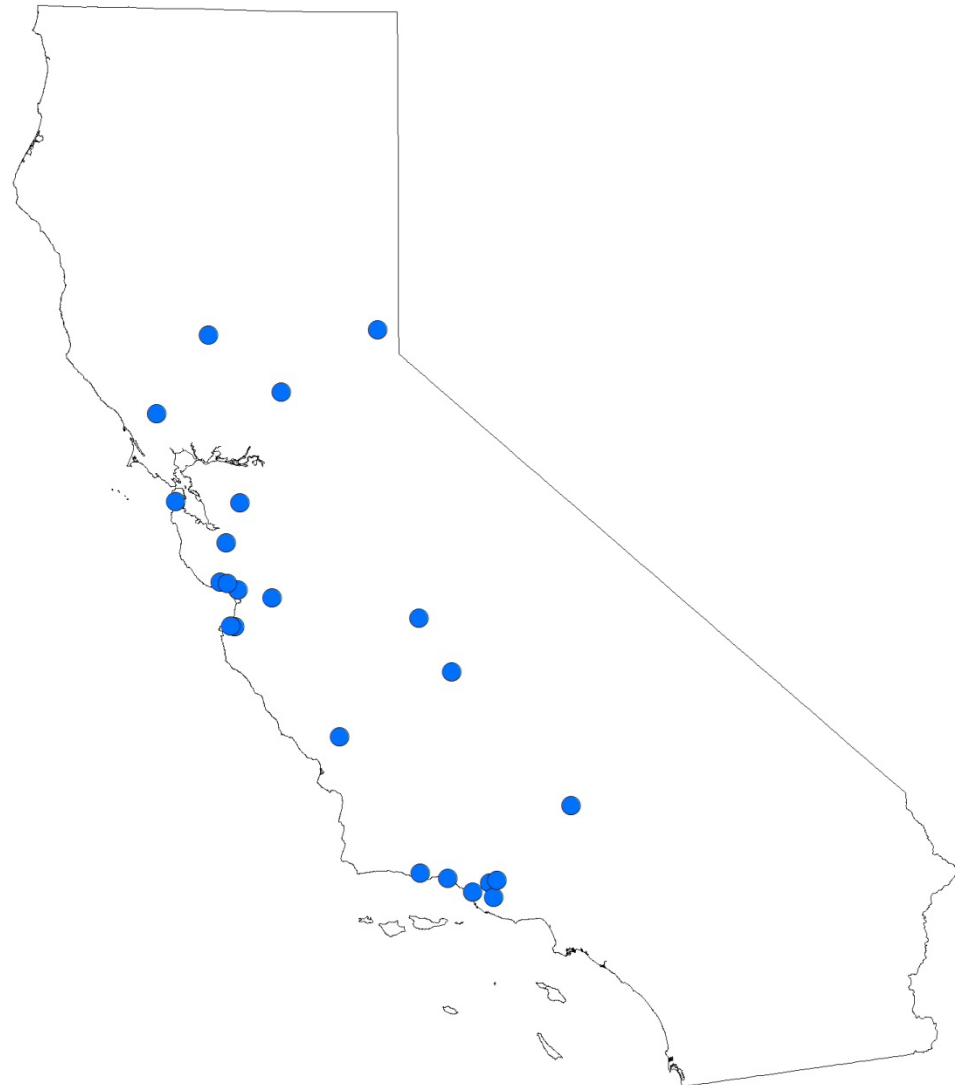


Mid-County Basin Groundwater Hydrology and Management

Presented on
July 8, 2014 to
Mid-County Groundwater
Stakeholder Advisory Group
Santa Cruz County

HydroMetrics WRI Introduction

- Consulting groundwater hydrologist for Soquel Creek Water District (SqCWD) since 2005
- Lead consultant on Basin Management Technical Study for Central Water District (CWD) funded by state grant



Outline

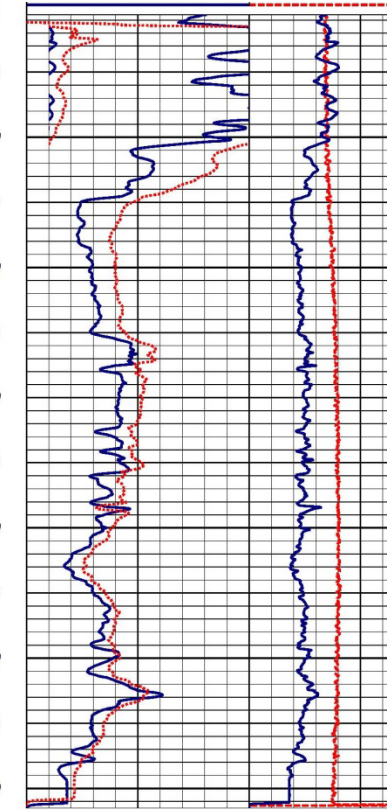
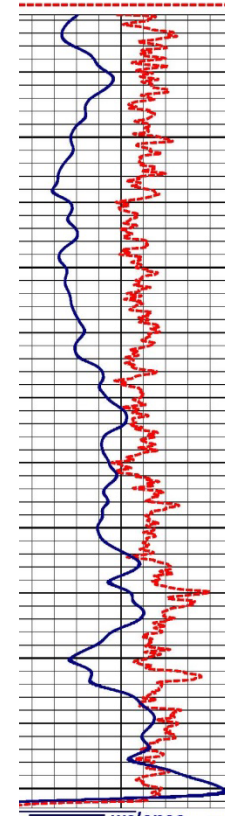
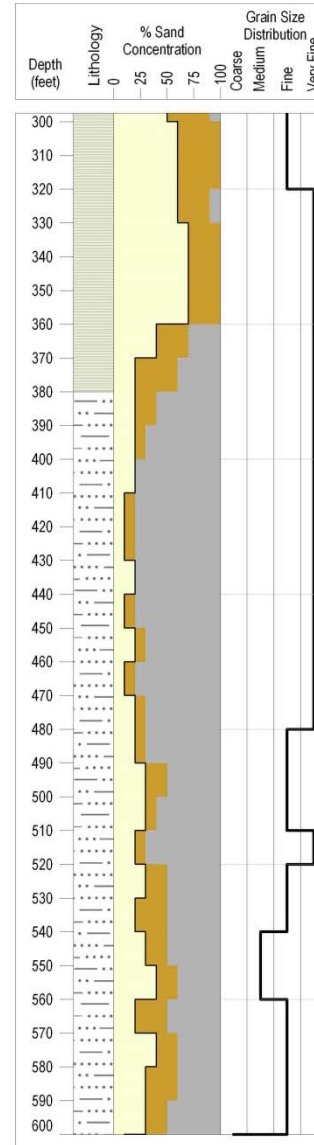
- Existing data and analyses for groundwater management
 - Basin hydrogeology
 - Seawater intrusion and basin overdraft
 - SqCWD Pumping plans
 - Drought conditions
 - Streamflow and shallow water levels
 - Well Master Plan effects on private wells
 - CWD groundwater model

Levels of Information

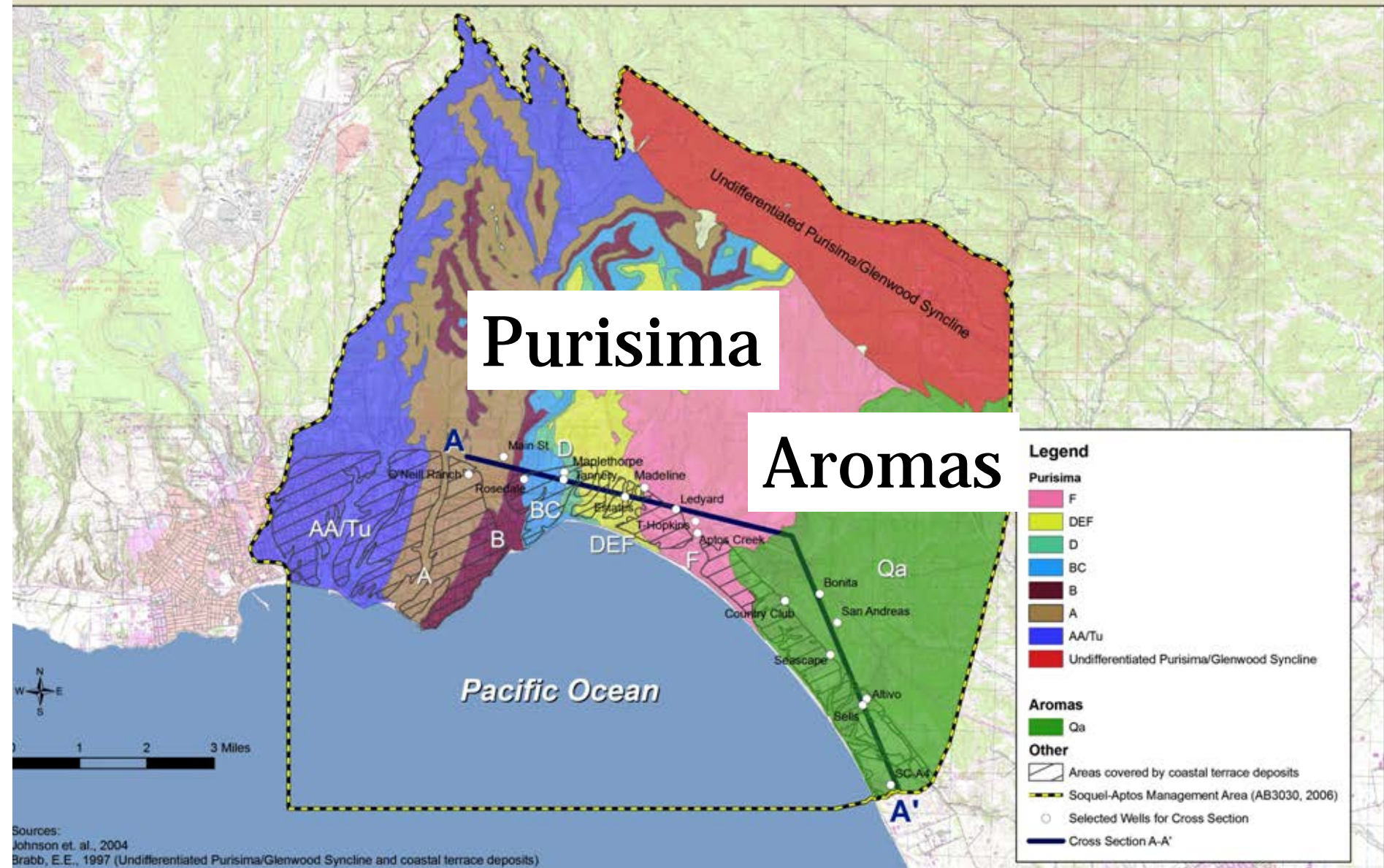
- **Collected Data**
- **Hydrogeologic Interpretation**
- **Calculated or Modeled Estimates**
- **Information to Refine**

