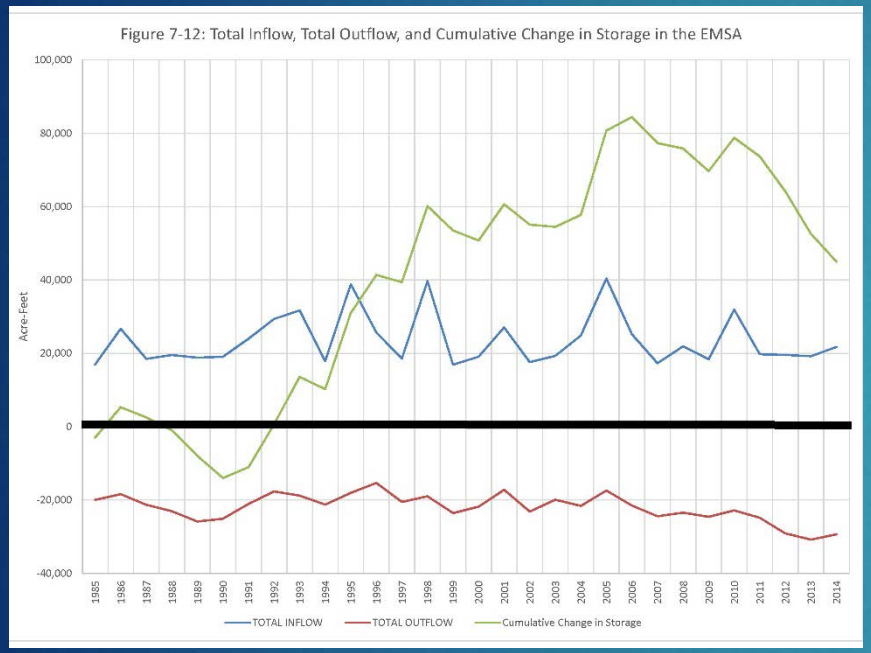
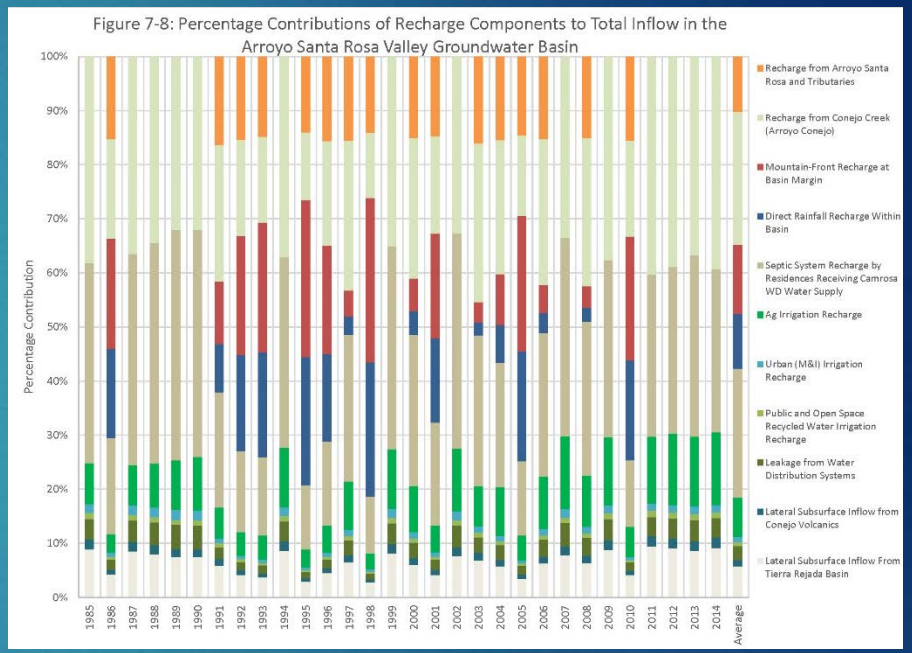
Summary of Water Budgets





Fox Canyon Groundwater Management Agency
Technical Advisory Group Meeting

April 29, 2016

GSI Water Solutions, Inc.

Water Budget

DRAFT GSP Emergency Regulations §354.18

"The Plan shall include a water budget for the basin…"

- **… that provides an accounting and assessment of the total annual amount of groundwater and surface water entering and leaving the basin**
- **including historical, current and projected water budget conditions…**

GSI Water Solutions, Inc.

