Carpinteria Groundwater Sustainability Agency

Workshop #1

October 19, 2022

SGMA 101
Hydrogeologic Setting
Groundwater Conditions
Historical/Current Water Budget

Presented by:

Jeff Barry/GSI Water Solutions, Inc.

Robert Marks/Pueblo Water Resources

Topics

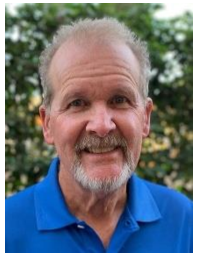
- Introductions
- What to Expect
- Stakeholder Engagement
- Sustainable Groundwater Management Act (SGMA) 101
- Hydrogeological Conceptual Model
- Groundwater Conditions
- Historical and Current Water Budget

Your GSP Development Team

Groundwater Sustainability Agency (GSA) Board Members

Matthew Roberts

Polly Holcombe



Ken Stendell

Case Van Wingerden

Shirley Johnson

GSA Staff

Bob McDonald

Consultant Team

Jeff Barry – GSI Water Solutions
Dave O'Rourke – GSI Water Solutions
Tim Nicely – GSI Water Solutions
Robert Marks – Pueblo Water Resources
Mike Burke -- Pueblo Water Resources
Bryan Bondy – Bondy Groundwater Consulting
Cameron Tana – Montgomery & Associates
Karen Snyder – Katz & Associates
Susan Harden – Katz & Associates
Emily Fan-Michaelson – Katz & Associates

What to Expect During GSP Development

- A GSP that is responsive to local needs and meets DWR requirements
- Understanding of the basin groundwater conditions
- Understanding of historical, current, and future projected water budgets for the basin
- Understanding groundwater quality in the basin
- Sustainable management criteria that tell us if the basin is being managed sustainably
- Projects or management actions that may be needed to bring the basin into a sustainable condition within 20 years
- Engagement of stakeholders to seek input

All perspectives will be heard and considered:

- Growers and groundwater users
- Public water systems
- Local land use planning agencies
- Environmental interests
- Disadvantaged communities
- Public/rate payers

SHARED GOAL:

A sustainably managed groundwater basin that supports our way of life.

- We plan to form a stakeholder advisory committee that includes many of these interests.
- GSP chapters will be posted for public review at: https://carpgsa.org/get-involved-meetings-docs-comments/
- Please provide written comments on the website. We will be sure to document and respond to all written comments as the GSP is prepared.

Sustainable Groundwater Management Act

- Legislation established in 2014 and effective as of January 2015.
- Applies to basins defined by DWR (Bulletin 118) that are classified as medium, high, or critically overdrafted (Carpinteria is classified as high priority).
- GSAs have 20 years to demonstrate sustainability (Carpinteria has until 2044).
- The key to demonstrating a basin is meeting its **sustainability goal** is by avoiding **undesirable results** defined by stakeholders.
- Sustainable management criteria are critical elements of the GSP that define sustainability in the basin.

Pathway to Sustainability

Addressing the Six Undesirable Results

Chronic Lowering of Groundwater Levels

Water Quality Degradation

Reduction of Groundwater Storage

Interconnected Surface Water Depletions

Land Subsidence

Seawater Intrusion

GSP Development Schedule

2021

- [x] DWR Grant Agreement
- [x] Contracting for Technical Services
- [x] Geophysics (ERT) Survey
- [x] Data Management System

2022

- [x] Outreach plan
- [x] Hydrogeologic & Numerical Model Updates
- [x] Basin setting and water budgets
- [ ] Workshop Nos. 1, 2, and 3
- [ ] Monitoring networks
- [ ] Sustainable management criteria

2023

- [ ] Monitoring well construction
- [ ] Sustainable management criteria
- [ ] Projects & Mgmt. Actions
- [ ] Workshop Nos. 4, 5, and 6
- [ ] Draft GSP and Comment Period (Oct. 2023)
- [ ] Update and adopt GSP (Nov. 2023)
- [ ] Submit GSP to DWR (Dec. 2023)

2024

- [ ] DWR Grant close out
- [ ] First SGMA Annual Report
- [ ] Begin GSP Implementation

Questions?

CARPINTERIA GSA

GROUNDWATER SUSTAINABILITY AGENCY

Carpinteria Groundwater Basin GSP Development Project

Workshop No. 1

10/19/22 6:00 PM

Robert C. Marks, PG, CHg

Principal Hydrogeologist

Pueblo Water Resources, Inc.

PUEBLO water resources

Presentation Outline

Basin Setting Chapter

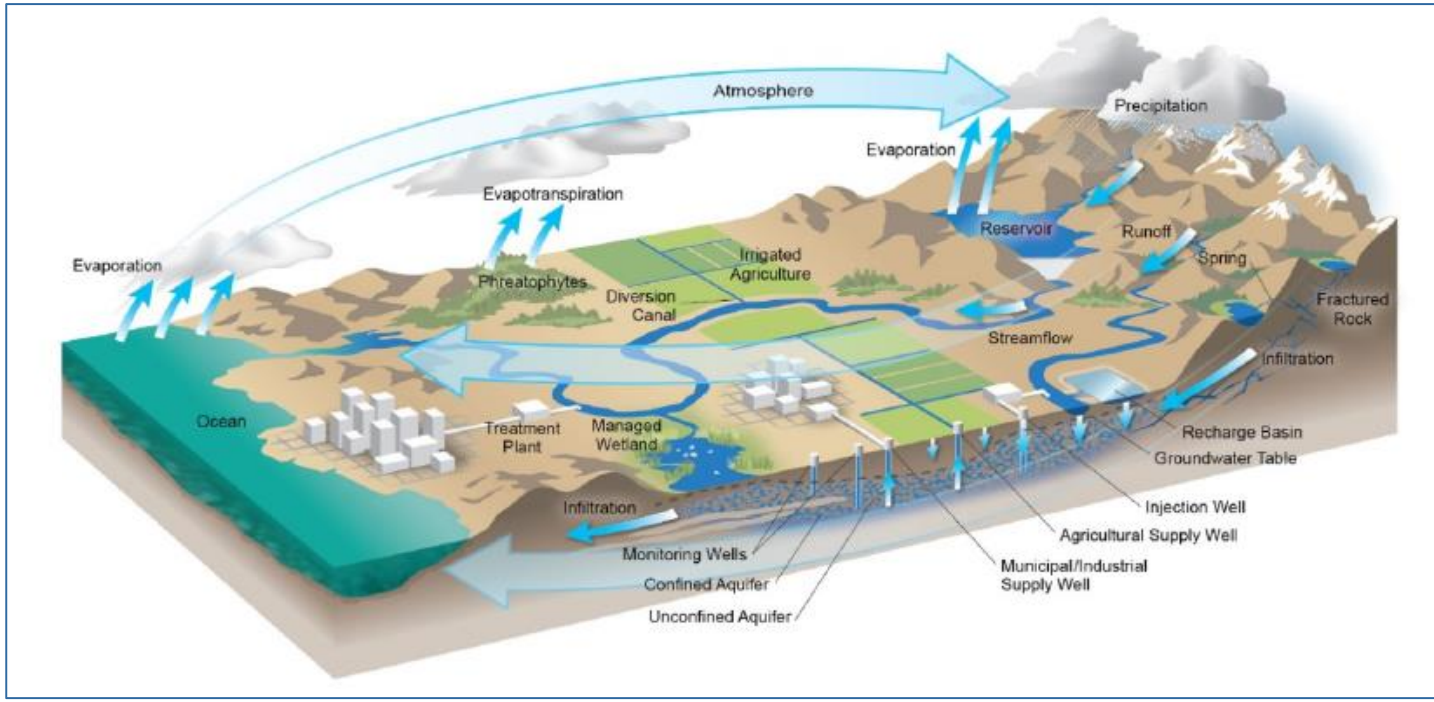
1. Hydrogeologic Conceptual Model (HCM)
2. Groundwater Conditions
3. Historical and Current Water Budgets

Hydrogeologic Conceptual Model (HCM)

What is an HCM?

"An idealized description of the real hydrogeological system in the study area, describing in a concise and coherent way the components of the hydrogeological system and the interactions between those components"

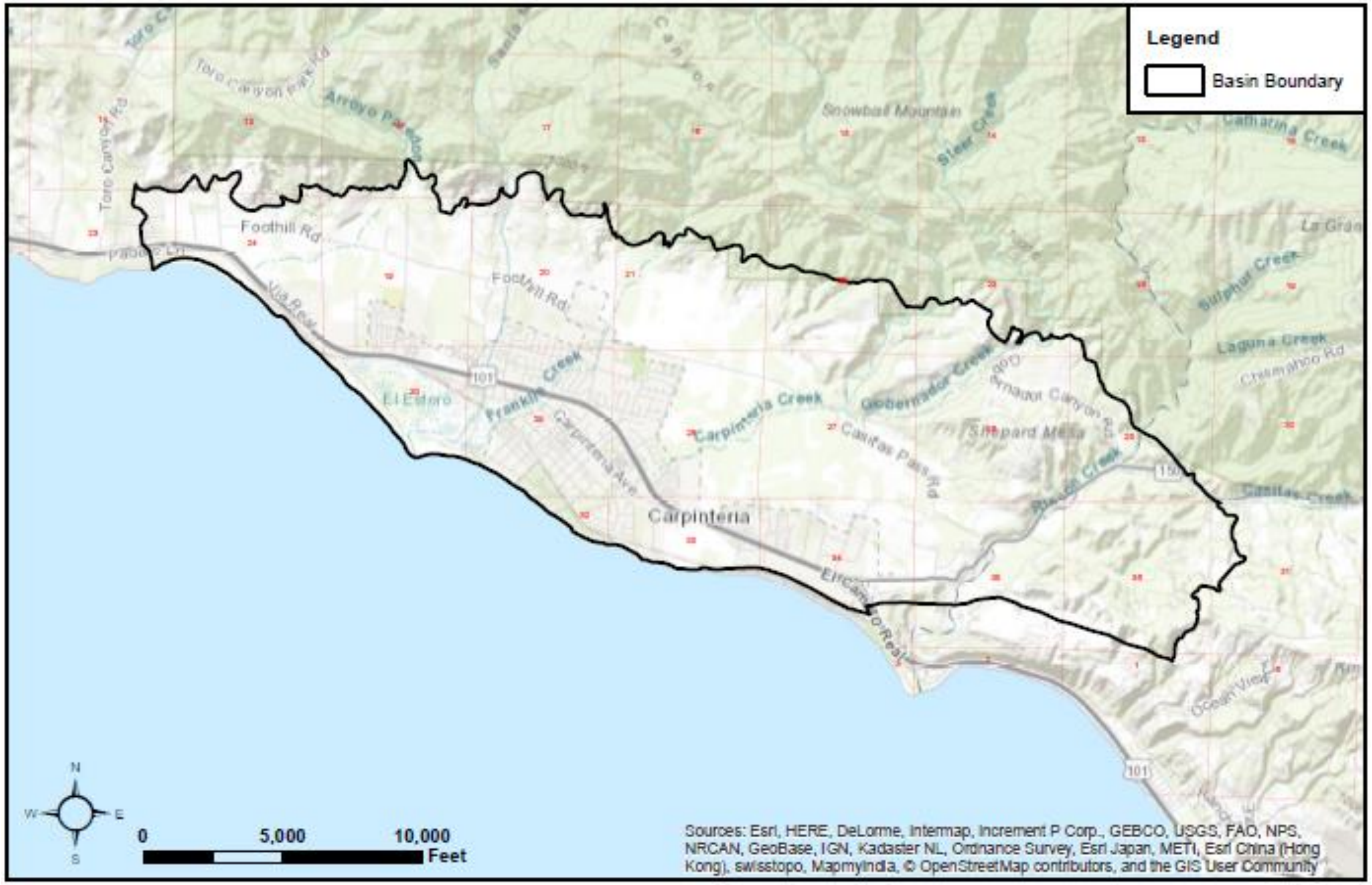
- ✓ Hydrogeology ~ Geology + Hydrologic Cycle
- ✓ Defensible and simplified, yet as realistic as possible, <u>supported by available data</u>



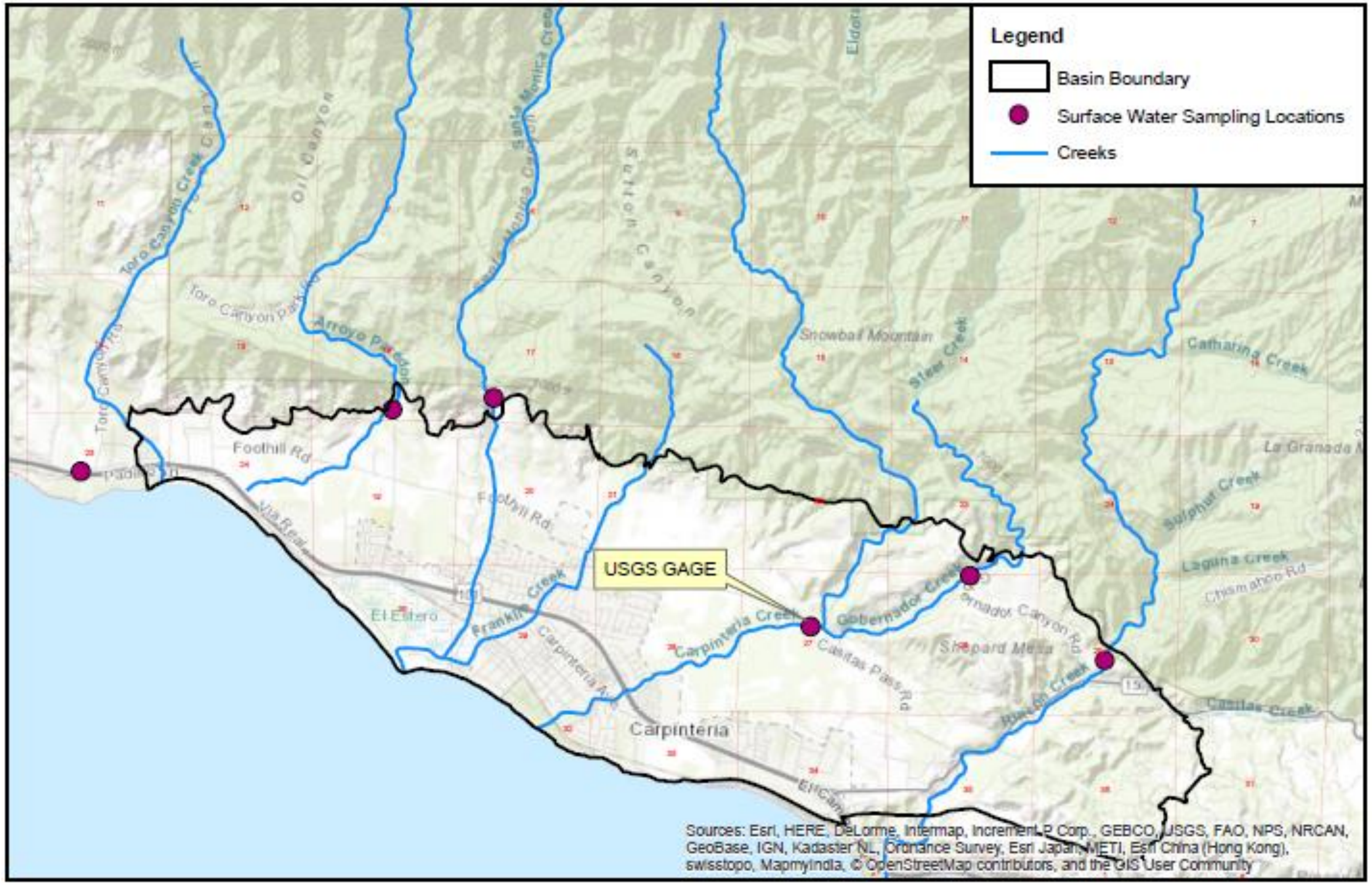
Previous Basin Investigations

- Upson, J.E. and Thomasson, H.G. (1951), Geology and Ground-Water Resources of the South-Coast Basins of Santa Barbara County, California, U.S. Geological Survey Water Supply Paper 1108.
- Lian, H.M (1952), The Geology and Paleontology of the Carpinteria District, Santa Barbara, California, unpublished Ph. D. dissertation, University of California at Los Angeles.
- Evenson, R.E., Wilson, H.D., Jr., and Muir, K.S. (1962), Yield of the Carpinteria and Goleta Ground Water Basins, Santa Barbara County, California, 1941 – 58, U.S. Geological Survey Open-File Report.
- Slade, R.C. (1975), Hydrogeologic Investigation of the Carpinteria Ground Water Basin, unpublished M.A. Thesis, University of Southern California.
- **Geotechnical Consultants, Inc. (1976),** Hydrogeologic Investigation of Carpinteria Ground Water Basin, prepared for Carpinteria County Water District.
- Geotechnical Consultants, Inc. (1985), Hydrogeologic Update, Carpinteria Groundwater Basin, prepared for Carpinteria County Water District.
- Sullwold, H.H. (1996), Carpinteria Groundwater Basin, A Geological Up-date, prepared for Carpinteria Valley Water District.
- **Pueblo Water Resources, Inc. (2012),** Carpinteria Groundwater Basin, Hydrogeologic Update and Groundwater Model Project, prepared for Carpinteria Valley Water District.

Basin Topographic Map



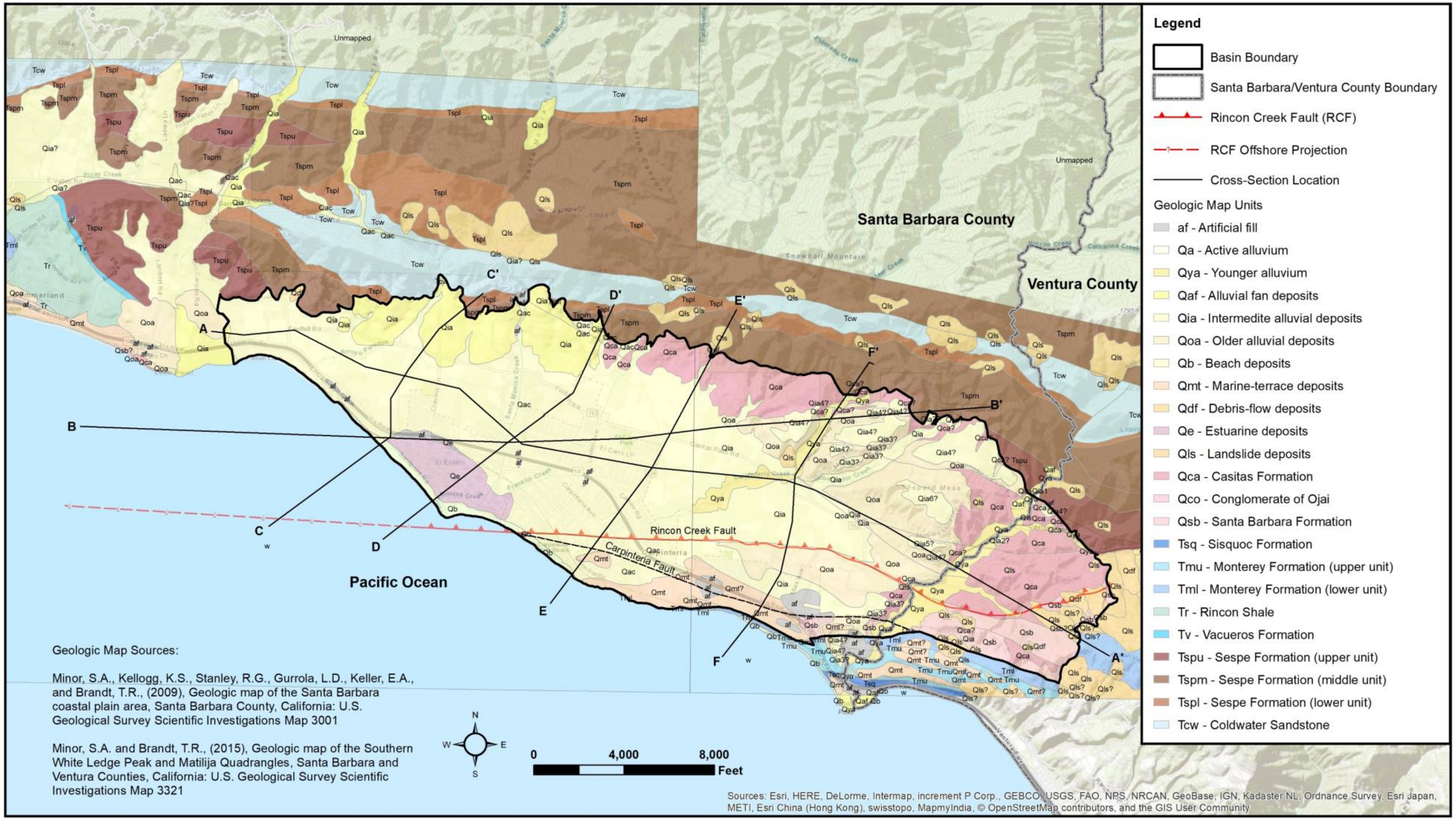
Basin Creeks



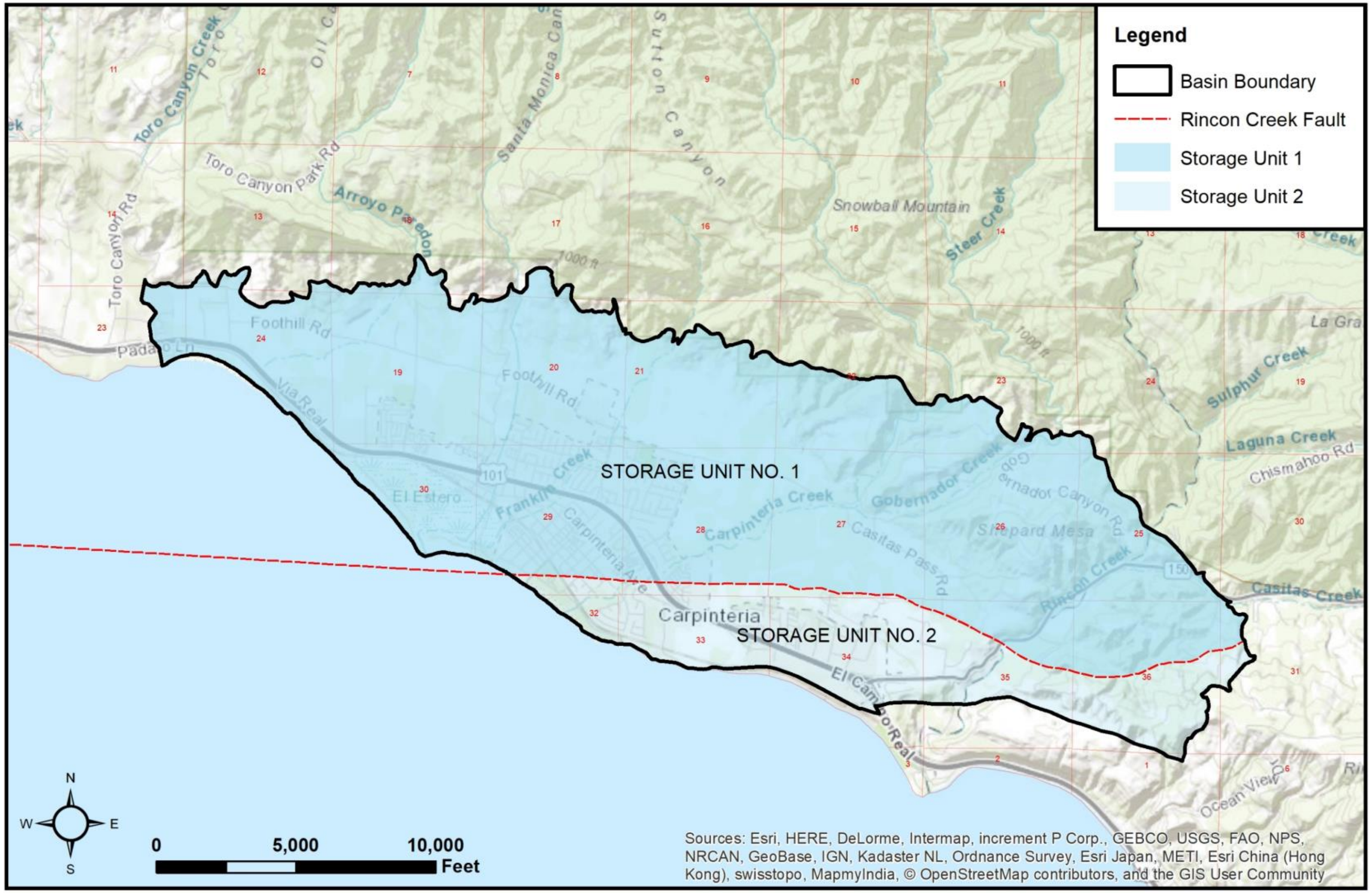
Basin General Description

- Geologic structural depression filled with unconsolidated deposits (sand, gravel, silt, & clay):
  - Alluvial Deposits
  - Casitas Formation
  - Santa Barbara Formation
- Boundaries consist of consolidated bedrock (hard rock) and the Pacific Ocean (administrative boundary w/ MGB)

