Vina Groundwater Sustainability Agency

308 Nelson Avenue, Oroville, California 95965
(530) 786-3303 • VinaGSA@gmail.com

Subject: Draft 2027 Periodic Evaluation and Draft Plan Amendments for the Vina Groundwater Sustainability Plan

To all stakeholders and interested parties:

The Vina Groundwater Sustainability Agency (GSA) and Rock Creek Reclamation District (RCRD) GSA have completed a draft of the required Five-Year Periodic Evaluation of the Vina Groundwater Sustainability Plan (GSP), pursuant to 23 CCR § 356.4. The Periodic Evaluation assesses the accompanying draft 2027 GSP Amendments and evaluates whether the subbasin continues to meet the requirements of SGMA and remains on track to achieve its sustainability goal.

There is no indication of undesirable results occurring in the subbasin and groundwater conditions remained in compliance with all Sustainable Management Criteria (SMCs) across all applicable sustainability indicators throughout the evaluation period (WY 2021–2025). Groundwater elevations averaged 20 feet above the Measurable Objectives and 71 feet above the Minimum Thresholds (WY 2025), and groundwater storage increased by and average of about 2,100 AF per year (WY 2021–2025). The subbasin remains on track to achieve its sustainability goal by 2042.

The draft 2027 Periodic Evaluation and Draft Amended GSP (redline and clean versions) are available for public review through **October 26, 2026**, at https://www.vinagsa.org/gsp-periodic-evaluation-plan-amendments. Comments may be submitted through the online comment form on the webpage, or directly by email to vinagsa@gmail.com, throughout the review period.

All comments received by October 26 will be compiled and provided to the SHAC at their November 18, 2026 meeting. Staff will identify and summarize comments that could lead to changes to the draft documents. The SHAC will review the draft documents and public comments at its November meeting and make recommendations to the Board. The Joint Boards will then consider public input and the SHAC's recommendations when adopting the final Plan Amendments and finalizing the Periodic Evaluation in December, ahead of submission to DWR by the January 2027 deadline.

Overview of Plan Amendments

Draft GSP amendments to the Plan reflect changes as directed by the GSA Boards, references to or context related to the 2027 Periodic Evaluation, and limited edits to accurately reflect current practices (ex. monitoring protocols for water quality).

The Board directed amendments include:

- The groundwater level representative monitoring network expanded from 17 to 29 wells. New wells in the North and South Management Areas were assigned Minimum Thresholds using the same comparability method applied in the 2022 GSP. New Local Management Levels (LMLs) – a non-regulatory, early-warning trigger set 20 feet below the Measurable Objective – were also assigned to a subset of the RMS wells (14).

- A new quantitative Minimum Threshold for land subsidence was established: 0.5 foot of cumulative subsidence over a five-year period at the same monitoring location, resulting from declining groundwater levels. This is based on InSAR satellite monitoring data and replaces the prior approach, which relied on groundwater levels as a proxy for land subsidence.

In addition, member agency staff from the City of Chico and Butte County have identified two shallow wells within the Chico Management Area for inclusion as Groundwater Level RMS wells to monitor conditions in relation to the Chico Urban Forest, specifically deep-rooted Valley Oaks. This approach is described in the draft Periodic Evaluation and reflected as draft GSP amendments. It is provided for consideration; the GSA Boards have not yet provided direction on this approach.

In addition, draft language regarding what actions will be taken if Local Management Levels are reached is included in the Periodic Evaluation and GSP documents. Specific to this topic, SHAC input is anticipated in October and Board direction in November, ahead of final approval in December.

Also of note: At its September 9, 2026 meeting, the Vina GSA Board directed staff to bring back two topics for further discussion at a future Board meeting: the Groundwater Levels Undesirable Result definition, specifically the two-consecutive-non-dry-year provision, and a presentation on an alternative Minimum Threshold approach that would combine Local Management Levels with raised Minimum Thresholds. Future Board direction on these or any other aspects of the draft documents will lead to the next version which the Joint Boards will consider in December prior to adoption/approval.

DRAFT Amended

GROUNDWATER SUSTAINABILITY PLAN

VINA GROUNDWATER SUBBASIN

Prepared ~~by~~for

~~Geosyntec Consultants~~Vina and Rock Creek Reclamation District Groundwater Sustainability Agencies

In Consultation with

Larry Walker Associates, Inc.
~~3043 Gold Canal Drive~~1480 Drew Avenue, Suite 100
~~Rancho Cordova~~Davis, California ~~95670~~95618

~~Project Number: SAC282~~

~~December 15, 2021~~

January 28, 2027

Style Definition: Heading 7: Outline numbered + Level: 7 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0" + Tab after: 0.9" + Indent at: 0.9"

Style Definition: Heading 8: Outline numbered + Level: 8 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0" + Tab after: 1" + Indent at: 1"

Style Definition: Heading 9: Outline numbered + Level: 9 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0" + Tab after: 1.1" + Indent at: 1.1"

Style Definition: Numbered list: Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.5" + Tab after: 0.75" + Indent at: 0.75"

Style Definition: Bullet list: Indent: Left: 0.75"

Style Definition: List Paragraph

Style Definition: List Bullet 2

Style Definition: tblbullet: Indent: Left: 0.2", Hanging: 0.2"

Formatted: Font: 20 pt

Formatted: Tab stops: 0.59", Left + Not at 0.66"

Groundwater Sustainability Plan

Vina Groundwater Subbasin

~~Geosyntec Consultants, Inc.~~
~~3043 Gold Canal Drive, Suite 100~~
~~Rancho Cordova, California 95670~~

~~Joseph Turner, P.G. 5125, C.Hg. 454~~Ryan Fulton, P.E. 87403
~~Senior Principal Hydrogeologist~~

~~Amer A. Hussain, P.E. 57343~~Laura Foglia, Ph.D.
~~Senior Principal Engineer~~

~~Project Number: SAC282~~

~~December 15, 2021~~

~~Note: Drafts of Section 2, Basin Setting, and portions of Section 4, Monitoring Networks, were prepared by Davids Engineering, Inc. These draft sections have been updated during GSP development as additional information became available and modified based on responses to public comment.~~January 28, 2027

Formatted: Body Text, Right: 0", Tab stops: 0.59", Left + Not at 0"

Formatted: Right: 0.18"

Formatted: Right: 0.18", Space After: 10.65 pt, Tab stops: 0.59", Left + Not at 0.66"

Formatted Table

Formatted: Right: 0.18", Tab stops: 0.59", Left + Not at 0.66"

Formatted: Right: 0.18", Space After: 10.65 pt, Tab stops: 0.59", Left + Not at 0.66"

Geosyntec consultants

WALKER TES

ACKNOWLEDGMENTS

Groundwater Sustainability Agencies

Rock Creek Reclamation District GSA

Vina GSA
Member Agencies
City of Chico, County of Butte, Durham Irrigation District

Rock Creek Adhoc Committee

Vina GSA Stakeholder Advisory Committee

Vina GSA Management Committee

Cooperating Agencies

Butte College

Consultant Teams

2022 GSP ~~Completion~~
Geosyntec Consultants

Basin Setting Project
Davids Engineering, Inc.
GEI Consultants, Inc.
Woodard and Curran

Facilitation
Consensus Building Institute

2027 Amended GSP
Larry Walker Associates

Luhdorff & Scalmanini, Consulting Engineers

In Remembrance of Byron Alan Clark, PE
(February 4, 1976 - April 3, 2021)
With thanks for his excellent leadership and foundational work on the Basin Setting Project for the Vina Subbasin GSP

Formatted: English (United States)

Formatted: Font: Bold

Formatted: Font: Bold

Formatted: Underline

Formatted: Space After: 0 pt

PREFACE

Development of the Vina Subbasin Groundwater Sustainability Plan (GSP), like many others throughout California, has coincided with one of the most severe and extensive droughts that has ever gripped the western United States. As of this writing in December 2021, as the final Vina Subbasin GSP is being assembled, drought conditions throughout most of California, including the Vina Subbasin (Subbasin), are classified as "exceptional", the most extreme classification defined by the U.S. Drought Monitor (USDM).[1] Historically, observed impacts during exceptional drought generally include: widespread water shortages, depleted surface water supplies, extremely low federal and state surface water deliveries, curtailment of water rights, extremely high surface water prices, increased groundwater pumping to satisfy water demands, dry groundwater wells, increased well drilling and deepening, increased pumping costs, wildfire, decreased recreational opportunities, and poor water quality, among other potential impacts reported by the USDM. All of these conditions are currently being experienced to some degree across California and, at least in part, within the Subbasin.

As of November 29, 2021, the County of Butte had received 44 reports of dry wells through the My Dry Water Supply Reporting System, and another approximately 20 from residents calling the Butte County Department of Water and Resource Conservation Department. While a number of the reported dry wells are in the foothills outside of the Subbasin, about one-quarter lie within the Vina Subbasin. Most reported dry wells are used for domestic water supply. Counts of dry wells are likely to be low because some landowners choose not to report well problems to the county.

At the State level and as a result of the unprecedented dry conditions, Governor Gavin Newsom declared a drought emergency on April 21, 2021, which was subsequently expanded on May 10 to include new drought-impacted areas including the Sacramento-San Joaquin Delta Watershed. Most recently, on October 19, Governor Newsom issued a proclamation extending the drought emergency statewide. On August 20, the State Water Resources Control Board (SWRCB) issued surface water curtailment orders to approximately 4,500 water right holders in the Sacramento-San Joaquin Delta Watershed to protect drinking water supplies, prevent salinity intrusion into fresh water supplies, and minimize impacts to fisheries and the environment. Given that these curtailment orders are in place for a period of one year, these curtailments have immediate impacts on existing surface water supplies and could impact surface water suppliers' ability to store water this coming winter, thereby potentially impacting available surface water supplies for 2022 and beyond. Given the recent curtailments and an already bleak surface water supply condition, there is an increased reliance on groundwater in the region. Currently, all of California's 58 counties have declared drought emergencies, including Butte County.

The reported numbers of dry wells discussed above, many of which were reported relatively early in the dry season raise concerns among landowners and residents, and prompted mitigation

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

[1] The U.S. Drought Monitor (https://droughtmonitor.unl.edu/) is produced through a partnership between the National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Center. Information for the State of California is available online at: https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?CA.

and response actions by the county. The county is tracking the well water shortage reporting to identify localized areas where wells are going dry and/or where other groundwater issues may exist. The county is also supporting the public through local and regional programs offered through the county, such as providing an emergency potable water filling station. The county has also applied for drought relief funding through DWR and other programs. At this time, prior to completion and adoption of the GSP, drought response efforts in the Subbasin are the responsibility of the county, cities, and other local agencies. At some point following adoption of the GSP, those responsibilities may shift to or be coordinated with the GSAs. A strategy for guiding potential inter-basin coordination between the GSAs is described in Section 6.7 of the GSP. Additional coordination with the county, cities, and local agencies would ensure preservation of public health and safety (the purview of the counties and cities) and groundwater sustainability for all beneficial users and uses (the purview of the GSAs).

Technical work and related public involvement processes supporting development of the Vina Subbasin GSP began in earnest in 2018 and are nearing completion as of December 2021. Development of the GSP has utilized the best available science and tools, with the most sufficient and credible information and data available for the decisions being made and the time frame available for making those decisions. Current and historical groundwater conditions and water budgets have been evaluated for the Subbasin in alignment with the GSP regulations. The technical work is based primarily on historical records of surface water and groundwater conditions from 1970 through 2018 which includes the prior drought conditions from approximately 2007 to 2015, but not the current drought in 2020 to 2021.

Formatted: English (United States)

Unfortunately, drought conditions in 2020 and 2021 have coincided with development of the GSP, a timing that has not permitted complete evaluation and inclusion of data from these years in the GSP at this time. Due to the schedule mandated by the Sustainable Groundwater Management Act (SGMA) for completion of GSPs by January 31, 2022, it has not been possible to include conditions that have manifested due to the current drought in development of the GSP. Records of drought-related conditions in 2020 to 2021 will not be systematically compiled, quality-controlled, and made publicly available until after the Vina Subbasin GSP has been adopted. However, those conditions will be factored into the required GSP annual reports and particularly the periodic (five-year) evaluations as they become available.

Formatted: English (United States)

Ongoing management of the Subbasin under the GSP will follow an "adaptive management" strategy that involves active monitoring of Subbasin conditions and addressing any challenges related to maintaining groundwater sustainability by scaling and implementing projects and management actions (PMAs) in a targeted and proportional manner in accordance with the needs of the Subbasin. Notwithstanding the information noted above regarding the challenges with GSP preparation and the current drought, some of the planned projects contained within this GSP could be fast tracked to address impacts associated with the current drought. GSP annual reports provide an opportunity each year to review current Subbasin conditions. Using annual reporting information, the Vina GSA and Rock Creek Reclamation District GSA Boards can assess the need for further PMAs. During the periodic five-year evaluations, the GSP will also be reviewed and revised, as needed and as more is known about the effects of current and future conditions.

Formatted: English (United States)

The Vina GSA and Rock Creek Reclamation District GSA and the stakeholders within the Subbasin recognize that this GSP is not the finish line; it is the starting line for sustainable

management of the Subbasin. As conditions within the Subbasin change, the GSAs within the Subbasin are committed to an open, transparent, and all-inclusive adaptive management strategy aimed at tackling the important local issues that they face. At the heart of SGMA is the power for locals to solve local problems with local resources. All parties in the Subbasin are committed to doing just that.

The GSP was approved by the DWR in July 2023. DWR identified recommended corrective actions (or RCAs) that should be considered by the GSAs for the first periodic evaluation of the GSP. During the development of the GSP, the GSAs identified data gaps and DWR suggested resolving these data gaps as part of the corrective actions. The GSAs received funding through DWR's Sustainable Groundwater Management (SGM) Round 2 Grant Program (2024-2026) to help address these data gaps and to complete the accompanying 2027 GSP Periodic Evaluation required under Water Code § 10728.2 and Plan Amendments (as applicable). Amendments to this GSP include updates to address DWR's RCAs.

TABLE OF CONTENTS

ACKNOWLEDGMENTS i

PREFACE ii

EXECUTIVE SUMMARY ES-1

~~1. AGENCY INFORMATION, PLAN AREA, COMMUNICATION ..... 1~~
~~1.1 Introduction and Agency Information ..... 1~~
~~1.1.1 Purpose of the Groundwater Sustainability Plan ..... 1~~
~~1.1.2 Sustainability Goal ..... 2~~
~~1.1.3 Contact Information ..... 2~~
~~1.1.4 Agency Information ..... 2~~
~~1.1.5 Memorandum of Understanding ..... 9~~
~~1.2 Groundwater Sustainability Plan Area ..... 9~~
~~1.2.1 Summary of Jurisdictional Areas and Other Features ..... 9~~
~~1.2.2 Management Areas ..... 24~~
~~1.3 Management Programs ..... 25~~
~~1.3.1 Groundwater Management Plan ..... 25~~
~~1.3.2 Urban Water Management Plans ..... 25~~
~~1.3.3 Northern Sacramento Valley Integrated Regional Water Management Plan ..... 26~~
~~1.3.4 Drought Management Plan ..... 26~~
~~1.3.5 Conjunctive Use Programs ..... 26~~
~~1.3.6 General Plans in the Plan Area ..... 26~~
~~1.4 Groundwater Level Monitoring and Data Sources ..... 34~~
~~1.4.1 Butte County Department of Water and Resource Conservation Program ..... 34~~
~~1.4.2 California Statewide Groundwater Elevation Monitoring ..... 35~~
~~1.4.3 Water Data Library ..... 35~~
~~1.4.4 Online System for Well Completion Reports ..... 35~~
~~1.5 Groundwater Quality Monitoring and Data Sources ..... 36~~
~~1.5.1 Butte County Department of Water and Resource Conservation Program ..... 36~~
~~1.5.2 Sacramento Valley Water Quality Coalition ..... 36~~
~~1.5.3 Geotracker/Groundwater Ambient Monitoring and Assessment ..... 36~~
~~1.5.4 Water Data Library ..... 36~~
~~1.6 Subsidence ..... 37~~
~~1.7 Interconnection of Databases ..... 37~~
~~1.8 Notice and Communication (23 California Code of Regulations § 354.10) ..... 38~~
~~1.8.1 Notice of Intent to Adopt Groundwater Sustainability Plan ..... 38~~
~~1.8.2 Overview ..... 38~~

~~1.8.3 Description of Beneficial Uses and Users in the Vina Subbasin ..... 39~~
~~1.8.4 Communications ..... 41~~
~~1.8.5 Informing the Public About Groundwater Sustainability Plan Development Progress ..... 42~~
~~1.9 Human Right to Water ..... 43~~

~~2. BASIN SETTING ..... 44~~
~~2.1 Hydrogeologic Conceptual Model ..... 44~~
~~2.1.1 Basin Boundaries ..... 44~~
~~2.1.2 Topography, Surface Water and Recharge ..... 45~~
~~2.1.3 Regional Geologic and Structural Setting ..... 54~~
~~2.1.4 Geologic Formations ..... 54~~
~~2.1.5 Groundwater Producing Formations ..... 62~~
~~2.1.6 Cross Sections ..... 64~~
~~2.1.7 Key Geologic Features ..... 66~~
~~2.1.8 Principal Aquifers and Aquitards ..... 70~~
~~2.1.9 Opportunities for Improvement to the HCM ..... 72~~
~~2.2 Groundwater Conditions ..... 73~~
~~2.2.1 Description of Current and Historical Conditions ..... 73~~
~~2.2.2 Groundwater Trends ..... 74~~
~~2.2.3 Seawater Intrusion ..... 85~~
~~2.2.4 Groundwater Quality ..... 85~~
~~2.2.5 Subsidence ..... 89~~
~~2.2.6 Interconnected Surface Water Systems ..... 91~~
~~2.2.7 Groundwater Dependent Ecosystems ..... 104~~
~~2.3 Water Budget ..... 111~~
~~2.3.1 Selection of Hydrologic Periods ..... 111~~
~~2.3.2 Usage of the Butte Basin Groundwater Model ..... 113~~
~~2.3.3 Water Budget Assumptions ..... 113~~
~~2.3.4 Water Budget Estimates ..... 118~~
~~2.3.5 Water Budget Uncertainty ..... 138~~
~~2.3.6 Sustainable Yield Estimate ..... 138~~
~~2.3.7 Opportunities for Improvement to the Water Budget ..... 139~~

~~3. SUSTAINABLE MANAGEMENT CRITERIA ..... 141~~
~~3.1 Sustainability Goal ..... 143~~
~~3.2 Sustainability Indicators, Minimum Thresholds, and Measurable Objectives ..... 143~~
~~3.2.1 Sustainability Indicators ..... 143~~

~~3.2.2 Minimum Thresholds ..... 144~~
~~3.2.3 Measurable Objectives ..... 144~~
~~3.3 Groundwater Levels Sustainable Management Criteria ..... 144~~
~~3.3.1 Undesirable Result ..... 145~~
~~3.3.2 Minimum Thresholds ..... 145~~
~~3.3.3 Measurable Objectives ..... 147~~
~~3.3.4 Summary ..... 149~~
~~3.4 Groundwater Storage Sustainable Management Criteria ..... 150~~
~~3.4.1 Undesirable Result ..... 150~~
~~3.4.2 Minimum Thresholds ..... 151~~
~~3.4.3 Measurable Objectives ..... 151~~
~~3.5 Water Quality Sustainable Management Criteria ..... 151~~
~~3.5.1 Undesirable Result ..... 151~~
~~3.5.2 Minimum Threshold ..... 152~~
~~3.5.3 Measurable Objective ..... 153~~
~~3.5.4 Summary ..... 153~~
~~3.6 Seawater Intrusion Sustainable Management Criteria ..... 154~~
~~3.7 Land Subsidence Sustainable Management Criteria ..... 154~~
~~3.7.1 Undesirable Result and Minimum Thresholds ..... 154~~
~~3.7.2 Measurable Objectives ..... 155~~
~~3.8 Interconnected Surface Water Sustainable Management Criteria ..... 155~~
~~3.8.1 Relevant Context ..... 155~~
~~3.8.2 Interconnected Surface Water Sustainable Management Criteria Framework ..... 158~~
~~3.8.3 Undesirable Result ..... 159~~
~~3.8.4 Minimum Thresholds ..... 160~~
~~3.8.5 Measurable Objectives ..... 160~~

~~4. MONITORING NETWORKS ..... 162~~
~~4.1 Monitoring Network Objectives ..... 162~~
~~4.2 Groundwater Level Monitoring ..... 164~~
~~4.2.1 Density of Monitoring Sites and Frequency of Measurement ..... 168~~
~~4.3 Groundwater Storage Monitoring ..... 169~~
~~4.3.1 Background ..... 169~~
~~4.3.2 Frequency of Measurement ..... 170~~
~~4.4 Groundwater Quality ..... 170~~
~~4.4.1 Background ..... 170~~
~~4.4.2 Density of Monitoring Sites and Frequency of Measurement ..... 172~~

~~4.5 Land Subsidence ..... 172~~
~~4.5.1 Background ..... 172~~
~~4.5.2 Location and Density of Monitoring Sites and Frequency of Measurement ..... 173~~
~~4.6 Interconnected Surface Waters ..... 173~~
~~4.6.1 Background ..... 173~~
~~4.7 Monitoring Protocols for Data Collection ..... 177~~
~~4.7.1 Monitoring Protocols and Frequency for Groundwater Levels ..... 177~~
~~4.7.2 Monitoring Protocols and Frequency for Water Quality ..... 178~~
~~4.8 Representative Monitoring Sites ..... 179~~
~~4.8.1 Selection Criteria for Representative Monitoring Sites ..... 179~~
~~4.9 Representative Monitoring Sites for Sustainability Indicators ..... 180~~
~~4.9.1 Groundwater Levels ..... 180~~
~~4.9.2 Water Quality ..... 184~~
~~4.10 Network Assessment and Improvements ..... 186~~

~~5. PROJECT AND MANAGEMENT ACTIONS ..... 188~~
~~5.1 Projects, Management Actions, and Adaptive Management Strategies ..... 188~~
~~5.2 Projects ..... 188~~
~~5.2.1 Project Identification ..... 188~~
~~5.2.2 Project Implementation ..... 189~~
~~5.2.3 Planned Projects ..... 193~~
~~5.2.4 Potential Projects ..... 198~~
~~5.2.5 Conceptual Projects ..... 207~~
~~5.2.6 Notification Process ..... 209~~
~~5.3 Management Actions ..... 209~~
~~5.3.1 General Plan Updates ..... 209~~
~~5.3.2 Domestic Well Mitigation ..... 209~~
~~5.3.3 Well Permitting Ordinance ..... 210~~
~~5.3.4 Landscape Ordinance ..... 210~~
~~5.3.5 Prohibition of Groundwater Use for Ski (Recreational) Lakes ..... 210~~
~~5.3.6 Expansion of Water Purveyors' Service Area ..... 210~~
~~5.3.7 Groundwater Allocation ..... 210~~
~~5.4 Data Collection ..... 211~~
~~5.4.1 County Contour Mapping ..... 211~~
~~5.4.2 Update the Butte Basin Groundwater Model ..... 211~~
~~5.4.3 Community Monitoring Program ..... 212~~
~~5.4.4 Interconnected Surface Water/Associated Impacts on Groundwater Dependent Ecosystems ..... 212~~

~~5.5 Adaptive Management Strategies ..... 212~~
~~5.6 Potential Available Funding Mechanisms ..... 212~~

~~6. PLAN IMPLEMENTATION ..... 214~~
~~6.1 Estimate of Groundwater Sustainability Plan Implementation Costs ..... 214~~
~~6.1.1 Administrative Costs ..... 214~~
~~6.1.2 Monitoring ..... 215~~
~~6.1.3 Data Analysis ..... 215~~
~~6.1.4 Reporting and Evaluation ..... 215~~
~~6.1.5 Data Collection ..... 216~~
~~6.1.6 Project and Management Actions ..... 216~~
~~6.2 Identify Funding Alternatives ..... 217~~
~~6.3 Schedule for Implementation ..... 218~~
~~6.4 Data Management Systems ..... 218~~
~~6.5 Annual Reporting ..... 220~~
~~6.6 Evaluation Report ..... 221~~
~~6.7 Inter-basin Coordination ..... 221~~

~~7. REFERENCES ..... 224~~

1. AGENCY INFORMATION, PLAN AREA, COMMUNICATION 1
1.1 Introduction and Agency Information 1
1.1.1 Purpose of the Groundwater Sustainability Plan 1
1.1.2 Sustainability Goal 2
1.1.3 Contact Information 2
1.1.4 Agency Information 2
1.1.5 Memorandum of Understanding 12
1.2 Groundwater Sustainability Plan Area 12
1.2.1 Summary of Jurisdictional Areas and Other Features 12
1.2.2 Management Areas 41
1.3 Management Programs 42
1.3.1 Groundwater Management Plan 42
1.3.2 Urban Water Management Plans 42
1.3.3 Northern Sacramento Valley Integrated Regional Water Management Plan 43
1.3.4 Drought Management Plan 43
1.3.5 Conjunctive Use Programs 43
1.3.6 General Plans in the Plan Area 43
1.4 Groundwater Level Monitoring and Data Sources 53
1.4.1 Butte County Department of Water and Resource Conservation Program 53

1.4.2 California Statewide Groundwater Elevation Monitoring 54
1.4.3 Water Data Library....54
1.4.4 Online System for Well Completion Reports....54
1.5 Groundwater Quality Monitoring and Data Sources....55
1.5.1 Butte County Department of Water and Resource Conservation Program....55
1.5.2 Sacramento Valley Water Quality Coalition....55
1.5.3 Geotracker/Groundwater Ambient Monitoring and Assessment....55
1.5.4 Water Data Library....56
1.6 Subsidence....56
1.6.1 DWR Subsidence Network 56
1.6.2 Interferometric Synthetic Aperture Radar (InSAR) Satellite Data 57
1.7 Interconnection of Databases 57
1.8 Notice and Communication (23 California Code of Regulations § 354.10)....57
1.8.1 Notice of Intent to Adopt Groundwater Sustainability Plan 57
1.8.2 Overview 58
1.8.3 Description of Beneficial Uses and Users in the Vina Subbasin 58
1.8.4 Communications....61
1.8.5 Informing the Public About Groundwater Sustainability Plan Development Progress 63
1.9 Human Right to Water 63

2. BASIN SETTING....65
2.1 Hydrogeologic Conceptual Model 65
2.1.1 Basin Boundaries....65
2.1.2 Topography, Surface Water and Recharge....66
2.1.3 Regional Geologic and Structural Setting 77
2.1.4 Geologic Formations 77
2.1.5 Groundwater Producing Formations 7
2.1.6 Cross Sections 9
2.1.7 Key Geologic Features 12
2.1.8 Principal Aquifers and Aquitards 19
2.1.9 Opportunities for Improvement to the HCM....21
2.2 Groundwater Conditions 22
2.2.1 Description of Current and Historical Conditions....22
2.2.2 Groundwater Trends....23
2.2.3 Seawater Intrusion 41
2.2.4 Groundwater Quality....41
2.2.5 Subsidence....45

2.2.6 Interconnected Surface Water Systems 47
2.2.7 Groundwater Dependent Ecosystems 62
2.3 Water Budget 69
2.3.1 Selection of Hydrologic Periods 69
2.3.2 Usage of the Butte Basin Groundwater Model 71
2.3.3 Water Budget Assumptions 71
2.3.4 Water Budget Estimates 76
2.3.5 Water Budget Uncertainty 97
2.3.6 Sustainable Yield Estimate 97
2.3.7 Opportunities for Improvement to the Water Budget 98

3. SUSTAINABLE MANAGEMENT CRITERIA 100
3.1 Sustainability Goal 102
3.2 Sustainability Indicators, Minimum Thresholds, and Measurable Objectives 103
3.2.1 Sustainability Indicators 103
3.2.2 Minimum Thresholds 103
3.2.3 Measurable Objectives / Interim Milestones 104
3.3 Groundwater Levels Sustainable Management Criteria 104
3.3.1 Undesirable Result 105
3.3.2 Minimum Thresholds 105
3.3.3 Measurable Objectives 109
3.3.4 Local Management Levels 111
3.3.5 Summary 112
3.4 Groundwater Storage Sustainable Management Criteria 114
3.4.1 Undesirable Result 114
3.4.2 Minimum Thresholds 114
3.4.3 Measurable Objectives 114
3.5 Water Quality Sustainable Management Criteria 115
3.5.1 Undesirable Result 115
3.5.2 Minimum Threshold 115
3.5.3 Measurable Objective 116
3.5.4 Summary 117
3.6 Seawater Intrusion Sustainable Management Criteria 118
3.7 Land Subsidence Sustainable Management Criteria 118
3.7.1 Undesirable Result and Minimum Thresholds 119
3.7.2 Minimum Threshold (MT) 119
3.7.3 Measurable Objective (MO) 119
3.8 Interconnected Surface Water Sustainable Management Criteria 120

3.8.1 Relevant Context 120
3.8.2 Interconnected Surface Water Sustainable Management Criteria Framework 124
3.8.3 Undesirable Result 126
3.8.4 Minimum Thresholds 126
3.8.5 Measurable Objectives 126

4. MONITORING NETWORKS 128
4.1 Monitoring Network Objectives 128
4.2 Groundwater Level Monitoring 130
4.2.1 Density of Monitoring Sites and Frequency of Measurement 140
4.3 Groundwater Storage Monitoring 142
4.3.1 Background 142
4.3.2 Frequency of Measurement 142
4.4 Groundwater Quality 142
4.4.1 Background 142
4.4.2 Density of Monitoring Sites and Frequency of Measurement 146
4.5 Land Subsidence 146
4.5.1 Background 146
4.5.2 Location and Density of Monitoring Sites and Frequency of Measurement 147
4.6 Interconnected Surface Waters 151
4.6.1 Background 151
4.7 Monitoring Protocols for Data Collection 159
4.7.1 Monitoring Protocols and Frequency for Groundwater Levels 159
4.7.2 Monitoring Protocols and Frequency for Water Quality 160
4.8 Representative Monitoring Sites 161
4.8.1 Selection Criteria for Representative Monitoring Sites 161
4.9 Representative Monitoring Sites for Sustainability Indicators 162
4.9.1 Groundwater Levels 162
4.9.2 Water Quality 170
4.9.3 Land Subsidence 173
4.10 Network Assessment and Improvements 178

5. PROJECT AND MANAGEMENT ACTIONS 180
5.1 Projects, Management Actions, and Adaptive Management Strategies 180
5.2 Projects 180
5.2.1 Project Identification 180
5.2.2 Project Implementation 181

5.2.3 Planned Projects 185
5.2.4 Potential Projects 190
5.2.5 Conceptual Projects 199
5.2.6 Notification Process 201
5.3 Management Actions 201
5.3.1 General Plan Updates 201
5.3.2 Domestic Well Mitigation 202
5.3.3 Well Permitting Ordinance 202
5.3.4 Landscape Ordinance 202
5.3.5 Prohibition of Groundwater Use for Ski (Recreational) Lakes 202
5.3.6 Expansion of Water Purveyors' Service Area 202
5.3.7 Groundwater Allocation 203
5.4 Data Collection 203
5.4.1 County Contour Mapping 203
5.4.2 Update the Butte Basin Groundwater Model 203
5.4.3 Community Monitoring Program 204
5.4.4 Interconnected Surface Water/Associated Impacts on Groundwater Dependent Ecosystems 204
5.5 Adaptive Management Strategies 204
5.6 Potential Available Funding Mechanisms 205

6. PLAN IMPLEMENTATION 207
6.1 Estimate of Groundwater Sustainability Plan Implementation Costs 207
6.1.1 Administrative Costs 207
6.1.2 Monitoring 208
6.1.3 Data Analysis 208
6.1.4 Reporting and Evaluation 208
6.1.5 Data Collection 209
6.1.6 Project and Management Actions 209
6.2 Identify Funding Alternatives 210
6.3 Schedule for Implementation 211
6.4 Data Management Systems 211
6.5 Annual Reporting 214
6.6 Evaluation Report 215
6.7 Inter-basin Coordination 215

7. REFERENCES 218

LIST OF TABLES

Table ES-1: Groundwater Levels Sustainability Management Criteria by Representative Monitoring System in Feet Above Mean Sea Level

Table ES-2: Summary of Network Site Wells

Table 1-1: Stakeholder Engagement Chart for Groundwater Sustainability Plan Development

Table 2-1: STATSGO2 Soils Table for Vina Subbasin

Table 2-2: Geologic Units

Table 2-3: Summary of Calculated Aquifer Parameters (Brown and Caldwell, 2013)

Table 2-4: Cumulative Subsidence and Approximate Annual Rate of Subsidence

Table 2-5: Average Monthly Gains to Streamflow from Groundwater, Water Years 2000 to 2018 (cubic feet per second)

Table 2-6: Summary of Water Budget Assumptions

Table 2-7: Water Budget Summary: Land and Surface Water System

Table 2-8: Water Budget Summary: Groundwater System

Table 2-9: Historical Water Supplies and Change in Groundwater Storage by Hydrologic Water Year Type

Table 2-10: Estimated Sustainable Yield Using Average Depth Below Measurable Objectives in 2042 and Range of Storativity Values

Table 3-1: Groundwater Levels Sustainability Management Criteria by Representative Monitoring Site in Feet Above Mean Sea Level

Table 3-2: Water Quality Sustainability Management Criteria by Representative Monitoring Site in µS/cm

Table 4-1: Vina Subbasin Groundwater Level Broad Monitoring Network Well Locations

Table 4-2: Monitoring Well Density Considerations

Table 4-3: Groundwater Quality Monitoring Locations

Table 4-4: Vina Subbasin Surface Water Interaction Monitoring Sites

Table 4-5: Groundwater Levels Representative Monitoring Site Well Construction Details

Table 4-6: Groundwater Levels Representative Monitoring Site Well Location Details

Table 4-7: Water Quality Representative Monitoring Site Well Construction Details

Table 4-8: Water Quality Representative Monitoring Site Well Location Details

Table 5-1: List of Sustainable Groundwater Management Act Projects

Table 6-1: Estimated Administrative Costs

Table 6-2: Monitoring Activities and Estimated Cost

Table 6-3: Data Analysis Activities and Estimated Cost
Table 6-4: Reporting and Evaluation Activities and Estimated Cost
Table 6-5: Estimated Costs for Implementing Data Gaps
Table 6-6: Estimated Project Costs

LIST OF FIGURES

Figure ES-1: Sacramento Valley Groundwater Basin
Figure ES-2: Groundwater Sustainability Agencies
Figure ES-3: Vina Subbasin East-West Airborne Electromagnetic Cross Section
Figure ES-4: Surface Water Features
Figure ES-5: Active Contamination Remediation Sites
Figure ES-6: Illustration of Terms Used for Describing Sustainable Management Criteria Using the Groundwater Level Sustainability Indicator
Figure ES-7: Representative Monitoring Site For Groundwater Levels With Relationship Of Measurable Objectives, Minimum Thresholds, and Operational Range
Figure ES-8: Illustration of Long-Term Trend Using Historical Water Levels Extended To 2030 for Development of Measurable Objectives
Figure ES-9: Cumulative Change in Groundwater Storage for Current and Future Conditions Baseline Scenarios
Figure ES-10: Groundwater Level Representative Monitoring Site Wells
Figure 1-1: Groundwater Sustainability Agencies
Figure 1-2: Sacramento Valley Groundwater Basin
Figure 1-3: Neighboring Groundwater Subbasins
Figure 1-4: Cities
Figure 1-5: Tribal Areas
Figure 1-6: Disadvantaged Communities (2018)
Figure 1-7: Land Use
Figure 1-8: Land Use by Crop Type
Figure 1-9: State and Federal Lands
Figure 1-10: Density of Domestic Wells per Section
Figure 1-11: Density of Public Wells per Section
Figure 1-12: Density of Industrial Wells per Section
Figure 1-13: Density of Irrigation Wells per Section

Figure 1-14: Surface Water Bodies
Figure 1-15: Northern Sacramento Valley Integrated Regional Water Management Plan
Figure 2-1: Base of Fresh Groundwater
Figure 2-2: Surface Topography
Figure 2-3: Hydrologic Soils Groups
Figure 2-4: Soil Mapping Units
Figure 2-5: Surface Water Features
Figure 2-6: Precipitation Source Areas (Brown and Caldwell, 2017 – modified to add Vina Subbasin)
Figure 2-7: SAGBI Recharge Potential
Figure 2-8: Surficial Geology
Figure 2-9A: Vina Subbasin East-West Airborne Electromagnetic Cross Section
Figure 2-9B: Cross Section Alignments
Figure 2-9C: Geologic Cross Section A-A' (Vina North Management Area)
Figure 2-9D: Geologic Cross Section D-D' (Vina South Management Area)
Figure 2-10: Water Surface Elevation Contours – Spring 2015
Figure 2-11: Water Surface Elevation Contours – Fall 2015
Figure 2-12: Water Surface Elevation Contours – Spring 2019
Figure 2-13: Water Surface Elevation Contours – Fall 2019
Figure 2-14: Representative Hydrographs (Vina North Management Area)
Figure 2-15: Representative Hydrographs (Vina Chico Management Area)
Figure 2-16: Representative Hydrographs (Vina South Management Area)
Figure 2-17: Change in Storage and Groundwater Pumping by Water Year Type
Figure 2-18: Active Contamination Remediation Sites
Figure 2-19: Historical Subsidence (2008-2017)
Figure 2-20: Recent Subsidence (2015-2019)
Figure 2-21: Illustration of Gaining and Losing Interconnected and Disconnected Stream Reaches (Source: United States Geological Survey)
Figure 2-22: Location of Selected Nested and Chico Nitrate Monitoring Wells
Figure 2-23: Hydrographs for Nested Well Located Near Sacramento River (Upper Hydrograph, Well 23N01W31M) and Nested Well Located Further from the Sacramento River (Lower Hydrograph, Well 23N01W28M)

Figure 2-24: Hydrographs Showing Feet Below Ground Surface For Eight Shallow Wells Monitored as Part of Chico Nitrate Study (AECOM, 2020)

Figure 2-25: Vina Subbasin Stream Segments

Figure 2-26: Vina Subbasin Gaining and Losing Stream Reaches based on Butte Basin Groundwater Model, Water Year 2000 to 2018

Figure 2-27: Vina Subbasin Average Spring Depth to Groundwater, 2014 to 2018

Figure 2-28: Potential Groundwater Dependent Ecosystems (iGDEs) in the Northern Portion of the Vina Subbasin as Identified in the NCCAG Database Developed by The Nature Conservancy

Figure 2-29: Potential Groundwater Dependent Ecosystems (iGDEs) in the Southern Portion of the Vina Subbasin as Identified in the NCCAG Database Developed by The Nature Conservancy

Figure 2-30: Water Budget Components (Department of Water Services, 2016)

Figure 2-31: 1971 – 2018 Sacramento Valley Water Year Index and Water Year Types

Figure 2-32: Sensitivity to the Change in Storage to the Time Period Selected for the Calculation

Figure 2-33: Average Annual Historical Land and Surface Water System Water Budget

Figure 2-34: Average Annual Historical Groundwater System Water Budget

Figure 2-35: Average Annual Current Conditions Land and Surface Water System Water Budget

Figure 2-36: Average Annual Current Conditions Groundwater System Water Budget

Figure 2-37: Average Annual Future Conditions without Climate Change Land and Surface Water System Water Budget

Figure 2-38: Average Annual Future Conditions without Climate Change Groundwater System Water Budget

Figure 2-39: Average Annual Future Conditions with 2030 Climate Change Land and Surface Water System Water Budget

Figure 2-40: Average Annual Future Conditions with 2030 Climate Change Groundwater System Water Budget

Figure 2-41: Average Annual Future Conditions with 2070 Climate Change Land and Surface Water System Water Budget

Figure 2-42: Average Annual Future Conditions with 2070 Climate Change Groundwater System Water Budget

Figure 2-43: Cumulative Change in Groundwater Storage for Current and Future Conditions Baseline Scenarios

Figure 3-1: Flow Chart for Sustainability

Figure 3-2: Illustration of Terms Used for Describing Sustainable Management Criteria Using the Groundwater Level SI

Figure 3-3: Graph Showing Graphing Method Used to Establish MTs for Each Representative Monitoring Site Well

Figure 3-4: Illustration of Long-term Trend Using Historical Water Levels Extended to 2030 for Development of Measurable Objectives

Figure 3-5: Water Quality Measurable Objectives and Minimum Thresholds in Relation to Reported Historical Specific Conductance for Representative Monitoring Site Wells

Figure 3-6: Groundwater Dependent Ecosystems

Figure 3-7: Illustration of Monitoring Points Needed to Develop Sustainability Management Criteria for Interconnected Surface Waters

Figure 4-1: Groundwater Level Monitoring Network

Figure 4-2: Groundwater Quality Monitoring Network

Figure 4-3: Subsidence ~~Monument Locations~~Monitoring Network

Figure 4-4: Stream Gage and Shallow Well Locations

Figure 4-5: Groundwater Level Representative Monitoring Site Wells

Figure 4-6: Water Quality Representative Monitoring Site Wells

Figure 4-7: Subsidence Representative Monitoring Site Locations

Figure 6-1: Implementation Schedule

LIST OF APPENDICES

Appendix 1-A: Preparation Checklist for Groundwater Sustainability Plan Submittal

Appendix 1-B: Cooperation Agreement and Notice of Intent

Appendix 1-C: Joint Powers Agreement

Appendix 1-D: Groundwater Status Report for the 2020 Water Year

Appendix 1-E: Communication and Engagement Plan

Appendix 1-F: Comments to the Draft Groundwater Sustainability Plan and Responses

Appendix 2-A: Groundwater Dependent Ecosystems Maps

Appendix 2-B: Historical Annual Water Budget Estimates

Appendix 3-A: Figures Showing Average Depth of Domestic, Irrigation, and Public Supply Wells

Appendix 3-B: Figures of Representative Monitoring Sites

Appendix 3-C: Representative Monitoring Site Well Hydrographs

Appendix 6-A: Northern Sacramento Valley Inter-basin Coordination Report

ACRONYMS AND ABBREVIATIONS

µS/cm	microsiemens per centimeter
AB	Assembly Bill
ACS	American Community Survey
AEM	airborne electromagnetic
AF	acre-feet
AFY	acre-feet per year
Agreement	Joint Powers Agreement
BBGM	Butte Basin Groundwater Model
BCDWRC	Butte County Department of Water and Resource Conservation
bgs	below ground surface
BMOs	Basin Management Objectives
BMPs	Best Management Practices
C&E Plan	Communication and Engagement Plan
Cal Water	California Water Service
CASGEM	California Statewide Groundwater Elevation Monitoring
CCR	California Code of Regulations
CDEC	California Data Exchange Center
CDFW	California Department of Fish and Wildlife
CECs	chemicals of emerging concern
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CNRA	California Natural Resources Agency
CSUC	California State University, Chico
CWE	Center for Water and the Environment
DACs	Disadvantaged Communities
DMS	data management system
DTSC	Department of Toxic Substances Control
DWR	Department of Water Resources
GAMA	Groundwater Ambient Monitoring and Assessment
GDEs	Groundwater Dependent Ecosystems

GIS	geographical information systems
GPS	Global Positioning System
GQTMWP	Groundwater Quality Trend Monitoring Work Plan
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HCM	Hydrogeologic Conceptual Model
ILRP	Irrigated Lands Regulatory Program
IM	interim milestone
InSAR	Interferometric Synthetic Aperture Radar
IRWM	Integrated Regional Water Management
JPL	Jet Propulsion Laboratory
MA	Management Area
MAF	million acre-feet
MHI	median household income
mm	millimeters
MO	measurable objectives
msl	mean sea level
MT	minimum thresholds
NASA	National Aeronautics and Space Administration
NAVD88	North American Vertical Datum 1988
NCCAG	Natural Communities Commonly Associated with Groundwater
NEPA	National Environmental Policy Act
NOI	Notice of Intent
NRCS	National Resource Conservation Service
OSWCR	Online System for Well Completion Report
PAC	Interagency Task Force and Public Advisory Committee
PCE	tetrachloroethene
PG&E	Pacific Gas and Electric Company
PID	Paradise Irrigation District
PPFS	parks, public facilities, and services
PVC	polyvinyl chloride

RCRD	Rock Creek Reclamation District
RMS	representative monitoring sites
SAGBI	Soil Agricultural Groundwater Banking Index
SB	Senate Bill
SDACs	Severely Disadvantaged Communities
SGMA	Sustainable Groundwater Management Act
SHAC	Stakeholder Advisory Committee
SIs	sustainability indicators
SMC	sustainable management criteria
SMCL	Secondary Maximum Contaminant Level
SOI	Sphere of Influence
SVWQC	Sacramento Valley Water Quality Coalition
SWRCB	State Water Resources Control Board
TAF	thousand acre-feet
TAF/year	thousand acre-feet per year
TCE	trichloroethene
TNC	The Nature Conservancy
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UTT	Upper Tuscan/Tehama
UWMP	Urban Water Management Plan
Vina Subbasin	the Vina Groundwater Subbasin
WCR	well completion report
WDL	Water Data Library
WMP	Water Master Plan

EXECUTIVE SUMMARY

Sustainability Goal:

to ensure that groundwater is managed to provide a water supply of adequate quantity and quality to support rural areas and communities, the agricultural economic base of the region, and environmental uses now and in the future.

Introduction

In 2014, the California legislature enacted the Sustainable Groundwater Management Act (SGMA) in response to continued overdraft of California's groundwater resources. SGMA provides for local control of groundwater resources while requiring sustainable management of the state's groundwater basins. Under the provisions of SGMA, local agencies must establish governance of their subbasins by forming Groundwater Sustainability Agencies (GSAs) within the authority to develop, adopt, and implement a Groundwater Sustainability Plan (GSP or Plan) for the Vina Groundwater Subbasin. Under the GSP, GSAs must adequately define and monitor groundwater conditions in the Vina Groundwater Subbasin and establish criteria to maintain or achieve sustainable groundwater management within 20 years of GSP adoption. Within the framework of SGMA, sustainability is generally defined as long-term reliability of the groundwater supply and the absence of undesirable results.

Critical Dates for the Vina Groundwater Subbasin	
2022	By January 31, submit GSP to DWR
2027	Evaluate GSP and ~~update~~amend, if warranted
2032	Evaluate GSP and ~~update~~amend, if warranted
2037	Evaluate GSP and ~~update~~amend, if warranted
2042	Achieve sustainability for the subbasin

The Vina Groundwater Subbasin (Vina Subbasin) is identified by the California Department of Water Resources (DWR) as being in a high priority subbasin. For high priority basins, SGMA requires that preparation of the GSP by January 31, 2022.

The Vina Subbasin is managed by two GSAs, the Vina GSA and the Rock Creek Reclamation District (RCRD) GSA. The Vina GSA was formed through the execution of a Joint Powers Agreement (Agreement) by three member agencies - the County of Butte, City of Chico, and Durham Irrigation District. The Vina GSA Board of Directors (Board) is composed of five seats, each with equal and full voting rights, which consists of an elected official from each member agency, an agricultural groundwater user, and a domestic well user (non-agricultural); the latter two positions being appointed by the Butte County Board of Supervisors. The Vina GSA covers the portions of the Vina Subbasin outside of the RCRD GSA jurisdictional boundary. In addition, in 2017 Butte College withdrew GSA status and agreed to participate in the development of the GSP by way of a Memorandum of Understanding with the Vina GSA.

The RCRD provides flood control and groundwater sustainability services to approximately 4,625 acres of agricultural and single-family residential parcels in northern Butte County. On

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

October 18, 2016, the RCRD elected to become a GSA and sent notice to DWR of its intent to undertake sustainable groundwater management over its jurisdictional boundaries.

The Vina GSA and RCRD GSA has assumed all SGMA authorities. The GSAs entered into a Coordination Agreement for the purpose of developing and implementing a single GSP for the Vina Subbasin.

The purpose of the Coordination Agreement was to (a) develop, adopt, and implement a GSP for the Vina Subbasin to implement SGMA requirements and achieve the sustainability goals; and (b) involve the public and Vina Subbasin stakeholders through outreach and engagement in developing and implementing the GSP. At the heart of the Coordination Agreement is the focus to maximize local input and decision-making and address the different water demands and sustainability considerations in the municipal and rural areas of the Vina Subbasin.

The Agreement also defines three Management Areas (MAs) within the subbasin; Vina North, Vina Chico, and Vina South. An MA refers to an area within a basin for which a GSP may identify different minimum thresholds (MT), measurable objectives (MO), monitoring, and projects and actions based on unique local conditions or other circumstances as described in the GSP regulations. The interests and vulnerability of stakeholders and groundwater uses in these MAs vary based on the nature of the water demand (agricultural, domestic, municipal), numbers and characteristics of wells supplying groundwater, and to some degree the hydrogeology and mix of recharge sources. The RCRD GSA is part of the Vina North MA.

Formatted: English (United States)

SGMA requires development of a GSP that achieves groundwater sustainability in the subbasin by 2042. A pragmatic approach to achieving sustainable groundwater management requires an understanding of 1) historical trends and current groundwater conditions in the subbasin, based on evaluating six sustainability indicators (SIs) that include groundwater levels, groundwater storage, groundwater quality, land subsidence, depletion of interconnected streams, and seawater intrusion; and 2) what must change in the future to ensure sustainability without causing undesirable results (described and defined in Section 3) or negatively impacting beneficial uses and users of groundwater, including groundwater dependent ecosystems.

The GSP is organized as follows and the various components of each section are summarized further below:

1. Section 1: Agency Information, Plan Area, Communication. This section includes agency information, description of the Plan Area, and applicable programs and data sources used to prepare the GSP as well as a description of beneficial users and uses within the Basin and a summary of stakeholder communications and engagement.
2. Section 2: Basin Setting. This section discusses the Hydrogeologic Conceptual Model (HCM), groundwater conditions and water budget.
3. Section 3: Sustainable Management Criteria (SMC). This section discusses undesirable results, identifies the MT, and MO for each of the six SIs.
4. Section 4: Monitoring Networks. This section describes the methods used to monitor the SIs.

5. Section 5: Project Management Actions. This section describes projects and management actions that will achieve sustainability within the subbasin.
6. Section 6: Plan Implementation. This section describes how the GSA will partner with other groundwater users to implement the GSP to achieve groundwater sustainability.

The GSP outlines the need to address overdraft and related conditions and has identified 15 projects for potential development that either replace groundwater use (offset) or supplement groundwater supplies (recharge) to meet current and future water demands. During the 2022-2027 implementation period, several projects received funding and were completed or began feasibility studies including the Agricultural Irrigation Efficiency and Extend Orchard Replacement Programs, Scoping for Flood MAR / Surface Water Supply and Recharge Projects, and Agricultural Surface Water Supplies Projects. In addition, the GSP also identifies seven management actions that can be implemented to focus on reduction of groundwater demand. The estimated sustainable yield, or the amount of groundwater that can be withdrawn without causing undesirable results, for the subbasin is 233,000 acre-feet per year (AFY). This estimate is based on average annual historical groundwater pumping of 243,000 AFY and an annual decrease in storage of 10,000 AFY. As such, groundwater pumping offsets and/or recharge on the order of 10,000 AFY may be required to achieve sustainability although additional efforts are needed to confirm these levels. These efforts include collecting additional data and a review of the subbasin groundwater model, along with other efforts as outlined in the GSP.

A Public Draft 2022 GSP was prepared and made available for public review and comment on September 9, 2021, for 40 days, ending on October 19, 2021. The GSAs received numerous comments from the public, reviewed and prepared responses to comments, and revised the Draft GSP. Comment letters and responses are included as Appendix 1-F to this GSP. A Public Draft 2027 amended GSP was prepared and made available for public review and comment on September X, 2026, for XX days, ending on October XX, 2026.

In 2027, this amended GSP was submitted to DWR in response to the Recommended Corrective Actions (RCAs) provided in DWR's Determination Letter.[2] This amended GSP incorporates DWR's RCAs as summarized in Table ES-1. The Amended GSP updates SMCs for land subsidence and the monitoring network for groundwater levels and land subsidence sustainability indicators (SI). Land subsidence that previously used the groundwater level SI as a proxy has its own established network and SMC.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

[2] Vina Subbasin Determination Letter is available for download here: https://sgma.water.ca.gov/portal/gsp/preview/86

Table ES-1: Summary of DWR Recommended Corrective Actions (July 27, 2023 Determination Letter) and Amendments.

Determination Letter Page No.	GSP Section No.	GSP Section	Recommended Corrective Action (RCA)	Description
43	2.2.4.2	Basin Setting - Groundwater Quality	**RCA 1a:** Provide additional information in the GSP outlining the location and extent of contamination plumes, identifying which constituents are being monitored under various programs, and thoroughly describing ongoing remediation efforts within the Subbasin.	Updated contamination plumes in the Subbasin based on new information as feasible. Explicitly listed and described all existing contamination sites and the corresponding responsible agency and/or mitigation program. No amendment necessary; documented in Periodic Evaluation.
43	2.2.4.1	Basin Setting - Groundwater Quality	**RCA 1b:** Evaluate whether groundwater management actions, including production and/or replenishment under the jurisdiction of the GSA, may influence the migration of contaminant plumes.	Evaluated whether groundwater management actions influence the migration of contaminant plumes. Evaluation of water quality data did not reveal significant impacts from pumping. No amendment necessary; documented in Periodic Evaluation.
43	2.2.4.1	Basin Setting - Groundwater Quality	**RCA 1c:** Investigate if groundwater quality issues are adversely impacting groundwater supply and beneficial uses and provide information if there are any mitigation programs in place and the effectiveness of such programs.	Evaluation of water quality data did not reveal significant impacts from pumping; existing contamination sites with corresponding mitigation program were listed and described. No amendment necessary; documented in Periodic Evaluation.
43	2.2.4.1	Basin Setting - Groundwater Quality	**RCA 1d:** Coordinate with the lead agencies overseeing these remediation sites regularly and update the Plan stating how existing groundwater quality conditions and/or remediation efforts may impact the GSA's ability to manage groundwater.	Provided an update on existing groundwater quality conditions and described how local remediation efforts impact the GSAs' ability to manage groundwater. No amendment necessary; documented in Periodic Evaluation.