Overview of Scope for the Water Budget Analysis

- One water budget for each of the four basins
- Rely on information from GMA, TAG, others
- Minimal derivation or technical analysis of individual water budget terms
- Focus on:
  - Assembling terms
  - Verifying and documenting water budget terms
  - Conducting sensitivity analysis, uncertainty assessment
- Significantly more analysis was required

Work To Date

- Presented the approach at the February TAG meeting
- Met with TAG members working in specific basins to discuss:
  - Recharge and discharge components of the water budget
  - Overall approach (time frame, area, aquifers, etc.)
  - How the basin works
  - Available estimates
  - Methods of quantifying terms that require estimation
  - Available data sets for developing estimates
  - Data sources, quality, uncertainties
  - Data needs from the TAG member's agency

Work To Date (cont'd)

- Data compilation and analysis
  - Queries, GIS analysis, follow-up with TAG members
- Spreadsheet programming, budget development, reasonableness checks, sensitivity analyses
- Completed preliminary draft versions of the water budgets and reports for the Las Posas and Arroyo Santa Rosa Valley basins
- Oxnard and Pleasant Valley basins in progress
  - Preliminary reports by May 13, if not sooner

Review Spreadsheet Tools (And the "Knobs" to Turn)

- The knobs help us understand the significance (or lack thereof) of uncertainties in the various input data terms

SHUCKS Significantly High UnCertainty Knobs

MUCK Moderate UnCertainty Knob

LUCK Low UnCertainty Knob

Courtesy: The Porcello HOA (House of Acronyms)

Demonstration (Las Posas)

Las Posas Basin Summary

- Big uncertainty in West Las Posas
  - Subsurface flows/exchanges with Oxnard Basin
  - Large range of published aquifer parameters
  - Greater range of possibilities for amount of subsurface inflow and outflow than for other water budget terms
- Computed change in stored groundwater volume since 1985:
  - Increase in East-South Las Posas (Eastern Management Sub-Area)
  - Possible slight decrease in West Las Posas
    - May reflect current drought conditions rather than long-term trend

Las Posas Basin Summary (continued)

- Dry-weather recharge from Arroyo Simi/Arroyo Las Posas
  - Largest component of recharge in EMSA, except possibly during the highest-rainfall years
- Pumping
  - Agricultural pumping is largest discharge term
  - M&I pumping is much less
- Evapotranspiration in riparian corridor is not minor
  - Estimated to be on the order of 3,000 AFY
  - This was similar to the amount of M&I pumping during 2011-2014

Role of Water Budgets in the GSP Process

1. Sustainability is achieved by avoiding undesirable results, not by achieving calculated basin yield from a water budget
2. If a basin meets its measurable objectives, then by definition basin pumping is within sustainable yield

Role of Water Budgets in the GSP Process (cont'd)

3. Water budgets provide a starting point for understanding how much water might be needed to achieve certain measurable objectives
4. Other tools that quantify the physical inter-relationships between pumping, recharge, and changes in groundwater levels and storage are needed to evaluate alternatives that best meet objectives

Recommended Next Steps *(All Out of Scope)*

1. Meet with TAG members again to review individual water budgets
2. Determine if additional analysis (water budgets or otherwise) are required to address data gaps and support development of measurable objectives
3. Conduct further review and discussion with the entire TAG as a whole

Sustainability Criteria

FCGMA TAG – April 29, 2016

Presented by HydroMetrics Water Resources, Inc.

Critical Parameters and Undesirable Results

- Purpose

  Identify basin specific undesirable results that are related to the six critical parameters listed in SGMA

