GWA Advisory Committee
May 9, 2018

Agenda

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

- Introductions/Overview of Advisory Committee role
- Advisory Committee Charter Review
- Model Update & Historical Water Budget
- Working Exercise – Undesirable Results for Sustainability Indicators
- Approach for Projected Water Budget
- DMS Overview
- DWR Technical Support Services
- Schedule Recap

Overview of Advisory Committee & Charter

Overview of Advisory Committee

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

- Roles: Provide Preliminary input on technical and policy-related elements of GSP
- Includes: Representatives from ESJ Subbasin GSAs

Policy-related input:

- **Management actions and projects – prioritization and implementation**
- **Water accounting framework**
- **Fee / cost structure**
- **Stakeholder and public feedback**

Technical input:

- **Hydrologic Conceptual Model**
- **Model updates**
- **Monitoring locations**
- **Water budget**
- **Project development**
- **Stakeholder and public feedback**

GWA Advisory Committee Charter

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

- Focus Area
- Organizational Structure
- Roles & Responsibilities
- Membership
- Schedule
- Decision making
- Ground rules

Adoption of Charter

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

- Review of comments received back
- Formal approval and adoption

Model Update


Sustainable Groundwater
Management Act Readiness Project
ESJ Water Resources Model (ESJWRM)
Development & Application for SGMA
SAN JOAQUIN COUNTY
CALIFORNIA
May 9, 2018

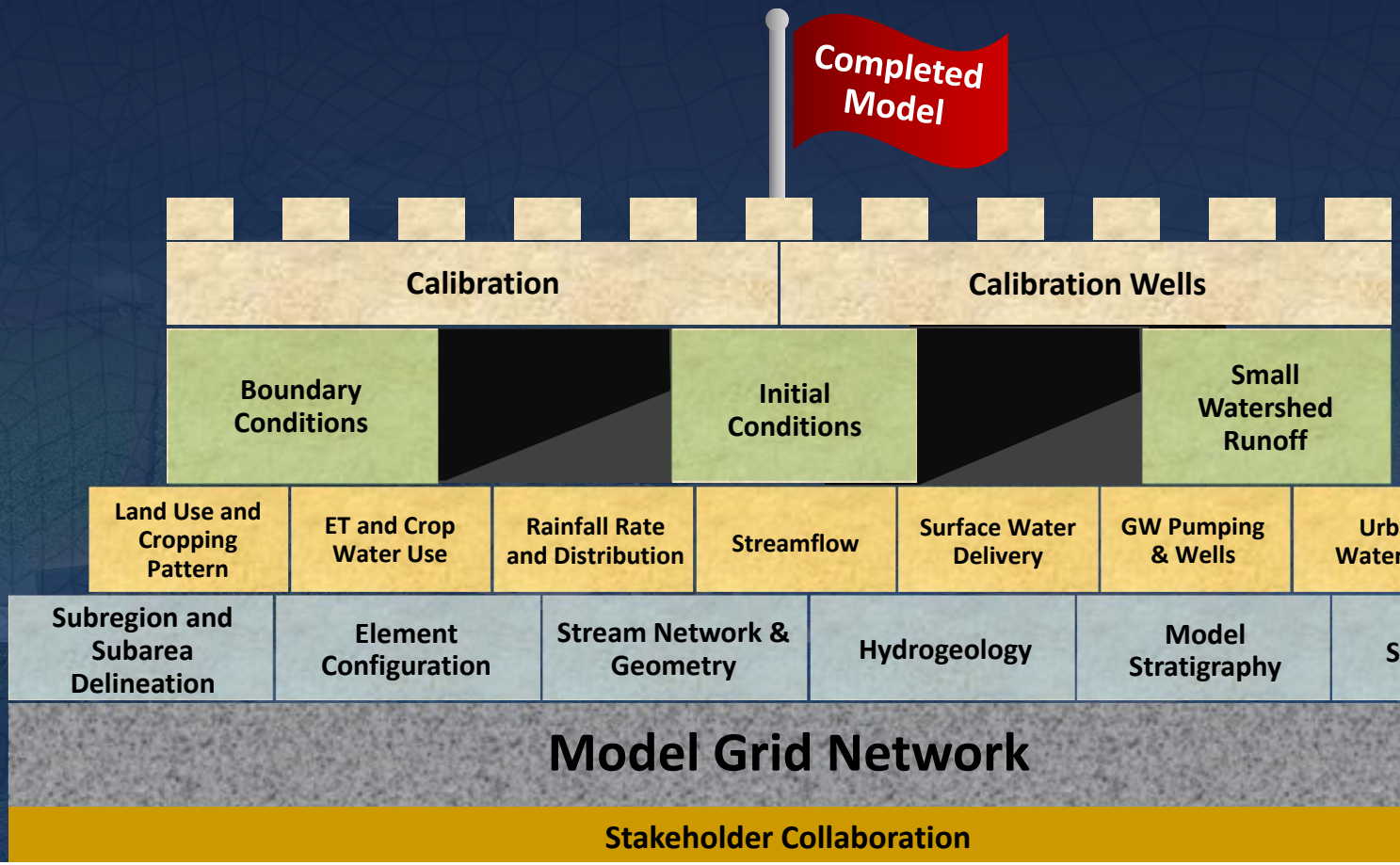
Agenda

1. Model Development Goals
2. Model Development Stakeholder Collaboration
3. Geology and Hydrogeology
4. Hydrology
5. Land Use and Water Use
6. Water Supply
7. Model Features (Elements, etc.)
8. Model Calibration
9. Model Application to GSP Support

Model Development Goals

- To Develop a robust and defensible analytical tool that supports:
  - Understanding the state of the GW Basin over a reasonable recent historical period
  - Development of GSP for the Basin
  - Evaluation of plans, projects, and actions to bring the Basin into sustainable condition
  - Individual irrigation and water districts in development of AWMPs
  - Individual municipal entities in development of their UWMP
  - SJ County in land and water use planning

ESJ Water Resources Model Development



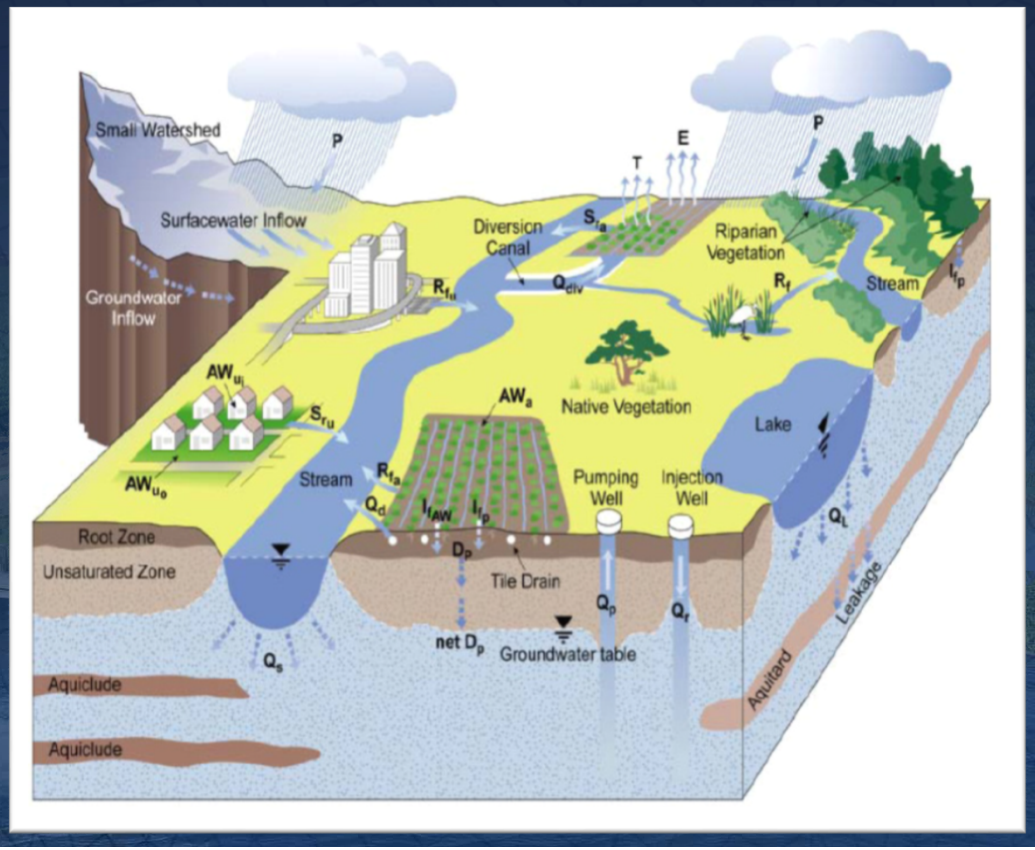
Open and Transparent Model Development Process

Stakeholder Technical Participation

- Cal Water
- Calaveras County Water District
- Central Delta
- DWR North Central District
- Escalon, City of
- Lathrop, City of
- Linden County Water District
- Lockeford Community Services District
- Lodi, City of
- Manteca, City of
- North San Joaquin Water Conservation District
- Oakdale Irrigation District
- Ripon, City of
- San Joaquin County
- South San Joaquin Irrigation District
- Stanislaus County
- Stockton, City of
- Stockton East Water District
- Woodbridge Irrigation District

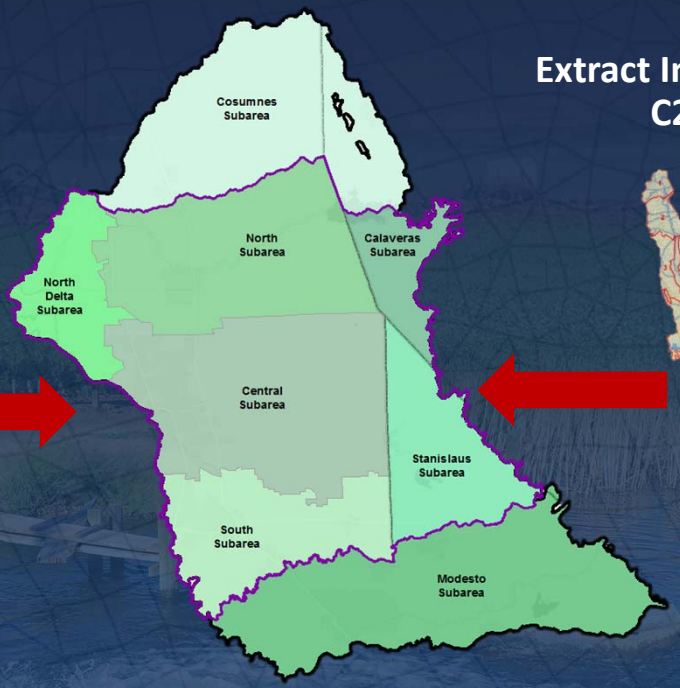
Integrated Water Flow Model (IWFM)

- 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 is developed based on DWR's integrated hydrologic modeling platform and local/statewide datasets*

Migration of Existing DYNFLOW Data

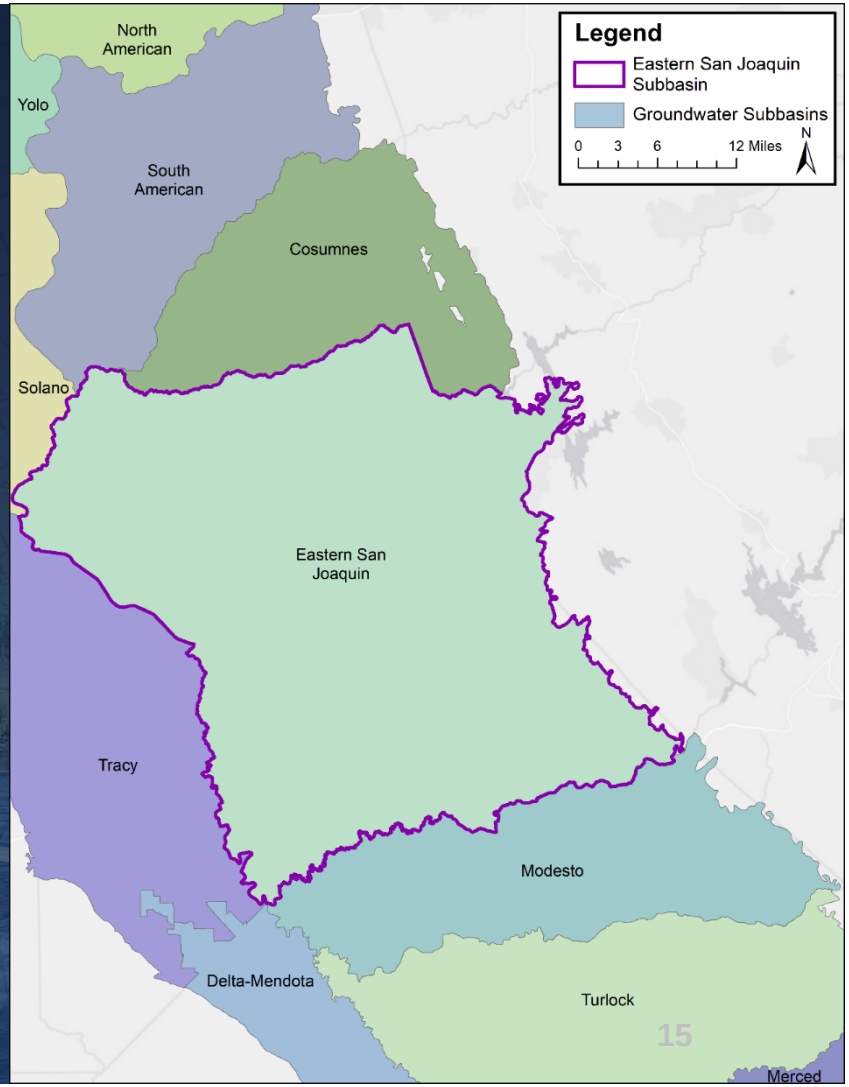


Extract Information from C2VSim-FG

*Recommendation to the ESJ GBA Board by the Ad Hoc Technical Committee on August 5, 2016

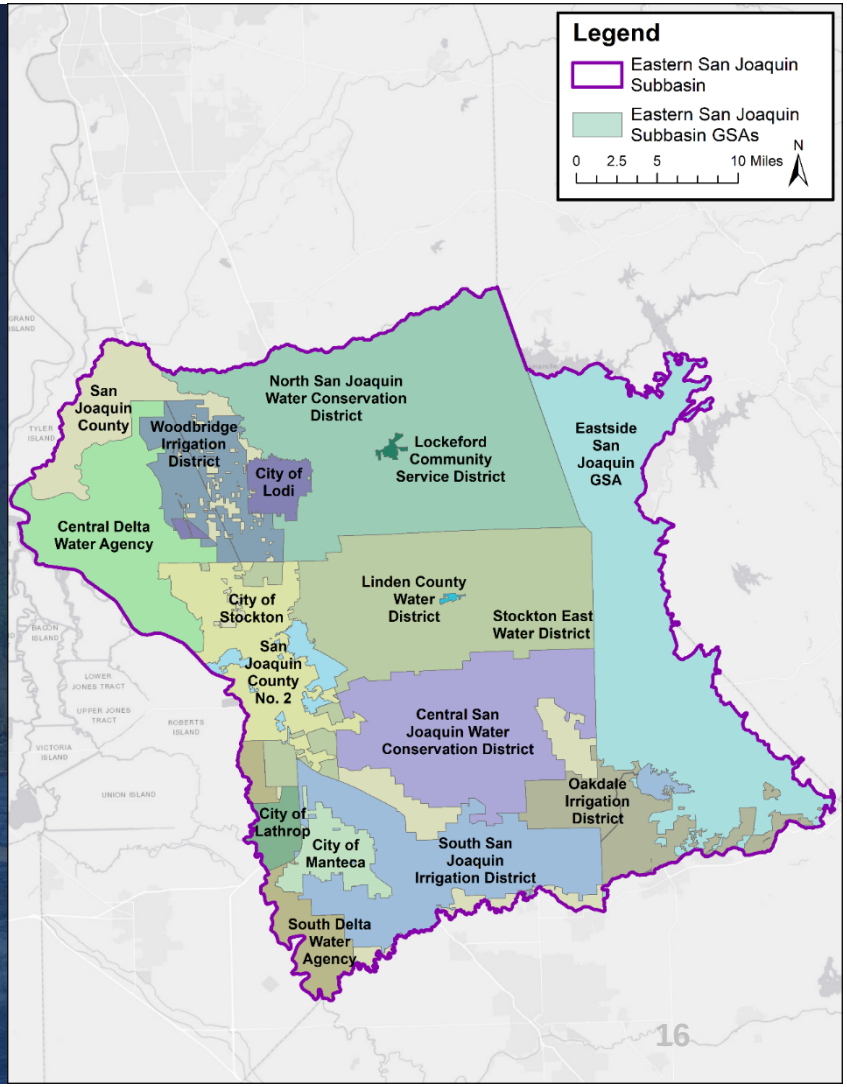
Groundwater Subbasins

- Neighboring groundwater subbasins
  - Cosumnes
  - South American
  - Solano
  - Tracy
  - Delta-Mendota
  - Modesto



