

Sustainable Management Criteria Definitions, Examples, and Ideas

**SVBGSA Monterey Subbasin
Committee Meeting**

July 7, 2020





Process Concepts

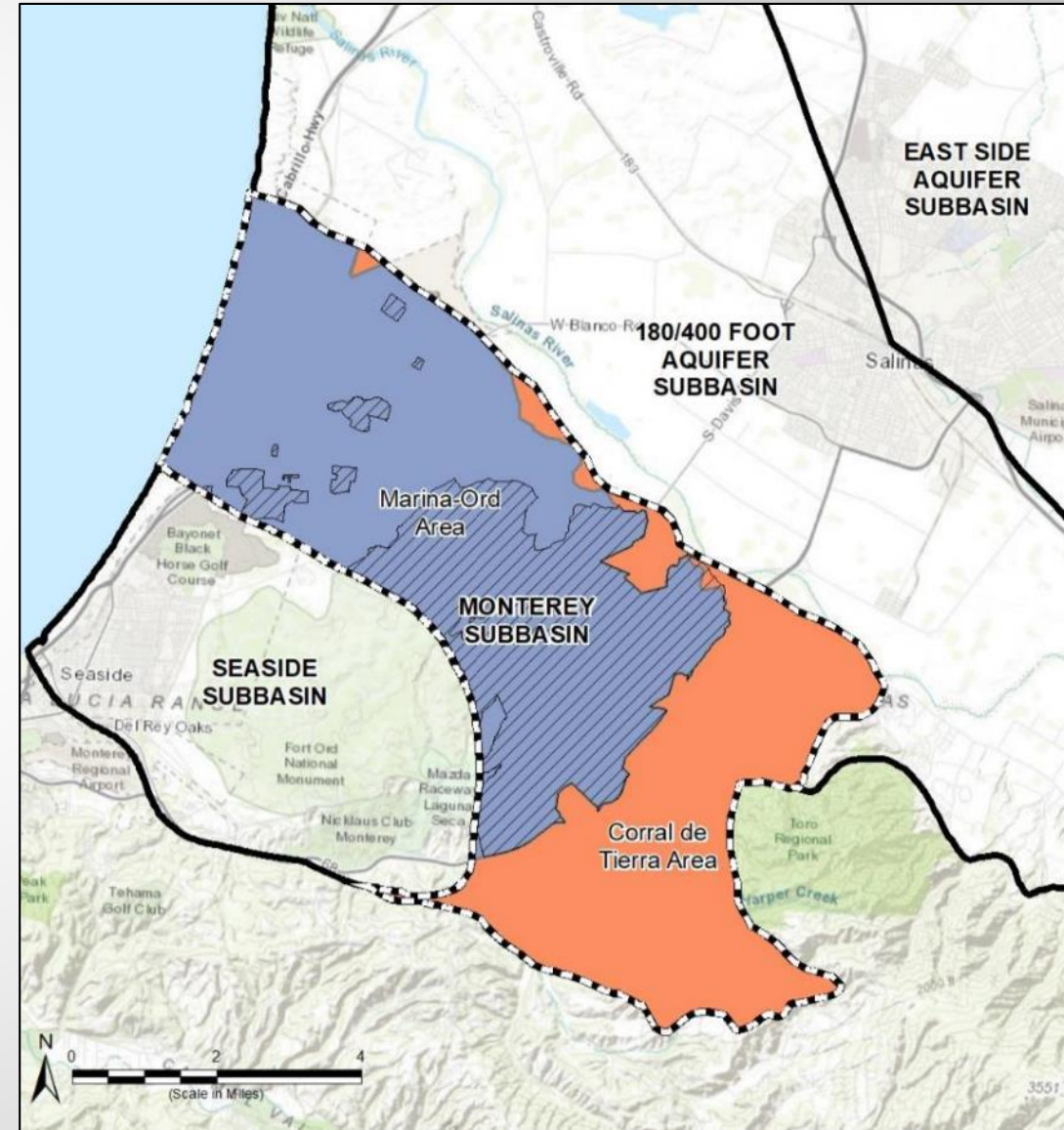
- ▶ July 28 web meeting on SMC terminology and concepts
 - ▶ Setting minimum thresholds, measurable objectives, and undesirable results is not a linear process
 - ▶ Setting criteria is clearer if you understand the entire process

Opinions/guidance will be included in boxes

Monterey Subbasin Setting

- One subbasin, two areas
- ONE GSP
 - Coordinated SMCs

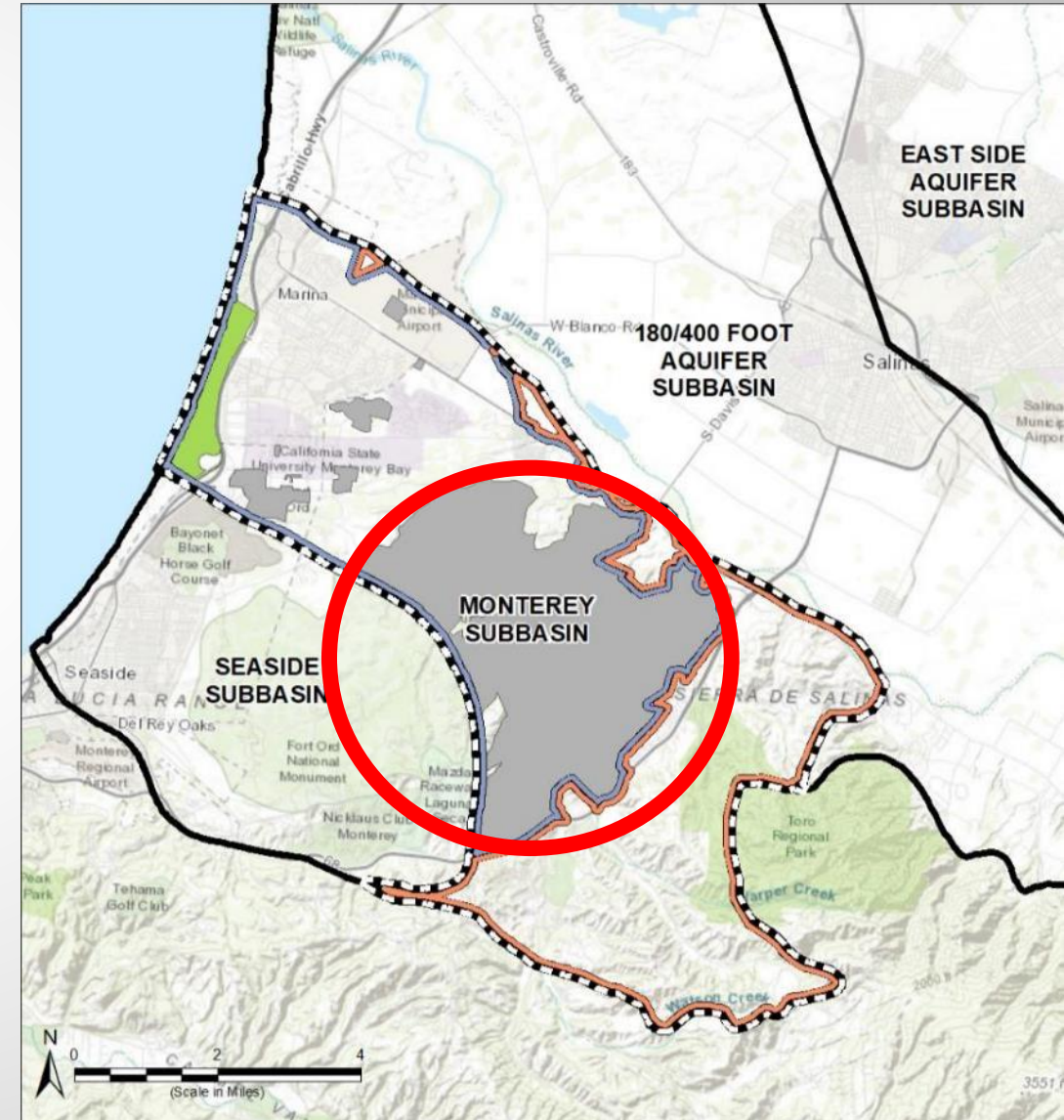
Each area can set their own SMC.
However, each area cannot prevent the
other area from reaching sustainability



Monterey Subbasin Setting

- Major Data Gap impacting coordinated/unified SMCs
 - Former Fort Ord Area
- These are not the only data gaps

Implementation should include investigation into how to link Marina area with Corral de Tierra area. Data can be used to improve the GSP at the 5yr update for a more unified approach.



