EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

ESJ GWA Board
February 9, 2021

Workshop

A. ESJ IWFM Model- Future Baseline and GSA Water Budgets
   1. Discuss Hydrologic Budget, Operating Budget Elements
   2. Questions, Issues and Needs to Support GSA Review

B. Water Accounting Framework (WAF) Strategy Development
   1. WAF & Financing Plan Approach and Overview
   2. Survey Results
   3. Focus Groups and Potential Interview Questions
   4. Roles, Process and Work Plan (Emily Finnegan)

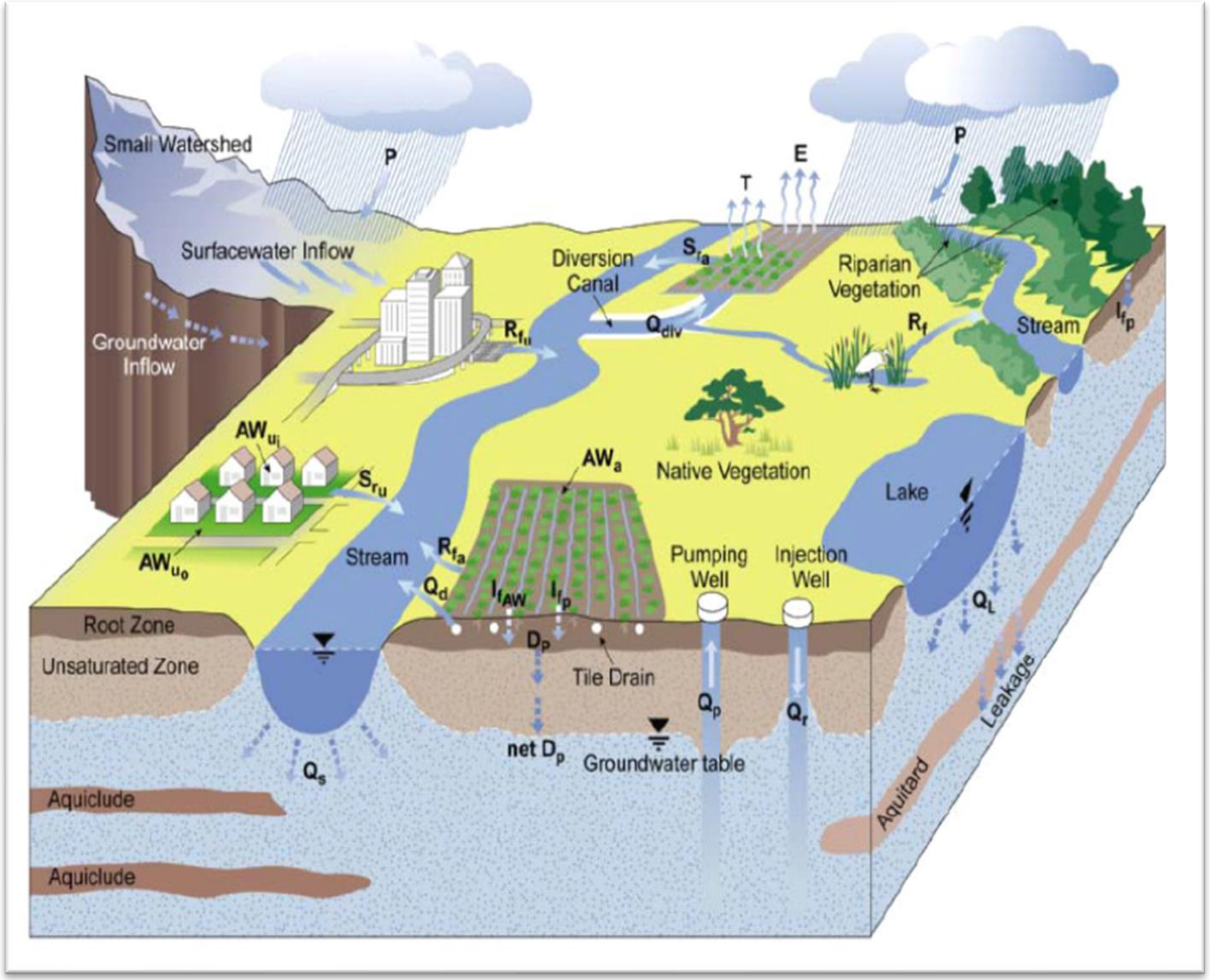
C. Funding & Financing Strategy Development

Agenda

- Decision Support Tool: ESJ Water Resources Model
  - Background
  - Historical Calibration Update
- Projected Conditions Without Projects Baseline Development
- Projected Conditions Hydrologic and Operational Water Budgets

Decision Support Tool: ESJ Water Resources Model (ESJWRM)

Based on the DWR Integrated Water Flow Model (IWFM)



- Public domain model developed and maintained by the California Department of Water Resources
  - Same model platform as C2VSim
- Includes
  - Land Surface Processes
  - Groundwater Flow
  - Streamflow
  - Physical Systems Integration
  - Water Budgets

ESJWRM Development Timeline and Data Needs

Sep 28, 2016
- Model Development KO Meeting

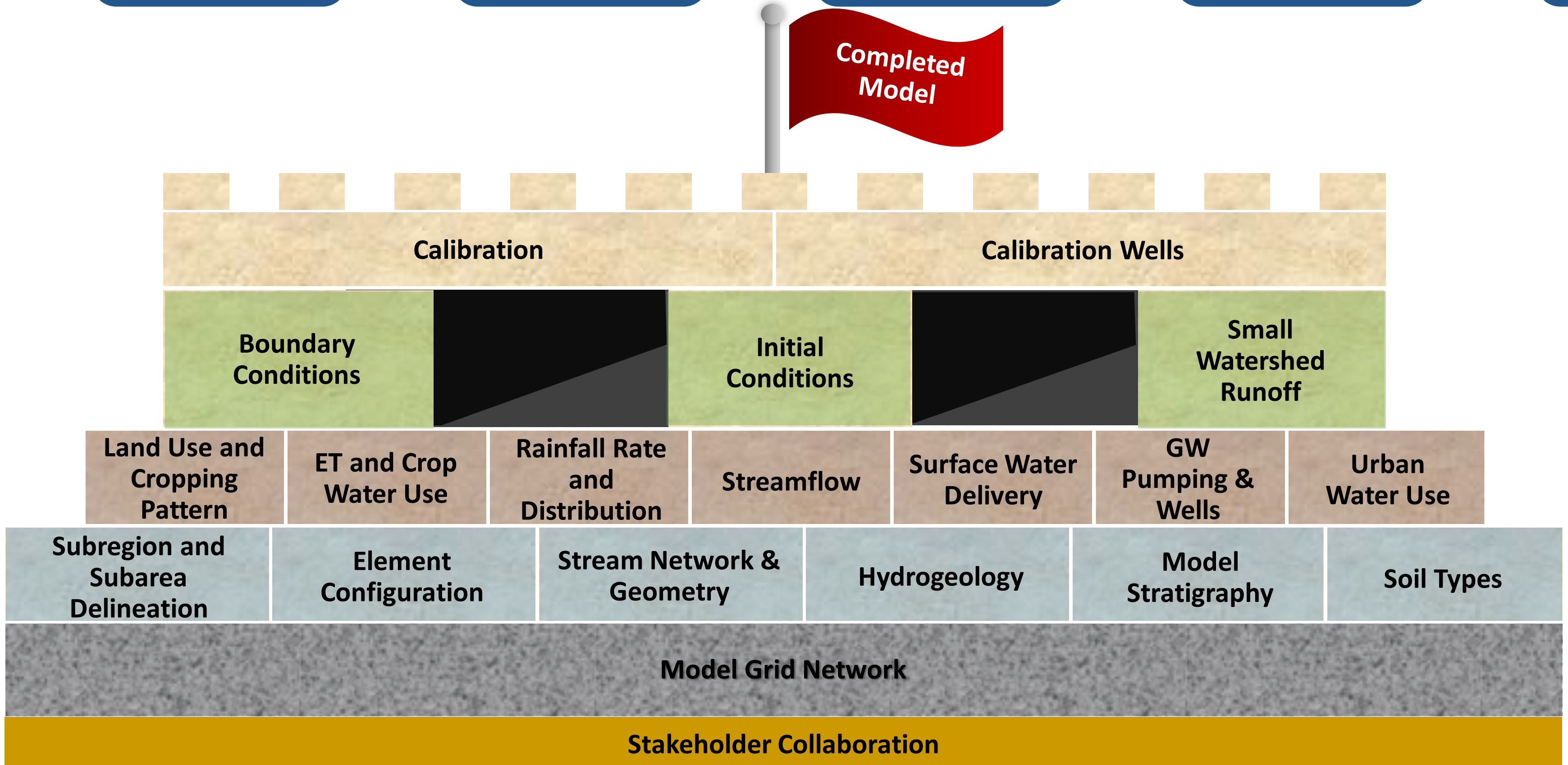
2016 – 2018
- Model Development
- GBA TAC Collaboration and Review of Model Development

May 9, 2018
- GWA Board Approval of Model Use for GSP

August 2018
- Historical Calibration, Water Budgets and Model Report Completed

2018-2020
- Model Application to the GSP Development

2021 Model Update
- Update of historical calibration, projected conditions, and GSA water budgets



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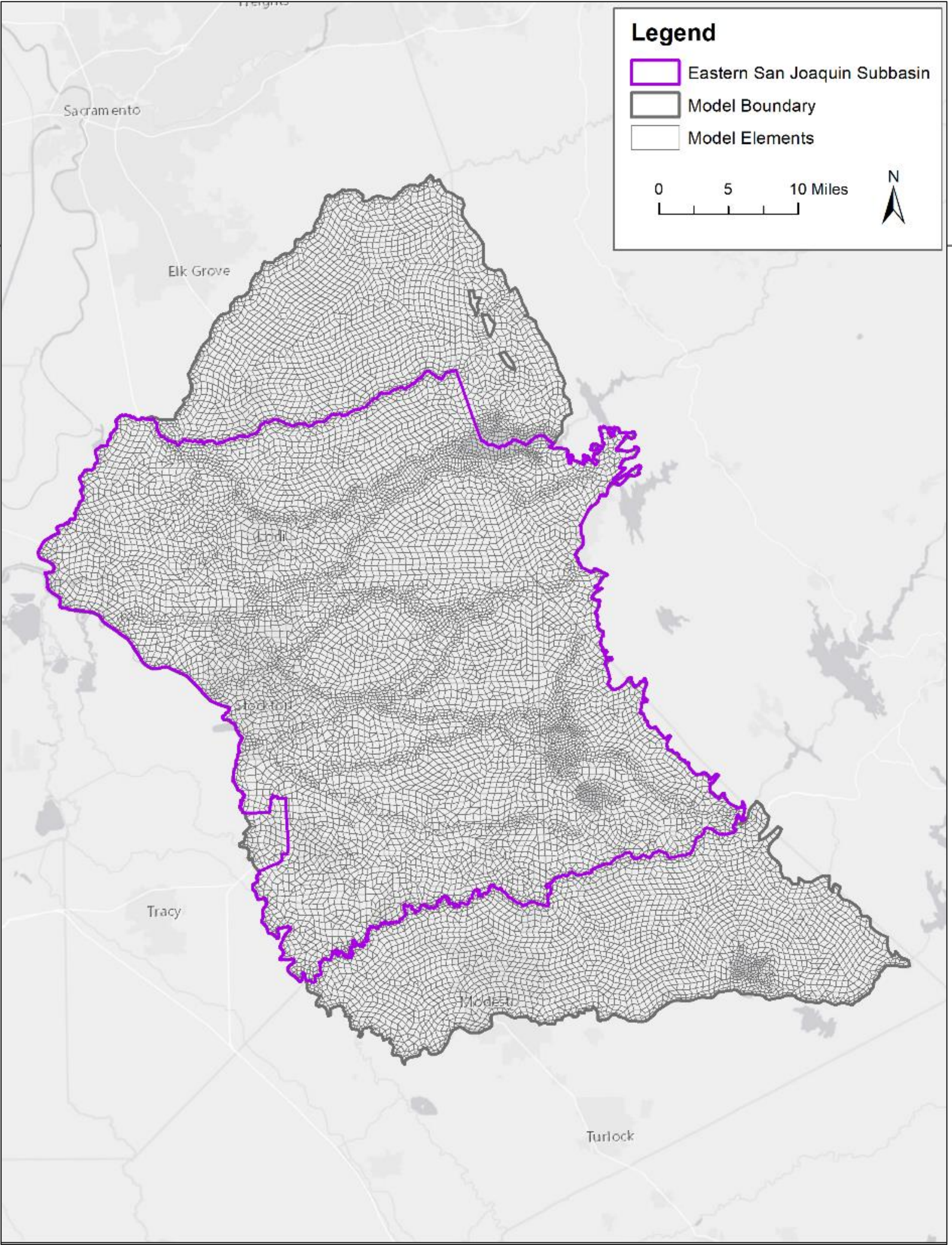

ESJWRM Model Structure

- Model Extent: Cosumnes, Eastern San Joaquin, and Modesto Groundwater Subbasins with Lathrop portion of Tracy Subbasin
  - North: Cosumnes River
  - South: Tuolumne River
  - West: San Joaquin River and Mokelumne River
  - East: Sierra Nevada Foothills
- Model Simulation:
  - Monthly from WY 1995-2020 (October 1, 1994 through September 30, 2020)
- Model Grid:
  - 16,054 elements
  - Average Area: 76.5 acres
  - 15,302 nodes
- Node Spacing:
  - Across Model Area: 0.37 mile
  - Along the Rivers/Water Courses: 0.28 miles