Basin Hydrogeology

Data: Geologic and Geophysical Logs



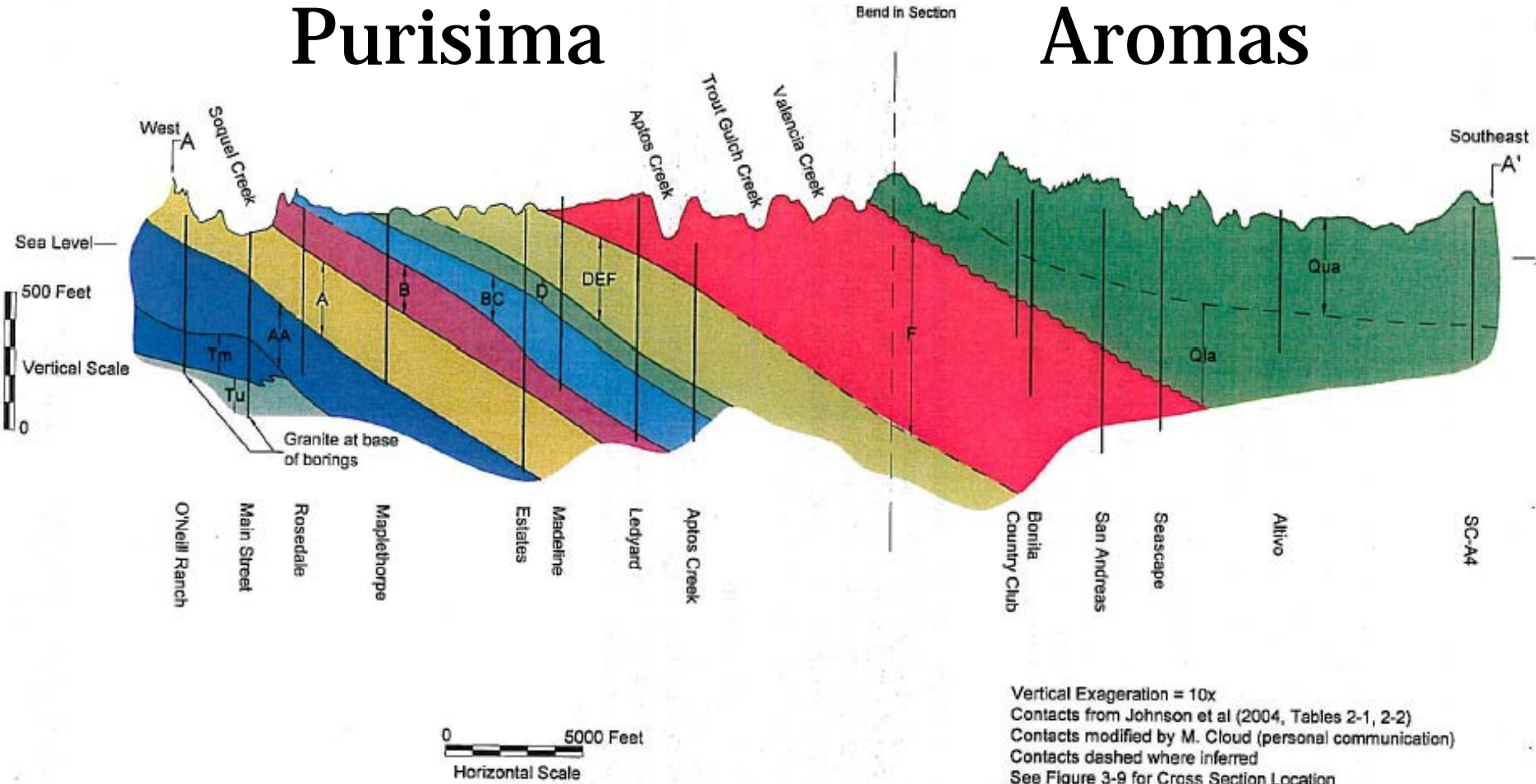
Interpreted: Basin Geologic Outcrops



Interpreted: Basin Geologic Cross Section

Purisima

Aromas



Data: Groundwater Level Monitoring



**Historical Record:
Monthly measurements
with airline or sounder**



**Ongoing Record:
Every 15 minutes
Checked with sounder
quarterly**

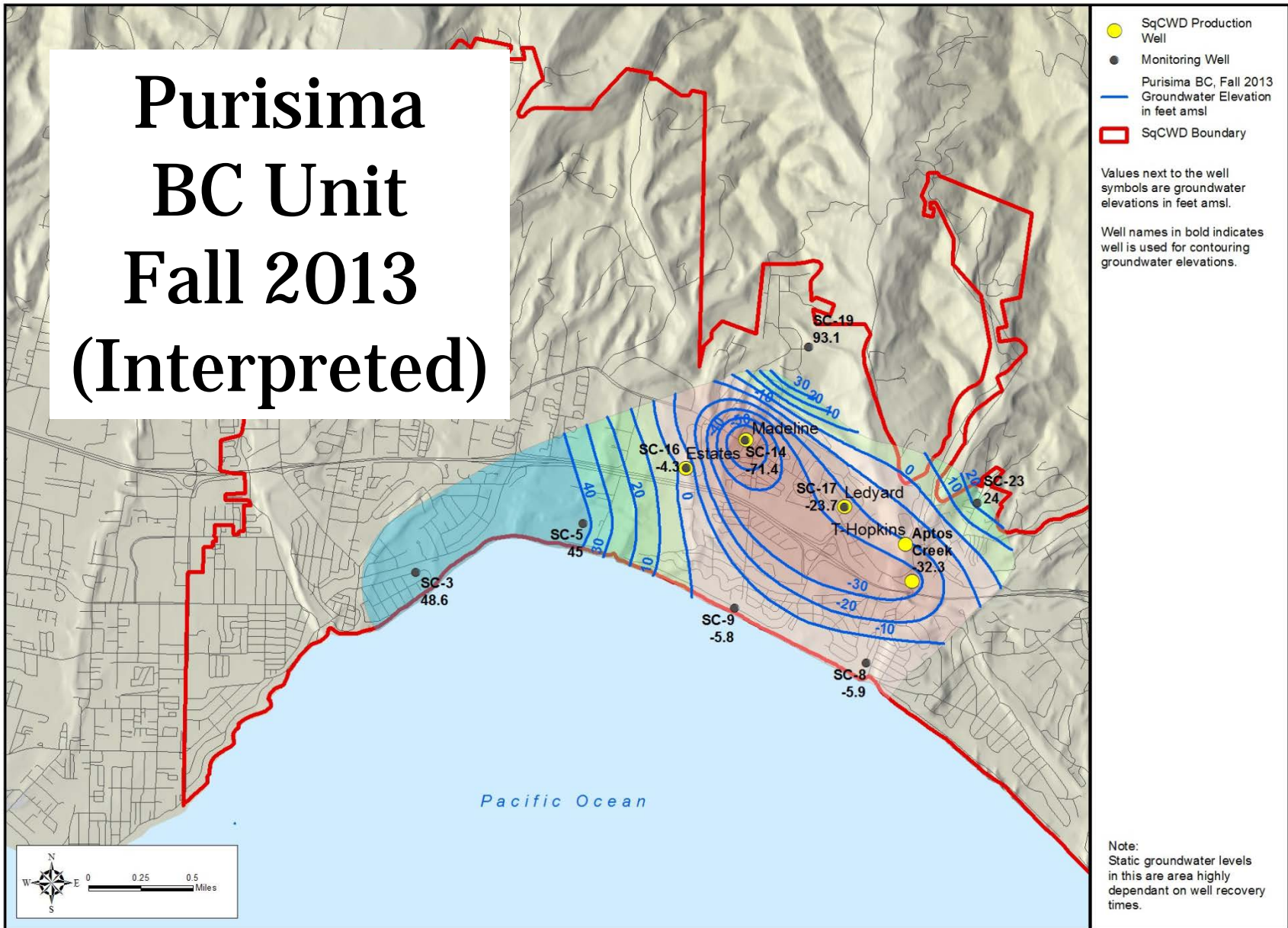
Data: Wells Monitored for Basin Management

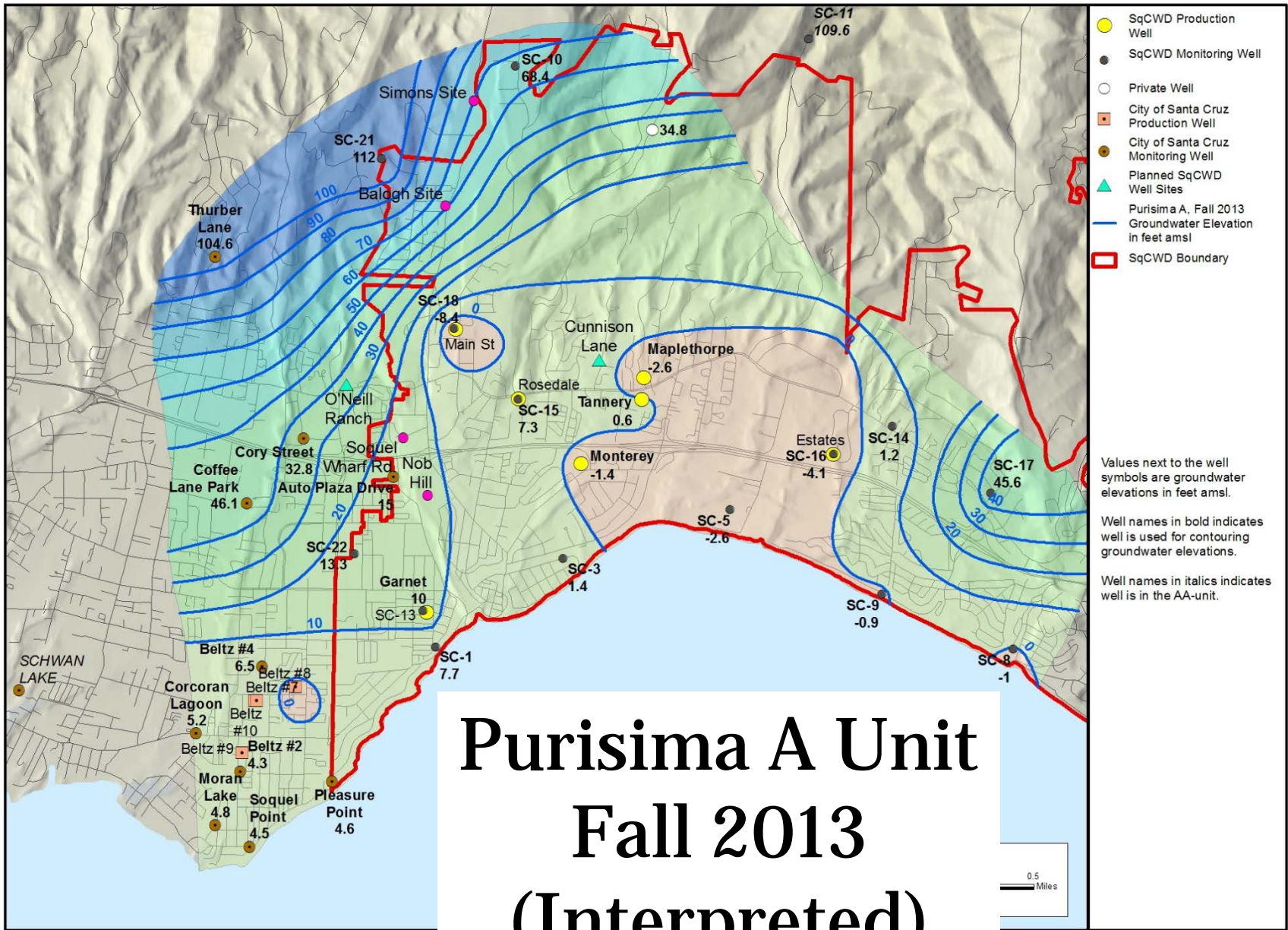
- Soquel Creek Water District production and monitoring wells
- Central Water District production and monitoring wells
- City of Santa Cruz production and monitoring wells
- ~30 private wells monitored by Santa Cruz County
- Wells monitored by Pajaro Valley Water Management Agency



Aromas Fall 2013 (Interpreted)