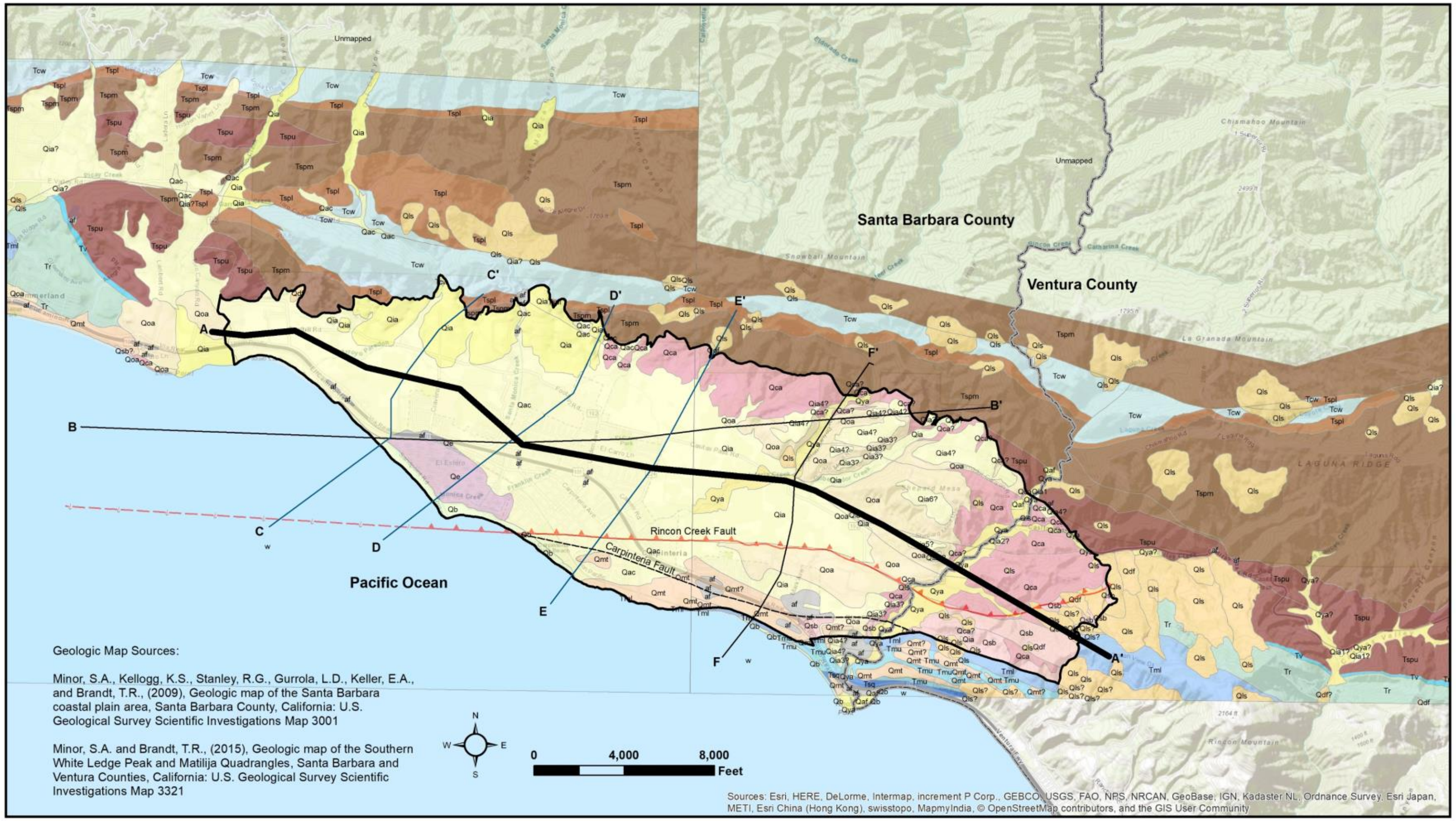
Geologic Map – Basin Boundaries



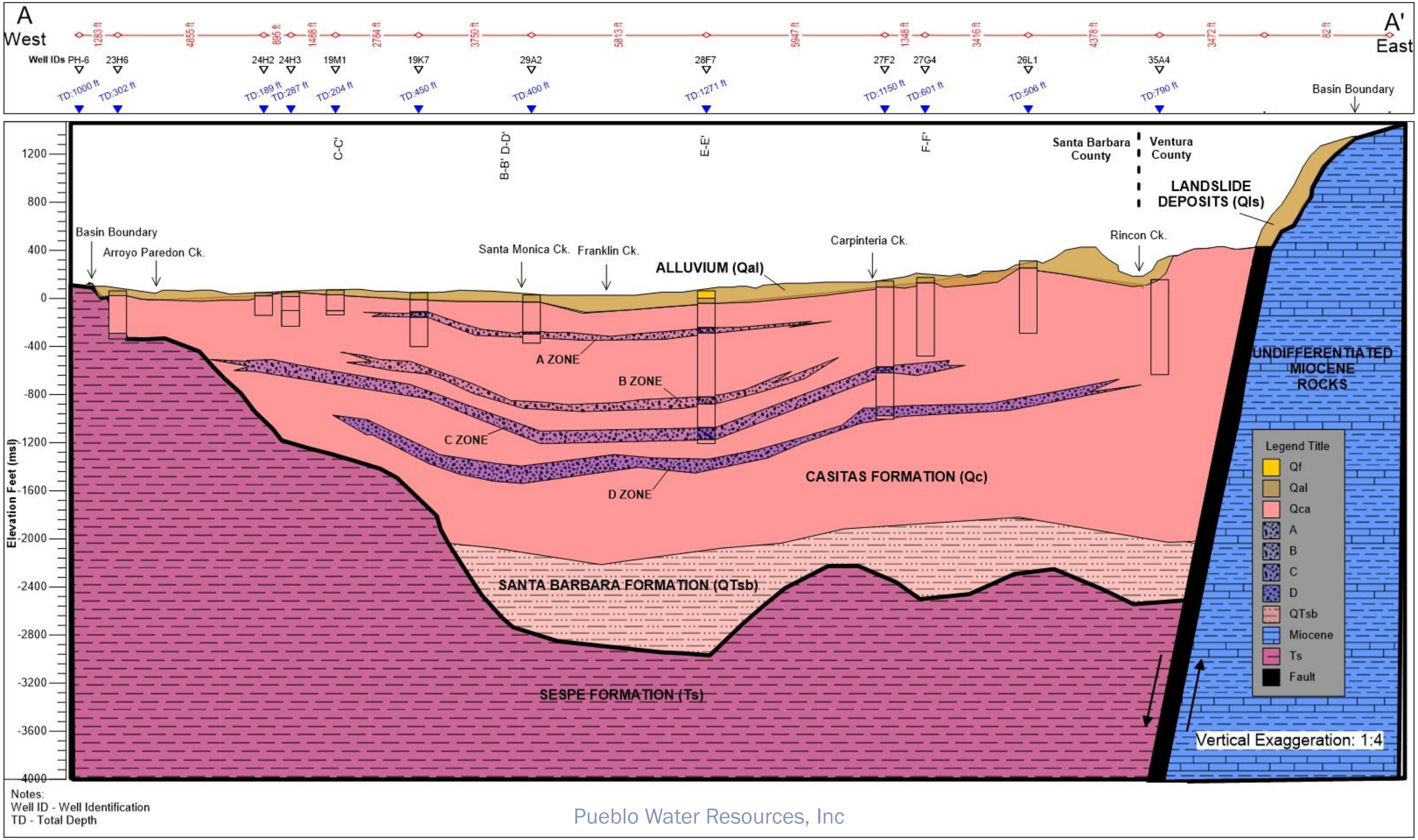
Storage Units



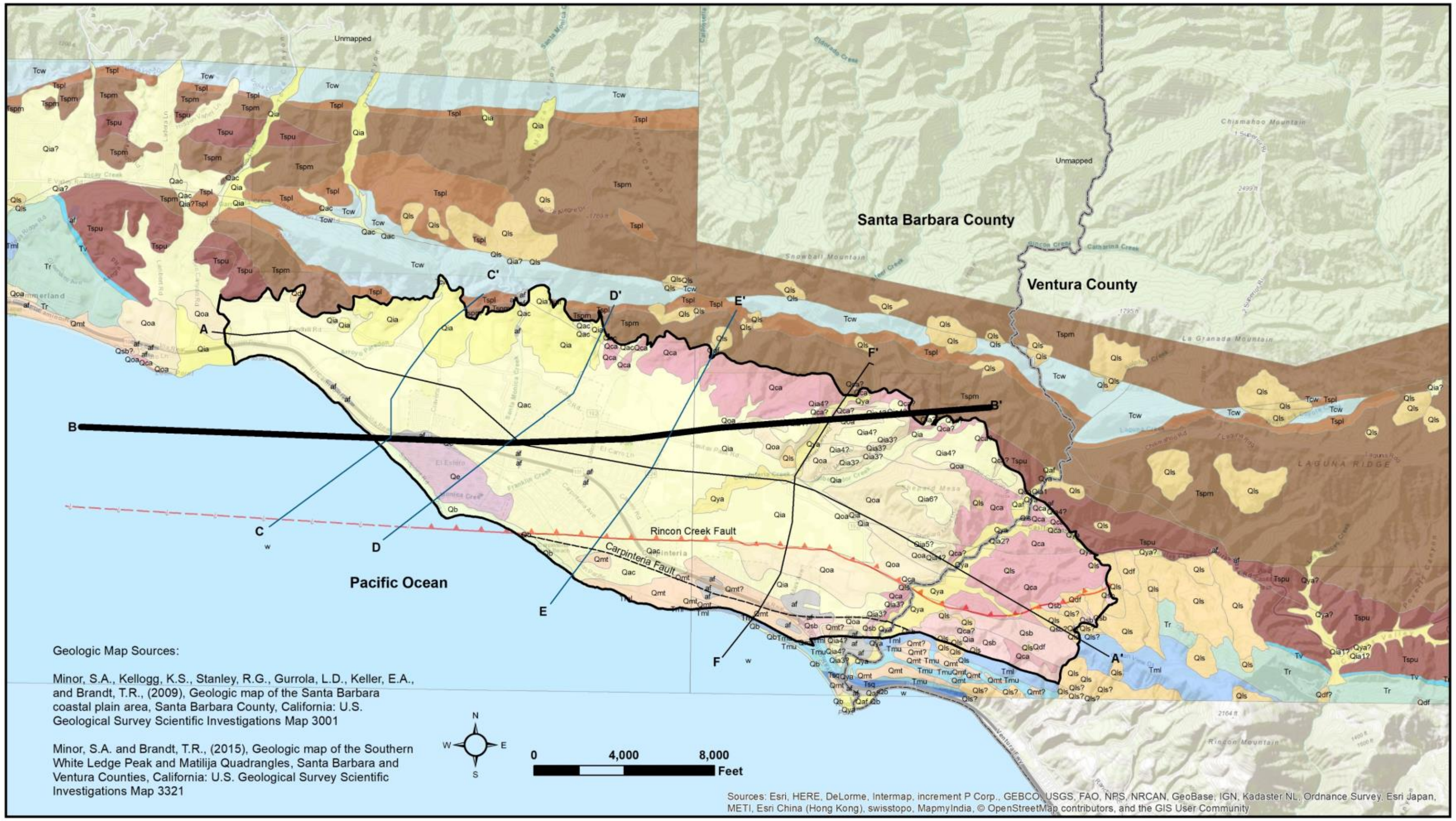
Geologic Cross-Section Location (A – A')



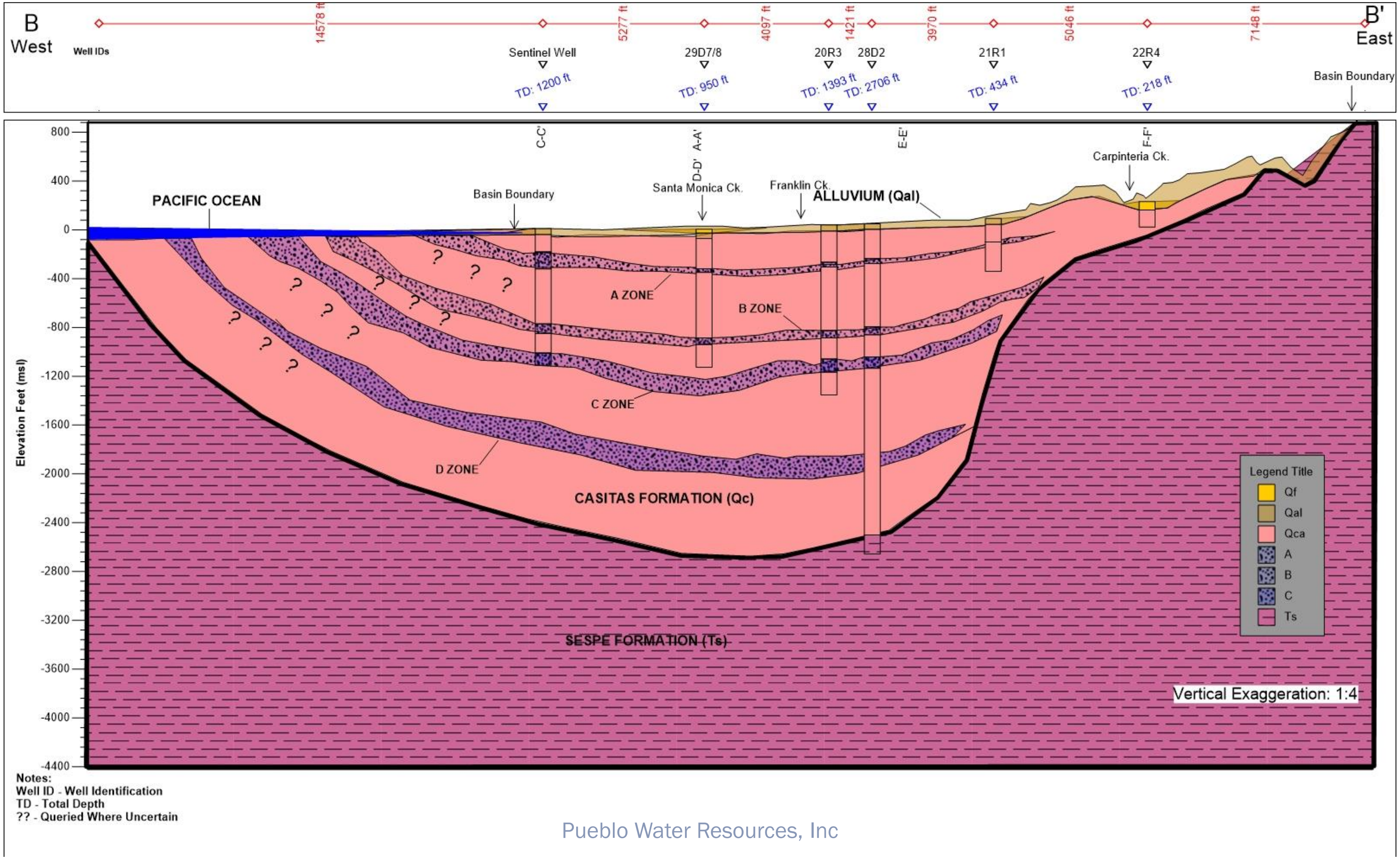
Geologic Cross-Section A – A’



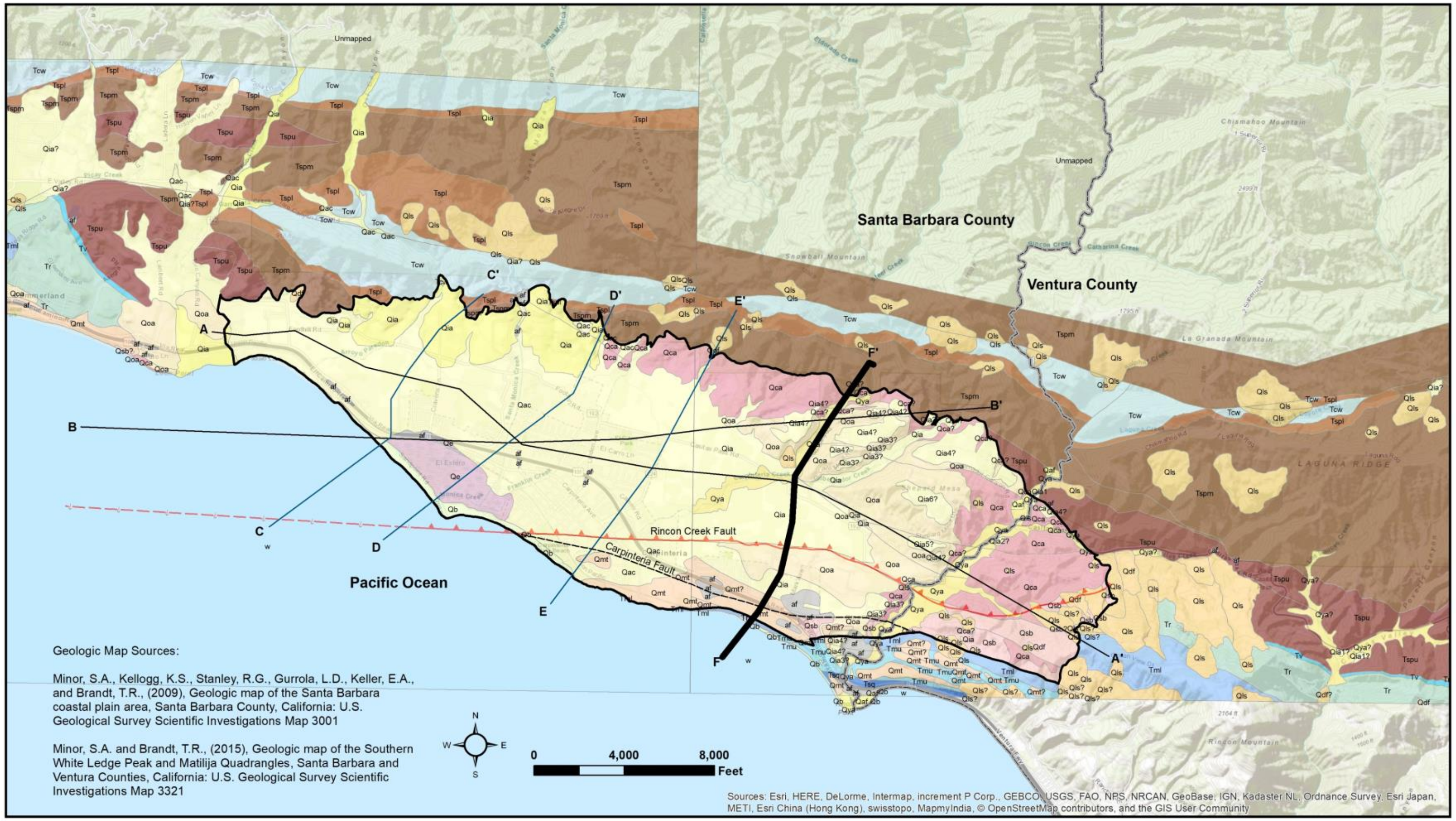
Geologic Cross-Section Location (B – B')



