

Colusa Subbasin Groundwater Sustainability Plan

***Update on Hydrogeologic Conceptual Model and
Water Budget Development***

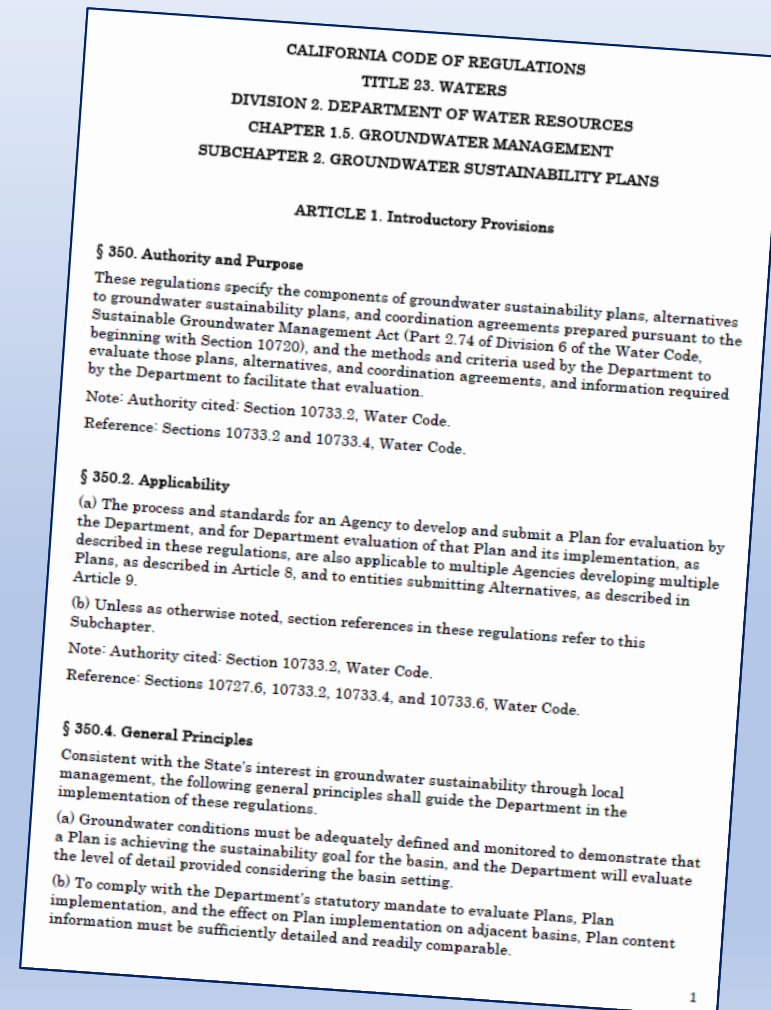
Dauids Engineering

April 12, 2019

GSP Basin Setting Components

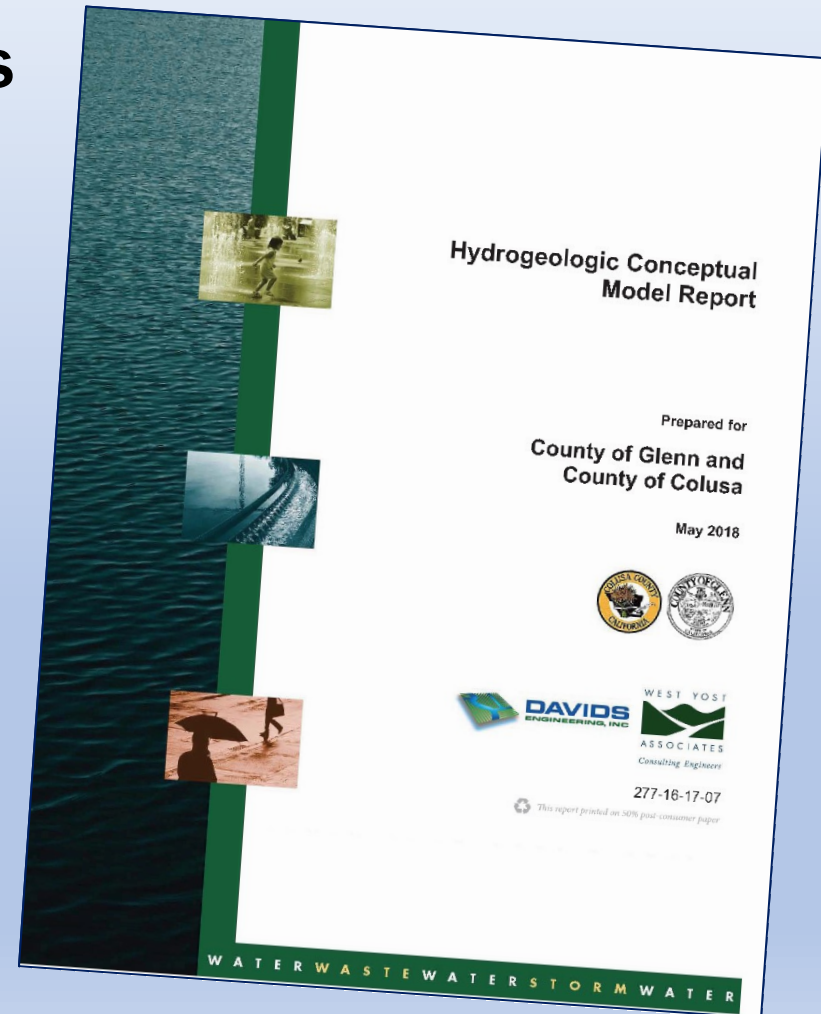
(Regulations Subarticle 2)

- Introduction to Basin Setting (§354.12)
- Hydrogeological Conceptual Model (§354.14)
- Groundwater Conditions (§354.16)
- Water Budget (§354.18)
- Management Areas (§354.20)



Hydrogeologic Conceptual Model (HCM)

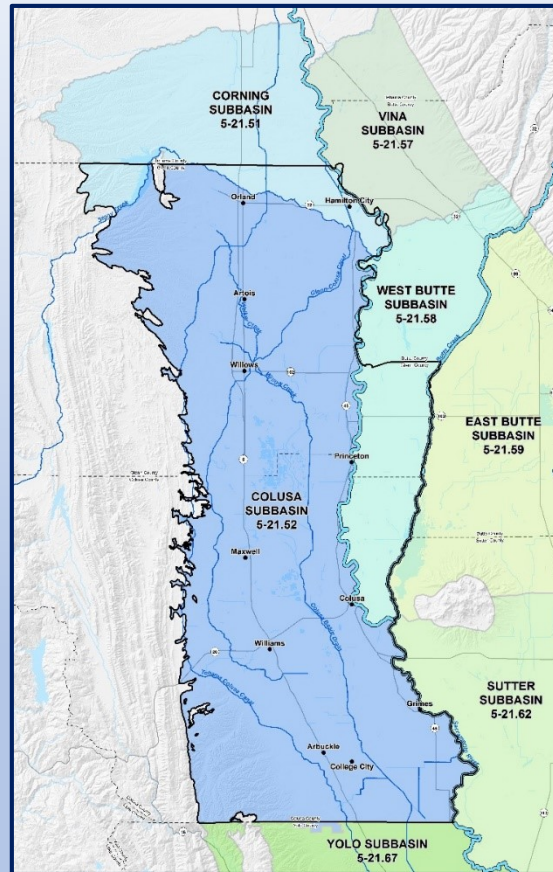
- Drafted under Prop 1 Counties with Stressed Basins Grants (completed in 2018)
- Next Steps
 - Evaluate and refine HCM based on comparison to selected Integrated Hydrologic Model (IHM)
 - Identify uncertainties and potential refinements
 - Prepare updated HCM section for GSP