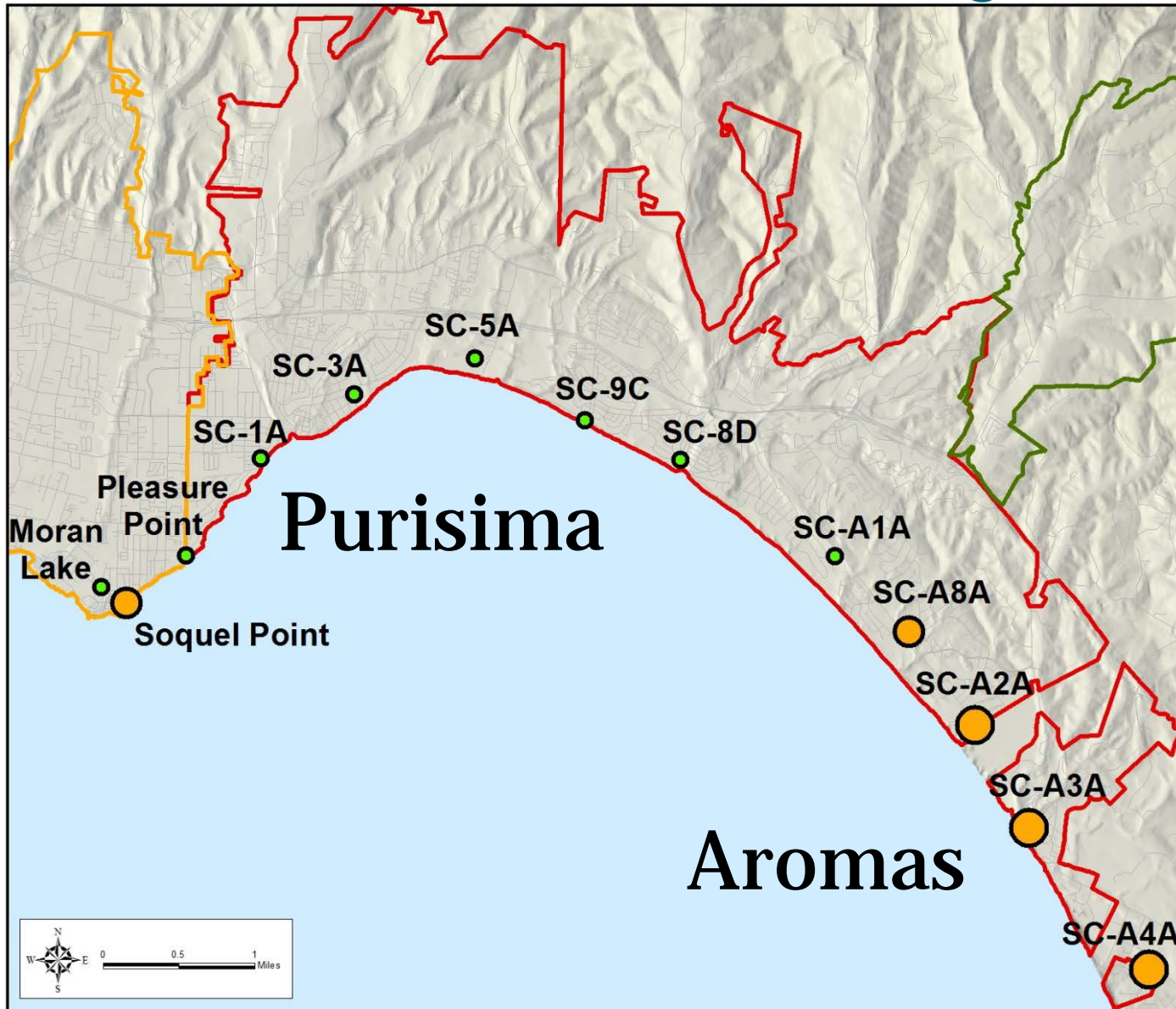
Purisima BC Unit Fall 2013 (Interpreted)





Seawater Intrusion and Basin Overdraft

Data: Coastal Monitoring Wells



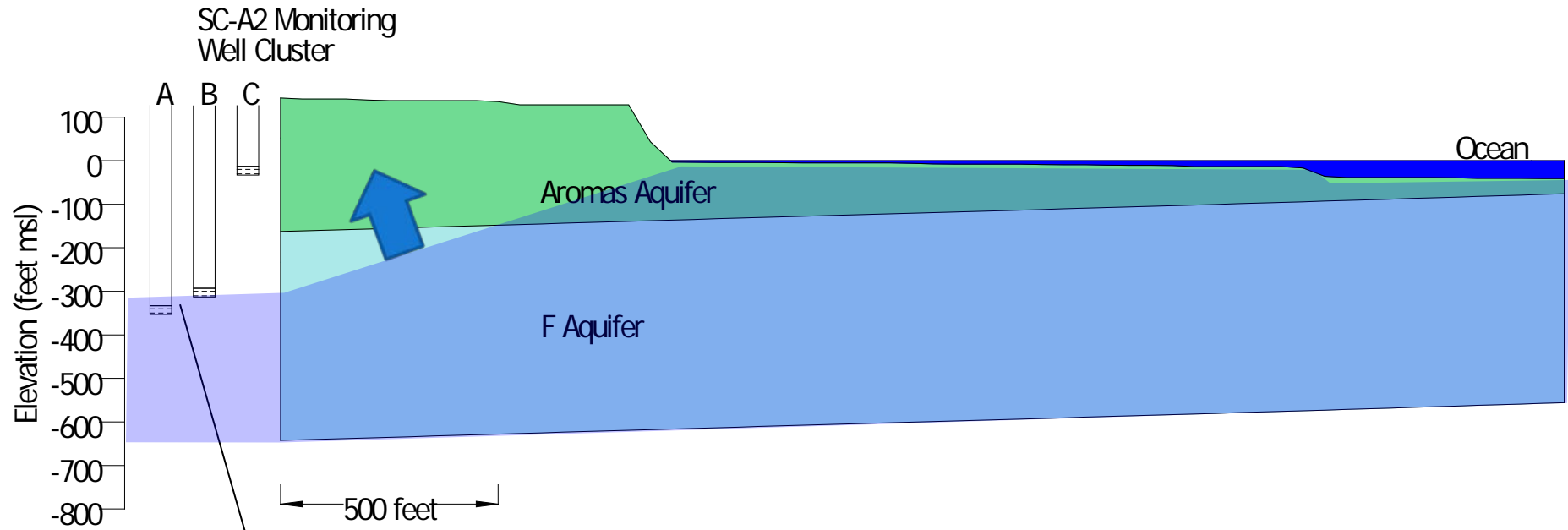
Data: Monitoring Well Sampling Equipment



Data: Coastal Well Chloride Concentrations



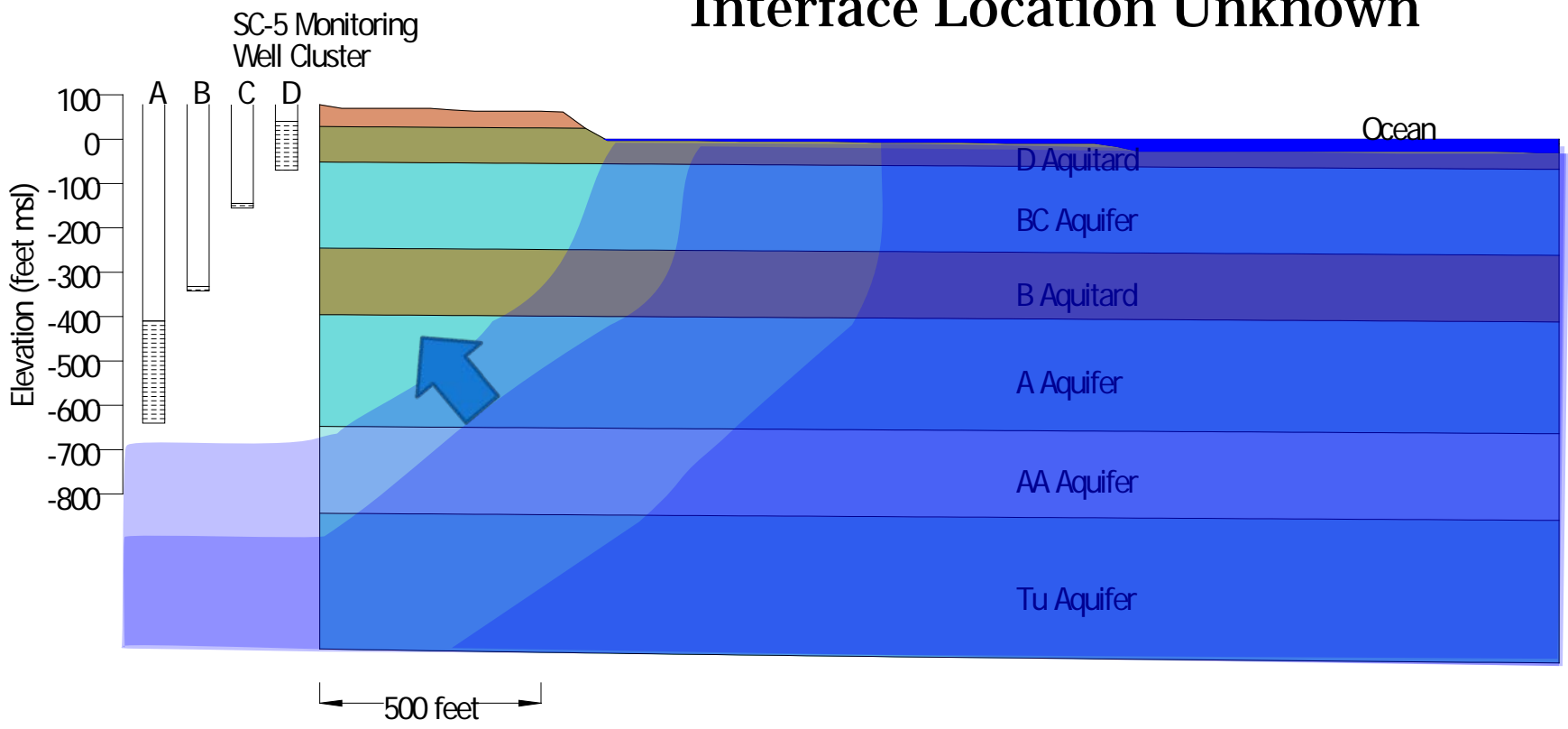
Interpreted: Seawater Intrusion in Aromas



**Deepest Monitoring Wells (A Screen)
Installed Below Salt Interface**

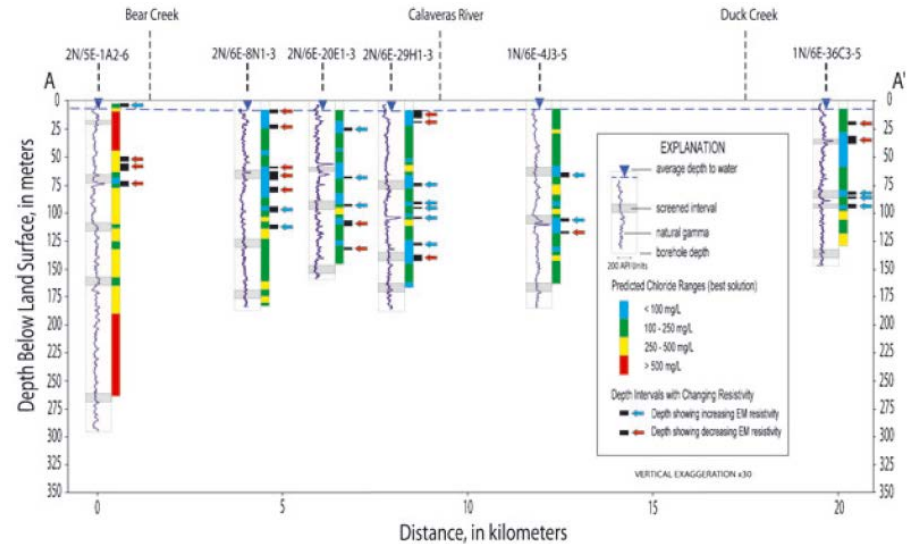
Interpreted: Seawater Intrusion in Purisima