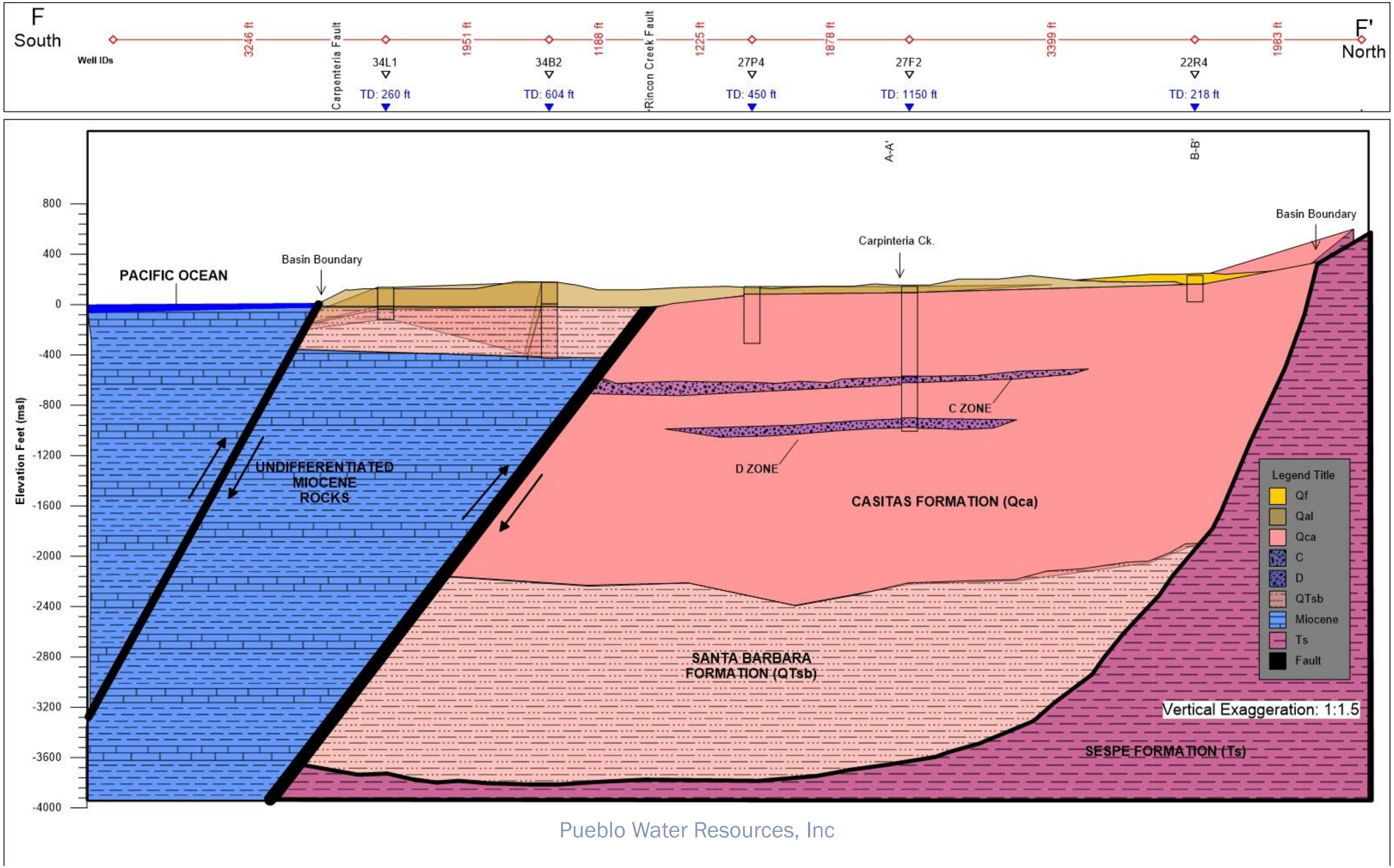
Geologic Cross-Section B – B’



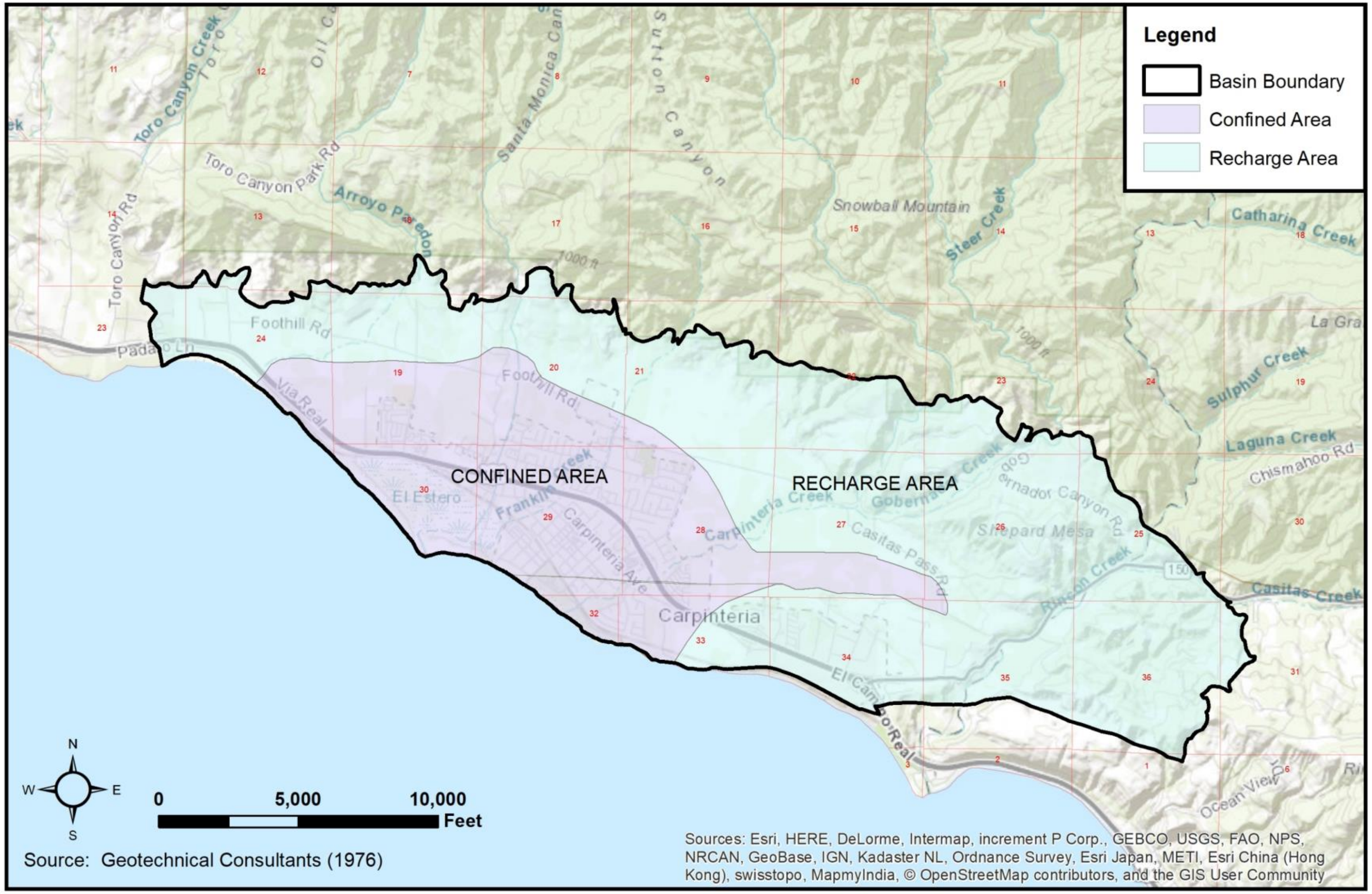
Geologic Cross-Section Location (F – F’)



Geologic Cross-Section F – F’



Confined and Recharge Areas

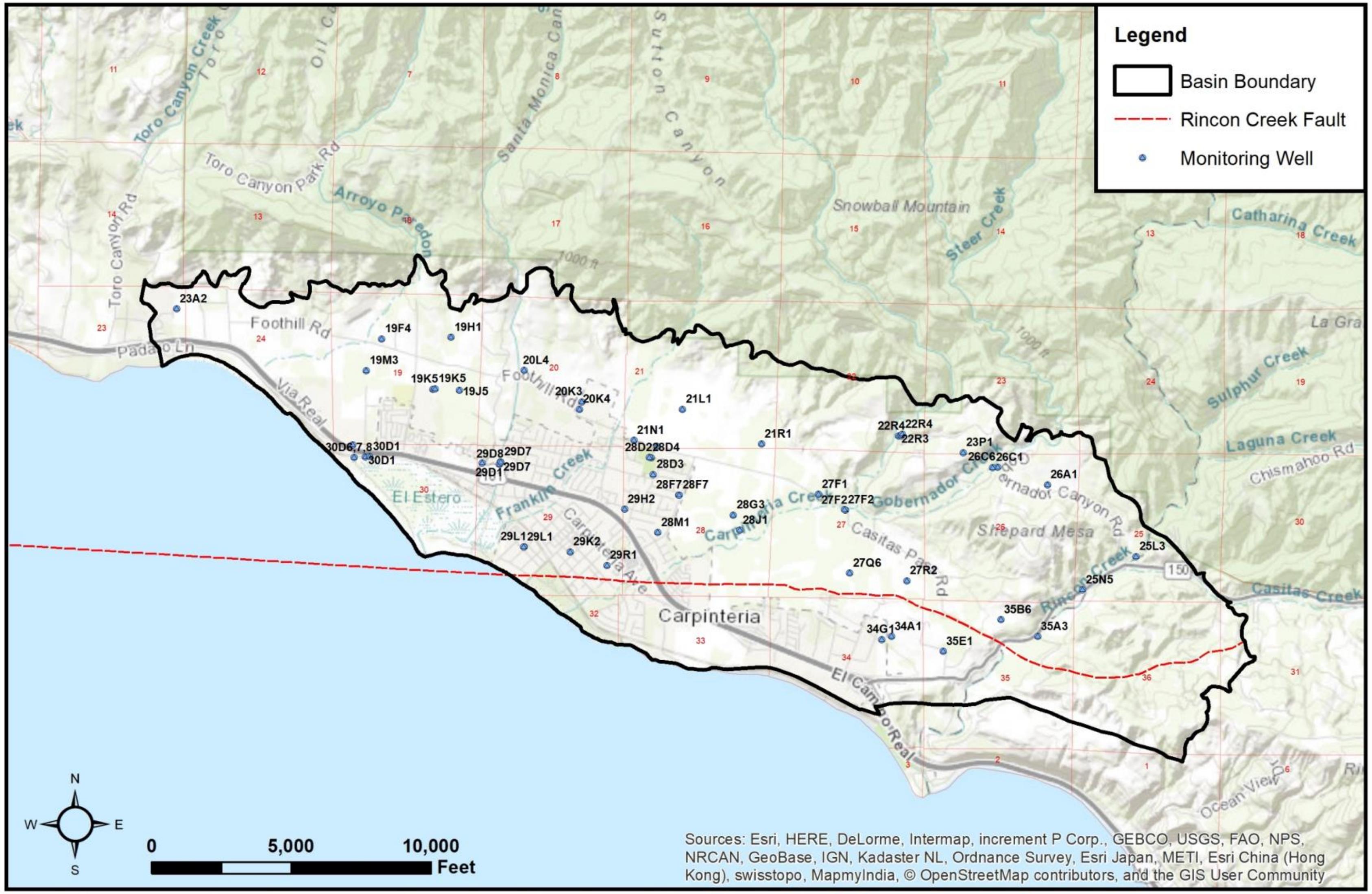


HCM Q&A

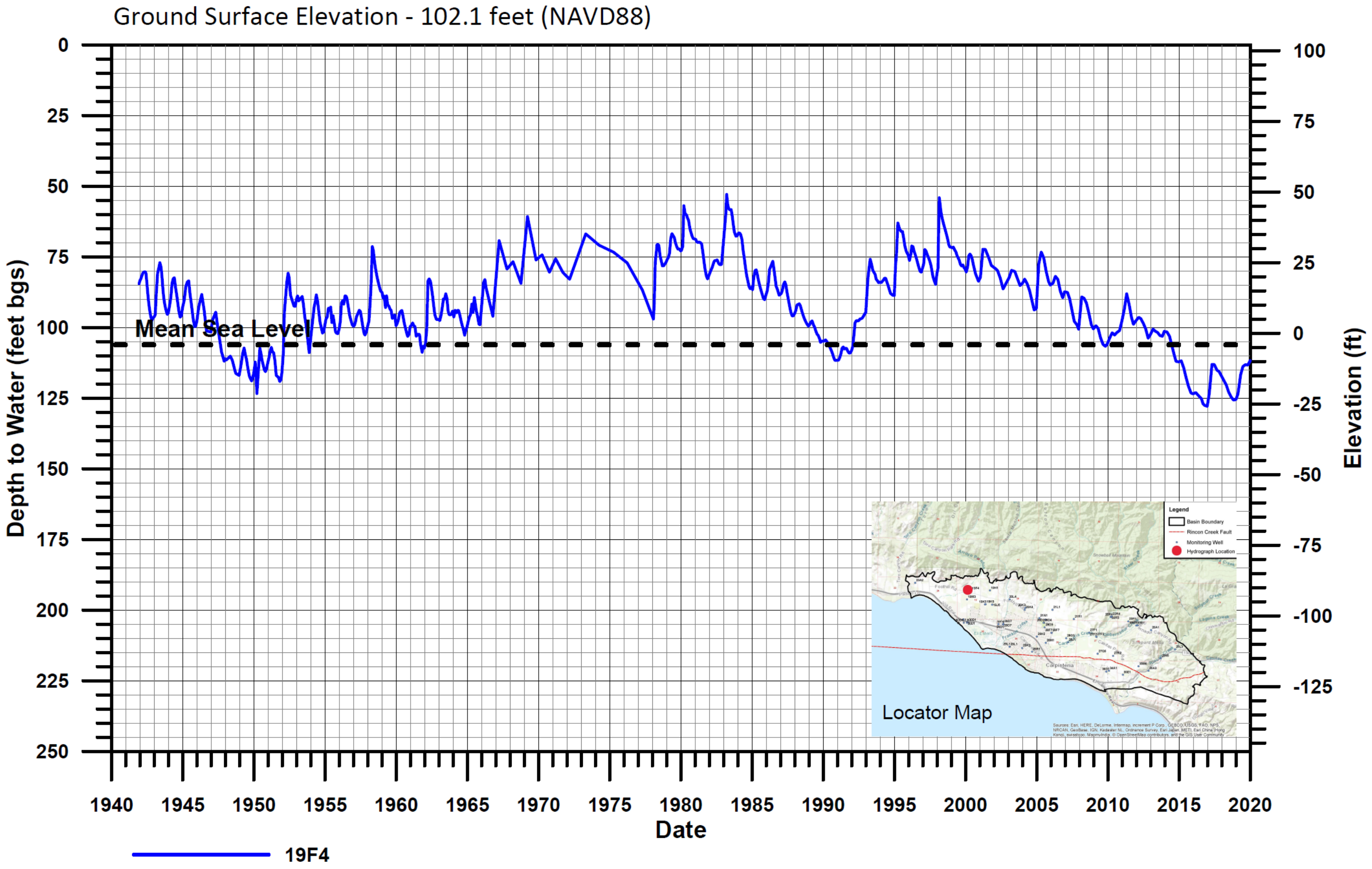
Groundwater Conditions

- Water Levels
- Water Quality
- Seawater Intrusion
- Interconnected Surface Water and Groundwater
- Groundwater Dependent Ecosystems
- Land Subsidence

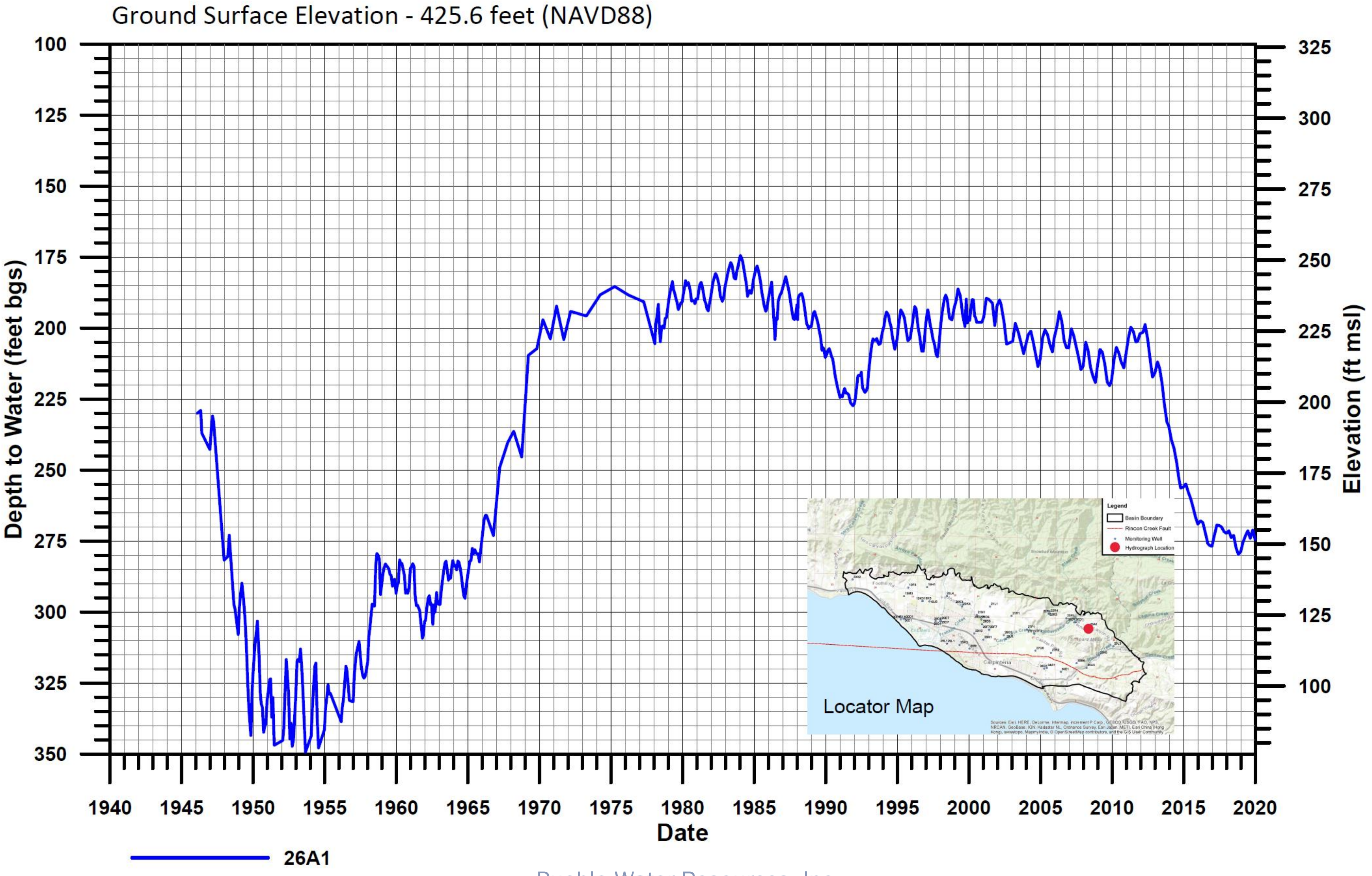
Monitoring Well Network



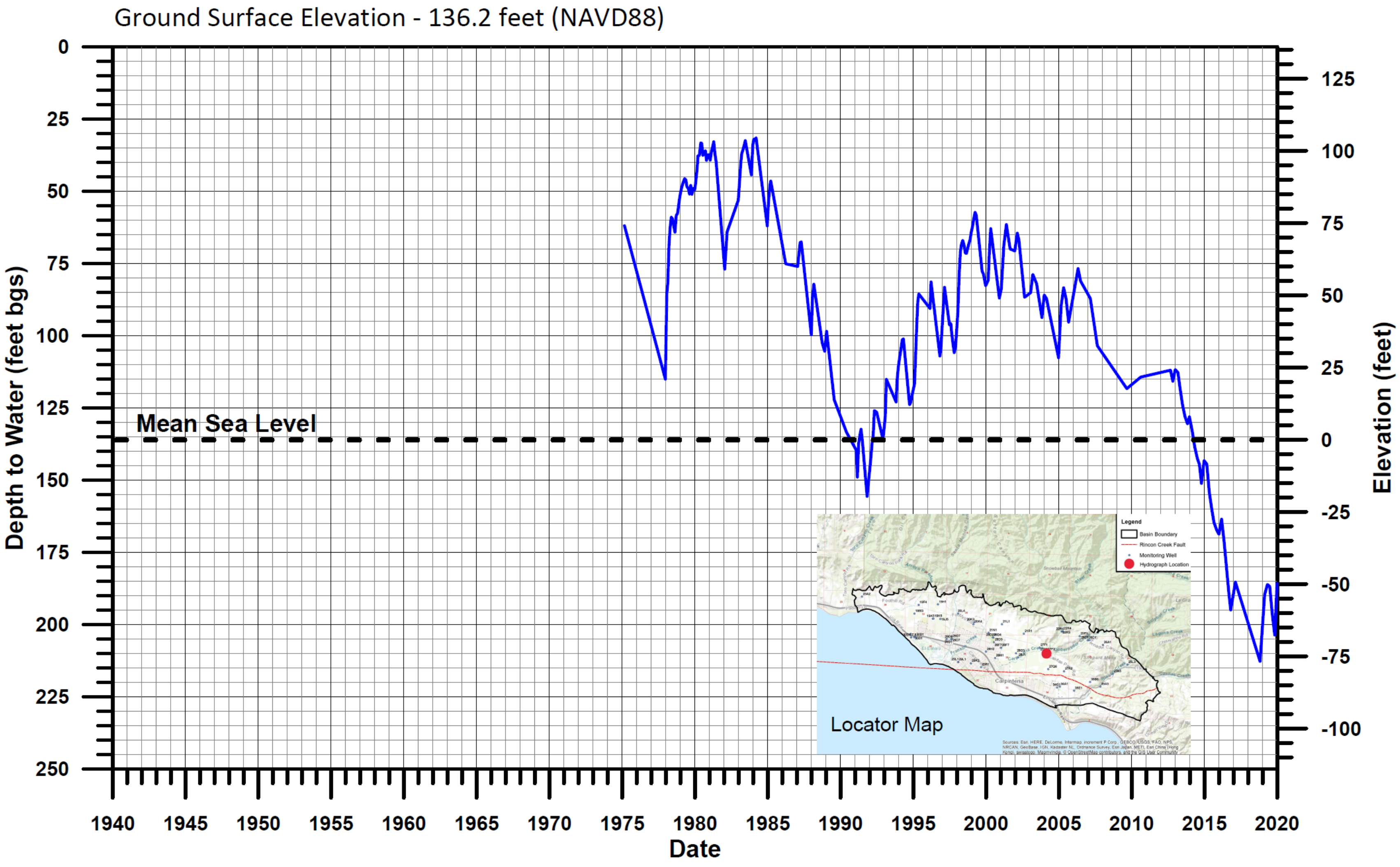
Water Level Hydrograph (19F4)