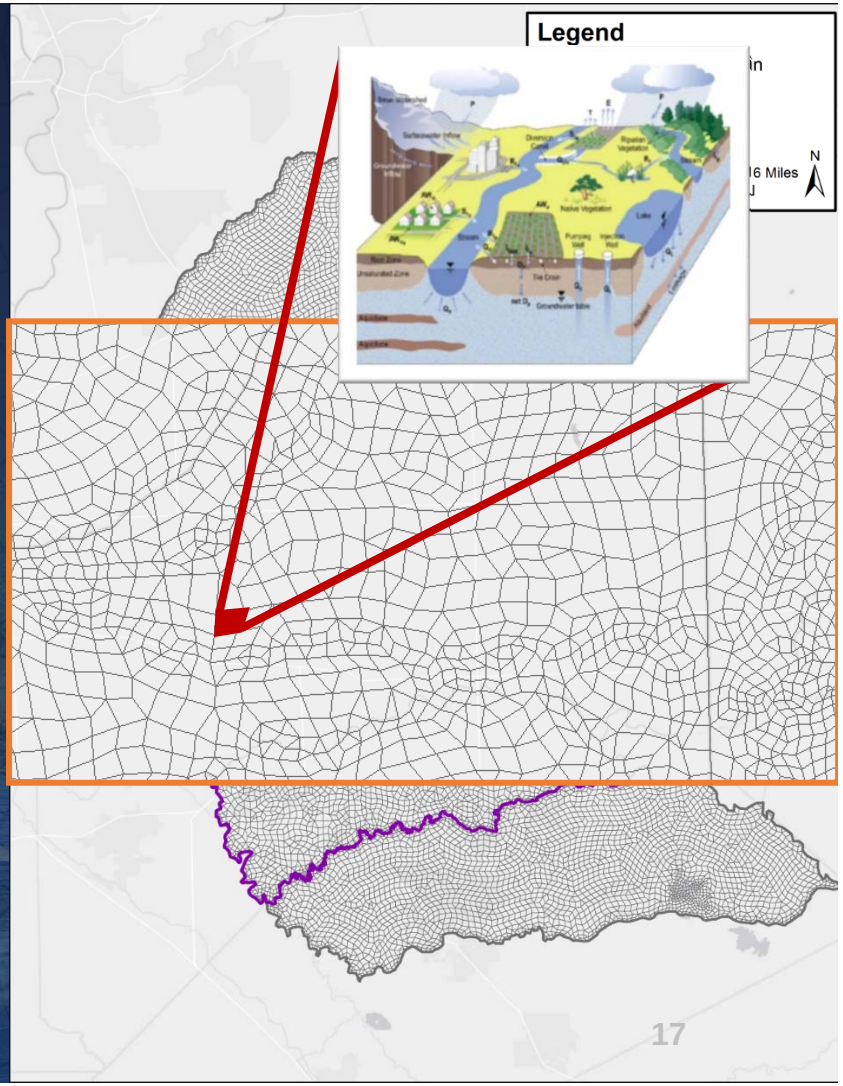
Groundwater Sustainability

- 17 GSAs



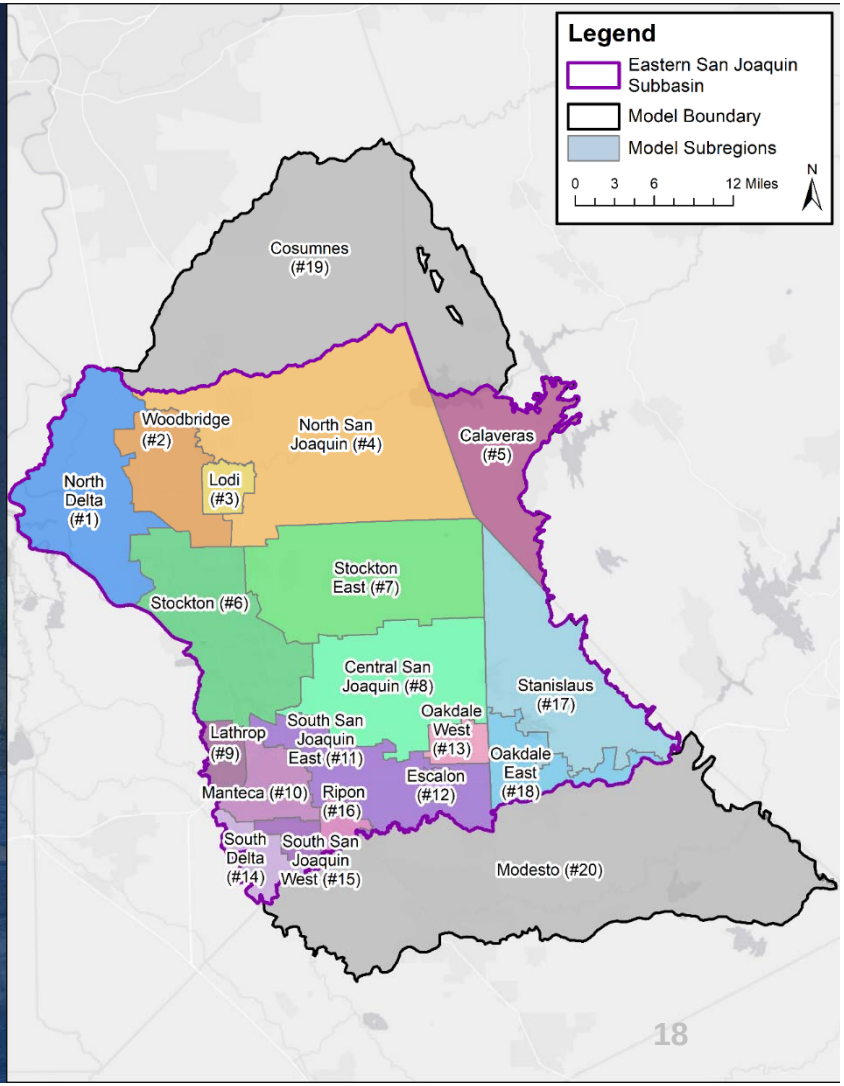
Final ESJWRM Grid: Elements and Node Configuration

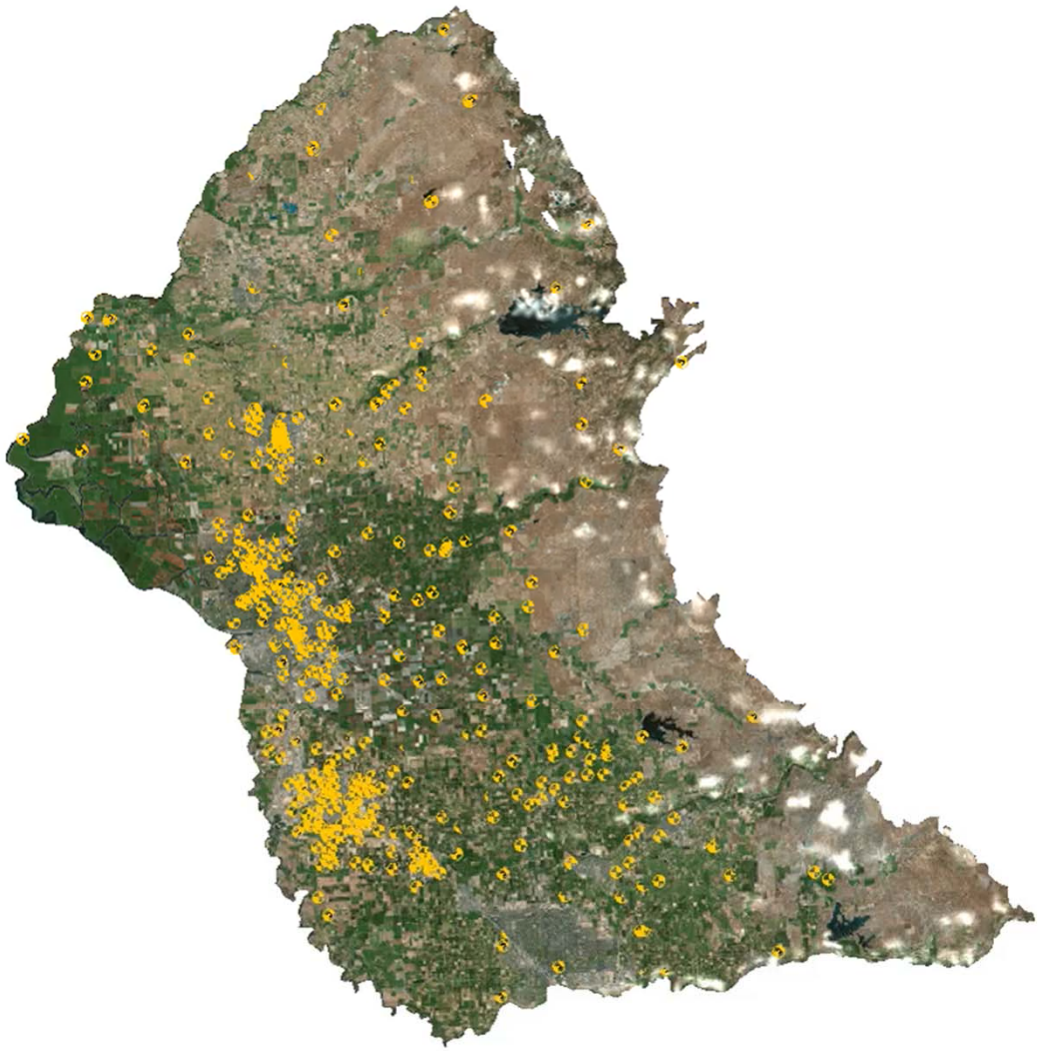
- Hydrologic and hydrogeologic computations are performed at each element level
- Model Grid
  - 16,054 elements
    - Average Area: 76.5 acres
  - 15,302 nodes
    - Node Spacing:
      - Across Model Area: 0.37 mile
      - Along the Rivers/Water Courses: 0.28 miles