Determination Letter Page No.	GSP Section No.	GSP Section	Recommended Corrective Action (RCA)	Description
43	2.2.6	Basin Setting – Interconnected Surface Water Systems	**RCA 2:** Review the model inputs/outputs and provide consistent information regarding stream loss and gains throughout the GSP. Clarify whether these values simply represent the overall interaction between the surface water and groundwater system or the quantity of depletion due to groundwater pumping.	Updated Butte Basin Groundwater Model (BBGM) and provided new ISW results on the location, timing, and rate of depletions. Values representing the overall interaction between the surface water and groundwater system and the quantity of depletion due to groundwater pumping were reported. Conducted ISW inter-basin coordination. No amendment necessary; documented in Periodic Evaluation.
44	3.3.1	Sustainable Management Criteria - Groundwater Levels - Undesirable Result	**RCA 3a:** Revise the definition of undesirable results and language pertaining to significant and unreasonable lowering of groundwater level to remove the non-dry year condition or discuss how extractions and recharge will be managed as necessary to ensure that reductions in groundwater levels or storage during dry years are offset by increases in groundwater levels or storage during other years within the sustainable management criteria for the chronic lowering of groundwater levels.	The undesirable result definition was not changed. Provided description of how extractions and recharge will be managed as necessary to ensure that reductions in groundwater levels or storage during dry years are offset by increases in groundwater levels or storage during other years. No amendment necessary to existing SMC; documented in Periodic Evaluation.
44	3.3.2 & 4.2	Sustainable Management Criteria - Groundwater Levels - Minimum Thresholds AND Monitoring Networks – Groundwater Level Monitoring	**RCA 3b:** Provide information on impacts to domestic wells during projected conditions where minimum thresholds are exceeded but undesirable results do not occur and also quantify domestic wells that will be impacted by the proposed minimum threshold. Furthermore, the GSAs should evaluate the impacts of proposed minimum thresholds on other beneficial uses and users, such as public and small water systems and environmental users and users.	Quantified the number of domestic wells at-risk at the minimum thresholds. The GSA intends to develop a Domestic Well Mitigation Program during the next implementation period (2027–2032), tailored to the specific conditions and needs of the subbasin. Evaluated the impacts of proposed minimum thresholds on other beneficial uses and users, including public and small water systems and environmental users and users. Documented in Periodic Evaluation.

Determination Letter Page No.	GSP Section No.	GSP Section	Recommended Corrective Action (RCA)	Description
				Groundwater level monitoring network was amended to include additional RMS wells and to establish Local Management Levels to strengthen representativeness of the monitoring network for beneficial uses and users of groundwater.
44	3.3.2 & 4.2	Sustainable Management Criteria - Groundwater Levels - Minimum Thresholds AND Monitoring Networks – Groundwater Level Monitoring	**RCA 3c:** Evaluate how the proposed minimum thresholds for the chronic lowering of groundwater levels may impact other sustainability indicators (e.g., groundwater storage, depletion of interconnected surface water, etc.).	Evaluated how the proposed minimum thresholds for the chronic lowering of groundwater levels may impact other sustainability indicators (e.g., groundwater storage, depletion of interconnected surface water, etc.). The GSA incorporated additional RMS wells to improve groundwater storage estimate. The GSA established a shallow groundwater monitoring network to improve understanding of depletion of interconnected surface water. Documented in Periodic Evaluation. Groundwater level monitoring network was amended to include additional RMS wells and to establish Local Management Levels.
44	3.5.1	Sustainable Management Criteria - Water Quality - Undesirable Result	**RCA 4:** Revise the definition of undesirable results to remove the non-dry year condition or discuss how degradation during dry period will be managed as necessary to ensure that adverse water quality conditions are offset during other periods.	Discussed how degradation during dry period will be managed as necessary to ensure that adverse water quality conditions are offset during other periods. No amendment necessary to existing SMC; documented in Periodic Evaluation.

Determination Letter Page No.	GSP Section No.	GSP Section	Recommended Corrective Action (RCA)	Description
44	3.7.1	Sustainable Management Criteria - Land Subsidence - Undesirable Result & MT	**RCA 5a:** 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.	The definition of undesirable results was updated in the GSP.
44	3.7.1	Sustainable Management Criteria - Land Subsidence - Undesirable Result & MT	**RCA 5b:** 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.	GSP amendments establishe annual monitoring protocol for subsidence using surveyed wells, InSAR data, and local GPS stations for ground-truthing (as data allows).
45	3.8.1	Sustainable Management Criteria - ISW	**RCA 6a:** Consider utilizing the interconnected surface water guidance, as appropriate, when issued by the Department to establish quantifiable minimum thresholds, measurable objectives, and management actions.	The GSAs reviewed the guidance released to date; the guidance was taken into consideration during the Periodic Evaluation and Plan Amendment process. DWR Guidance on setting SMCs is not yet available. No amendment necessary to existing SMC; documented in Periodic Evaluation.
45	4.6	Monitoring Networks - ISW	**RCA 6b:** Continue to fill data gaps, collect additional monitoring data, and implement the current strategy to manage depletions of interconnected surface water and define segments of interconnectivity and timing.	Improved the ISW monitoring network by classifying existing monitoring wells by depth, establishing a groundwater level monitoring network representative of the shallow aquifer, drilling new shallow monitoring wells, and installing new stream gages. No amendment necessary; documented in Periodic Evaluation.
45	2.2.6 & 2.2.7	Basin Setting – ISW / GDE	**RCA 6c:** Prioritize collaborating and coordinating with local, state, and federal regulatory agencies as well as interested parties to better understand the full	Coordinated activities along the North Sacramento River corridor including with Butte, Colusa, Corning, Red Bluff, and Los Molinos

Determination Letter Page No.	GSP Section No.	GSP Section	Recommended Corrective Action (RCA)	Description
			suite of beneficial uses and users that may be impacted by pumping induced surface water depletion within the GSAs' jurisdictional area.	Subbasins. Coordinated efforts with DWR and the Northern California Water Association. No amendment necessary; documented in Periodic Evaluation.
45	4.6	Monitoring Networks - ISW	**RCA 6d:** Clarify the groundwater level monitoring sites that will be used for the evaluation of depletions of interconnected surface water and provide site-specific information.	Improved the ISW monitoring network by classifying existing monitoring wells by depth, establishing a groundwater level monitoring network representative of the shallow aquifer, drilling new shallow monitoring wells, and installing new stream gages. No amendment necessary; documented in Periodic Evaluation.

Groundwater Sustainability Plan Area

The Vina Subbasin is in Butte County within the Sacramento Valley, as shown in Figure ES-1. The Vina GSA jurisdictional area is defined by the boundaries of the Vina Subbasin in DWR's 2003 Bulletin 118 as updated in 2016 and 2018 except for the area overseen by the RCRD GSA. The RCRD GSA is defined as the jurisdictional boundaries of the RCRD. Figure ES-2 shows the boundaries of the Vina Subbasin, jurisdictional areas for both GSAs, and the three MAs.

Outreach Efforts

A stakeholder engagement strategy was developed to solicit and discuss the interests of all beneficial users of groundwater in the subbasin and Plan Area. The strategy included monthly meetings of the Vina GSA and RCRD Board of Directors and the Stakeholder Advisory Committee (SHAC), meetings of the Subbasin Technical Working Group, numerous public workshops and events and a website where all announcements, meeting dates, times, and materials were posted.

Formatted: English (United States)

The Vina GSA also prepared and implemented a Communication and Engagement Plan to encourage involvement from diverse social, cultural, and economic elements of the population of the Vina Subbasin, in addition to meeting SGMA requirements for intrabasin coordination.

Formatted: English (United States)

In addition, various sections of the GSP were available for preliminary review and comment prior to the final Public Draft version released on September 10, 2021.

Amendments to the GSP prepared in 2026, followed the same process as the 2022 GSP and was also available for review and comment by the public before final adoption and submission to DWR in 2027.

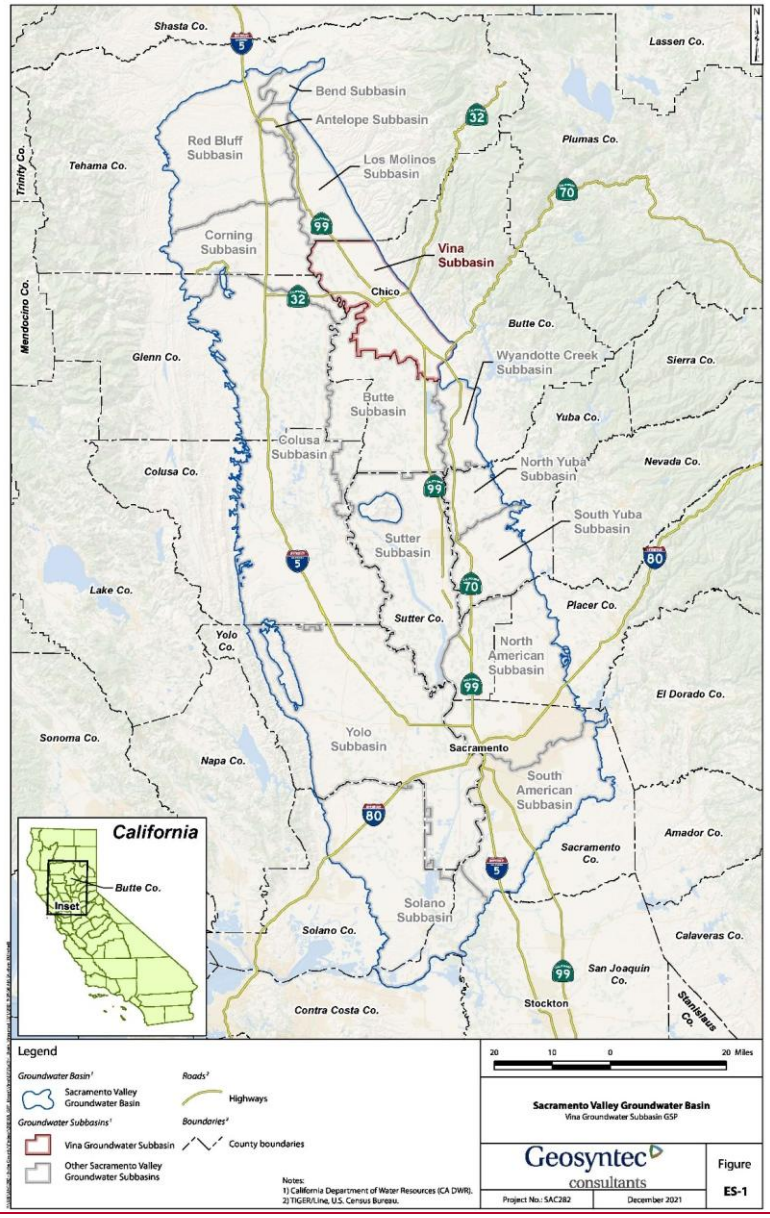


Figure ES-1 ~~placeholder page~~: Sacramento Valley Groundwater Basin

Formatted: Caption,Caption1

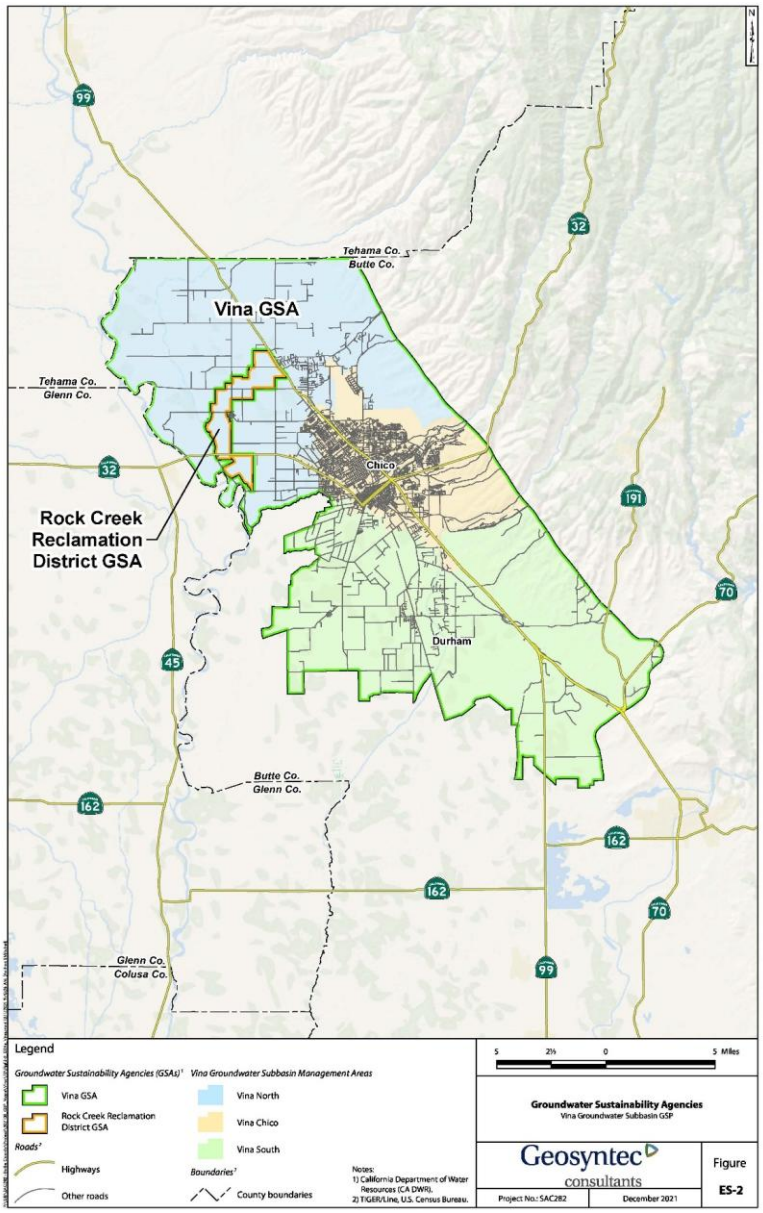


Figure ES-2 ~~placeholder page~~: Groundwater Sustainability Agencies

Formatted: Caption,Caption1

Comments received on preliminary draft sections were incorporated as deemed appropriate and helped guide and shape the Public Draft. As part of the 40-day public review period initiated on September 10, 2021, with issuance of the Public Draft of the GSP, the GSA Management Committee worked with numerous entities to inform them about the plan and encourage their involvement. In addition, a special GSP Advisory Committee meeting was held after the 40-day public comment period on November 4, 2021, to solicit comments. All comments received via the comment form, letter, or email were provided to the SHAC and Vina GSA Board in agenda packets for review.

Formatted: English (United States)

On November 15, 2021, the Vina and RCRD GSAs conducted a joint public hearing where the GSA Management Committee provided an overview of public comments and the methods for responding to these comments. In addition, three proposed revisions to the Public Draft were presented to the GSA Boards. The GSA Boards reviewed the revisions and took action for functional changes to the Public Draft GSP. Additional public comments were received and recorded for each of the proposed revisions and to the overall Public Draft GSP. A revised GSP based on the public comments was provided to the GSAs on December 9, 2021. The GSA Boards reviewed the recommended changes and took action to approve the functional changes to the Public Draft GSP on December 15, 2021.

Formatted: English (United States)

Update based on 2026 public review process

Basin Setting

The Vina Subbasin lies in the eastern central portion of the Sacramento Groundwater Basin. The northern boundary is the Butte-Tehama County line, the western boundary is the Butte-Glenn County line, the southern boundary is a combination of the property boundaries owned by the M&T Ranch, the service area boundaries of RD 2106 and Western Canal Water District, and the eastern boundary is the edge of the alluvium as defined by DWR Bulletin 118 Update 2003. It is bounded by the following subbasins: Los Molinos to the north; Corning to the west; and Butte to the south. The lateral boundaries of the subbasin are jurisdictional in nature, and it is recognized that groundwater flows across each of the defined boundary lines to some degree.

Formatted: English (United States)

Continental sediments of the Tehama, Tuscan, and Laguna Formation compose the major fresh groundwater-bearing formations in the valley with the Tuscan Formation and, to a lesser degree, the Tehama Formation compose the major fresh groundwater-bearing formations in the subbasin. Figure ES-3 shows a cross section within the subbasin using data from an Airborne Electromagnetic (AEM) survey conducted in 2018 funded through a grant from DWR. The base of these continentally derived formations is generally accepted as the base of fresh water in the northern Sacramento Valley. Locally, the base of fresh groundwater fluctuates depending on local changes in the subsurface geology and geologic formational structure, especially in the southeastern area of the Vina Subbasin. Generally, it ranges from 800 to 1,200 feet below ground surface (bgs).

Groundwater flows from the north toward the southwestern corner of the subbasin. While groundwater elevations are lower in the fall than spring, the general direction and gradient of flow are similar during both periods. The Sacramento River borders the Vina Subbasin on its

Formatted: English (United States)

western side and flows from north to south. The larger surface water bodies generally flow from east to west towards the Sacramento River and include Big Chico Creek and Butte Creek.

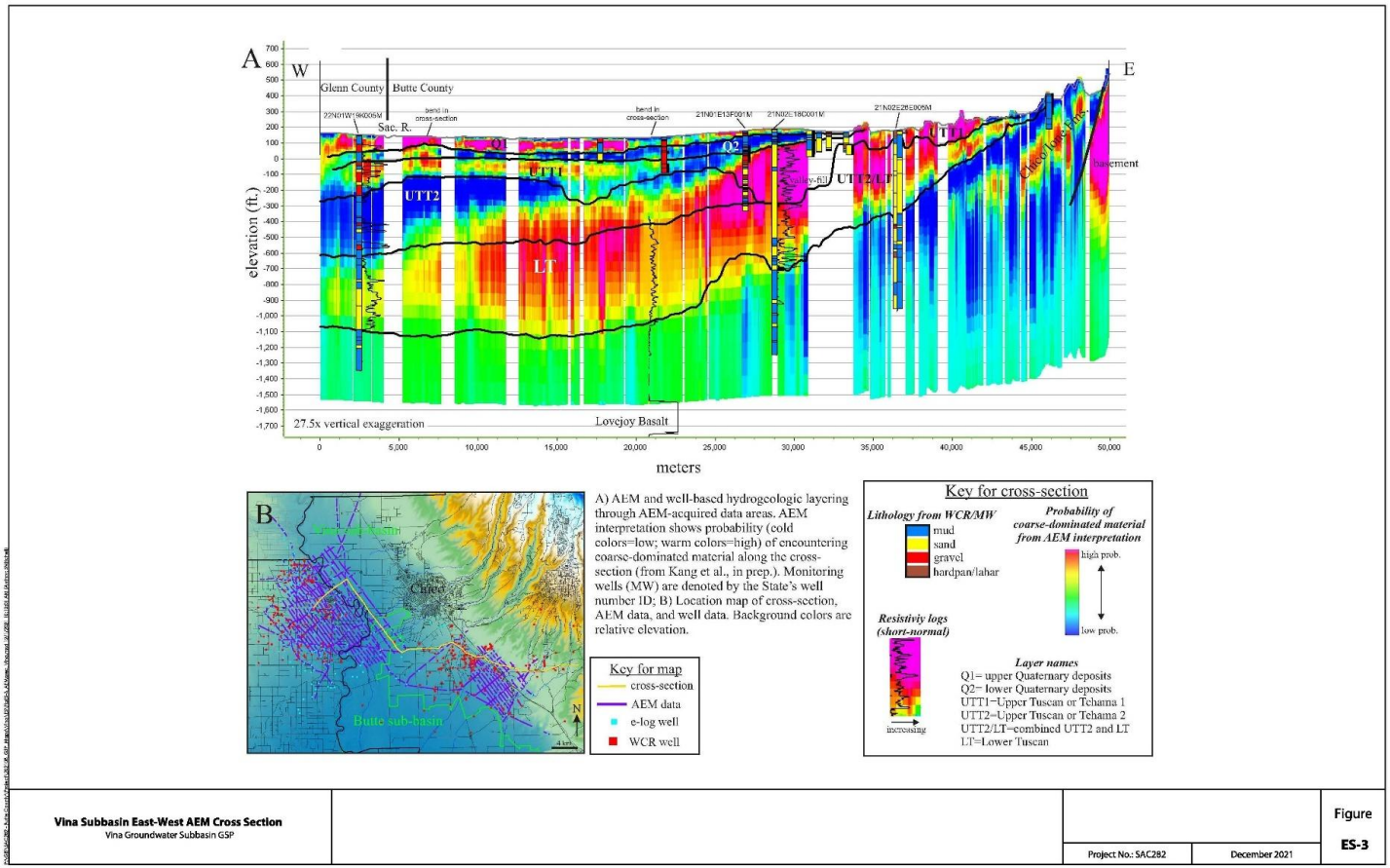


Figure ES-3 ~~placeholder page~~: Vina Subbasin East-West Airborne Electromagnetic Cross Section

Formatted: Caption,Caption1

Other smaller or ephemeral streams also generally flow from east to west and include Pine Creek, Rock Creek, Mud Creek, Sycamore Creek, Little Chico Creek, Hamlin Slough, Little Dry Creek, and Clear Creek. The location of the Vina Subbasin along with surface water features is shown in Figure ES-4.

Existing Groundwater Conditions

Groundwater conditions in the Vina Subbasin are continually monitored and have been comprehensively described in reports produced by Butte County since 2001. The Vina GSA submits GSP annual reports to DWR, documenting the state of the groundwater basin. These documents and other reports portray a subbasin that has adequate groundwater resources to meet demands under most hydrologic conditions. However, hydrographs from monitoring wells show cyclical fluctuations of groundwater levels over a four- to seven-year cycle consistent with variations in water year type. Groundwater levels typically decline during dry years and increase during wet years. Superimposed on this four- to seven-year short-term cycle is a long-term decline in groundwater levels beginning around 2000. In other words, groundwater levels during more recent dry-year cycles are lower than groundwater levels in earlier dry-year cycles. This downward trend during dry years indicates an overall decline in groundwater storage. Groundwater quality in the basin is good except in areas where anthropogenic sources have impacted the groundwater. Figure ES-5 shows the locations of known impacted groundwater from these sources.

Groundwater storage in the subbasin is relatively stable and changes in groundwater storage reflect groundwater level trends. The Sacramento River and streams that cross the Vina Subbasin stabilize storage volumes by providing recharge to the Vina Subbasin. The total fresh groundwater in storage was estimated at over 16 million acre-feet (MAF). The amount of groundwater in storage has decreased by approximately 0.07 percent per year between 2000 and 2018. Between 2020 to 2022, the Subbasin experienced a severe drought followed by several wet and above normal years. Groundwater storage decreased during the critically dry years and recovered in part during the wet and above normal years (2023-2025). As such, it is highly unlikely that the Vina Subbasin will experience conditions under which the volume of stored groundwater poses a concern. However, the depth to access that groundwater across the Vina Subbasin does pose a concern.

Land subsidence has not historically been an area of concern in the Vina Subbasin, and there are no records of land subsidence caused by groundwater pumping. Seawater intrusion is not applicable to the Vina Subbasin due to distance from the Delta and Pacific Ocean.

Surface waters can be hydraulically interconnected with the groundwater system, where the stream baseflow is either derived from the aquifer (gaining stream) or recharged to the aquifer (losing stream). If the water table beneath the stream lowers as a result of groundwater pumping, the stream may disconnect entirely from the underlying aquifer. Both situations exist in the Vina Subbasin. Within the floodplain of the Sacramento River, there is a continuous saturated zone that connects the shallowest aquifer to the river. The connectivity between shallow and deeper aquifer zones will dictate the overall connectivity to the river. In the upland areas outside of the Sacramento River floodplain, there are creeks that flow seasonally and often dry up in late summer or are dry for an entire year during dry conditions. In this case, the upland creeks may

Formatted: English (United States)

not be influenced by “high groundwater connectivity” and the presence of an undesirable result is not clear cut with respect to surface water depletion. The streams dry up regardless of the groundwater condition, and streams that are already dry are not considered interconnected surface water.

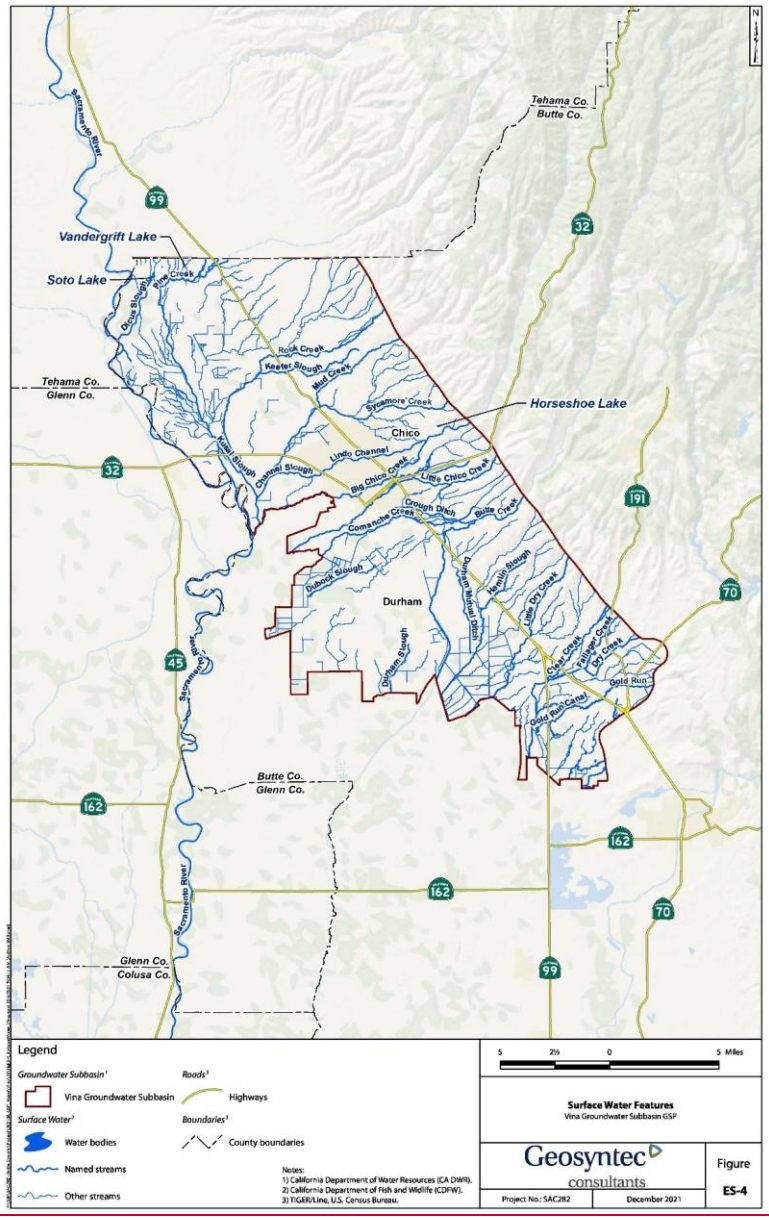


Figure ES-4 ~~placeholder page~~

: Surface Water Features

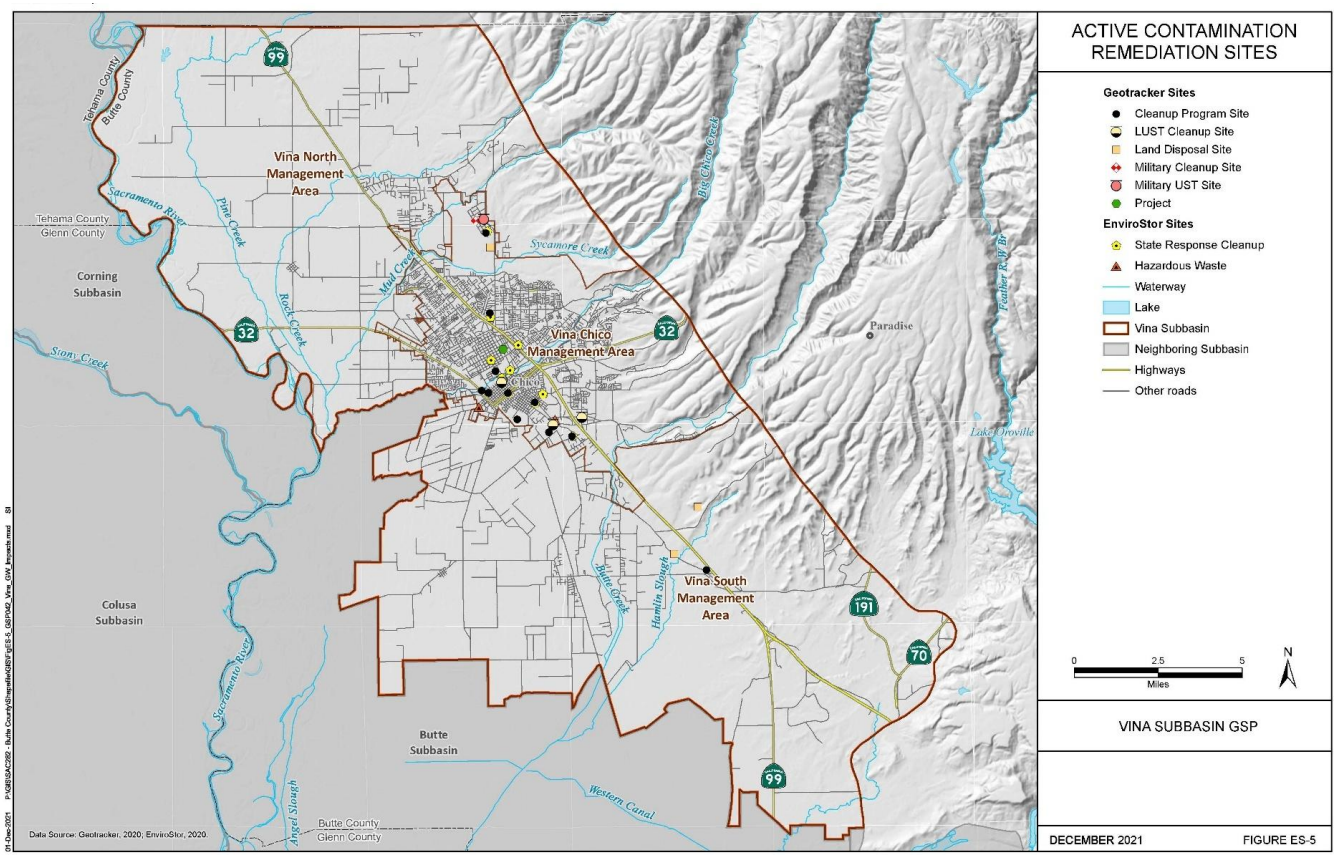


Figure ES-5 ~~placeholder page~~: Active Contamination Remediation Sites

Formatted: English (United States)

Formatted: English (United States)

Formatted: Caption,Caption1

However, the upland streams are an important source of recharge to the aquifer, so the health of these stream channels and their adjacent riparian zones is important to groundwater sustainability.

Potential impacts of the depletion of interconnected surface water were discussed by stakeholders during technical discussions covering the fundamentals of groundwater-surface water interactions and mapping analysis of groundwater dependent ecosystems (GDEs) prepared by Butte County Department of Water and Resource Conservation (BCDWRC). Potential impacts identified by stakeholders were:

Formatted: English (United States)

- Disruption to GDEs
- Reduced flows in rivers and streams supporting aquatic ecosystems and water right holders
- Degradation of "Urban Forest" habitat in the City of Chico
- Streamflow changes in upper watershed areas outside of the Vina GSA's boundary
- Water table depth dropping below the maximum rooting depth of Valley Oak (*Quercus lobata*) or other deep-rooted tree species
- Cumulative groundwater flow moving toward the Sacramento River from both the Vina Subbasin and surrounding GSAs on both the east and west side of the river

The Vina Subbasin acknowledges that overall function of the riparian zone and floodplain is dependent on multiple components of the hydrologic cycle that may or may not have relationships to groundwater levels in the principal aquifer. For example, hydrologic impacts outside of the Vina Subbasin, such as upper watershed development or fire-related changes in runoff, could result in impacts to streamflow, riparian areas, or GDEs that are completely independent of any connection to groundwater use or conditions within the Vina Subbasin.

Sustainable Management Criteria

SGMA introduces several terms to measure sustainability. The sustainability goal is the culmination of conditions resulting in a sustainable condition (absence of undesirable results) within 20 years. The sustainability goal for the Vina Subbasin is:

> *to ensure that groundwater is managed to provide a water supply of adequate quantity and quality to support rural areas and communities, the agricultural economic base of the region, and environmental uses now and in the future.*

SIs refer to any of the effects caused by groundwater conditions occurring throughout the Vina Subbasin that, when significant and unreasonable, cause undesirable results. The six SIs identified by DWR are:

Formatted: English (United States)

1. Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon
2. Significant and unreasonable reduction of groundwater storage

3. Significant and unreasonable degraded water quality
4. Significant and unreasonable land subsidence that substantially interferes with surface land uses
5. Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water
6. Significant and unreasonable seawater intrusion

Undesirable results are the significant and unreasonable occurrence of conditions that adversely affect groundwater use in the Vina Subbasin, including reduction in the long-term viability of domestic, agricultural, municipal, or environmental uses of the Vina Subbasin's groundwater. Categories of undesirable results are defined through the SIs.

Minimum thresholds (MT) are numeric values for each SI and are used to define when undesirable results occur. Undesirable results occur if MTs are exceeded in an established ~~percentage~~number of sites in the Vina ~~Subbasin's~~Subbasin's representative monitoring network. Interim milestones (IMs) are targets set in 5-year increments over the implementation period of the GSP, offering a defined pathway toward achieving the sustainability goal. IMs allow GSAs and the DWR to track progress toward sustainability through Annual Reporting and 5-Year Periodic Evaluations. Measurable objectives are a specific set of quantifiable goals for the maintenance or improvement of groundwater conditions. ~~The margin of operational flexibility is the range of active~~Projects and management ~~between the MT and the MO. Interim milestones (IMs) are targets set in 5-year increments over the implementation period of the GSP offering a path to sustainability.~~actions will be implemented to maintain groundwater levels at the proposed IMs and MOs. Failing to meet an interim milestone may signal that the GSA is unlikely to achieve the sustainability goal, and DWR will periodically review GSPs (at least every five years) to assess whether such shortfalls could affect the basin's ability to reach sustainable groundwater management. Figure ES-6 illustrates these terms using the groundwater level SI. This approach is consistent with DWR's Sustainable Management Criteria Best Management Practices (2017).

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

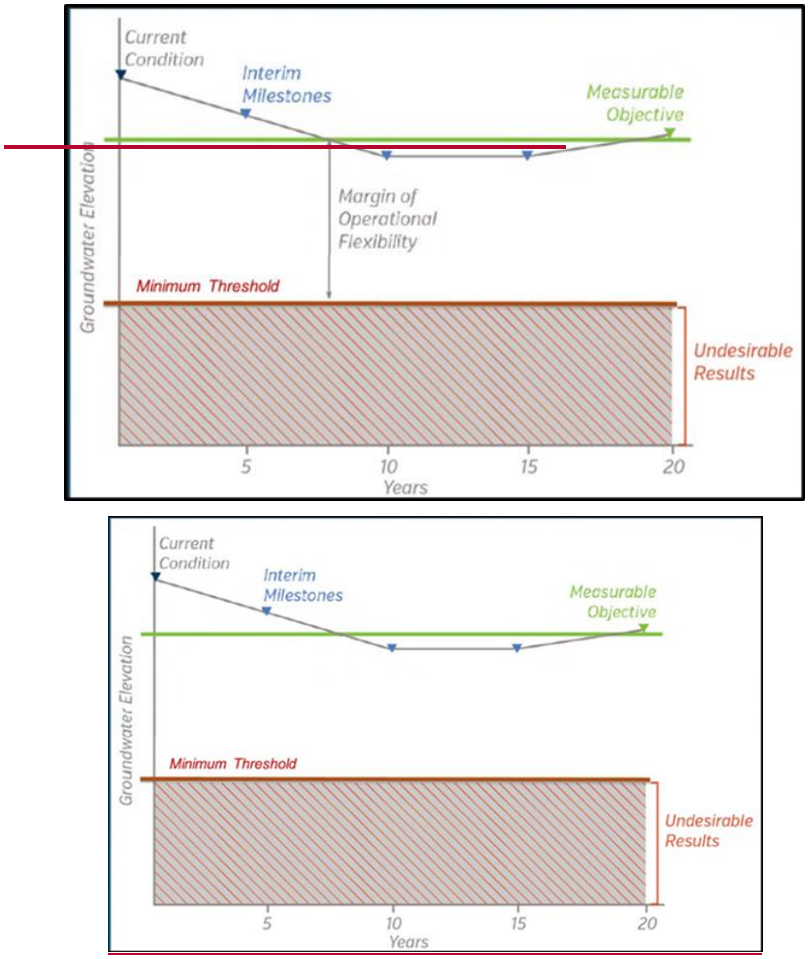


Figure ES-6: Illustration of Terms Used for Describing Sustainable Management Criteria Using the Groundwater Level Sustainability Indicator

A total of ~~17~~ thirty-one (31) representative monitoring sites (RMS) were identified for measurement of groundwater levels in the subbasin~~, and eight~~. Two of the thirty-one were specifically selected to monitor GDEs within the Chico Management Area. Seven RMS were identified for groundwater quality monitoring. The GSP uses groundwater quality data as a basis for evaluating conditions from saline water below the fresh water and uses groundwater level data as the basis for evaluating conditions for groundwater levels~~,~~ and groundwater storage~~, and subsidence~~. The GSP has identified a data gap for development of SMC for depletion of interconnected surface waters and has provided a framework for evaluation of this SI. ~~However,~~

Formatted: English (United States)

Formatted: English (United States)

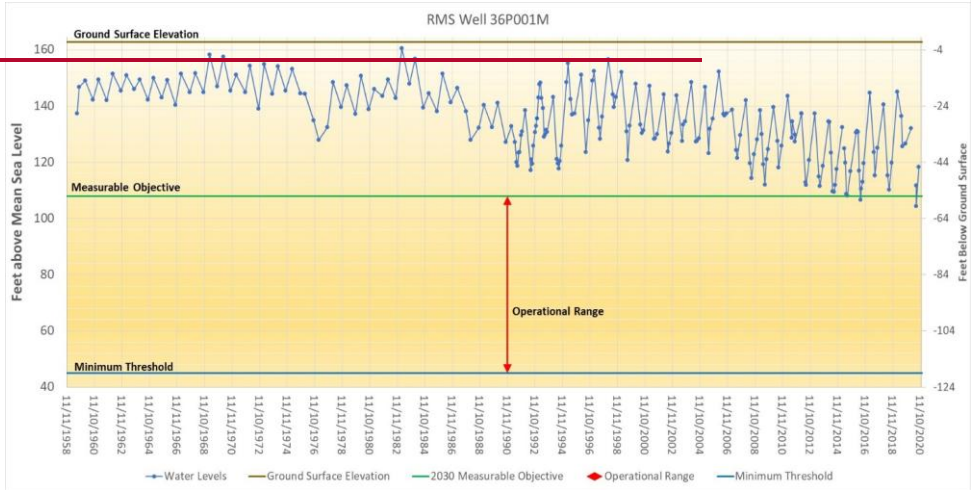
Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

~~for~~For, this GSP, the SMC developed for groundwater levels are used as a proxy for interconnected surface water in an interim manner until data gaps are addressed. Subsidence RMS network uses data from a new source: satellite- and aircraft-based Interferometric Synthetic Aperture Radar (InSAR) from DWR. The dataset covers most of the plan area, with some spatial gaps in the western half of the Subbasin. The TRE Altamira InSAR dataset provides estimates of total vertical displacement from June 2015 to present. No subsidence has been observed in the Vina Subbasin. As such, the RMS described above provide the basis for measuring the five relevant SIs across the subbasin.

~~Minimum thresholds~~ MOs and ~~MOs~~MTs were developed for each RMS. Figure ES-7 shows a typical relationship of the ~~MSs,~~ MOs, LMLs, and MTs, and historical groundwater level data for a sample groundwater level RMS.



Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

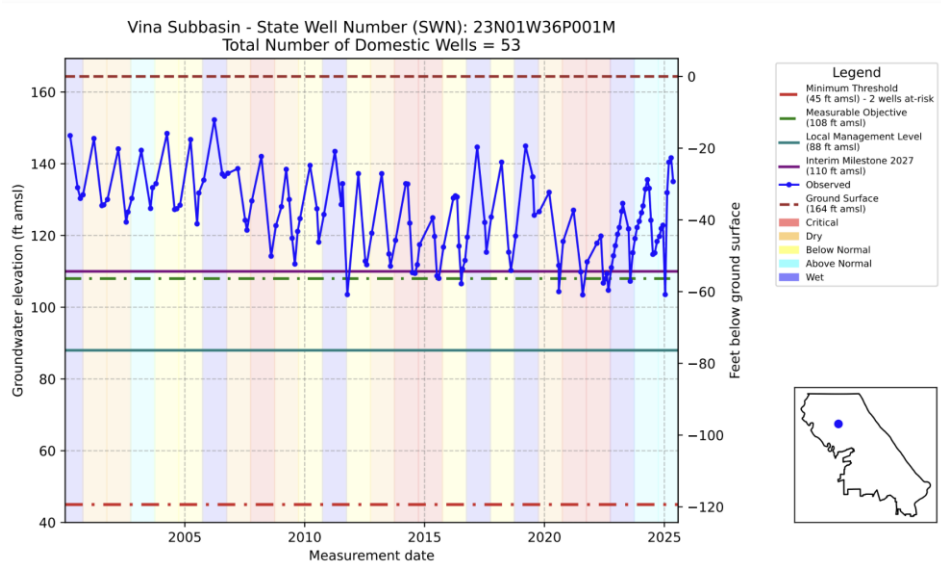


Figure ES-7: Representative Monitoring Site for Groundwater Levels with Relationship of Measurable ~~Objectives,~~ Objective, Local Management Level, and Minimum Thresholds~~, and Operational Range~~

Minimum thresholds for groundwater levels were developed with reference to domestic well depths~~.~~ except two wells within the Chico Management Area (e.g., CMW-102A and SWMW-06A) intended to protect nearby groundwater dependent ecosystems. Each MA was divided into polygons that represent proximate areas to each representative monitoring site well. The size of each polygon depends on the density of the RMS network. For example, the higher the density of RMS wells in an MA, the smaller the polygons. Each polygon is a different shape and size, determined by the distribution of the RMS wells in the MA. The result is a more refined dataset that more proximately reflects the relationship of domestic wells with each RMS well. In addition, rather than just looking at a percentage of domestic wells to protect, the elevation levels were examined in comparison to what would be considered sustainable domestic wells for the area. For the Vina Chico MA, due the area, the polygon was the entire MA. The DWR database used for information on total depths of the domestic wells is not always accurate or precise, nor is it known which of the wells in the database are in use or have been abandoned or replaced. As such, additional characterization of active domestic wells within the subbasin may be considered during GSP implementation (see Section 5.4.3). Minimum thresholds for wells CMW-102A and SWMW-06A were developed with reference to the assumed rooting depth of Valley Oaks (e.g., 30 feet below ground surface) within the Chico Management Area.

To establish the MO, the water-level hydrograph of observed groundwater levels at each RMS was evaluated~~.~~ except for wells CMW-102A and SWMW-06A. The historical record at these

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

locations shows cyclical fluctuations of groundwater level over a four- to seven-year cycle. The MO for groundwater levels at each RMS well was set at the trend line for the dry periods (since 2000) of observed short-term climatic cycles extended to 2030. Figure ES-8 shows an example of this trend line for an RMS well. ~~Table ES-1 shows the MTs and MOs for groundwater levels at each RMS well.~~For wells CMW-102A and SWMW-06A, the measurable objective is set at the average of the historical data across the period of record.

Formatted: English (United States)

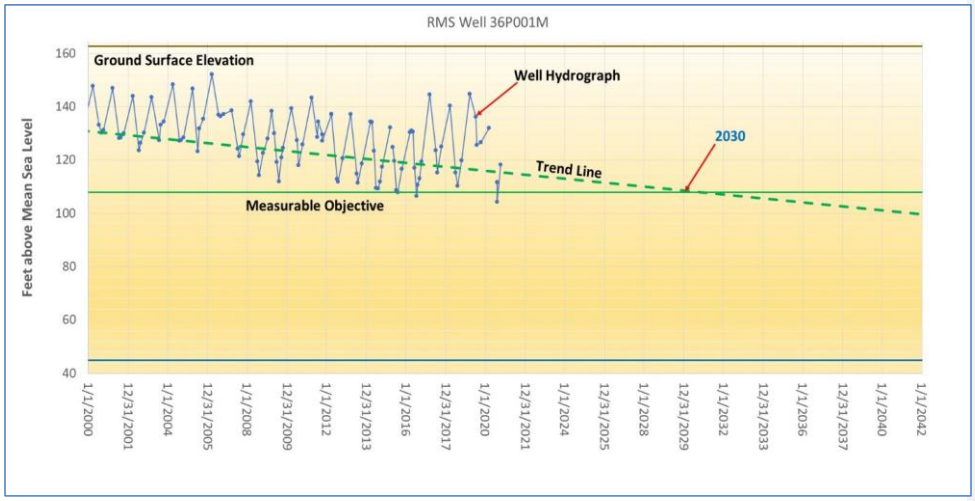


Figure ES-8: Illustration of Long-Term Trend Using Historical Water Levels Extended to 2030 for Development of Measurable Objectives

Local Management Levels (LMLs), established 20 feet below the Measurable Objectives, have been designated for a subset of groundwater level RMS wells to guide the GSAs in evaluating and implementing adaptive management actions in order to manage groundwater conditions toward the MO. LMLs provide an implementation tool for local management that will provide interim measures before groundwater levels approach significant or unreasonable conditions. Set at shallower levels than minimum thresholds, LMLs serve as an early warning mechanism to support proactive water management in the Vina Subbasin. Adaptive management is triggered when groundwater levels reach LMLs, enabling early intervention before minimum thresholds are exceeded. If observed groundwater level measurements reach the LML and persist through multiple observed groundwater measurements across differing seasons (i.e. spring, summer, or fall), the GSAs will investigate the underlying cause and identify appropriate actions to address and respond to the condition. Additional information on LMLs is provided in Section 3.3.4 of this amended GSP.

Table ES-1 shows the LMLs, MOs, IMs, and MTs for groundwater levels at each RMS well.

Table ES-1: Groundwater Levels ~~Sustainable Management Criteria~~SMC by ~~Representative Monitoring Site~~RMS in Feet Above Mean Sea Level

RMS Well ID	~~MT~~ LML	MO	IM			MT
			2027	2032	2037	
Vina Subbasin – North Management Area						
25C001M	~~50~~110	130	130	130	130	50
09E001M~~10E001M~~	~~80~~115	135	136	~~137~~135	~~136~~ 135	~~136~~ 68
~~07H001M[a]~~ 20K001M[a]	~~72~~95	~~136~~115	~~140~~117	~~136~~ 115	~~136~~ 115	48
05M001M	~~31~~95	115	116	115	115	31
28M004M	-	118	120	118	118	51
10M001M	-	138	140	138	138	71
27L001M	101	121	123	121	121	55
07H001M	-	136	140	136	136	72
14R002M	-	132	134	132	132	66
36P001M	~~45~~88	108	110	108-	108-	45
29P002M	107	127	129	127	127	61
~~33A001M~~ 33A001M[a]	~~72~~-	125	128	125-	125-	72
09B001M[a]	-	113	115	113	113	46
Vina Subbasin – Chico Management Area						
~~CWSCH01b~~ PWSCH01b	~~85~~-	106	107	106-	106-	
~~CWSCH02~~ PWSCH02	-	105	108	105-	105-	
~~CWSCH03~~ PWSCH03	-	108	109	108-	108-	85
~~CWSCH07~~ PWSCH07	-	95	97	95	95	
~~28J003M~~CMW-102A	-	~~111~~188	~~113~~188	~~111~~188	~~111~~188	175
SWMW-06A	-	173	173	173	173	160
Vina Subbasin – South Management Area						
~~21C001M~~	~~10~~	~~64~~	~~67~~	~~64~~	~~64~~	
~~18C003M~~	~~65~~	~~130~~	~~132~~	~~130~~	~~130~~	
~~10C002M~~ 10B003M	~~20~~72	92	~~93~~94	92-	92-	30
27D001M	64	84	87	84	84	23
13L004M	-	82	85	82	82	21
25K001M	-	83	85	83	83	21
02H003M	53	73	75	73	73	11
24C001M	~~18~~57	77	81	77-	77-	18
18C003M~~09L001M~~	~~30~~-	~~91~~130	~~93~~132	~~91~~ 130	~~91~~ 130	65
32E001M	67	87	89	87	87	25
~~26E005M~~ 26E006M	~~36~~-	95	97	95-	95-	36
~~Note:~~ 09G001M	67	87	89	87	87	25

32B001M	-	195	197	195	195	133
33L001M	67	87	90	87	87	26

[a] ~~MO is associated with GSP Well ID 18A001M.~~Notes:
[a] RMS well is located within Chico Management Area (MA) but is representative of a portion of North MA.

Formatted Table

Formatted: Font: Bold

MTs and MOs for water quality were defined by considering two primary beneficial uses, drinking water and agricultural uses, that would be at risk of undesirable results as they relate to specific conductance, a measure of the water's saltiness. MTs are 1,600 micro-siemens per centimeter (µS/cm) for each representative monitoring well, consistent with the upper limit of the California Secondary Maximum Contaminant Level (SMCL) for electrical conductivity. MOs are 900 µS/cm for each representative monitoring well, consistent with the California SMCL for electrical conductivity.

Data needed to develop the SMCs for interconnected surface waters include definition of stream reaches and associated priority habitat, streamflow measurements to develop profiles at multiple time periods, and measurements of groundwater levels directly adjacent to stream channels, first water bearing aquifer zone, and deeper aquifer zones. These data are not available and are a data gap for the GSP. The GSAs in the Vina Subbasin intend to further evaluate this SMC to avoid undesirable results to aquatic ecosystems and GDEs. To that end, an Interconnected Surface Water SMC framework has been developed for the GSP. As such, for this GSP the groundwater levels SMC are used by proxy and the MT and MO for interconnected surface water is the same as for groundwater levels.

The MTs and MOs for groundwater levels are also used for ~~the land subsidence and~~ groundwater storage SIs~~, as both are strongly linked to groundwater levels.~~. The groundwater levels MTs are found to be protective of ~~land subsidence and~~ groundwater storage.

The subsidence analysis in Section 2.2.5.2 shows that the Subbasin did not experience measurable subsidence historically (elastic), with subsidence values inside the range of InSAR measurement uncertainty. The MT is set to 0.5 feet of subsidence over a five-year period at the same location, and is meant to represent inelastic, or irreversible, subsidence solely due to lowering groundwater levels and may lead to undesirable results. The MO is set to 0.0 feet per year of land subsidence at representative monitoring locations, recognizing that minor variation within measurement uncertainty does not indicate inelastic subsidence.

Water Budgets

The groundwater evaluations conducted as part of GSP development have provided estimates of the historical, current, and projected groundwater budget conditions. The current analysis was prepared using the best available information and through use of the Butte Basin Groundwater Model (BBGM). The BBGM was initially developed in 1992 and has been updated over time to simulate historical conditions through 2018. To prepare water budgets for this GSP, historical BBGM results for water years 2000 to 2018 have been relied upon, and four additional baseline scenarios have been developed to represent current and projected conditions utilizing 50 years of hydrology. It is anticipated that as additional information becomes available, the model will be updated, and more refined estimates of annual pumping and overdraft can be developed.

Formatted: English (United States)

Based on these analyses and an evaluation of declining water levels, the estimated long-term groundwater pumping offset and/or recharge required for the subbasin to achieve sustainability is approximately 10,000 AFY. The estimated sustainable yield for the Vina Subbasin is 233,000 AFY. Groundwater levels are expected to continue to decline based on projections of current land and water uses. Projects identified in Section 5 that offset groundwater pumping and/or increase recharge will help the subbasin reach sustainability.

Formatted: English (United States)

The projected subbasin water budget was also evaluated under climate change conditions, which simulate higher demand requiring increased groundwater pumping despite more precipitation and streamflows. The climate change scenario used for the analysis was based on the 2030 and 2070 central tendency climate change datasets provided by DWR to support GSP development. Figure ES-9 illustrates the cumulative change in groundwater storage for current and future conditions.

Formatted: English (United States)

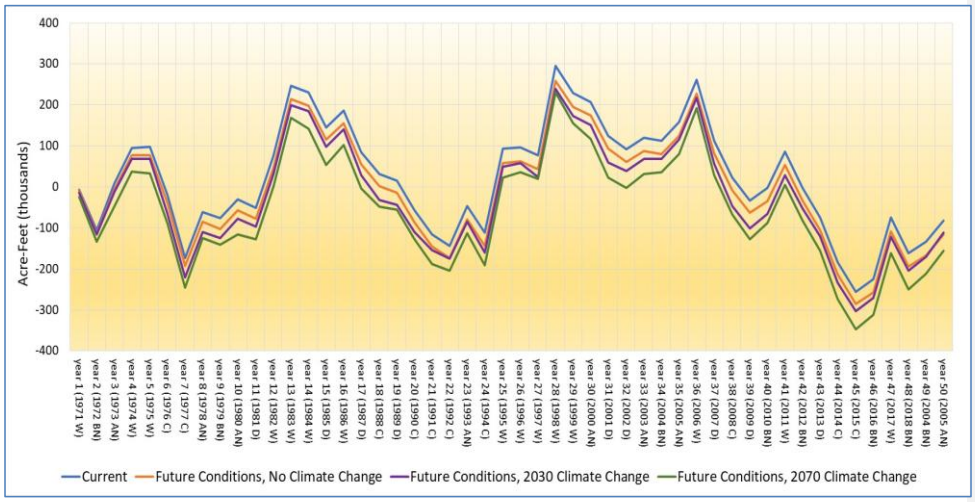


Figure ES-9: Cumulative Change in Groundwater Storage for Current and Future Conditions Baseline Scenarios

Monitoring Networks

The GSP outlines the monitoring networks for the six SIs. The objective of these monitoring networks is to monitor conditions across the subbasin and to detect trends toward undesirable results. Specifically, the monitoring network was developed to do the following:

Formatted: English (United States)

- Monitor impacts to the beneficial uses or users of groundwater
- Monitor changes in groundwater conditions relative to MO and MT
- Demonstrate progress toward achieving MO described in the GSP

There are ~~five~~six monitoring networks in the Vina Subbasin: a representative network for water levels~~;~~, a broad network for water levels; a representative network for water quality~~;~~, a broad network for water quality~~;~~, a representative network for land subsidence, and a broad network for land subsidence. Representative networks are used to determine compliance with the ~~MT, while the~~MTs. These sites are selected from broader networks administered by DWR, Butte County, and other outside agencies. These broad networks collect data for informational purposes to identify trends and fill data gaps~~. The two monitoring networks for water quality~~ across the entire Subbasin / State. Sites from the broader network will ~~additionally~~ be ~~used~~re-evaluated, as needed, to ~~develop an electrical conductivity isocontour~~assess whether or not to ~~monitor for potential intrusion from underlying saline waters, and water level data will inform depletions of interconnected surface water.~~include as a RMS.