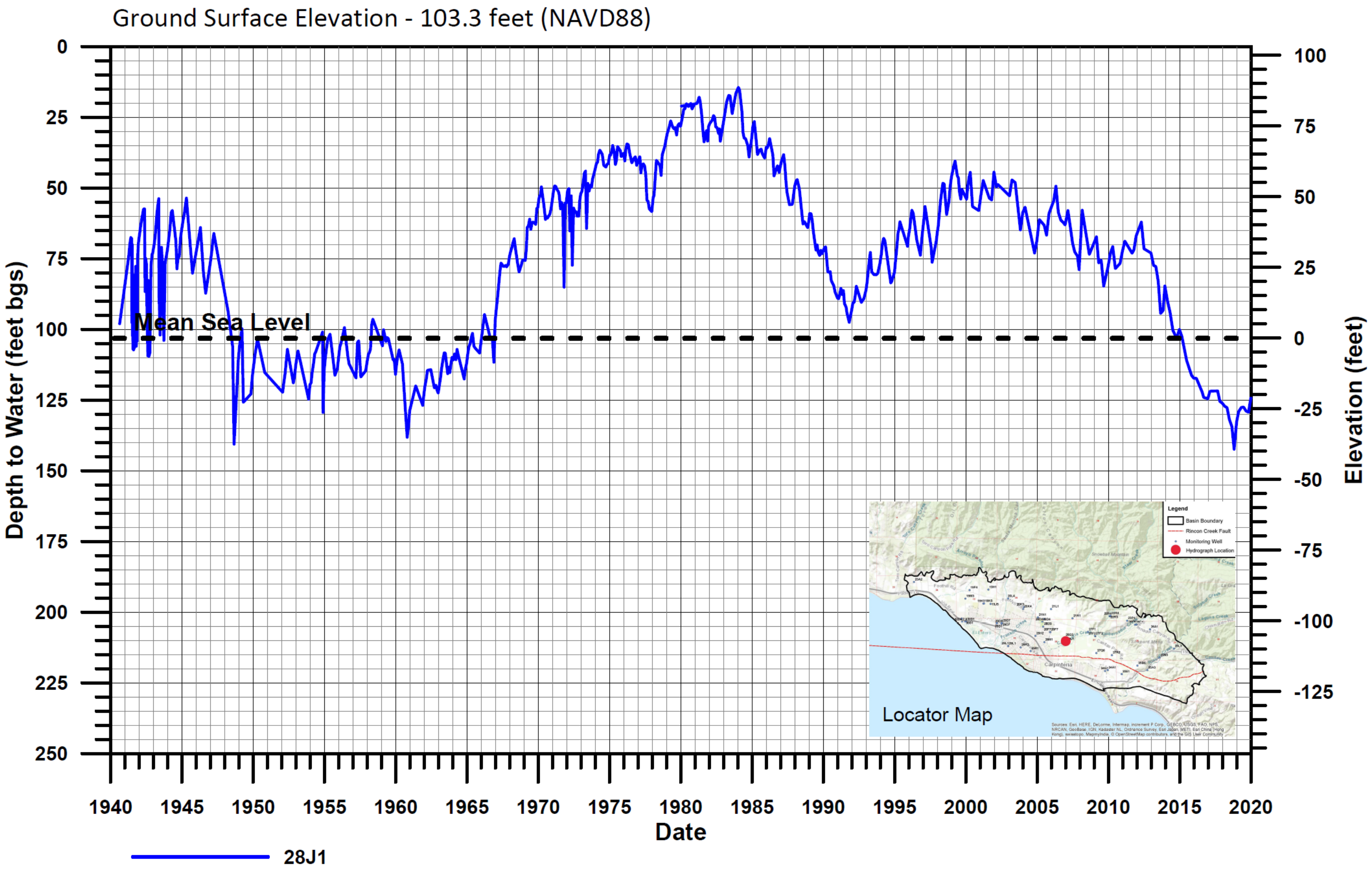
Water Level Hydrograph (26A1)



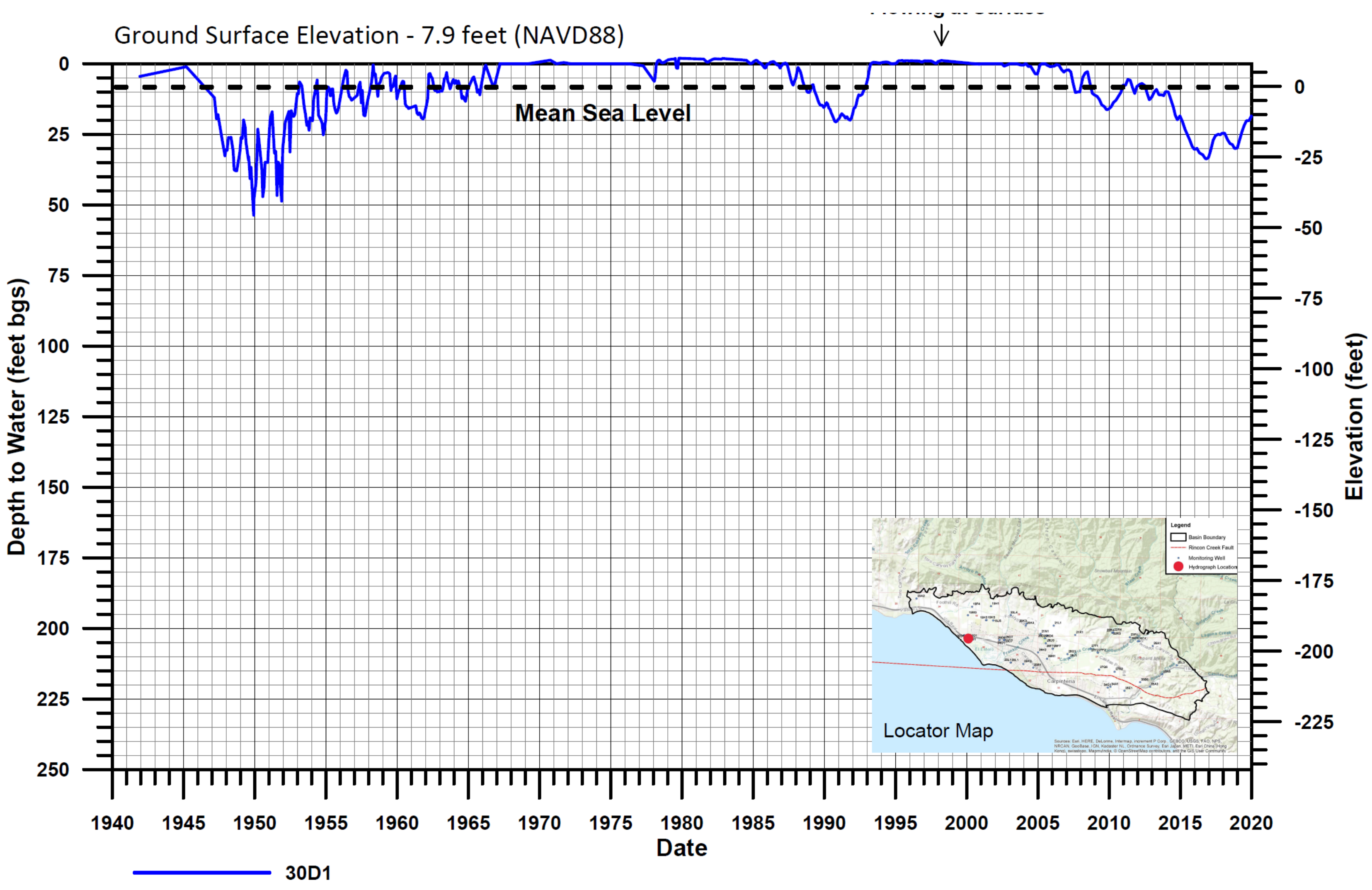
Water Level Hydrograph (27F2 - Smille)



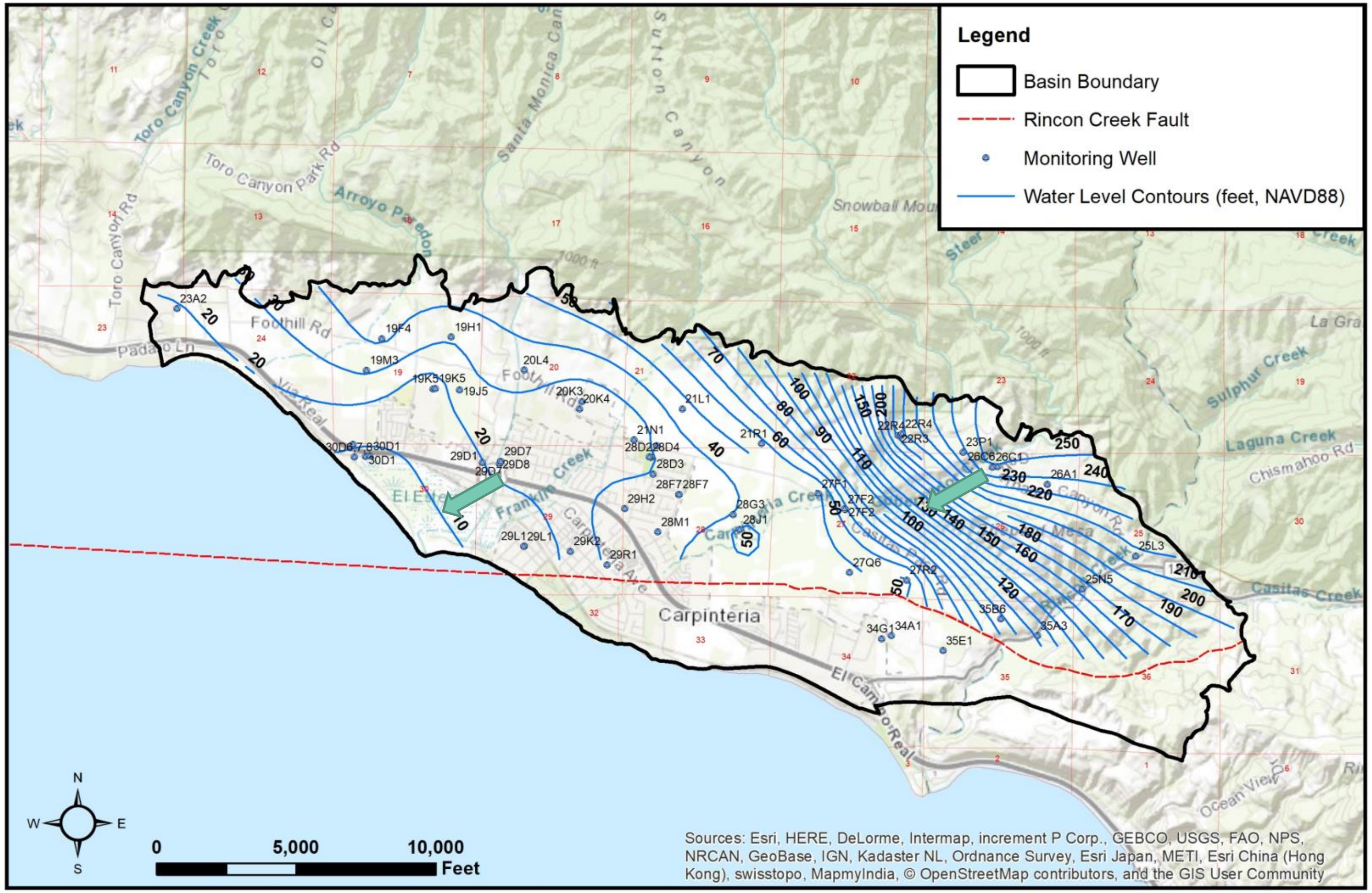
Water Level Hydrograph (28J1)



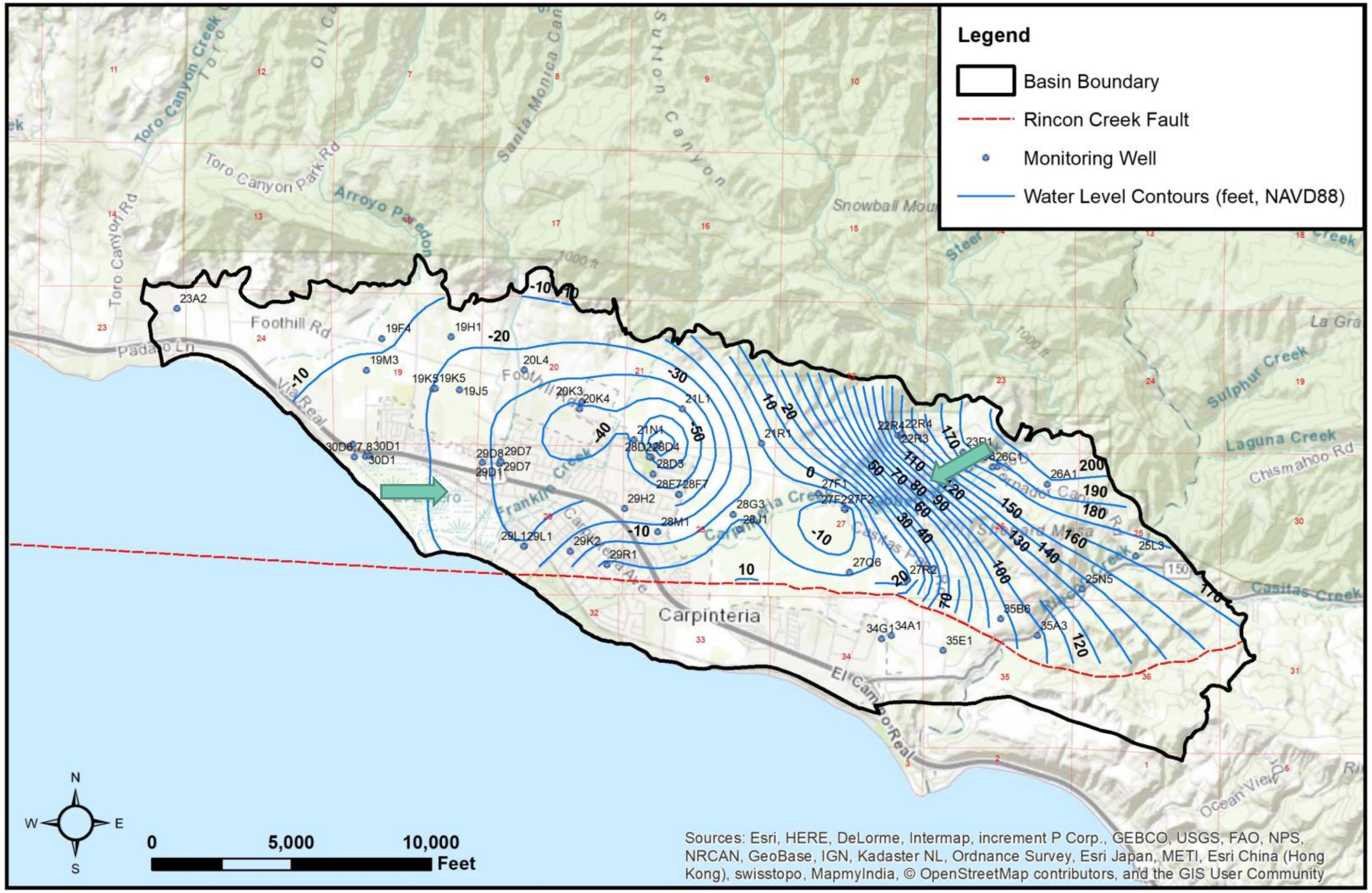
Water Level Hydrograph (30D1)



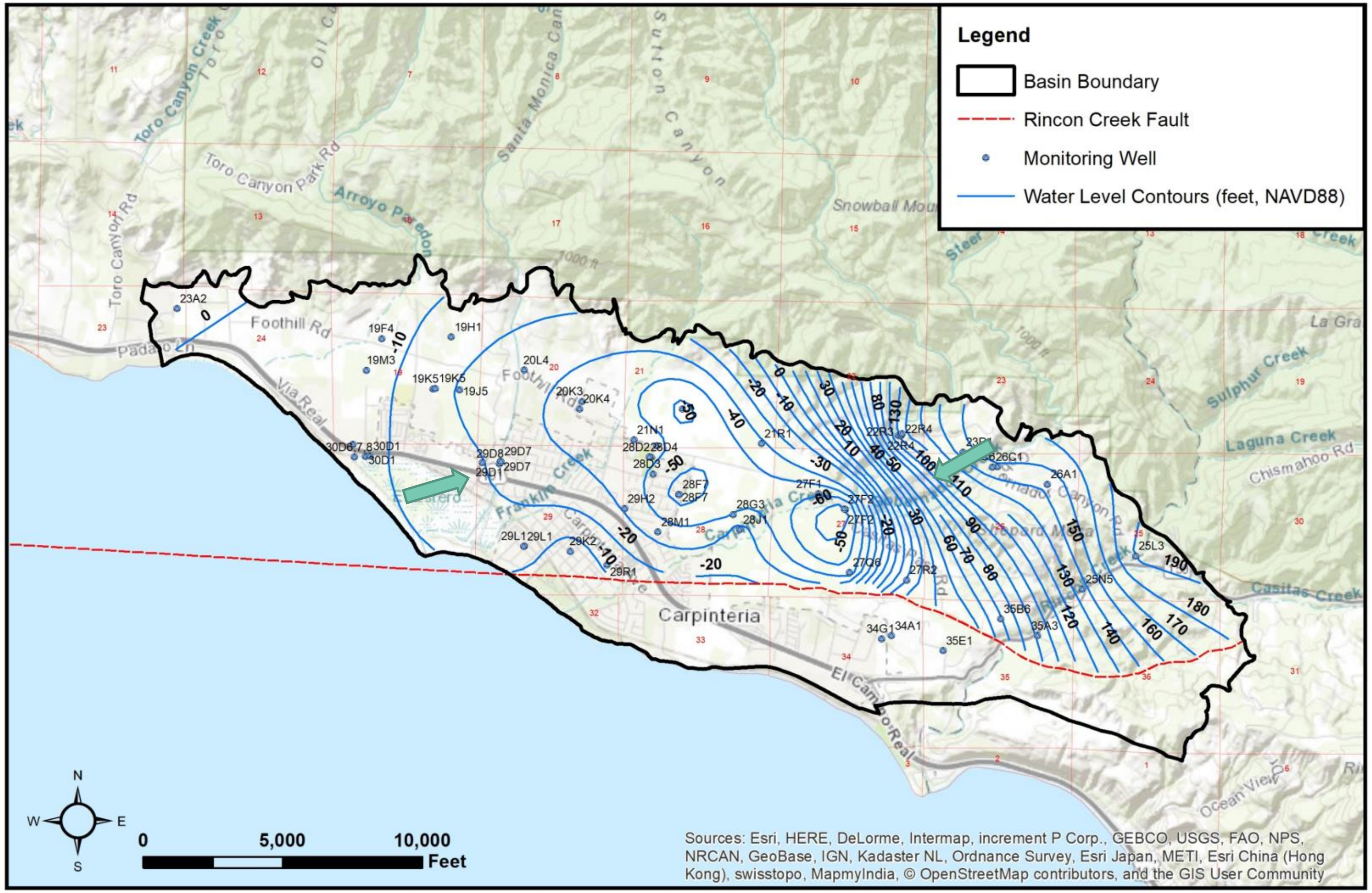
Groundwater Elevation Contours (Spring 1999)



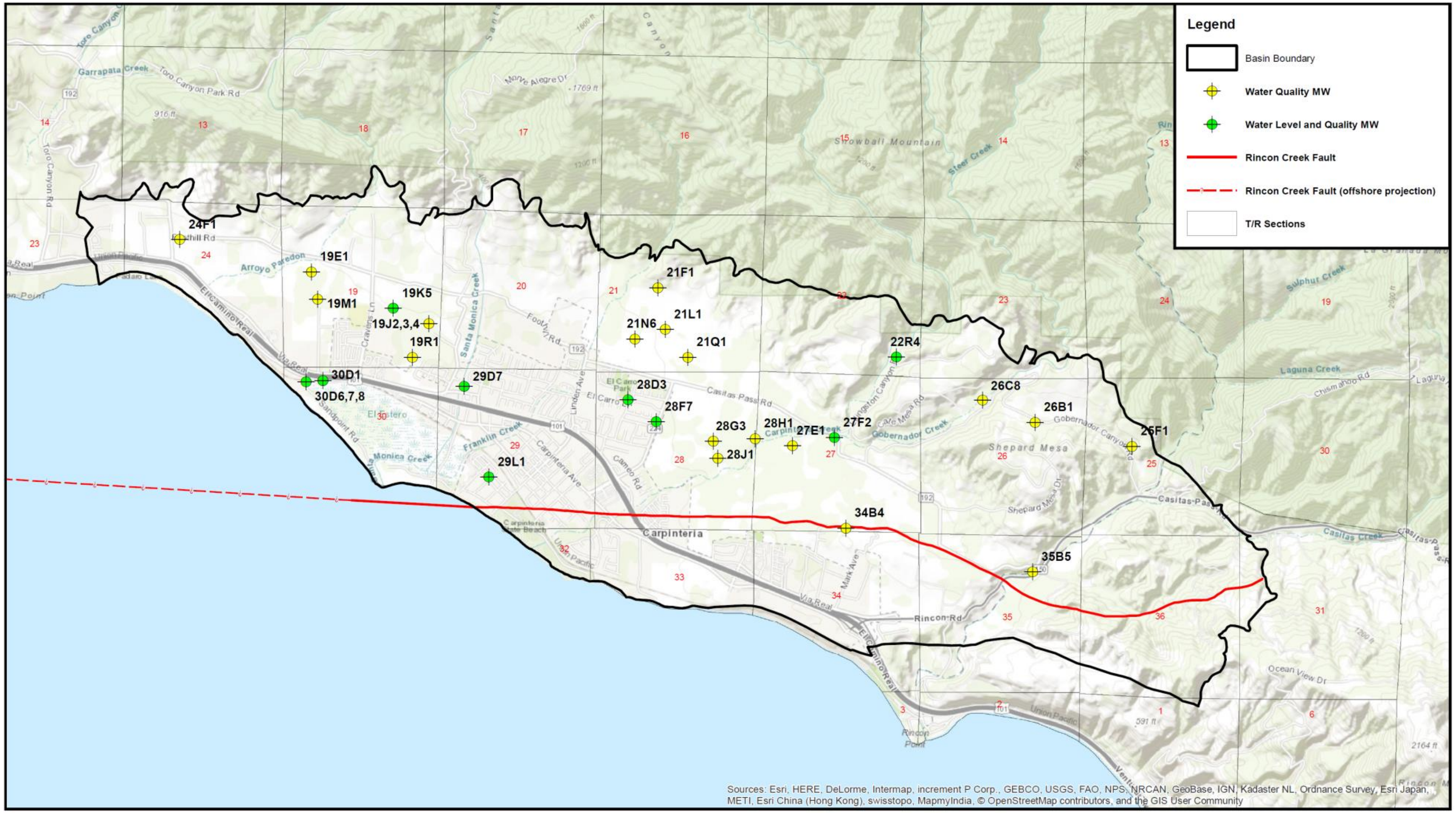
Groundwater Elevation Contours (Fall 1991)