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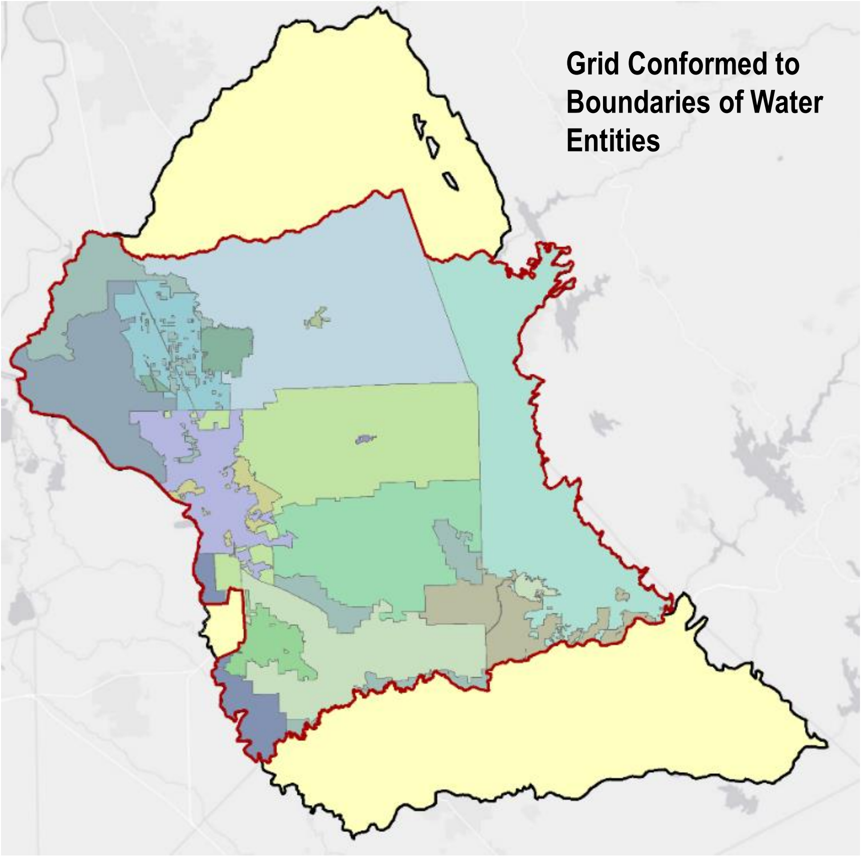
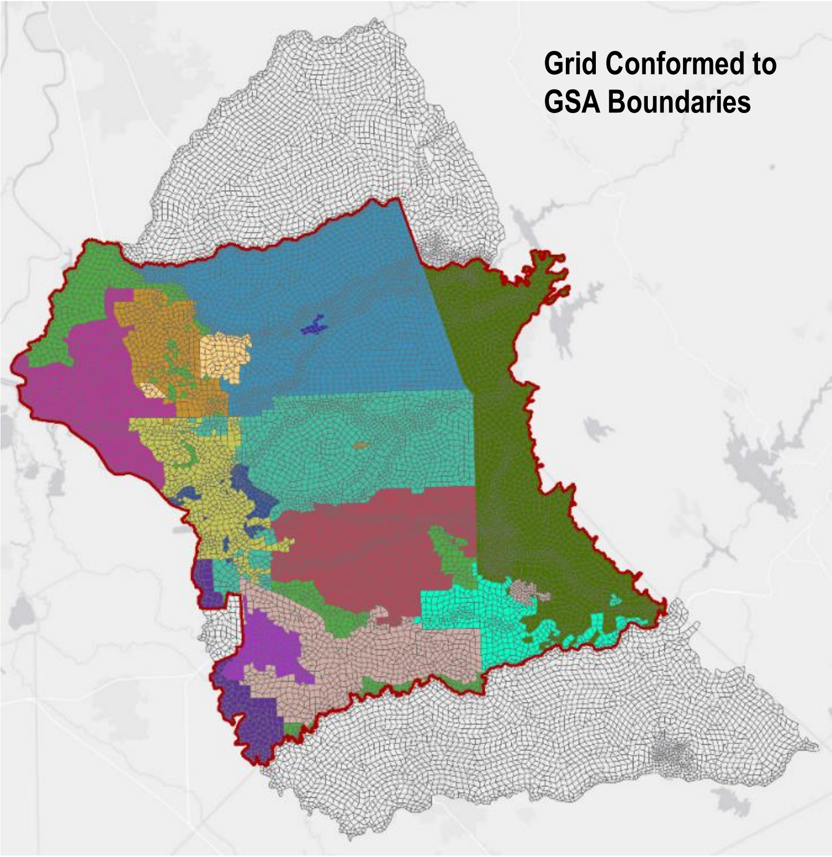
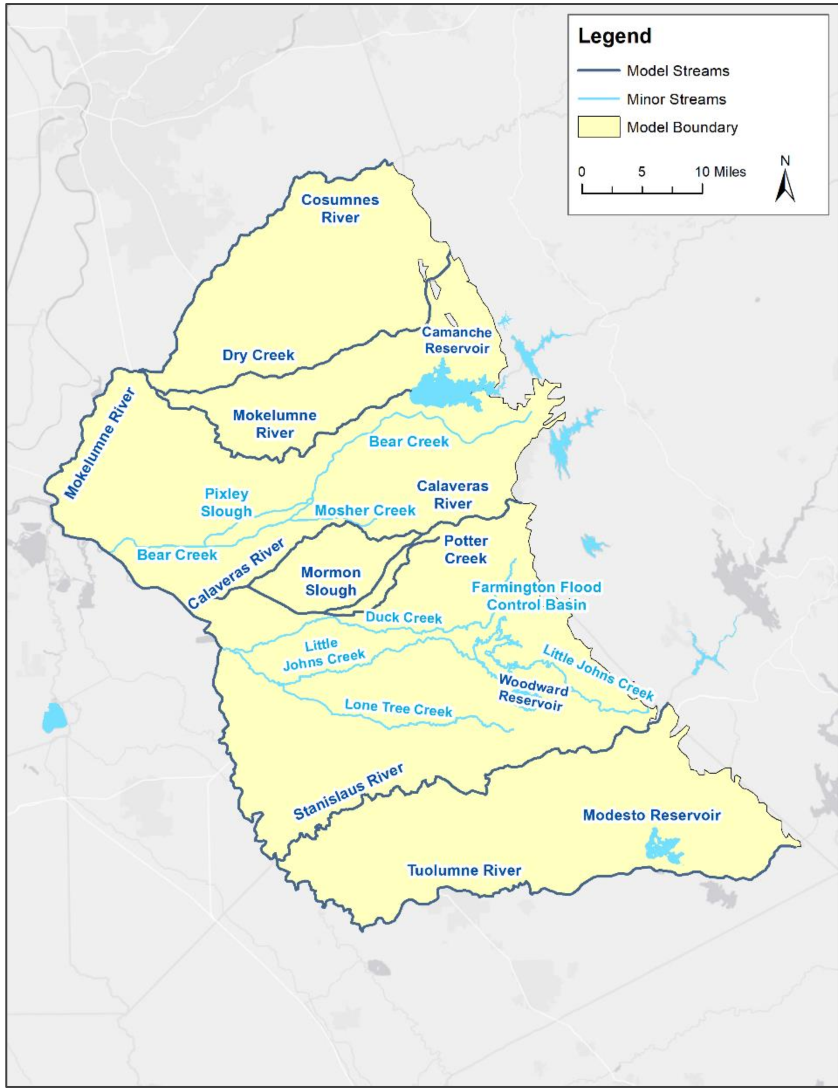
Major ESJWRM Features







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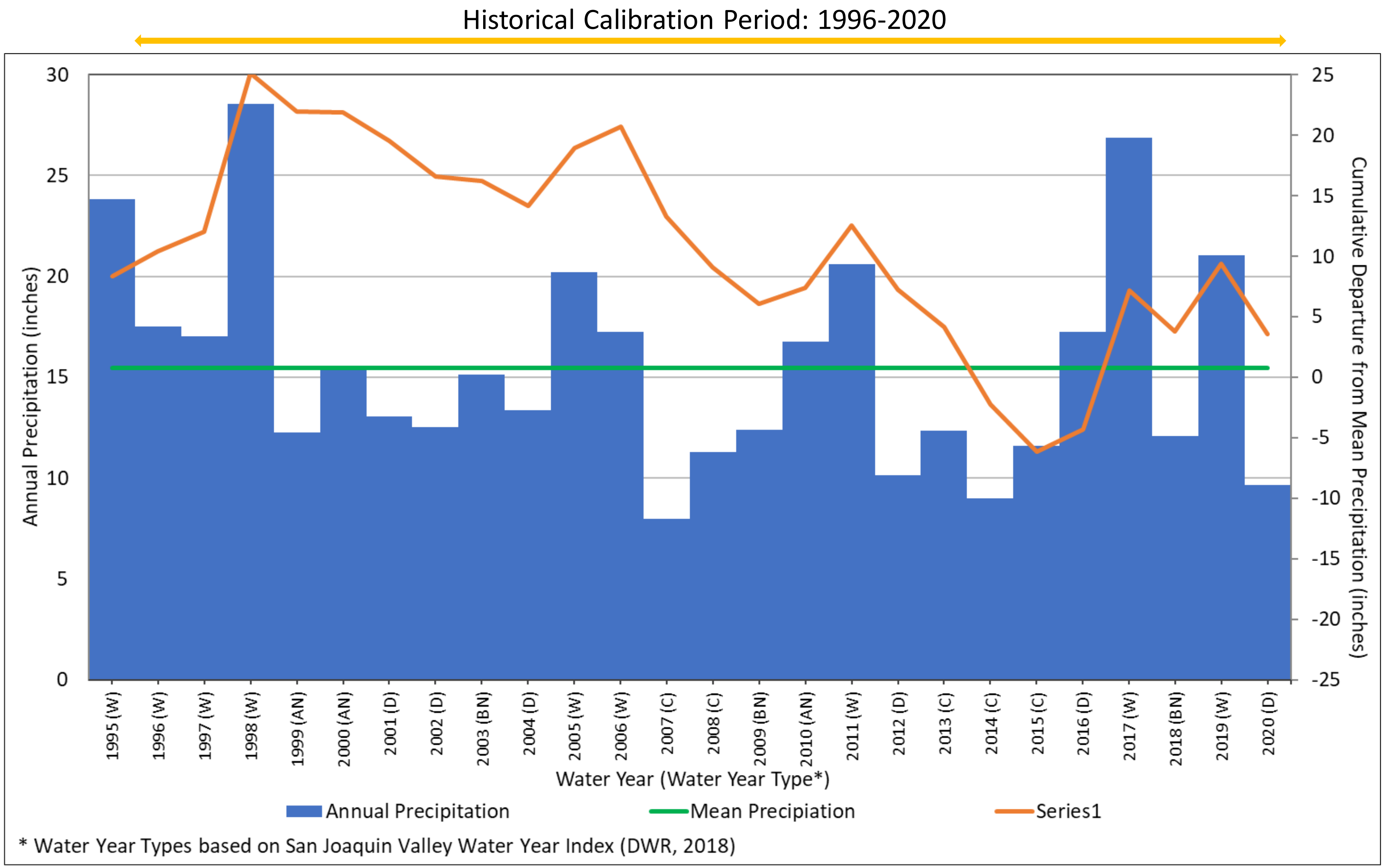
ESJWRM Hydrology



*Source: PRISM (Parameter elevation Regression on Independent Slopes Model)

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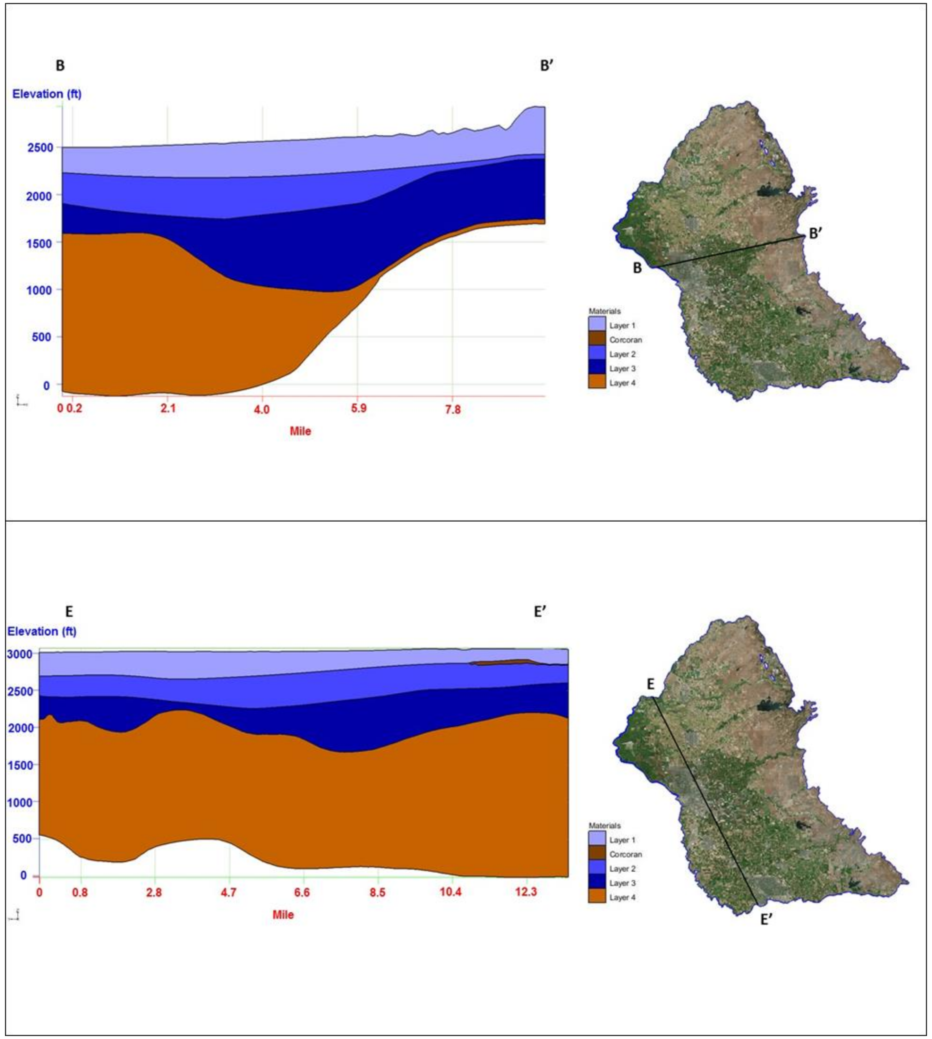
ESJWRM Model Layering

- **Consistent with DWR's C2VSimFG:**
  - **Layer 1:** Top unconfined portion of the aquifer (34-966 feet thick)
  - **Aquitard:** Corcoran Clay (10-160 feet thick)
  - **Layer 2:** Primary pumping zone and top confined layer where Corcoran Clay exists (50-540 feet thick)
  - **Layer 3:** Bottom represents base of fresh water (50-1335 feet thick)
  - **Layer 4:** Continental deposits (50-2250 feet thick)

Fresh Water

Saline Water



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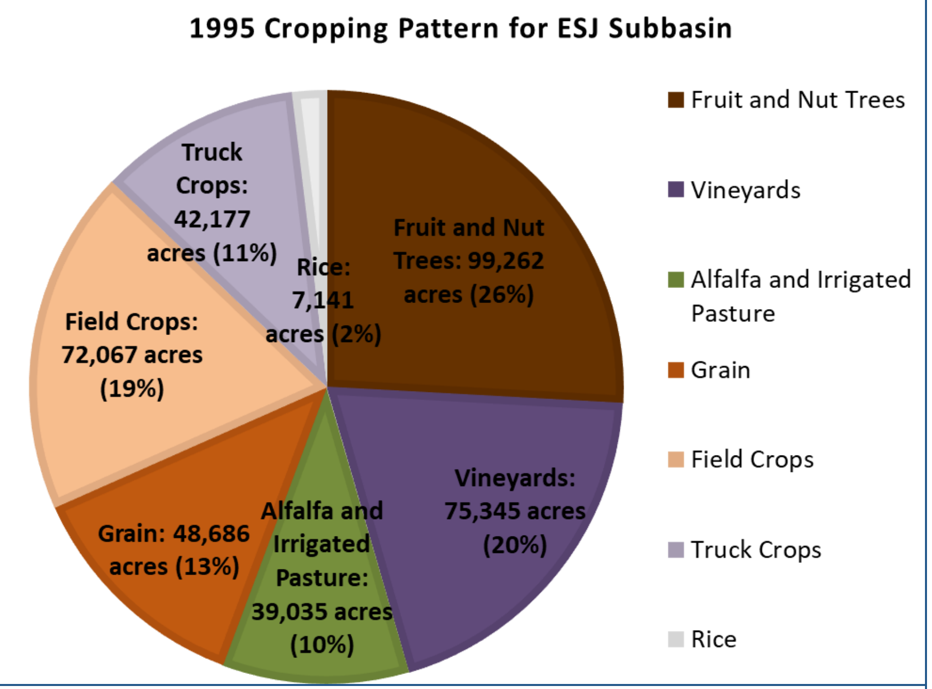
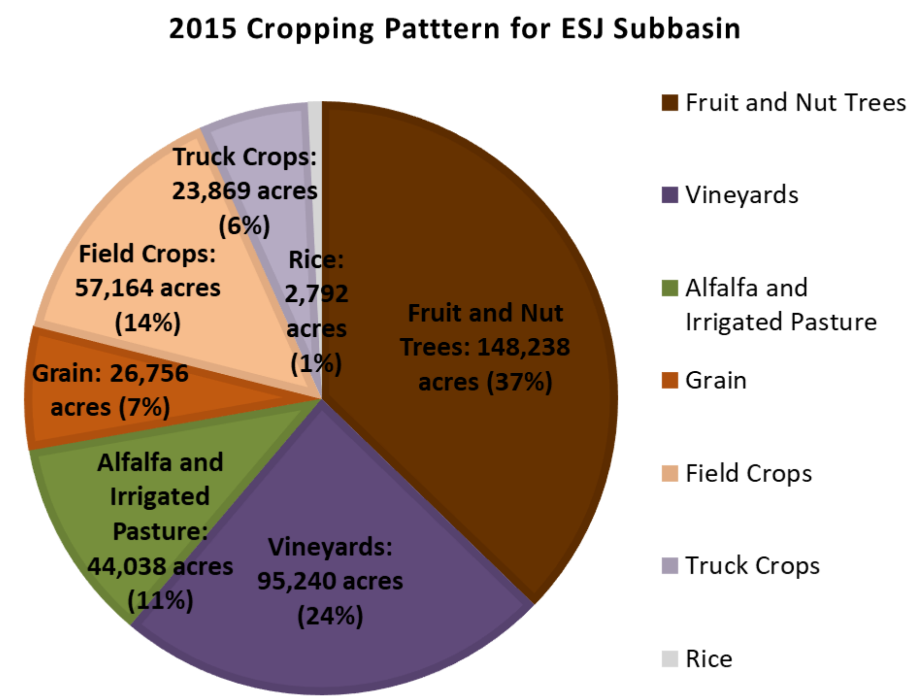
ESJWRM Land Use