Interface Location Unknown

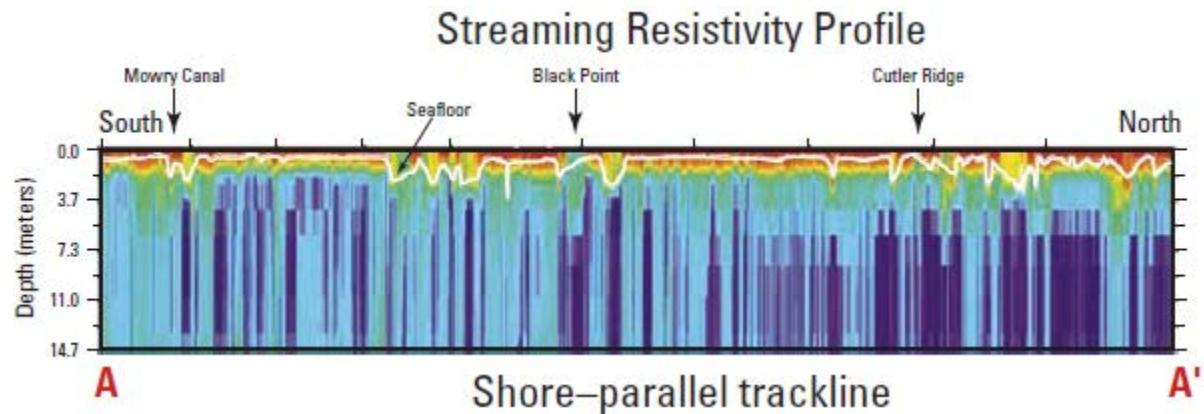


Refinement: Geophysics Studies

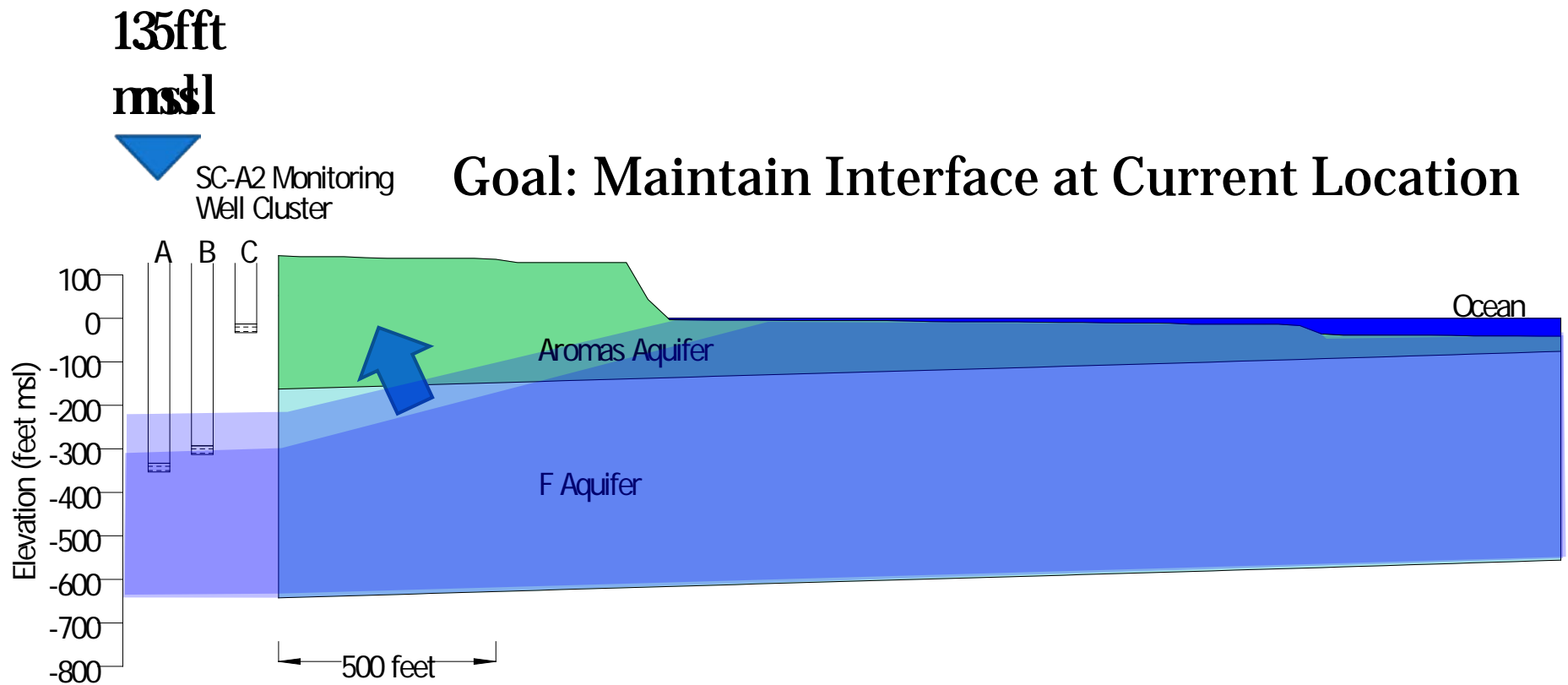
Onshore in wells
(eg Metzger and Izbicki, 2013)



Offshore
(eg Swarzenski, 2004)

