

Fillmore and Piru Basins: Summary of Historical Water Budgets

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Fillmore and Piru Basins GSA Board of Directors Meeting
Thursday, February 20, 2020



Water Budget and SGMA/GSP Context

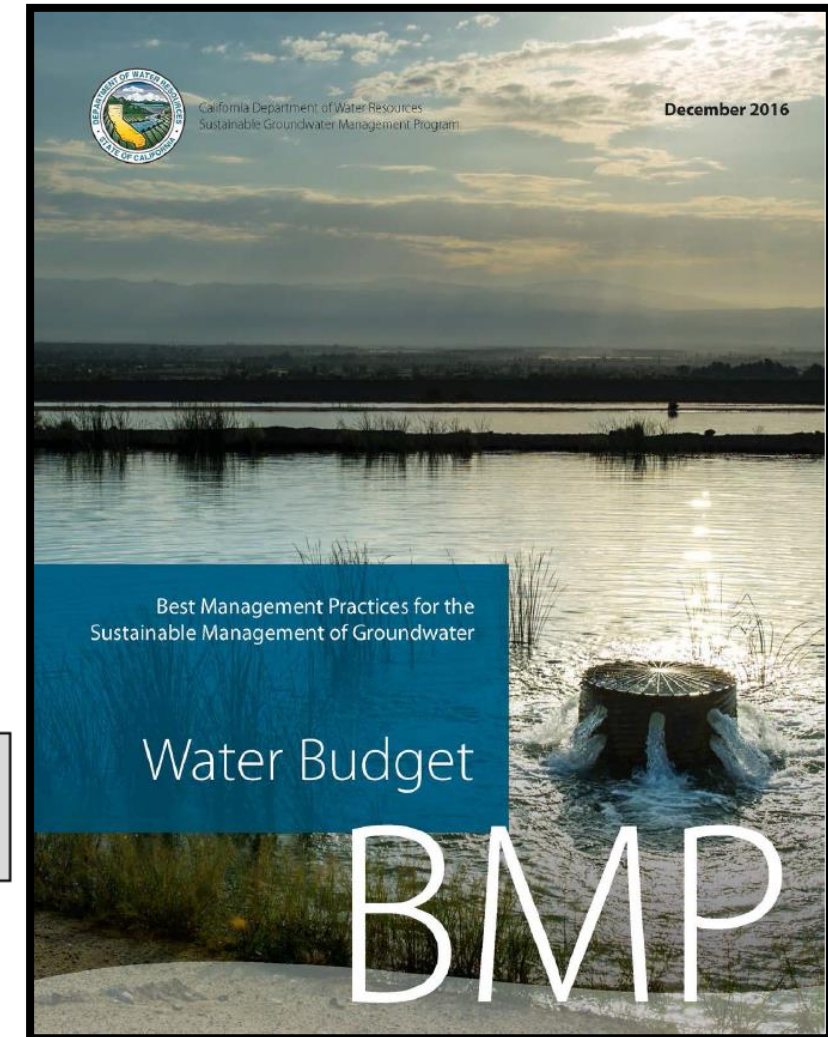
- CA Department of Water Resources (DWR)
BMP #4 – Water Budget

<https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents>

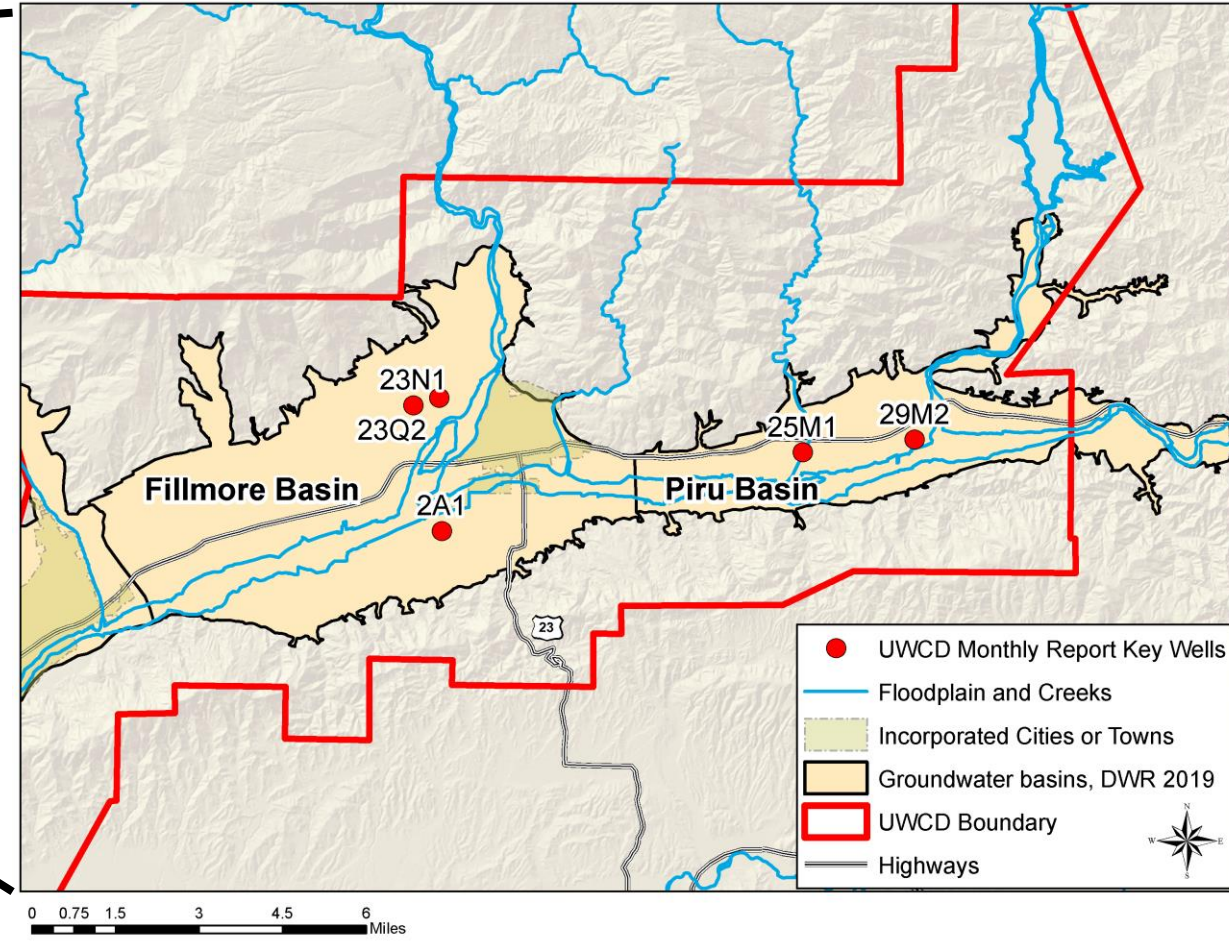
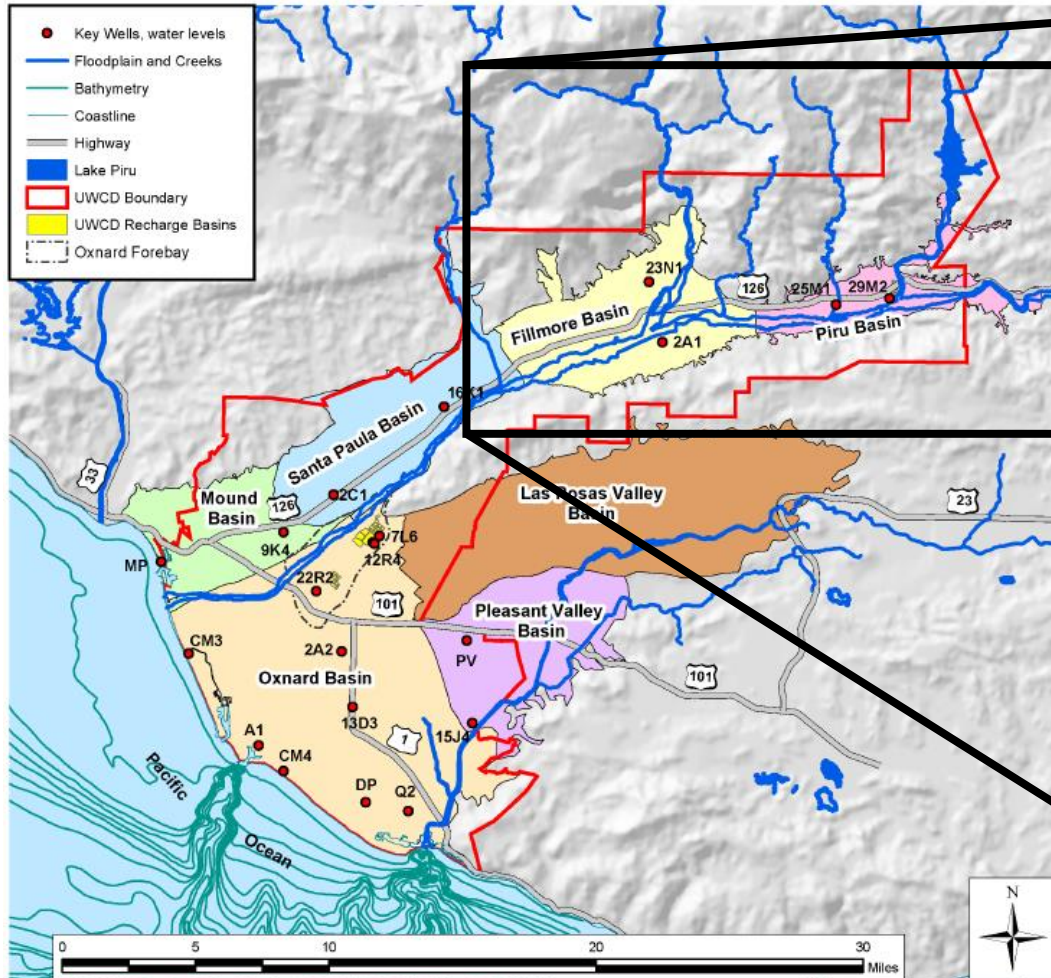
- California Code of Regulations (CCR)