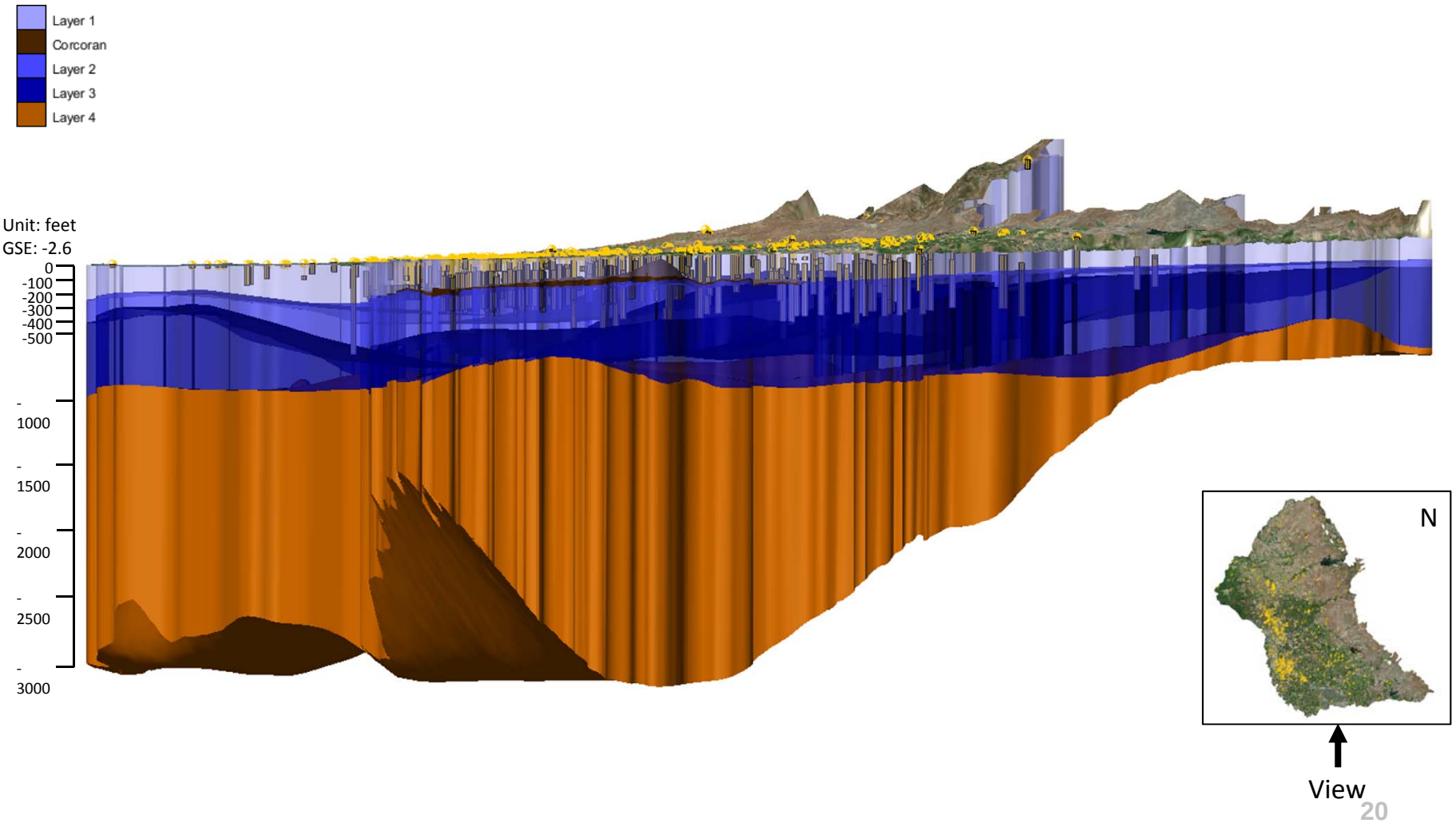


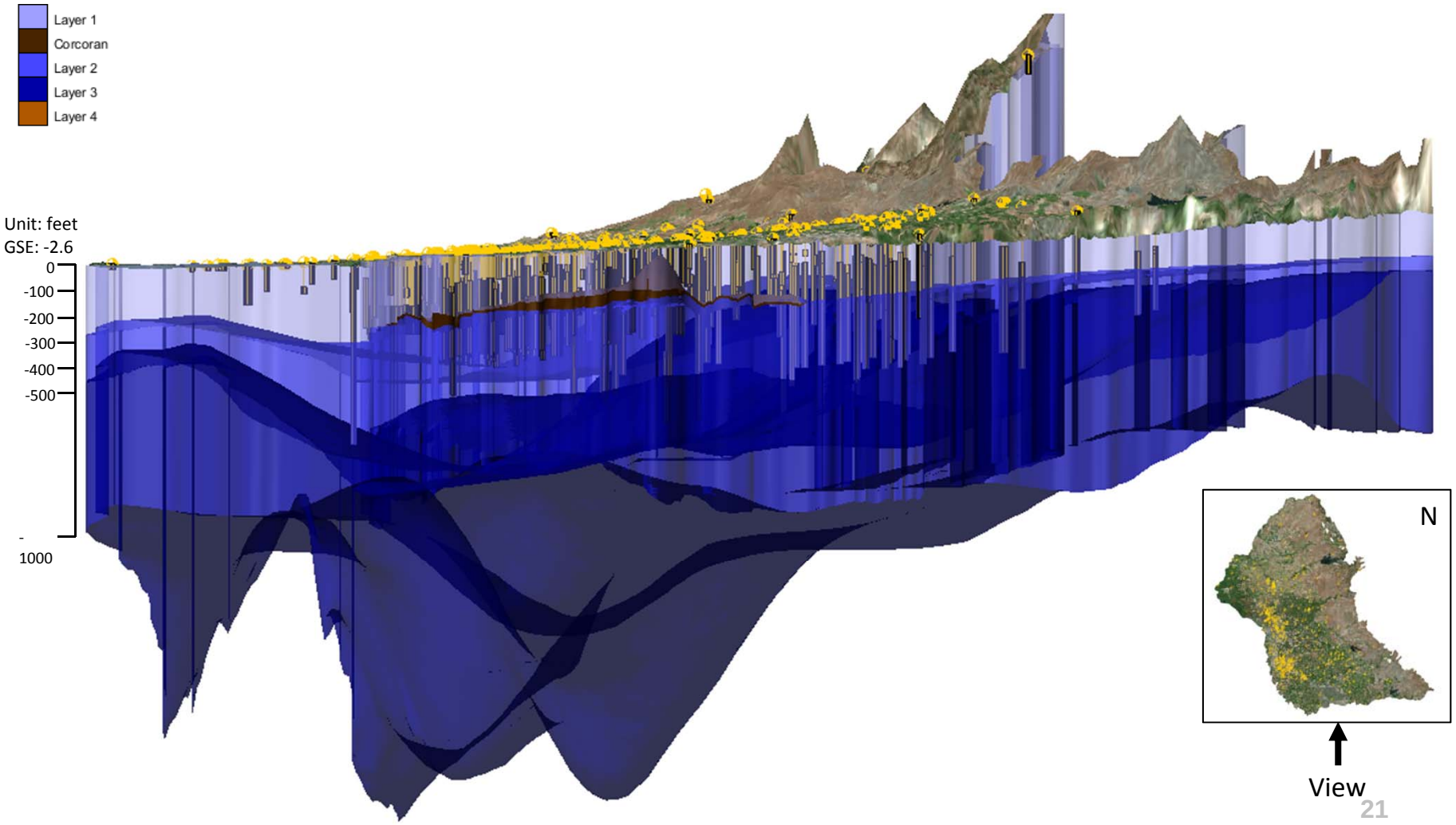
Model Subregions

- 20 subregions
- For data collection and preparation of model input files
- Used SOI boundaries as reference for cities






Layer 1
Corcoran
Layer 2
Layer 3
Layer 4
Unit: feet
GSE: -2.6
0
-100
-200
-300
-400
-500
1000
1500
2000
2500
3000
N
View


Layer 1
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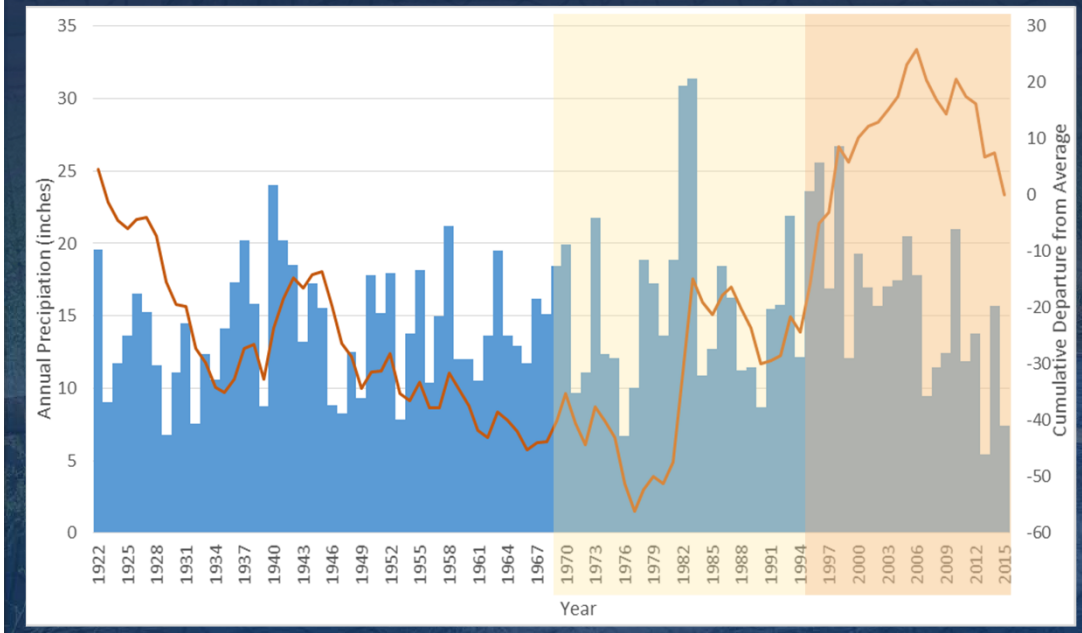
Layer 2
Layer 3
Layer 4
Unit: feet
GSE: -2.6
0
-100
-200
-300
-400
-500
-
1000
N
View

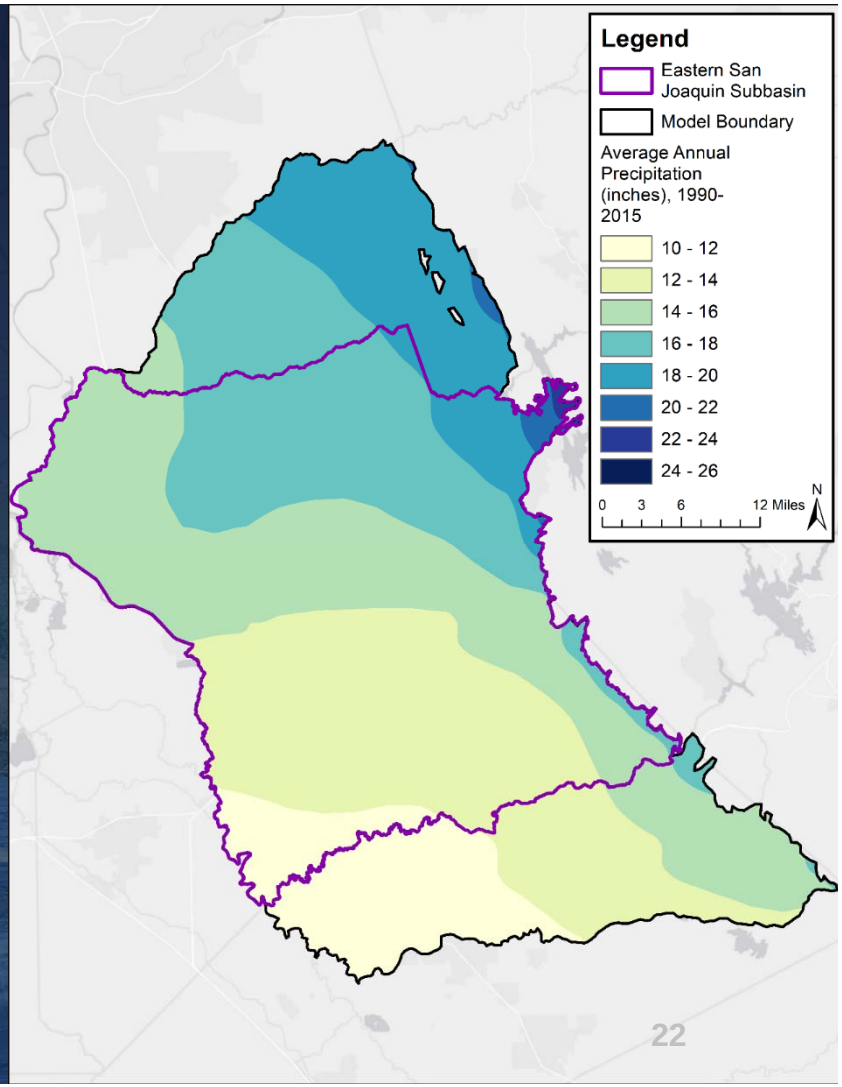
Model Contains a Long-Term Hydrology

Calibration Period: 1995-2015

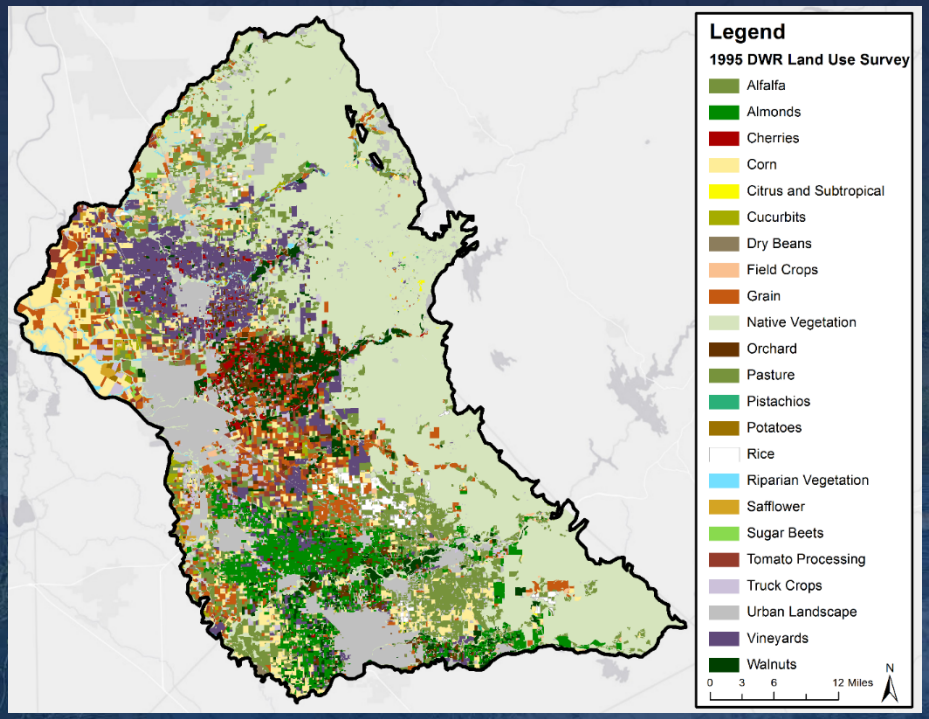
Model Period: 1970-2015

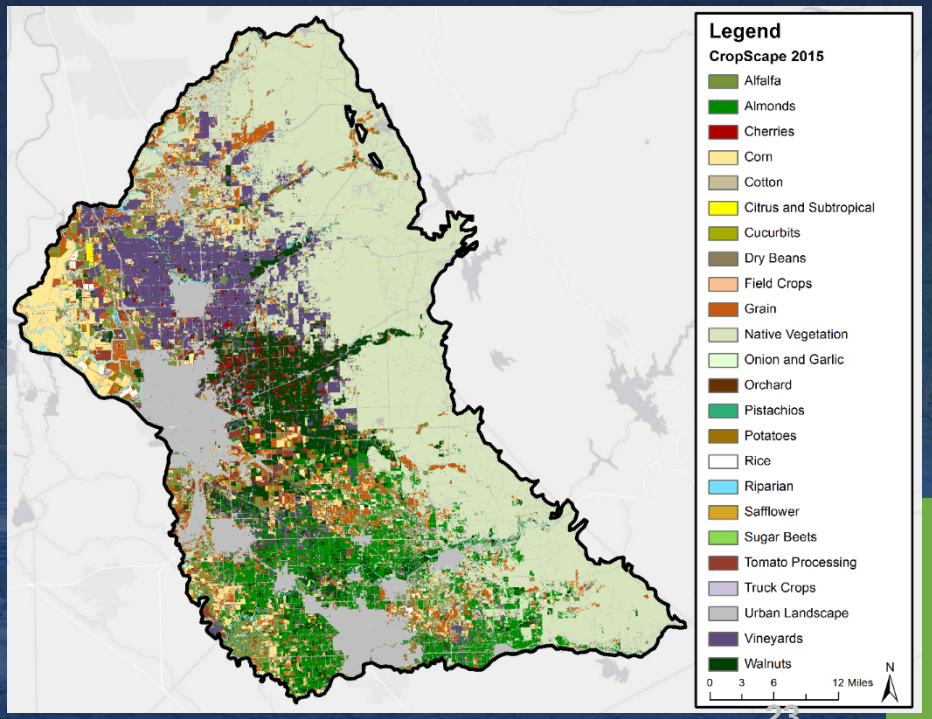


*Source: PRISM (Parameter elevation Regression on Independent Slopes Model)

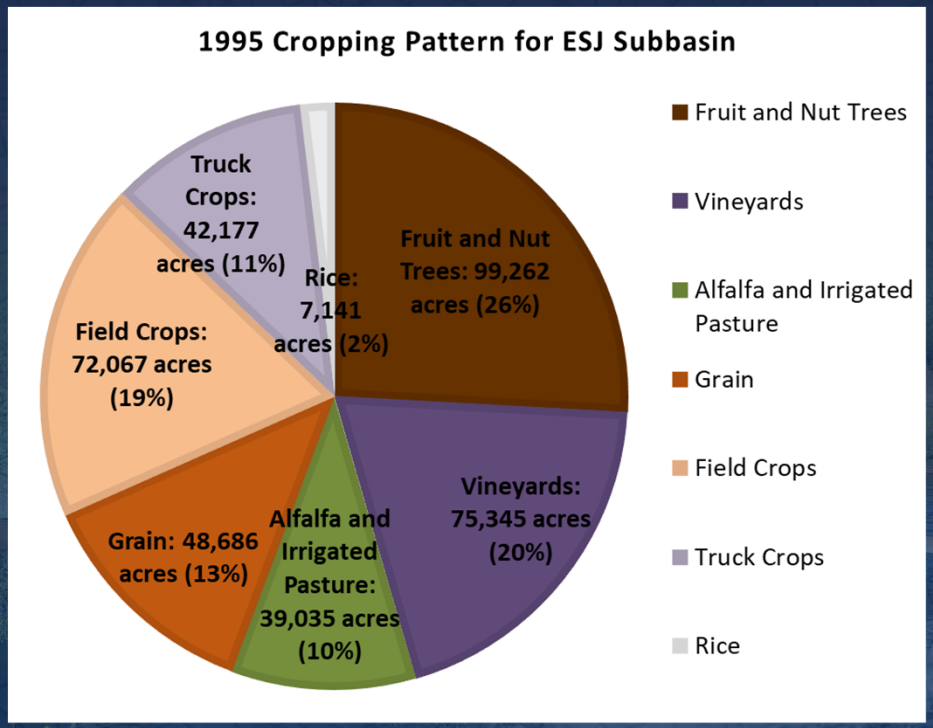


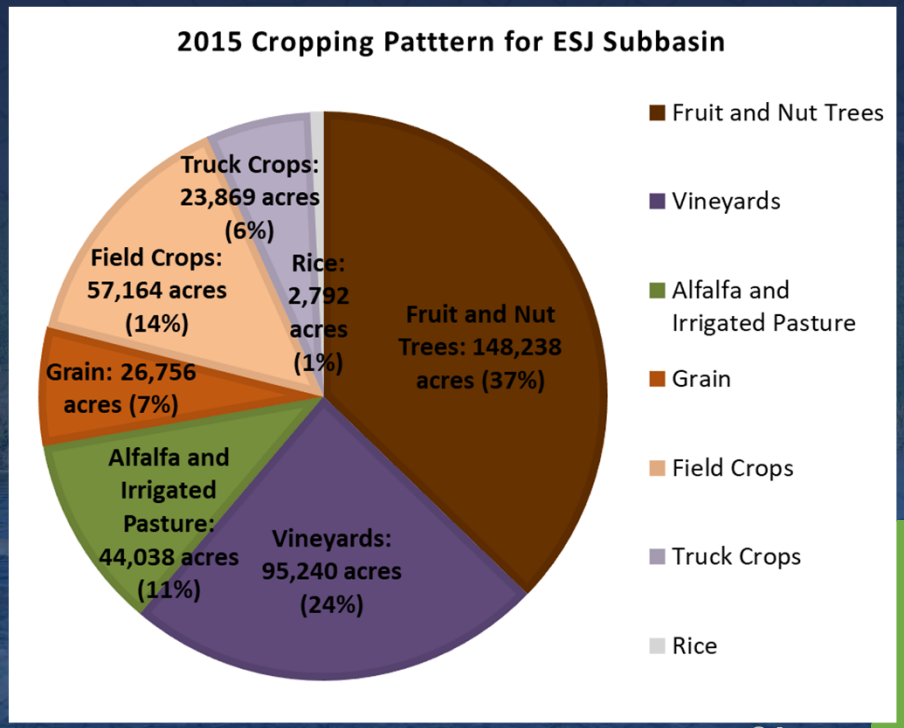
ESJ Model Area Cropping Pattern (1995 & 2015)