Groundwater Elevation Contours (Fall 2020)



Water Quality Monitoring Well Location Map



Water Quality – General

Overall good quality, with calcium-bicarbonate character

Central Coast RWQCB Basin Plan Water Quality Objectives (WQOs)

TDS = 700 mg/l

Chloride = 100 mg/L

Nitrate (as N) = 7 mg/L

Water Quality – Total Dissolved Solids (TDS)

- TDS concentrations range between approximately 600 – 900 mg/L at most locations in basin
- Notable exceptions include:

- 19E1: Increased from 1,000 to 1,500 mg/L
- 19K5: Increased from 1,200 to 1,400 mg/L

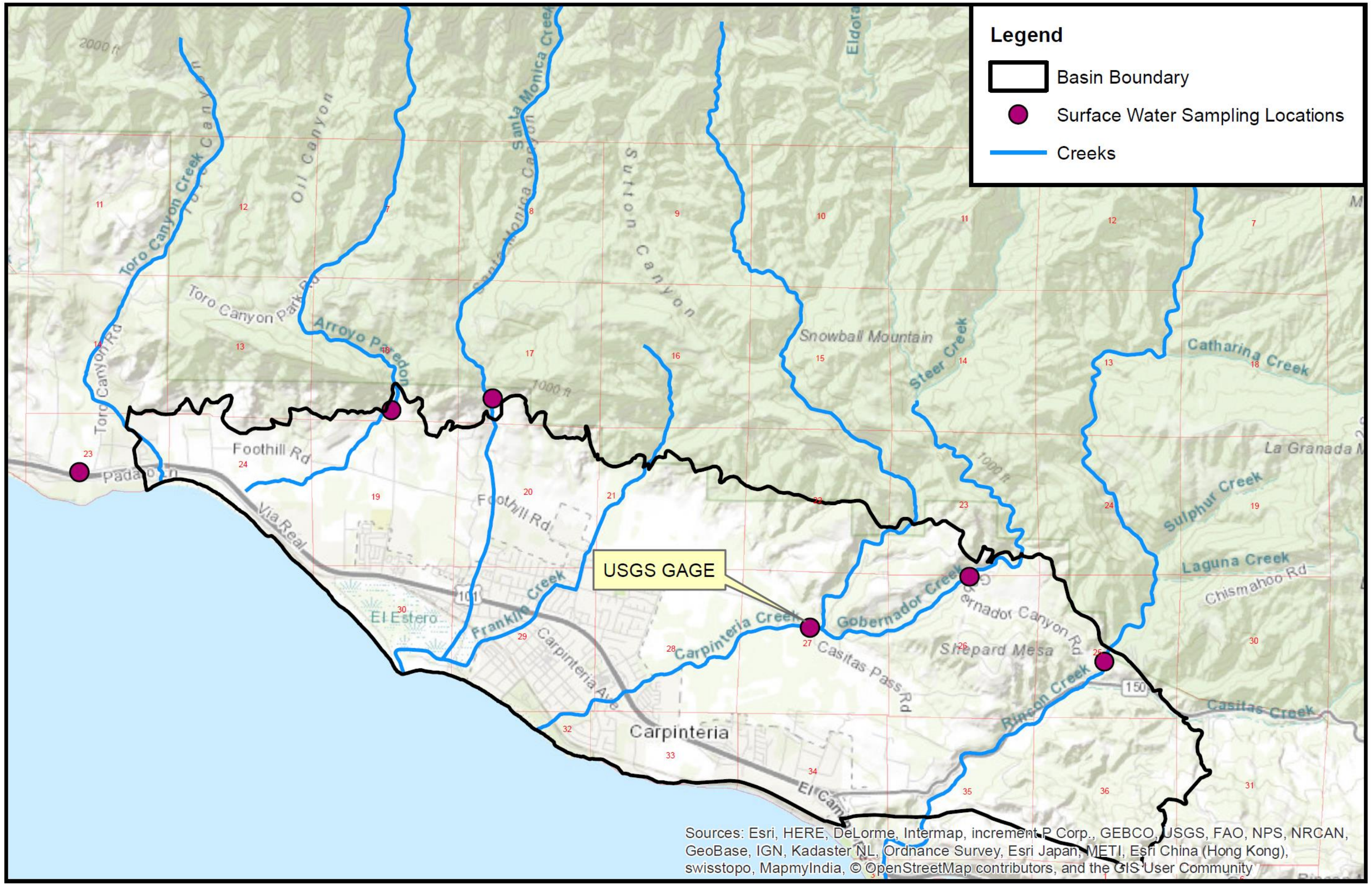
Water Quality – Chloride

- Chloride concentrations range between approximately 40 to 80 mg/L at most locations in basin
- Notable exceptions include:
  - 19E1: Increased from 300 to 600 mg/L
  - 19K5: Increased from 160 to 190 mg/L
  - Sentinel MW-1 (discussed later)

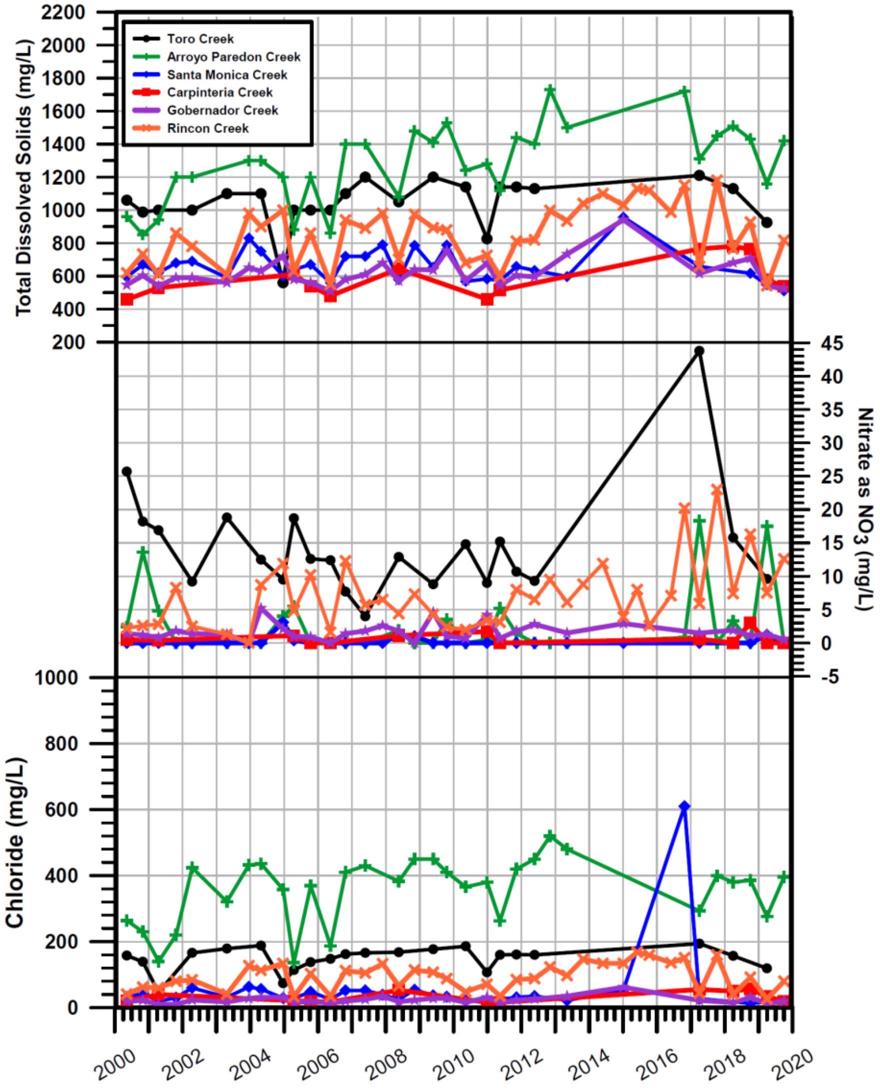
Water Quality – Nitrate

- Overall, nitrate concentrations in the basin are generally lower in wells that are completed in relatively deep aquifer units, and higher in shallower wells located in agricultural areas.
- Increasing trends also occurring at:
    - 19E1: Increased from 2 to 12 mg/L
    - 19K5: Increased from 38 to 62 mg/L, then has declined to 42 mg/L
    - 27E1: Increased from 2 to 14 mg/L, then has declined to 11 mg/L

Water Quality – Surface Water Sampling

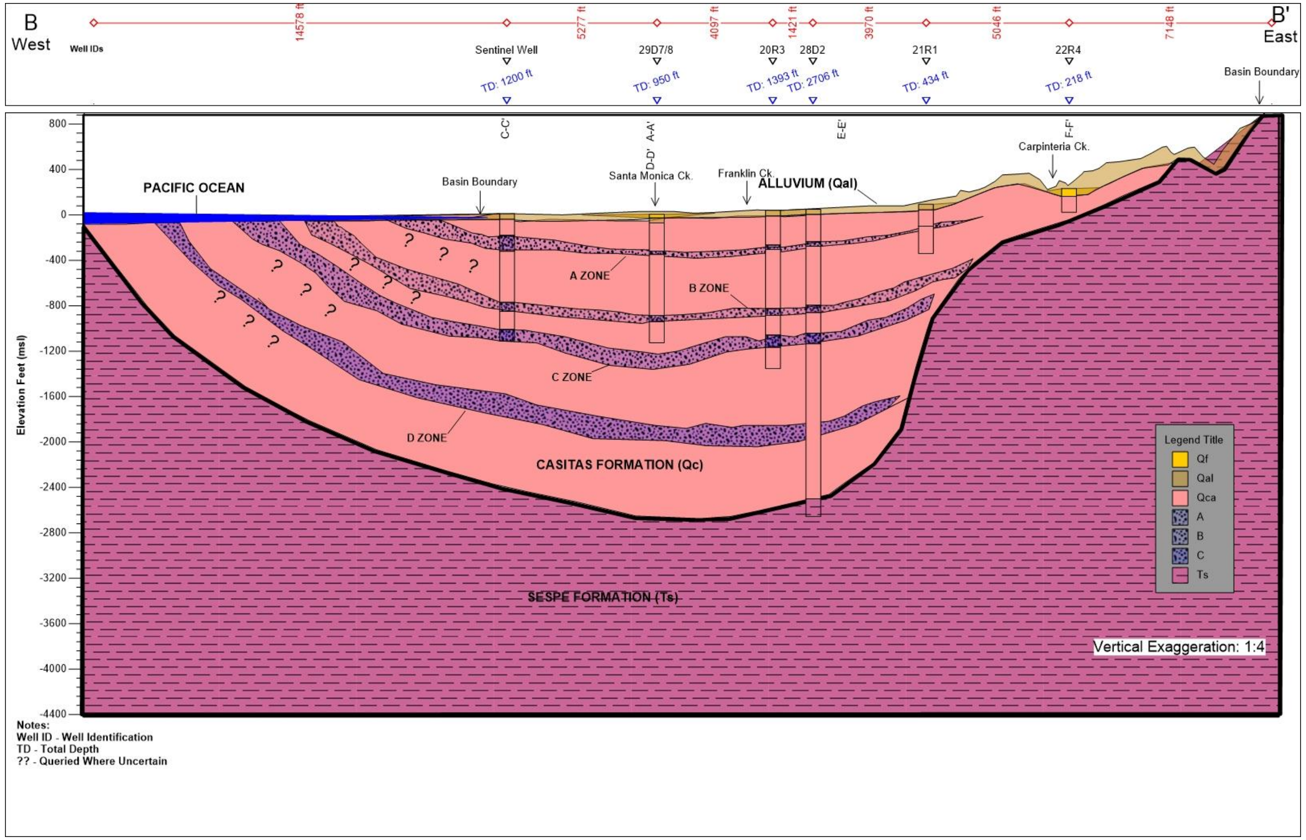


Water Quality – Surface Water Quality Data

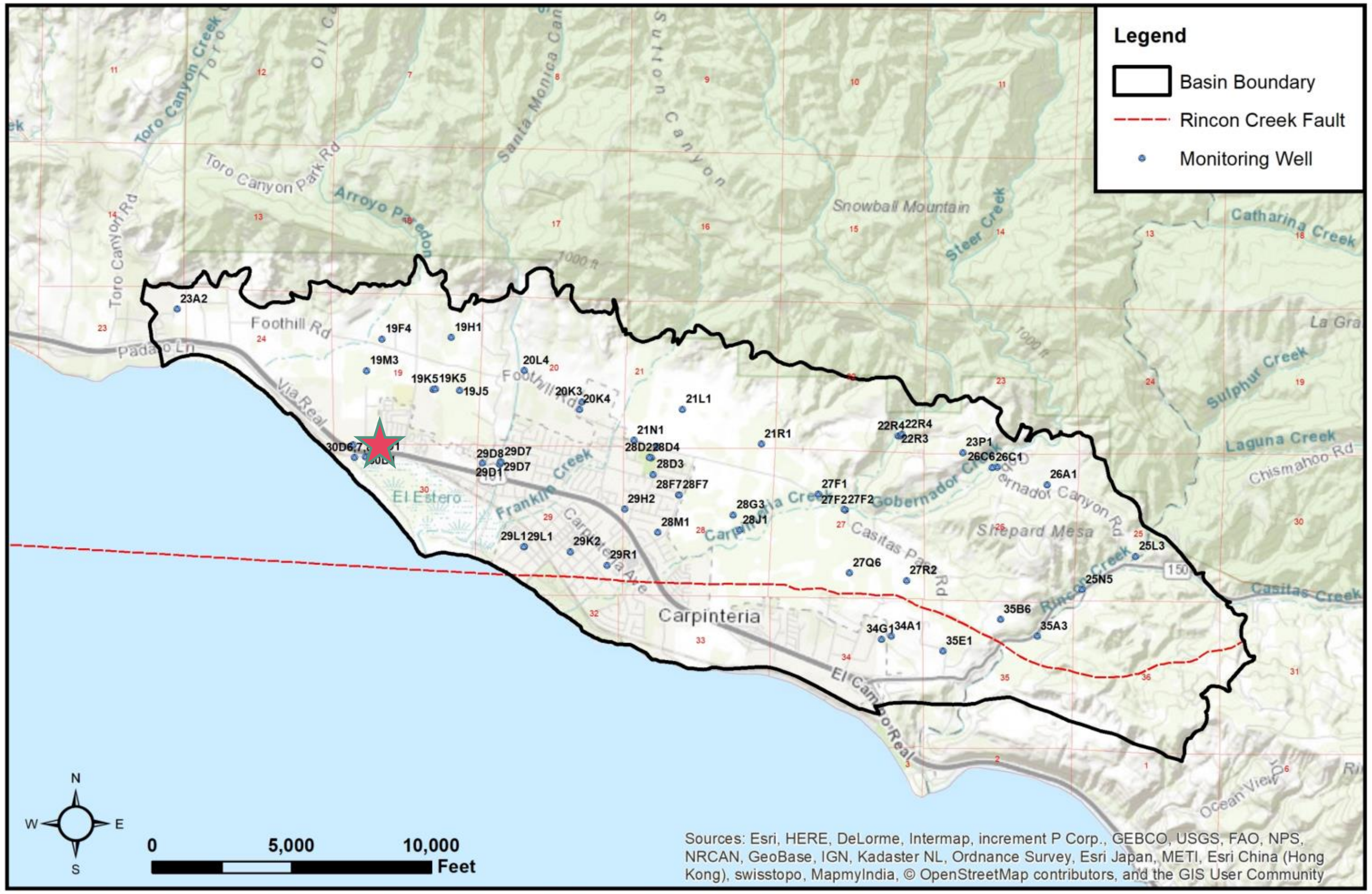


Seawater Intrusion Cross-Section B – B'

- Basin deposits known to extend offshore
- Believed to be in hydraulic communication with Pacific Ocean



Seawater Intrusion
Sentinel Monitoring Wells



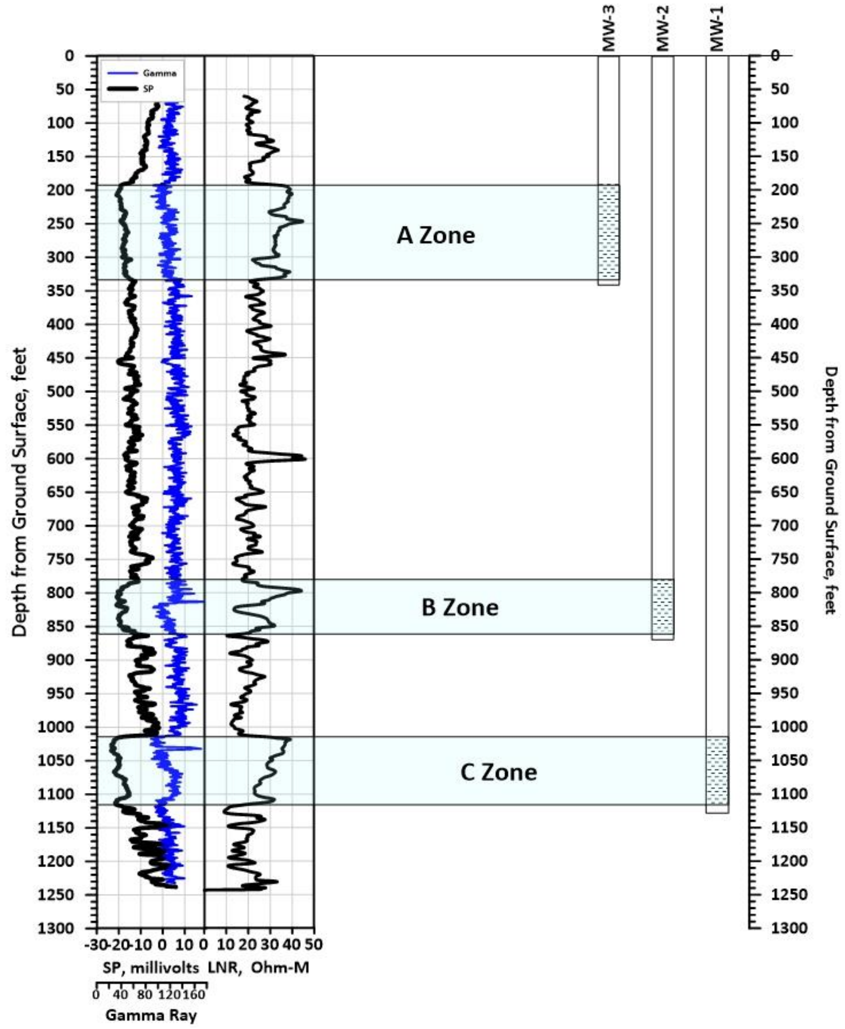
Seawater Intrusion Sentinel Monitoring Wells

Sentinel Monitoring Wells drilled in 2019

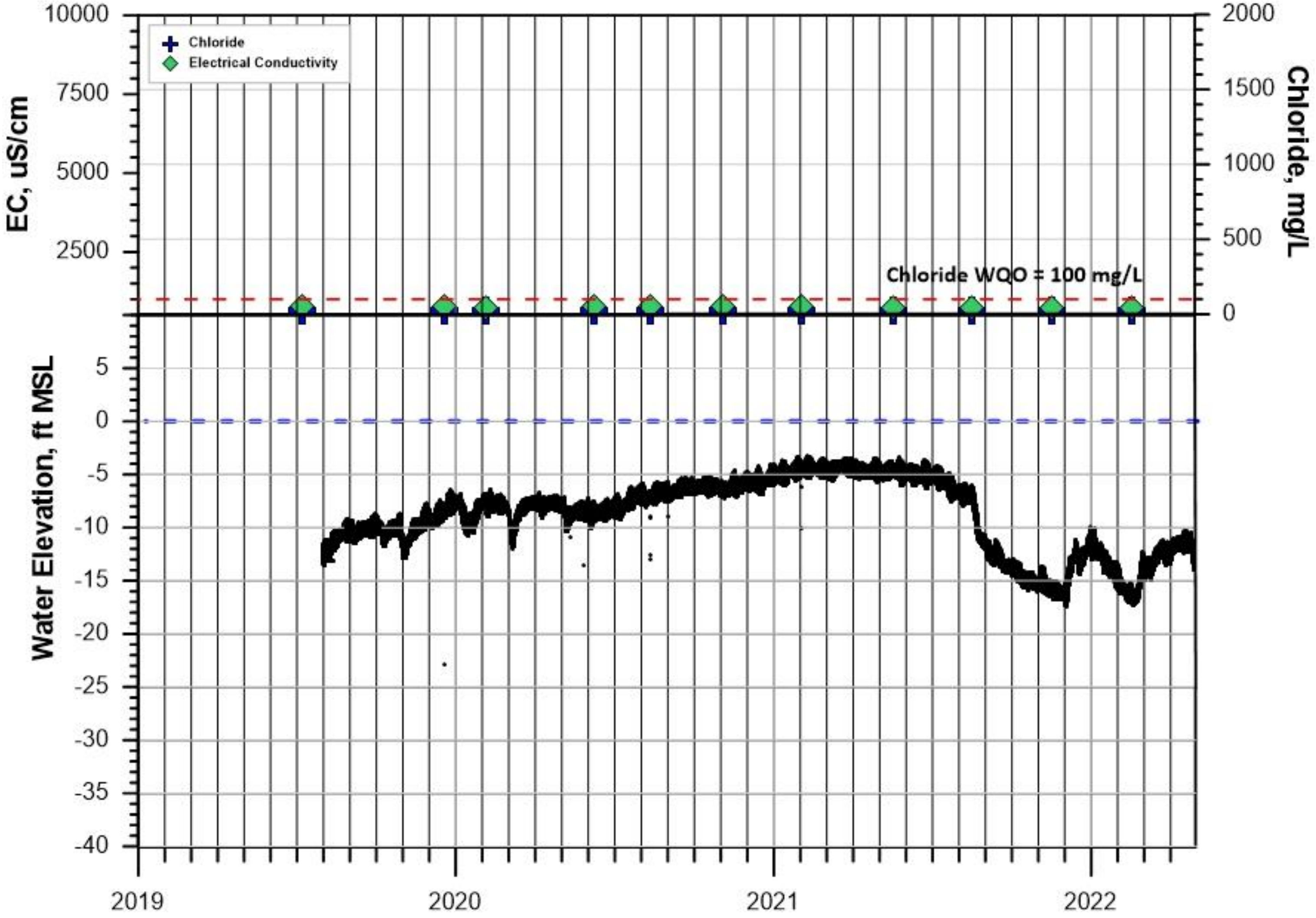
Prior to drilling of Sentinel Monitoring Wells, no wells existed at the coast that were deep enough into the A, B and C Zones.