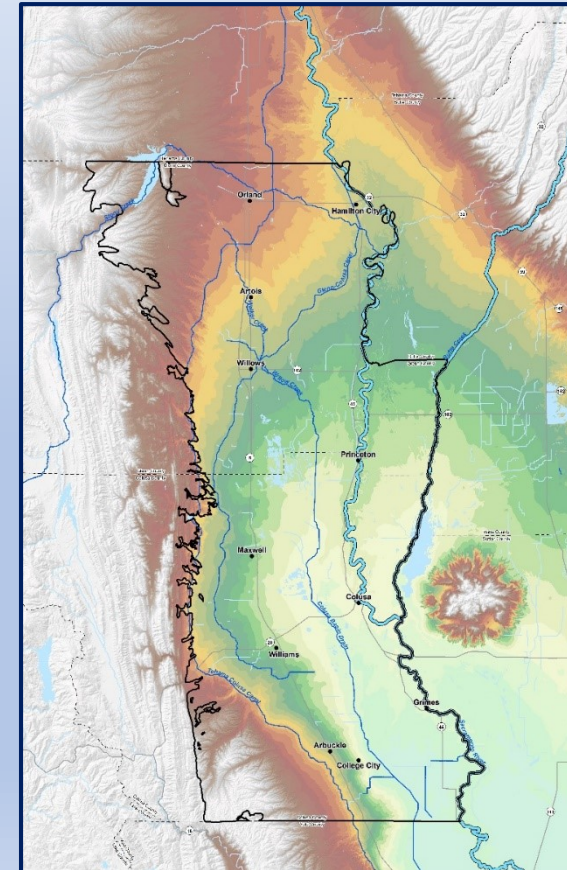
Hydrogeologic Conceptual Model

Groundwater Subbasins

- Basin Boundary
- Topography
- Geology
- Principal Aquifers
- Soil Characteristics
- Recharge Areas
- Water Sources
- ...

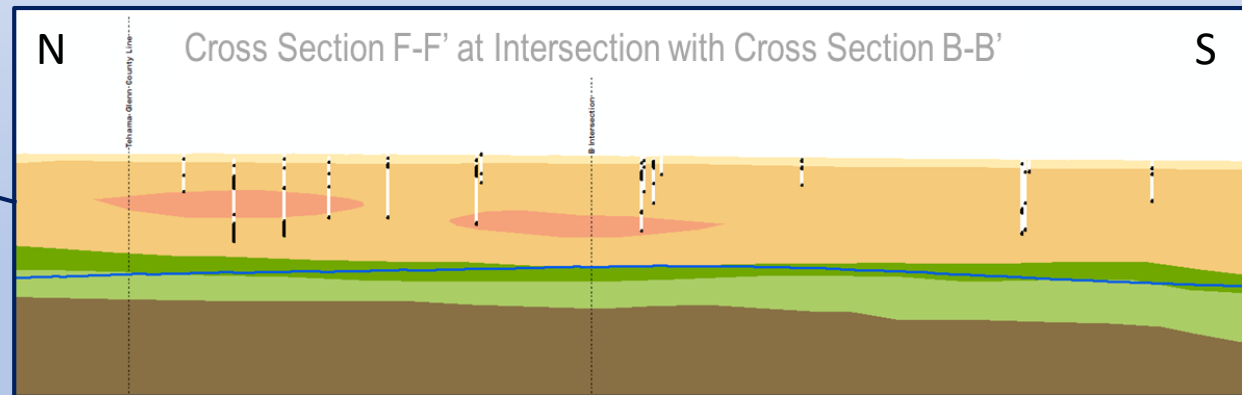
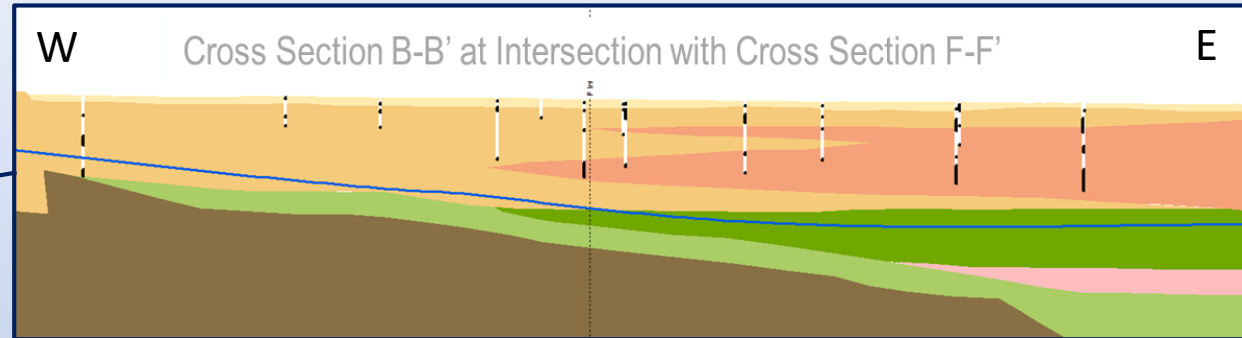
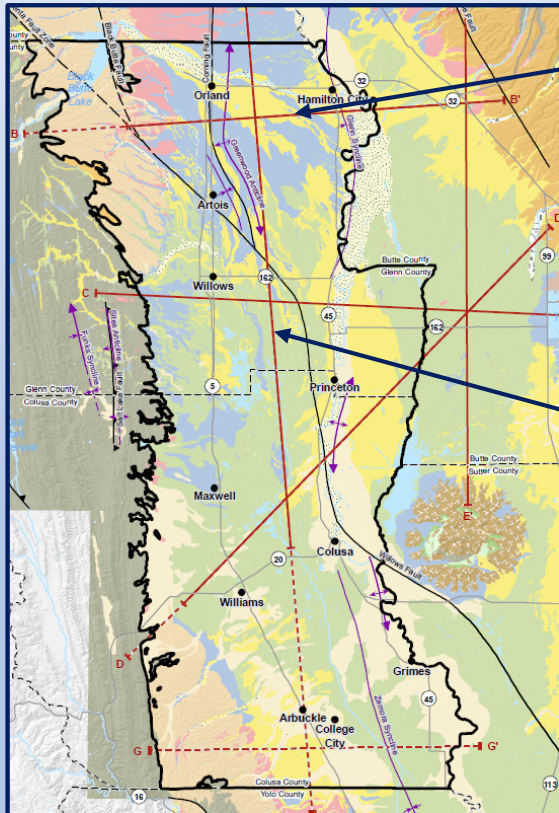