[https://govt.westlaw.com/calregs/Document/I86E380AB2D89470B951D8393BE80E831?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=\(sc.Default\)](https://govt.westlaw.com/calregs/Document/I86E380AB2D89470B951D8393BE80E831?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default))

23 CCR §354.18(c): Each Plan shall quantify the current, historical, and projected water budget for the basin.



Basin Setting



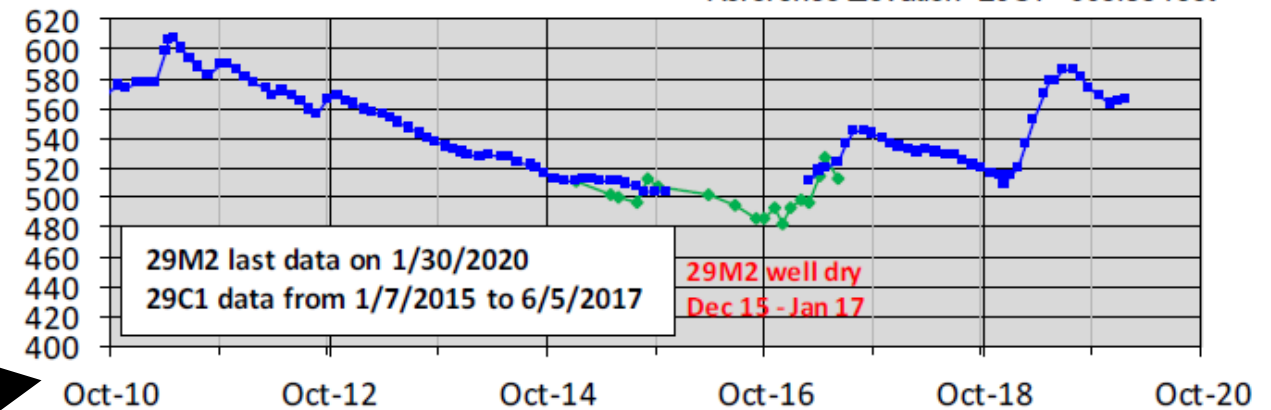
(UWCD's Monthly Hydrologic Conditions Reports:
<https://www.unitedwater.org/reports-5/groundwater-conditions>)

Groundwater Well Hydrographs - Piru

Well 04N18W29M02S (29M2)