The monitoring networks were designed by evaluating data from Butte County's ~~existing~~former Basin Management Objectives (BMOs) program, the United States Geological Survey (USGS), and participating GSAs. The monitoring network consists largely of wells that are already being used for monitoring in the subbasin. Figure ES-10 shows the location of groundwater monitoring wells for the groundwater level representative monitoring network.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

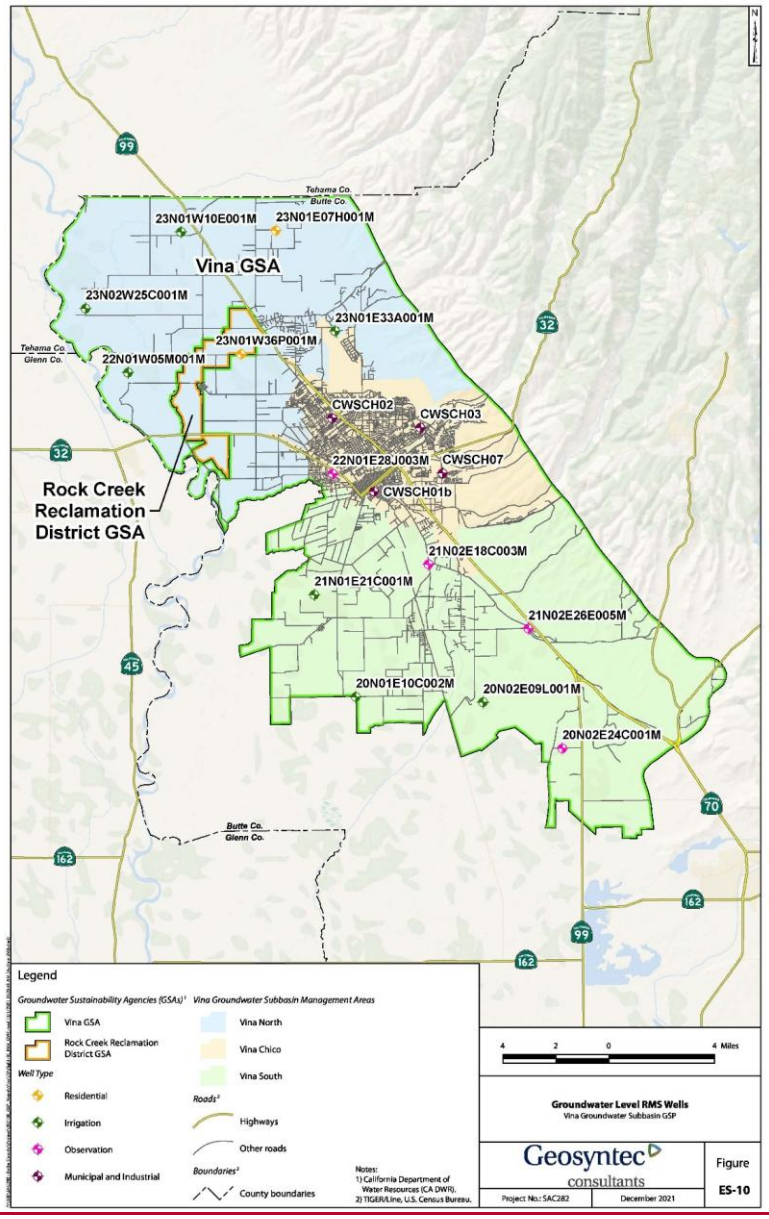


Figure ES-10 ~~**placeholder page**~~

Formatted: Caption,Caption1

Formatted

: Groundwater Level Representative Monitoring Site Wells

Formatted: English (United States)

Wells in the monitoring networks will be measured at least on a semi-annual schedule. Historical measurements will be entered into the Vina Subbasin Data Management System (DMS), and future data will also be stored in the DMS. A summary of the monitoring sites in the monitoring networks is shown in Table ES-2 below.

Table ES-2: Summary of Network Site Wells

Formatted Table

Summary of Monitoring Network Site Wells	
Representative Networks	**Monitoring Site Count**
Groundwater Level	~~17~~29
Groundwater Quality	~~8~~7
Subsidence	29
Broad Network	
Groundwater Levels	~~78~~106 completions across 78 individual locations
Groundwater Quality	~~7~~14
Subsidence	~~19~~Covers nearly the entire Subbasin

Formatted Table

Data Management System

The DMS that will be used is a geographical relational database that will include information on water levels, land elevation measurements, and water quality testing. The DMS will allow the GSAs to share data and store the necessary information for annual reporting.

The DMS will be on local servers, and data will be transmitted annually to form a single repository for data analysis for the subbasin's groundwater, as well as to allow for preparation of annual reports. GSA representatives have access to data and will be able to ask for a copy of the regional DMS. The DMS currently includes the necessary elements required by the regulations, including:

- Well location and construction information for the representative monitoring points (where available)
- Water level readings and hydrographs including water year type
- Land-based measurements
- Water quality testing results
- Estimate of groundwater storage change, including map and tables of estimation
- Graph with Water Year type, Groundwater Use, and Annual Cumulative Storage Change

Additional items may be added to the DMS in the future as required. Data will be entered into the DMS by each GSA. The majority of the data will then be aggregated to the entity that is responsible for the regional DMS and summarized for reporting to DWR.

Formatted: English (United States)

Projects and Management Actions

As stated above, the GSP outlines the need to address overdraft and related conditions and has identified 15 projects for potential development that either replace groundwater use (offset) or supplement groundwater supplies (recharge) to meet current and future water demands. In addition, the GSP also identifies seven management actions that can be implemented to focus on reduction of groundwater demand.

Projects

Each of the projects are in various stages of development ranging from planned to those still in the conceptual phase. Thus, each of the projects have a different level of development. The GSA will maintain a list of proposed projects and track their development status. The GSA will use this list to help secure funding as opportunities become available. Projects presented in this Plan will remain a part of the potential projects that the GSA may choose to implement, however as other projects come up those will be added to the list. The projects currently being considered are listed below and are listed from planned to conceptual.

Planned:

- Agricultural Irrigation Efficiency
- Residential Conservation
- Scoping for Flood Managed Aquifer Recharge (FloodMAR)/Surface Water Supply and Recharge
- Community Water Education Initiative
- Fuels Management for Watershed Health

Potential:

- Paradise Irrigation District Intertie
- Agricultural Surface Water Supplies
- Streamflow Augmentation
- Community Monitoring Program
- Recycled Wastewater
- Rangeland Management
- Removal of Invasive Species
- Surface Water Supply and Recharge

Conceptual:

- Extend Orchard Replacement
- Recharge from Miocene Canal

Formatted: Keep with next

Formatted: English (United States)

Formatted: English (United States)

Management Actions

GSAs have a variety of tools to use to achieve sustainable groundwater management. Projects focus primarily on capture, use, and recharge of surface water supplies while management actions focus on groundwater demand.

The GSP presents several management actions that the GSA may consider during GSP implementation. It is expected that the GSA will further develop and modify management actions in response to stakeholder input and available information. The management actions identified in this GSP include:

- General Plans Updates
- Domestic Well Mitigation
- Well Permitting Ordinance
- Landscape Ordinance
- Prohibition of Groundwater Use for Ski (Recreational) Lakes
- Expansion of Water Purveyors' Service Area
- Groundwater Allocation

Plan Implementation

The adoption of the GSP is official start of plan implementation for the Vina Subbasin. The GSAs will continue their public outreach efforts and work to secure funding to implement projects and management actions. The estimated budgets and implementation schedule for the proposed projects and management actions are presented in Section 6.

Implementing the Vina Subbasin GSP will require numerous management activities that will be undertaken by the GSAs, including:

- Monitoring conditions relative to applicable SIs at specified frequency and timing
- Entering updated monitoring data into the subbasin DMS
- Refining the subbasin model and water budget planning estimates
- Preparing annual reports summarizing the conditions of the subbasin and progress towards sustainability and submitting them to DWR
- Updating the GSP once every five years
- Overseeing and monitoring projects, management actions, and collection of data identified as "data gaps" within the GSP
- Identify funding sources
- Coordinating with neighboring subbasins

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

1. AGENCY INFORMATION, PLAN AREA, COMMUNICATION

1.1 Introduction and Agency Information

1.1.1 Purpose of the Groundwater Sustainability Plan

The purpose of this Groundwater Sustainability Plan (GSP) is to meet the regulatory requirements set forth in the three-bill legislative package consisting of Assembly Bill (AB) 1739 (Dickinson), Senate Bill (SB) 1168 (Pavley), and SB 1319 (Pavley), collectively known as the Sustainable Groundwater Management Act (SGMA). SGMA defines sustainable groundwater management as "management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results," which are defined by SGMA as any of the following effects caused by groundwater conditions occurring throughout the basin (Department of Water Resources [DWR], 2018a):

- Chronic lowering of groundwater levels, indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon
- Significant and unreasonable reduction of groundwater storage
- Significant and unreasonable seawater intrusion
- Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies
- Significant and unreasonable land subsidence that substantially interferes with surface land uses
- Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water

The Vina Groundwater Subbasin (Vina Subbasin) has been identified by DWR as a high priority basin. The Vina Groundwater Sustainability Plan (Vina GSP) was developed to meet SGMA regulatory requirements by the January 31, 2022, deadline for high priority basins while reflecting local needs and preserving local control over water resources. Requirements for the GSP are provided in California Code of Regulations Title 23, Division 2, Chapter 1.5, Subchapter 2, Article 5. Appendix 1-A provides a checklist of where to find the information required by these regulations.

Formatted: English (United States)

The Vina GSP provides a path to achieve and document sustainable groundwater management within 20 years following Vina GSP adoption, promoting the long-term sustainability of locally managed groundwater resources now and into the future.

The amended 2027 GSP updates SMCs for land subsidence and the monitoring network for groundwater levels and land subsidence sustainability indicators (SI). Land subsidence that previously used the groundwater level SI as a proxy has its own established network and SMC.

While the Vina GSP offers a new and significant approach to groundwater resource protection, it was developed within an existing framework of comprehensive planning efforts. Throughout the Vina Subbasin, several separate, yet related, planning efforts have occurred previously or are

Formatted: English (United States)

concurrently proceeding. In November 1996, the voters in Butte County approved "An Ordinance to Protect the Groundwater Resources in Butte County." One of the stated purposes of the ordinance was that "the groundwater underlying Butte County is a significant water resource which must be reasonably and beneficially used and conserved for the benefit of the overlying land by avoiding extractions which harm the Butte basin aquifers, causing exceedance of the safe yield or a condition of overdraft." Other significant reports prepared in the Vina Subbasin include integrated regional water management (IRWM), urban water management, habitat conservation, basin assessment, and general planning. The Vina GSP fits in with these prior planning efforts, building on existing local management and basin characterization. A description of prior planning efforts can be found in Section 1.2 of this document.

1.1.2 Sustainability Goal

A sustainability goal is the culmination of conditions resulting in a sustainable condition (absence of undesirable results) within 20 years. The sustainability goal reflects this requirement and succinctly states the GSP's objectives and desired conditions of the subbasin.

Formatted: English (United States)

The sustainability goal for the Vina Subbasin is "to ensure that groundwater is managed to provide a water supply of adequate quantity and quality to support rural areas and communities, the agricultural economic base of the region, and environmental uses now and in the future."

Additional discussion of the sustainability goal can be found in Section 3: Sustainable Management Criteria (SMC).

Formatted: English (United States)

1.1.3 Contact Information

The Vina Groundwater Sustainability Agency (GSA) has been tasked with submitting a single, jointly composed GSP to DWR on behalf of the entire subbasin. Contact information for the submitting agency and Plan Manger is provided below:

Formatted: English (United States)

Submitting Agency:	Vina Groundwater Sustainability Agency 308 Nelson Avenue Oroville, California 95965 https://www.vinagsa.org
Plan Manager:	~~Dr. Christina Buck~~Dillon McGregor 308 Nelson Avenue Oroville, California 95965 530.552.3595 ~~cbuck@buttecounty.net~~VinaGSA@gmail.com

1.1.4 Agency Information

The Vina GSA and the Rock Creek Reclamation District GSA are the two GSAs in the Vina Subbasin, as shown in Figure 1-1. The two GSAs intend to submit one GSP for the Vina Subbasin. The GSAs entered into a Cooperation Agreement for the purpose of developing and implementing a single GSP for the Vina Subbasin (Appendix 1-B).

Formatted: English (United States)

Formatted: English (United States)

Additional information for the two GSAs is provided below.

Formatted: English (United States)

1.1.4.1 Vina GSA

The Vina GSA was formed through the execution of a Joint Powers Agreement (Agreement) by the County of Butte, City of Chico, and Durham Irrigation District (Appendix 1-C). The Vina GSA filed to be a GSA on June 5, 2019. The purpose of the Agreement was to create the Vina GSA to: (a) develop, adopt, and implement a GSP for the Vina Subbasin in order to implement SGMA requirements and achieve the sustainability goals; and (b) involve the public and subbasin stakeholders through outreach and engagement in developing and implementing the GSP. The Vina GSA covers the portions of the Vina Subbasin outside of the Rock Creek Reclamation District GSA jurisdictional boundary. At the heart of the Agreement is the focus to maximize local input and decision-making and address the different water demands and sustainability considerations in the municipal and rural areas of the Vina Subbasin.

The Vina GSA Board serves as the policy-making role for SGMA implementation in the Vina GSA. All GSA Board meetings are subject to the Brown Act and are noticed and open to the public. The GSA Board is composed of five seats, each with equal and full voting rights, including:

1. Butte County – one seat (Member Agency)
2. City of Chico – one seat (Member Agency)
3. Durham Irrigation District – one seat (Member Agency)
4. Agricultural groundwater user – one seat (Butte County Appointed)
5. Domestic well user (non-agricultural) – one seat (Butte County Board Appointed)

The Vina GSA Board possesses the ability to exercise those powers specifically granted by the Joint Powers Act and SGMA. The Agreement states that the GSA shall possess the ability to exercise those powers specifically granted by the Joint Powers` Act and SGMA. Additionally, the GSA has the ability to exercise the common powers of its Members related to the purposes of the GSA, including, but not limited to, the following:

Formatted: English (United States)

- To designate itself as the exclusive GSA for the Vina Subbasin pursuant to SGMA
- To develop, adopt, and implement a GSP for the Vina Subbasin pursuant to SGMA
- To adopt rules, regulations, policies, bylaws, and procedures governing the operation of the GSA and adoption and implementation of a GSP for the Vina Subbasin
- To adopt ordinances within the Vina Subbasin consistent with the purpose of the GSA as necessary to implement the GSP and otherwise meeting the requirements of the SGMA
- To obtain legal, financial, accounting, technical, engineering, and other services needed to carry out the purposes of this Agreement

- To perform periodic reviews of the GSP, including submittal of annual reports
- To require the registration and monitoring of wells within the Vina Subbasin

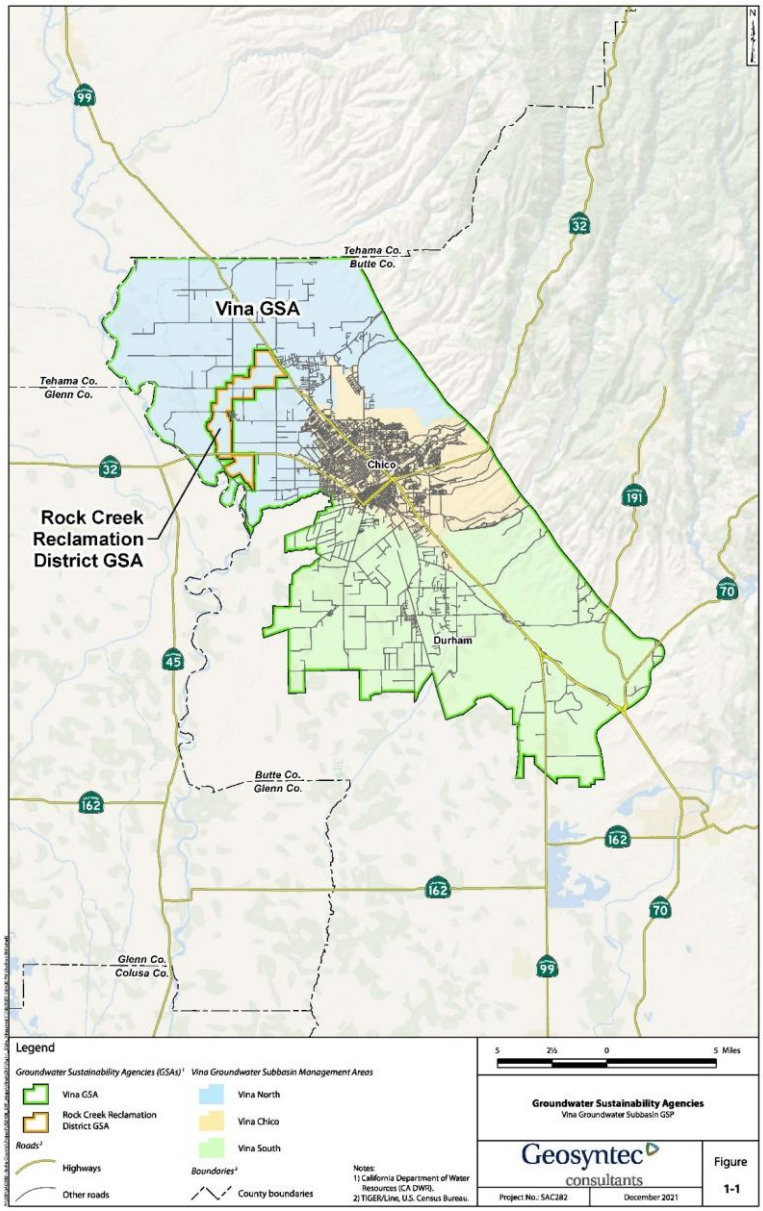


Figure 1-1 ~~placeholder page~~ : Groundwater Sustainability Agencies

Formatted: Caption,Caption1

- To issue revenue bonds or other appropriate public or private debt and incur debts, liabilities, or obligations
- To exercise the powers permitted under Government Code section 6504 or any successor statute
- To levy taxes, assessments, charges and fees as provided in SGMA or otherwise provided by law
- To regulate and monitor groundwater extractions within the Vina Subbasin as permitted by SGMA, provided that this Agreement does not extend to a Member's operation of its systems to distribute water once extracted or otherwise obtained, unless and to the extent required by other laws now in existence or as may otherwise be adopted
- To establish and administer projects and programs for the benefit of the Vina Subbasin
- To cooperate, act in conjunction and contract with the United States, the State of California, or any agency thereof, counties, municipalities, special districts, GSAs, public and private corporations of any kind (including, without limitation, Public Utilities Commission-regulated utilities and mutual water companies), and individuals, or any of them, for any and all purposes necessary or convenient for the full exercise of powers of the GSA
- To accumulate operating and reserve funds and invest the same as allowed by law for the purposes of the GSA and to invest funds pursuant to California Government Code section 6509.5 or other applicable State Law
- To apply for and accept grants, contributions, donations, and loans under any federal, state, or local programs for assistance in development or implementing any of its projects or programs for the purposes of the GSA
- To acquire by negotiation, lease, purchase, construct, hold, manage, maintain, operate, and dispose of any buildings, property, water rights, works, or improvements within and without the respective boundaries of the Members necessary to accomplish the purposes described herein
- To sue and be sued in the GSA's own name
- To exercise the common powers of its Members to develop, collect, provide, and disseminate information that furthers the purposes of the GSA, including but not limited to the operation of the GSA and adoption and implementation of a GSP for the Vina Subbasin, to the Members' legislative, administrative, and judicial bodies, as well as the public generally
- To perform all other acts necessary or proper to carry out fully the purposes of this Agreement

The Vina GSA Board aspires to seek consensus. If the Vina GSA Board cannot reach consensus, the Vina GSA Board defaults to the following voting structure.

- Quorum: A majority of the members of the Vina GSA Board members shall constitute a quorum for purposes of transacting business.
- Director Votes: Each member of the Vina GSA Board shall have one vote.
- Supermajority Voting Requirement (four affirmative votes) for the following:

1. Bylaws adoption, modification, or alteration.
2. GSP adoption, modification, or alteration.
3. Adoption of assessment, charges, and fees.
4. Adoptions of regulations and ordinances.
5. Adoption or modification of annual budget, including capital projects.
6. Property acquisition (excepting rights of way).
7. Removal of Advisory Committee Members.
8. Modifications to the composition and number of Advisory Committee Members.
9. Removal of stakeholder board seats as is consistent with the Agreement.

The Vina GSA Board does not have the authority to limit or interfere with the respective Member Agency's rights and authorities over their own internal matters, including, but not limited to, legal rights to surface water supplies and assets, groundwater supplies and assets, facilities, operations, water management and water supply matters. The Member Agencies made no commitments by entering into the Agreement to share or otherwise contribute their water supply assets as part of the development or implementation of a GSP. Nothing in the Agreement modifies or limits a Member Agency's police powers, land use authorities, or any other authority. The Member Agencies cooperate to obtain consulting, administrative and management services needed to efficiently develop a GSP and to identify mechanisms for the management and funding commitments reasonably anticipated to be necessary for the purposes of this Agreement.

Formatted: English (United States)

Each Member Agency (Butte County, City of Chico, and Durham Irrigation District) designates a staff person (in-kind support) to participate on the Vina GSA Management Committee. The Mechoopda Indian Tribe of Chico Rancheria, California (Tribe) is a federally recognized Tribe in the Vina Subbasin. The Vina GSA is collaborating with the Tribe on the development of the GSP, and the Tribe has a staff member designated as an ex-officio member of the Management Committee for the purpose of GSP development and implementation.

Formatted: English (United States)

The Management Committee receives direction from the Vina GSA Board, makes recommendations and generates staff reports and proposals to the Vina GSA Board. The Management Committee staffs the Advisory Committee and reports to the Vina GSA Board recommendations and actions from the Advisory Committee. The Management Committee

assures that staff and other resources are provided to prepare the GSP and administer the governance for the Vina GSA.

The Vina GSA does not and will not have any employees. However, the Vina GSA has the power to employ consultants to fulfill the objectives and purposes of SGMA and complete a GSP. Butte County ~~is leading the development of~~provides technical ~~aspects of the GSP, including contracting for professional services~~and staff support in coordination with the Management Committee and the Vina GSA Board. The Management Committee may form ad hoc technical working groups to provide input on technical matters pertaining to the GSP. Preparation of the Vina GSP and carrying out governance requires various administrative activities such as meeting management, website development and maintenance, public outreach, and communication.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

The Vina Stakeholder Advisory Committee (SHAC) provides input and recommendations to the Vina GSA Board on GSP development and implementation as well as other items outlined in their Charter. There are 10 ~~Advisory Committee~~voting SHAC members and one additional non-voting Ex Officio member from Rock Creek Reclamation District, including:

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

- Agricultural groundwater users (3)
- At-large ~~domestic~~Domestic well users (2)
- At-large environmental representative (1)
- At-large local business representative (1)
- Cal Water-Chico (1)
- ~~California State University, Chico (CSUC) (1)~~
- ~~Butte College (1)~~
- Water Scientist (1)
- Non-Irrigated/Rangeland User (1) – Vacant
- Rock Creek Reclamation District Representative, Non-Voting Member (1)

The Management Committee participates in Advisory Committee meetings. The Vina GSA Board appoints at-large members to fill Advisory Committee seats. Eligible individuals interested in participating on the Advisory Committee from the community or organizations within the Vina Subbasin can apply to the Vina GSA to become a member. At-large members must live, farm, or be employed by a firm operating in the Vina GSA. To inform the Vina GSA Board and assist in decision-making, the Advisory Committee will provide written recommendations that will be included in Management Committee reports. The recommendations will identify areas of agreement and disagreement. The Advisory Committee will strive for consensus when possible, but reaching consensus is not necessary. Consensus means that everyone can at least "live with" the recommendation. When unable to reach consensus on recommendations, the Advisory Committee will outline the areas in which it does not agree, providing some explanation to inform the Vina GSA Board decision-making. The

Formatted: English (United States)

Vina GSA Board will consider Advisory Committee recommendations when making decisions. If that Board does not agree with the recommendations of the Advisory Committee, the Vina GSA Board shall state the reasons for its decision. The Advisory Committee will be staffed by a member of one of the Member Agencies. All Advisory Committee meetings are subject to the Brown Act and will be noticed and open to the public.

Updates to the Board and Committee members will be posted to the GSA's website.

1.1.4.2 Rock Creek Reclamation District GSA

The Rock Creek Reclamation District (RCRD) provides flood control and groundwater sustainability services to approximately 4,625 acres of agricultural and single-family residential parcels in northern Butte County. The District is located in the Big Chico Creek and Pine Creek watersheds. RCRD is governed by a seven-member Board of Trustees elected by the landowners to staggered four-year terms. The Board of Trustees conducts its regular meetings quarterly and holds special meetings as needed. Board meetings are open to the public and are conducted in accordance with the Brown Act. Members of the public regularly attend meetings virtually or in person. RCRD regularly contracts with a District Counsel and a Secretary to the Board, who provide professional services (legal and secretarial, respectively) at the discretion of and as directed by the Board of Trustees. Most other RCRD services, including reclamation and flood control work, are performed by contracted parties on a seasonal or ad-hoc basis at the direction of the Board of Trustees.

Formatted: English (United States)

Initially formed in 1985 under the State Reclamation Act (California Water Code Section 50000 et seq.) and Butte County Board of Supervisors Resolution No. 85-167, RCRD has a long track record of undertaking flood projects for the benefit of its landowners and will continue to provide services and benefits to the community in this area. In 2018, RCRD expanded its Sphere of Influence (SOI) to approximately 19,027 acres (total 23,652 acres).

RCRD provides for repair, maintenance, and improvement of natural channel water conveyance and flood protection facilities within the area. RCRD is empowered to construct, maintain, and operate drains, canals, sluices, bulkheads, watergates, levees, embankments, pumping plants, dams, diversion, or irrigation works, and all other facilities reasonably necessary or convenient to accomplish District purposes.

Formatted: English (United States)

As a local agency with water supply, water management, or land use responsibilities within the Vina Subbasin, RCRD is authorized to become a GSA over the Vina Subbasin, pursuant to Water Code sections 10723 and 10721(n). On October 18, 2016, RCRD elected to become a GSA over its boundaries, in accordance with the notice and hearing requirements of Water Code section 10723 and Government Code section 6066. On or around October 26, 2016, the RCRD GSA sent notice to DWR of its intent to undertake sustainable groundwater management, pursuant to Water Code sections 10723(d) and 10723.8. RCRD became the exclusive GSA over its jurisdictional boundaries.

Formatted: English (United States)

The RCRD GSA is managed by the Board of Trustees of RCRD with meetings conducted in accordance with the Brown Act. The RCRD GSA formed an ad-hoc SGMA Committee to provide assistance to the RCRD Board of Trustees on development of the GSP. The ad-hoc committee consists of two RCRD trustees. The RCRD GSA's SGMA committee members are

Formatted: English (United States)

uncompensated and assist the Board of Trustees with in-kind contributions of time and resources. All GSA powers are retained and exercised by the Board of Trustees of RCRD. Upon formation, and as of 2021, the committee is staffed by RCRD's Chair, Hal Crain, and RCRD's Vice-Chair, Darren Rice. The function of the ad-hoc committee is to provide input and make recommendations to the RCRD Board of Trustees on development of the GSP and to serve as the point of contact between the Vina GSA and RCRD GSA. A member of the committee attends Vina GSA meetings and Vina GSA Stakeholder Advisory committee meetings. Additionally, several joint meetings of the boards of Vina GSA and RCRD GSA were held during the development of the GSP.

Development and implementation of the GSP is funded primarily by a DWR grant administered by Butte County on behalf of the GSAs and pursuant to a Cooperation Agreement between the Vina GSA and RCRD GSA. RCRD GSA additionally provides in-kind contributions of its SGMA committee members' time and resources. Other incidental RCRD GSA costs are funded by RCRD's annual special assessment. RCRD GSA's implementation of the GSP will be funded by these sources and any additional sources of revenue or funding that the Board of Trustees of RCRD deems proper and consistent with applicable law and its obligations as a GSA and Reclamation District.

Formatted: English (United States)

1.1.5 Memorandum of Understanding

The Vina GSA also signed a Memorandum of Understanding (MOU) with Butte College to work cooperatively to advance the purposes of SGMA and groundwater sustainability. As part of the MOU, the Vina GSA agreed to the following conditions: not to impose fees, assessments, or other charges pertaining to groundwater management to Butte College, to not limit groundwater extraction, to not alter the current boundaries of the Vina Subbasin or consolidation of the Vina Subbasin or regulate or interfere with the surface water rights or groundwater rights of Butte College. These conditions could be altered upon written consent from Butte College. In addition, Butte College agreed to support the efforts of the Vina GSA, to provide associated data as it relates to the Vina Subbasin, and to work cooperatively with the GSA in the review, development, and implementation of the GSP. Butte College appointed a member to the Vina Advisory Committee to provide input and recommendations to the Vina GSA Board on GSA development and implementation.

1.2 Groundwater Sustainability Plan Area

This section provides a detailed description of the Vina Subbasin, including major streams and creeks, institutional entities, agricultural and urban land uses, locations of groundwater wells, and locations of state lands. The GSP Area document also describes existing surface water and groundwater monitoring programs, existing water management programs, and general plans in the GSP Area.

1.2.1 Summary of Jurisdictional Areas and Other Features

The Vina Subbasin falls within the larger Sacramento Valley Groundwater Basin (Figure 1-2). Basin designations by DWR were first published in 1952 in Water Quality Investigations Report No. 3, Ground Water Basins in California, and subsequently updated in Bulletin 118 in 1975, 1980, 2003, and draft update in 2020. As shown in Figure 1-3, the Vina Subbasin (Bulletin 118

Formatted: English (United States)

Basin Number 5-021.57) is bordered to the north by the Los Molinos Subbasin (Bulletin 118 Basin Number 5-021.56), the Corning Subbasin (Bulletin 118 Basin Number 5-021.51), and the Butte Subbasin (Bulletin 118 Basin Number 5-021.40); to the south by the Wyandotte Creek Subbasin (Bulletin 118 Basin Number 5-021.69); and to the east by the Sierra Nevada geomorphic province.

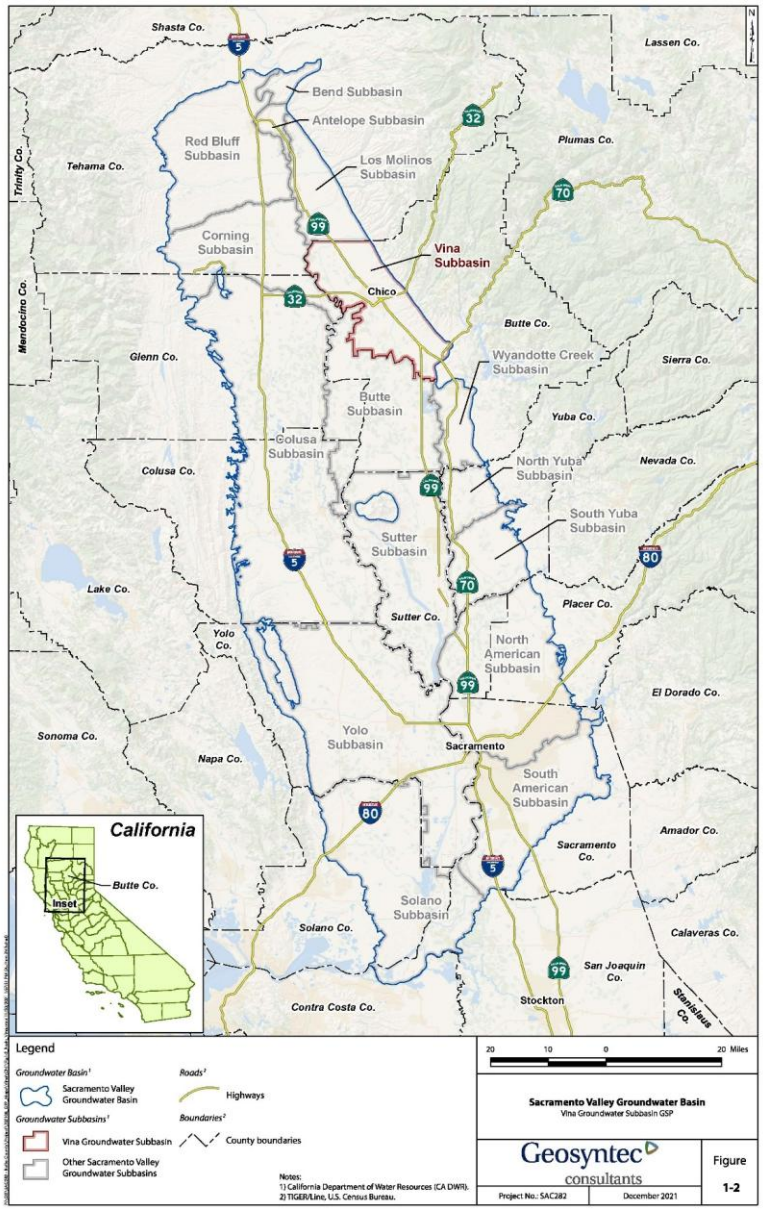


Figure 1-2 ~~placeholder page~~: Sacramento Valley Groundwater Basin

Formatted: Caption,Caption1

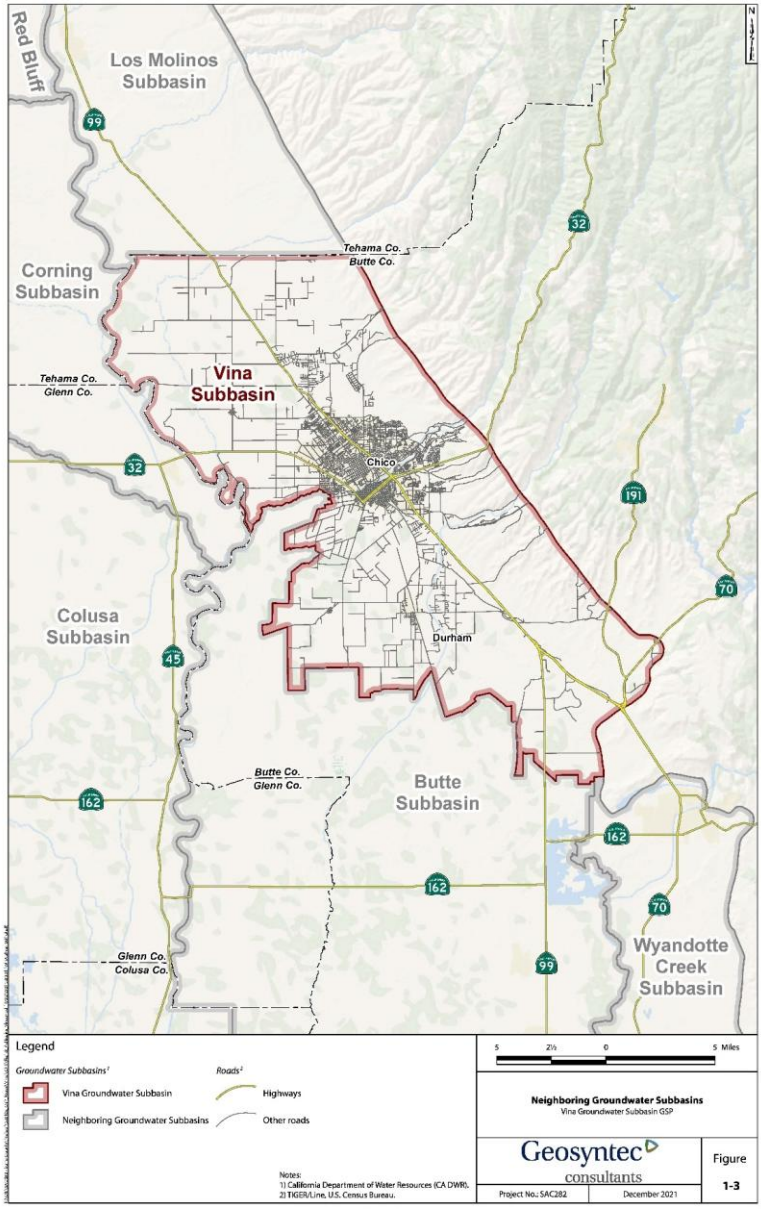


Figure 1-3 ~~placeholder page~~: Neighboring Groundwater Subbasins

Formatted: Caption,Caption1

The Vina Subbasin is located within Butte County. Geologic units in the Vina Subbasin consist of consolidated rocks and unconsolidated deposits, as discussed in detail in Section 2. No adjudicated areas or areas covered by an alternative to a GSP exist within the Vina Subbasin.

Figure 1-4 shows the Vina Subbasin's key geographic features, including city boundaries. The Vina Subbasin encompasses an area of about 289 square miles. There are two entities within the Vina Subbasin with land use jurisdiction: Butte County and the City of Chico.

Figure 1-5 shows the tribal areas within the Vina Subbasin that includes the Mechoopda Tribal Designated Statistical Areas. Figure 1-6 shows the spatial extent of Disadvantaged Communities (DACs) and Severely Disadvantaged Communities (SDACs) in the Vina Subbasin. DWR defines DACs as census geographies (census tracts, census block groups, and census-designated places) with an annual median household income (MHI) that is less than 80% of the statewide annual MHI. SDACs are defined as census geographies with an MHI less than 60 percent of the statewide annual MHI. DWR uses the most recently available five-year American Community Survey (ACS) dataset to identify these areas. For this GSP, the 2012-2016 ACS dataset was used, establishing statewide MHI as $63,783 (DWR, Mapping Tools).

Figure 1-7 shows a map of land use in the Vina Subbasin across four general categories: cropland, industrial, undeveloped, and urban. These categories were mapped based on categories provided by 2015 land use from the United States Department of Agriculture's (USDA) CropScape 2015 dataset.

Land use patterns in the Vina Subbasin are dominated by agricultural uses, including nut and fruit trees, vineyards, row crops, grazing, and forage. Throughout the Vina Subbasin, both agricultural and urban land use rely on a combination of surface water and groundwater. Land use is primarily controlled by local agencies. Land use patterns in the low foothills to the east are dominated by native vegetation and unirrigated pasture lands (USDA, 2020).

Crop type varies by region, with fruit and nut trees and rice fields comprising the majority of agriculture in the Vina Subbasin. Almond and walnut orchards dominate the northern and central portion of the Vina Subbasin, and rice fields dominate the southern portion of the Vina Subbasin (Figure 1-8). Figure 1-9 shows a map with boundaries of federal and state public lands within the region that includes the Vina Subbasin.

Figure 1-10 to Figure 1-13 show the density of domestic, public, industrial, and irrigation wells per square mile in the Vina Subbasin, as classified by the DWR Online System for Well Completion Reports (OSWCR), which is discussed in Section 1.4.4. Though there are overlaps and discrepancies in the designation of wells, domestic wells are largely private residential wells, public wells are municipal operated wells, and production wells are for irrigation, municipal, public, and industrial purposes (DWR, 2019a). Areas with few wells exist in the Vina Subbasin, particularly in the northwestern corner of the Vina Subbasin and to the east. Wells containing groundwater level data are described further in Section 1.4.

Figure 1-14 shows locations of major rivers, streams, and creeks within the Vina Subbasin. The Sacramento River borders the Vina Subbasin on its western side. Other larger surface water bodies traversing the Vina Subbasin include Big Chico Creek and Butte Creek.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

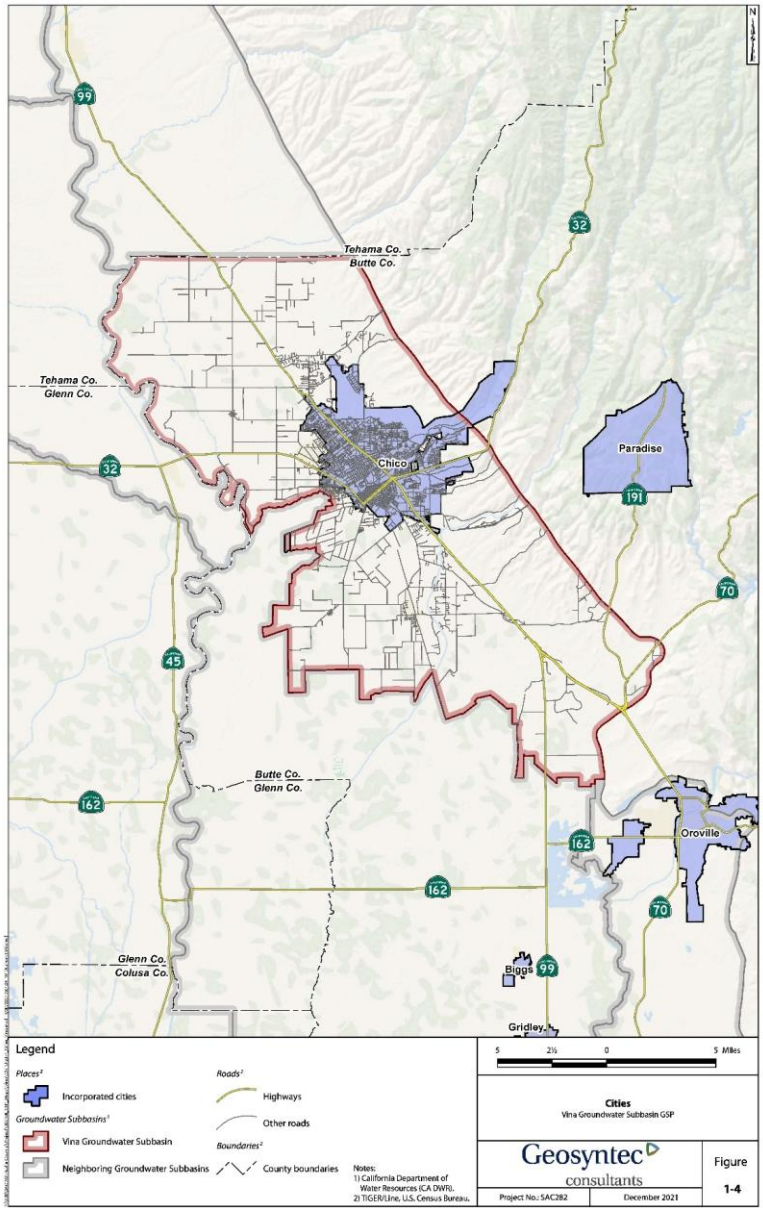


Figure 1-4 ~~placeholder page~~: Cities

Formatted: Caption,Caption1

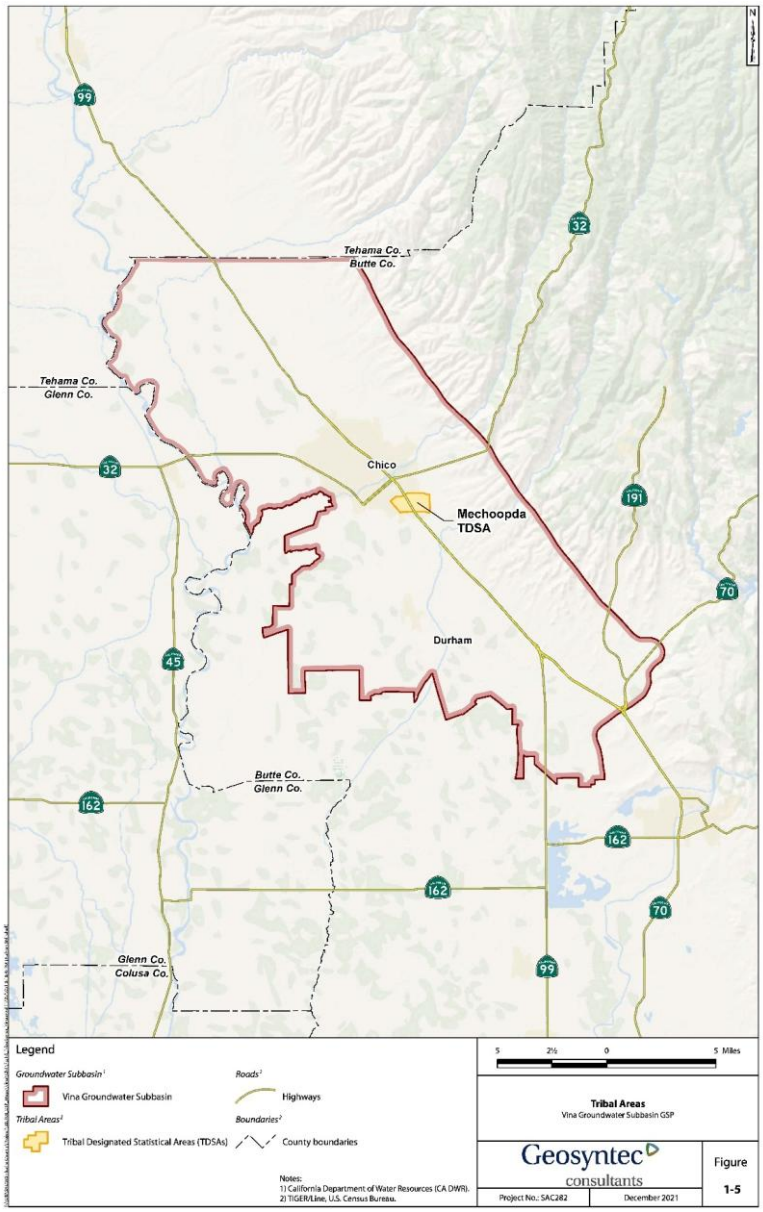

Tehama Co.
Butte Co.
Tehama Co.
Glenn Co.
Chico
Mechoopda TDSA
Durham
Butte Co.
Glenn Co.
Glenn Co.
Colusa Co.
99
32
191
70
45
162
Legend
Groundwater Subbasin[1]
Vina Groundwater Subbasin
Tribal Areas[2]
Tribal Designated Statistical Areas (TDSAs)
Roads[2]
Highways
Boundaries[2]
County boundaries
Notes:
1) California Department of Water Resources (CA DWR).
2) TIGER/Line, U.S. Census Bureau.
5 2½ 0 5 Miles
Tribal Areas
Vina Groundwater Subbasin GSP
Geosyntec consultants
Project No.: SAC282
December 2021
Figure
1-5

Figure 1-5 ~~placeholder page~~: Tribal Areas

Formatted: Caption,Caption1

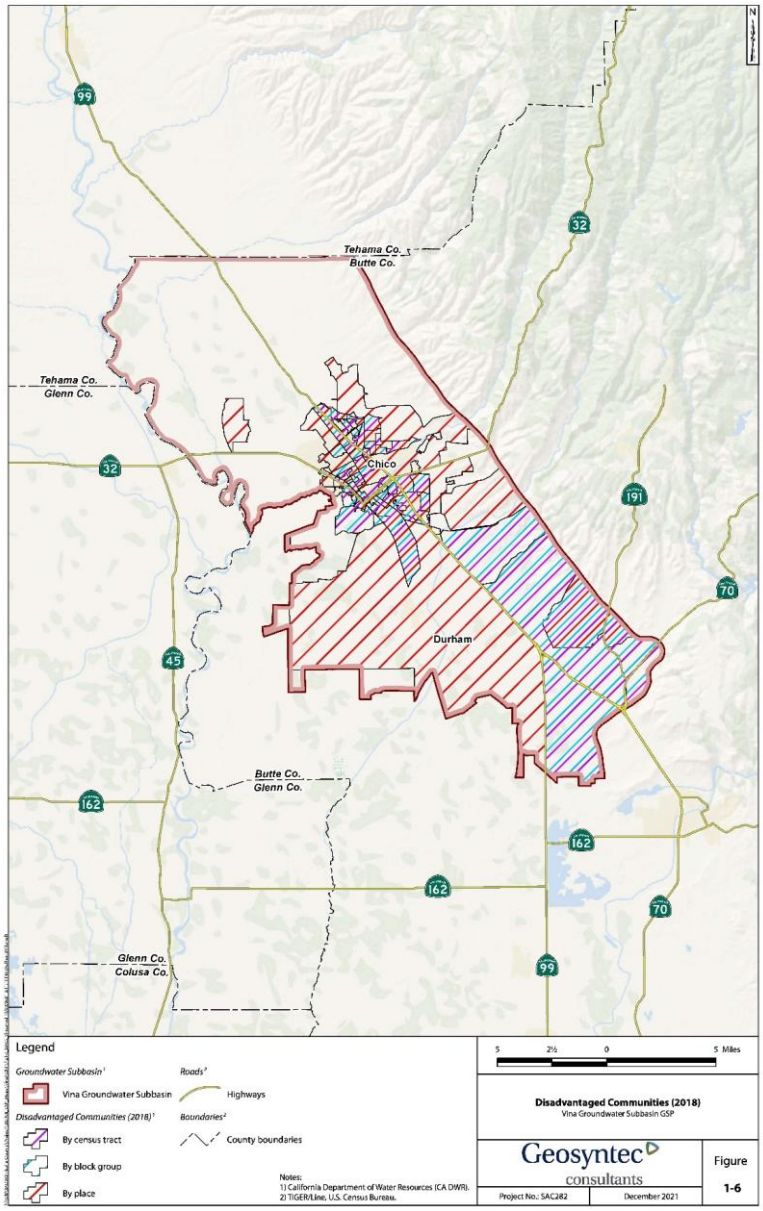

Tehama Co.
Butte Co.
Tehama Co.
Glenn Co.
Chico
Durham
Butte Co.
Glenn Co.
Glenn Co.
Colusa Co.
99
32
191
70
45
162
Legend
Groundwater Subbasin[1]
Vina Groundwater Subbasin
Disadvantaged Communities (2018)[1]
By census tract
By block group
By place
Roads[2]
Highways
Boundaries[2]
County boundaries
Notes:
1) California Department of Water Resources (CA DWR).
2) TIGER/Line, U.S. Census Bureau.
5 2½ 0 5 Miles
Disadvantaged Communities (2018)
Vina Groundwater Subbasin GSP
Geosyntec consultants
Figure 1-6
Project No.: SAC282
December 2021

Figure 1-6 ~~placeholder page~~: Disadvantaged Communities (2018)

Formatted: Caption,Caption1

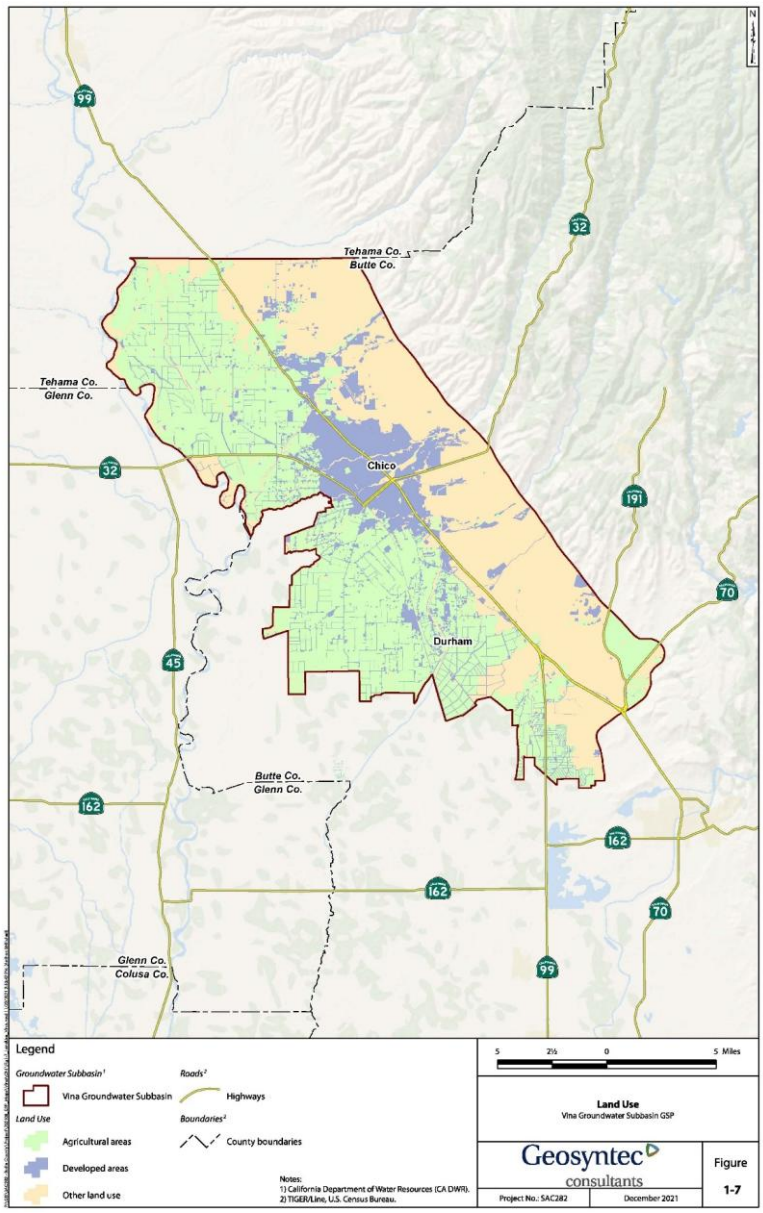

Tehama Co.
Butte Co.
Tehama Co.
Glenn Co.
Chico
Durham
Butte Co.
Glenn Co.
Glenn Co.
Colusa Co.
99
32
191
70
45
162
Legend
Groundwater Subbasin[1]
Vina Groundwater Subbasin
Land Use
Agricultural areas
Developed areas
Other land use
Roads[2]
Highways
Boundaries[2]
County boundaries
Notes:
1) California Department of Water Resources (CA DWR).
2) TIGER/Line, U.S. Census Bureau.
5 2½ 0 5 Miles
Land Use
Vina Groundwater Subbasin GSP
Geosyntec consultants
Project No.: SAC282
December 2021
Figure
1-7