Topography



Hydrogeologic Conceptual Model

Geologic Cross Sections



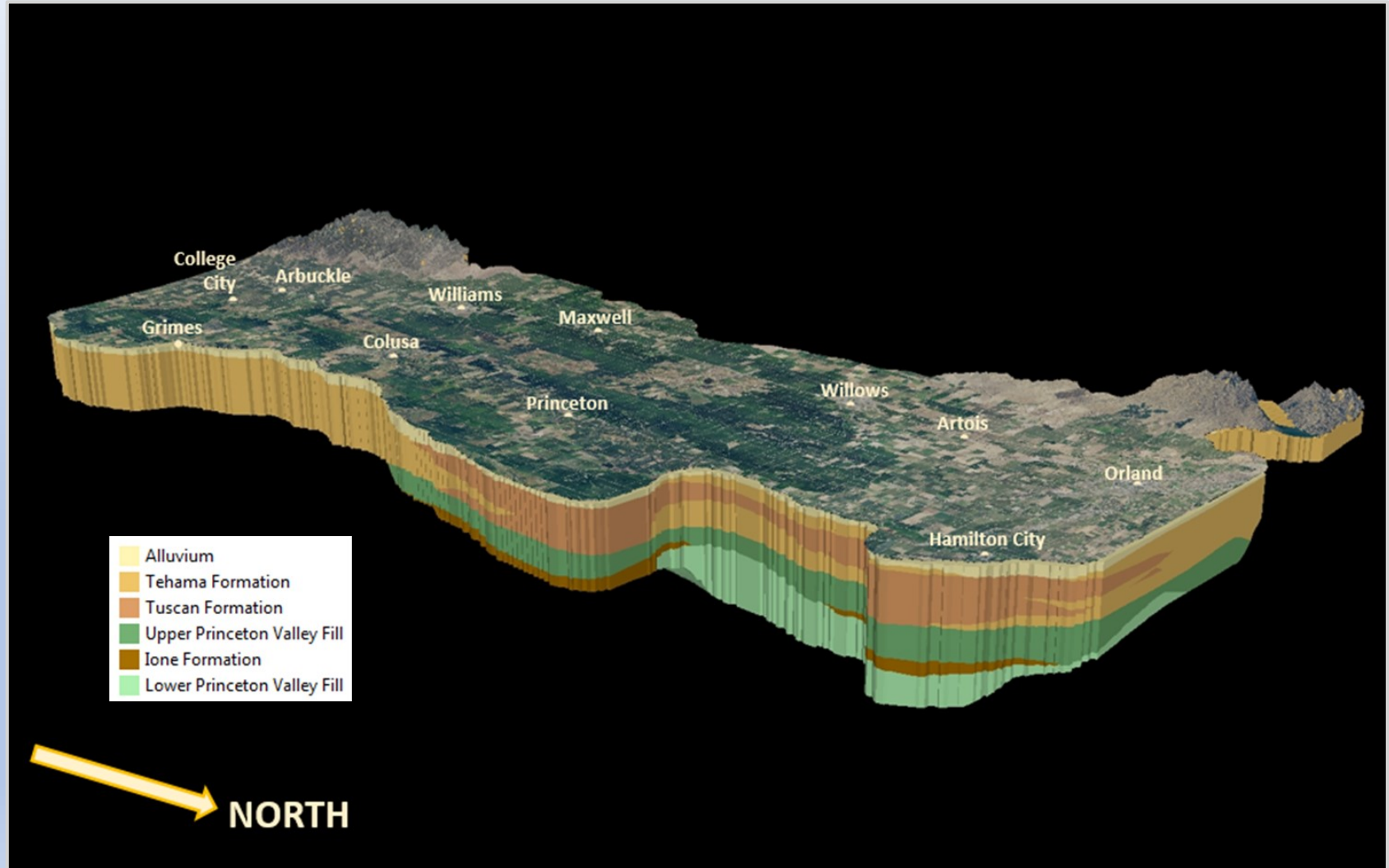
Geologic Units

Alluvium	Lovejoy Basalt
Tehama Formation	Ione Formation
Tuscan Formation	Lower Princeton Valley Fill
Upper Princeton Valley Fill	pre-Tertiary Rocks and Deposits

Base of Fresh Water
(~2,000mg/L TDS)

Hydrogeologic Conceptual Model

3D Geologic Model



Groundwater Conditions

- **Substantial Information Gathered through Stressed Basins Grant**
 - Groundwater elevation maps
 - Hydrographs
 - Land subsidence
 - Interconnected surface waters and depletions
 - Groundwater dependent ecosystems
- **Additional Information**
 - Annual and cumulative change in groundwater storage

Groundwater Conditions

- **Next Steps**
 - **Update based on most recent information**
 - Updated groundwater levels
 - Updated subsidence survey
 - **Incorporate changes in groundwater storage**
 - Requires updated groundwater levels and/or IHM results

Water Budget

- **Prior Efforts**

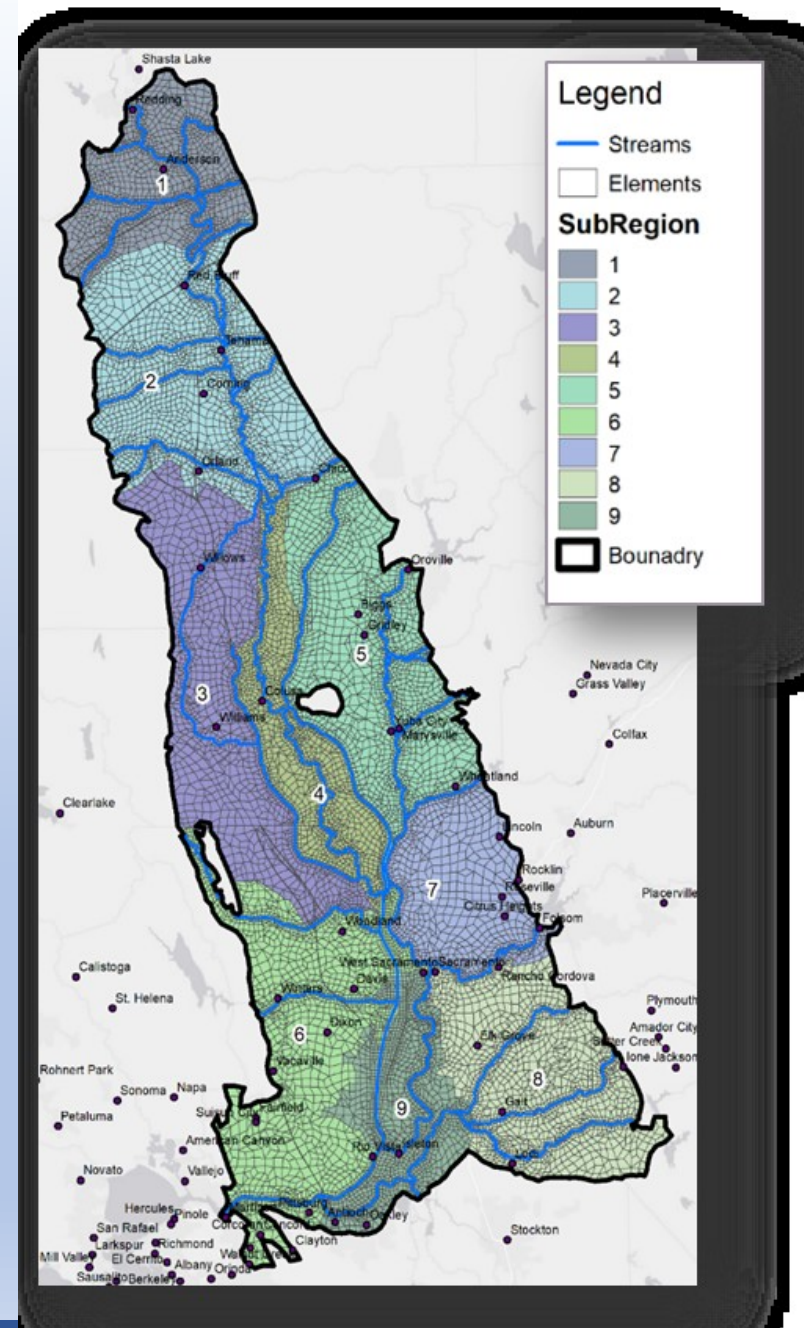
- Agricultural Water Management Plans and special studies
- Pre-GSP SGMA efforts
- Review of existing models (C2VSimFG) and comparison to local data
- Coordination with DWR to incorporate local data

- **Next Steps**

- Select IHM for local refinement
- Identify and prioritize refinements
- Implement refinements
- Develop historical, current, and future water budgets

Model Evaluation

- **Evaluate existing/forthcoming Integrated Hydrologic Models (IHM)**
- **Objective of leveraging existing information**
- **Develop and apply evaluation criteria**
- **Recommend IHM for local refinement**



Model Component	SVSim	C2VSimFG	CVHM
Availability	December 2019???	May 2018 (Beta), April 2019 (Beta v. 2)	December 2019???
Simulation Period	1922-2015	1922-2015	1962-2003 → 1962-2013 (forward run 1921-2013)
Land Use Refinement	<ul style="list-style-type: none"> DWR Land Use Survey Cropland Data/Cropscape (Satellite Data) 2014 Statewide Land Use Data Ag Commissioner Reports 	<ul style="list-style-type: none"> DWR Land Use Survey Cropland Data/Cropscape (Satellite Data) 2014 Statewide Land Use Data Ag Commissioner Reports 	<ul style="list-style-type: none"> DWR Land Use Survey Other Historical Land Use Maps Ag Commissioner Reports
Managed Wetlands	✓	✓	✓
Surface Water Diversions at Water District Level	✓	✓	✓
Model Code	IWFM	IWFM	MODFLOW-OWHM
Aquifer Parameters Basis	DWR's Texture Model	DWR's Texture Model	USGS's Texture Model
Other Improvements	9 layers, Model Refinement along Streams	4 Layers, Stream Data from Flood Studies	15 Layers, Stream Data based on C2VSim Data, Well Locations

