
GWA
EASTERN SAN JOAQUIN
GROUNDWATER AUTHORITY
GWA Advisory Committee
August 8, 2018

Agenda

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

- Approval of July Meeting Minutes
- Minimum Thresholds
- Hydrogeologic Conceptual Model
- Projected Water Budget
- Project and Management Actions
- September Agenda Items

Minimum Thresholds

Developing Minimum Thresholds is an Iterative Process

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Proposed Groundwater Levels Threshold - Objectives

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- Understand work completed to date
  - Preliminary threshold
  - Preliminary monitoring locations

- Review and confirm with your GSA leadership prior to next meeting
  - A file with GSA details will be emailed to each within the week (GSA map, full basin map, file with data for wells)

Threshold Development

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- Mapped lowest elevation of 1992 or 2015
- Met with GSAs to confirm understanding
- Developed alternative methodology with high/stable groundwater elevations (variance of last 5 years of data applied to lowest level recorded as a buffer)
- Identified monitoring locations for groundwater thresholds

Proposed Monitoring Well Selection

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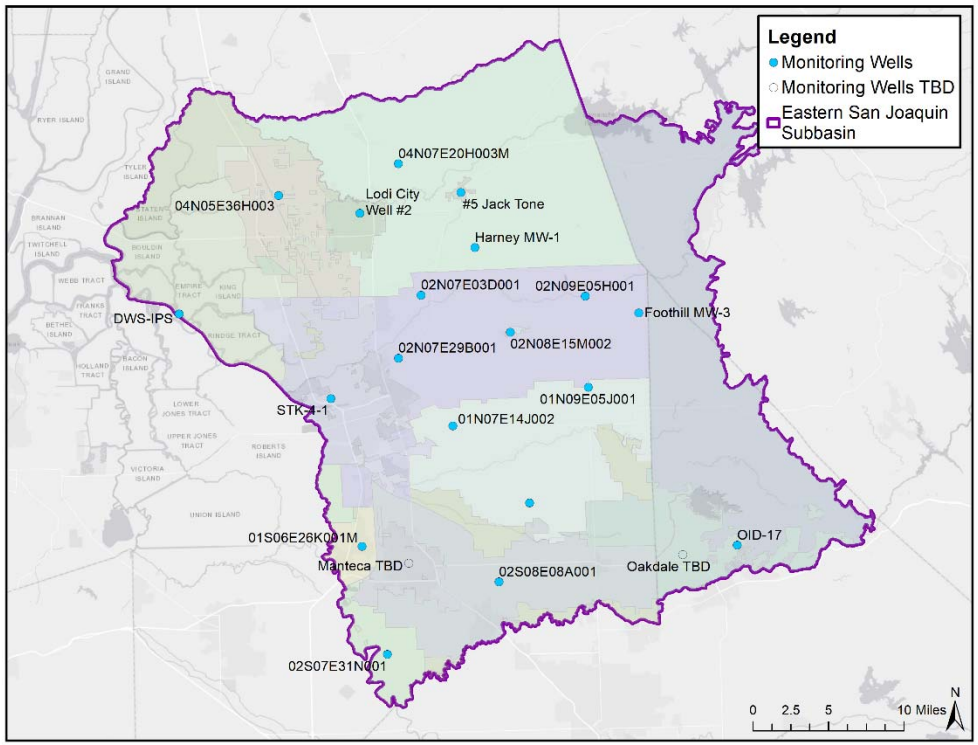

Well Characteristics

- Spatial representation (>1 well per GSA)
- Wells selected are CASGEM where available (pre-screened/selected by County during CASGEM process)
- Wells have representative behavior of area
- Good historical record
- Well construction information

Proposed Groundwater Elevation Thresholds – First Iteration

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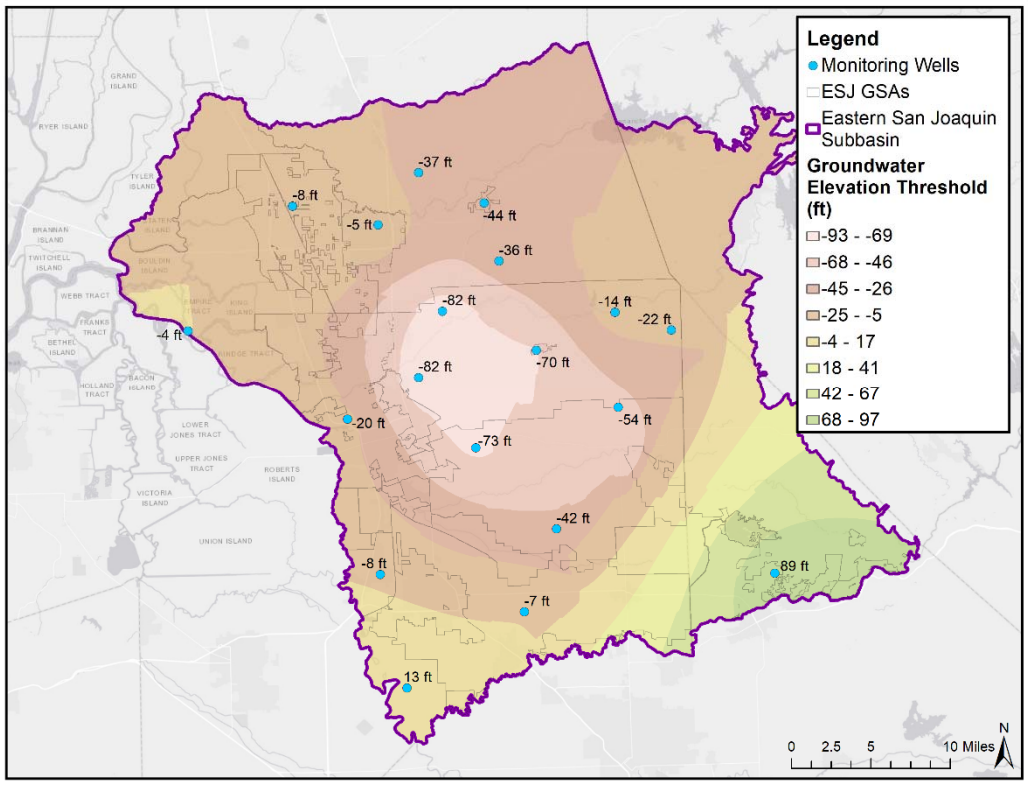

Proposed Groundwater Elevation (as DTW) Thresholds

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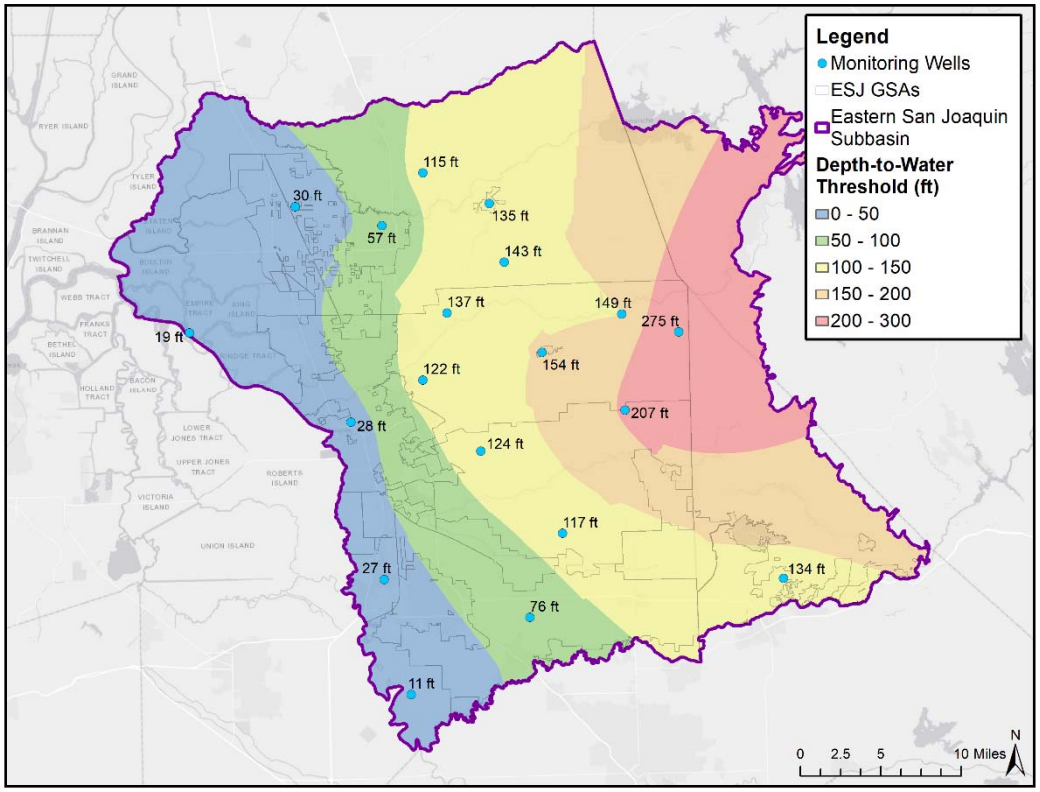

Preliminary Thresholds Compared to Current DTW

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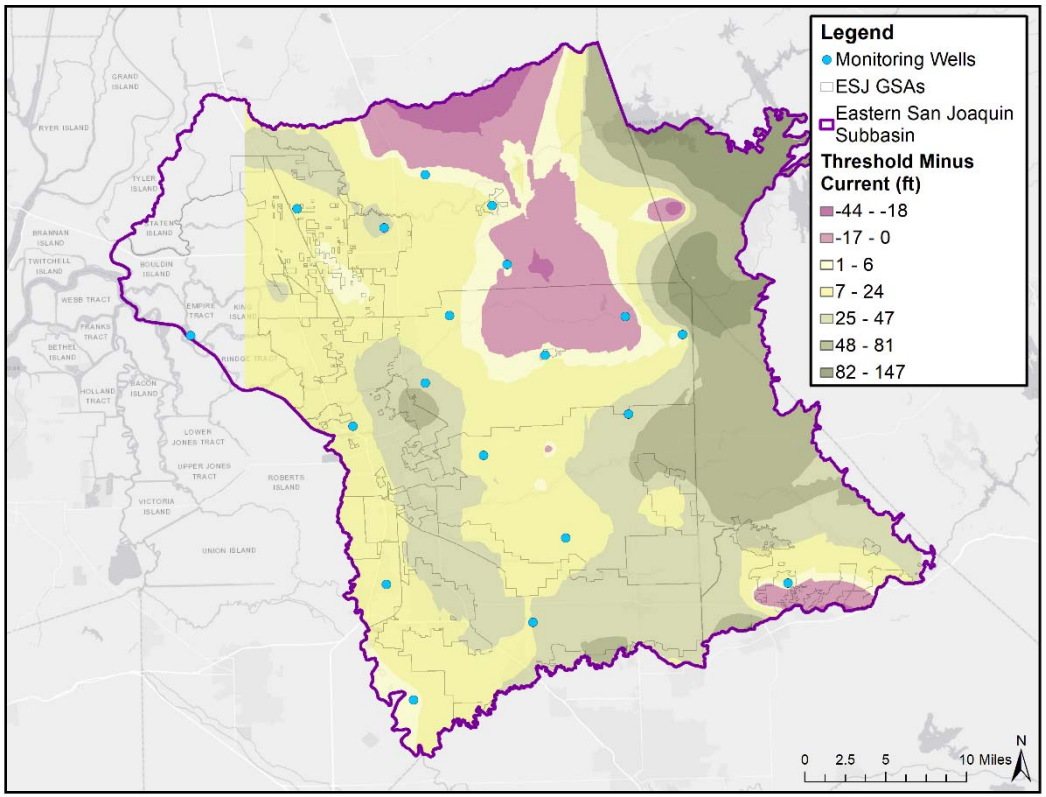

Average Domestic Well Depth

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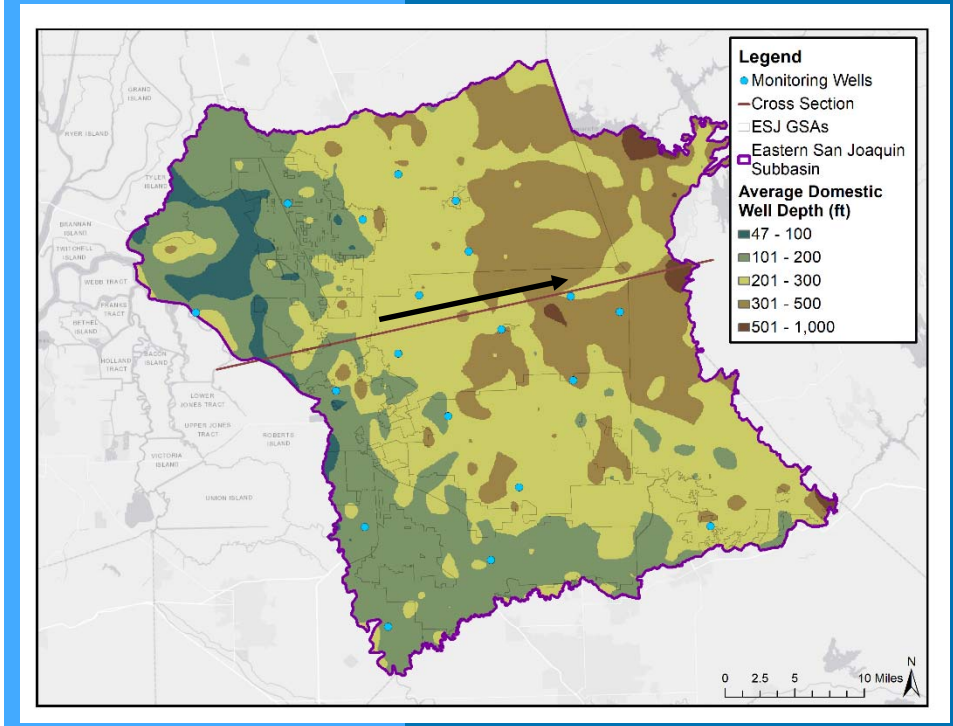

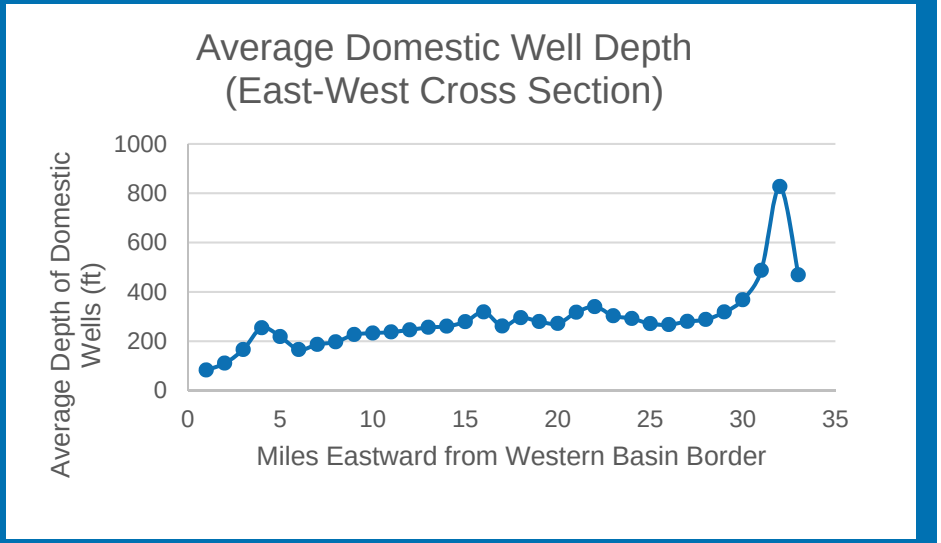

Source: OSWCR

Comparison of Proposed Threshold and Domestic Well Depth

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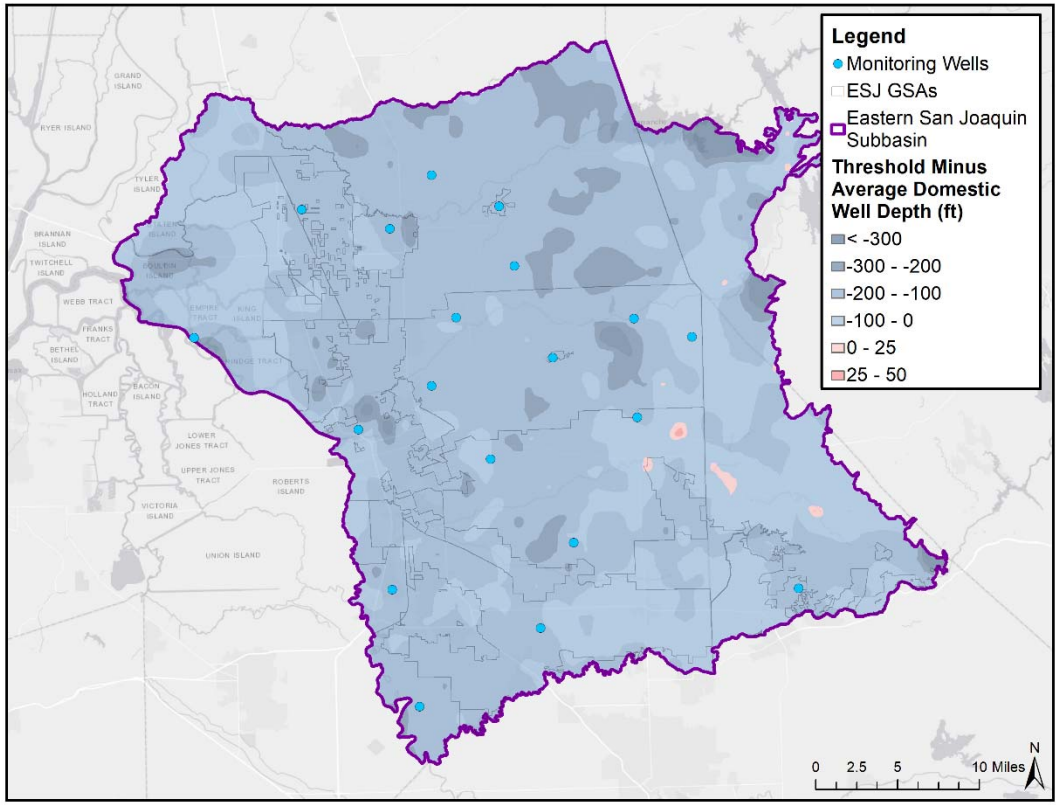

