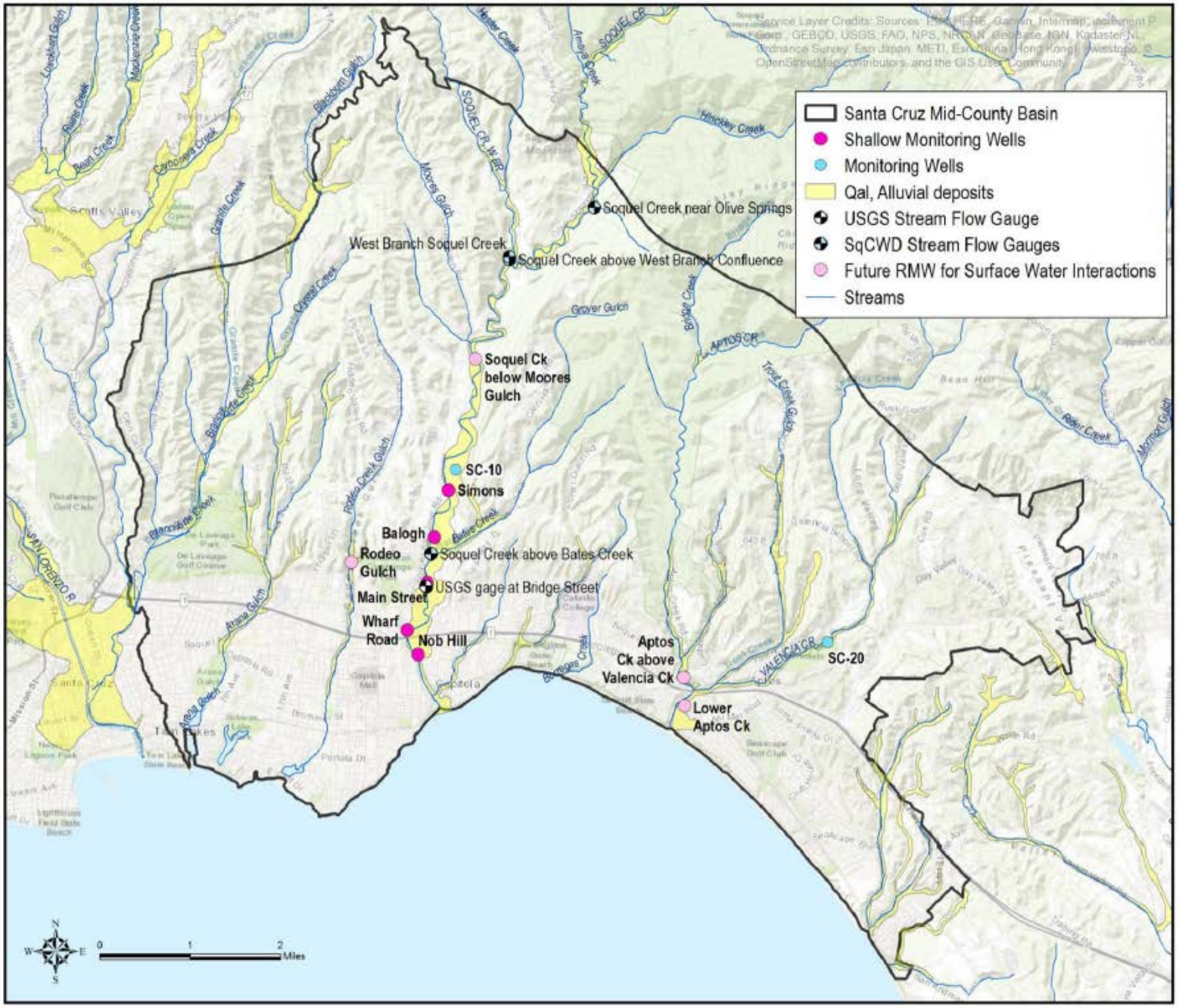
Proposed Representative Monitoring Wells for Chronic Lowering of Groundwater Levels