Figure 1-7 ~~placeholder page~~: Land Use

Formatted: Caption,Caption1

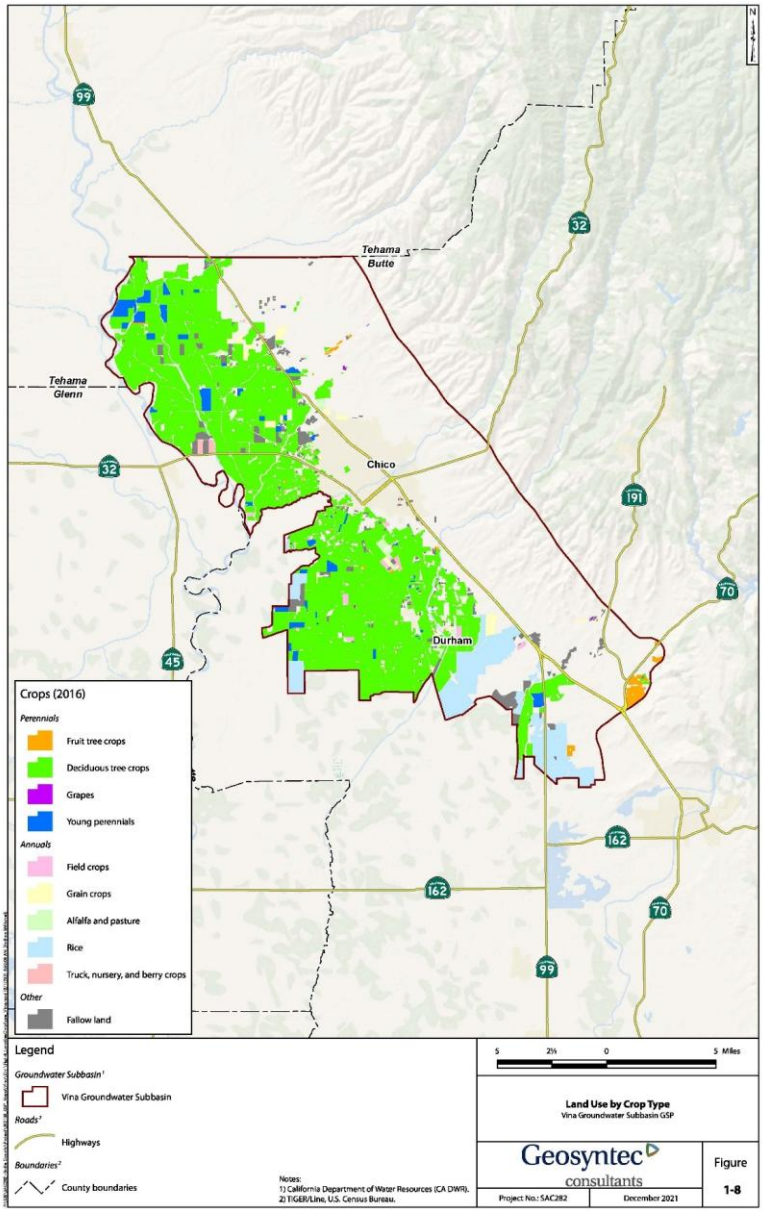

Tehama
Butte
Tehama
Glenn
Chico
Durham
99
32
191
70
45
162
Crops (2016)
Perennials
Fruit tree crops
Deciduous tree crops
Grapes
Young perennials
Annuals
Field crops
Grain crops
Alfalfa and pasture
Rice
Truck, nursery, and berry crops
Other
Fallow land
Legend
Groundwater Subbasin[1]
Vina Groundwater Subbasin
Roads[2]
Highways
Boundaries[2]
County boundaries
Notes:
1) California Department of Water Resources (CA DWR).
2) TIGER/Line, U.S. Census Bureau.
5 2½ 0 5 Miles
Land Use by Crop Type
Vina Groundwater Subbasin GSP
Geosyntec consultants
Figure
1-8
Project No.: SAC2812
December 2021

Figure 1-8 ~~placeholder page~~: Land Use by Crop Type

Formatted: Caption,Caption1

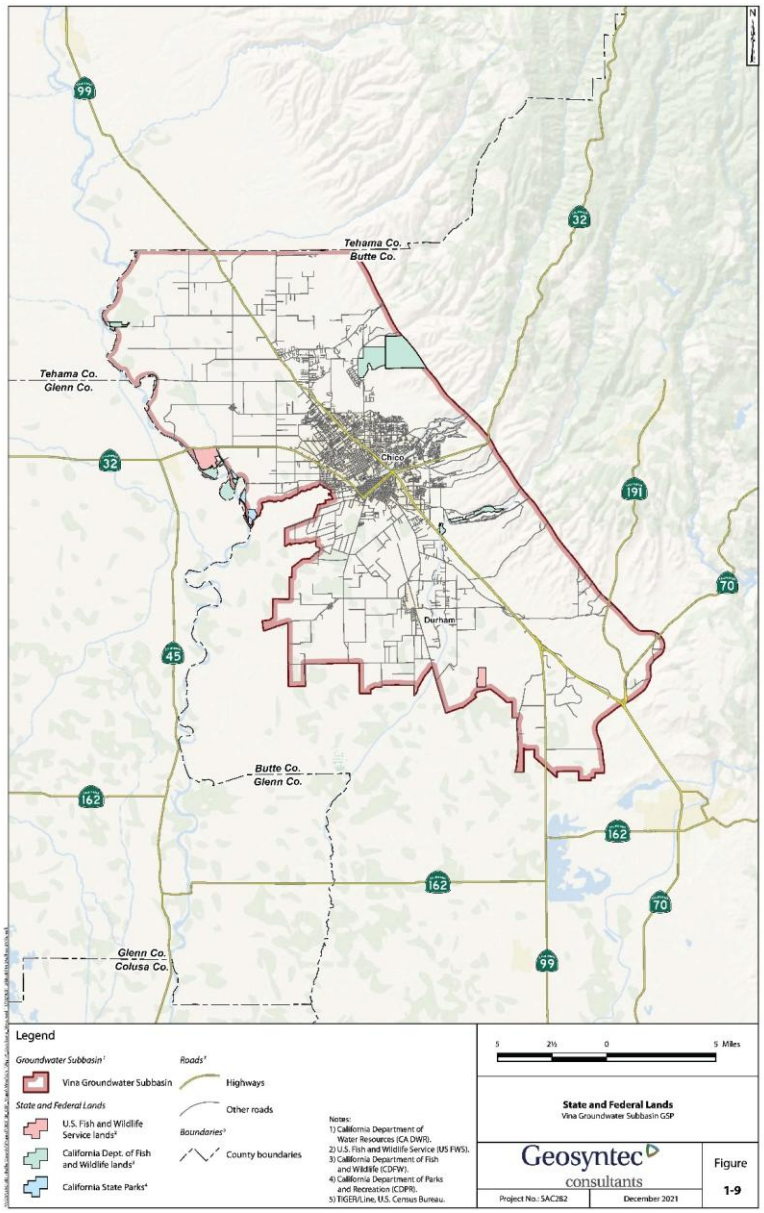

Tehama Co.
Butte Co.
Tehama Co.
Glenn Co.
Chico
Durham
Butte Co.
Glenn Co.
Glenn Co.
Colusa Co.
99
32
191
70
45
162
Legend
Groundwater Subbasin[1]
Vina Groundwater Subbasin
State and Federal Lands
U.S. Fish and Wildlife Service lands[2]
California Dept. of Fish and Wildlife lands[3]
California State Parks[4]
Roads[5]
Highways
Other roads
Boundaries[5]
County boundaries
Notes:
1) California Department of Water Resources (CA DWR).
2) U.S. Fish and Wildlife Service (US FWS).
3) California Department of Fish and Wildlife (CDFW).
4) California Department of Parks and Recreation (CDPR).
5) TIGER/Line, U.S. Census Bureau.
5 2½ 0 5 Miles
State and Federal Lands
Vina Groundwater Subbasin GSP
Geosyntec consultants
Figure 1-9
Project No.: SAC282
December 2021

Figure 1-9 ~~placeholder page~~: State and Federal Lands

Formatted: Caption,Caption1

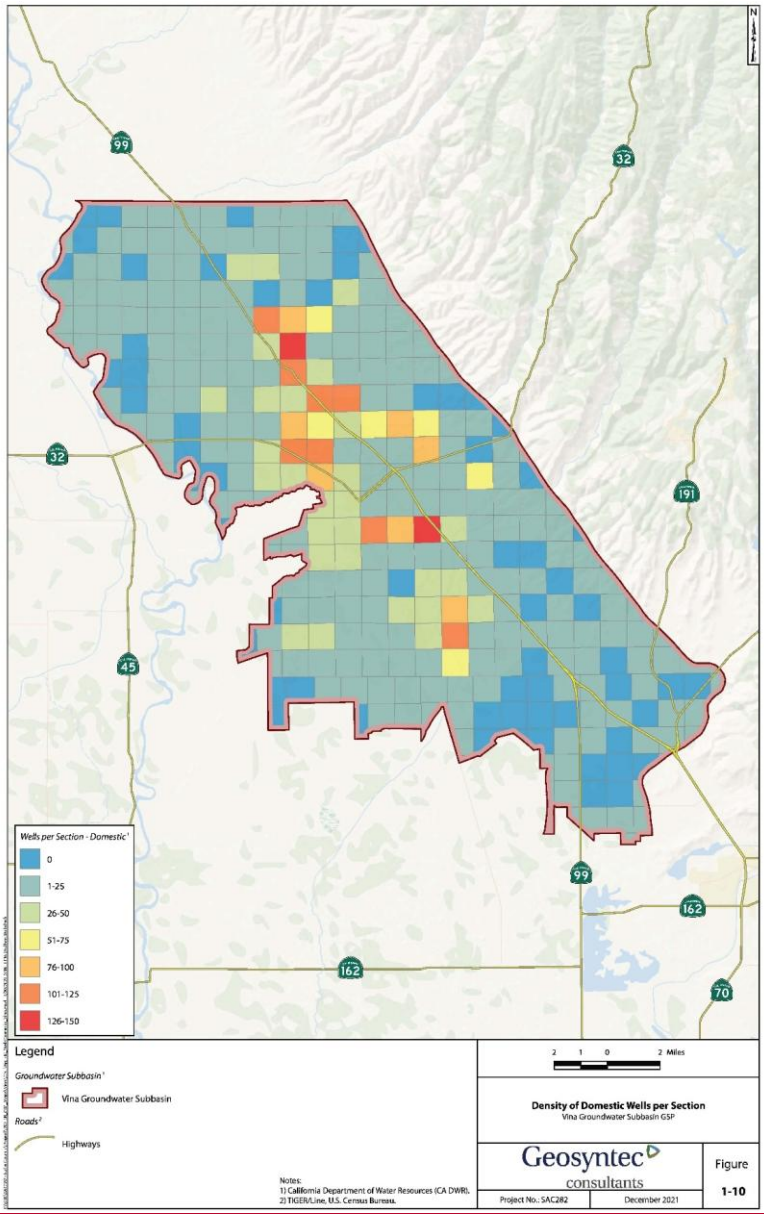

N
99
32
32
191
45
99
162
162
70
Wells per Section - Domestic[1]
0
1-25
26-50
51-75
76-100
101-125
126-150
Legend
Groundwater Subbasin[1]
Vina Groundwater Subbasin
Roads[2]
Highways
Notes:
1) California Department of Water Resources (CA DWR).
2) TIGER/Line, U.S. Census Bureau.
2 1 0 2 Miles
Density of Domestic Wells per Section
Vina Groundwater Subbasin GSP
Geosyntec consultants
Figure
1-10
Project No.: SAC282
December 2021

Figure 1-10 ~~placeholder page~~: Density of Domestic Wells per Section

Formatted: Caption,Caption1

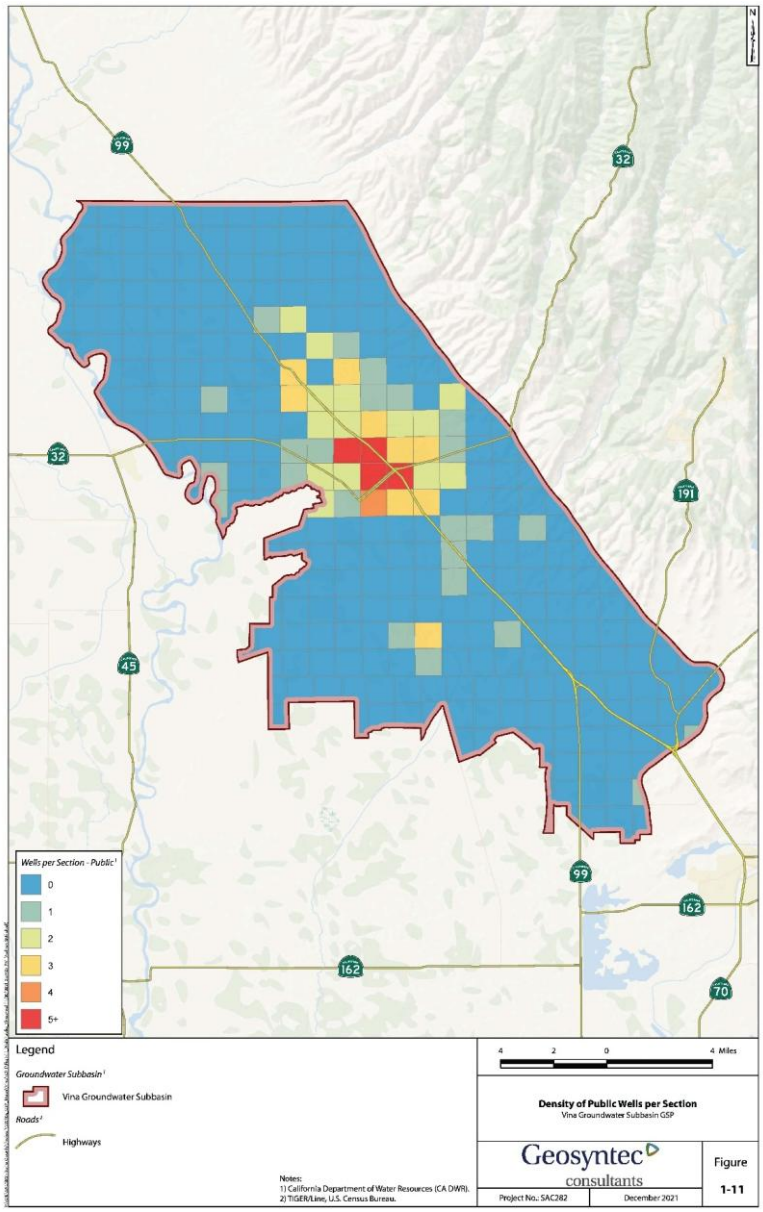

N
99
32
32
191
45
99
162
162
70
Wells per Section - Public[1]
0
1
2
3
4
5+
Legend
Groundwater Subbasin[1]
Vina Groundwater Subbasin
Roads[2]
Highways
Notes:
1) California Department of Water Resources (CA DWR).
2) TIGER/Line, U.S. Census Bureau.
4 2 0 4 Miles
Density of Public Wells per Section
Vina Groundwater Subbasin GSP
Geosyntec consultants
Project No.: SAC282
December 2021
Figure
1-11

Figure 1-11 ~~placeholder page~~: Density of Public Wells per Section

Formatted: Caption,Caption1

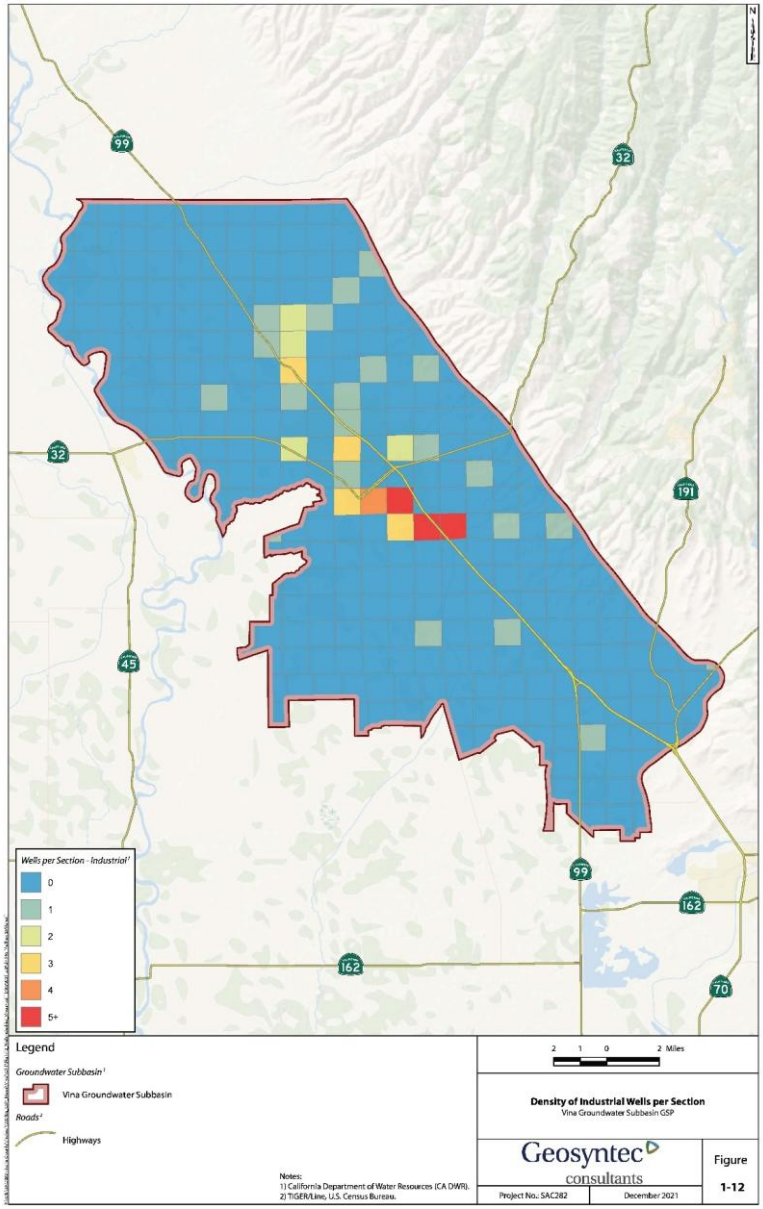

N
99
32
32
191
45
99
162
162
70
Wells per Section - Industrial[2]
0
1
2
3
4
5+
Legend
Groundwater Subbasin[1]
Vina Groundwater Subbasin
Roads[2]
Highways
Notes:
1) California Department of Water Resources (CA DWR).
2) TIGER/Line, U.S. Census Bureau.
2 1 0 2 Miles
Density of Industrial Wells per Section
Vina Groundwater Subbasin GSP
Geosyntec consultants
Project No.: SAC282
December 2021
Figure
1-12

Figure 1-12 ~~placeholder page~~: Density of Industrial Wells per Section

Formatted: Caption,Caption1

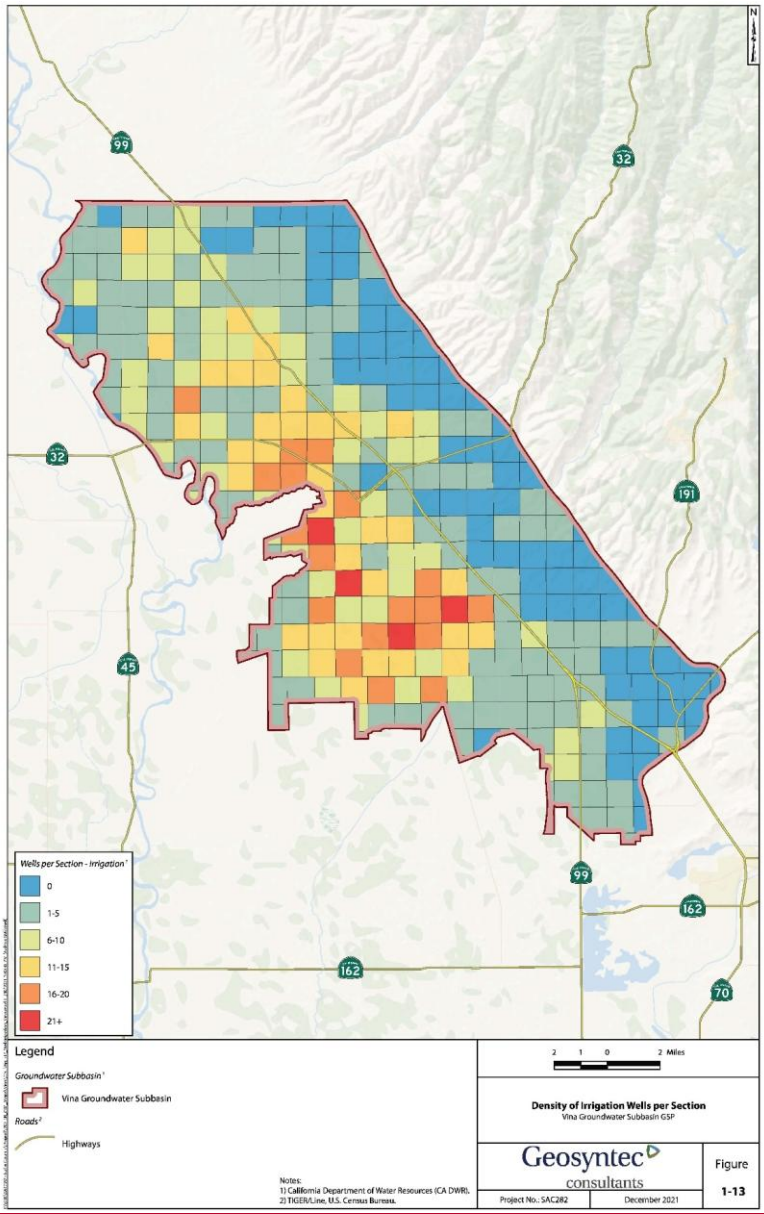

N
99
32
32
191
45
99
162
162
70
Wells per Section - Irrigation[1]
0
1-5
6-10
11-15
16-20
21+
Legend
Groundwater Subbasin[1]
Vina Groundwater Subbasin
Roads[2]
Highways
2 1 0 2 Miles
Density of Irrigation Wells per Section
Vina Groundwater Subbasin GSP
Geosyntec consultants
Figure
1-13
Project No.: SAC282
December 2021
Notes:
1) California Department of Water Resources (CA DWR).
2) TIGER/Line, U.S. Census Bureau.

Figure 1-13 ~~placeholder page~~: Density of Irrigation Wells per Section

Formatted: Caption,Caption1

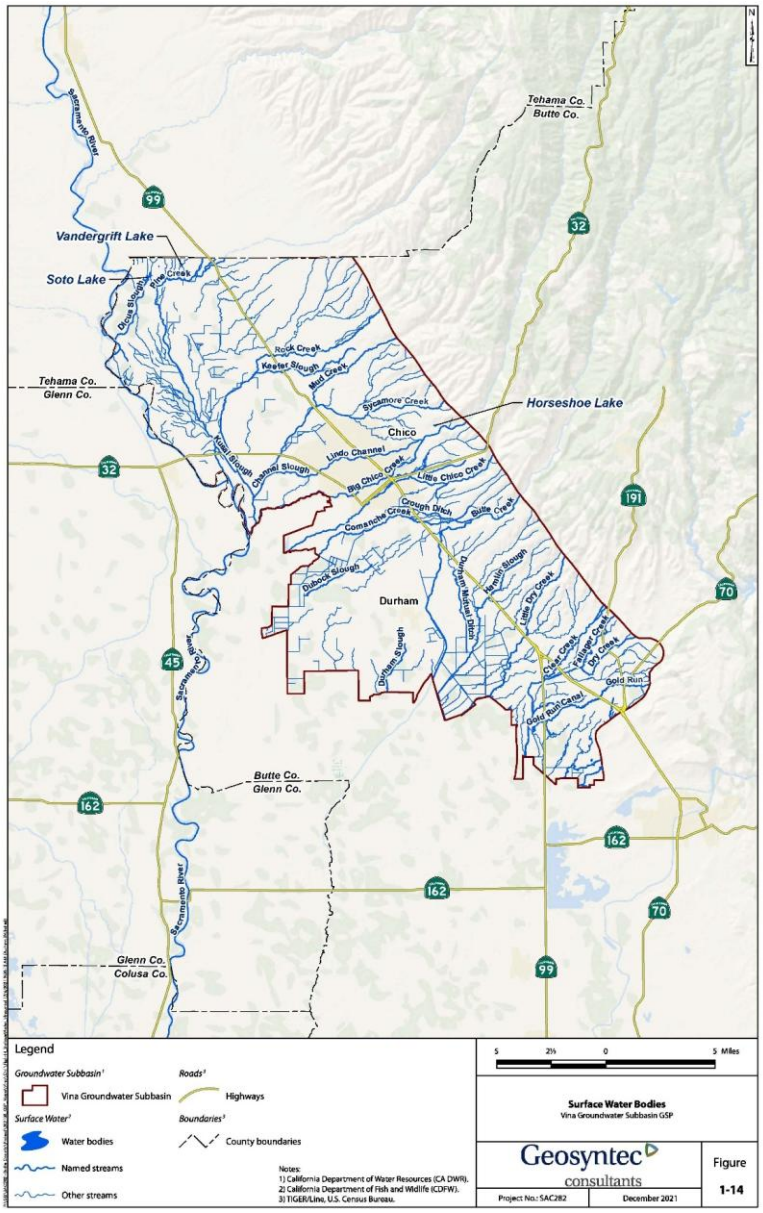

Tehama Co.
Butte Co.
Sacramento River
Vandergrift Lake
Soto Lake
Dice Slough
Rice Creek
Rock Creek
Keeter Slough
Mud Creek
Tehama Co.
Glenn Co.
Sycamore Creek
Horseshoe Lake
Chico
Lindo Channel
Kusal Slough
Channel Slough
Big Chico Creek
Little Chico Creek
Crough Ditch
Comanche Creek
Butte Creek
Dubois Slough
Durham
Durham Mutual Ditch
Henline Slough
Little Dry Creek
Durham Slough
Cusa Canal
Pellinger Creek
Dry Creek
Gold Run
Gold Run Canal
Butte Co.
Glenn Co.
Sacramento River
Glenn Co.
Colusa Co.
Legend
Groundwater Subbasin[1]
Vina Groundwater Subbasin
Surface Water[2]
Water bodies
Named streams
Other streams
Roads[3]
Highways
Boundaries[3]
County boundaries
Notes:
1) California Department of Water Resources (CA DWR).
2) California Department of Fish and Wildlife (CDFW).
3) TIGER/Line, U.S. Census Bureau.
5 2½ 0 5 Miles
Surface Water Bodies
Vina Groundwater Subbasin GSP
Geosyntec consultants
Project No.: SAC282
December 2021
Figure
1-14

Figure 1-14 ~~placeholder page~~: Surface Water Bodies

Formatted: Caption,Caption1

Smaller local or ephemeral streams entering and traversing the Vina Subbasin include Pine Creek, Rock Creek, Mud Creek, Sycamore Creek, Little Chico Creek, Hamlin Slough, Little Dry Creek, and Clear Creek. Additional information regarding surface waters can be found in Section 2, Basin Setting.

Formatted: English (United States)

1.2.2 Management Areas

A Management Area (MA) refers to an area within a basin for which a GSP may identify different minimum thresholds (MT), measurable objectives (MO), monitoring, and projects and actions based on unique local conditions or other circumstances as described in the GSP regulations. The GSP must describe each MA, including rationale for approach and demonstrate it can be managed without causing undesirable results within or outside the MA. Three MAs are defined in the Vina Subbasin: Vina North, Vina Chico, and Vina South (Figure 1-1).

Formatted: English (United States)

Although all stakeholders have a shared interest in sustainable management of groundwater in this predominantly groundwater dependent Vina Subbasin, the landscape of beneficial users varies among MAs. The interests and vulnerability of stakeholders and groundwater uses in these MAs vary based on the nature of the water demand (agricultural, domestic, municipal), numbers and characteristics (i.e., depth) of wells supplying groundwater, and to some degree the hydrogeology and mix of recharge sources (i.e., the presence of Butte Creek in Vina South compared to ephemeral streams in Vina North). The reason for creating these MAs in the Vina Subbasin is to focus development of MT, MO, monitoring, and projects and actions in a way that best meets the mix of needs of the uses and users of groundwater unique to the MA. The defined MAs also allow Member Agencies to focus efforts and staff resources on development of portions of the GSP most relevant to stakeholders within their jurisdiction. These established MAs facilitate successful development and long-term implementation of the GSP by effectively targeting the needs, vulnerabilities, and opportunities of local conditions in these areas.

1.2.2.1 Vina North Management Area

The Vina North MA overlies the Butte County area north of the City of Chico and Big Chico Creek, within the jurisdictional boundary of the GSA. The Rock Creek Reclamation District GSA is situated in this MA. The Vina GSA and the Rock Creek Reclamation District GSA have committed through a Cooperation Agreement to develop a single GSP for the Vina Subbasin. The two GSAs will coordinate their efforts in the Vina North MA. Vina North is dominated by irrigated agriculture dependent on wells with sparsely distributed rural residential domestic well users and the small community of Nord. The Sacramento River flows along the western boundary but otherwise, ephemeral streams are present including Pine Creek, Rock Creek, and Mud Creek. It contains the jurisdictions of Rock Creek Reclamation District GSA and Vina GSA.

Formatted: English (United States)

1.2.2.2 Vina Chico Management Area

The second MA encompasses the area that overlies the municipal area within and adjacent to the City of Chico (Vina Chico MA). The Vina Chico MA is predominantly an urban area with California Water Service (Cal Water) providing groundwater supplies for residential and municipal use. To a very limited extent, private domestic wells provide the primary source of water to households or in some cases provide a secondary supply for outdoor water use. Several

Formatted: English (United States)

creeks traverse the Vina Chico MA including Big Chico Creek, Little Chico Creek, and Butte Creek. The Vina GSA is the exclusive GSA for the Vina Chico MA.

1.2.2.3 Vina South Management Area

The Vina South MA overlies the Durham Irrigation District and the Butte County areas south of the City of Chico. The Vina South MA is dominated by irrigated agriculture dependent on groundwater and to a lesser extent, surface water diversions primarily from Butte Creek. In and around the community of Durham, significant numbers of rural residents and ranchettes depend on groundwater typically from relatively shallow domestic wells interspersed with agricultural land uses. Both perennial and ephemeral streams traverse the Vina South MA, including but not limited to, Butte Creek, Little Dry Creek, and Dry Creek, which becomes the Cherokee Canal. The Vina GSA is the exclusive GSA for the Vina South MA.

Formatted: English (United States)

1.3 Management Programs

Existing management programs within the Vina Subbasin are described below.

1.3.1 Groundwater Management Plan

The County of Butte has a Groundwater Management Plan (GMP) that covers the entire County except for areas covered by Urban Water Management Plans (UWMPs). The GMP supports the long-term maintenance of high-quality groundwater resources within the Plan Area for agricultural, environmental, rural domestic and urban needs. Specifically, the Butte County Groundwater Management Plan endeavors to:

- Minimize the long-term drawdown of groundwater levels;
- Protect groundwater quality;
- Prevent inelastic land surface subsidence from occurring as a result of groundwater pumping;
- Minimize changes to surface water flows and quality that directly affect groundwater levels or quality;
- Minimize the effect of groundwater pumping on surface water flows and quality; and
- Evaluate groundwater replenishment and cooperative management projects.

The Butte County Groundwater Management Plan can be found at:

http://www.buttecounty.net/waterresourceconservation/groundwatermanagementplan

1.3.2 Urban Water Management Plans

Urban Water Management Plans provide an assessment of long-term water supply reliability, demand management measures, water shortage contingency plans, progress towards reduced per capita consumption, and the planned use of recycled water. An UWMP has been developed for the City of Chico by Cal Water, 2020. This document provides water system descriptions, supplies and demands, and supply reliability to ensure that adequate water supplies are available

Formatted: English (United States)

to meet existing and future needs. An UWMP is prepared every five years by law to support Cal Water's long-term resource planning.

1.3.3 Northern Sacramento Valley Integrated Regional Water Management Plan

Six counties, including Butte, Shasta, Tehama, Glenn, Colusa, and Sutter counties (Figure 1-15), of the Northern Sacramento Valley have been working together for over 10 years to lay the foundation for an integrated regional plan to address water-related issues such as economic health and vitality; water supply reliability; flood, stormwater, and flood management; water quality improvements; and ecosystem protection and enhancement. The counties have completed the development of a valley-wide IRWM Plan and have committed to continuing the efforts of regional water management through this plan. The IRWM is a collaborative effort to enhance coordination of the water resources in a region. IRWM involves multiple agencies, stakeholders, tribes, individuals, and groups to address water-related issues and offer solutions which can provide multiple benefits to the region. Representatives of the six counties are working in partnership with community stakeholders, tribes, and the public to identify the water-related needs of the region. This information was used to develop goals and objectives of the IRWM Plan, and the identification of projects and programs to be included in the GSP. The IRWM Plan was adopted in April 2014 and ~~will~~updated in 2020 and better ~~position~~positions the region and local partners to receive funding for high-priority projects.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

1.3.4 Drought Management Plan

The Butte County Drought Preparedness and Mitigation Plan (Drought Plan) was adopted in 2004 and was developed to protect the County from the effects of a drought. The Drought Plan includes: an overview of Butte County's drought background; institutional framework to approach drought; a monitoring plan; a response and mitigation plan; and a discussion of water transfers during a drought. The purpose of the Drought Plan is to provide an efficient and systematic process for Butte County that results in a short- and long-term reduction in drought impacts to the citizens, economy, and environment.

Formatted: English (United States)

1.3.5 Conjunctive Use Programs

There are no conjunctive use programs in the Vina Subbasin.

1.3.6 General Plans in the Plan Area

The Vina Subbasin is subject to the Butte County General Plan 2030 and the City of Chico General Plan. In 2018, the Camp Fire destroyed 18,000 structures in Butte County, displacing over 27,000 residents. In 2020, the North Complex Fire destroyed homes in Berry Creek, Feather Falls, and other areas. While the Town of Paradise, Concow, Berry Creek, and other impacted areas rebuild, many residents have relocated to other parts of Butte County. The existing General Plans may not fully account for the relocation of wildfire survivors. The GSP accounts for changes in population and updates to General Plans during GSP implementation.

Formatted: English (United States)

1.3.6.1 Butte County General Plan 2030

The Butte County General Plan 2030 was adopted by the Butte County Board of Supervisors in October 2010. The General Plan 2030 identifies the goals, policies, and actions governing land use in the unincorporated portions of Butte County. The General Plan 2030 reflects the

Formatted: English (United States)

community desire to conserve and enhance the legacy of their forebears, namely, sustainable development.

~~Figure 1-15 placeholder page~~

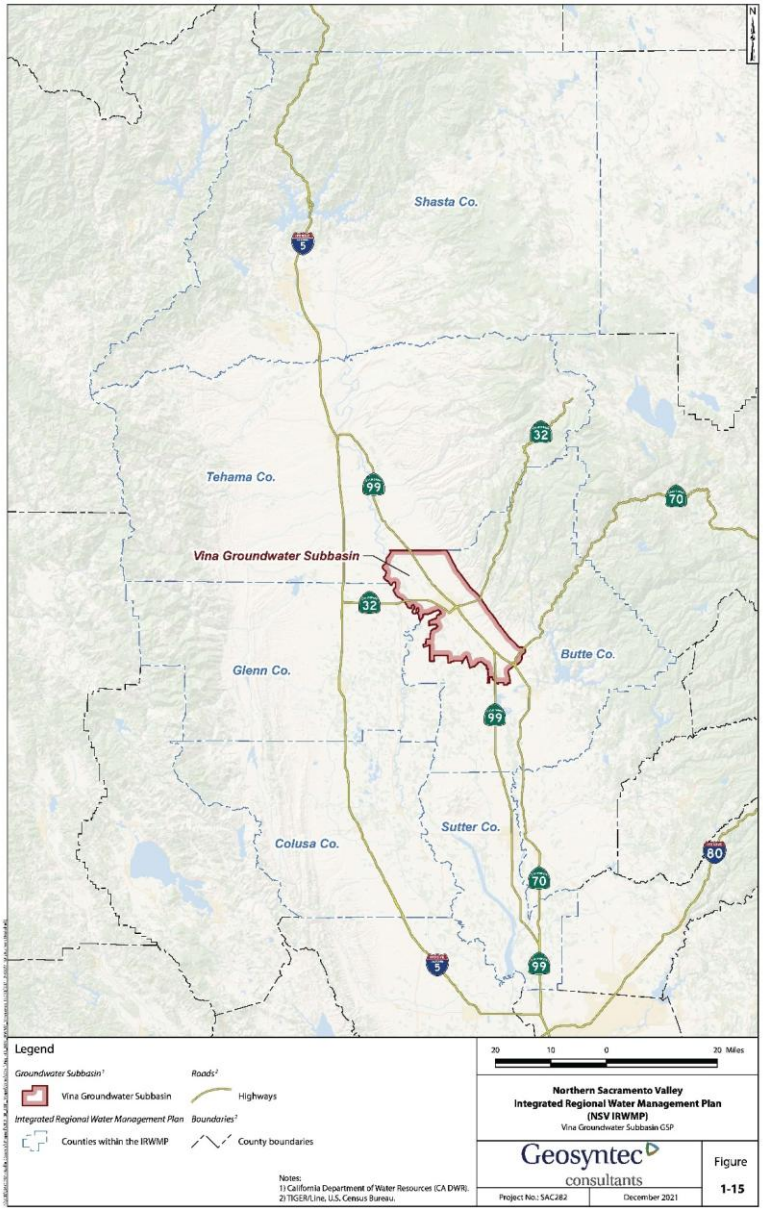


Figure 1-15: Northern Sacramento Valley Integrated Regional Water Management Plan

To this end, the General Plan 2030 envisions and supports a Butte County in 2030 where:

- Urban development will be primarily centralized within and adjacent to the existing municipal limits and larger unincorporated communities. Urban development will have efficient, reliable public facilities and infrastructure. Employment centers and a range of services will be located near residential areas so that people spend less time in their cars. Residential communities will be walkable, bicycle facilities will be provided, and there will be access to public transit.
- Small unincorporated areas will be well-planned through community-driven planning processes so that community character is preserved and adequate public services and facilities are provided. Rural residential development will be limited and will strive to be compatible with agricultural and environmental uses and will address wildfire risks and public service's needs.
- Agriculture and open space will continue to dominate Butte County's landscape and be an important part of the County's culture and economy. Existing agricultural areas will be maintained, and an array of agricultural services will support agriculture while providing new jobs to Butte County residents.

The General Plan 2030 includes an optional Water Resources Element in addition to the mandatory elements of Land Use, Housing, Economic Development, Agriculture, Circulation, Conservation and Open-space, Health and Safety, and Public Facilities and Services. In adopting the Water Resources Element, the General Plan 2030 recognized the importance and interrelationship between land use and water resources management. The General Plan 2030 Water Resources Element has six goals:

1. Maintain and enhance water quality
2. Ensure an abundant and sustainable water supply to support all uses in Butte County
3. Effectively manage groundwater resources to ensure a long-term water supply for Butte County
4. Promote water conservation as an important part of a long-term and sustainable water supply
5. Protect water quality through effective stormwater management
6. Improve stream bank stability and protect riparian resources

Key Water Resources Element policies include:

- W-P1.4: Where appropriate, new development shall be Low Impact Development that minimizes impervious area, minimizes runoff and pollution, and incorporates best management practicesW-P2.1: The County supports solutions to ensure the sustainability of community water supplies.
- W-P2.3: Water resources shall be planned and managed in a way that relies on sound science and public participation.

- W-P2.5: The expansion of public water systems to areas identified for future development on the General Plan land use map is encouraged.
- W-P2.6: The County supports water development projects that are needed to supply local demands.
- W-P2.8: The County supports Area of Origin water rights, the existing water right priority system, and the authority to make water management decisions locally to meet the county's current and future needs, thereby protecting Butte County's communities, economy and environment.
- W-P2.9: Applicants for new major development projects, as determined by the Department of Development Services, shall demonstrate adequate water supply to meet the needs of the project, including an evaluation of potential cumulative impacts to surrounding groundwater users and the environment.
- W-P3.1: The County shall continue to ensure the sustainability of groundwater resources, including groundwater levels, groundwater quality, and avoidance of land subsidence through a basin management objective program that relies on management at the local level, utilizes sound scientific data, and assures compliance.
- W-P3.2: Groundwater transfers and substitution programs shall be regulated to protect the sustainability of the County's economy, communities and ecosystem, pursuant to Chapter 33 of the Butte County Code.
- W-P3.3: The County shall protect groundwater recharge and groundwater quality when considering new development projects.
- W-P4.1: Agricultural and urban water use efficiency shall be promoted.
- W-P4.2: Water conservation efforts of local Resource Conservation Districts, the Natural Resource Conservation Service, and irrigation districts should be coordinated.
- W-P4.3: The County shall work with municipal and industrial water purveyors to implement water conservation policies and measures.
- W-P4.4: Opportunities to recover and utilize wastewater for beneficial purposes shall be promoted and encouraged.
- W-P4.5: The use of reclaimed wastewater for non-potable uses shall be encouraged, as well as dual plumbing that allows graywater from showers, sinks, and washers to be reused for landscape irrigation in new developments.
- W-P4.6: New development projects shall adopt best management practices for water use efficiency and demonstrate specific water conservation measures.
- W-P5.2: New development projects shall identify and adequately mitigate their water quality impacts from stormwater runoff.

- W-P5.3: Pervious pavements shall be allowed and encouraged where their use will not hinder mobility.

Implementation of the Vina GSP will provide for sustainable groundwater management and is not anticipated to affect water supply assumptions in the General Plans. Information on the Butte County General Plan 2030 and related documents can be found at ~~www.buttegeneralplan.net~~www.buttegeneralplan.net.

Formatted: English (United States)

Formatted: English (United States)

1.3.6.2 City of Chico

The Chico City Council adopted the Chico 2030 General Plan in April 2011. The General Plan was comprehensively reviewed and updated in 2017. Chico's 2030 General Plan reflects the community's commitment to meeting the challenge of creating and maintaining a sustainable community. Sustainability in Chico means maintaining a culture of stewardship to enhance our natural environment, economic strength, and quality of life for present and future generations. The Chico General Plan's goals, policies, and actions are intended to work together to achieve sustainability. The Chico General Plan recognizes that sustainability is an organizing principle, and that the City must consider the interdependent interests of protecting the environment, promoting social equity, and achieving a healthy economy in its actions and programs.

Formatted: English (United States)

To establish a sustainable development trend for the community, the Chico General Plan identifies and promotes certain development patterns, including compact urban development, infill development and redevelopment, mixed-use development, complete neighborhoods, and a variety of housing types. The Chico General Plan further seeks to preserve and enhance its older neighborhoods, promote economic development, protect sensitive environmental resources, and provide open space and parks. To achieve these sometimes-competing goals, the Chico General Plan addresses three distinct areas of the City: areas of stability; areas of potential change; and areas for new growth.

Formatted: English (United States)

The State General Plan Guidelines call for the Chico General Plan to address all land within the City limits, land within the City's designated SOI, and other land in unincorporated Butte County that relates to the City's planning efforts.

Formatted: English (United States)

Chico General Plan Organization

State law requires the General Plan to address the subjects of land use, circulation, housing, noise, safety, conservation, and open space. Additional topics (or "elements") may be covered at the discretion of the jurisdiction, provided that they are consistent with one another. Chico's General Plan includes the following optional elements: Sustainability; Downtown; Community Design; Economic Development; Parks, Public Facilities and Services; and Cultural Resources and Historic Preservation.

Formatted: English (United States)

Parks, Public Facilities, and Services Element

This Element addresses parks, greenways, preserves and recreational open space as well as wastewater service, water facilities, and storm drainage.

The Chico 2030 General Plan Parks, Public Facilities, and Services Element acknowledges:

> *The Tuscan aquifer is the primary groundwater reservoir underlying and providing municipal and agricultural water to the Planning Area. The groundwater supply is*

largely recharged by infiltration in the foothills located east of Chico, from Big Chico and Little Chico Creeks, Lindo Channel, and to a lesser extent from precipitation throughout the area. The California Water Service Company (Cal Water), the City's water supplier, has adopted a Water Master Plan (WMP) which analyzes the aquifer's supply. The WMP concludes that no substantial overdraft of the aquifer is currently occurring within the Planning Area. In addition, Butte County continually monitors the groundwater basin and maintains a series of monitoring and test wells located throughout the County to provide information on water supply.

Relevant Goals, Policies, Actions from the Water Supply and Water Quality section of the Element are provided below:

- Goal OS-3: Conserve water resources and improve water quality.
- Policy OS-3.1 (Surface Water Resources) – Protect and improve the quality of surface water.
- Action OS-3.1.1 (Comply with State Standards) – Comply with the California Regional Water Quality Control Board's (CRWQCB) regulations and standards to maintain, protect, and improve water quality and quantity.
- Policy OS-3.2 (Protect Groundwater) – Protect groundwater and aquifer recharge areas to maintain groundwater supply and quality.
- Action OS-3.2.1 (Protect Recharge Areas) – Avoid impacts to groundwater recharge areas through open space preservation, runoff management, stream setbacks, and clustering of development.
- Action OS-3.2.2 (Map Recharge Areas) – Work with local, state, and regional agencies to identify and map groundwater recharge areas within the SOI.
- Action OS-3.2.5 (Groundwater Protection) – Oppose regional sales and transfers of local groundwater.
- Policy OS-3.3 (Water Conservation and Reclamation) – Encourage water conservation and the reuse of water.
- Action OS-3.3.1 (Water Conservation Program Funding) – Work with Cal Water to implement a water conservation program to reduce per capita water use 20 percent by 2020 pursuant to the requirements of the State Water Plan.
- Action OS-3.3.4 (Reclaimed Water) – Determine the feasibility and costs and benefits of reusing the City's treated wastewater for irrigation.

The Chico 2030 General Plan Parks, Public Facilities, and Services Element acknowledges:

Water service in the City is provided by the California Water Service Company (Cal Water). Cal Water is a private company whose Chico District was formed in 1926. Residents not supplied by Cal Water obtain water through private wells. Cal Water currently uses a system of 65 wells which deliver approximately 27 million gallons of

water to customers each day. The delivery system is composed of over 355 miles of pipeline, seven storage tanks and six booster pumps.

Cal Water maintains two primary management plans for the Chico area water system, as required by state law. Their Urban Area Management Plan, adopted in 2007, provides an overview of Cal Water and the Chico area water system, establishes policies and programs concerning water delivery and treatment, as well as water conservation and management practices. The Water Supply and Facilities Master Plan, adopted in 2008, guides the growth and development of their water delivery system to meet the community's future needs.[3]

Per California Water Code, which requires urban water suppliers to update their plan once every five years, the Cal Water Urban Water Management Plan (UWMP) was updated and adopted in June 2021.

The Water Supply and Facilities Master Plan will be updated in the near future along with a Reliability Study being planned for 2023 for the Cal Water Districts in the region.

Formatted: English (United States)

Relevant Goals, Policies, Actions from the Water Facilities section are provided below:

- Goal Parks, Public Facilities, and Services (PPFS)-5: Maintain a sustainable supply of high-quality water, delivered through an efficient water system to support Chico's existing and future population, including fire suppression efforts.
- Policy PPFS-5.1 (Protect Aquifer Resources) – Protect the quality and capacity of the upper and Lower Tuscan and Tehama aquifers underlying the Chico Planning Area.
- Action PPFS-5.1.1 (Groundwater Protection Advocacy) – Oppose regional sales and transfers of local groundwater, including water export contracts, and actively participate in county-wide and regional discussions and advocacy for the protection of groundwater resources.
- Action PPFS-5.1.2 (Groundwater Supplies and Budgeting) – Support periodic evaluation of groundwater availability using the Butte Basin Groundwater Model (BBGM) and Cal Water's work to establish a water supply budget with specific measures to assure sustainable levels of groundwater.
- Action PPFS-5.1.3 (Groundwater Recharge and Quality) – Where feasible given flood management requirements, maintain the natural or existing condition of waterways and floodplains and protect watersheds to ensure groundwater recharge and water quality.
- Action PPFS-5.1.5 (Monitor Groundwater Levels) – Utilize the annual comprehensive groundwater monitoring data collected by the Butte County

[3] Per California Water Code, which requires urban water suppliers to update their plan once every five years, the Cal Water Urban Water Management Plan (UWMP) was updated and adopted in 2020.

Department of Water and Resource Conservation (BCDWRC) to assess the quality and quantity of water for the Chico area.

- Policy PPFS-5.2 (Future Water System) – Consult with Cal Water to ensure that its water system will serve the City's long-term needs and that State regulations SB 610 and SB 221 are met.
- Action PPFS-5.2.3 (Water Services for New Development) – Work with Cal Water to ensure that water treatment and delivery infrastructure are in place prior to occupancy or assured through the use of bonds or other sureties to the City and Cal Water's satisfaction.
- Policy PPFS-5.3 (Water Conservation) – Work with Cal Water to implement water conservation management practices.
- Action PPFS-5.3.1 (Treated Wastewater) – Explore the feasibility of using treated wastewater to provide irrigation to landscaped areas and other suitable locations to reduce the demand for groundwater.

Implementation of the Vina GSP will provide for sustainable groundwater management and is not anticipated to affect water supply assumptions in the City's General Plan. Information on the City of Chico 2030 General Plan and related documents can be found at ~~https://chico.ca.us/general-plan-other-planning-documents~~https://chico.ca.us/general-plan-other-planning-documents

Formatted: English (United States)

1.3.6.3 Permitting of New Wells

The construction, repair, or destruction of wells are subject to permitting by the Butte County Division of Environmental Health pursuant to Chapter 23B of the Butte County Code, Water Wells. The chapter provides minimum procedures for the proper construction of water wells and for the proper destruction of abandoned wells to ensure that water obtained from wells within the County of Butte will be suitable for the purposes for which it is used, and that wells constructed or abandoned pursuant to this chapter will not cause pollution or impairment of the quality of the groundwater within the county. An additional purpose is to reduce potential well interference problems to existing wells and potential adverse impacts to the environment that could be caused by the construction of new wells or the repair or deepening of existing wells where a permit is required. Important provisions of the chapter include:

Formatted: English (United States)

- The construction, repair, reconstruction, deepening, abandonment, or destruction of wells in Butte County must follow the standards in Bulletin 74-81 and its supplement bulletin 74-90, Water Well Standards, State of California.
- After July 25, 1996, the pumping capacity of a new well cannot be greater than 50 gallons per minute (gpm) per acre to reasonably serve the overlying land, including contiguous parcels of land under the same ownership as the land upon which the well is located.
- Wells can only be drilled by a person licensed to drill water wells pursuant to the provisions of Business and Professions Code section 7000 et seq. possessing a C-

57 water well contractor's license required by section 13750.5 of the California Water Code.

- Domestic well owners are required to ensure that a new well will operate properly, assuming a repeat of the groundwater conditions experienced during the period 1987 through 1994 in the area in which the new well is located.
- Well drillers reports must be filed with Butte County as well as with DWR.
- Notification of well permit applications is required in specific instances to adjoining landowners and/or local agencies with an adopted groundwater management plan pursuant to part 2.75 of division 6 of the California Water Code (commencing at section 10750). Landowners and/or local agencies are provided 30 days to provide comments prior to permit issuance.
- Wells with a casing diameter greater than 8 inches are required to be drilled at specific distances away from existing wells.
- In addition to well sealing requirements specified within state well standards bulletin 74-81 and bulletin 74-90, the seal shall be extended 5 feet into the first consolidated formation encountered below 15 feet to a maximum required sealing depth of 50 feet.

1.3.6.4 Land Use Plans Outside of the Vina Subbasin

The Tehama County General Plan and the Glenn County General Plan and zoning ordinances are the land use plans adjacent to the Vina Subbasin. The Vina GSA will continue to monitor amendments to the Tehama County and Glenn County General Plans.

Formatted: English (United States)

1.4 Groundwater Level Monitoring and Data Sources

Groundwater level programs predominantly used for development of the GSP include BCDWRC, Cal Water, California Statewide Groundwater Elevation Monitoring (CASGEM), and the CA DWR Water Data Library. Each of these programs are discussed below.

Formatted: English (United States)

1.4.1 Butte County Department of Water and Resource Conservation Program

As discussed above, in November 1996, the voters in Butte County approved "AN ORDINANCE TO PROTECT THE GROUNDWATER RESOURCES IN BUTTE COUNTY." The ordinance is now codified as Chapter 33 of the Butte County Code relating to groundwater conservation. Section 3.01 of this code, Groundwater Planning Process, requires the preparation of a groundwater status report based upon the data gathered and analyzed pursuant to Section 3.02, Groundwater Monitoring. In 2000, the Butte County Board of Supervisors amended Chapter 33, the Groundwater Conservation Ordinance, to require the delivery of the Groundwater Status Report by February of each year. In 2010, the Water Commission designated the BCDWRC as the entity responsible for creating and submitting the annual report.

Formatted: English (United States)

In February 2004, the Butte County Board of Supervisors adopted the Groundwater Management Ordinance, which was codified as Chapter 33A of the Butte County Code. Chapter 33A calls for the establishment of a monitoring network and Basin Management Objectives (BMOs) for groundwater elevation, groundwater quality related to saline intrusion and land subsidence. The

Formatted: English (United States)

BMO concept was incorporated into California Water Code §10750 et. seq., as a component of AB 3030 Groundwater Management Plans. On September 28, 2004, the Butte County Board of Supervisors formally approved Resolution 04-181 adopting the countywide AB 3030 Groundwater Management Plan that includes components of the BMO program.

In 2011, Chapter 33A was amended and retitled to "Basin Management Objectives" requiring a report each February describing conditions in the basin relative to established basin management objectives. The foregoing actions by the Board allow the consolidation of reporting of groundwater conditions from both Chapter 33 and 33A into a single report submitted by BCDWRC on an annual basis in February. Groundwater level measurements occur four times per year following this program. Appendix 1-D provides the Groundwater Status Report for the 2020 Water Year following this program. With the new requirements of SGMA, revisions to Chapter 33A were approved in 2019 and will sunset on January 31, 2022, to continue the transition of groundwater management in Butte County from the BMO program to implementation of SGMA in each of the three subbasins in Butte County, including the Vina Subbasin.