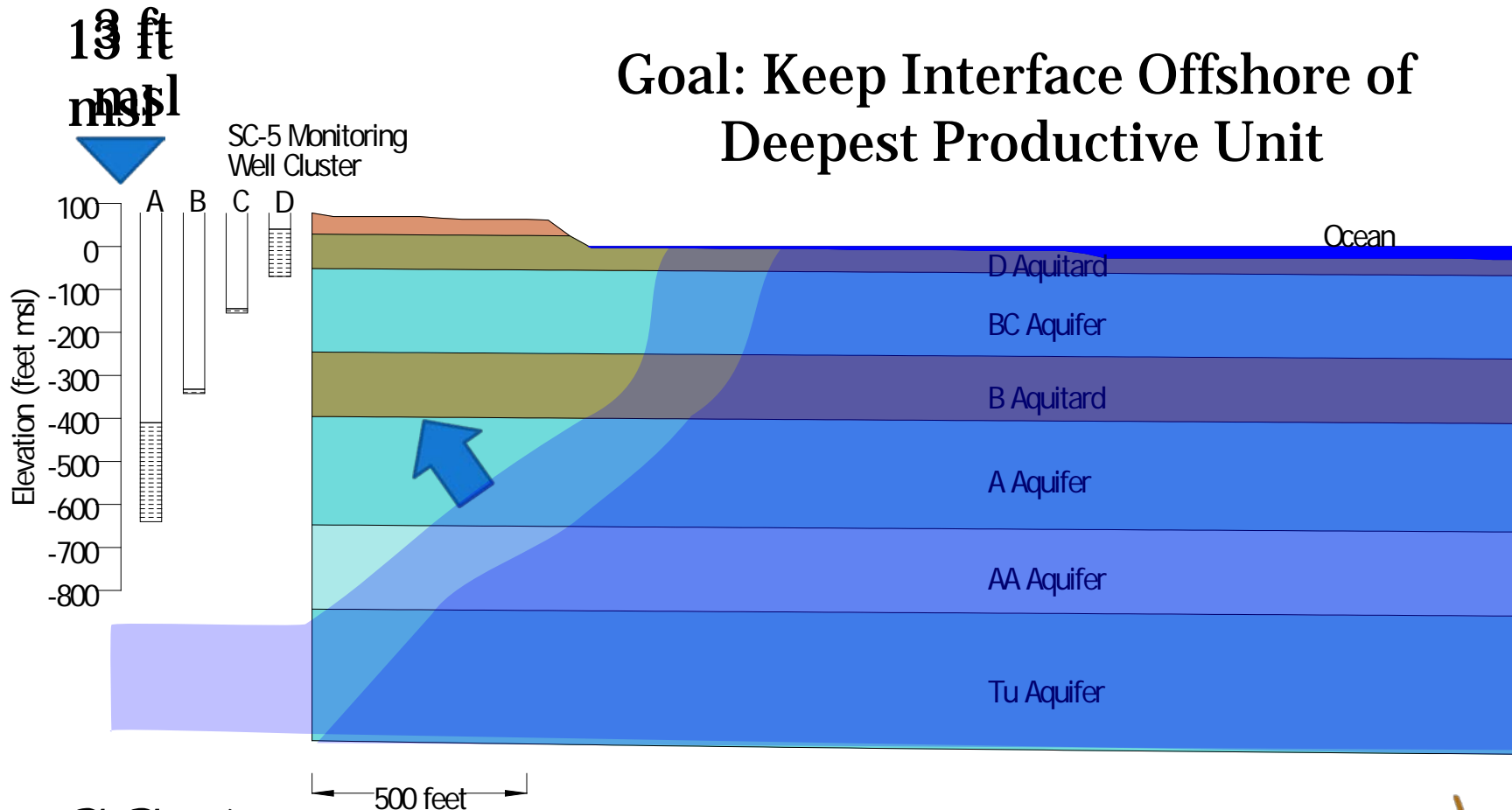


Estimated: Protective Elevations to Stop Seawater Intrusion in Aromas



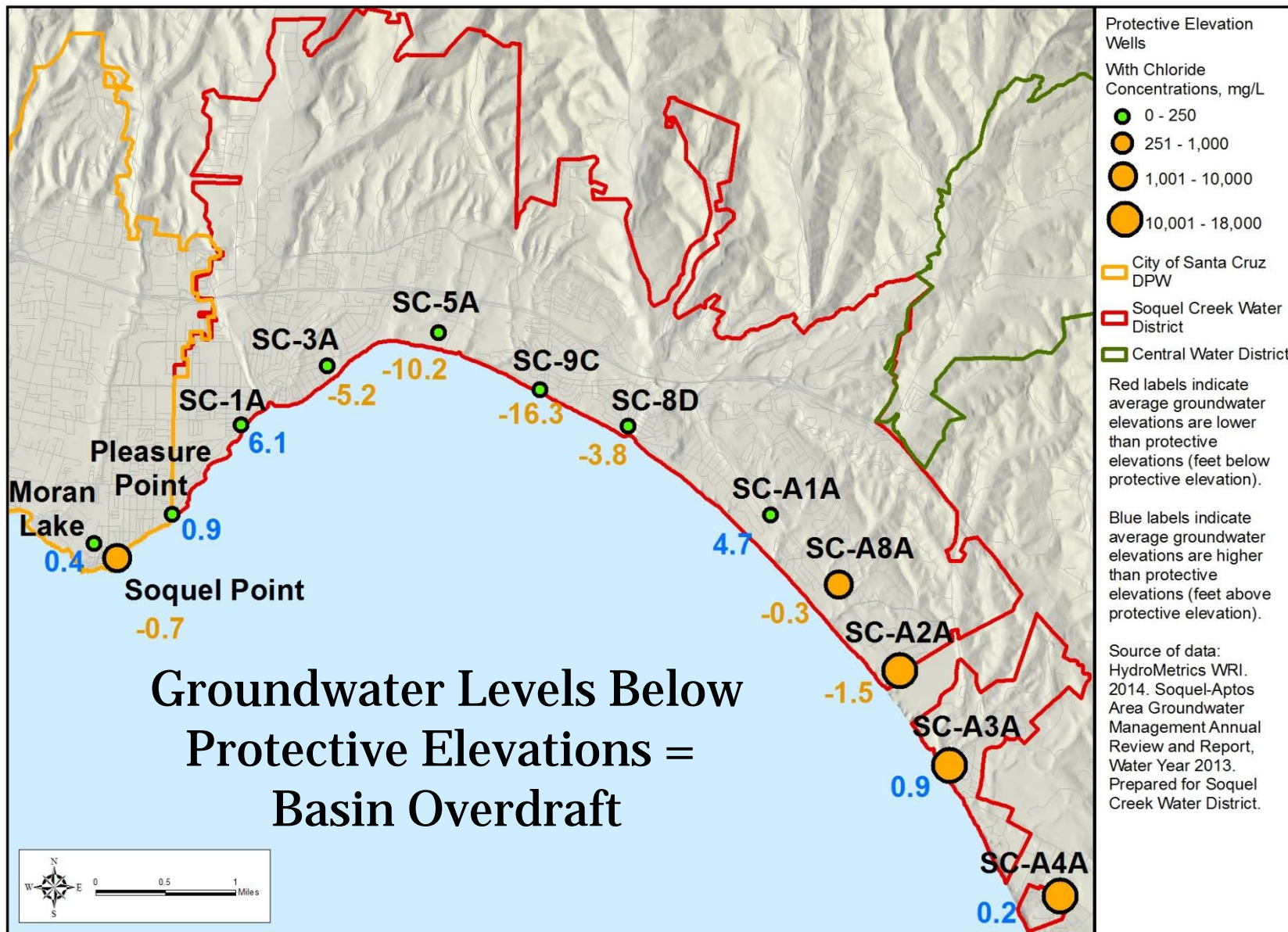
SC-A2

Estimated: Protective Elevations to Prevent Seawater Intrusion in Purisima



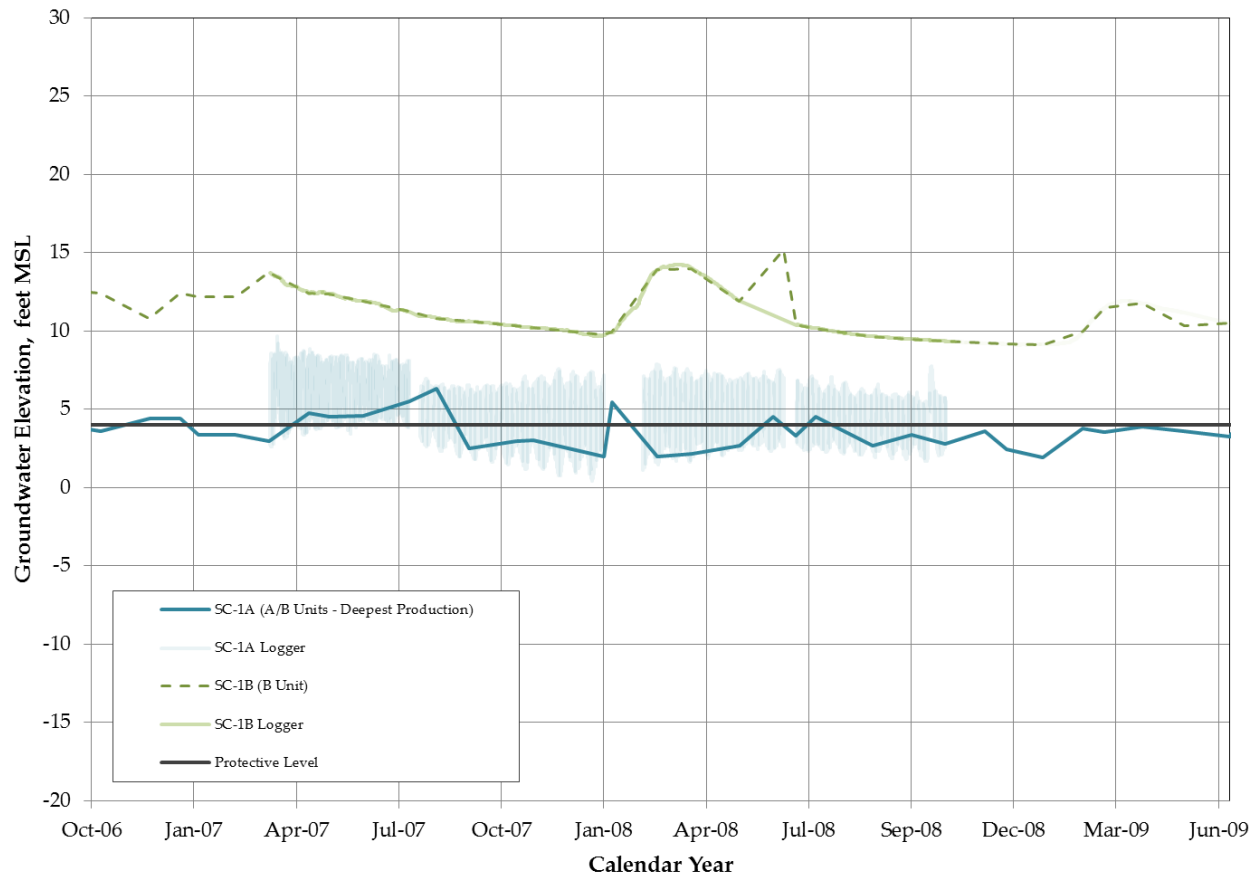
SC-5

Current Levels vs. Protective Elevations



Refinement: Use Logger Data

- Calculate More Accurate Annual Averages to Compare to Protective Elevations



Soquel Creek Water District Pumping Plans

SqCWD Planned Pumping Reductions

- SqCWD will adaptively manage pumping to raise and maintain groundwater levels to protective elevations and prevent seawater intrusion
- SqCWD plans pumping reductions to eliminate long-term overdraft based on water balance:

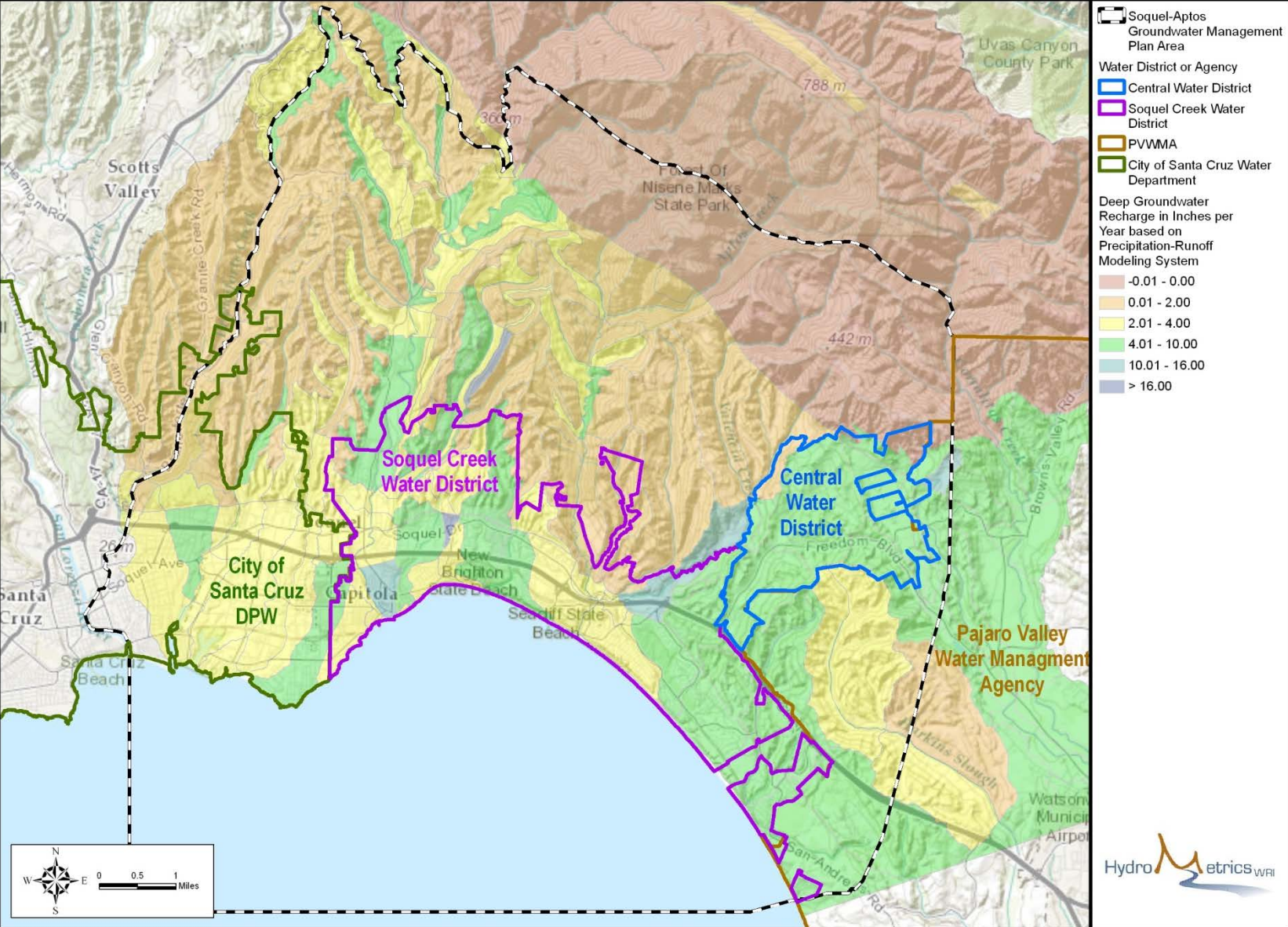
SqCWD Long-Term Consumptive Use=
Recharge