Assessing GDEs

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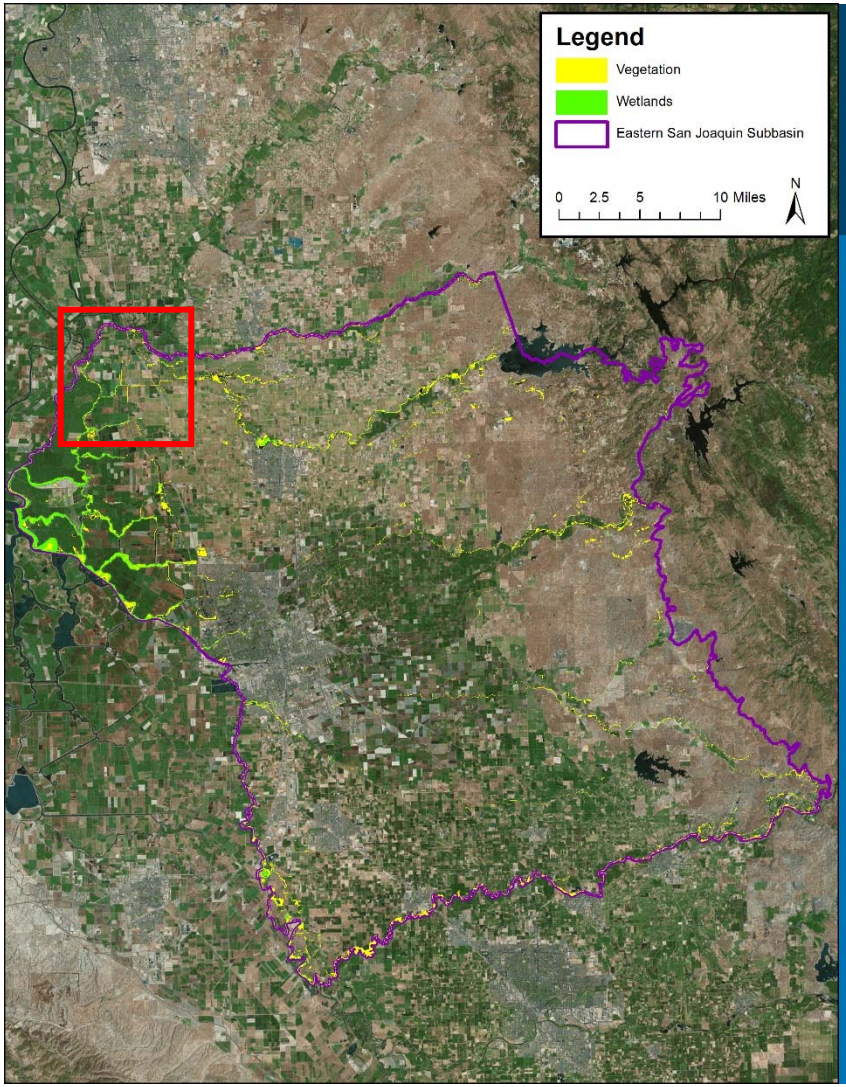
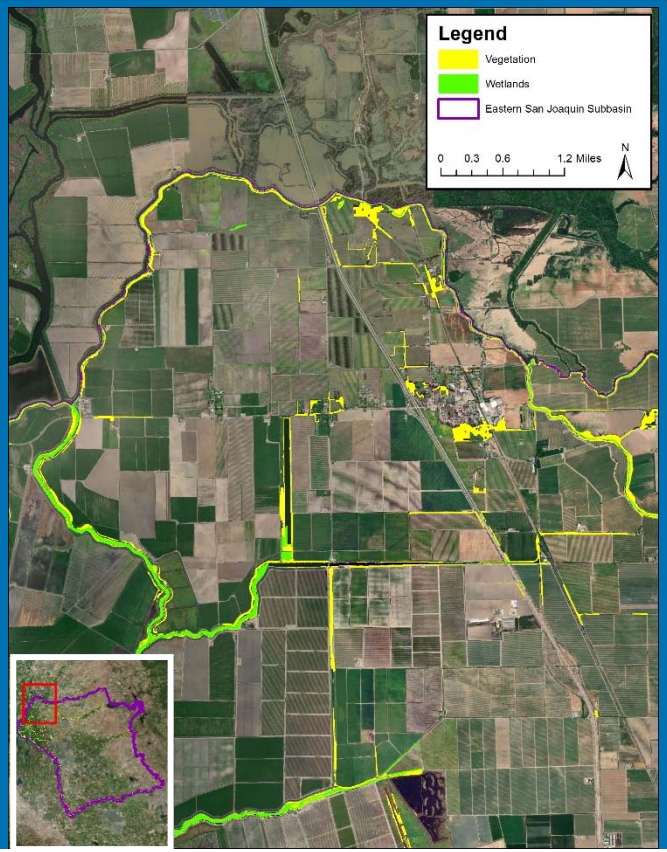
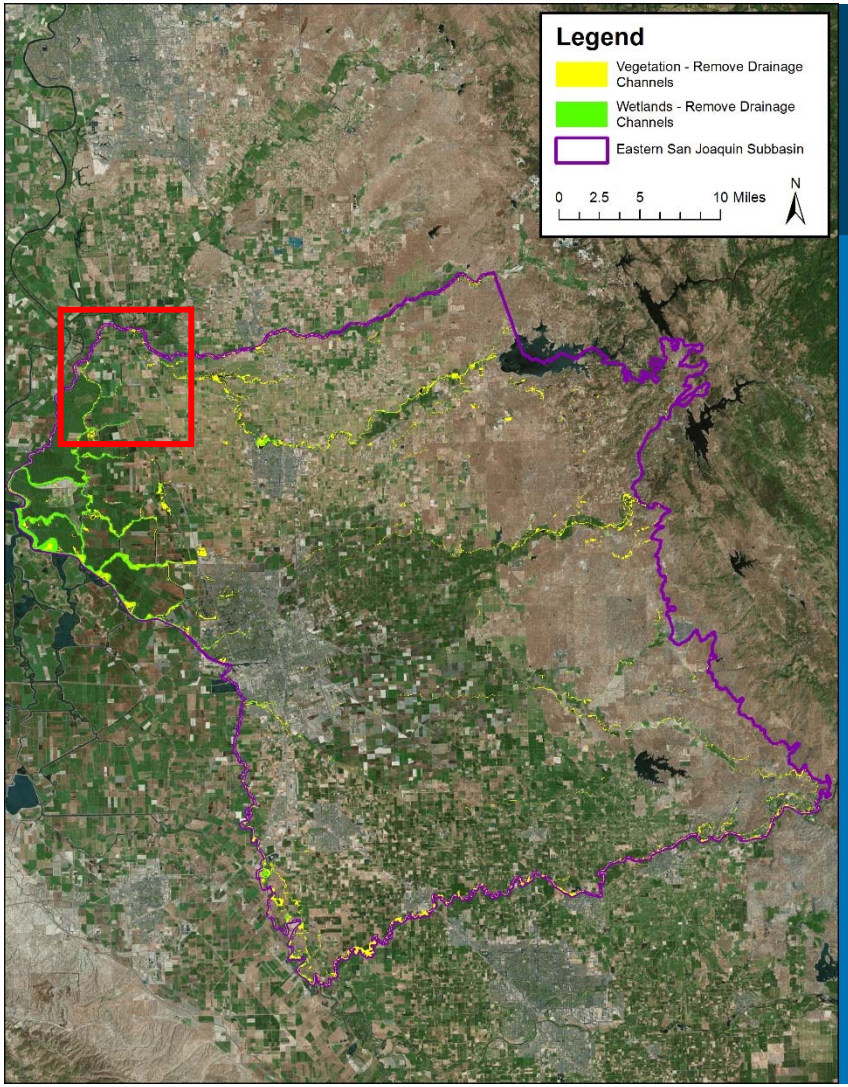
- Started with data from The Nature Conservancy and ground-truthing to eliminate obvious non-GDE areas
  - Removed drainages, canals
  - Applied 300-ft buffer from losing stream midlines

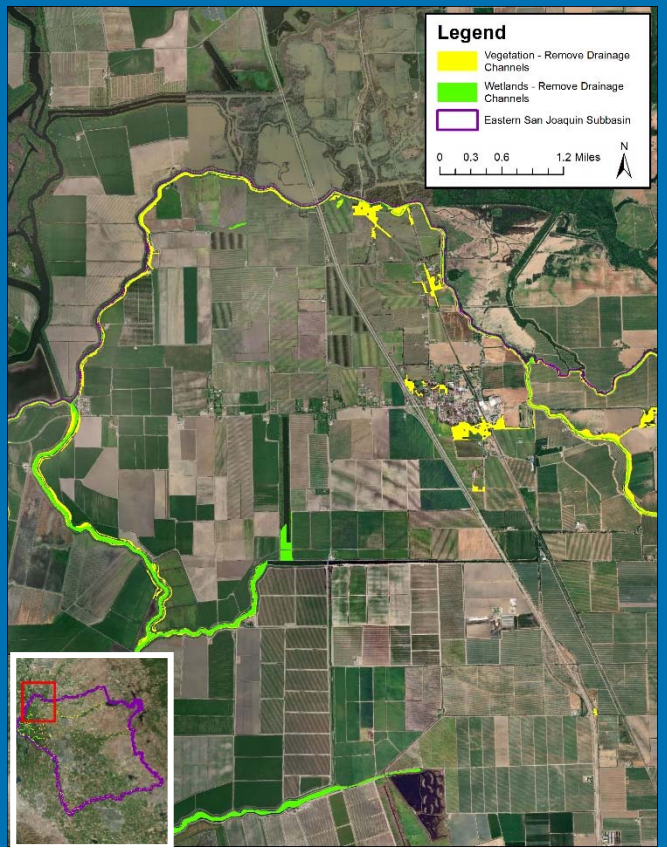
GDE Locations (TNC Data)



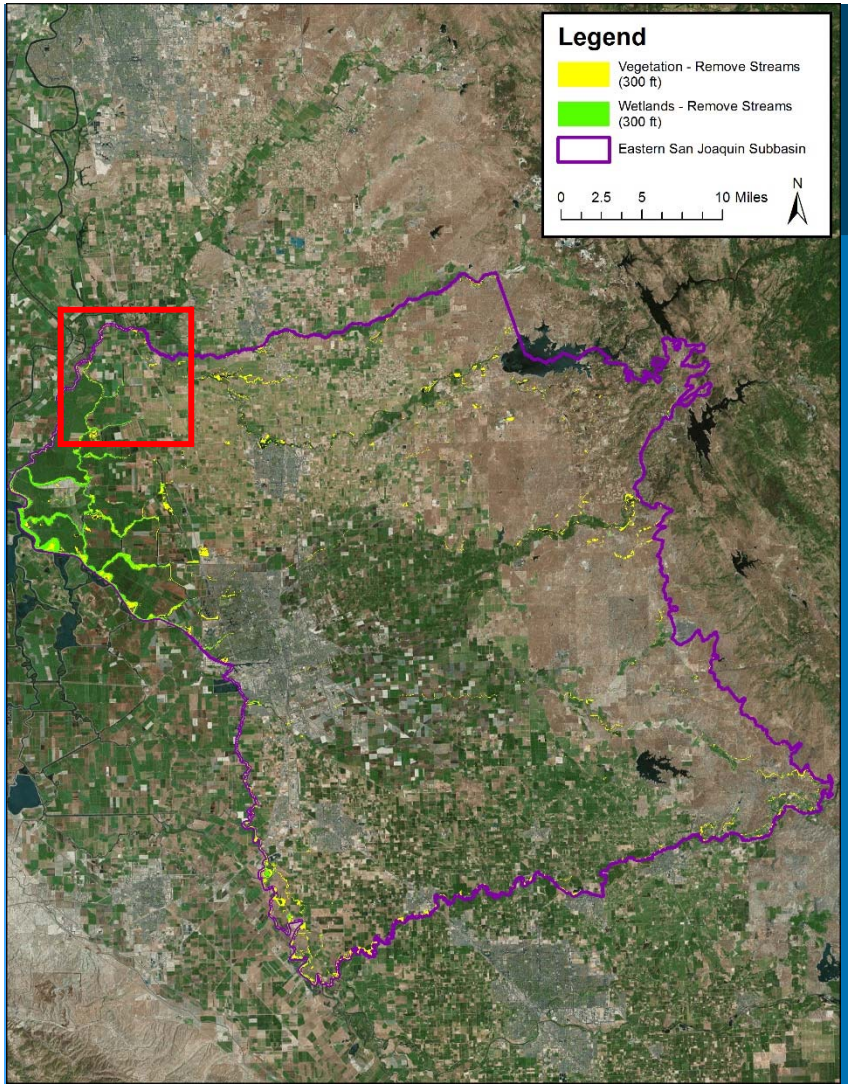


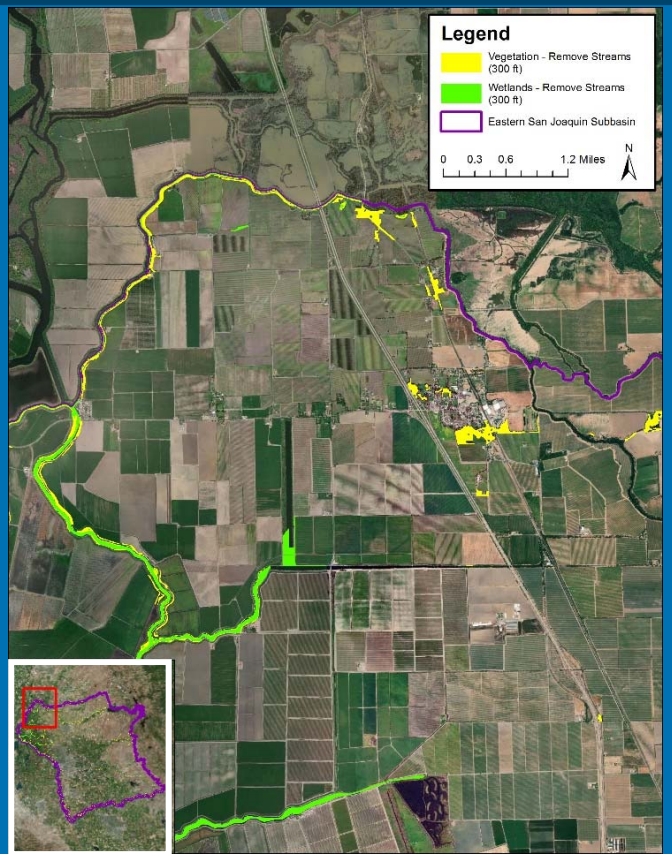
Drainages Removed





Losing Streams Removed with 300 ft Buffer





GDE Next Steps

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- Review buffer width
- Review shallow GW levels adjacent to remaining potential GDEs
- Coordinate with Department of Fish and Wildlife to prioritize areas with highest ecological value

What Comes Next?

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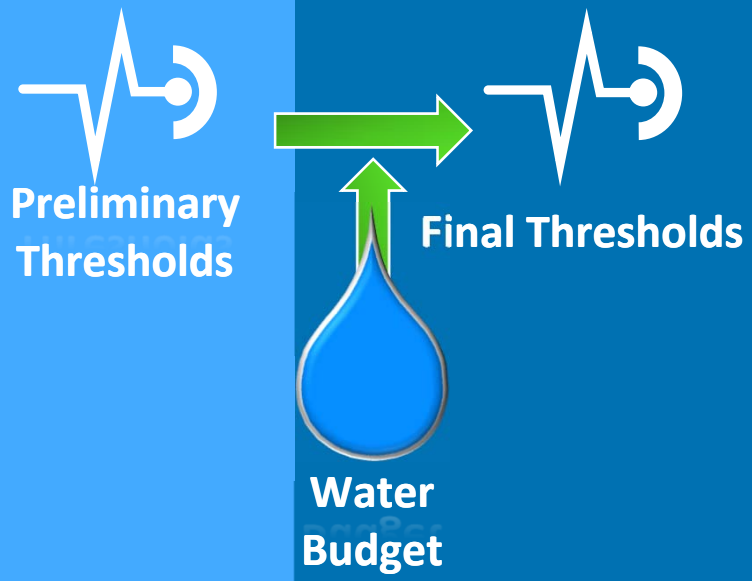

- Projected Water Budget will be used to understand average sustainable pumping rates basin-wide
- Projects and Management Actions need to be identified to include supply and demand-side measures to achieve sustainability
- Depending on rate of project implementation, groundwater elevation thresholds may need to be adjusted

Rate of Plan Implementation May Necessitate Changes in GW Elevation Thresholds

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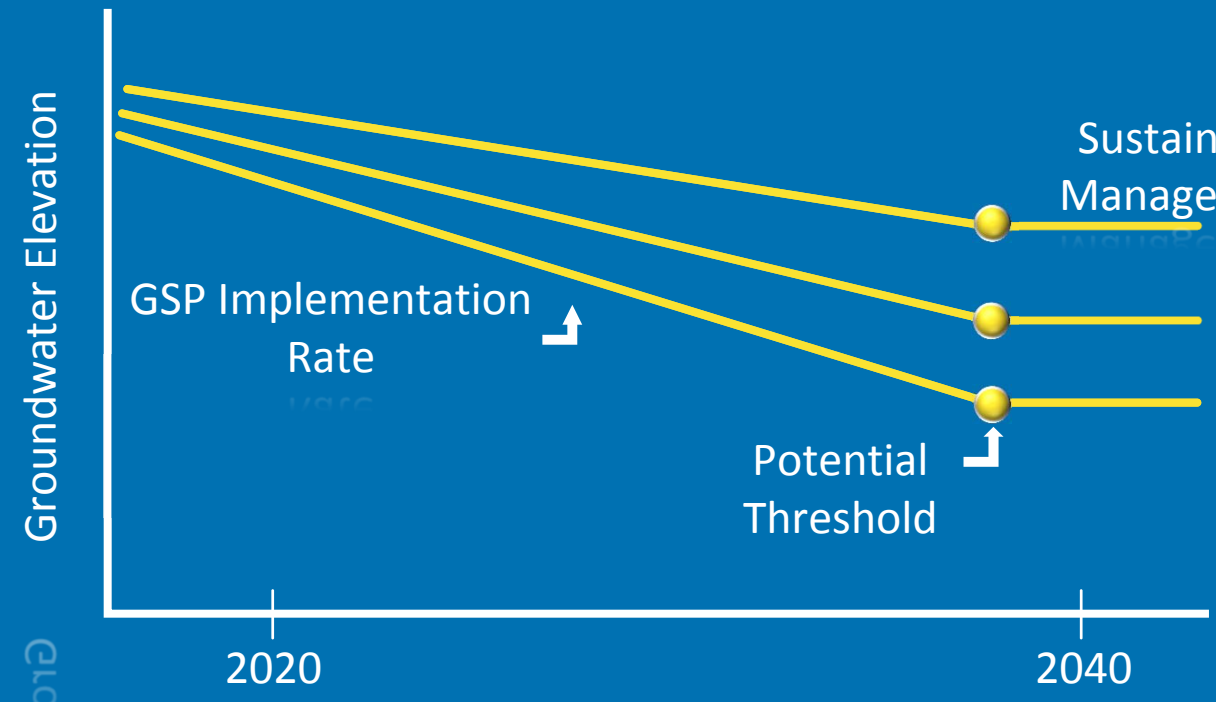