Each of the Six Sustainability Indicators have Four Sustainability Management Criteria Terms



Lowering
GW Levels



Reduction
of Storage



Seawater
Intrusion



Degraded
Quality

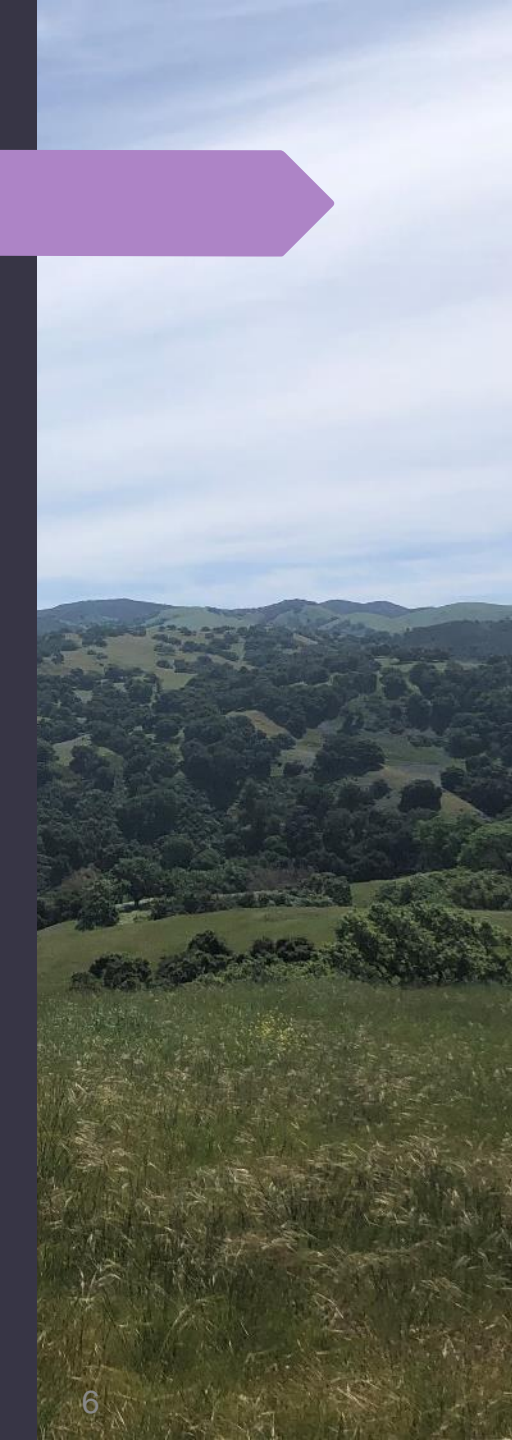


Land
Subsidence



Surface Water
Depletion

- Significant and Unreasonable – Qualitative Statements
- Minimum Thresholds – Quantitative Measurement
- Measurable Objectives – Quantitative Goal
- Undesirable Results – Combination of Minimum Thresholds



Sustainability Criteria – Ease of Developing SMC

- Subsidence
- Interconnected surface water
- Groundwater levels
- Groundwater storage
- Sea Water Intrusion

➤ Groundwater quality

Will cover the following for each Sustainability Indicator:

- Metrics
- Data
- Present Options
- Example the 180/400-foot Aquifer

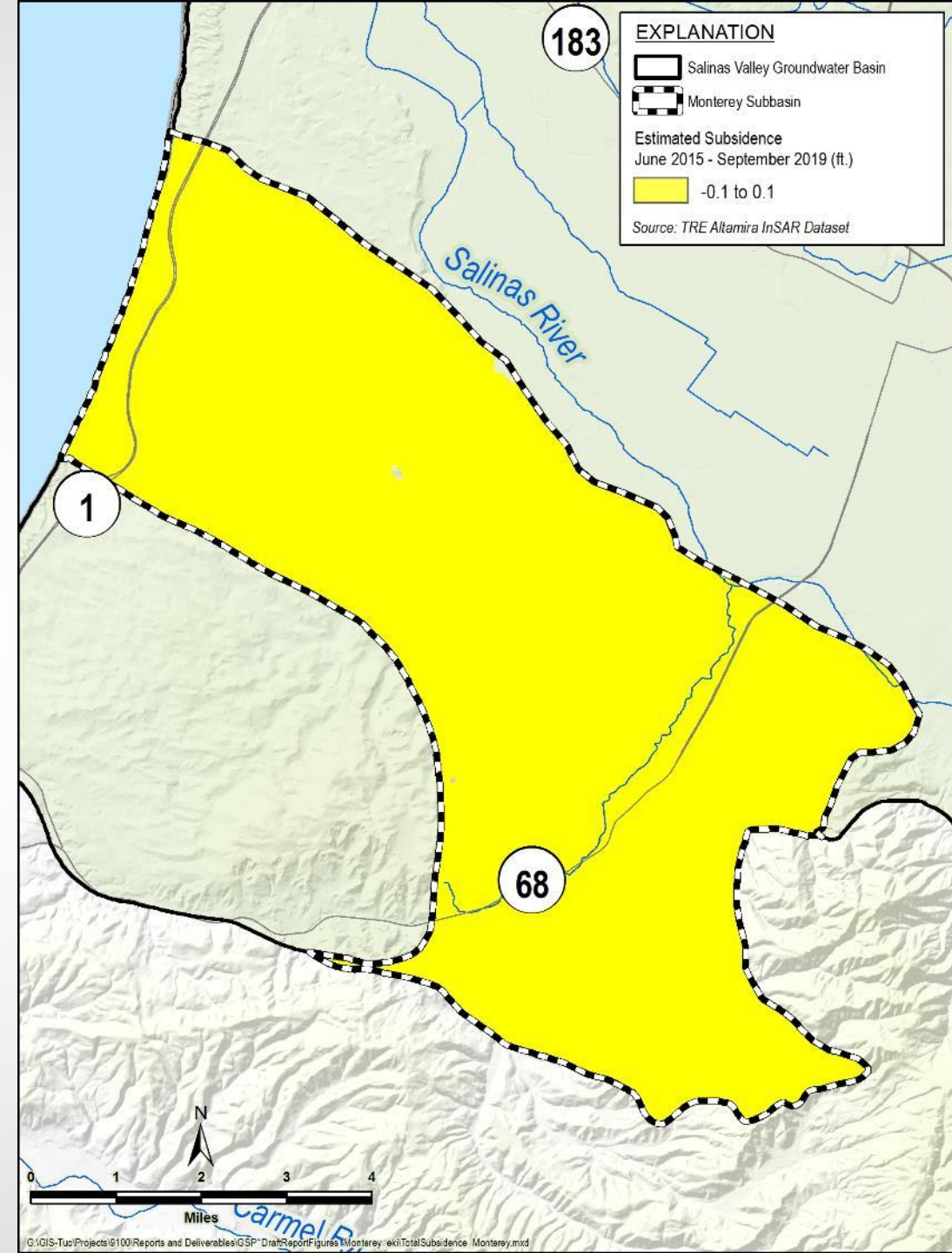


Thresholds & Objectives (354.28(c))

Sustainability Indicator	Metric
Land subsidence	<p>Change in land surface elevation at each measuring point</p> <ul style="list-style-type: none">• One minimum threshold and one measurable objective per measuring point• Option to use groundwater level as a proxy for ground surface elevation

Example Subsidence Data – InSAR (From DWR)

Subsidence is not a significant
problem in this subbasin





Subsidence SMC Options

1. Any subsidence anywhere in the Subbasin is significant and unreasonable
 - ➡ Minimum threshold = 0 subsidence
 - ➡ Measurable Objective = 0 subsidence
2. Any subsidence may impact infrastructure in the Subbasin is significant and unreasonable
 - ➡ Map infrastructure locations
 - ➡ Minimum threshold = 0 in mapped locations
 - ➡ Minimum threshold = ? outside of mapped locations
 - ➡ Measurable objective = 0 everywhere



Subsidence SMC Options

3. Some level of subsidence is acceptable.
 - ➡ Minimum threshold = ? subsidence everywhere
 - ➡ Measurable Objective = 0 subsidence everywhere



Subsidence Example from the 180/400-Foot Subbasin

Any subsidence anywhere in the Subbasin is significant and unreasonable [option 1]

- Use InSAR data, not groundwater level proxy
- To account for measurement error in InSAR data, the minimum threshold for subsidence is 0.1 feet/year
- Option to address long term, slow subsidence

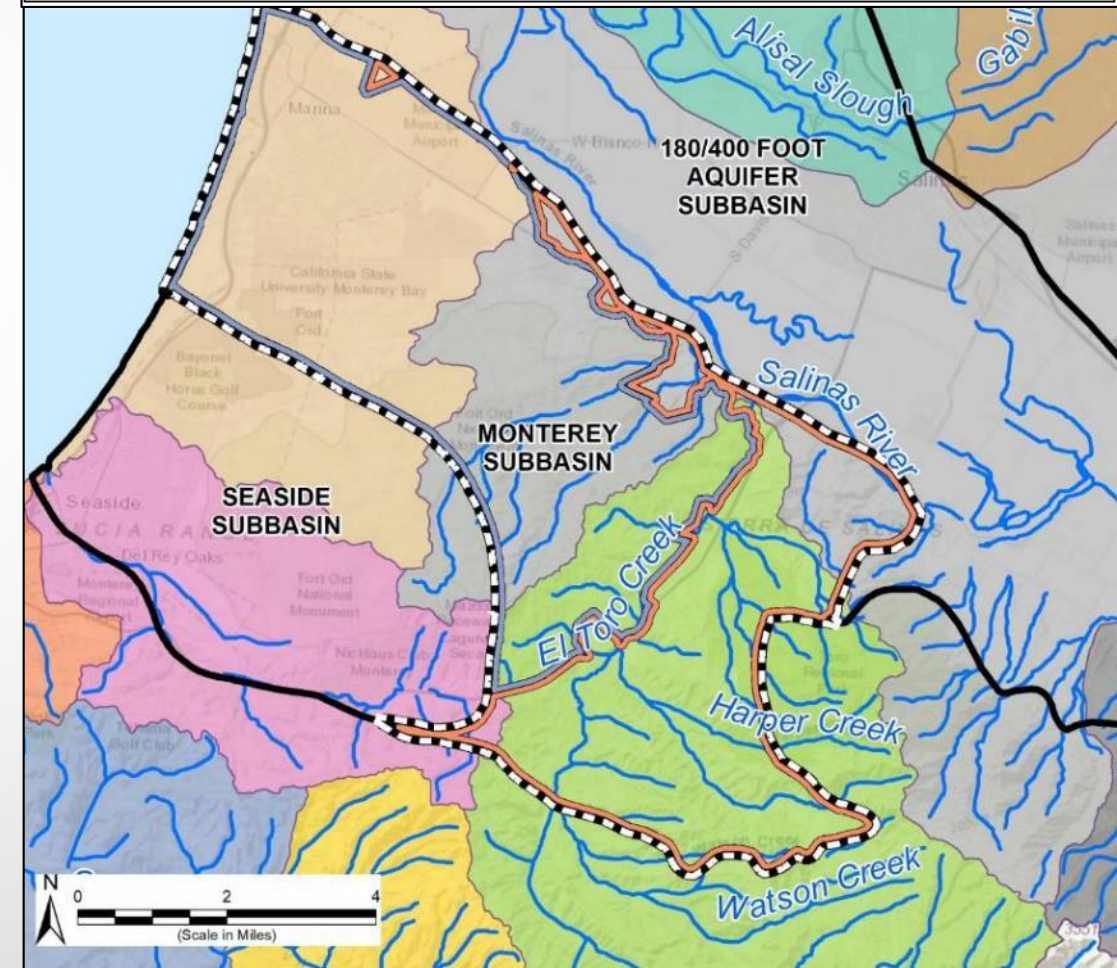
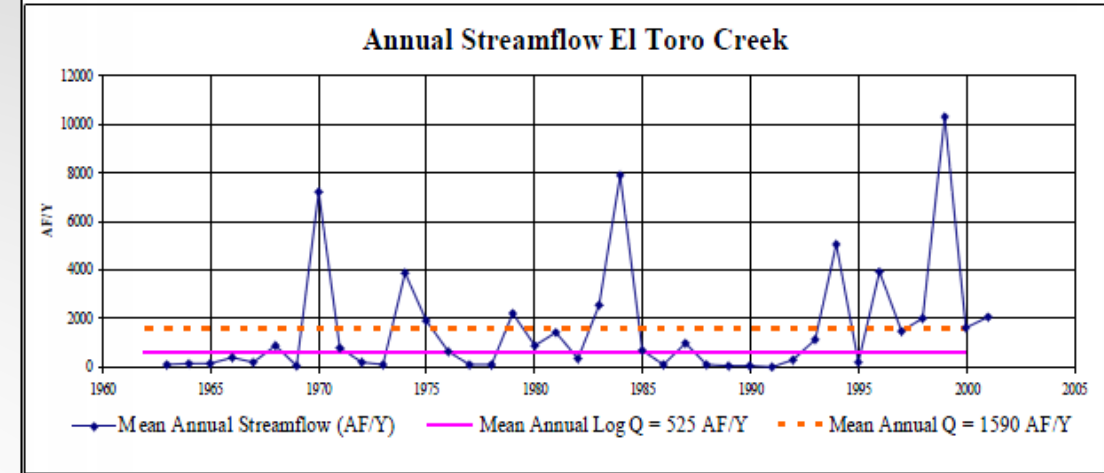