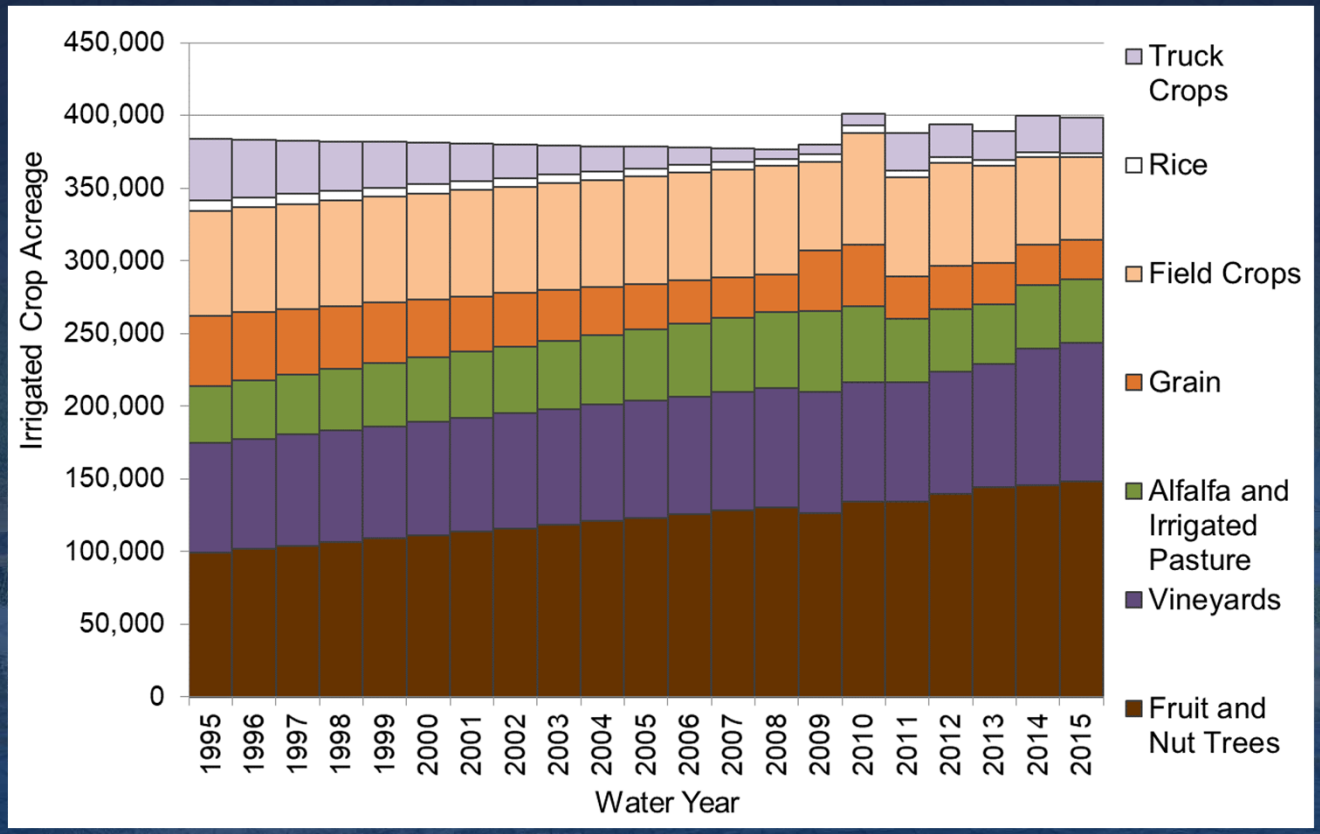


Primary Cropping Pattern in ESJ Subbasin

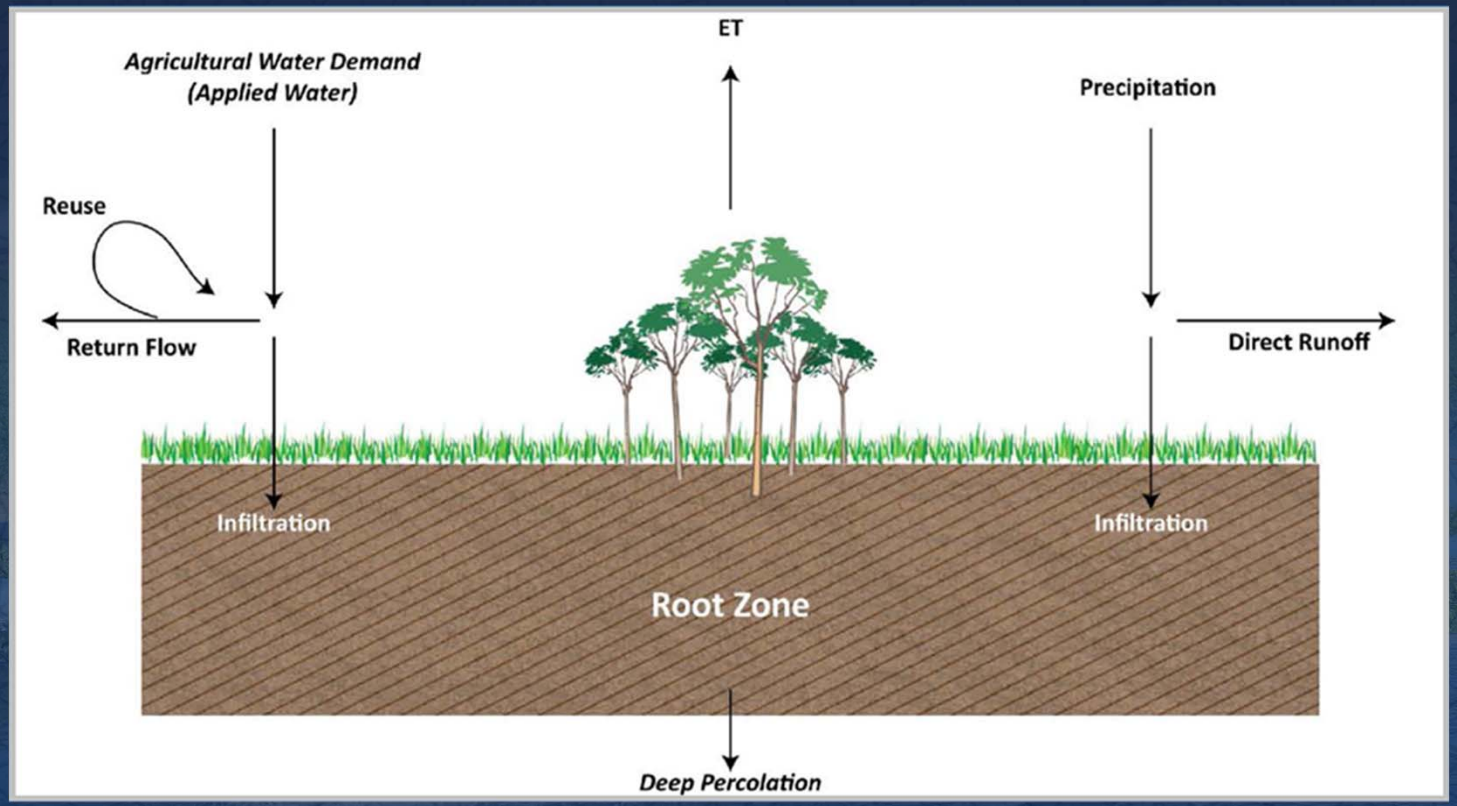




Primary Cropping Pattern in ESJ Subbasin

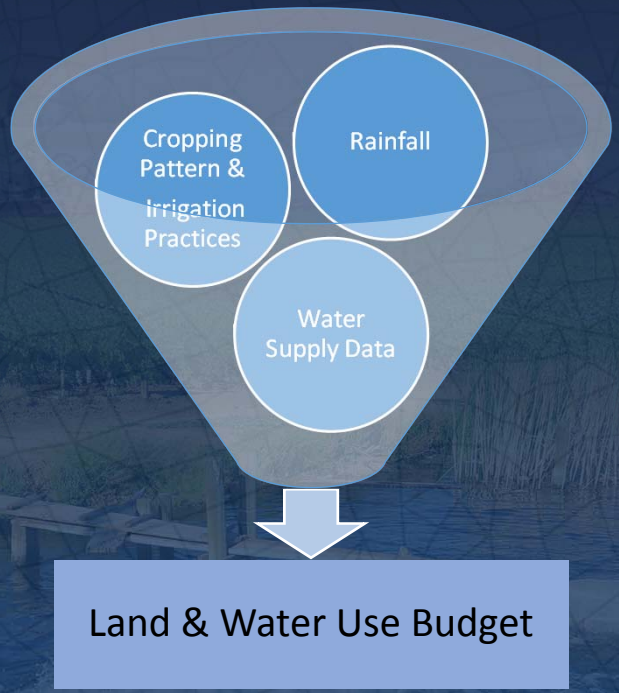


IWFM Demand Calculator: IDC



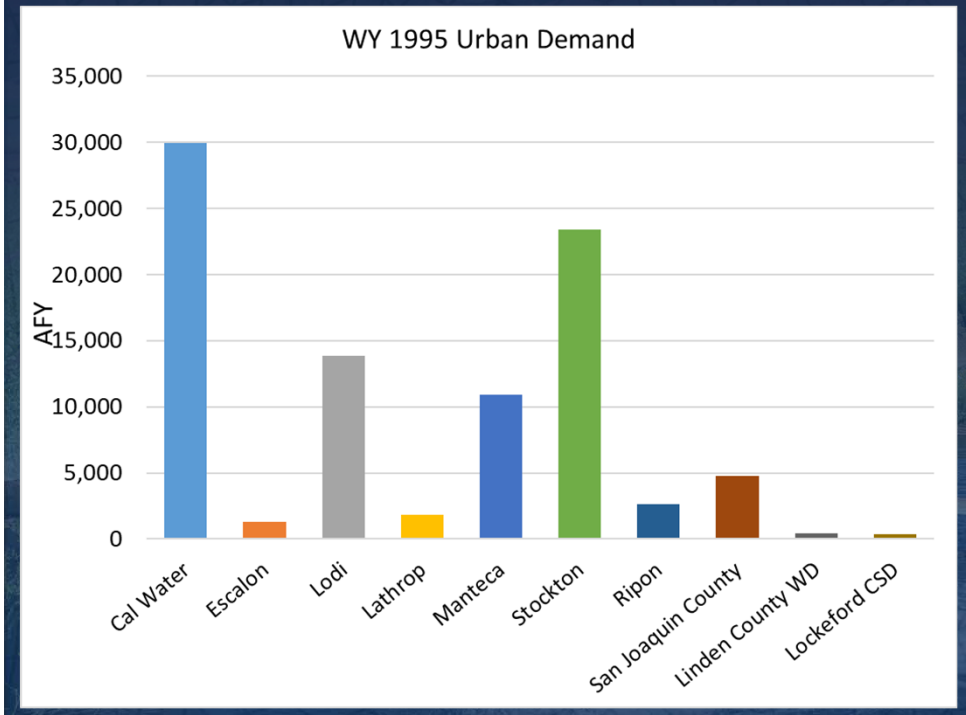
Source: IDC training workshop (DWR)

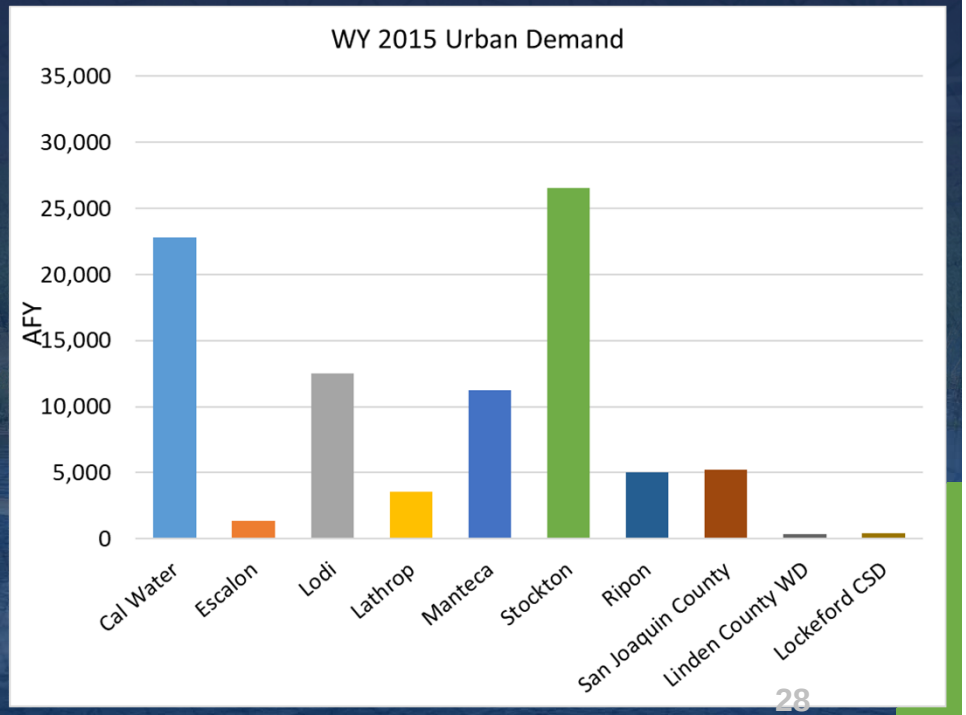
Land & Water Use Budget Components



Urban Water Demand

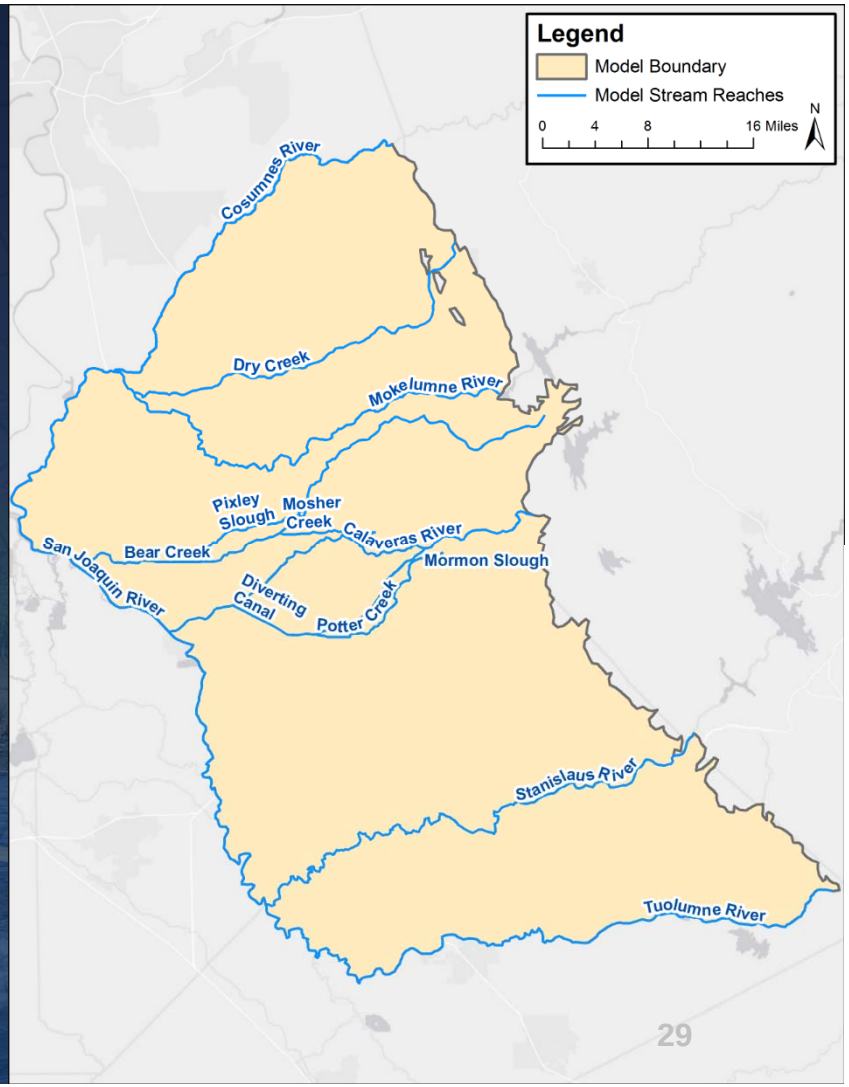
- Based on GPCD and population if water demand information unavailable





