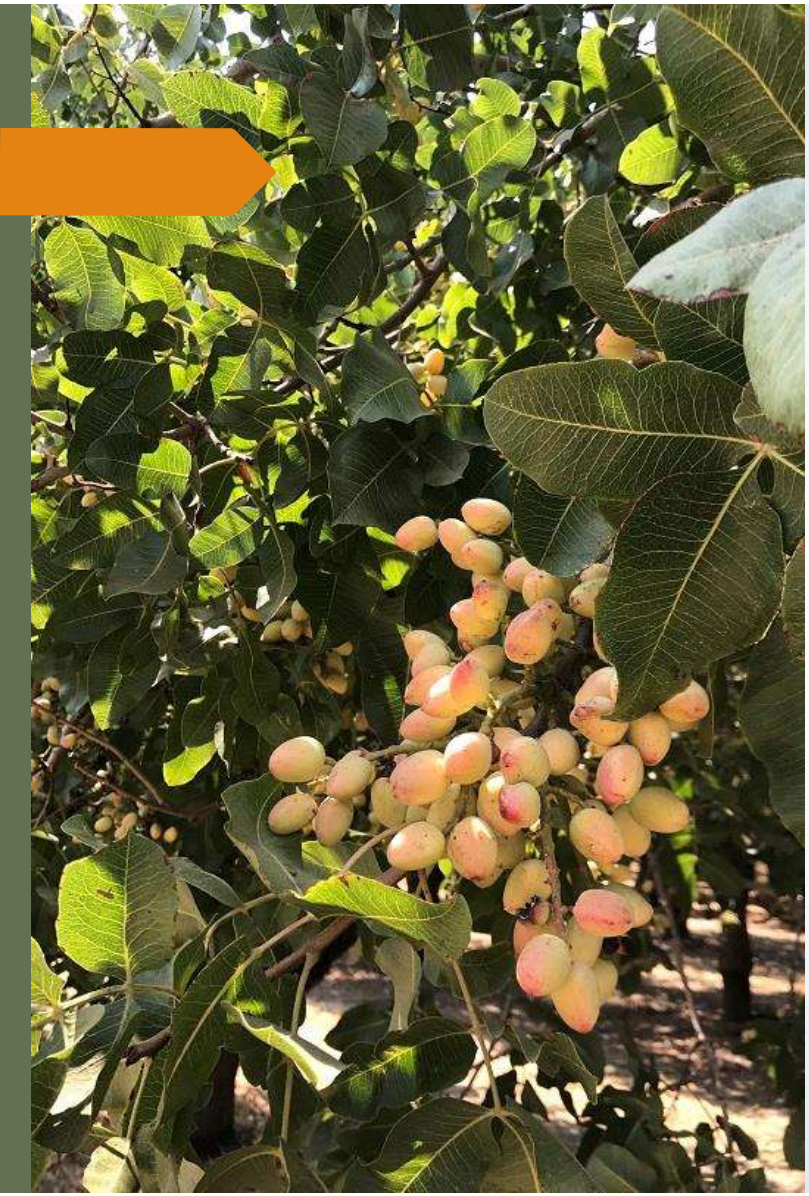
Corning Subbasin
Groundwater Sustainability Plan
Technical Presentation

Presented to Corning Subbasin Advisory Board
02/03/2020 | Teleconference

Prepared by
MONTGOMERY & ASSOCIATES



Today's Meeting

- Status and path forward for GSP development
- Introduction to Streamflow Depletion data and SMC
- Introduction to Subsidence data and SMC
- 2021 CSAB meeting schedule, topics, and recommendations to be made

Corning Subbasin GSP Status

- Where are we now?
- Where are we headed?
- What do we have left to do?
- What problems were identified?

2020 Accomplishments

- Held monthly CSAB meetings; generally well attended, getting more traction on discussions
- Developed Basin understanding
- Identified initial data gaps
- Developed monitoring networks
- Developed integrated model and computed water budgets
- Wrote first few sections of the GSP
- Started discussion on Sustainable Management Criteria
- Identified challenges
- Started to think about potential solutions in terms of projects and management actions

2021 Work Remaining

- Solidify understanding of problem areas
- Develop and approve initial SMC for all 5 applicable sustainability indicators
- Identify projects and actions
- Design and test projects and actions with respect to SMC
- Write implementation plan (develop funding mechanisms)

What a GSP is and what is it not

What is a GSP?

- An **initial roadmap** to long-term sustainable groundwater management
- Provides for a **proactive approach** to better understanding water resources in the subbasin and how to best manage them by setting management criteria in an iterative manner
- Includes **policy decisions** based on **local concerns** and stakeholder input
- Provides for **adaptive management** over the next 20 years to reach sustainability as defined by local water users

A GSP is a policy document based on best available science and data.

What is a GSP NOT?

- An **answer** to all current and future groundwater management problems
- A **reactive approach** to defined trigger levels
- Includes management options **required by DWR**
- Is **adopted once** and **used as-is** for the next 70 years

A GSP is NOT a hydrogeology report providing engineering solutions.

Corning Subbasin Sustainability Goal

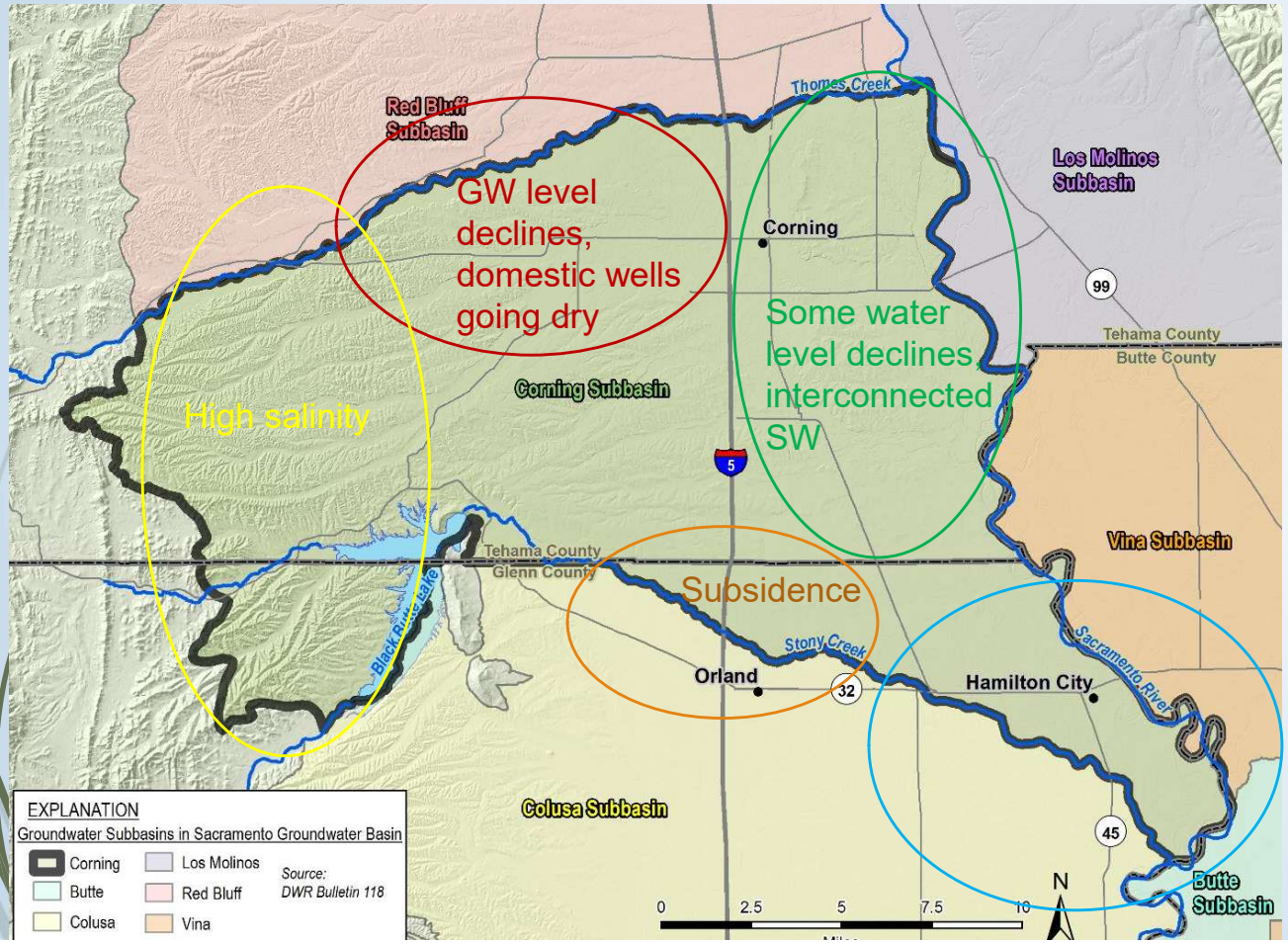
- "The goal of the Groundwater Sustainability Plan is to ensure sufficient and affordable water of good quality be available on a sustainable basis to meet the unique needs of agricultural, residential, municipal, industrial, recreational, and environmental users within the Corning Subbasin, both now and in the future. The GSAs recognize that sustainability can only be possible with the support of the public and coordination of local, state, and federal agencies and the utilization of both surface and groundwater resources."

Locally Defined Significant and Unreasonable Conditions for Each Sustainability Indicator Identify Problems that Need to be Resolved to Attain and Maintain Sustainability

Chronic Lowering of Groundwater Levels	Land Subsidence	Degraded Groundwater Quality	Depletion of Interconnected Surface Water	Decreased Storage
• Domestic well users • Ag well users	• Pumping • Local geology	• Movement of constituents of concern • Existing programs	• Protection of Groundwater Dependent Ecosystems • Beneficial users	• Water budgets • Sustainable yield • Pumping

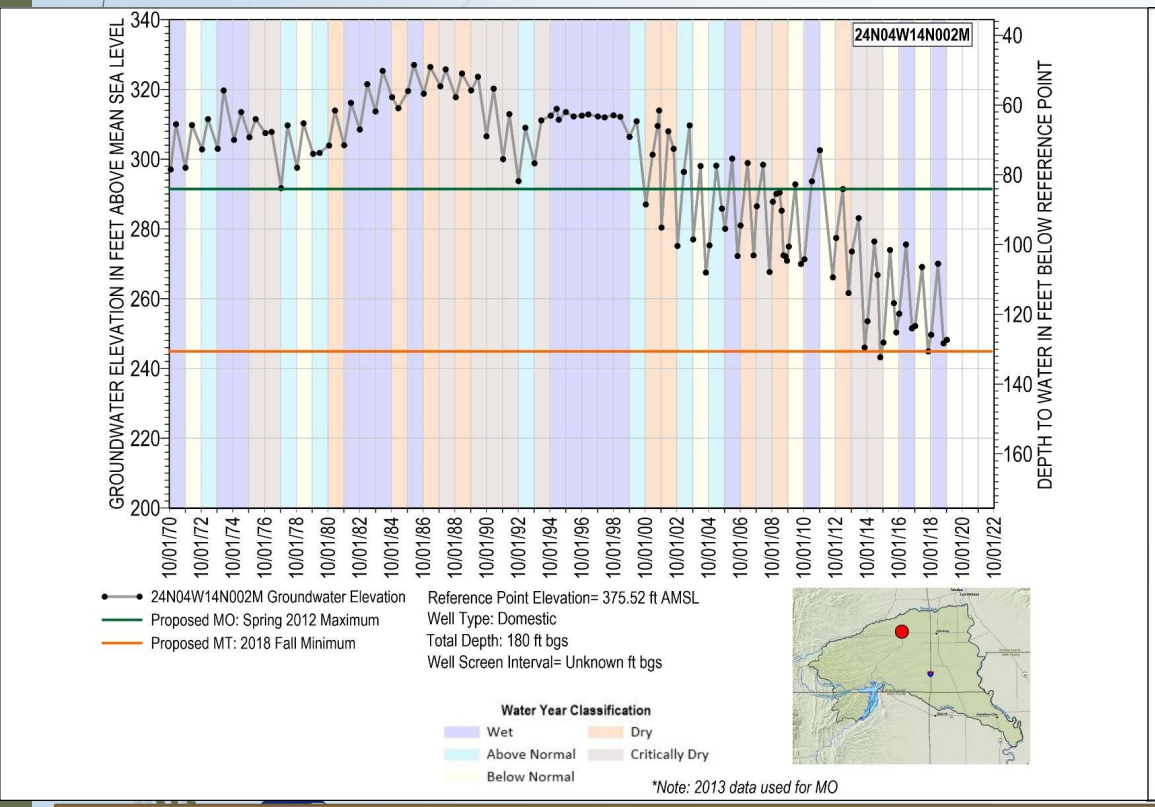
- All are related to groundwater pumping
- Most can be linked back to declining groundwater levels one way or another
- That is why we start with groundwater levels SMC
- All SMC are interrelated
- Conjunctive use of both surface water and groundwater is key
- Projects and actions need to focus on sustainability of the Subbasin **as a whole**

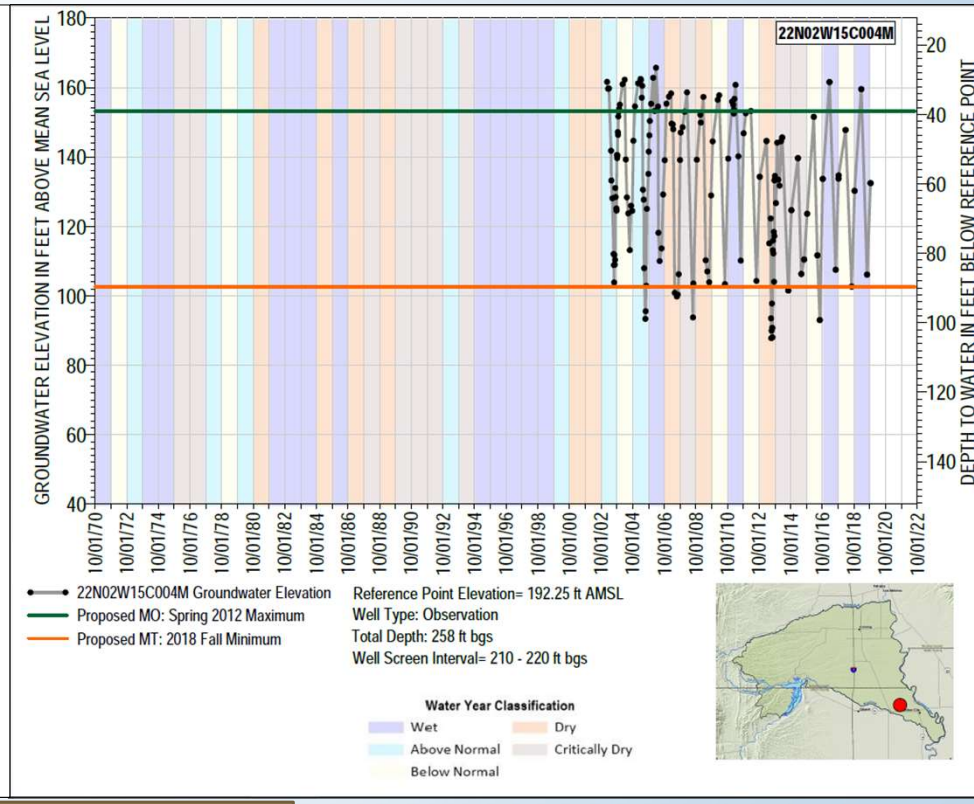
Subbasin has a few areas with groundwater concerns or protection needs



