Basin Setting Public Review Documents-
Highlights and Discussion

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Butte County Water and Resource Conservation

Vina GSA Board
October 14, 2020

Basin Setting Project- Technical Foundation

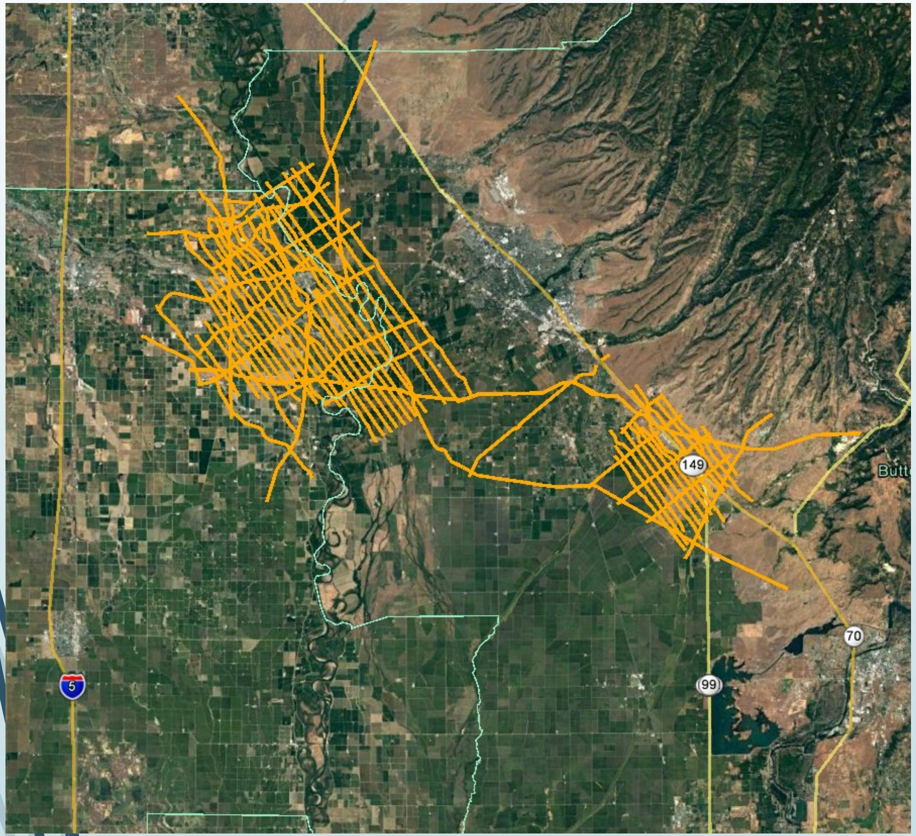
Groundwater Sustainability Plan (GSP)

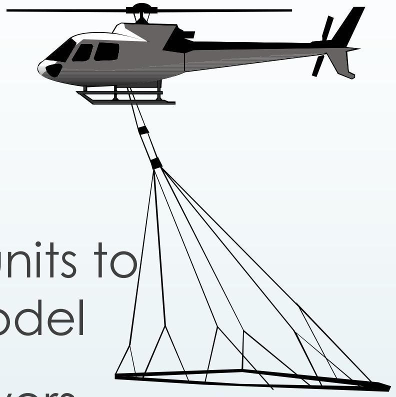
- **1. Administrative Information**
- **2. Basin Setting**
  - Hydrogeologic Conceptual Model
  - Groundwater Conditions
  - Water Budget
  - Management Areas
- **3. Sustainable Management Criteria**
  - Sustainability Goal
  - Undesirable Results
  - Minimum Thresholds
  - Measurable Objectives
- **4. Monitoring Networks**
  - Monitoring Network
  - Representative Monitoring
  - Assessment & Improvement
  - Reporting Monitoring Data
- **5. Projects and Management Actions**

Groundwater Dependent Ecosystems (GDEs)

- Work is underway
- Documentation still to be added to the Basin Setting Document

Airborne Electromagnetic (AEM) Survey





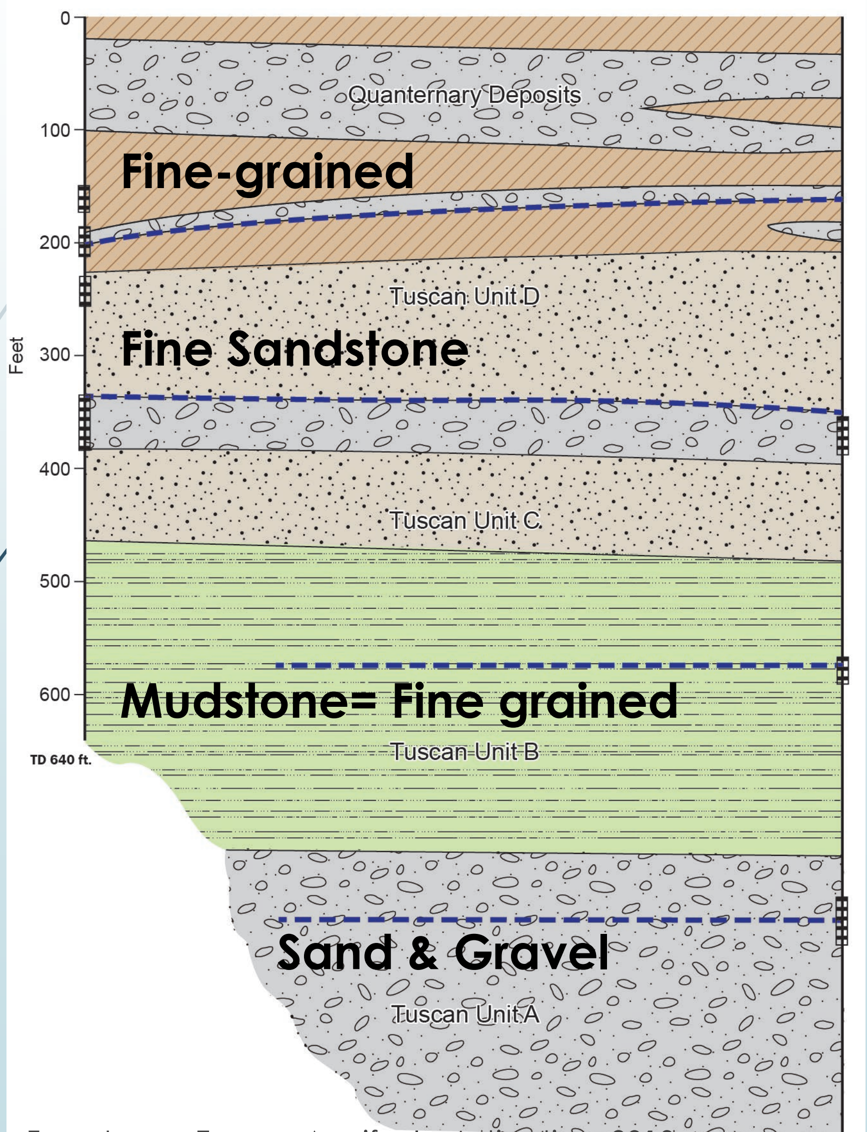
- **What are we hoping to learn?**
- Delineate major aquifer and aquitard units to improve hydrogeologic conceptual model
- Assess spatial distribution of clay-rich layers. How extensive are they?
- Examine level of connectivity between upper and lower portions of the Tehama/Tuscan aquifer systems
- Identify hydrostatigraphic layers with similar aquifer characteristics (transmissivity, specific yield, boundaries, surface water-groundwater relationships) for use in groundwater model development

Vertical Connectivity??

https://www.buttecounty.net/waterresourceconservation/AEM-Project
https://mapwater.stanford.edu/

