

Project Update:
Upper and Lower Ventura River Basin
Groundwater Budget and Approach for
Groundwater Management Plan
(75% Complete)

August 24, 2010

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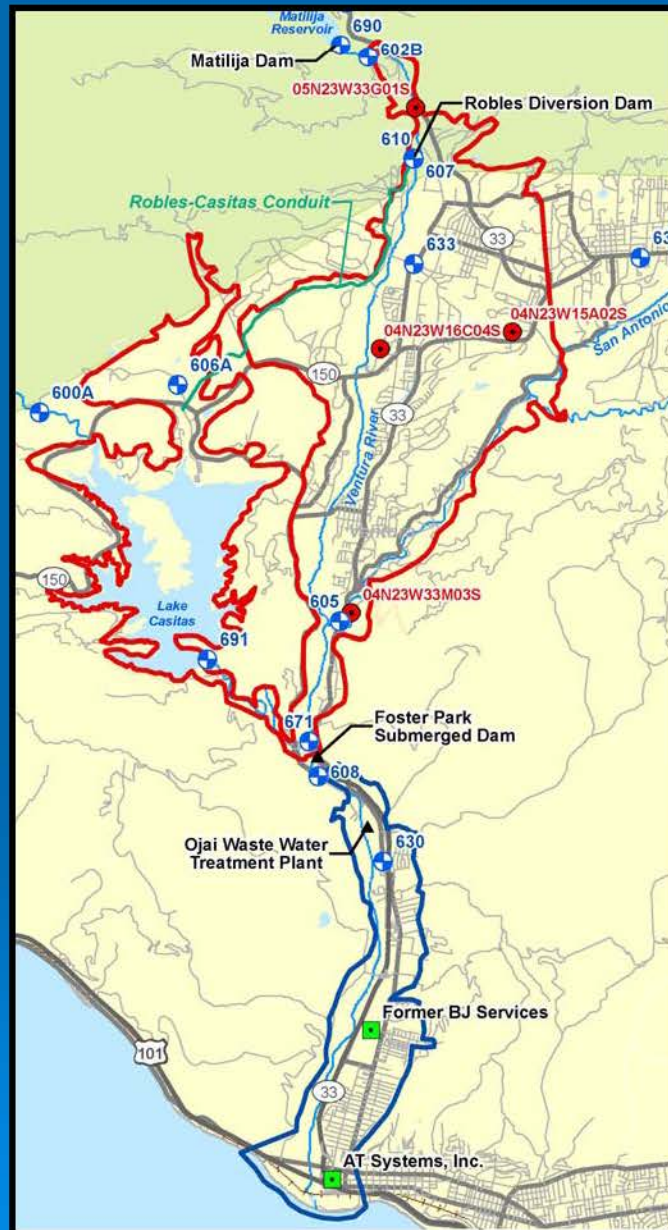
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Jordan Kear, P.G., C.Hg.

Kear Groundwater



Project Study Area



Explanation

- | | |
|--------------------|---|
| Active stream gage | Wells with groundwater level hydrographs presented |
| Groundwater basin | Sites used for determination of hydraulic gradient in Lower Basin |
| Lower Ventura | |
| Upper Ventura | |

Project Schedule

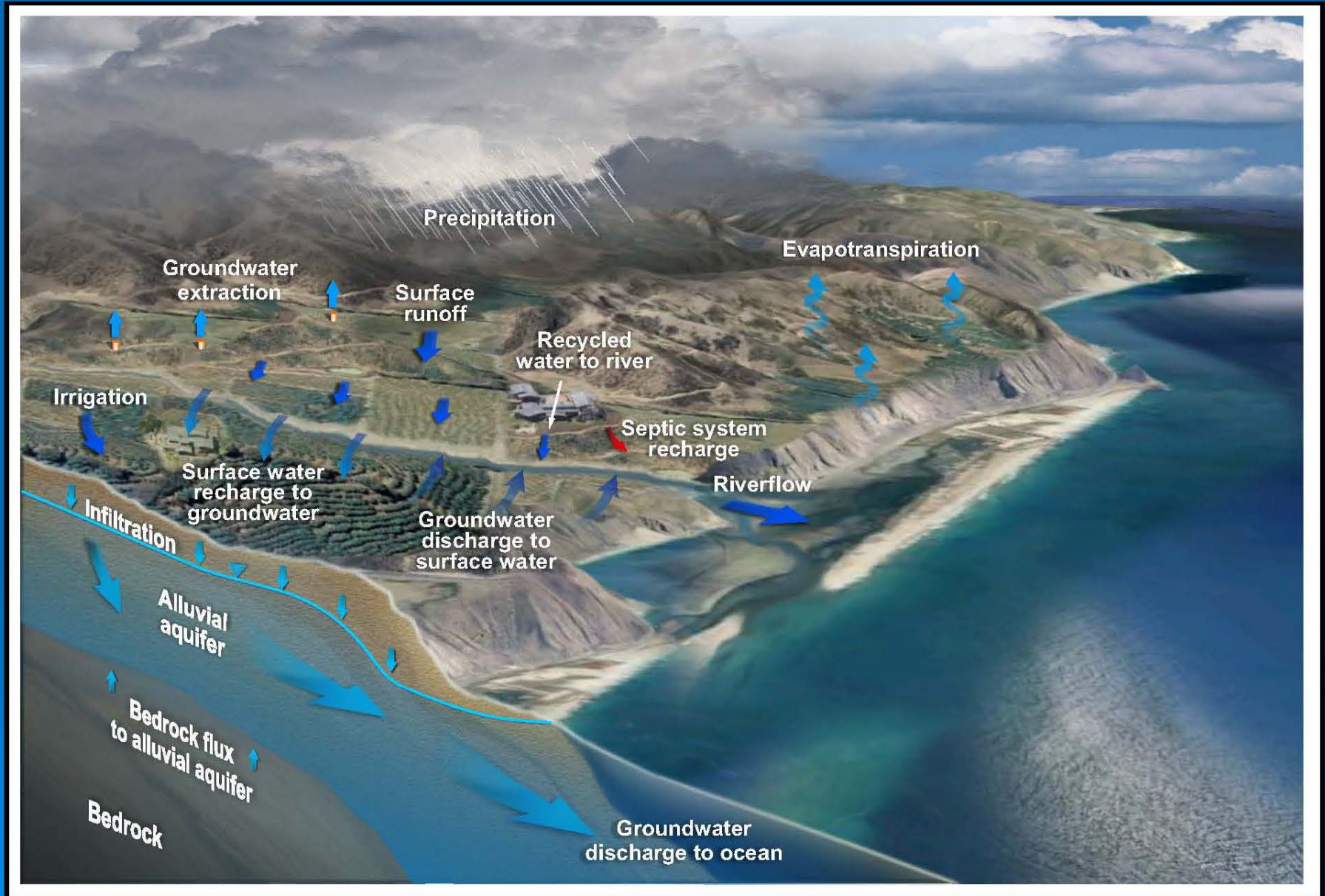
- ◆ August 24: Presentation of draft (75% complete) groundwater budget/approach for a groundwater management plan (GWMP) report
- ◆ September 24: Receive stakeholder comments
- ◆ October 8: Submit complete draft (90% complete) report to Ventura County
- ◆ October 22: Receive comments from County
- ◆ November 15: Submit complete final report

