Redding Area Groundwater Basin
Hydrogeologic Conceptual Model
Average Annual Precipitation (1980–2010)
Primary Streams and Catchments
Sacramento River Streamflow Gains ~2 MAF as River Passes Through Redding Basin

Est. Long-term Average Annual Baseflow (~700K AF)
Groundwater Flow Directions
Domestic Well Count

Well Count

- 0
- 1 - 5
- 6 - 10
- 11 - 25
- 26 - 50
- 51 - 75
- 76 - 100
- 101 - 145
Production Well Count

Well Count

- 0
- 1 - 5
- 6 - 10
- 11 - 25
- 26 - 50
- 51 - 75
- 76 - 100
- 101 - 145
Public Well Count

Well Count

- 0
- 1 - 5
- 6 - 10
- 11 - 25
- 26 - 50
- 51 - 75
- 76 - 100
- 101 - 145
Groundwater-level Trends – Anderson Subbasin
Groundwater-level trends – Enterprise Subbasin

Sacramento Valley Water Year Index
- Wet (W)
- Above Normal (AN)
- Below Normal (BN)
- Dry (D)
- Critical (C)

DWR Continuous GW Level Measurement
DWR Periodic GW Level Measurement
USGS Periodic GW Level Measurement
Hydrograph Comparison – Adjudicated Basin Example

Enterprise Subbasin

Antelope Basin
Hydrograph Comparison – Critically Over-drafted Basin Example

Enterprise Subbasin

Merced Subbasin
SGMA Data Collection
Groundwater Components for Analysis
Water Purveyor Data Collection

Data Collection Status
- Water Use/Supply Data Received
- Not Contacted
- A.C.I.D. - SW Diversion Data
Water Supply/Use Data Collection Types

GW Pumping

SW Diversions

WTP WWTP Flows

Deliveries
Example – Relative Annual Surface Water Diversion

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<th>BN</th>
<th>C</th>
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<td>2018</td>
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</tbody>
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- **ACID**
- **BVWD**
- **CCCSD**
- **Centerville CSD**
- **City of Redding**
- **CSA 11 French Gulch**
- **CSA 25 Keswick**
- **Mountain Gate CSD**
- **Shasta Lake City**
- **Shasta CSD**

**Legends**:
- **W** - Wet
- **AN** – Above Normal
- **BN** – Below Normal
- **D** – Dry
- **C** - Critical
Example – Relative Annual Groundwater Production

AN – Above Normal
BN – Below Normal
C – Critical

W – Wet

BVWD
City of Anderson
City of Redding
Mountain Gate CSD
CCCSD
CSA 8 Palo Cedro
Cottonwood WD
Rio Alta WD
Sustainability Indicators

- Chronic lowering of GW levels
- Significant reduction of GW storage
- Significant depletions of interconnected SW
- Significant land subsidence
- Significant seawater intrusion
- Significant degraded water quality
Enterprise and Anderson Subbasins Characteristics Relative to Sustainability Indicators

Seawater intrusion?
- Nearest ocean is nearly 100 miles away.

Land subsidence?
- Not applicable to Redding Basin aquifers.*

Enterprise and Anderson Subbasins Characteristics Relative to Sustainability Indicators

Chronic lowering of GW levels?
- GW levels have been stable over long term.

Significant reduction of GW storage?
- GW storage has also been stable over long term.

Degraded water quality?
- Water quality is generally good in Redding Basin.

Depletions of interconnected SW and GW?
- GW and SW systems are interconnected.

GW-SW interaction will be the more important process to evaluate for the GSPs, because increased reliance on local GW pumping in future could reduce streamflows in Sacramento River and its tributaries.
Management Actions

• SGMA requires that GSPs evaluate potential future conditions that may lead to loss of basin sustainability
• Several scenarios that may lead to potential concerns regarding basin sustainability have been identified
Example Management Action Questions

• Would increased GW use at City well fields from population growth cause significant and unreasonable effects?
Example Management Action Questions

• How much additional GW pumping could be tolerated at City well fields without causing significant and unreasonable effects?
Example Management Action Questions

• How might reductions of SW allocations affect subbasin sustainability?

• How might climate change affect water management?