Minimum Threshold will be Adjusted based on Projected GWE

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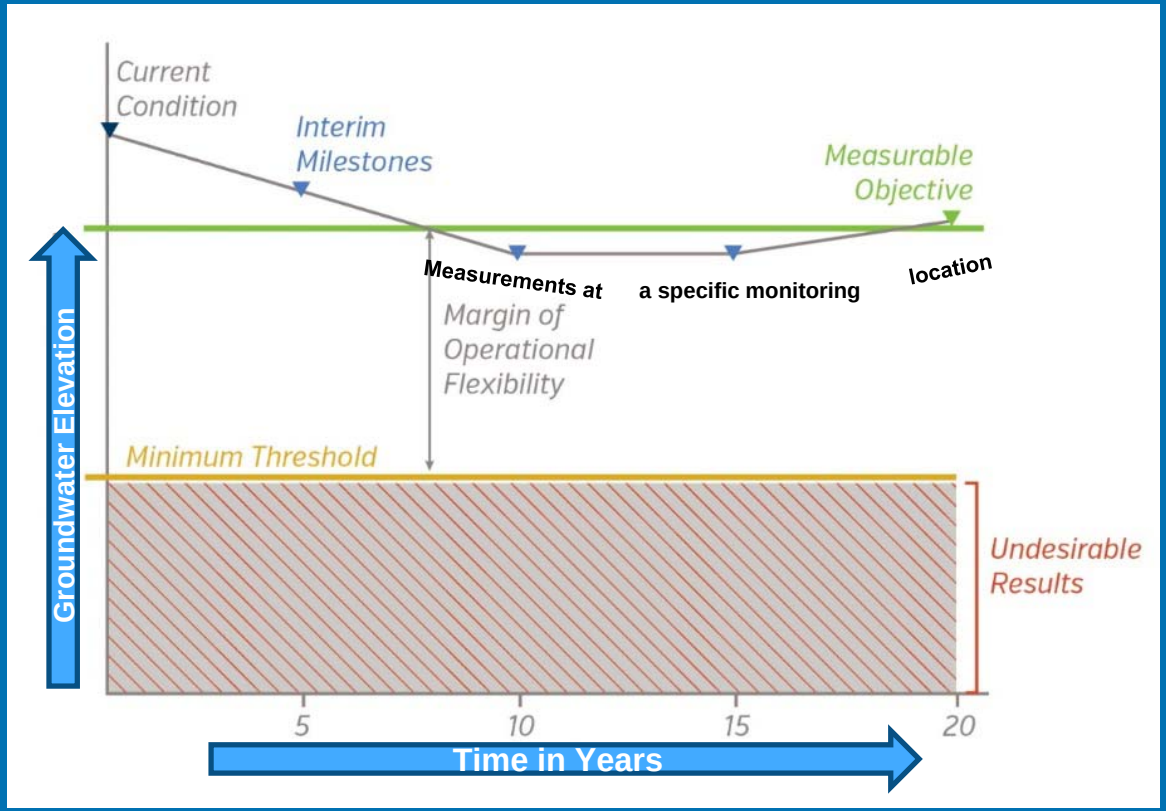

Next Steps for GWE Thresholds

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- Proposed as starting point
- Review and confirm with your GSA leadership prior to next meeting
  - A file with GSA details will be emailed to each within the week (GSA map, full basin map, file with data for wells)
- Overlay GDE information

Minimum Thresholds for Sustainability Indicators

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- Chronic Lowering of Groundwater Levels
- Reduction in Groundwater Storage
- Seawater Intrusion
- Degraded Water Quality
- Land Subsidence
- Depletion of Interconnected Surface Water

Undesirable Results for Degraded Water Quality

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Degraded Water Quality

Why is this a concern? What are we trying to avoid?

- **Localized salinity issues – connate water and delta brackish water intrusion from reduced water levels**
- **Nitrates – septic and agricultural historical issues. Being addressed through CV SALTS and Irrigated Lands programs.**

Water Quality Recap

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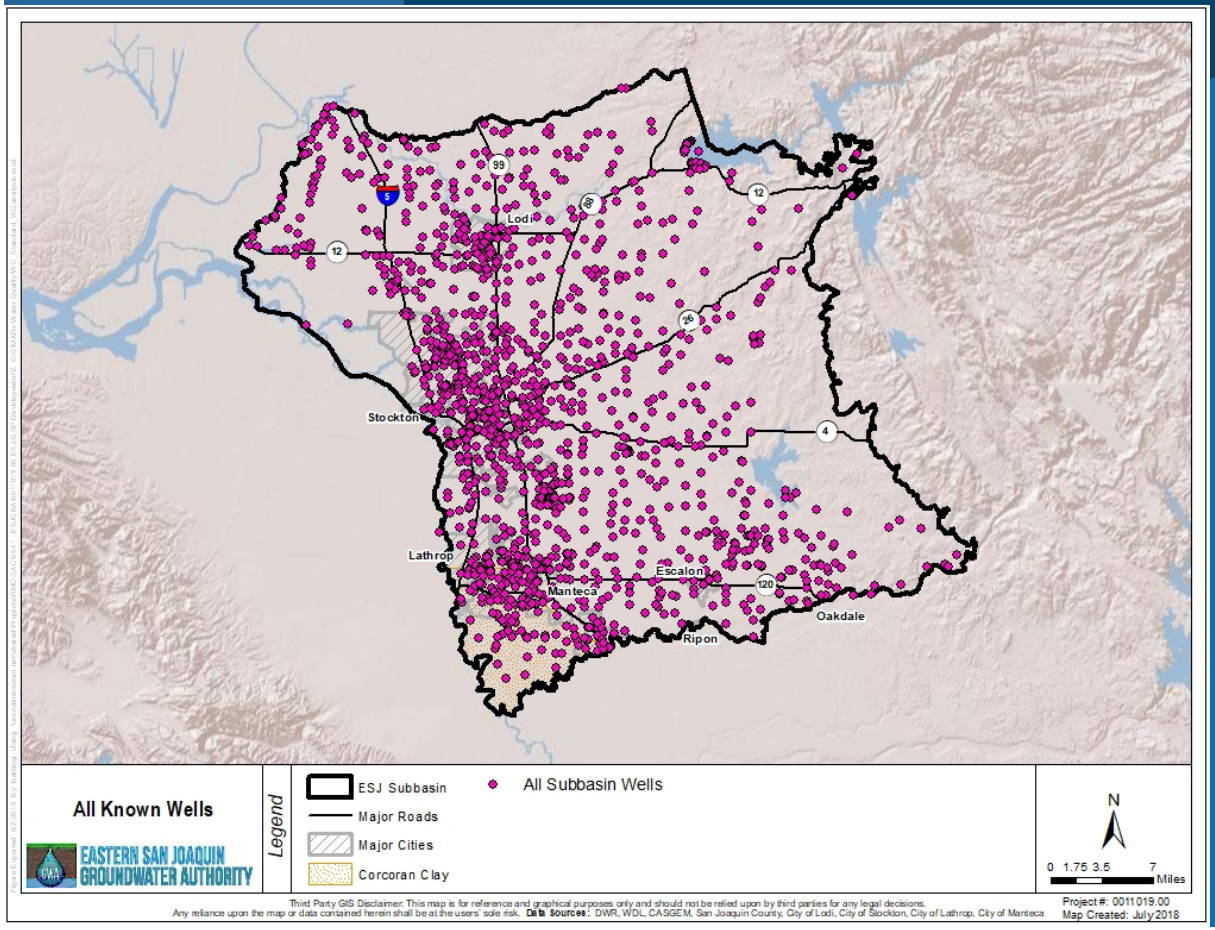
Focused on salinity – using TDS &/or Chloride

3 main sources of salinity:

1. High-Chloride Water from San Joaquin Delta Sediments
2. High-Chloride Water from Deep Deposits
3. Irrigation Return Water

All Known Wells



All wells, including wells:

- With & without WQ data
- With & without depth information

In general, lack of wells in the east and northwest

Known Wells – By Data Type

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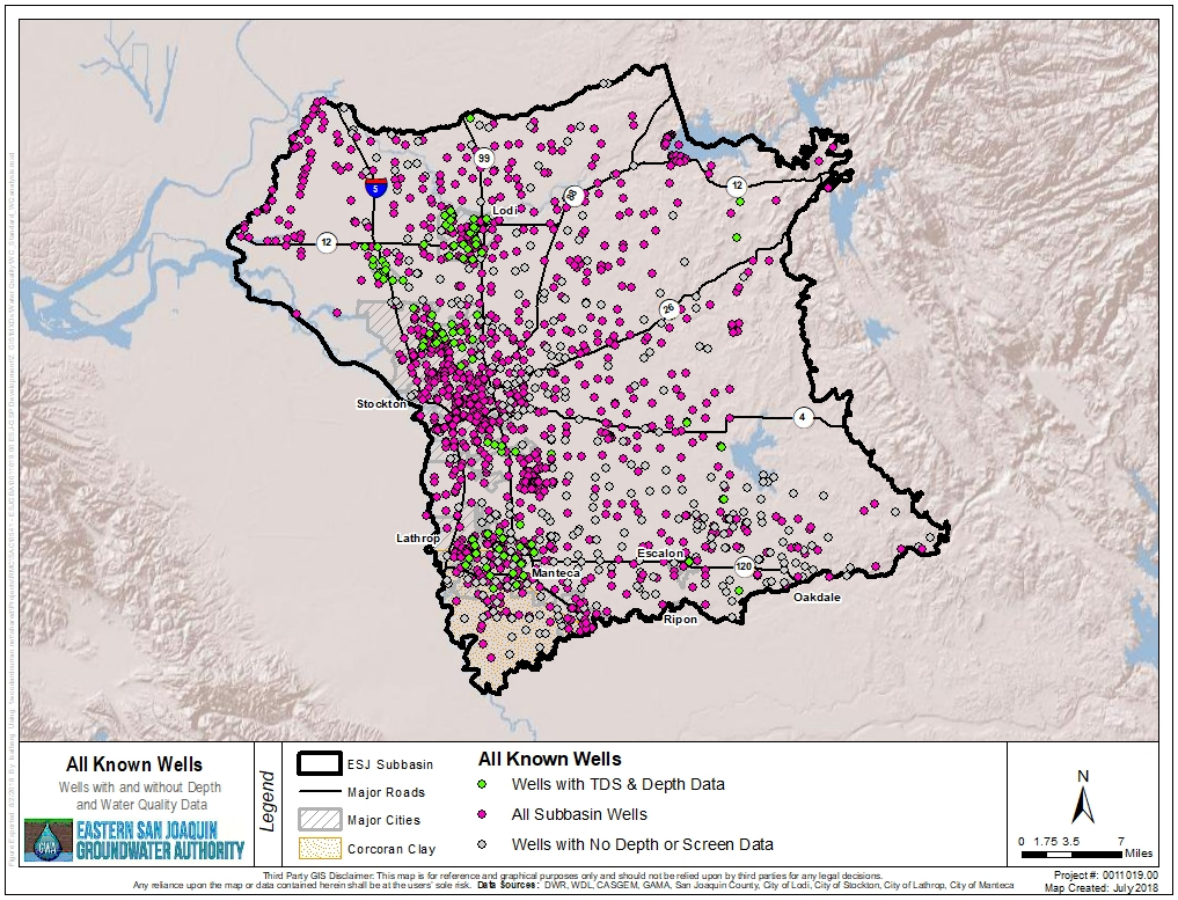

Wells with both depth and TDS data are shown in green and are limited to urban centers.

Max. TDS Concentrations 2008 - 2018

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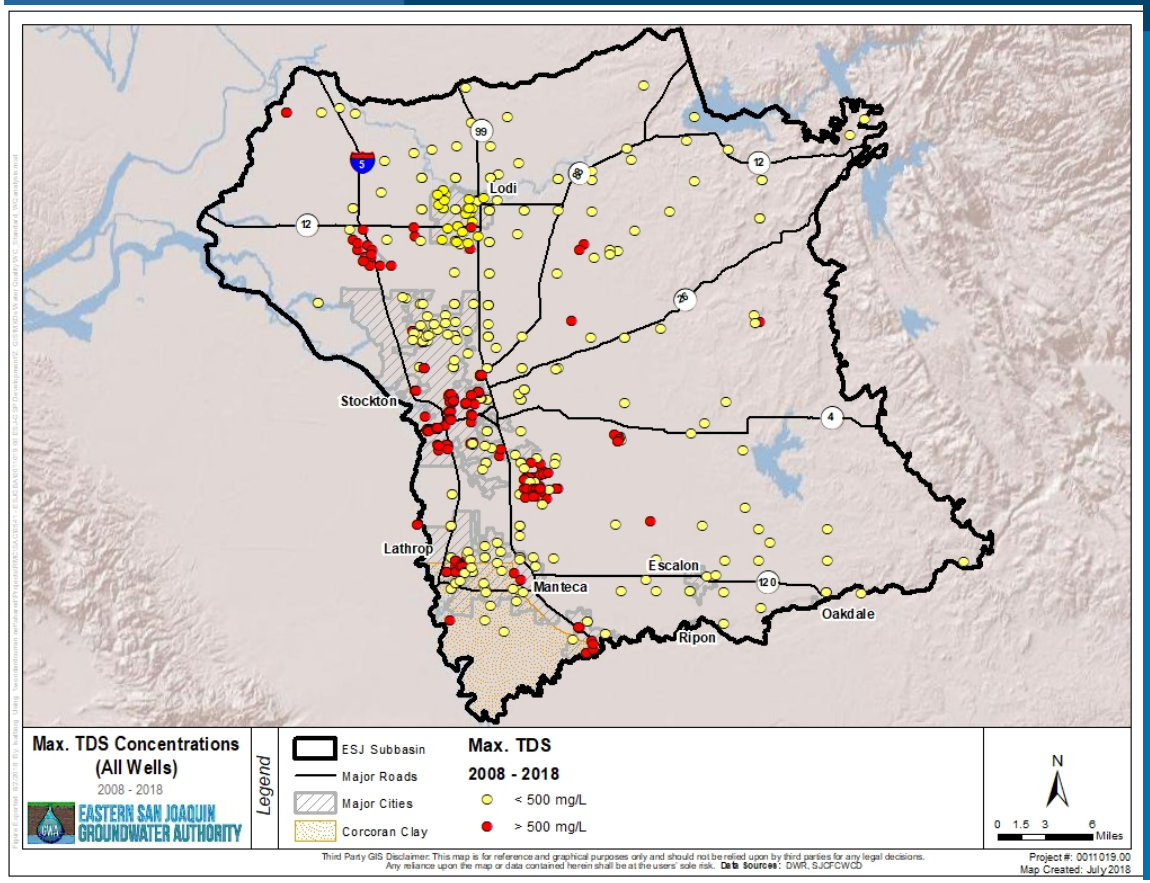

TDS exceedances are generally found in the western half of the Subbasin

Average TDS Concentrations 2015 - 2018

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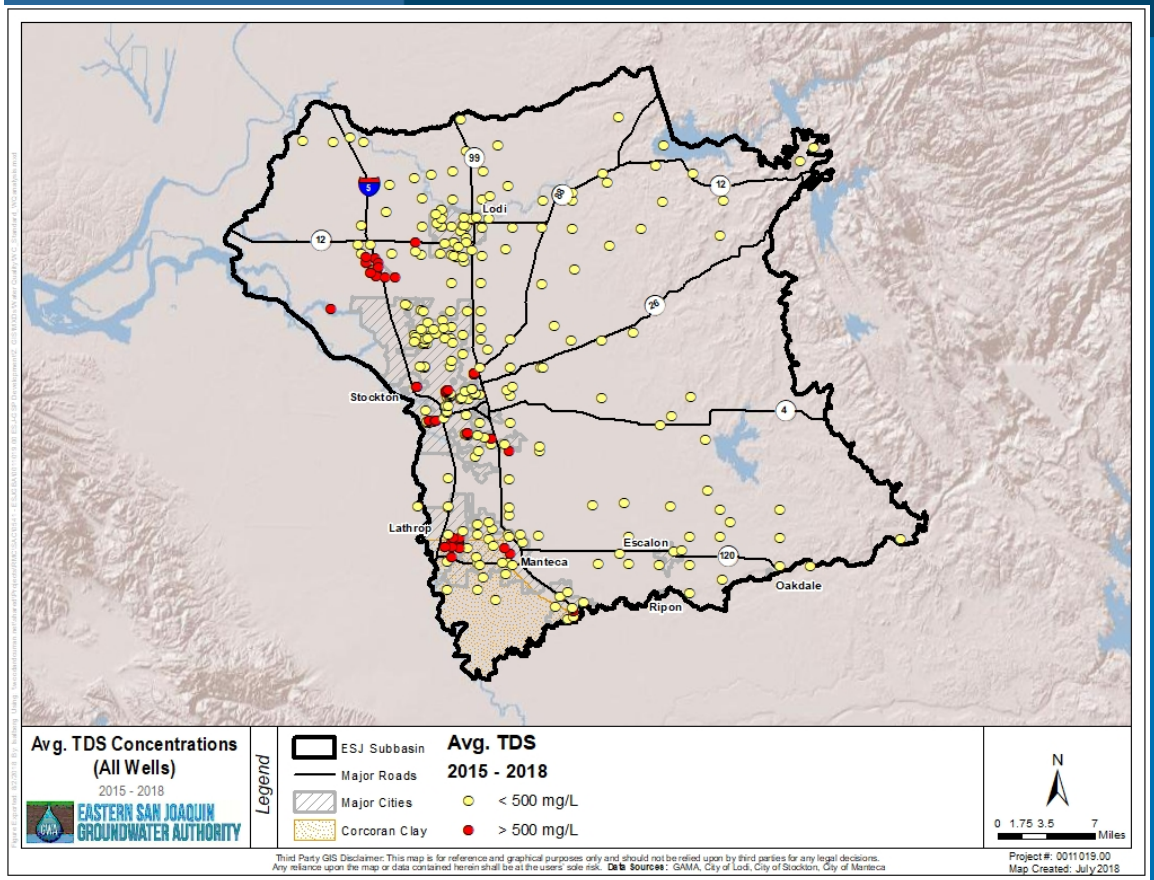