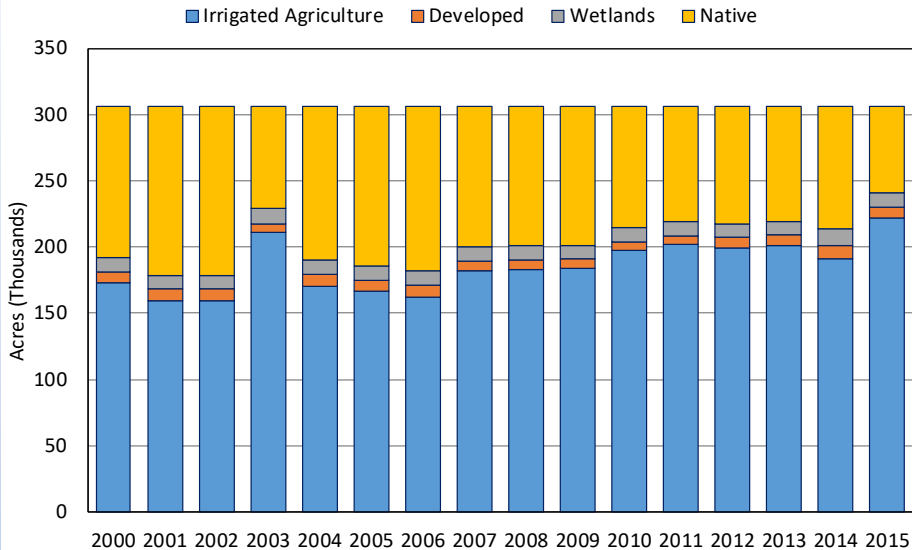
Initial Evaluation of C2VSimFG

- Meeting with DWR C2VSimFG developers at GCID
- Invited to provide local information (e.g. land use, diversions, etc.) for incorporation into next model release by DWR
- Provided updated land use and diversion information

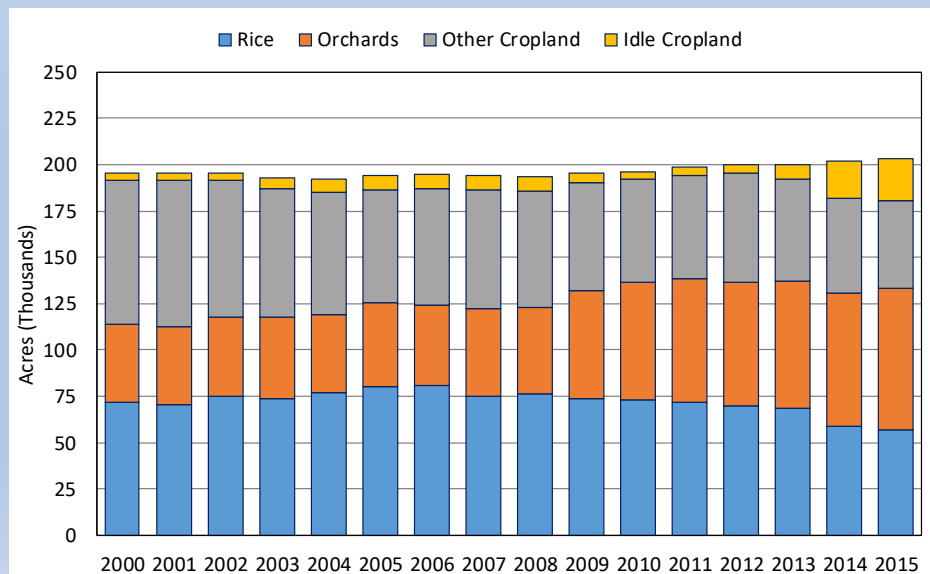
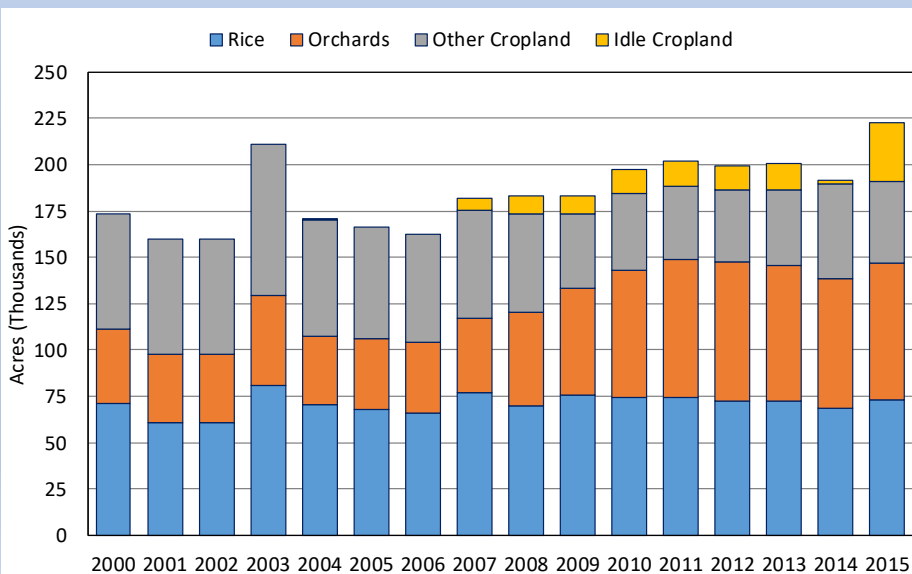
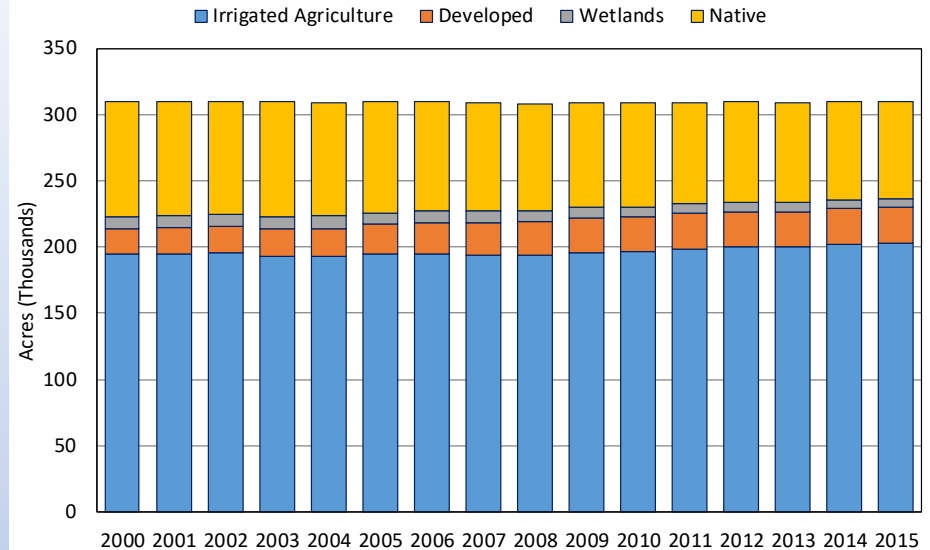
Glenn County – Colusa Subbasin Land Use Comparison