Hydrogeologic units vs. Stratigraphic units

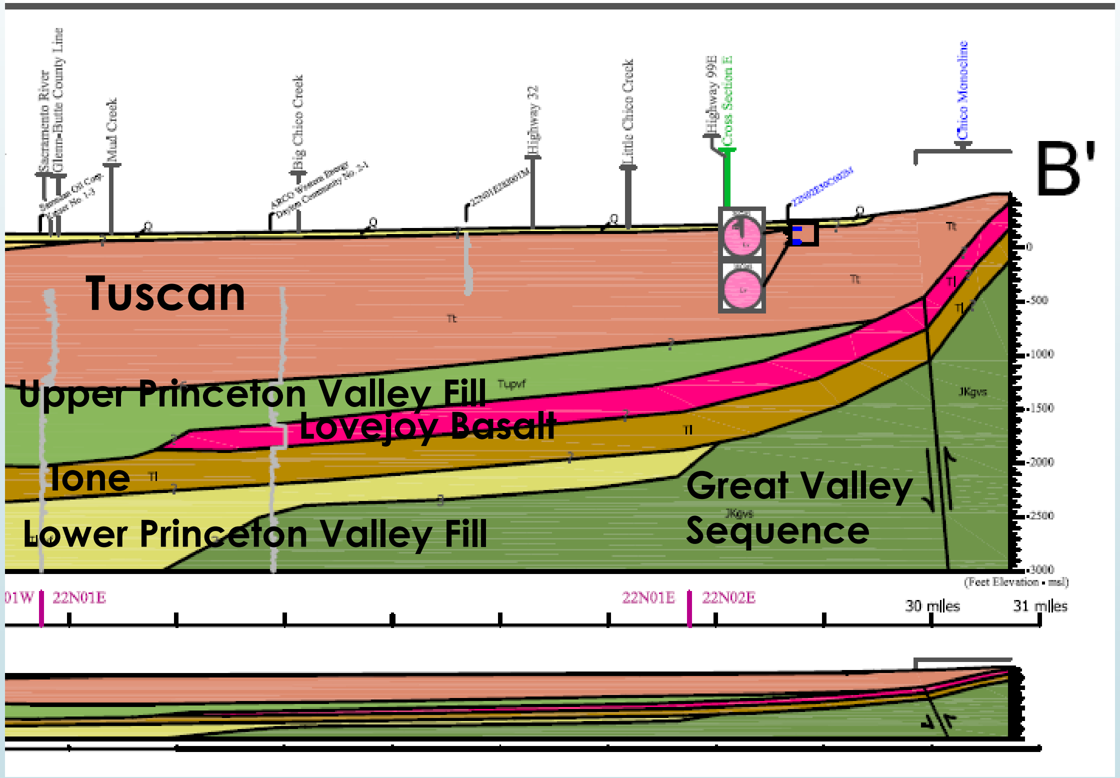
Sediment Type= Fine vs. Course grained



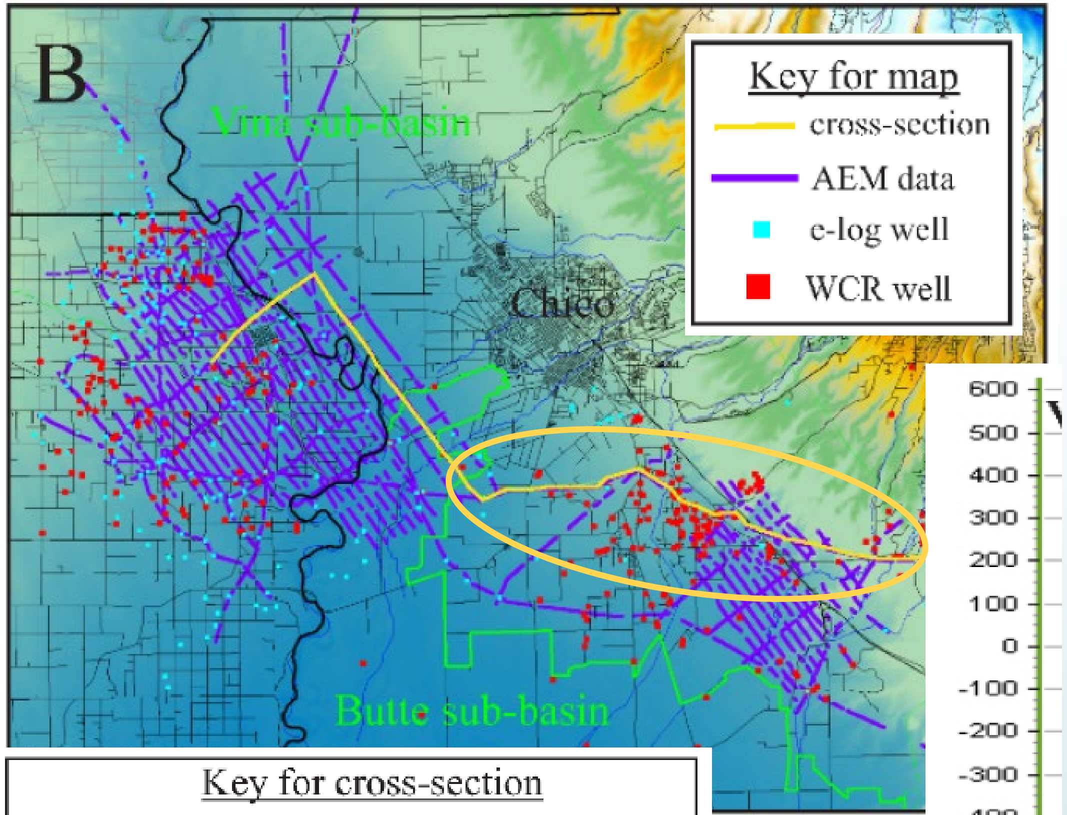
From Lower Tuscan Aquifer Investigation, 2013

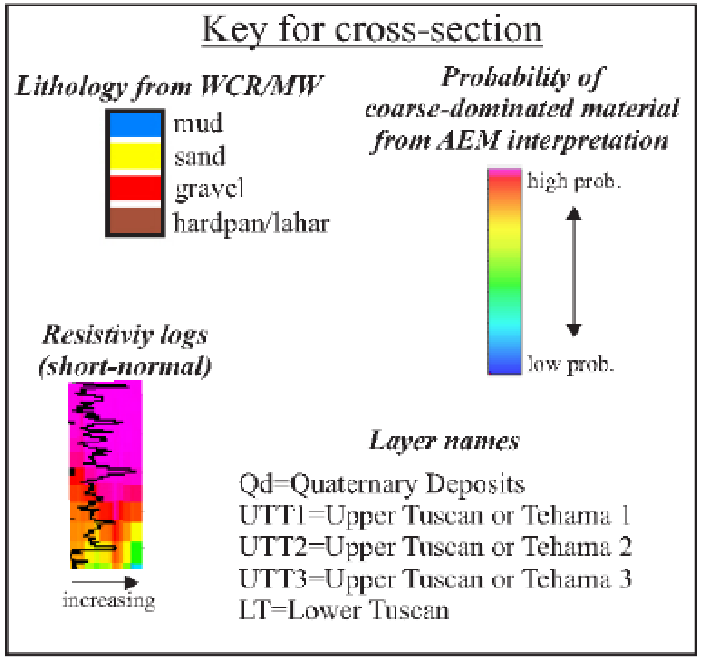
Geologic Formations

- **Quaternary Deposits**
- **Tuscan**
- **Tehama**



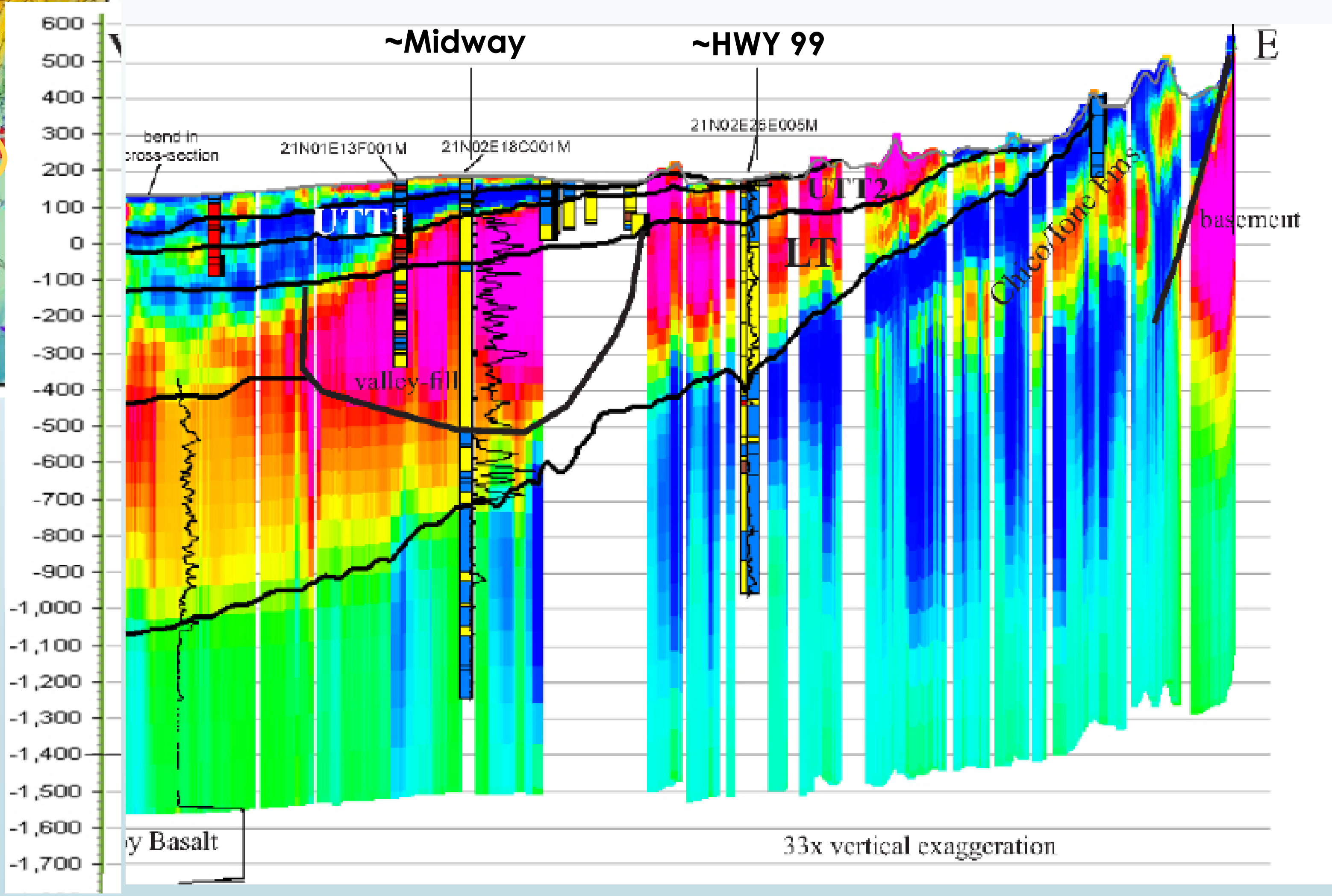
Portion of DWR Cross Section B-B' from 2014 Geology of Northern Sacramento Valley Report