Reminder: GW currently may contribute ~700K AF of water to river between Keswick and Bend Bridge.
Path Forward

- Prepare Hydrogeologic Conceptual Model chapter of GSP
- Develop numerical groundwater flow model of the Redding Area Groundwater Basin
- Develop water budgets for the Enterprise and Anderson Subbasins
- Begin to evaluate management actions
Thank You!
Enterprise Anderson Groundwater Sustainability Agency Board Meeting
Groundwater Sustainability Planning (GSP)

- GSP Background and Objectives
- Plan Components
- Defining Sustainability
- What to expect during GSP development
- Management Questions for Sustainability
- Groundwater Data to Collect and Analyze
Discussion items

• Groundwater Sustainability Plan (GSP) update
  – Overview of compiled data
  – Thoughts on GSP preparation and defining sustainability
  – **What to expect during GSP development**

• Next steps
  – Hydrogeologic conceptual model development
  – Numerical modeling to support GSP development
  – Potential DWR Technical Support Services (TSS) funding opportunities
  – Public outreach
Discussion

• Define what constitutes *significant and unreasonable*
• Assess whether *minimum thresholds* are adequate or too restrictive
• Assess whether *measurable objectives* are reasonable
• Agree on how to combine *minimum thresholds* into *undesirable results*
• Agree what potential *projects and management actions* are necessary
• Decide who will pay for ongoing SGMA-related costs
GSP Sections

• **Part 1**: Describe who you are
• **Part 2**: Describe subbasin geology and hydrogeology (with sustainable yield)
• **Part 3**: Define how you will measure sustainability
• **Part 4**: Identify programs and projects that get you to sustainability
• **Part 5**: GSP implementation information
Part 1: Describe Who You Are

• Maps of cities and towns
• Water districts
• Land use
• Well density
• Existing groundwater management activities
• Existing general plans, UWMPs, AWMPs, & IRWMPs
Part 2: Describe the Basin

- Hydrogeologic conceptual model
- Historical and current water budgets
  - Groundwater recharge and pumping
  - Change in groundwater storage
  - Estimate of sustainable yield
- Future groundwater budget
  - Include effects of climate change
- Existing monitoring programs
Part 3: Define Sustainability and Measurement

- Policy section
- Opportunity for public input and review

Sustainability Indicators

- Lowering GW Levels
- Reduction of Storage
- Seawater Intrusion
- Degraded Quality
- Land Subsidence
- Surface Water Depletion

This is one of the most important sections of the GSP
- Uncertainty in your sustainable yield is OK
- Lack of clarity in how you define sustainability is NOT OK
Part 4: Projects and Programs for Sustainability

- Technical and policy aspects
- Opportunity for public input and review
- Achieve sustainability in 20 yrs.
- Maintain sustainability for 30 years thereafter
- Funding Plan and beneficiaries

**Projects**: physical projects that require CEQA.

**Management Actions**: relate to altering use, changes, implementing conservation strategies, etc. land-use
Part 5: GSP Implementation

- Implementation schedule
- Implementation costs
- Permitting requirements
Defining Sustainability Thresholds
• **Minimum Threshold:**

Threshold for significant and unreasonable groundwater levels at selected monitoring points

The line we don’t want to cross.

• **Measurable Objective:**

Goal. Early warning for approaching minimum threshold.

• **Undesirable Result:**

Combination of *minimum thresholds* at selected monitoring points = sustainability.
Representative monitoring points

- Representative Monitoring Point (RMP)
- Other Monitoring Point (MP)

Minimum thresholds and measurable objectives are only defined at RMPs
Undesirable results

“The description of undesirable results … shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.”

Avoiding *undesirable results* is how you prove sustainability.
Example

Undesirable result

- 10% decrease of groundwater elevations, measured at Representative Monitoring Points, decrease below the minimum threshold.

How you define *undesirable results* is how you can accommodate flexibility.
Evidence – based Proof of Sustainability

- Measured groundwater conditions starting in 2020 demonstrate that groundwater levels at the selected monitoring points, in combination, are above the min. thresholds.

- Plan to meet *measurable objectives* in the plan’s time horizon.
Undesirable Results = Combination of Min. Thresholds
Land Use - 2014
Sacramento River streamflows gain ~2 MAF as river passes through Redding Basin

Est. Long-term Average Annual Baseflow (~700K AF)
Aquifer transmissivity (productivity)
Groundwater flow directions
Domestic well count

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Enterprise Anderson Groundwater Sustainability Planning Schedule

2019

Technical Analyses
- April-Sep. Groundwater Data Analysis and Hydrogeologic Conceptual Model
- June 2019-May 2020 Groundwater Modeling

Public Workshops
- Oct.

GSA Management Committee Meetings
- April
- July
- Oct.

GSA Board Meetings
- April
- Aug.
- Dec.

GSP Chapters
- Ch.1 Introduction
- Ch.2 Plan Area/Basin Setting
- Ch.3 Sustainable Management Criteria
- Ch.4 Projects Management Actions
- Ch.5 Plan Implementation

2020

Min. Thresholds & Measurable Objectives

- Aug/Sept.

Draft Groundwater Sustainability Plan
- Nov. 2019-Sep. 2020 Water Budget
- Nov. 2019-Sep. 2020

Technical Analyses

Public Workshops
- Aug/Sept.

GSA Management Committee Meetings
- April
- July
- Nov.

GSA Board Meetings
- April
- Aug.
- Dec.