- Land Use Types:
  - 23 irrigated crop categories
  - 7 high-level categories for verification purposes
  - 4 other land use categories
- Sources:
  - DWR Land Use Surveys (Representing ~1995)
    - San Joaquin County (1996)
    - Sacramento County (1993)
    - Amador County (1997)
    - Calaveras County (2000)
    - Stanislaus County (1996)
  - Remote Sensing Data:
    - USDA's CropScape (2007-2015)
    - DWR's Statewide Survey (2014 and 2016)
  - Local Data Sources





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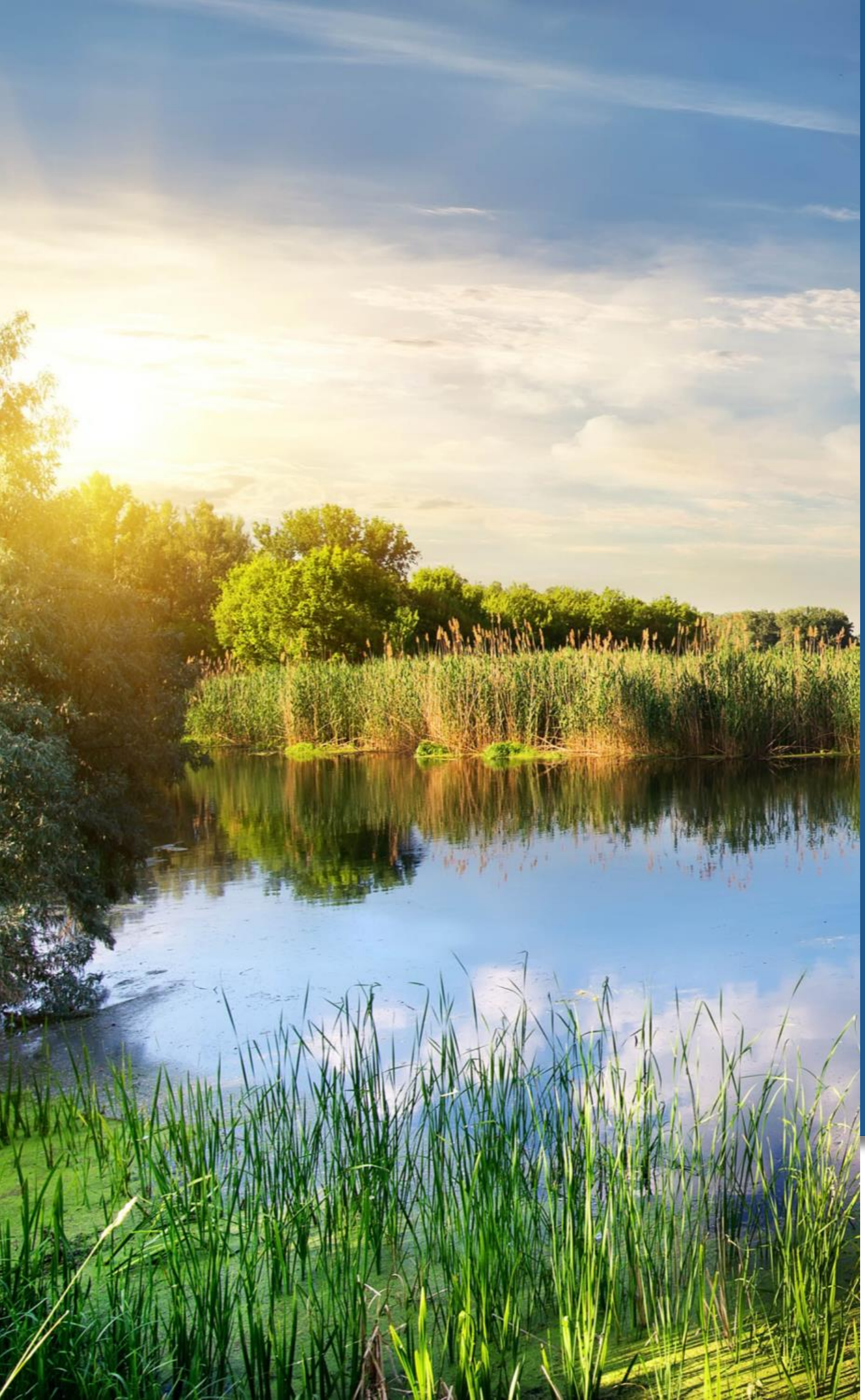
Discussion

- Can the ESJWRM calculate and estimate recharge and deep percolation?
- Can the Model calculate interaction between the surface and groundwater system?
- Can the Model calculate seawater intrusion?



Historical Model Update and Calibration

COMMITMENT & INTEGRITY DRIVE RESULTS

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Model Updates (2021)

- **Updated Data for 2 GSP Annual Reports**
  - Extended data WY 2016-2020 (population, 2016 land use, stream inflows, precipitation, surface water deliveries, groundwater pumping by well)
- **Updated SW Delivery and Water Use Data for OID and Modesto Subbasin**
- **Refined Land Use Patterns in LCSD and LCWD Areas, as well SSJID**
  - Edits to LCSD and LCWD elements to remove agricultural area
  - Edits to 2016 for SSJID
- **Updated the Surface Water Diversion and Well Pumping**
  - Separated NSJWCD ag diversions into north and south systems
  - Added CCWD Jenny Lind urban delivery (assume 43% within ESJ Subbasin)
  - Adjusted SW diversion volumes for Delta and riparian diversions
  - Updated time series based on feedback from agencies: Lodi, NSJWCD, OID, and SSJID
  - Compared ESJWRM results directly to corresponding AWMP components for OID and SSJID- Update ESJWRM to better represent AWMP information on water reuse, tailwater, farm deliveries, and canal seepage
  - Confirmed SW delivery element groups for all areas
- **Urban Demand**
  - Updated population estimates for LCSD
  - Calculated urban demand based on water supply
  - Matched urban demand areas to water supply delivery groups, including separating Stockton area into Cal Water, City of Stockton, and San Joaquin County users in Stockton

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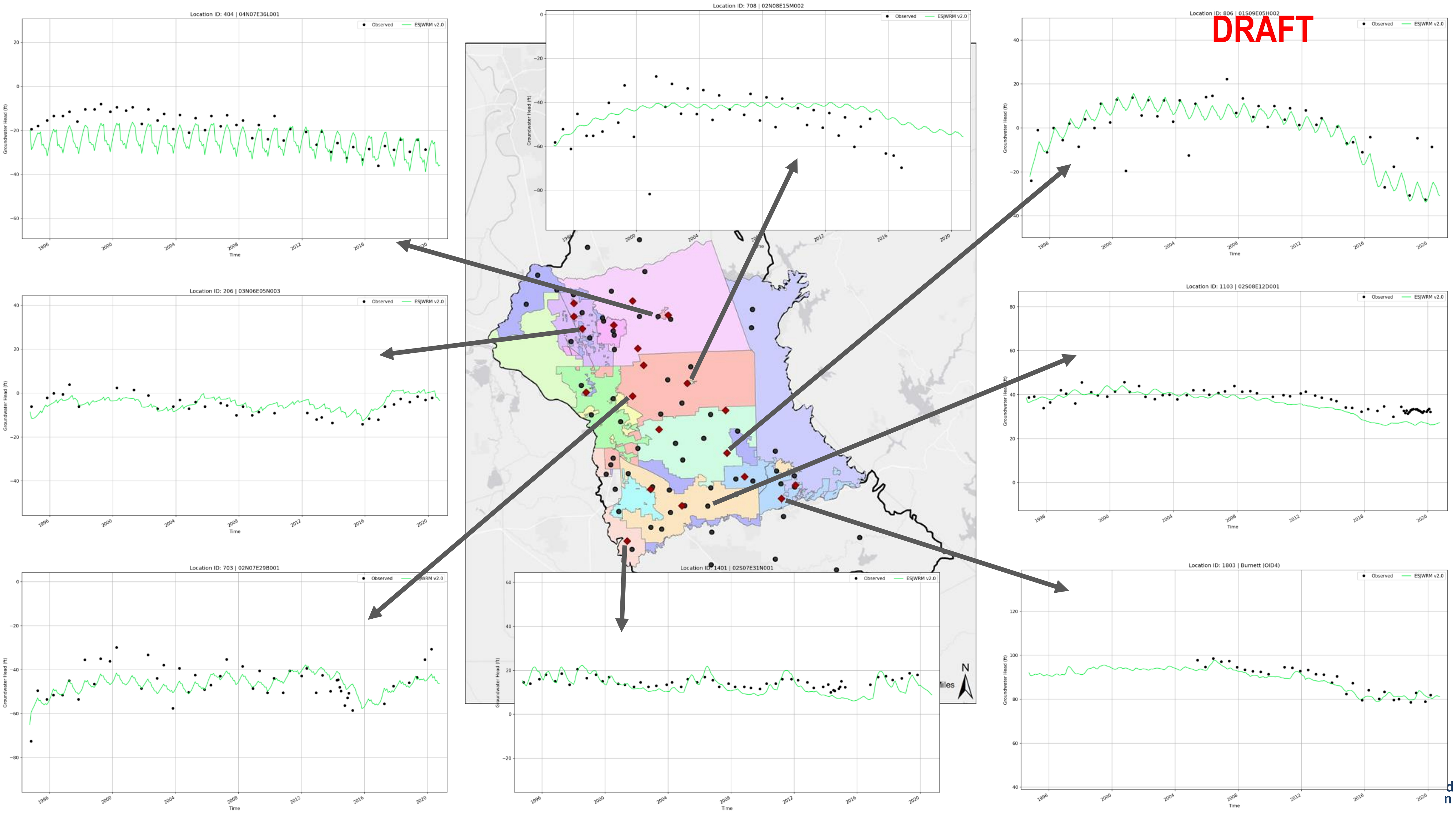
Calibration Updates (2021)

- Reviewed and updated root zone and unsaturated zone soil moisture and return flow and reuse fractions
- Reviewed and updated stream parameters based on updates made to C2VSimFG and nearby local models
- Reviewed and updated small watershed system to adjust GWL at foothill calibration wells
- Utilized PEST-assisted calibration to refine aquifer parameters
- Compared model results to observed groundwater levels and stream flows



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Location ID: 404 | 04N07E36L001
Location ID: 708 | 02N08E15M002
Location ID: 806 | 01S09E05H002
Location ID: 206 | 03N06E05N003
Location ID: 1103 | 02S08E12D001
Location ID: 703 | 02N07E29B001
Location ID: 1401 | 02S07E31N001
Location ID: 1803 | Burnett (OID4)
Observed
ESJWRM v2.0
Groundwater Head (ft)
Time
Miles
N

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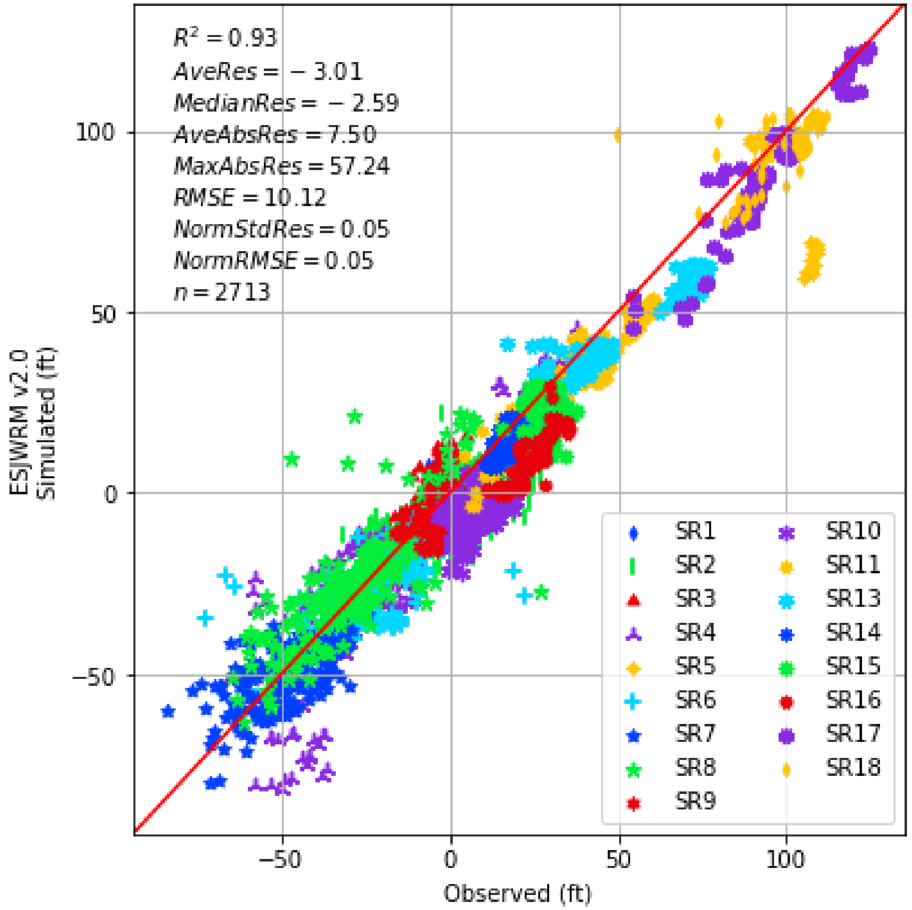
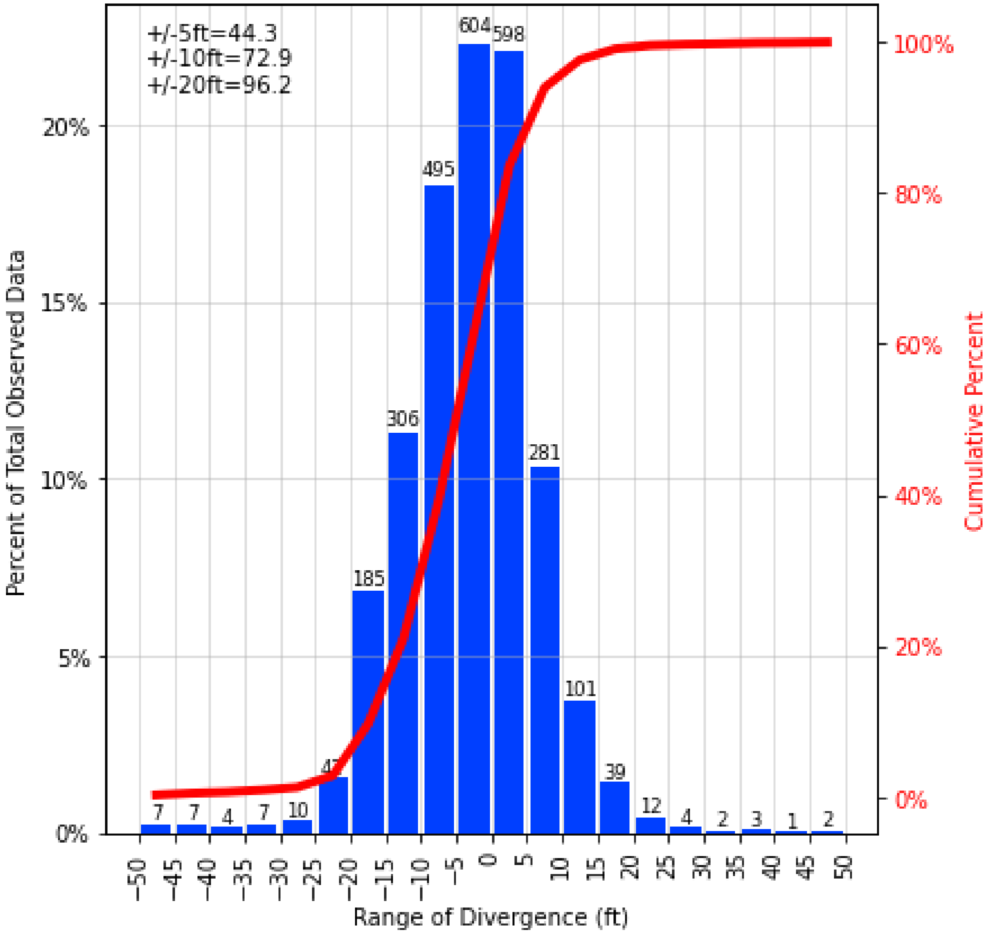
Calibration Statistics