Water Supply Data Sources

- Surface water deliveries for ag or urban purposes:
  - North Delta
  - Woodbridge ID
  - Lodi
  - North San Joaquin WCD
  - Calaveras County WD
  - Stockton/Cal Water
  - Stockton East WD
  - Central San Joaquin WCD
  - Lathrop
  - Manteca
  - Escalon
  - South San Joaquin ID
  - Oakdale ID
  - Modesto ID/Modesto
  - Riparian



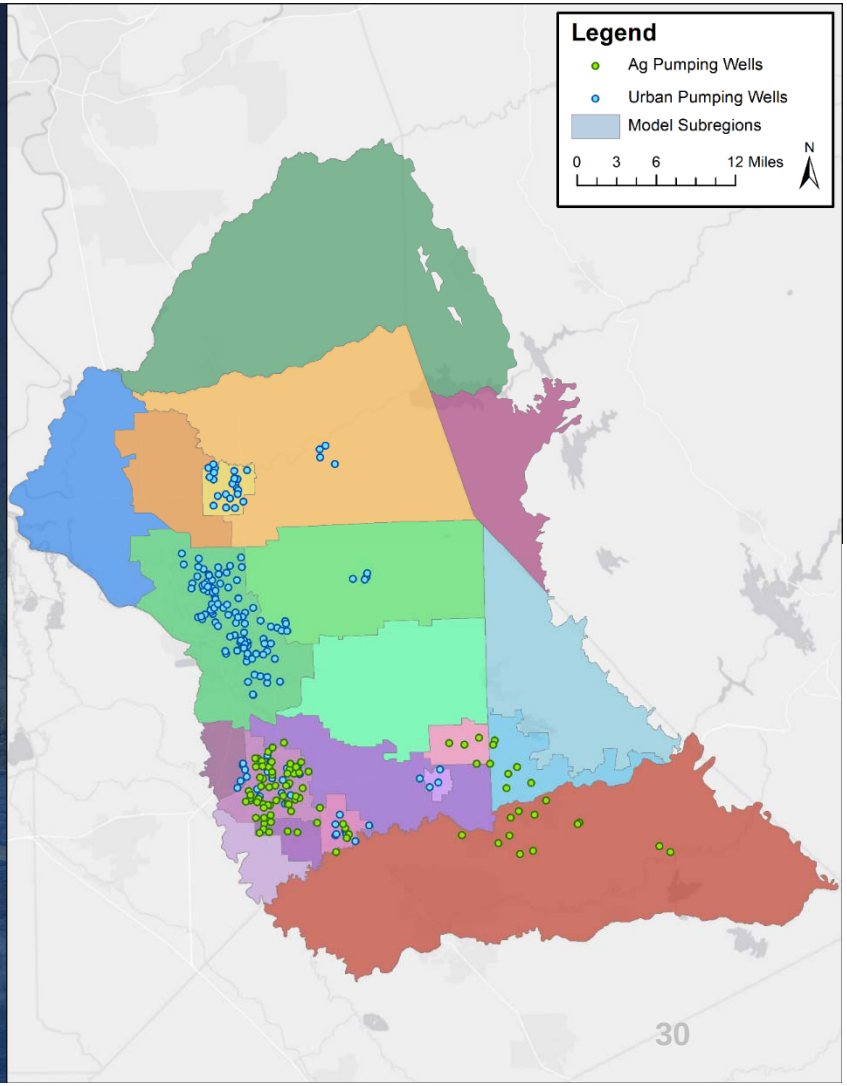
Water Supply Data Sources

GW Pumping

- Cal Water
- Escalon
- Lathrop
- Linden County
- Lockford CSD
- Lodi
- Manteca
- Oakdale ID
- Ripon
- Stockton East WD
- South San Joaquin ID
- Stockton

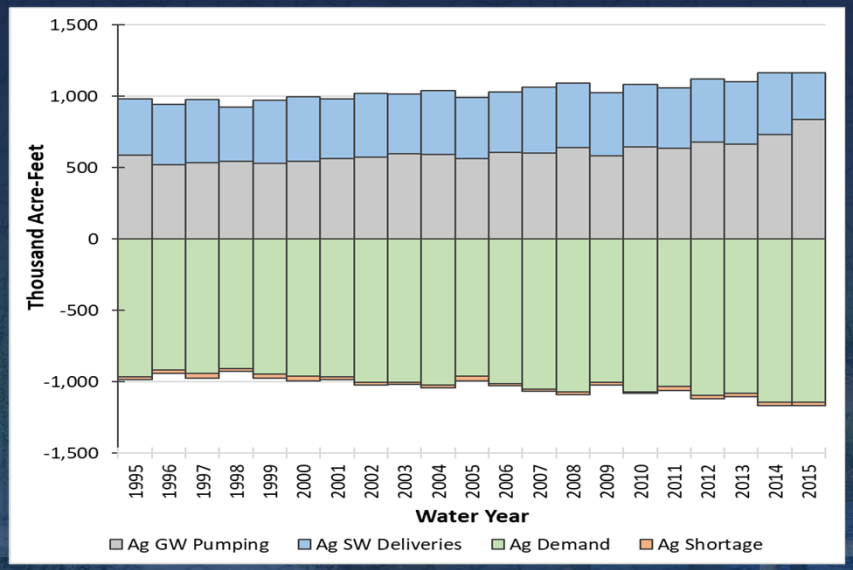
SW Delivery

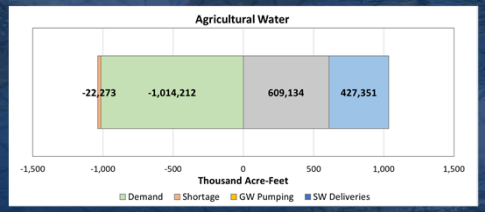
- North Delta
- Woodbridge ID
- Lodi
- North San Joaquin WCD
- Calaveras County WD
- Stockton/Cal Water
- Stockton East WD
- Central San Joaquin WCD
- Lathrop
- Manteca
- Escalon
- South San Joaquin ID
- Oakdale ID
- Modesto ID/Modesto
- Riparian