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C2VSim

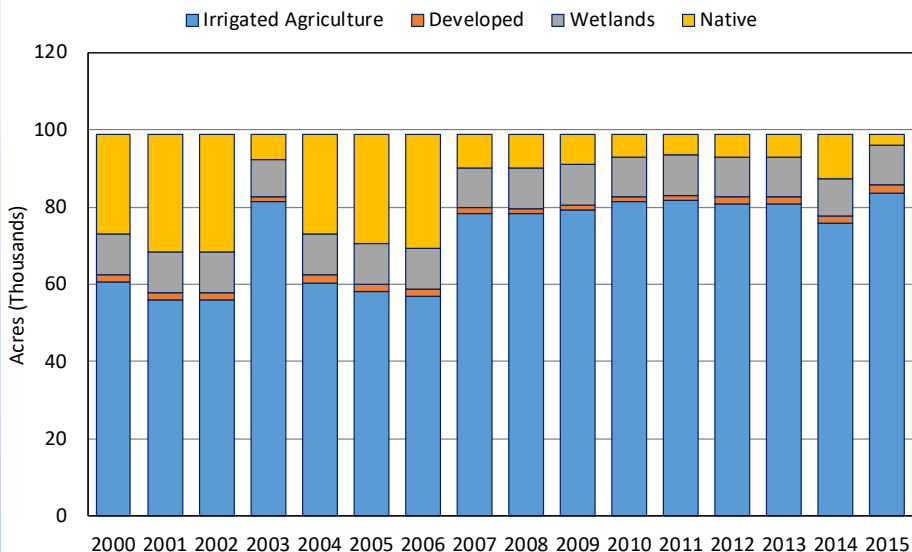


Stressed Basins



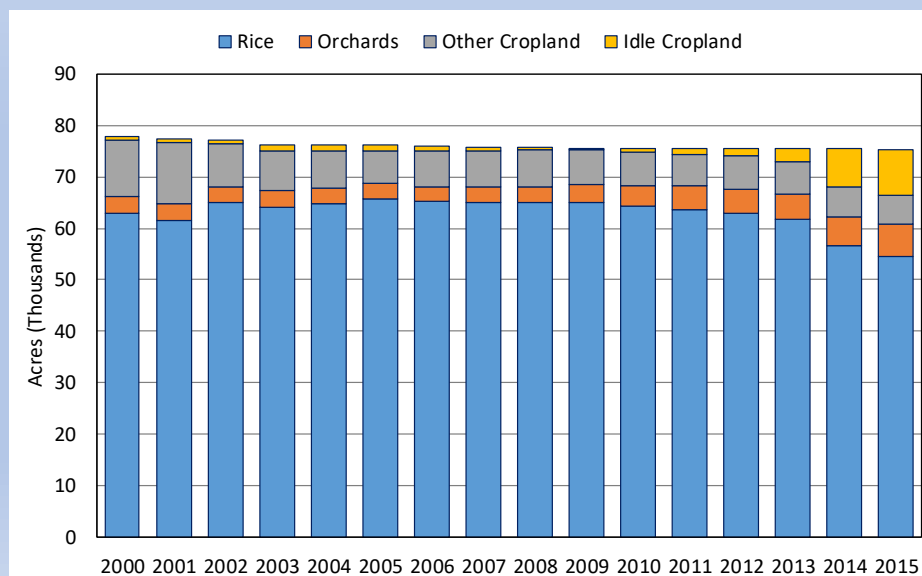
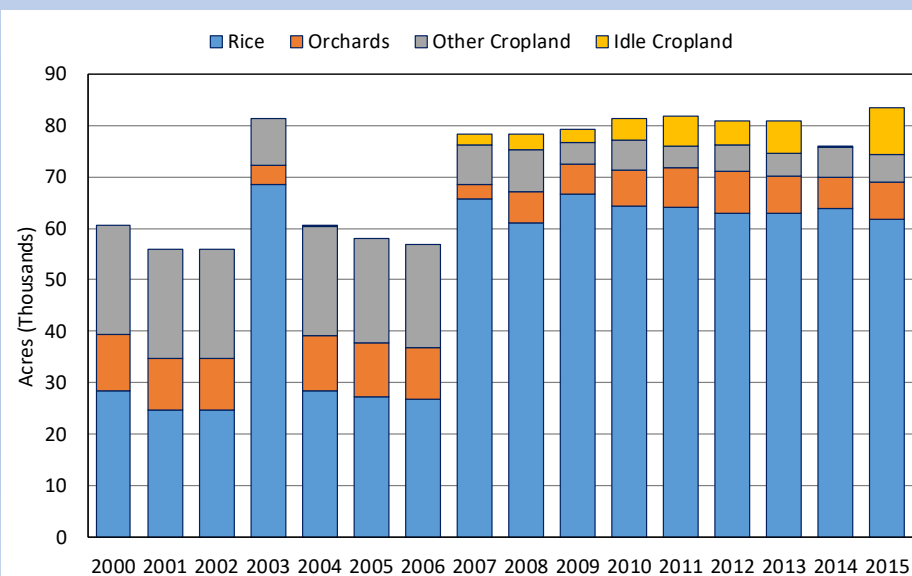
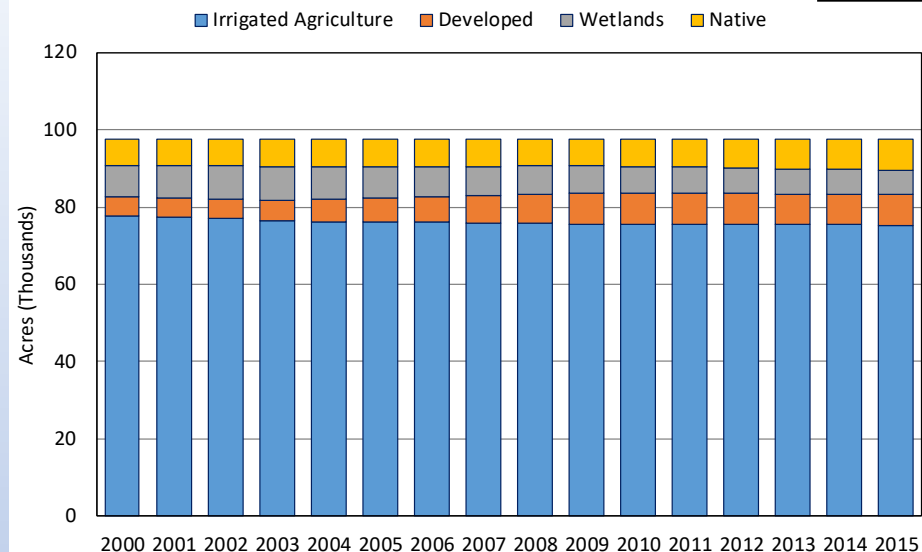
Glenn County – Colusa Subbasin SRSC Land Use Comparison

C2VSim



Stressed Basins

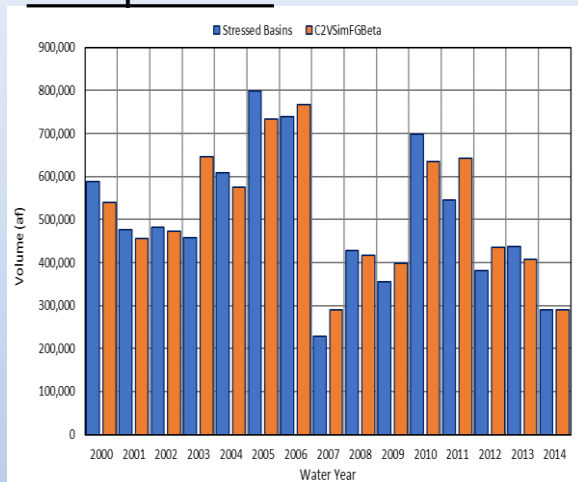
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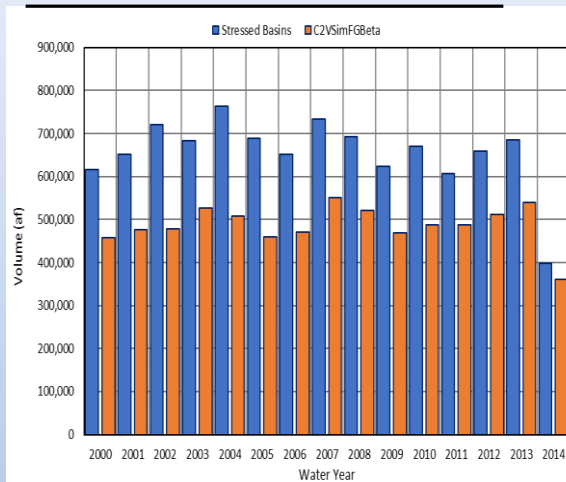
Glenn County – Colusa Subbasin Water Budget Comparisons

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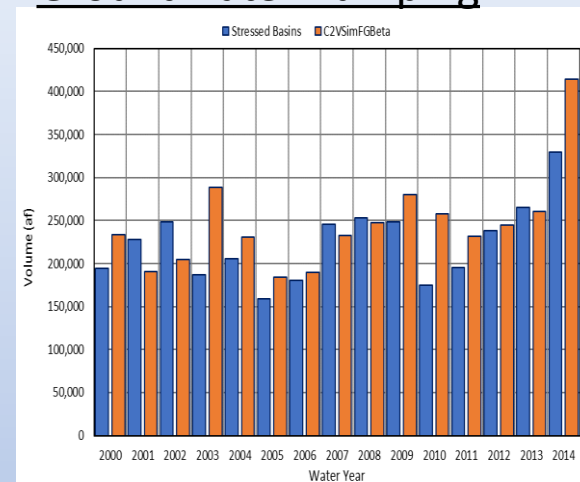
Precipitation