Formatted: English (United States)

1.4.2 California Statewide Groundwater Elevation Monitoring

DWR maintains several groundwater level monitoring programs, tools, and resources covering California. The CASGEM Program is DWR's primary resource for groundwater level data and has been used extensively in the development of this GSP. The CASGEM Program was authorized in 2009 by SB X7-6 to establish collaboration between local monitoring parties and DWR to collect and make public statewide groundwater elevation data. The program provides the framework for local agencies or other organizations to "assume responsibility for monitoring and reporting groundwater elevations in all or part of a basin or Subbasin" (Water Code §10927). The BCDWRC is the CASGEM monitoring entity for the Vina Subbasin. The groundwater monitoring program discussed above for BCDWRC complies with the reporting requirements of the CASGEM program.

Formatted: English (United States)

1.4.3 Water Data Library

DWR's Water Data Library (WDL) contains measurements of groundwater elevations from water supply and monitoring wells monitored by numerous entities, such as DWR and local agencies. Groundwater level measurements available from the WDL are either continuously or periodically measured. Continuous measurements are provided by automatic water level measuring devices that take readings at wells; periodic measurements are manual recordings typically occurring at monthly or semi-annual time intervals. Measurements displayed through the WDL are taken through other programs, such as CASGEM. The WDL lists the organization responsible for collecting each water level measurement. The WDL water level measurements are available through the California Natural Resources Agency (CNRA) Open Data website as a bulk download, or through the WDL website on a per station basis.

Formatted: English (United States)

1.4.4 Online System for Well Completion Reports

The OSWCR is a DWR program used to document and compile boring or well completion records throughout California. There are as many as two million domestic, irrigation, and monitoring water wells in California included in this dataset, including more than 4,000 domestic

Formatted: English (United States)

wells located in the Vina Subbasin. However, as discussed in Section 3, the well characteristics in this database are not always accurate or precise, and, unfortunately, it is not known which of the wells in the database are in use or have been abandoned or replaced. When a well is constructed, modified, or destroyed, drilling contractors are required to submit a Well Completion Report (WCR) to DWR for upload to the interactive OSWCR website. OSWCR is used as a data source for wells identified for monitoring. In this GSP, the OSWCR database was used to describe the GSP area and identify SMC.

1.5 Groundwater Quality Monitoring and Data Sources

Groundwater quality programs predominantly used for development of the GSP include BCDWRC, Sacramento Valley Water Quality Coalition (SVWQC), State Water Resources Control Board (SWRCB) Geotracker/ Groundwater Ambient Monitoring and Assessment Program (GAMA) and the DWR WDL. Each of these programs are discussed below.

1.5.1 Butte County Department of Water and Resource Conservation Program

As discussed in Section 1.4.1, the former BMO program ~~developed~~(Chapter 33A) implemented by Butte County ~~includes~~included groundwater quality monitoring ~~that is presented annually in~~. Although the ~~Groundwater~~ ordinance sunset, the Butte County Department of ~~Status Reports. Appendix 1-D provides the~~ Water ~~Year 2020 Groundwater Status Report summarizing the results of this~~and Resource Conservation continues to conduct groundwater quality trend monitoring and provides the data to GSAs within Butte County.

1.5.2 Sacramento Valley Water Quality Coalition

Because irrigated agriculture is the predominant land use in the Vina Subbasin, monitoring of the groundwater quality data developed through the Groundwater Quality Trend Monitoring Work Plan (GQTMWP) being implemented by the SVWQC for compliance with the Central Valley Regional Board's Irrigated Lands Regulatory Program (ILRP) is an important source of information to GSAs in the Vina Subbasin. This program is implemented by California Rice Commission that submits annual reports on groundwater quality throughout the region.

1.5.3 Geotracker/Groundwater Ambient Monitoring and Assessment

GeoTracker, operated by the SWRCB, contains records for sites that require cleanup, such as leaking underground storage tank (LUST) sites, Department of Defense sites, and cleanup program sites. GeoTracker also contains records for various unregulated projects as well as permitted facilities including ILRP, future CV-SALTS, oil and gas production, operating permitted underground storage tanks, and land disposal sites. GeoTracker receives records and data from SWRCB programs and other monitoring agencies.

The Geotracker System also contains links to GAMA. The GAMA Program is California's comprehensive groundwater quality monitoring program that was created by the SWRCB in 2000. It was later expanded by AB ~~599~~ 599 - the Groundwater Quality Monitoring Act of 2001. AB 599 required the State Water Board, in coordination with an Interagency Task Force and Public Advisory Committee (PAC) to integrate existing monitoring programs and design new program elements as necessary, resulting in a ~~publicly accepted plan~~publicly accepted plan to monitor and assess groundwater quality in basins that account for 95% of the state's groundwater

Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)

use. The GAMA Program is based on interagency collaboration with the State and Regional Water Boards, DWR, Department of Pesticide Regulations, USGS, and Lawrence Livermore National Laboratory, and cooperation with local water agencies and well owners.

1.5.4 Water Data Library

DWR's WDL contains groundwater quality data in addition to the groundwater level records described previously. This information includes data from discrete groundwater quality samples collected by DWR and other cooperating entities. These water quality data list the entity responsible for taking the sample but do not specify what program the sample was taken under. The WDL water quality measurements are available through the CNRA Open Data website as a bulk download or through the WDL website on a per-station basis. WDL water quality measurements in this GSP are utilized for basin characterization but are acquired from the other programs.

Formatted: English (United States)

1.6 Subsidence

To determine whether subsidence is occurring, a subsidence monitoring network ~~has been~~was established throughout Butte County consisting of observation stations and extensometers managed by DWR. Within the Vina Subbasin this network of monuments existed between 2008 to 2017 and has been replaced by data from satellite- and aircraft-based Interferometric Synthetic Aperture Radar (InSAR) from DWR. As of 2025, one GPS station continues to record vertical displacement within the Subbasin.

A summary of the historic information within the Vina Subbasin obtained from these networks is presented in Section 2, Basin Setting, and the monitoring network for implementation of the GSP is discussed in Section 4, Monitoring Networks.

1.6.1 DWR Subsidence Network

The historic observation stations ~~are~~were a result of DWR's efforts to establish a subsidence monitoring network across the valley to capture changes in the ground surface elevation. The observation stations are established monuments with precisely surveyed land surface elevations. They are distributed throughout the valley such that the entire county is well represented. In 2008, DWR along with numerous partners performed the initial Global Positioning System (GPS) survey of the observation stations to establish a baseline measurement for future comparisons. The network was resurveyed in 2017 using similar methods and equipment as those used in the 2008 survey and results were analyzed to depict the change in elevation at each station between those years. Results of the survey are available here, ~~https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#landsub~~https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#landsub

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Extensometers are installed in wells or boreholes and are a more site-specific method of measuring land subsidence as they can detect changes in the thickness of the sediment surrounding the well due to compaction or expansion. These instruments are capable of detecting very slight changes in land surface elevation on a continuous basis with an accuracy of +/- 0.01 feet or approximately 3 millimeters (mm). The three extensometers in Butte County have a period of record beginning in 2005 and were chosen by DWR based on a high likelihood of seeing subsidence in these areas if it were to occur, based on the presence of known clay and

Formatted: English (United States)

other fine-grained deposits in these areas. Data are available through July 2020 from the DWR Water Data Library. A summary of the historic information within the Vina Subbasin obtained from these networks is presented in Section 2, Basin Setting, and the monitoring network for implementation of the GSP is discussed in Section 4, Monitoring Networks.

1.6.2 Interferometric Synthetic Aperture Radar (InSAR) Satellite Data

DWR provides Interferometric Synthetic Aperture Radar (InSAR) satellite data available on their SGMA Data Viewer web map[4] and DWR WDL, including downloadable raster datasets to estimate subsidence (DWR contracted TRE Altamira to make this data available). The dataset is generated from two satellites operated by the Sentinel mission, which is part of the European Radar Observatory for the Copernicus joint initiative of the European Commission and the European Space Agency (ESA). Data calibration uses Global Navigation Satellite System (GNSS) stations within California and one GNSS station resides within Butte County near Lake Oroville. The dataset nearly covers the entire Subbasin, with some gaps in the southwest. The TRE Altamira InSAR dataset provides estimates of total vertical displacement from June 2015 to present.

1.7 Interconnection of Databases

Several of the databases discussed above utilize the same water level or water quality data. These records often specify the monitoring entity responsible for the measurement. Although these data overlap between databases, the correlation between databases is not specified. For example, water level data in the WDL are also in CASGEM, but this link is not mentioned in WDL records. This lack of connection poses problems for gathering water level and quality data throughout California. Efforts have been made in the development of this GSP to overcome the issue related to overlap and poor correlation between databases, but the issue remains. It is recommended that agencies work together to utilize a common unique identifier to ease use of multiple datasets.

1.8 Notice and Communication (23 California Code of Regulations § 354.10)

1.8.1 Notice of Intent to Adopt Groundwater Sustainability Plan

A notice of intent (NOI) to adopt ~~a~~the 2022 GSP ~~was~~and amended GSP were signed by the ~~GSAs~~GSA and distributed on June 28, 2021~~.~~ and September XX, 2026; respectively. The hard copies of the ~~NOI~~NOIs were mailed to cities and counties within the Vina Subbasin including the following:

- Butte County
- City of Chico

Copies of the NOI are provided in Appendix 1-B.

Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)

[4] https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#landsub

1.8.2 Overview

California's SGMA of 2014 requires broad and diverse stakeholder involvement in GSA activities and during the development and implementation of GSPs for groundwater basins around the state, including the Vina Subbasin. The intent of SGMA is to ensure successful, sustainable management of groundwater resources at the local level, success of GSP development and implementation will require cooperation by all beneficial users (defined below). Therefore, coordinated communication and consistent messaging of valid information and facilitation of opportunities for the involvement of beneficial users will guide the path forward.

To facilitate stakeholder involvement in the GSA process, a Communication and Engagement Plan (C&E Plan) (Appendix 1-E) was created for the Vina GSA. The desired outcomes and goals of the C&E Plan were to:

Formatted: English (United States)

Outcomes: The desired outcome of the C&E Plan was to achieve understanding and support for GSP adoption and implementation in consideration of the people, economy, and environment within the Vina Subbasin and in coordination with adjacent subbasins.

Plan Goals:

1. Enhance understanding and inform the public about water and groundwater resources in the Vina Subbasin, the purpose and need for sustainable groundwater management, the benefits of sustainable groundwater management, and the need for a GSP.
2. Engage diverse interested parties and stakeholders and promote informed feedback from stakeholders, the community, and groundwater-dependent users throughout the GSP preparation and implementation process.
3. Coordinate communication and involvement between the GSA (Board, Stakeholder Advisory Committee and Management Committee), Rock Creek Reclamation District GSA, and other local agencies, elected and appointed officials, and the general public.
4. Rely on the Stakeholder Advisory Committee to facilitate a comprehensive public engagement process.
5. Employ a variety of outreach methods that make public participation accessible and that encourage broad participation.
6. Respond to public concerns.
7. Provide accurate and up-to-date information.
8. Create public value and use GSA resources wisely by managing communications and engagement in a manner that is resourceful and efficient.

1.8.3 Description of Beneficial Uses and Users in the Vina Subbasin

SGMA calls for consideration of all interested parties that the GSA must consider when developing and implementing the GSP. GSAs must encourage the active involvement of diverse social, cultural, and economic elements of the population. Therefore, stakeholders or beneficial users are any stakeholders who have an interest in groundwater use and management in the Vina

Subbasin. Their interest may be related to GSA activities, GSP development and implementation, and/or water access and management in general.

To assist in identifying categories of beneficial users in the Vina Subbasin, the C&E Plan listed broad categories of interested parties to be considered during development and implementation of the GSP. These include, but are not limited to:

- General public
- Agricultural users of water
- Domestic well owners
- Municipal well operators
- Public water systems
- Land use planning agencies
- Environmental users of groundwater
- Surface water users
- The federal government
- California Native American tribes
- Disadvantaged communities and historically underrepresented groundwater users (including those served by private domestic wells or small community water systems)

Table 1-1 further identifies potential stakeholder groups and engagement purpose.

Formatted: English (United States)

Formatted: English (United States)

Table 1-1: Stakeholder Engagement Chart for Groundwater Sustainability Plan Development

Category of Interest	Examples of Stakeholder Groups	Engagement purpose
General Public	• Citizens groups • Community leaders • Service clubs and professional organizations	Inform to improve public awareness of sustainable groundwater management
Private users	• Private pumpers • Domestic users • School/College systems; Butte College • Hospitals	Inform and involve to minimize negative impact to these users
Urban/ Agriculture users	• Water agencies • Colleges/Universities; Butte College, CSUC • Water associations; Groundwater Pumpers Advisory Committee, Agricultural Groundwater Users of Butte County • Irrigation districts; Durham Irrigation District (member agency), Rock Creek Reclamation District (a GSA within Vina Subbasin) • Mutual water companies • Resource conservation districts • Farm Bureau: Butte County Farm Bureau	Collaborate to ensure sustainable management of groundwater
Industrial users	• Commercial and industrial self-supplier • Local trade association or group	Inform and involve to avoid negative impact to these users
Land Use Planning Agencies	• Municipalities (City, County planning departments): • Regional land use agencies	Consult and involve to ensure land use policies are supporting GSPs
Environmental and Ecosystem	• Regional agencies: Butte County Resource Conservation District • Federal and State agencies: California Department of Fish and Wildlife (CDFW); National Oceanic and Atmospheric Administration; United States Fish and Wildlife Service • Environmental groups: Butte Environmental Council, The Nature Conservancy	Inform and involve to sustain a vital ecosystem
Economic Development	• Chambers of commerce: City of Chico • Business groups/associations • Elected officials (Board of Supervisors, City Council) • State Assembly members • State Senators	Inform and involve to support a stable economy
Human right to water	• Disadvantaged Communities • Small community systems • Environmental Justice Groups: Leadership Council for Justice and Accountability, Self-Help Enterprises, Community Water Center	Inform and involve to provide a safe and secure groundwater supplies to all communities reliant on groundwater
Tribes	• Federally Recognized Tribes and non-federally recognized Tribes with Lands or potential interests in the Vina Subbasin such as the Meechoopda Indian tribe of Chico Rancheria	Inform, involve and consult with tribal government

Category of Interest	Examples of Stakeholder Groups	Engagement purpose
Federal lands	• United States Bureau of Reclamation (USBR) • Bureau of Land Management • United States Fish and Wildlife Service (USFWS)	Inform, involve and collaborate to ensure basin sustainability
Integrated Water Management	• Regional water management groups (IRWM regions); Upper Feather River IRWM and the North Sacramento Valley IRWM group • Flood agencies	Inform, involve and collaborate to improve regional sustainability

1.8.4 Communications

1.8.4.1 Decision-making Processes

As noted above, two GSAs were formed in the Vina Subbasin for GSP development: the Vina GSA and the RCRD GSA. The two GSAs have jointly developed this coordinated GSP.

GSA Boards are the final decision-makers for the Vina Subbasin. To assist in GSP development, the Vina GSA convened a Stakeholder Advisory Committee (SHAC) in 2019. The composition of the SHAC is intended to represent the beneficial uses and users of groundwater in the Vina GSA. The SHAC is comprised of seven at-large members appointed by the GSA Board~~ and three members~~, one member representing Cal Water~~, City of~~ Chico, ~~CSUC, and Butte College~~one Water Scientist member, one Non-Irrigated/Rangeland User member, and one non-voting member representing RCRD. The SHAC is charged with actively engaging with the public for input and feedback. The SHAC has been meeting approximately monthly since its formation.

Generally, the representatives attending the GSA Management Committee meetings are designated staff from the member agencies. In addition to administering the SHAC and GSA Board, the GSA Management Committee assists the SHAC in identifying and clarifying recommendations for GSP development and implementation, which are presented to the GSA Boards in public meetings.

1.8.4.2 Public Engagement Opportunities

There were a number of different meetings at which the public had the opportunity to engage during the GSP development process:

- GSA Board meetings: The Vina GSA Board and the RCRD GSA Board in the Vina Subbasin held regular public meetings, including joint meetings, to facilitate public input. The RCRD GSA held regular public meetings in many cases in conjunction with the Reclamation District's standing board meetings.
- Subbasin-wide technical meetings.
- SHAC meetings.
- Farm Bureau Water Forum meetings.
- City of Chico meetings.
- Regional Water Management Group meetings.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

1.8.4.3 Encouraging Active Involvement

The GSAs carried out community engagement during the development of the GSP, which included meetings and presentation materials to inform the public. The GSP has been revised to incorporate public feedback. There were also activities related to encouraging involvement and building capacity for engagement. The GSAs Management Committees used a variety of tools to solicit input, including maintaining an up-to-date website with announcements, calendar of events and meetings, and links to draft sections of the GSP; establishing an interested parties list; email newsletters; brown bag seminars, workshops, webinars, and public notices. These documents and events encouraged and prepared community members to participate in GSP development by providing technical information, as well as information about opportunities for engagement.

Formatted: English (United States)

As part of the 40-day public review period initiated on September 10, 2021, with issuance of the Public Draft of the GSP, the GSA Management Committee worked with the numerous entities to inform them about the plan and encourage their involvement. Appendix 1-E lists the SGMA public meetings that were held throughout the GSAs formation and GSP preparation process.

Formatted: English (United States)

Update after 2026 public review process.

1.8.4.4 Soliciting Written Comments

In addition to soliciting feedback at GSA meetings, opportunities were provided to offer written comments on the various sections of the GSP as draft versions became available. Stakeholders could provide comments via an online comment form, letter, or email. An informal comment period began when the draft of the first section of the GSP was released in April 2019, and an official 40-day comment period began with issuance of the Public Draft of the GSP on September 10, 2021, that continued through October 19, 2021. In addition, a special GSP Advisory Committee meeting was held after the 40-day public comment period on November 4, 2021, to solicit comments. All comments received via the comment form, letter, or email were provided to the SHAC and Vina GSA Board in agenda packets for review.

Formatted: English (United States)

On November 15, 2021, the Vina and RCRD GSAs conducted a joint public hearing where the GSA Management Committee provided an overview of public comments and the methods for responding to these comments. In addition, three proposed revisions to the Public Draft were presented to GSA Boards. Additional public comments were received and recorded for each of the proposed revisions and to the overall Public Draft GSP.

Formatted: English (United States)

A revised GSP based on the public comments was provided the GSAs on December 9, 2021. The GSA Boards reviewed the recommended changes and took action to approve the functional changes to the Public Draft GSP on December 15, 2021. The written comments and responses can be found in Appendix 1-F.

Formatted: English (United States)

Update after 2026 public review process.

1.8.5 Informing the Public About Groundwater Sustainability Plan Development Progress

1.8.5.1 Interested Parties List

An email distribution list of Vina Subbasin-wide stakeholders and beneficial users was developed for outreach throughout the GSP planning process. Any interested member of the public may request to be added to the list via this link: Contact Us - Vina Groundwater Sustainability Agency (vinagsa.org)

1.8.5.2 Distribution of Flyers

Typically, before a public meeting in the Vina Subbasin, an email flyer was created with key information provided. The flyer was emailed out to the Interested Party list.

1.8.5.3 Press Outreach

Press releases were issued at key junctures and decision-making points for the Vina Subbasin.

1.8.5.4 A Centralized Vina GSA Website

Throughout the planning process (and beyond), the Vina GSA has maintained a website with information about Vina Subbasin-wide planning efforts related to SGMA.

Formatted: English (United States)

The Vina Subbasin website contains:

Formatted: English (United States)

- Homepage with links to key pages within the site
- About Us, with an overview of the Vina GSA and SGMA
- Governance that describes the structure of the GSAs, Board Members, SHAC Members, Meeting Dates and Agendas, and Transparency Documents
- Calendar of Board and SHAC Meetings and Workshops
- Library Links, including the GSP
- Contact Us page for email correspondence

1.8.5.5 Stakeholder Input and Responses

The engagement opportunities described above provided various avenues for stakeholders to provide input on GSP development. The matrix in Appendix 1-E summarizes the public comments received, organized by commenter, organization, section/line of comment location, comment, and location of where the comment was addressed or changed within the final document, as applicable.

1.9 Human Right to Water

Not formerly included in DWR's GSP checklist, but still important to address, is human right to clean water. California Water Code Section 106.3, Human Right to Water, states that "every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes." Private domestic well groundwater pumper representation on the Advisory Committee and community engagement via public workshops and outreach are venues through which those potentially most vulnerable to loss of clean drinking water ~~are able to~~can share information and concerns throughout the GSP development

Formatted: English (United States)

Formatted: English (United States)

and implementation. During preparation of this GSP public meetings were held at times, locations, and in a manner, both in-person and remotely online that supported and allowed for effective engagement of all stakeholders.

Formatted: English (United States)

Formatted: English (United States)

Formatted: Font: Times New Roman, 8.5 pt, Not Bold, Font color: Auto, English (United States), Not All caps

2. BASIN SETTING

2.1 Hydrogeologic Conceptual Model

A Hydrogeologic Conceptual Model (HCM) identifies the major factors contributing to groundwater flow and movement and how physical features and characteristics affect conditions within a subbasin. This section describes the HCM for the Vina Subbasin. The HCM serves as an important component of the basin setting, providing the framework for understanding groundwater conditions and water budgets.

Formatted: English (United States)

Much of the information in this section is drawn from existing reports detailing the hydrogeology of the Sacramento Valley and the formations making up the aquifer systems in the groundwater basin. These reports include the Geology of the Northern Sacramento Valley (DWR, 2014) and the Butte County Groundwater Inventory Analysis, 2005 (DWR, 2005). Local studies include the Butte County Lower Tuscan Aquifer Monitoring, Recharge, and Data Management Project Final Report (Brown and Caldwell, 2013), the Stable Isotope Recharge Study (Brown and Caldwell, 2017), Butte County Water Inventory and Analysis Report (Davids Engineering, 2016), and the Hydrostratigraphy and Pump-Test Analysis of the Lower Tuscan/Tehama Aquifer, Northern Sacramento Valley (Greene and Hoover, 2015). Better understanding the hydrogeology, aquifer dynamics, and recharge paths of the aquifer systems in the Northern Sacramento Valley region is an area of active study and research.

Formatted: English (United States)

2.1.1 Basin Boundaries

2.1.1.1 Lateral Boundaries

The Vina Subbasin lies in the eastern central portion of the Sacramento Groundwater Basin. It is bounded by the following subbasins: Los Molinos Subbasin to the north; Corning Subbasin to the west; Butte Subbasin to the south; and a small portion of the Wyandotte Creek Subbasin on the southeast border (Figure 1-3).

Formatted: English (United States)

The lateral boundaries of the Vina Subbasin are jurisdictional in nature, and it is recognized that groundwater flows across each of the defined boundary lines to some degree. The northern boundary is the Butte-Tehama County line, the western boundary is the Butte-Glenn County line, the southern boundary is a combination of the property boundaries owned by the M&T Ranch, and the service area boundaries of RD 2106 and Western Canal Water District, and the eastern boundary is the edge of the alluvium as defined by DWR Bulletin 118 Update 2003 (DWR, 2003).

Formatted: English (United States)

2.1.1.2 Bottom of Basin

Continental sediments of the Tehama, Tuscan, and Laguna Formation compose the major fresh groundwater-bearing formations in the valley. The base of these continentally derived formations is generally accepted as the base of fresh water in the northern Sacramento Valley (Berkstresser, 1973; Olmsted and Davis, 1961, as cited in DWR, 2014). DWR has corroborated this assertion through analysis of geophysical logs and water quality sampling results obtained from groundwater level observation wells that have been drilled, installed, and tested since the year 2000 in the northern Sacramento Valley (DWR, 2014).

Formatted: English (United States)

Locally, the base of fresh groundwater fluctuates depending on local changes in the subsurface geology and geologic formational structure (DWR, 2005). In the Vina Subbasin, this is especially the case in the southeastern area of the Subbasin where marine sediments occur at shallower depths on the margins of the valley. Figure 2-1 shows the base of fresh groundwater in the Vina Subbasin ranging from 800 to 1,200 feet below ground surface (bgs) (Berkstresser, 1973).

Formatted: English (United States)

2.1.2 Topography, Surface Water and Recharge

2.1.2.1 Terrain and Topography

Elevations within the Vina Subbasin generally decrease from the northeast to the southwest, with elevations ranging from about 700 feet above mean sea level (msl) in the low foothill area in the east to approximately 150 feet msl along the Sacramento River in the northwest area of the Vina Subbasin and 130 feet above msl along the boundary of Western Canal Water District. The topography encourages drainage towards the Sacramento River and to the south. More significant topographic relief occurs along the eastern margin of the basin and in the southeastern area of the Vina Subbasin. Figure 2-2 shows the topography of the Vina Subbasin.

2.1.2.2 Soils

The area generally west of Highway 99 and north of Butte Creek where the dominant crops are orchards is underlain by lighter textured soils consisting of loamy sands and sandy loams. Heavier soils with slower infiltration or a restrictive layer located in the southeastern area of the Vina Subbasin are well suited for growing rice. Figure 2-3 shows the distribution of hydrologic soil groups for the Vina Subbasin. Soils designated as C/D are lands having soils that would have been classified as having very low infiltration rates (Group D) but have characteristics such as natural slope or management improvements that improved their drainage relative to that of similar soils.

Formatted: English (United States)

Based on the Digital General State Soil Geographic dataset (STATSGO2), soil data for the Vina Subbasin, the dominant soil mapping unit within the area is well-drained Vina-Brentwood (s642), which represents approximately 30.6% of the Vina Subbasin. Other common well-drained soils within the Vina Subbasin include Toomes-Supan (16.6% of area), Vina-Riverwash-Reiff-Columbia (12.3% of area), and Stockton-Clear Lake-Capay (5.9% of area). The Corning-Anita (9.8% of area) is somewhat poorly drained. Characteristics of these soils are summarized in Table 2-1. The distribution of dominant soils (e.g., “map units”) in the Vina Subbasin is shown in Figure 2-4.

Formatted: English (United States)

Formatted: Font: Not Bold, English (United States)

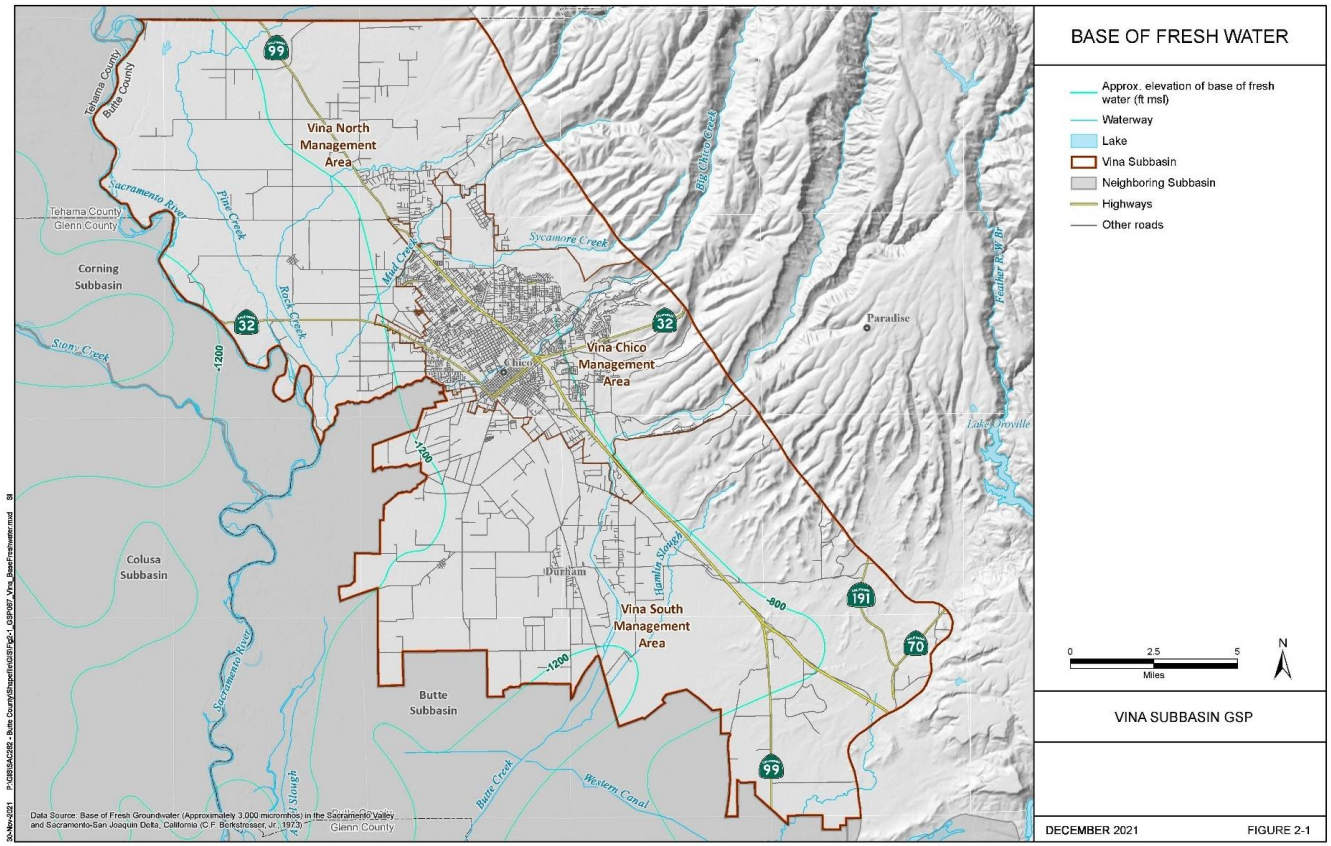


Figure 2-1 ~~placeholder page~~ : Base of Fresh Groundwater

Formatted: Caption,Caption1

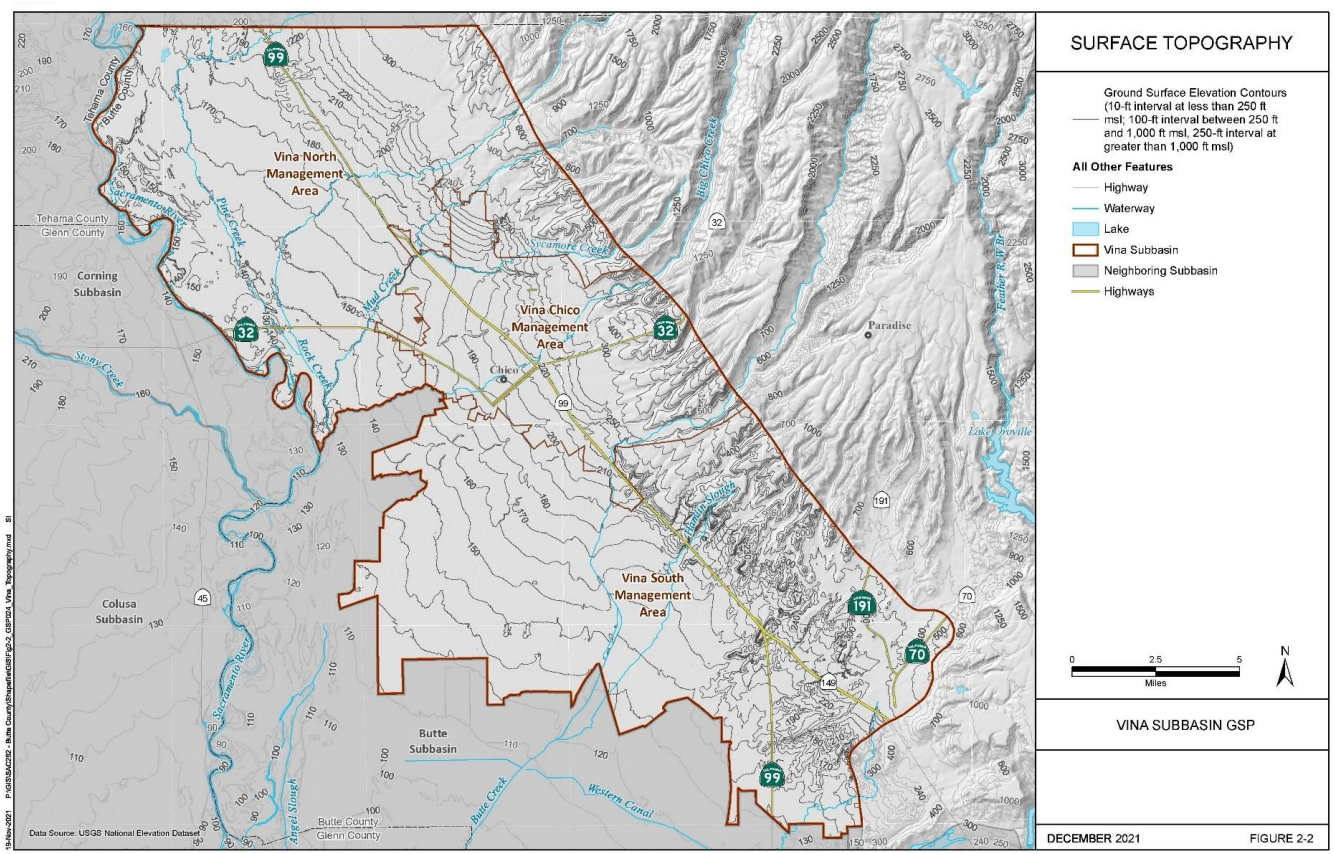


Figure 2-2 ~~placeholder page~~ : Surface Topography

Formatted: Caption,Caption1

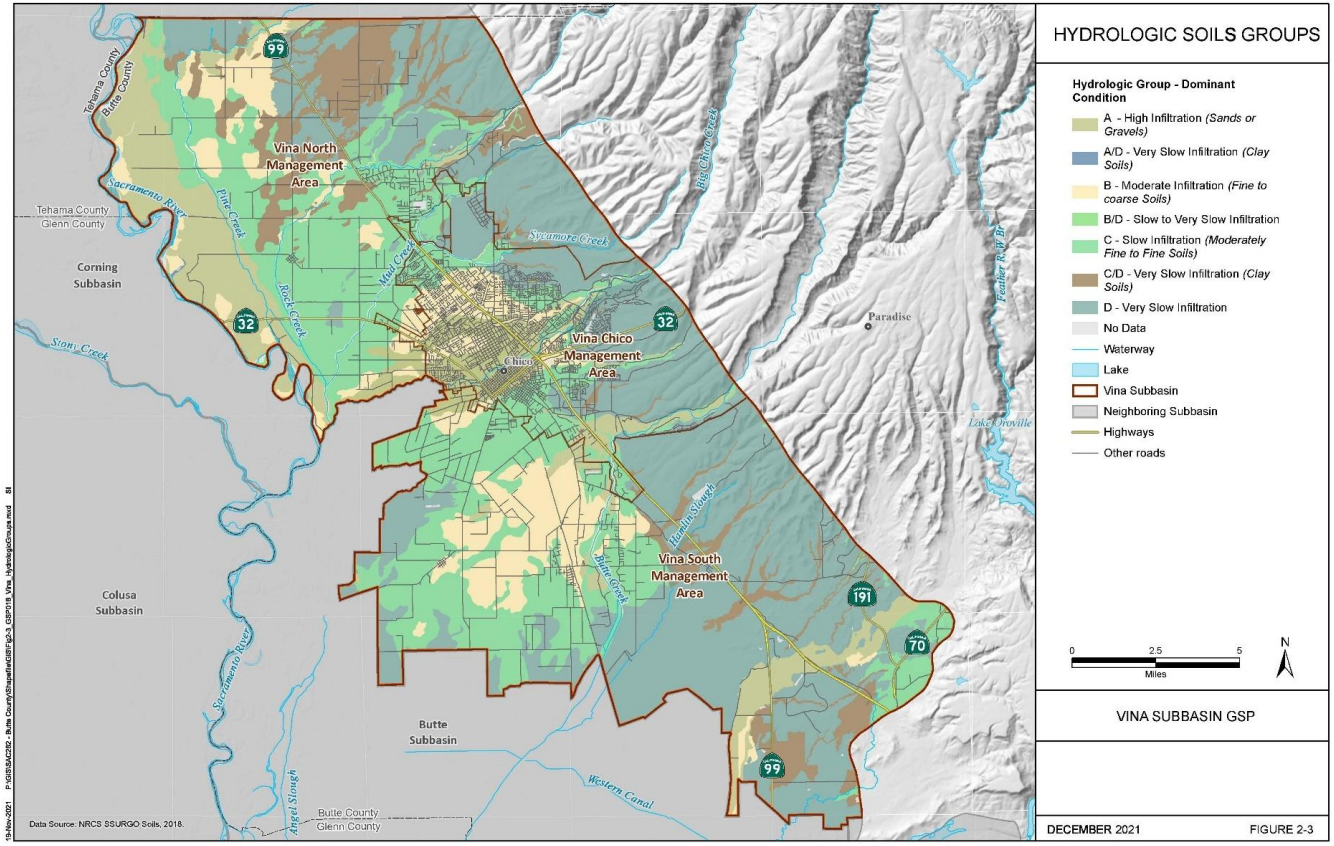


Figure 2-3 ~~placeholder page~~ **: Hydrologic Soils Groups**

Formatted: Caption,Caption1

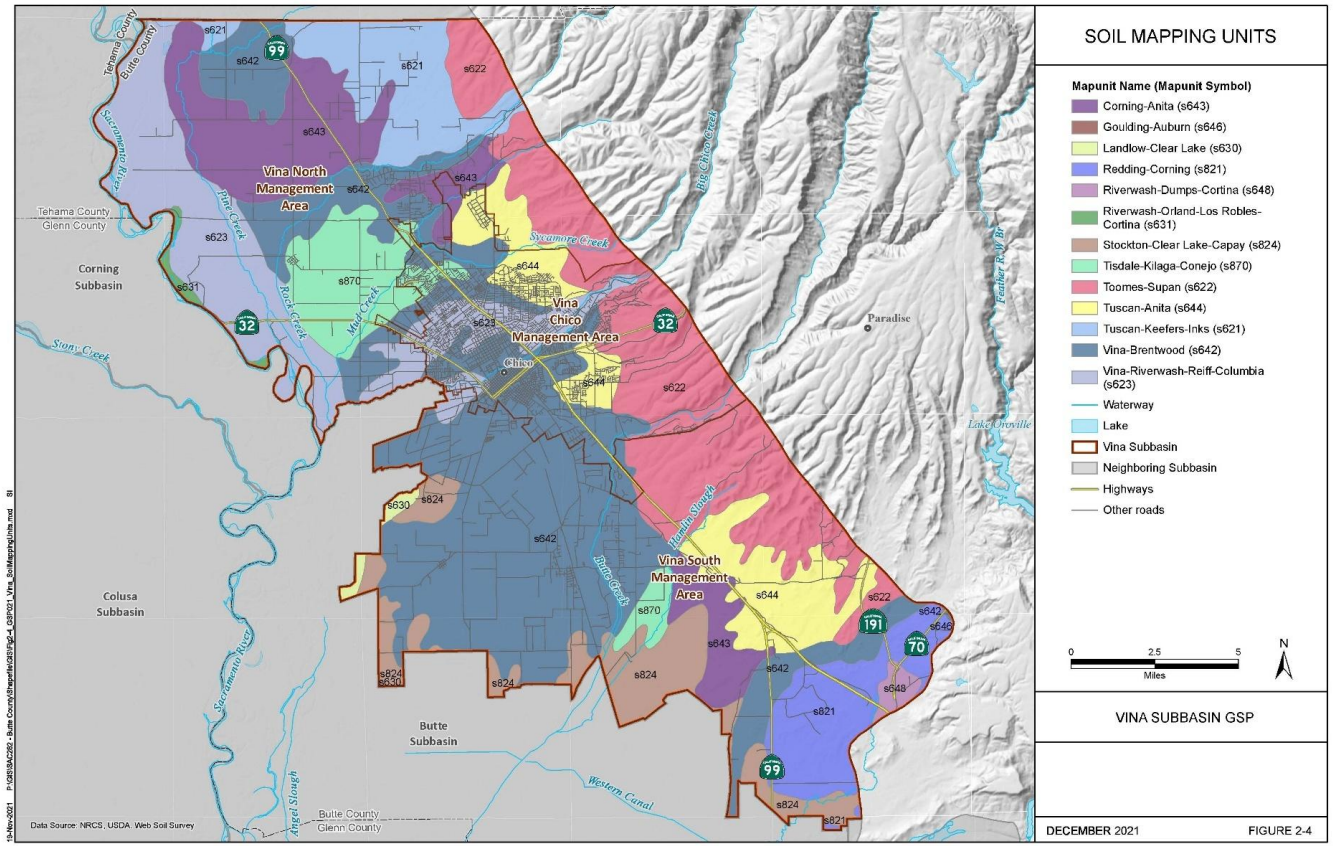


Figure 2-4 ~~placeholder page~~ **: Soil Mapping Units**

Formatted: Caption,Caption1

Table 2-1: STATSGO2 Soils Table for Vina Subbasin

Soil Map Unit	Percent of Area	Sum of Acres	Slope Range	Drainage
Corning-Anita (s643)	9.8%	18,159	4.3	Somewhat poorly drained
Goulding-Auburn (s646)	0.0%	14	1	Somewhat excessively drained
Landlow-Clear Lake (s630)	0.4%	684	5.3	Moderately well drained
Redding-Corning (s821)	4.9%	9,121	2.6	Well drained
Riverwash-Dumps-Cortina (s648)	0.5%	936	1	Poorly drained
Riverwash-Orland-Los Robles-Cortina (s631)	0.4%	709	1	Well drained
Stockton-Clear Lake-Capay (s824)	5.9%	10,967	1.1	Poorly drained
Tisdale-Kilaga-Conejo (s870)	5.3%	9,868	2.6	Well drained
Toomes-Supan (s622)	16.6%	30,721	27.8	Well drained
Tuscan-Anita (s644)	7.6%	14,096	1.2	Well drained
Tuscan-Keefers-Inks (s621)	5.5%	10,244	25.8	Well drained
Vina-Brentwood (s642)	30.6%	56,675	3.1	Well drained
Vina-Riverwash-Reiff-Columbia (s623)	12.3%	22,723	9.4	Well drained
Vina Subbasin	100%	184,918		

2.1.2.3 Surface Water

Surface Water Sources and Channels

The Sacramento River borders the Vina Subbasin on its western side. Other larger surface water bodies traversing the Vina Subbasin include Big Chico Creek and Butte Creek. Smaller local or ephemeral streams entering and traversing the Vina Subbasin include Pine Creek, Rock Creek, Mud Creek, Sycamore Creek, Little Chico Creek, Hamlin Slough, Little Dry Creek, and Clear Creek. Lindo Channel (Sandy Gulch) and the Sycamore Bypass Channel are flood control channels for the City of Chico. Figure 2-5 shows the locations of rivers, streams, and major water supply, and drainage features.

Water for power generation is transferred from the Feather River watershed to the Butte Creek watershed. Water from the West Branch of the Feather River is diverted to the Toadtown Canal for power generation and cold water for fish by the Pacific Gas and Electric Company (PG&E). The Butte Canal carries Toadtown Canal and Butte Creek water to the De Sabla power plant forebay. Hydropower is also generated at several other locations. Operations at all of these sites affect the timing of water releases. Diversions from Butte Creek supplies water for irrigation in portions of the Vina Subbasin.

Stream-groundwater interaction is an important component of groundwater dynamics in the Vina Subbasin. In some areas, runoff and streamflow in creeks and streams provide a source of recharge to the aquifer system. Additionally, in some places and at times, groundwater contributes to streamflow and is an outflow from the groundwater system.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

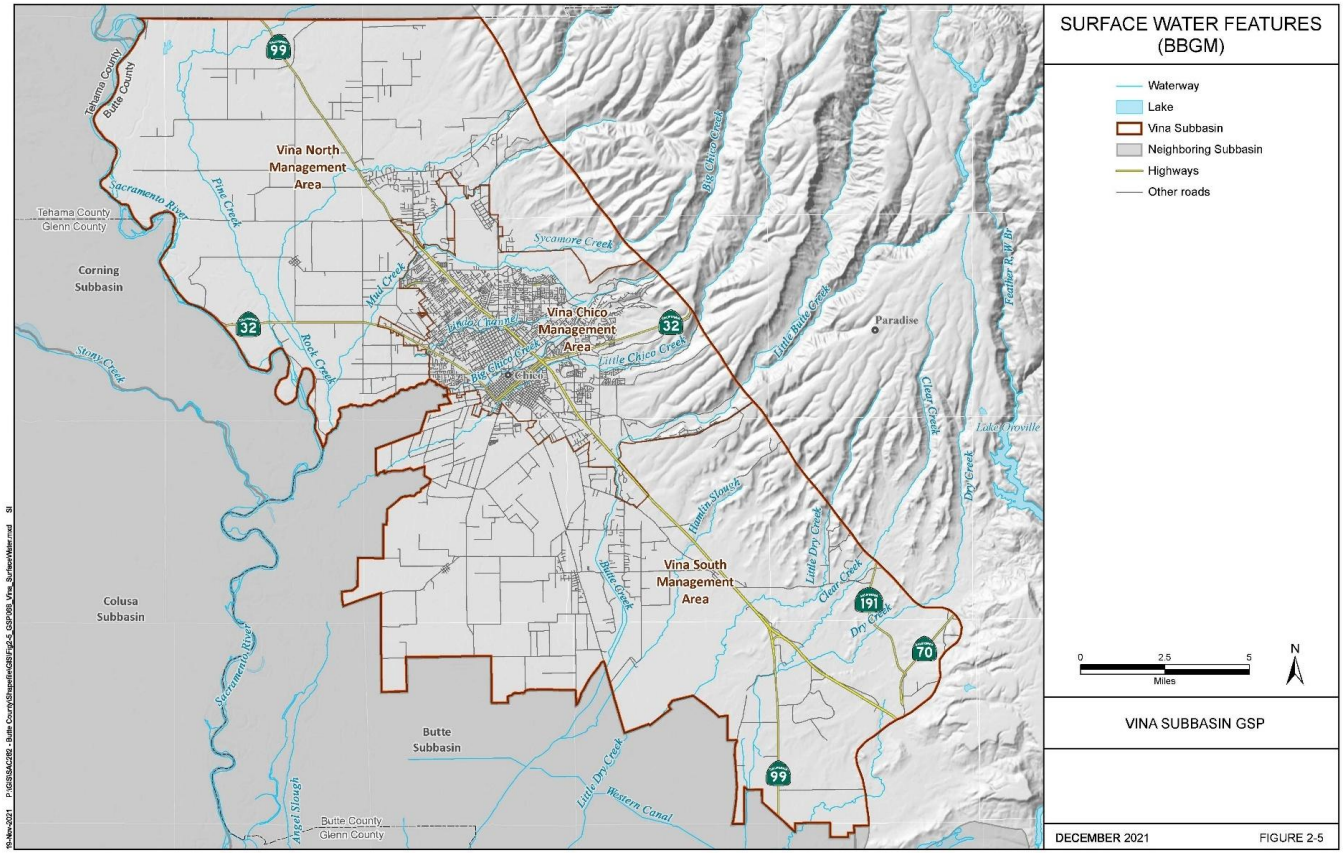


Figure 2-5 ~~placeholder page~~: Surface Water Features

Formatted: Caption,Caption1

2.1.2.4 Groundwater Recharge Areas

Groundwater recharge is the downward movement of water from the surface to the groundwater system. This can include percolation of water from rainfall, irrigation, or water bodies (rivers, lakes). Several water sources and mechanisms recharge the groundwater system in the Vina Subbasin.

The Stable Isotope Recharge Study (Brown and Caldwell, 2017) delineated three areas based on land surface elevation that are general sources of precipitation and serve as water sources to the surface water and groundwater systems in Butte County. Figure 2-6, reproduced from Brown and Caldwell (2017), shows these areas labeled as Upper Watershed, Lower Foothills, and Valley Floor. Identifying these source areas and then observing the destination of that source water within the aquifer system using stable isotope analysis for samples from multi-completion wells led to insights about recharge sources and mechanisms in the Vina Subbasin.

Formatted: English (United States)

The Vina Subbasin is located primarily within the Valley Floor area, as shown in Figure 2-6. The Upper Watershed receives rain and snow, primarily during the winter and spring months. Rainfall runoff and snowmelt from the Upper Watershed enters the Valley Floor via streamflow of major streams and rivers that originate at higher elevations, including Butte Creek and the Sacramento River. Geologically, the Upper Watershed consists primarily of volcanic, granitic, and metamorphic rocks that do not have any appreciable primary porosity. Fracturing within these rock units may occur locally, but the fractures are not pervasive on a regional scale, which limits the amount of water that can percolate into the bedrock geologic units and the volume of groundwater available to migrate to other regions such as the valley alluvial groundwater basin on the Valley Floor (Brown and Caldwell, 2017).

Formatted: English (United States)

The Lower Foothills region occurs within a relatively narrow topographic band along the eastern edge of the Sacramento Valley and contains the outcrop of the Tuscan Formation in addition to small alluvial fans and other Recent sedimentary deposits that directly overlie the Lower Tuscan Formation. Rainfall that occurs in the Lower Foothills may percolate into the Tuscan Formation and the recent alluvial sediments or it may run off through local, ephemeral streams to the Valley Floor. In both cases, this precipitation source is potentially a direct source of recharge to the aquifer system.

Formatted: English (United States)

Recharge mechanisms vary both by depth and area across the Vina Subbasin. Results from stable isotope data indicated that the only route by which the Upper Watershed provides recharge to the groundwater system in the vicinity of Butte Creek in the Vina South MA is through percolation of water from water bodies (i.e., streamflow) at the surface within the Valley Floor. This includes percolation from Butte Creek and possibly the Sacramento River as they traverse the Vina Subbasin, or via percolation of applied surface water for irrigation diverted from Butte Creek or the Sacramento River. Evidence of the Upper Watershed water source was observed in isotope data in relatively shallow portions of the aquifer system (400 feet bgs or shallower).

Formatted: English (United States)

Isotope data from well samples indicated that intermediate and deeper depth intervals are recharged from rainfall and percolation in the Lower Foothills region. Rainfall in this region percolates directly into the Tuscan Formation at the outcrop or may percolate into the small alluvial fans and other sedimentary deposits in the Lower Foothills area.

Formatted: English (United States)

~~Figure 2-6 placeholder page~~

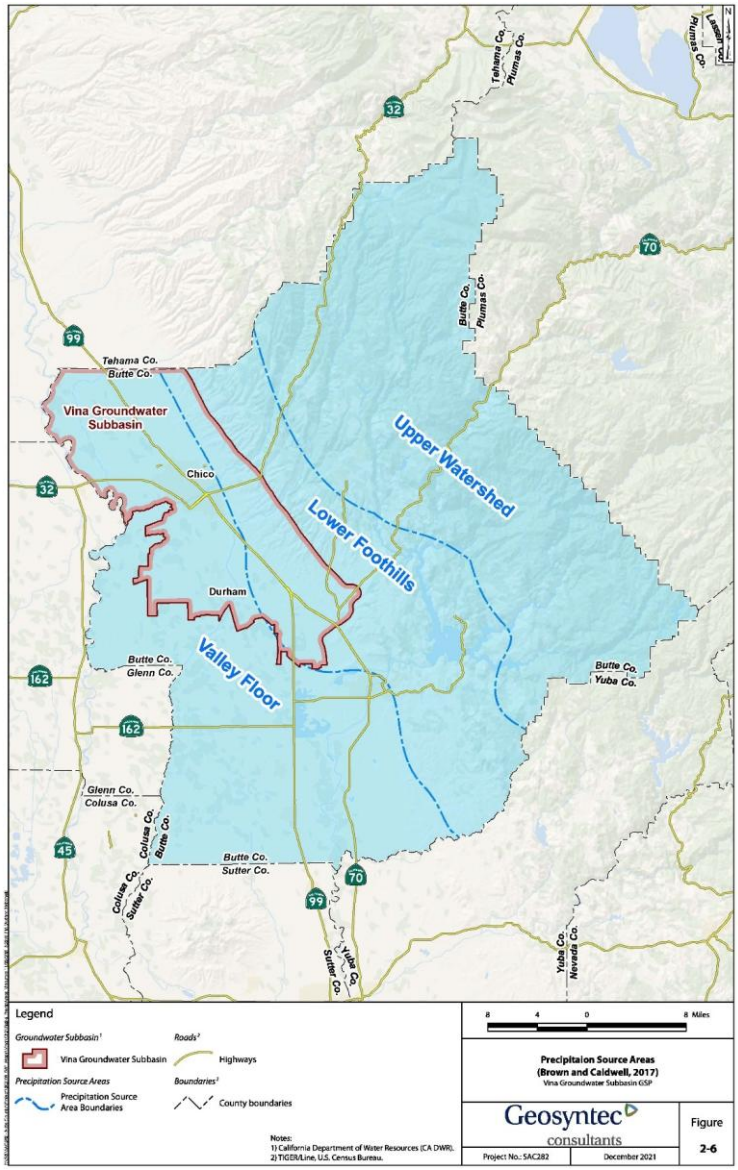


Figure 2-6: Precipitation Source Areas (Brown and Caldwell, 2017 – modified to add Vina Subbasin)

Aquifer testing conducted as part of the Lower Tuscan Aquifer study (Brown and Caldwell, 2013) indicated that there is also the potential for Upper Watershed recharge in the shallow aquifer interval to move down to greater depths due to irrigation pumping, causing a mixing of recharge sources in the intermediate and possibly deeper aquifer zones in the Vina South MA.

Further south and to the east in the area of the Esquon Ranch, the shallow aquifer intervals are likely to be recharged by direct percolation primarily from Valley Floor precipitation, supplemented by some rainfall recharge at the base of the Lower Foothills. The intermediate and deep aquifer intervals are recharged from the lowest elevation part of the Lower Foothills region, most likely from percolation directly into the Tuscan Formation at the outcrop or through recharge into the local alluvial fans and sedimentary deposits and subsequent downward vertical migration into deeper aquifer zones. This demonstrates that precipitation on the valley floor and in the Lower Foothill area is a predominant source of recharge for much of the Vina Subbasin.