- ◆ Please submit comments to:
 - ◆ gschnaar@dbstephens.com
 - ◆ CC barbara.council@ventura.org
 - ◆ CC rick.viergutz@ventura.org
 - ◆ CC zia.hossenipour@ventura.org

Disclaimer

- ◆ *All result of the groundwater budget and the approach to the GWMP are preliminary*
- ◆ *Results of the groundwater budget are specific to the 'budgeted time period' (water years 1997-2007)*

ULVRB Groundwater Budget



ULVRB Groundwater Budget

Change in Groundwater Storage

=

Inputs to Groundwater - Outputs from Groundwater

Inputs:

- ♦ Infiltration (from precipitation and irrigation)
- ♦ Groundwater flow from upgradient Subbasin
- ♦ Surface water recharge to groundwater
- ♦ Bedrock influx to alluvial Subbasin
- ♦ Recharge from domestic septic systems

Outputs:

- ♦ Extraction (municipal, domestic, agricultural and industrial)
- ♦ Groundwater flow to downgradient Subbasin or the Ocean
- ♦ Groundwater discharge to Surface water
- ♦ Efflux of groundwater from alluvial Subbasin to Bedrock

Groundwater Budget: Approach

- ◆ Estimate, based on available data and hydrogeologic analyses, the magnitude of each groundwater input and output for each Subbasin
- ◆ Resulting budget provides an estimate of the net gain or loss of the volume of groundwater in storage within each Subbasin (Acre-feet per year, AF/yr)
- ◆ Relied on the Ventura River Watershed Hydrology Model (VRWHM) when possible (Tetra Tech, 2009)
- ◆ Acquired additional data for the study area (e.g., extraction data) when necessary

Baseline Model Calibration and Validation Report

Ventura River Watershed Hydrology Model

Prepared for:

**Ventura County Watershed Protection District
Ventura, CA**

Prepared by:

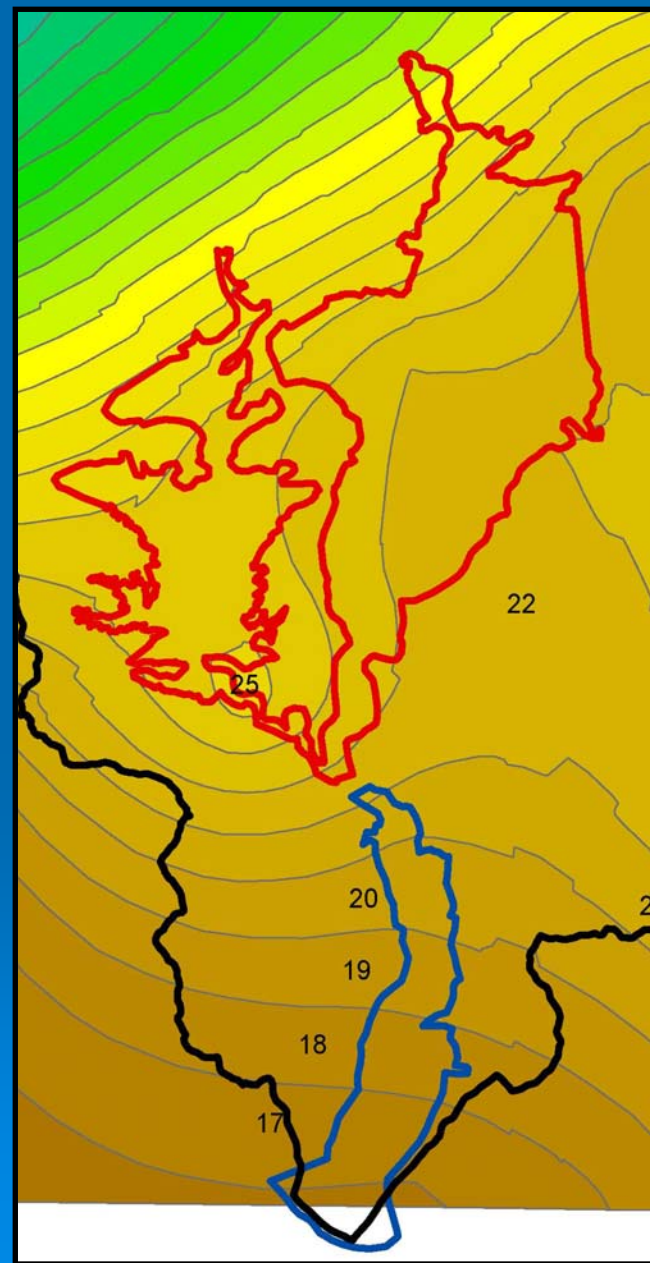


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July 21, 2009

Precipitation

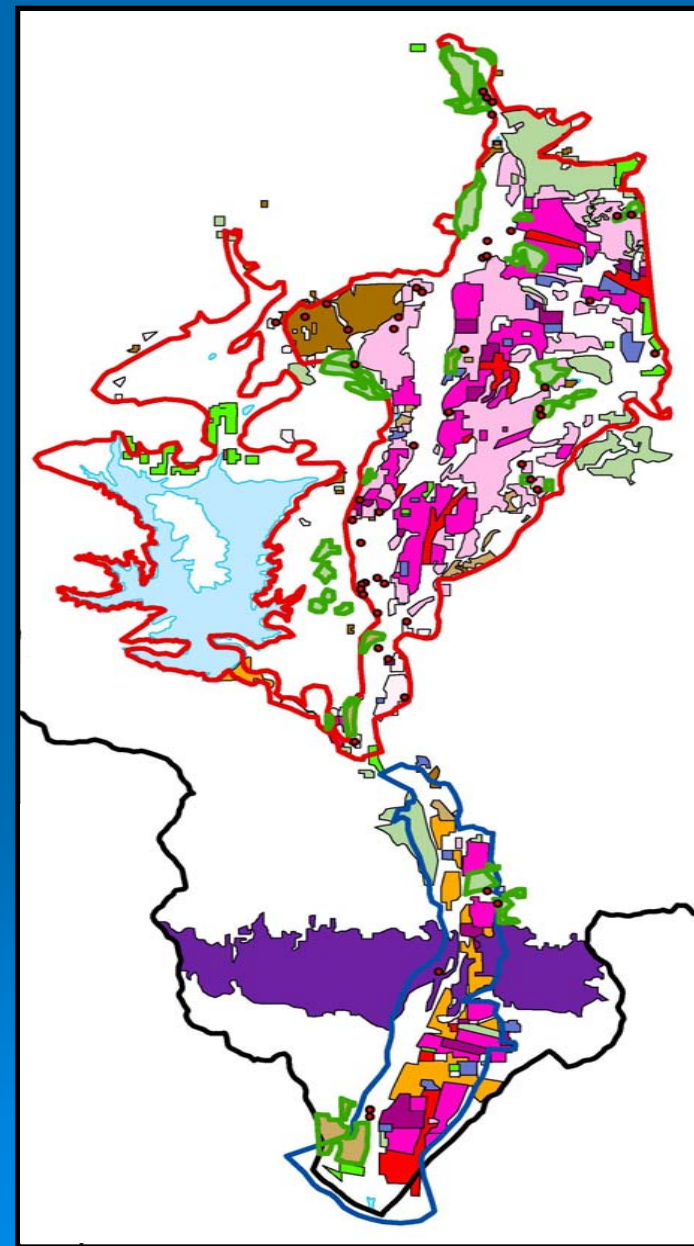
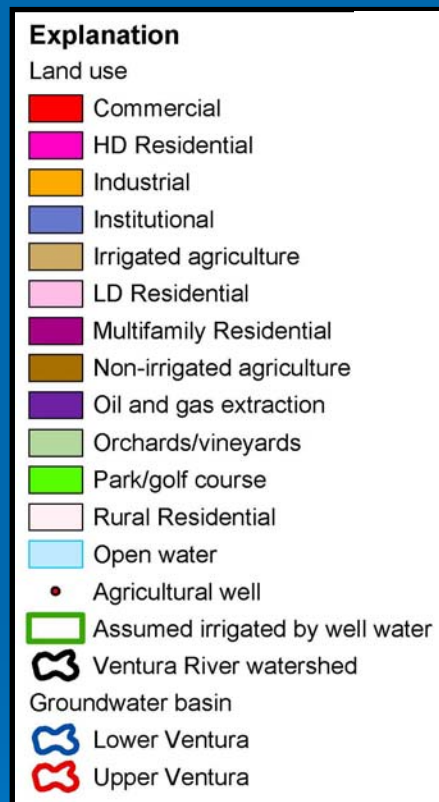
- ◆ Lower Ventura: 4,946 AF/yr
 - ◆ Upper Ventura (east): 17,659 AF/yr
 - ◆ Upper Ventura (west): 3,661 AF/yr (land surface)
- Source: Tetra Tech, 2009. Baseline Model and Calibration Report.



Irrigation

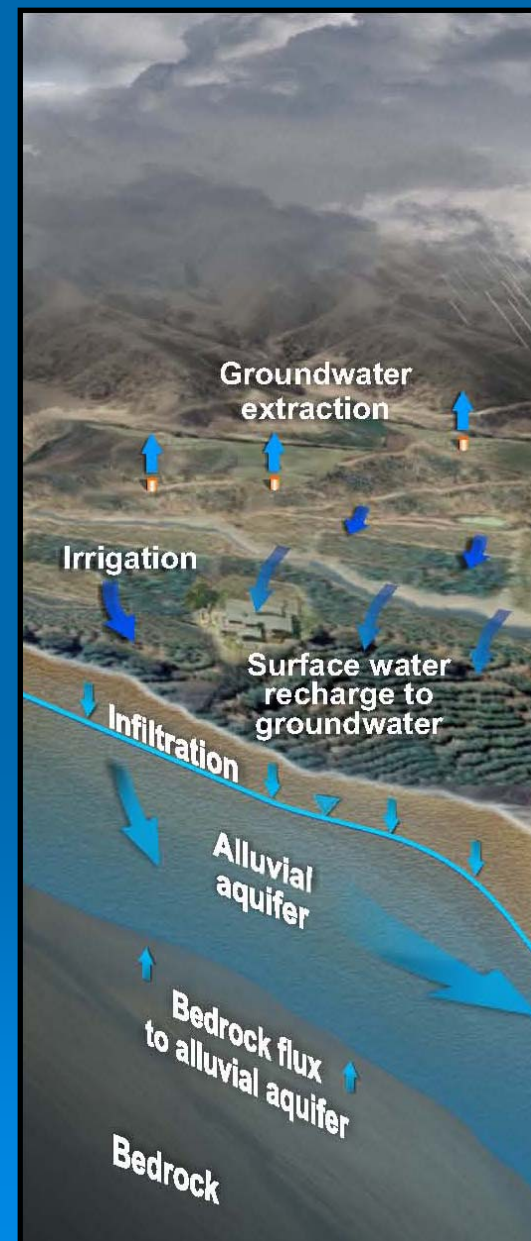
- ◆ Lower Ventura: 2,822 AF/yr
- ◆ Upper Ventura (east): 12,865 AF/yr
- ◆ Upper Ventura (west): 670 AF/yr

- Areas under irrigation calculated from Tetra Tech (2009)
- Irrigation amounts for each crop from California Department of Water Resources (2010)



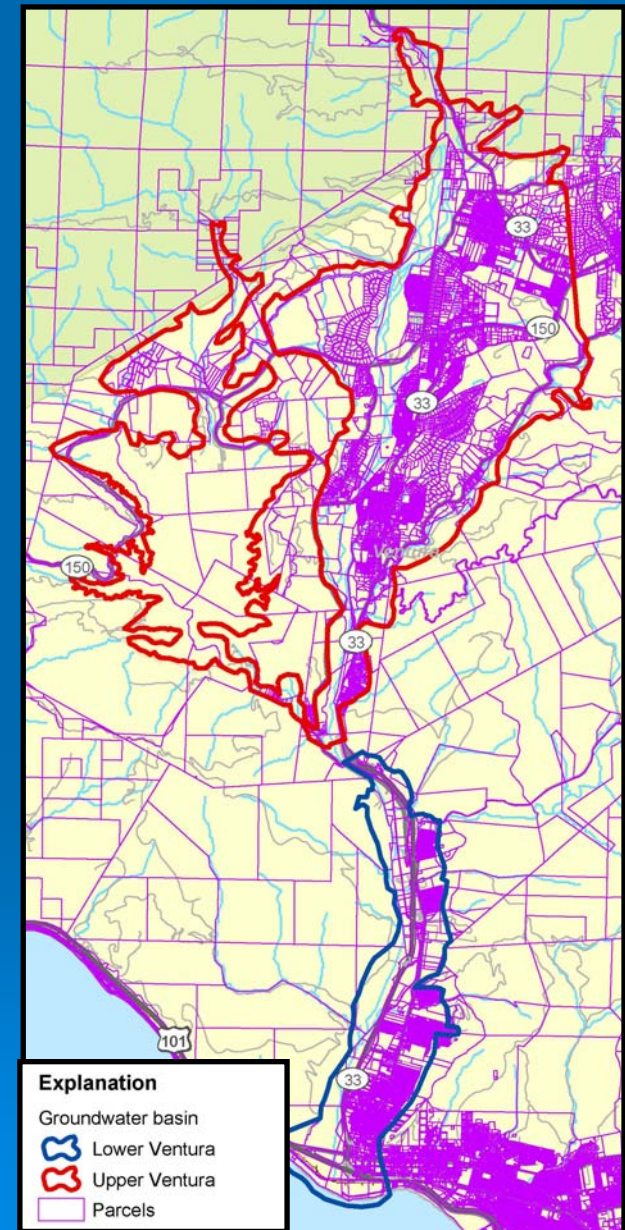
Infiltration to Groundwater

- ◆ Lower Ventura: 332 AF/yr
- ◆ Upper Ventura (east): 1,303 AF/yr
- ◆ Upper Ventura (west): 150 AF/yr
- Used infiltration factors (i.e., infiltration as a percentage of infiltration and precipitation) derived from the VRWHM (Tetra Tech, 2009)
- Estimates would be improved by obtaining data from VRWHM more specific to the area of the Subbasins