MINUS Protective Outflow to Ocean

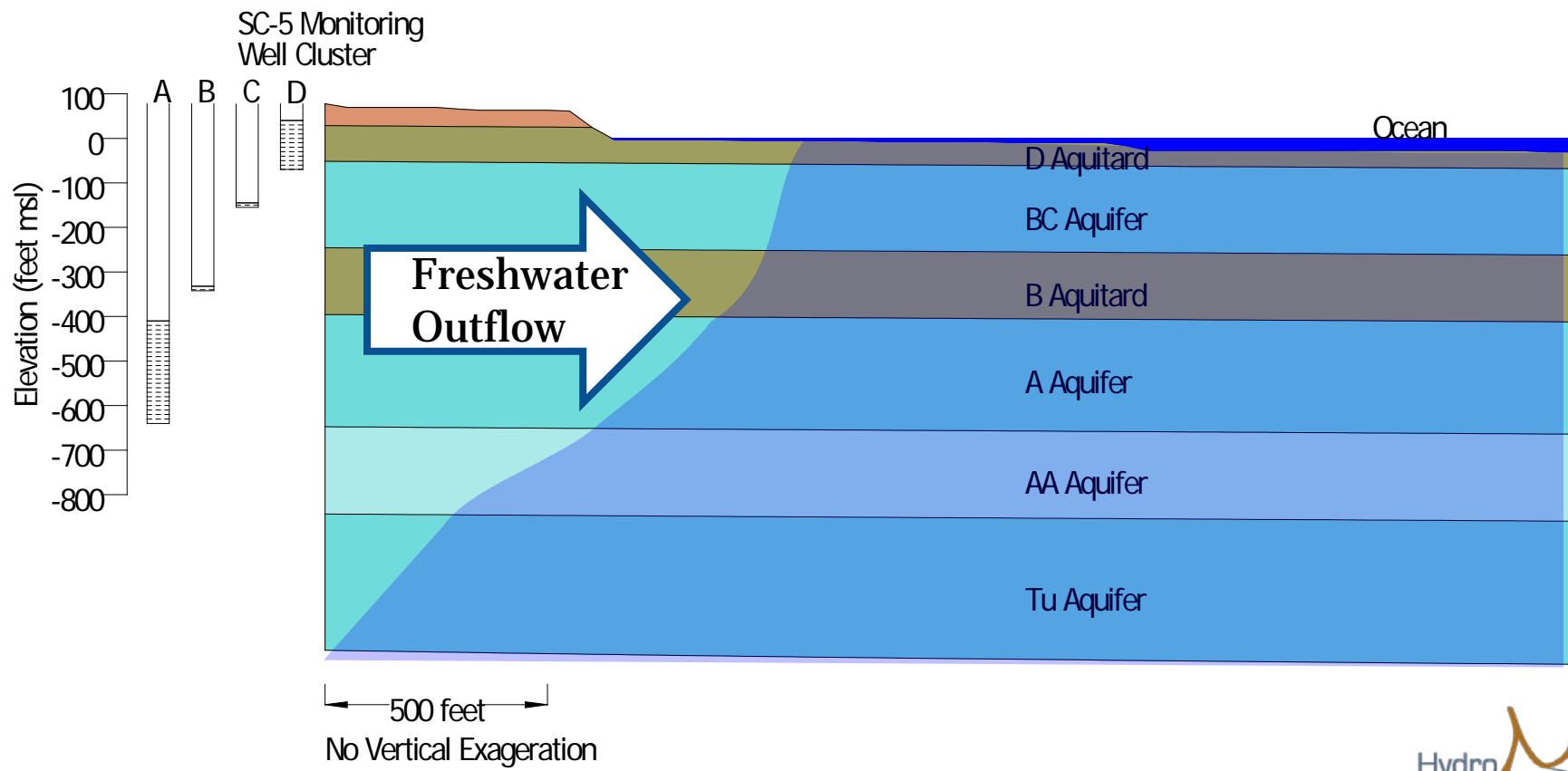
MINUS Outflow to Pajaro Valley

MINUS non-SqCWD Consumptive Use

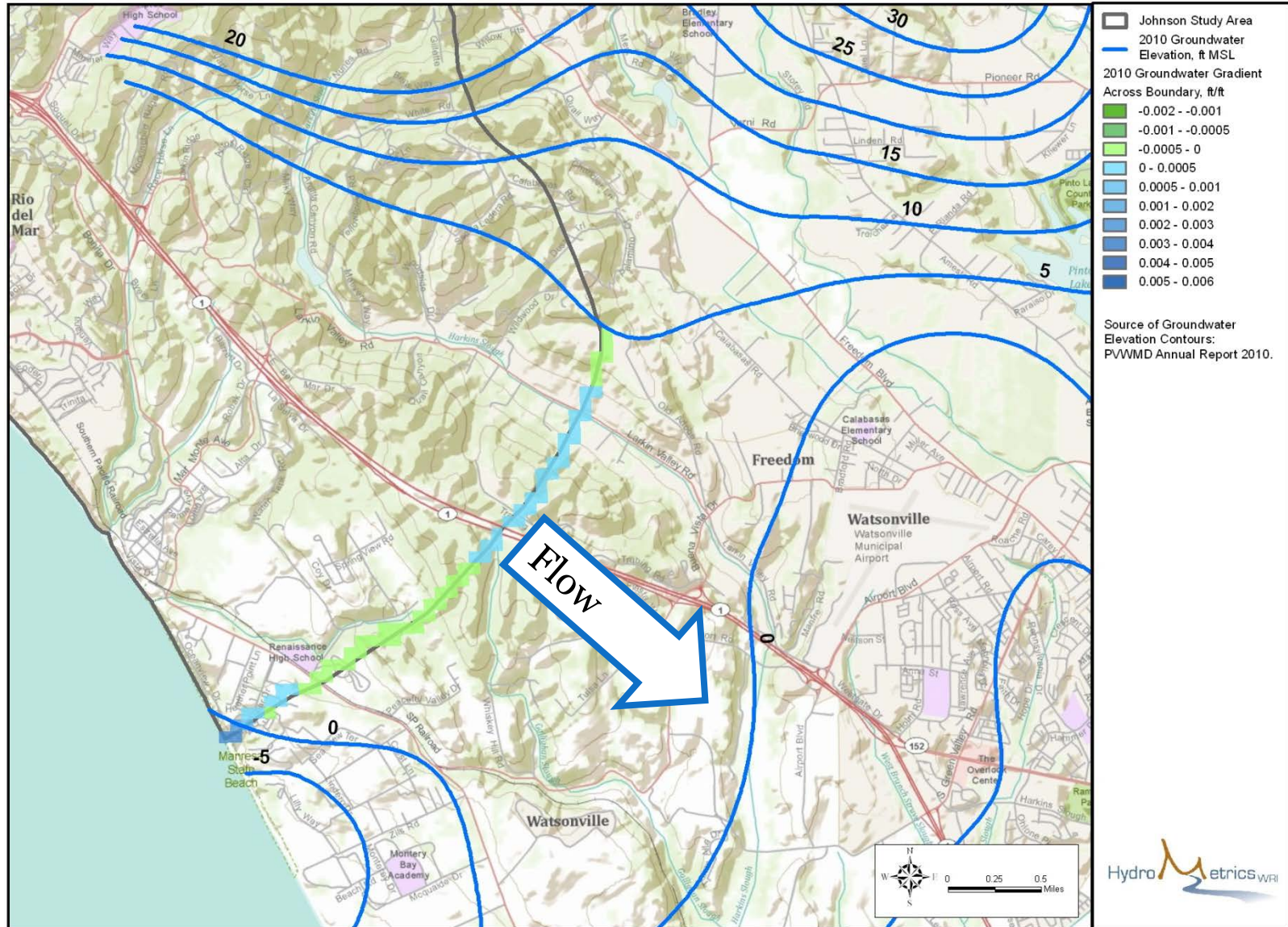
Estimated: Recharge Using PRMS Model



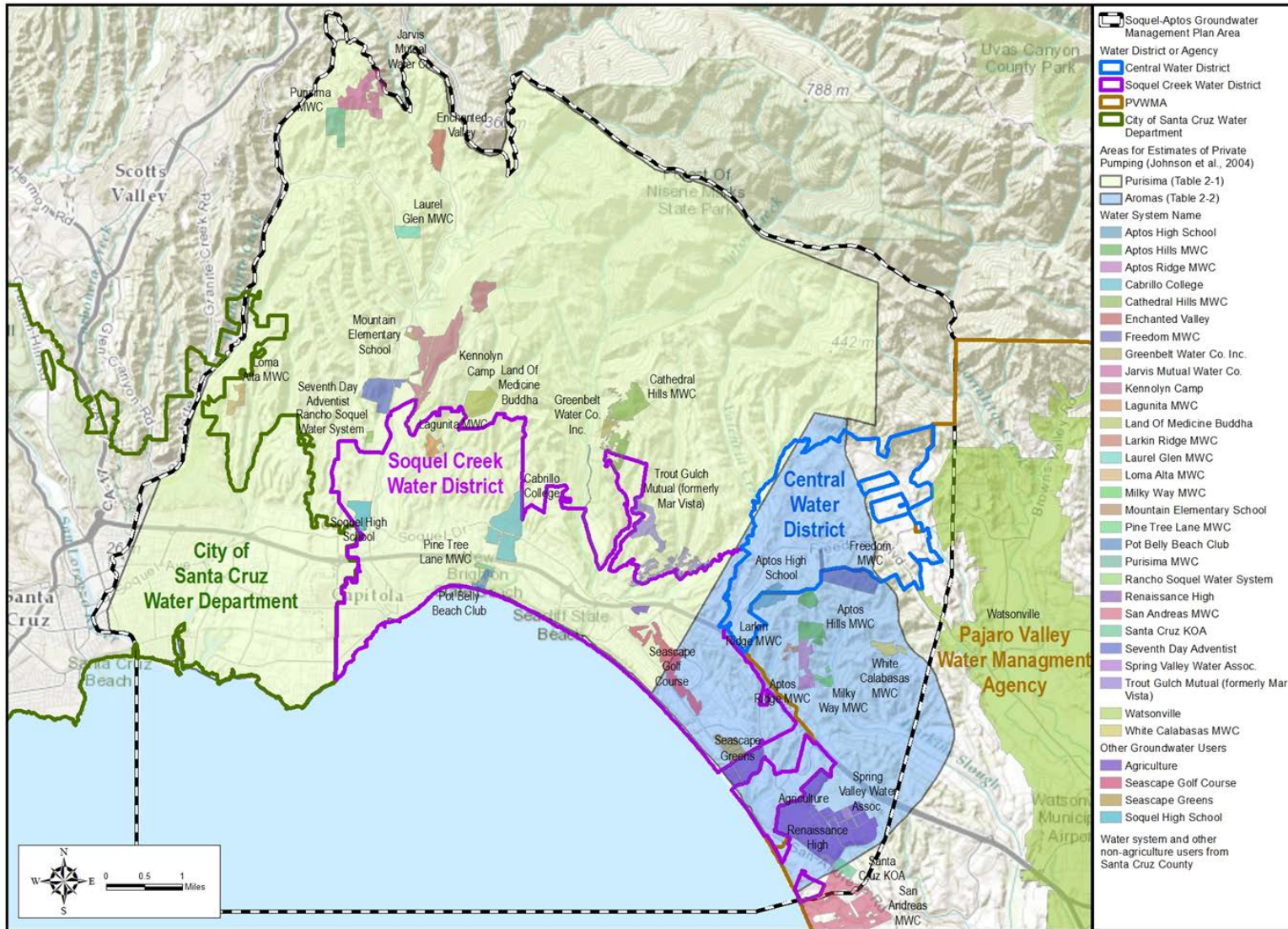
Estimated: Protective Outflow to Ocean



Estimated: Flow to Pajaro Valley



Data and Estimated: Non-SqCWD Use



Estimated: Non-Ag Water Use Factors

Land Use	AFY/ parcel	Source
Residential/Accommodations		
Urban/Suburban	0.39-0.50	Faler (1992) Wolcott (1999)
High Urban	0.43	Faler (1992) – avg of SFR and duplex
Mountain/Rural	0.44-1.00	Wolcott (1999) – Pingree (1997)
On Agricultural Parcel	0.39	Same as urban
Mobile Park	0.12	Faler (1992)
Visitor Accommodations	1.53	50 gpd/ppl
Small Water Systems	0.44	Wolcott (1999)
Commercial		
Public/Community Facility	1.00	Faler (1992)
Service	0.50	Estimate

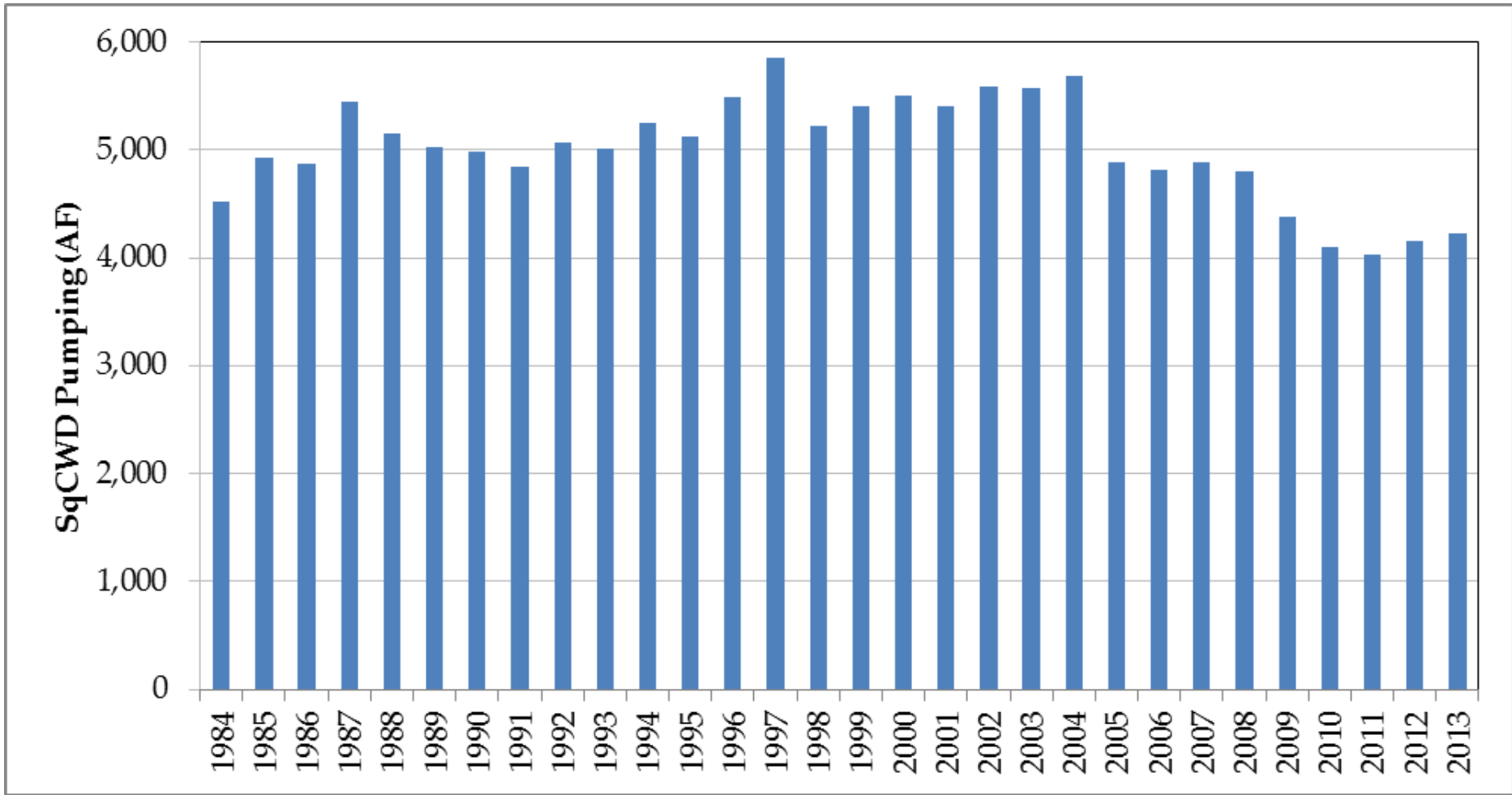
Estimated: Ag/Irrigation Water Use Factors

