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MEMORANDUM

To: Vina GSA and Rock Creek Reclamation District GSA Boards

From: Christina Buck, Asst. Director Butte County Dept. Water and Resource Conservation
(providing technical staff support to the GSA)

Date: June 4, 2026

Subject: Consideration of Plan amendments to the Land Subsidence Sustainable Management Criteria in response to Department of Water Resources' Recommended Corrective Actions

Background

The Vina Groundwater Sustainability Plan (GSP) was adopted in December 2021 by the Vina Groundwater Sustainability Agency (GSA) and Rock Creek Reclamation District GSA and subsequently reviewed and approved by the California Department of Water Resources (DWR) in July 2023. As part of its review, DWR provided Recommended Corrective Actions (RCAs) in its [Determination Letter](#) identifying several areas for improvement with an expectation that the RCAs should be considered by the GSAs in the first periodic evaluation of the GSP or addressed through amendments to the GSP. The Sustainable Groundwater Management Act (SGMA) requires the GSAs to submit the first Periodic Evaluation (PE) by January 2027. The PE is the GSA's written assessment of its GSP implementation. The Vina GSA received funding through the Sustainable Groundwater Management Round 2 grant program to support work to address data gaps identified in the plan and complete the PE. Larry Walker Associates (LWA) was competitively selected to complete this work. In addition, Butte County staff provide technical staff support to the Vina GSA due to their local expertise and institutional knowledge. Documents and resources related to development of the PE can be found online: <https://www.vinagsa.org/gsp-periodic-evaluation>.

Approach to Addressing Land Subsidence

This memo provides relevant context and information to support the joint GSA Boards in making a decision regarding how the GSAs will address DWR's RCA related to land subsidence (one of six sustainability indicators). The Vina GSA released a [strawman proposal](#) on April 27, 2026 to facilitate discussion and receive public input on whether the SMC for Land Subsidence should be amended in the GSP in response to DWR's RCA. As a result of public input, the strawman was revised and proposed draft amendments were provided for SHAC's consideration at their meeting on May 27, 2026. Consistent with the SHAC's recommendation, the draft amendments were further revised (see Attachment A) and are provided for the Boards' consideration and direction for possible incorporation into the Periodic Evaluation and GSP amendments.



Relevant Context

The following provides important relevant context regarding potential changes to the Land Subsidence SMC in the GSP.

No Observed Land Subsidence in Vina Subbasin

Under the Sustainable Groundwater Management Act (SGMA), land subsidence is one of six sustainability indicators that is required to be managed in the GSP to avoid "undesirable results," which is defined as significant and unreasonable land sinking caused by excessive groundwater pumping. The 2025 Water Year Annual Report (and previous annual reports) show that no inelastic land subsidence has been recorded in the Vina Subbasin. The 2025 Annual Report's Figure 5-2 (included below for quick reference) shows "no significant change" of vertical displacement over a 5-year period. The entire Annual Report is available [online](#).