Sustainability Criteria Spreadsheet

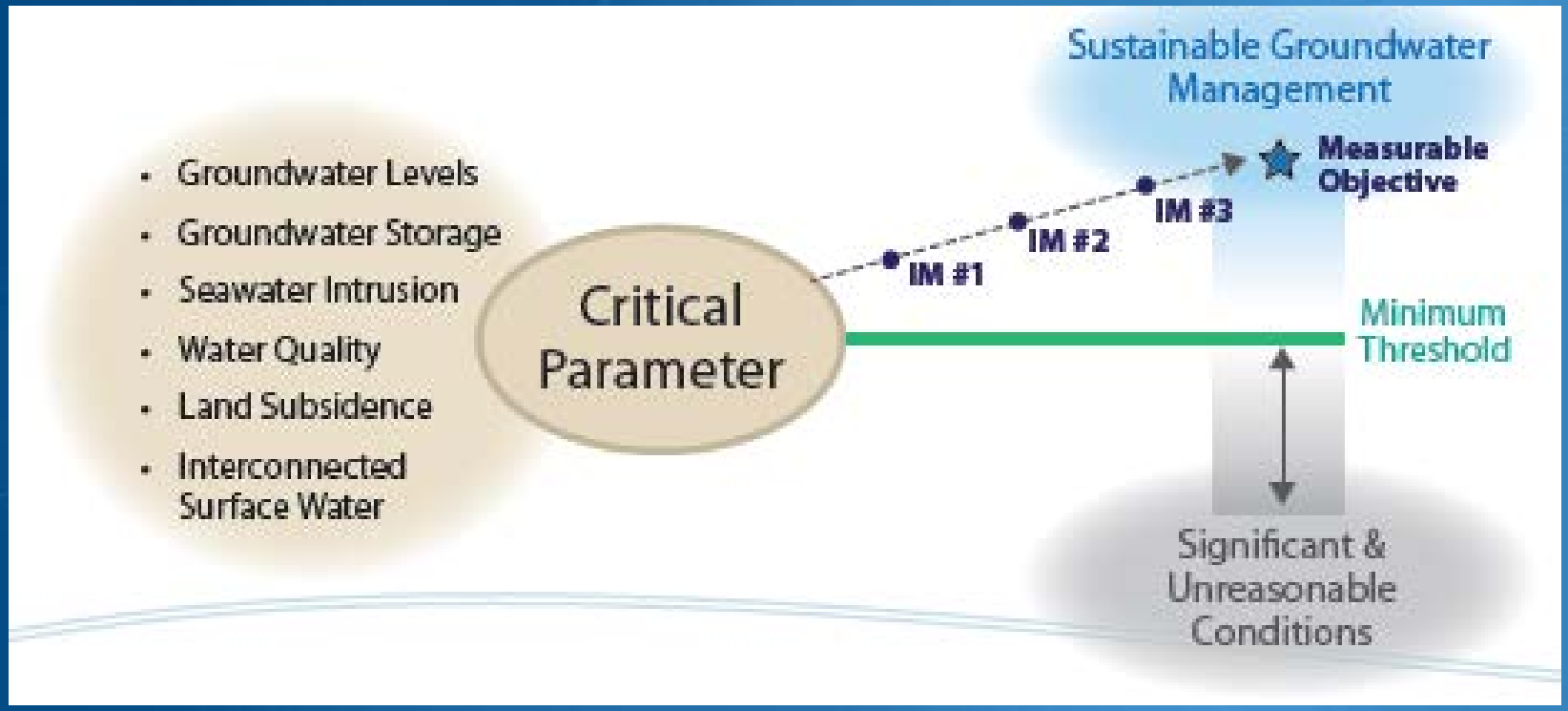
Must be Achievable

Basin/ Management Area	Beneficial Uses	Critical Parameters	Undesirable Results	Minimum Thresholds	Measurable Objectives	Interim Milestones	Monitoring Features

FCGMA Planning Goals taken into account

GW conditions under which critical parameters are significant and unreasonable

To provide a reasonable margin of operational flexibility under adverse conditions. This is what needs to be achieved after 20 years of GSP Implementation



Source: http://www.water.ca.gov/groundwater/sgm/pdfs/GSP_Regulations_Guide.pdf

Sustainability Criteria Spreadsheet

Basin/ Management Area	Beneficial Uses	Critical Parameters	Undesirable Results	Minimum Thresholds	Measurable Objectives	Interim Milestones	Monitoring Features
Basin A	Municipal Domestic Agricultural Industrial Environmental	Chronic lowering of groundwater levels					
		Reduction of groundwater storage					
		Seawater intrusion					
		Degraded water quality					
		Land subsidence					
		Depletions of surface water					

Critical Parameters and FCGMA Planning Goals

Critical Parameters that may lead to undesirable results (from Draft Emergency GSP Regulations)	**FCGMA Planning Goal Early Guide for GSP Planning**
1. Chronic lowering of groundwater levels	Planning Goal 4. Promote water levels that mitigate or minimize undesirable results (including **pumping trough depressions**, surface water connectivity, and **chronic lowering of water levels**)
2. Reduction of groundwater storage	Planning Goal 4. Promote water levels that mitigate or minimize undesirable results (including pumping trough depressions, surface water connectivity, and chronic lowering of water levels)
3. Sea water intrusion (SWI)	Planning Goal 1. Control seawater intrusion at its current position
4. Degraded water quality	Planning Goal 2. Do not allow groundwater quality to further degrade without mitigation
5. Land subsidence that substantially interferes with surface land uses	Planning Goal 3. No net subsidence due to groundwater withdrawal
6. Depletions of surface water that have adverse impacts on beneficial uses of surface water	Planning Goal 4. Promote water levels that mitigate or minimize undesirable results (including pumping trough depressions, **surface water connectivity**, and chronic lowering of water levels)

Undesirable Results

- Undesirable results occur when significant and unreasonable effects for any of the critical parameters are caused by groundwater conditions occurring throughout the basin

- What conditions are considered significant and unreasonable for each of the critical parameters for each basin?