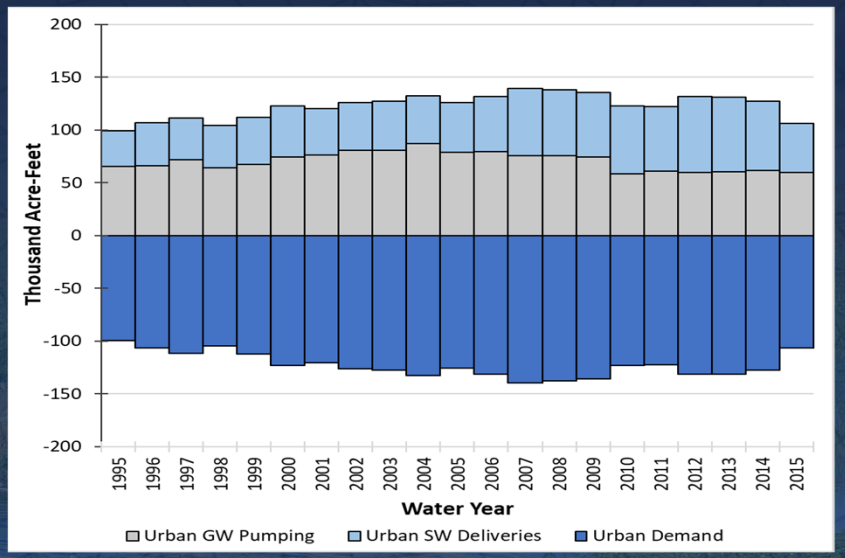
Land & Water Use Budget

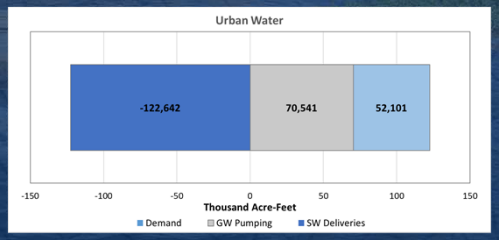
Agricultural Water Use





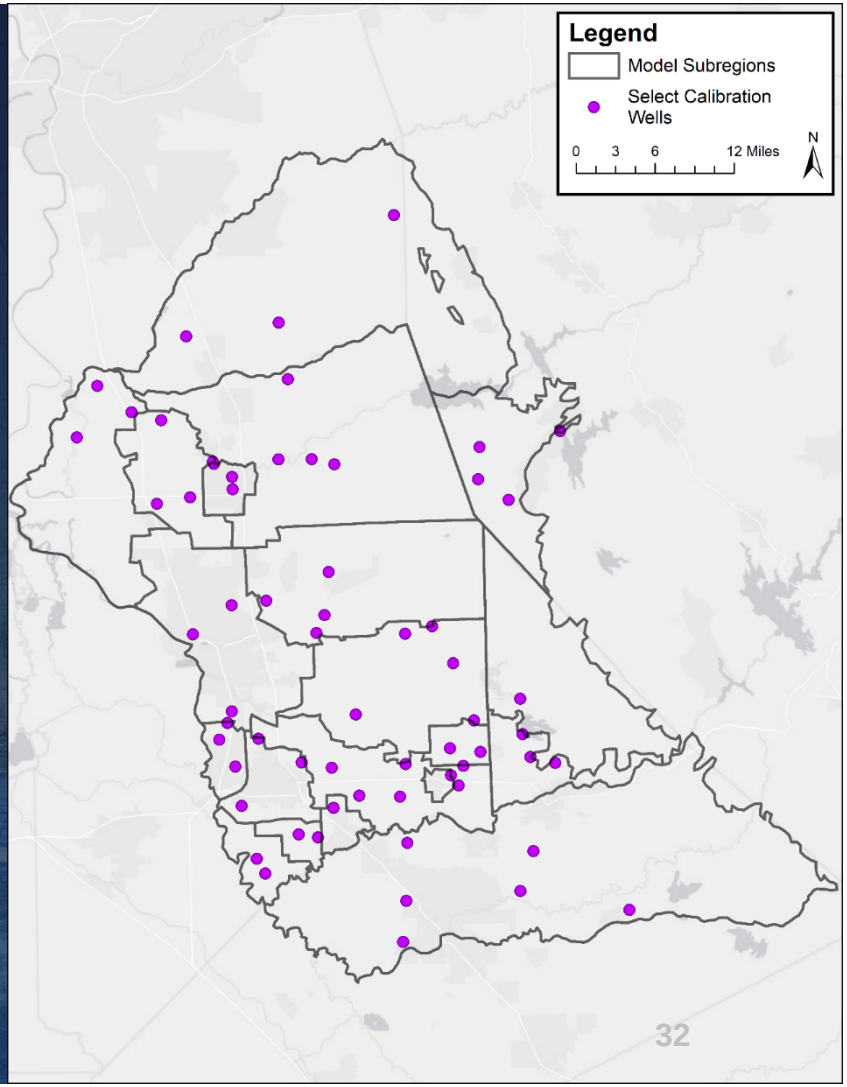
Urban Water Use

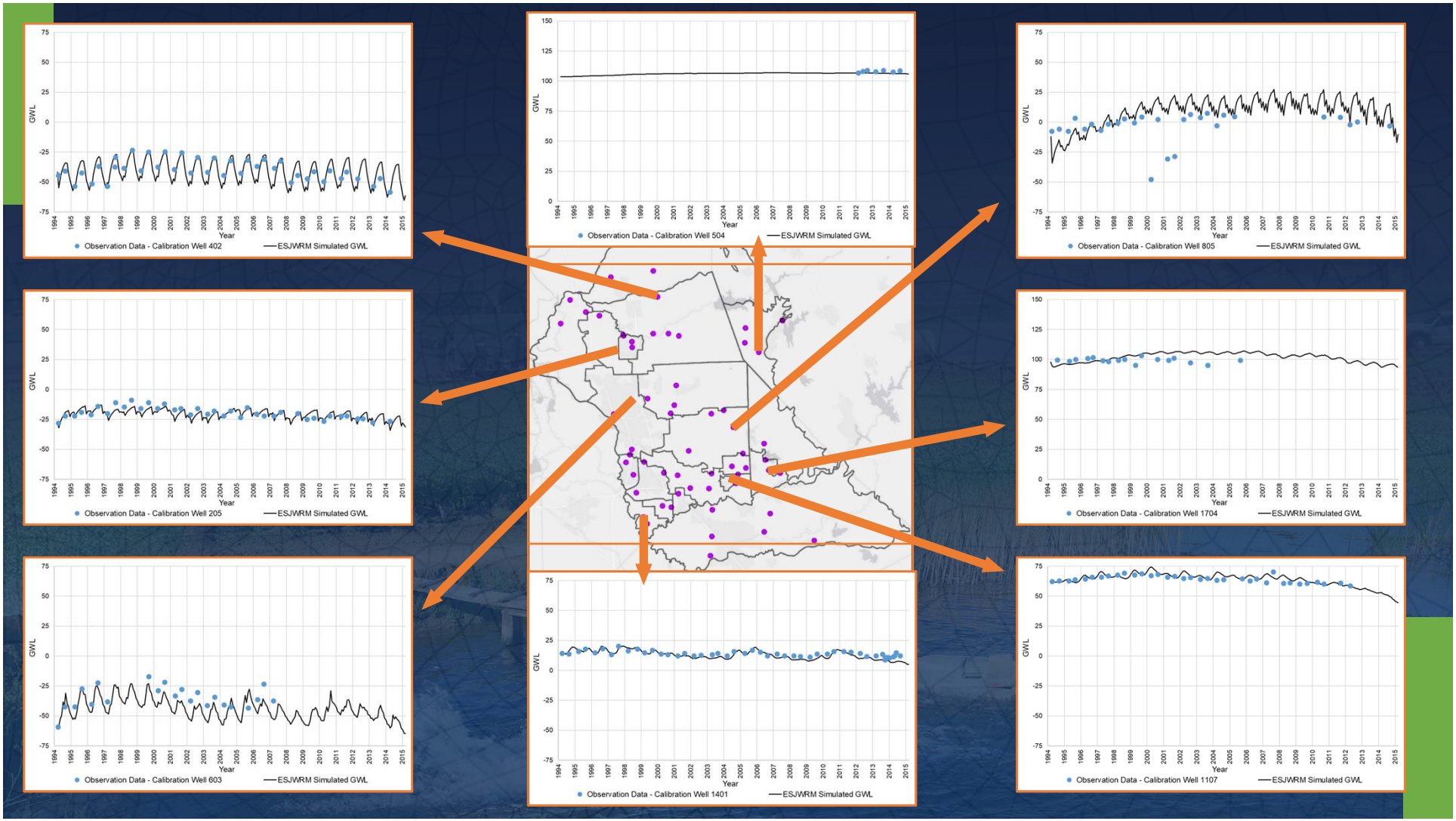




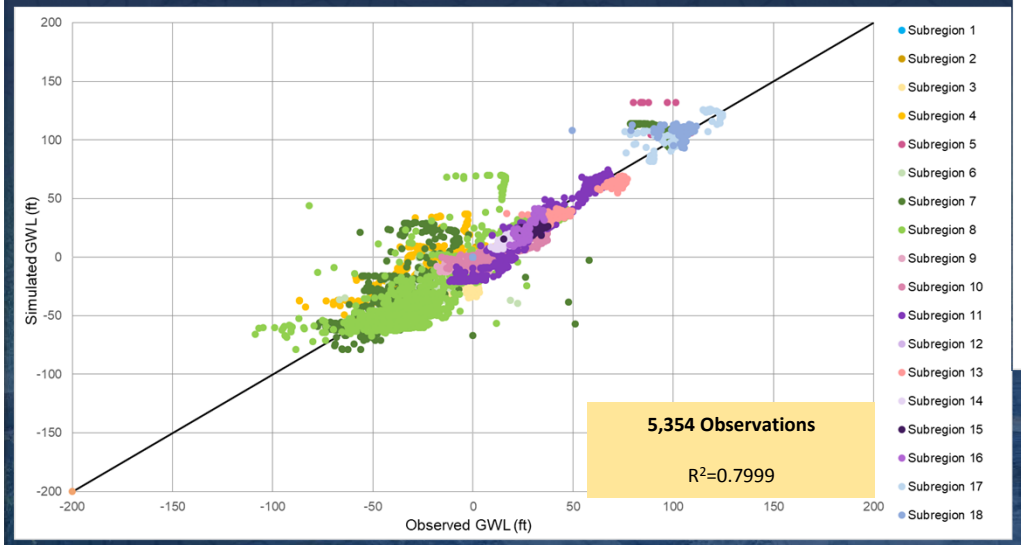
GW Level Calibration Wells

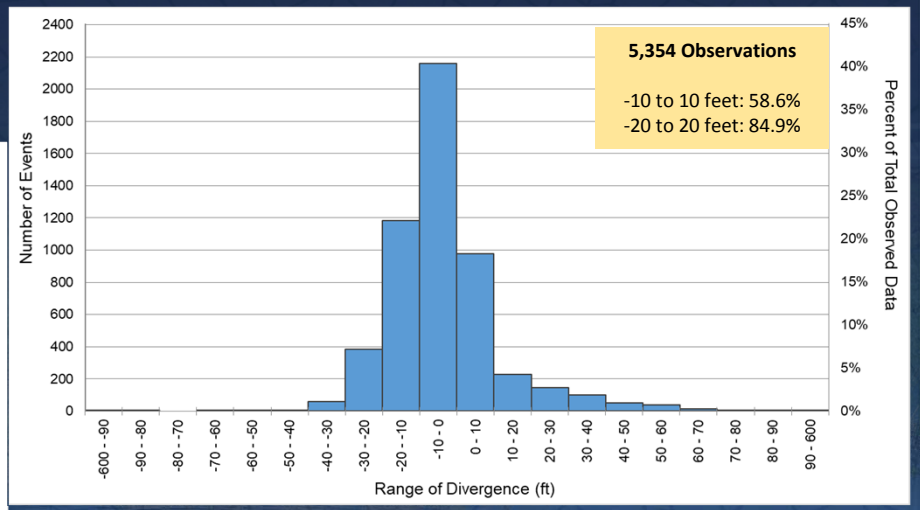
- 160 model calibration wells selected to represent spatial and temporal variability across model time period
- As many as 63 model calibration wells selected to represent calibration and GWL trends across the model area




GWL
Year
Observation Data - Calibration Well 402
ESJWRM Simulated GWL
Observation Data - Calibration Well 504
Observation Data - Calibration Well 805
Observation Data - Calibration Well 205
Observation Data - Calibration Well 1704
Observation Data - Calibration Well 603
Observation Data - Calibration Well 1401
Observation Data - Calibration Well 1107

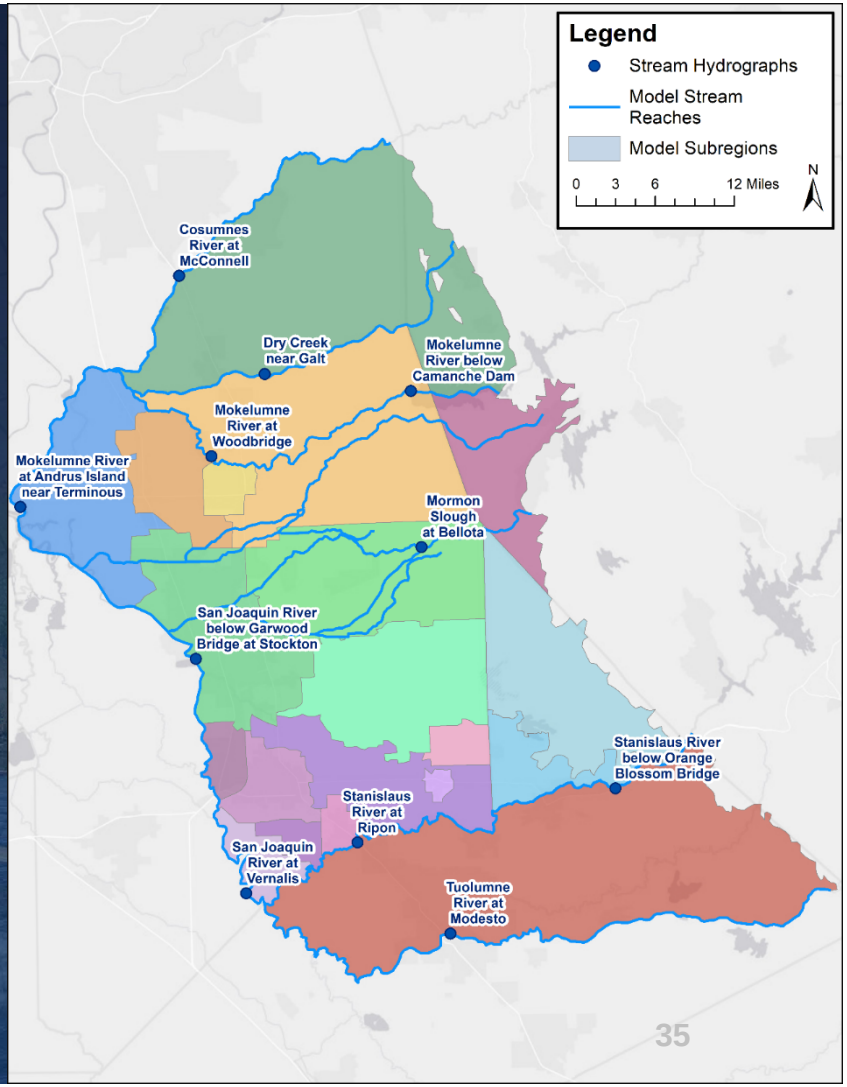
GW Level Calibration Quality

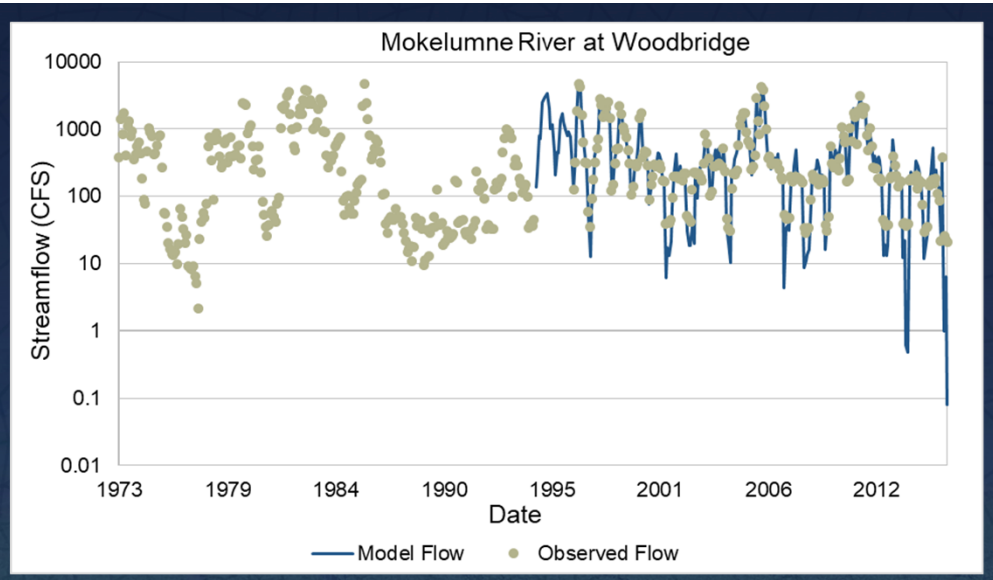


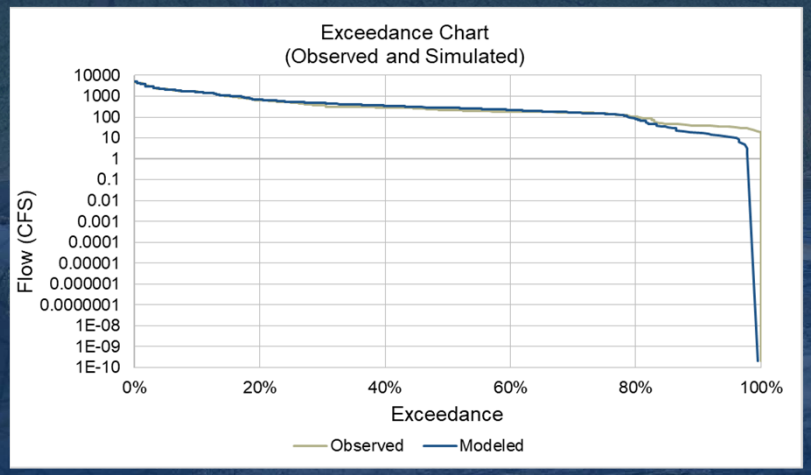


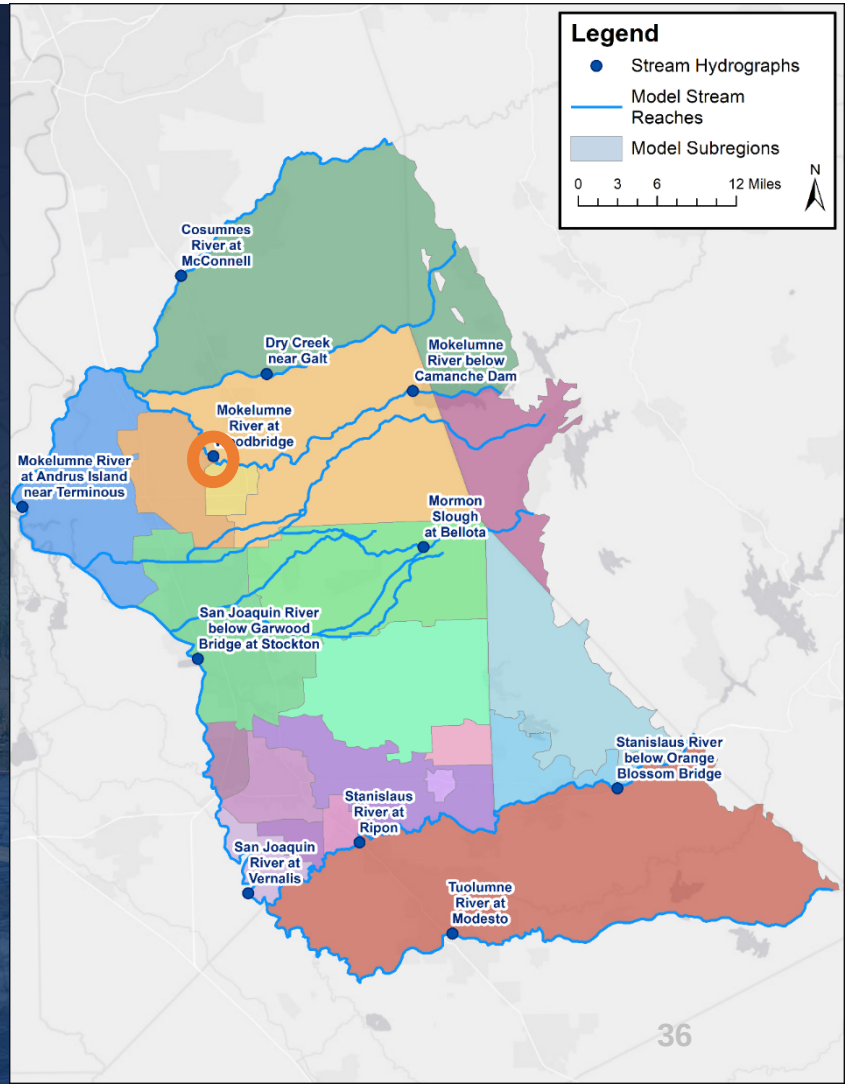
Streamflow Calibration Stations

- 11 streamflow calibration stations
  - USGS, USACE, or DWR CDEC
- Since boundary of model is largely controlled by boundary conditions, important stations are those interior in the model

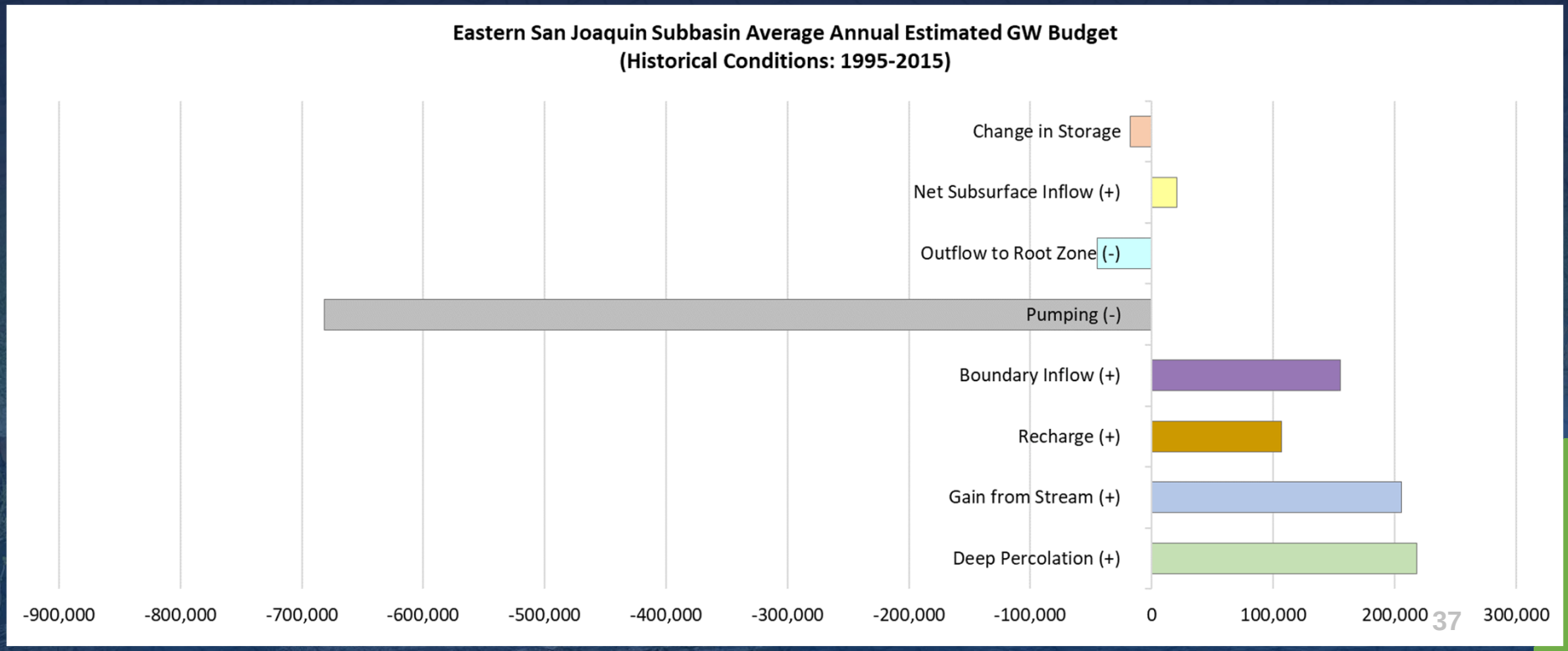



Mokelumne River at Woodbridge
Streamflow (CFS)
10000
1000
100
10
1
0.1
0.01
1973
1979
1984
1990
1995
2001
2006
2012
Date
Model Flow
Observed Flow