Note: Showing model statistics for original calibration wells in ESJ Subbasin over entire model time period (WY 1995-2020)

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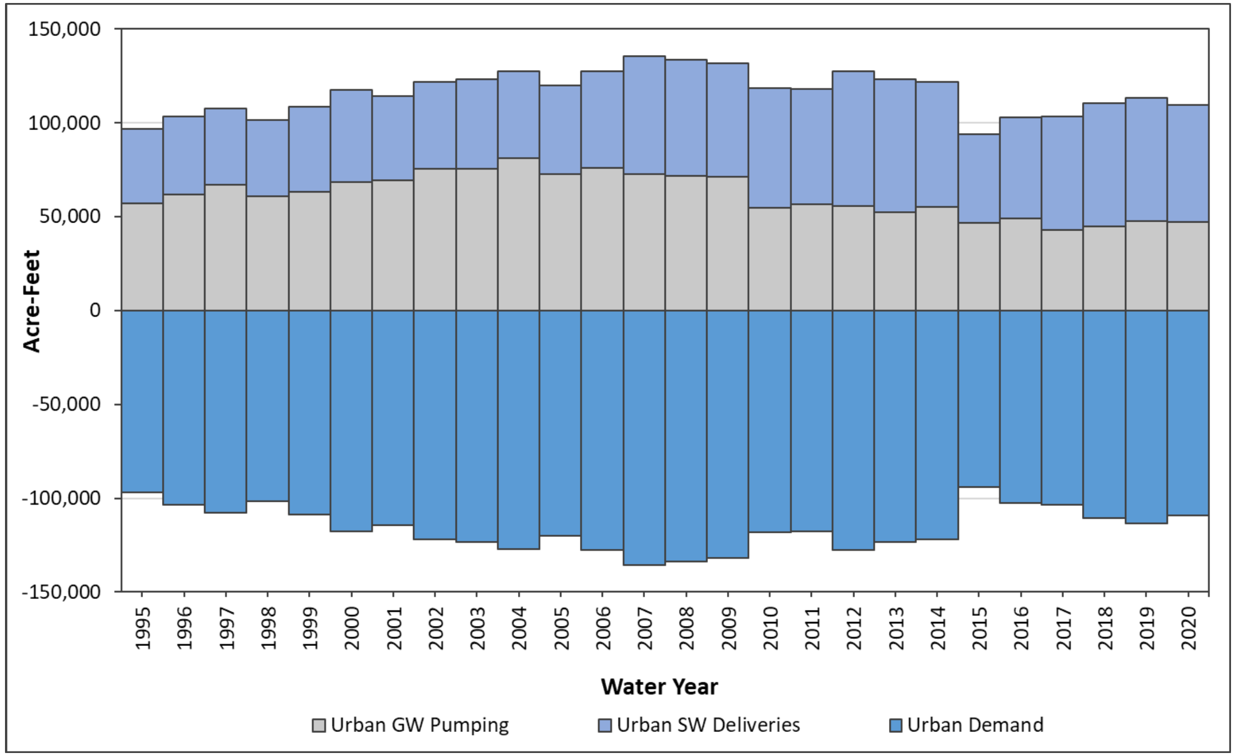
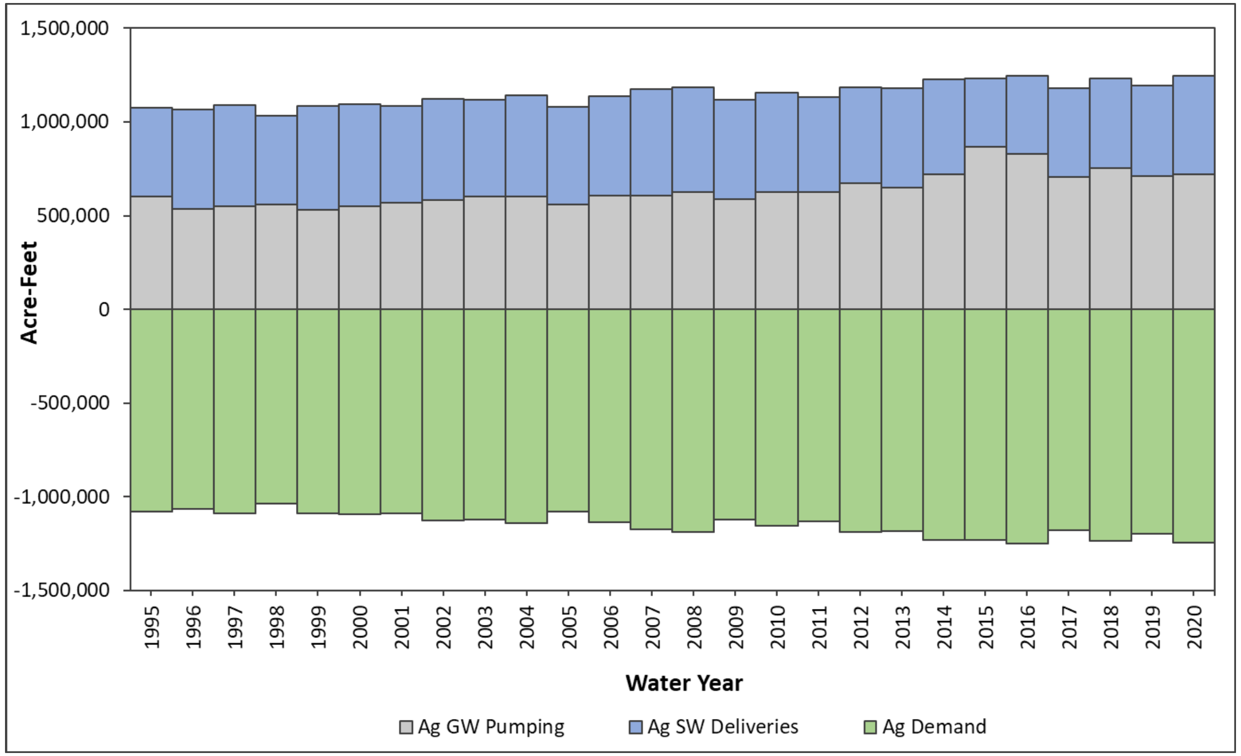
Land & Water Use Budget



Urban Areas



Agricultural Areas

Note: Showing model results from ESJWRM v2.0

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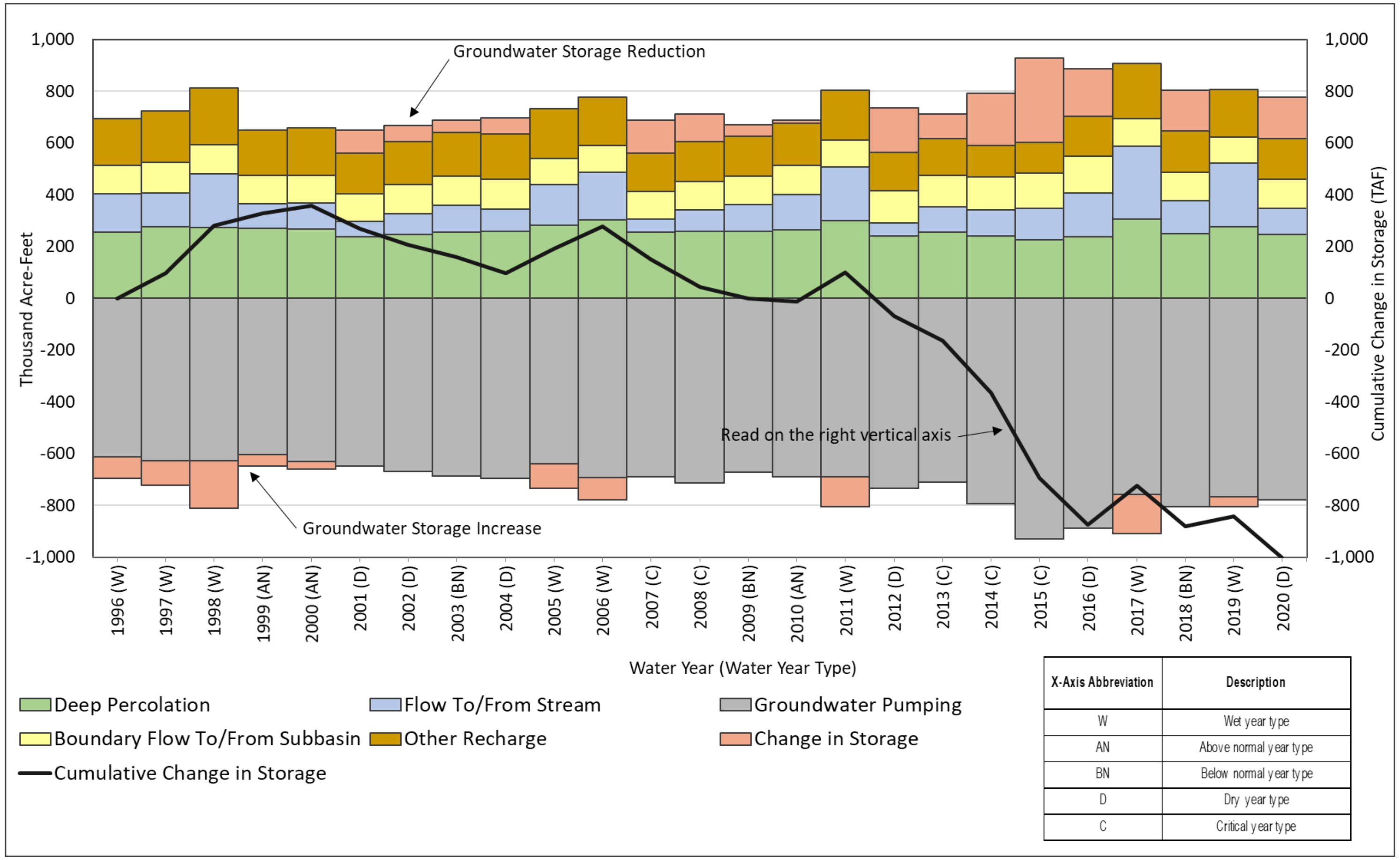
Groundwater Budget



X-Axis Abbreviation	Description
W	Wet year type
AN	Above normal year type
BN	Below normal year type
D	Dry year type
C	Critical year type

Long-term Average(Wy 1996-2020) Annual Groundwater Storage Deficit of 37,000 AFY

Notes:

1. Water Year Types based on San Joaquin Valley Water Year Index
2. “Other Recharge” includes managed aquifer recharge, recharge from unlined canals and/or reservoirs, and recharge from ungauged watersheds.
3. “Change in Storage” balances the water budget. For instance, if annual outflows (-) are greater than inflows (+), there is a decrease in storage, but this would be shown as storage depletion on the positive side of the bar chart to balance out the increased outflows on the negative side of the bar chart.

Note:
Model results from ESJWRM v2.0

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Model Calibration for Historical Period

- Historical Model updated and calibrated to WY 2020
- Model reasonably represents the historical subbasin and GSA scale water budgets, and is reasonably calibrated to GW levels and streamflows
- Model is a defensible analytical tool to evaluate the Projected Conditions Baseline (PCBL)
- Model is a reasonable analytical tool to evaluate the benefits and impacts of projects under the Projected Conditions

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Discussion

- Is the model calibrated enough to meet the GSP goals?
- Are there uncertainties associated with the Model estimates and results?
- Can the calibrated Model be used for future projections?

TAC Recommendation to the GWA Board

On January 6, 2022, the TAC recommended to the GWA Board of Directors to accept the updated calibration of the ESJWRM (Version 2.0) for further use in water resources planning projects, including the GSP implementation.

Projected Conditions Model Assumptions and Results

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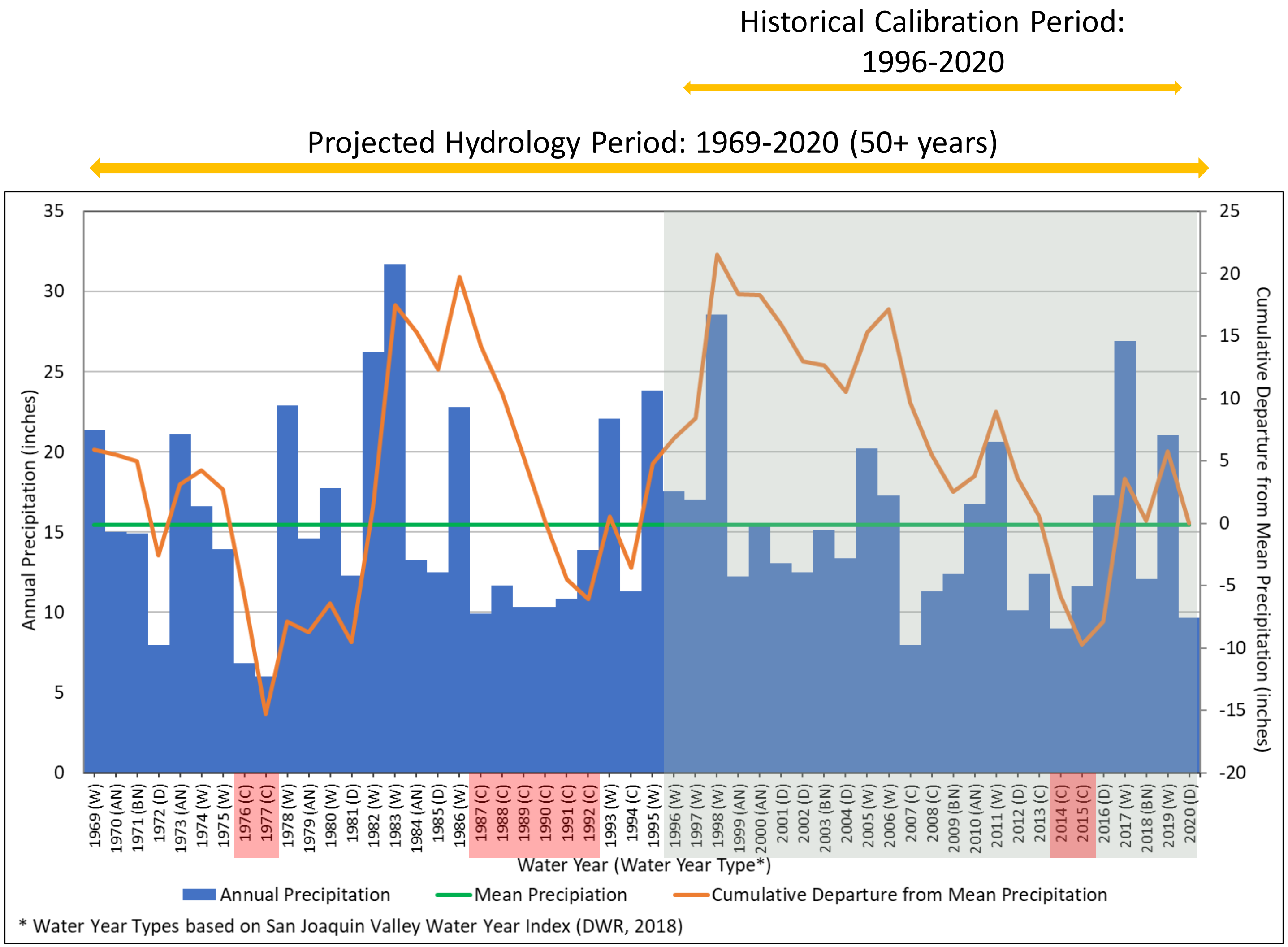
Projected Hydrology



