

Information Item 7A  
Sustainable  
Management  
Criteria: Land  
Subsidence



## Today's goal

- Review work-to-date on Land Subsidence SMC
- Describe key points and considerations
- Discuss proposed approach
- Review Advisory Committee recommendations
- Board consideration

# SMC development to date



- The Land Subsidence SMC was discussed with Advisory Committee on May 12, June 6 and July 14
- Written materials were provided to Advisory Committee between meetings
- SMC was discussed with Board on June 1
- Technical work occurred prior to and between Advisory Committee and Board discussions

# Key Points/Considerations

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- GSAs are only responsible for managing inelastic (or unrecoverable) subsidence caused by groundwater pumping
- GSAs are not responsible for elastic (recoverable) subsidence nor for subsidence caused by anything other than groundwater pumping
- Limited datasets do not indicate the occurrence of historical inelastic land surface subsidence due to groundwater pumping within the Subbasin
- Subsidence can be measured with extensometers, GPS stations, levelling surveys or Interferometric Synthetic-Aperture Radar (InSAR)
- InSAR data made available from 2015 to present do not indicate occurrence of inelastic subsidence

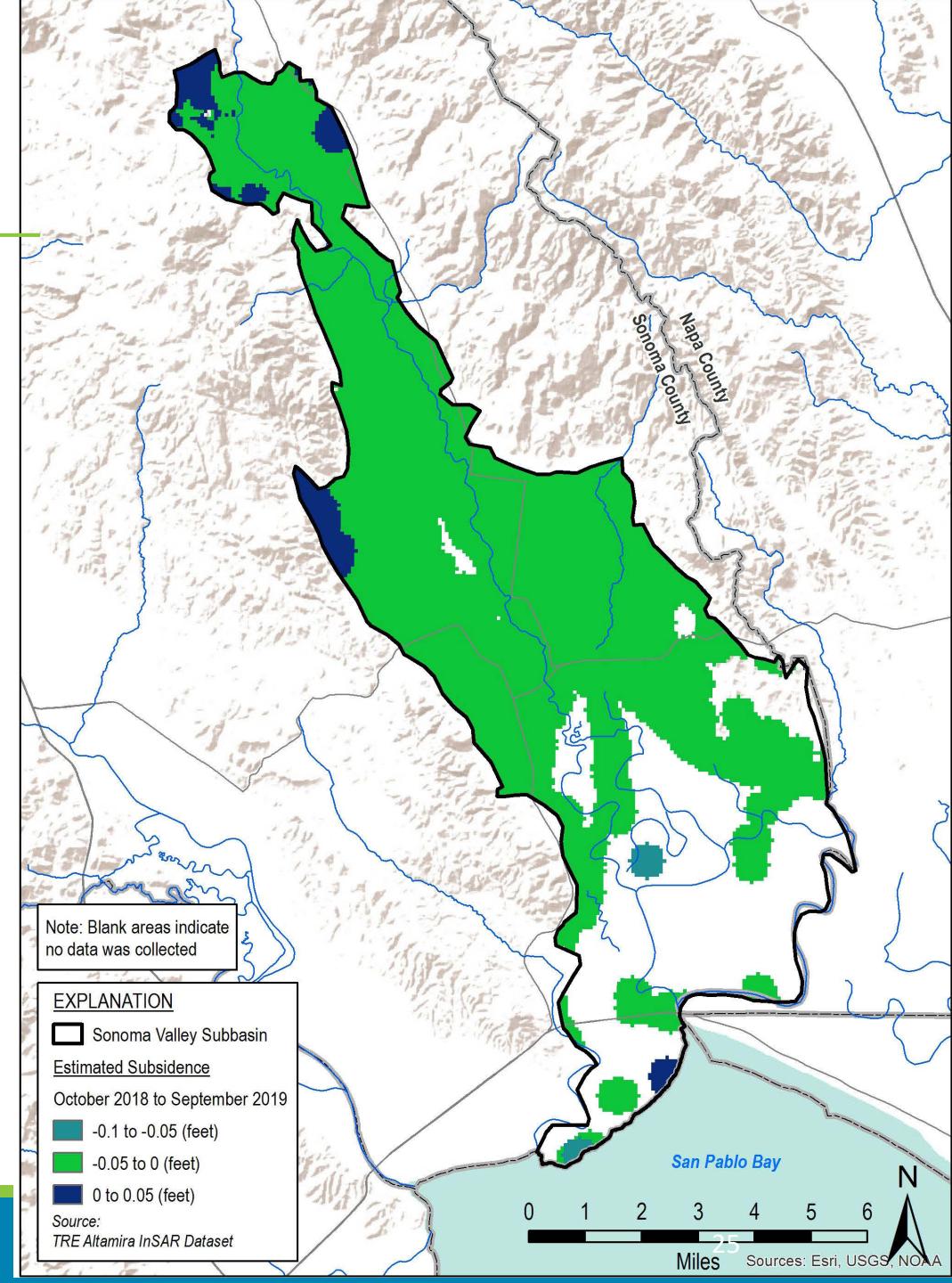
# Recommended Monitoring: InSAR Datasets