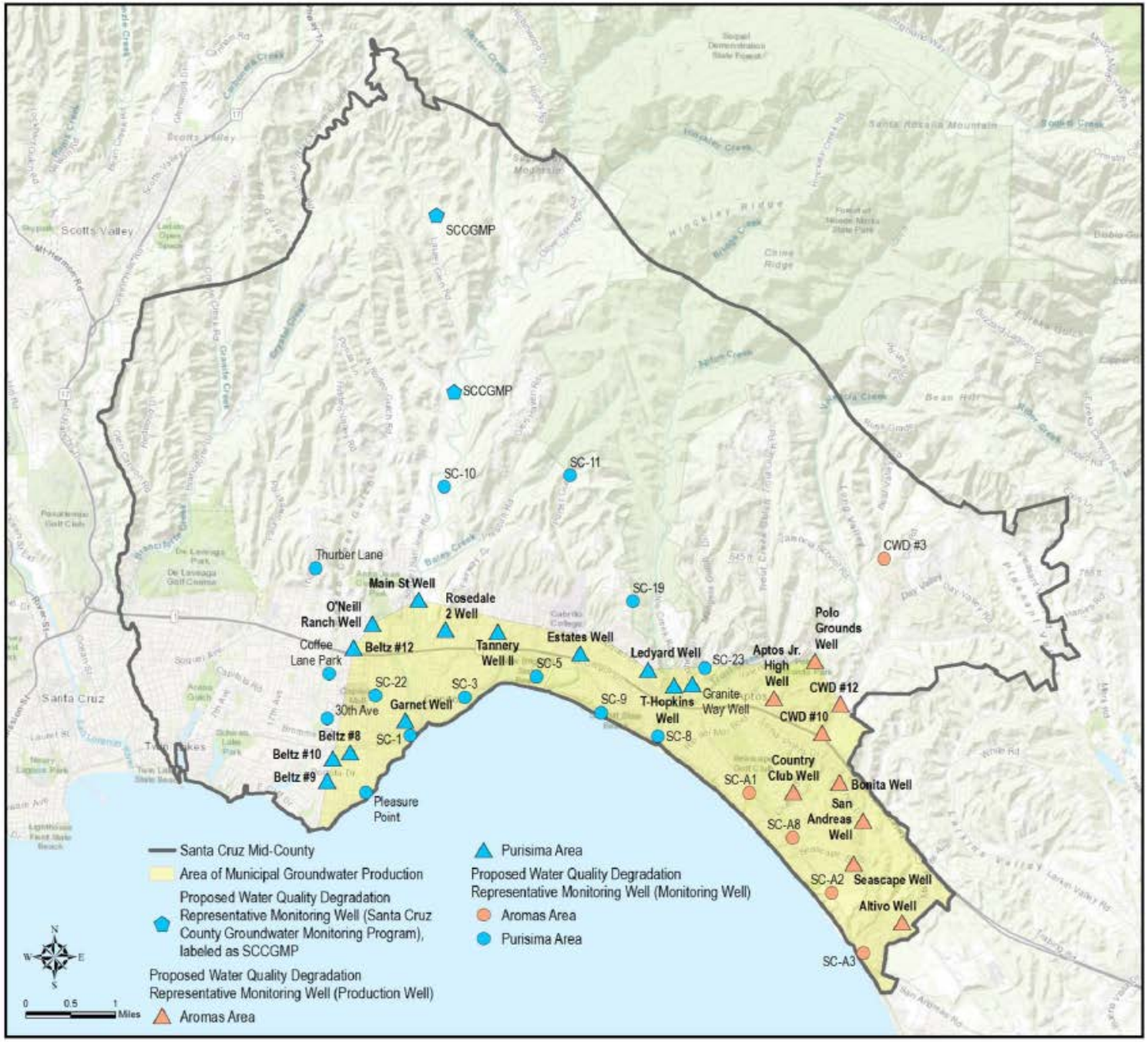
Proposed Representative Monitoring Points for Reduction of Storage



Proposed Representative Monitoring Wells for Depletion of Interconnected Surface Water