Formatted: English (United States)

Additional recharge through management activities of flood flows or irrigation practices has potential in the Vina Subbasin. The Soil Agricultural Groundwater Banking Index (SAGBI) is a suitability index for groundwater recharge on agricultural land based on five major factors: deep percolation, root zone residence time, topography, chemical limitations, and soil surface condition. This dataset can serve as a starting point indication for areas conducive to natural or managed recharge. Large portions of the Vina Subbasin generally received a moderately good to good rating (Figure 2-7), except for in the southeastern area of the Vina Subbasin. Additional considerations will be important for specific evaluation of any proposed recharge project.

Formatted: English (United States)

2.1.3 Regional Geologic and Structural Setting

The regional structure of the Sacramento Valley groundwater basin consists of an asymmetrical trough tilting to the southwest with a steeply dipping western limb and a gently dipping eastern limb (Page, 1986). Older granitic and metamorphic rocks underlie the valley forming the basement bedrock on which younger marine and continentally derived sediments and volcanic rock have been deposited. Along the valley axis and west of the present-day Sacramento River, basement rock is at considerable depth, ranging from 12,000 to 19,000 feet bgs. Overlying marine and continentally derived sediments have been deposited almost continuously from the Late Jurassic period to the present. Of these deposits, older sediments in the basin were emplaced in a marine environment and usually contain saline or brackish groundwater. Younger sediments were deposited under continental conditions and generally contain fresh groundwater. Sediments thin near the margins of the basin, exposing older metamorphic and granitic rocks underlying and bounding the Sacramento Valley sediments (DWR, 2005).

Formatted: English (United States)

2.1.4 Geologic Formations

The region is composed of a diverse mix of geologic units ranging from very productive water-bearing sedimentary units to non-water-bearing plutonic and metamorphic rocks. The main hydrogeologic unit and source of groundwater in the Vina Subbasin is the Tuscan Formation. Other units that are less predominant are the Tehama, Riverbank, and Modesto formations (DWR, 2005).

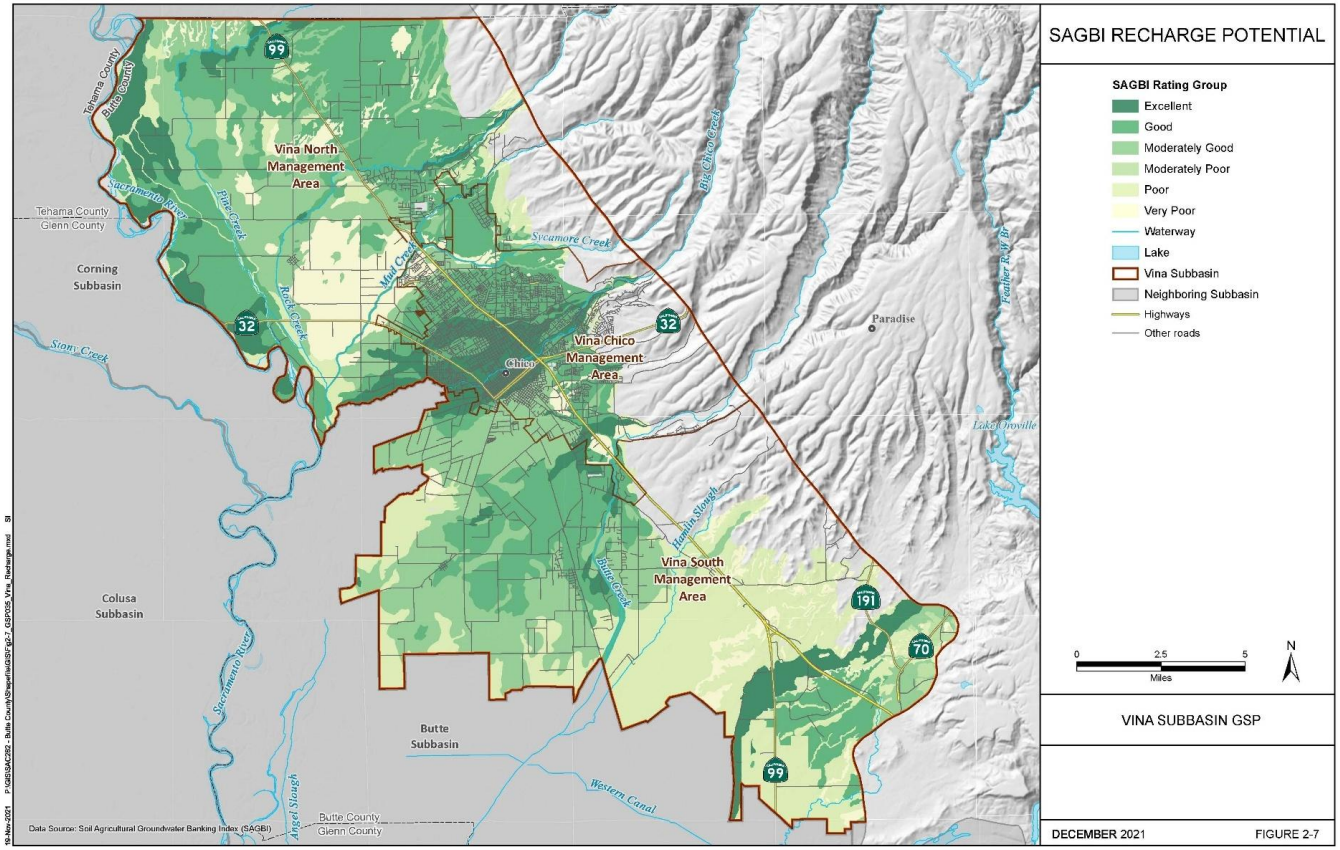


Figure 2-7 ~~placeholder page~~

Formatted: Caption,Caption1

: SAGBI Recharge Potential

Formatted: English (United States)

Groundwater occurs under both unconfined and confined conditions. Unconfined conditions are generally present in the surficial Quaternary Deposits and in the Pliocene deposits that are exposed at the surface. Confined conditions usually exist at a depth of 100 feet or more, where one or more confining layers rests above the underlying aquifer deposits. Although the Tuscan Formation is unconfined where it is exposed near the valley margin, at depth, the Tuscan Formation is semi-confined or confined and forms the major aquifer system in the Vina Subbasin.

Formatted: English (United States)

Figure 2-8 is the Surficial Geologic Map for the Vina Subbasin, which shows the surface distribution of geologic units. The surface geology is composed mostly of alluvial deposits, including stream floodplains and channels. The Tuscan Formation outcrops on the eastern side of the basin and then is present at depth throughout the Vina Subbasin as the source material of the aquifer system. Table 2-2 provides brief descriptions of the significant geologic units that are found in the Vina Subbasin.

The following is a discussion of groundwater producing geologic units found within the Vina Subbasin and region.

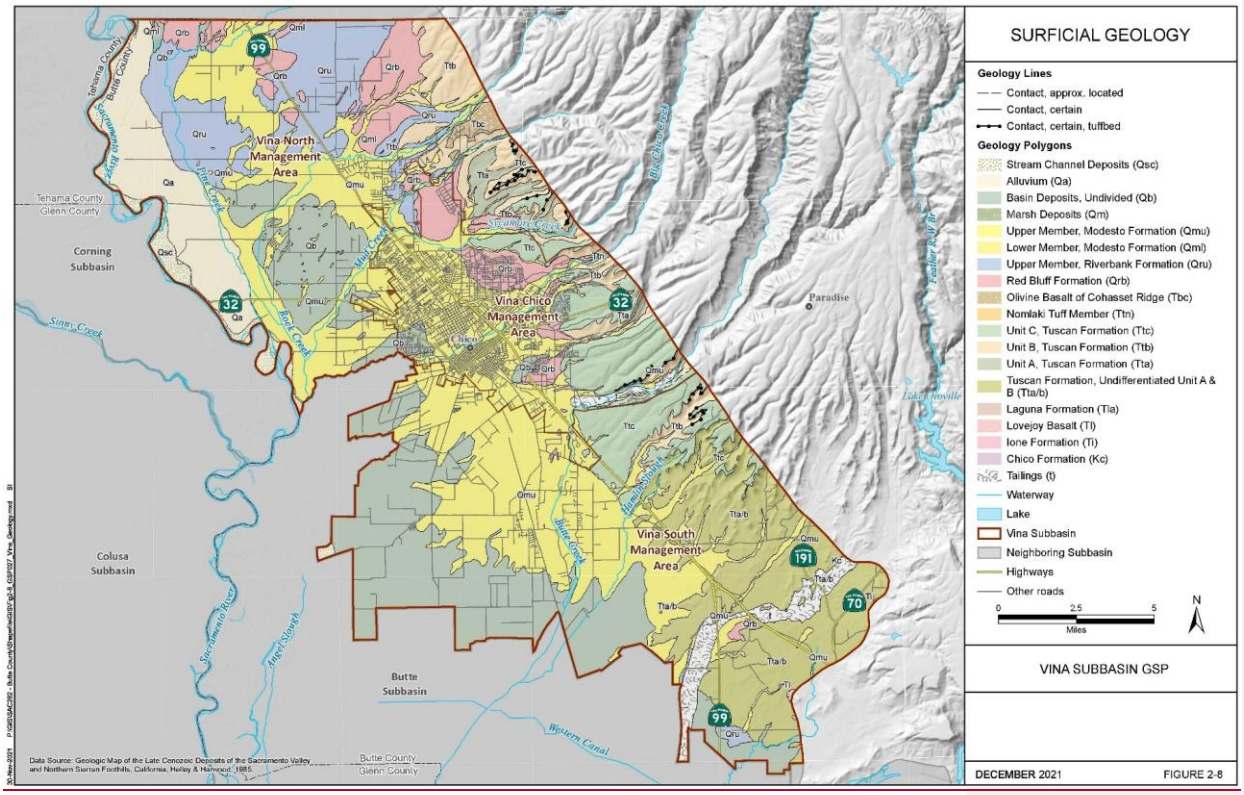


Figure 2-8 ~~placeholder page~~: Surficial Geology

Formatted: Caption,Caption1

Table 2-2: Geologic Units

System and Series		Geologic Unit	Lithologic Character		Maximum Thickness, [a] feet	Water-bearing Character
Quaternary	Holocene	Alluvium, Qa	Unconsolidated unweathered gravel, sand, silt, and clay[a].		80	Deposits are moderately to highly permeable with high permeability gravelly zones yielding large quantities to shallow wells[b]. Although deposits along Big Chico Creek are important recharge areas[b], extensive water-bearing capacity is restricted by thickness and areal extent[a].
		Basin Deposits, Qb	Unconsolidated[d] fine-grained silts and clays, locally interbedded with stream and channel deposits along the Sacramento River[a].		150	Deposits are typically saturated nearly to the ground surface[b]. The low to moderate permeability results in yields of small quantity and poor groundwater quality to domestic wells[a,b].
	Pleistocene	Modesto Formation, Qm	Poorly sorted unconsolidated weathered and unweathered gravel, sand, silt, and clay[c].	Upper Member Modesto Formation, Qmu: Unconsolidated, unweathered gravel, sand, silt and clay.	200	Moderately to highly permeable[a].
				Lower Member Modesto Formation, Qml: Unconsolidated, slightly weathered gravel, sand, silt and clay.		
		Riverbank Deposits, Qr	Poorly sorted unconsolidated to semi-consolidated(c) pebble and small cobble gravels interlensed with reddish clay, sand, and silt[a].	Upper Member Riverbank Formation, Qru: Unconsolidated but compact, dark brown to red alluvium composed of gravel, sand, silt and with minor clay.	200	Water-bearing capability is limited by thickness. These poorly to highly permeable deposits supply moderate groundwater amounts to domestic and shallow irrigation wells. Deeper irrigation wells may be supplied if the wells contain multiple perforation zones[a].
				Lower Member Riverbank Formation, Qrl: Red semiconsolidated gravel, sand, and silt.		
		Red Bluff Formation, Qrb	A thin veneer of distinctive, highly weathered bright-red gravels beveling and overlying the Tehama, Tuscan, and Laguna Formations.		-	Cemented, does not transmit water well.

System and Series		Geologic Unit	Lithologic Character		Maximum Thickness, [a] feet	Water-bearing Character
Neogene & Quaternary	Pliocene & Pleistocene	Laguna Formation, Tla	Fluviatile moderately consolidated and poorly to well cemented; heterogeneous mixture of interbedded alluvial gravel, fine sand, silt, and clay of granitic and metamorphic origin[d].		500	Generally has low to moderate permeability, except in scattered gravels in the upper portion. Yields moderate quantities of water to wells along the south eastern margin of the valley[d].
		Tehama Formation, Tte	Fluviatile moderately consolidated pale green, gray, and tan sandstone and siltstone enclosing lenses of sand and gravel; silt and gravel; and cemented conglomerate derived from the Coast Ranges[a,c].		2,000	Local high permeability zones within this characteristically low to moderate permeability unit, widespread distribution, and deep thickness cause this formation to be the principal water bearing unit in the area. Deep well yields are typically moderate but are highly variable[b].
		Olivine Basalt of Cohasset Ridge (Tbc)	Gray vesicular porphyritic basalt flows with olivine phenocrysts as much as 6 mm in diameter set in diktytaxitic matrix of plagioclase and clinopyroxene.		-	-
		Nomlaki Tuff Member, (Ttn)	White, light-gray, locally reddish-tan to salmon dacitic tuff and pumice lapilli tuff exposed in widely separated areas at or very near the bases of the Tuscan and Tehama Formations.		-	-
Neogene	Pliocene	Tuscan Formation, Tt	This series of volcaniclastic flows (lahars), consolidated tuff breccia, tuffaceous sandstone, and volcanic ash derived from the Cascade Range interfingers with the Tehama Formation as it westerly grades into volcanic sands, gravels, and clays[a,b].	Unit C, Tuscan Formation (Ttc): Lahars with some interbedded volcanic conglomerate and sandstone locally, north of Antelope Creek, separated from overlying units by partially stripped soil horizon.	1,500	Within this formation, moderately to highly permeable volcanic sediments are hydraulically confined by layers of volcaniclastic breccias and clays[b]. Units A and B are the primary water-bearing zones and are composed of volcanic conglomerate, sandstone, and siltstone layers interbedded with volcaniclastic breccias. Stratigraphically higher, the massive breccia deposits of unit C confine groundwater in the permeable beds of units A and B1.
				Unit B, Tuscan Formation (Ttc): Defined along the Chico Monocline as interbedded lahars, volcanic conglomerate, volcanic sandstone, and siltstone similar to Unit C, but underlying the Ishi Tuff Member.		

System and Series		Geologic Unit	Lithologic Character		Maximum Thickness, [a] feet	Water-bearing Character
			The formation is divided into four lithologically similar units A-D[a].	Unit A, Tuscan Formation (Tta): Interbedded lahars, volcanic conglomerate, volcanic sandstone, and siltstone all containing scattered fragments of metamorphic rocks.		
	Miocene	Upper Princeton Valley Fill, Tupg	Non-marine sandstone containing mudstone, conglomerate, and sandstone conglomerate interbeds[c]		1,400	Largely non-water bearing or contains interstitial confined fresh to brackish water
	Miocene	Lovejoy Basalt (Tl)	Black, dense, hard, microcrystalline to extremely grained, equigranular to sparsely porphyritic basalt.		-	-
		Lower Princeton Submarine Valley Fill, Tlpg	Marine conglomerate and sandstone interbedded with silty shale		2,400	Largely non-water bearing or contains saline water.
	Eocene	Ione Formation (Ti)	Light-colored, commonly white conglomerated, sandstone, and claystone. Argillaceous sandstone and claystone comprise about 75 percent of the Ione along the southeast side of Sacramento Valley; northward the rest of the unit consists of interbedded siltstone, conglomerate, and shale.		-	-
	Cretaceous	Chico Formation (Kc)	Tan, yellowish-brown to light-gray, fossiliferous marine sandstone with lenticular beds of pebble to fine cobble conglomerate and minor siltstone.		-	-

System and Series	Geologic Unit	Lithologic Character	Maximum Thickness, [a] feet	Water-bearing Character

Source: This table was originally included as part of the HCM for Colusa Subbasin Hydrogeologic Conceptual Model Report (Davids Engineering et al., 2018). This table has been revised and expanded to include the HCM units for the study area represented in this report.

Notes:

(a) WR, web page (www.wq.water.ca.gov).
(b) DWR, 1978. Bulletin 118-6.
(c) DWR, Bulletin 118-7 (Draft, not published).
(d) DWR, Geology of the Northern Sacramento Valley, 2014.

2.1.5 Groundwater Producing Formations

Groundwater resources come from the alluvial groundwater basin where spaces between gravel, sand, and clay particles of various formations store and transmit water in the aquifer systems. Principal hydrogeologic units of the Sacramento Valley groundwater basin consist of Pliocene sedimentary deposits, such as the Tuscan, Laguna, and Tehama formations, comprising primarily a semi-confined to confined aquifer system. Younger Quaternary deposits, such as the Riverbank and Modesto Formations, overlie these and comprise a relatively shallow and generally an unconfined aquifer system (DWR, 2005, as cited in Davids Engineering, 2016). All post-Tuscan sediments in the area, including the Riverbank and Modesto Formations and recent deposits of the various stream channels, are designated as Quaternary Deposits. Primary groundwater producing formations are described below.

Formatted: English (United States)

2.1.5.1 Tuscan Formation

Tuscan Formation deposits are characterized by their Cascade Range origin and volcanic signature. The formation extends from Redding south to near Oroville, where surface exposures of the Tuscan formation are seen on the east side of the Sacramento Valley. In the subsurface, the volcanic sediments of the Tuscan Formation intermix with the metamorphic sediments of the Tehama Formation (Garrison, 1962; Lydon, 1968). The westward extent of the intermixed sediments generally occurs in the subsurface west of the Sacramento River (DWR, 2014).

Formatted: English (United States)

Overall, the Tuscan Formation is composed of a series of volcanic lahars (debris flows) that includes volcanic breccia, sandstone, and siltstone, and pumiceous tuff layers that were deposited over a period of about one million years (Lydon, 1968; Helley and Harwood, 1985). The source areas of the lahars were the eroded ancestral volcanoes, Mount Yana and Mount Maidu, that were historically located northwest and south of Lassen Peak in the Cascade Range (Lydon, 1968). As the lahars flowed westward off of the ancestral volcanoes and onto the valley floor, they fanned out, causing deposition to vary in thickness and in topographic elevation. Over time, ancient streams and rivers flowed downslope over the lahars, forming channels which were then infilled with reworked volcanic sand and gravel sediments whose pore spaces contain fresh groundwater. Subsequent lahars flowed over and covered the reworked sediments, creating a confining layer over the sand and gravel aquifers (DWR, 2014).

Formatted: English (United States)

The Tuscan Formation has been divided into four units, A, B, C and D by Helley and Harwood (1985) based on outcrop photo geology. It is difficult to apply this nomenclature to the subsurface. The oldest and deepest unit, A, is composed of interbedded lahars, volcanic conglomerate, volcanic sandstone, and siltstone that contain minor amounts of metamorphic rocks. Overlying Unit A in places is Unit B, which is more widespread throughout the eastern part of the northern Sacramento Valley. It is composed of interbedded lahars, volcanic conglomerate, volcanic sand, volcanic sandstone, and siltstone, but no metamorphic rocks, and shows a more regularly layered sequence (Helley and Harwood 1985). Units A and B together are referred to as the Lower Tuscan unit. Units C and D overlie Unit B and are composed of a series of lahars with some interbedded volcanic conglomerate and sandstone (DWR, 2014).

Formatted: English (United States)

The Tuscan Formation is intermittently overlain by the youngest deposits of the Tehama Formation toward the center of the valley; or by the Red Bluff, Modesto, or Riverbank Formations; or by stream channel and basin deposits in varying locations (together, referred to as

Formatted: English (United States)

Quaternary Deposits). However, in some places the Tuscan Formation interfingers with the lower portion of the Tehama Formation in the center of the valley (Greene and Hoover, 2015). In the south part of the valley, the tuff breccia of the Sutter Buttes overlies and possibly interfingers with the Tuscan Formation north of the Sutter Buttes (DWR, 2014).

2.1.5.2 Tehama Formation

Exposures of the Tehama Formation are seen on the west side of the valley from Redding south to Vacaville. In the subsurface, the metamorphic and sedimentary deposits of the Tehama Formation intermix with the volcanic sediments of the Tuscan Formation (Helley and Harwood, 1985). Previous studies inferred that the eastward extent of the intermixed sediments generally occurs in the subsurface west of the Sacramento River. Recent DWR efforts supported the intermixing of Tehama and Tuscan formation sediments from analysis of lithologic cuttings and geophysical logs (DWR, 2014).

Formatted: English (United States)

The Tehama Formation is composed of noncontiguous layers of metamorphic pale green, gray, and tan sandstone and siltstone, with lenses of pebble and cobble conglomerate (Helley and Harwood, 1985). The source area of the Tehama Formation sediments is the Coast Ranges to the west and, to a lesser extent, the Klamath Mountains to the north. Sediments were deposited by streams flowing from the west under floodplain conditions. These fluvial deposits are characterized by a series of poorly sorted sediments, by channels of coarser sediments in the finer-textured strata, and by the lenticular character of the coarser beds (Russell, 1931 as cited in DWR, 2014).

The Tehama Formation is overlain intermittently by the Tuscan Formation toward the center of the valley; or by the Red Bluff, Modesto, or Riverbank Formations; or by the Stony Creek fan alluvium in varying locations (DWR, 2014).

2.1.5.3 Riverbank and Modesto Formations (Quaternary Deposits)

Together, the Riverbank and Modesto Formations, along with other post-Tuscan deposits, will be referred to as Quaternary Deposits for hydrogeologic layering.

The Riverbank Formation consists of poorly to highly permeable pebble and small cobble gravels interbedded with reddish clay, sand, and silt. The formation is exposed throughout the Sacramento Valley and the San Joaquin Valley, extending discontinuously from Redding south to Merced (Marchand and Allwardt, 1981). Terrace deposits of the Riverbank Formation appear in stream cuts that are topographically above the younger Modesto Formation terrace deposits. The terraces were formed by streams carrying eroded material from the surrounding mountain ranges to the base of the foothills, where they were deposited in wide alluvial fans and terrace deposits. Groundwater generally occurs under unconfined conditions. The Riverbank Formation is overlain by the Modesto Formation, basin deposits, or surficial alluvium.

Formatted: English (United States)

The Riverbank Formation was formed by streams carrying eroded material from the Coast Ranges, Cascade Range, Sierra Nevada, and foothill areas to the base of the foothills where it was deposited in wide alluvial fans. It is present in discontinuous surface exposures, primarily from west of Oroville southward. In many places, the Riverbank Formation has been covered by more recent alluvial fan development. The thickness of the formation varies from less than 1 foot to over 200 feet, depending on location (Maps: California, 1985). The Riverbank Formation

Formatted: English (United States)

primarily overlies the Laguna Formation in the southern portion of Butte County and the Tuscan Formation in the northern portion of the county (DWR, 2005).

The Modesto Formation consists of moderately to highly permeable gravels, sands, and silts and is widespread throughout the Sacramento Valley, occurring from Redding south into the San Joaquin Valley. The most notable occurrences are found along the Sacramento and Feather rivers and their tributaries. The Modesto sediments were deposited by streams that still exist today, and they are seen in the terrace and alluvial fan sediments that border present-day streams (Helley and Harwood, 1985). The source area for the formation sediments are the surrounding Coast Ranges, Klamath Mountains, Cascade Range, and Sierra Nevada. Fresh groundwater occurs under unconfined conditions (DWR, 2014).

Wells penetrating the sand and gravel units of the Riverbank and Modesto Formations produce up to about 1,000 gpm; however, the production varies depending on local formation thickness. Wells screened in the Riverbank and Modesto Formations are generally domestic and relatively shallow irrigation wells (DWR, 2004).

Formatted: English (United States)

2.1.6 Cross Sections

2.1.6.1 Airborne Electromagnetic (AEM) Survey

Figure 2-9A was developed using data from a 2018 study (The Stanford Groundwater Architecture Project, which used the AEM method calibrated to existing well data added considerable detail to the known aquifer-bearing units in portions of the Vina Subbasin [Kang et al., 2021]). Therefore, preliminary interpretations from the AEM study are presented here that have not yet been applied to areas outside the study area to contrast the value of these types of studies to understanding the overall hydrogeologic structure.

Pre-existing ideas about the aquifer units have not changed substantially; however, more detail into delineating the properties of the shallower units is now possible. In addition, all the layers can now be represented as having more realistic lateral changes in sediment type (gravel/sand vs. silt/mud), which can be related to hydraulic conductivity and confined/unconfined conditions for more detailed groundwater studies.

Figure 2-9A is a general east-west cross section spanning two main AEM acquisition areas. Superimposed with lithology and electric-logs from WCRs and monitoring wells is the AEM interpretation showing the relative probability of encountering coarse-dominated material (i.e., sand/gravel) along the cross section (Kang et al., 2021, for methodology). Warm colors represent zones that have a high probability of being coarse dominated; inversely, cold colors represent zones that have a lower probability of being coarse dominated but have a high probability of being fine dominated (e.g., silt/clay). The cross section represents the overall knowledge gained from examining all 800 line-kilometers of the AEM study, but greater detail is available for certain individual areas.

Formatted: English (United States)

The AEM cross section depicts three main units previously described: 1) Tuscan Formation; 2) Tehama Formation; and 3) Quaternary Deposits. It is important to realize the Tuscan and Tehama Formations interfinger within individual layers toward the western side of the cross section.

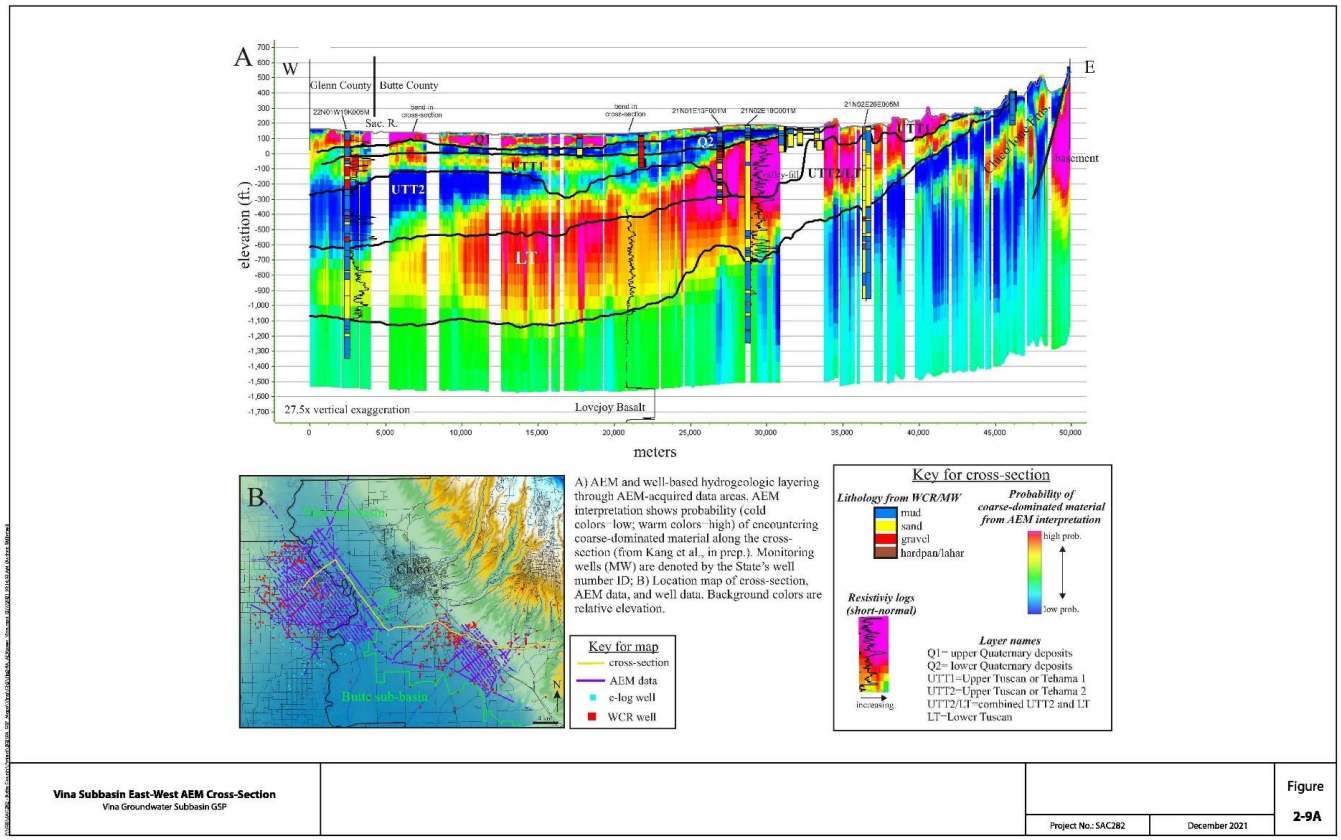


Figure 2-9A ~~**placeholder page**~~

Formatted: Caption,Caption1

: Vina Subbasin East-West Airborne Electromagnetic Cross Section

Formatted: English (United States)

In the upper portions of the Tuscan and Tehama Formations it is often not possible to know the location of that boundary; those layers are called Upper Tuscan/Tehama (UTT1 and UTT2). However, the lower portion of the Tuscan Formation is readily noticeable with no lower Tehama represented in the cross section. Overlying all of these units is the Quaternary Deposits (Q1 and Q2) which includes the Riverbank and Modesto Formations.

The Lower Tuscan layer is mostly coarse-grained material that thickens to the west to 500 to 600 feet thick. The overlying UTT2 layer only exists in the western portion (200 to 500 feet thick) and is fine dominated with intermittent coarse-dominated channels. UTT1 is mostly a coarse-dominated unit 100 to 200 feet thick that combines with the Lower Tuscan in the eastern portion of the cross section. Q2 is mostly fine dominated (~50 feet thick) that has rare occurrences of coarse-dominated material. Q1 is 50 to 100 feet thick and consists of mostly coarse dominated with small zones of fine-dominated material. Finally, there is an interpreted ancient valley that formed during the time of Tuscan deposition that filled with coarse-dominated material in the vicinity of Butte Creek. This valley fill was then buried by UTT1, Q2, and Q1 sediments.

2.1.6.2 Additional Cross Sections

Figure 2-9B is a cross section key that shows the location of Vina cross sections developed from studies performed by DWR (DWR, 2014) and GEI Consultants (GEI, 2018) and the extensions of these sections into the adjacent Wyandotte Creek and Butte subbasins. Figure 2-9C shows a southwest to northeast cross section in the northern portion of the Vina Subbasin, and Figure 2-9D shows a southwest to northeast cross section in the southern portion of the Vina Subbasin.

2.1.7 Key Geologic Features

Barriers to groundwater flow in the northern Sacramento Valley include geologic structures such as the Red Bluff Arch, the Corning domes, the Sutter Buttes, and the buried Colusa dome. In the northern part of the valley, the Red Bluff Arch acts as a groundwater divide separating the Sacramento Valley groundwater basin from the Redding groundwater basin. South of Corning, the surface expression of the Corning domes influences the flow patterns of Stony Creek and Thomes Creek. Stony Creek flows southeast of the domes, with regional flow to the confluence of the Sacramento River, whereas Thomes Creek flows northeast of the domes, against regional flow to the Sacramento River (Blake et al., 1999). In the southern part of the valley, groundwater mounds up on the north side of the Sutter Buttes before it flows westward around the Buttes and between the buried Colusa dome and southward (DWR, 2014).

2.1.7.1 Chico Monocline

The Chico monocline is a northwest-trending, southwest-facing flexure that roughly follows the northeastern boundary of the Sacramento Valley, extending from Chico to Red Bluff. The monocline was formed under an east-west compressive stress regime that steeply thrust up the Sierra Mountains (Helley and Harwood, 1985). This late Cenozoic tectonic feature was formed after deposition of the Ishi Tuff member of the Tuscan Formation, about 2.6 million years ago (Ma), and prior to the Deer Creek olivine basalt eruption, which has been age-dated at 1.08 + 0.16 Ma (Helley and Harwood, 1985). North of Chico, the Chico monocline deforms the Tuscan Formation and has a dip of up to 25 degrees where it becomes the eastward alluvial aquifer boundary (DWR, 1978). South of Chico, beds have a gentler slope of approximately 2 to 5 degrees, and evidence of the monocline disappears north of Oroville (DWR, 2014).

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

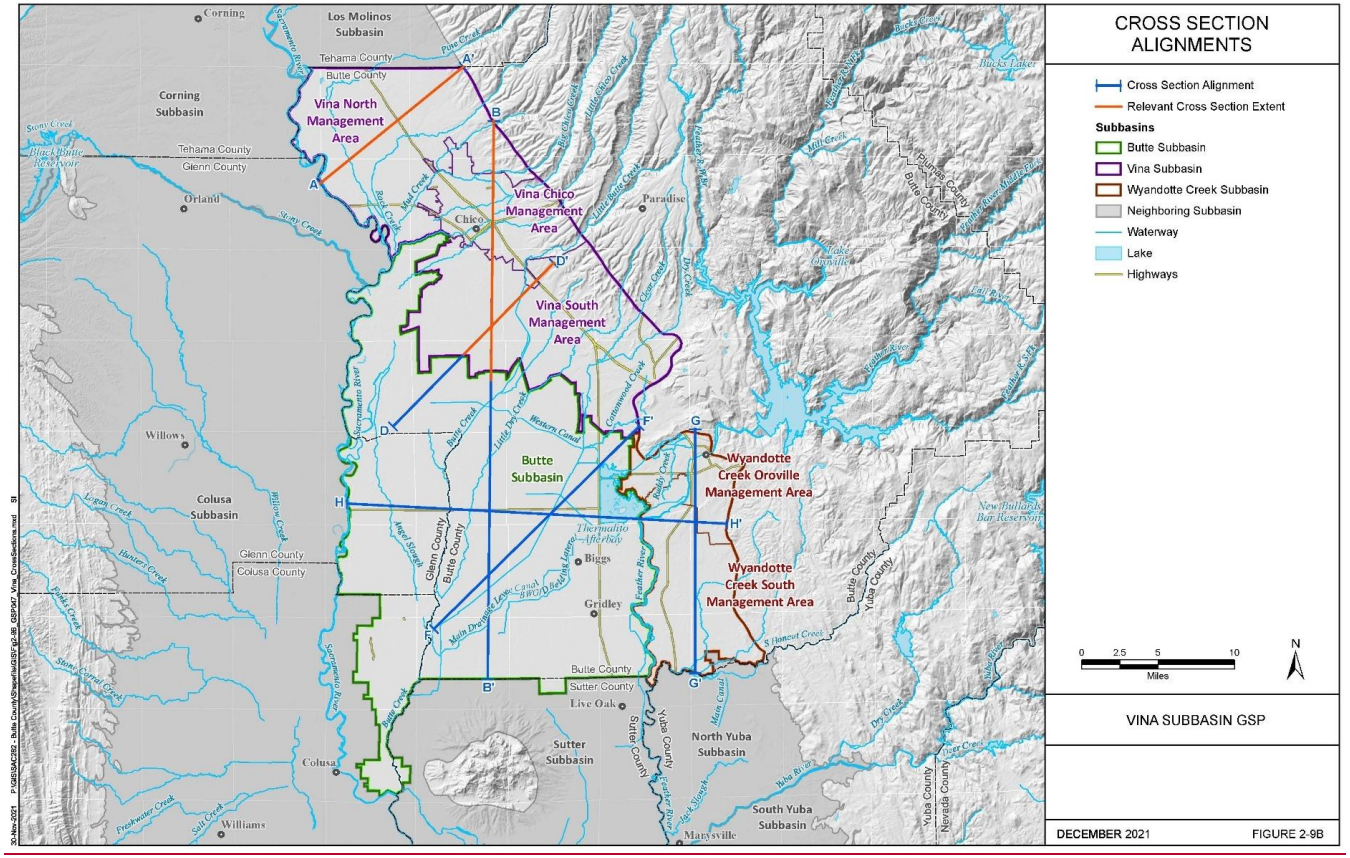
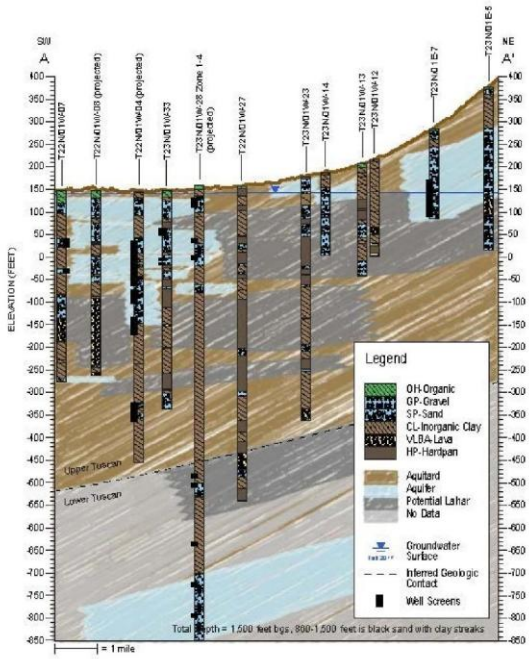


Figure 2-9B ~~placeholder page~~: Cross Section Alignments

Formatted: Caption,Caption1



Geologic Cross-Section A-A'
Vina North Management Area
Vina Groundwater Subbasin GSP

Project No.: SAC282 | December 2021 | Figure 2-9C

Figure 2-9C ~~placeholder page~~: Geologic Cross Section A-A' (Vina North Management Area)

Formatted: Caption,Caption1

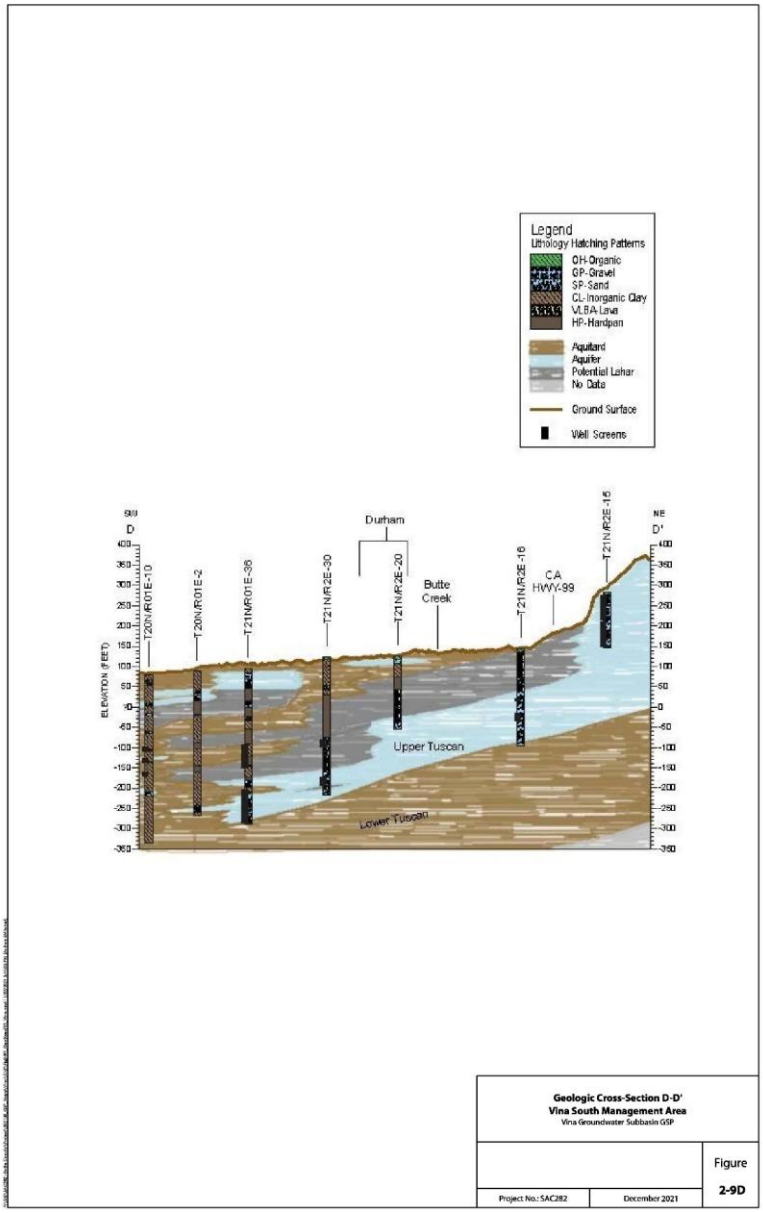

Legend
Lithology Hatching Patterns
OH-Organic
GP-Gravel
SP-Sand
CL-Inorganic Clay
VLB-Lava
HP-Hardpan
Aquitard
Aquifer
Potential Lahar
No Data
Ground Surface
Well Screens
SW
D
NE
D'
ELEVATION (FEET)
T20N/R01E-10
T20N/R01E-2
T21N/R01E-36
T21N/R2E-30
T21N/R2E-20
T21N/R2E-16
T21N/R2E-15
Durham
Butte Creek
CA HWY-99
Upper Tuscan
Lower Tuscan
Geologic Cross-Section D-D'
Vina South Management Area
Vina Groundwater Subbasin GSP
Figure
2-9D
Project No.: SAC282
December 2021

Figure 2-9D ~~placeholder page~~: Geologic Cross Section D-D' (Vina South Management Area)

Formatted: Caption,Caption1

2.1.8 Principal Aquifers and Aquitards

2.1.8.1 Overview

The Vina Subbasin groundwater system is comprised of a single principal aquifer composed of the Quaternary Deposits (Q1, Q2), Upper Tuscan/Tehama (UTT1 and UTT2) and Lower Tuscan units creating various aquifer zones with different hydrogeologic properties and both unconfined and semi-confined conditions. This leaky aquifer system has varied hydraulic connectivity between different depth zones in different areas of the Vina Subbasin. Due the localized variation of vertical connectivity, this is identified as a data gap.

Formatted: English (United States)

Characteristics of the groundwater system vary from the northeast to the southwest as the Tuscan Formation materials become more reworked and less consolidated with distance from their geologic source. The characteristics of the aquifer system also vary in the vicinity of the Sacramento River, Butte Creek, and the base of the eastern foothills as different processes deposited materials that make up the aquifer system at depth.

Formatted: English (United States)

The degree of connectivity between various zones in the aquifer system are evident in some areas based on hydrographs, pumping tests, and water level measurements. Hydrographs from nested wells show slight vertical gradients in the subsurface (Section 1.2.2.2). A pump test in the northeastern area of the Vina Subbasin (at monitoring well 23N01W03H02-04) demonstrated that in some cases low-permeability lahar units caused different discrete aquifer zones to be hydraulically disconnected while in other cases the lahar layers functioned as a leaky aquitard, allowing a delayed hydraulic connection between aquifer zones (Appendix E of Brown and Caldwell, 2013).

Formatted: English (United States)

In the central area of the valley near the Sacramento River, thick fine-dominated layers of the UTT2 separate coarser-dominated materials of the UTT1 from the coarse-dominated zone of the Lower Tuscan (Figure 2-9A). Yet a pump test in the area (on M&T Ranch) demonstrated hydraulic connectivity between these zones and significant storage in the aquitard of the UTT2 separating them (Appendix E of Brown and Caldwell, 2013). A pump test in the vicinity of Rancho Esquon demonstrated hydraulic connectivity between an intermediate and deeper aquifer zone of the Lower Tuscan unit with 100 feet or more of low permeability fines separating them. However, in the same monitoring well no connectivity was observed between the shallower aquifer zone of the UTT1 (80 to 150 feet bgs) and the Lower Tuscan unit's intermediate zones where 100 feet of low-permeability fines separated them (Appendix E of Brown and Caldwell, 2013).

Formatted: English (United States)

Due to the variance in hydraulic connectivity between zones in different areas of the Vina Subbasin and between different depths, a single principal aquifer is defined. In most cases, patterns of groundwater levels in nested wells suggest some degree of connectivity. DWR defines "principal aquifers" under SGMA as the "aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems" (Cal. Code of Regs., title 23, § 351(aa)).

There are no known structural properties (i.e., faults) that significantly restrict groundwater flow within the Vina Subbasin within the portion of the aquifer that stores, transmits, and yields significant quantities of water.

Formatted: English (United States)

2.1.8.2 Beneficial Uses

In 1972, the CRWQCB adopted a uniform list and description of beneficial uses to be applied throughout all basins of the State. In the revised Basin Plan for the Sacramento River and San Joaquin River Basins prepared by the CRWQCB, Central Valley Region (Water Board, 2018) it is stated that unless otherwise designated by the Water Board, all ground waters in the Region are considered as suitable or potentially suitable, at a minimum, for municipal and domestic water supply, agricultural supply, industrial service supply, and industrial process supply.

Water produced from the principal aquifer is primarily used to meet irrigation, domestic, and municipal water demand. Domestic supply is largely used to meet rural residential demands. Municipal supply is largely used to meet demand from cities and towns such as Chico and Durham. Irrigation demands in the Vina Subbasin primarily rely upon wells for applied water. Relatively shallow groundwater in some areas of the Vina Subbasin support Groundwater Dependent Ecosystems (GDEs) and stream flows.

Formatted: English (United States)

2.1.8.3 Storage Coefficient

Specific yield or storativity quantifies the ability of the aquifer to hold or store water. Estimates of specific yield for areas in the Vina Subbasin range from 5.9 to 7.1 percent (DWR, 2005; DWR, 2004). Specific Yield applies to unconfined aquifer conditions.

Formatted: English (United States)

Aquifer tests conducted for the Lower Tuscan Aquifer Study (2013) estimated values for storativity (S) (Table 2-3) for three locations within or adjacent to the Vina Subbasin. Storativity is a property of a confined or semi-confined aquifer and is typically several orders of magnitude less than specific yield.

Formatted: English (United States)

Values for specific yield (unconfined) and storativity (confined) used in the calibrated BBGM throughout the Vina Subbasin are 10 percent and 0.00001, respectively (BCDWRC, 2021). The groundwater system is a mix of confined and unconfined conditions so the average storage coefficient in the Vina Subbasin in the BBGM is 0.04 (unitless).

Formatted: English (United States)

Table 2-3: Summary of Calculated Aquifer Parameters
Table taken from Lower Tuscan Aquifer Study Final Report (Brown and Caldwell, 2013)

Summary of aquifer parameters calculated using Moench (1985) solutions			
	T (square feet/day)	S (unitless)	K (feet/day)
Hackett Property	2,322 to 3,078	0.00004 to 0.00009	66 to 881
M&T Ranch	11,550 to 20,540	0.0003 to 0.0005	321 to 5712
Esquon Ranch	12,230 to 23,650	0.00004 to 0.001	41 to 793

Note:
Source: Lower Tuscan Aquifer Study Final Report (Brown and Caldwell, 2013).
1. Assumes aquifer thickness of 35 feet.
2. Assumes aquifer thickness of 36 feet.
3. Assumes aquifer thickness of 300 feet.

2.1.8.4 Transmissivity

Transmissivity (T) quantifies the ability of water to move through aquifer materials. The aquifer hydraulic conductivity (K) quantifies the rate of groundwater flow and is related to the transmissivity and aquifer thickness (b) by the following formula: T = K x b. Aquifer tests conducted for the Lower Tuscan Aquifer Study (Brown and Caldwell,2013) estimated values for hydraulic conductivity (K) and transmissivity (T) (Table 2-3) for three locations within or adjacent to the Vina Subbasin.

Estimates for transmissivity can vary widely in different areas of the Vina Subbasin. Results from an aquifer performance test utilizing a well designed and constructed to draw water only from the lower confined portion of the Tuscan Formation calculated aquifer transmissivity to be approximately 75,000 gallons per day (gpd) per foot (10,026 square feet per day). From the same test, storativity was estimated between 0.0001 and 0.00001. This test was conducted in the Butte County portion of the Bulletin 118-2003 West Butte Subbasin (DWR, 1995, as cited in DWR, 2005).

Formatted: English (United States)

In the Lime Saddle area east of the Vina Subbasin, transmissivity values in the confined portion of the Tuscan Formation were estimated to be low: 1,100 gpd per foot (147 square feet per day) (Slade, 2000 as cited in DWR, 2005).

Formatted: English (United States)

2.1.9 Opportunities for Improvement to the HCM

The following lists activities or projects that can be used to improve the HCM.

2.1.9.1 Identify Areas in the County Where Additional Monitoring Would Help Increase Understanding of the Aquifer

Determine the best approach for increasing monitoring in these areas such as installation of new wells or increased monitoring at existing wells.

Formatted: English (United States)

2.1.9.2 Assess Interaction between Sacramento and Other River Stage Response to Changes in Groundwater Levels

It is recommended additional studies be conducted to better assess the interaction between the river stage on the Sacramento River, Feather River, and other major tributaries with changes in groundwater levels in the Lower Tuscan Aquifer and other aquifers that may also provide water to the Lower Tuscan Aquifer.

2.1.9.3 Expand Isotopic Analysis to Further Assess Groundwater Recharge

Future recharge and aquifer studies should include the collection and interpretation of stable isotope data. Methodology considerations include: 1) Seasonal sampling should be performed as part of future surface water and groundwater isotope studies for purposes of assessing groundwater recharge. 2) Monitoring wells with multiple screened intervals (multi-completion monitoring wells) are recommended to assess stable isotope data at different depths. Sampling locations with a single well-screen interval do not provide nearly as much insight as sampling locations with wells screened at multiple depths in discrete zones. 3) Monitoring wells with relatively short-screened zones (20 feet or less) are preferred to minimize mixing between aquifer zones or between aquifer zones and residual water retained within the aquitard zones between aquifers. Although not quantified, the Lower Tuscan Aquifer study (Brown and

Formatted: English (United States)

Caldwell, 2013) suggested that the aquitards could release a significant volume of water to the aquifer in areas where large volumes of groundwater are extracted.

2.1.9.4 Characterize Recharge Source with General Water Quality Analysis

Conduct general mineral analysis on groundwater samples to evaluate whether elevated electrical conductivity values observed during sampling are due to irrigation influences (e.g., elevated nitrate, calcium, sulfate) or due to proximity to the Ione Formation (e.g., elevated sodium, chloride, and boron).

Formatted: English (United States)

2.1.9.5 Contribution of Recharge from Rainfall Directly on the Lower Tuscan Outcrop

Stable isotope abundances indicate that a substantial proportion of local recharge is derived from elevations consistent with the outcrop of the Lower Tuscan Formation (i.e., within the Lower Foothills in Figure 2-6). Thus, it is recommended that local precipitation be collected during an entire precipitation season at varying elevations across the outcrop and analyzed for stable isotopes to better correlate or calibrate the groundwater isotope values with local precipitation sources.

Formatted: English (United States)

2.1.9.6 Recharge Rate

Most well locations and depths should be sampled and analyzed for presence of tritium to help distinguish whether recharge to individual aquifer zones is occurring over periods shorter than about 60 years or whether recharge is occurring over longer timeframes. This can help better understand the nature of hydraulic connection between different zones in the aquifer system.

Formatted: English (United States)

2.1.9.7 Field Testing and Monitoring Equipment Installation to Understand the Recharge Rates and Stream Losses in the Recharge Zone

Expansion of stream gaging locations should occur to document and better understand changes in stream-aquifer interactions. In addition to the stream gaging, a series of shallow dedicated monitoring wells with temperature sensors installed along stream courses in the recharge corridor and downstream to the Sacramento River may help identify what sections of streams are losing or gaining.

Formatted: English (United States)

2.1.9.8 Additional AEM Data Collection

Expanding the extent of AEM surveys is recommended to help address uncertainty in the structure of the Vina Subbasin and to refine the 3D hydrogeological conceptual model of the subsurface. AEM data may also help identify and better characterize recharge mechanisms and the connectivity between aquifer layers.

Formatted: English (United States)

2.2 Groundwater Conditions

2.2.1 Description of Current and Historical Conditions

Groundwater conditions in the Vina Subbasin are regularly monitored and are described in the 2001 and 2016 Water Resource Inventory and Analysis Reports produced by Butte County. These documents and other reports indicate that the Vina Subbasin has adequate groundwater resources to meet demands under most hydrologic conditions. However, comparison of the reports illustrates how in the period between their issuance, groundwater conditions have tightened and show a declining trend over the past 20 years, and as forces ranging from population growth to climate change play out, the value of well-informed water management

policies and practices is likely to increase. The water budget analysis presented in Section 2.3 provides a quantitative assessment of how conditions have changed in the Vina Subbasin at the time of the 2022 GSP development and an indication of how conditions may change in the future. The GSA will provide updated groundwater condition assessments in GSP Annual Reports and Five-Year Periodic Evaluations (i.e. 2027, 2032, 2037, 2042).

Formatted: English (United States)

Formatted: English (United States)

2.2.2 Groundwater Trends

2.2.2.1 Elevation and Flow Directions

Figures 2-10 and 2-11 show groundwater elevation contours in the Vina Subbasin for the spring and fall of 2015 and Figures 2-12 and 2-13 show elevation contours for the spring and fall of 2019. These contours show groundwater levels as reported by the CASGEM program. The data were processed as follows:

- Data from CASGEM were used to identify wells in the Vina Subbasin plus supplemental sites used to extend the contours to the west.
- Water level readings for 2015 and 2019 were then filtered for measurements taken between September 20 and October 30 for the fall contours and between March 20 and April 30 for the spring contours.
- Wells showing depths to first encountered groundwater deeper than 500 feet were eliminated from the data set. The remaining readings were sorted by well depth. Wells having identical state well number site codes were then filtered to select the shallowest well from each nested well cluster.

The maps shown in Figures 2-10 to 2-13 do not distinguish between completion intervals of the wells. So, the contours represent an aggregate of groundwater elevations across all zones of the principal aquifer system. The equipotential maps illustrate several general features of the groundwater flow system in the Vina Subbasin, including:

Formatted: English (United States)

- Overall west-southwest flow consistent with recharge along Quaternary alluvial fans along the eastern foothills.
- Convergence of flow toward Sacramento River in the Vina North MA.
- Flow from the Vina Chico MA converging toward pumping in the Vina South MA and sub-parallel to Sacramento River floodplain. Groundwater generally flows west-southwest in the Vina Chico MA towards the Sacramento River. There is evidence of convergence toward Chico and Little Chico Creek. Contours in this area are based on shallow groundwater levels, which are below the elevation of Big Chico Creek. The convergence of flow in this area may be associated with wells supplying potable water for the City of Chico and/or higher permeability channelized features in this portion of the Quaternary alluvial fans along the eastern foothills.
- Flow from the Vina South MA converging toward pumping and convergence toward Sacramento River in the Vina Subbasin. Groundwater generally flows west-southwest in the Vina South MA towards the Sacramento River. There is

evidence of convergence toward areas with higher groundwater pumping, likely associated with agricultural pumping west of Butte Creek.