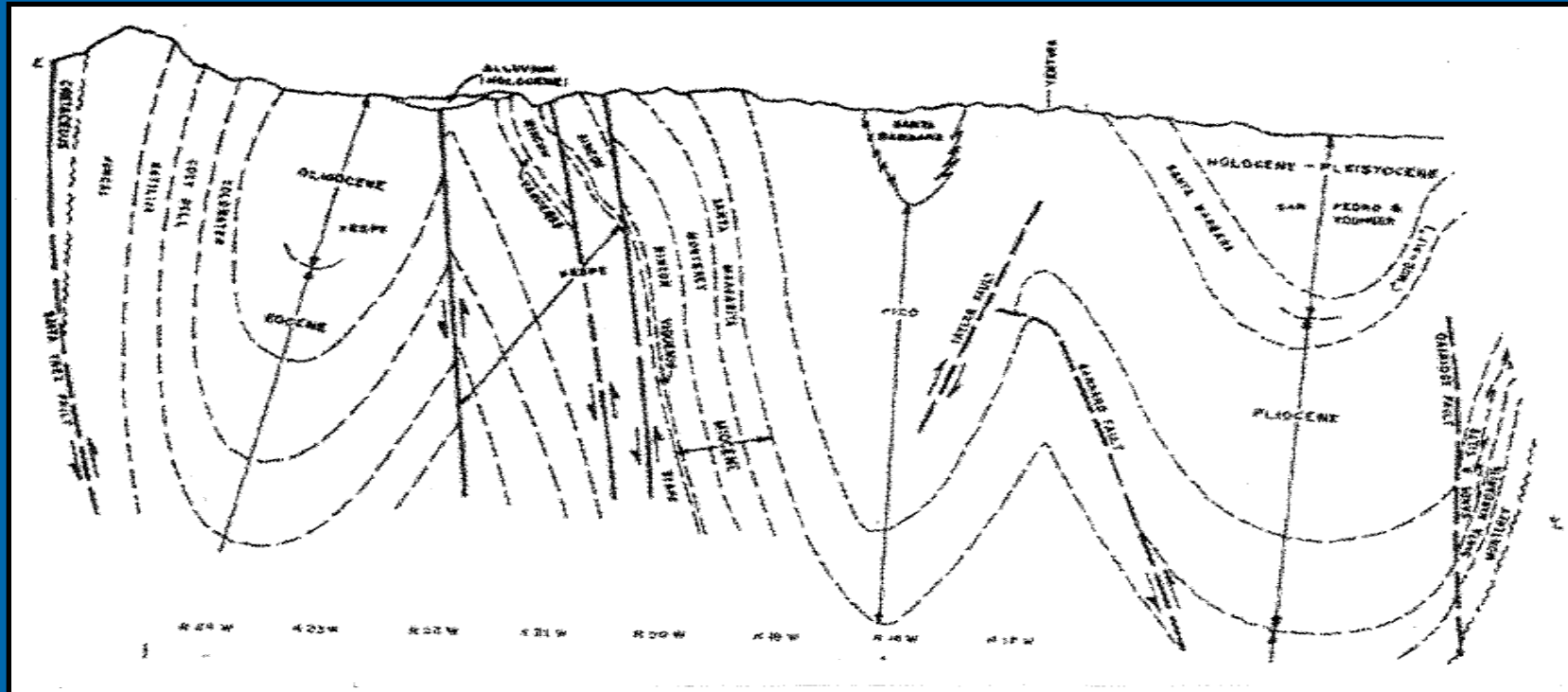


Recharge from Septic Systems

- ◆ Lower Ventura: 6 AF/yr
- ◆ Upper Ventura (east): 126 AF/yr
- ◆ Upper Ventura (west): 19 AF/yr
- Data on location of septic systems (by Assessor's Parcel Number) from County of Ventura Individual Sewage Disposal Systems Applications/Permits Database
- Assumed recharge of 150 gal/day (0.16 AF/yr) per septic system (Hantzche and Finnemore, 1992)



Groundwater Influx from Bedrock



- ◆ Lower Ventura: 606 AF/yr
- ◆ Upper Ventura (combined): 256 AF/yr
- Bedrock geology from Diblee (1987,1988), AAPG (1975), and DOG (1992)
- Darcy's Law used to estimate flux from bedrock, using methods from Driscoll (1986) and GRA (2004)

Net Surface Water/Groundwater Balance

Groundwater Output

- ◆ Lower Ventura: 1,254 AF/yr groundwater discharge to surface water
 - Water balance of Lower Ventura River from VRWHM (Tetra Tech, 2009)

Groundwater Input

- ◆ Upper Ventura (east): 2,290 AF/yr surface water recharge to groundwater
 - Water balance of Upper Ventura River and San Antonio Creek from VRWHM (Tetra Tech, 2009)
- ◆ Upper Ventura (west): 2,003 AF/yr surface water recharge to groundwater
 - Recharge from Lake Casitas estimated from VRWHM and data on Lake evaporation and direct precipitation obtained from Casitas Municipal Water District