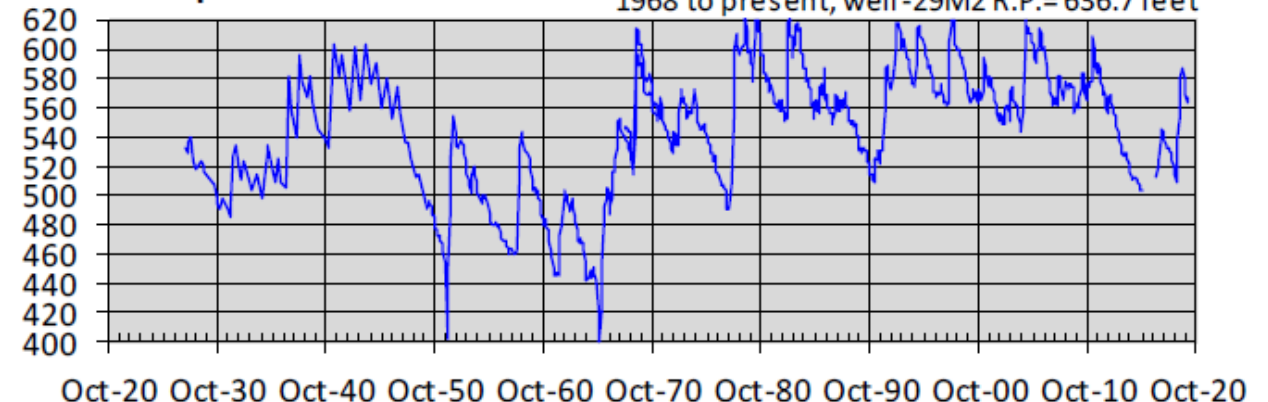
Last 10 Years

Reference Elevation -29M2= 636.7 feet
Reference Elevation -29C1= 663.03 feet



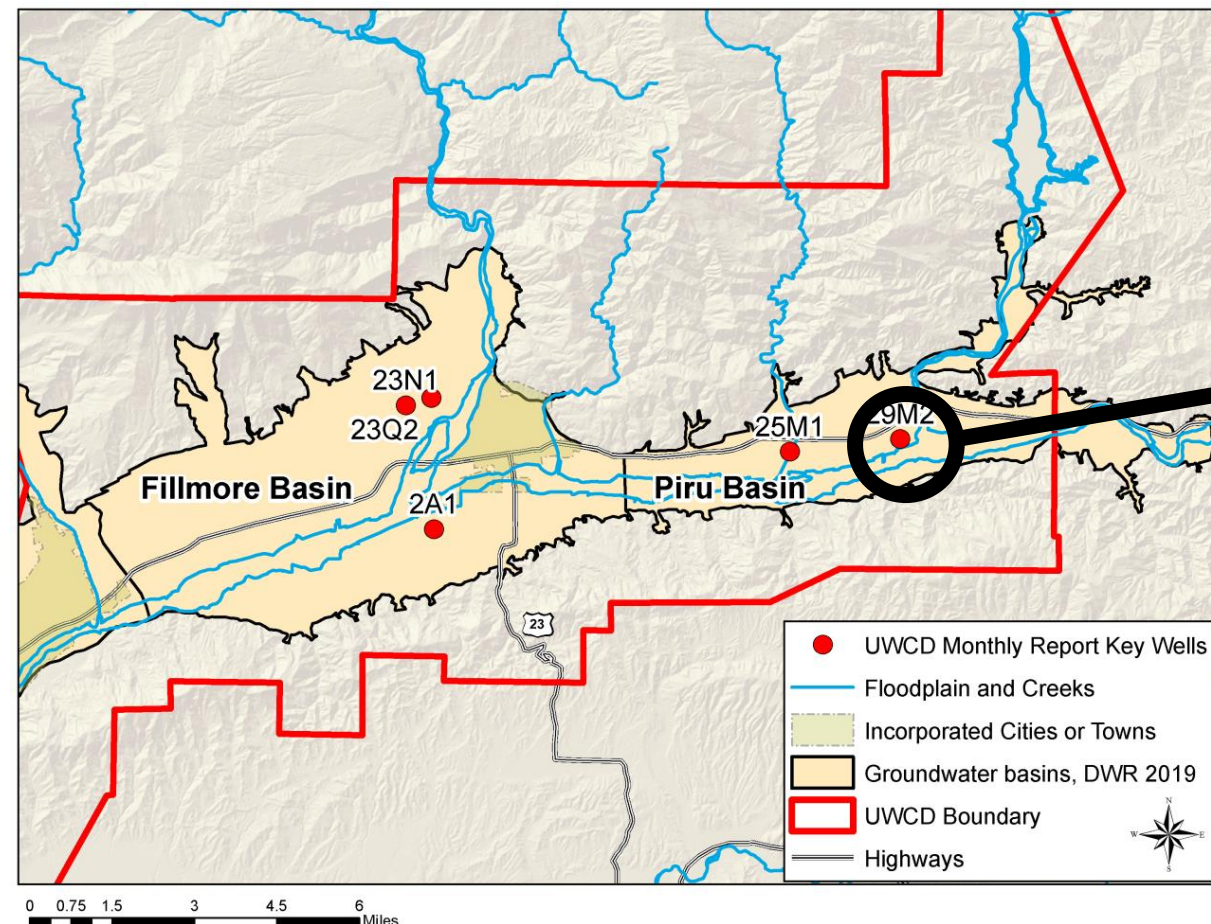
Complete Record

1926 to 1971, well -30G2 R.P.= 629 feet
1968 to present, well -29M2 R.P.= 636.7 feet



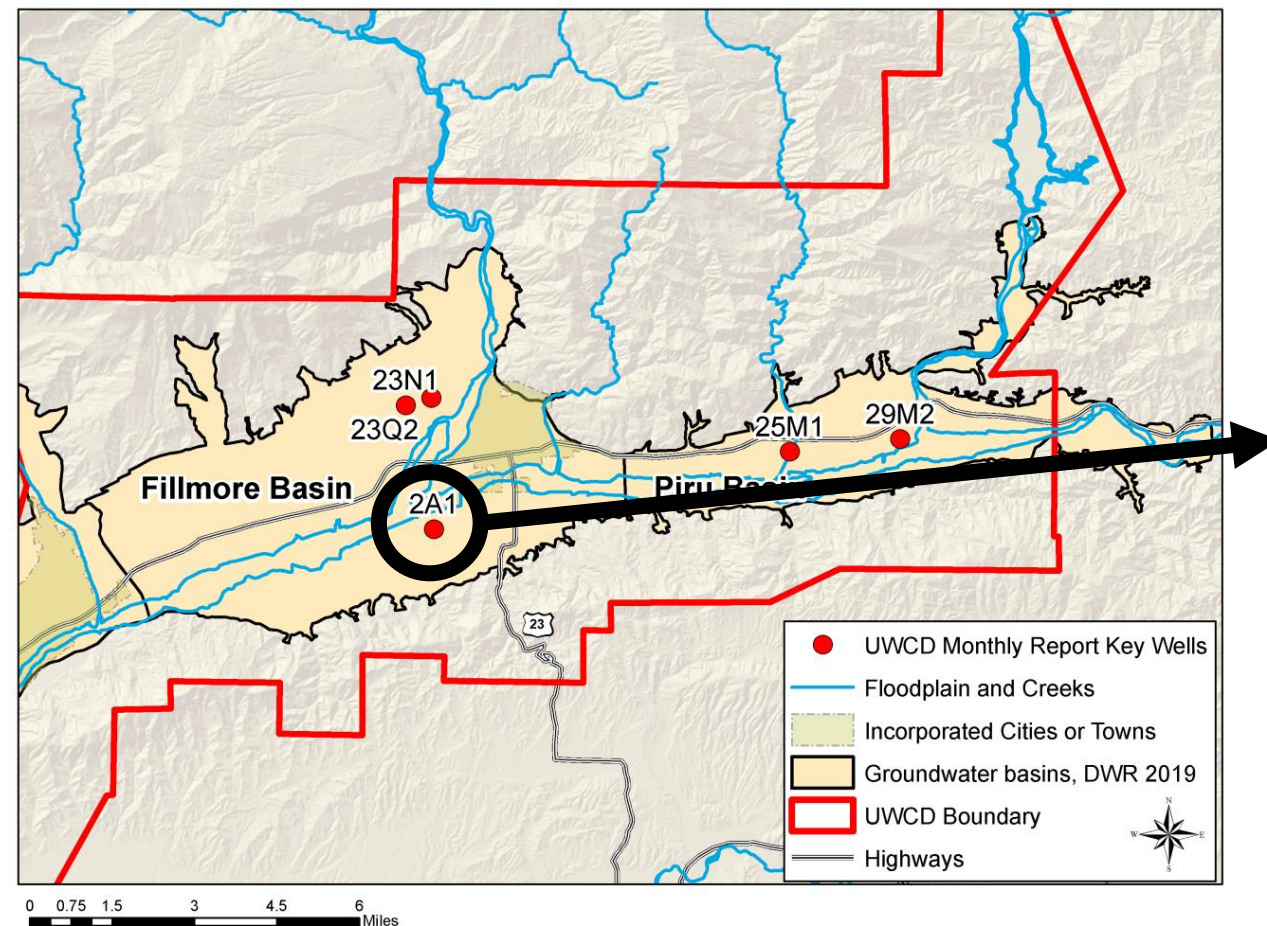
(UWCD's Monthly Hydrologic Conditions Reports:

<https://www.unitedwater.org/reports-5/groundwater-conditions>)



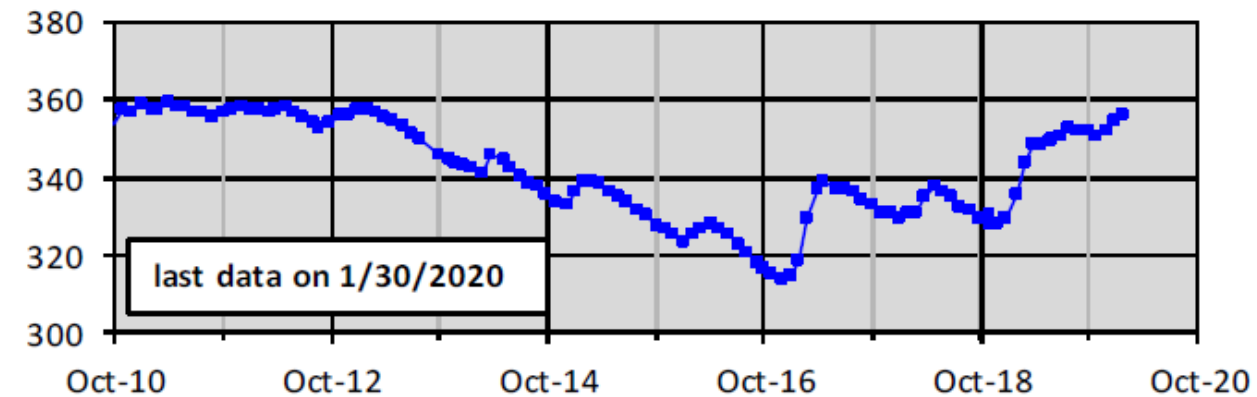
Groundwater Well Hydrographs - Fillmore

Well 03N20W02A01S (2A1)