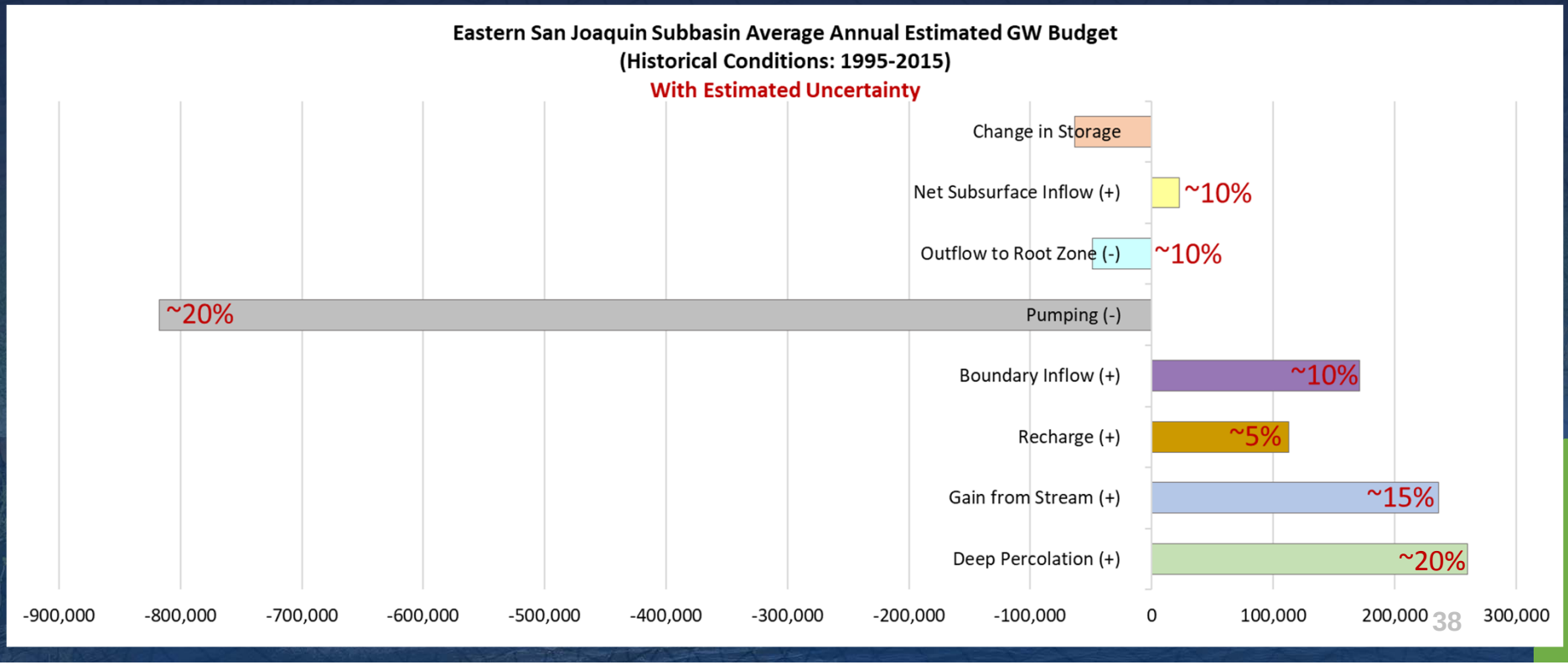

Exceedance Chart
(Observed and Simulated)
Flow (CFS)
10000
1000
100
10
1
0.1
0.01
0.001
0.0001
0.00001
0.000001
0.0000001
1E-08
1E-09
1E-10
0%
20%
40%
60%
80%
100%
Exceedance
Observed
Modeled


Legend
Stream Hydrographs
Model Stream Reaches
Model Subregions
0 3 6 12 Miles
N
Cosumnes River at McConnell
Dry Creek near Galt
Mokelumne River below Camanche Dam
Mokelumne River at Woodbridge
Mokelumne River at Andrus Island near Terminous
Mormon Slough at Bellota
San Joaquin River below Garwood Bridge at Stockton
Stanislaus River below Orange Blossom Bridge
Stanislaus River at Ripon
San Joaquin River at Vernalis
Tuolumne River at Modesto

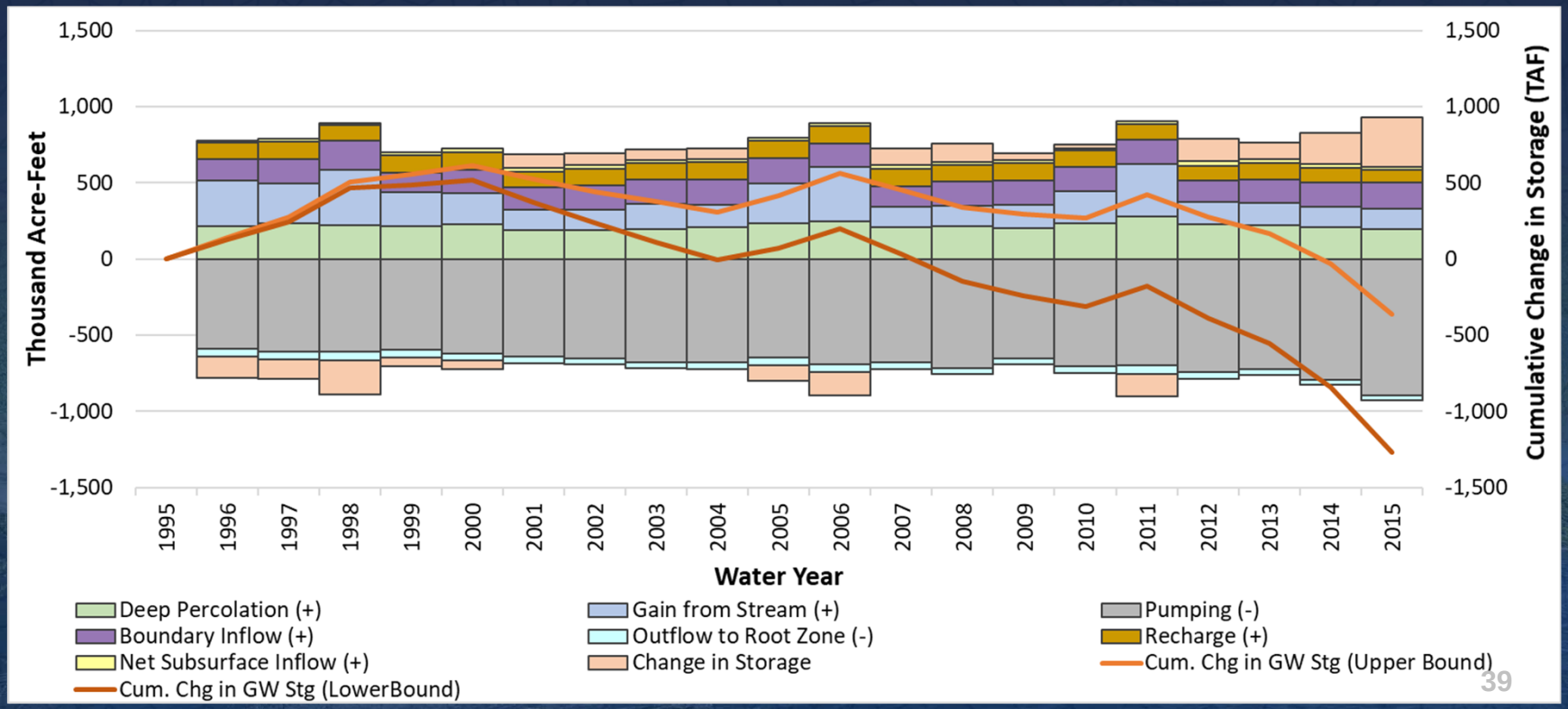
ESJ Subbasin Estimated Average Annual GW Budget Historical Conditions



ESJ Subbasin Estimated Average Annual GW Budget Historical Conditions

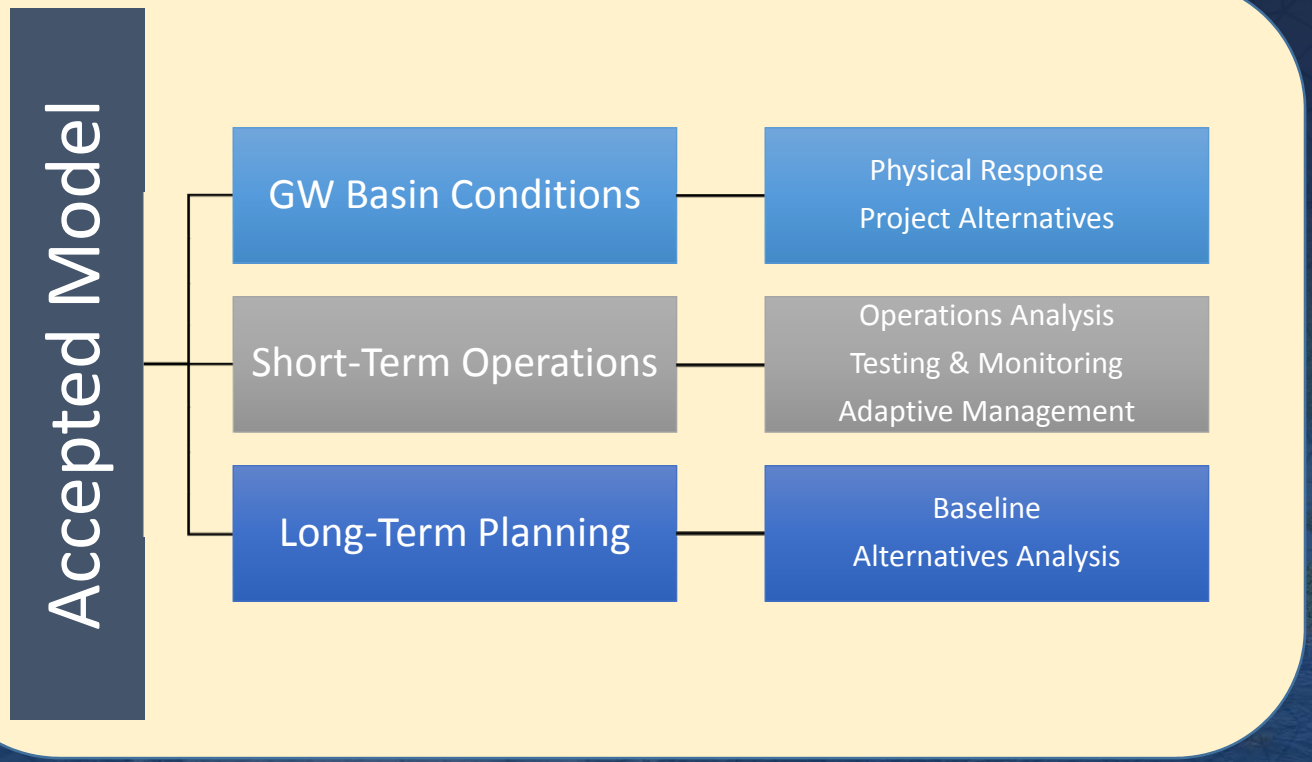


ESJ Subbasin Estimated Average Annual GW Budget Historical Conditions



Model Use and Application to SGMA

Model Applications Next Steps …



Model Can Help Address SGMA Related Questions

- What is the current status of the GW Basin?
- What are the potential effects of Basin Boundary adjustments on GW Management?
- What are the metrics and thresholds for sustainability in the basin?
  - GW Storage / Levels
  - GW Quality
  - Stream-aquifer interaction
  - Land Subsidence
- What is the time frame to achieve sustainability?
- What are the measures to attain sustainability?
  - Demand-side
  - Supply-side
  - Combined measures
- What are the economic implications of sustainability?

Next Steps

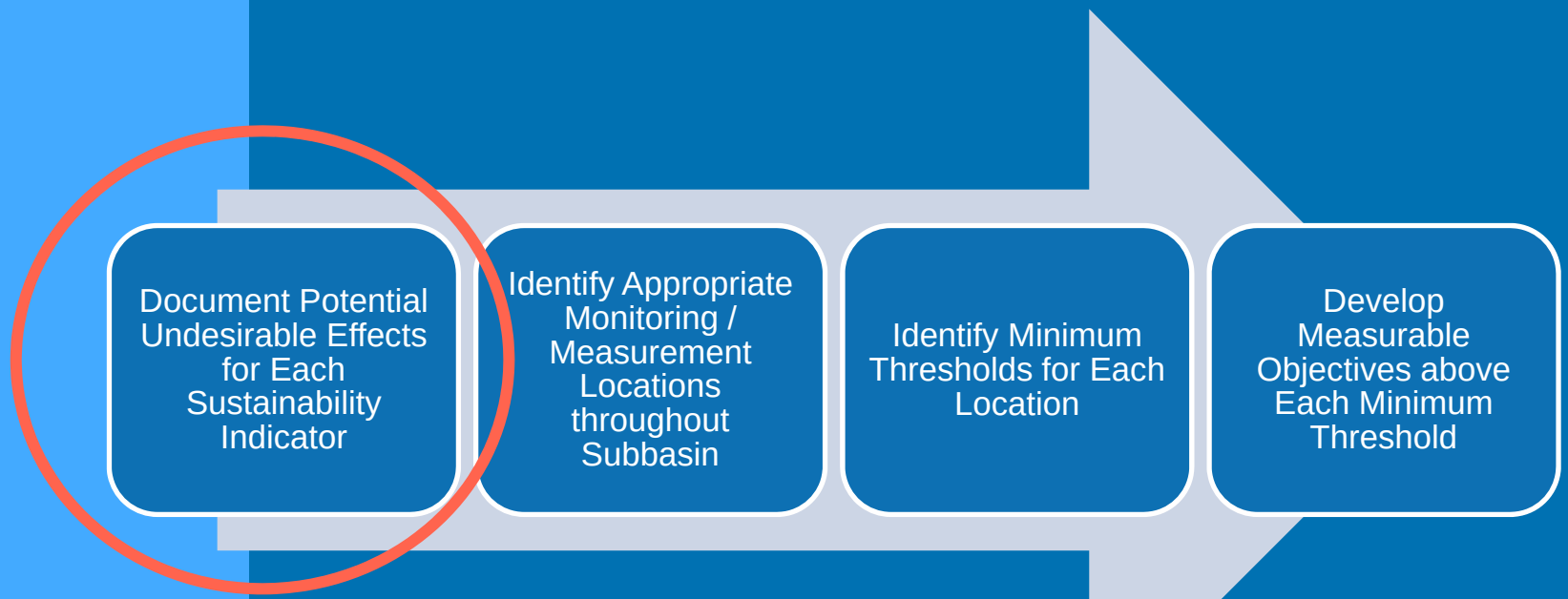
- Finalize Calibration
- Prepare Model Report
- Present Model Development and Results to ESJ GWA Board
- Support GSP Development
  - Develop Baseline Scenarios
    - Current Conditions
    - Future Conditions
  - Perform Sustainability Scenarios

Action Item

- GWA Advisory Committee recommends to the BOD of the Authority to approve the use of the groundwater model in support of the development of the GSP.