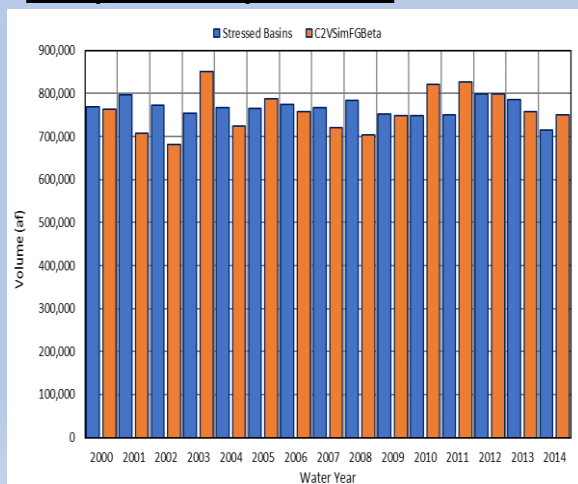
Surface Water Deliveries



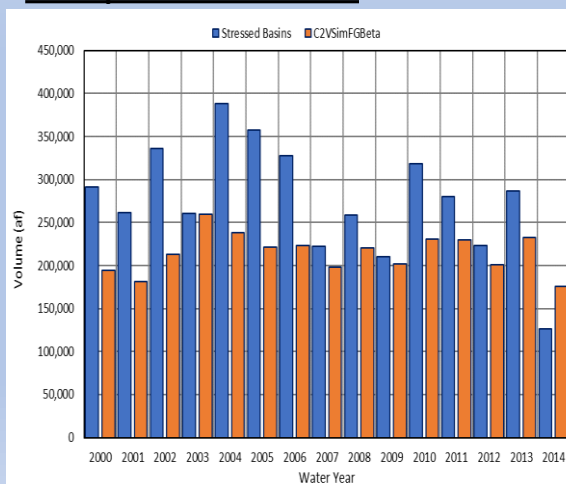
Groundwater Pumping



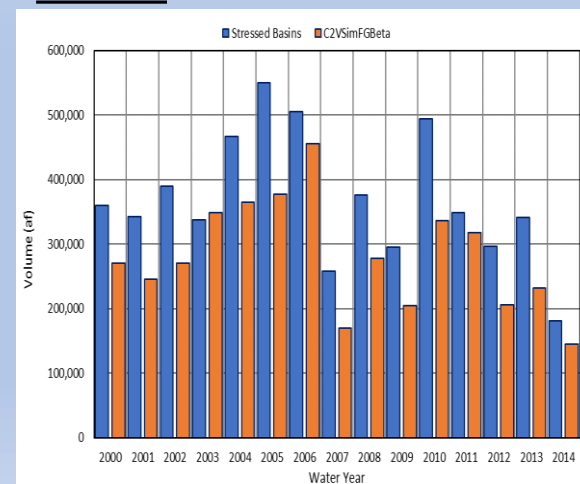
Evapotranspiration



Deep Percolation

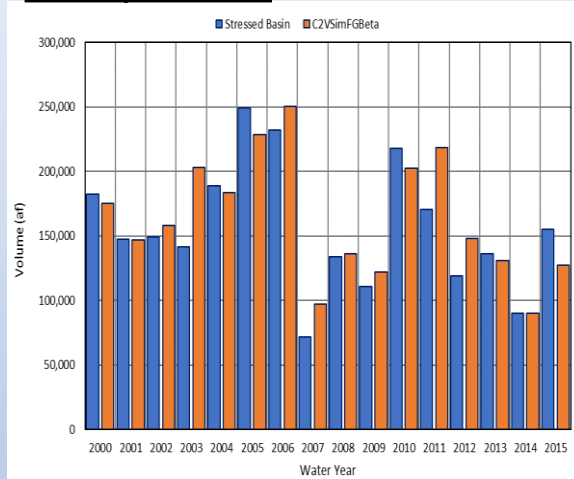


Runoff

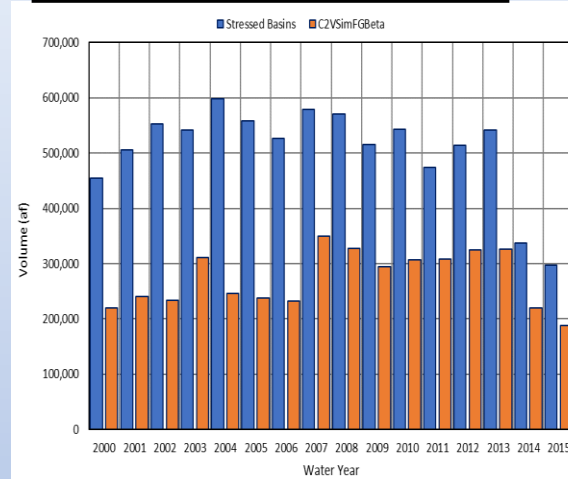


Glenn County – Colusa Subbasin SRSC Water Budget Comparisons

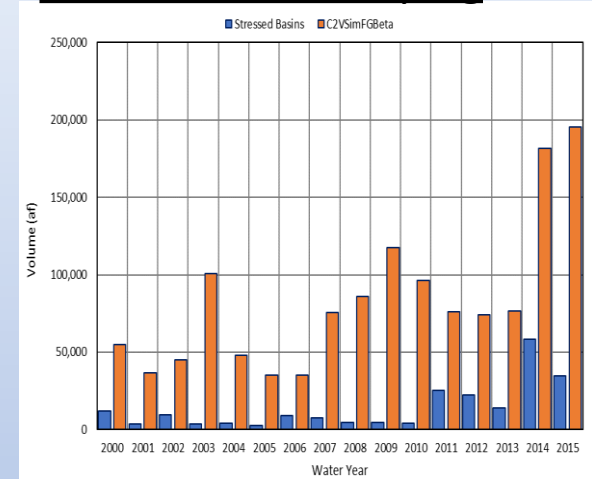
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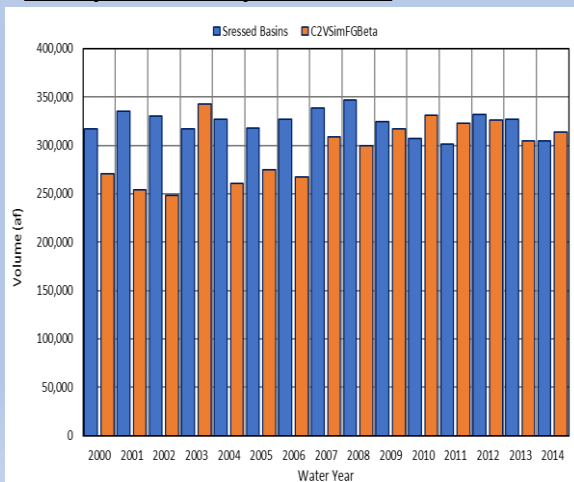
Surface Water Deliveries