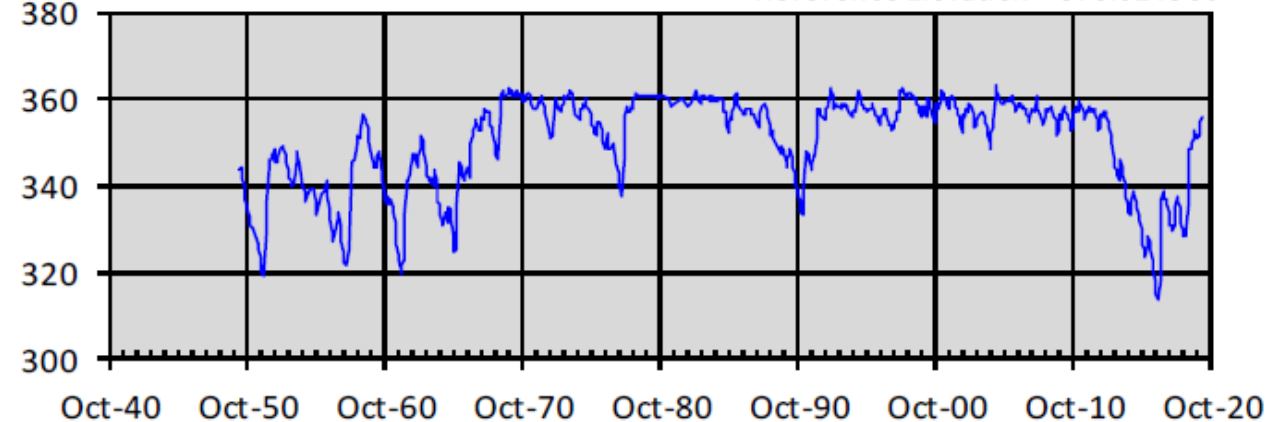
Last 10 Years

Reference Elevation = 376.61



Complete Record

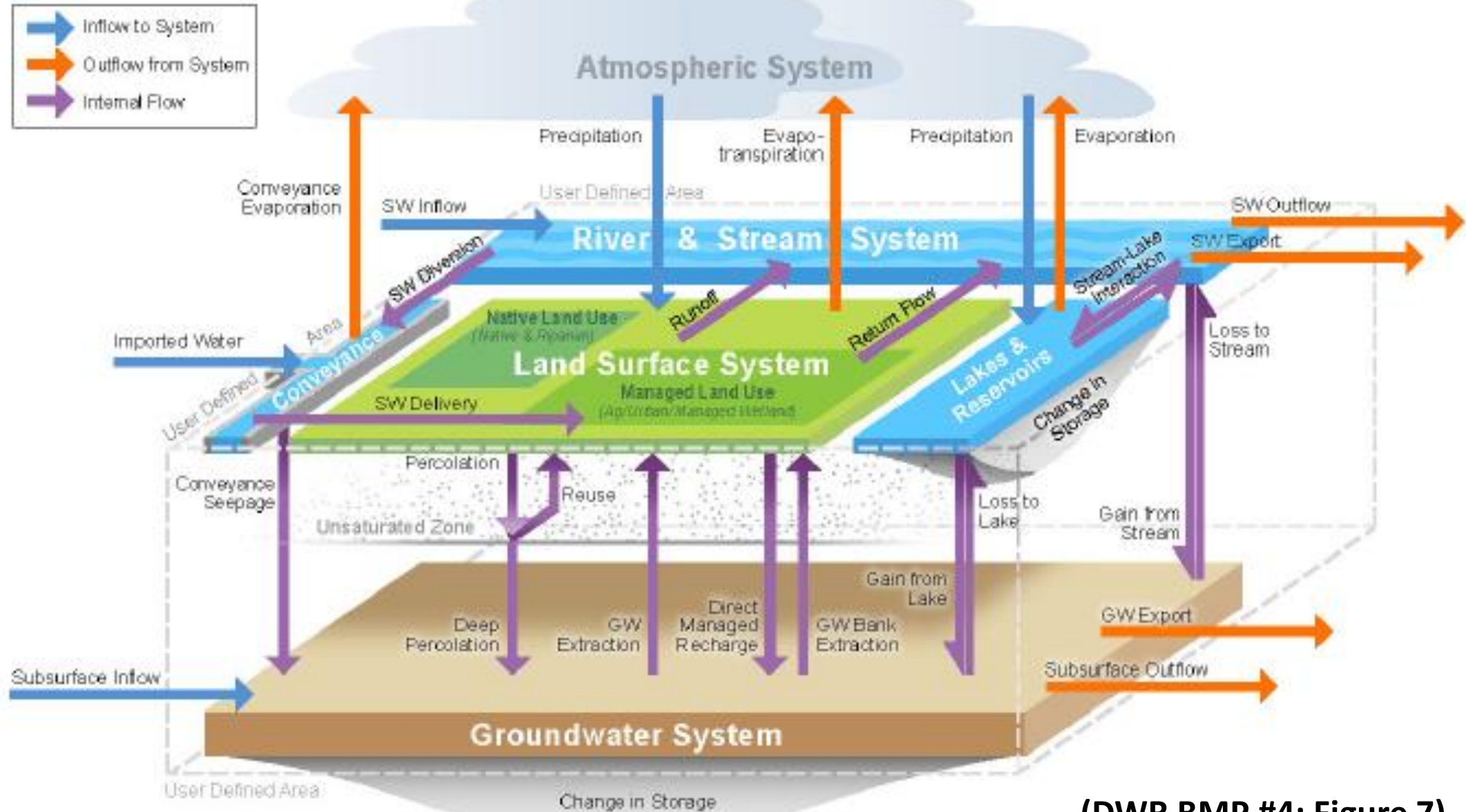
Reference Elevation = 376.61 feet



(UWCD's Monthly Hydrologic Conditions Reports:

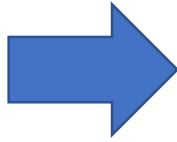
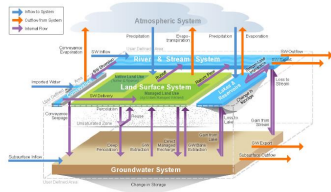
<https://www.unitedwater.org/reports-5/groundwater-conditions>)

Water Budget Fundamentals



(DWR BMP #4; Figure 7)

Water Budget Fundamentals



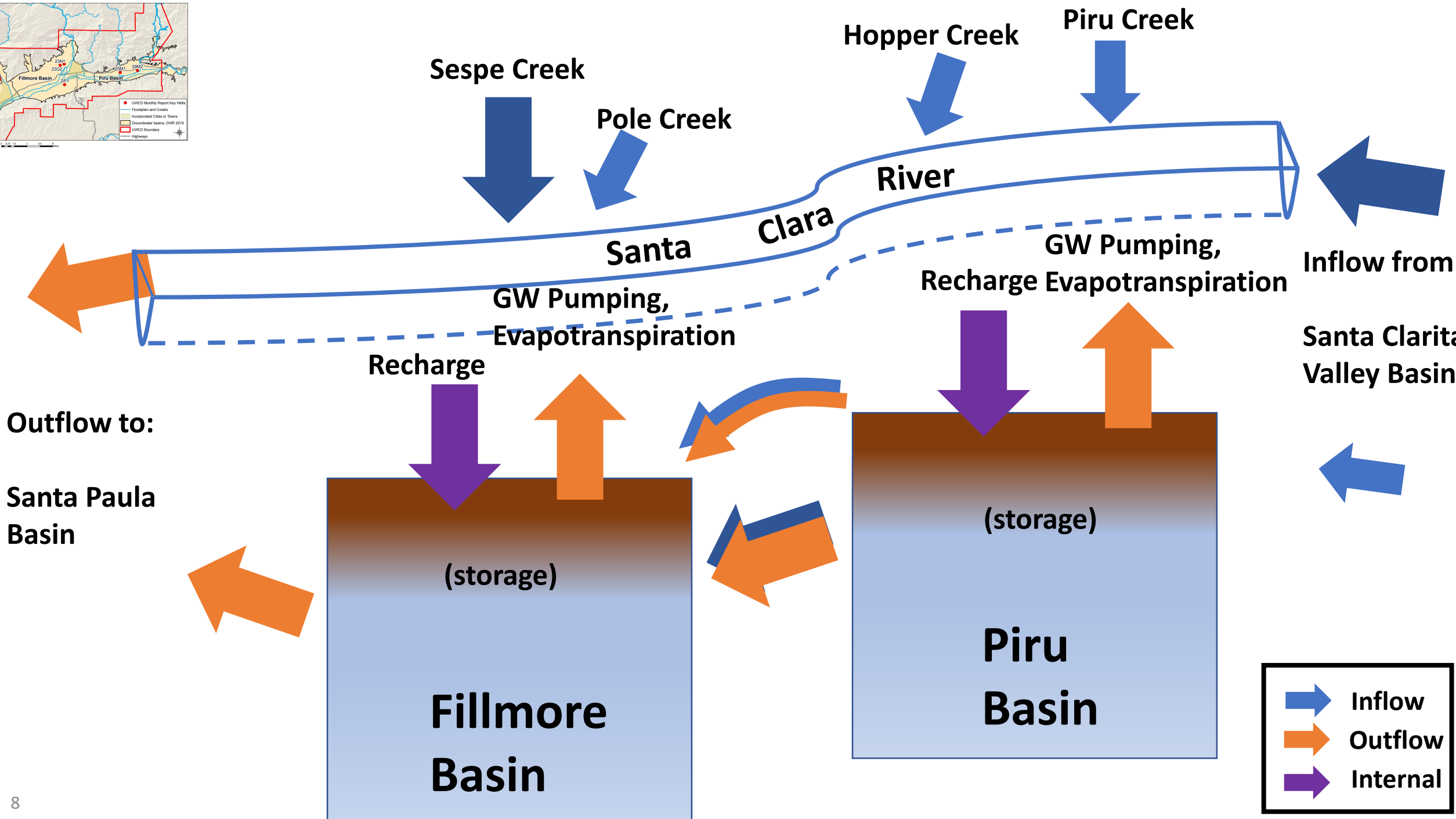
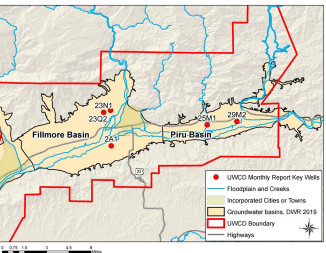
Water Year:

Water Year Type:

INFLOWS		OUTFLOWS	
Inflow Source	Volume (af/yr)	Outflow Sink	Volume (af/yr)
Surface Water Inflow ^{\1}		Surface Water Outflow ^{\1}	
Precipitation		Evapotranspiration ^{\4}	
Subsurface Groundwater Inflow		Subsurface Groundwater Outflow	
Total Basin Inflow		Total Basin Outflow	
Subsurface Groundwater Inflow		Subsurface Groundwater Outflow	
Infiltration of Precipitation		Groundwater Extraction ^{\1}	
Infiltration from Surface Water Systems ^{\2}		Discharge to surface water systems ^{\2}	
Infiltration of Applied Water ^{\3}		Total Groundwater Outflow	
Total Groundwater Inflow			
		Change in Surface Storage Volume	
		Change in Groundwater Volume	
^{\1} by water source type			
^{\2} lakes, streams, canals, springs, conveyance systems			
^{\3} includes applied surface water, groundwater, recycled water, and reused water			
^{\4} by water use sector			

(DWR BMP #4; Table 1)

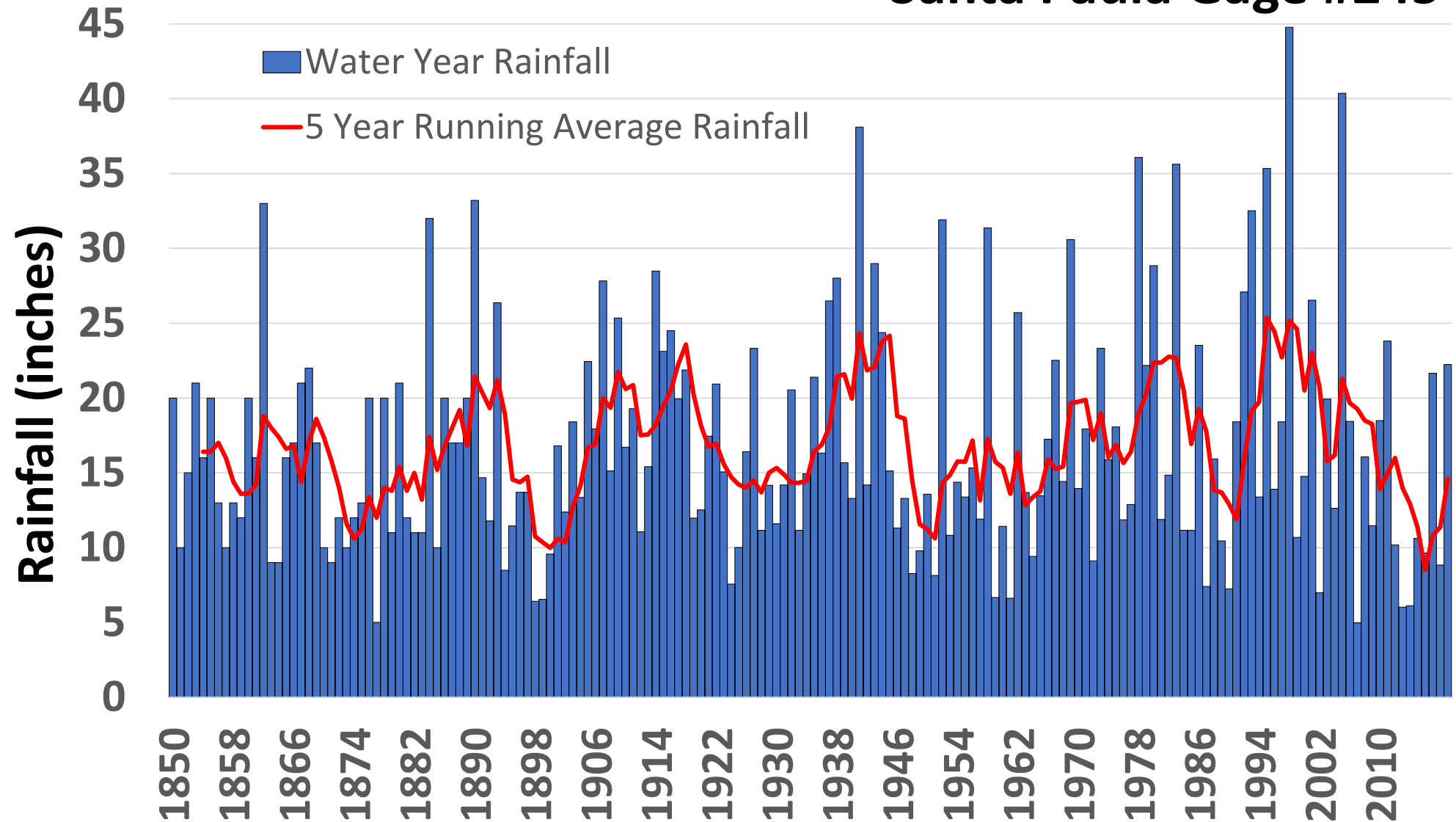
Table 1 – Simple Water Budget Tabulation Example



Historical Rainfall Record

Water Years 1850 - 2019

Santa Paula Gage #245



Water Year:
October 1 –
September 30

Representative Years

U.S. Geological Survey;
2003;
Fillmore, subsurface;
outflow;
1984 – 1993
(1891 – 1993 total)