Primary purposes:

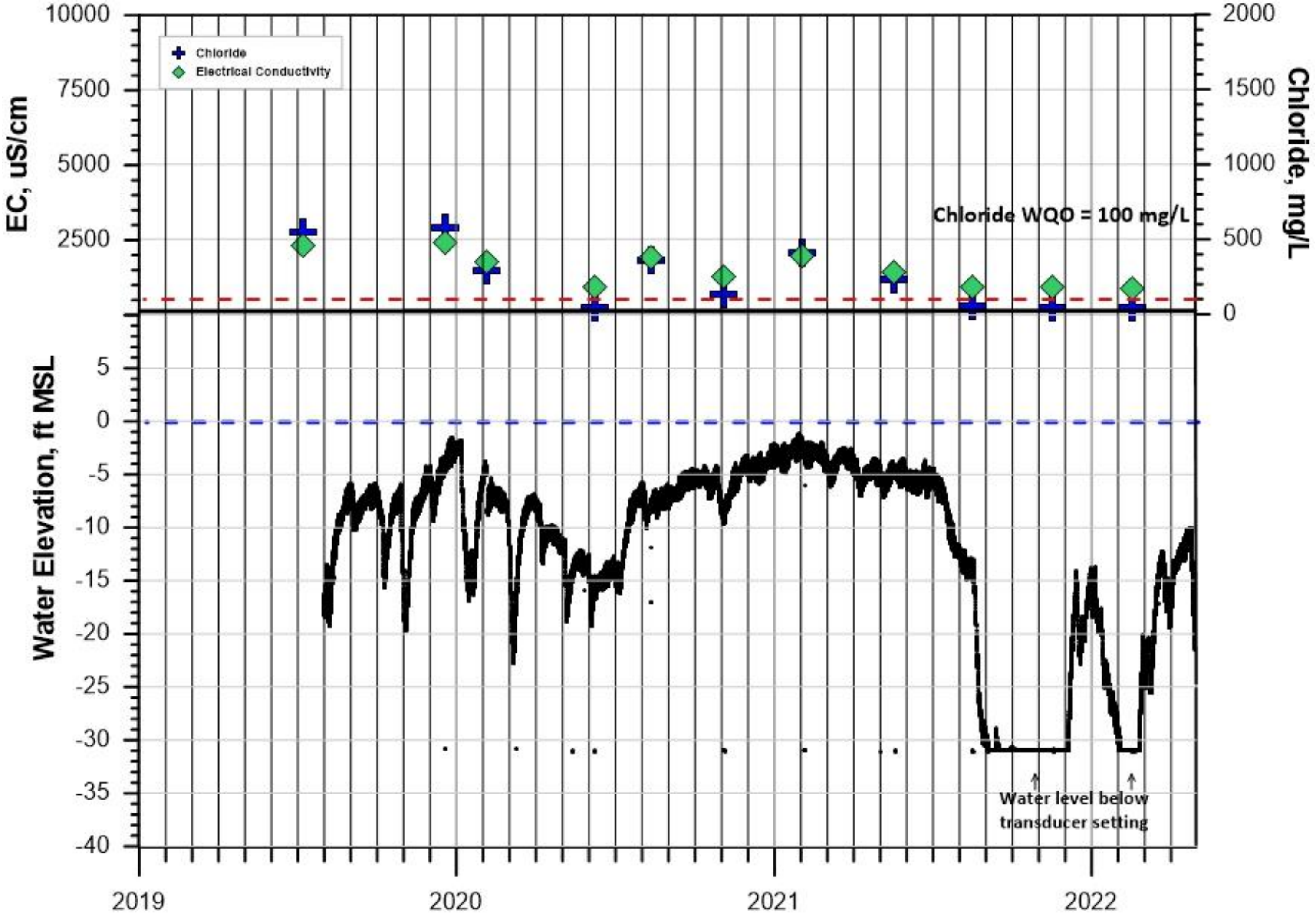
1. Allow for the collection of water-level and water-quality data through routine monitoring;
2. Establish a mechanism to track water-quality changes in distinct water bearing zones through routine induction logging, and;
3. Serve as an early warning indicator (i.e., “sentinel”) for seawater intrusion into the basin.



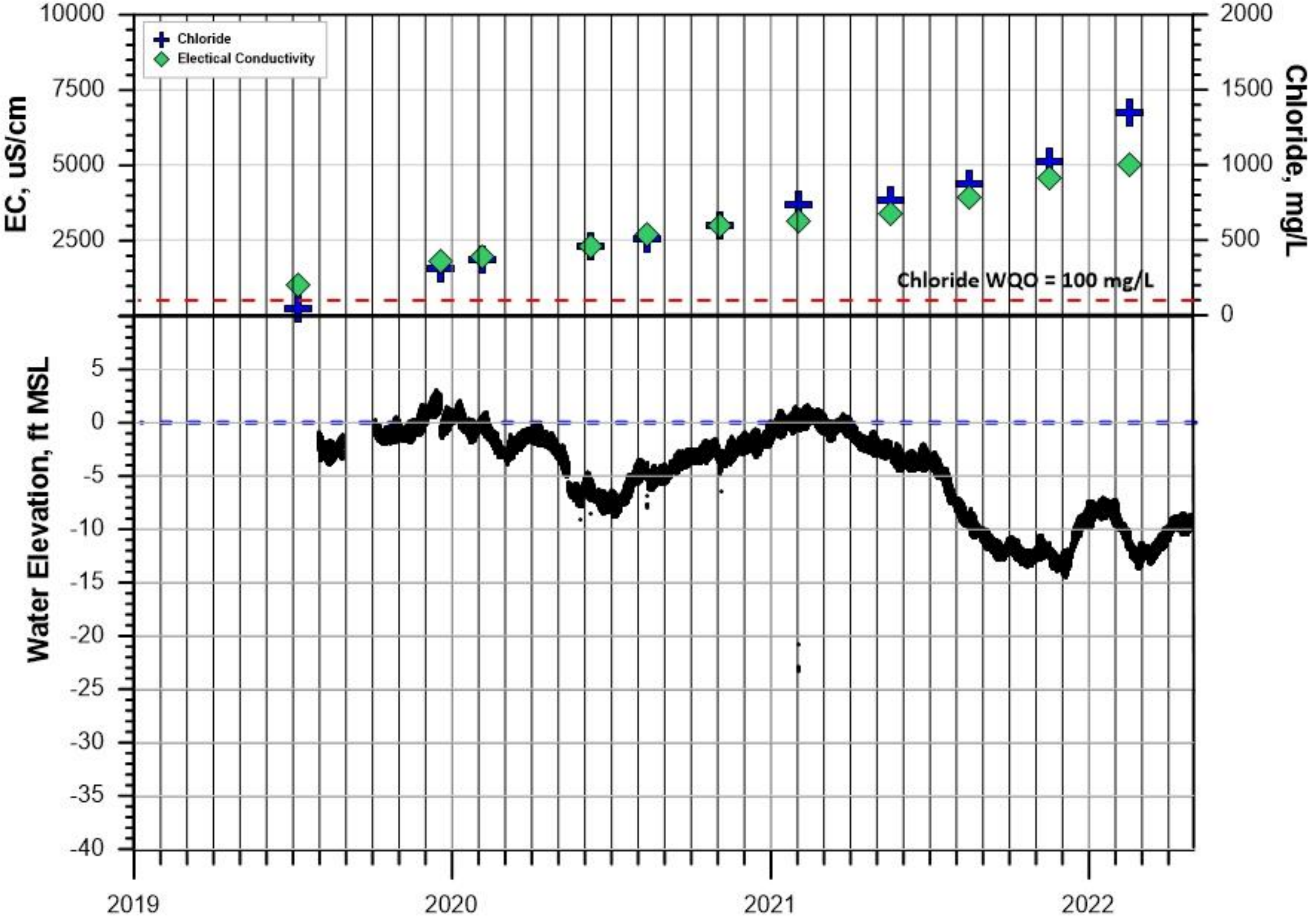
Sentinel Well Data - MW-3 (A Zone)



Sentinel Well Data - MW-2 (B Zone)



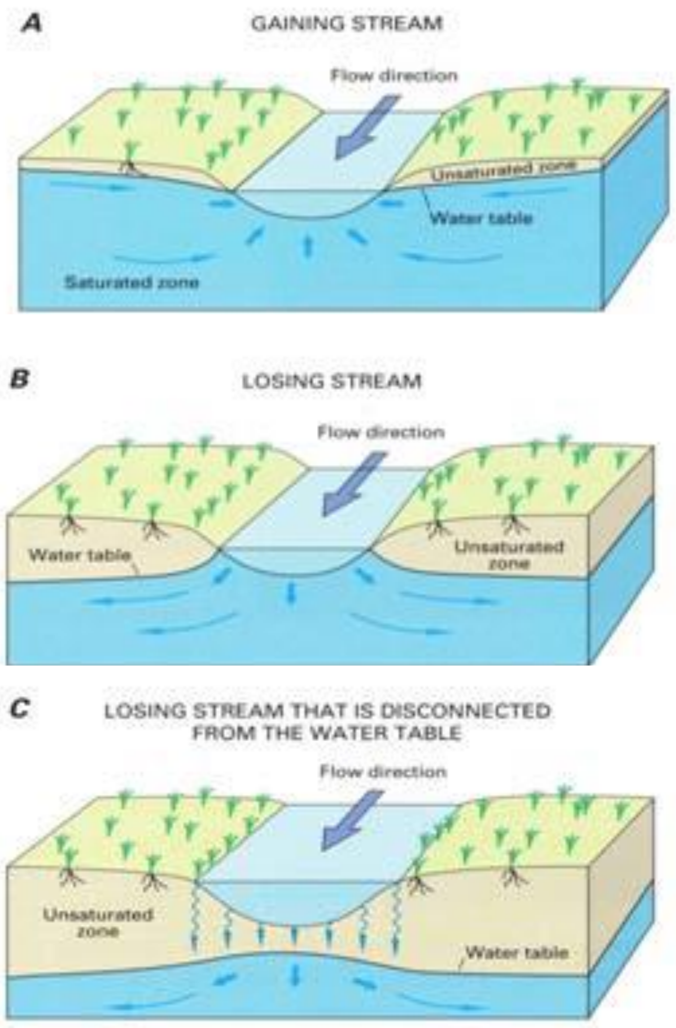
Sentinel Well Data - MW-1 Data (C Zone)



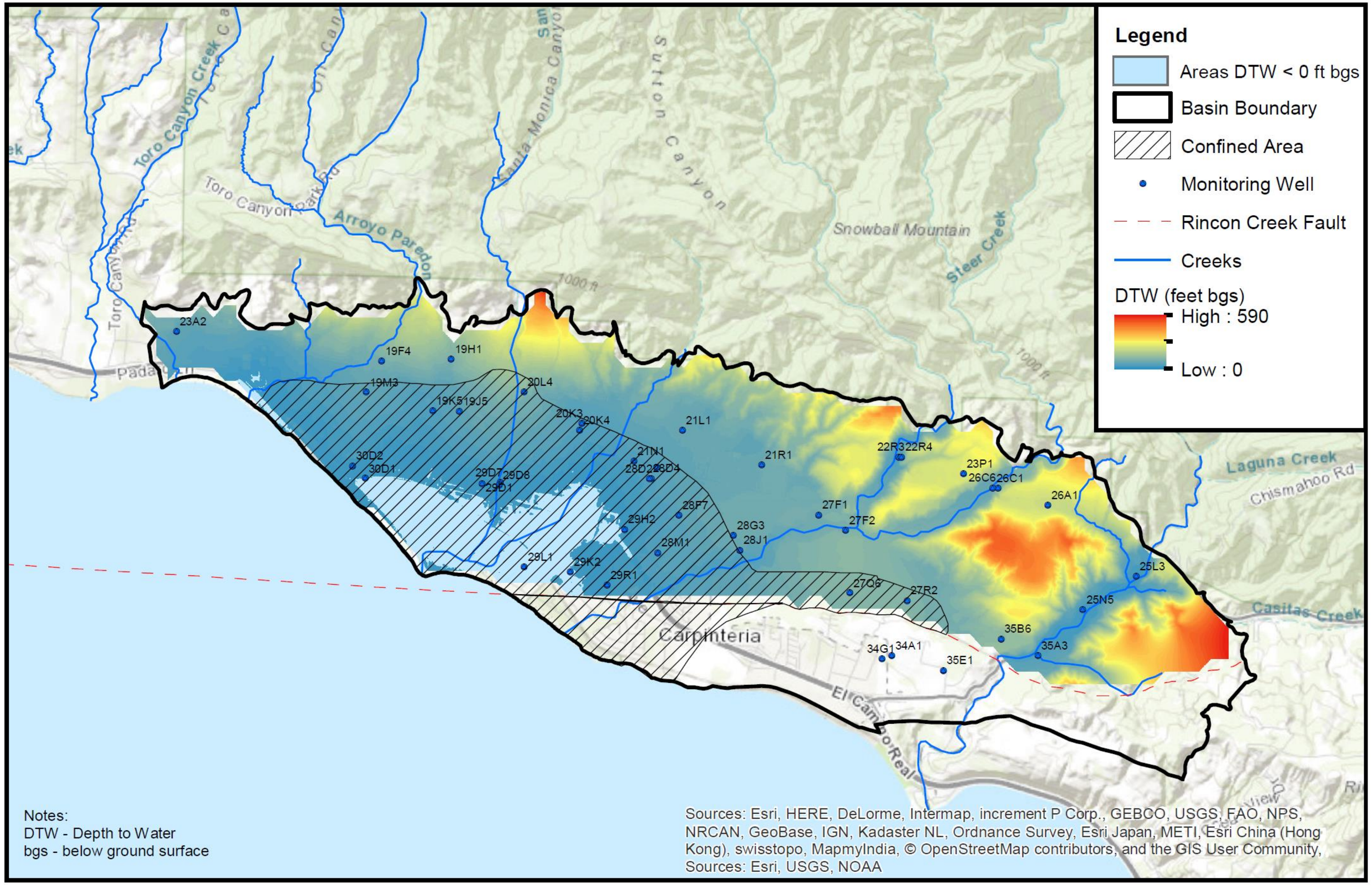
Interconnected Surface Water and Groundwater

The potential interactions between surface water bodies (such as creeks) and groundwater in a basin can take place in three basic ways:

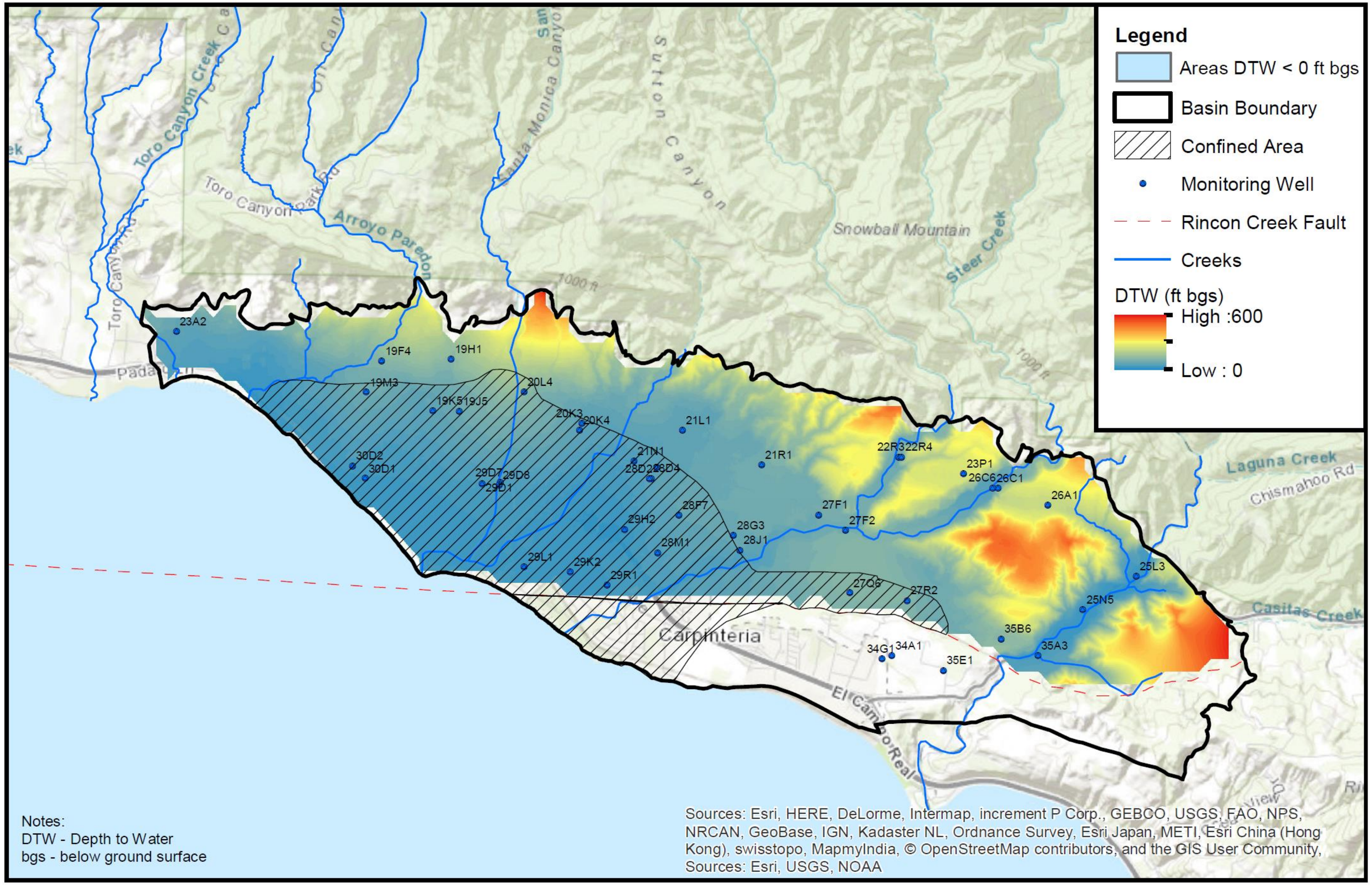
1. A gaining stream or creek that receives water from groundwater,
2. A losing stream or creek that recharges basin aquifers from surface water, or
3. A stream or creek that may be separated from groundwater by a hydrologic formation, such as a low-permeability aquitard that prevents interaction between surface water and groundwater completely.



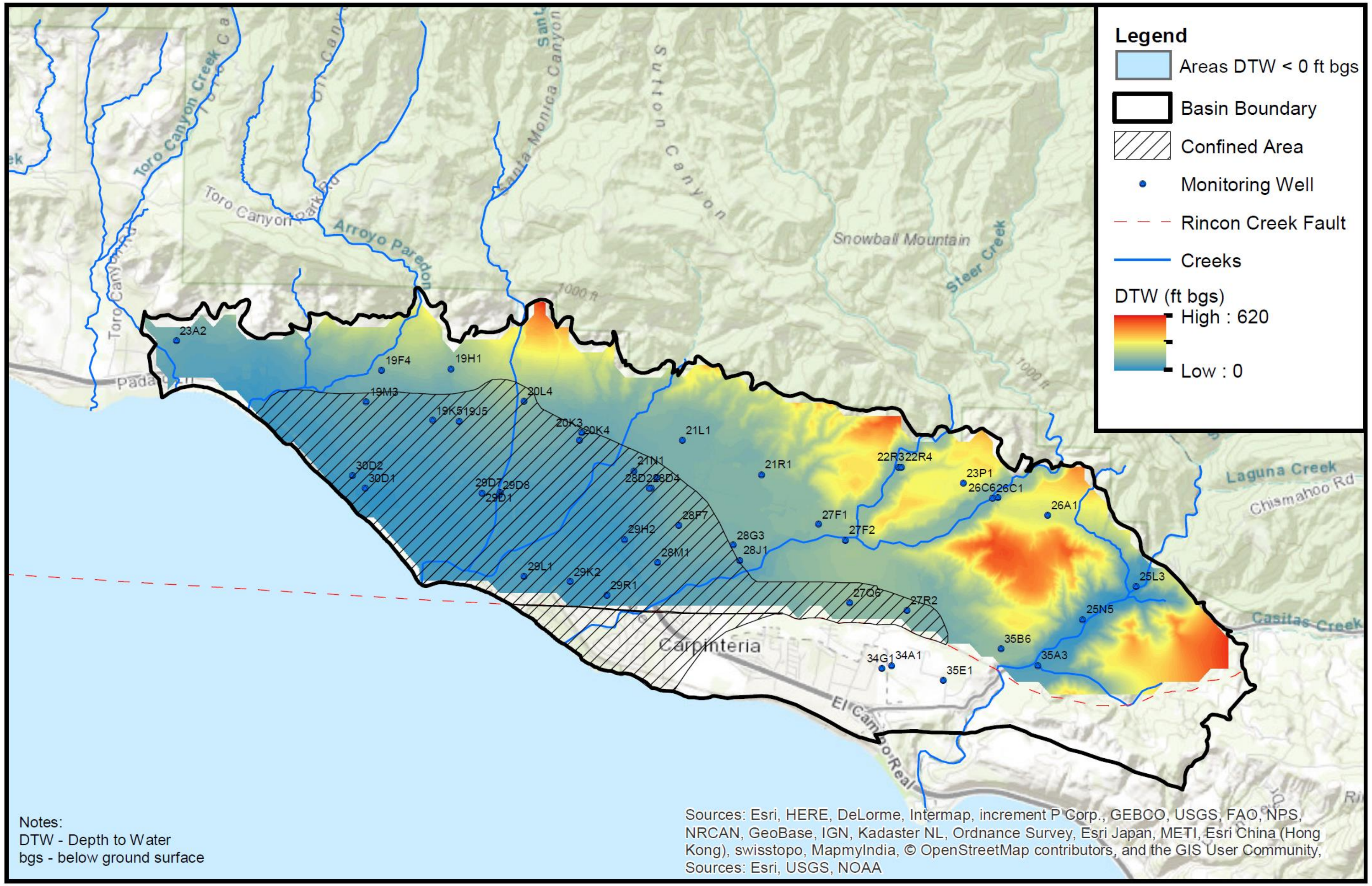
Depth-to-Water Map – Spring 2005 (Wet Year)



Depth-to-Water Map – Spring 2010 (Normal Year)