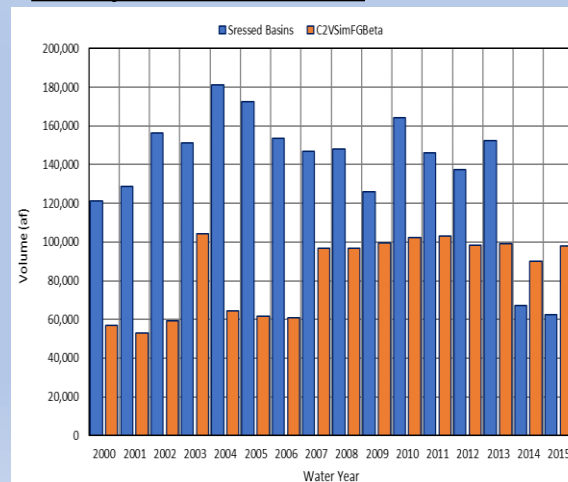
Groundwater Pumping



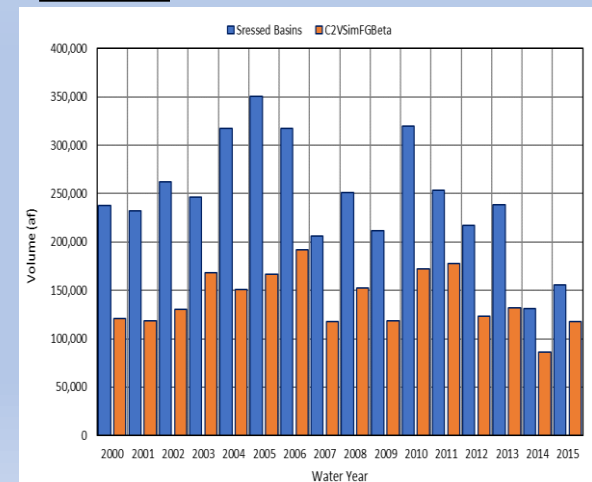
Evapotranspiration



Deep Percolation

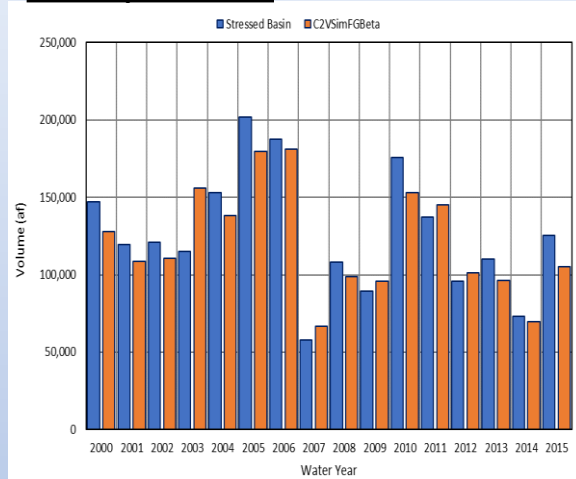


Runoff

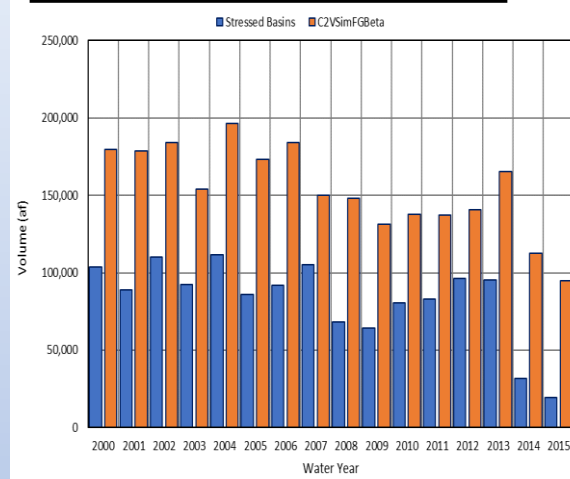


Glenn County – Colusa Subbasin TCCA Water Budget Comparisons

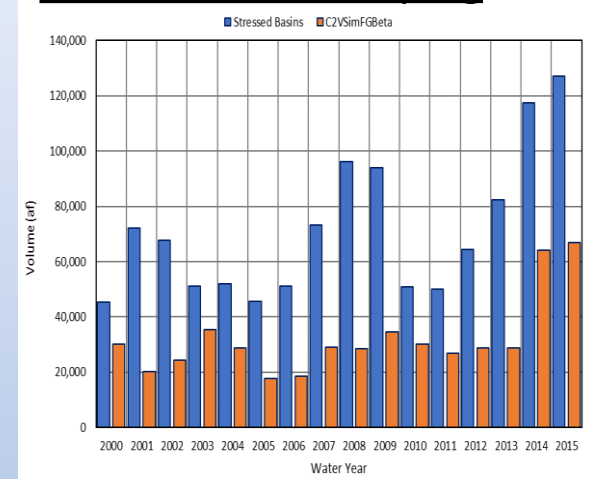
Precipitation



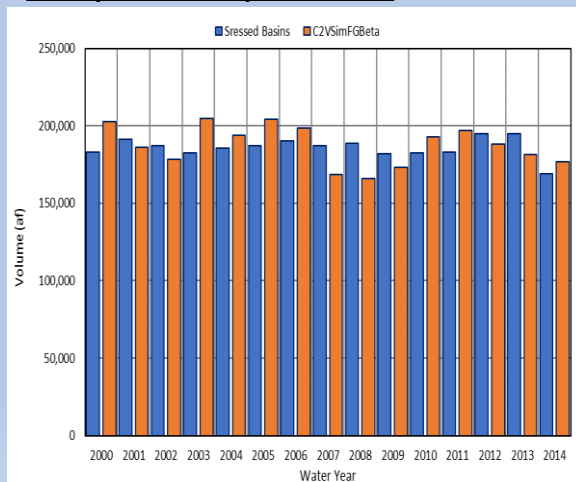
Surface Water Deliveries



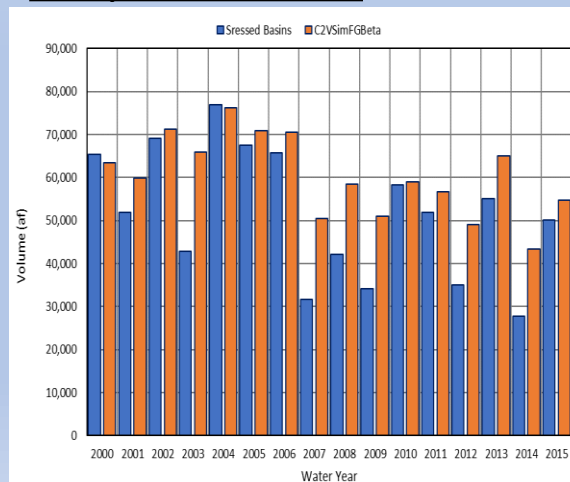
Groundwater Pumping



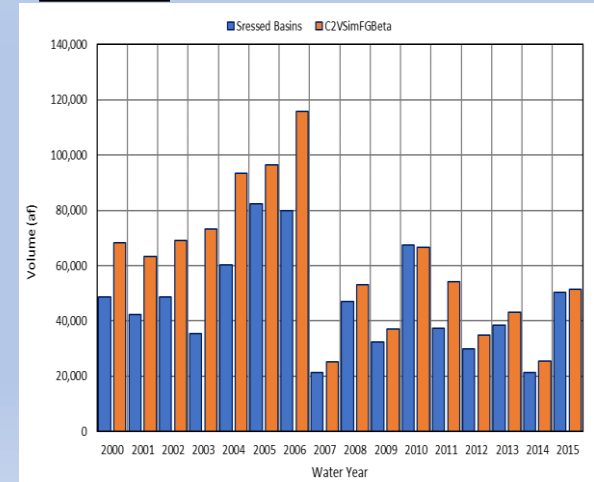
Evapotranspiration



Deep Percolation



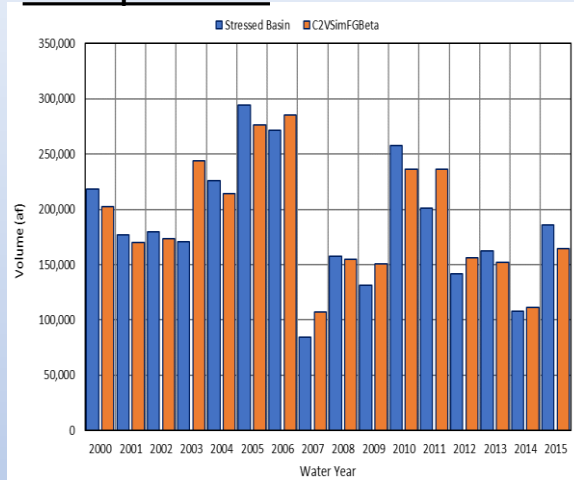
Runoff



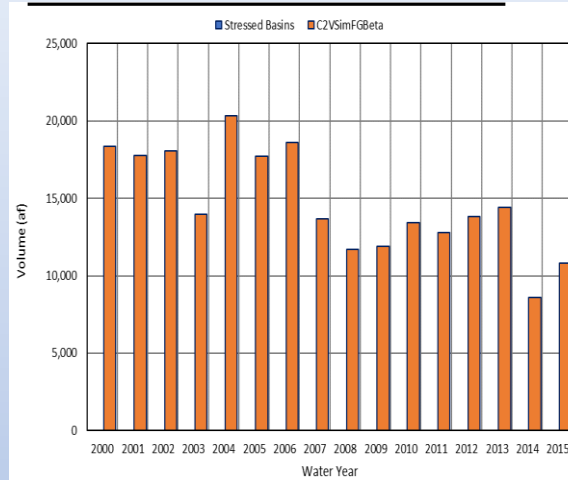
Glenn County – Colusa Subbasin GW Only Water Budget Comparisons