Shallow water levels, interconnected surface water

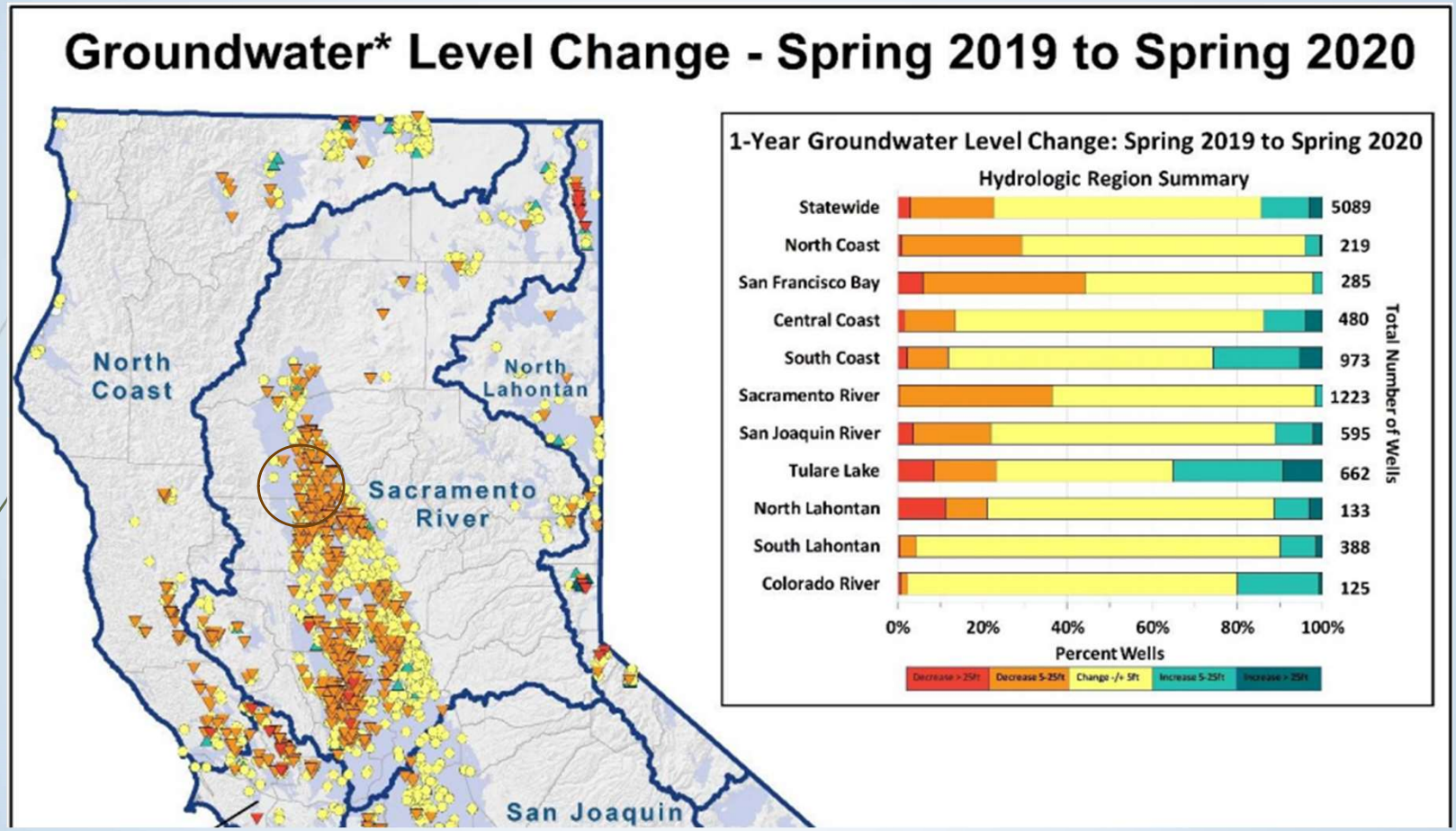
Recent Trends in Water Level Declines and the Desire to Protect all Beneficial Users Guided Initial Development of Groundwater Minimum Thresholds (Fall 2018) and Measurable Objectives (Spring 2012)





There is no Undesirable Result until 2042 – SMC can be revised until 2042, based on monitoring and additional data and projects and actions

California Groundwater Conditions Update – Spring 2020 (DWR Report)



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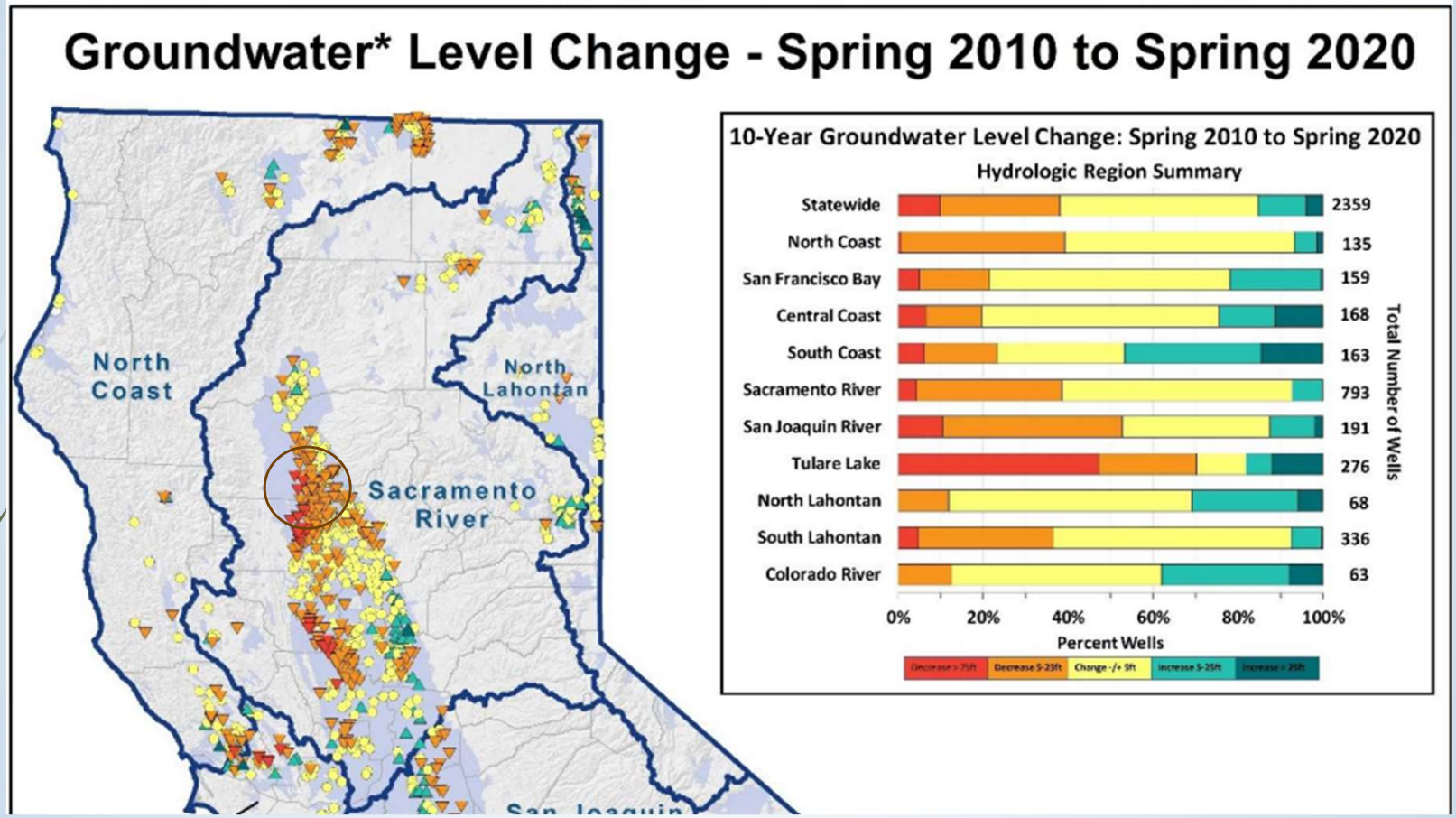

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Introduction to Depletion of Interconnected Surface Water

Data, Regs, SMC

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- **Introduction to the depletion of interconnected surface water sustainable management criteria (SMC)**
  - What is Depletion of Interconnected Surface Water
  - SGMA and GSP Requirements
  - Subbasin Conditions Overview
  - SMC Initial Thoughts

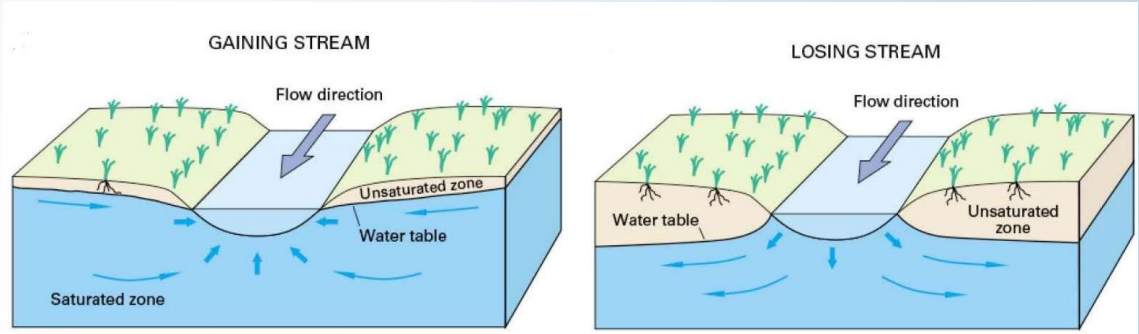
Discussion throughout – ask questions!

What is Interconnected Surface Water?

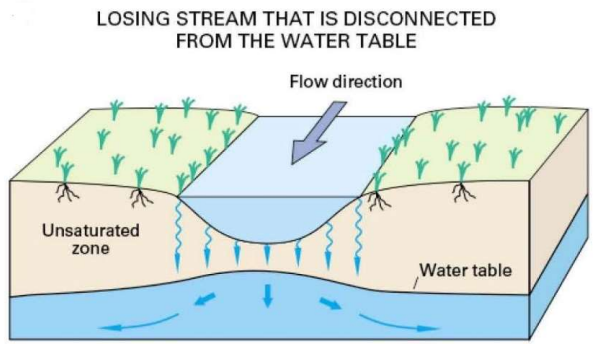
"Interconnected surface water refers to surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted." (23 CCR § 351)

Interconnected Surface Water and Groundwater

- Many surface water bodies are **interconnected** with groundwater (i.e. there is exchange of water between the stream and the aquifer)



- Some surface water systems can be completely **disconnected** from groundwater.
- A surface water body may be connected to groundwater during some periods and disconnected during other periods.



(USGS)

Common Challenges with Identifying Surface Water Depletion for SGMA

- Technical Complexities
  - GW and SW are two linked and different systems
    - What portion of surface water depletion is caused by groundwater pumping?
    - Influence of groundwater pumping on streamflow may occur over long timeframes
- Data and Information Limitations
  - Monitoring infrastructure is typically limited
  - Locations, depths and timing of groundwater pumping are often not known
- Surface Water Rights and Conveyance
  - Regulatory complications for managing surface water use
  - GSA does not have control over managed reservoir releases

Overview of SGMA Requirements for Depletion of Interconnected Surface Water

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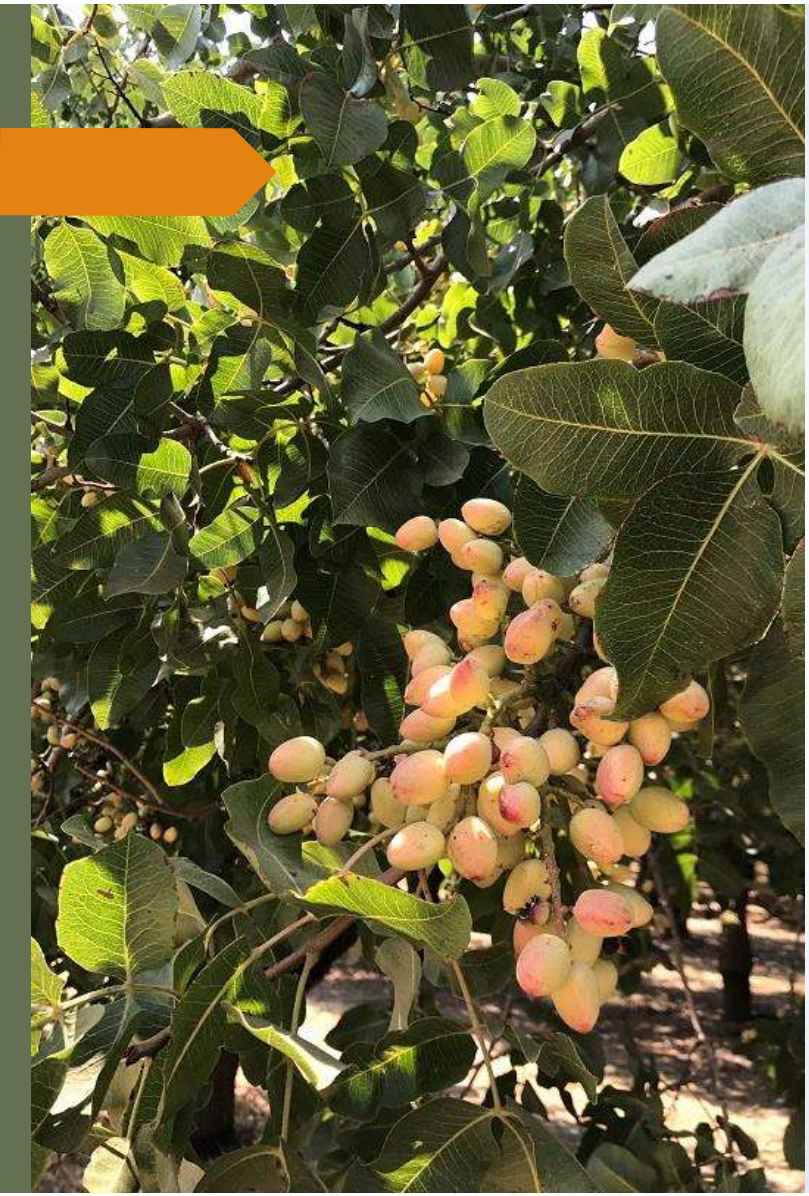
GSP Regulations
Depletion of Interconnected Surface Water

- SGMA requires the identification of **interconnected surface waters**, and of **Groundwater Dependent Ecosystems** (GDEs) (§354.16 (f)(g))
  - Assess the location, quantity, and timing of depletion and if the depletion of surface water is causing a **Significant and Unreasonable** impact
  - If conditions are significant and unreasonable, they cannot get worse than they were on January 1, 2015
- GSA must set **Minimum Thresholds** and **Measurable Objectives** to prevent further significant and unreasonable impacts
- GSA must define **Undesirable Results** based on a combination of minimum threshold exceedances



Key Items to Consider

- Identify areas that have interconnected surface water in the Subbasin
- Identify beneficial users, including GDEs
- Identify areas that have pumping along streams
- Focus analysis on areas that have 1) interconnected surface water, 2) GDEs, 3) pumping