*Source: PRISM (Parameter elevation Regression on Independent Slopes Model)

- To simplify projected assumptions, assume water year type groupings:
  - Wet (W)
  - Normal (AN, BN)
  - Dry (D, C)
  - Drought Period (Select C years)
    - WY 1976-77, 1987-92, 2014-15
    - Assumed drought years with reductions in surface water supply at 2015 level
- For water supply data, used 11-year historical average (WY 2010-2020) grouped by year type

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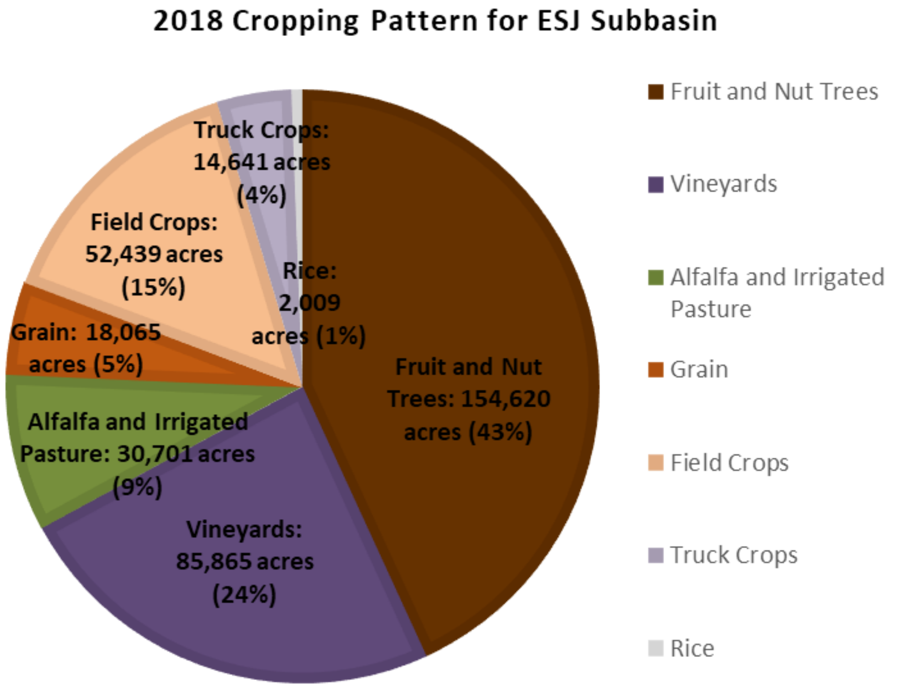
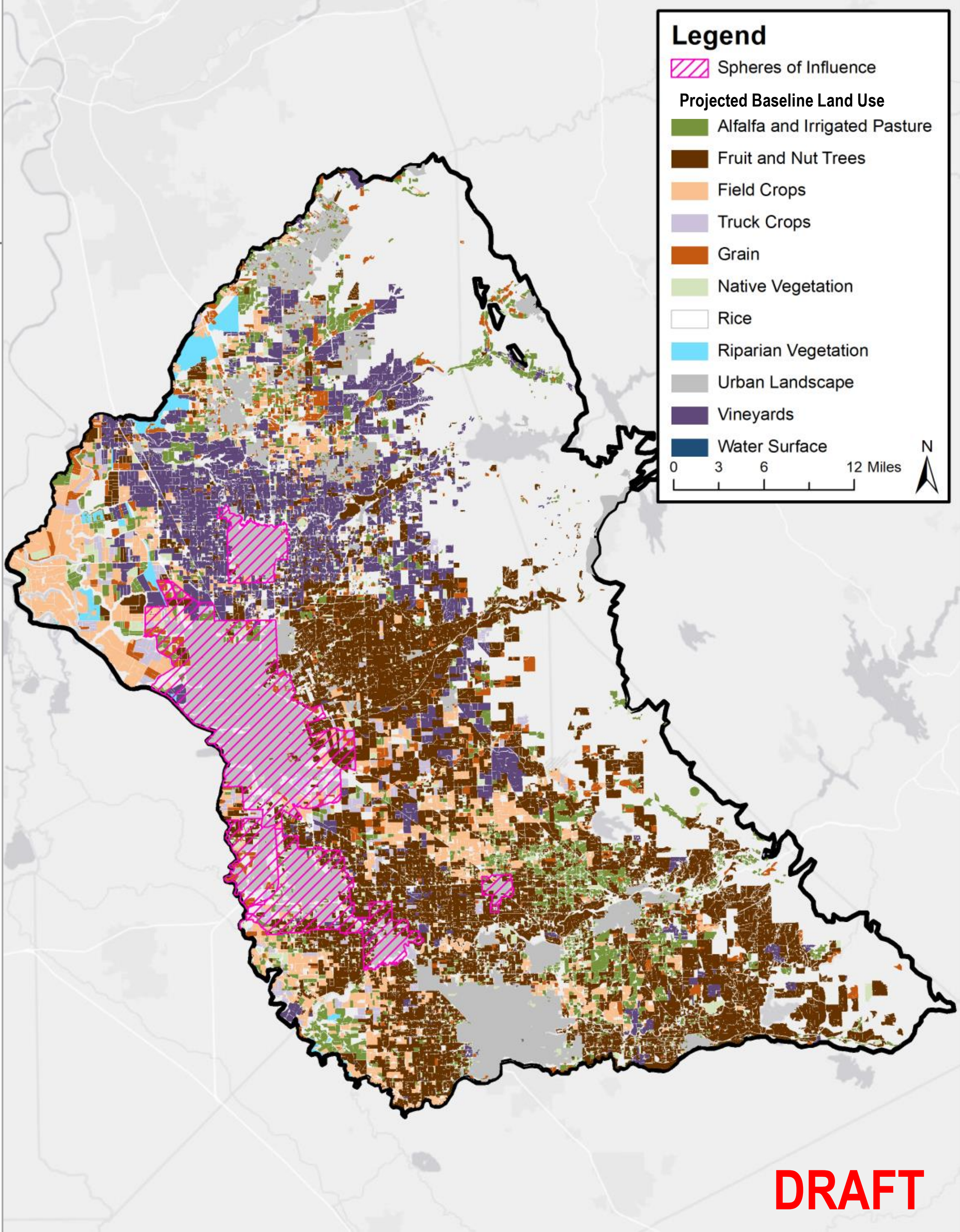
Projected Baseline Land Use

- Based on the DWR 2018 LU Survey
- Urban growth to buildout at SOI or General Plan boundaries
- Urban growth encroached on Ag and undeveloped land





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Projected Baseline Land Use Refinement

Land Use Type	DWR 2018 Survey	Baseline Model	Change From DWR 2018 Survey
Ag Acreage	392,112	358,340	-33,772
Urban Acreage	104,858	153,484	48,625
Undeveloped Acreage	255,143	240,289	-14,853
Riparian	12,579	12,579	0

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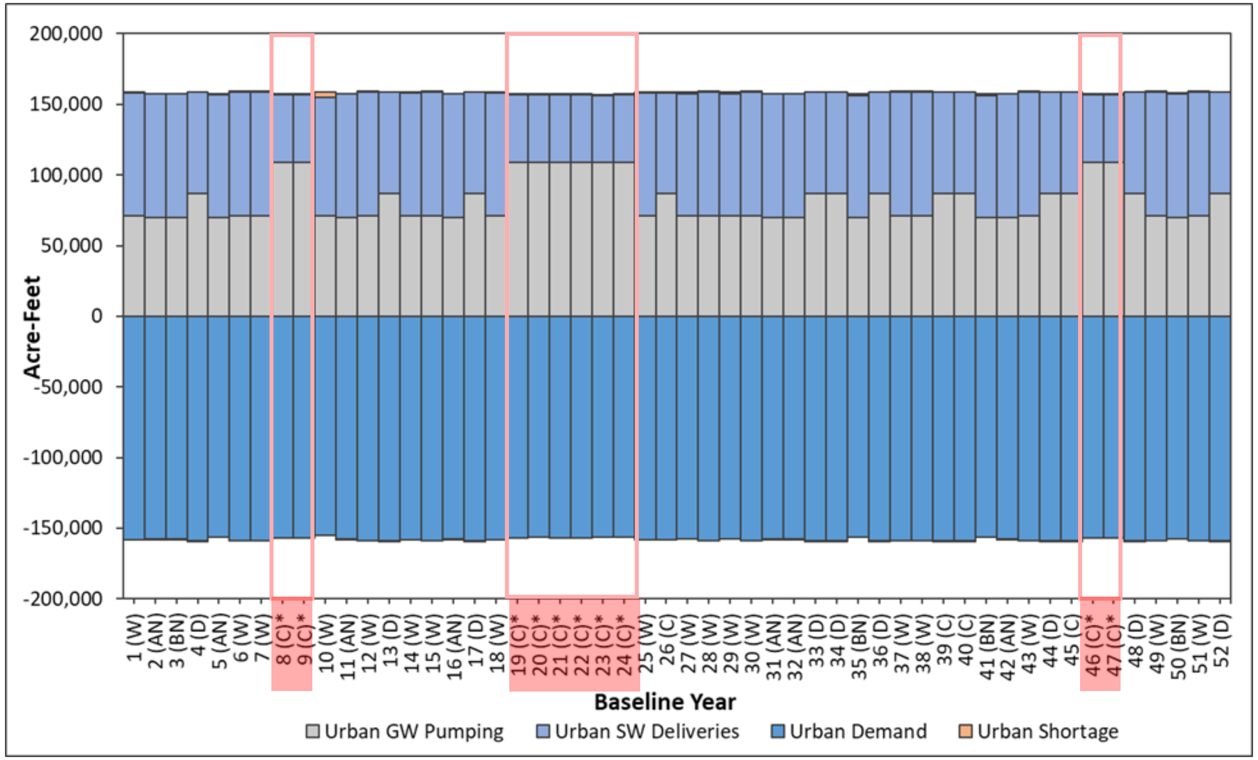
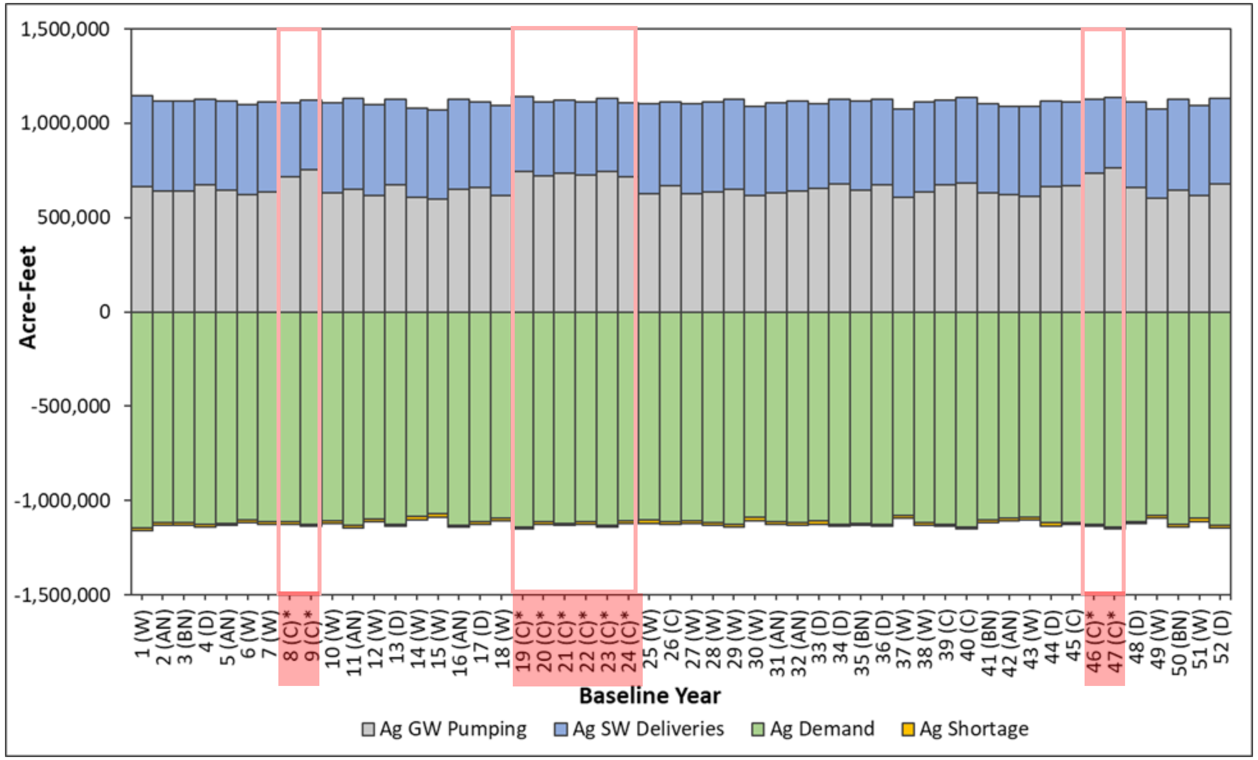
Land & Water Use Budget





Urban Areas

Agricultural Areas

Note: Showing model results from ESJWRM PCBL v2.0.18

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Projected Conditions Water Budgets

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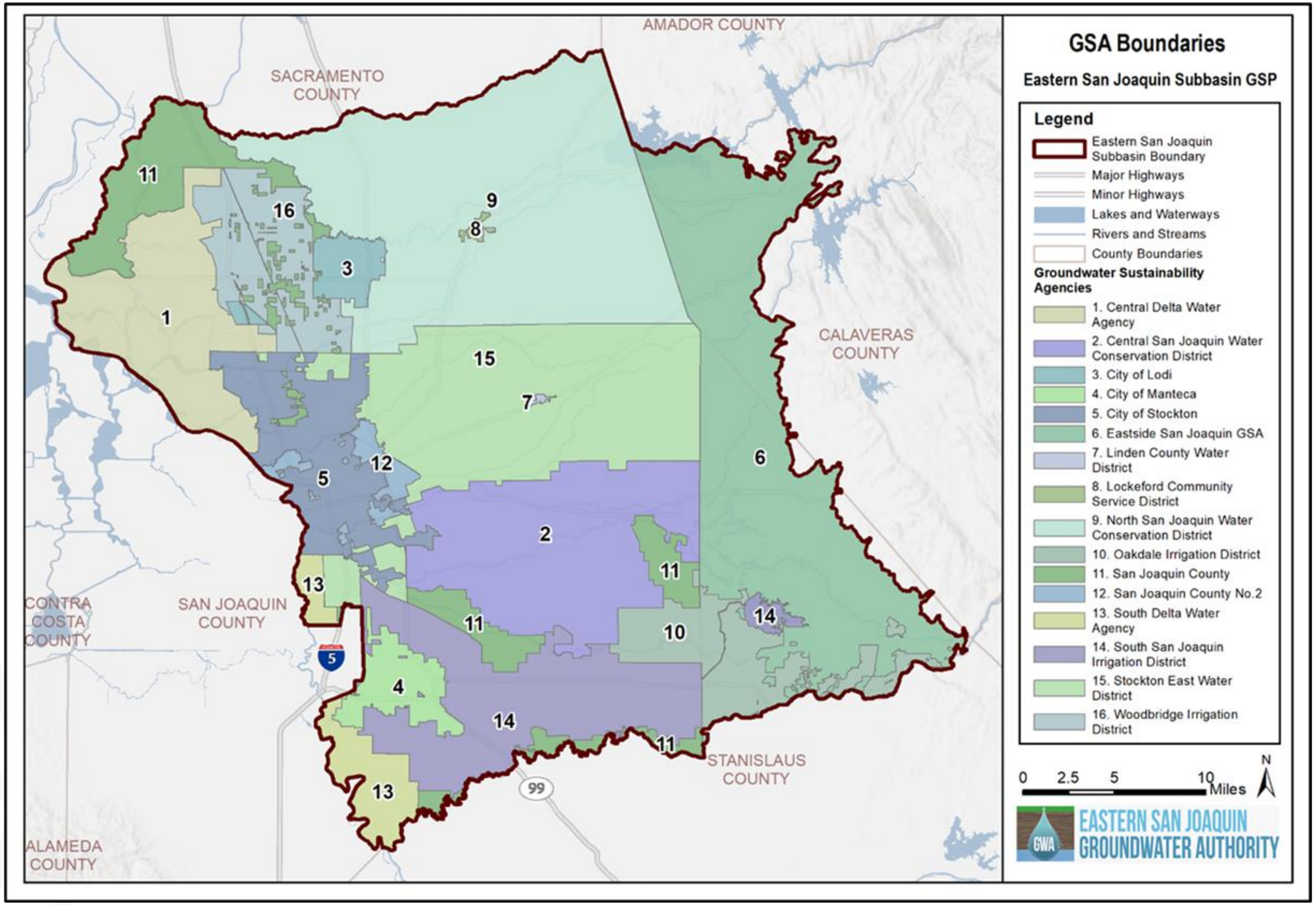
ESJ Subbasin GSAs