Measuring Thresholds & Objectives (354.28(c))

Sustainability Indicator	Metric
Depletion of Interconnected surface water	<p>A rate or volume of surface water depletion. Set one minimum threshold and one measurable objective per surface water body. (per reach?)</p> <ul style="list-style-type: none">• Option 1. Estimate depletions with a model• Option 2. Use groundwater elevations as a proxy

Potential Interconnected Surface Waters

- El Toro Creek below confluence with Watson Creek
- USGS Stream gage 11152540
- Record from 1961 to 2001





Interconnected Surface Water SMC Options

1. The current rate of surface water depletion is significant and unreasonable, and we choose to reduce the rate of depletion (leave more water in surface water bodies)
 - ➡ Minimum threshold
 - ➡ Less simulated depletion, or
 - ➡ Higher shallow groundwater levels
 - ➡ Measurable objectives
 - ➡ Less simulated depletion, or
 - ➡ higher shallow groundwater levels



Interconnected Surface Water SMC Options

2. The current rate of surface water depletion is significant and unreasonable, but SVBGSA chooses not to reduce the rate of depletion
 - Minimum threshold
 - Less than today's simulated depletion, or
 - Higher shallow groundwater levels
 - Measurable objectives
 - Less simulated depletion, or
 - Higher shallow groundwater levels
 - We are not required to meet the minimum thresholds in this example



Interconnected Surface Water SMC Options

3. The current rate of surface water depletion is not unreasonable (although it may be significant)

- ➡ Minimum threshold

- ➡ Equal to today's simulated depletion, or

- ➡ Equal to today's shallow groundwater levels

- ➡ Measurable objectives

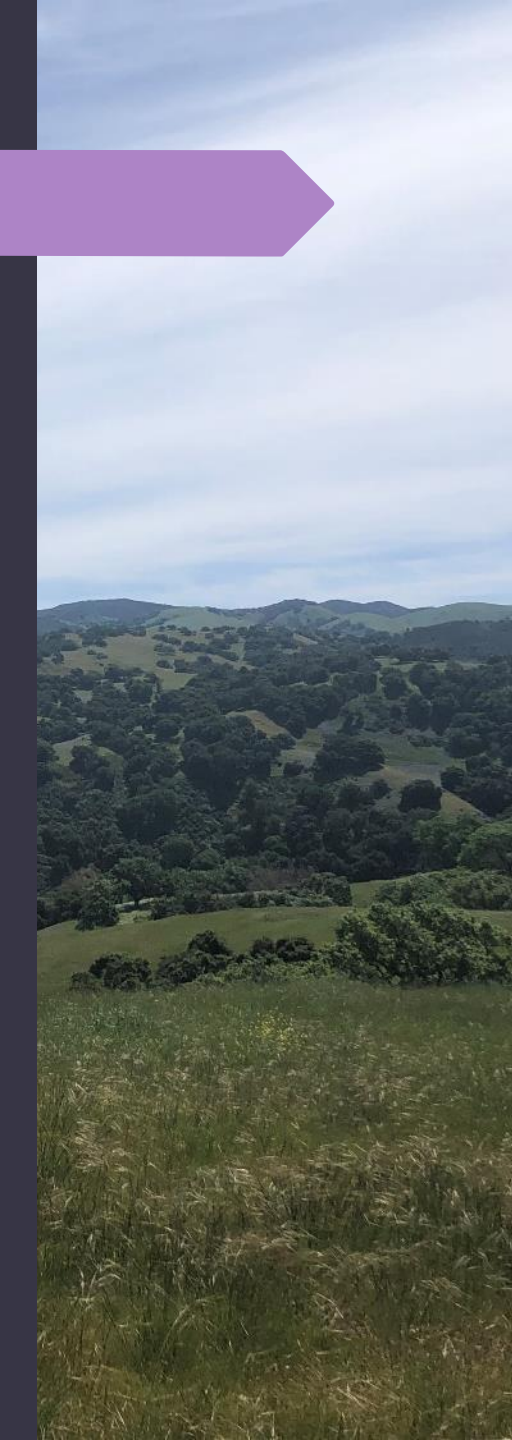
- ➡ Equal to today's simulated depletion, or

- ➡ Equal to today's shallow groundwater levels



Interconnected Surface Water SMC Options

4. Additional surface water depletion is neither significant nor unreasonable (take more water out of surface water bodies)
 - ➡ Minimum threshold
 - ➡ More than today's simulated depletion, or
 - ➡ Lower shallow groundwater levels
 - ➡ Measurable objectives
 - ➡ More than today's simulated depletion, or
 - ➡ Lower shallow groundwater levels



Surface Water Depletion Example from the 180/400-Foot Subbasin

Current depletion rates are not unreasonable (although possibly significant) [option 3]

- ▶ Using simulated depletions, but might change to shallow groundwater levels
- ▶ We will not increase depletion rates (lower shallow groundwater levels) in the future

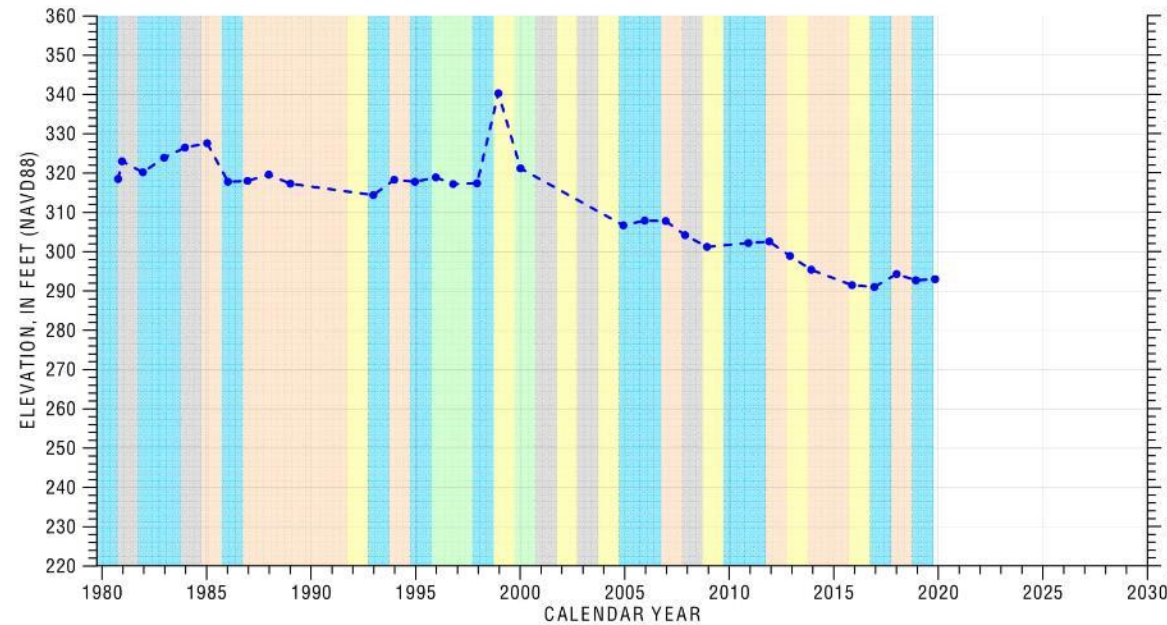


Measuring Thresholds & Objectives (354.28(c))

Sustainability Indicator	Metric
Groundwater elevations	Groundwater levels measured in representative monitoring wells <ul style="list-style-type: none">• One minimum threshold and one measurable objective per well