Background

Beneficial Users of Surface Water in the Corning Subbasin

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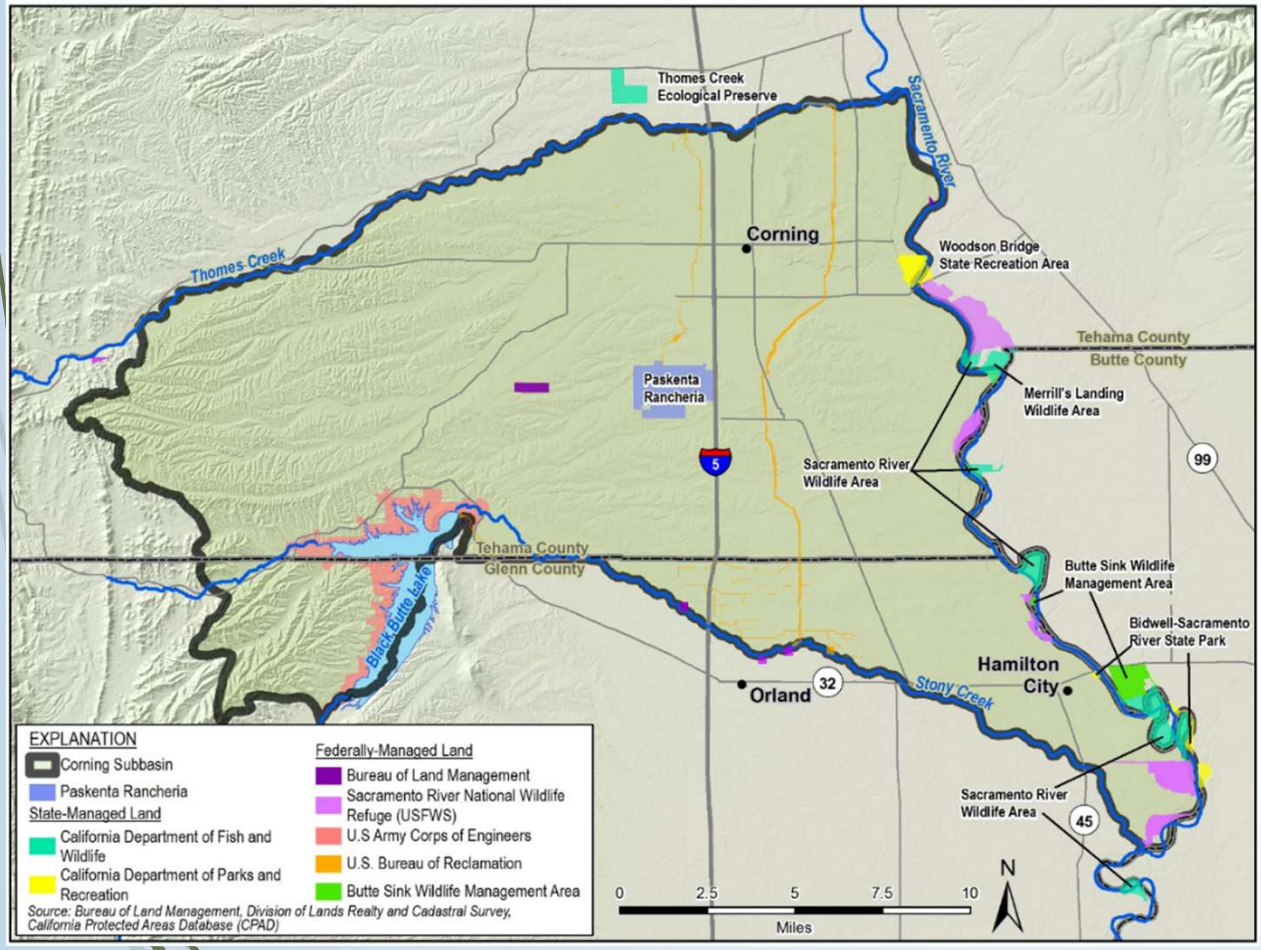
Beneficial Users of Surface Water



- Irrigation water supply
  - Riparian/appropriative water rights
  - CVP/Bureau water contracts
- Riparian habitat for wildlife and endangered species
- Groundwater Dependent Ecosystems (GDEs)
- Recreation (parks)

Beneficial Users - critical species that rely on GDEs

- Compiled a list of threatened and endangered species that might rely on GDEs in the Corning Subbasin
  - Used CDFW county database of critical species and GDE-specific Critical Species LookBook
- These species are reportedly found in riverine or riparian ecosystems in the Subbasin

Critical Species	Species Type
California red-legged frog	Amphibian
Western yellow-billed cuckoo	Bird
Least Bell's vireo	Bird
Conservancy fairy shrimp	Crustacean
Green sturgeon	Fish
Steelhead	Fish
Chinook salmon	Fish
Valley elderberry longhorn beetle	Insect
Giant gartersnake	Reptile

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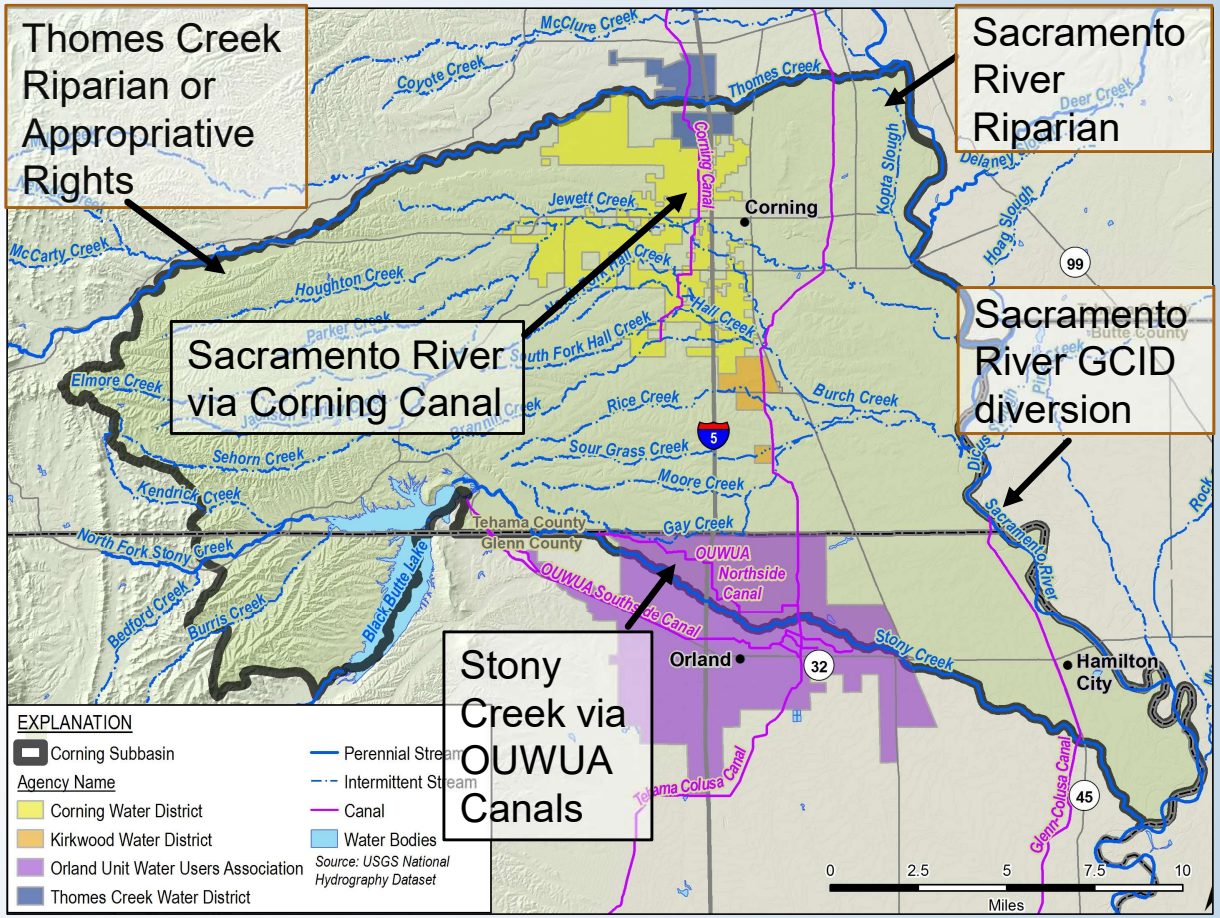
Beneficial Uses of Surface Water – Irrigation Water Supply

- Sacramento River
  - CVP Contractors via Corning Canal
  - GCID diversion North of Hamilton City
  - Minor riparian and appropriative rights
- Thomes Creek
  - Minor riparian and appropriative rights
- Stony Creek
  - Bureau of Reclamation OUWUA Contract; adjudicated stream via Angle decree
- Ephemeral streams
  - Not a significant source of irrigation supply



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Depletion of Interconnected Surface Water

Subbasin Conditions

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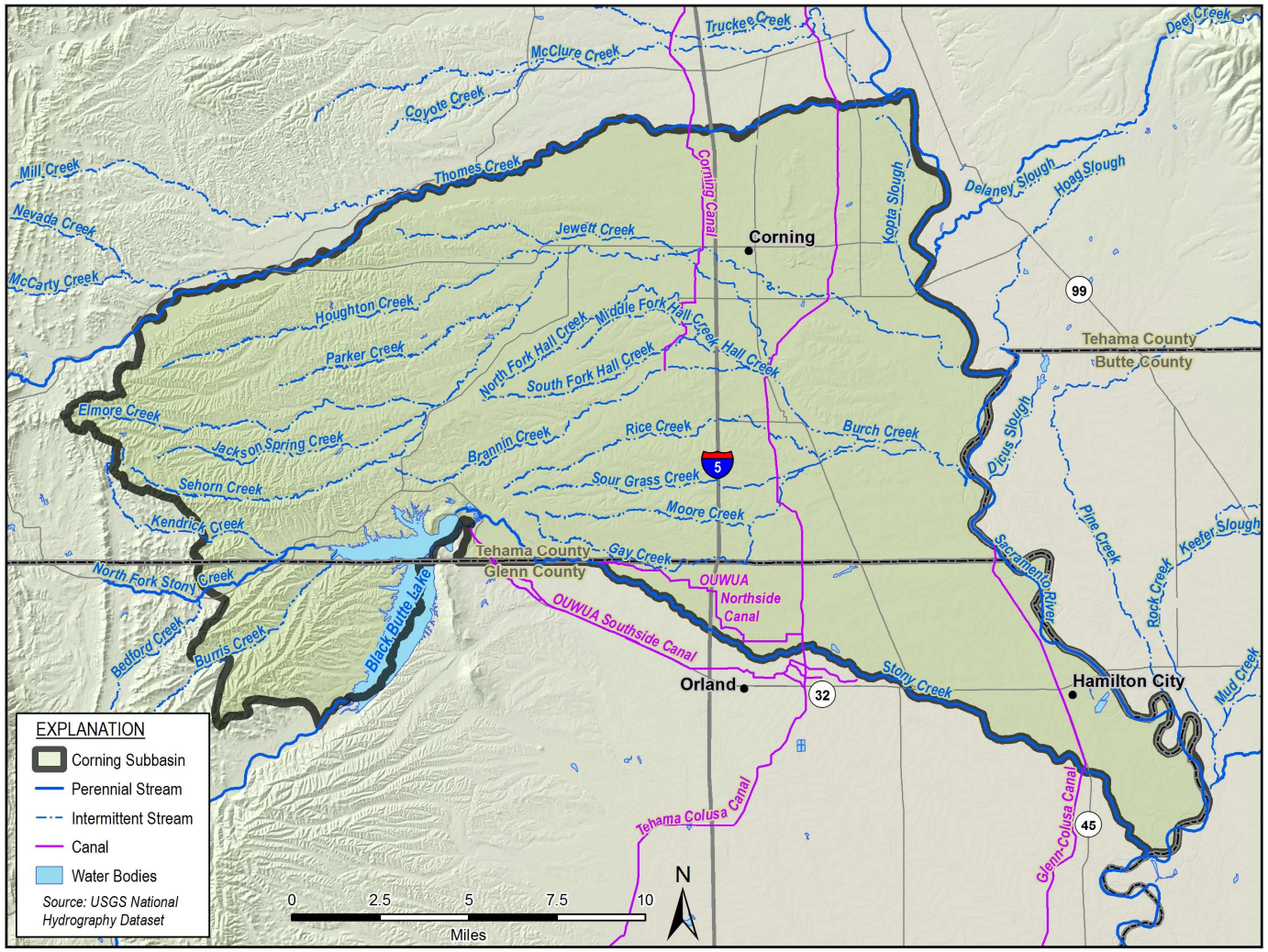
Major Surface Water Features

- Sacramento River
- Thomes Creek
- Stony Creek / Black Butte Lake
- Numerous ephemeral stream branches that generally feed Jewett or Burch Creek that flow into the Sacramento River
- Conveyance canals



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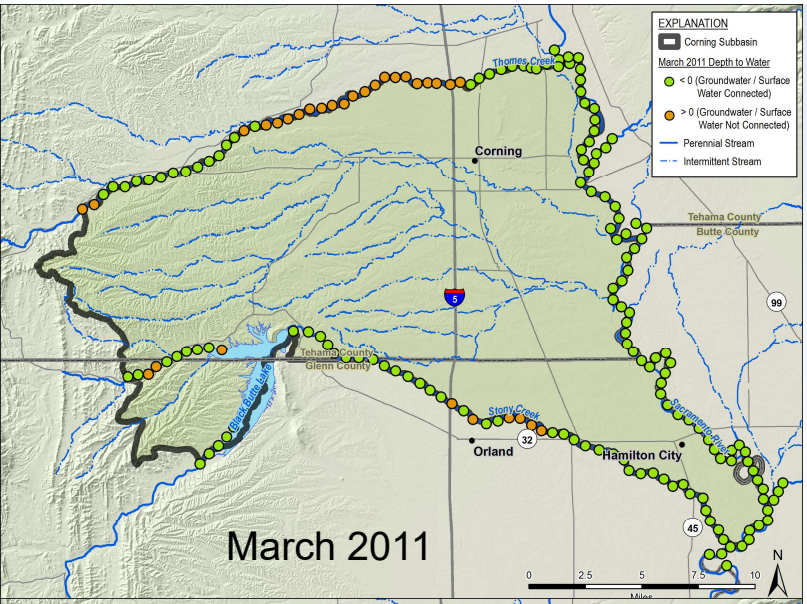
Subbasin Surface Water Summary

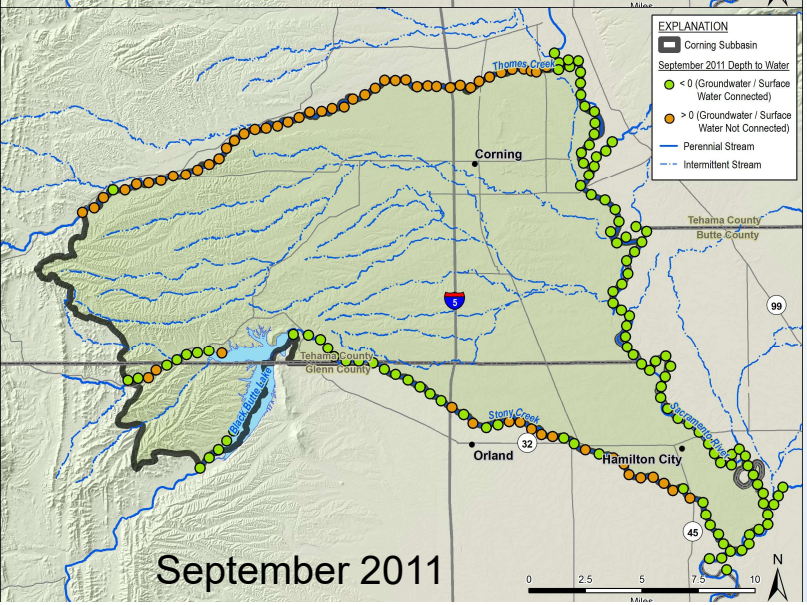
- The major surface water bodies in the Subbasin are interconnected with groundwater in at least some reaches.
  - Sacramento River and Stony Creek are likely fully connected to groundwater.
  - Sacramento River is generally a gaining stream.
  - Thomes Creek is likely only partially or seasonally connected and mostly losing stream.
  - Ephemeral streams are likely disconnected from groundwater.
- Each major surface water body supports potential GDEs and provides at least seasonal habitat for critical species.