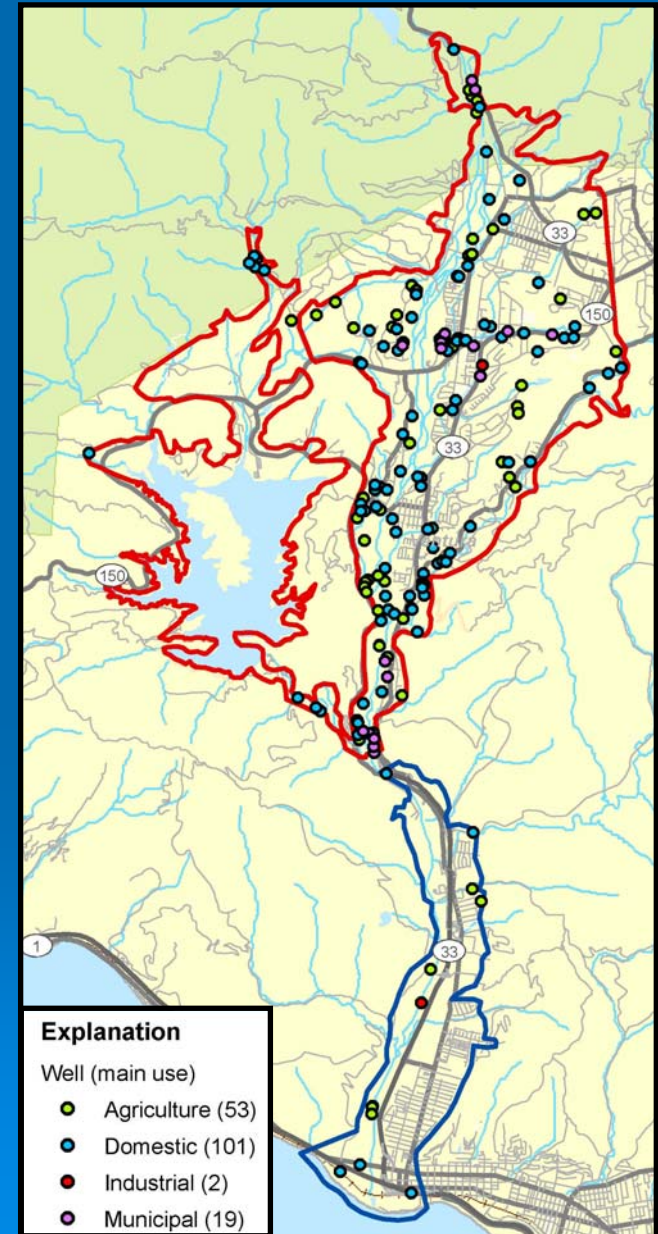
Groundwater Flux

- ◆ Flux from Upper East to Lower Subbasin: 80 AF/yr
 - Estimated using Darcy's Law
 - Hydraulic gradient at Casitas Narrows from Turner (1971)
 - Assumed hydraulic conductivity of 100 feet/day
 - Data on Foster Park Submerged Dam from SBRA (2002)
- ◆ Flux from Lower Subbasin to Ocean: 1,218 AF/yr
 - Estimated using Darcy's Law
 - Hydraulic gradient from two regulated contaminated sites (Former BJ Services and AT Systems, Inc)
 - Assumed hydraulic conductivity of 100 feet/day (Fetter, 2001)



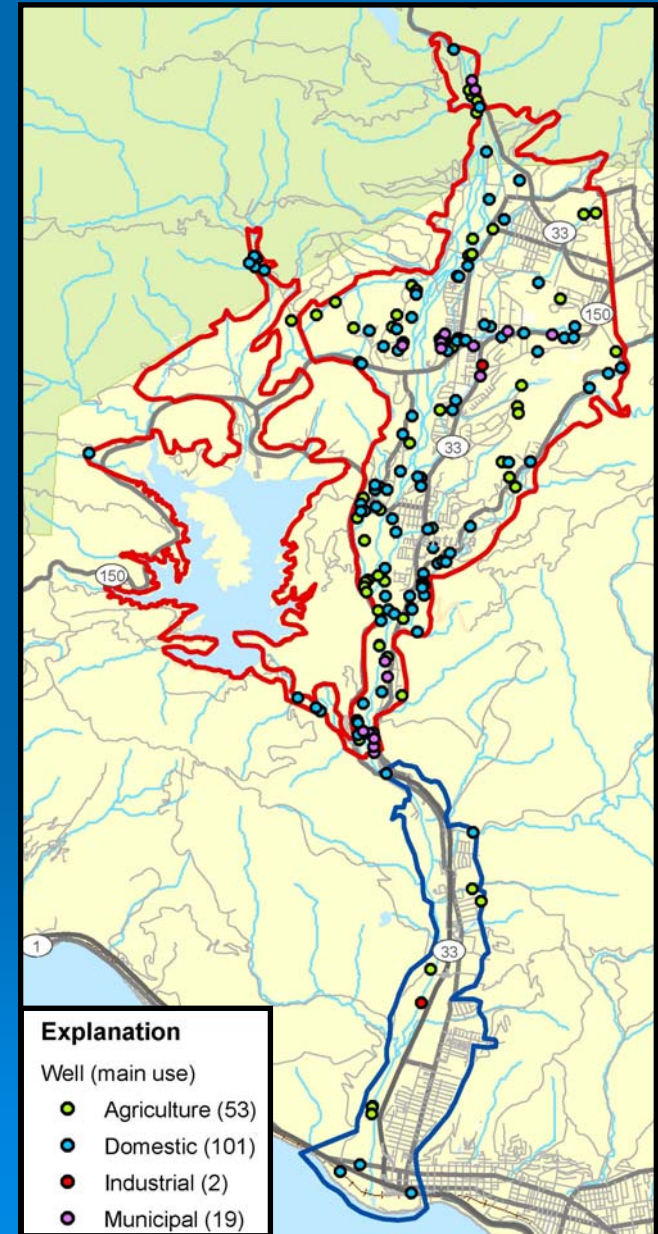
Groundwater Extraction (Municipal)

- ◆ Upper Ventura (east): 7,385 Ac-ft/yr
- Data from Casitas Municipal Water District, Meiner's Oaks, Ventura Co. Water District, and City of Ventura