Next Steps for GSP Development Process

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

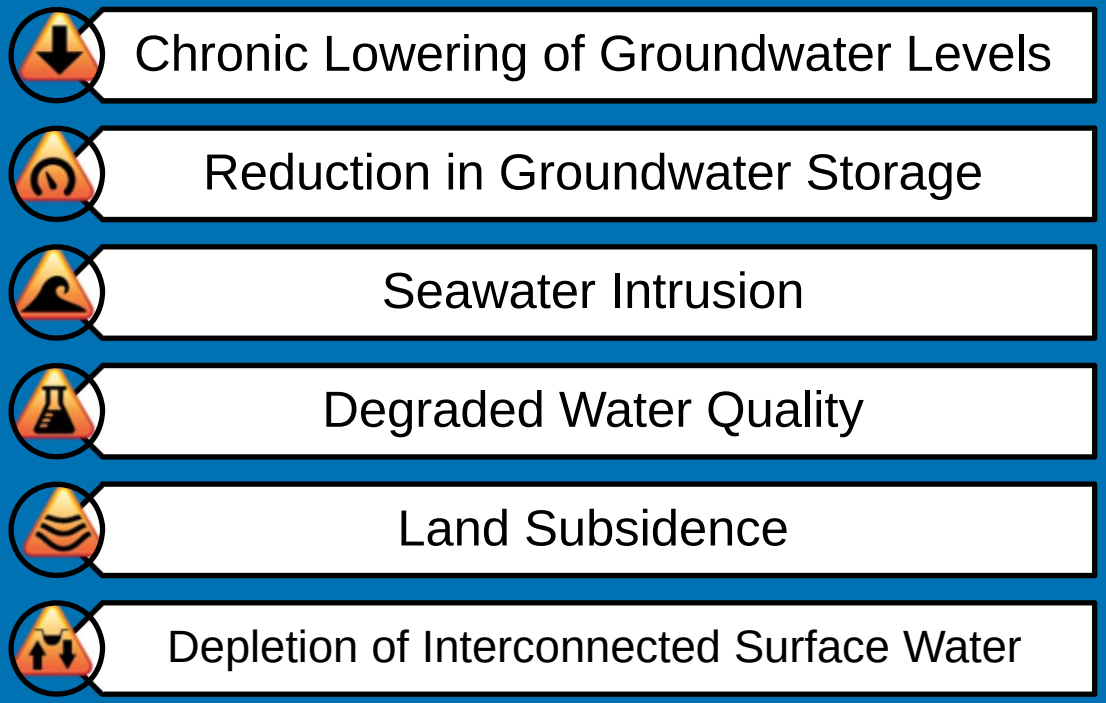


Working Exercise

Six “Sustainability Indicators” - Categories of Negative Groundwater-Related Impacts

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

- Will be described and managed through the GSP



Example GSA – Indicate which wells have had issues…

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

GSA: City of Lodi

Eastern San Joaquin GSA Well Locations (1992-Current)

Sustainability Indicator: Chronic Lowering of Groundwater Levels

1992 2015 Current

Please circle on the map, or indicate on an attached page, which wells, if any, have experienced issues related to the corresponding Sustainability Indicator. (For example, which wells, if any, have experienced issues related to chronic lowering of groundwater elevations? Which wells, if any, have experienced issues related to degraded water quality? What were the issues?)

Note: Many "inactive" wells have no reported measurements from 2015 to present in the DWR Water Data Library database used to construct this map. Many of these "inactive" wells may actually be active and have not reported measurements recently.

Legend

- GSA Extent
- Subbasin Boundary
- County Line
- Active Well
- Inactive Well

0 0.5 1 2 Miles

N

Approach for Projected Water Budget

GSP Water Budget Approach

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

Step 1	Identify future demands through 2040
Step 2	Identify supply projects with yield and timing
Step 3	Develop water budget from “current” (2015) to 2040

References Utilized

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

- Agricultural Water Management Plans
- Urban Water Management Plans
- Groundwater Management Plans
- Integrated Regional Water Management Plans
- Data directly from GSAs
- MokeWISE Water Availability Analysis
- Capital Improvement Programs
- General Plans

DMS Overview

Key DMS Success Criteria Go Beyond Requirements

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

Now

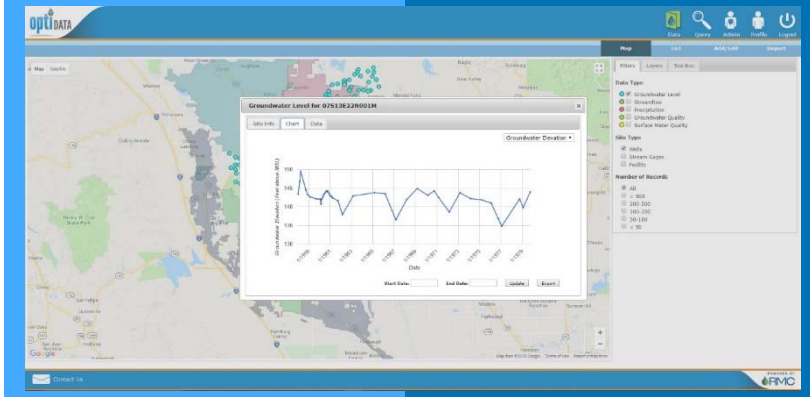
- Flexible and open one-stop-shop
- Transparent and efficient data entry and visualization
- Coordination and sharing
- Automated reporting

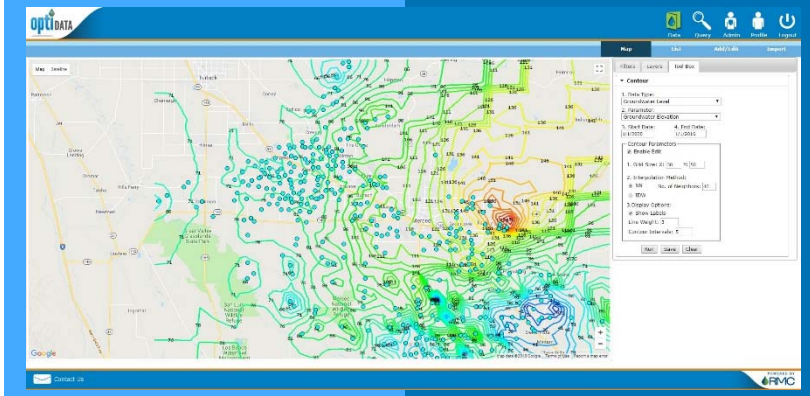
Future

- Sustainable groundwater management monitoring
- Ability to track undesirable results

Opti is a Ready-to-Use Proven Tool

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

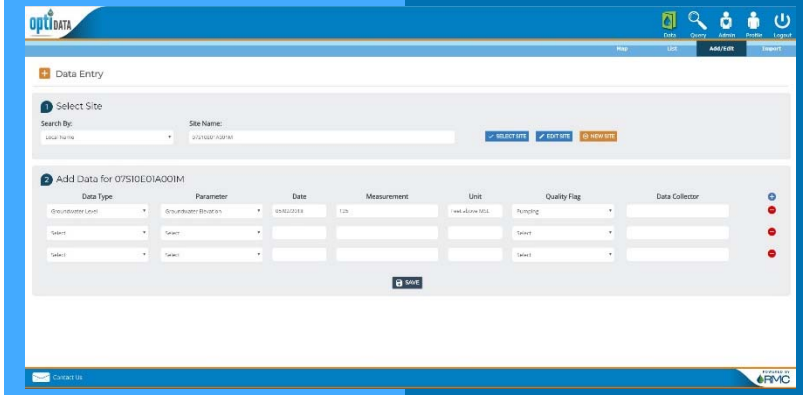


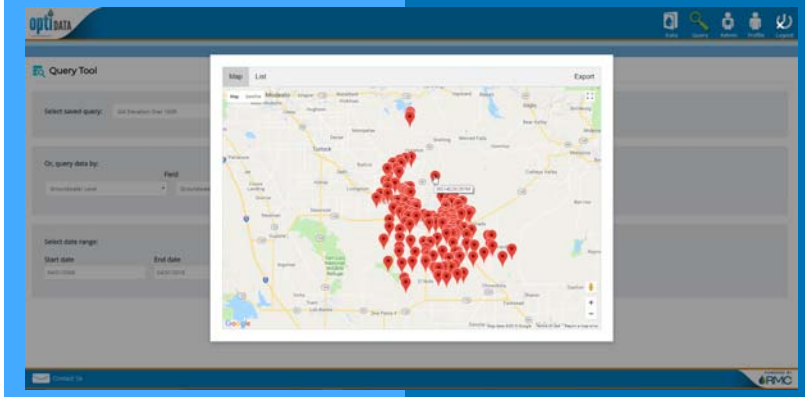


- 8 IRWM groups have used Opti, 3+ GSAs are implementing Opti
- Off-the-Shelf customized DMS to meet the specific needs of the Eastern San Joaquin Basin
- Meets all current phase Key Success Criteria
- Open platform enables future enhancements

Opti Features

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY





- Web-based, GIS-enabled
- Easy-to-Use
- Flexible Data Structure to Store and Manage Different Datasets
- User and Agency Security/Permissions
- Data Entry and Validation
- Visualization and Analysis
- Query and Reporting
- Framework to Link to other Data Management Systems and Modeling Results

DWR Technical Support Services Funding Update

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

- Designate a Basin Coordinator in May BOD
  - Recommendation from the Advisory Committee
- Draft application initiated with DWR
- Develop priority projects for potential funding
  - "Most challenging technical needs of the basin"
    - Monitoring wells – data gaps

Schedule Recap

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

JUNE ADVISORY COMMITTEE TOPICS

- Minimum Thresholds
- Projected Water Budget
- Data Management

Glossary of Terms

Understanding Key Terminology is Important

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

Measurable Objective

Groundwater Conditions

Sustainable Groundwater Management Act

Hydrogeologic Conceptual Model

Interim Milestone

Sustainability Indicator

Water Budget

Undesirable Results

Significant and Unreasonable

Minimum Threshold

Basin Settings

Margin of Operational Flexibility

Let's Talk Terminology

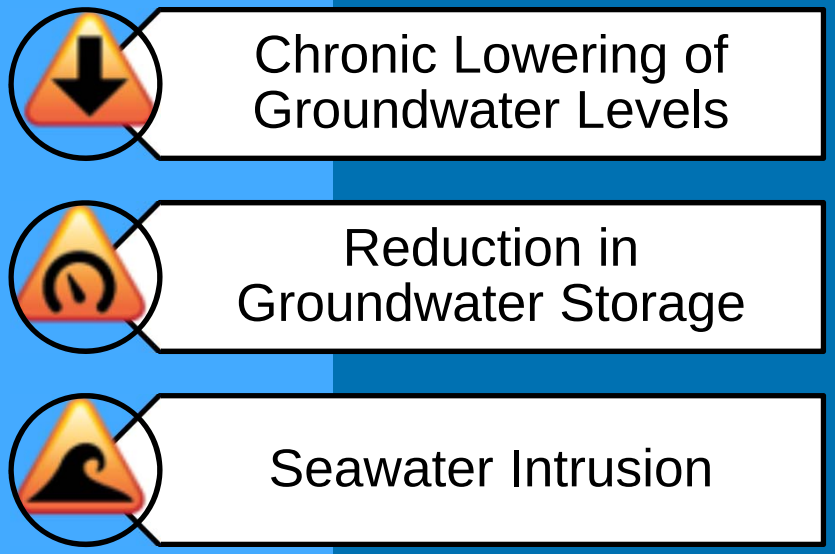
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

- Why are terms important?
  - Established by regulation
  - Used by regulators during GSP review
  - Consistency of terms assists SGMA discussion

- Important to understand is the relationship between:
  - Sustainability Indicators
  - Undesirable Results
  - Minimum Thresholds
  - Measurable Objectives
    a. Interim Milestones
    b. Margin of Operational Flexibility
  - Monitoring Network

Undesirable Results are Significant and Unreasonable Impacts

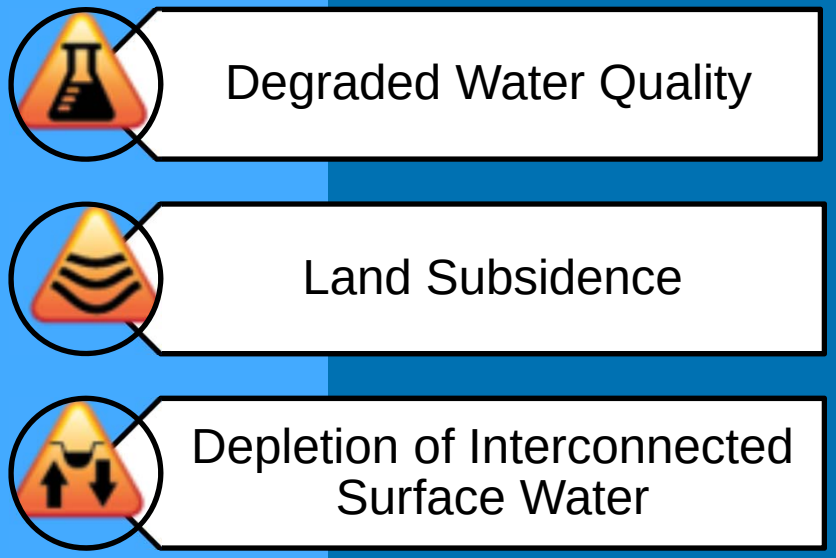
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY



- "Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon"
- "Significant and unreasonable reduction in groundwater storage"
- "Significant and unreasonable seawater intrusion"

Undesirable Results are Significant and Unreasonable Impacts

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY



- "Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies"
- "Significant and unreasonable land subsidence that substantially interferes with surface land uses"
- "Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water"

Minimum Thresholds

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- Point at which undesirable results may begin to occur
- The lowest the basin can go at this monitoring point without something significant and unreasonable happening to groundwater
- Quantitative thresholds

Measurable Objectives are 2040 targets that provide a buffer to prevent Undesirable Results

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- Establish the high side of an operating margin that the basin will be managed to in order to prevent undesirable results (above the minimum thresholds)
- Quantitative targets

Interim Milestones are established to chart progress toward meeting objectives

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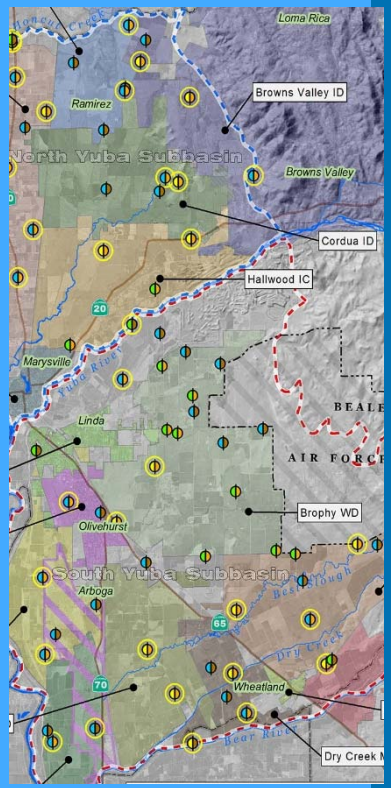
- Interim Milestone
  - Interim Milestones are the 5 year targets for the Measurable Objective
- Margin of Operational Flexibility
  - Margin of Operational Flexibility is the space between the measurable objective and the minimum threshold

Monitoring Network

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY



- Is used to monitor for conditions that would cause undesirable results
- Must address the six sustainability indicators
- Adequate spatial and temporal coverage for each primary aquifer
- Need minimum thresholds and measurable objectives for each monitoring point used in the network