Proposed Representative Monitoring Wells for Degradation of Groundwater Quality



Proposed Representative Monitoring Wells for Seawater Intrusion

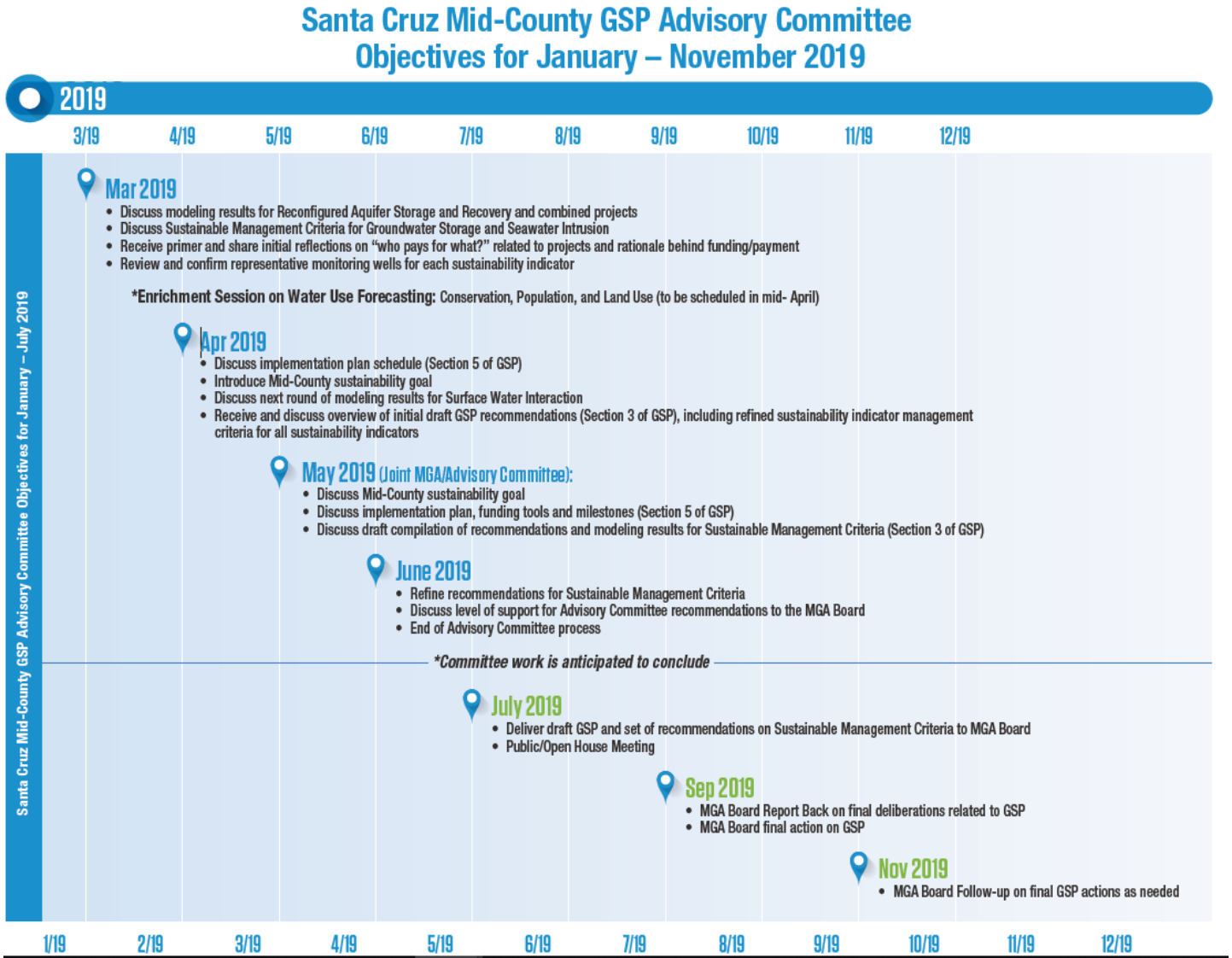
Public Comment

Confirm

February 27, 2019 GSP Advisory Committee Meeting Summary

Recap and Next Steps

GSP 2019 Project Timeline



Next Steps:
Enrichment Session and Meetings 18, 19 & 20

- **April 18, 2019 Land Use – Water Enrichment Session**
- **April 24, 2019 Meeting (#18)**
  - Discuss implementation plan and funding tools (Section 5 of GSP)
  - Discuss Mid-County sustainability goal
  - Discuss next round of modeling results for Surface Water Interaction
  - Receive and discuss overview of initial draft GSP recommendations (Section 3 of GSP), including refined sustainability indicator management criteria for all sustainability indicators
- **May 16, 2019 (Joint MGA/Advisory Committee) Meeting (#19)**
  - Discuss Mid-County sustainability goal
  - Discuss implementation plan, funding tools and milestones (Section 5 of GSP)
  - Discuss draft compilation of recommendations and modeling results for Sustainable Management Criteria (Section 3 of GSP)
- **June 19, 2019 (Last Advisory Committee) Meeting (#20)**
  - Refine recommendations for Sustainable Management Criteria
  - Discuss level of support for Advisory Committee recommendations to the MGA Board
  - Commemorate and close the Advisory Committee Process

THANK YOU!

FOR ANY QUESTIONS, PLEASE CONTACT:

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