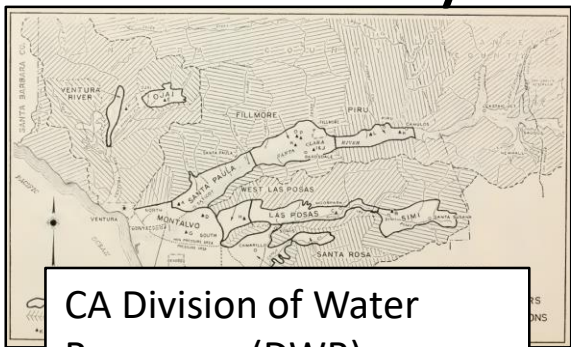
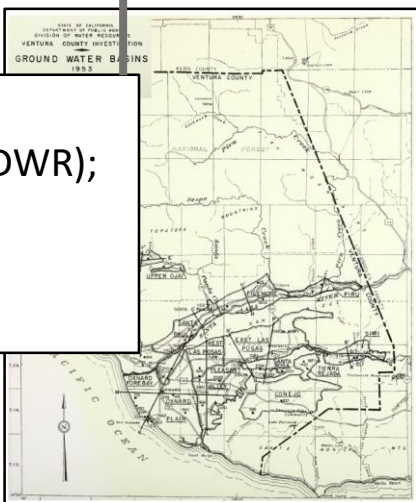
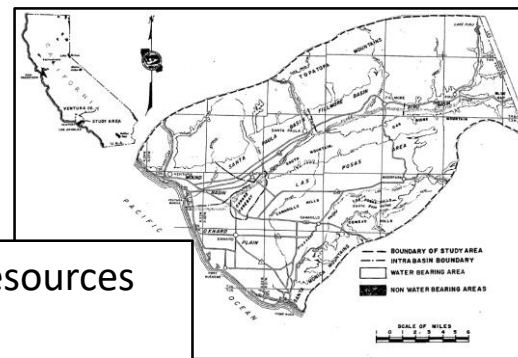
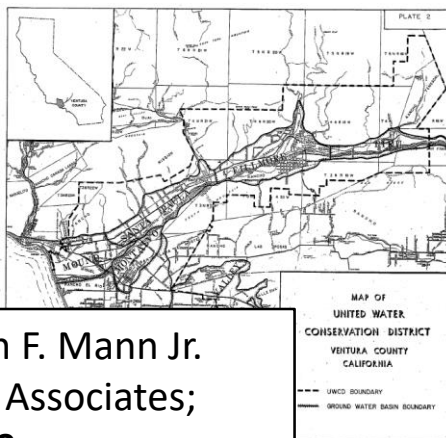
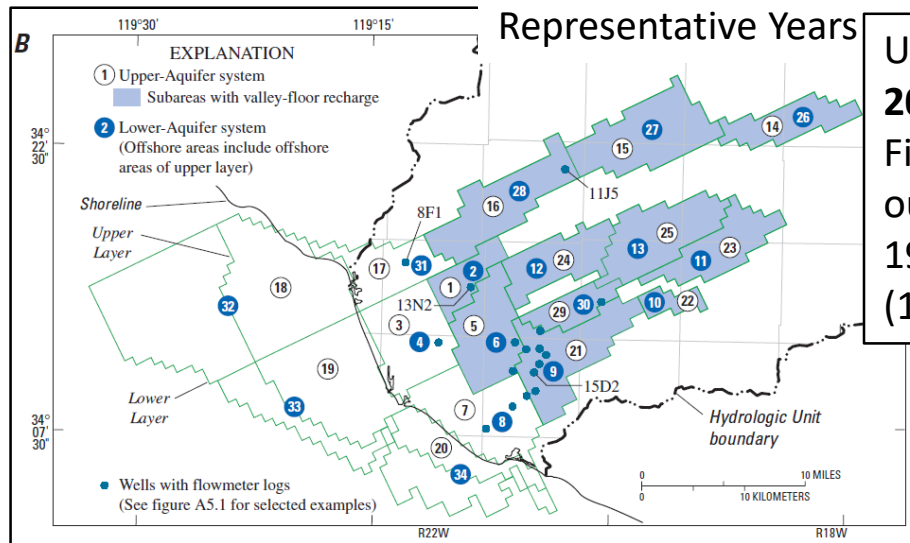
U.S. Geological Survey;
1995;
None;
1984-1989, 1989 – 2004
(hypothetical)

Law/Crandall, INC;
1993;
 Fillmore, subsurface outflow;
 1956 - 1990

CA Dept. of Water Resources
(DWR);
1974;
Piru, subsurface inflow;
1956 - 1967

CA State Water
Resources Board (DWR);
1956;
Both, various;
1936 - 1951

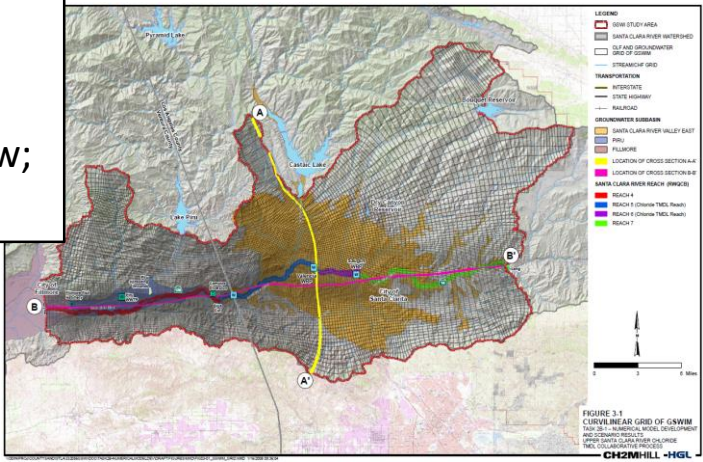
CA Division of Water
Resources (DWR);
1933;
Both, various;
1927 - 1932;



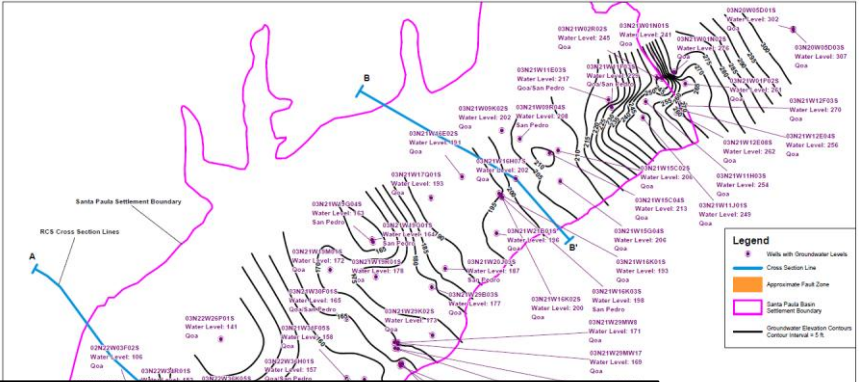
Summary of Previous Investigations

FORMAT:
Entity;
Year Published;
Fillmore/Piru budget components provided;
Representative Years

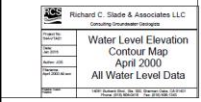
CH2M HILL/HGL
HydroMetrics review;
2008;
Piru, subsurface inflow;
1975 - 2005



Dr. Steve Bachman;
2015;
Fillmore, subsurface
outflow;
1947 – 2014 (Wet/Dry)

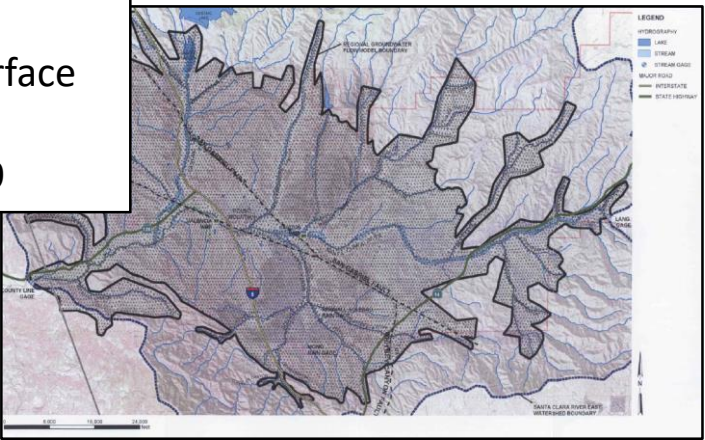


Daniel B. Stephens and Associates, INC/
Richard C. Slade and Associates LLC;
2017;
Fillmore, subsurface outflow;
1999 - 2012