Example Groundwater Level Data

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/02E-01M01

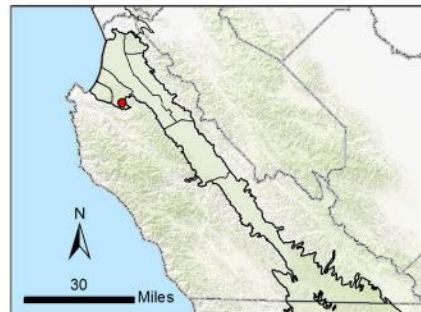


EXPLANATION

- GROUNDWATER ELEVATION
- ESTIMATED ELEVATION
- LAND SURFACE (406 FT MSL)

WATER YEAR TYPE DESIGNATION

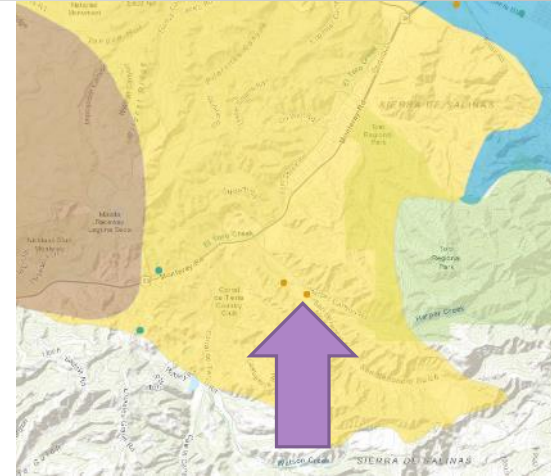
- | | |
|--------------|--------------|
| DRY | WET - NORMAL |
| DRY - NORMAL | WET |
| NORMAL | |



Monterey Subbasin

Multiple perforated intervals between 326 and 226 feet msl

Well Bottom 112 feet msl

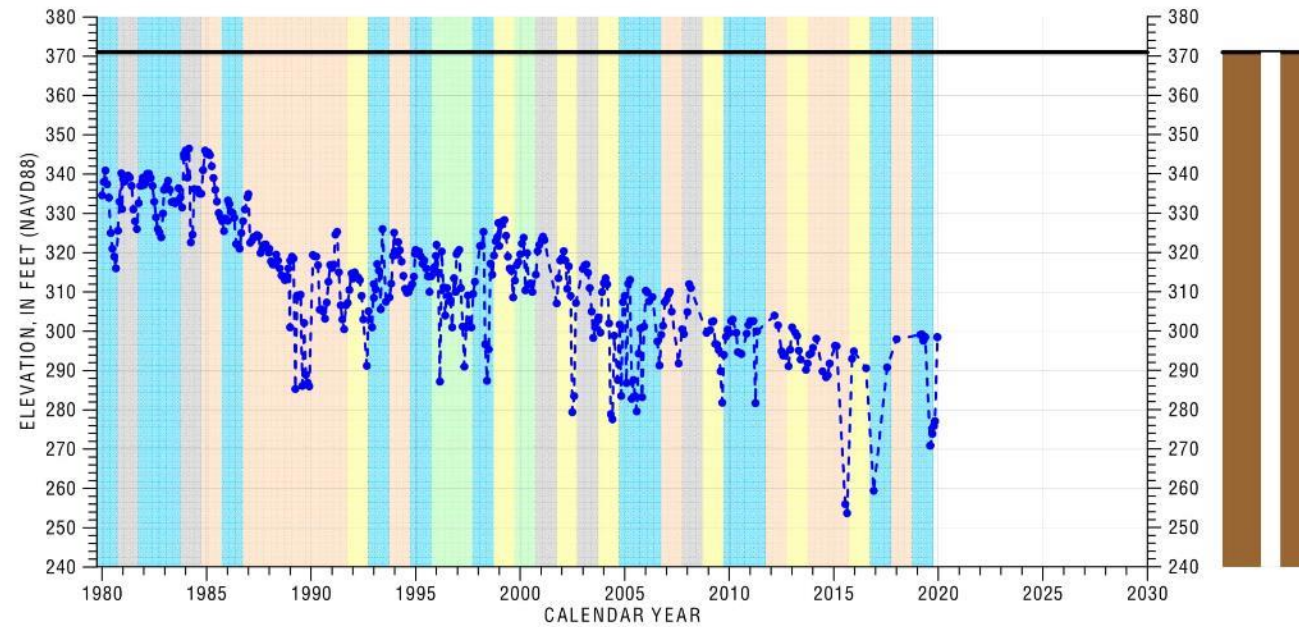


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Example Groundwater Level Data

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/02E-02G01

Monterey Subbasin

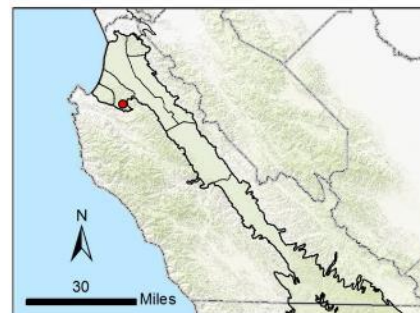


EXPLANATION

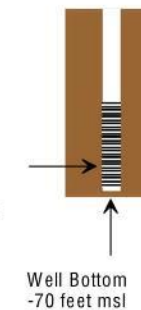
- GROUNDWATER ELEVATION
- ESTIMATED ELEVATION
- LAND SURFACE

WATER YEAR TYPE DESIGNATION

- | | |
|--------------|--------------|
| DRY | WET - NORMAL |
| DRY - NORMAL | WET |
| NORMAL | |

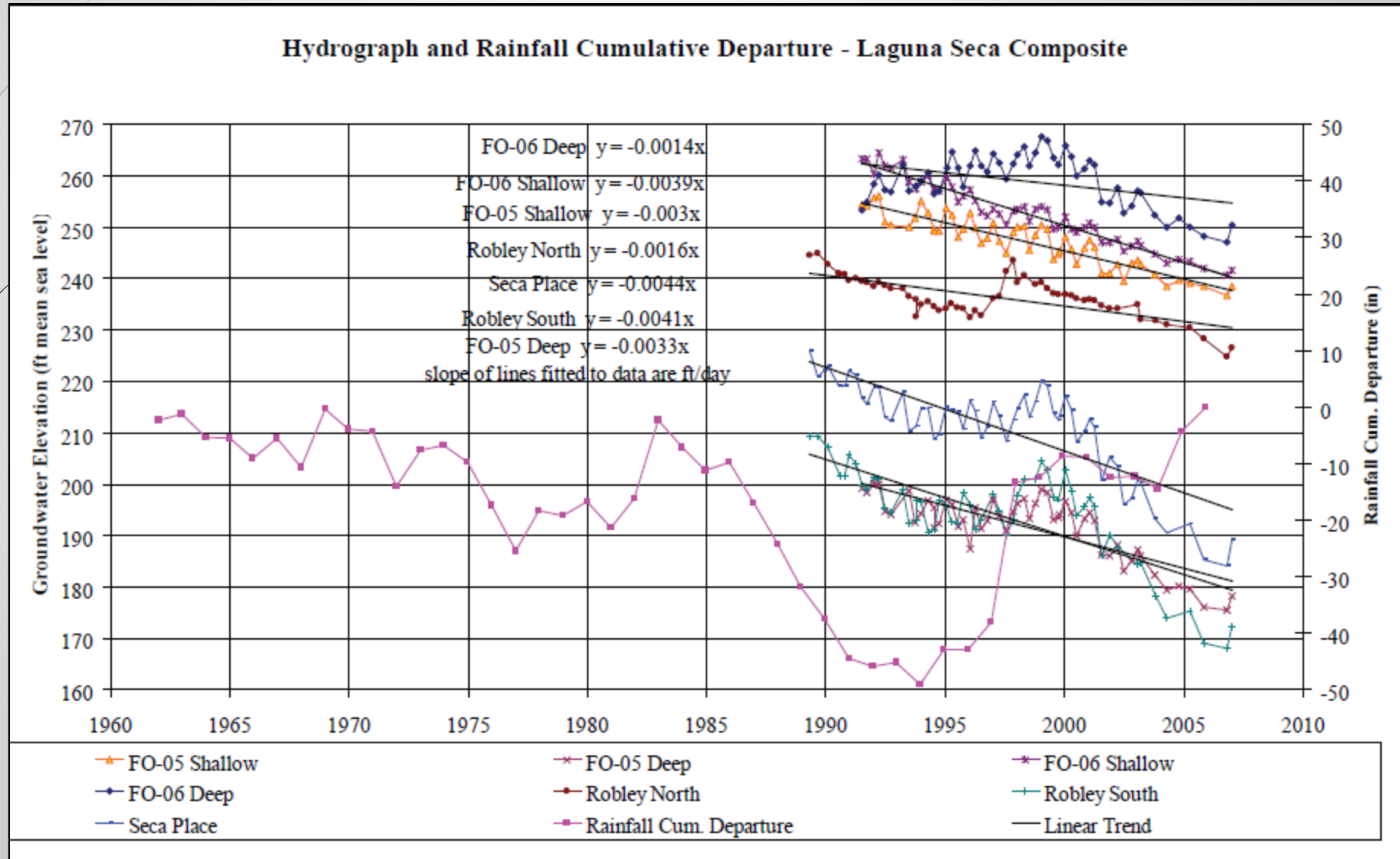


Multiple perforated intervals between 50 and -70 feet msl



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Example Groundwater Level Data – Laguna Seca