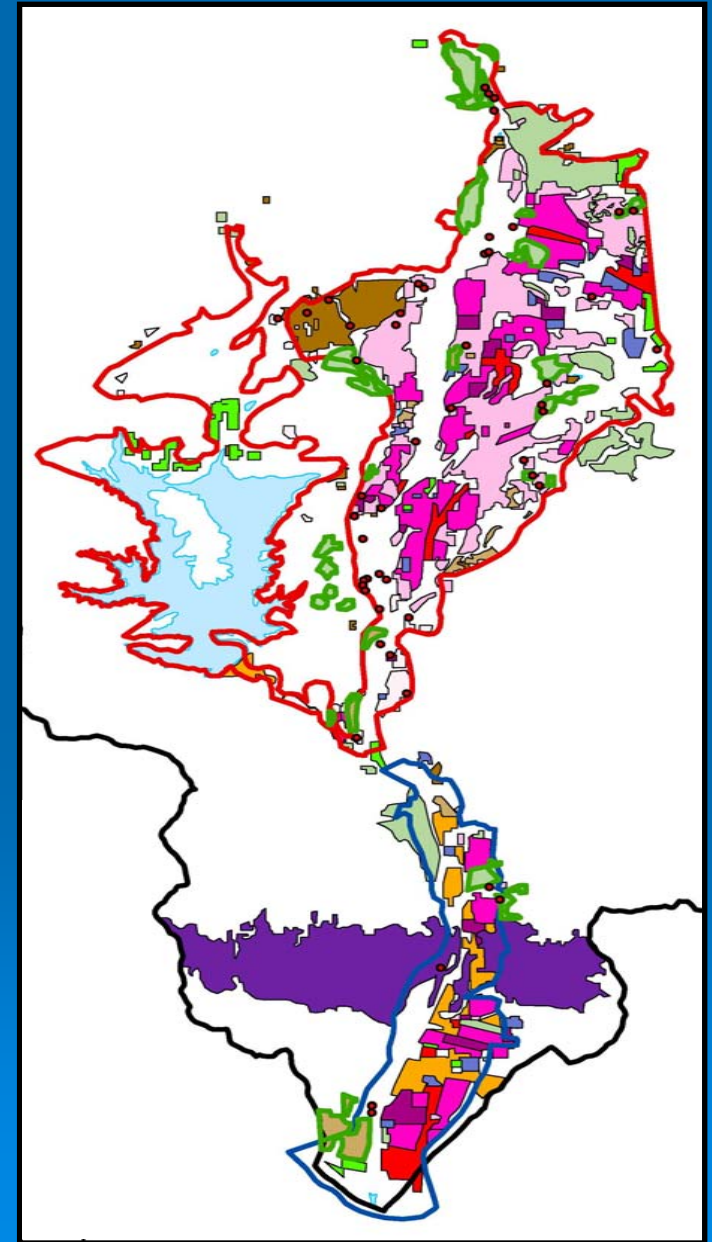
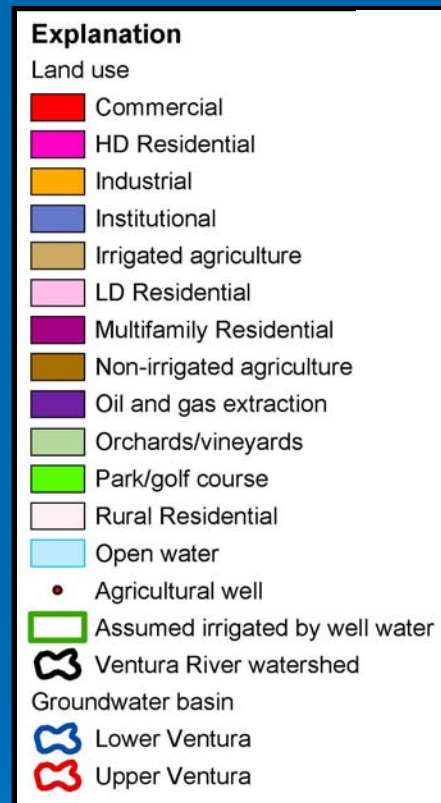
Groundwater Extraction (Domestic)

- ◆ Lower Ventura: 1 AF/yr
- ◆ Upper Ventura (east): 22 AF/yr
- ◆ Upper Ventura (west): 2 AF/yr
- Data on domestic well locations from Ventura County Well Database
- Assumed domestic water use of 225 gal/day (0.25 AF/yr) from USGS (2000) (specific to domestic water well users in California)



Groundwater Extraction (Agricultural)

- ♦ Lower Ventura: 522 AF/yr
- ♦ Upper Ventura (east): 1898 AF/yr
- Data on agricultural locations from Ventura County Well Database
- Assumed irrigation uses groundwater from agricultural areas co-located with agricultural wells



Summary Balance (Upper Ventura)

Category	Parameter	Value (ac-ft/yr)		
		Upper West	Upper East	Upper (Combined)
Basin inputs	Precipitation	3,661	17,659	21,320
	Irrigation	670	12,865	13,535
Groundwater inputs	Infiltration	150	1,303	1,453
	Net surface water to groundwater	2,003	2,290	4,293
	Septic system recharge	19	126	145
	Bedrock to alluvial	—	—	256
Groundwater outputs	Extractions (domestic)	2	22	24
	Extractions (municipal)	—	7,385	7,385
	Extractions (agricultural)	—	1,898	1,898
	Groundwater outflow to Lower Subbasin	—	—	80
Final balance ^a				-3,240

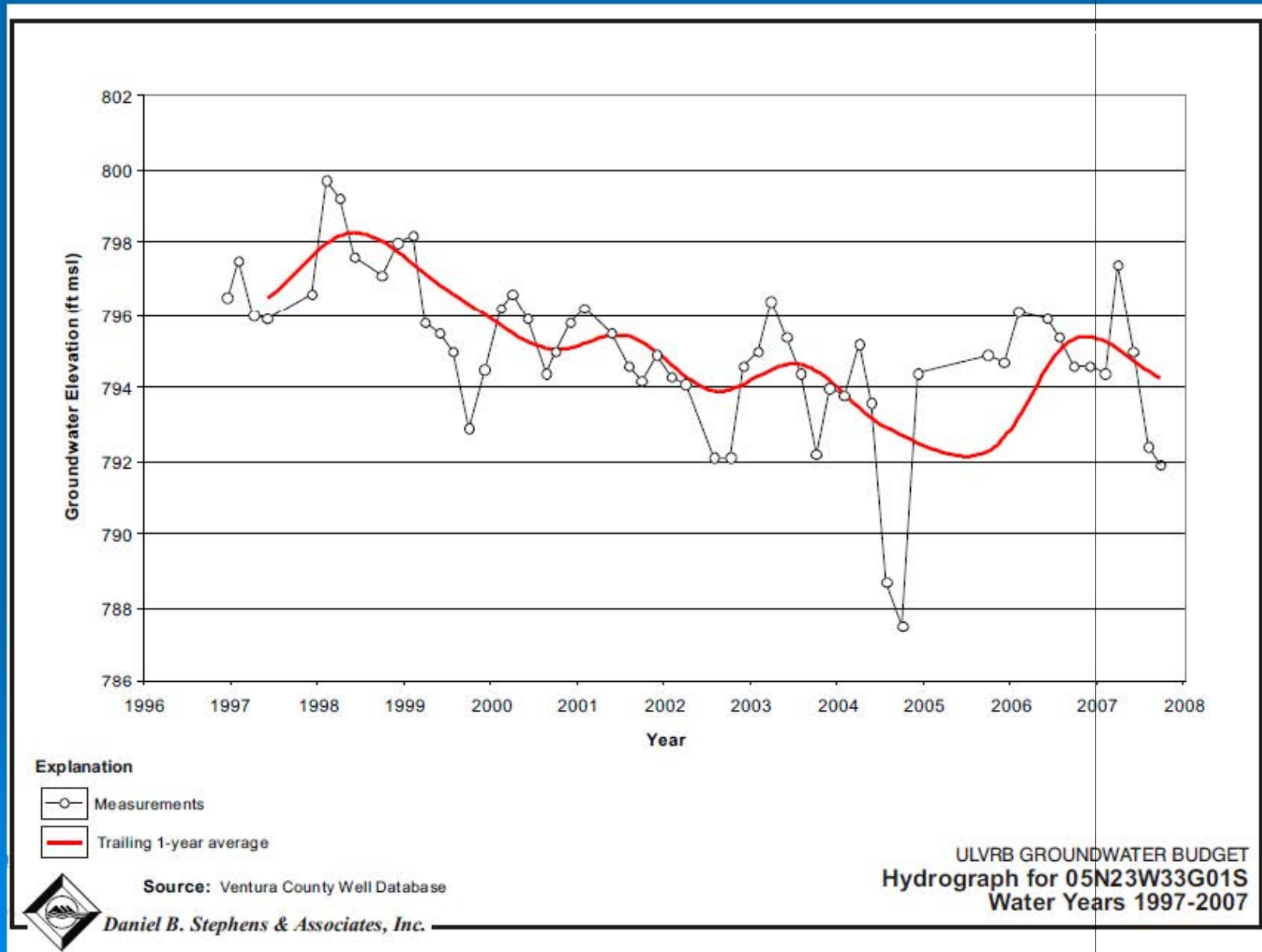
Source: Tables 3 through 11

^a Sum of groundwater inputs minus sum of groundwater outputs.