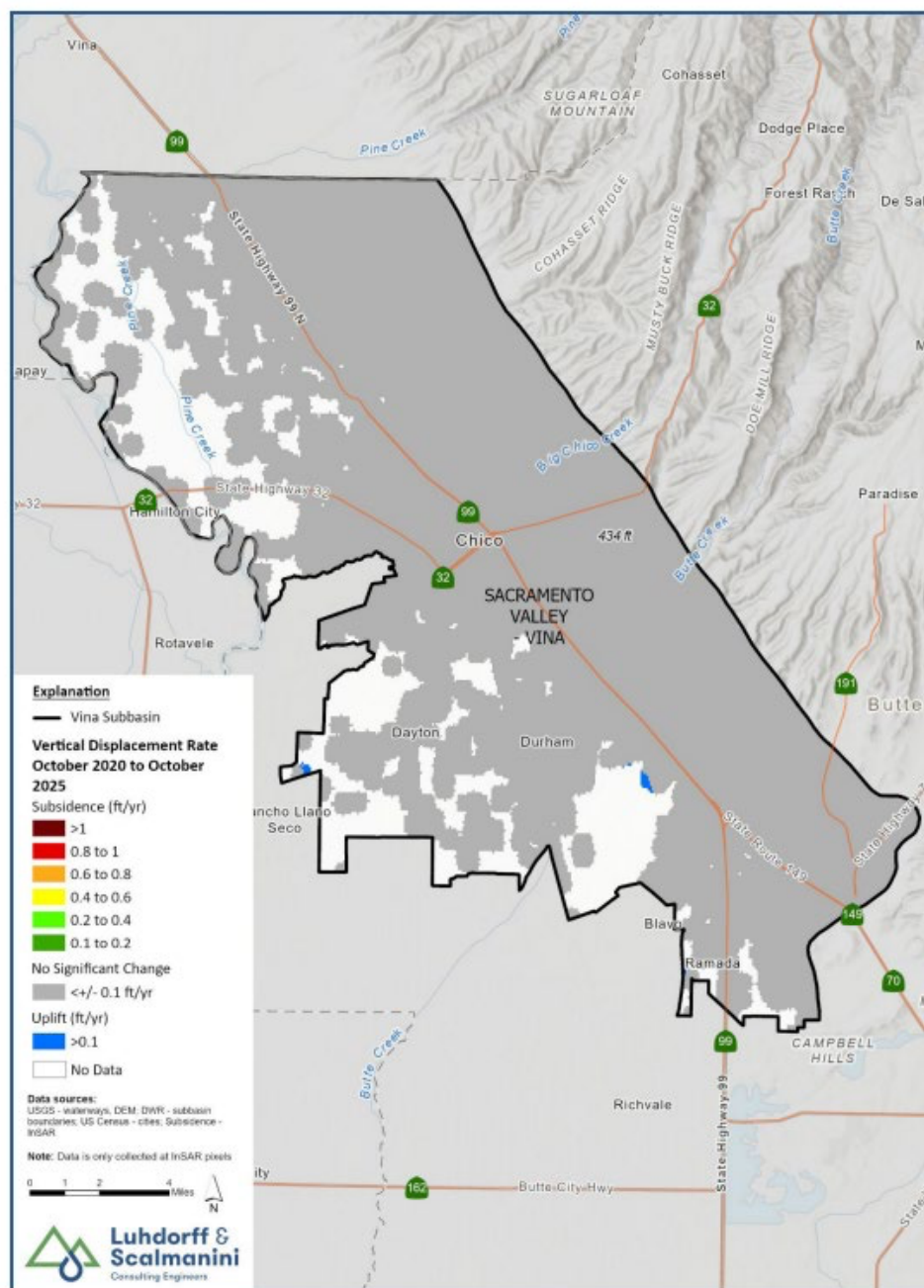


Figure 5-2. Vina Subbasin Vertical Displacement in Ground Surface from 10/2020 to 10/2025

DWR Recommended Corrective Actions

DWR provided recommended corrective actions (RCAs) in its GSP Determination Letter identifying several areas for improvement with respect to the land subsidence sustainability indicator. It is DWR's expectation that RCAs should be considered by the GSAs in the first periodic evaluation of the GSP (due to be submitted in January 2027). Provided below is Recommended Corrective Action 5, as stated in the Determination Letter:

Provide additional information on criteria used to identify undesirable results, and sustainable management criteria for land subsidence, including:

- a. Provide a clear, quantitative definition of when undesirable results for land subsidence may occur in the Subbasin, as required by the GSP regulations, to support the selection of land subsidence minimum thresholds that demonstrate avoidance of undesirable results.*
- b. Establish sustainable management criteria for land subsidence for the Subbasin utilizing a monitoring network that directly measures land elevation change such as remote sensing data, survey monuments, or global positioning system stations.*

Current Approach in the 2022 GSP

The [Vina Subbasin Groundwater Sustainability Plan \(2022\)](#) currently uses groundwater levels as a proxy, using the groundwater level SMC and monitoring network for land subsidence as well. This needs to be addressed since it relies entirely on observed groundwater level conditions and not a direct measurement of land surface changes (as requested in DWR's RCA 5b, above).