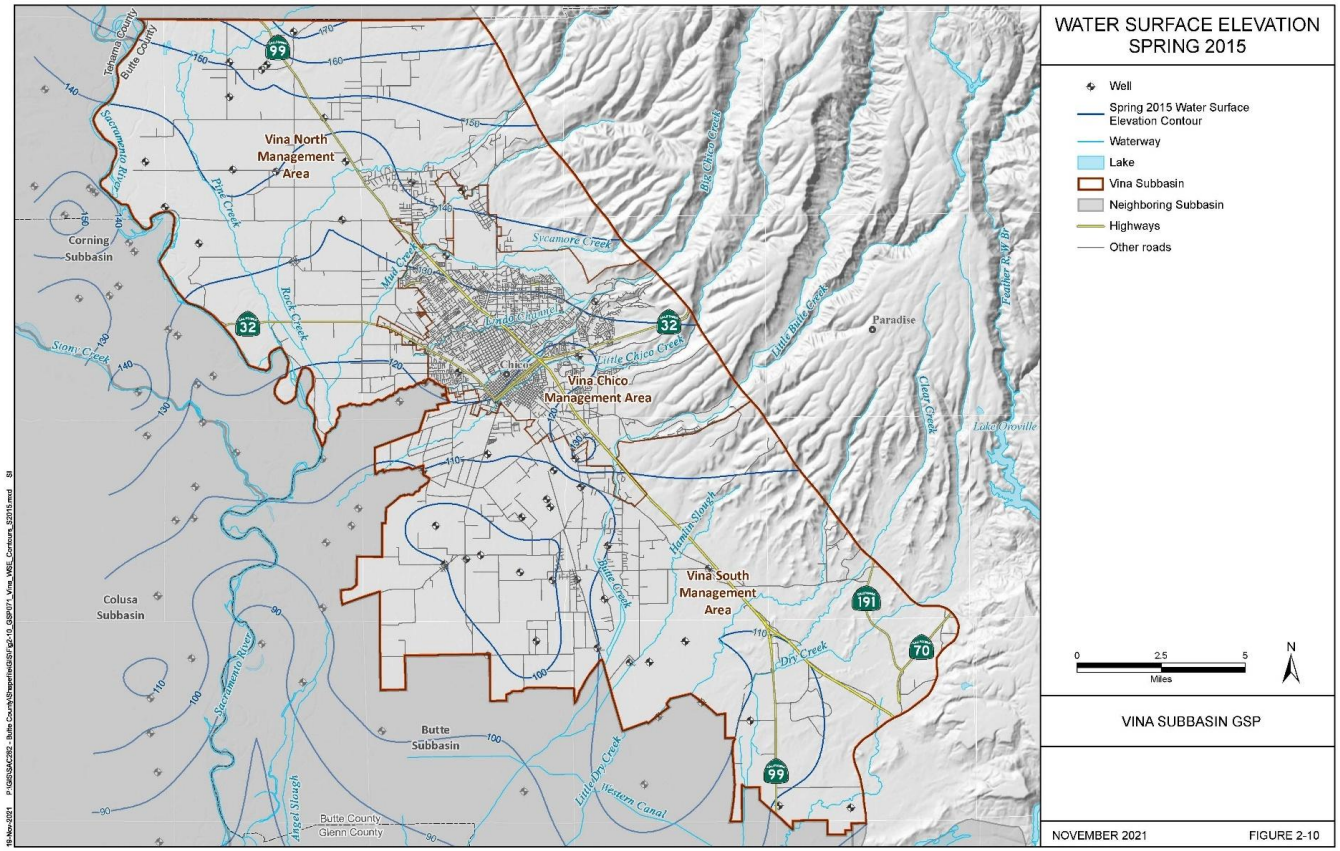


Figure 2-10 ~~placeholder page~~**: Water Surface Elevation Contours – Spring 2015**

Formatted: Caption,Caption1

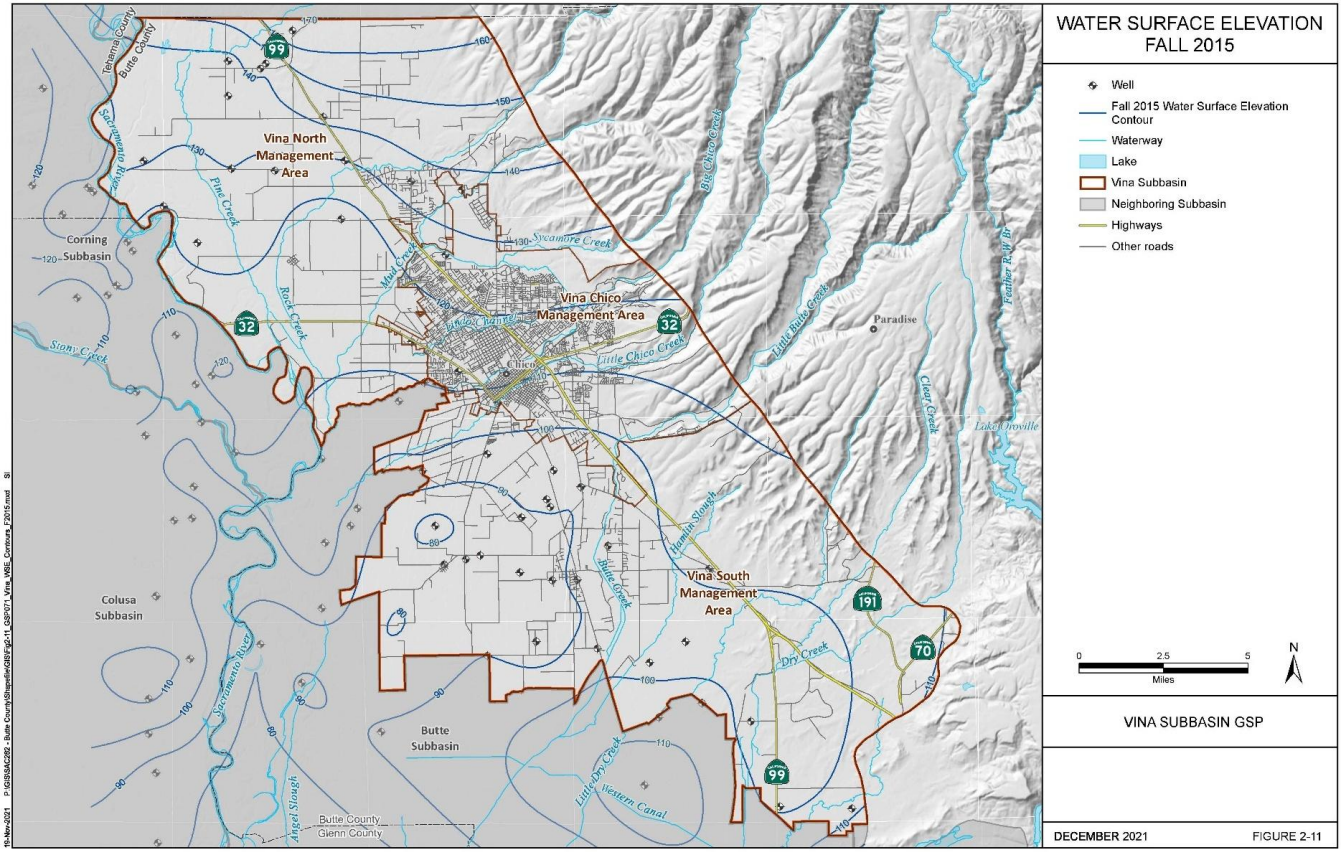


Figure 2-11 ~~placeholder page~~: Water Surface Elevation Contours – Fall 2015

Formatted: Caption,Caption1

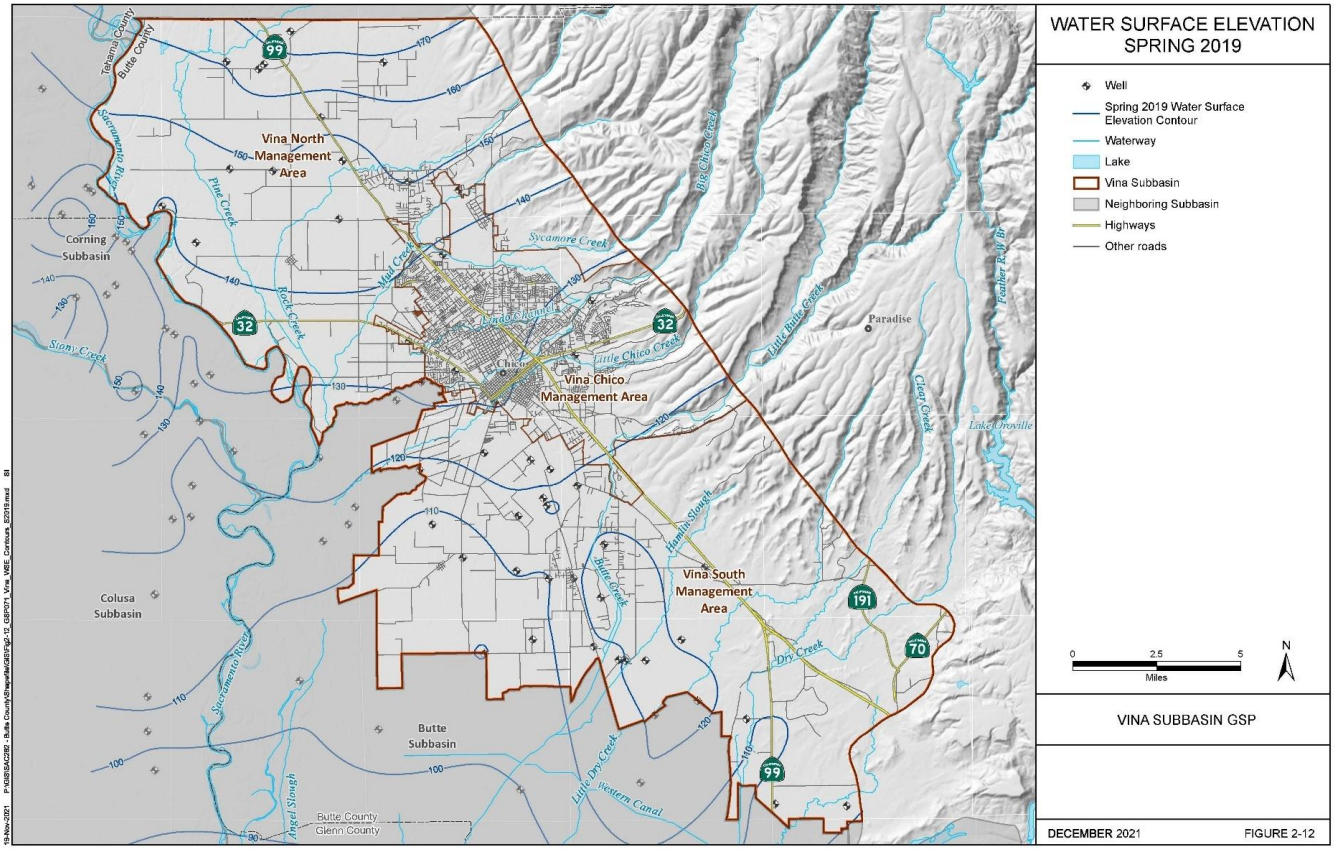


Figure 2-12 ~~placeholder page~~**: Water Surface Elevation Contours – Spring 2019**

Formatted: Caption,Caption1

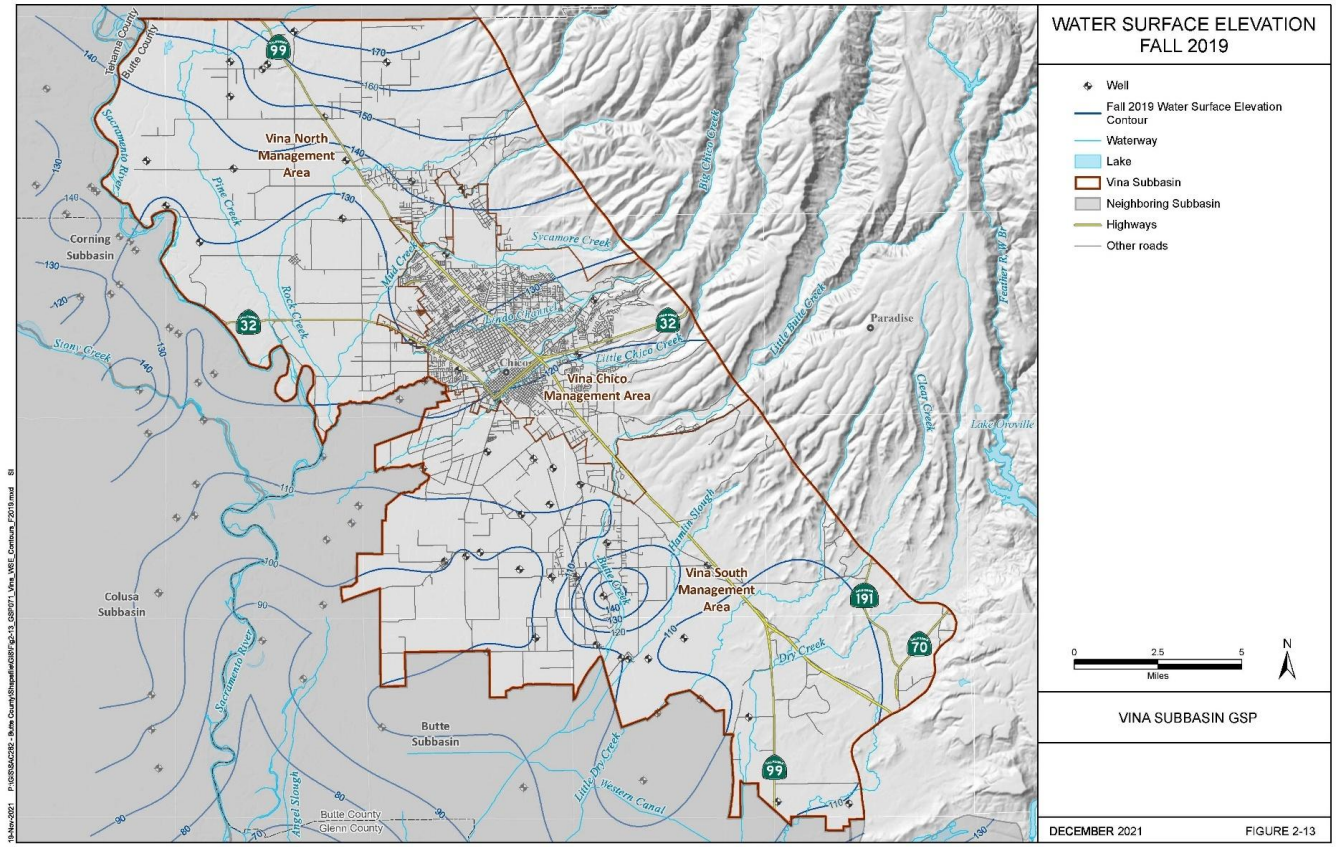


Figure 2-13 ~~placeholder page~~: Water Surface Elevation Contours – Fall 2019

Formatted: Caption,Caption1

Each of the four contour maps displays groundwater elevations that are higher in the north of the Vina Subbasin than in the south, indicating a gradient that would cause water to flow from north toward the southwestern corner of the Vina Subbasin. While groundwater elevations are lower in the fall than in the spring, the general direction and gradient of flow are similar during both periods.

When comparing elevations reported in 2015 with those reported in 2019, groundwater elevations reported for the spring of 2015 are generally somewhat higher than those observed in the spring of 2019. However, elevations reported for the fall of 2015 are slightly lower than those observed in 2019. This may be an indication of an increase in the volume of water recharged from upland areas flowing into the Vina Subbasin's principal aquifer during subsequent wet years (2017 and 2019).

2.2.2.2 Hydraulic Gradients

Horizontal or lateral hydraulic gradients generally reflect ground surface topography. In the foothills east of the Sacramento Valley the gradient is steep, as high as 60 feet per mile. In the floodplain of the Sacramento River, lateral gradients are relatively flat, even in the deeper zones of the aquifer. There is a transitional gradient zone between the floodplain and upland areas, which generally reflects the gradient of the main tributary creeks that flow into the Sacramento River, such as Big Chico and Little Chico creeks.

However, the gradient in most of the Vina Subbasin is gentle, reflecting the area's flat topography and the presence of the Sacramento River. Although the overall gradient is relatively flat, there are locations in the Vina Subbasin where local conditions affect the direction and gradient of flow, such as the groundwater depression under the City of Chico, where groundwater flows toward the depression. A second localized condition is a depression in the Durham area.

Regionally, there is a groundwater mound near the Thermalito Afterbay, where groundwater flows outward from the groundwater mound. Another groundwater mound occurs in the neighboring subbasin to the west near Hamilton City fed by the Stony Creek Fan.

Figures 2-14, 2-15, and 2-16 are maps of the Vina North, Vina Chico, and Vina South MAs with hydrographs of key monitoring wells displayed on each map. Just as comparison of the spring and fall contours indicated the shift in groundwater elevations that typically occurs between the seasons, the hydrographs display annual oscillations in elevations as well as trends over the monitoring period, snapshots of which are captured in comparison between the 2015 and 2019 contours. Each hydrograph displays water surface elevations in feet above msl and also gives the depth of the bottom of the well, which indicates the location of the zone being measured.

Most of the hydrographs are taken from single completion wells where only one aquifer zone is screened, however a number of the hydrographs are from clusters of nested monitoring wells which measure groundwater elevations at three or four aquifer zones at a single location.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

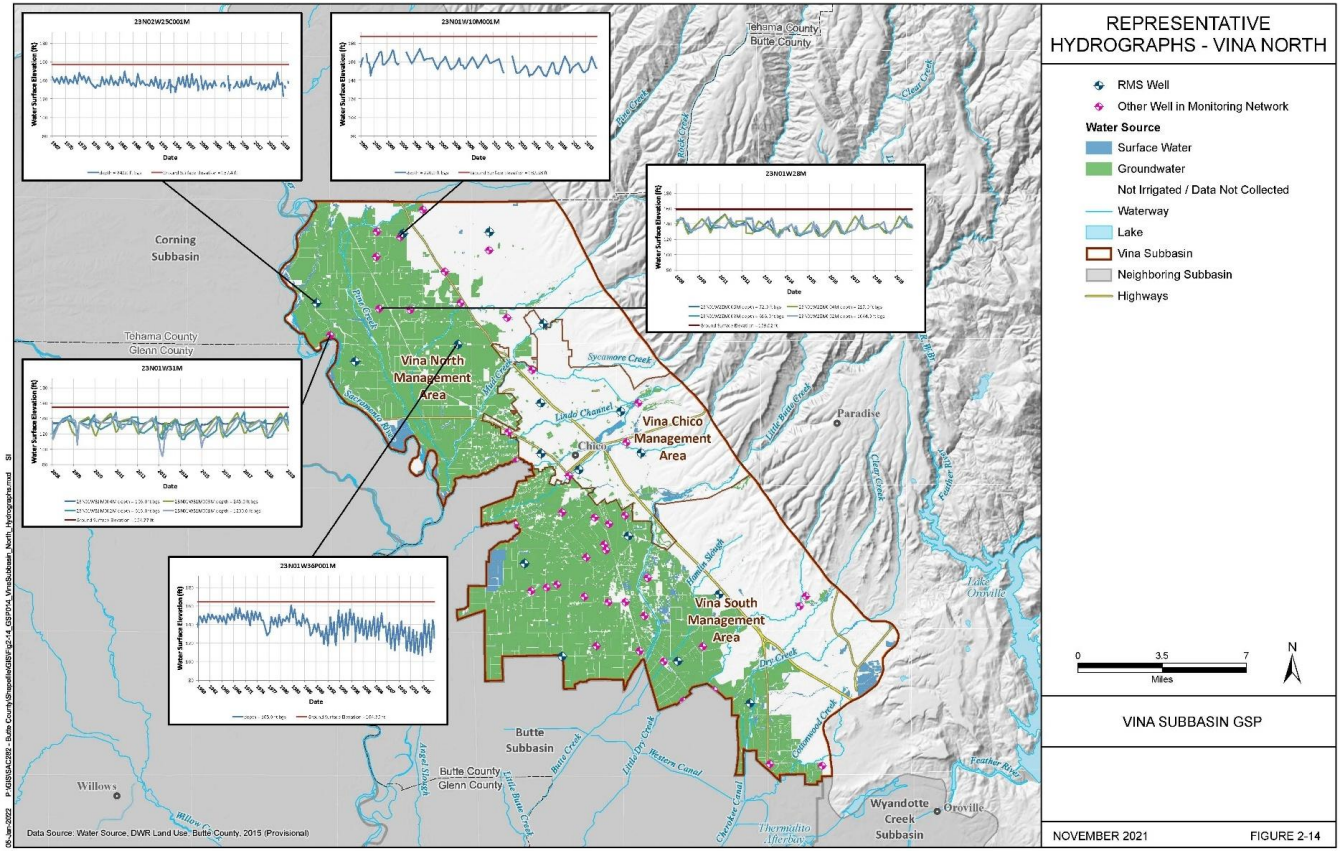


Figure 2-14 ~~placeholder page~~: Representative Hydrographs (Vina North Management Area)

Formatted: Caption,Caption1

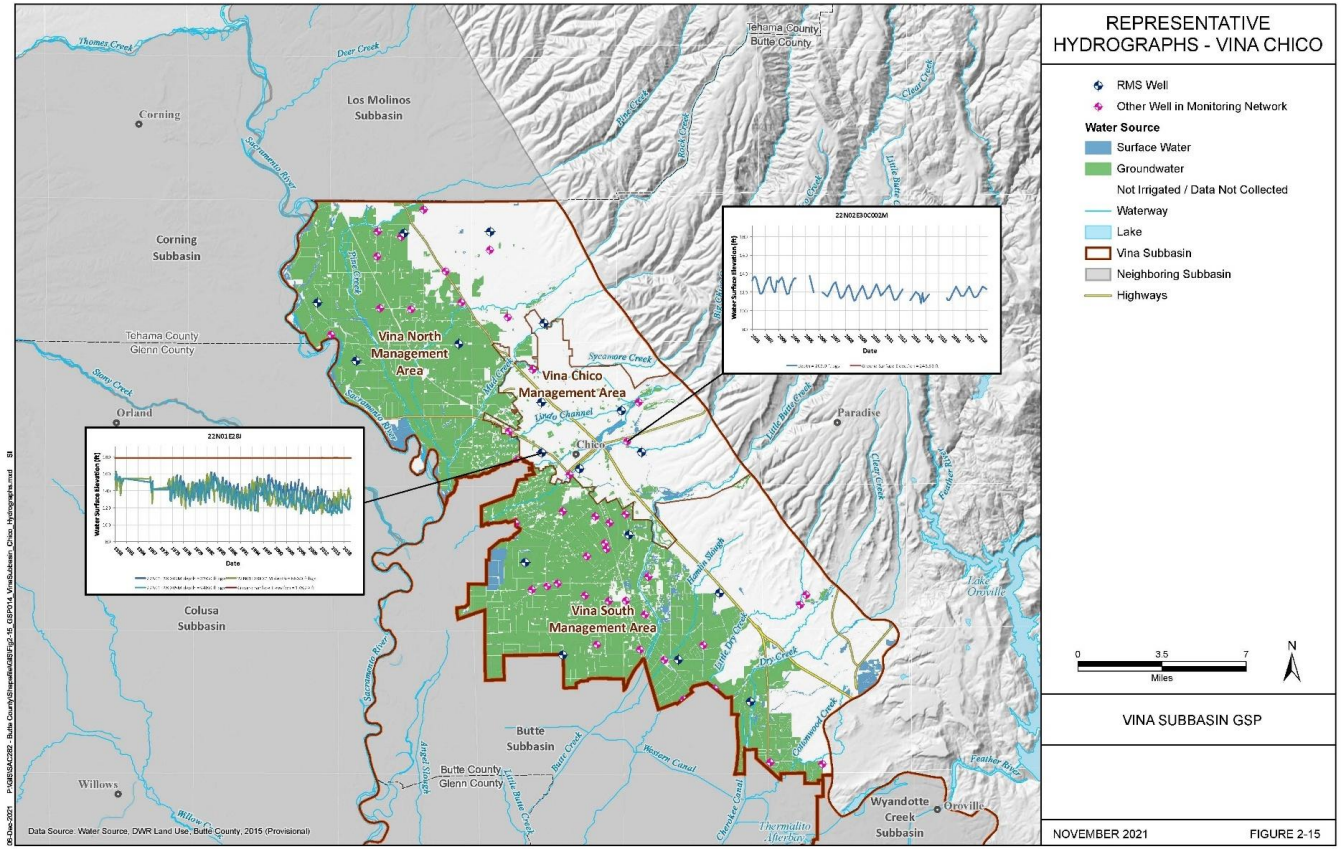


Figure 2-15 ~~placeholder page~~**: Representative Hydrographs (Vina Chico Management Area)**

Formatted: Caption,Caption1

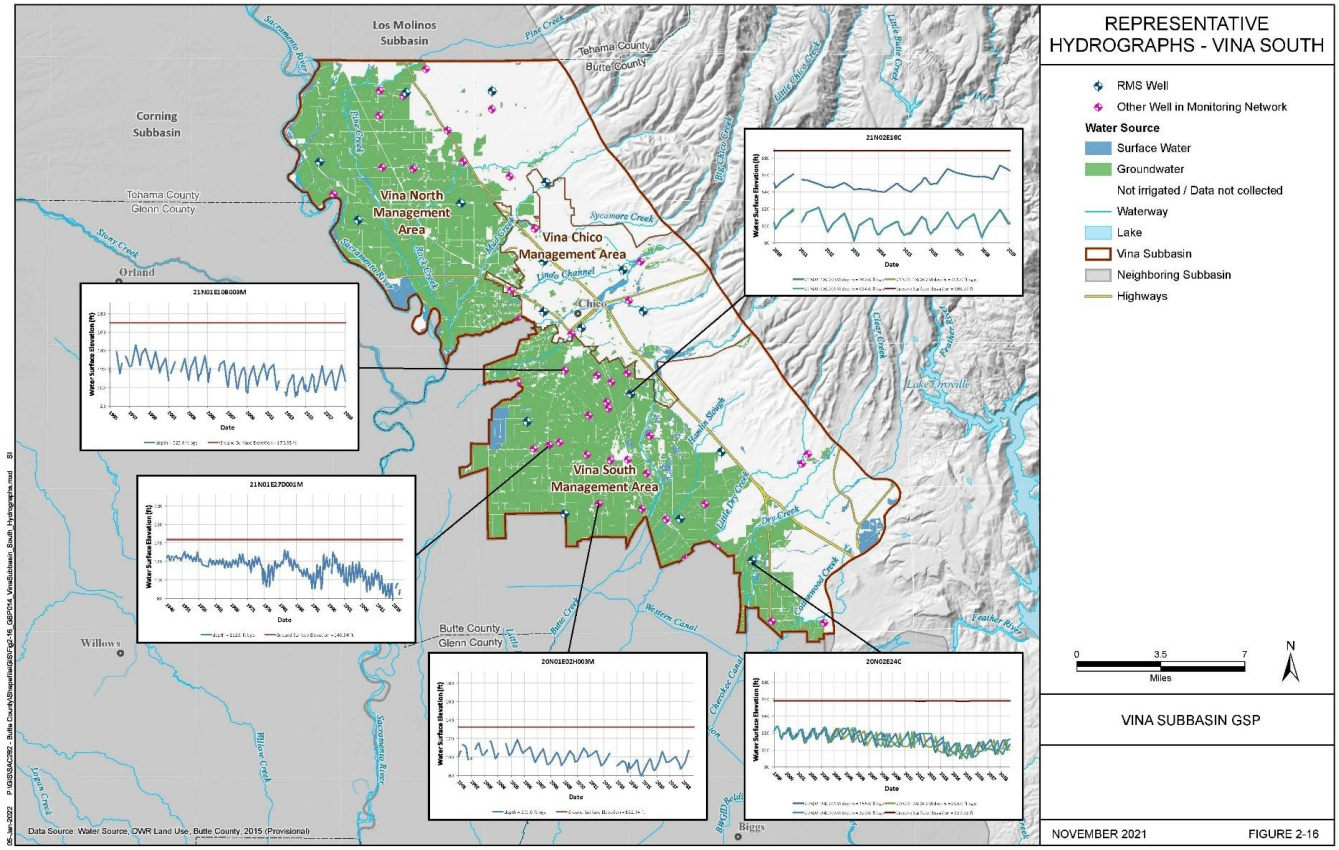


Figure 2-16 ~~placeholder page~~

: Representative Hydrographs (Vina South Management Area)

Hydrographs for the selected wells in the Vina North MA echo the seasonal fluctuations illustrated in the contour maps, with groundwater level depths at all locations being shallower in the winter and spring than in the summer and fall. Most of the hydrographs show annual changes in groundwater levels oscillating around a central axis with the three wells (23N01W10M001M, 23N01W28M, 23N01W36P001M)) lying in the interior of the MA showing declines in annual high and low readings that correspond to the period of the recent drought while the water levels in the wells (23N02W25C001M and 23N01W31M) located near the Sacramento River show little impact from the drought.

Vertical groundwater gradients are indicative of the hydraulic connectivity of shallow and deep zones of the aquifer system. They are measured by comparing groundwater elevations from multi-completion or nested wells that are completed across different depth zones. A "true" vertical hydraulic gradient is measured in a nested well at the same map location, but vertical gradients can sometimes be estimated using wells completed at different depths in different locations. When groundwater levels in the shallower wells are higher than in the deeper completions, the gradient indicates downward movement of groundwater. The volume of downward flow is proportional to the gradient and the hydraulic conductivity between the shallow and deep measurement points. In locations where groundwater levels in the shallower wells are lower than in the deeper wells, the gradient indicates upward movement of groundwater, with a similar relationship defining the volume of upward flow. Groundwater levels that are similar in elevation, even with distinctly different completion depths, indicate a uniform flow field with limited vertical gradient and vertical exchange of groundwater.

Formatted: English (United States)

Hydrographs for two nested wells in the Vina North MA are presented in Figure 2-14 and illustrate the heterogeneity of the primary aquifer laterally and vertically within different aquifer zones. The first nested well (well 23N01W31M) is located adjacent to the Sacramento River and consists of four individual wells screened from 65 to 75 feet bgs, 140 to 201 feet bgs, 590 to 600 feet bgs, and 1,020 to 1,030 feet bgs. This hydrograph shows that water levels in the shallowest well display little annual fluctuation, which indicates that this shallowest zone is in direct continuity with river levels and the adjacent floodplain. The deeper wells display greater fluctuation in seasonal water levels that generally tend to track each other, indicating less direct continuity with river levels and the adjacent floodplain. The second nested hydrograph (23N01W28M, Figure 2-14) is farther from the river and consists of four individual wells screened from 30 to 50 feet bgs, 120 to 165 feet bgs, 690 to 670 feet bgs, and 791 to 1,021 feet bgs. As seen on this hydrograph, there is a close correspondence in water elevations recorded at all screened intervals being monitored. This indicates a clear connection across the aquifer zones.

Formatted: English (United States)

Hydrographs for selected monitoring wells in the Vina Chico MA resemble those in Vina North in that they show some decline in water surface elevations during the drought. The single nested monitoring well in this MA shows water levels in the intermediate and lower zones closely tracking those in the upper zone indicating strong connection among the three zones.

Formatted: English (United States)

Hydrographs for selected monitoring wells in the Vina South MA show groundwater elevations lower than those in MA to the north, an indication of the general north-to-south gradient of flow in the Vina Subbasin. Most of the hydrographs in the Vina South MA also display more pronounced responses to the drought than do wells to the north. The nested monitoring wells in the south of the MA (Well ID Nos. 20N02E24C001M-003M) show the close communication

Formatted: English (United States)

among aquifer zones displayed in the nested sites in the Vina North and Vina Chico MAs. However, the nested well on the Midway in the vicinity of Butte Creek (Well ID Nos. 21N02E18C001M-003M) shows weak communication between the upper zone and the two lower zones and a strong recovery in water elevations in the upper zone that corresponds with the change in hydrologic conditions between the drought and the period immediately following the drought.

2.2.2.3 Change in Storage

Hydrographs from monitoring wells show cyclical fluctuations of groundwater levels over a four- to seven-year cycle consistent with variations in water year type according to the Sacramento Valley Water Year Hydrologic Classification (Figure 2-17). Groundwater levels typically decline during dry years and increase during wet years. Superimposed on this four- to seven-year short-term cycle is a long-term decline in groundwater levels. In other words, groundwater levels during more recent dry-year cycles are lower than groundwater levels in earlier dry-year cycles. This downward trend during dry years indicates an overall decline in groundwater storage.

Formatted: English (United States)

The dynamics of the interaction between inflows, outflows, changes in groundwater elevations, and changes in storage are captured in the water budget for the Vina Subbasin and by the BBGM (BCDWRC, 2021). A graph depicting estimates of the annual and cumulative change in the volume of groundwater in storage between seasonal high groundwater conditions, including the annual groundwater use and water year type based on the Sacramento Valley Water Year Index, is provided in Figure 2-17. Water year types are identified as wet (W, shaded blue), above normal (AN, shaded green), below normal (BN, shaded yellow), dry (D, shaded orange), or critical (C, shaded red). Annual change in storage was estimated using the BBGM based on March groundwater storage amounts. Groundwater pumping was estimated using the BBGM and is shown on a water year basis. Values are reported in thousands of acre-feet (TAF).

As indicated in the figure, groundwater storage generally decreases in below normal, dry, and critical years and increases in above normal and wet years. Groundwater pumping, shown by the solid black line, generally reflects higher pumping volumes during below normal, dry, and critical years and lower pumping volumes during above normal and wet years. Since the year 2000, there has been a cumulative decline in March 1 groundwater storage of about 400,000 acre-feet (AF). This indicates that the cycles of groundwater pumping are not in balance with the cycles of recharge that replenish the aquifer and that groundwater depletion has occurred consistent with long-term decline in groundwater levels. In general, it shows that wetter periods are able to recover around 100,000 to 150,000 AF of storage, but that dryer cycles result in storage declines of 200,000 to 300,000 AF. Historical and projected changes in storage are discussed in greater detail in Section 2.3, Water Budget. The BBGM estimates the total freshwater storage of the basin at about 16,000,000 AF, indicating the estimated yearly decline in storage is about 0.1 percent.

Formatted: English (United States)

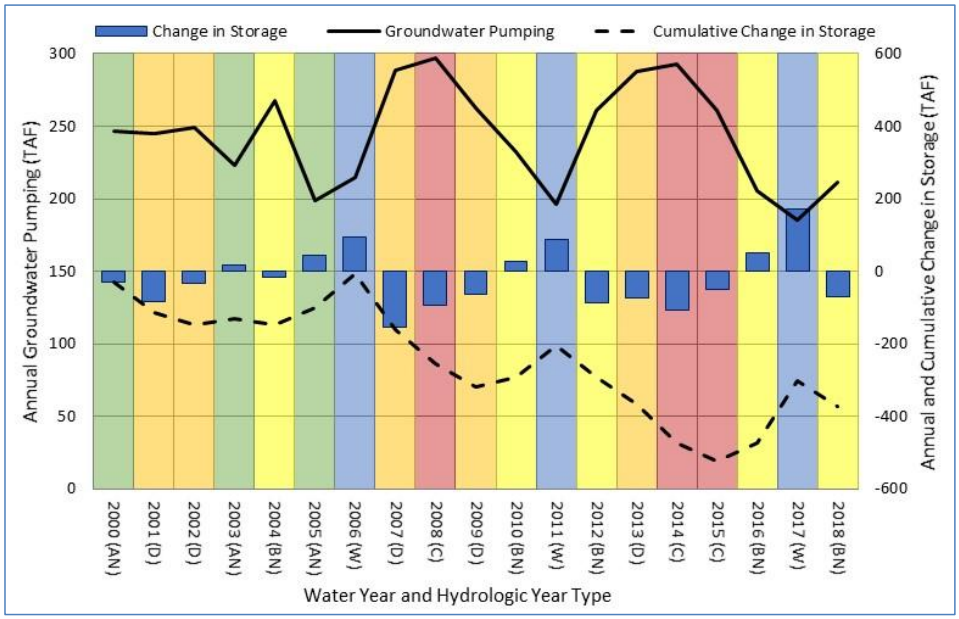


Figure 2-17: Change in Storage and Groundwater Pumping by Water Year Type. Values calculated from March to March for each water year. AN – above normal, D – dry, BN – below normal, W – wet, C – critical.

2.2.3 Seawater Intrusion

Intrusion of seawater is not a consideration in the Vina Subbasin because of the subbasin's inland location and distance from the coastline where saline intrusion originates from the ocean's influence on freshwater aquifers. For this reason, no monitoring of seawater intrusion is required nor is there a need for projects and management actions to mitigate seawater intrusion.

Formatted: English (United States)

2.2.4 Groundwater Quality

2.2.4.1 General Water Quality of Principal Aquifer

DWR Bulletin 118 Vina Subbasin Report (DWR, 2004) characterized the water quality of groundwater in the Vina Subbasin as predominantly Calcium-magnesium bicarbonate and magnesium-calcium bicarbonate. Total dissolved solids range from 48 to 543 milligrams per liter, averaging 285 milligrams per liter (DWR unpublished data as cited in DWR, 2004). Impairments include localized high calcium and high nitrates and total dissolved solids in the Chico area.

The Lower Tuscan Aquifer study also conducted a water quality analysis on monitoring well and pumping wells used in the study and constructed piper diagrams. They show that groundwater samples from these wells indicate calcium bicarbonate waters (Brown and Caldwell, 2013). The goal of groundwater quality management under SGMA is to supplement information available

Formatted: English (United States)

from other sources with data targeted to assist GSAs in the Vina Subbasin to comply with the requirements of SGMA. Development of groundwater quality-related SMC for the Vina Subbasin is not intended to duplicate or supplant the goals and objectives of ongoing programs, including those by Butte County, the Sacramento Valley Water Quality Coalition (SVWQC), and the State Drinking Water Information System. Because irrigated agriculture is the predominant land use in the Vina Subbasin, monitoring of the groundwater quality data developed through the GQTMWP being implemented by the SVWQC for compliance with the Central Valley Regional Board's ILRP will be an important source of information to GSAs in the Vina Subbasin.

Among the contaminants that may affect groundwater conditions in the future are chemicals of emerging concern (CECs). These are contaminants having toxicities not previously recognized, which may have the potential to cause adverse effects to public health or the environment and are found to be building up in the environment or to be accumulating in humans or wildlife. CECs such as perfluorooctanesulfonic acid and per- and polyfluoroalkyl substances will not be monitored under the groundwater quality monitoring program established for SGMA. However, GSAs will have access to data on CECs collected by other agencies and will be attentive to the effect the presence of CECs may have on groundwater management in specific locations.

Formatted: English (United States)

2.2.4.2 Description and Map of Known Sites and Plumes

The SGMA regulations require that GSPs describe locations, identified by regulatory agencies, where groundwater quality has been degraded due to industrial and commercial activity. Locations of impacted groundwater were identified by reviewing information available on the SWRCB Geotracker/GAMA website, the California Department of Toxic Substances Control (DTSC) EnviroStor website, and the United States Environmental Protection Agency's (USEPA) National Priorities List. Cases that have been closed by the supervisory agency are not considered.

Formatted: English (United States)

Figure 2-18 shows sites of known or potential groundwater impacts from EnviroStor and Geotracker/GAMA databases in the Vina Subbasin. The sites were divided into the following categories based on regulatory designation:

Formatted: English (United States)

- Other Sites with Corrective Action (Current)
- Sites Needing Evaluation (Active or Inactive)
- Federal Superfund-Listed Sites
- Leaking LUST Cleanup Sites

Active DTSC Cleanup Program Sites in the Vina Subbasin include the following:

- No. 04880002 - Chico - Skyway Subdivision groundwater plume:
  - Past use that caused contamination: Manufacturing – metal
  - Potential contaminants of concern: Halogenated solvents, tetrachloroethene (PCE), trichloroethene (TCE)

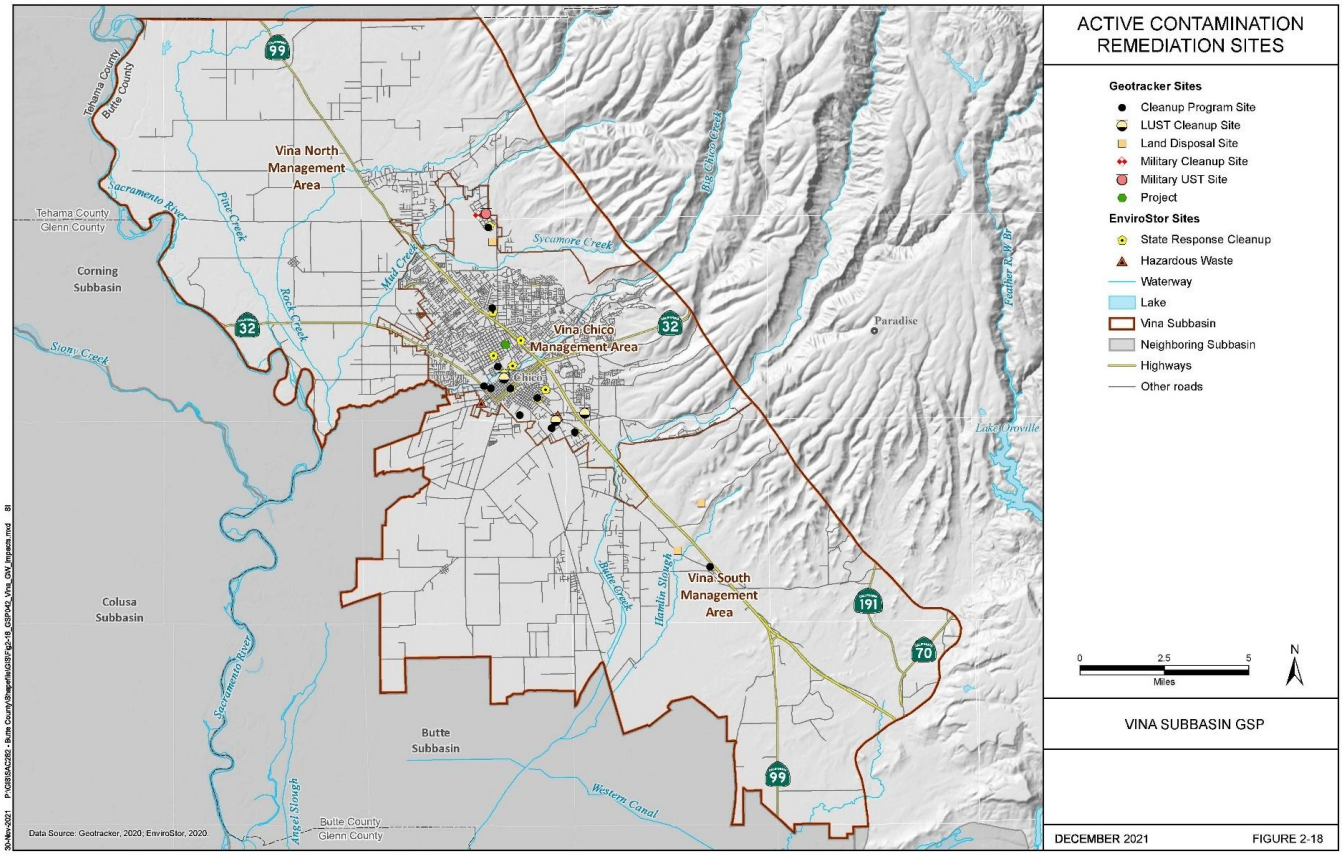


Figure 2-18 ~~placeholder page~~: Active Contamination Remediation Sites

- Potential media affected: Aquifer used for drinking water supply; well used for drinking water supply
  - No. 04990002 - Chico Groundwater Plume – Southwest:
- Past use that caused contamination: dry cleaning
- Potential contaminants of concern: PCE
- Potential media affected: Aquifer used for drinking water supply, other groundwater affected, well used for drinking water supply
  - No. 04990003 - Chico Groundwater Plume – Central:
- Past use that caused contamination: dry cleaning
- Potential contaminants of concern: PCE
- Potential media affected: Aquifer used for drinking water supply, other groundwater affected, well used for drinking water supply
  - No. 04450006 - Chico Municipal Airport:
- Past use that caused contamination: manufacturing – metal
- Potential contaminants of concern: TCE
- Potential media affected: Aquifer used for drinking water supply, indoor air, soil, soil vapor
  - No. 4720001 - Esplanade Cleaners:
- Past use that caused contamination: Dry cleaning
- Potential contaminants of concern: PCE
- Potential media affected: Groundwater uses other than drinking water
  - No. 4720002 - First Avenue Cleaners:
- Past use that caused contamination: Dry cleaning
- Potential contaminants of concern: PCE
- Potential media affected: Aquifer used for drinking water supply, well used for drinking water supply
  - No. 4720003 - Flair Custom Cleaners:
- Past use that caused contamination: Dry cleaning
- Potential contaminants of concern: PCE
- Potential media affected: Groundwater uses other than drinking water, soil, soil vapor
  - No. 4720005 - North Valley Plaza Cleaners:
- Past use that caused contamination: Dry cleaning

- Potential contaminants of concern: cis-1,2-dichloroethene, trans-1,2-dichloroethene, PCE
- Potential media affected: Aquifer used for drinking water, well used for drinking water supply, indoor air, soil vapor
  - No. 4360003 - Victor Industries:
- Past use that caused contamination: Manufacturing – metal
- Potential contaminants of concern: TCE
- Potential media affected: Aquifer used for drinking water supply, well used for drinking water supply, soil

Of the nine open cases in the Vina Subbasin, all were identified as having the potential to impact groundwater. Information on these sites is available at ~~www.envirostor.dtsc.ca.gov~~www.envirostor.dtsc.ca.gov.

Formatted: English (United States)

Formatted: English (United States)

2.2.5 Subsidence

2.2.5.1 Rates and locations

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials often caused by groundwater or oil extraction. The potential effects of land subsidence include:

- Differential changes in elevation and gradients of stream channels, drain and water transport structures
- Failure of water well casings due to compressive stresses generated by compaction of the aquifer system
- Compressional strain in engineering structures and houses

To date, no land subsidence has been recorded in Butte County. To determine whether subsidence is occurring, a subsidence monitoring network has been established throughout the Sacramento Valley, the Sacramento Valley GPS Subsidence Monitoring Network. This system consists of observation stations and extensometers managed jointly by Reclamation and DWR. The observation stations are a result of DWR's efforts to establish a subsidence monitoring network to capture changes in subsidence across the Sacramento Valley. The observation stations are established monuments with precisely surveyed land surface elevations, which are distributed throughout the County such that the entire county is well represented. In 2008, DWR along with numerous partners performed the initial GPS survey of the observation stations to establish a baseline measurement for future comparisons. The network was resurveyed again in 2017 (DWR, 2018c) using similar methods and equipment as those used in the 2008 survey, and results were analyzed to depict the change in elevation at each station between those two years.

Formatted: English (United States)

Extensometers are installed in wells or boreholes and are a more site-specific method of measuring land subsidence, as they can detect changes in the thickness of the sediment surrounding the well due to compaction or expansion. These instruments are capable of detecting very slight changes in land surface elevation on a continuous basis with an accuracy of +/- 0.01

Formatted: English (United States)

feet or approximately 3 mm. The three extensometers in Butte County, all located in the Butte Subbasin, have a period of record beginning in 2005 and were chosen by DWR based on a high likelihood of seeing subsidence in these areas if it were to occur, due to the presence of known clay and other fine-grained deposits in these areas. Data are available through July 2019 and can be found in the DWR SGMA Data Viewer.[5] While seasonal displacement of -9.13 mm (+/- 0.3 mm) have been recorded at one of these extensometers during 2006 (a wet water year) and 2015 (a critical water year), changes in ground surface elevations are slight and remain at or above baseline levels in 2019.

Processes that can contribute to land subsidence include aquifer compaction by overdraft, hydrocompaction (shallow or near-surface subsidence) of moisture deficient deposits above the water table that are wetted for the first time since deposition, and subsidence caused by tectonic forces (Ireland et al., 1984). Land subsidence in the Vina Subbasin would most likely occur as a result of aquitard consolidation. An aquitard is a saturated geologic unit that is incapable of transmitting significant quantities of water. As the pressure created by the height of water (i.e., head) declines in response to groundwater withdrawals, aquitards between production zones are exposed to increased vertical loads. These loads can cause materials in aquitards to rearrange and consolidate, leading to land subsidence. Factors that influence the rate and magnitude of consolidation in aquitards include mineral composition, the amount of prior consolidation, cementation, the degree of aquifer confinement and aquitard thickness.

Subsidence has elastic and inelastic deformation components. As the head lowers in the aquifer, the load that was supported by the hydrostatic pressure is transferred to the granular skeletal framework of the formation. As long as the increased load on the formation does not exceed the pre-consolidation pressure, the formation will remain elastic. Under elastic conditions, the formation will rebound to its original volume as hydrostatic pressure is restored. However, when the head of the formation is lowered to a point where the load exceeds pre-consolidation pressure, inelastic deformation may occur. Under inelastic consolidation, the formation will undergo a permanent volumetric reduction as water is expelled from aquitards.

Recent subsidence studies in the Central Valley have utilized satellite- and aircraft-based Interferometric Synthetic Aperture Radar (InSAR). Much of the InSAR work has been led by the National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL). However, because JPL InSAR data are limited to a period from 2015 through 2017, TRE ALTIMIRA InSAR available through DWR was used for this analysis, as data from this source are available for a period extending from June 2015 through September 2019.

2.2.5.2 Historical and Recent Cumulative Subsidence and Rates of Subsidence

The data shown in Table 2-4 include the range of cumulative subsidence observed within the Vina Subbasin over the period between 2008 and 2017, as reported by Sacramento Valley GPS Subsidence Monitoring stations included in the Vina Subbasin Monitoring Network and a range of annual subsidence rates calculated from the cumulative totals. The range of recent cumulative subsidence and rates of subsidence over the period from June 2015 through September 2019 are also presented in the table and are based on InSAR data. As both the Sacramento Valley GPS

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

[5] Accessed at https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#landsub

monuments and InSAR monitor changes in land surface elevations, the data do not distinguish between elastic and inelastic subsidence. However, the cumulative subsidence values observed by both sources indicate that inelastic subsidence is not significant in the Vina Subbasin.

Table 2-4: Cumulative Subsidence and Approximate Annual Rate of Subsidence

Subbasin Area (square miles)	Date Range	Cumulative Subsidence (feet)	Calculated Annual Rate of Subsidence (feet/year)	Source
289	2008-2017	0.176 to -0.074	0.020 to -0.008	Sac Valley
289	2015-2019	0.25 to -0.25	0.063 to -0.063	InSAR

Figures 2-19 and 2-20 show historical and recent levels of subsidence within the Vina Subbasin. Historical levels for the period from 2008 to 2017 are shown in Figure 2-19 – Historical Subsidence, as are the locations of subsidence monitoring network monuments used to measure subsidence. Recent levels for the period from 2015 through 2019 are presented in Figure 2-20 – Recent Subsidence. The values presented in Table 2-4 and in Figures 2-19 and 2-20 support the observation that inelastic land subsidence due to groundwater withdrawal is unlikely to result in an Undesirable Result in the Vina Subbasin. Although none of the subsidence data shows substantial changes in ground surface elevations, the InSAR mapping presented in Figure 2-20 shows a clear distinction between changes in elevations observed on the northern and eastern flanks of the Vina Subbasin versus changes observed in the center.