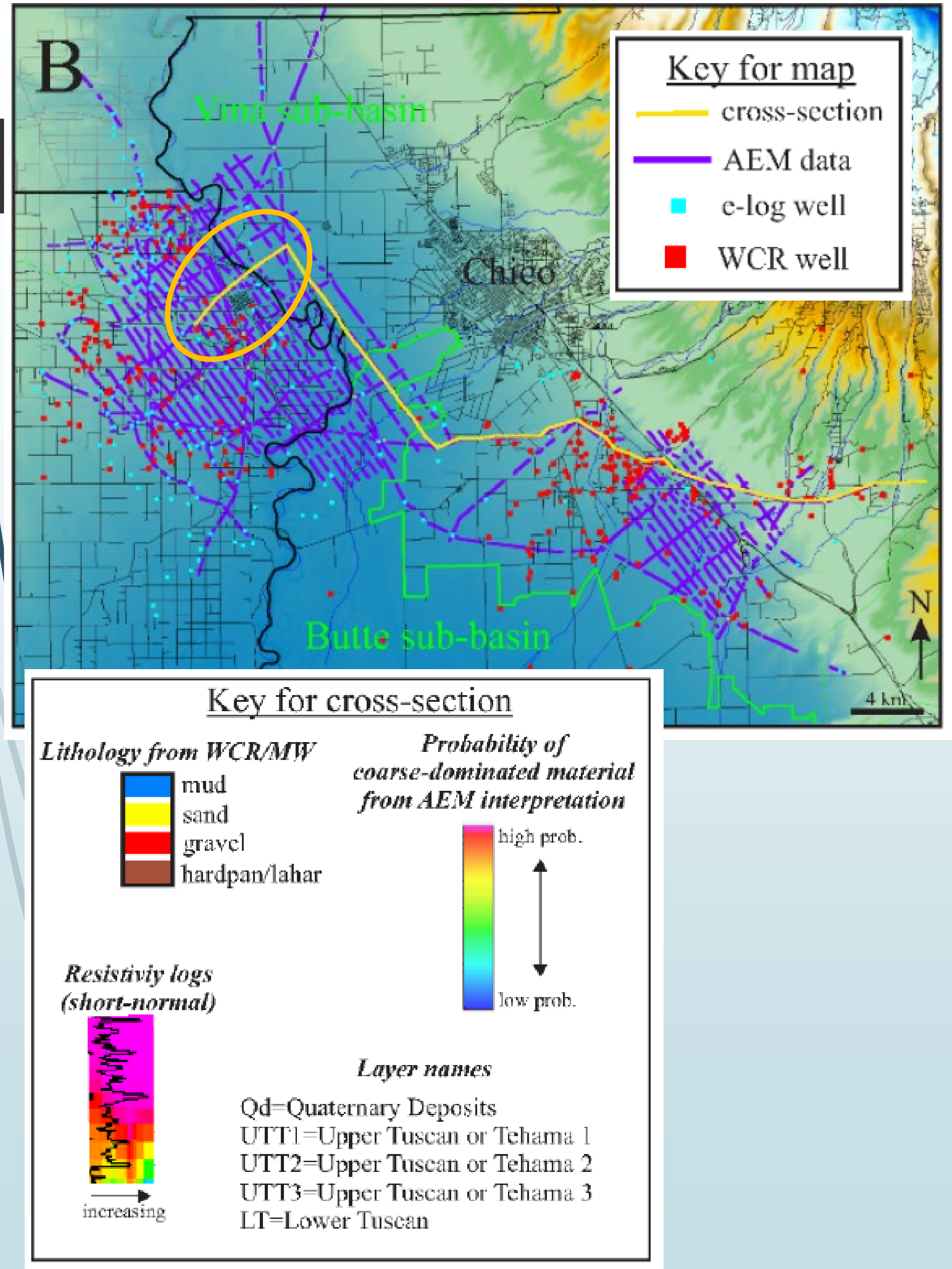
Common Terms:

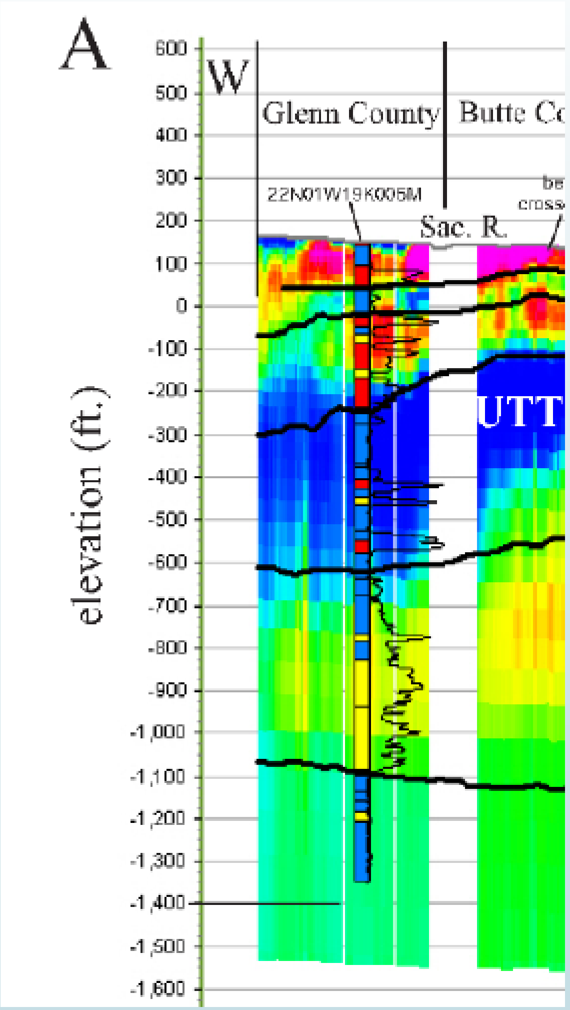
- Coarse grained material, coarse dominated= sands/gravels
- Fine grained material, fine-dominated= silt/clay



Common Terms:

- Coarse grained material, coarse dominated, aquifer material= sands/gravels
- Fine grained material, fine-dominated, aquitard material= silt/clay





Water Supplies in the Vina Subbasin

- Ag Surface Water:

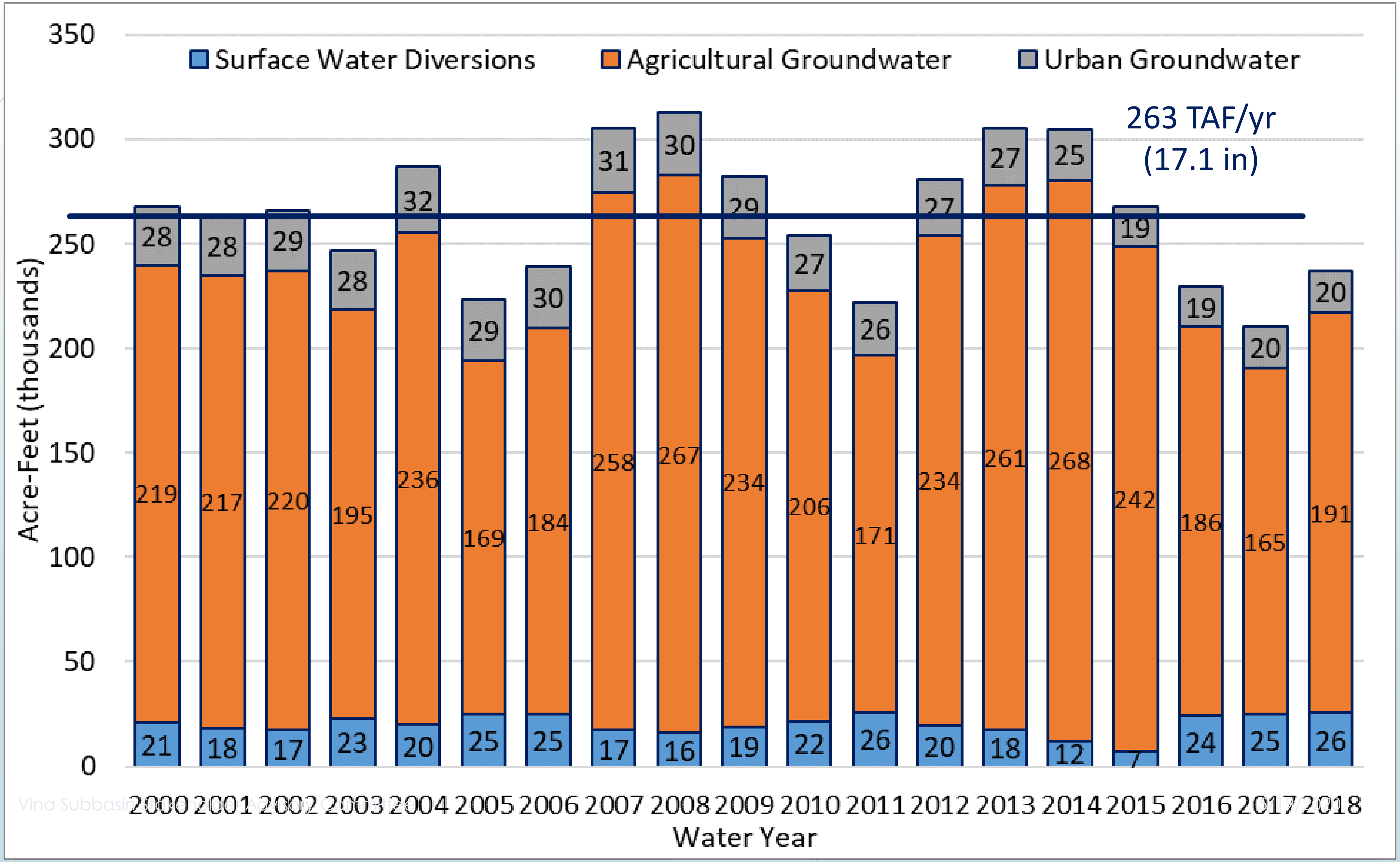
  8%

- Ag Pumping:

  82%

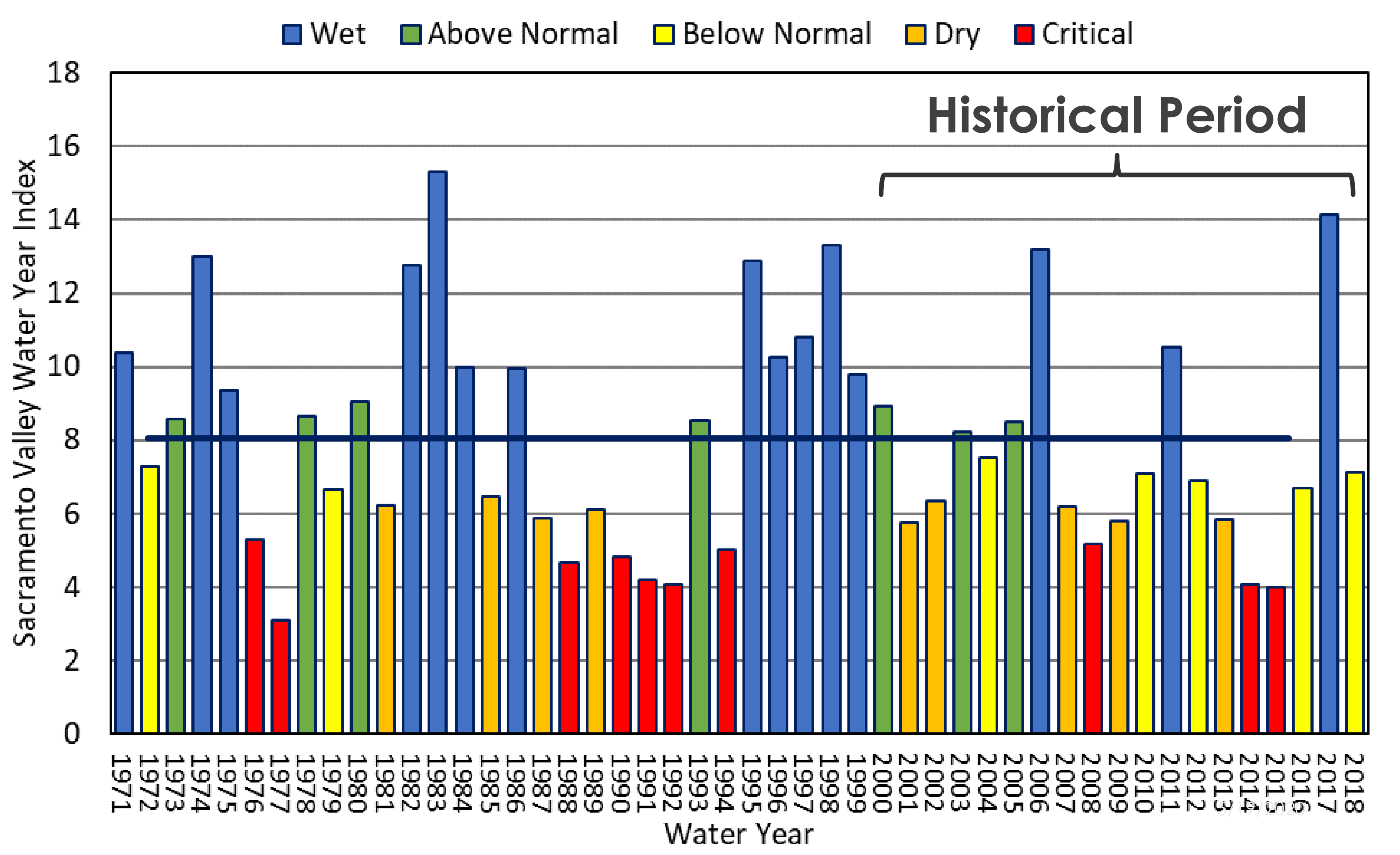
- Urban Pumping:

  10%



Hydrologic Variability

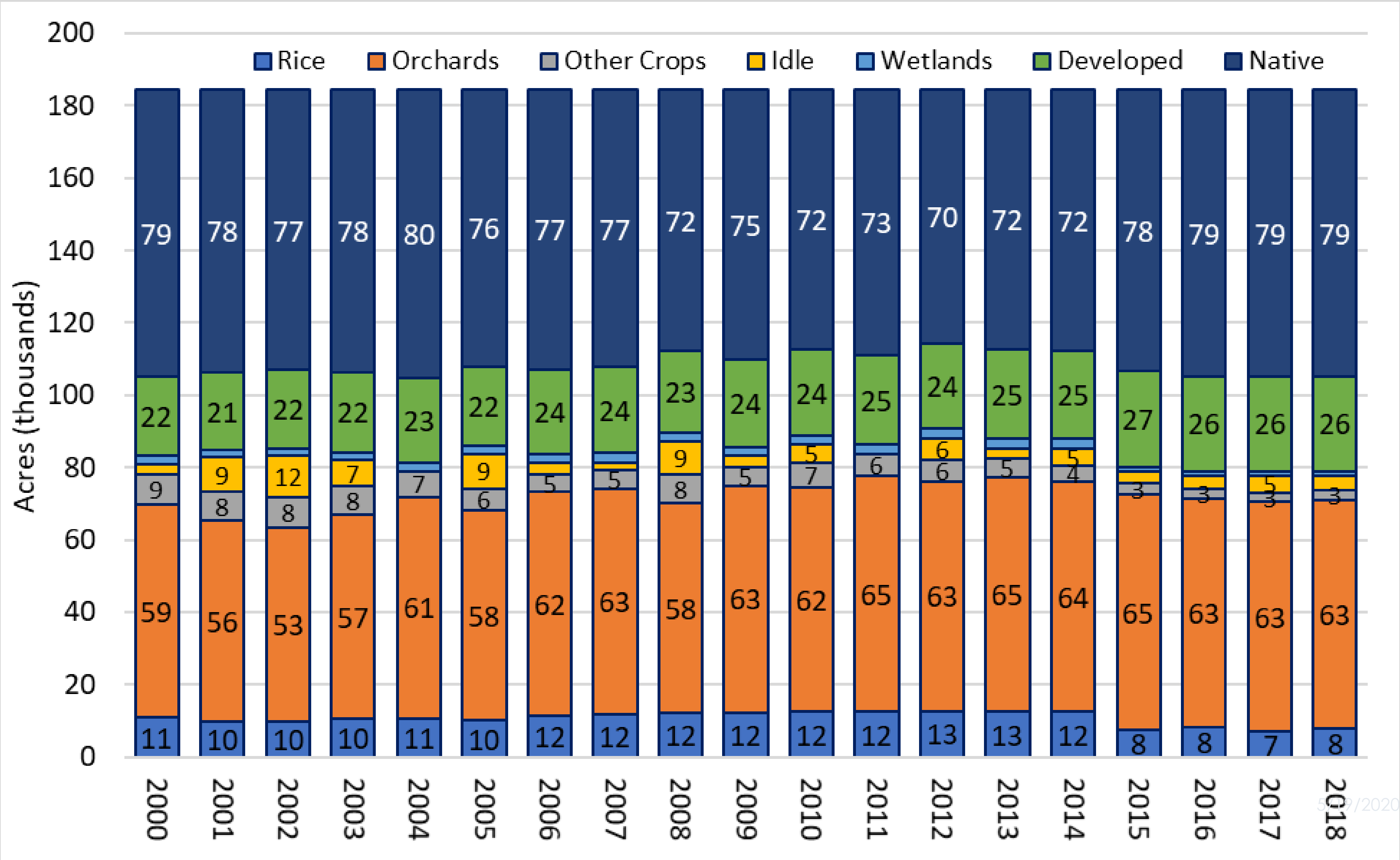
- Sacramento Valley Index
  - 1906 to 2018 avg. = 8.1
  - 1971 to 2018 avg. = 8.0
- Precipitation
  - 1906 to 2018 avg. = 24.8 in
  - 1971 to 2018 avg. = 26.3 in
  - 2000 to 2018 avg. = 26.7 in



Land Use

Native vegetation includes grasslands, riparian, and wetlands.

- Agriculture: 45%
- Developed: 13%
- Native: 42%



Water Budget Results

- Water Budget Results:
  - Historical- 2000-2018
  - "Current"- 2016 land use, 2016-2018 urban demands
  - Future Conditions
  - Climate Change
- Main changes to inputs:
  - Land Use foot print
  - Hydrology (precipitation, stream inflows, evapotranspiration)

Table 1-8. Water Budget Summary: Groundwater System.

Component	Historical (AFY)	Current (AFY)	Future, No Climate Change (AFY)	Future, 2030 Climate Change (AFY)	Future, 2070 Climate Change (AFY)
Inflows					
Subsurface Inflows	137,400	143,200	142,800	144,600	145,500
Foothill Area	*45,700*	*50,100*	*49,700*	*50,600*	*50,600*
Los Molinos Subbasin	*63,000*	*67,000*	*67,300*	*67,900*	*68,100*
Butte Subbasin	*28,600*	*25,900*	*25,500*	*25,800*	*26,600*
Wyandotte Creek Subbasin	*200*	*300*	*200*	*300*	*300*
Deep Percolation	192,700	191,800	189,300	194,500	196,800
Precipitation	*120,200*	*125,400*	*120,400*	*123,500*	*123,600*
Applied Surface Water	*4,800*	*5,600*	*5,600*	*4,900*	*4,500*
Applied Groundwater	*67,600*	*60,900*	*63,300*	*66,100*	*68,700*
Seepage	24,000	27,700	27,800	27,800	27,400
Streams	*20,800*	*24,100*	*24,200*	*24,600*	*24,400*
Canals and Drains	*3,200*	*3,600*	*3,600*	*3,200*	*3,000*
Total Inflow	***354,100***	***362,700***	***359,900***	***366,900***	***369,700***
Outflows					
Subsurface Outflows	70,400	76,200	72,000	70,700	67,800
Foothill Area	*300*	*200*	*200*	*200*	*200*
Los Molinos Subbasin	*4,700*	*900*	*900*	*900*	*900*
Butte Subbasin	*65,400*	*75,100*	*70,800*	*69,500*	*66,600*
Wyandotte Creek Subbasin	*0*	*0*	*0*	*0*	*0*
Groundwater Pumping	243,500	209,200	215,800	225,900	238,000
Agricultural	*209,100*	*185,500*	*184,800*	*194,700*	*206,800*
Urban and Industrial	*26,500*	*20,100*	*27,500*	*27,500*	*27,500*
Managed Wetlands	*8,000*	*3,500*	*3,500*	*3,600*	*3,700*
Stream Gains from Groundwater	3,700	1,100	1,000	1,000	1,000
Western Boundary Net Outflows	56,100	77,400	73,000	71,000	65,600
Total Outflow	***373,700***	***363,900***	***361,800***	***368,600***	***372,400***
Change in Storage (Inflow - Outflow)	***-19,600***	***-1,100***	***-1,700***	***-1,700***	***-2,600***