Recently Released DWR Best Management Practices (BMP) on Land Subsidence

In January 2026, DWR released its Best Management Practices ([BMP\) on Land Subsidence](#). This document provides guidance to Groundwater Sustainability Agencies on how to monitor, evaluate, and establish Sustainable Management Criteria for land subsidence in a manner that identifies and avoids significant and unreasonable impacts to infrastructure and land use. It describes four different land subsidence management scenarios and suggests different approaches depending on the conditions in the subbasin. The Vina Subbasin falls into **Scenario 2**, which describes conditions where little or no subsidence has been observed to date, but groundwater levels may be allowed to decline below historical lows (based on how Groundwater Levels Minimum Thresholds are set), creating a risk of inelastic subsidence and requiring monitoring and SMC that identify conditions that could lead to significant and unreasonable impacts. Land Subsidence is a sustainability indicator DWR has provided clear guidance on, in addition to the RCAs.

Neighboring Subbasins

Additionally, the approaches neighboring subbasins have taken regarding land subsidence monitoring and SMC is informative to the Vina Subbasin. This is summarized in Table 5 of the ['Joint GSP Evaluation for the North Sacramento River Corridor'](#) Tech Memo and is included in the materials that were provided to the SHAC (Attachment B).

SHAC Discussion and Recommendations

At their May 27, 2026 meeting, staff presented the SHAC with the materials described in this memo to support discussion and a potential recommendation to the Vina GSA Board, including: a staff memo outlining background, context, and the approach to addressing DWR's Recommended Corrective Action 5 related to land subsidence; proposed draft amendment language for GSP Sections 3.7, 4.5, and 4.9.3; a comparison of neighboring subbasin approaches; and the results of the public discussion session held on May 7, 2026. Staff requested SHAC discussion and a recommendation regarding whether to support the proposed GSP amendments to the Land Subsidence Sustainable Management Criteria and monitoring network.

SHAC Discussion

The SHAC engaged in a substantive discussion of the proposed land subsidence amendments, with questions and comments spanning the monitoring network, costs, the scope of DWR's expectations, and the relationship between InSAR data and groundwater level monitoring. Members of the public also provided comment in support of the proposal and approach.

Key themes and perspectives from the discussion included:

- A. **Monitoring costs and responsibilities:** SHAC members asked about the cost of acquiring and using InSAR data and who would be responsible for monitoring. Staff clarified that DWR provides InSAR data at no cost to the GSA, that the groundwater level monitoring wells proposed for use as representative monitoring sites are already installed, and that monitoring responsibilities are split between DWR, Butte County Water and Resource Conservation, and the Vina GSA—consistent with the existing budget. Some SHAC members expressed a preference against adding new monitoring wells or data collection points beyond what is necessary or required by DWR.
- B. **Monitoring network and the list of representative monitoring wells:** Several SHAC members asked about the basis for the proposed list of 44 representative monitoring well locations included in Table 1 of the proposed amendments (see Attachment B for materials provided to the SHAC), including how the wells were selected and whether the list can be changed. Some members indicated they wanted additional time to review the proposed monitoring network before approving it, while others noted the value of broader spatial coverage to confirm whether any observed subsidence signal is linked to groundwater level changes. Discussion included whether the monitoring well list could be revised without a GSP amendment, and whether it would be appropriate to defer approval of the monitoring network until it can be considered alongside the upcoming groundwater level monitoring network discussion. Staff indicated that the list in Table 1 is a set of wells from the long term DWR/County monitoring network and also a handful of wells monitored by other agencies as part of other monitoring programs (ex. Chico Nitrate monitoring program, or Department of Toxic Substance Control associated with monitoring of plumes in Chico) that have been identified as providing useful data relevant to the groundwater level sustainability indicator. Staff suggested the specific list of wells could be taken up in more detail when the groundwater level sustainability indicator monitoring networks are discussed. Staff and members of the SHAC expressed the perspective that there could be an advantage of using the same set of wells for land subsidence that is used for groundwater levels, rather than having separate lists of wells for the two indicators.
- C. **Scope of DWR's expectations:** Some members expressed a preference for responding to DWR's RCA at the minimum necessary level rather than adding requirements beyond what was requested. Others noted the low additional burden of the proposal given the zero cost of InSAR data and the existing monitoring infrastructure, and suggested that broader coverage provides the ability to investigate any future subsidence signal and tie it definitively to groundwater conditions.
- D. **Causation language and linkage to groundwater levels:** A member asked whether the proposed amendment language includes causation provisions to recognize that land subsidence can result from factors other than groundwater pumping. Staff confirmed that the proposed Minimum Threshold and Undesirable Result language ties the Sustainable Management Criteria to declining groundwater levels, and that pairing InSAR data with groundwater level monitoring well data is specifically intended to support that causal linkage.