## Advantages:

- Extensive spatial coverage - nearly entire Subbasin
- Monthly high resolution measurements
- DWR intends to continue to fund and make InSAR datasets available to GSAs

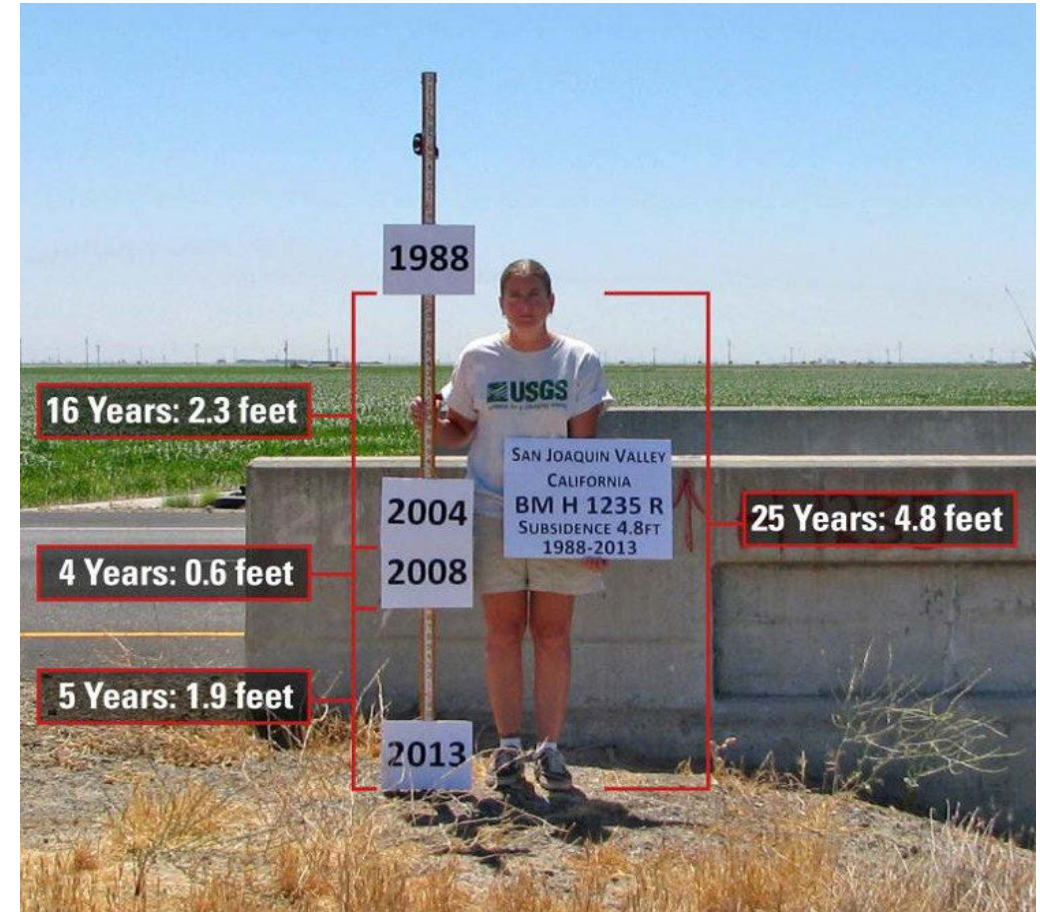
## Disadvantages:

- Measures total subsidence only (elastic + inelastic)
- Data only available since 2015



# Recommendation: Significant and Unreasonable Conditions

Any inelastic subsidence caused by groundwater pumping is a significant and unreasonable condition, everywhere in the subbasin and regardless of the beneficial uses and users



# Recommendation: Measurable Objective

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The Measurable Objective for land subsidence is 0.1 feet\* per year total subsidence (elastic & inelastic) measured by InSAR for each 100 meter x 100 meter grid.

*\*0.1 feet per year accounts for estimated error of InSAR technology*

# Recommendation: Minimum Threshold

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The Minimum Threshold for land subsidence is 0.1 feet per year of total subsidence (elastic and inelastic) measured by InSAR for each 100 meter by 100 meter grid.

(Regulations require 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.'*)

# Undesirable Results Options

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## **All options require:**

1. An exceedance of the Minimum Threshold (0.1 feet per year of total subsidence); and
2. Subsidence must be determined to be correlated to groundwater level declines due to groundwater pumping.

## **Option variables:**

- Timeframe of subsidence (Option 1)
- Cumulative magnitude of subsidence (Option 2)
- Geographic extent of subsidence (Option 3)



# Option 1: Timeframe of Subsidence

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An undesirable result will occur if subsidence is determined to be correlated with groundwater level declines due to groundwater pumping, AND:

- The Minimum Threshold (0.1 feet per year of total subsidence) is exceeded in at least one InSAR pixel (~2.5 acres), OR
- Five continuous years of total subsidence at any detectable magnitude in any area, even if each year's annual subsidence rate is less than the Minimum Threshold

# Option 2: Cumulative Magnitude of Subsidence

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An undesirable result will occur if subsidence is determined to be correlated with groundwater level declines due to groundwater pumping, AND:

- The Minimum Threshold (0.1 feet per year of total subsidence) is exceeded in at least one InSAR pixel (~2.5 acres), OR
- Within any five year period cumulative total subsidence exceeds 0.2 feet in any area (even if each year's annual subsidence rate is less than the Minimum Threshold)

# Option 3: Geographic Extent of Subsidence

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An undesirable result will occur if subsidence is determined to be correlated with groundwater level declines due to groundwater pumping, AND:

- The Minimum Threshold (0.1 feet year of total subsidence) is exceeded over 25 continuous acres (about 10 InSAR pixels), OR
- Five continuous years of subsidence occurring over 25 contiguous acres (about 10 InSAR pixels) including developed land or infrastructure facilities even if each year's annual subsidence rate is less than the Minimum Threshold)

# Staff Comparison of Undesirable Results Options

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**Option 1:** Staff concerned that this option brings greater risk of false exceedances of the minimum threshold because any measurement of total subsidence, even at extremely low levels within the error of InSAR.

**Option 2:** The risk of small amounts of annual total subsidence below the minimum threshold adding up to a significant cumulative amount of subsidence is more effectively addressed through the cumulative cap proposed for Option 2.

**Option 3:** This option has the least risk of false exceedances of minimum threshold but would also be less sensitive to triggering evaluation of undesirable results based on total subsidence measurements.

**Staff most comfortable with Options 2 & 3**

# Advisory Committee Feedback

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- Discussed in May, June and July
- Reviewed several options, and provided feedback and alternatives
- Agreed that all of the three options provided a reasonable range of decision criteria
- Raised concerns about the inclusion of "developed land or infrastructure" for Option 3 (this language could be removed)
- Favored Option 2

# Requested Board Action



Provide feedback to staff on the overall approach to the draft SMC for land subsidence

Consider approval of one of the three draft options presented, with the understanding that all of the SMCs will be revisited in total prior to final adoption