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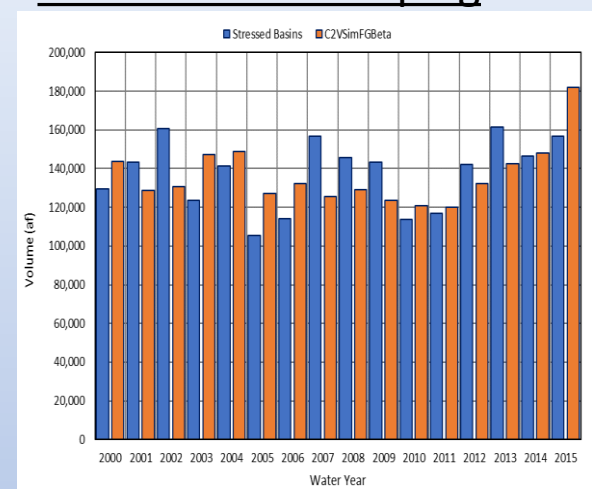
Precipitation



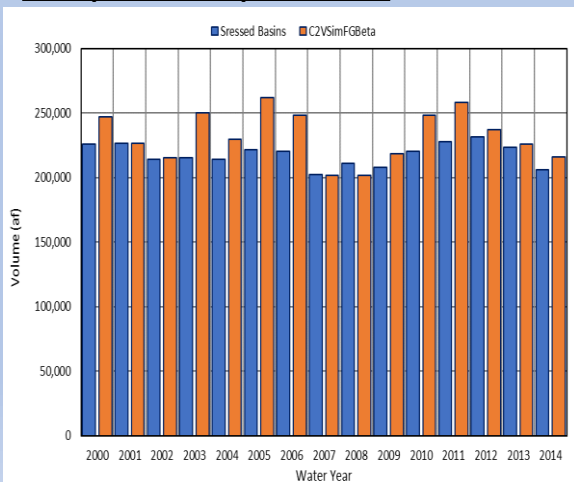
Surface Water Deliveries



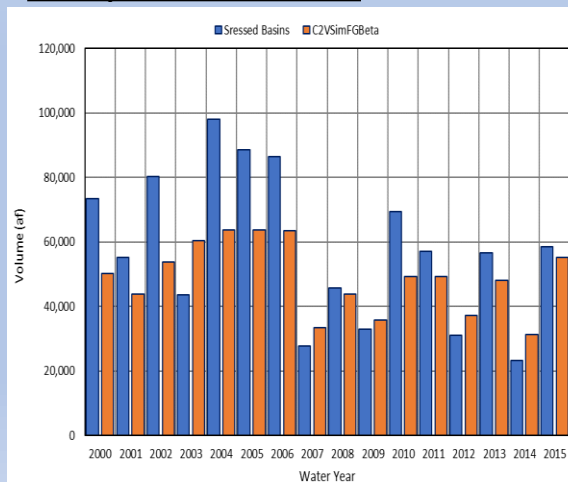
Groundwater Pumping



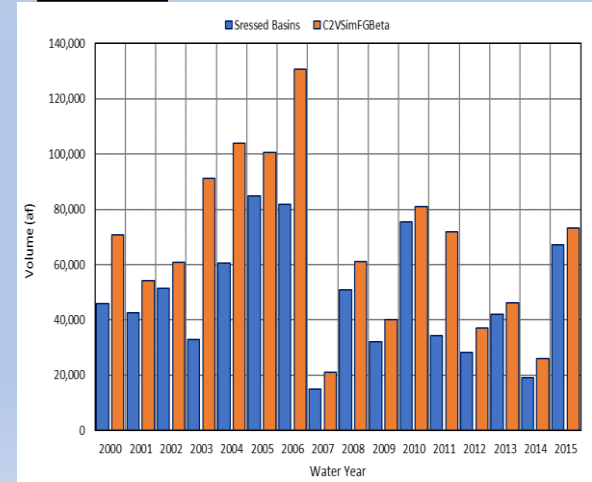
Evapotranspiration



Deep Percolation



Runoff



Other Water Budget Activities

- **Coordination with Yolo County FCWCD regarding RD108 water budget**
 - Provided prior water budget estimates and discussed data/assumptions
 - Follow up once draft water budgets developed for Colusa Subbasin to develop consistency along basin boundary
- **Coordination with EDF OpenET Project**
 - Participating in ongoing discussion of use of satellite ET data for water budget development
 - Requested sample data for 2014 for comparison to existing estimates

Water Budget Next Steps

- Compare local data to next release of C2VSimFG
- Identify and prioritize refinements
- Implement refinements and calibrate model
- Develop historical water budget
- Develop current conditions and future conditions baseline scenarios
 - Land use
 - Population change
 - Climate change
 - Other factors
- Develop current conditions and future conditions water budgets

Schedule Overview

Task	2018				2019												2020					
	A	S	O	N	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
Hydrogeologic Conceptual Model																						
Groundwater Conditions																						
Water Budgets																						
Integrated Hydrologic Model																						

- IHM development delayed in anticipation of next release of C2VSimFG; water budgets to follow
- HCM updates can be initiated in concert with IHM refinements

Discussion

Model Evaluation

DRAFT Ranking Results

	Model/Application			
	C2VSim-FG	SVSim	CVHM	SacFEM2013
Criteria Based on BMP Guiding Principles and General Modeling Requirements^(a)				
Model code is publicly available at no cost and complete modeling platform (input and output files and executables) can be provided to DWR at no cost	10	10	10	0
Model code has been peer reviewed for the intended use	10	10	10	0
Model has publicly available supporting documentation, including explanation of the model code (physical processes simulated, mathematical equations, and assumptions) and model application (conceptual model, application development, assumptions, inputs, etc.)	10	10	10	0
Models developed after effective date of GSP regulations (August 15, 2016) must use public domain open-source software	10	10	10	0
Spatial extent of the model application covers entire subbasin at a minimum ^(b)	10	10	10	10
Score Based on Binary Criteria	50	50	50	10
Criteria Based on BMP Modeling Considerations^(c)				
Application capable of evaluating each sustainability indicator and the potential presence of and magnitude of undesirable results in the basin, including:				
Lowering of Groundwater Levels	3	3	3	3
Reduction of Groundwater Storage	3	3	3	3
Seawater Intrusion	Not applicable in the Glenn County Subbasins			
Degraded Water Quality	1	1	1	1
Land Subsidence	3	3	3	1
Depletion of Interconnected Surface Water	2	3	1	1
Model application supports development of water budgets	2	3	1	2
Model application capable of forecasting future conditions, such as reduction of surface water supplies, changes in land use and associated water demands, the effects of climate change, and quantifying the uncertainty in these predictions	3	3	3	2
Model application capable of demonstrating how selected projects and management actions will achieve the sustainability goal within 20 years of GSP implementation	3	3	3	2
Model application capable of identifying data gaps and monitoring needs	2	3	1	2
Model application capable of assessing impacts on adjacent basins	2	3	1	2
Model application adaptable to refined hydrogeologic interpretations and incorporation of additional data.	3	3	3	3
Model application capable of simulating forecast changes in agricultural practices, including changes in crop types, irrigation practices, irrigation water source, etc.	3	3	2	3
Model application capable of efficiently and effectively conveying simulation outputs, either directly or with post-processing tools	3	3	3	2
Score Based on Gradational Criteria	33	37	28	27
Total Score	83	87	78	37