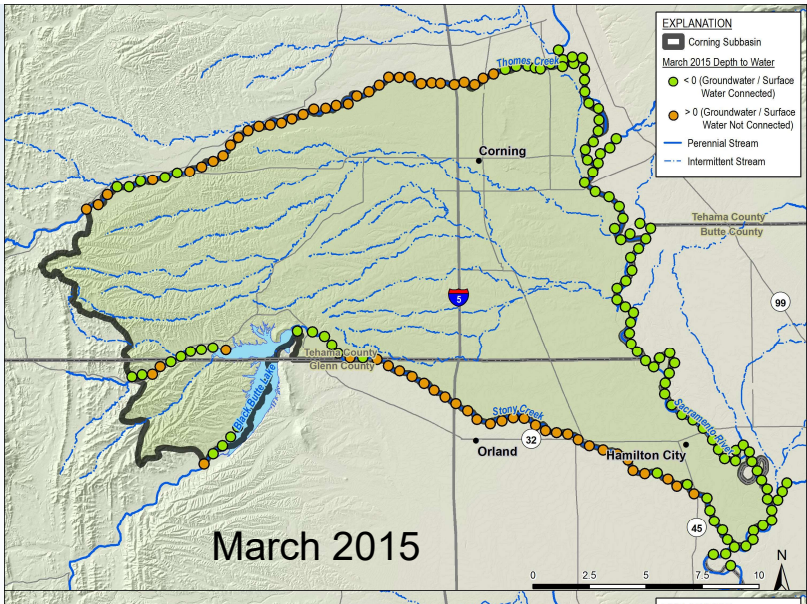
Stream-aquifer Connection

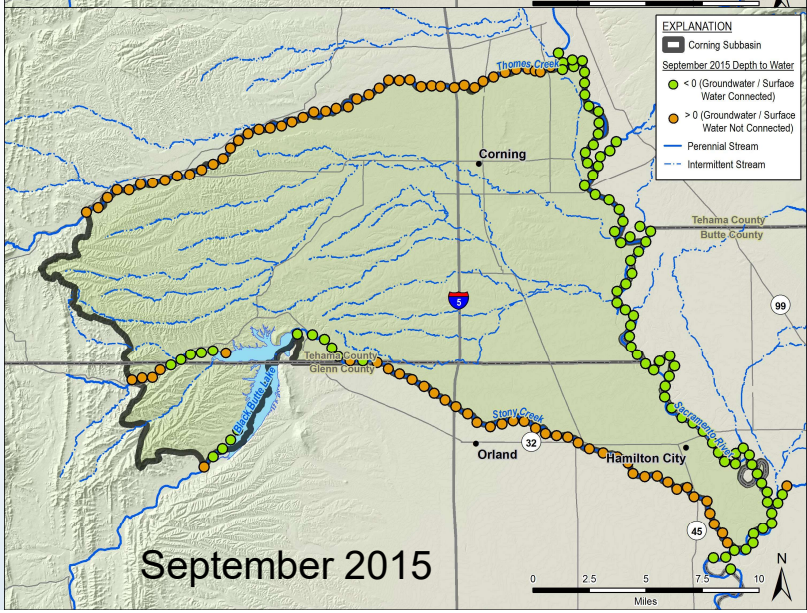
Simulated depth to water at stream nodes:

- < 0 (Groundwater / Surface Water Connected)
- > 0 (Groundwater / Surface Water Not Connected)
- Perennial Stream
- Intermittent Stream









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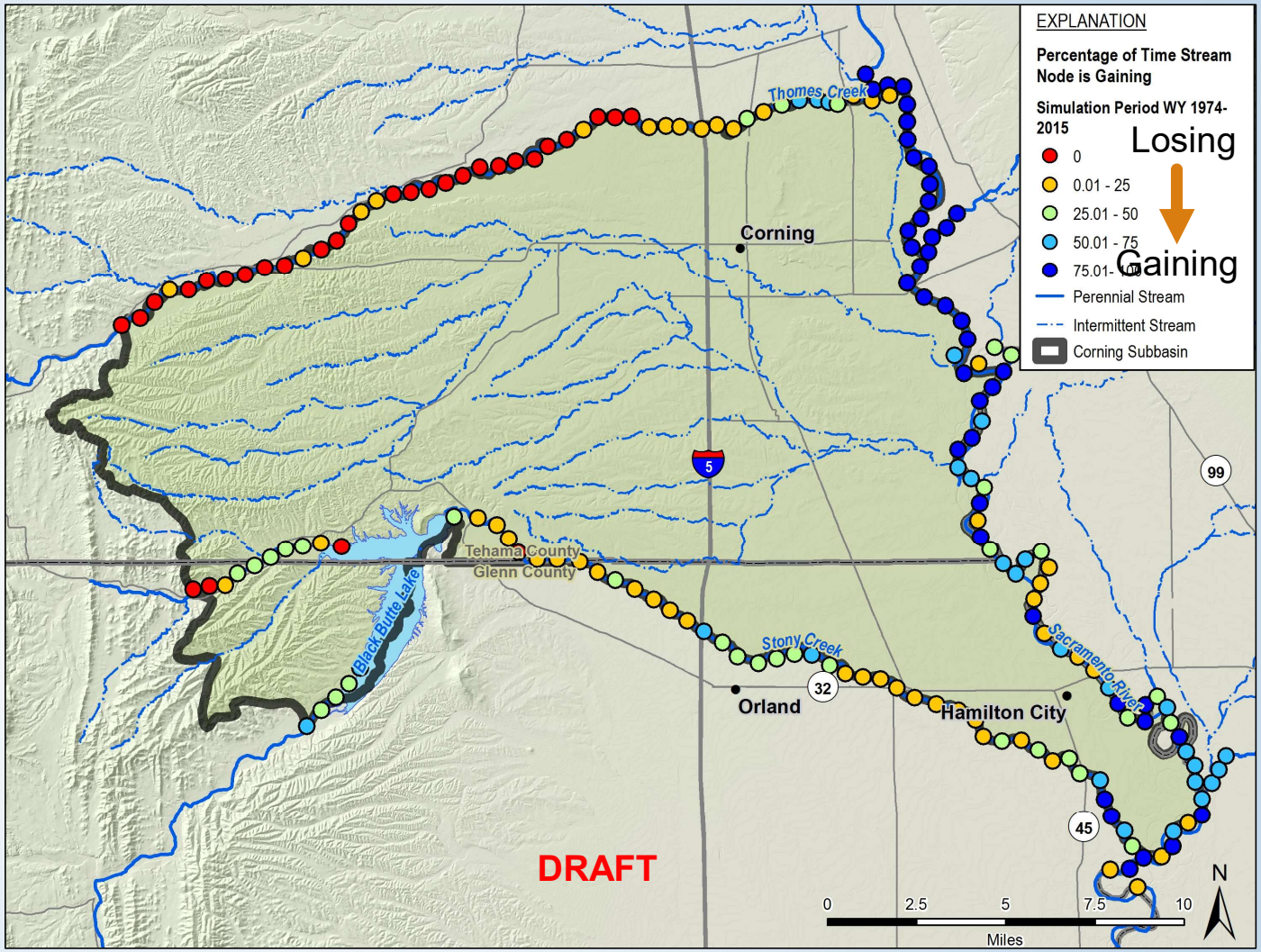
Surface Water Interaction in the GW Model

- Red nodes do not gain groundwater and are possibly disconnected.
- Orange to blue nodes were connected at times in historical simulation



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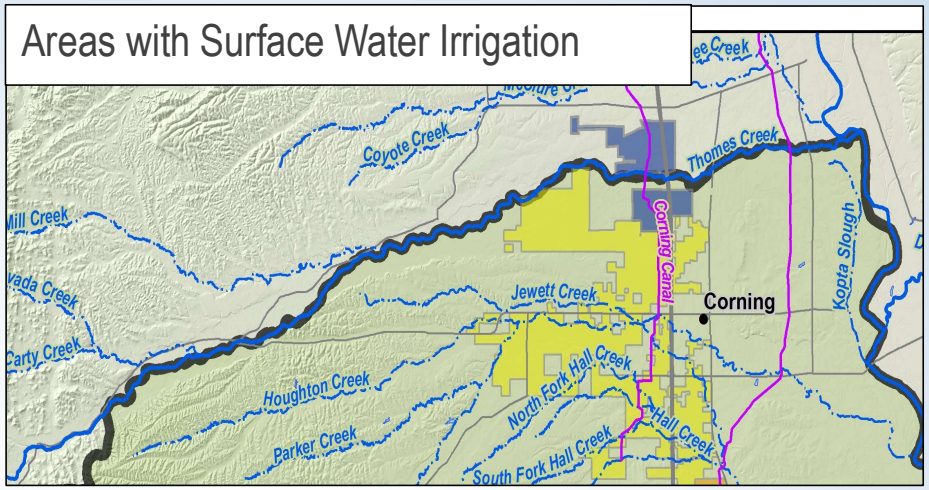
Thomes Creek Summary

- Likely mostly disconnected from groundwater due to deeper groundwater levels
- Often runs dry seasonally east of Henleyville
- Mainly losing reaches in Subbasin
- Some water is diverted for irrigation by riparian users
- Creek supports spring run of salmon and other potential GDE habitat



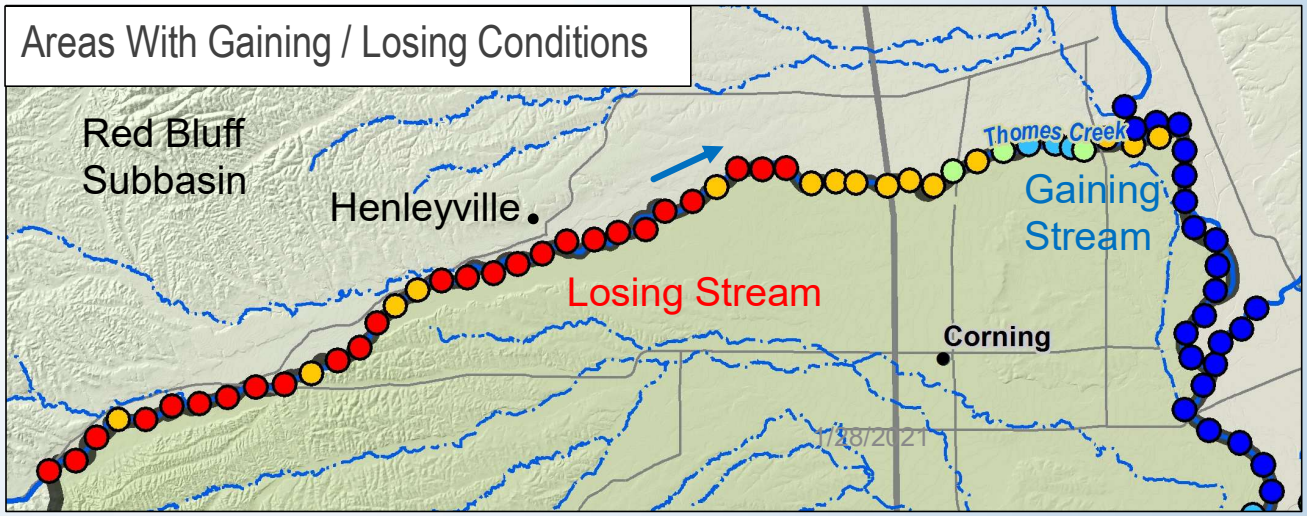
EXPLANATION

Percentage of Time Stream Node is Gaining

Simulation Period WY 1974-2015

- 0
- 0.01 - 25
- 25.01 - 50
- 50.01 - 75
- 75.01- 100
- Perennial Stream
- Intermittent Stream

Losing → Gaining



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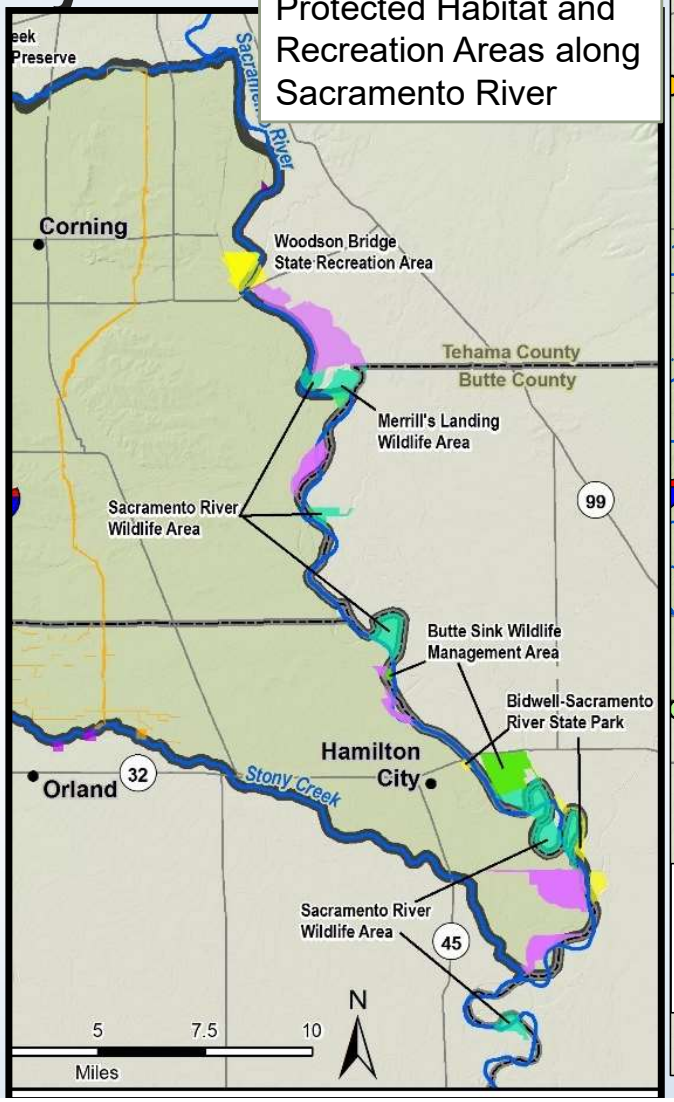
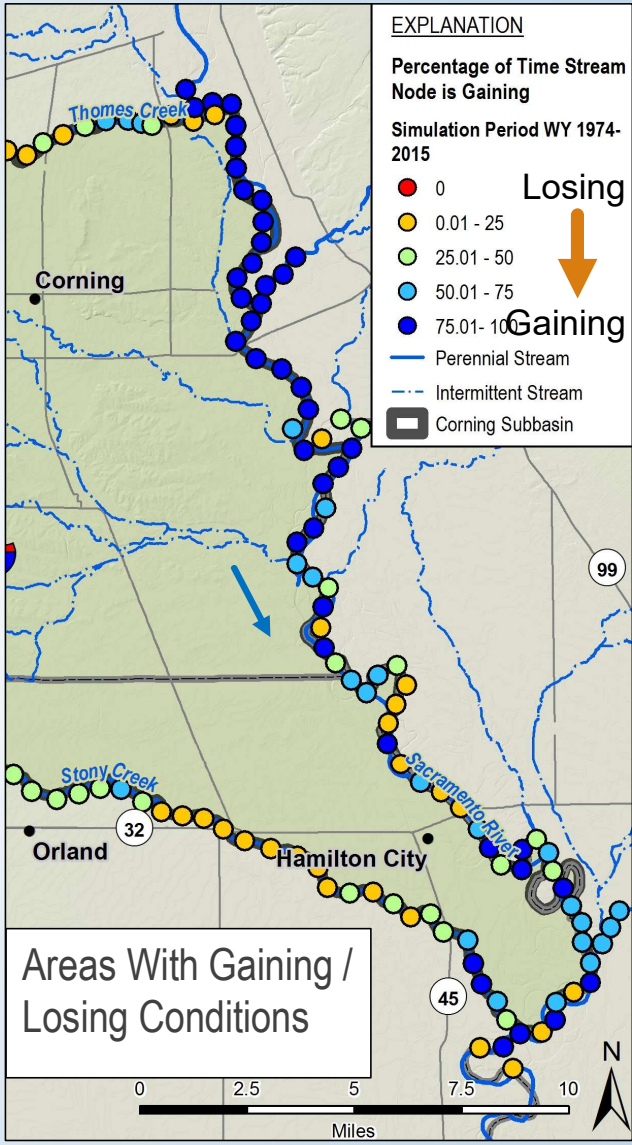
Sacramento River Summary