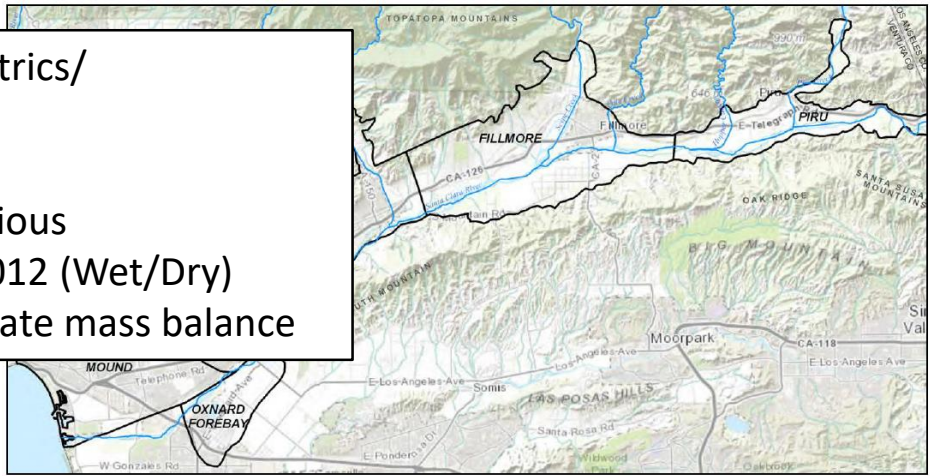


CH2M HILL;
2005;
Piru, subsurface
inflow;
1980 - 2005

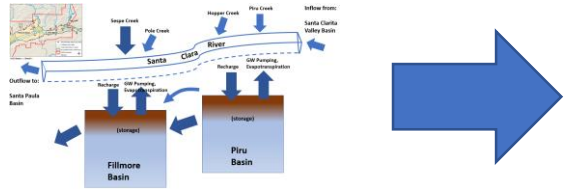
CH2M HILL;
2004;
Piru, subsurface
inflow;
1980 - 1999



HydroMetrics/
Others;
2015;
Both, Various
1996 – 2012 (Wet/Dry)
Steady-State mass balance



Summary of Previously Reported Water Budget Components



	Piru Range of values			Fillmore Range of values	
Budget Components (AFY)	<i>Lower</i>	<i>Upper</i>		<i>Lower</i>	<i>Upper</i>
Inflows					
Subsurface underflow	240	18800		12570	35700
Stream percolation	6400	61850		1790	49130
Precipitation recharge	190	20200		470	54200
Mountain front recharge	2620	2620		3530	3530
Managed recharge	0	11800		--	--
Imported	0	5840		4900	11770
Total inflow¹	9450	121110		23260	154330
Outflows					
Subsurface underflow	12570	35700		3900	25240
Rising groundwater	0	37800		6030	48200
Consumptive use ²	6820	15000		20590	36200
Exported	2200	6450		0	5160
Total outflow¹	21590	94950		30520	114800
Change in groundwater storage³	-19600	44600		-20170	49300
Available Storage	0	113000		0	80000

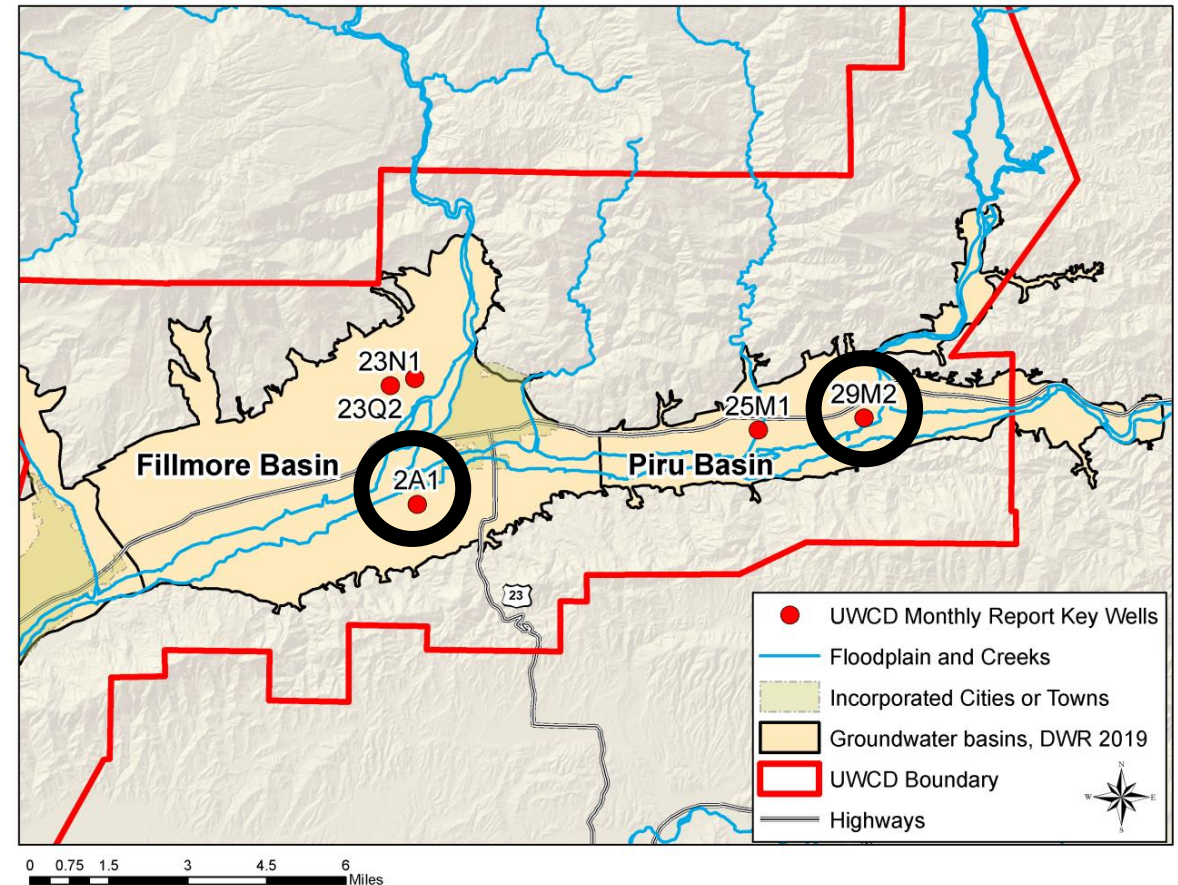
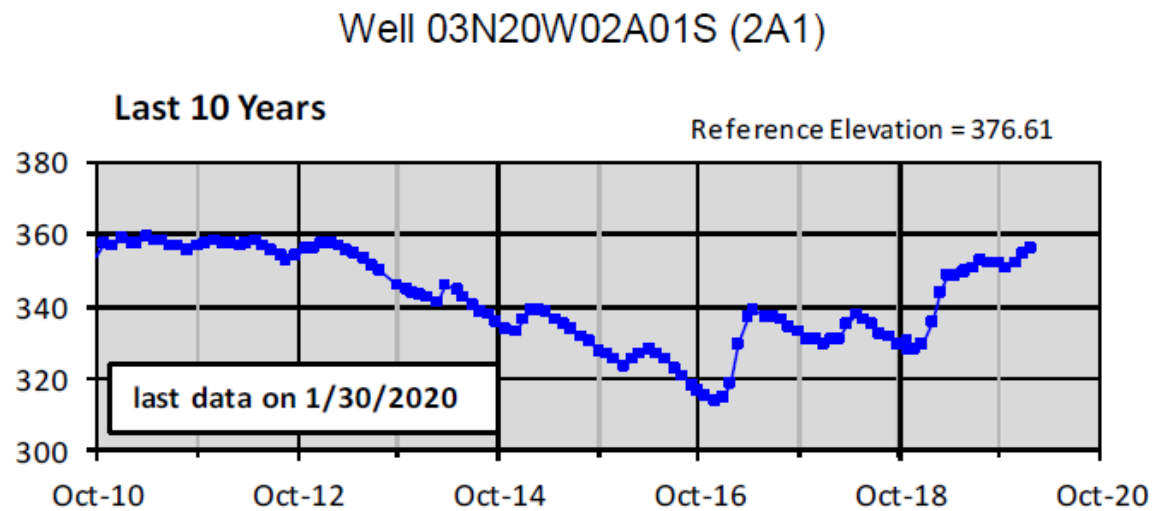
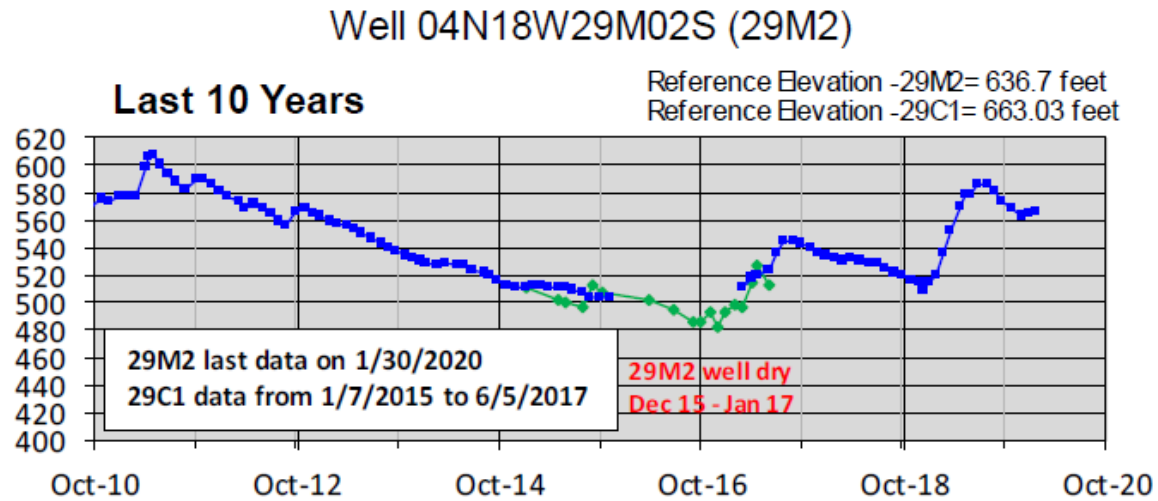
¹Total inflow and outflow calculated from values reported in this table