Historical Results: Groundwater Change in Storage

- Groundwater demand is sensitive to water year type
- Change in Storage is sensitive to water year type also
- Overall Change in Storage over the Historical Period is about 400,000 AF from 2000 to 2018
  - Average almost 20,000 AF annually (from Table 1-8 on previous slide)

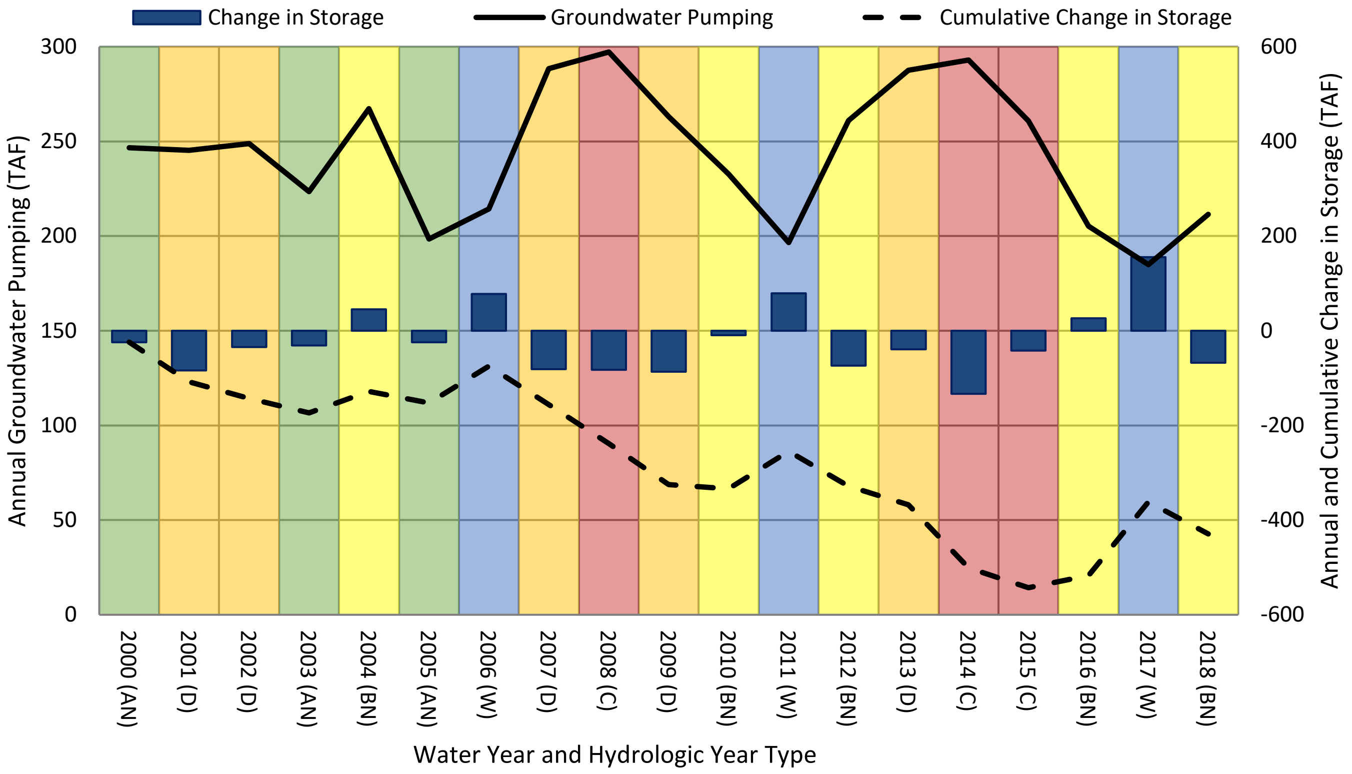


Table 1-9. Historical Water Supplies and Change in Groundwater Storage by Hydrologic Water Year Type

Water Year Type	Surface Water Deliveries (AFY)	Groundwater Pumping (AFY)	Total Supply (AFY)	Change in Groundwater Storage (AFY)
Wet	24,000	198,600	222,700	117,900
Above Normal	21,100	222,800	243,900	10,700
Below Normal	20,600	235,500	256,200	-19,200
Dry	17,300	266,600	284,000	-82,000
Critical	12,200	283,700	295,800	-84,500

Water Budget Scenarios

Water Budget Sensitivity- How does the system respond to changes in Land Use (Current/Future) and Climate Changed-Hydrology (CC 2030 and CC 2070)?

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Precipitation	*120,200*	*125,400*	*120,400*	*123,500*	*123,600*
Applied Surface Water	*4,800*	*5,600*	*5,600*	*4,900*	*4,500*
Applied Groundwater	*67,600*	*60,900*	*63,300*	*66,100*	*68,700*
Seepage	24,000	27,700	27,800	27,800	27,400
Streams	*20,800*	*24,100*	*24,200*	*24,600*	*24,400*
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↑ Subsurface Inflows