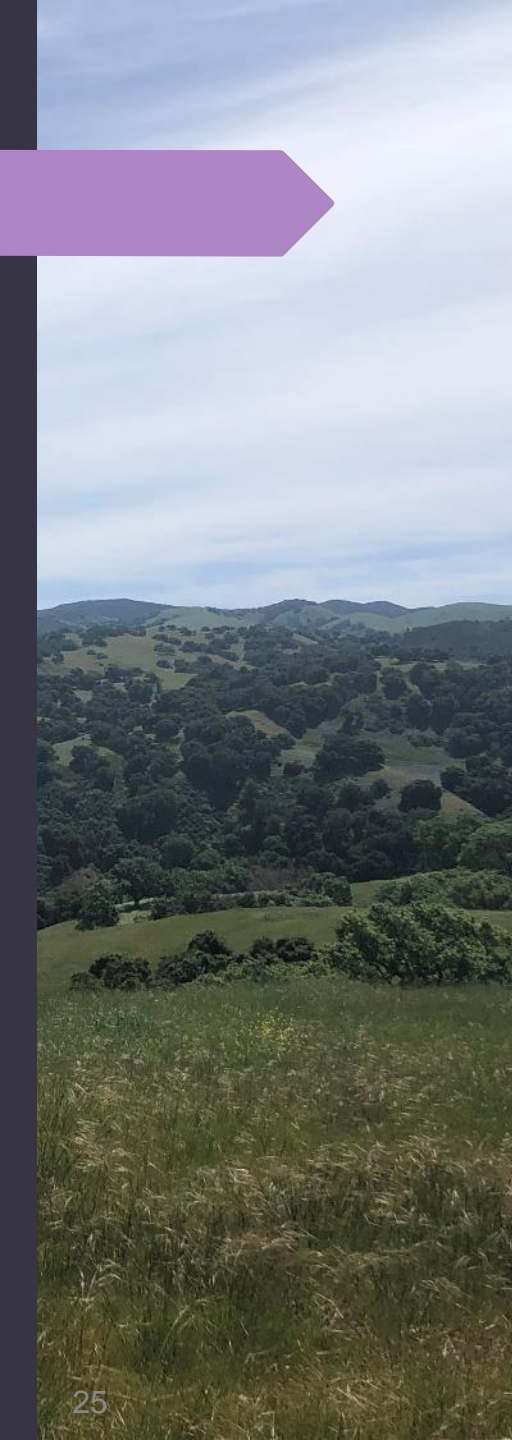
Groundwater Elevation SMC Options

1. Groundwater elevations in a certain year were significant and unreasonable
 - ➡ Set minimum thresholds above whatever was recorded in the year in question
2. Groundwater elevation Minimum Thresholds will be set a depth below the measurable objective at each well
 - ➡ Set the groundwater level goal you would like to achieve, then set a minimum threshold that allows groundwater levels to drop during a drought.
 - ➡ Need a way to set your groundwater level goal. Maybe current conditions?



Groundwater Elevation SMC Options

3. Groundwater elevations minimum thresholds are set at the lowest point predicted by models if current practices continue
 - Extend the current rate of groundwater decline out 20 years. Set the minimum thresholds there.
 - Option is to set minimum thresholds after 5,10, or 15 years of declines at current rates
4. Impacting shallow, domestic wells is significant and unreasonable
 - Minimum thresholds are set to ensure **most** shallow domestic wells have adequate water for operation
 - Option: set minimum thresholds excluding the very shallowest domestic wells
 - Option: use this as a check on the reasonableness of minimum thresholds

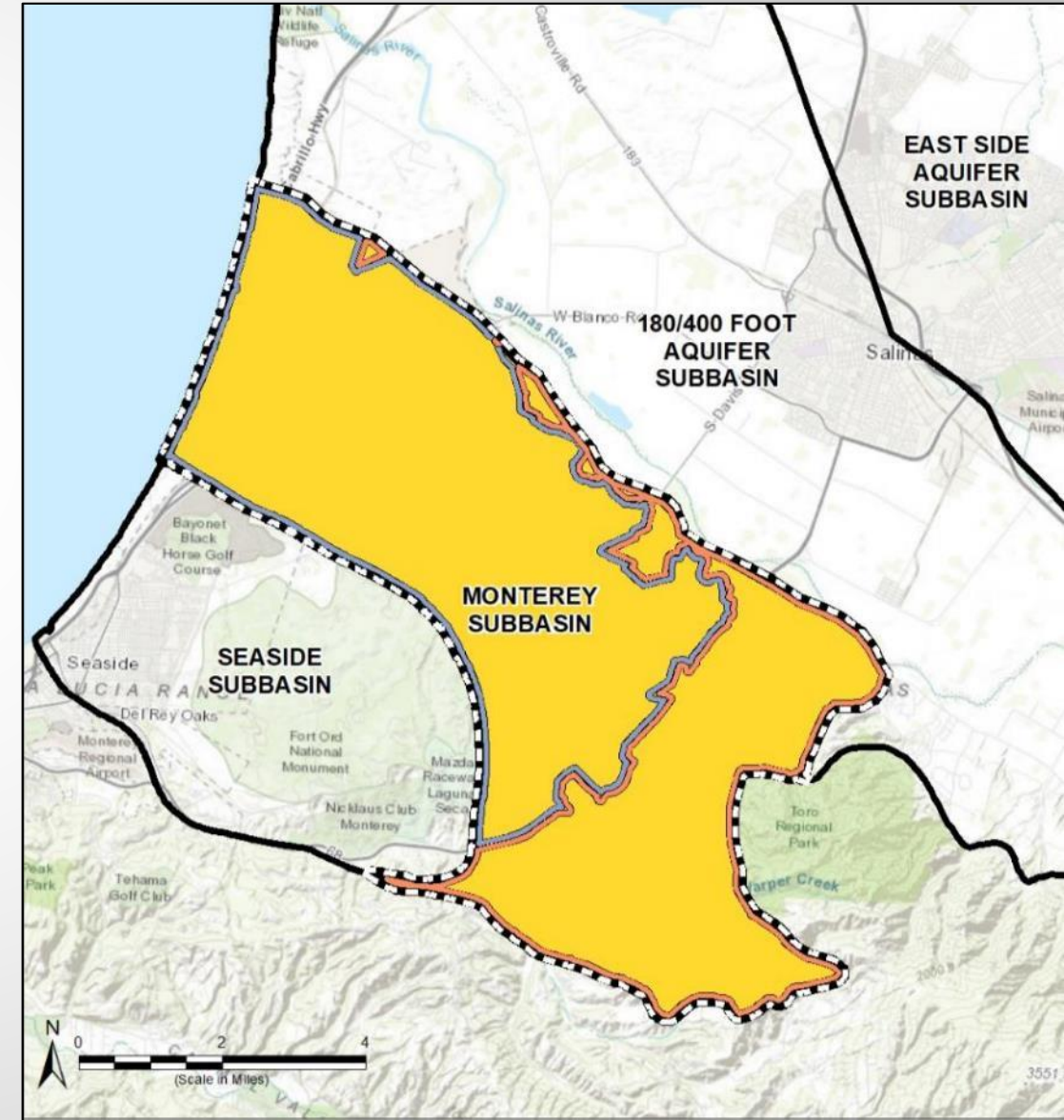


Groundwater Elevation Minimum Threshold Examples

5. Lowering groundwater elevations below the root zone of all (or selected) GDEs is significant and unreasonable
 - Minimum thresholds based on an assumed rooting depth of plants in a GDE
 - Measurable Objectives are above this depth to account for droughts
6. Lowering groundwater levels to where wells pump poor quality groundwater is significant and unreasonable
 - Requires data on groundwater quality with depth.
 - Used for naturally occurring constituents such as Arsenic etc.

Variability Across the Subbasin

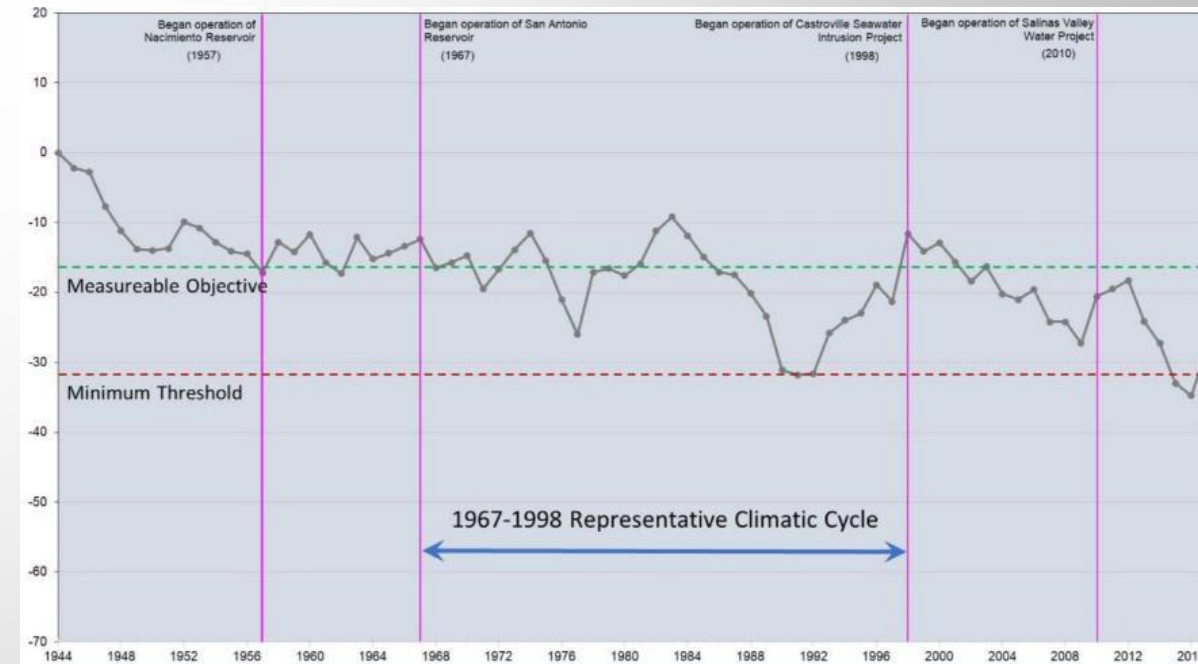
- ▶ SMC in different management areas can be based on different definitions of significant and unreasonable.
- ▶ However, minimum thresholds in one area cannot prevent another area from achieving its own sustainability