²Of applied water and precipitation on basin (including phreatophytes)

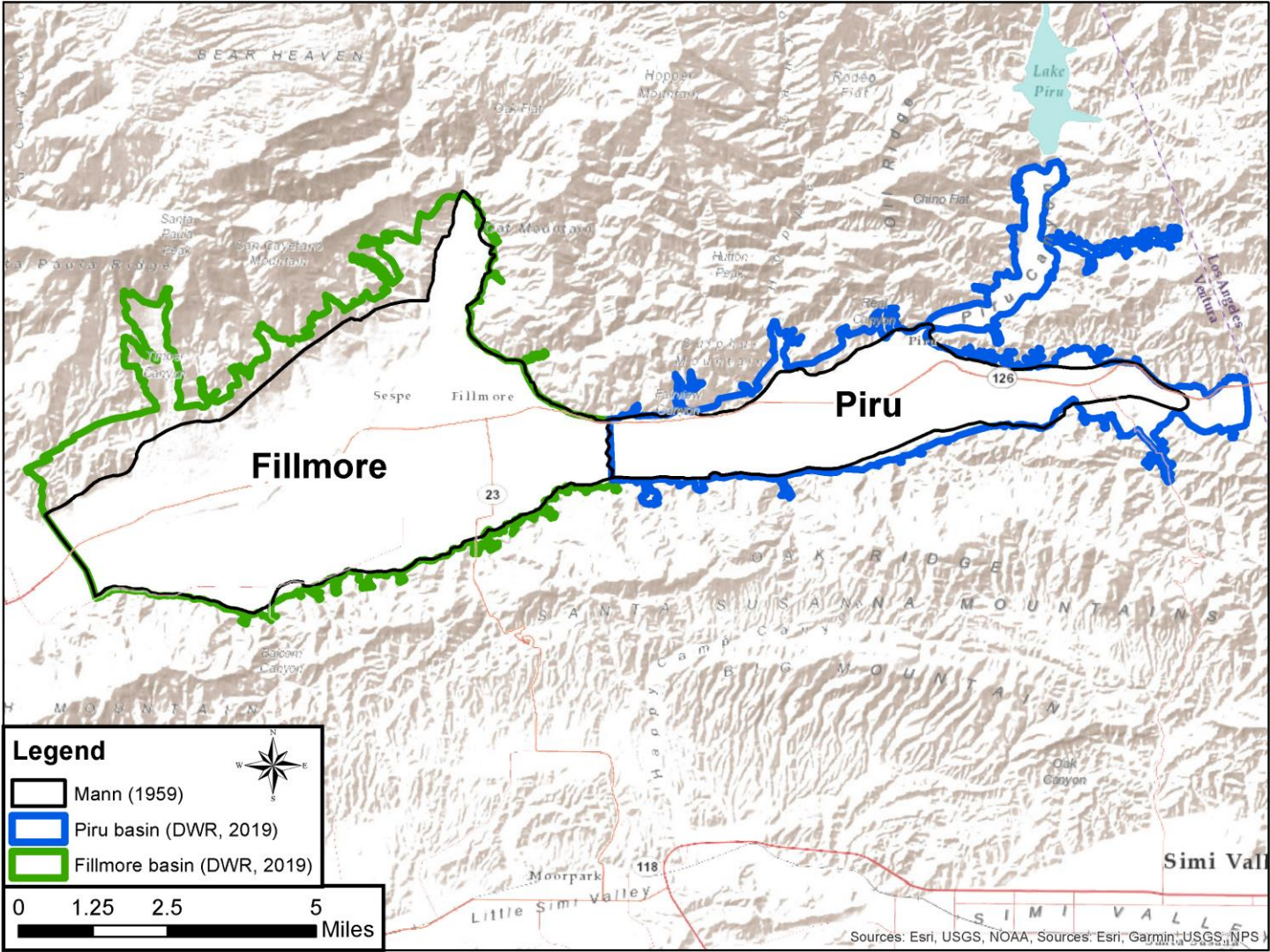
³Reported changes in storage, not representative of calculated total (inflow - outflow) values above

Values rounded to nearest 10 AF

Review of current basin conditions



Review of current basin conditions



	Groundwater Basin Area (acres)		
	Mann (1959)	DWR (2019)	% increase
Fillmore	18497	22583	22
Piru	7201	10896	51

Moving Forward

- Continued UWCD numerical model calibration and development
- Continued UWCD internal writing and review of water budget documentation for GSPs
 - Historical
 - Current
 - Projected (Future)

References

California Department of Public Works, Division of Water Resources (DWR), 1933. *Bulletin No. 46 Ventura County Investigation*.

California State Water Resources Board (DWR), 1953, revised 1956. *Bulletin No. 12 Ventura County Investigation*. April.

California Department of Water Resources, 1974. *Mathematical Modeling of Water Quality for Water Resources Management, Volume I, Development of the Groundwater Quality Model*. August.

California Department of Water Resources, 2019. Bulletin 118 update, <https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118>

CH2M HILL, 2004. *Regional Groundwater Flow Model for the Santa Clarita Valley, Model Development and Calibration*. April.

CH2M HILL, 2005. *Calibration Update of the Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California*. August.

CH2M HILL/HGL, 2006. *Task 2A – Conceptual Model Development East and Piru Subbasins*, Upper Santa Clara River Chloride TMDL Collaborative Process. Prepared for Sanitation Districts of Los Angeles County Los Angeles Regional Water Quality Control Board. October.

CH2M HILL/HGL, 2008. *Task 2B-1 – Numerical Model Development and Scenario Results East and Piru Subbasins*, Upper Santa Clara River Chloride TMDL Collaborative Process. Prepared for Sanitation Districts of Los Angeles County Los Angeles Regional Water Quality Control Board. March.

DBSA, 2017; Safe Yield Report

Bachman (2015); Santa Paula Safe Yield report/underflow estimate

HydroMetrics, 2006. Groundwater Model Modifications. Letter from Derrik Williams to Ken Turner, UWCD. July and August.

HydroMetrics, 2008. *Review of GSWIM Model*. Prepared for United Water Conservation District. February.

Larry Walker and Associates (LWA) and others, 2015. *Lower Santa Clara River Salt and Nutrient Management Plan*. June.

Law/Crandall, 1993. *Water Resources Evaluation, Santa Paula Ground Water Basin, Ventura County, California*. March.

Mann, John F. Jr., 1959. (Mann). *A Plan for Ground Water Management*. Prepared for United Water Conservation District. September.

Reichard and others (USGS), 1995; Groundwater-surface water management with stochastic surface water supplies: A simulation optimization approach. November.
<https://doi.org/10.1029/95WR02328>

USGS, 2003; *Simulation of Ground-water/Surface-Water Flow in the Santa Clara-Calleguas Basin, Ventura County, California*.
<https://pubs.er.usgs.gov/publication/wri024136>

Thank You

Questions?

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