↑ Deep Percolation

═ Seepage

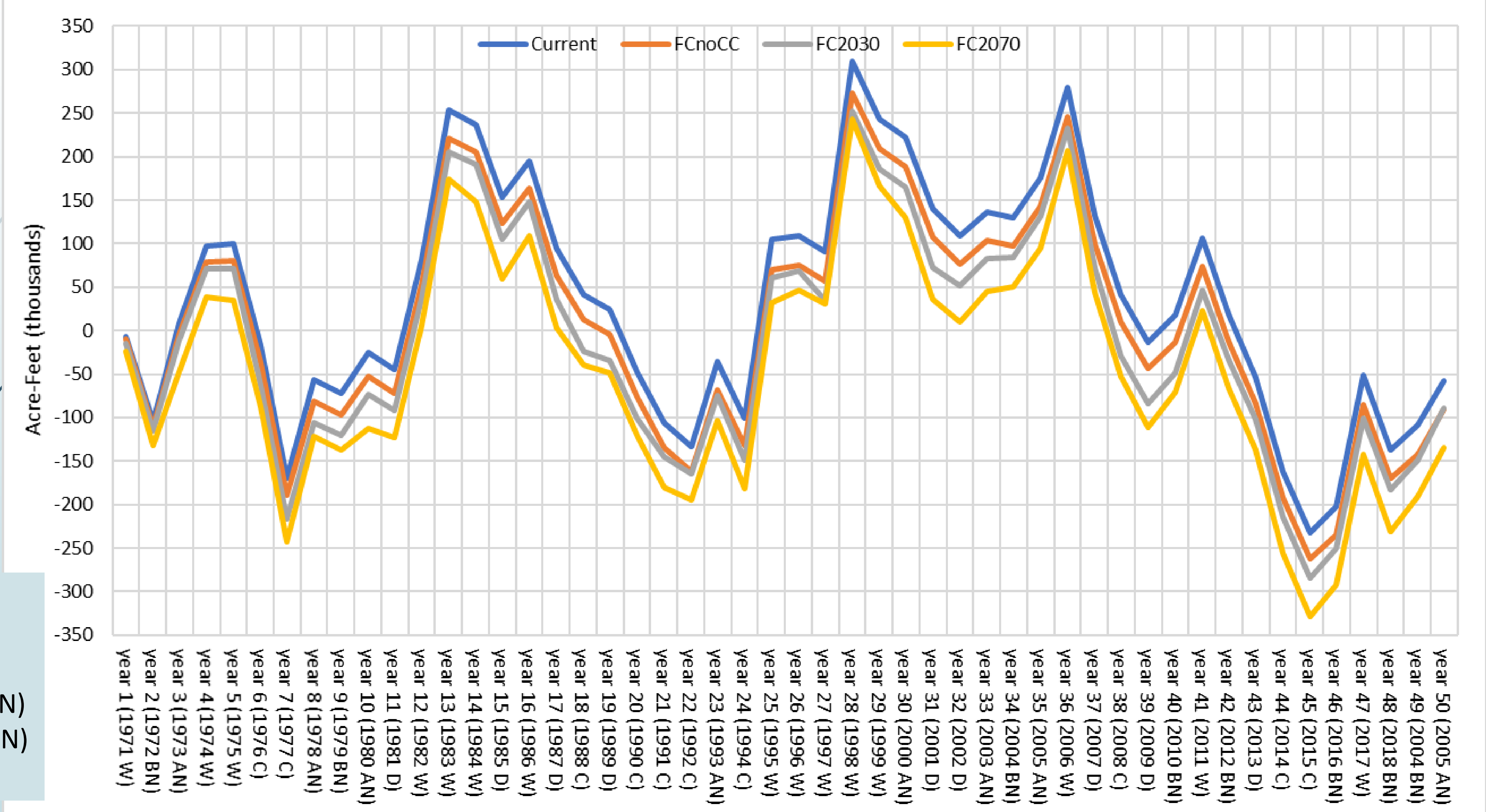
↓ Subsurface Outflows

↑ Groundwater pumping

↓ W. Boundary Net Outflows

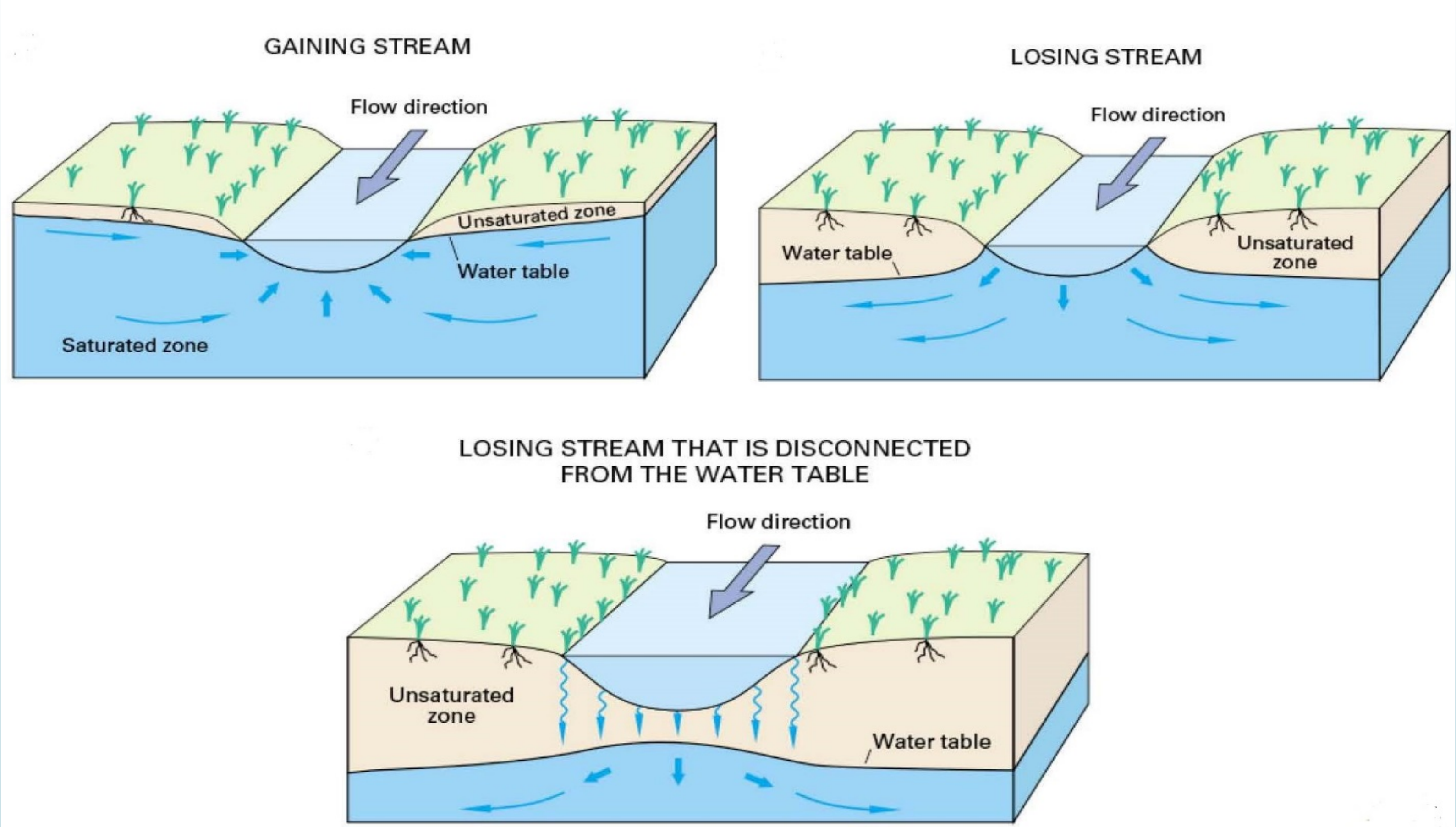
Change in Groundwater Storage

Current = Current Conditions **FCnoCC** = Future Development, No Climate Change
FC2030 = Future Development, 2030 Climate Change **FC2070** = Future Development, 2070 Climate Change



Year Types:
Critical (C)
Dry (D)
Below Normal (BN)
Above Normal (AN)
Wet (W)

Interconnected Surface Water



Interconnected Surface Water

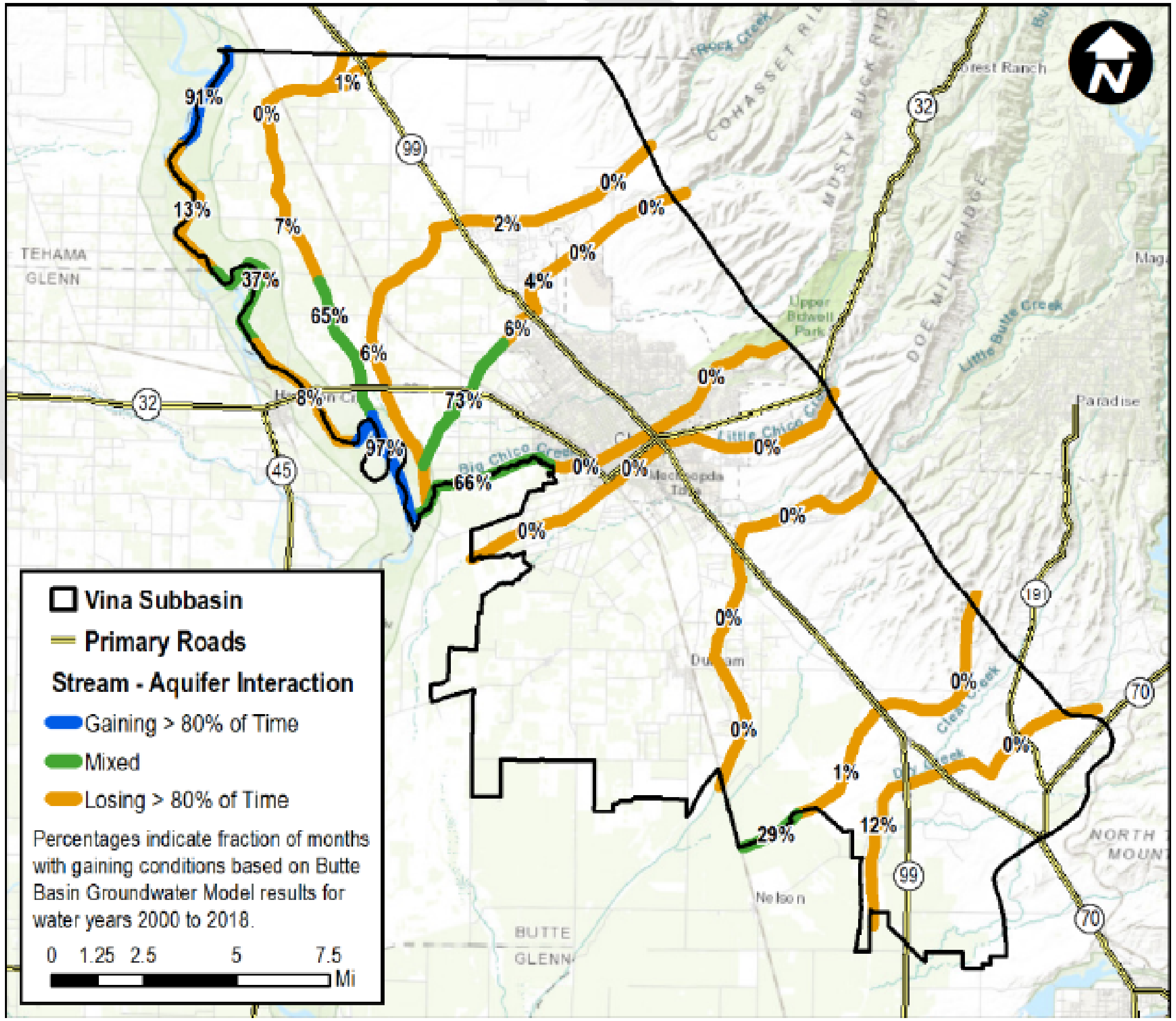
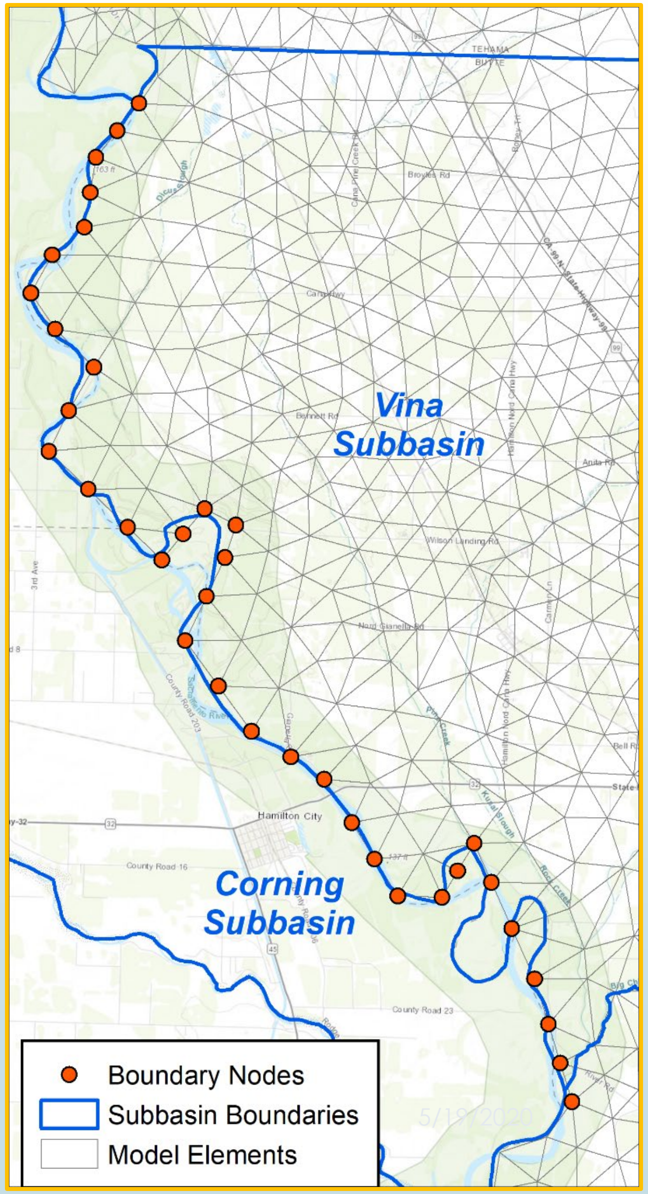