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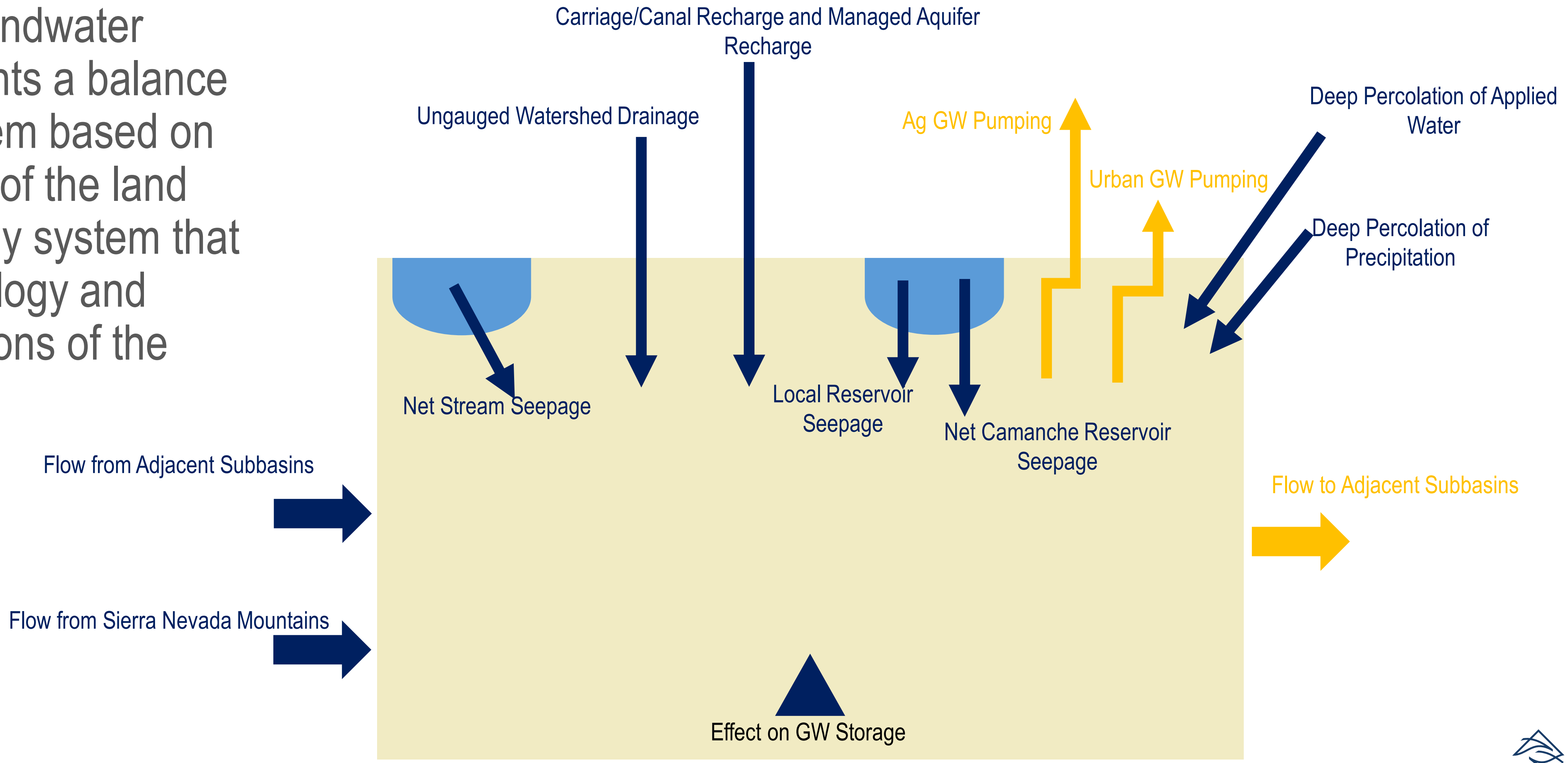
Groundwater Budget (Hydrologic)

- Hydrologic groundwater budget represents a balance of the GW system based on all components of the land and water supply system that affect the hydrology and physical conditions of the GW system



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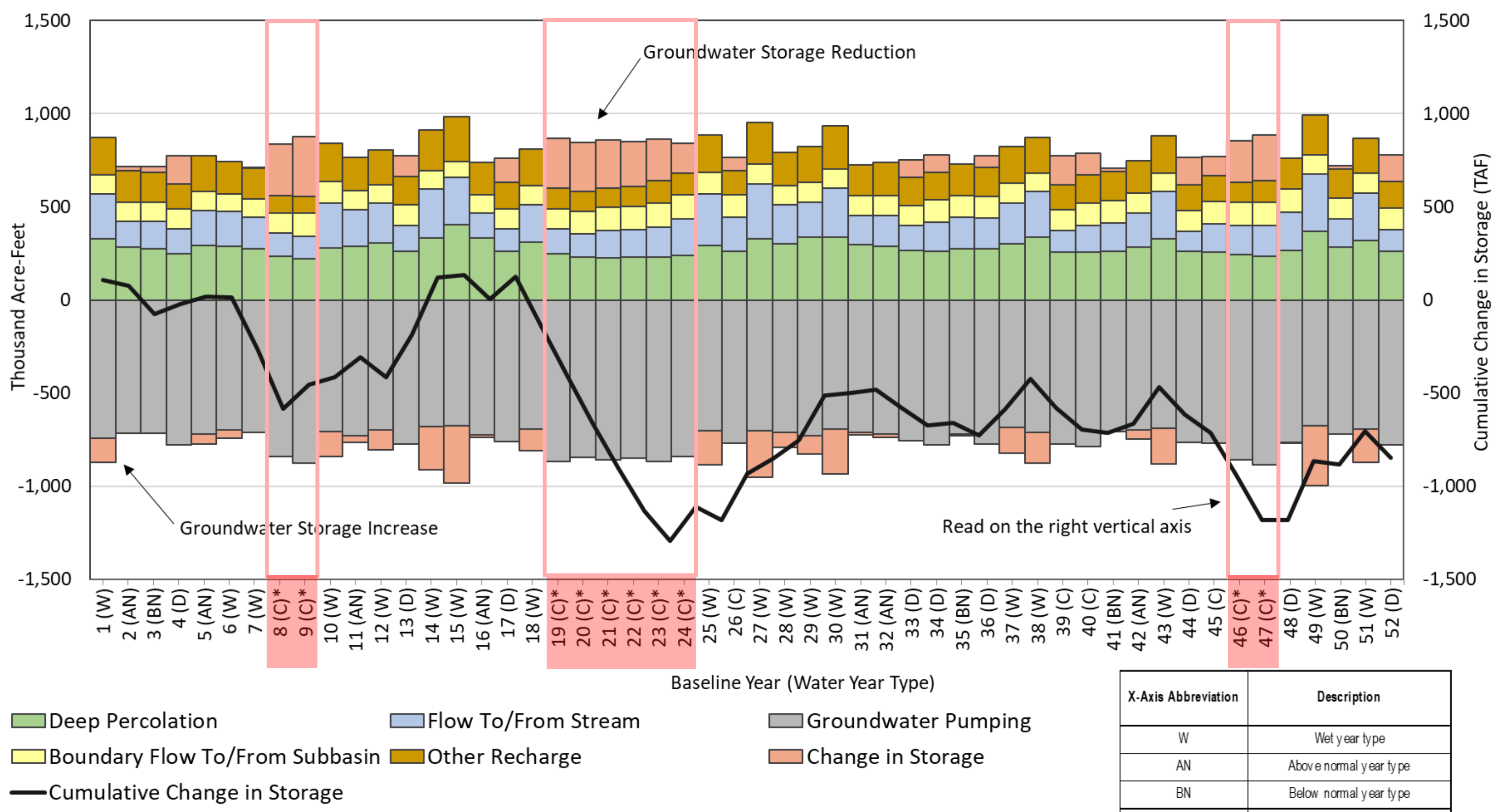
Projected Groundwater Budget



X-Axis Abbreviation	Description
W	Wet year type
AN	Above normal year type
BN	Below normal year type
D	Dry year type
C	Critical year type

Projected Long-term Average(52 years) Annual Groundwater Storage Deficit of 16,000 AFY

Notes:
1. Water Year Types based on San Joaquin Valley Water Year Index
2. “Other Recharge” includes managed aquifer recharge, recharge from unlined canals and/or reservoirs, and recharge from ungauged watersheds.
3. “Change in Storage” balances the water budget. For instance, if annual outflows (-) are greater than inflows (+), there is a decrease in storage, but this would be shown as storage depletion on the positive side of the bar chart to balance out the increased outflows on the negative side of the bar chart.

Note:
Model results based on ESJWRM PCBL v2.0.18

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Local Scale Water Budget

- **“Hydrologic”** Groundwater Budgets are used to analyze and develop sustainable yield conditions at the Subbasin level
- **“Operational”** Groundwater Budgets are used for accounting of GSA level water operational activities and net contributions to the Subbasin GW storage

Operational Water Budget Subbasin Scale

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Water Budget Components Assignment for Water Accounting Framework (WAF)

Water Budget Component	WAF Assignment	Notes
Deep Percolation	Operational	From both rainfall and irrigation applied water
Ag GW Pumping	Operational	Used for irrigation water supply
Urban GW Pumping	Operational	Used for municipal water supply
Other Recharge	Operational	Includes managed aquifer recharge and recharge from agency-operated unlined canals and/or local reservoirs
Stream Seepage	Common Pool	Due to stream-aquifer interaction
Boundary Flow	Common Pool	To/from neighboring GW Subbasins and the Sierra Nevada Mountains

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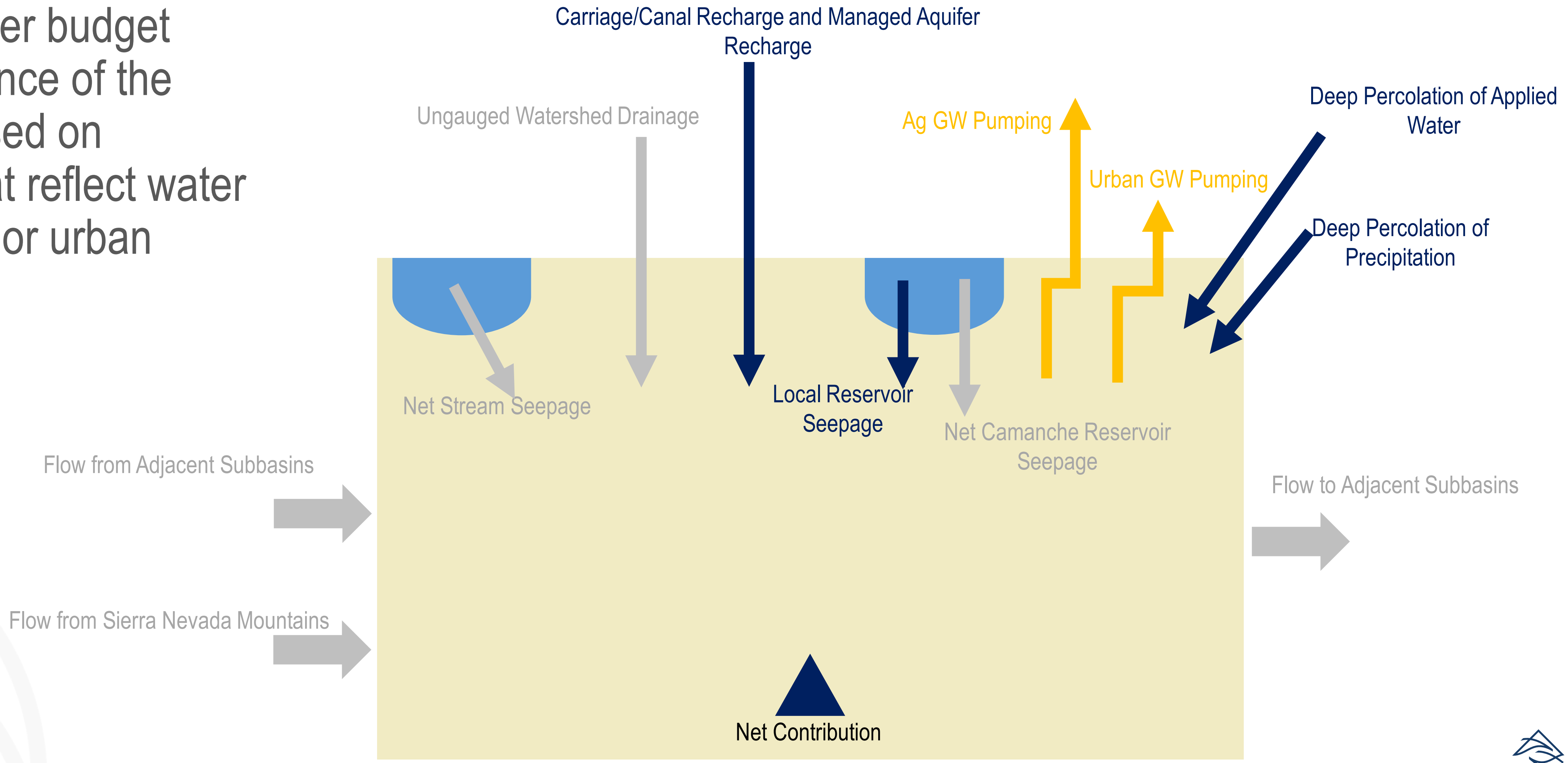
Operational Water Budget

- Operational water budget represents balance of the GW system based on components that reflect water use by each ag or urban entity



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Water Accounting Framework

	Hydrologic Groundwater Budget		Operational Account (Bucket 1)		Common Pool Account (Bucket 2)	
Component	**Inflows**	**Outflows**	**Inflows**	**Outflows**	**Inflows**	**Outflows**
Deep Percolation	282,100	0	282,100	0	0	0
Precipitation	70,100	0	70,100	0	0	0
Applied Water (SW & GW)	212,000	0	212,000	0	0	0
Stream Seepage	288,700	108,000	0	0	288,600	108,000
Other Recharge	161,700	0	105,800	0	56,100	0
Carriage/Canal Recharge and Managed Aquifer Recharge	97,800	0	89,800	0	8,200	0
Local Reservoir Seepage	16,000	0	16,000	0	0	0
Net Camanche Reservoir Seepage	2,700	0	0	0	2,700	0
Ungauged Watershed Drainage	45,200	0	0	0	45,200	0
Boundary Inflow	201,800	91,300	0	0	201,800	91,300
Sierra Nevada Mountains	57,000	0	0	0	57,000	0
Sacramento-San Joaquin River Delta	42,200	4,200	0	0	42,200	4,200
Between Adjacent Subbasins	102,600	87,100	0	0	102,600	87,100
Groundwater Pumping	0	751,300	0	751,300	0	0
Distributed Pumping	0	683,000	0	683,000	0	0
Well Pumping	0	68,300	0	68,300	0	0
Total	**934,300**	**950,600**	**387,900**	**751,300**	**546,400**	**199,300**
Net Inflow - Outflow	**(16,300)**		**(363,400)**		**347,100**	