No TDS exceedances in the eastern half of the subbasin

TDS – Shallow Wells

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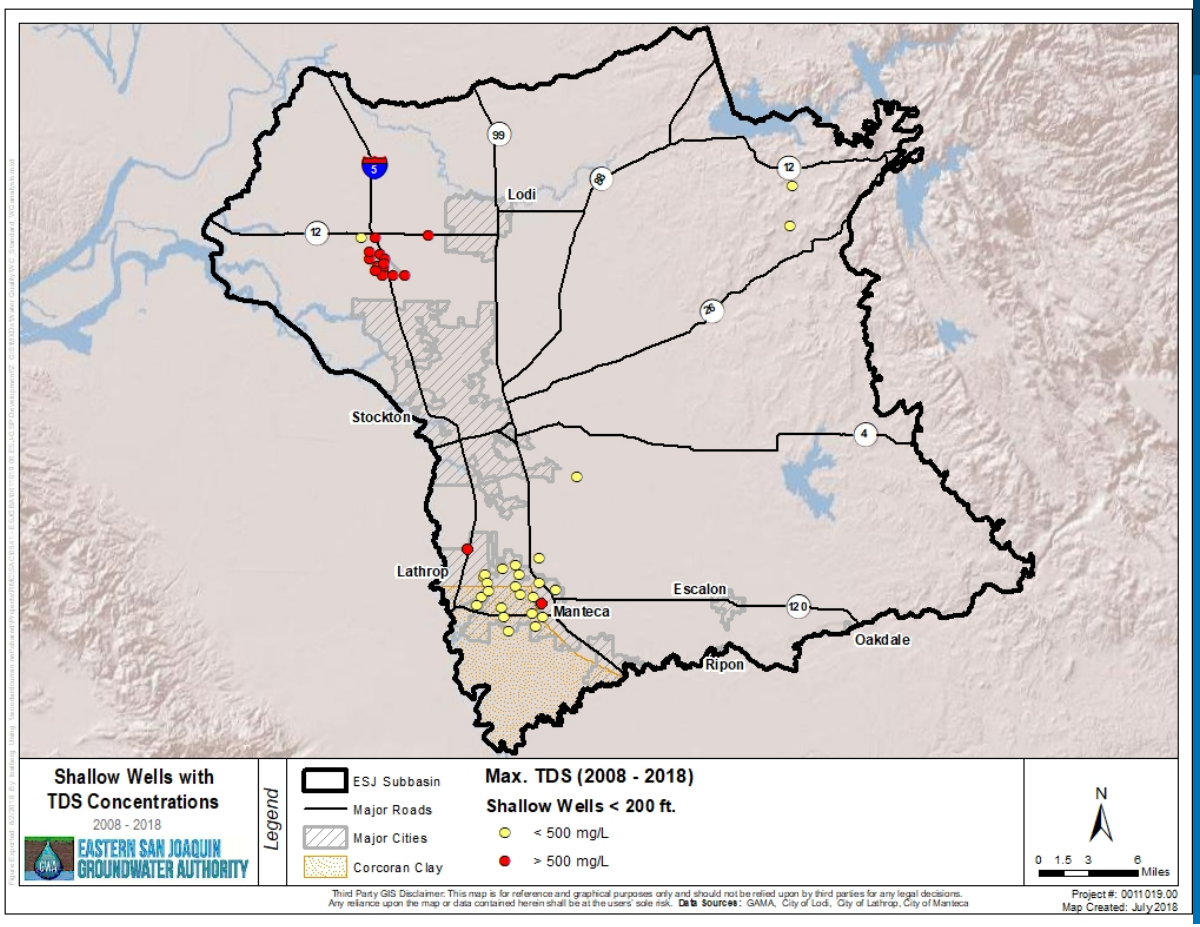

TDS – Deep Wells

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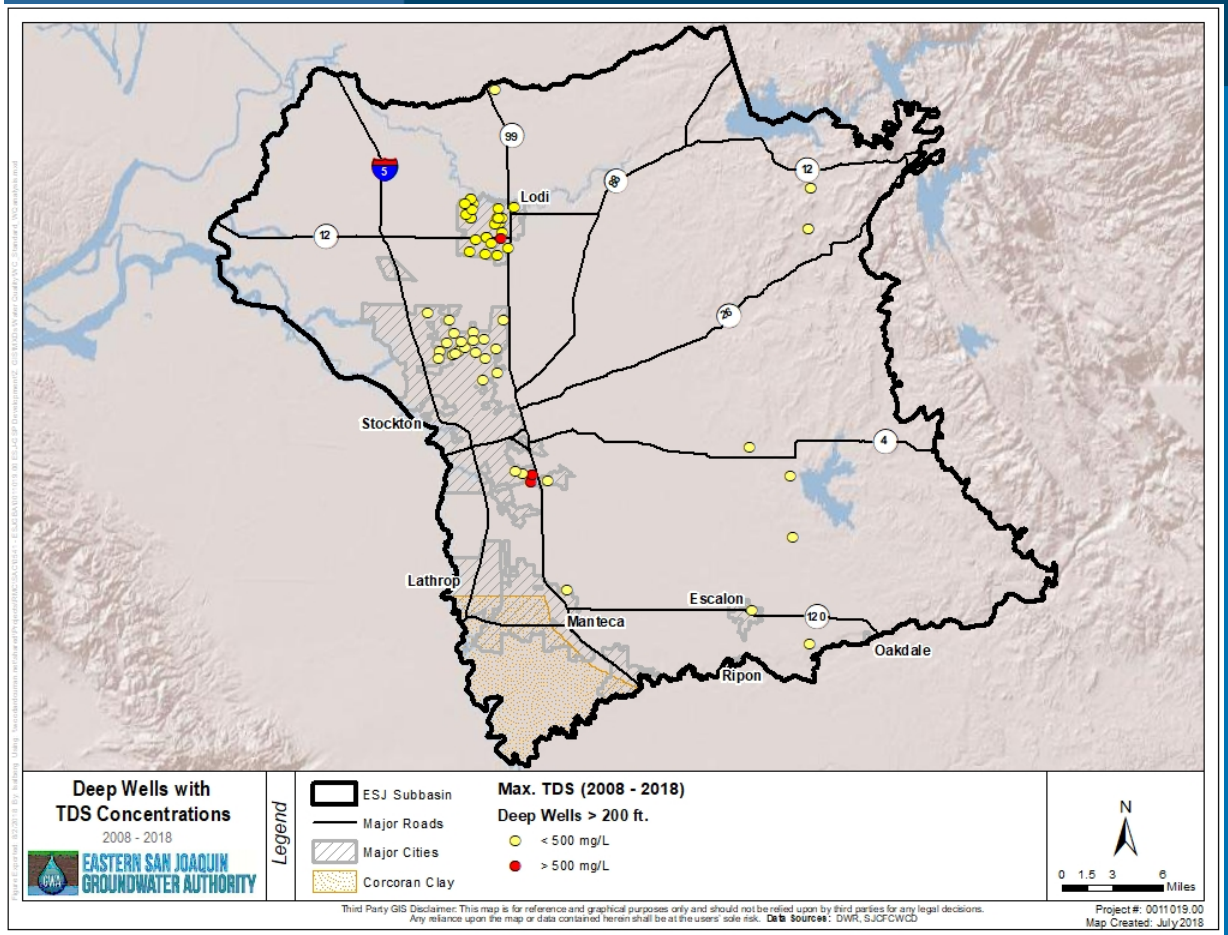

Proposed Monitoring Wells

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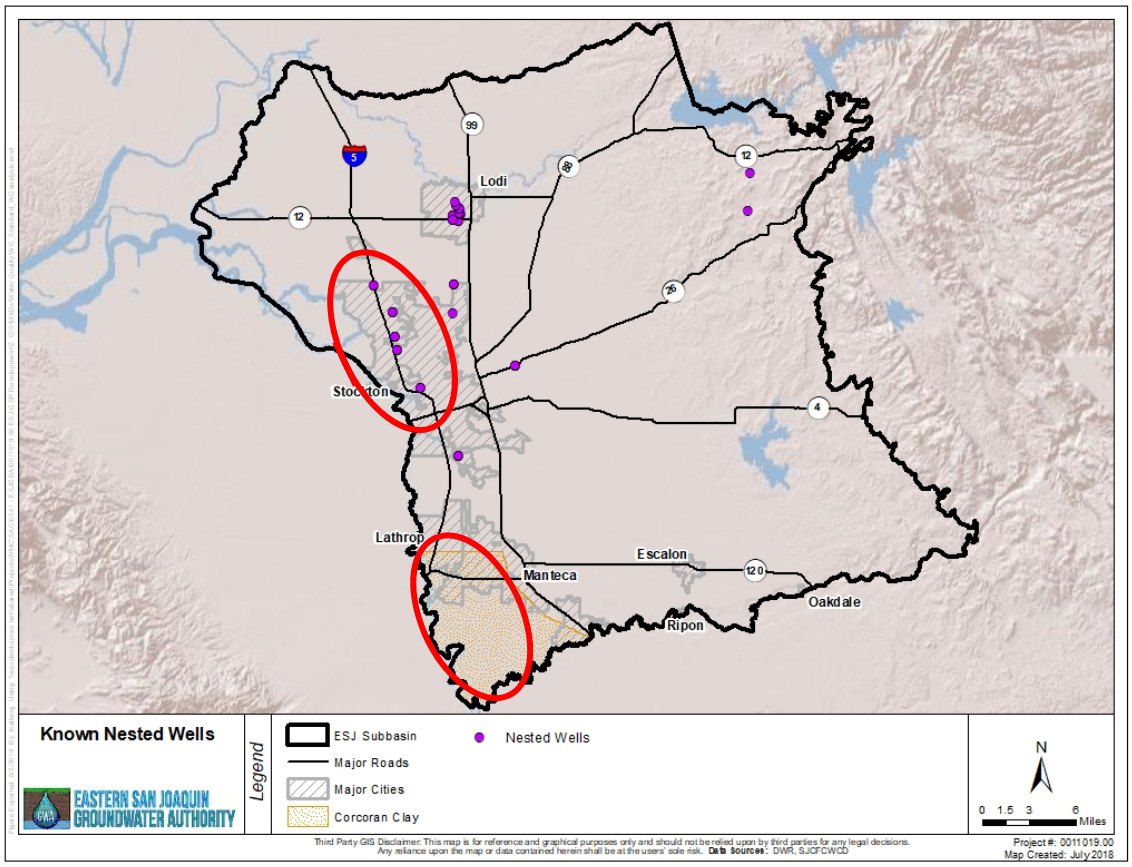

Known nested wells are located in Stockton & Lodi

Lack of known wells in the southwest of Subbasin

Work to identify wells currently monitored by:

- Cal Water
- City of Lodi
- City of Manteca
- City of Stockton

“Active” Groundwater Contamination Sites

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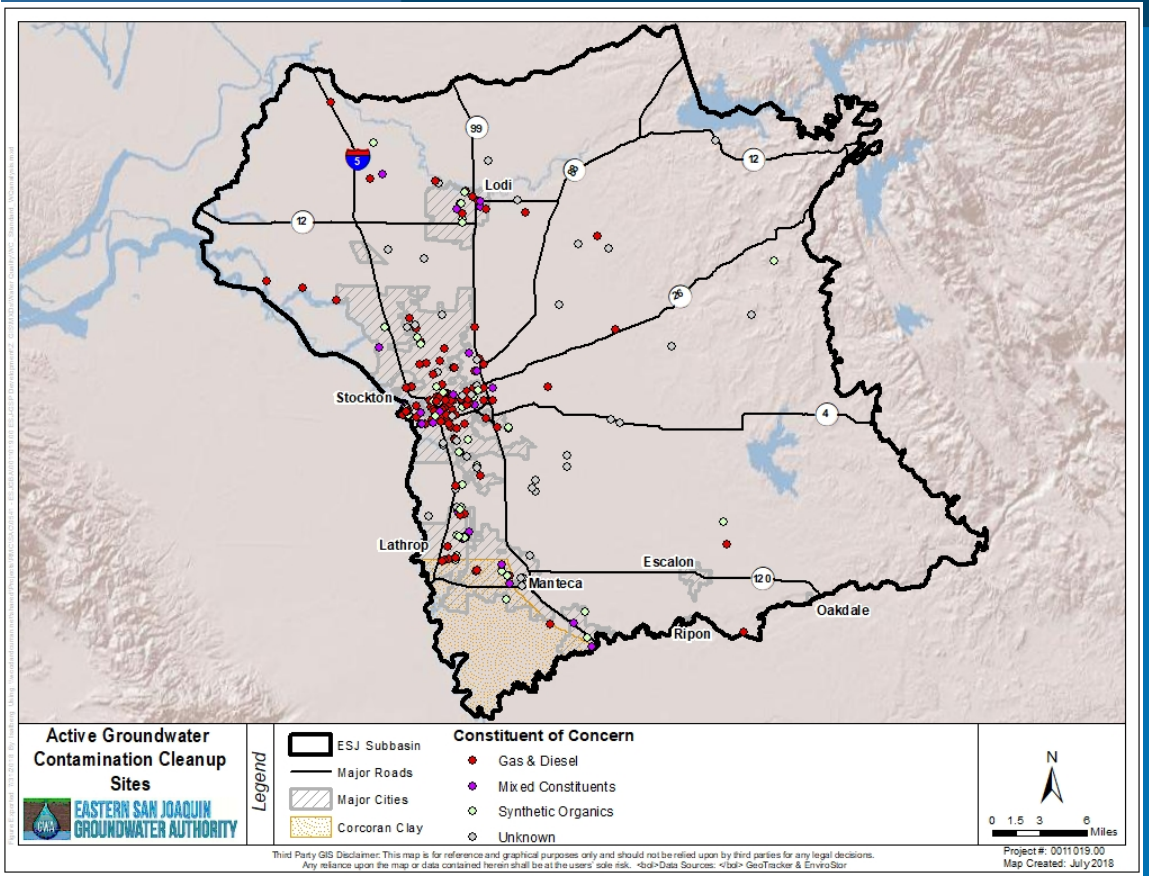

Identifies sites undergoing investigation and those with voluntary & mandatory cleanup orders

258 active sites in the Subbasin

Potential Plumes

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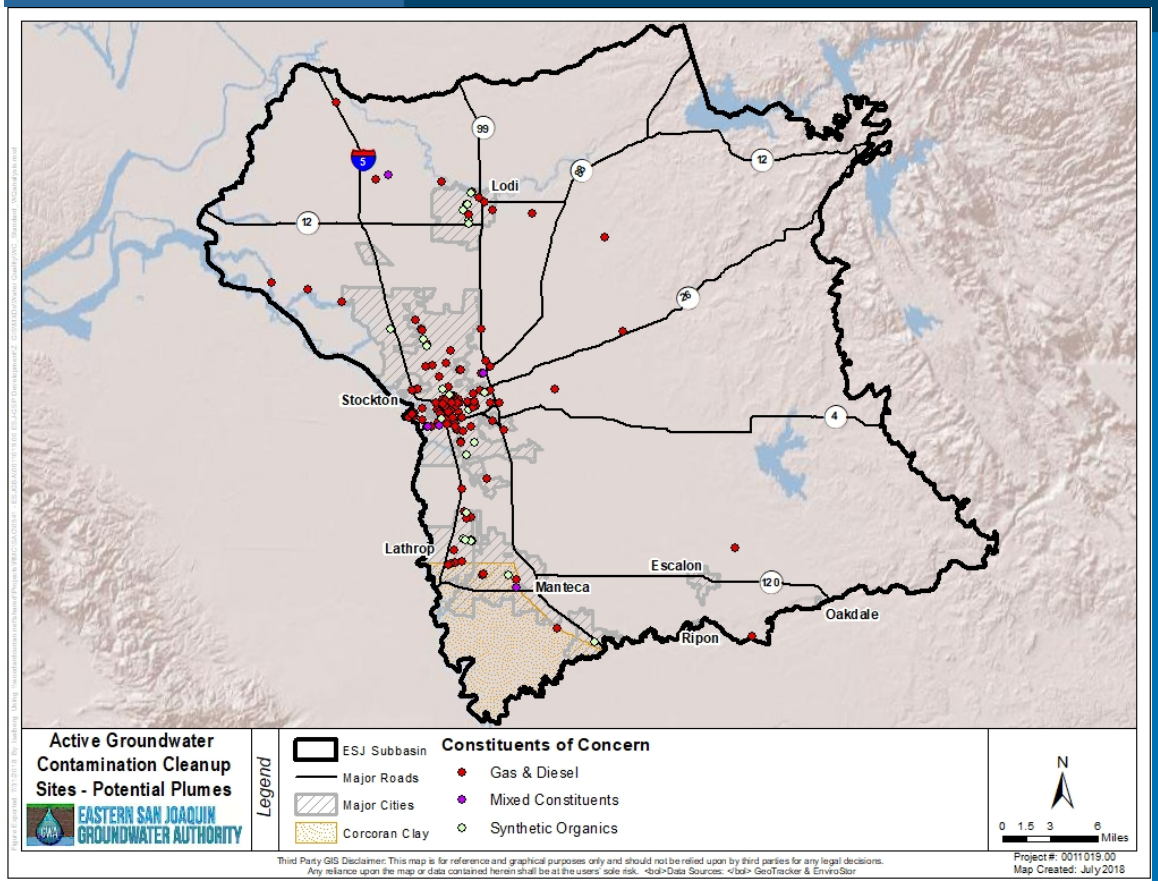

Sites with the potential to cause a groundwater plume (based on constituents)

Avoid these sites when considering monitoring programs

Next Steps for Filling Water Quality Data Gaps

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1. Obtain construction information at select wells with TDS data

- Refine well matching analysis in GIS
- Coordinate with Cal Water and cities to identify wells with depth
- Identify wells to measure total depth
- Identify wells to video log

2. Identify local groundwater flow directions at potential monitoring well locations

- Review reports with recent groundwater elevations

Minimum Thresholds for Sustainability Indicators

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- Chronic Lowering of Groundwater Levels
- Reduction in Groundwater Storage
- Seawater Intrusion
- Degraded Water Quality
- Land Subsidence
- Depletion of Interconnected Surface Water

Setting Minimum Thresholds for Depletion of Interconnected Surface Water

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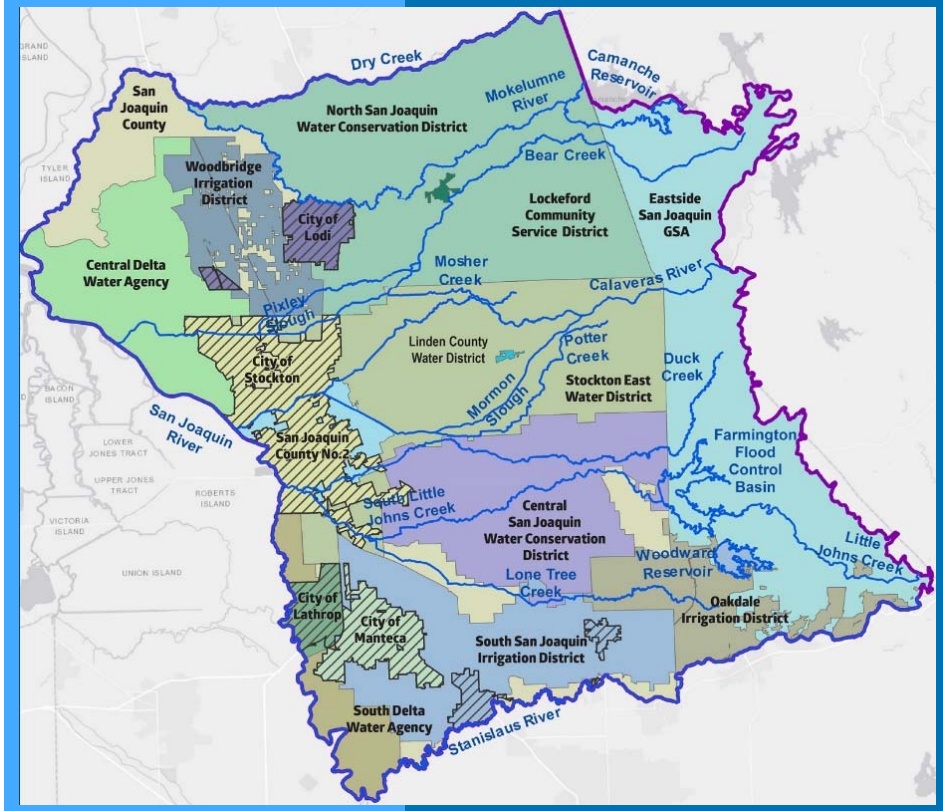

Major river systems in the Subbasin are highly managed. Instream flow requirements, water quality standards, and water rights govern upstream releases.