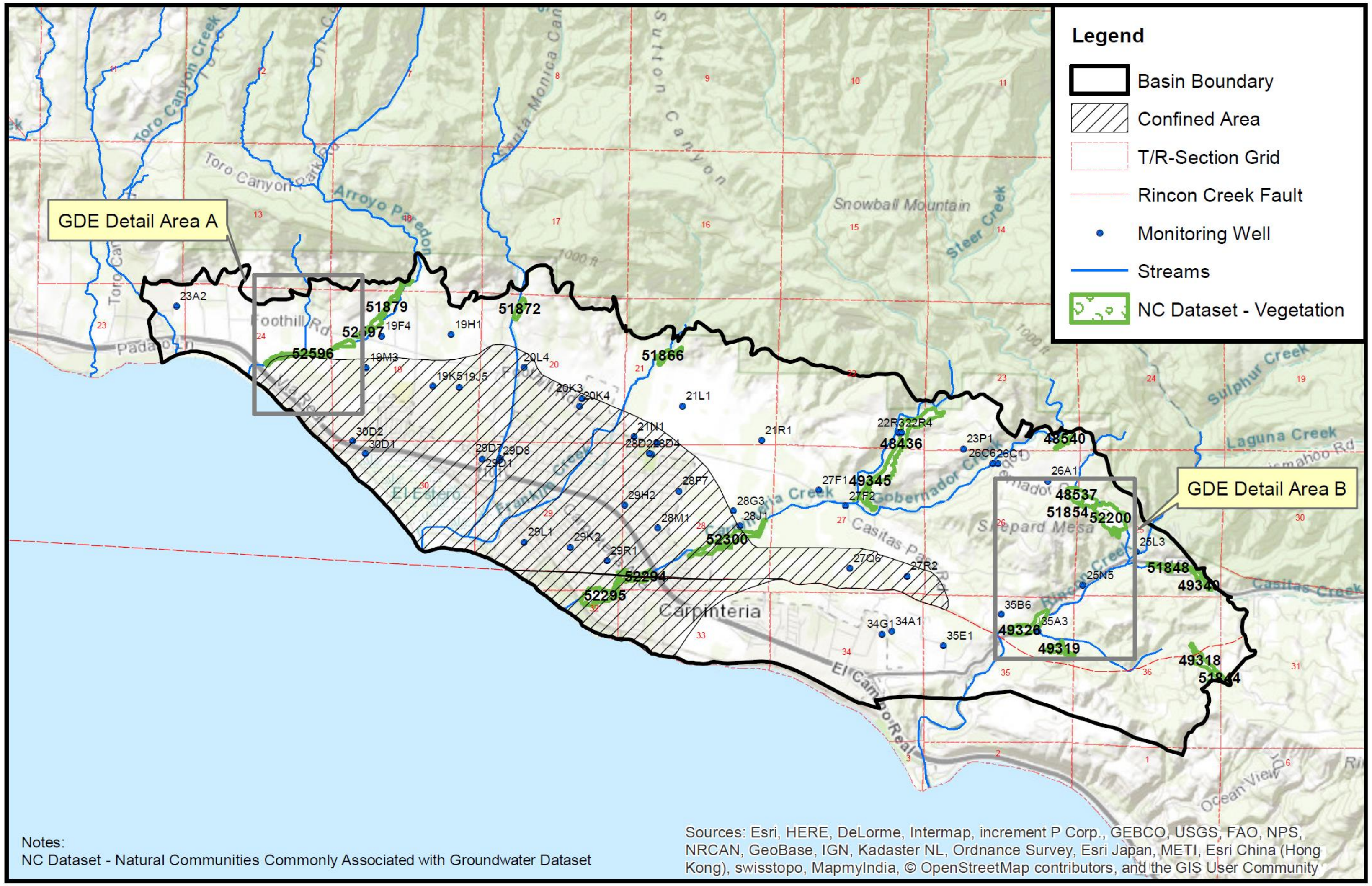
Depth-to-Water Map – Spring 2015 (Dry Year)



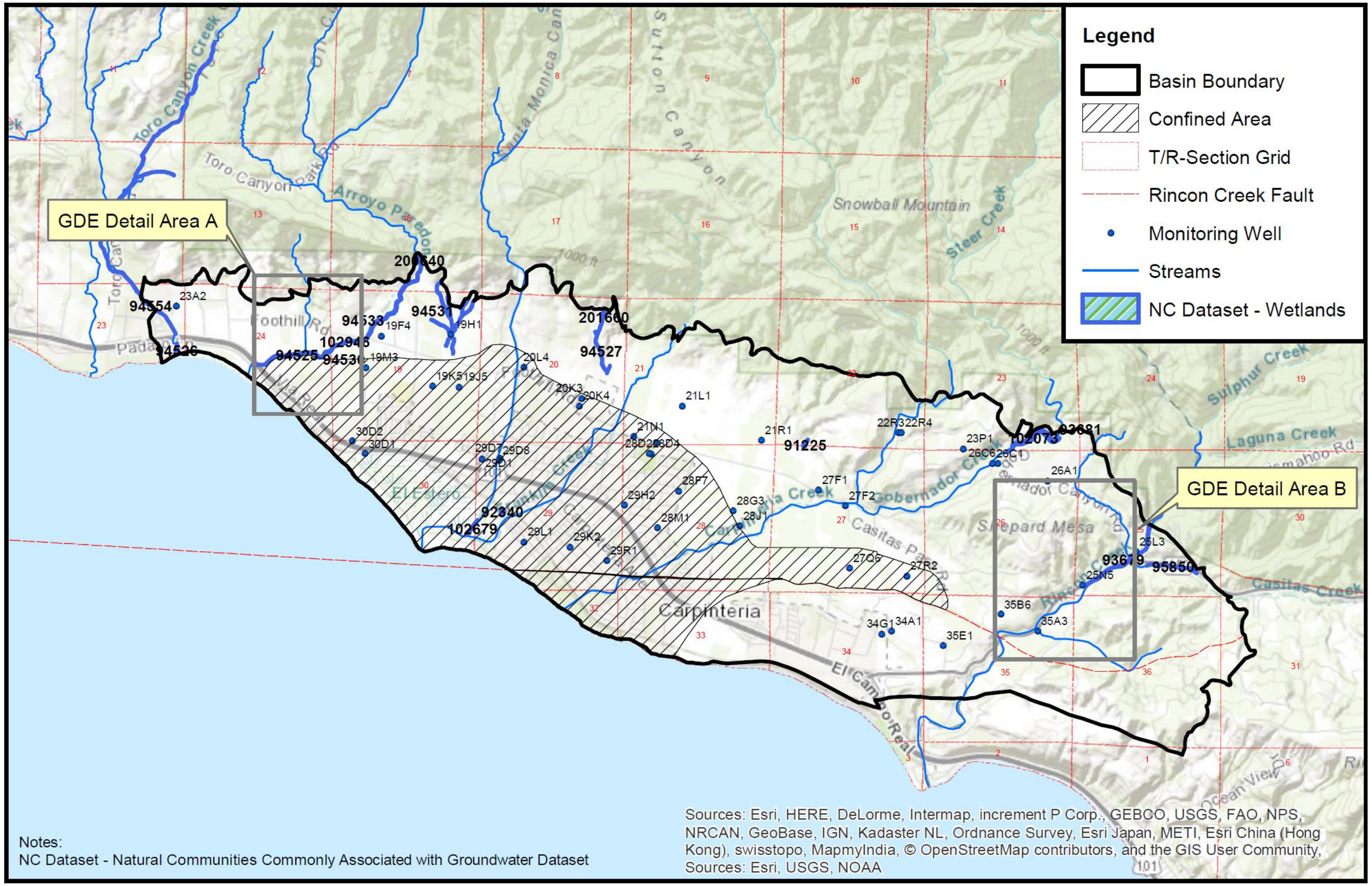
Groundwater Dependent Ecosystems (GDEs)

- GSP Emergency Regulations require the identification of groundwater dependent ecosystems (GDEs) that ***could*** be adversely affected by lowered groundwater levels in principal aquifer.
- The Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) was downloaded from DWR to identify potential GDEs.

Potential GDEs – Vegetation



Potential GDEs – Wetlands

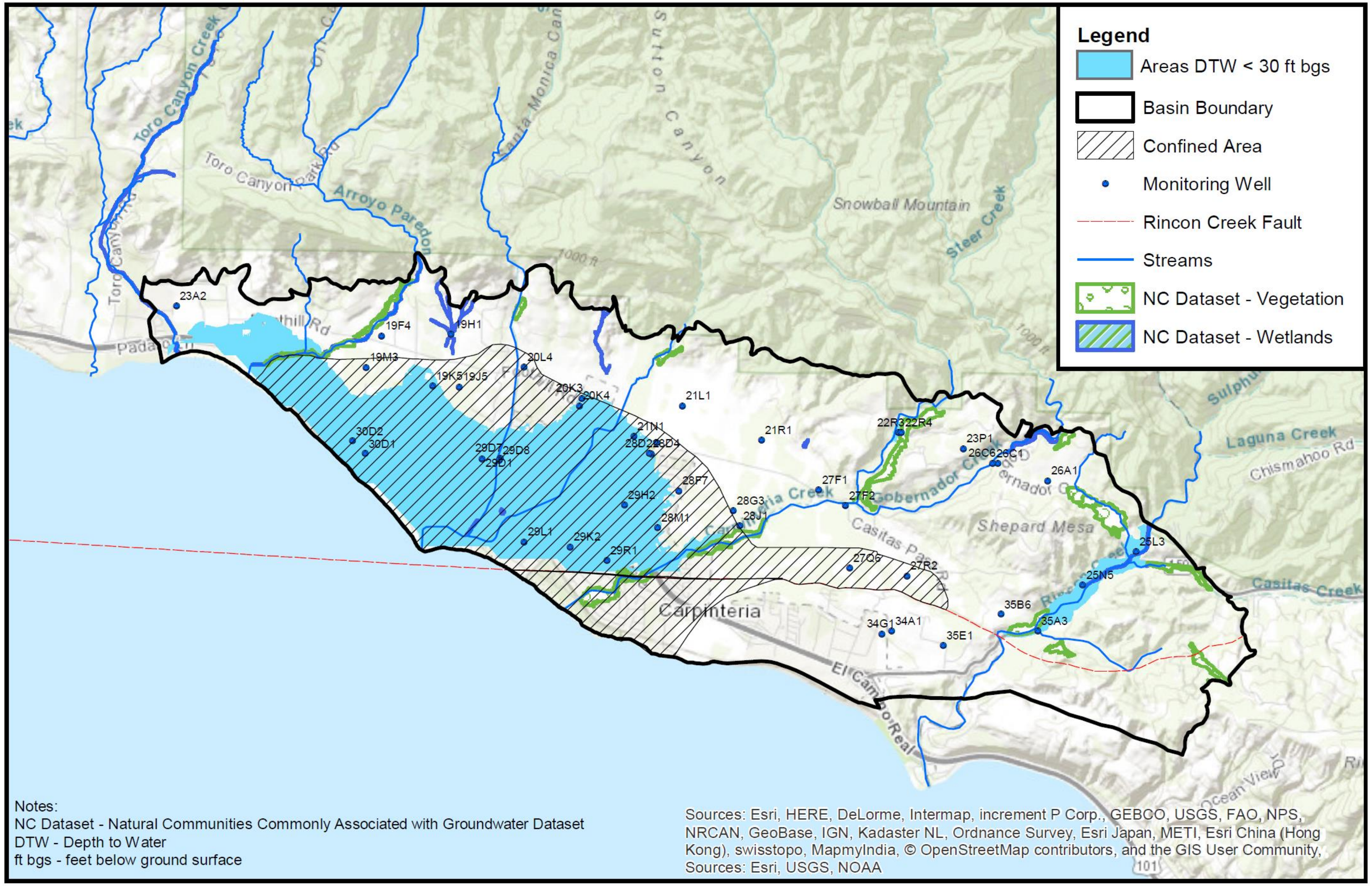


Potential GDE Screening

- Depth-to-water groundwater levels of less than 30 feet of the land surface is a generally accepted method to initially screen potential GDEs for groundwater dependence.
- To consider the interannual variability of the areas of the basin where the depth-to-water has been less than 30 feet, depth-to-water was calculated as described in the preceding section for the spring water levels for three different water year types in the recent past:

  WY 2005 – Wet water year type
  WY 2010 – Normal water year type
  WY 2015 – Critically Dry water year type

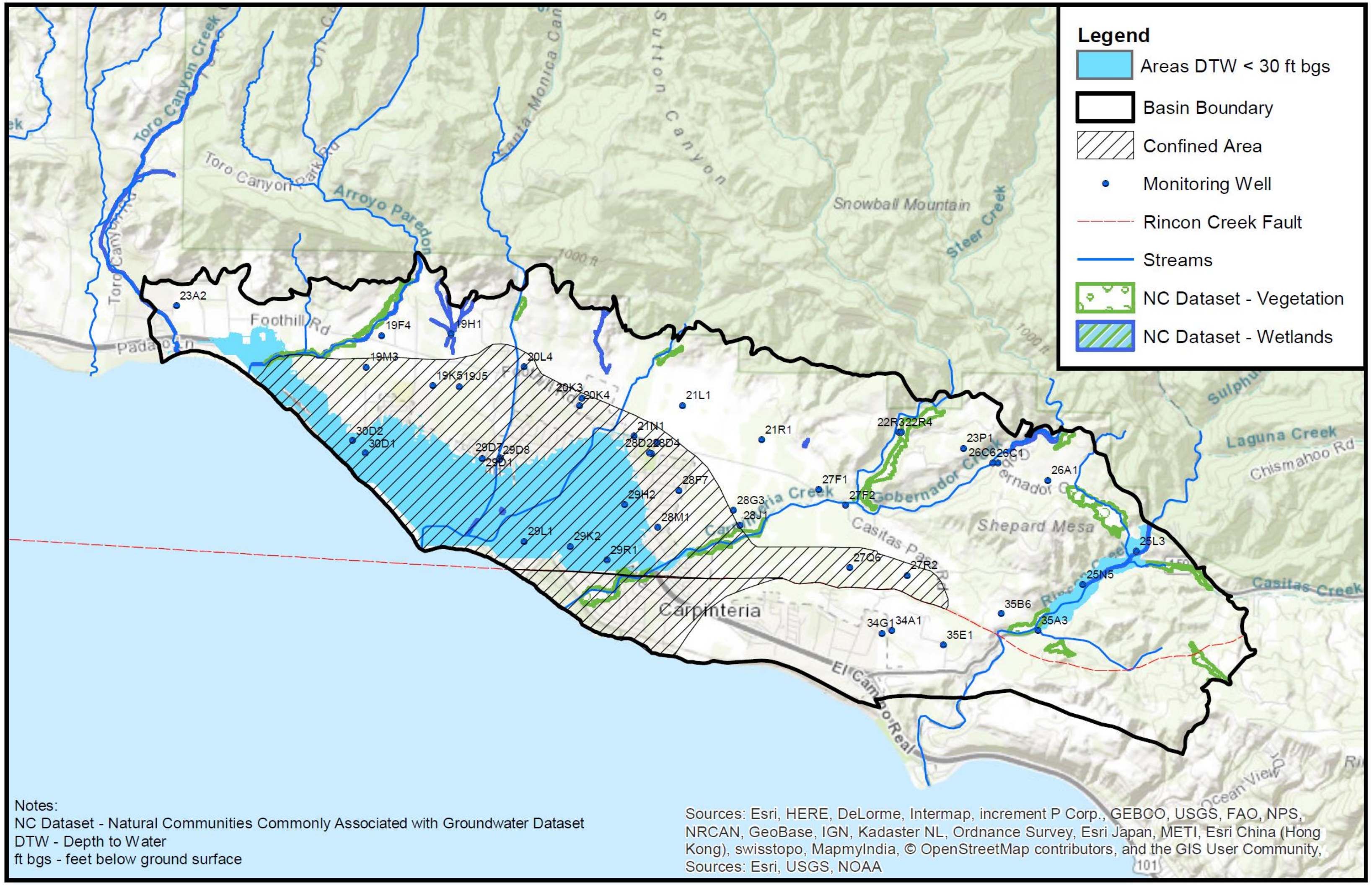
Potential GDE Screening – DTW < 30 ft (2005)



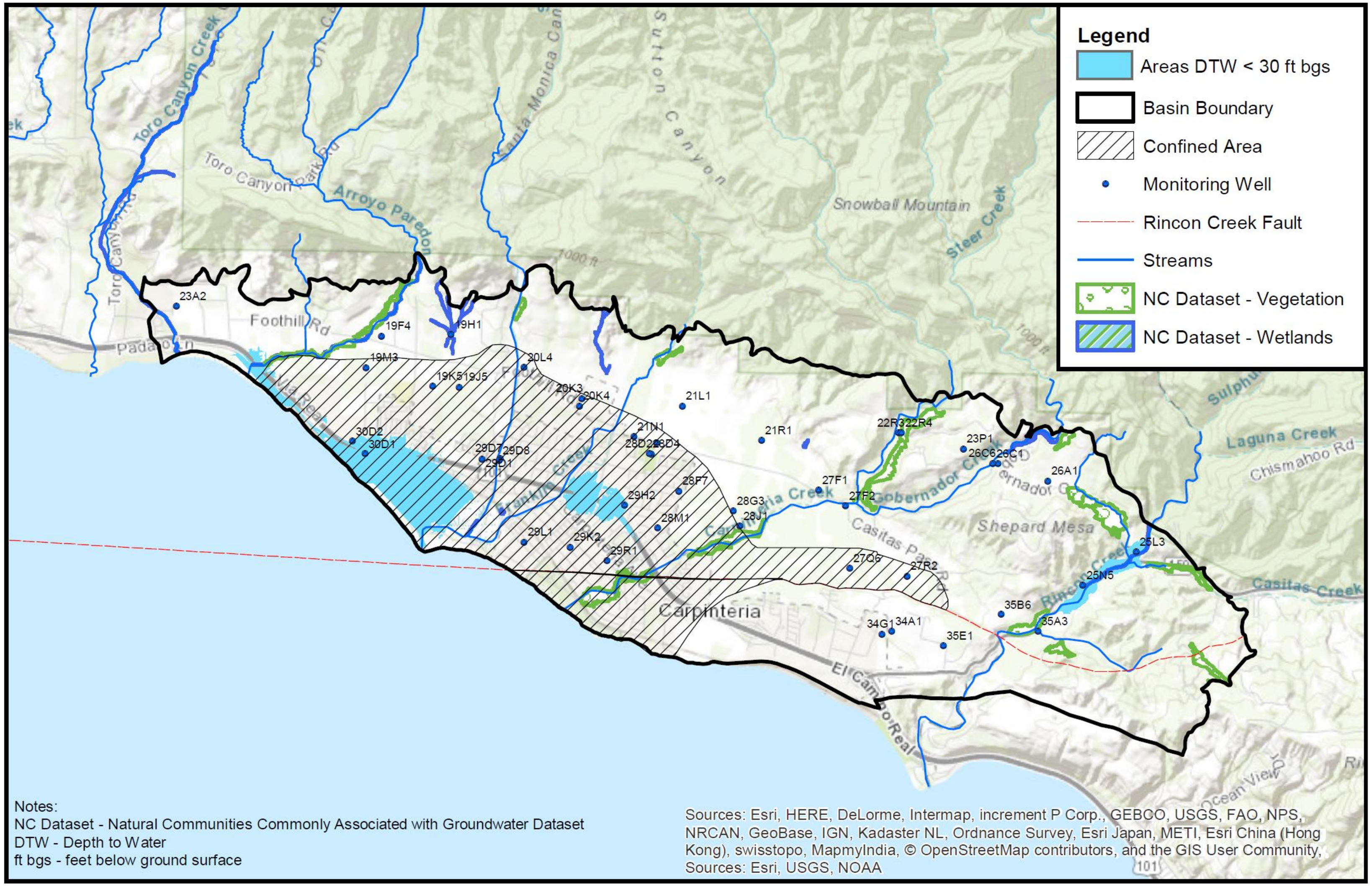
Notes:
NC Dataset - Natural Communities Commonly Associated with Groundwater Dataset
DTW - Depth to Water
ft bgs - feet below ground surface

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community, Sources: Esri, USGS, NOAA

Potential GDE Screening – DTW < 30 ft (2010)



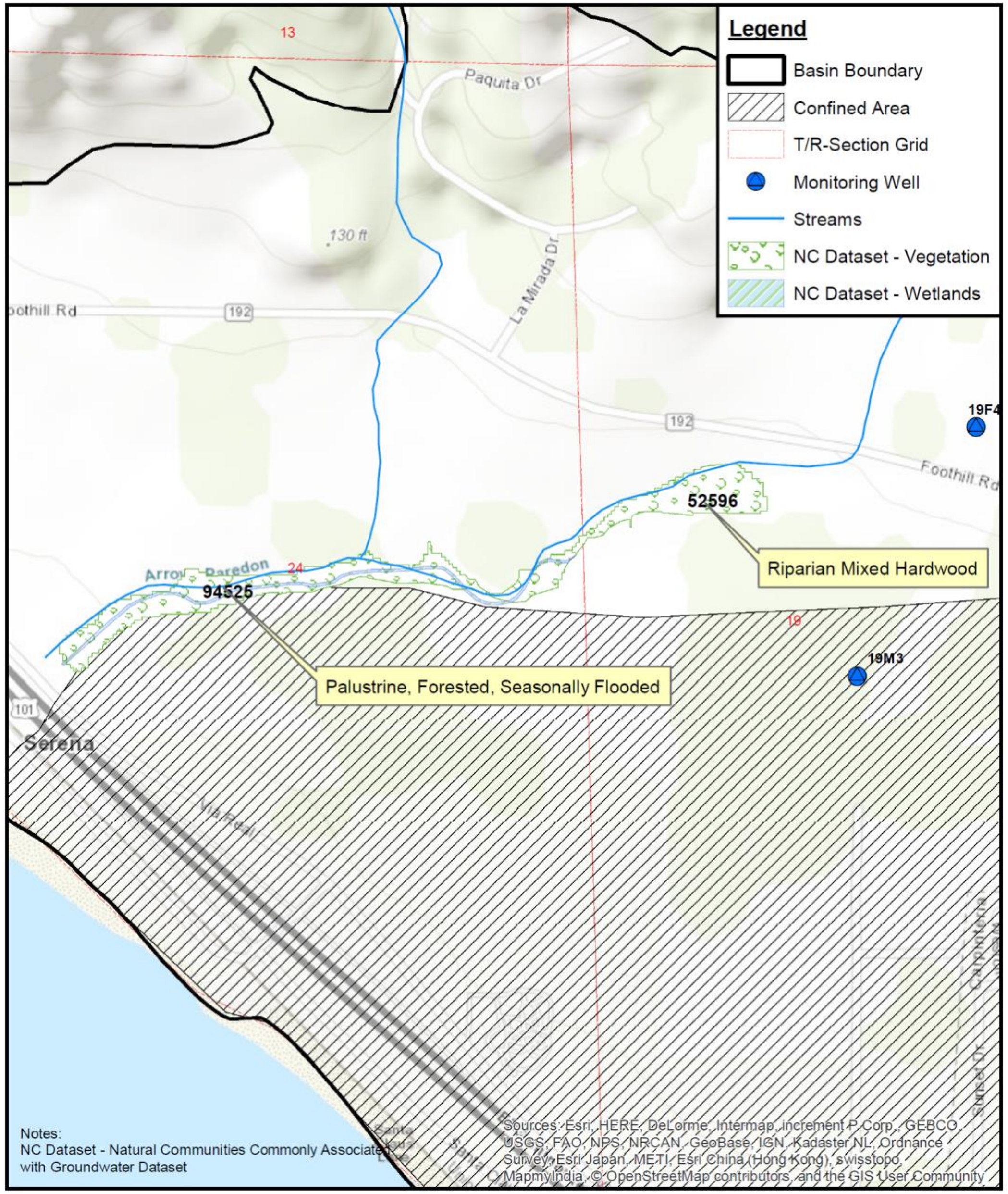
Potential GDE Screening – DTW < 30 ft (2015)