Type	AFY/ acre	Source
Truck	2.00	Faler (1992), San Andreas Mutual
Apple	0.23	CWD Usage 2010-11 (little water applied to established trees)
Vineyards	0.40	CWD Usage 2010-11 (little water applied to established vines)
Pasture	2.0	DWR, Faler (1992), adjusted for warm season only
Golf	1.93	Faler (1992)
Fields	1.71	Faler (1992)
Park	1.0	Faler (1992), adjusted for 60% of parcel irrigated, includes urban open space
Bamboo	0.43	CWD Usage 2010-11
Citrus	0.23	Same as apple
Egg Ranch	2.70	AFY/parcel, CWD Usage 2010-11
Horses	3.00	AFY/parcel, estimate for parcels with >10 horses

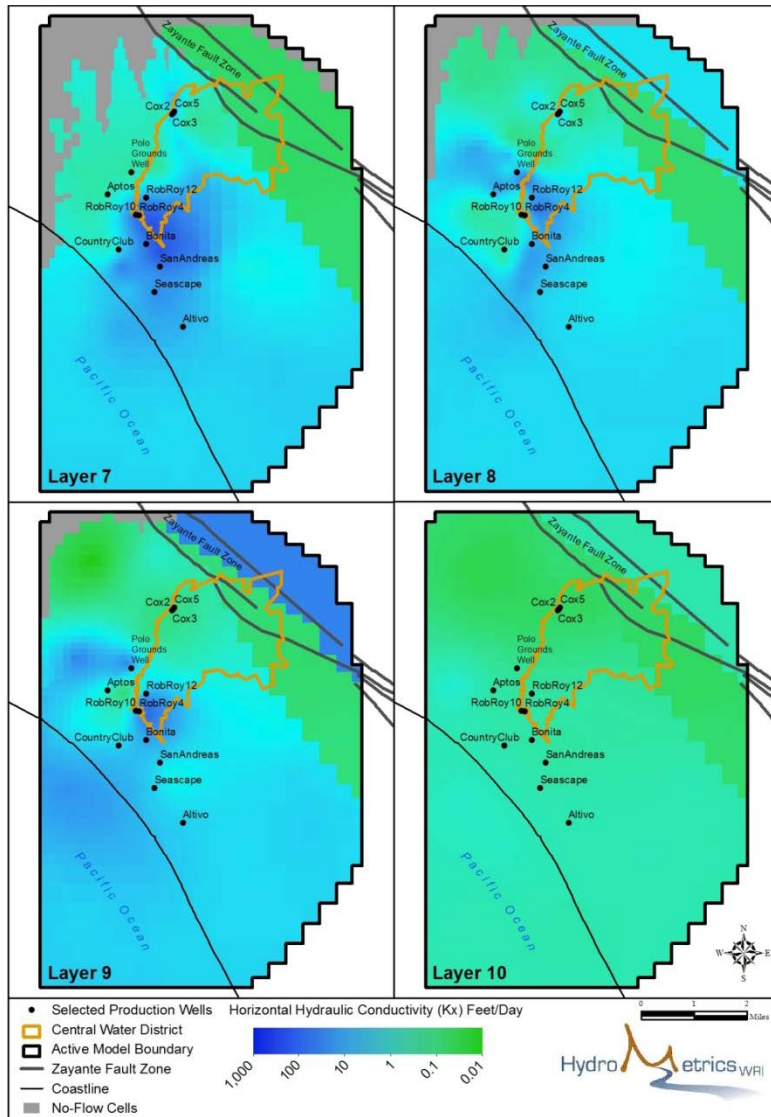
Other Estimates of Water Use

- **PVWMA Study of Aromas WD, Central WD, San Andreas Mutual: 0.47-0.73 AFY/parcel**
- **San Lorenzo Valley mountain residential: 0.2 AFY/parcel**
- **Small horse properties: 1 AFY/parcel (Ricker, 2014)**

Data: SqCWD Pumping Reduced Last 5 Years



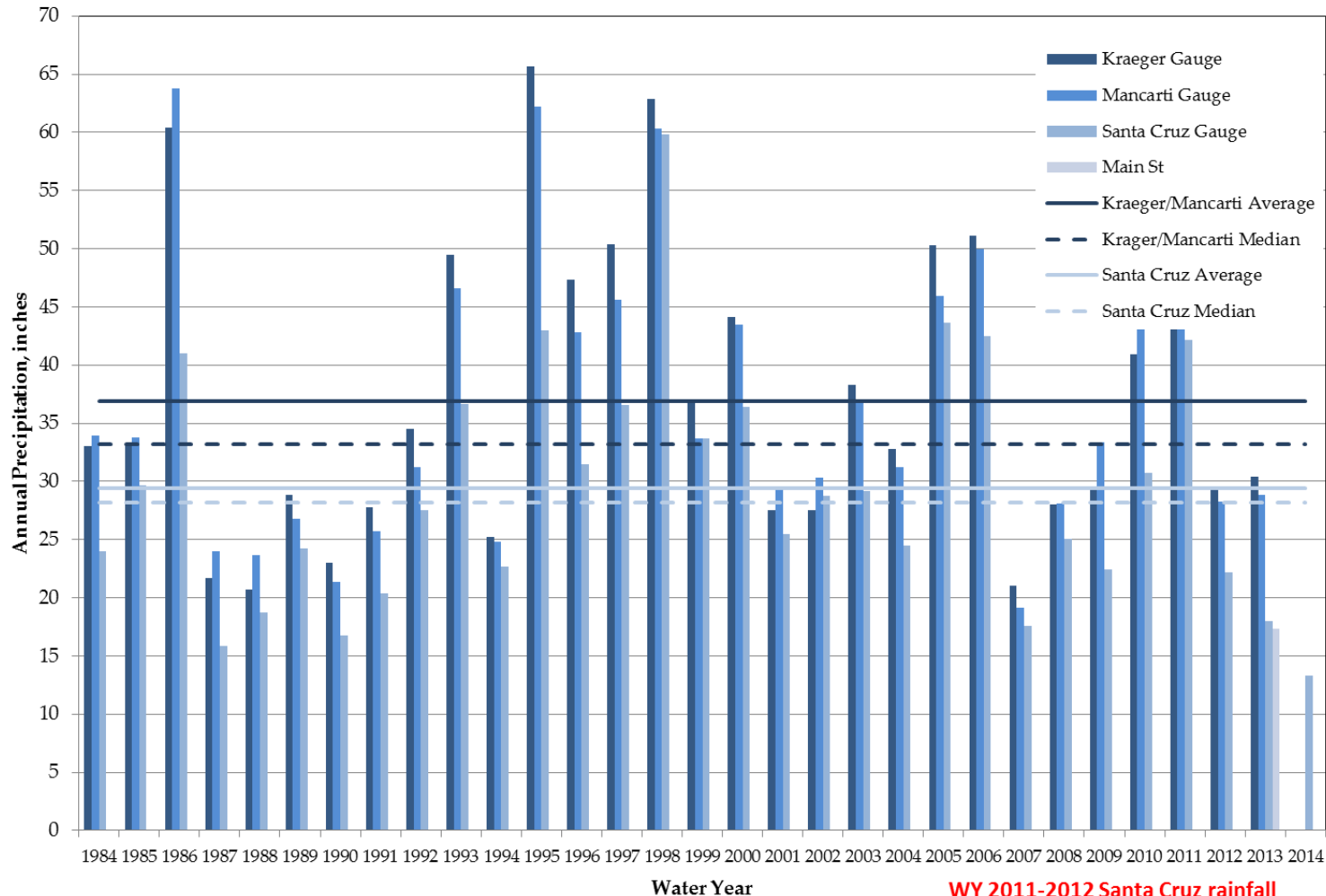
Refinement: Groundwater Model



- Expand CWD groundwater model to Purisima area
- Evaluate pumping plans such as recovery times
- Evaluate water balance components such as outflows
- Evaluate supplemental supply options

Drought Conditions

Data: 3rd Consecutive Low Rainfall Year

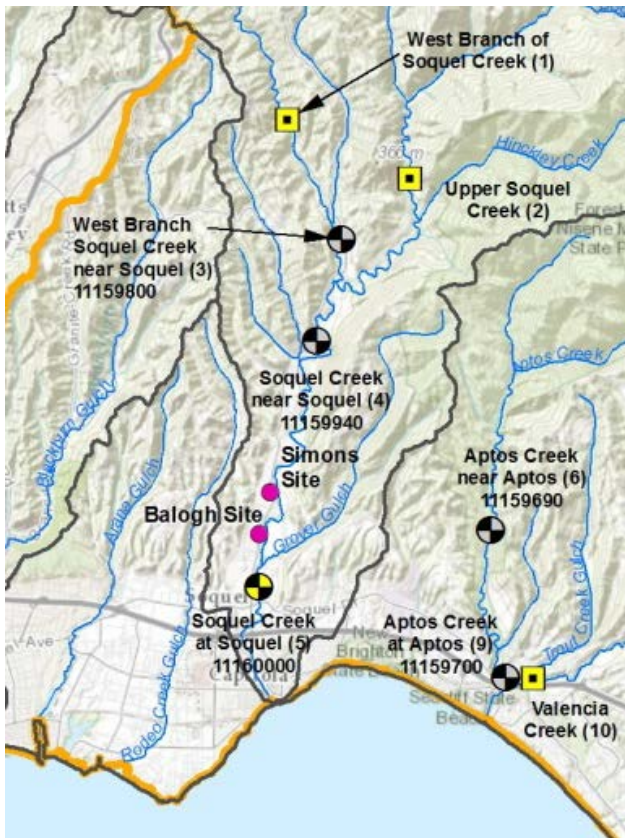


WY 2011-2012 Santa Cruz rainfall
estimated based on De Laveaga Stn
WY 2014 through May

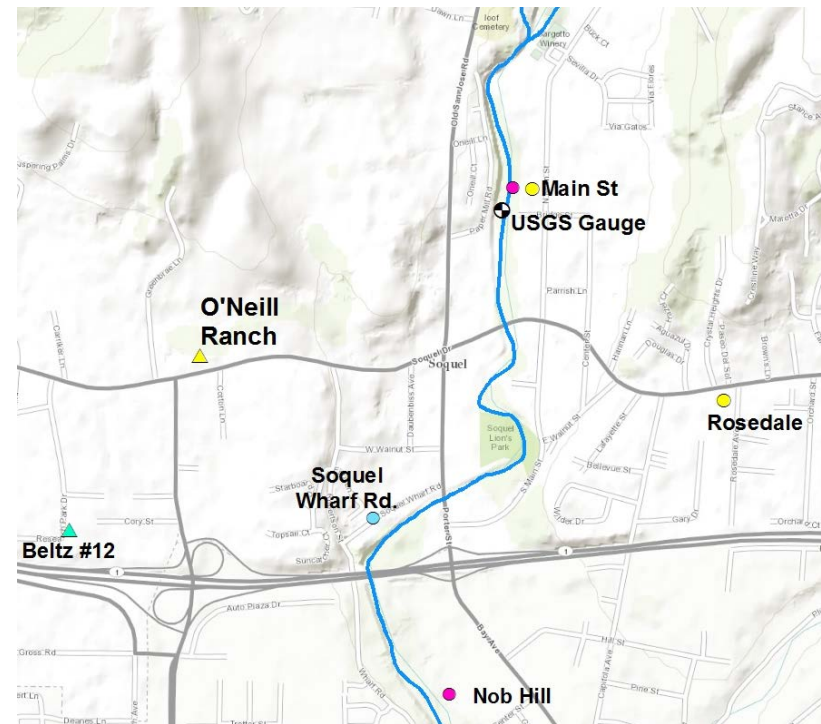
- Estimated Recharge last 3 years
16% of Average for WY 1984-2009