Potential Minimum Threshold Approach

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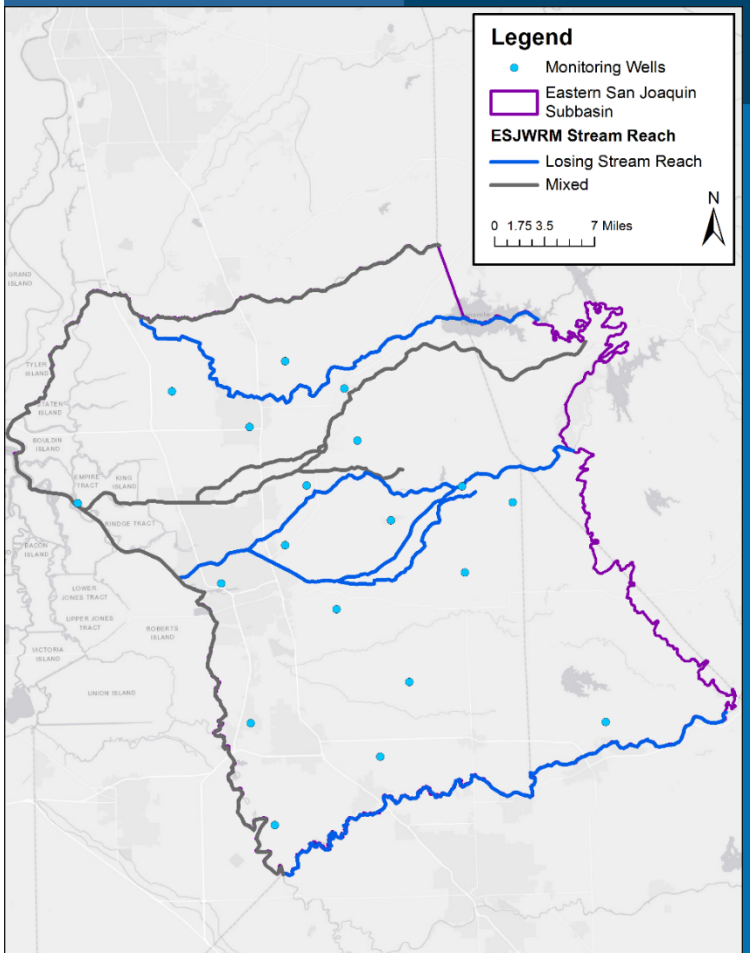
- Recognize existing management and regulatory programs in place
- Identify coordination and management activities that integrate with existing programs
- Identify losing streams and consider elevation thresholds to protect against significant and unreasonable stream depletion

Losing Streams



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Model was used to identify reaches of losing streams

Defined through the model as streams with reaches and nodes that lose water to the groundwater budget

Hydrogeologic Conceptual Model (HCM)

HCM Development Process

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Framework and Setting

- Understand the regulatory framework, Coordinate with other plan efforts
- Understand hydrogeologic setting - physiography, geologic history, basin boundaries and soil

Examine Data

- Define stratigraphy, principal aquifers and aquitards
- Define aquifer flow, properties and water quality variation

HCM

- Use basin-specific differentiators, minimum thresholds and sustainable indicators to identify HCM and Monitoring Data Gaps

Topography and Basin Boundaries

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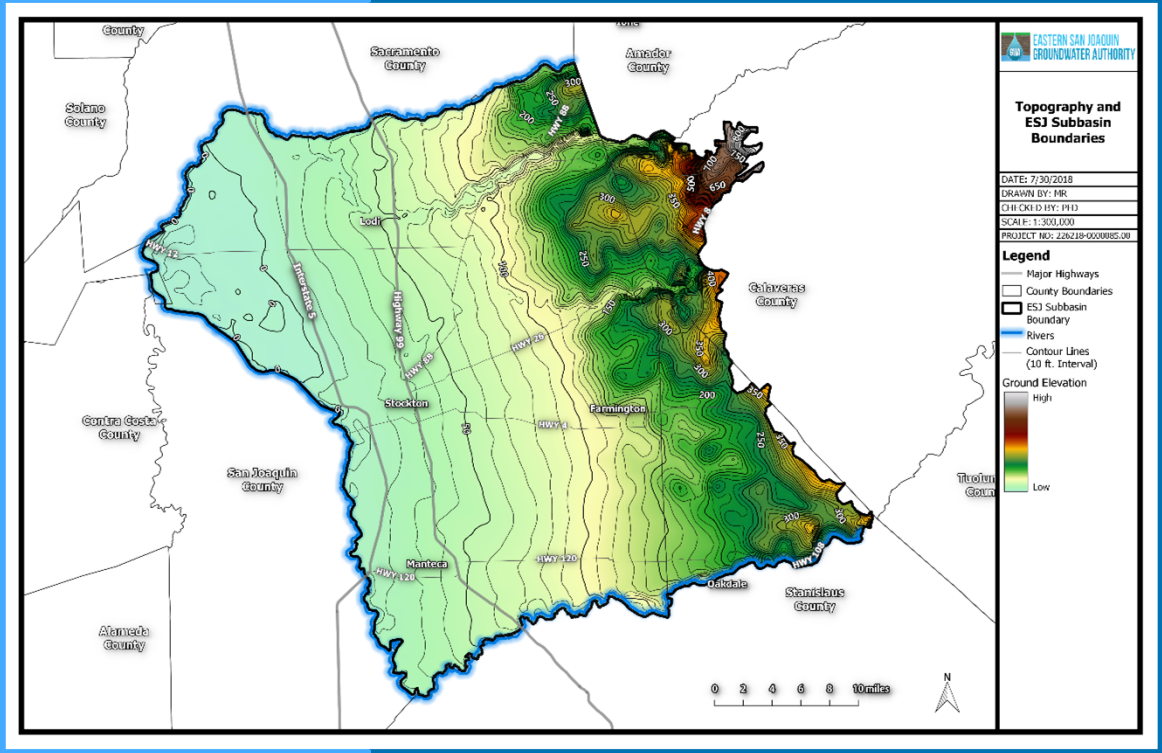

ESJ Subbasin boundaries:

- North – Cosumnes River
- West –San Joaquin River
- South – Stanislaus River
- East –Bedrock Outcrop
- Bottom – Fresh Water then Bedrock

Neighboring Subbasins:

- North – Cosumnes
- South – Modesto
- West – Tracy
- East – None

- Twelve named rivers, creeks and sloughs are within the ESJ Subbasin. The topography slopes upward to the east with high relief near the eastern boundary

Soils and Hydrology

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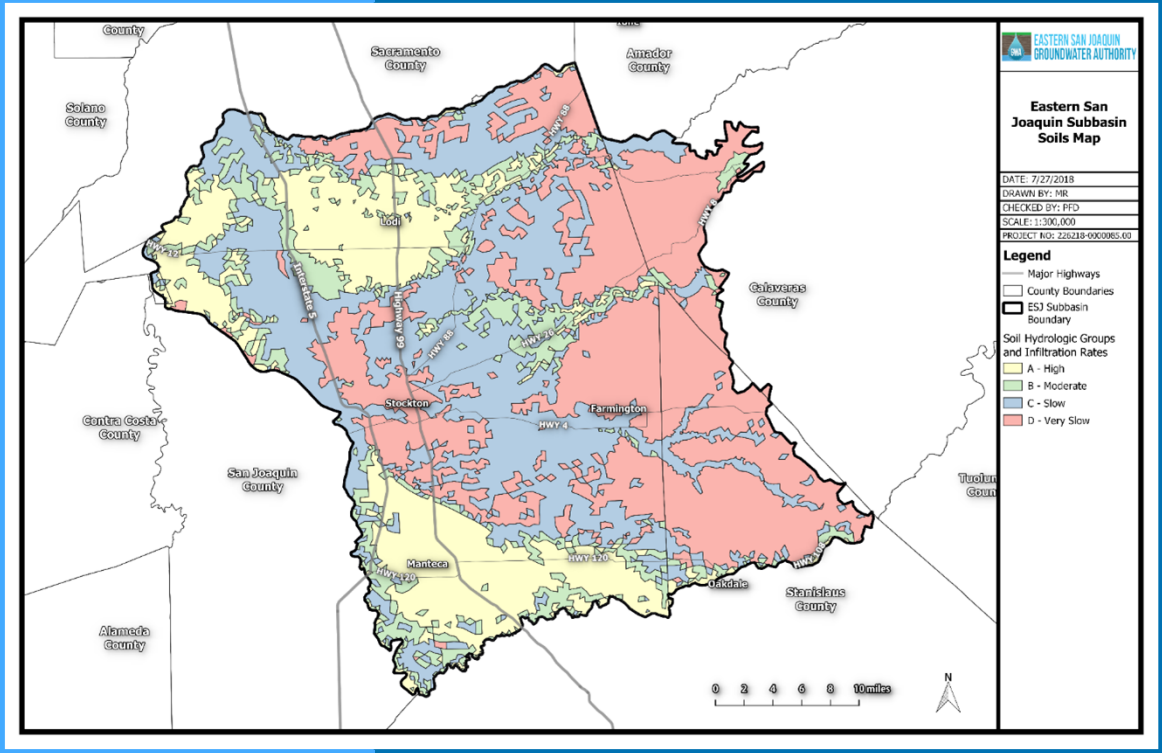

Source: Burow, K.R., Shelton, J.L., Hevesi, J.A., and Weissmann, G.S., 2004, Hydrogeologic Characterization of the Modesto Area, San Joaquin Valley, California: U.S. Geological Survey Scientific Investigations Report 2004-5232, 9 p.

Surface soils reflect the underlying alluvial and bedrock geology.

The oldest soils exist in the east, on the nearly level terraces and old fluvial fans

Highly permeable soils are generally young and located along major stream channels

Low permeability soils exist on the interfan areas between the major streams, at the distal end of several fans and along the San Joaquin River floodplain

Surface Geology Map

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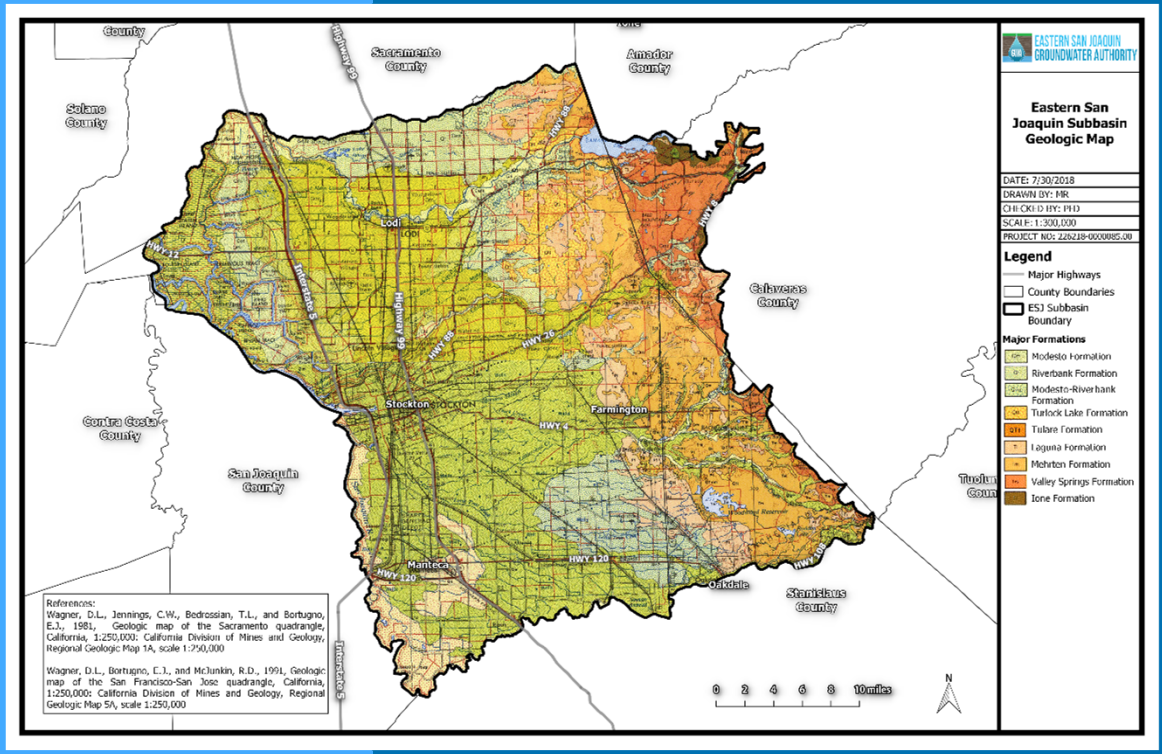

Surface geology reflects the geologic structure and valley fill setting.

The oldest formation is exposed on the east side of the Subbasin resting on west tilted basement rock of the Sierra Nevada

Sediments become younger moving westward across the valley and with decreasing depth.

The youngest sediments comprises recent alluvium and Modesto/Riverbank Sands

Principal Aquifers, Aquitards and Basal Units

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Principal hydrogeology has been identified based on geologic stratigraphy and hydraulic properties.

Three aquifer units are encountered within the permeable sands of these formations:

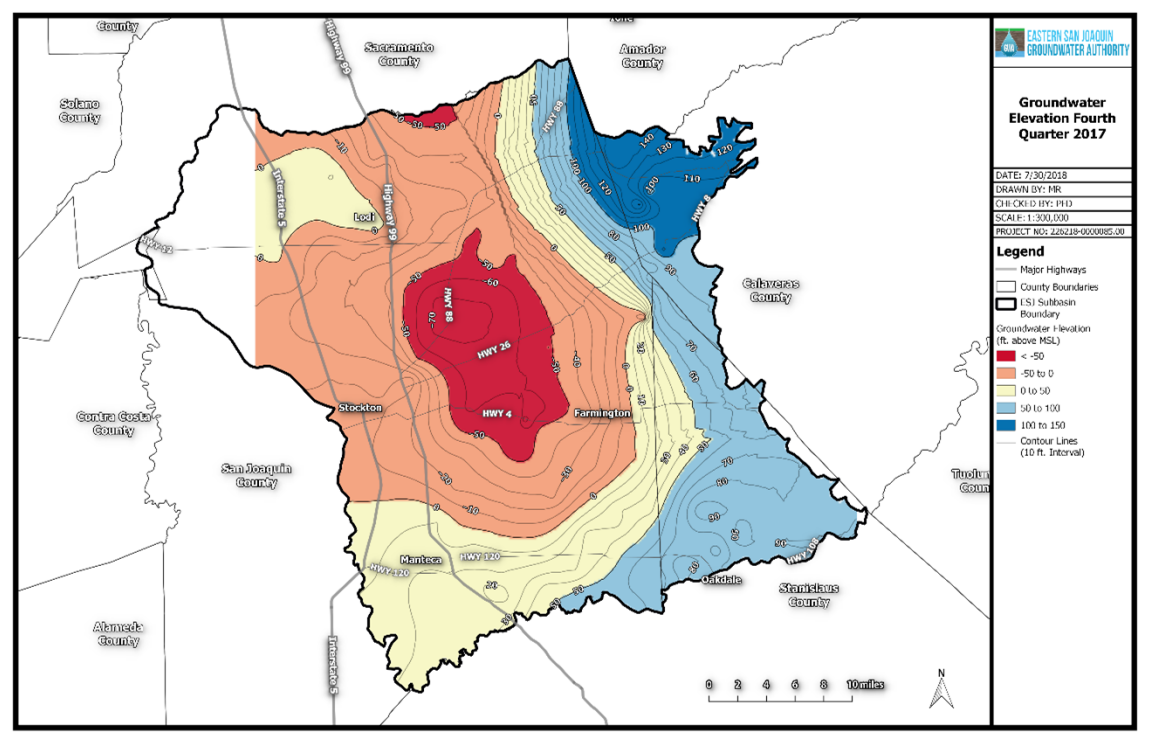
1. Recent Alluvium and Modesto/Riverbank Formations (Fm)
2. Turlock Lake and Laguna Fm
3. Mehrten Fm

Two aquitard units:

1. Corcoran Clay (Turlock Lake Fm)
2. Clay layers within the Laguna and Mehrten Fm's

- Eastern Basin – Exposed Mehrten Fm (weathered bedrock)
- Base of Fresh Water – depth varies (Williamson, USGS, 1989)
- Base of Continental Deposits - Pre-Ione Eocene rocks: marine origin sands, clays, and gravels (Page, USGS, 1974)

Groundwater Flow



Groundwater flow direction is westerly from mountains however toward the center of the basin, flow is influenced by surface water interaction, recharge, and pumping.