- River flow controlled upstream at Shasta Dam
- TCCA Diversion to TCC and Corning Canal
- Diversion at Glenn Colusa Canal
- Reaches in Subbasin are connected to groundwater and generally gaining
- River supports GDEs and multiple salmon runs across the Northern Sacramento Valley
- Multiple protected riparian habitat areas (parks, recreation, vegetation, restoration projects, flood control)





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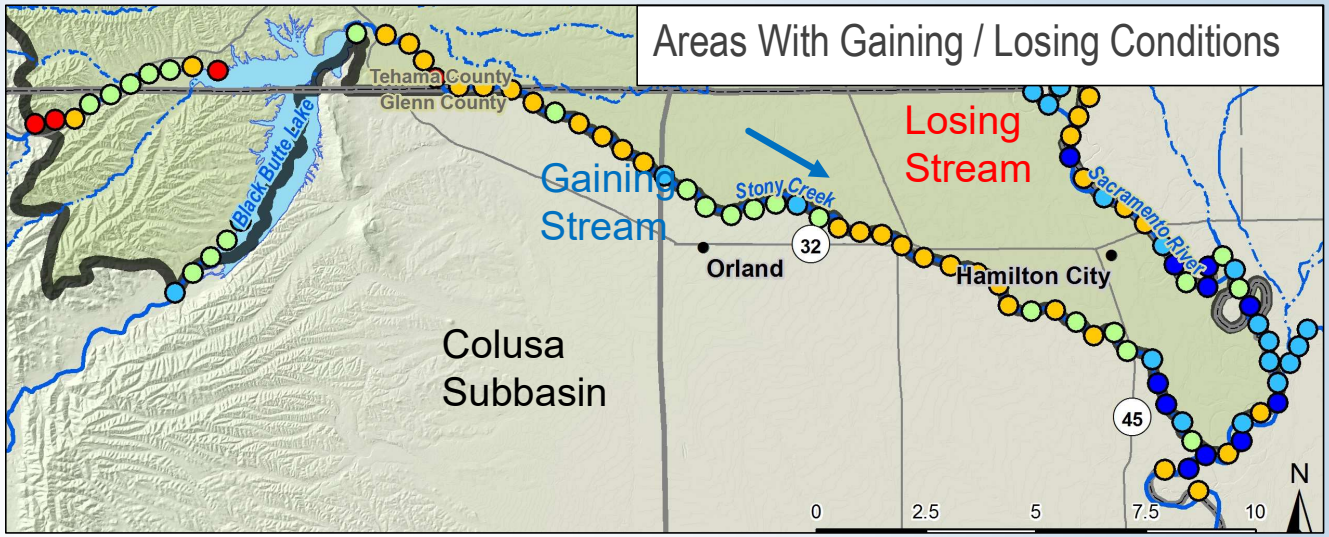
Stony Creek Summary

- Creek flow regulated at Black Butte Dam for flood control and irrigation
- Creek connected to shallow groundwater
  - Alluvium fan surrounding Stony Creek is very transmissive, and Stony Creek is known as a significant source of direct groundwater recharge
  - Creek is typically gaining upstream where surface water is used for irrigation and generally losing downstream where groundwater is used
- Creek supports salmon and other potential GDE habitat



EXPLANATION

Percentage of Time Stream Node is Gaining

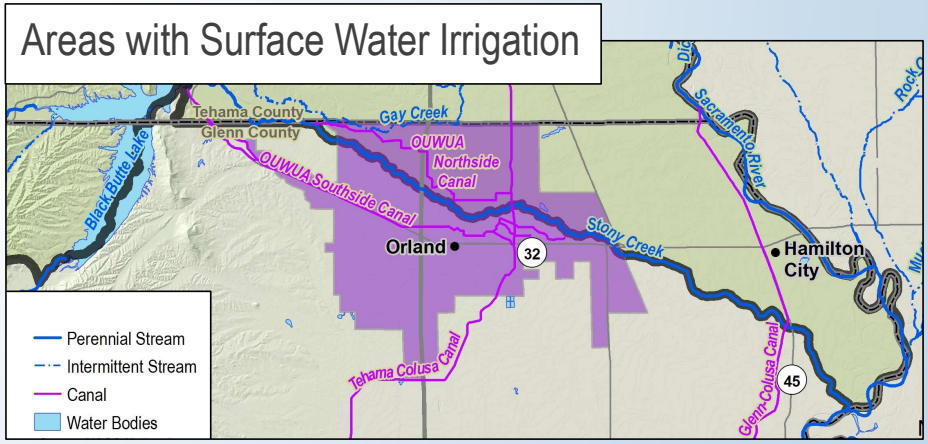
Simulation Period WY 1974-2015

- 0
- 0.01 - 25
- 25.01 - 50
- 50.01 - 75
- 75.01- 100

Losing

Gaining

- Perennial Stream
- Intermittent Stream



Identifying Potential GDEs in the Subbasin

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General Approach to Identifying Potential GDEs in the Subbasin

1. Identify areas where SW and GW are connected
2. Review maps of GDE vegetation indicator species
3. Perform initial screening based on 30 ft depth to groundwater

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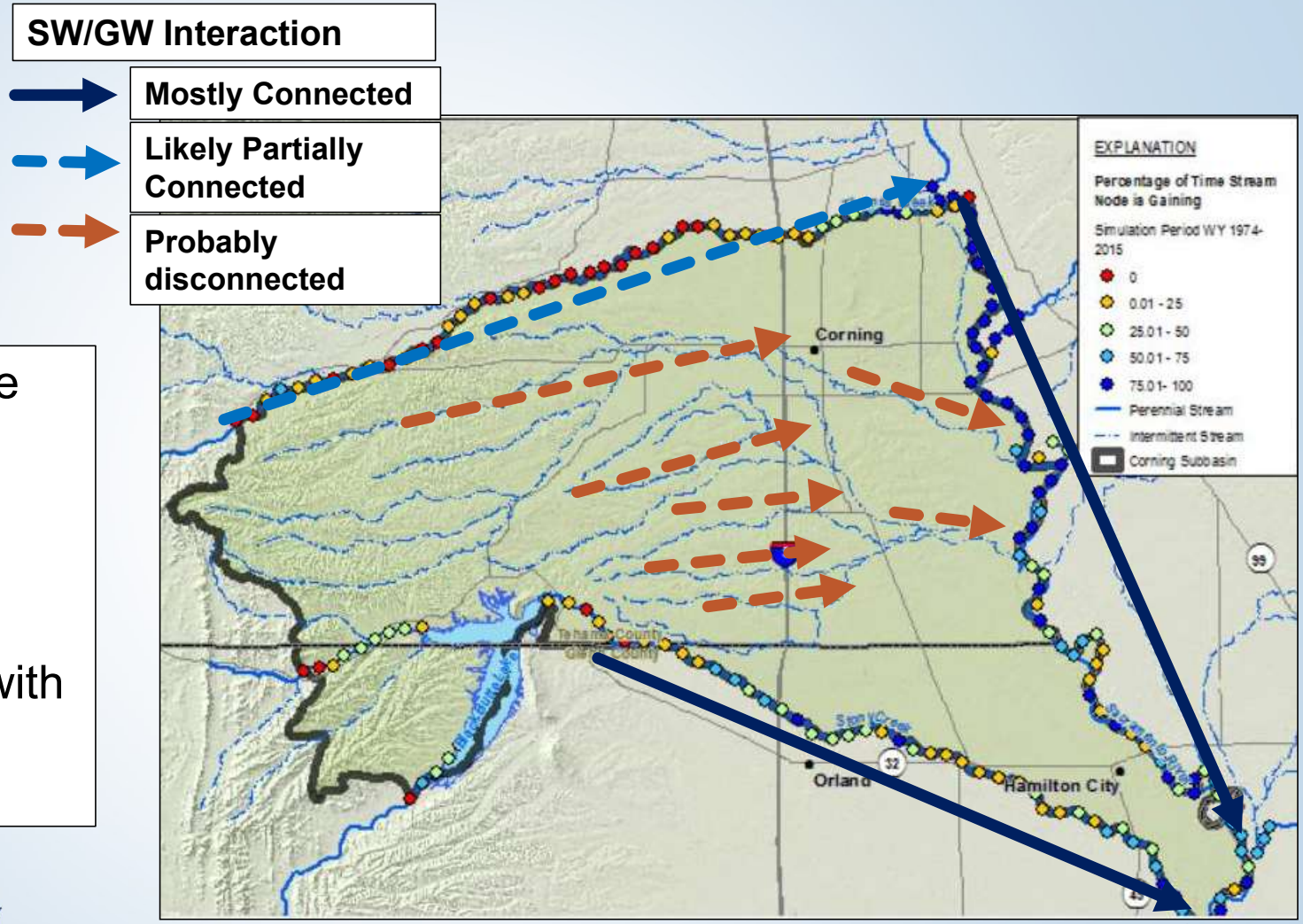
General Approach to Identifying Potential GDEs

1. Identify areas where SW and GW are connected
   - Use model to identify stream interconnection with aquifer



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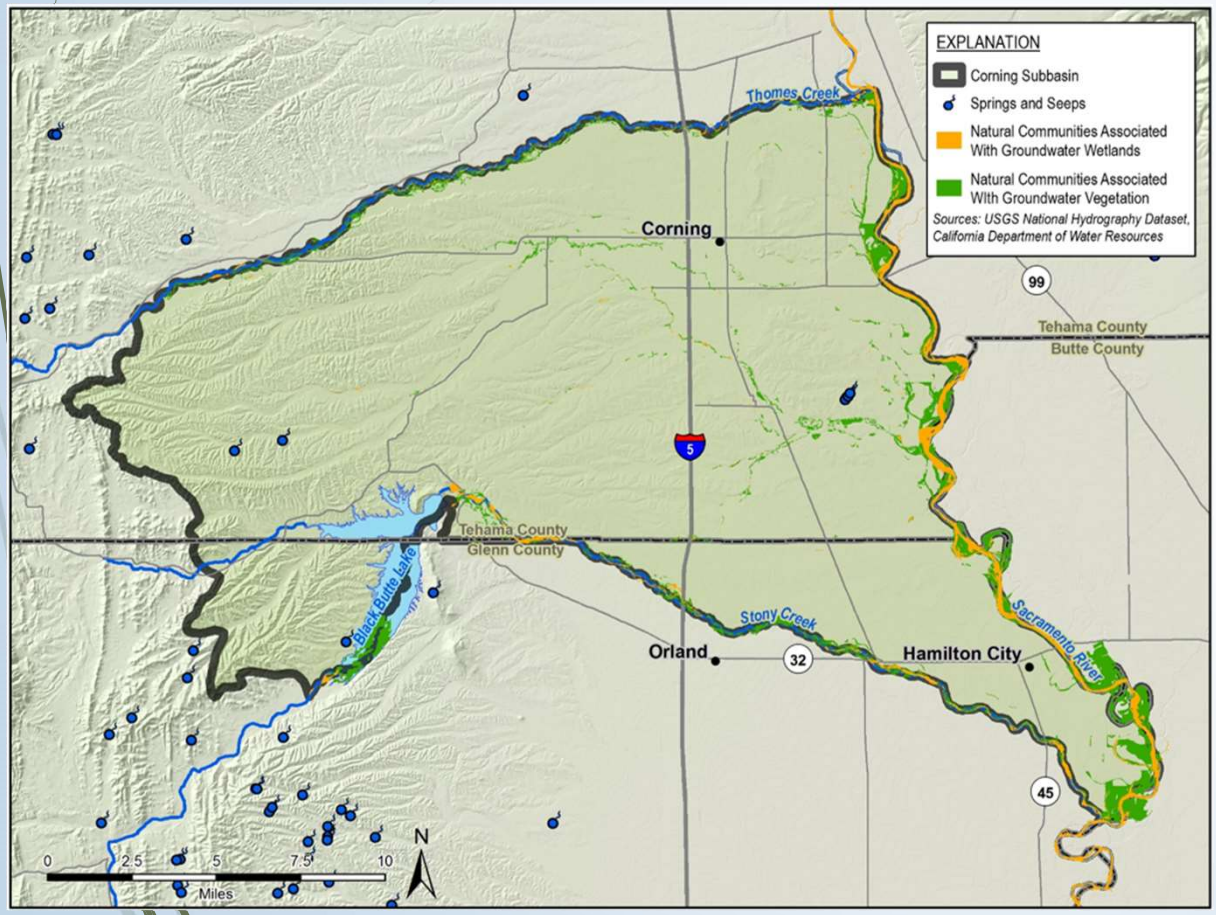
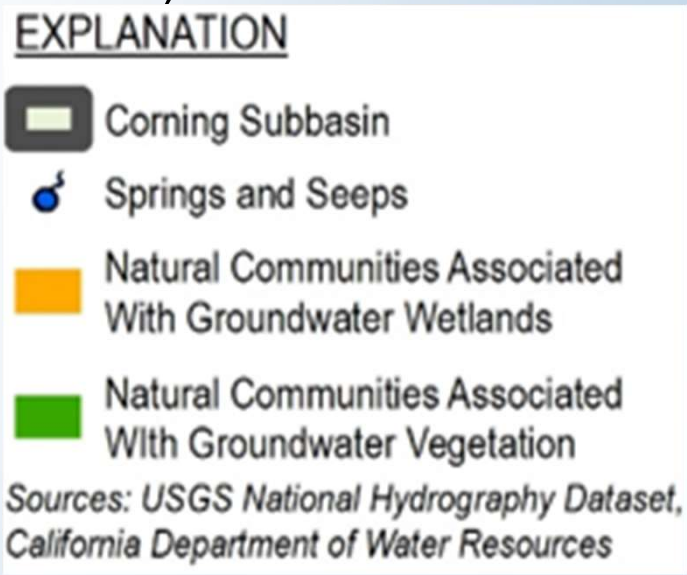
General Approach to Identifying Potential GDEs