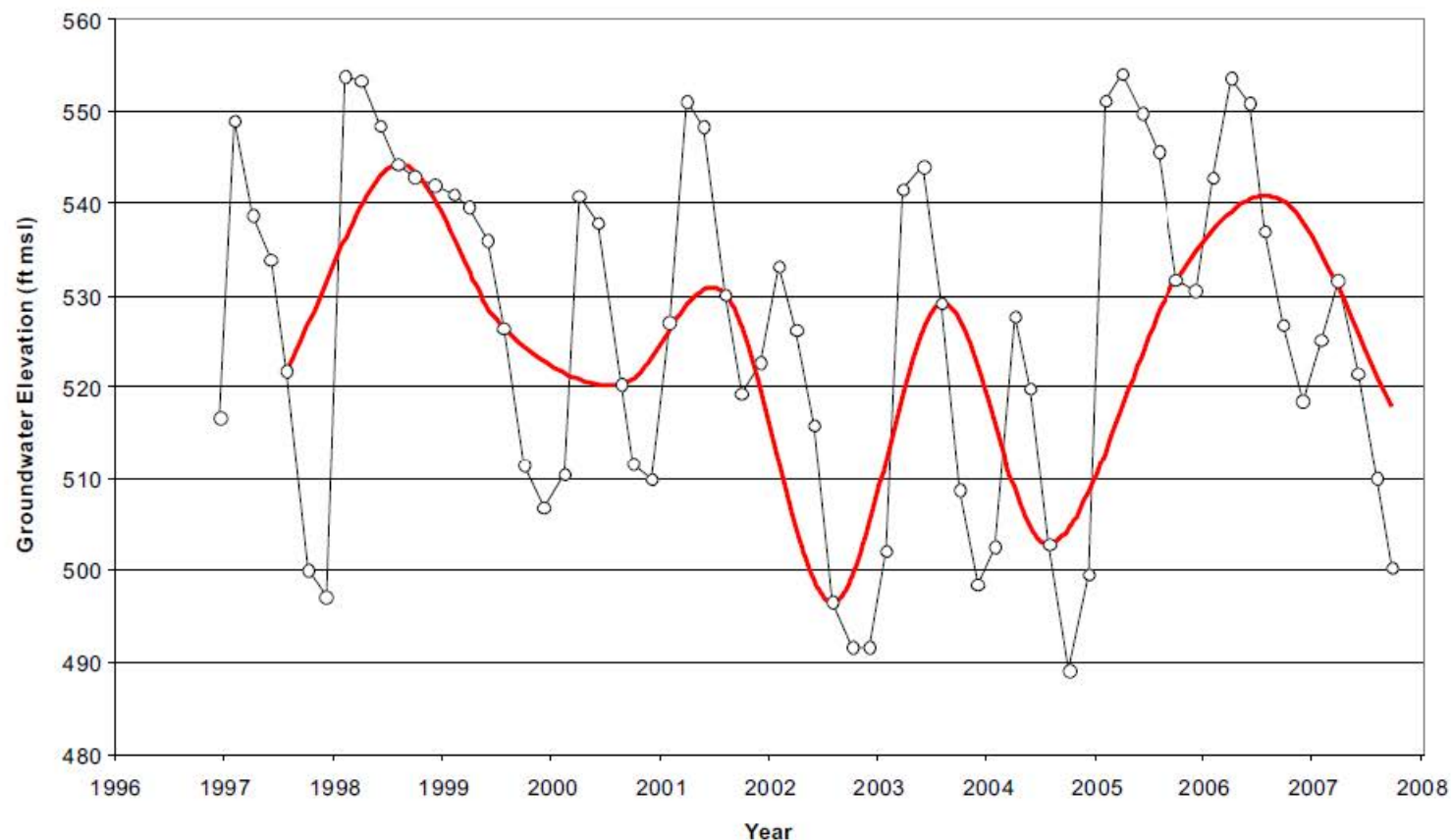
ac-ft/yr = Acre-feet per year

— = Not applicable

Summary Balance (Upper Ventura)



Summary Balance (Upper Ventura)