Groundwater yields are typically higher in Mehrten Formation wells.

This data also allows for comparisons of current to past conditions.

HCM Figure Development

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Cross sections and other HCM figures are being created using the following process

Wells and Logs

- Obtain well logs from various sources.
- Compare spatial distribution of wells for usefulness in HCM.

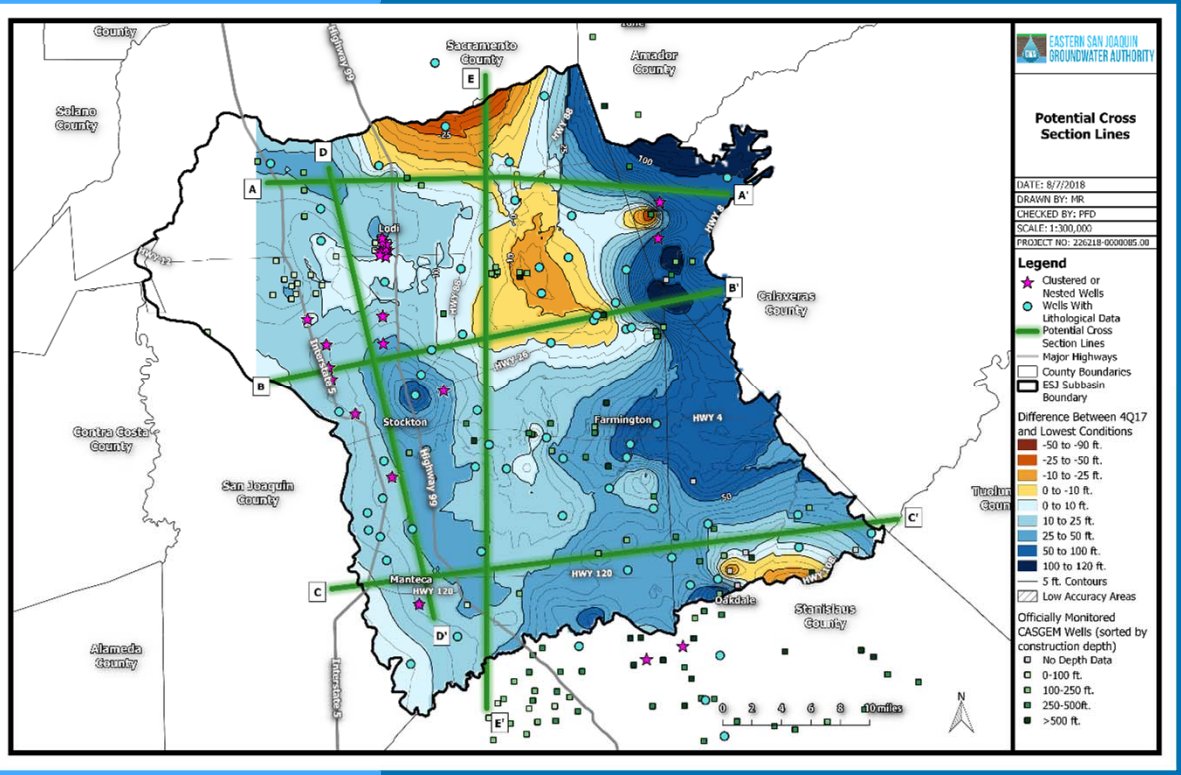
Data Examination

- Document well log data, such as construction and lithological information.
- Organize data for use in GIS software and DMS.

Figure Generation

- Produce cross sections and 3D figures of subsurface geology and groundwater conditions via GIS software.

HCM Cross-Section Line Selection

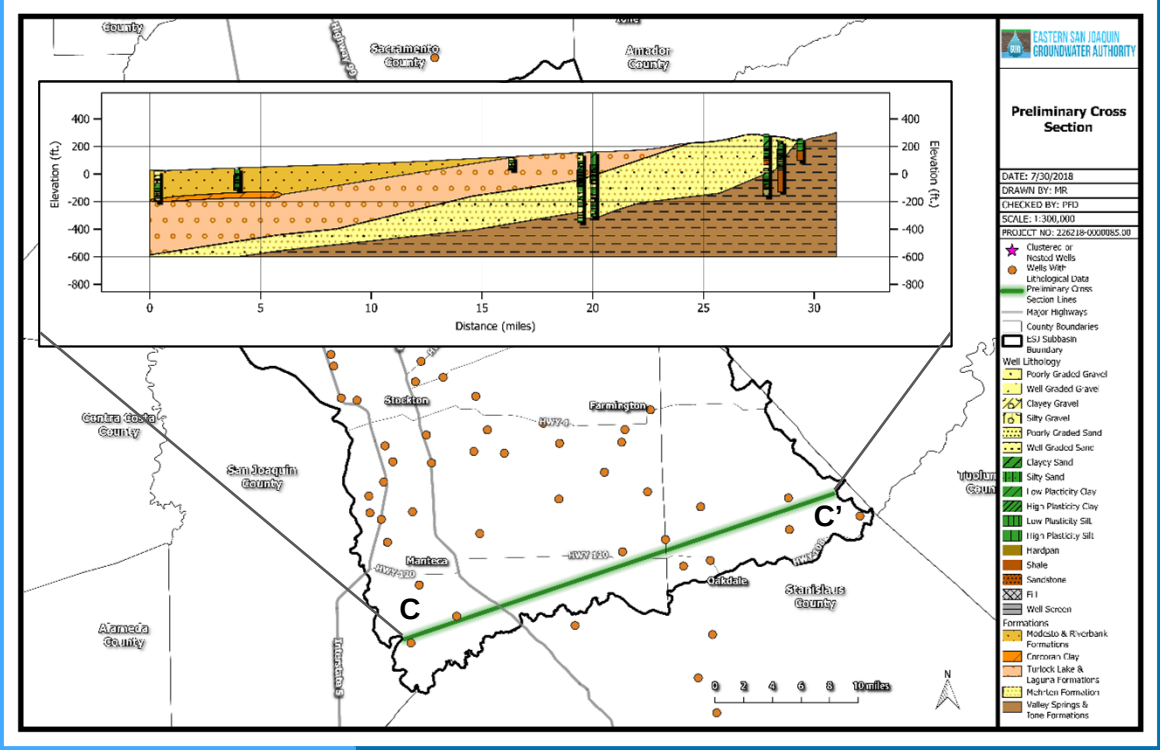


Cross section lines were chosen based having the following characteristics:

- Spans the entire subbasin
- Proximity to an adequate number of wells with borehole geologic and construction information
- Covers areas where current groundwater levels are lower than 1992 and 2015 levels (minimum thresholds)

HCM Cross Section C-C’

Preliminary Cross Section



Cross sections show principal aquifers, aquitards, and stratigraphy

Basin configuration

- West tilting stratigraphy

Oldest to Youngest:

- Ione/Valley Springs, Mehrten, Laguna Turlock/Lake, Corcoran Clay, Modesto/Riverbank Formations
- Borehole specific geology and well screen intervals depicted at each well

HCM and Monitoring Data Gaps

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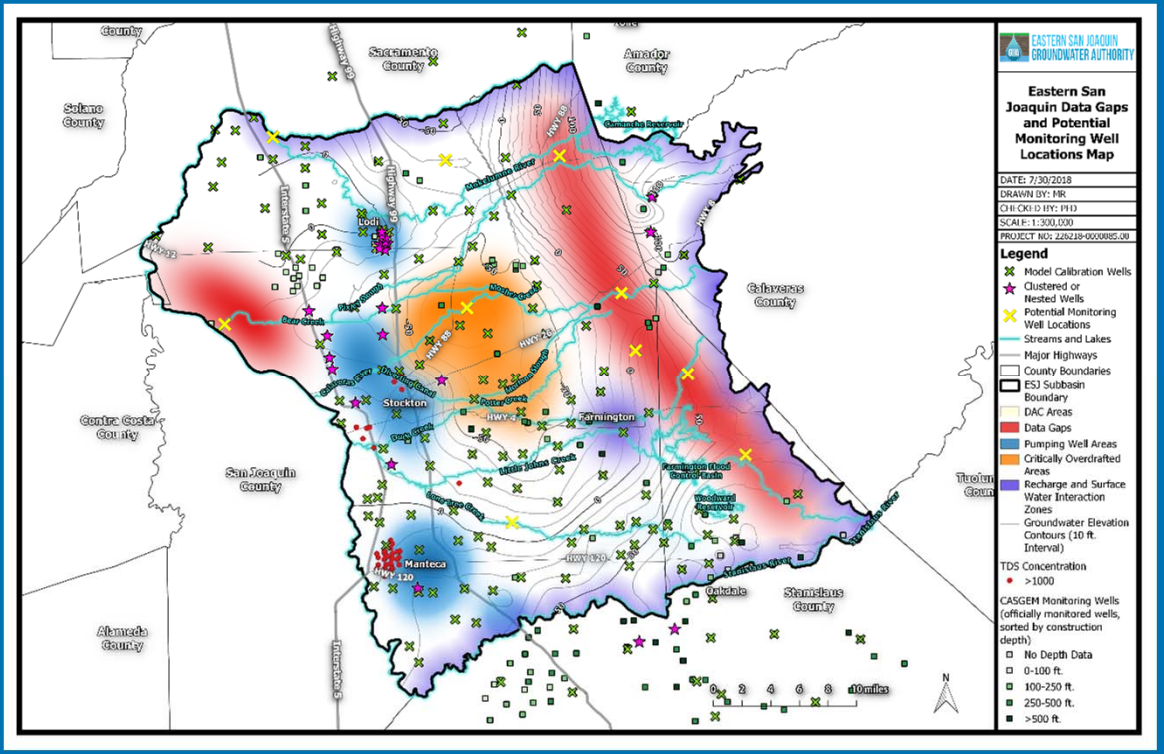
Clustered or nested wells are critical for obtaining water level and water quality data with depth.

Proposed monitoring well locations are based on:

- Existing monitoring well sites
- Areas with recharge and surface water interaction
- Areas of critical overdraft
- Areas of water quality concerns
- Minimum thresholds



Approach for Ranking Monitoring Well Sites to Address Data Gaps

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Objective: Score and rank proposed nested monitoring well locations based on requirements of the GSP and CASGEM Program.

The outcome will be a numerical ranking of 10 potential nested monitoring well locations for the Advisory Committee to discuss for further selection.

Approach for Ranking Monitoring Well Sites to Address Data Gaps

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Criteria:

1. Aids the refinement of minimum thresholds for sustainability indicators
2. Supports the HCM
3. Provides adequate horizontal spacing (6 to 8 wells per 100 square miles)
4. Provides sufficient vertical displacement of well screens across multiple zones
5. Allows additional water quality sampling points
6. Supports development of future GSA projects

Approach for Ranking Monitoring Well Sites to Address Data Gaps

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Scoring procedure:

Locations will be assigned a score of 0 or 1 for each of the previously listed criteria with special weighting for sustainability indicators, as follows:

- Chronic Lowering of Groundwater Levels – (high)
- Degraded Water Quality – (high)
- Depletion of Interconnected Surface Water – (medium)
- Land Subsidence – (low)
- Seawater Intrusion – (none)
- Reduction in Groundwater Storage (none)

Baseline Water Budget

Water Budget: Defining Time Frames

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Historical

Uses historical information for hydrology, precipitation, water year type, water supply and demand, and land use going back a minimum of 10 years.

Covered in May

Current Conditions

Holds constant the most recent or "current" data on population, land use, year type, water supply and demand, and hydrologic conditions.

Covered June

Future Conditions

Uses the future planning horizon to estimate population growth, land use changes, climate change, etc.

Covered This Month

Baseline Hydrology

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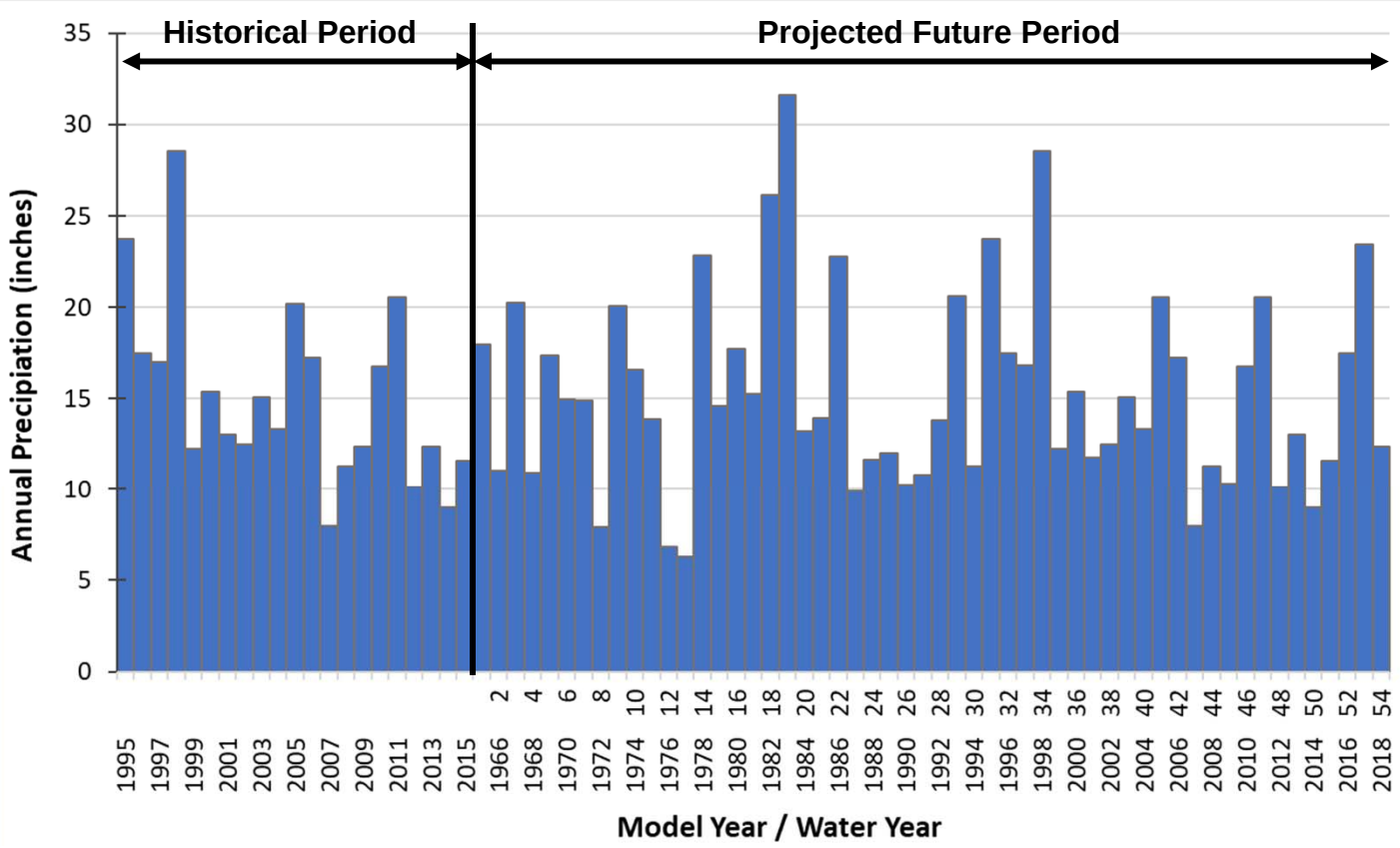
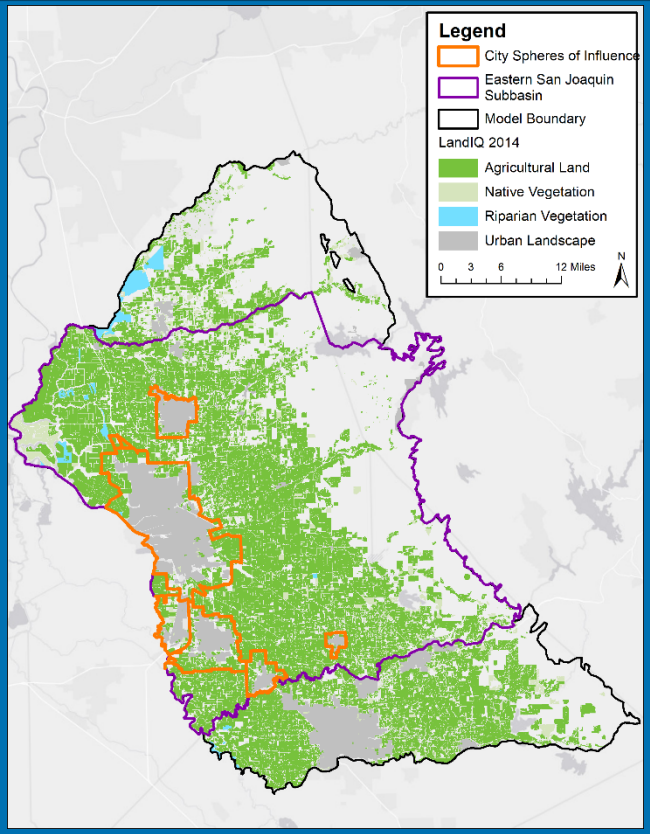