Groundwater Elevation Minimum Threshold Examples from 180/400-Foot Subbasin

Groundwater elevations will be maintained 1 foot above measured 2015 elevations.
[option 1]

- The GSP statistically assessed impacts on domestic wells
[option 4]

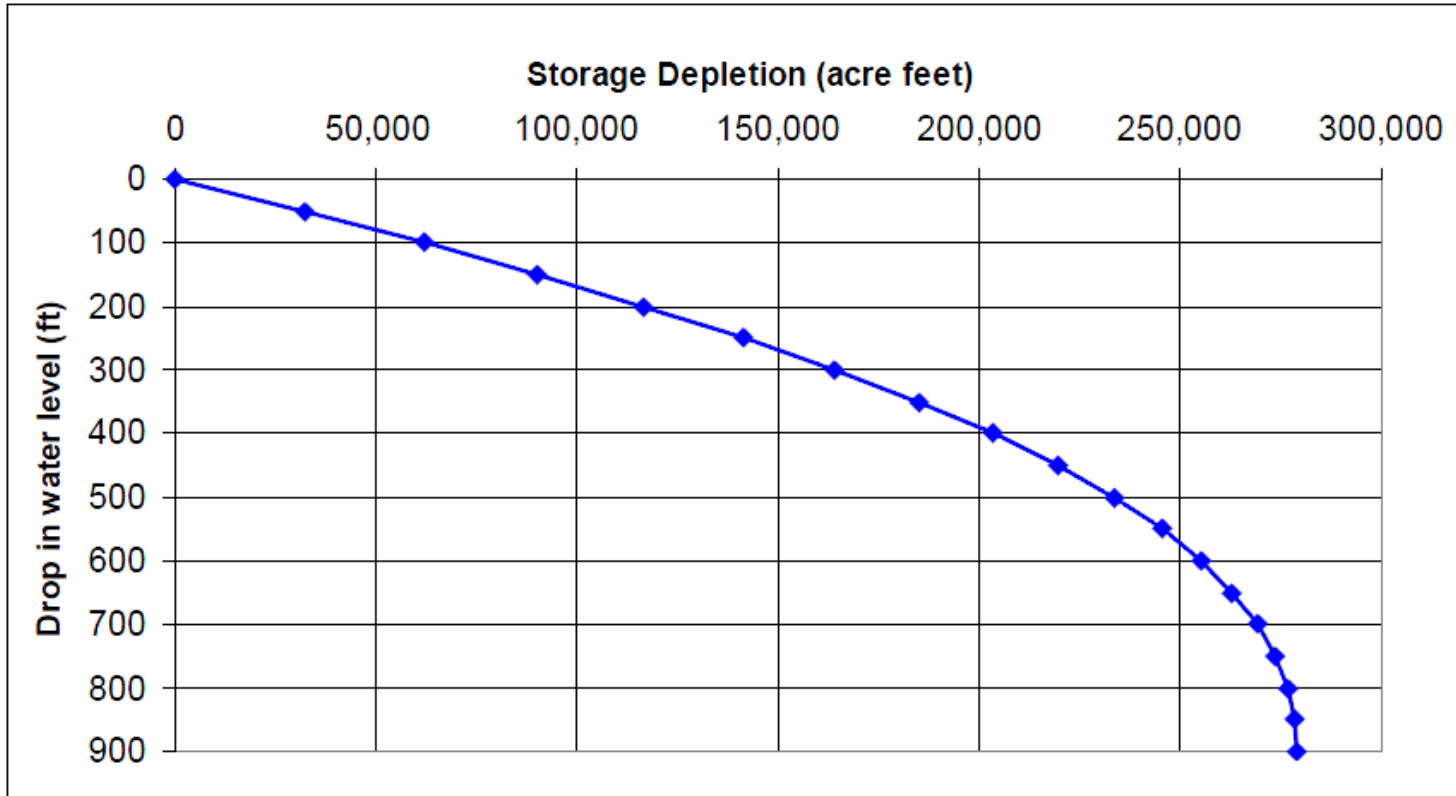




Measuring Thresholds & Objectives (354.28(c))

Sustainability Indicator	Metric
Groundwater storage	<p>Total extractions (pumping)</p> <ul style="list-style-type: none">• One minimum threshold and one measurable objective for the entire subbasin• Many GSPs have opted to calculate storage from groundwater levels as a proxy for extractions

Example Change in Storage Data



Calculated Groundwater Storage Depletion with Declining Water Level

El Toro Groundwater Study
Monterey County, California

Geosyntec[®]
consultants

Figure
6-5

Notes: Assumes storage coefficient of 10% and uniform water level decline for QTc-Tsm
Aquifer System (see isopach maps and saturated thickness maps).

Example Change in Storage Data – Initial Estimates

	2030	2070
Estimated Extractions (Acre-Feet/Year)	13,531	13,560
Estimated Overdraft (Acre-Feet/Year)	-1,220	-1,020
Percent Pumping Reduction	9.0%	7.5%

These estimates appear to underestimate extractions
This is a significant data gap

- Provided for generalized guidance only
- Estimates will be updated with new GW model
- Pumping reduction likely depends on reservoir operations
 - Pumping reductions not necessarily equally distributed in the Subbasin

Example Change in Storage Data – Initial Estimates

Source with area and publish year	GW Extraction or Outflows (AFY)	Future Use (AFY)	Recharge or Inflows (AFY)	Difference (AFY)
Anderson-Nichols (El Toro) 1981	677	1,735	5,996	5,319
Staal Gardner Dunne (El Toro) 1991	1,126	2,160	2,072	-946
FUGRO (El Toro) 1996	1,256	2,145	2,976	1,720



Groundwater Storage Minimum Threshold SMC Options

1. Pumping in excess of the sustainable yield leads to significant and unreasonable impacts
 - ➡ Minimum threshold = pump within the sustainable yield.
Provide an estimate of the sustainable yield, acknowledging it will be refined with better data
 - ➡ Measurable objective = pump at, or less than the sustainable yield.

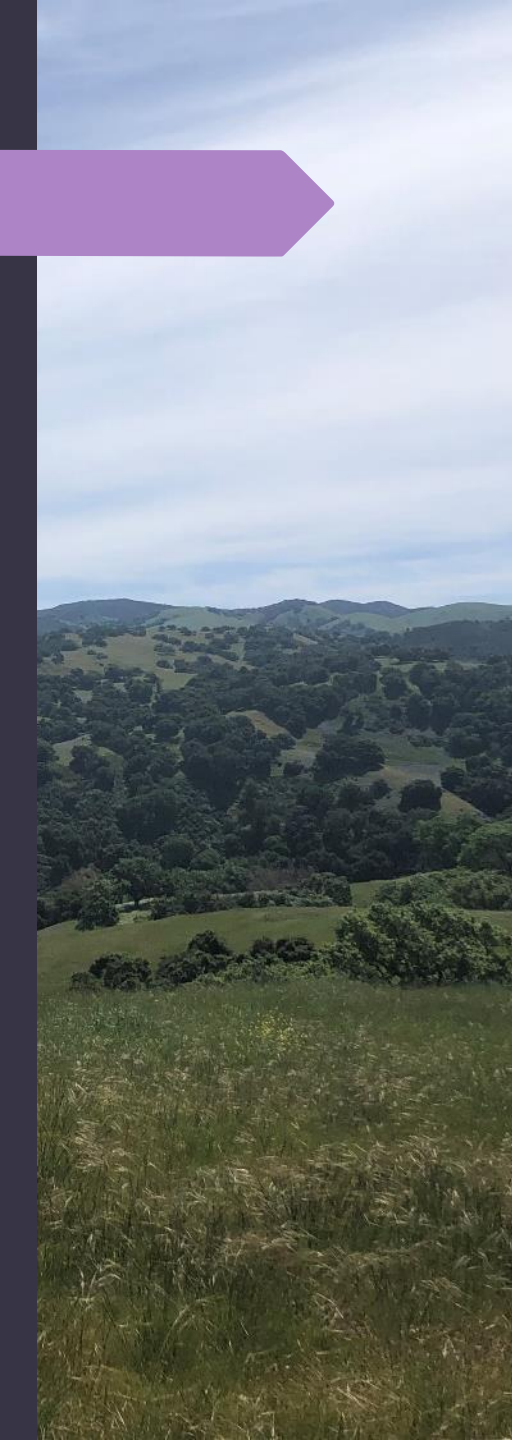


Groundwater Storage Minimum Threshold SMC

Options: Groundwater levels as a proxy

2. Net change in groundwater storage, based on groundwater elevations is zero
 - ➡ Minimum threshold = no long-term change in storage based on calculations using groundwater elevation data
 - ➡ Measurable objective = long-term stability, or increase in storage based on calculations using groundwater elevation data

It is unclear how using groundwater levels as a proxy strictly meet SGMA regulations



Groundwater Storage Minimum Threshold Example from 180/400-Foot Subbasin

Minimum threshold is set to the estimated long-term future sustainable yield of 180/400-Foot Aquifer Subbasin [option 1]

- ➡ Initially set to 112,000 AF/yr. This will be refined with better data.