Public comments were supportive of the proposal. Members of the public noted that there is potential for land subsidence to occur in the future, expressed support for moving away from groundwater level as a proxy for subsidence SMC, and endorsed using InSAR as a direct, no-cost monitoring tool. One commenter noted the proposal does not represent a heavy lift for the GSA and encouraged the GSA to proceed.

SHAC Recommendations

The SHAC voted unanimously to recommend the proposed Land Subsidence SMC amendments as presented in slide 8 of the presentation to amend the 2022 GSP and to establish the land subsidence RMS network consistent with the groundwater level sustainability indicator monitoring network.

Slide 8 from SHAC presentation:

Proposed SMC: nuts and bolts

Draft amendment language is written to replace GSP Sections 3.7, 4.5, and add Section 4.9.3.

MO	0.0 ft/yr of land subsidence at representative monitoring locations, recognizing uncertainty.
MT	0.5 foot cumulative subsidence over a 5-year period at the same location, as a result of declining groundwater levels.
IM	No interim milestone needed because no subsidence has occurred in the Subbasin.
UR	MT exceedance at the same representative location for two consecutive years with confirmed infrastructure impacts and declining groundwater levels.
Uncertainty	<0.10 ft/yr considered within the range of InSAR measurement uncertainty.

Annual rates remain useful for context, but compliance is based on rolling 5-year cumulative change.

Vine GSA | Land Subsidence SMC Amendments

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Draft Amendments to the Land Subsidence SMC

Provided in attachment A for the Boards' consideration is draft GSP language that would be used to amend the 2022 GSP, specifically sections 3.7, 4.5 and 4.9.3 (new section). The draft proposed amendments incorporate revisions per the SHAC's recommendation to link the land subsidence RMS network to the groundwater level sustainability indicator monitoring network. The changes are shown in tracked changes. The set of wells to be considered for the groundwater level sustainability indicator broad and RMS networks will be made available to the public in the coming weeks. The SHAC and GSA Boards will have an opportunity to provide direction on these networks when the groundwater level topic is included on meeting agendas in the near future. It is anticipated that discussions on this complex topic may begin in June and continue into July and/or August.

Requested Action

Consider the following action:

Direct staff to incorporate changes to the Land Subsidence Sustainable Management Criteria into the Vina GSP as plan amendments and document the response to DWR's Recommended Corrective Action in the Periodic Evaluation consistent with the approach to amend the GSP.

Attachments

- A. Land Subsidence – Proposed Amended GSP Sections
- B. SHAC May 27, 2026 Meeting Materials

Attachment A: Land Subsidence - Proposed Amended GSP Sections



The following is proposed for consideration as a Plan amendment to respond to the Department of Water Resources' Recommended Corrective Actions related to the Land Subsidence sustainability indicator. The following sections of the GSP would be amended with the content below replacing Sections 3.7, 4.5 and (new) 4.9.3. This is written as direct language to be used to amend the GSP. Consistent with the SHAC recommendation (May 27, 2026), Table 1 and monitoring network language is revised to reference the groundwater level monitoring network as the basis of the land subsidence RMS network. The table and map would be updated once the GSA Boards make decisions about the Broad and RMS networks for the groundwater level sustainability indicator.

Proposed Amendments to Specified Sections of the 2022 GSP:

3.7 Land Subsidence Sustainable Management Criteria

Land subsidence in the Subbasin is evaluated using direct measurements of land surface deformation, primarily through Interferometric Synthetic Aperture Radar (InSAR) data, supplemented by available Global Positioning System (GPS) measurements where applicable. These datasets provide spatially distributed estimates of vertical land surface change and are used to assess both the rate and cumulative magnitude of subsidence across the Subbasin.

Consistent with the Department of Water Resources (DWR) Land Subsidence Best Management Practice (BMP), the Subbasin is characterized as having no documented history of significant inelastic land subsidence, but recognizes that subsidence may occur if groundwater elevations decline sufficiently to induce compaction of fine-grained sediments. Accordingly, the Sustainable Management Criteria (SMC) are designed to identify conditions under which subsidence could result in significant and unreasonable impacts to beneficial uses and users, including infrastructure and land use. The locally defined undesirable result, MT, and MO are discussed in the next sections.