Note: Numbers rounded to nearest hundred

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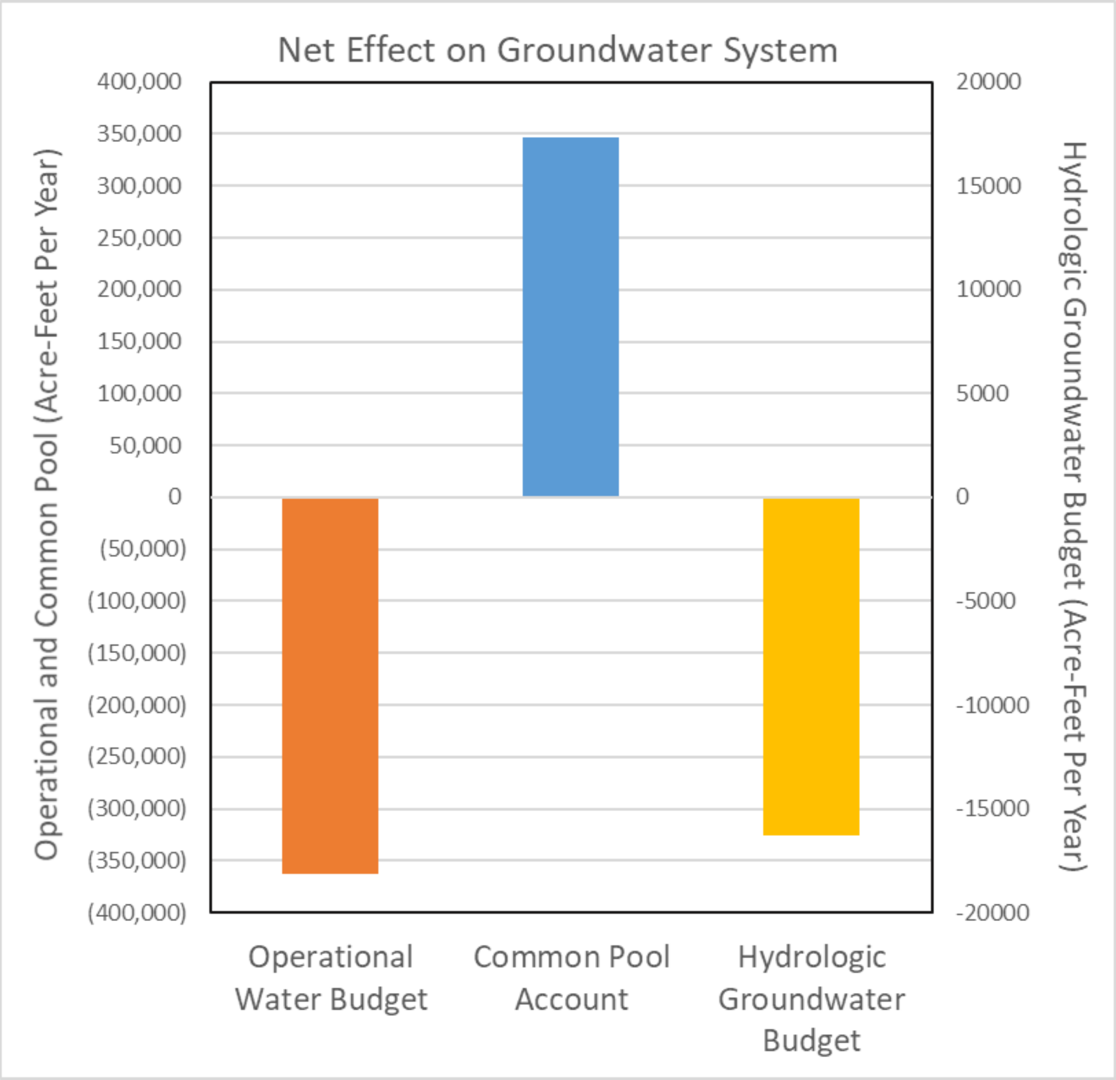
Net Contribution to GW Storage Change

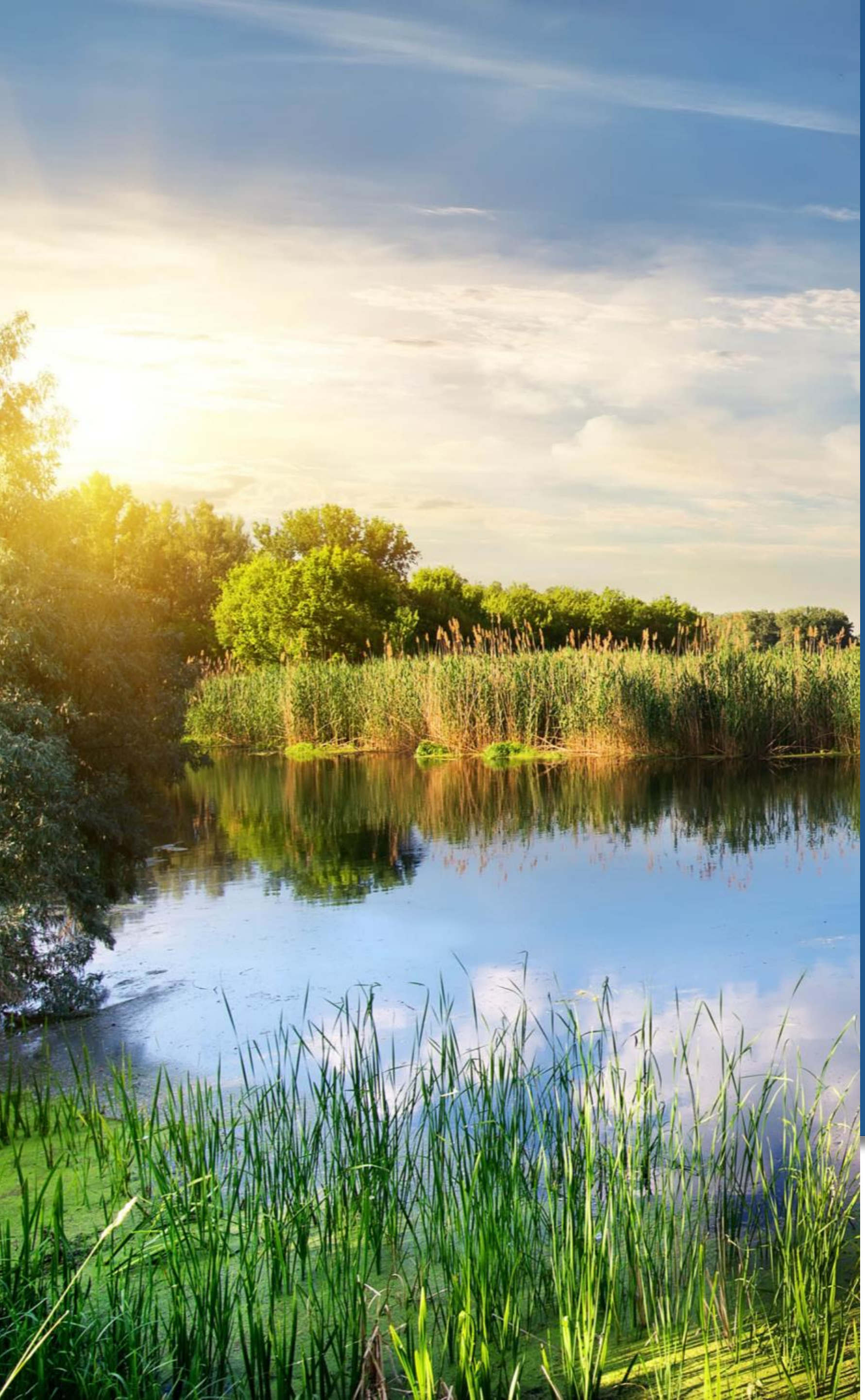


Net Total Contribution by GSA

Operational Budget + Common Pool Share = Net Total Contribution by GSA

Discussion

- Do you agree with how the pieces for each bucket are assigned?
- Do you have any thoughts on other ways of accounting for the components of the water budget at the Subbasin scale?



Discussion / Questions

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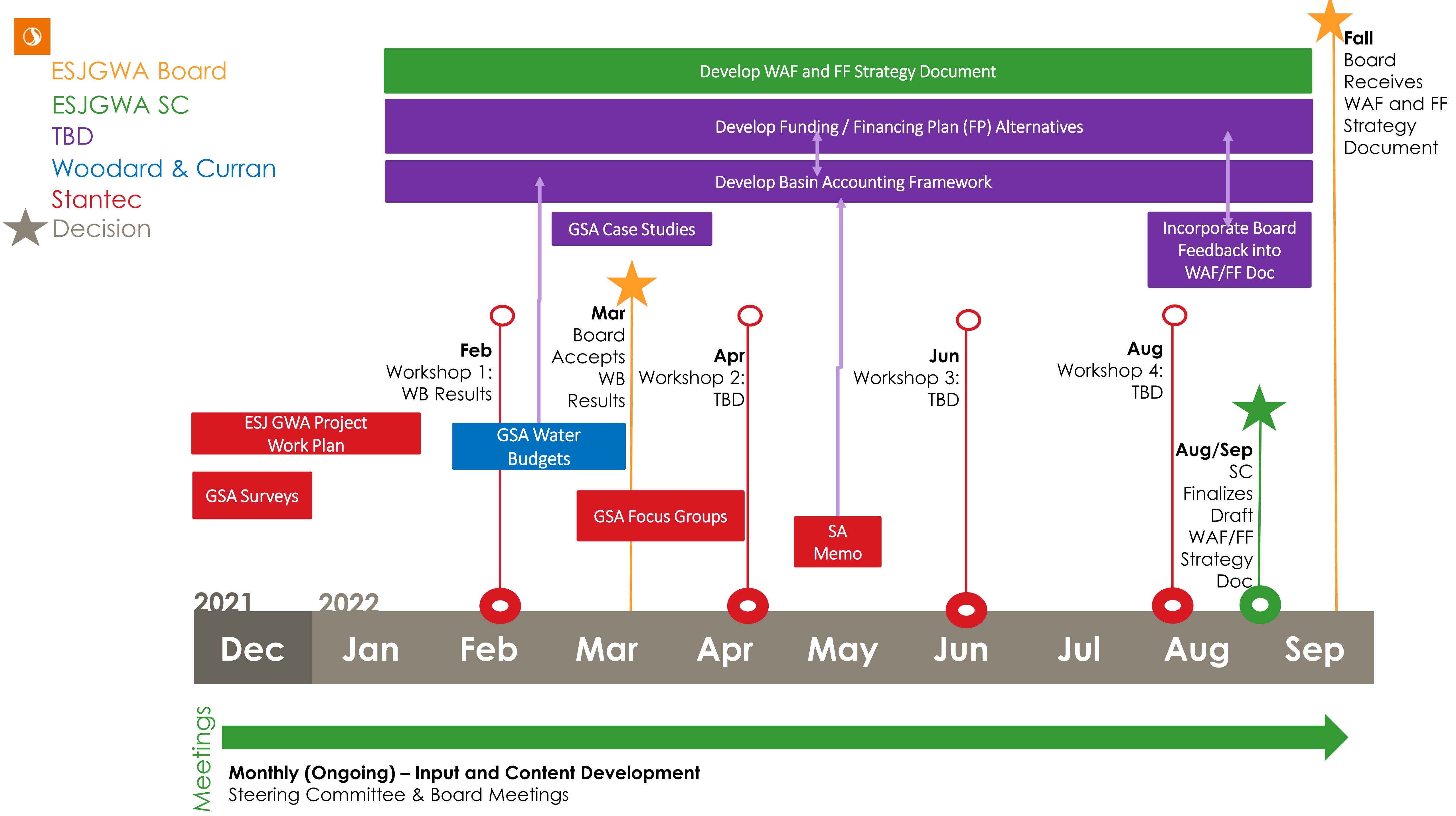
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

Water Accounting Framework Strategy Document Update & Next Steps

WAF Roles, Process, and Work Plan



ESJGWA Board
ESJGWA SC
TBD
Woodard & Curran
Stantec
Decision
Develop WAF and FF Strategy Document
Develop Funding / Financing Plan (FP) Alternatives
Develop Basin Accounting Framework
GSA Case Studies
Incorporate Board Feedback into WAF/FF Doc
Fall Board Receives WAF and FF Strategy Document
Feb Workshop 1: WB Results
Mar Board Accepts WB Results
Apr Workshop 2: TBD
Jun Workshop 3: TBD
Aug Workshop 4: TBD
Aug/Sep SC Finalizes Draft WAF/FF Strategy Doc
ESJ GWA Project Work Plan
GSA Surveys
GSA Water Budgets
GSA Focus Groups
SA Memo
2021
2022
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Meetings
Monthly (Ongoing) – Input and Content Development
Steering Committee & Board Meetings

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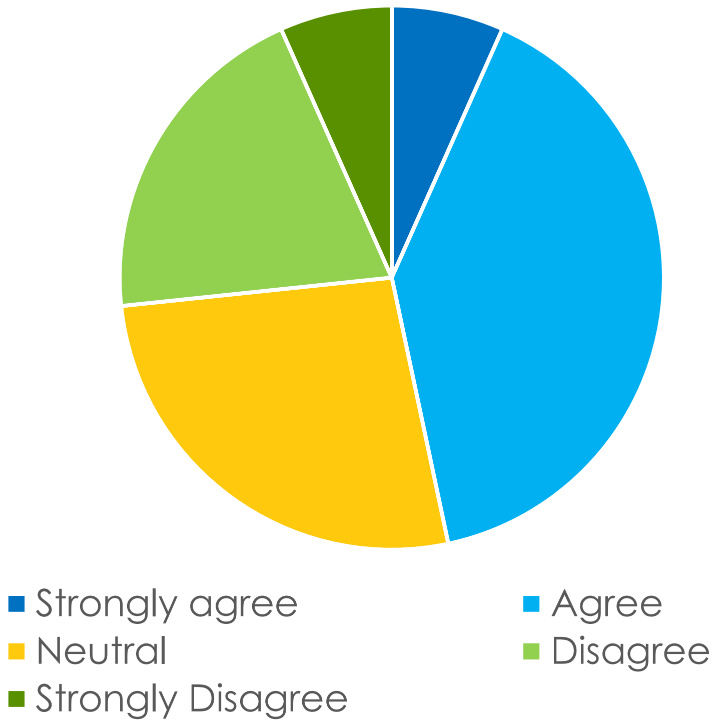
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

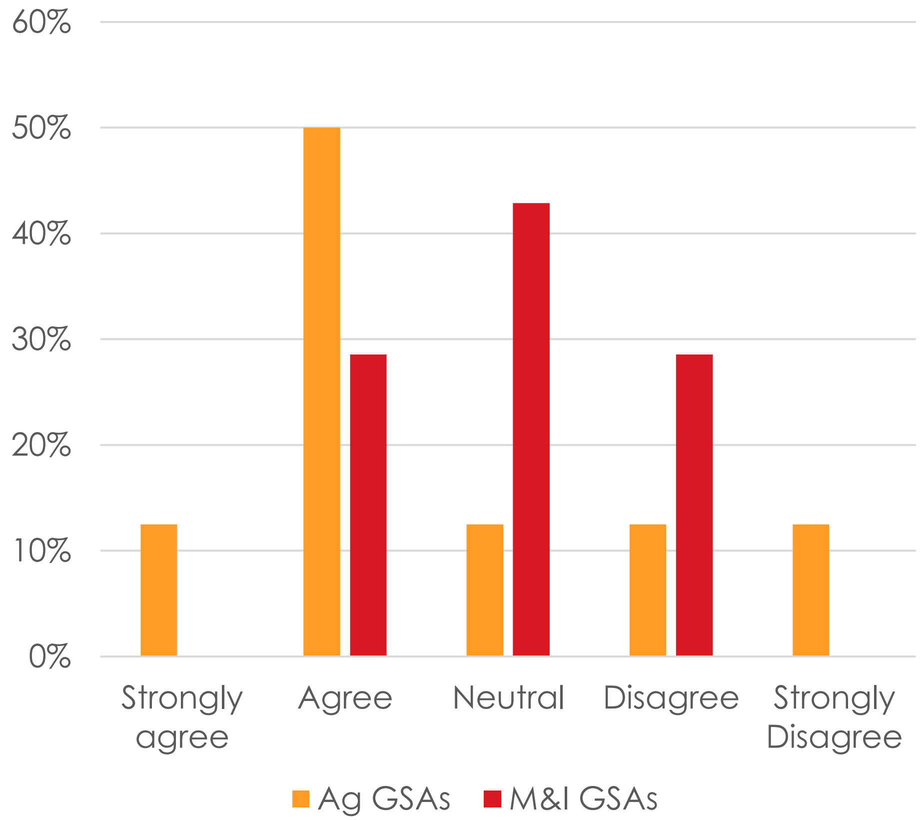
Basin Accounting Framework Survey Results