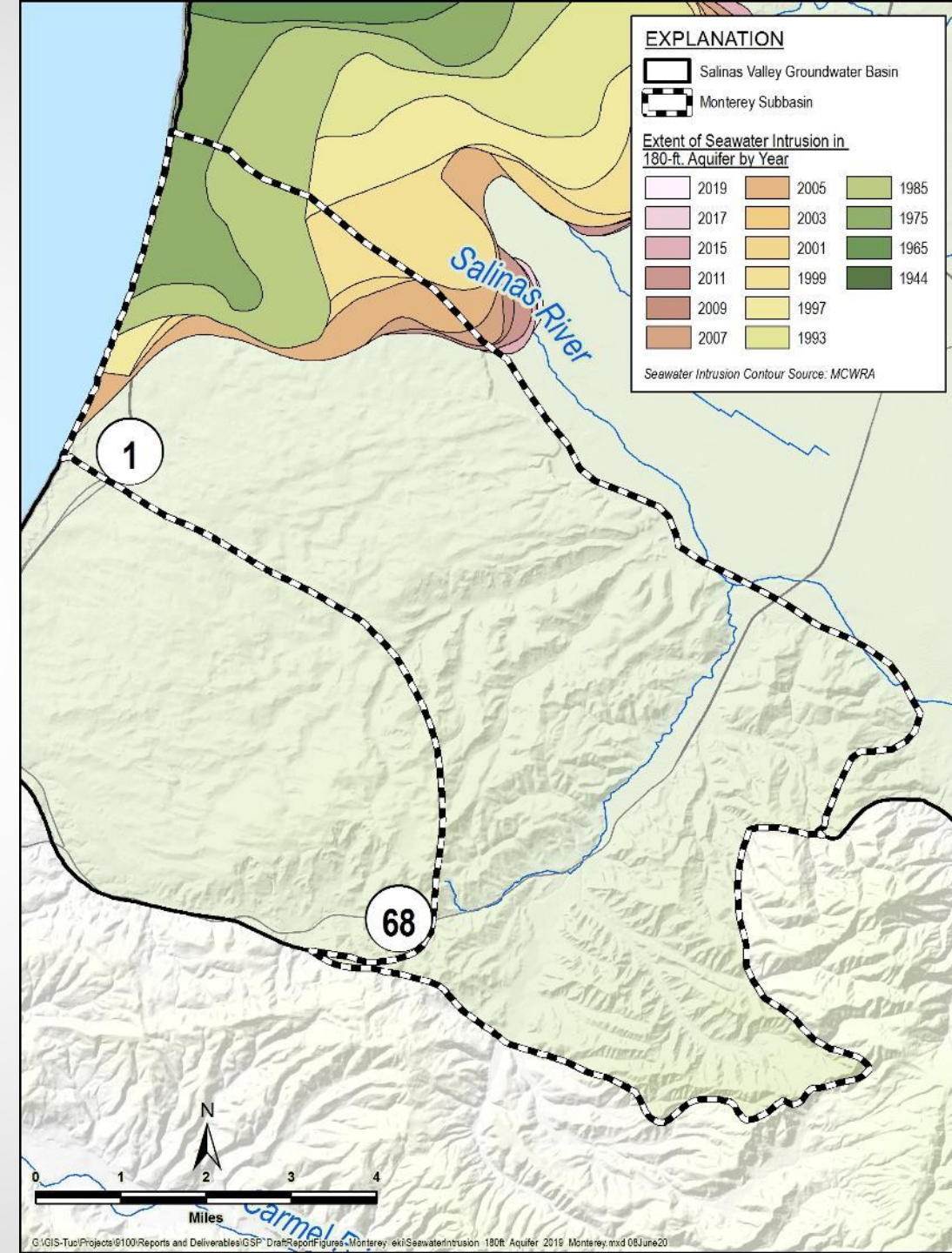
It may be difficult to justify a minimum threshold of pumping more than the sustainable yield, or allowing a loss of groundwater storage



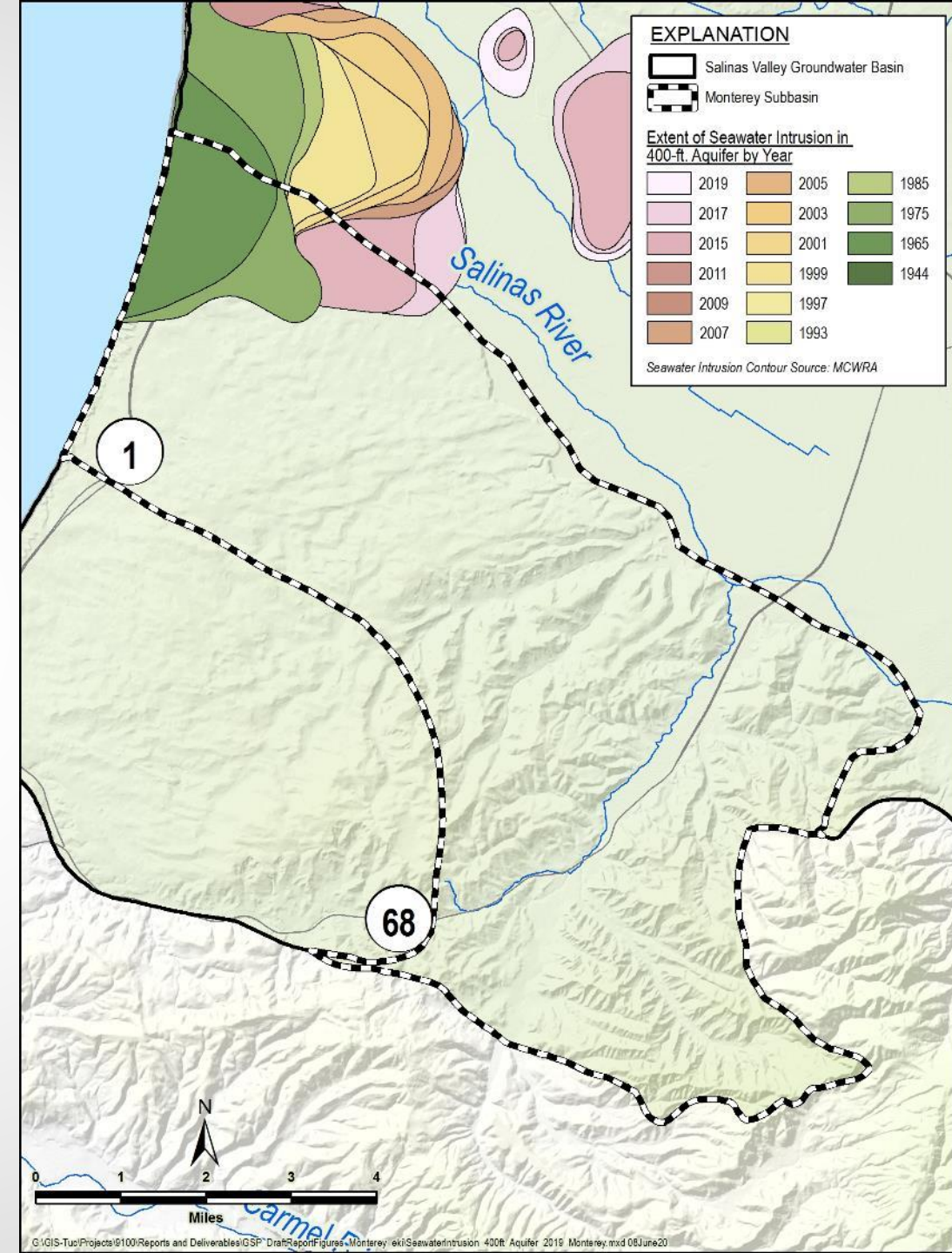
Measuring Thresholds & Objectives (354.28(c))

Sustainability Indicator	Metric
Seawater Intrusion	<p>Location of a chloride isocontour line</p> <p>Option: groundwater elevations that are protective of seawater intrusion</p>

Sea Water Intrusion – 180-Foot Aquifer



Sea Water Intrusion – 400-Foot Aquifer





Sea Water Intrusion Minimum SMC Options

1. Any seawater intrusion in the Subbasin is significant and unreasonable
 - Minimum threshold = a chloride isocontour at the shoreline
 - Measurable objective = same as minimum threshold



Groundwater Quality Minimum SMC Options

2. Existing SWI is significant and unreasonable, and SVBGSA chooses to improve SWI. Goal is to push back seawater intrusion.
 - Minimum threshold = a chloride isocontour at the current location, or closer to the ocean
 - Measurable objective = a chloride isocontour closer to the ocean, or at the shoreline



Groundwater Quality Minimum SMC Options

3. Existing SWI is significant and unreasonable, but SVBGSA chooses not to push back SWI
 - Minimum threshold = a chloride isocontour at it's current location
 - Measurable objective = same as minimum threshold
 - We are not required to meet the minimum thresholds in this example



Groundwater Quality Minimum SMC Options

4. Additional SWI is neither significant nor unreasonable. Seawater intrusion can advance farther inland.
 - Minimum threshold = a chloride isocontour inland of the current location
 - Measurable objective = same as minimum threshold