Measurement Uncertainty. Subsidence rates less than 0.10 feet per year are considered within the range of InSAR measurement uncertainty and are not interpreted as indicative of inelastic land subsidence.

3.7.1 Undesirable Result

An undesirable result due to land subsidence is experienced if:

Subsidence exceeding the Minimum Threshold results in significant and unreasonable impacts to beneficial uses and users, including infrastructure, namely highways, roads, drainage, irrigation, or railroad infrastructure, power transmission lines, or well casings. An undesirable result due to subsidence occurs as a result of declining groundwater levels. Groundwater levels are evaluated alongside InSAR data to assess risk of inelastic compaction and inform management actions.

This occurs when:

1. The Minimum Threshold is exceeded at the same representative monitoring location for two consecutive years with confirmed associated impacts to infrastructure and declining groundwater levels.

3.7.2 Minimum Threshold (MT)

The minimum threshold for land subsidence is defined as:

0.5 foot cumulative subsidence over a 5-year period at the same location as a result of declining groundwater levels.

3.7.3 Measurable Objective (MO)

The measurable objective for land subsidence is defined as:

0.0 feet per year of land subsidence at representative monitoring locations, recognizing that minor variation within measurement uncertainty does not indicate inelastic subsidence.

Since no subsidence has occurred in the subbasin, no interim milestone is needed.

4.5 Land Subsidence (Monitoring Network)

4.5.1 Background

The broad monitoring network for land subsidence includes all available InSAR data and one available GPS monitoring site available within the Vina Subbasin. These datasets will be used for analysis and basin setting understanding.

Therefore, the land subsidence monitoring network consists of:

- DWR-provided InSAR data, evaluated from data pixels distributed throughout the Subbasin;
- Available GPS monument (chco station) used to corroborate InSAR-derived displacement estimates (one site in Vina);

4.5.2 Location and Density of Monitoring Sites and Frequency of Measurement

To support evaluation of land subsidence, the Vina Subbasin utilizes InSAR-derived land surface deformation data across the full Subbasin extent. All available InSAR data are reviewed annually in relation to groundwater level changes to evaluate spatial patterns, identify potential areas of deformation, and assess overall subsidence conditions. InSAR data are evaluated with consideration of both annual rates and cumulative deformation trends. SMC compliance is based on a rolling 5-year cumulative change, while annual rates are used as supporting information.

Measurement Uncertainty. Subsidence rates less than 0.1 feet per year are considered within the range of InSAR measurement uncertainty and are not interpreted as indicative of inelastic land subsidence.

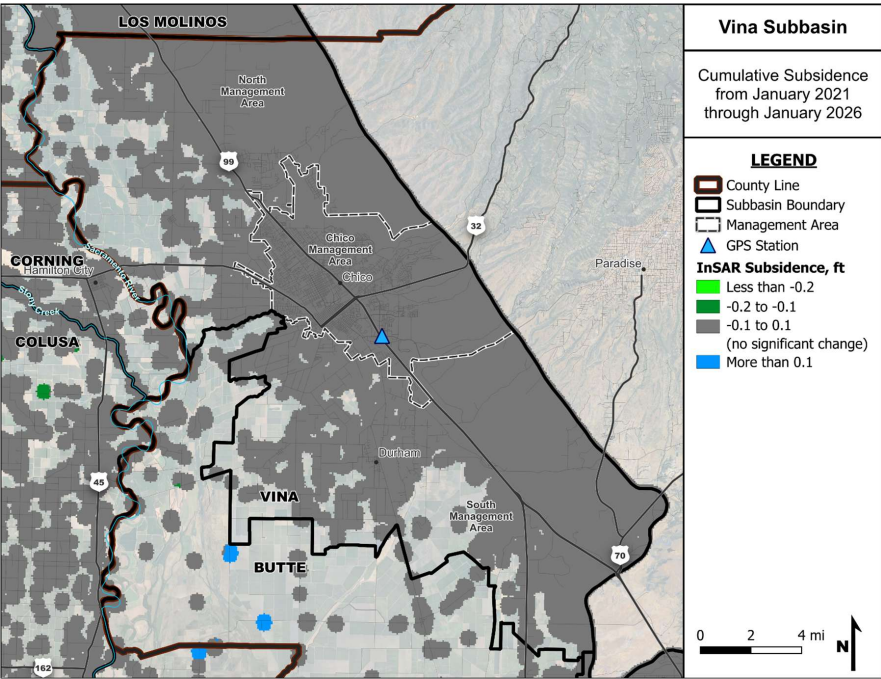


Figure 1. Broad Monitoring Network for Land Subsidence consisting of InSAR and GPS Station Data