- Descriptive only – Minimum Thresholds provide for numeric values

Possible Undesirable Results

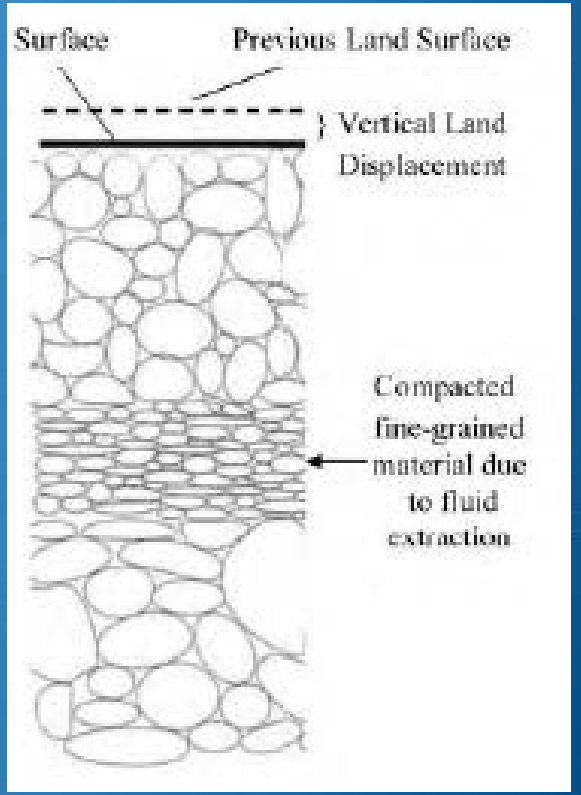
Critical Parameters that may lead to undesirable results (from Draft Emergency GSP Regulations)	Possible Undesirable Results Things we are trying to prevent from happening
Chronic lowering of groundwater levels	• Decline in groundwater levels to a point at which active supply wells are no longer able to produce sufficient water to meet users needs • Groundwater levels drop below pump bowls (including private wells) • Exceeding a certain rate of decline • Exacerbate groundwater quality problems to the point undesirable water quality results occur • Decline in groundwater levels to the point that induces SWI • Causes subsidence that substantially interferes with surface land uses • Results in induced outflow from adjacent basins that causes undesirable results in those basins
Reduction of groundwater storage	• Ongoing reduction of groundwater storage • The volume of groundwater remaining in storage at the end of a pumping season is insufficient to meet anticipated supply reliability needs if drought conditions occurred in the subsequent 1- to 5-year period

Possible Undesirable Results … cont

Critical Parameters that may lead to undesirable results (from Draft Emergency GSP Regulations)	Possible Undesirable Results Things we are trying to prevent happening
Sea water intrusion	• SWI further inland than current position within the UAS and LAS (is the current position well defined enough and are there MW at locations to monitor this?) • Alternative: beyond the boundary of a SWI management area? • Alternative: further deterioration of groundwater quality at agricultural or M&I supply wells as a result of advance of the seawater intrusion front from its current position (what about future wells?)
Degraded water quality	• Water quality degraded without mitigation • Exceeding Basin Plan WQO and/or BMOs • Alternative: Something with higher concentrations than WQOs based on beneficial use? • Further impairment of water quality as a result of continued expansion or migration of poor quality water within the UAS and LAS • Further impairment of water quality as a result of other sources, such as overlying perched aquifer, shallow aquifer, upwelling from aquitards or deeper formations, poorer quality surface water

Possible Undesirable Results … cont

Critical Parameters that may lead to undesirable results (from Draft Emergency GSP Regulations)	Possible Undesirable Results Things we are trying to prevent happening
Land subsidence that substantially interferes with surface land uses	• No net subsidence due to groundwater withdrawal • Differential subsidence high enough to cause damage to infrastructure at or near land surface (roads, canals, pipelines, etc.), interfering with existing land uses
Depletions of surface water that have adverse impacts on beneficial uses of surface water	• If GDEs exist, groundwater levels greater than 30 feet ground level or some other historical level • In areas with groundwater baseflow, diminished flows that sustain the environment or surface water users during certain parts of the year



Questions