Hydrology (precipitation and stream inflow): WY 1965-2018

Future Conditions Baseline Assumptions

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

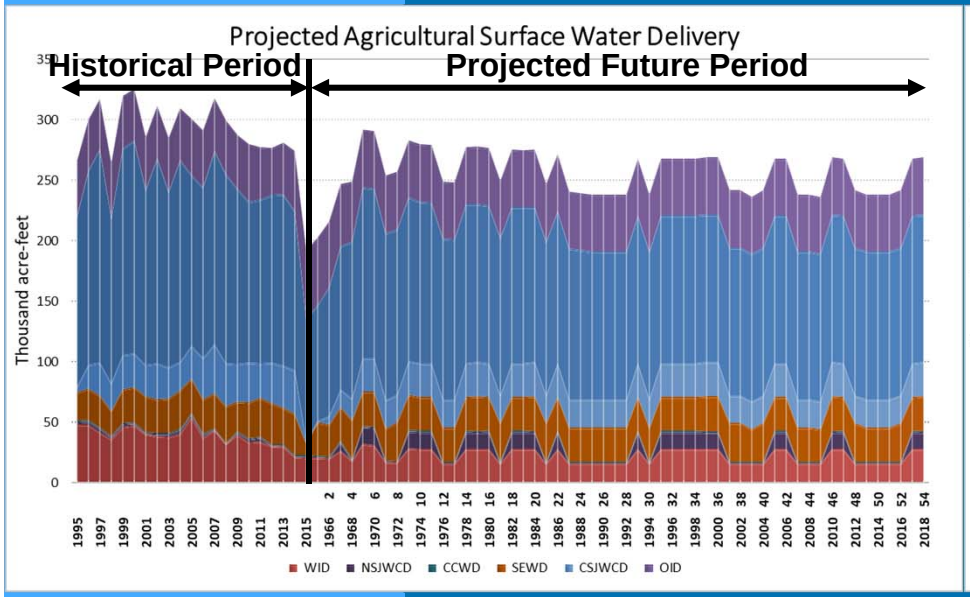


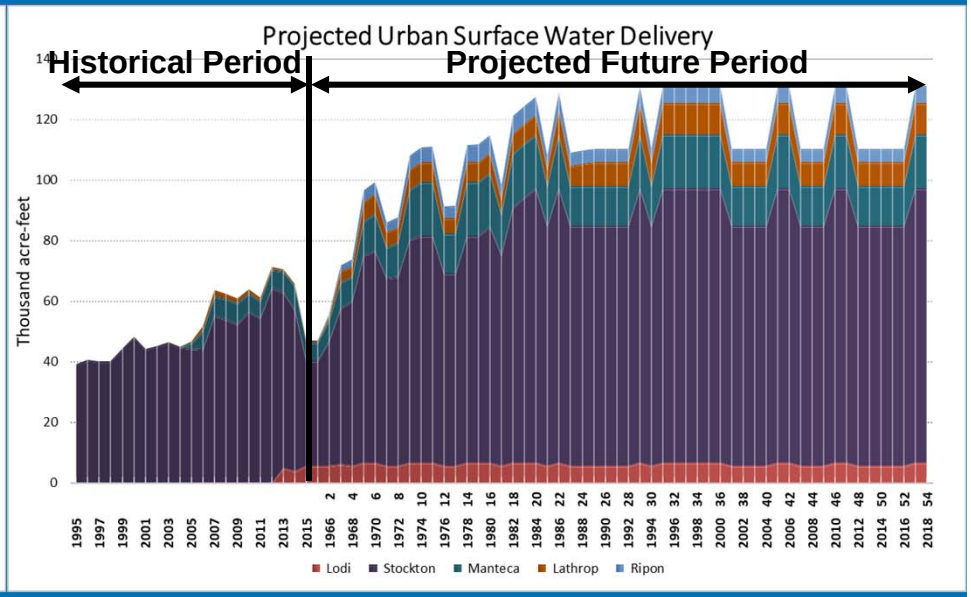
- Land Use
  - Ag cropping pattern at 2014 DWR (Land IQ) level
  - Urban footprint at Sphere of Influence
- Urban Demand:
  - Projected urban demand received from the GSAs
  - Project population based on published planning documents

Future Conditions Baseline Assumptions

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

- Surface Water Deliveries and Well Pumping:
  - Projected SW delivery estimates received from the GSAs



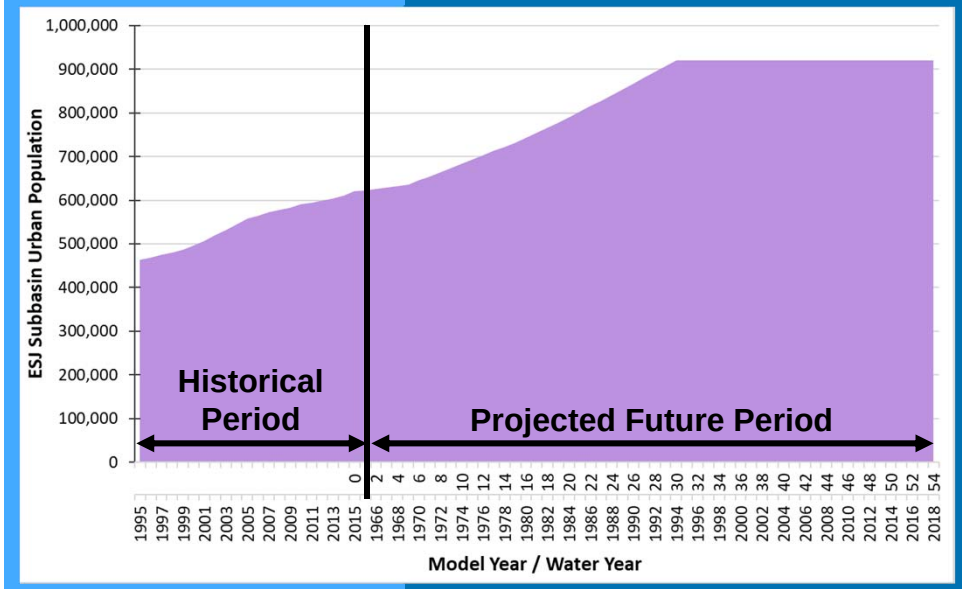


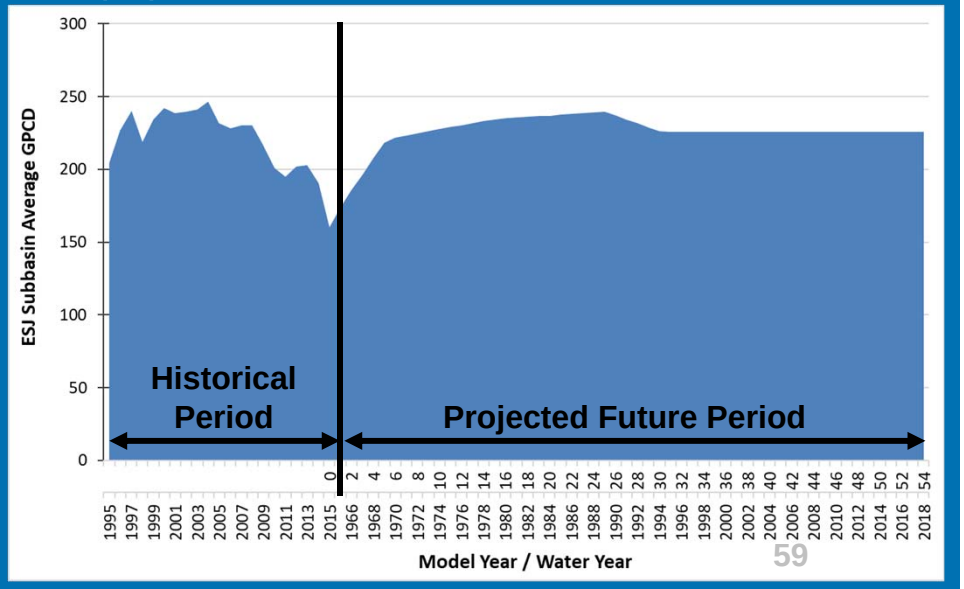
Projected Urban Water Use

Projected Conditions Baseline Assumptions

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

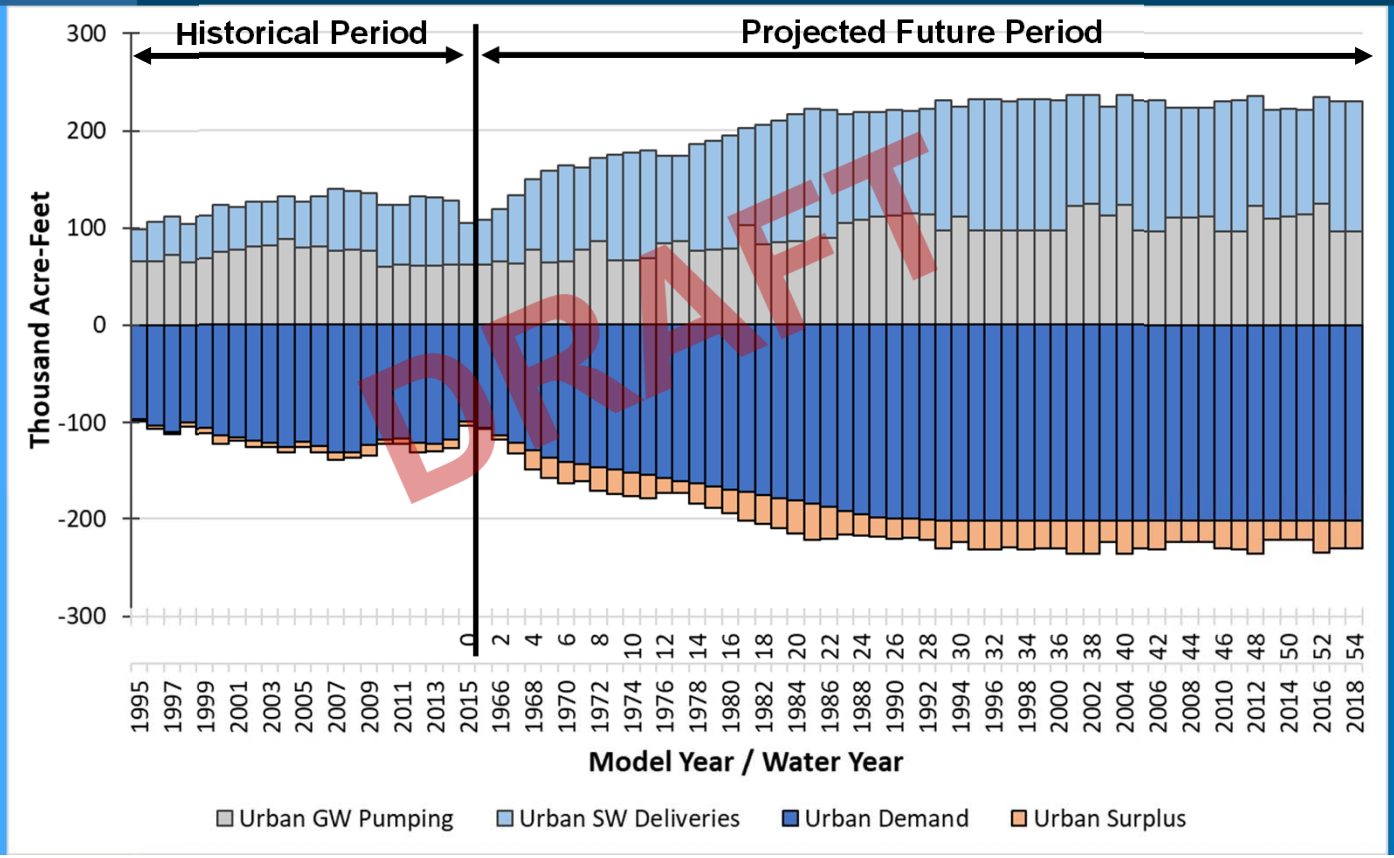
- Urban Demand:
  - Population growth based on San Joaquin Council of Governments
  - Urban Demand growth based on data from agencies (UWMPs)
  - GPCD calculated based on population and demand





Projected Conditions Baseline L&WU: Urban Water Use

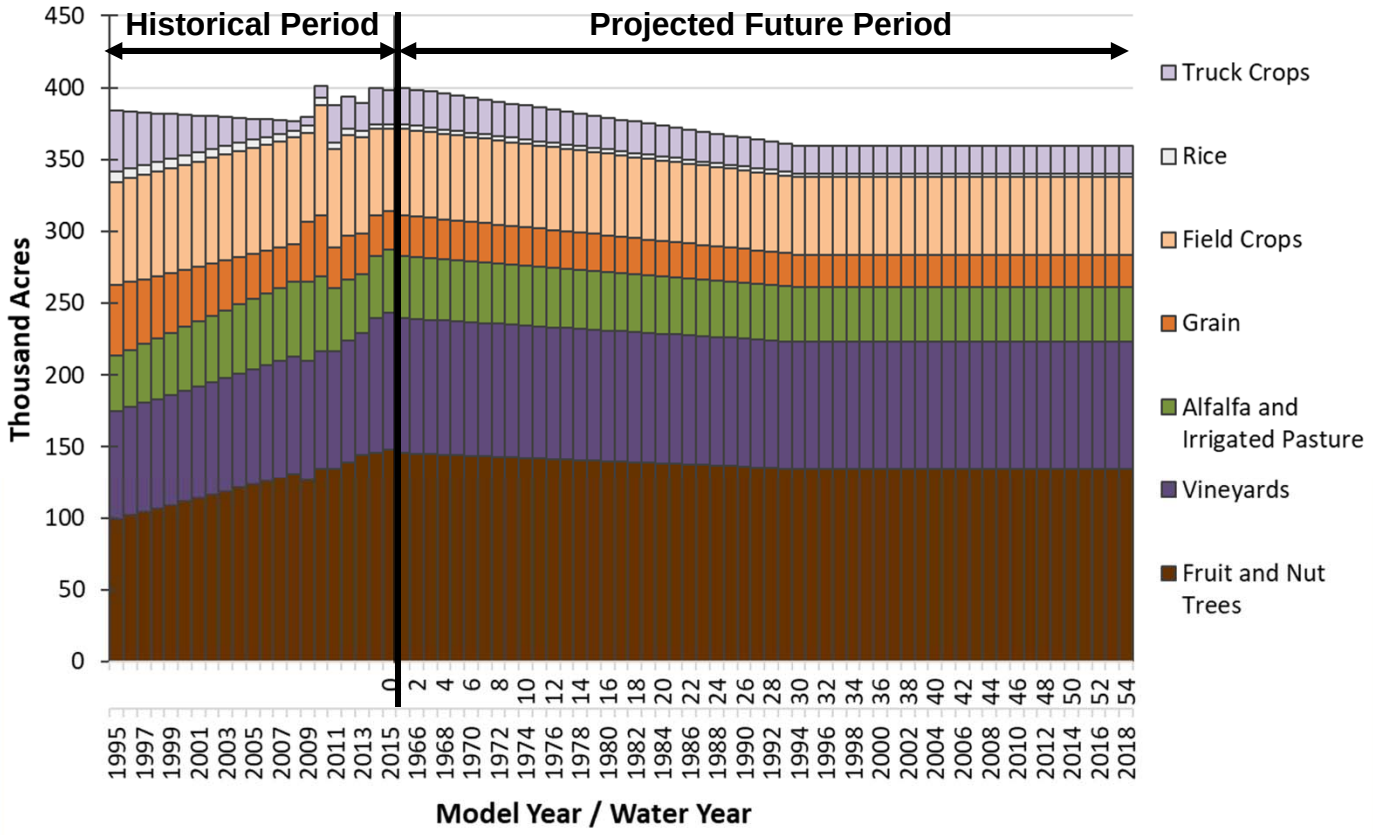
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY



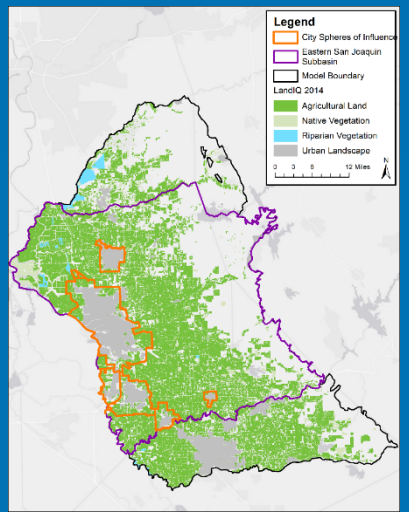
Projected Agricultural Water Use

Projected Conditions Baseline

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

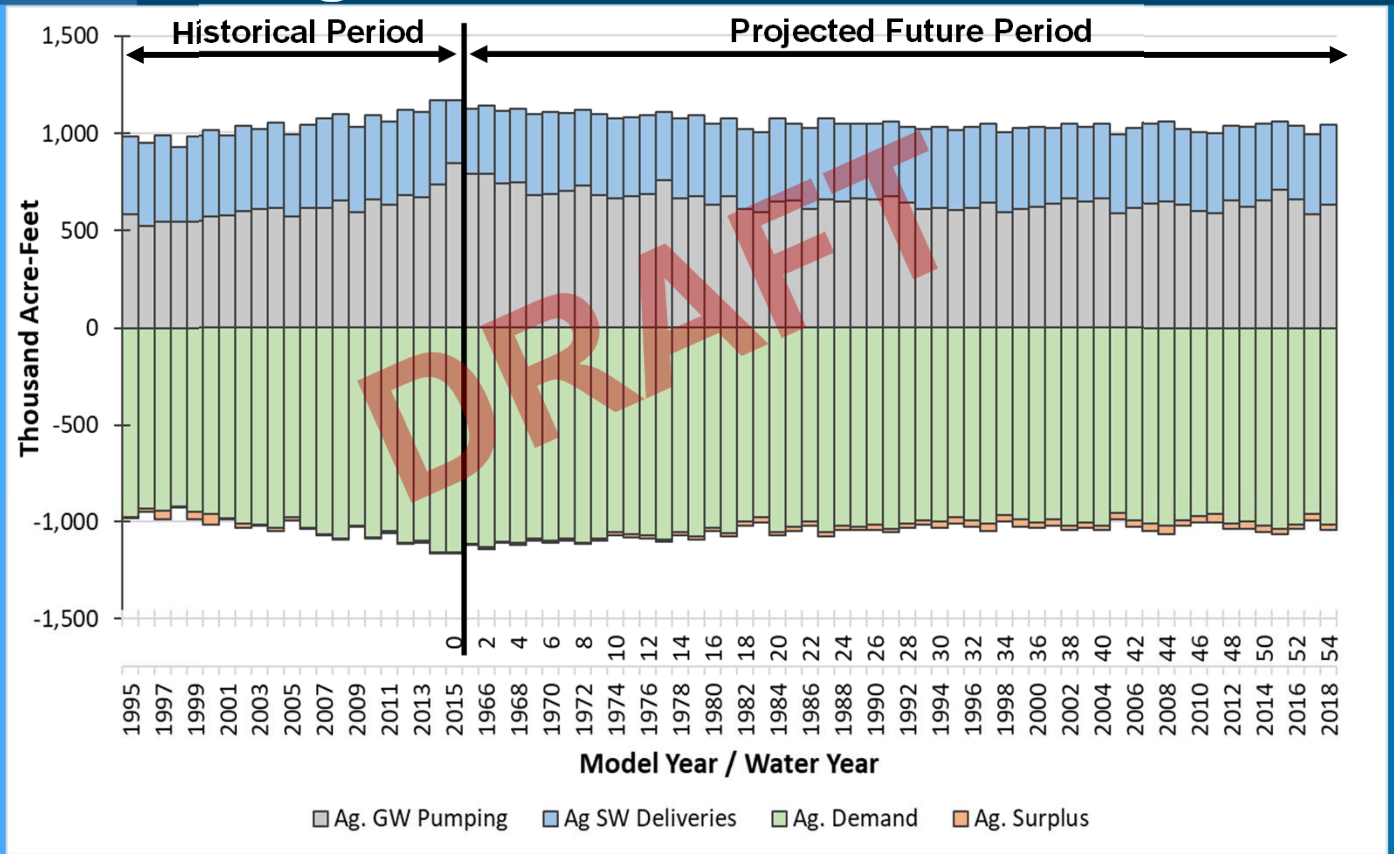


- Land Use and Cropping Pattern: 2014 DWR (LandIQ)
- Urban growth at SOI



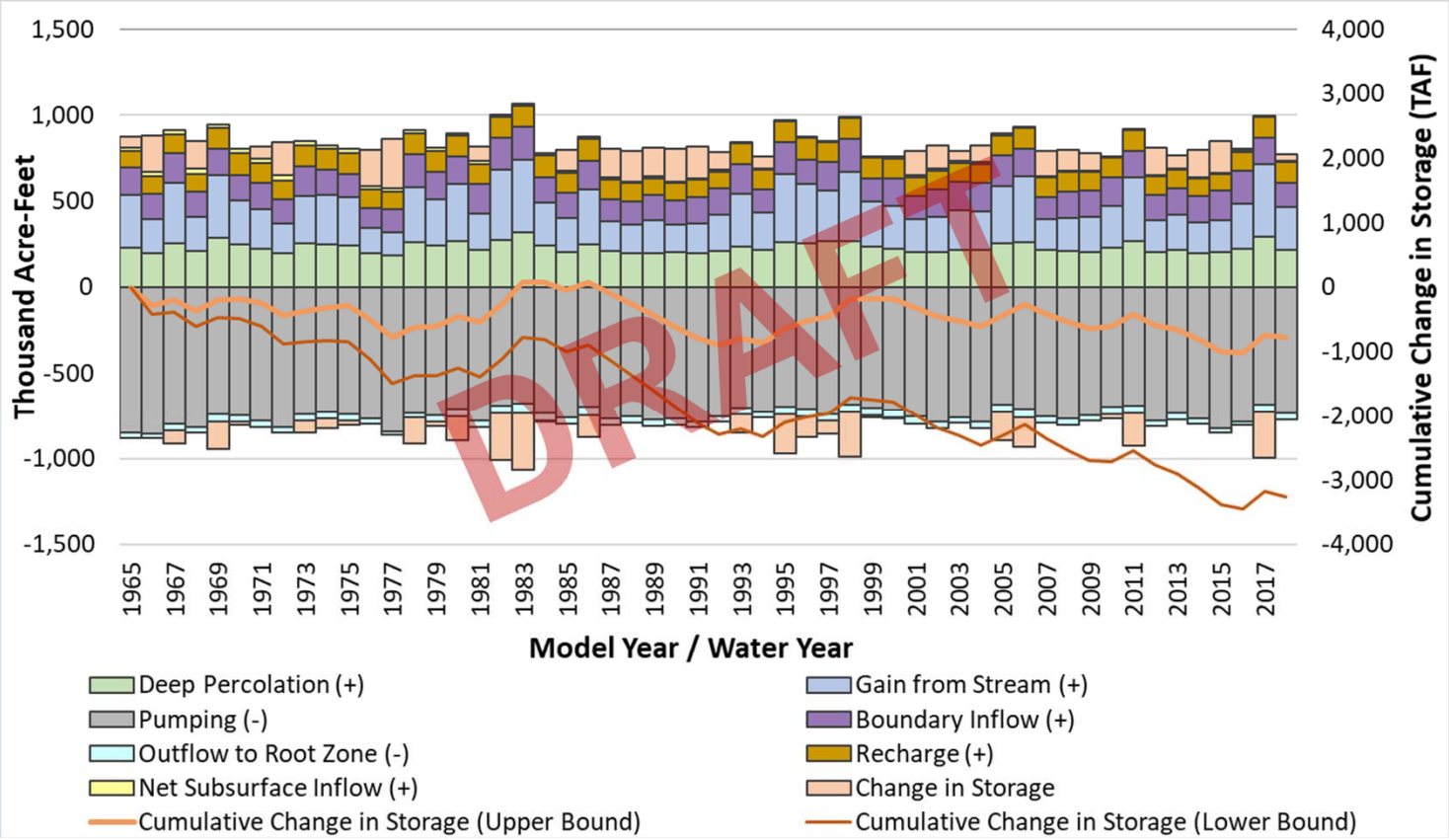
Projected Conditions Baseline L&WU: Agricultural Water Use

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY



Projected Conditions
Baseline Groundwater

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY



Next Steps

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

- Confirm budgets by GSA
  - Land and growth projections
  - Water use and demand conditions
  - SW Delivery rights, access, conveyance and delivery infrastructure, agreements, etc.

Projects and Management Actions

Approach

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

Establish frameworks for Projects and Management Actions at September 12th Board Meeting

Plan Project and Management Actions Workshop following Board Meeting on October 10th

- Brainstorming session with GSAs to meet and discuss potential future projects and management actions
- Identify project types and areas of benefit
- Identify potential management actions and associated areas of application (Basin-wide or by GSA)

September Agenda Items

September Advisory Committee Topics

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

- Hydrogeologic Conceptual Model
- Projected Water Budget
- Projects and Management Actions

Open House – August 29th

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

- The first Public Open House will be held on August 29 at 6:30pm
- The event will follow an open house format with one outreach station for each GSA
- SGMA background provided through four stations (Background, Process, Get Involved, Technology)
- All GSAs are strongly encouraged to participate and to promote the event
- Outreach flyer provided

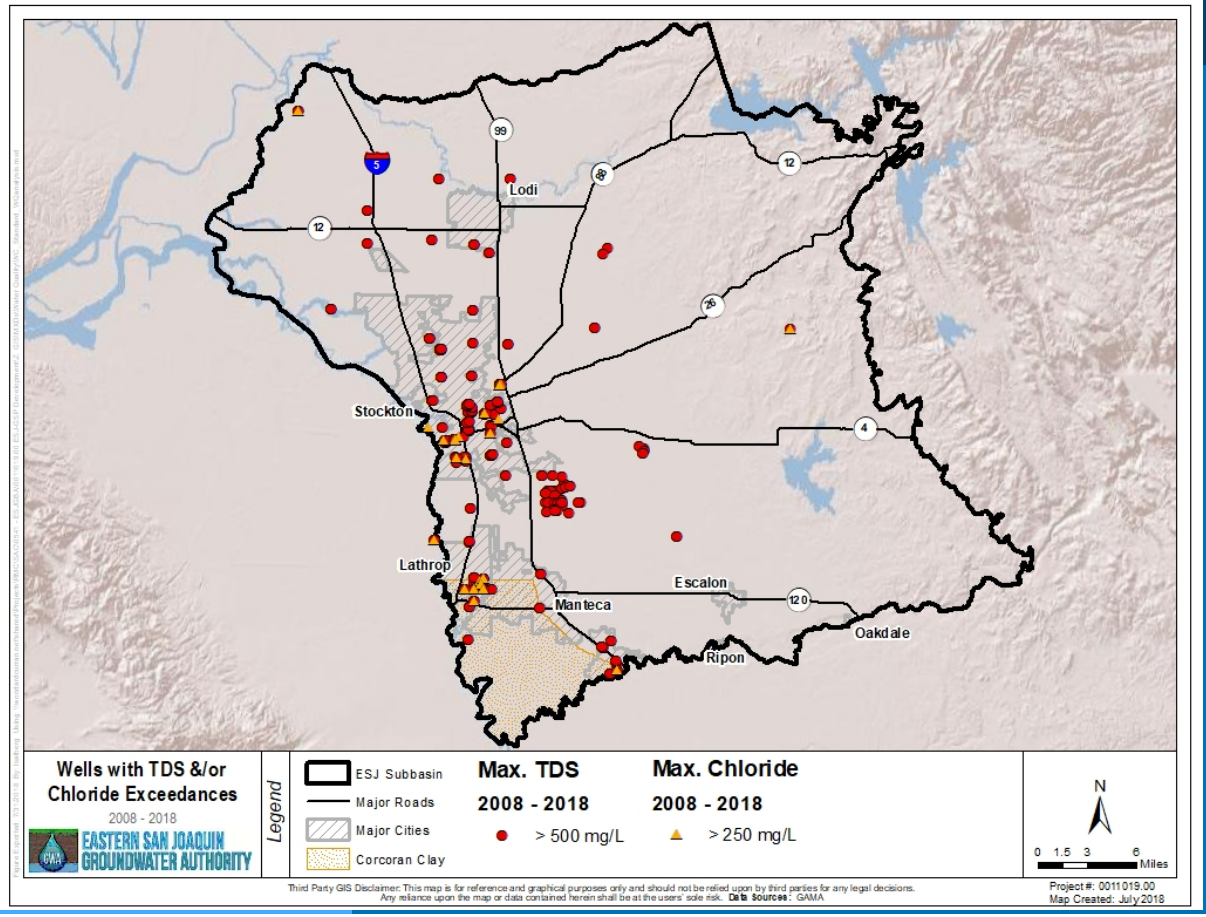
August 29th
6:30 p.m. – 8 p.m.
Robert J. Cabral Agricultural Center, Calaveras Room


GWA
EASTERN SAN JOAQUIN
GROUNDWATER AUTHORITY
GWA Advisory Committee
August 8, 2018


Extra Slides

TDS & Chloride Exceedances

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY



Sites with TDS exceedances almost always have chloride data

Less chloride data available generally

Hydrogeologic Setting

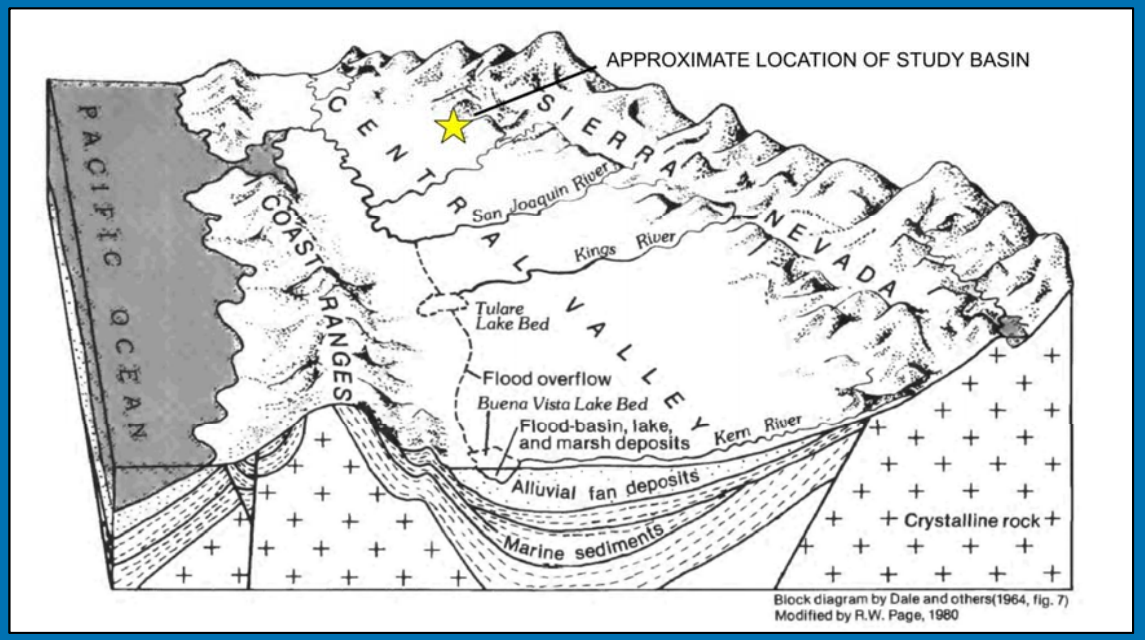
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

Geologic history, physiography, and soils are used to define the setting:

Tectonic events resulted in dramatic mountain building events east and west of the Central Valley

Valley configuration supports the stratigraphic layering and sediment accumulation

Sediment accumulation exceeds 16,000 feet



Topography and Basin Boundaries (continued)

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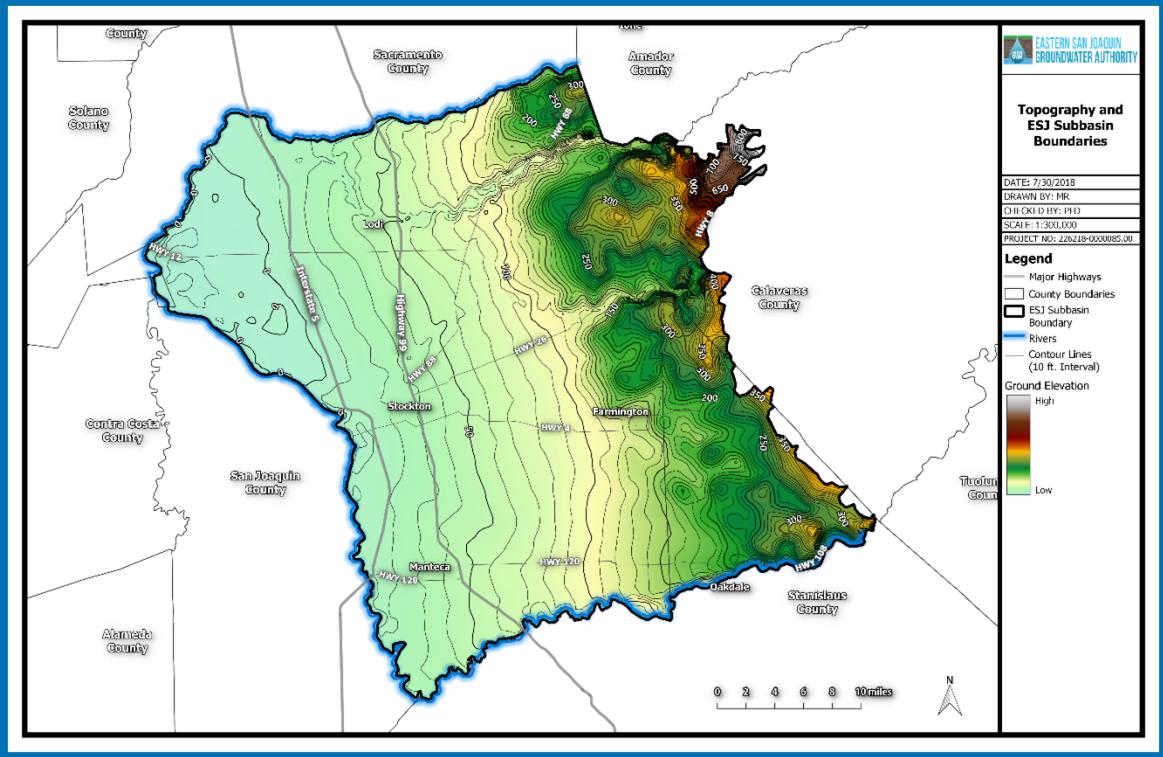
Dissected uplands found along the flanks of the valley between Sierra Nevada to the east and alluvial plains and fluvial fans to the west. Local relief is up to 100 feet

West of the dissected uplands and east of the nearly flat lying valley trough lies a belt of coalescing fluvial fans of low relief (<10 ft). Forming the low alluvial plains and fans that range in width from 14 to 20 miles wide

River floodplains and channels occur as narrow, disconnected strips along major rivers

Overflow lands define the area inundated by rivers during floods under natural conditions



Source: Burow, K.R., Shelton, J.L., Hevesi, J.A., and Weissmann, G.S., 2004, Hydrogeologic Characterization of the Modesto Area, San Joaquin Valley, California: U.S. Geological Survey Scientific Investigations Report 2004-5232, 9 p.

Geologic Formations

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

Formation	Distinguishing Characteristics
Modesto	Weakly developed B-horizon that is compact with minor clay and abundant sand-sized grains of quartz and feldspar; coarse-grained material not significantly weathered; granitic material usually fresh. Lithology similar to that of Laguna, Turlock Lake, and Riverbank Formations, although more fine-grained.
Riverbank	B-horizon soils fairly compact with considerable clay, coarse-grained material weathered and stained, but granite pebbles and cobbles commonly intact. Reddish, clay-rich duripan caps this unit.
Turlock Lake	Succession of gravel and coarse sand that overlies well sorted, fine-grained sand, silt, and clay of possible lacustrine origin. Sands distinguishable from the Mehrten sands by dominant quartz and feldspar lithology (>70%). Reddish, clay-rich paleosol at the top of the upper unit; blue lacustrine Corcoran Clay at base of upper unit covers much of the study area; Corcoran Clay is overlain by Friant pumice in places. This formation coevolved with the Tulare Formation to the west.
Laguna	Discontinuous distribution in outcrop, but may exist in subsurface; lithologic character may not serve to distinguish it from overlying Pleistocene sediments, although feldspars more weathered and biotite altered or bleached; may contain reworked andesitic detritus from Mehrten. Moderate to strong degree of compaction.
Mehrten	Distinguishable from overlying formations by predominance of andesitic material (>50%) and generally well sorted beds of more uniform texture; general decrease in mean grain size southward from Stanislaus River.
Valley Springs	Presence of rhyolitic materials distinguishes the Valley Springs from the Ione Formation. Absence of andesitic fragments delineates it from the Mehrten Formation; erodes to form valleys; altered zones that are kaolinitic and pisolitic form ledges.
Ione	Lateritic soils containing crystalline iron oxides and kaolinitic clay; locally contains marine fossils.

Source: Burow, K.R., Shelton, J.L., Hevesi, J.A., and Weissmann, G.S., 2004, Hydrogeologic Characterization of the Modesto Area, San Joaquin Valley, California: U.S. Geological Survey Scientific Investigations Report 2004-5232, 54 p.