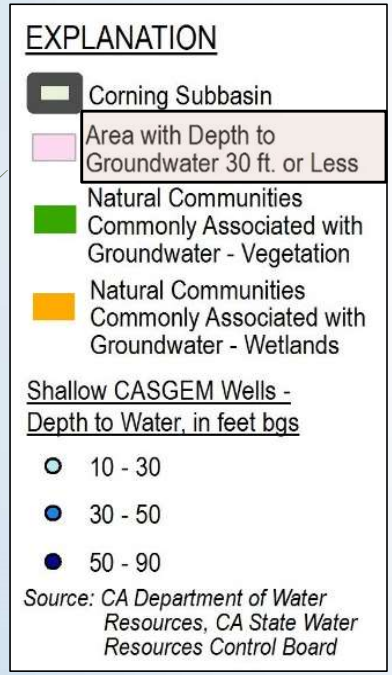


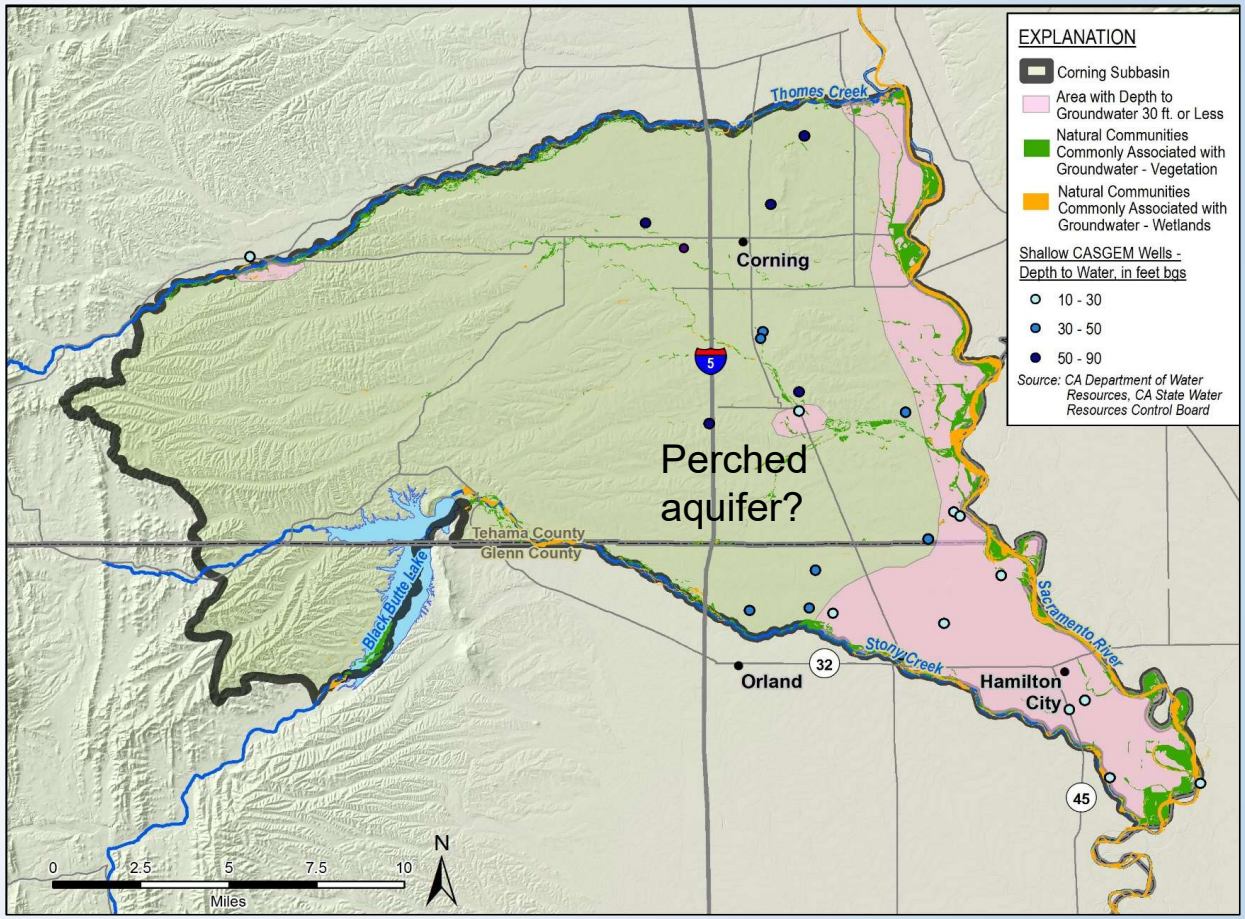
2. Review maps of GDE vegetation indicator species (NCCAG Dataset from DWR)



Potential GDEs Identification

3. Perform initial screening based on 30 ft depth to groundwater





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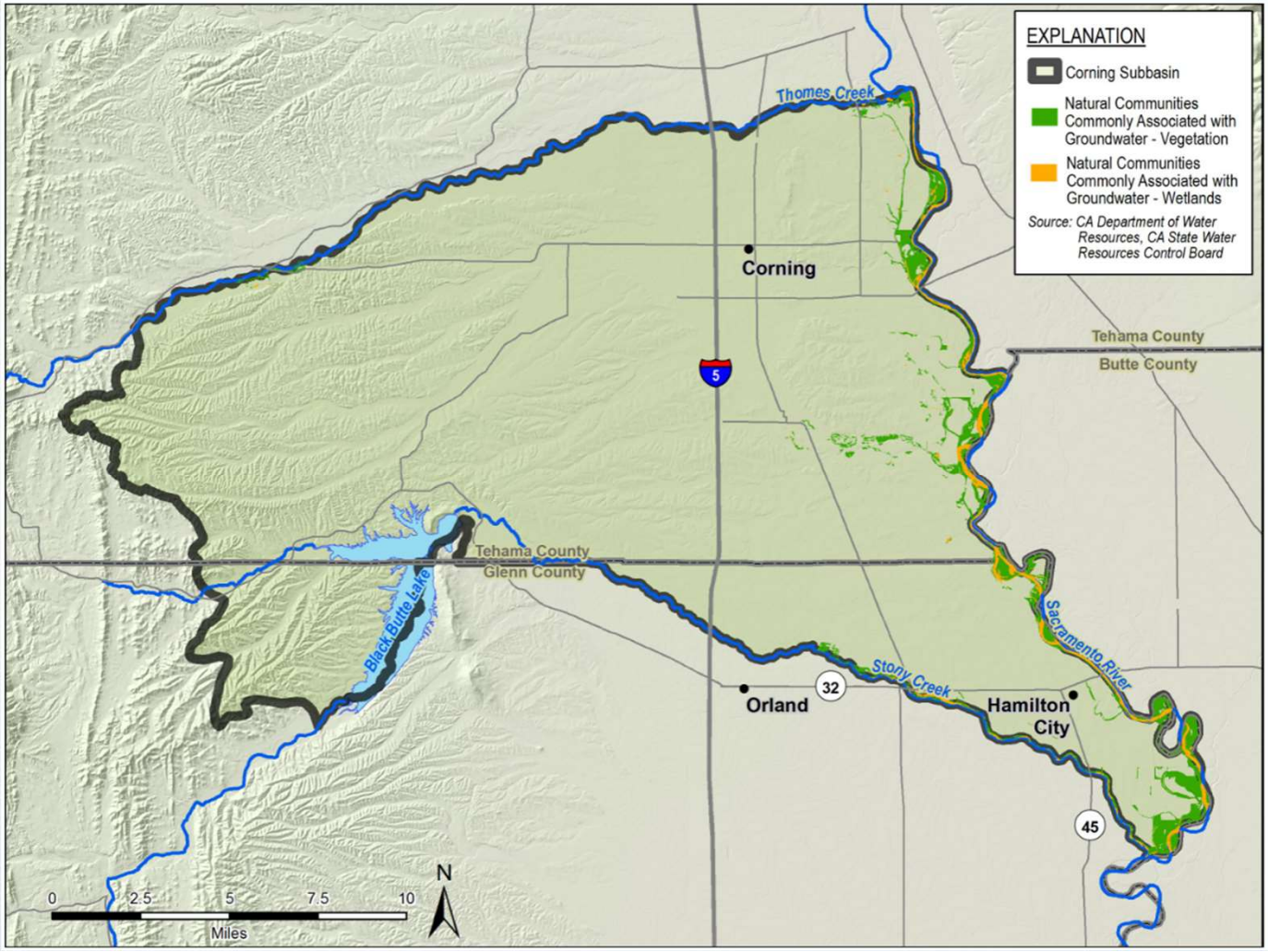
Potential GDEs Identified in the Subbasin



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Depletion of Interconnected Surface Water Pumping Areas

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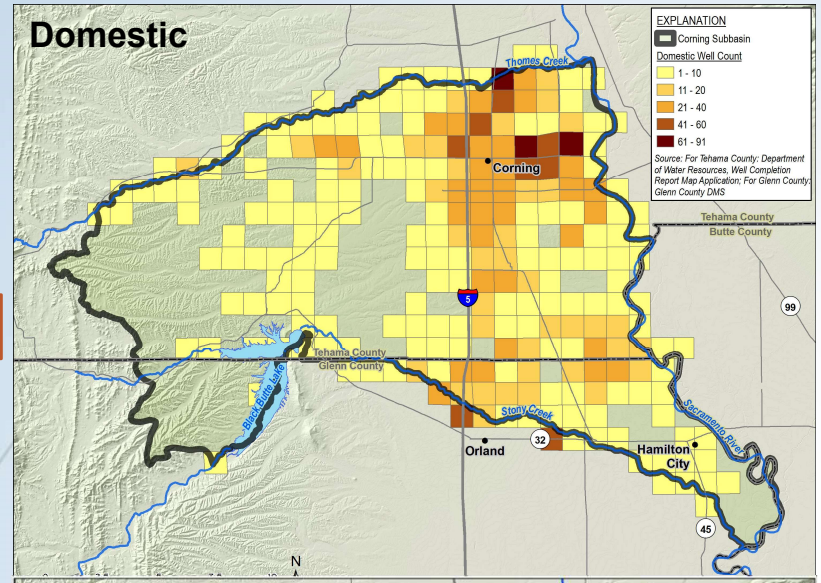
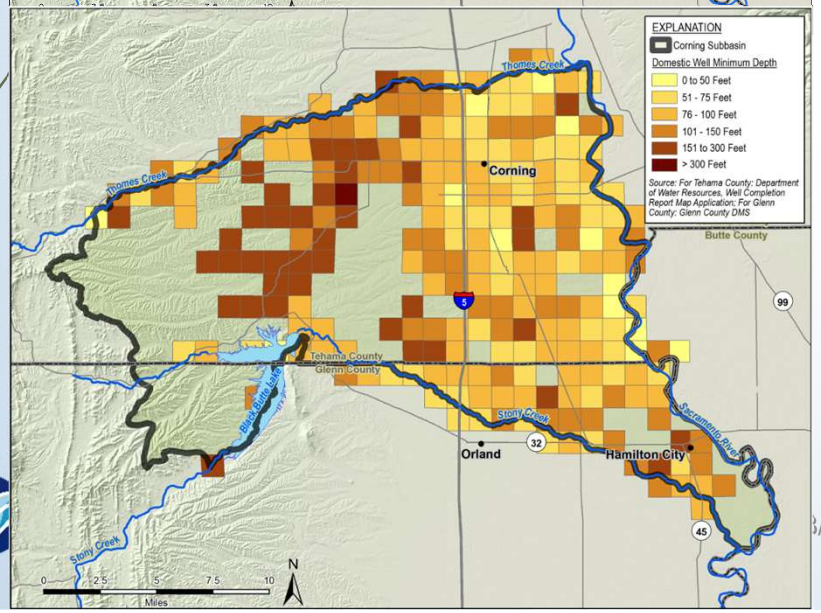
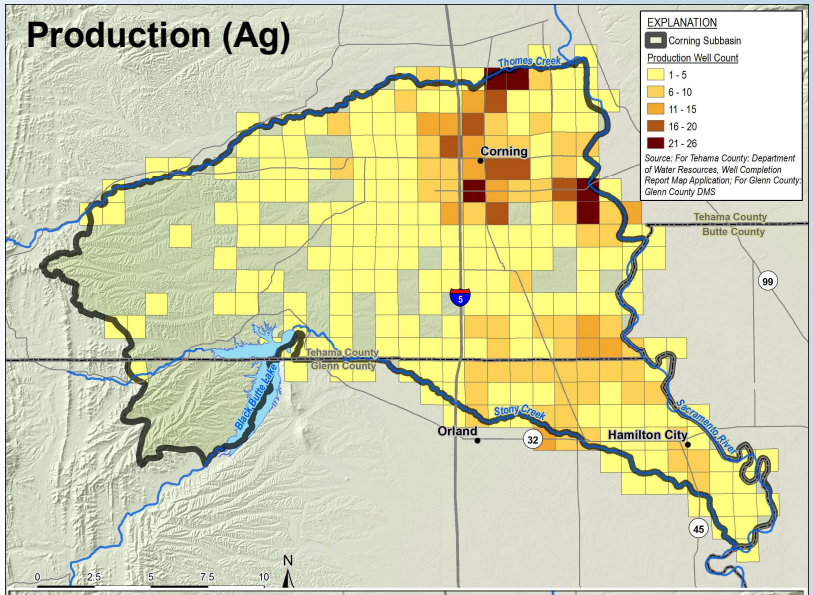
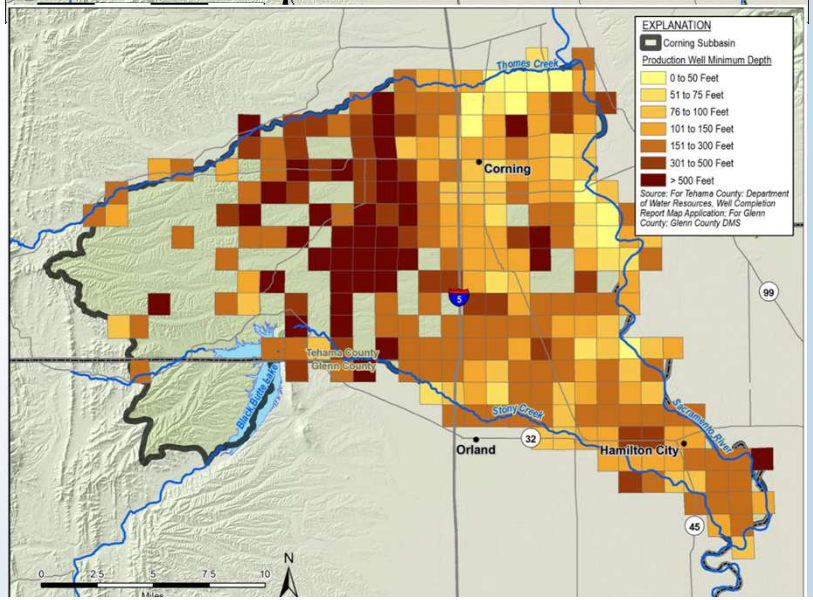
Well Density

Min Depth









Depletion of Interconnected Surface Water

Sustainable Management Criteria

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Surface Water Depletion SMC Metrics

- Section 354.28(c)(6) of the Regulations states that "The minimum threshold for depletions of interconnected surface water shall be the **rate or volume of surface water depletions caused by groundwater use** that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results."
- The SGMA regulations allow for the use of **groundwater elevations as a proxy** for volume or rate of surface water depletion if a significant correlation exists between groundwater elevations and surface water depletions.
- Minimum thresholds should only apply to the interconnected stream reaches.

Considerations for Significant and Unreasonable Conditions

- Who or what is impacted?
  - Groundwater dependent ecosystems (flora and fauna)?
  - Agricultural/Municipal/rural users?
- What kind of impact constitutes significant and unreasonable? Over what time period?
  - Significant and unreasonable conditions may be more noticeable in months with low stream flow when a larger portion of surface water comes from groundwater baseflow.
  - Low rainfall does not constitute a significant & unreasonable impact. The impact must be due to groundwater use.
- Where Does the Interconnected Surface Water Sustainability Indicator Apply?
  - Where surface water is interconnected with groundwater
  - Where there are GDEs
  - Where groundwater is being used

Development of Significant and Unreasonable Conditions Statement

- Significant and unreasonable conditions for surface water depletion common elements:
  - *(Common GSP theme) – Causing significant adverse impact to beneficial uses and users of surface water within the Subbasin*
  - *(EDF Guidance) – No further depletion of surface flows, beyond the level of depletion that occurred prior to 2015*
  - *(Other Considerations) –The GSA does not have authority to manage reservoir releases*

Example Statements from Other GSPs

- **Salinas Valley Basin – 180/400 ft Aquifer GSP**
  - *Significant and unreasonable depletion of interconnected surface water in the Subbasin is depletion of interconnected surface water flows that may prevent the MCWRA from meeting biological flow requirements in the Salinas River, or would induce an unreasonable impact on other beneficial uses and users such as surface water rights holders. The GSA does not have authority to manage reservoir releases and is not required to manage surface waters.*
- **Eastern San Joaquin and Merced GSPs**
  - *Significant and unreasonable depletions of interconnected surface water in the Eastern San Joaquin (or Merced) Subbasin are depletions that result in reductions in flow or levels of major rivers and streams that are hydrologically connected to the basin such that the reduced surface water flow or levels have a significant adverse impact on beneficial uses and users of the surface water within the Subbasin over the planning and implementation horizon of this GSP.*

Thoughts from staff and the CSAB?