Figure 1-22. Vina Subbasin Gaining and Losing Stream Reaches based on BBGM, Water Year 2000 to 2018

Western Boundary (Sacramento River)

- Edge of Model Domain
- Groundwater Levels at 39 Boundary Nodes Based on Earlier DWR C2VSim Model
- Combination of
  - Sacramento River Interaction
  - Corning Subbasin Interbasin Flows
- Split Between River Interaction and Interbasin Flows Highly Uncertain
- Groundwater level contours from monitoring data provide insight into interbasin flow
- Interbasin Coordination effort underway- comparing water budget numbers from regional models used by neighbors



Summary of Comments from Staff Memo

Several themes emerged which are summarized in the bullets below:

- Commenters highlight the importance of the multiple aquifer zones that are present in the subbasin and the pressurized nature of the deeper zones. This has implications for understanding flow paths, vertical gradients, groundwater conditions and connectivity between zones, interbasin flow in the pressurized deep aquifer zone, connection of shallow groundwater to deeper zones and vulnerability of groundwater dependent ecosystems (GDEs), efficacy of recharge projects to provide benefits to shallow vs. deep zones, delayed and long lasting potential effects of deep pumping on stream-groundwater interactions.
- Commenters point out that monitoring the four defined aquifer zones is a data gap that should be filled with monitoring groundwater levels in each zone. The aquifer zones should also be better defined using well logs, cross sections to understand connectivity between zones, groundwater flow paths, and changes in vertical gradients over time.
- Monitoring of the shallowest portion of the groundwater system was identified as a need to identify baseline and dynamic water levels that support groundwater dependent ecosystems. A shallow monitoring network needs to be developed and implemented to understand conditions in the shallowest portions of the aquifer system.
- A comment suggested that the rooting depth of the Valley Oak is incorrectly limited by The Nature Conservancy documentation on GDEs to 30 feet. Sources listed by the US Forest Service identify a rooting depth of 80 feet. The urban forest in Chico should also be identified and considered as a GDE and habitat monitoring should survey and monitor impacts on wetlands and other GDE areas.
- A number of clarification questions and comments were submitted

Comments largely relate to the Hydrogeologic Conceptual Model and have implications for expansion of monitoring to address identified data gaps.

Summary of Comments from Staff Memo- continued

Other significant issues that have been raised include:

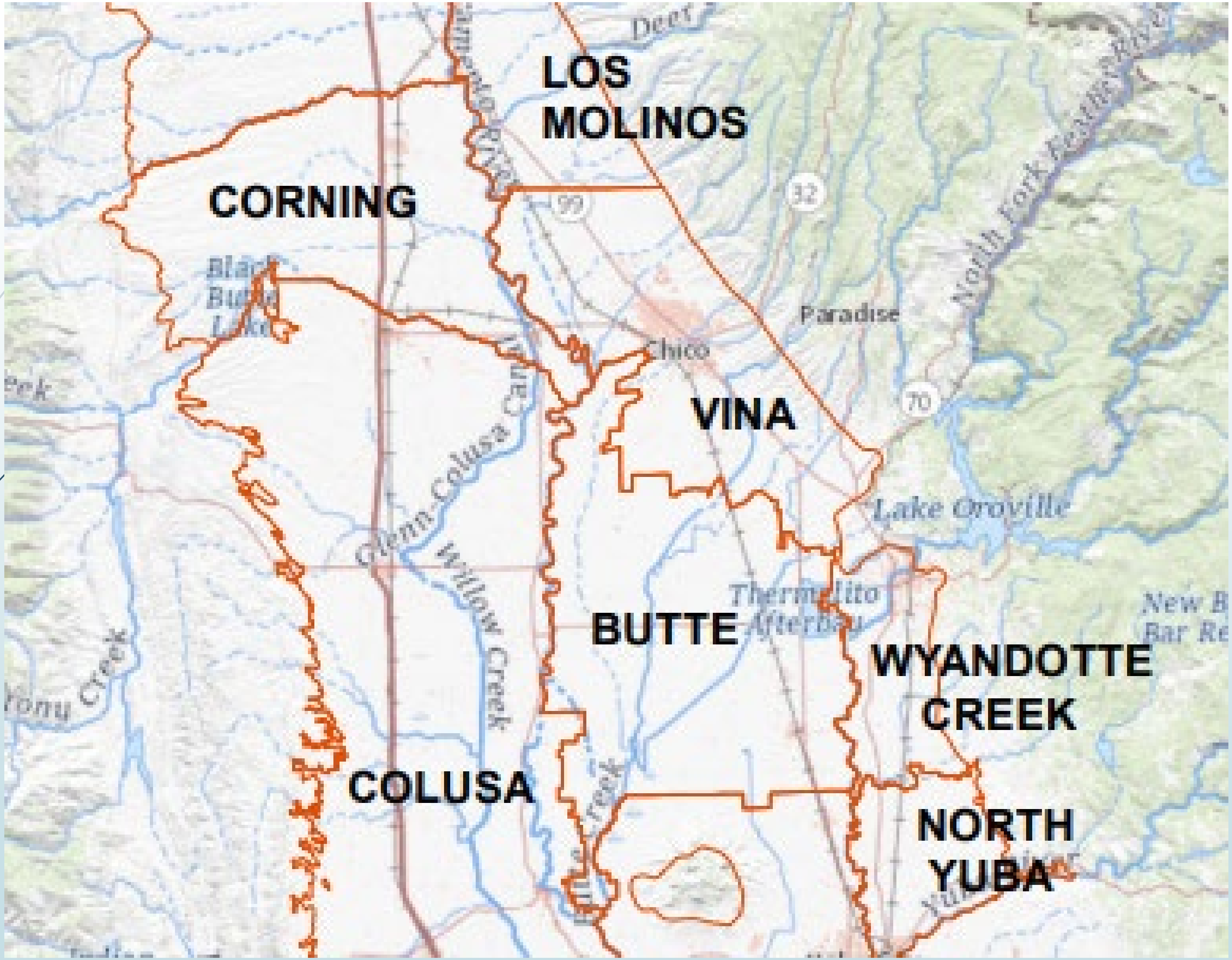
- Importance of understanding and characterizing interbasin flows
- Climate change impact assessment

Highlighted Topics for Possible Discussion/Recommendation

1. Shallow Monitoring Network
   - The document and public comment identify deficient monitoring in the shallowest portions of the aquifer system as an important data gap. The SHAC agreed that understanding the shallow zone is important and expressed interest in establishing a shallow monitoring network.
2. Climate Change and Water Budget Sensitivity
   - The SHAC indicated a desire to assess how the approach/data used for the Basin Setting compares to Climate Action Plans developed by the City of Chico and Butte County.

Discussion

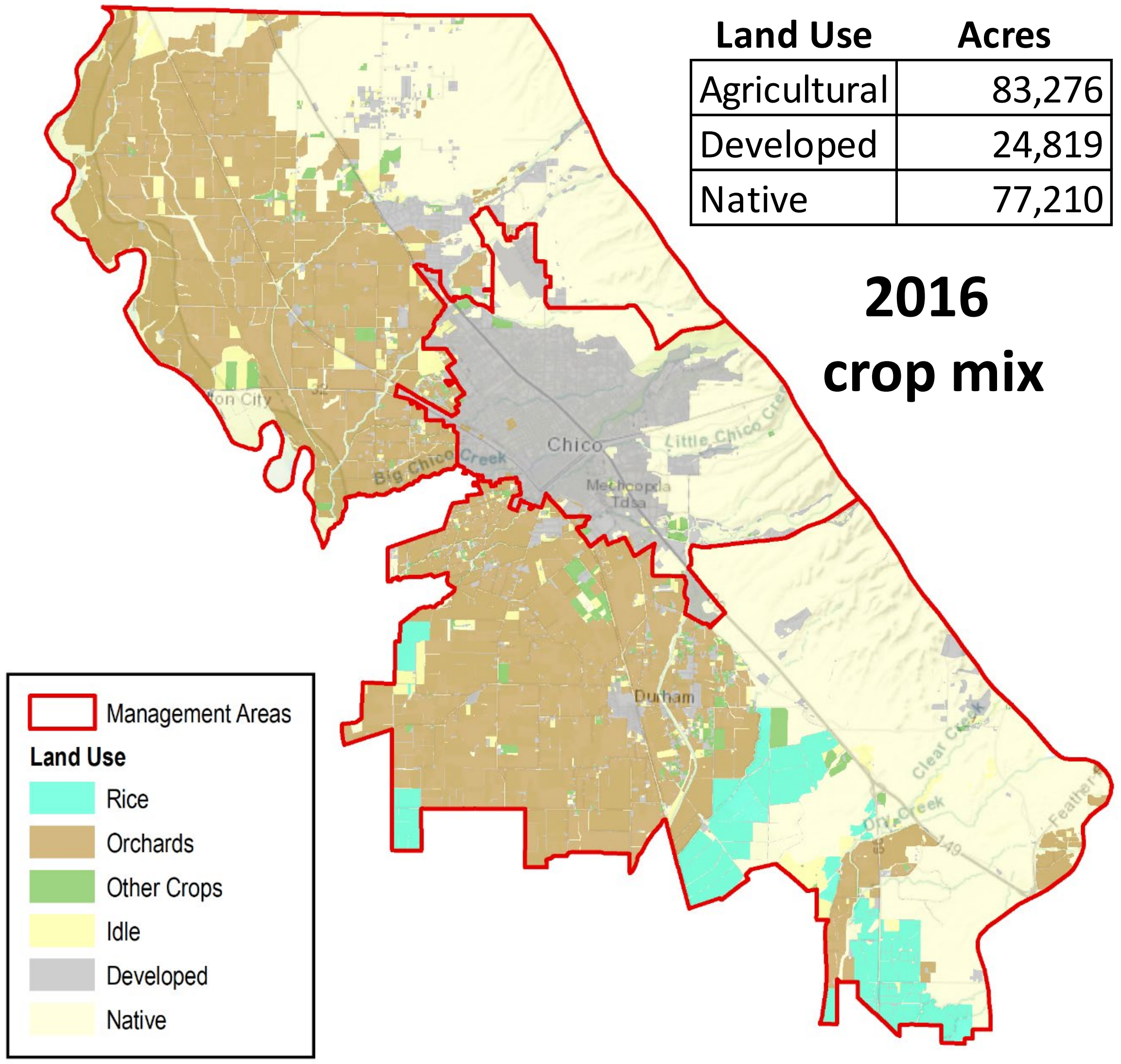
Contact:
Christina Buck
cbuck@buttecounty.net