4.9.3 Land Subsidence [Representative Monitoring Site (RMS) for Sustainability Indicators]

For purposes of Sustainable Management Criteria (SMC) evaluation and long-term tracking, a subset of representative monitoring locations is designated from the full InSAR dataset. These representative locations are not intended to replace the full dataset, but rather to

provide a consistent, stable, and interpretable set of monitoring points for evaluating compliance with SMC over time. Therefore, the sustainability indicator for land subsidence is evaluated by monitoring land surface elevation at select InSAR data pixels near groundwater level monitoring wells and other critical infrastructure. Specifically, each representative monitoring well location consists of one central InSAR pixel and eight adjacent supporting pixels monitored for vertical displacement. Selecting pixels near the groundwater monitoring wells allows the GSAs to study the impact of falling and rising water levels on subsidence in the same location and develop a relationship between water levels and subsidence over time. The pixels and rationale for selection are presented in Table 1 (below).

Representative monitoring locations are defined using the following criteria and considerations:

- **Data Quality and Reliability**
Selected locations are based on InSAR pixels exhibiting consistently high data quality, including stable coherence and minimal evidence of processing artifacts or anomalous variability over the available time series.
- **Proximity to Critical Infrastructure**
Representative locations include areas near infrastructure that could be sensitive to land subsidence, such as roads, pipelines, and flood conveyance features, to ensure that monitoring captures conditions relevant to beneficial uses and users. This includes highway 99, highway 32, irrigation and drainage infrastructure, locations throughout the City of Chico and Cal Water Service area, and the community of Durham.
- **Integration with Groundwater Monitoring**
Representative InSAR locations are selected near existing groundwater level monitoring wells ~~included in the groundwater level sustainability indicator network~~ to support evaluation of the relationship between groundwater elevations and land surface deformation.
- **Spatial Representation of the Subbasin**
Monitoring locations are distributed across the Subbasin, including each management area, to capture spatial variability in groundwater conditions and potential subsidence response.

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A representative monitoring location consists of a central InSAR pixel supported by a group of eight adjacent pixels, allowing for confirmation that observed deformation patterns are spatially consistent and not attributable to localized data artifacts. For SMC compliance, the representative monitoring location will be evaluated using the average vertical displacement of the nine-pixel cluster.

The number and distribution of representative monitoring locations are periodically reviewed and may be refined over time as additional data become available or as

understanding of subsidence conditions evolves. However, changes to representative locations will be made in a manner that maintains continuity in long-term trend evaluation.

This approach is consistent with DWR’s monitoring and land subsidence BMP guidance, which emphasizes the use of spatially distributed data to assess basin-wide conditions, while also identifying representative monitoring locations sufficient to detect conditions that could lead to significant and unreasonable impacts.

The RMS network includes XX representative monitoring locations consistent with the groundwater level sustainability indicator network, each consisting of a groundwater monitoring well and associated nine-pixel InSAR cluster.

Table 1. Land Subsidence RMS Monitoring Network site locations. All sites are groundwater monitoring wells and associated InSAR pixels (cluster of 9 at each well site)

Site ID	Site Type ¹	Latitude	Longitude	Selection Criteria
Vina - North Management Area				
	Well/InSAR pixels			GW Monitoring Site
	Well/InSAR pixels			Critical Infrastructure & GW Monitoring Site
Vina - Chico Management Area				
	Well/InSAR pixels			GW Monitoring Site
	Well/InSAR pixels			Critical Infrastructure & GW Monitoring Site
Vina - South Management Area				
	Well/InSAR pixels			GW Monitoring Site
	Well/InSAR pixels			GW Monitoring Site
	Well/InSAR pixels			Critical Infrastructure & GW Monitoring Site

- 1. “Well” site types are wells included in the broad groundwater level monitoring network.
- 2. Public Water Supply (PWS) locations not published due to confidentiality considerations
- 3. Identified as Critical Infrastructure site in this table if located within ½ mile of Hwy 99 and Hwy 32

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Commented [CB1]: To be updated once groundwater level Broad and RMS networks are determined by the GSA Boards.