Survey Overview

- 12 Questions
- Completed by 17 GSA reps in Nov/Dec 2021
- Normalized the data – 1 response per GSA
- Analyzed summary data and variations between ag and M&I water providers

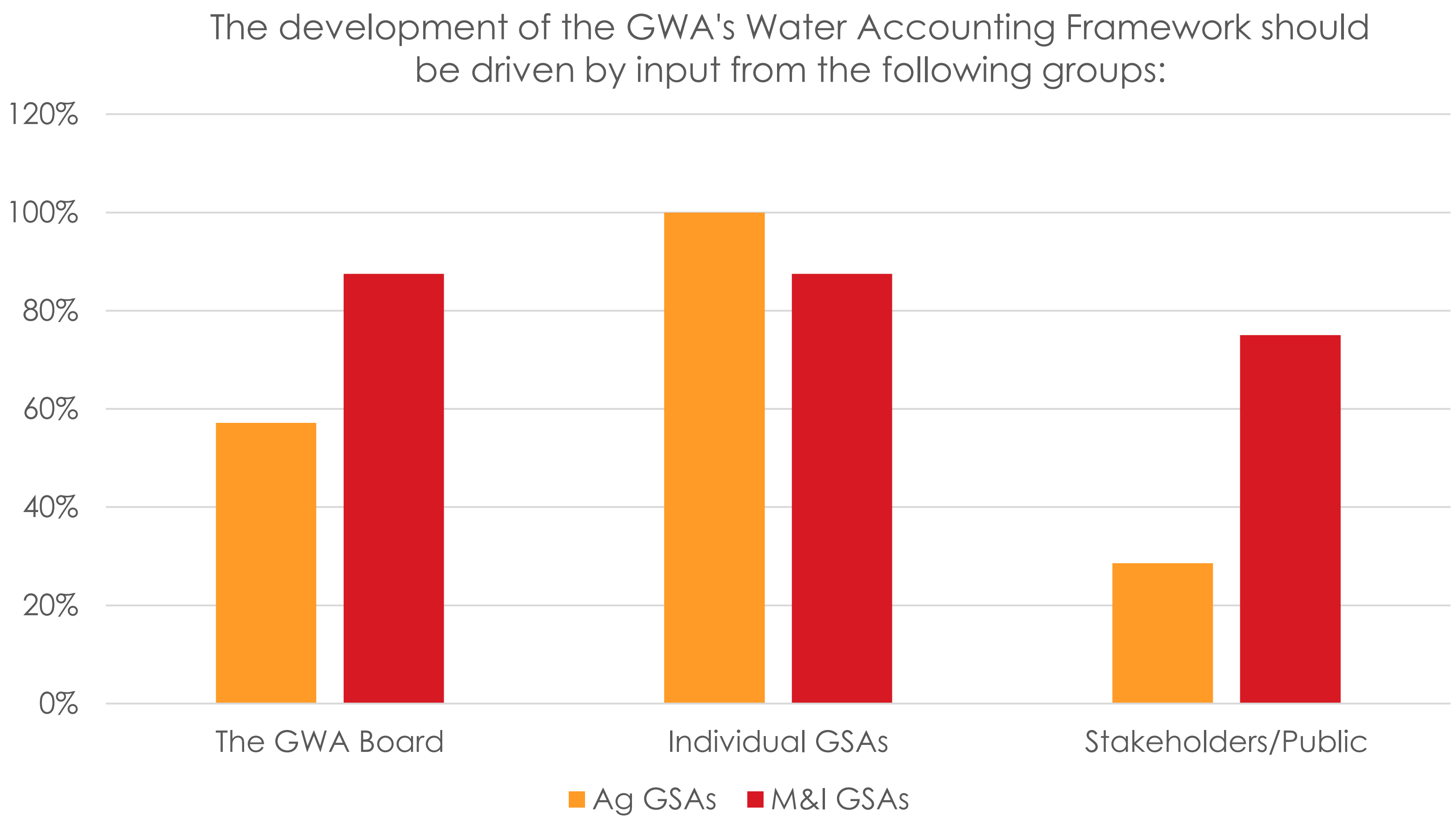
Beneficial users in my jurisdiction have a full understanding of my GSA's water supply portfolio.





Item 2.B.

Who should drive development of the WAF?



WAF Purpose – A WAF is needed to…

	Ag GSAs (8):			M&I GSAs (7):			Total (15):		
	Agree	Neutral	Disagree	Agree	Neutral	Disagree	Agree	Neutral	Disagree
Fully comply with the Sustainable Groundwater Management Act (SGMA)	6	1	1	7	0	0	13	1	1
Give credit for those investing in projects to reduce groundwater pumping or to expand water supplies	7	1	0	6	1	0	13	2	0
Retain local control and provide for local management of groundwater resources	8	0	0	7	0	0	15	0	0
Recognize hydrologic variability and differences in the basin	8	0	0	7	0	0	15	0	0
Recognize supply and demand imbalance	8	0	0	7	0	0	15	0	0
Respond to drought	4	3	1	5	1	1	9	4	2
Reflect water rights and entitlements	8	0	0	5	1	1	13	1	1

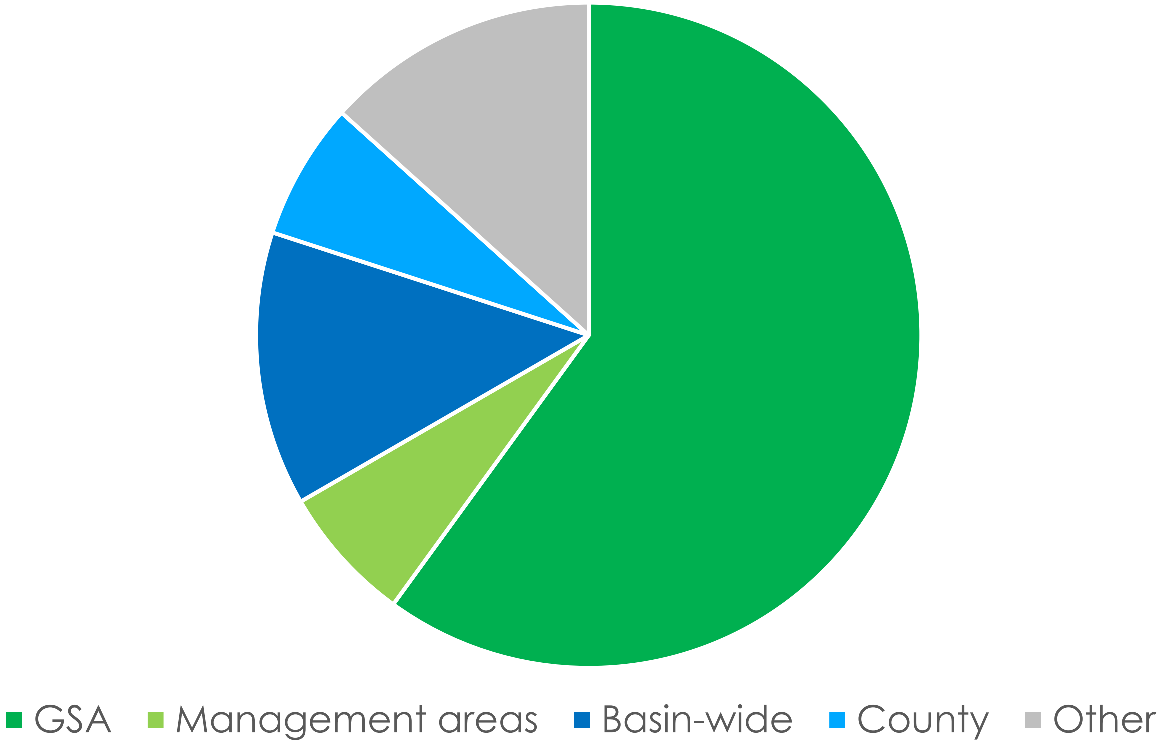
WAF Purpose – A WAF is needed to…

	Ag GSAs (8):			M&I GSAs (7):			Total (15):		
	Agree	Neutral	Disagree	Agree	Neutral	Disagree	Agree	Neutral	Disagree
Make groundwater users aware of their contribution to the overdraft problem	8	0	0	6	1	0	14	1	0
Hold groundwater users accountable for their pumping and contribution to overdraft	3	3	2	6	0	1	9	3	3
Make groundwater users aware of the need to invest in solutions	7	1	0	6	1	0	13	2	0
Create incentives to use available surface water supplies in-lieu of using groundwater	6	2	0	6	1	0	12	3	0
Ensure equity in distributing costs for development of new supplies and projects	4	2	2	6	1	0	10	3	2
Distribute costs equitably for projects and program management actions	5	1	2	7	0	0	12	1	2

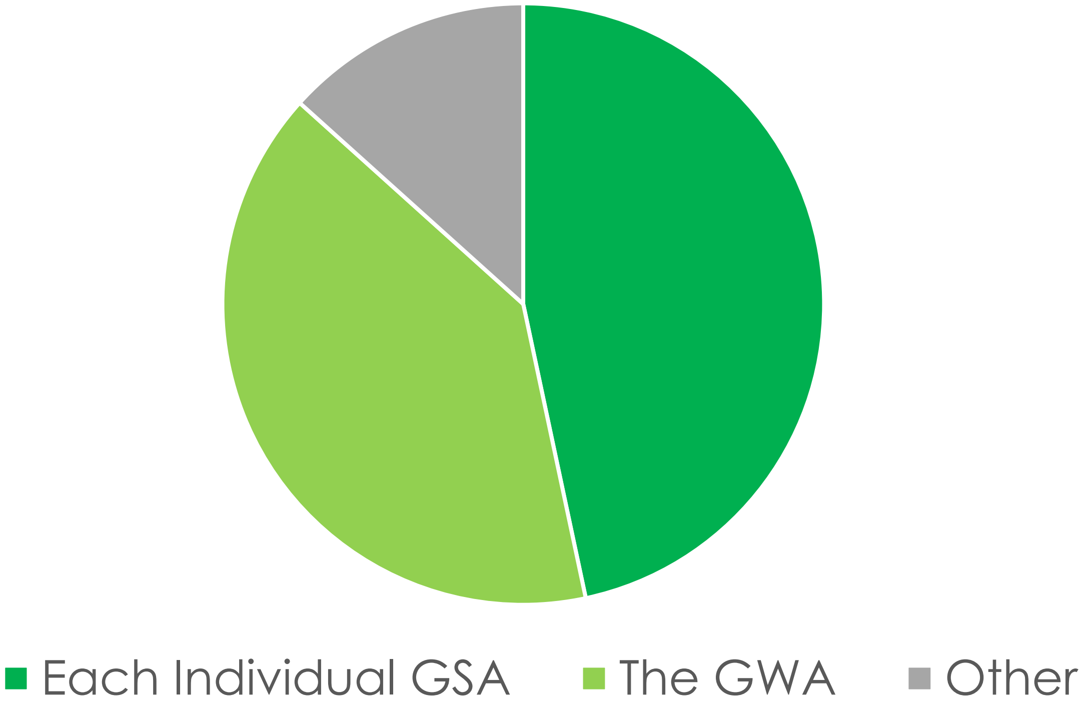
Which of the following elements should be included in the development of a WAF?

	Ag GSAs (8):			M&I GSAs (7):			Total (15):		
	Agree	Neutral	Disagree	Agree	Neutral	Disagree	Agree	Neutral	Disagree
Current and planned water supplies	8	0	0	7	0	0	15	0	0
Current and projected water demand and types of use	6	1	0	7	0	0	13	1	0
Accounting standards – e.g. size of reporting units, frequency of data collection and reporting, measurement and estimation methods, etc.	7	1	0	7	0	0	14	1	0
Information sharing protocols	5	3	0	6	0	0	11	3	0
Policies for determining allocations and settling disputes	4	3	1	7	0	0	11	3	1
Modeling scenarios to understand the potential benefits and impacts of management strategies	6	0	2	7	0	0	13	0	2
Inter-basin coordination protocols	5	3	0	6	1	0	11	4	0
Recommendations for a basin-scale water trading program	3	4	1	6	1	0	9	5	1
Known data gaps	6	2	0	6	1	0	12	3	0

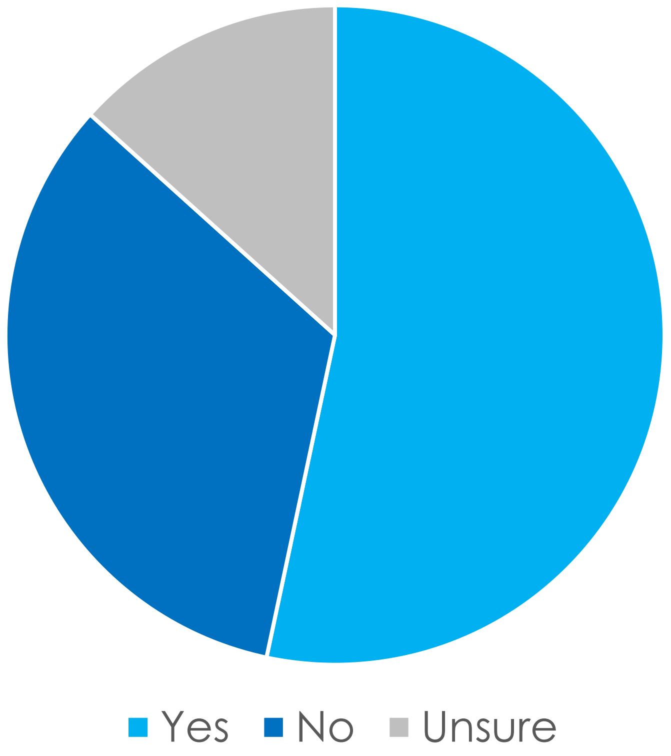
On what level should groundwater use be quantified?



Who should be responsible for oversight and management of the WAF?



Should the annual report also include a summary of groundwater conditions and consumptive use data on the GSA-scale?



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Next Steps: Focus Groups

Focus Group Objectives

- Outcome: Focus groups and surveys will form the basis for the Stakeholder Assessment Memo
  - SA Memo will inform the WAF Strategy Document
- Focus group sessions will explore shared concepts and WAF guiding principles

Focus Group Approach

- Building upon survey results
  - Results indicate that it would be beneficial to conduct data collection in larger groups
  - 5-7 focus groups
- Standardized set of questions
- Virtual whiteboard exercise that will allow anonymous input

Next Steps – GSA Focus Groups

- Focus Groups anticipated to place end of February / March

Funding and Financing Considerations

- Authorities
  - ✓JPA and GSA powers and authorities
  - ✓Original authorities for Districts, Cities, County
- What is being funded
- Proportionality and costs splits
- Equity
- Benefits to be realized

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What is Being Funded

- Regulatory requirements
- Monitoring
- Annual reporting
- GSP updates
- Data Management System
- Program management and administration
- Professional services
- Outreach
- Projects

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Funding Mechanisms

- Grants
- Other assistance programs (e.g.; TSS, FSS)
- Fees
- Assessments
- General funds
- Taxes

Business Agenda

1. Approval of the December 8, 2021, Meeting Minutes
2. AB 361 Reso
3. Resolution Approving Submittal of a Grant Application and Spending Plan
4. DWR GSP Comments and Response Plan

Break before business meeting