Feedback on Significant and Unreasonable Statement Considerations

Statement of **Significant & Unreasonable** is a qualitative statement. describing groundwater conditions unacceptable to beneficial uses and users of water in the basin. These describe what conditions are to be avoided and serve as an initial framework around which the quantitative SMC are developed.

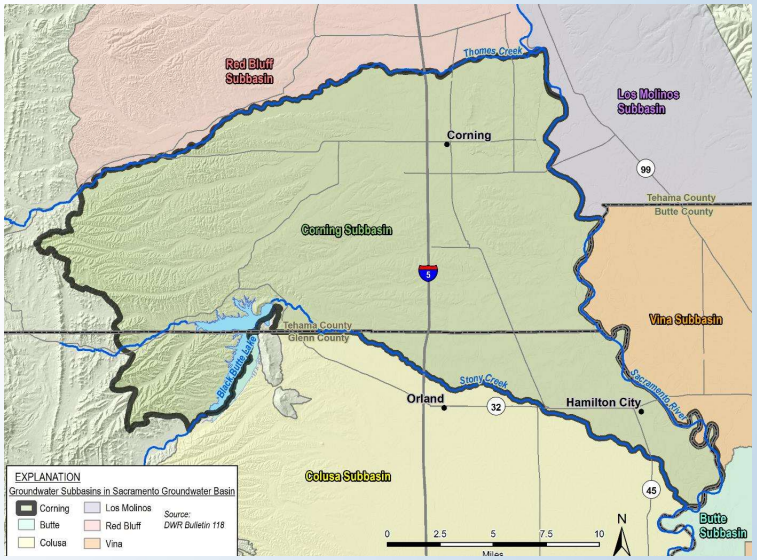
- **Who or what is impacted by significant and unreasonable conditions,**
- **What kind of impact constitutes significant and unreasonable,**
- **Over what time period are conditions significant and unreasonable, and**
- **Over what geographic area are conditions evaluated.**

Sacramento Valley Interbasin Coordination Efforts Regarding Streamflow Depletion

NCWA-led Technical Coordination

- Consultant teams meet regularly to try and come up with a reasonable coordinated Sacramento Valley wide approach
- Coordinate with TNC and EDF on approaches and GDE identification

Coordination needs with neighboring subbasins, since we share boundaries at streams



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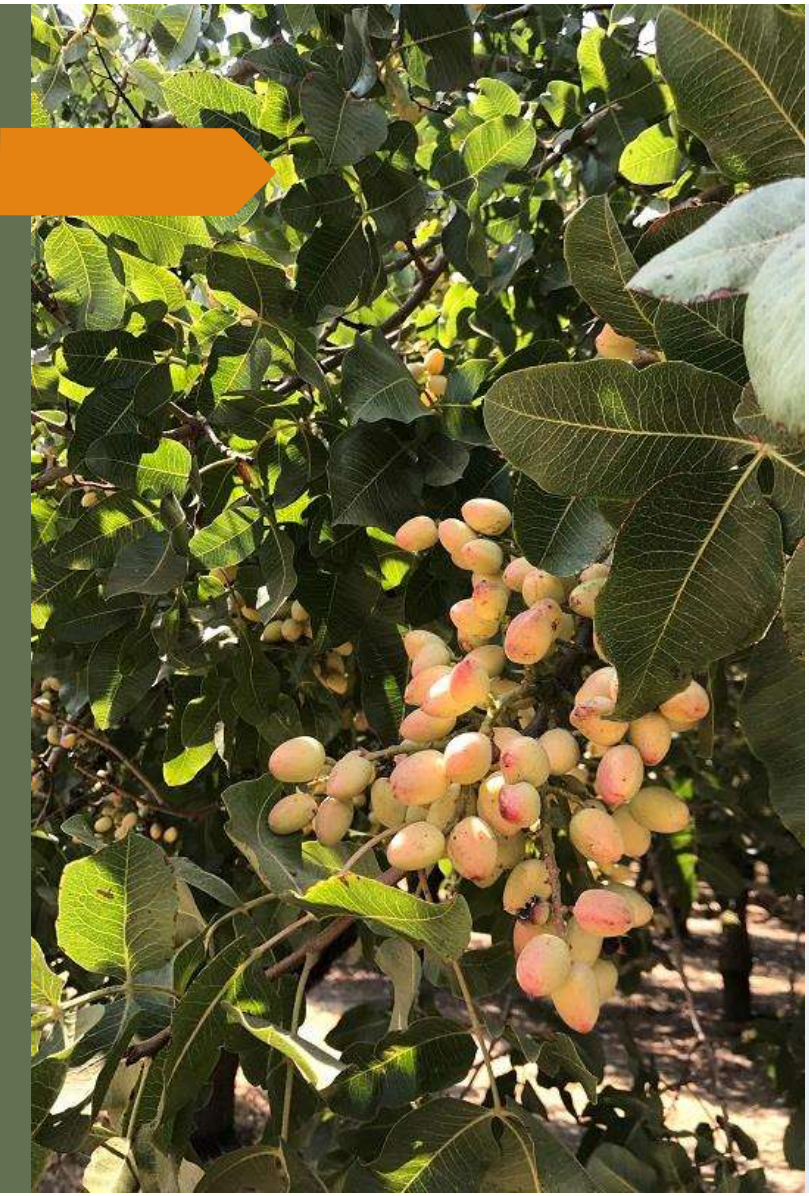

Interconnected Surface Water Discussion: Questions and Comments?

- CSAB comments
- Public comments

Introduction to Land Subsidence

Data, Regs, SMC

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What is Subsidence and how does it happen?

- Land subsidence is a gradual settling or sudden sinking of the Earth's surface
- Causes of subsidence
  - GW Level Decline - dewaters or depressurizes the porous media/aquifer skeleton
  - Geology – Subsidence is more pronounced where layers of fine-grained sediments exist
- Aquifer-system compaction may be seasonal or otherwise non-permanent (elastic), or permanent and irreversible (inelastic).

Potential Impacts from Inelastic Subsidence

- Damage to surface and subsurface infrastructure (eg, canals, roads, buildings, pipelines, etc.)
- Drainage issues
- Some permanent loss in aquifer storage

GSP Regulations - Subsidence

- Section 354.28(c)(5) of the Regulations states that "The minimum threshold for land subsidence shall be the **rate and extent of subsidence** that **substantially interferes with surface land uses** and may lead to undesirable results"
- The defined metric from the GSP regulations for measuring total subsidence is the **rate of change in ground surface elevation**. This can be measured with extensometers, continuous GPS stations, levelling surveys, or Interferometric Synthetic-Aperture Radar (InSAR) data.

Considerations for Significant and Unreasonable Conditions Description

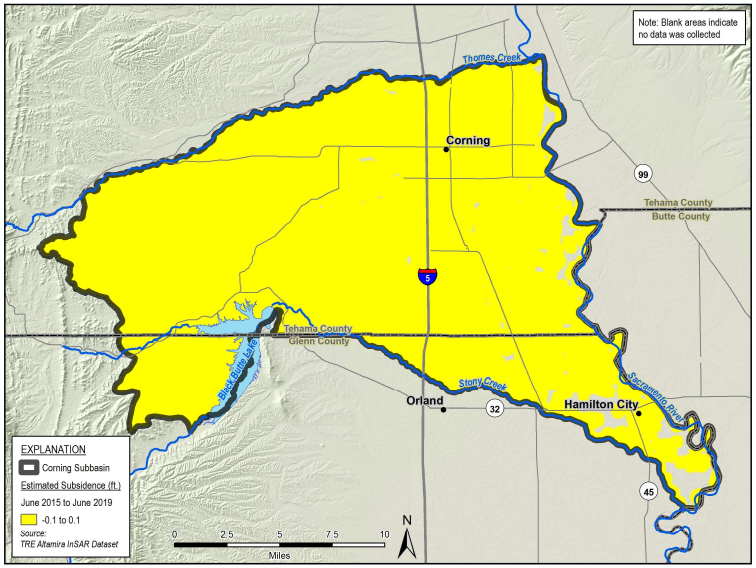
- Who or what is impacted?
  - Ag or Developed Infrastructure?
- What type of impact constitutes significant and unreasonable?
  - GSP should consider the amount of subsidence that substantially interferes with surface land uses.
  - The impact must be due to groundwater use
  - Only applies to inelastic (irreversible) subsidence

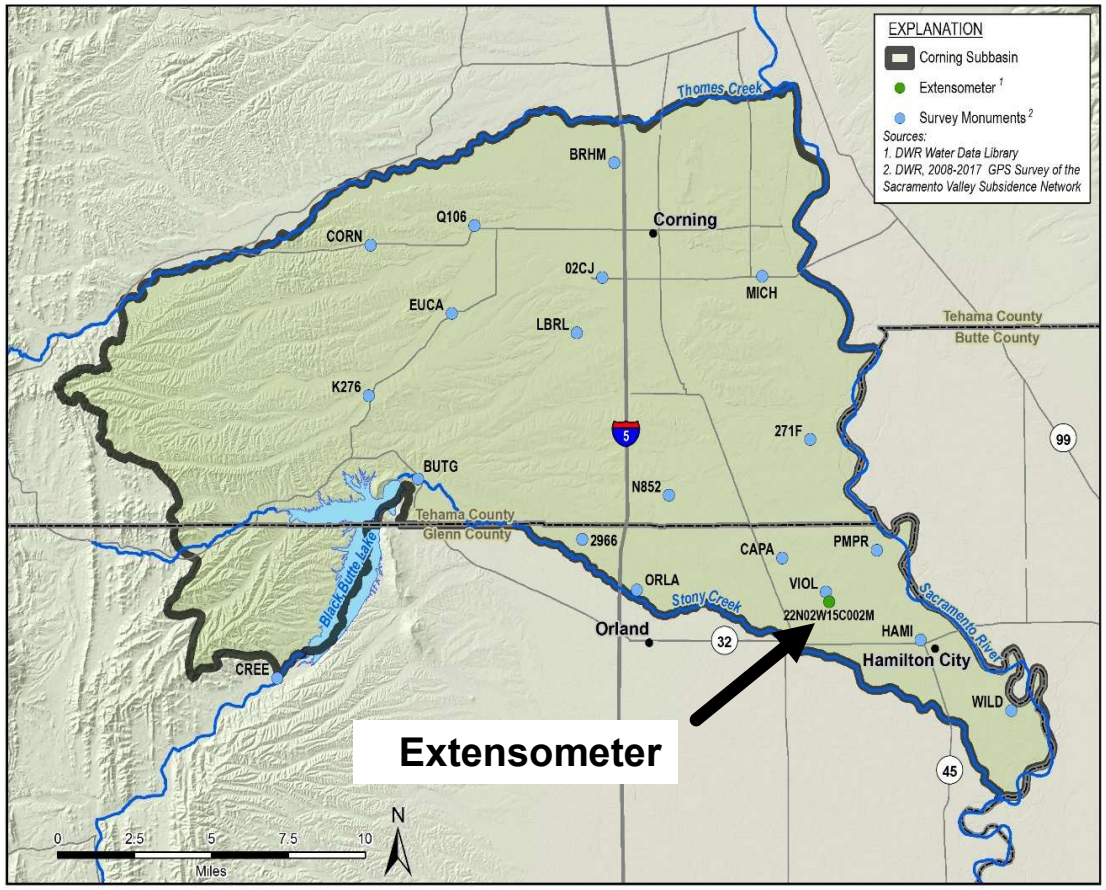
Overview of Subbasin Conditions

- To date there has been little to no inelastic subsidence observed in Corning Subbasin
- There is geology potentially conducive to inelastic subsidence if groundwater levels continue to decline
- Noted area of subsidence mostly to south of Subbasin could spread in future
- Maintaining water levels at current levels will be crucial in preventing future subsidence

DWR Subsidence Monitoring Network

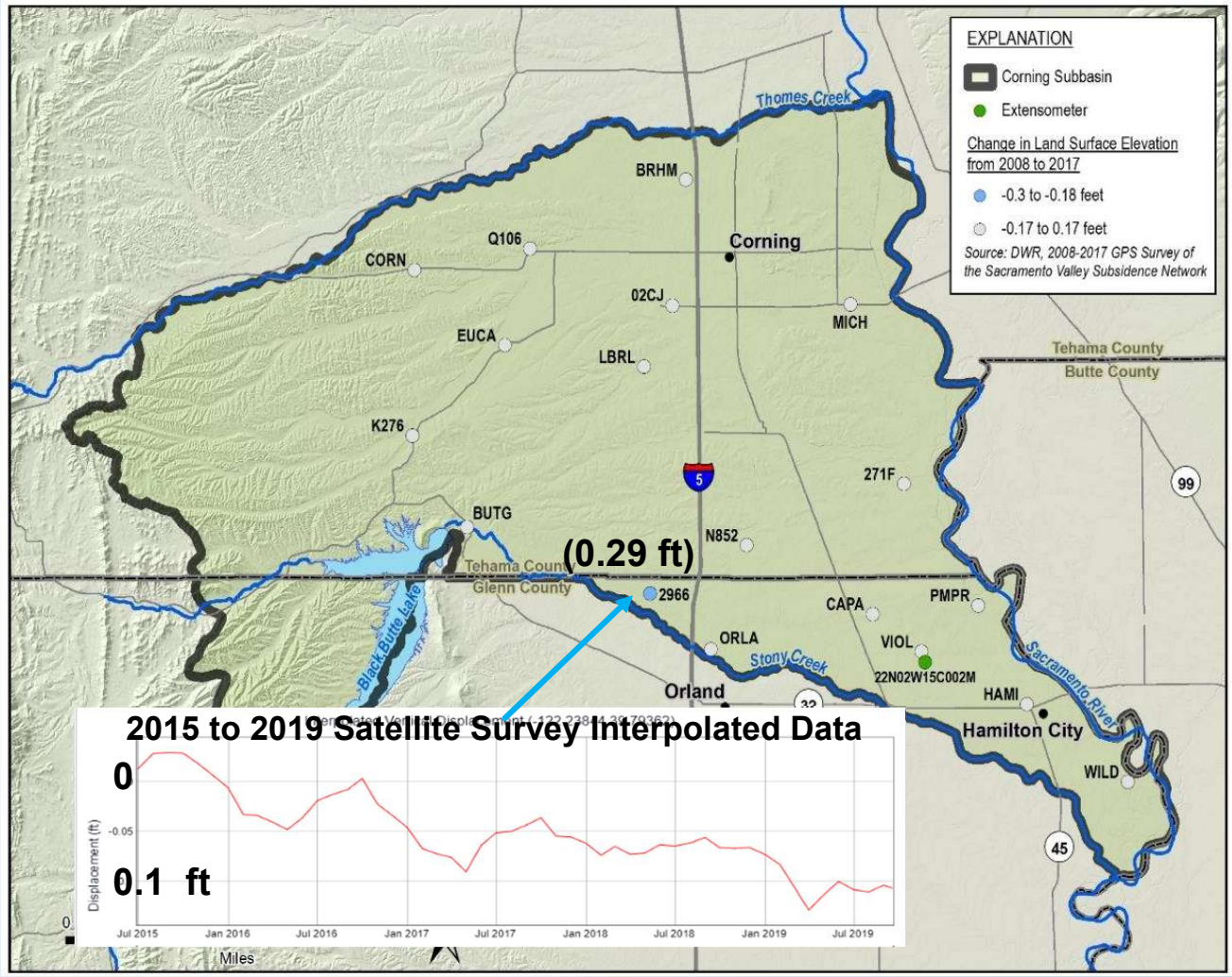
- 20 survey monuments
- 1 extensometer
- Comprehensive In-SAR satellite data