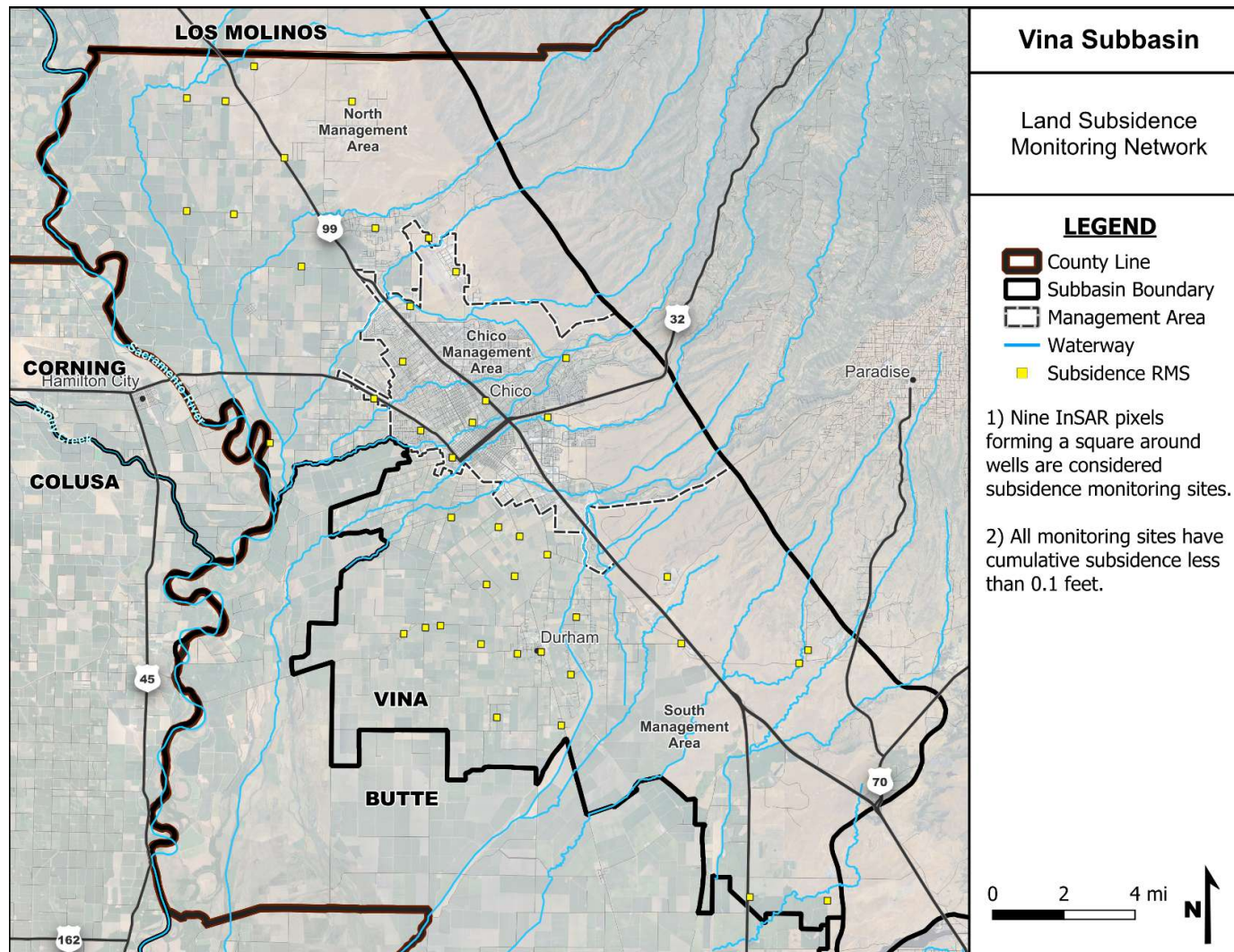


Figure 2. Land Subsidence Representative Monitoring Site (RMS) network

Commented [CB2]: To be updated once the groundwater level network is determined by the GSA Boards