Potential GDEs Remaining in GSP

Lower Arroyo Paredon Creek:

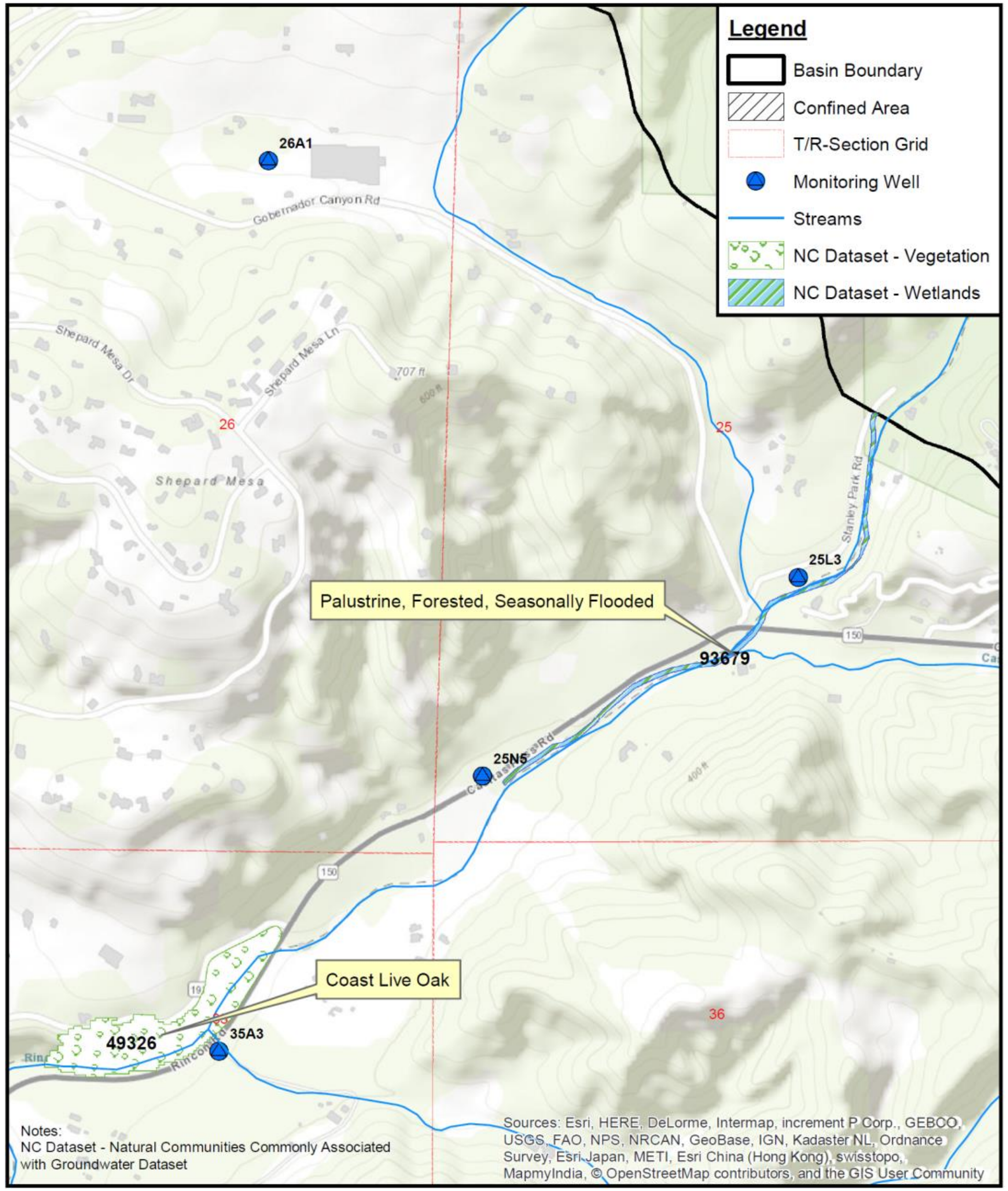
- Vegetation
- Wetlands



Potential GDEs Remaining in GSP

Rincon Creek:

- Vegetation
- Wetlands



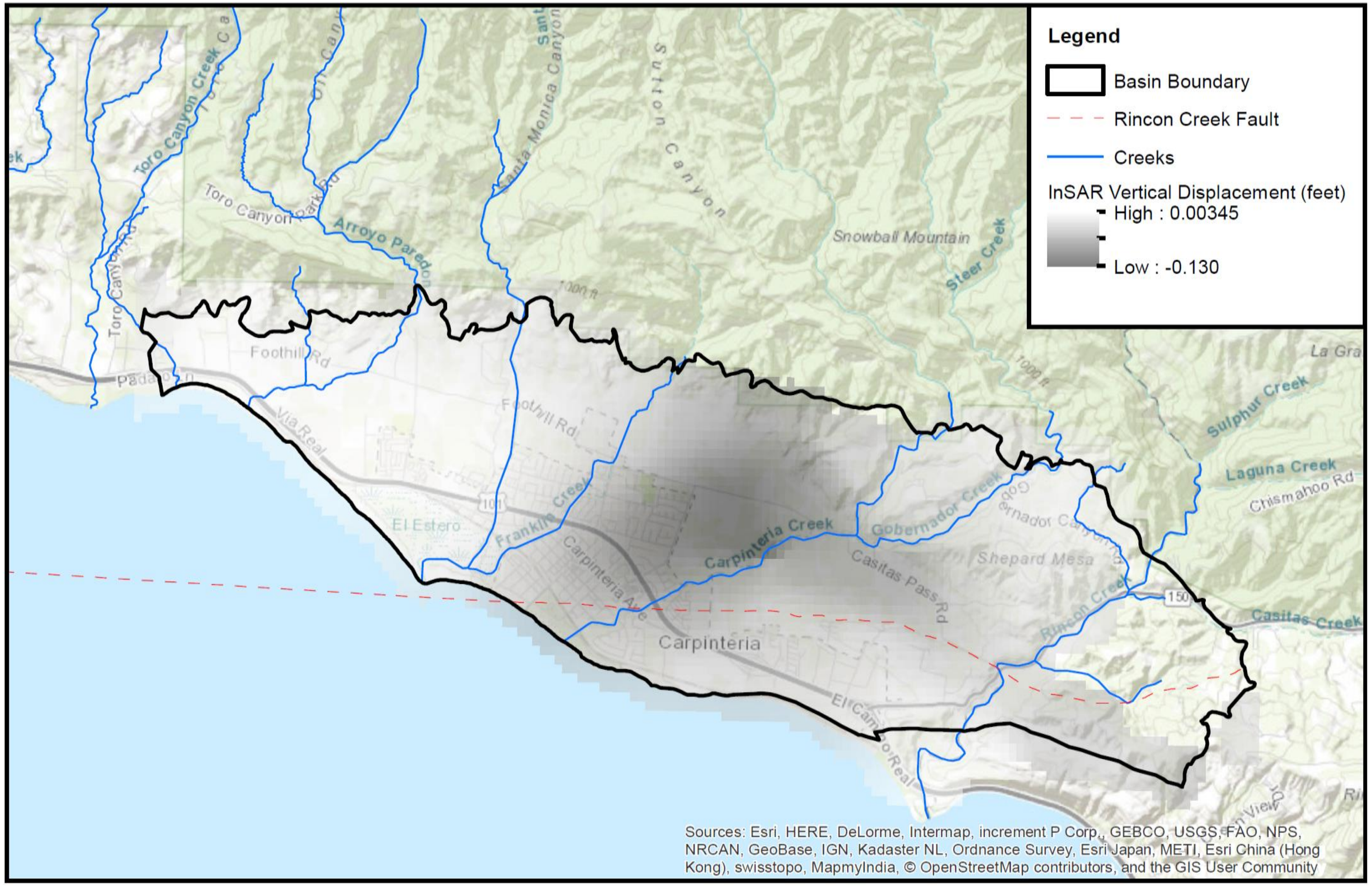
Subsidence

For land subsidence to occur certain conditions are needed, such as:

- Drainage and decomposition of organic soils,
- Underground mining, oil and gas extraction, hydrocompaction, natural compaction, sinkholes, and thawing permafrost, or,
- Aquifer-system compaction.

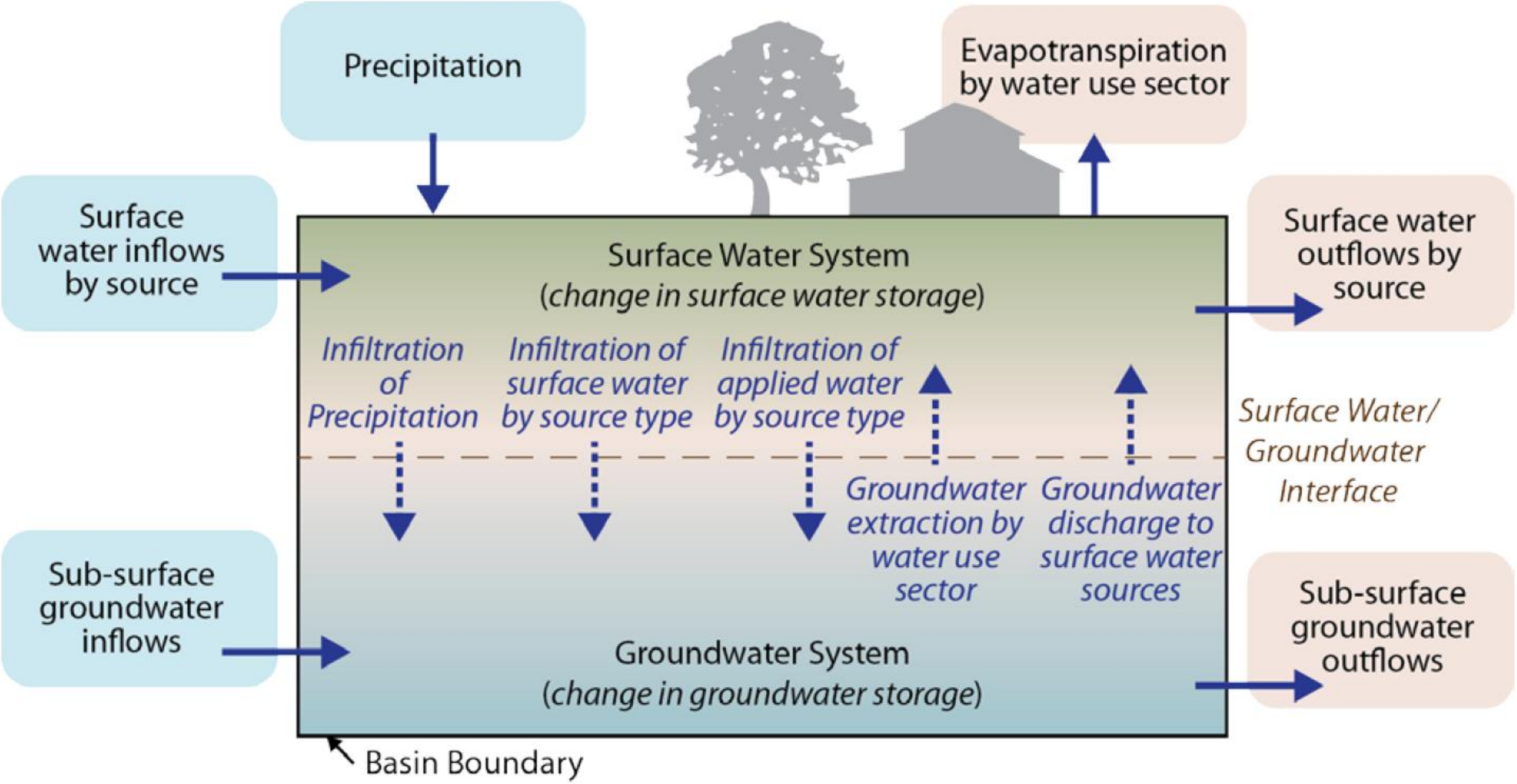
None of these conditions are previously known to be present in the basin and there is no known or anecdotal evidence of subsidence related to groundwater extractions in the basin.

Subsidence – InSAR Data from DWR
Vertical Displacement (June 2015 – July 2022)



Groundwater Conditions Q&A

Water Budget for Basin - Schematic



Water Budget for Basin - Equation

Inflow = Outflow (+/-) Change in Storage

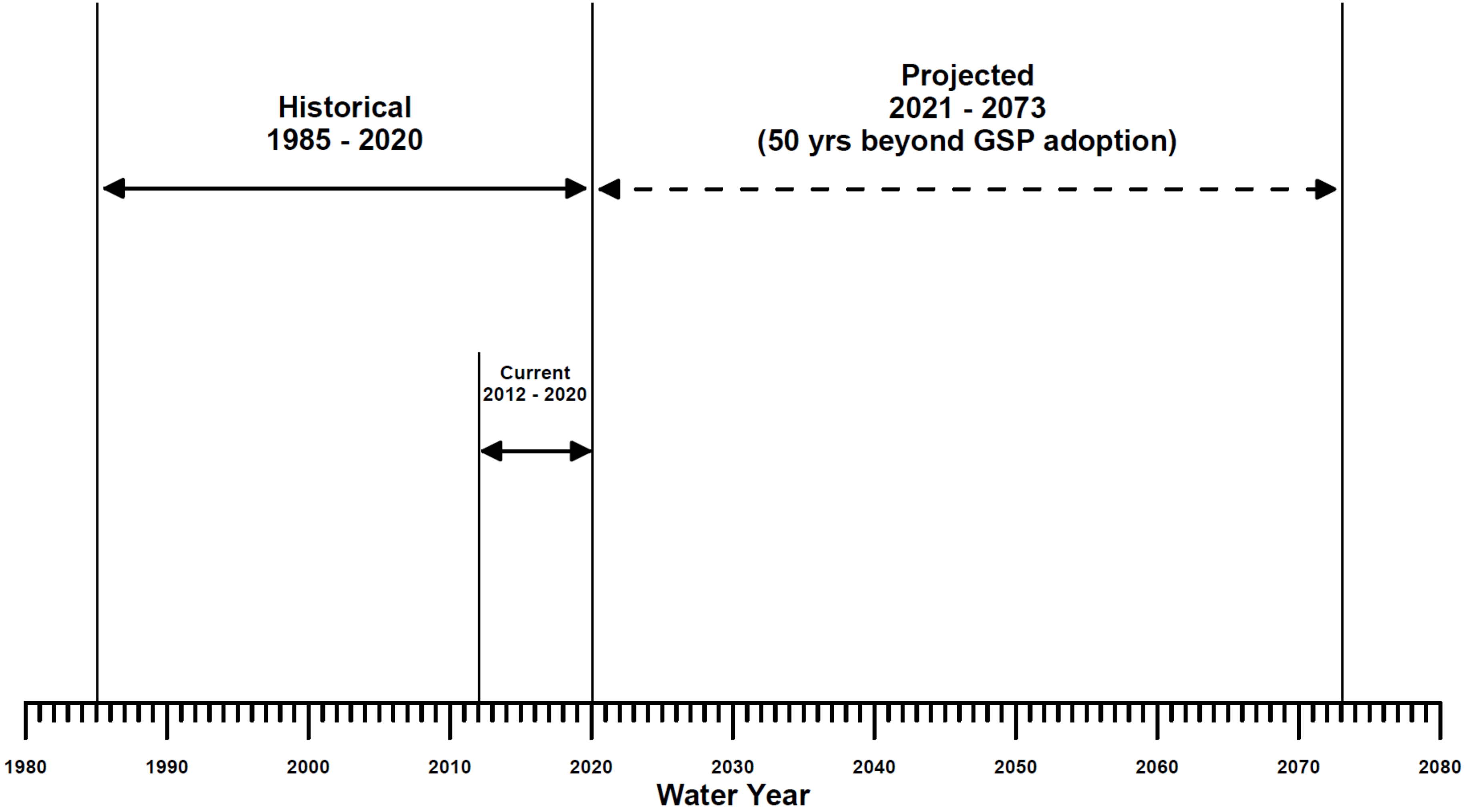
Water Budget for Basin - Inflows

- Percolation of precipitation;
- Subsurface inflow from bedrock boundary (mountain front recharge);
- Streambed percolation;
- Percolation of irrigation return water (pumped and delivered);
- Subsurface inflow across boundary with Pacific Ocean, and;
- Subsurface inflow across boundary with Montecito Groundwater Basin.

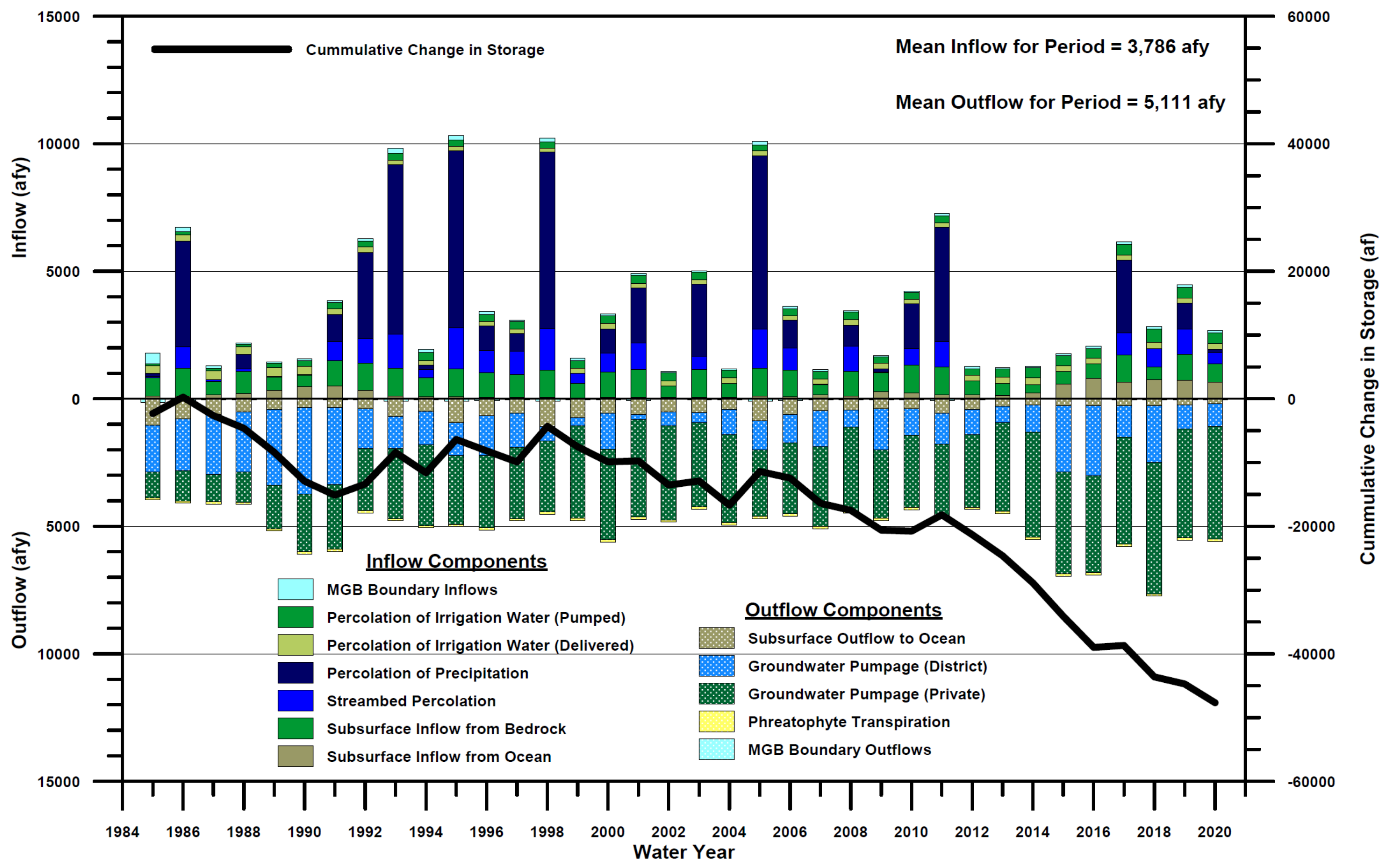
Water Budget for Basin - Outflows

- Groundwater pumping;
- Evapotranspiration by phreatophytes;
- Subsurface outflow across boundary with Pacific Ocean, and;
- Subsurface outflow across boundary with Montecito Groundwater Basin.

Water Budget Timeframes



Historical Water Budget – Annual Inventory



Historical Water Budget – Component Averages

Groundwater Budget Component		Annual Minimum	Annual Maximum	Annual Average	Average %
Inflows (acre-feet per year)					
Subsurface Inflow		327	1,087	805	21
Streambed Percolation		0	1,621	563	15
Percolation of Precipitation		0	6,946	1,572	42
Percolation of Irrigation Water	Delivered	149	360	219	6
	Pumped	77	509	284	7
MGB Boundary Inflow		50	428	101	3
Subsurface Inflow from Ocean Boundary		43	808	242	6
			Total Inflow	**3,786**	**100**
Outflows (acre-feet per year)					
MGB Boundary Outflow		20	140	50	1
Subsurface outflow to Ocean Boundary		186	1,072	511	10
Groundwater Pumping	CVWD	185	3,413	1,455	28
	Private	1,016	5,141	3,005	59
Phreatophyte Transpiration		89	89	89	2
			Total Outflow	**5,111**	**100**
Change in Storage (acre-feet per year)		**Cummulative**		**Average**	
		-47,678		-1,324	

Water Budget Q&A

Key Takeaways

- Basin is filled with sediment with thickness of up to several thousand feet
- The Rincon Creek Fault creates structural barrier in basin that isolates southwestern portion of basin from Pacific Ocean
- During drought periods, water levels in the basin decline below sea level due to lack of rainfall and recharge to keep up with pumping, which causes storage depletion
- Water levels are currently about 50 feet below sea level in the central portion of the basin
- There is recent evidence of SWI in the lower C Zone at the coast