Sea Water Intrusion Minimum Threshold Examples from 180/400-Foot Subbasin

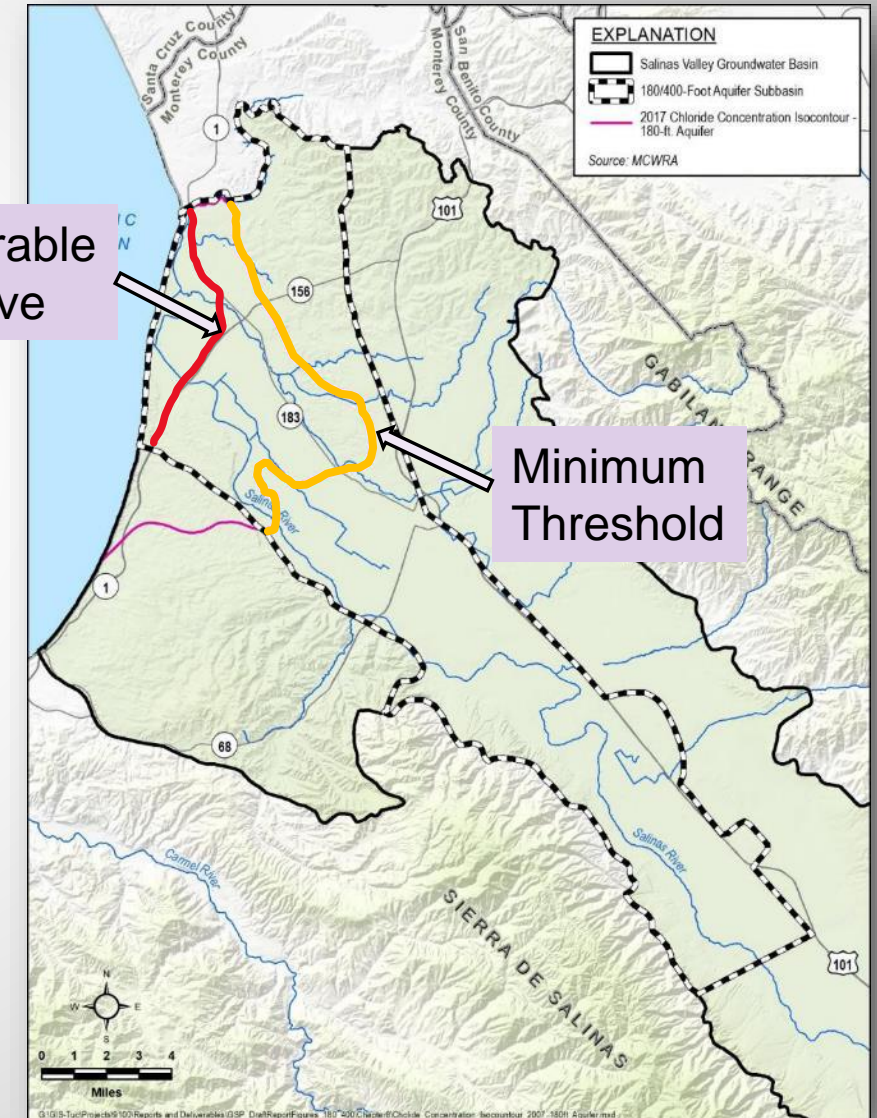
Minimum Threshold set to the 2017 chloride isocontour

Measurable objective set to a line closer to the coast.

[option 2]

Measurable Objective

Minimum Threshold





Measuring Thresholds & Objectives (354.28(c))

Sustainability Indicator	Metric
Degraded water quality	<p>Three options in the regulations.</p> <ol style="list-style-type: none">1. A volume of impacted groundwater. Annually contour and calculate the volume of impacted groundwater2. The location of an isocontour. Annually contour concentrations3. A number of supply wells. Review drinking water and irrigation water quality data



Groundwater Quality Minimum SMC Options

1. Degraded groundwater quality resulting from direct GSA actions is significant and unreasonable
 - ➡ Minimum threshold = maintain current groundwater quality impacts
 - ➡ Measurable objective = same as minimum threshold



Groundwater Quality Minimum SMC Options

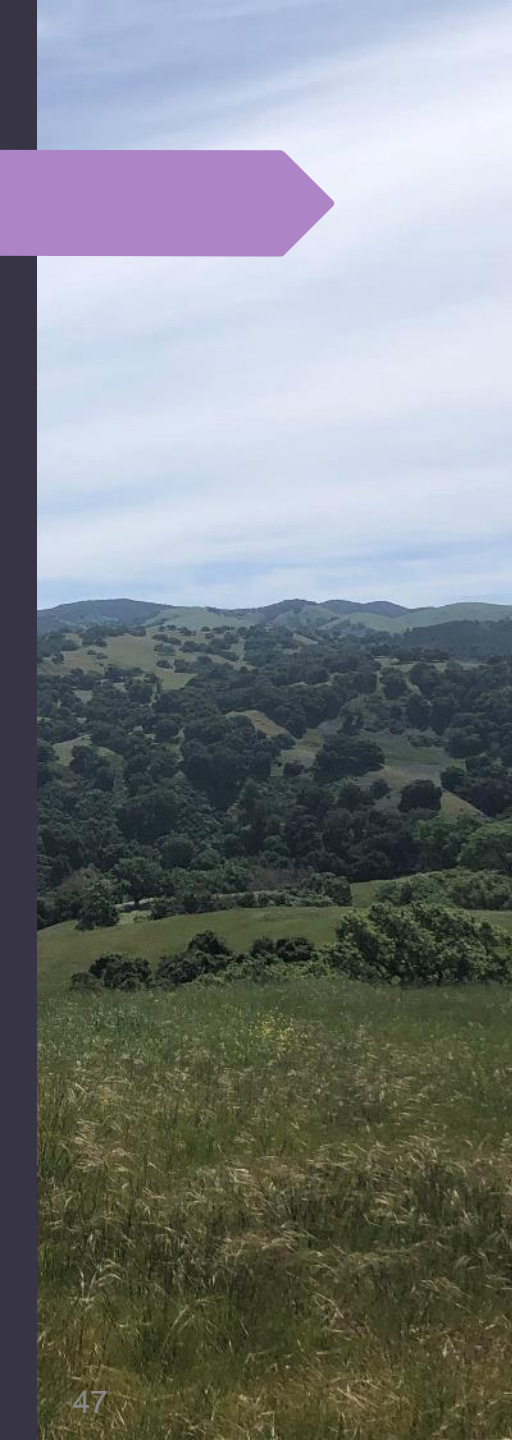
2. Existing groundwater quality conditions are significant and unreasonable, but SVBGSA chooses not to improve existing groundwater quality
 - ➡ Minimum threshold = improve groundwater quality impacts
 - ➡ Measurable objective = same as minimum threshold
 - ➡ We are not required to meet the minimum thresholds in this example



Groundwater Quality Minimum SMC Options

3. Existing groundwater quality conditions are significant and unreasonable, and SVBGSA chooses to improve existing groundwater quality
 - Minimum threshold = improve groundwater quality impacts
 - Measurable objective = same as minimum threshold

Be cautious adopting responsibilities and authorities already held by other agencies such as CCRWQB, or County of Monterey

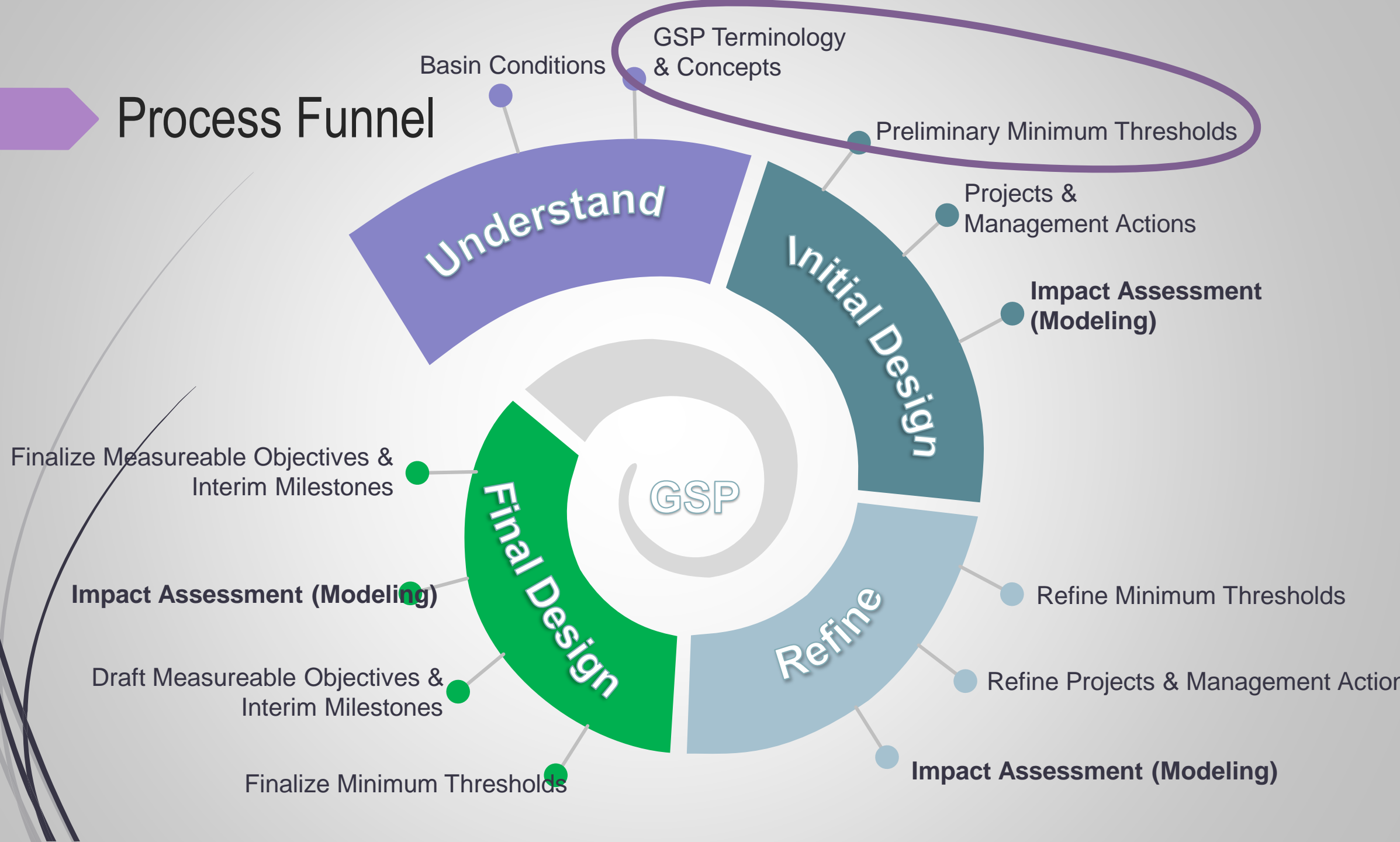


Groundwater Quality Minimum Threshold 180/400-Foot Subbasin Example

Minimum threshold is zero **additional** exceedances of groundwater quality constituents of concern known to exist in the Subbasin [option 1]

- Based on the idea that it is significant and unreasonable for the GSA to take an action that financially impacts a well owner.
 - Well owner has to treat water
 - Well owner has to abandon a well
 - Reduced crop production due to water quality

Process Funnel



Questions