LOS
MOLINOS
CORNING
Black
Butte
Lake
Paradise
Chico
VINA
Lake Oroville
North Fork Feather River
Glenn-Colusa Canal
Willow Creek
Thermalito
Afterbay
BUTTE
WYANDOTTE
CREEK
COLUSA
NORTH
YUBA
Stony Creek
Deer
99
32
70

Land Use

Future Development Based on 2030 General Plan and Parcel Zoning

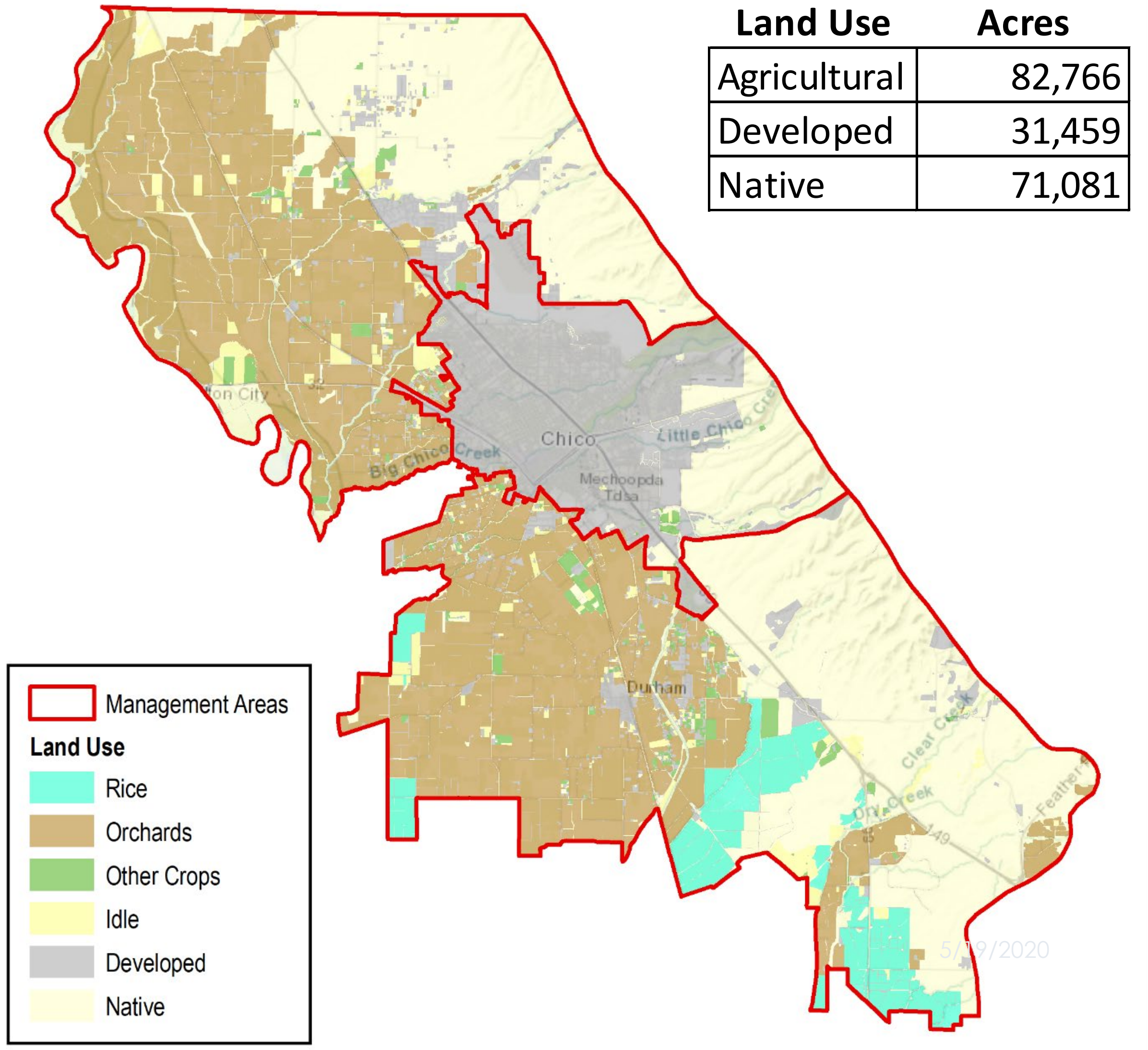
Current Conditions



Land Use	Acres
Agricultural	83,276
Developed	24,819
Native	77,210

2016 crop mix

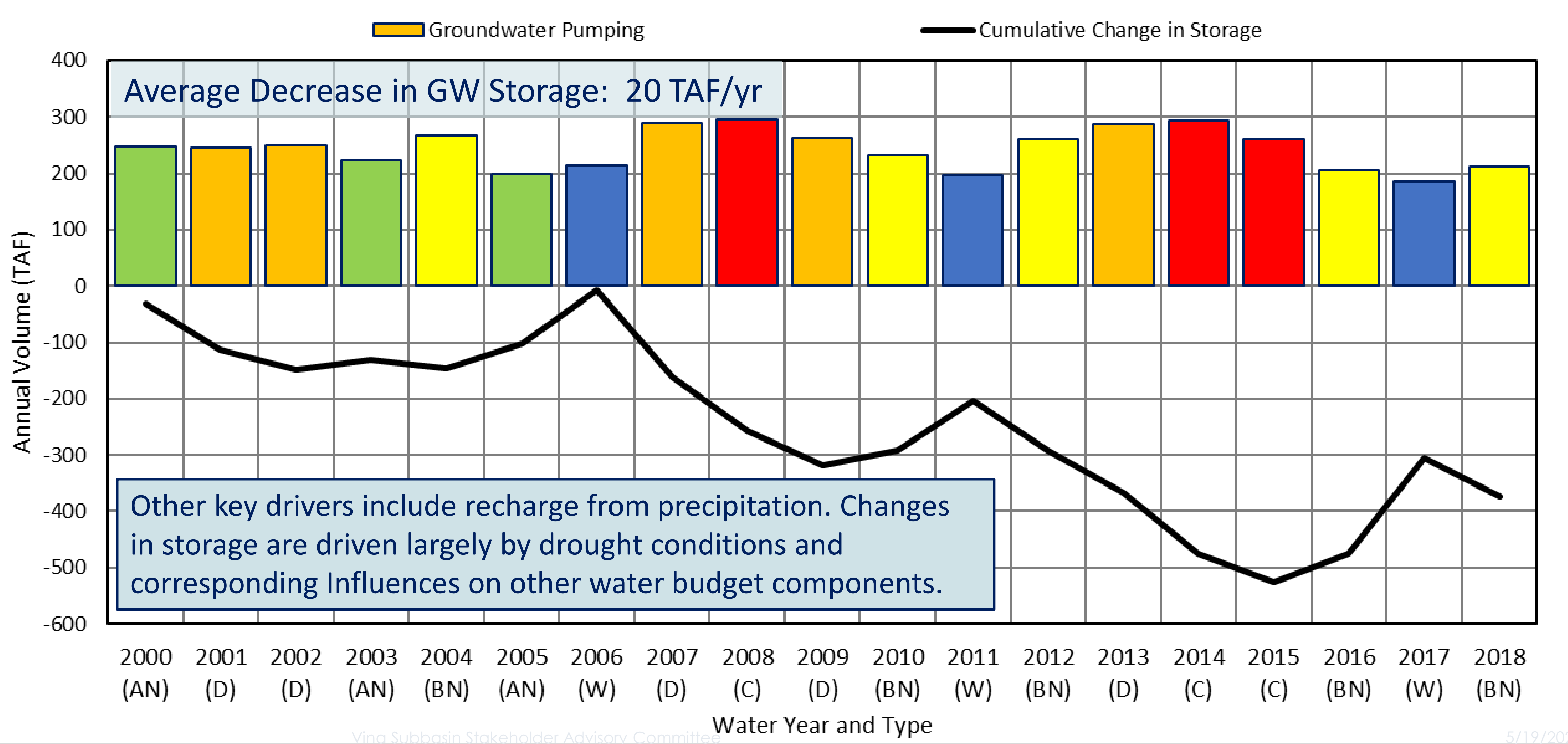
Future Conditions



Land Use	Acres
Agricultural	82,766
Developed	31,459
Native	71,081

Historical Water Budget Summary

Annual Groundwater Pumping and Cumulative Change in Storage



Year Types: Critical (C), Dry (D), Below Normal (BN), Above Normal (AN), Wet (W)