Explanation

- Measurements
- Trailing 1-year average

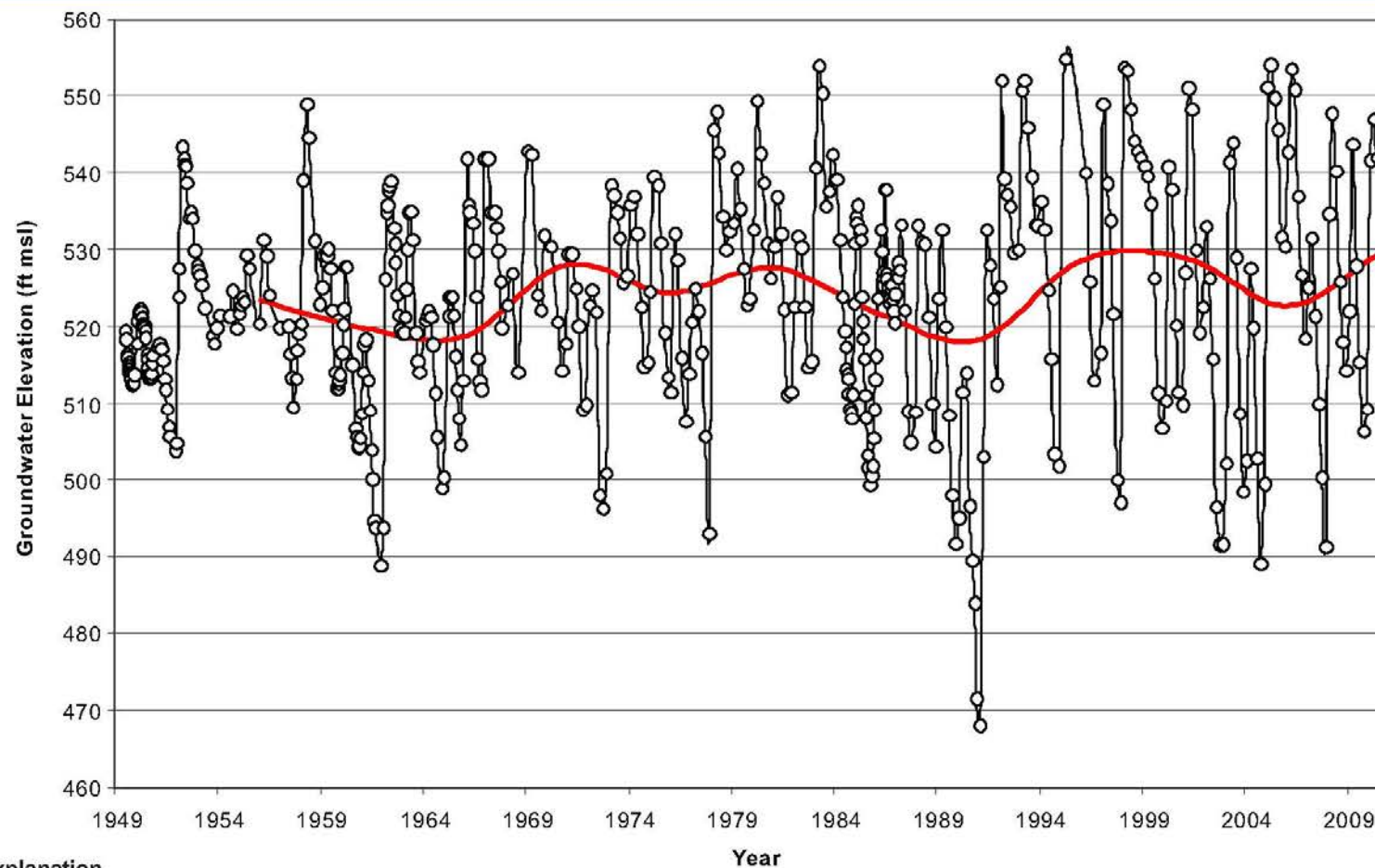


Source: Ventura County Well Database

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ULVRB GROUNDWATER BUDGET
Hydrograph for 04N23W16C04S
Water Years 1997-2007

Summary Balance (Upper Ventura)



Explanation

- Measurements
- Trailing 5-year average



Source: Ventura County Well Database
Daniel B. Stephens & Associates, Inc.

ULVRB GROUNDWATER BUDGET
Hydrograph for Ventura County
Key Well 04N23W16C04S

Summary Balance (Lower Ventura)

Category	Parameter	Value (ac-ft/yr)
Basin inputs	Precipitation	4,946
	Irrigation	2,822
Groundwater inputs	Infiltration	332
	Septic system recharge	6
	Bedrock to alluvial	606
	Groundwater inflow from Upper Subbasin	80
Groundwater outputs	Groundwater discharge to surface water	1,254
	Extractions (domestic)	1
	Extractions (agricultural)	522
	Downgradient out	1,218
Final balance ^a		-1,971

Source: Tables 3 through 11

ac-ft/yr = Acre-feet per year

^a Sum of groundwater inputs minus sum of groundwater outputs.

Recommendations for Groundwater Budget

- ◆ Develop a groundwater model of the Subbasins to improve estimation of the groundwater budget
- ◆ Obtain data from VRWHM that is more specific to the areas of the Subbasins
- ◆ Obtain agricultural and industrial extraction rates from individual wells
- ◆ Identify wells within the Lower Subbasin for groundwater level monitoring
- ◆ Consider siting additional surface water gages along the Ventura River and San Antonio Creek to better understand groundwater/surface water dynamics

Approach to a GWMP

- ◆ **Component 1.** Develop a map showing the area of the Basin, as defined by CDWR Bulletin 118, with the area that will be subject to the GWMP, as well as the boundaries of other local agencies that overlie any portion of the Basin.
- ◆ **Component 2.** Provide a written statement to the public describing the manner in which interested parties may participate in development of the GWMP. The statement should be provided to the public via local newspapers and/or other media, with distribution throughout the Basin. Documentation of public notification will be included in the GWMP.
- ◆ **Component 3.** Establish a plan to involve other agencies whose boundaries overlie the Basin in development of the GWMP. This may include involvement via agency representative participation in the VRWC (see Component 4).
- ◆ **Component 4.** Establish process for the VRWC to serve as the designated advisory committee of stakeholders (interested parties) within the plan area that will help guide the development and implementation of the GWMP and provide a forum for resolution of controversial issues.

Approach to a GWMP

- ◆ **Component 5.** Describe, in detail, the area to be managed under the GWMP, including (1) the physical structure and characteristics of the aquifer system underlying the plan area in the context of the overall basin, (2) a summary of the availability of historical data, (3) issues of concern, and (4) a general discussion of historical and projected water demands and supplies.
- ◆ **Component 6.** Establish management objectives (MOs) for the groundwater basin that is subject to the plan.
- ◆ **Component 7.** For each MO in Component 6, describe how meeting the MO will contribute to a more reliable supply for long-term beneficial uses of groundwater in the plan area, and describe existing or planned management actions to achieve MOs.
- ◆ **Component 8.** Adopt monitoring protocols for the monitoring and management of groundwater levels, groundwater quality, potential inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality.

Approach to GWMP

- ◆ **Component 9.** Describe the monitoring program, including the following:
 - ◆ A map indicating the general locations of any applicable monitoring sites for groundwater levels, groundwater quality, subsidence stations, or stream gages.
 - ◆ A summary of monitoring sites indicating the type (groundwater level, groundwater quality, subsidence, stream gage) and frequency of monitoring. For groundwater level and groundwater quality wells, indicate the depth interval(s) or aquifer zone monitored and the type of well (public, irrigation, domestic, industrial, or monitoring).
 - ◆ A quality assurance project plan (QAPP) for monitoring in the Basin.
 - ◆ Standard operating procedures (SOPs) for monitoring in the Basin.
- ◆ **Component 10.** Describe any current or planned actions by the local managing entity to coordinate with other land use, zoning, or water management planning agencies or activities.

Approach to GWMP

- ◆ **Component 11.** Provide for periodic report(s) summarizing groundwater basin conditions and groundwater management activities. The report(s), prepared annually or at other frequencies as determined by the WCVC, should include the following:
 - ◆ Summary of monitoring results, including a discussion of historical trends
 - ◆ Summary of management actions during the period covered by the report
 - ◆ A discussion, supported by monitoring results, of whether management actions are achieving progress in meeting MOs
 - ◆ Summary of proposed management actions for the future
 - ◆ Summary of any plan component changes, including addition or modification of MOs, during the period covered by the report
 - ◆ Summary of actions taken to coordinate with other water management and land use agencies, and other government agencies
- ◆ **Component 12.** Provide for the periodic reevaluation and updating of the plan by the VRWC