Subsidence Background - Elevation Surveys

- Max subsidence in Subbasin at location near Orland is 0.29 ft between 2008 and 2017



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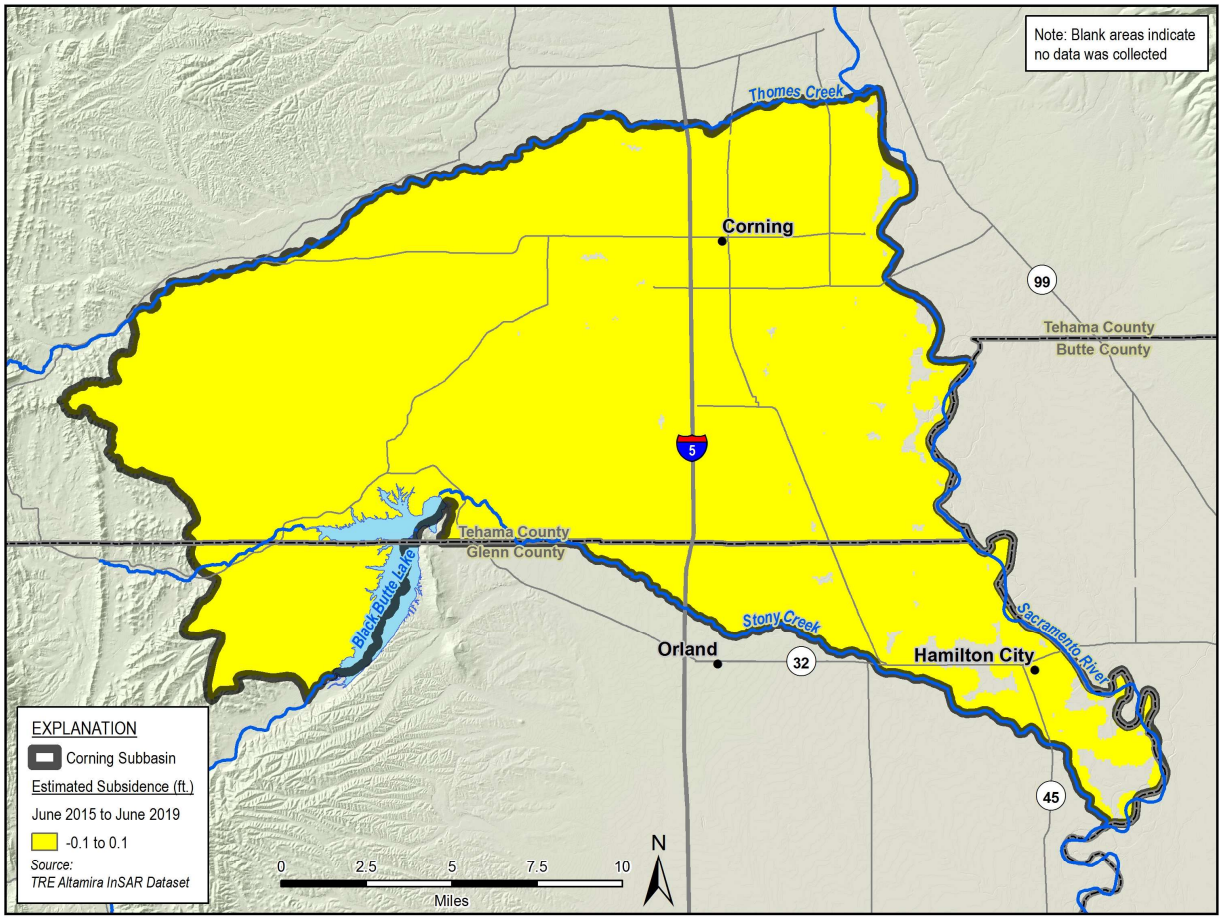
Subsidence Background – In-SAR

- Essentially no subsidence (+/- 0.1 ft) measured by satellite in Subbasin between 2015 and 2019



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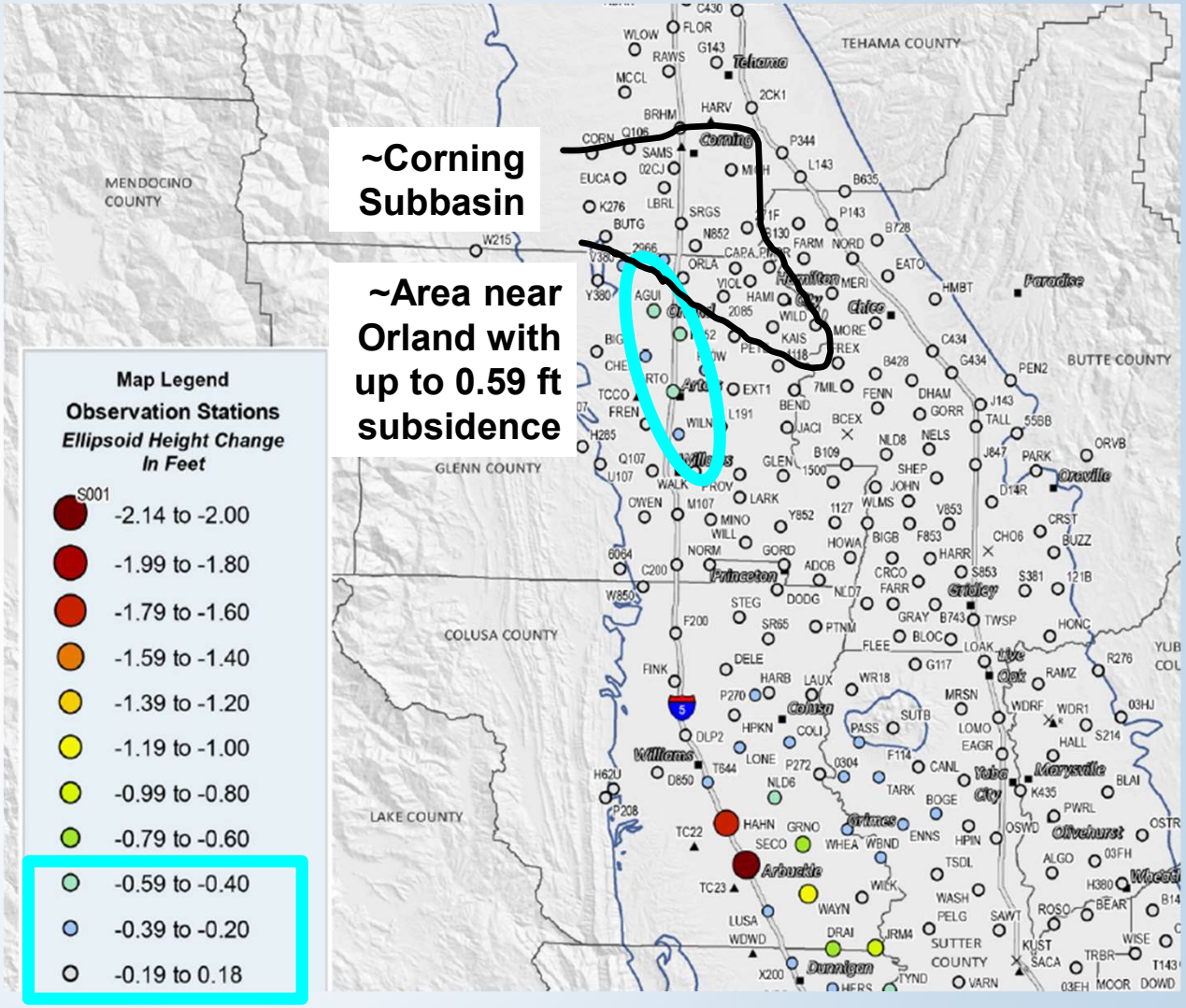
Regional Subsidence Overview

- Area mostly adjacent to Corning Subbasin with subsidence (up to 0.59 ft or 7 inches) between 2008 and 2017 elevation surveys



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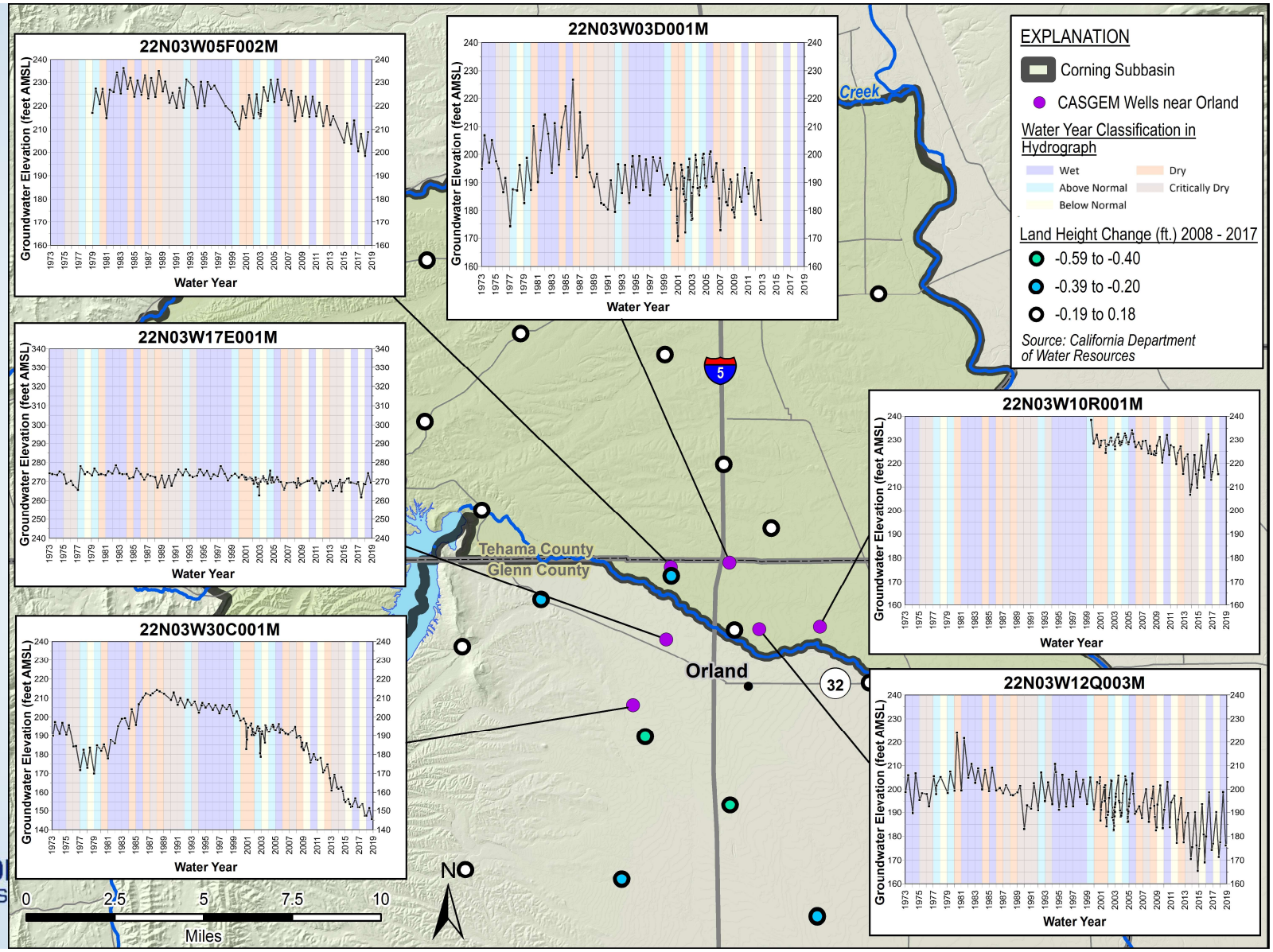
Regional Subsidence Compared to Water Levels



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Land Subsidence

Sustainable Management Criteria

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DISCUSSION: Develop a description of what is **significant and unreasonable**

- **Example from Salinas Valley Basin – 180/400 ft Aquifer GSP**
  - *Any inelastic land subsidence that impacts infrastructure and is caused by lowering of groundwater levels occurring in the subbasin is significant and unreasonable.*

Feedback on Significant and Unreasonable Statement Considerations for Land Subsidence

DISCUSSION: Set Minimum Thresholds

The value you do not want to cross

- Quantitative value that is used to define an undesirable result at each representative monitoring point (e.g., InSAR subsidence monitoring grid)
- **Minimum Thresholds based on what is *Significant and Unreasonable***
- Example minimum threshold:
  - *The minimum threshold for inelastic subsidence due to lowered groundwater elevations is zero throughout the subbasin. To account for error in the InSAR data, the annual minimum threshold is set to 0.1 feet of subsidence per year, while maintaining no subsidence.*

DISCUSSION: Undesirable Results are a Combination of Minimum Thresholds

Example:

Any exceedance of a minimum threshold is an undesirable result, if the exceedance is irreversible and caused by lowering groundwater elevations. It is furthermore an undesirable result if any area experiences five continuous years of subsidence due to lowered groundwater levels, even if each year's annual subsidence rate is less than the minimum threshold.

How you define Undesirable Results is how you can accommodate flexibility

Subsidence SMC Additional Considerations

- Draft chronic lowering of water level minimum thresholds are set at the 2018 fall minimum water level.
- If water levels are maintained at equal to or greater levels than the past, no additional subsidence should occur
- Coordination w/ Colusa Subbasin is needed regarding subsidence area mostly to south of Corning Subbasin

Subsidence Discussion: Questions and Comments?

- CSAB comments
- Public comments

Next Steps and Meeting Schedule

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Upcoming CSAB Meetings and Proposed Topics

Date	Key Meeting Topics	CSAB Meeting Objectives
Mar 3	• Depletion of interconnected surface water SMC discussion #2 – review SMC approaches • Land subsidence SMC discussion #2 – review SMC approaches	• Input on proposed approaches for MT and MO development • Discussion of undesirable results • **Potential recommendations to GSA Boards for Lowering of GWLs and Subsidence SMC**
Apr 7	• Discussions and development of SMCs for Groundwater Quality and Reduction in Storage – Meeting #1 • Background on basin conditions, review water budgets, and GSP requirements • Initial discussion on potential projects and management actions	• Input on significant and unreasonable conditions and initial discussion on MT development • **Potential recommendations to GSA Boards for depletion of interconnected surface water SMC** • Input on potential projects and management actions
May 5	• Discussions and development of SMCs for Groundwater Quality and Reduction in Storage – Meeting #2 • Review SMC approaches	• Input on proposed approaches for MT and MO development • **Potential recommendations to GSA Boards on water quality and storage SMC**
June 2	• Revised List of Projects & Management Actions • Introduction to funding mechanisms	• Input on final list of Projects & Management Actions • Input on funding mechanisms
July 7	• Present predicted impacts to groundwater conditions based on projects and management actions. • Compare against draft MT and MO for all Sustainability Indicators	• Input on revisions of draft projects and management actions based on predicted impacts and comparison for all sustainability indicators
Aug 4	• Review Projects & Management Actions and effects on Sustainable Management Criteria • Re-evaluate funding mechanisms • Discuss priority actions for plan implementation • Review data gaps	• **Potential recommendations to GSA Boards on Projects and Management Actions to reach and maintain sustainability** • Recommendations on funding mechanisms • Input on Plan Implementation and addressing data gaps

Receive public comments at each meeting

End of Meeting

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