Data: Soquel Creek Streamflow and Shallow Groundwater

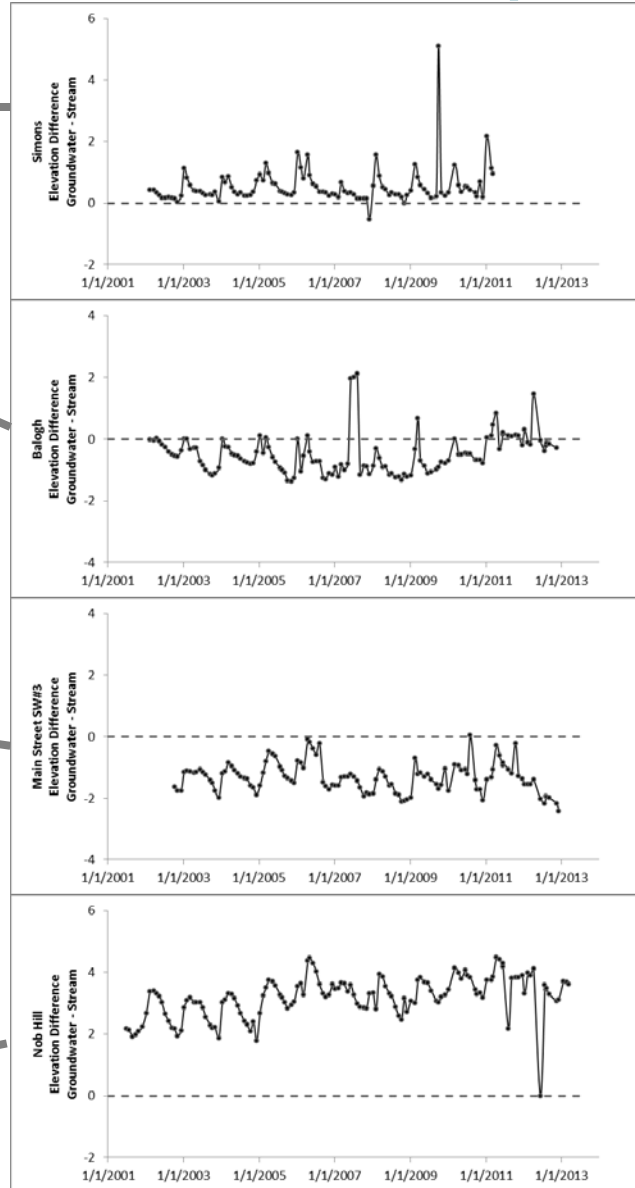
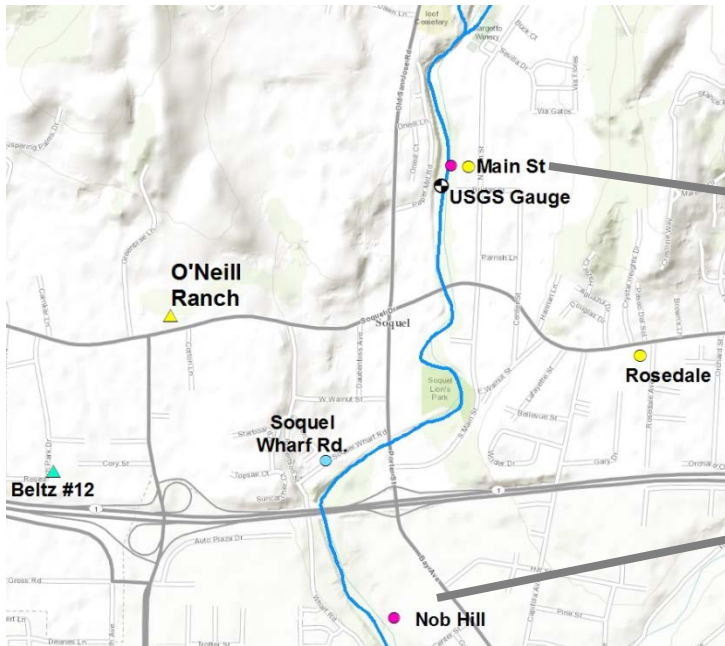
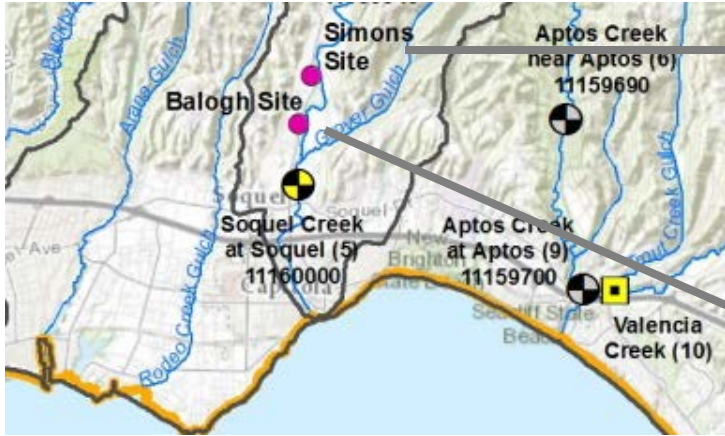
Upstream



Monitoring to Interpret Pumping Effects



Interpreted: Losing Reach of Soquel Creek



Losing Reach

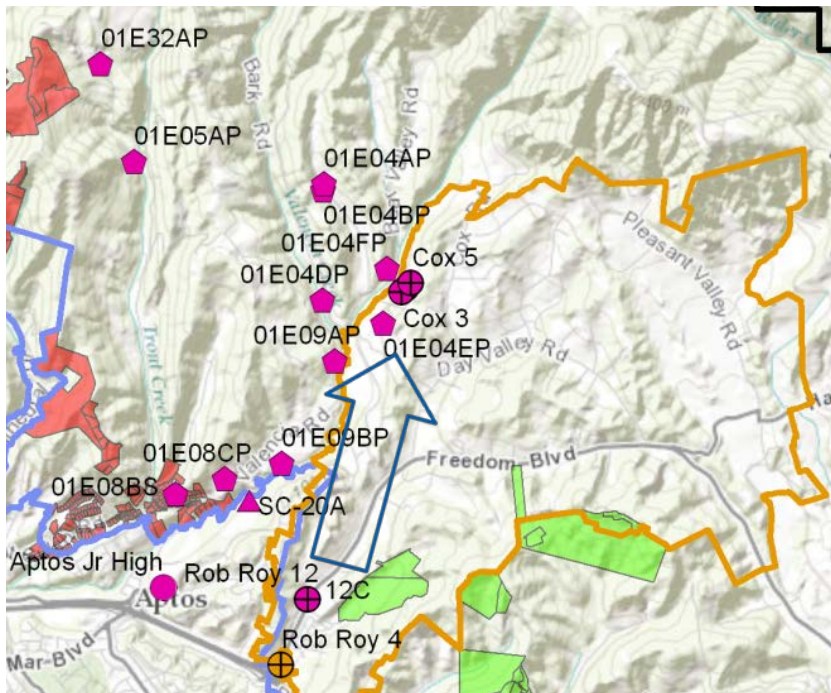
Pumping Effects at Private Wells

Data: Private Well Monitoring and Mitigation

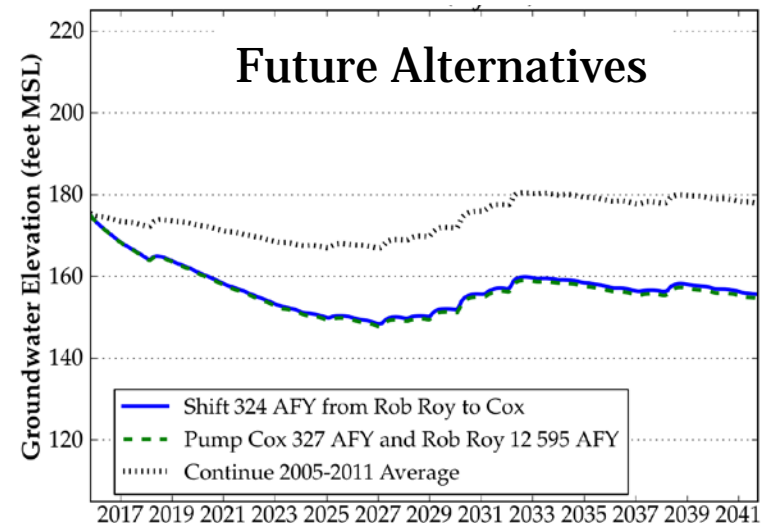
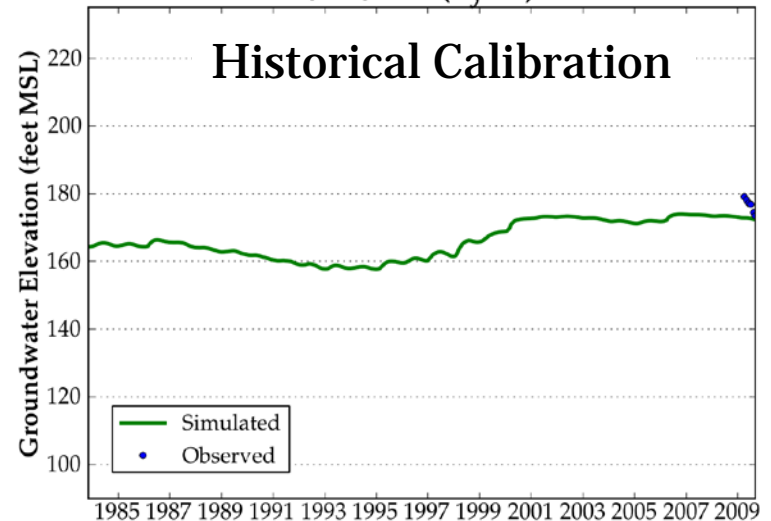


- Monitoring private wells near new SqCWD pumping for pumping effects
 - 13 private/mutual wells enrolled near Polo Grounds well
 - 8 private wells enrolled near O'Neill Ranch well

Estimated: Pumping Effects on Private Wells Evaluated by CWD Model



01E04EP (Lyr 7)



Data Collected

- Geologic and geophysical logs
- Groundwater levels
- Groundwater quality
- Water agency use
- Water use of some small water systems
- Rainfall
- Soquel Creek stream water levels and shallow groundwater levels
- Private well water levels and use for municipal pumping effects

Hydrogeologic Interpretation

- Basin geology (Hydrostratigraphy)
- Groundwater elevation contour maps
- Seawater intrusion salt interface
- Surface water-groundwater interaction on Soquel Creek
- Pumping effects on private wells

Calculated or Modeled Estimates

- Protective Elevations – coastal groundwater levels to protect basin from seawater intrusion
- Areal recharge
- Protective outflow to ocean
- Flow to Pajaro Valley
- Water use of some small water systems
- Water use of private pumpers
- Effects of potential pumping re-distribution by CWD

Information Refinements

- **Geophysics studies to locate seawater intrusion salt interface**
- **Calculate more accurate average levels from groundwater level logger data for comparison with protective elevations**
- **Expand CWD model to cover Purisima**

Q & A