Formatted: English (United States)

2.2.6 Interconnected Surface Water Systems

2.2.6.1 Definitions

Interconnected surface water is defined under SGMA as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted."[6] There are two key terminology references in this statement. First, the surface water must be connected to the underlying aquifer by a "continuous saturated zone." This implies that the connection can be via a "zone" that is not the same as the underlying aquifer, and that deeper aquifer zones are, through connections upward to shallower aquifer zones, hydraulically connected to surface water. This is consistent with most conceptual representations of how groundwater is interconnected with surface water systems. The second reference implies that an overlying surface water that is "completely depleted" does not represent an interconnection with the underlying groundwater.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

[6] Cal. Code Regs. Tit. 23, § 351

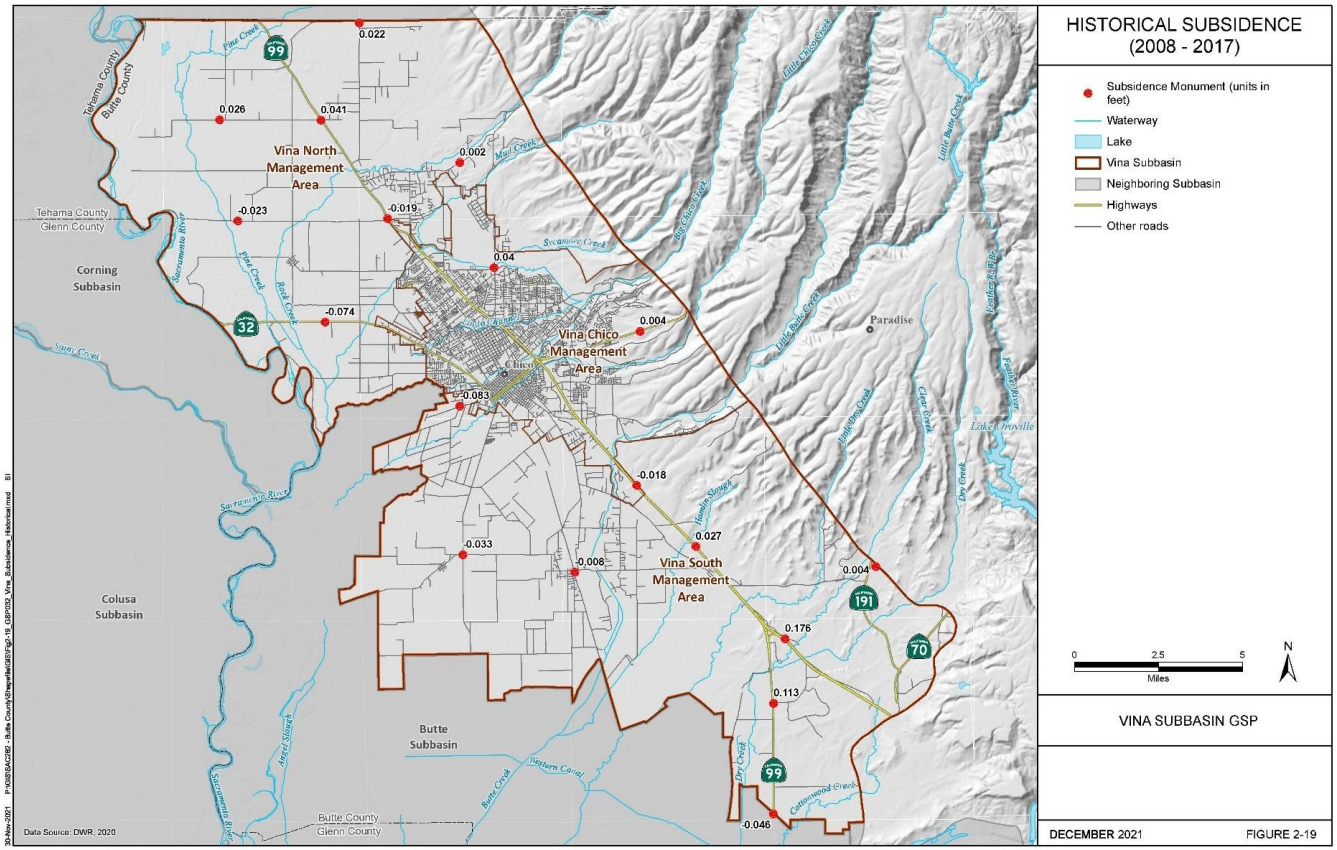


Figure 2-19 ~~placeholder page~~: Historical Subsidence (2008-2017)

Formatted: Caption,Caption1

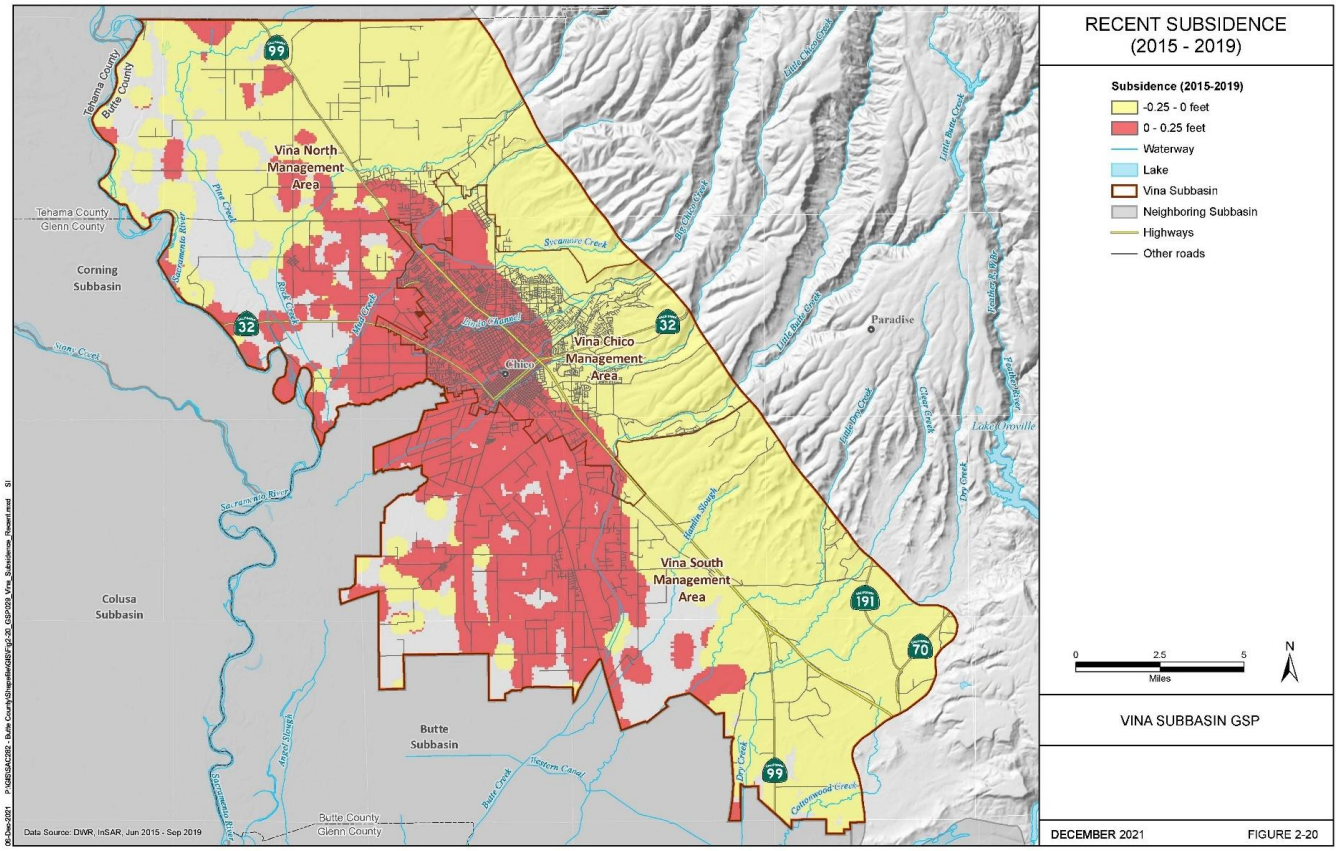


Figure 2-20 ~~placeholder page~~

Formatted: Caption,Caption1

: Recent Subsidence (2015-2019)

Formatted: English (United States)

Both of these situations exist in the Vina Subbasin:

Formatted: English (United States)

1. Within the floodplain of the Sacramento River, there is a continuous saturated zone (i.e., the floodplain sediments) that connects the shallowest aquifer to the river. The connectivity between shallow and deeper aquifer zones will dictate the overall connectivity to the River. Therefore, the Sacramento River floodplain represents a "high groundwater connectivity" zone with respect to the surface water.
2. In the upland areas outside of the Sacramento River floodplain, there are creeks that flow seasonally and often dry up in late summer or are dry for an entire year during dry conditions. In this case, the upland creeks may not be influenced by "high groundwater connectivity" and the presence of an undesirable result is not clear cut with respect to surface water depletion. The streams dry up regardless of the groundwater condition, and streams that are already dry are not considered interconnected surface water. However, the upland streams are an important source of recharge to the aquifer, so the health of these stream channels and their adjacent riparian zones is important to groundwater sustainability.

Streams and rivers are classified as either gaining, losing, or disconnected with respect to the connectivity to groundwater. The difference between gaining and losing reaches is illustrated in Figure 2-21 and dependent upon the hydraulic gradient of the river stage and head in the principal aquifer. For gaining reaches, the water table adjacent to the stream is above the elevation of water in the stream, resulting in flow of water from the groundwater system to the stream. These are termed streamflow gains or accretions. For losing reaches, the water table adjacent to the stream is below the elevation of water in the stream, resulting flow of water from the stream to the groundwater systems. These are termed streamflow losses or depletions. In both cases, there is a continuous hydraulic gradient between the stream and the underlying sediments (i.e., there is no unsaturated or partially saturated zone present beneath the streambed). A disconnected system is present when there is an intervening unsaturated or partially saturated zone between the streambed and the water table. A disconnected system is also present when the stream is dry and therefore cannot interact with the underlying water table.

Formatted: English (United States)

It is important to recognize that these interconnections are dynamic and are affected by many factors along an entire reach of a stream or river. Variations in local geology, hydrology, vegetation patterns, and water use can all influence how these interconnections occur. Monitoring groundwater levels in appropriate zones of the aquifer near available stream stage data is needed to understand and analyze these dynamics, which ultimately help characterize interconnected surface waters and stream depletions.

Formatted: English (United States)

Two examples of this complexity are described below:

- At a single point in time, a stream may have both gaining, losing, and disconnected reaches. For this reason, defining stream reaches and key points in the stream system where flows are managed is very important. The volume of water that is "gained" or "lost" depends, in part, on how individual stream reaches are defined and the amount of streamflow data available to calculate gains or losses to each reach. In general, it is not possible to directly measure gains or

losses to streamflow using groundwater data alone. Streamflow data is extremely important in determining how groundwater interacts with surface water.

- Reaches that are gaining under certain seasonal or longer-term conditions may become losing under others. In this case, understanding the magnitude of groundwater level fluctuation adjacent to a stream reach and the hydraulic properties of the streambed is important. The volume of water that is gained or lost is proportional to the head difference between the stream, the elevation of the streambed, the elevation of the groundwater adjacent to the stream, and the hydraulic properties of the streambed.

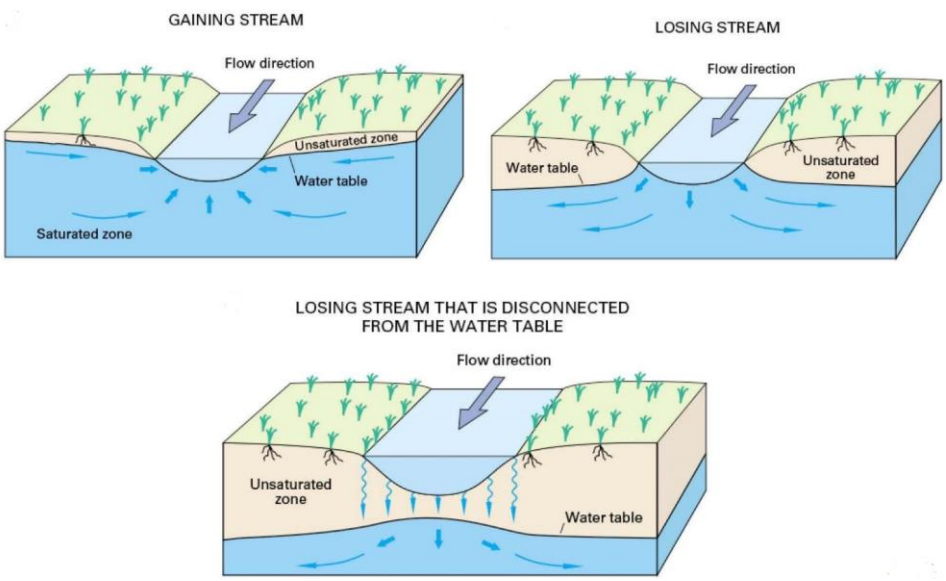


Figure 2-21: Illustration of Gaining and Losing Interconnected and Disconnected Stream Reaches (Source: United States Geological Survey [USGS])

2.2.6.2 Evaluation of Surface Water Connectivity

This section presents a general evaluation of surface water connectivity based on limited discrete data sets that do not encompass the entire Vina Subbasin. The results of the BBGM model are discussed separately in Section 2.2.6.3.

The data sets used to evaluate surface water connectivity in general include:

- Hydrograph for a nested well located adjacent (about 0.8 miles) to the Sacramento River, well 23N01W31M)

- A second nested hydrograph farther from the Sacramento River, well 23N01W28M
- A streamflow gaging study conducted by Chico State University (Davids et al., 2020)
- Groundwater levels measured in seven shallow monitoring wells as part of a nitrate study conducted in the City of Chico (AECOM, 2020)

Each data set has limitations with respect to an integrated evaluation of surface water connectivity across the Vina Subbasin. Locations of the wells referenced above are provided in Figure 2-22. A summary of the findings is provided below.

- Section 2.2.2.2 provides an initial discussion of the nested wells located adjacent to and further away from the Sacramento River, and Figure 2-14 provides hydrographs for these wells covering their period of record. To allow for a more detailed assessment of trends within each of the zones screened, Figure 2-23 provides hydrographs for these wells (23N01W31M and 23N01W28M) over a shorter time period (January 2014 through December 2016).

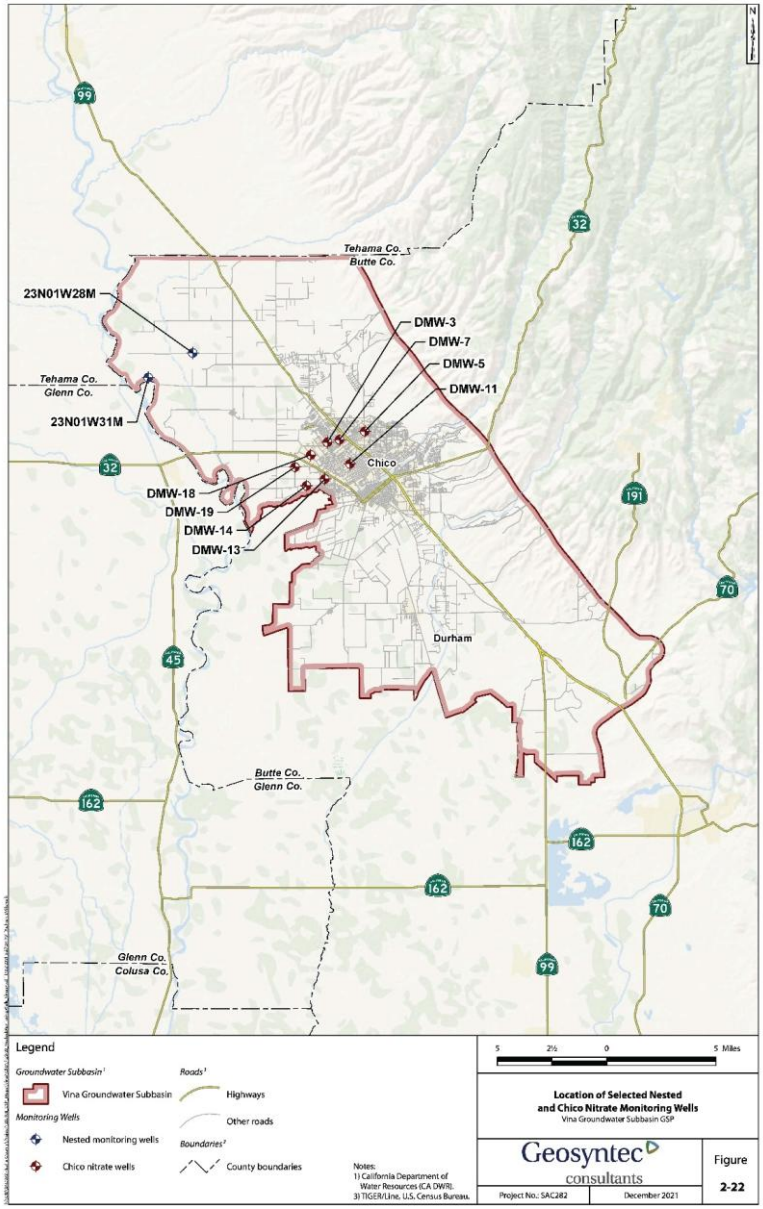

Tehama Co.
Butte Co.
23N01W28M
DMW-3
DMW-7
DMW-5
DMW-11
Tehama Co.
Glenn Co.
23N01W31M
Chico
DMW-18
DMW-19
DMW-14
DMW-13
Durham
Butte Co.
Glenn Co.
Glenn Co.
Colusa Co.
Legend
Groundwater Subbasin[1]
Vina Groundwater Subbasin
Monitoring Wells
Nested monitoring wells
Chico nitrate wells
Roads[1]
Highways
Other roads
Boundaries[2]
County boundaries
Notes:
1) California Department of Water Resources (CA DWR).
3) TIGER/Line, U.S. Census Bureau.
5 2½ 0 5 Miles
Location of Selected Nested and Chico Nitrate Monitoring Wells
Vina Groundwater Subbasin GSP
Geosyntec consultants
Figure 2-22
Project No.: SAC282
December 2021

Figure 2-22 ~~placeholder page~~

: Location of Selected Nested and Chico Nitrate Monitoring Wells

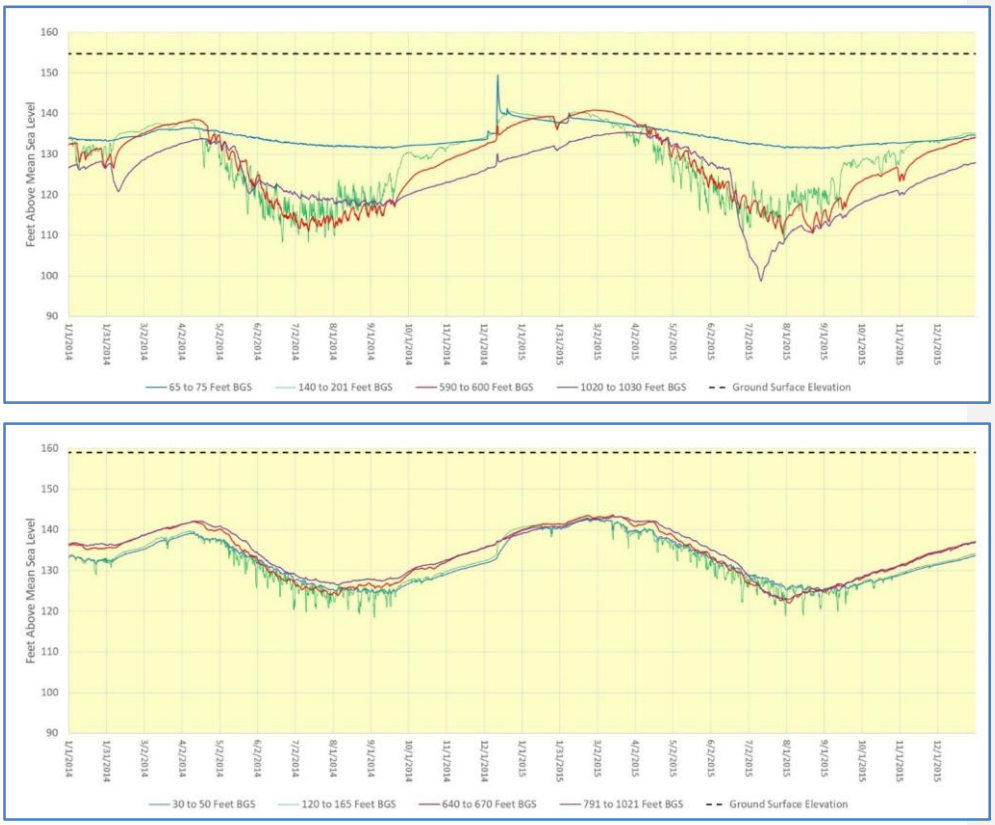


Figure 2-23: Hydrographs for Nested Well Located Near Sacramento River (Upper Hydrograph, Well 23N01W31M) and Nested Well Located Further from the Sacramento River (Lower Hydrograph, Well 23N01W28M)

As seen in this figure, the hydrograph for the nested well located adjacent to the Sacramento River (23N01W31M, upper graph in Figure 2-23) shows that water levels in the shallowest well display little annual fluctuation and are similar to the elevation of the river. This indicates that this shallowest well completion interval is in direct continuity with river levels and the adjacent floodplain supported by the up-tick of water levels in December 2014 that are most likely due to increases in river flows. It is likely that this shallow well is completed in what could be termed "floodplain sediments," as opposed to a regional shallow aquifer that extends across the Vina

Formatted: English (United States)

Subbasin. The deeper wells within this nest display greater fluctuation in seasonal water levels that generally tend to track each other, indicating less direct continuity with river levels and the adjacent floodplain.

The hydrograph for the nested well farther from the river (well 23N01W28M, lower graph on Figure 2-23) shows a close correspondence in water elevations recorded at all screened intervals being monitored. This indicates a clear connection across the aquifer zones. The trend in these zones is also similar to the trends observed for the three deeper wells within the nested well located adjacent to the Sacramento River.

Formatted: English (United States)

The streamflow gaging study conducted by Chico State University on Big Chico Creek in 2020 (Davids et al., 2020) consisted of repeated measurements of streamflow at six different locations along Big Chico Creek between June and mid-October. The study consisted solely of streamflow data and no groundwater information or analysis of the floodplain/riparian area was conducted. The results clearly show a progressive decrease in streamflow from the uppermost station to the lowermost station for each of the time points measured. The results also clearly show a rapid decrease in streamflow from June to July, followed by a more gradual decrease after July. Finally, the results clearly show that the lower 8 kilometers of Big Chico Creek (below Rose Drive Bridge) become dry by early July and flows in the middle portion of the Creek decrease to below 5 cubic feet per second (cfs) by late July. This recent data indicates that, in general, within the subbasin Big Chico Creek is a losing stream during high flood flows and becomes a disconnected stream in its lower reaches by early to mid-summer. There is no indication in the streamflow data at the measured time and locations to suggest groundwater interactions contribute to the streamflow behavior, thereby suggesting Big Chico Creek was observed to be a losing stream disconnected from the water table. Similar conditions would be expected for other creeks that traverse the Vina Subbasin (Little Chico, Sycamore, Rock, and Butte Creek) since they flow across a similar fan topography and similar shallow subsurface geology. The overall conclusion from this study in relation to interconnected surface water is that, for significant portions of the year, the upland creeks in the Vina Subbasin would be classified as disconnected streams and the surface water would be considered "completely depleted" as defined under SGMA.

Formatted: English (United States)

Eight shallow monitoring wells installed within the City of Chico in the vicinity of Little Chico Creek (AECOM, 2020: Figure 2-23) provide similar findings to the streamflow study on Big Chico, but are based on groundwater data. All the monitoring wells were completed at depths of less than 60 feet bgs and are therefore representative of groundwater levels that could directly interact with the adjacent stream channels (i.e., Little Chico Creek and the Lindo Channel). Figure 2-24 provides hydrographs for these eight wells for data collected since 2012. All the groundwater levels collected across all time periods are below the elevation of the stream channel adjacent to the monitoring wells. This indicates that groundwater levels are not capable of interacting directly with the adjacent stream channel.

Formatted: English (United States)

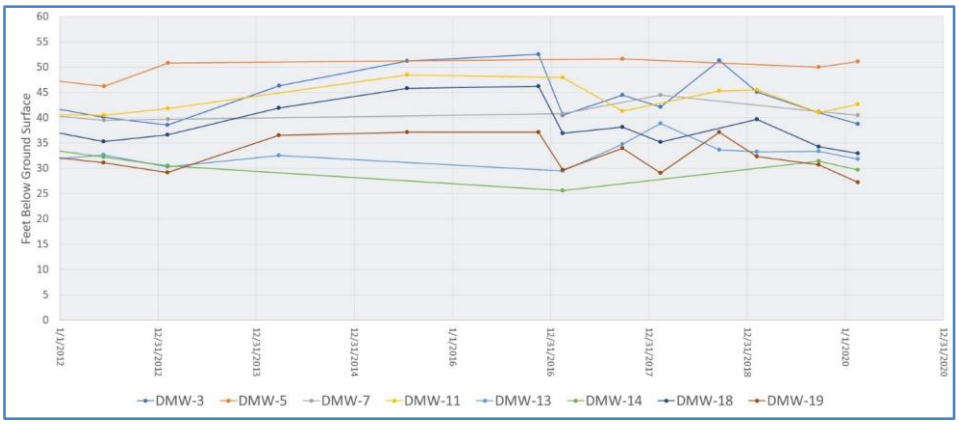


Figure 2-24: Hydrographs Showing Feet Below Ground Surface for Eight Shallow Wells Monitored as Part of Chico Nitrate Study (AECOM, 2020)

At the downstream end of the stream channel, groundwater levels were somewhat closer to the bottom of the stream channel, but still did not intersect the stream channel. This downstream area represents the edge of the upland area and the transition zone to the Sacramento River floodplain. Some groundwater interaction may occur in these lower reaches but is more representative of surface water interactions in the floodplain as opposed to the upland area.

Finally, it should be noted that only the northern portion of the Vina Subbasin extends to the Sacramento River (north of its confluence with Big Chico Creek). The southern portion of the Vina Subbasin does not extend into the Sacramento River floodplain, and therefore consists only of upland creeks that dissect the alluvial fan system emanating from the foothills. Any direct interaction with the Sacramento River south of its confluence with Big Chico Creek occurs in the Butte Subbasin.

2.2.6.3 Estimates of Surface Water Connection Based on BBGM

The interactions between groundwater systems and surface water features within the Vina Subbasin are estimated at a basin scale in the BBGM. A total of 32 stream segments traversing or bounding the Vina Subbasin with a total length of approximately 115 miles are defined in the BBGM. The segments range in length from 1 to 9 miles with an average length of 3.6 miles and are shown in Figure 2-25. Streamflows are defined in each stream at the eastern edge of the model based on available stream gage data. Streamflow data in upland creeks between the edge of the model and the Sacramento River were not available for use in model calibration. The floodplain of the Sacramento River is not explicitly defined in the BBGM, so there is no distinction between floodplain sediments that may interact directly with the Sacramento River and more regional shallow aquifers that extend east to the recharge areas along the foothills.

Figure 2-26 shows the model-predicted stream interaction from 2000 to 2018. The results are expressed as a percentage based on number of months that either a gaining or losing condition was predicted. The figure shows that the upland stream segments above the Sacramento River

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

floodplain are predominantly losing reaches that provide recharge to the aquifer. Streambed elevations at individual stream nodes from the BBGM were also compared to groundwater elevations from spring groundwater level measurements provided by DWR as part of the SGMA Data Viewer.[7] As indicated in Figure 2-27, the estimated average distance between the streambed and groundwater over a five-year period (2014-2018) was 20 feet for upland streams before they entered the Sacramento River floodplain. This disconnection between upland streams and shallow groundwater is consistent with the evaluation of shallow well groundwater levels described previously.

Reaches of the Sacramento River showed more variable model response, with a broader distribution of gaining and losing months. As indicated in Figure 2-27, the estimated average distance between the streambed and groundwater over a five-year period (2014-2018) was 10 feet or less in the Sacramento River floodplain. This is consistent with a more complex and large-scale interaction between floodplain sediments, underlying aquifer zones, and the elevation profile of the Sacramento River.

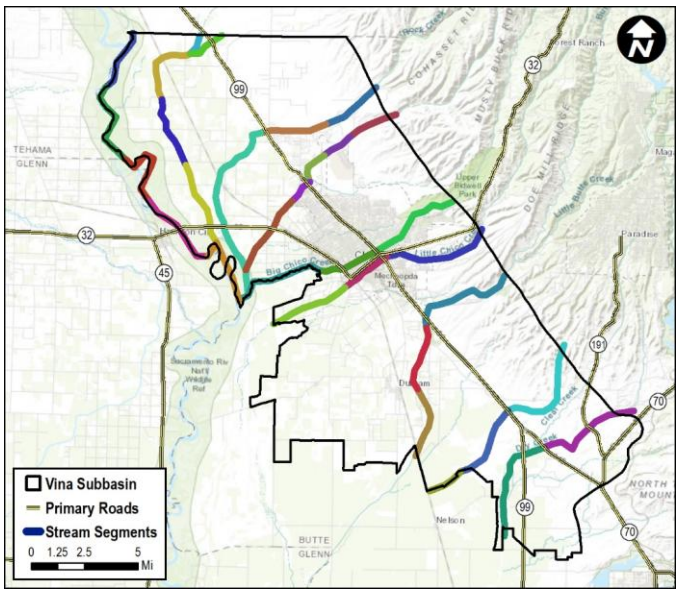


Figure 2-25: Vina Subbasin Stream Segments

[7] Accessed at https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#gwlevels.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

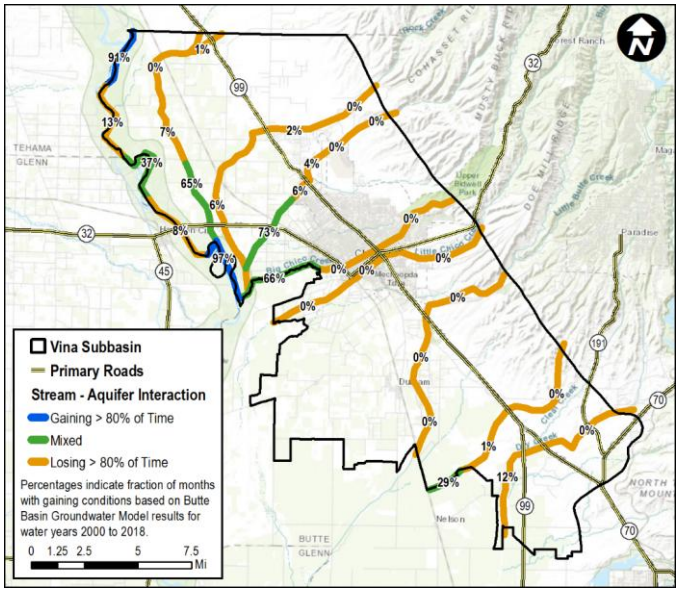


Figure 2-26: Vina Subbasin Gaining and Losing Stream Reaches based on Butte Basin Groundwater Model, Water Year 2000 to 2018

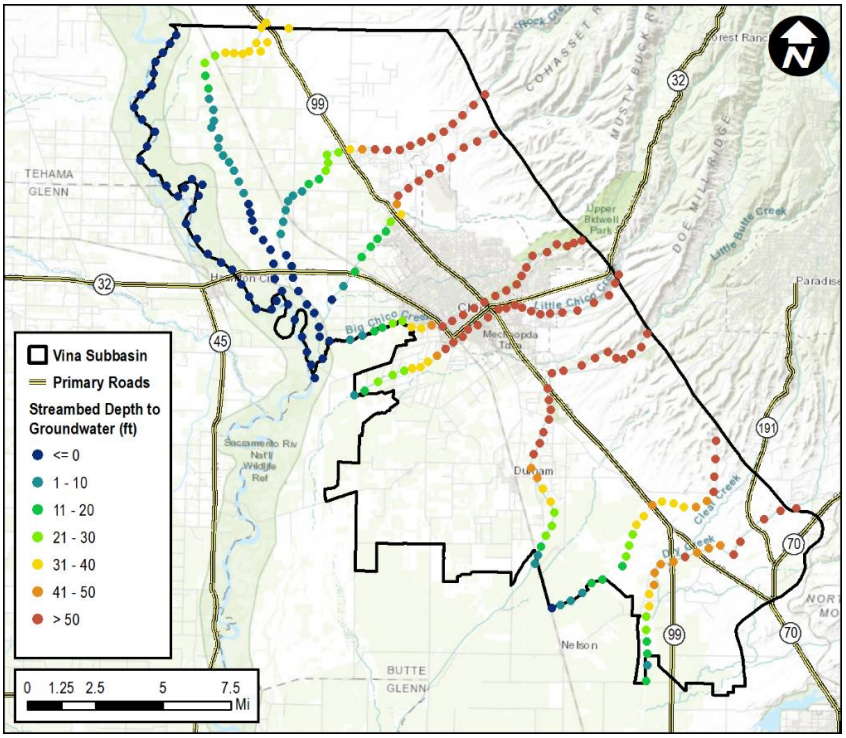


Figure 2-27: Vina Subbasin Average Streambed Spring Depth to Groundwater, 2014 to 2018

2.2.6.4 Water Balance for Surface Water – Groundwater Interaction

The water balance for surface water – groundwater interaction was estimated using the BBGM on a monthly time step. The volume of interaction was calculated across the entire length of each stream. Monthly net streamflow gains or losses from groundwater were calculated by the model water balance for the historical period from water year 2000 to 2018. These results are summarized in Table 2-5. Average monthly gains to streamflow are expressed in cfs. Negative values denote losses from streamflow to groundwater (i.e., seepage or depletion).

Formatted: English (United States)

Table 2-5: Average Monthly Gains to Streamflow from Groundwater, Water Years 2000 to 2018 (cubic feet per second)

Stream	Monthly Gains from Groundwater (cfs)												Average (cfs)
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
Angel Slough	0	0	0	0	0	0	0	0	0	0	0	0	0
Big Chico Creek	-2	-3	-6	-7	-7	-8	-5	-3	-2	-2	-2	-1	-4
Butte Creek	-7	-10	-15	-15	-18	-20	-18	-14	-10	-7	-6	-6	-12
Dry Creek	-1	-1	-3	-2	-2	-2	-1	0	0	0	0	0	-1
Little Chico Creek	-1	-1	-2	-2	-2	-2	-2	-1	-1	-1	-1	-1	-1
Little Dry Creek	-2	-3	-6	-6	-6	-5	-4	-2	-2	-1	-1	-1	-3
Mud Creek	0	0	-1	1	1	2	2	1	1	0	0	0	0
Pine Creek	-1	-2	-4	-1	0	2	3	3	2	1	1	0	0
Rock Creek	-3	-3	-4	-3	-3	-2	-2	-2	-2	-2	-2	-2	-2
Sac River	109	151	24	-44	20	50	181	142	91	13	33	57	69
Singer Creek	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**92**	**129**	**-17**	**-79**	**-18**	**15**	**154**	**123**	**76**	**1**	**22**	**46**	**45**

Table 2-5 shows that most of the streams that traverse the alluvial fan from the foothills to Sacramento River lose water to the groundwater system at a rate of between 1 and 12 cfs, with Butte Creek showing the highest amount of seepage to groundwater. Total streamflow loss to groundwater averages about 23 cfs or about 16,650 AFY.

Formatted: English (United States)

Mud Creek and Pine Creek, which are located near or within the Sacramento River floodplain, show more variation (with both gaining and losing months), but are, on an annual basis, neutral with respect to total volume of stream interaction.

Formatted: English (United States)

The Sacramento River shows net gaining conditions along the reaches adjacent to the Vina Subbasin for all months except January. On average, there is approximately 70 cfs of streamflow gain, or 50,600 AF per year, which represents about 23% of the total modeled recharge to the Vina Subbasin (Section 2.3). The remaining 77% of recharge to the Vina Subbasin discharges into pumping wells and model boundaries.

Formatted: English (United States)

2.2.7 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDEs) are defined in the SGMA regulations as "ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" (California Code of Regulations [CCR] Title 23, § 351(m)). GDEs exist within the Vina Subbasin largely where vegetation accesses shallow groundwater for survival and in areas with streams and creeks where a connection to groundwater exists. Without access to shallow groundwater, these plants and the ecosystems supported by the hydrology would die.

2.2.7.1 NCCAG Database

The initial identification of GDEs for this GSP was performed by using the Natural Communities Commonly Associated with Groundwater (NCCAG) database to identify and map potential GDEs (iGDEs) in the Vina Subbasin. The NCCAG database was developed by a working group comprised of DWR, CDFW, and The Nature Conservancy (TNC) by reviewing publicly available state and federal agency datasets that have mapped California vegetation, wetlands, springs, and seeps and by conducting a screening process to retain types and locations of these commonly associated with groundwater. The results were compiled into the NCCAG database with two habitat classes defined. The first class includes wetland features commonly associated with the surface expression of groundwater under natural, unmodified conditions. The second class includes vegetation types commonly associated with the sub-surface presence of groundwater (phreatophytes). Figures 2-28 and 2-29 show the locations of all iGDEs identified by the NCCAG database within the Vina Subbasin.

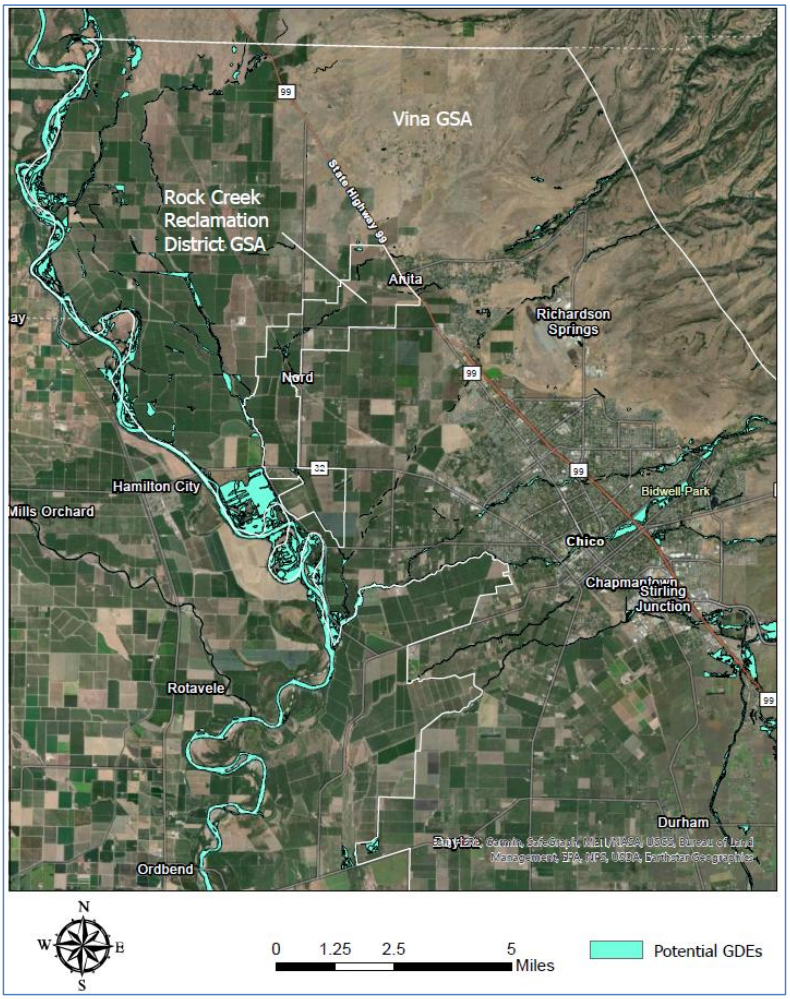


Figure 2-28: Potential Groundwater Dependent Ecosystems (iGDEs) in the Northern Portion of the Vina Subbasin as Identified in the NCCAG Database Developed by TNC

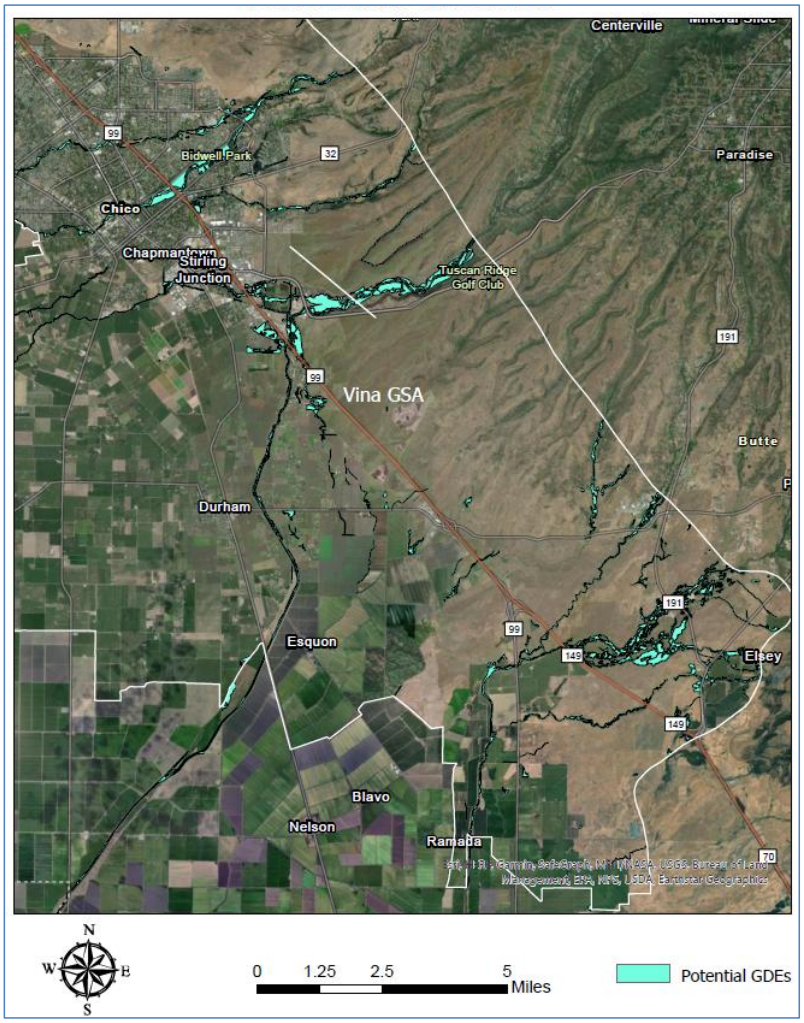


Figure 2-29: Potential Groundwater Dependent Ecosystems (iGDEs) in the Southern Portion of the Vina Subbasin as Identified in the NCCAG Database Developed by TNC

The NCCAG dataset is based on 48 layers of publicly available data developed by state or federal agencies that map vegetation, wetlands, springs, and seeps in California (DWR, 2019b). A NCCAG technical working group with representatives from DWR, CDFW, and TNC reviewed the datasets compiled to assemble the NCCAG dataset. The NCCAG dataset attempts to extract mapped vegetation and wetland features that have indicators suggesting dependence on

groundwater. The data presented in NCCAG dataset display vegetation polygons that have indicators of GDEs based on published and/or field observations of phreatophytic vegetation defined as a "deep-rooted plant that obtains water that it needs from the phreatic zone (zone of saturation) or the capillary fringe above the phreatic zone" (Rohde et al., 2018). The dominance of phreatophytic plant species in a mapped vegetation type is a primary indicator of GDEs. A list of plant species considered to be phreatophytes based on peer-reviewed scientific literature on rooting depths, published lists of phreatophytes, expert field observations, and vegetation alliance descriptions is publicly available (Klausmeyer et al., 2018; DWR, 2018b).

While developing the NCCAG dataset of areas with indicators of GDEs, the technical working group attempted to exclude vegetation and wetland types and polygons that are less likely to be associated with groundwater (Klausmeyer et al., 2018). The NCCAG working group attempted to remove any polygons that are not likely to be GDEs where they occurred in areas where they are likely to be supported by alternate artificial water sources (e.g., local seepage from agricultural irrigation canals), or where appropriate available data indicated the shallow groundwater depth is located well below the rooting zone, (Klausmeyer et al., 2018).

The vegetation data presented in the NCCAG dataset is the latest available starting point for the identification of GDEs, as the dataset includes the best available public datasets and has been screened to include only areas that have indicators of groundwater dependent vegetation. DWR has stated that use of the NCCAG dataset is not mandatory and does not represent DWR's determination of a GDE (DWR, 2018b). Rather, the NCCAG dataset can provide a starting point for the identification of GDEs within a groundwater basin.

Additional information, such as near surface groundwater depth obtained from piezometers, information about subsurface stratigraphy and geology on confining layers, and information on local land use and hydrology can be used to confirm whether vegetation in areas identified by the NCCAG as iGDEs is, in fact, reliant on groundwater.

2.2.7.2 Initial iGDE Analysis

GSA Managers from the Vina Subbasin used this database as a starting point to analyze a portion of the total iGDEs in the NCCAG database to evaluate local groundwater dependence. Specific criteria to each polygon to answer a series of questions led to an eventual characterization for each iGDE. These iGDEs were designated as either "Likely a GDE," "Not likely a GDE," or "Uncertain" based on evaluations. The criteria aimed at understanding each iGDE's dependence on groundwater, including questions about land use changes, proximity to perennial surface water supplies, irrigated agriculture and agricultural dependent surface water, condition of vegetation during drought years and water applications to the iGDEs.

The first phase of the analysis was conducted by thorough review of aerial photographs from Google Earth across multiple years specifically focusing on the 2007, 2009, 2013, and 2015 drought years as well as the Managers' local knowledge of these areas.

2.2.7.3 iGDE Designations

While there were some areas identified as "Not likely a GDE" during this effort, Managers were also able to add any iGDEs into the map that were not captured in the original NCCAG database.

NCCAG areas identified as "Not likely a GDE" from the initial analysis by Managers can be categorized as follows.

Not Likely a GDE Due to Significant Land Use Change
Some areas in the NCCAG database have changed in land use since the database was published. Developed areas where there have been significant land use changes to the iGDE (i.e., land that transitioned into cultivated irrigated agricultural lands, industrial, or residential development) occurred or lands had undergone man-made changes such as golf courses or other obvious anthropogenic changes were labeled as "Not likely a GDE."

Not Likely a GDE Due to Perennial Surface Water Supplies
Areas with perennial water supplies such as those near reservoirs were labeled as "Not likely a GDE." Reservoirs provide water year-round for adjacent ecosystems. If any iGDEs were located within 150 feet of reservoirs, they were assumed to be able to access the nearby surface water bodies and were labeled as "Not likely a GDE."

Not Likely a GDE Due to Supplemental Water Supplies
Irrigated agriculture, irrigated refuge / managed wetlands or irrigated urban areas with supplemental water deliveries were identified by Managers during the initial GDEs analysis effort. These areas are assumed to be accessing supplemental water supplies and not reliant on groundwater and were labeled as "Not likely a GDE."

Not Likely a GDE Due to Adjacency to Irrigated Agricultural Fields
Agricultural lands are dependent on reliable water supplies to ensure a successful harvest. Surface water and / or groundwater pumped from the aquifer is used to irrigate crops in the Vina Subbasin. Such irrigation benefits not only the crops, but also surrounding vegetation. Potential GDEs further than 150 feet from irrigated rice fields and areas further than 50 feet from all other irrigated agriculture were assumed to be unable to access irrigation water. These distances are based on professional judgment, including past experience in the region and consideration of the physical characteristics of the Vina Subbasin, such as hydraulic conductivity. Rice fields, along with other irrigated agriculture, are known to have percolation and lateral seepage, supplying water to the aquifer and into adjacent areas. Lateral seepage in Sacramento Valley rice areas has been estimated at between 1.0% and 1.9% of the total irrigation volume (LaHue and Lindquist, 2019). A larger distance was used for rice due to the long-term ponding of water and due to restrictive layers in the subsurface that result in the horizontal spreading of irrigation water. Potential GDEs near these irrigated areas are assumed to be accessing irrigation water through lateral movement through the soils; thus, they were labeled as "Not likely a GDE."

Not Likely a GDE Due to Dependence on Agricultural-dependent Surface Water
Similar to areas adjacent to reservoirs, iGDEs adjacent to surface water bodies that are perennial due to agricultural practices and those near drainage canals, are able to access surface water throughout the year. Agricultural water conveyance features, i.e., the Cherokee Canal is included in this definition however, this does not include the Sacramento River, Butte Creek, or Honcut Creek because these natural waterways also convey non-agricultural water. Potential GDEs within 150 feet of these agricultural-dependent surface water bodies were assumed to be accessing water from them thus, they were labeled as "Not likely a GDE."

Not Likely a GDE Due to Non-Survival during Drought Conditions
To assess if the iGDE was groundwater dependent, Managers reviewed the condition of the iGDE over multiple dry drought years using aerial photographs from Google Earth. Specifically, the group focused on the drought years of 2007, 2009, 2013, and 2015 in addition to the Managers' local knowledge of these areas. Green vegetation over multiple drought years during summer months indicated survival of the iGDE as well as an assumed connection to groundwater. Potential GDEs that did not indicate any surviving conditions over multiple drought years were assumed to not be connected to groundwater and were labeled as "Not likely a GDE."

Uncertain – All Other Areas
The iGDEs analyzed by the Managers in this initial effort, which did not receive a designation as either "Not likely a GDE" or "Likely a GDE" based on the conclusions from the analysis above, were labeled as "Uncertain" and were further analyzed as described below.

2.2.7.4 Additional Geographical Information Systems (GIS) Analysis

Irrigated Agricultural Land Use
After the initial analysis was completed for a selection of the total iGDEs in the NCCAG database as described above, a geographical information systems (GIS) analysis was performed for all remaining iGDEs in this Vina Subbasin by Butte County staff to determine each iGDE's proximity to rice and other irrigated agriculture as described below. The DWR / Land IQ land use and crop mapping data for 2016 (DWR, 2019b) was used to determine the dominant crop type throughout the Vina Subbasin.

Land classified as "Rice" for the "Crop Type 2016" in the dataset was identified. Then all polygons in the TNC iGDEs dataset within 150 feet of land classified as Rice were identified and designated as "Not likely a GDE near irrigated rice" for the same reasons as described above in the "Not Likely a GDE Due to Adjacency to Irrigated Agricultural Fields" section of this document above.

Land with "Crop Type 2016" classifications other than "Managed Wetland," "Urban," "Rice," and "Mixed Pasture" in the dataset were identified and for this purpose referenced as "Other Irrigated Agriculture" for this GIS analysis, as all other remaining irrigated crop types. All polygons in the NCCAG dataset within 50 feet of land classified as "Other Irrigated Agriculture" were designated as "Not likely a GDE near irrigated agriculture (Non-Rice)" for the same reasons as described above in the "Not Likely a GDE Due to Adjacency to Irrigated Agricultural Fields" section of this document.

Valley Oak Dominated Areas
The dataset provided by TNC indicates the dominant species of vegetation for each polygon, including Valley oak (*Quercus lobata*) in the Vina Subbasin. Those polygons were classified as "Likely a GDE" due to feedback from TNC staff that this species can access groundwater over a wide range of depths (M. Rohde personal communication March 2, 2021).

Sacramento River Corridor Areas
Using GIS analysis tools, polygons located within the active floodplain of the Sacramento River were selected manually. These polygons were classified as "Likely a GDE" due to their

proximity to the Sacramento River, which is classified as a gaining river throughout most, if not all of its length throughout the Vina Subbasin.

2.2.7.5 Mapping

The maps in Appendix 2-A shown as Figures 3 and 4 show iGDEs classified as "Likely a GDE" or "Not Likely a GDE" for one of the reasons described above. The iGDEs classified as "Not Likely a GDE" in the Vina Subbasin were designated this way due to either their proximity to irrigated agriculture as rice, proximity to irrigated agriculture other than rice, or because they did not survive dry conditions as determined during the initial analyses performed by the GSAs Managers.

2.3 Water Budget

This section describes historical, current, and projected water budgets in accordance with §354.18 of the GSP Emergency Regulations, including quantitative estimates of inflows to and outflows from the basin over time and annual changes in water storage within the basin. Components of the water budgets are depicted in Figure 2-30.

Formatted: English (United States)

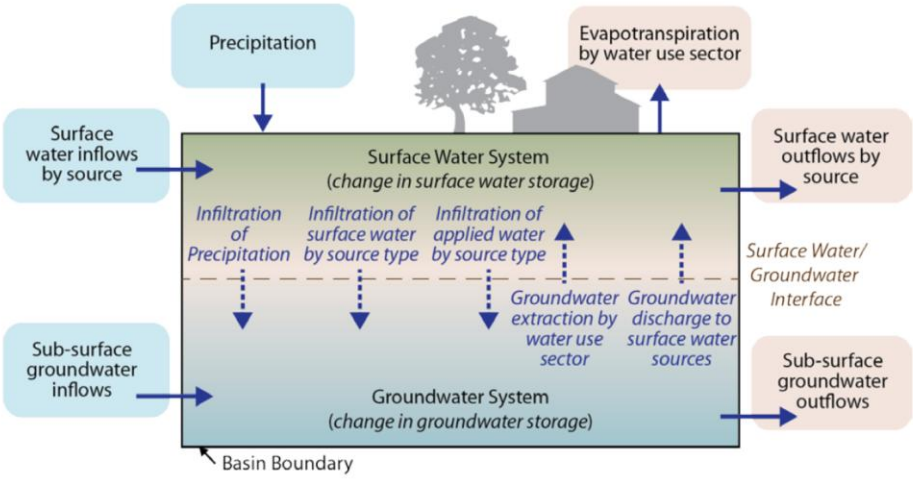


Figure 2-30: Water Budget Components (DWR, 2016)

Water budgets were developed considering hydrology, water demand, water supply, land use, population, climate change, surface water – groundwater interaction, and subsurface groundwater inflows and outflows to and from neighboring basins. Water budget results are reported on a water year basis spanning from October 1 of the prior year to September 30 of the current year.

2.3.1 Selection of Hydrologic Periods

The GSP Emergency Regulations require evaluation of water budgets over a minimum of 10 years for the historical water budget, using the most recent hydrology for the current water

Formatted: English (United States)

budget, and 50 years of hydrology for the projected water budget. Hydrologic periods were selected for each water budget category based on consideration of the best available information and science to support water budget development and based on consideration of the ability of the selected periods to provide a representative range of wet and dry conditions.

- Historical – The 19-year period from water years[8] 2000 to 2018 was selected based on the level of confidence in historical information to support water budget development considering land use, surface water availability, hydrology, and other factors.
- Current Conditions – Historical water budget information for 2018 represents the most recent hydrology (Appendix 2-B). To provide a broader basis for understanding current water budget conditions, a water budget scenario combining most recently available land use and urban demands with 50 years of hydrology was selected. The period selected was 1971 to 2018 (48 years) with 2004 and 2005 (two relatively normal years) repeated at the end of the scenario. An advantage of evaluating the current conditions water budget over a representative 50-year period is that the results provide a baseline for evaluation of the projected water budgets.
- Future Conditions – Consistent with the current conditions water budget, the period selected for the projected water budgets was 1971 to 2018 (48 years) with 2004 and 2005 repeated at the end of the scenarios.
- Selection of the 50-year hydrologic period for the current and projected water budget scenarios was based primarily on three considerations:

  - The BBGM, the primary tool used to develop the water budgets, has a simulation period from water years 1971 to 2018.
  - The Sacramento Valley Water Year Index[9] over the period from 1971 to 2018 has an average of 8.0, as compared to 8.1 for the 103-year period from 1906 to 2018 (1906 is the first year for which the index is available) (Figure 2-31).
  - The selected period includes a combination of wet and dry cycles, including relatively wet periods in the early 1970s, mid 1980s, and late 1990s and dry periods in the late 1970s, early 1990s, and from approximately 2007 to 2015.

Additionally, annual precipitation for the 1971 to 2018 period averaged approximately 26.3 inches per year, as compared to 24.8 inches for the 1906 to 2018 period.

[8] A water year is defined as the period from October 1 of the prior year to September 30 of the current year. For example, water year 2000 refers to the period from October 1, 1999 to September 30, 2000.
[9] Additional details describing the Sacramento Valley Water Year Index are available from the California Data Exchange Center (https://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST).

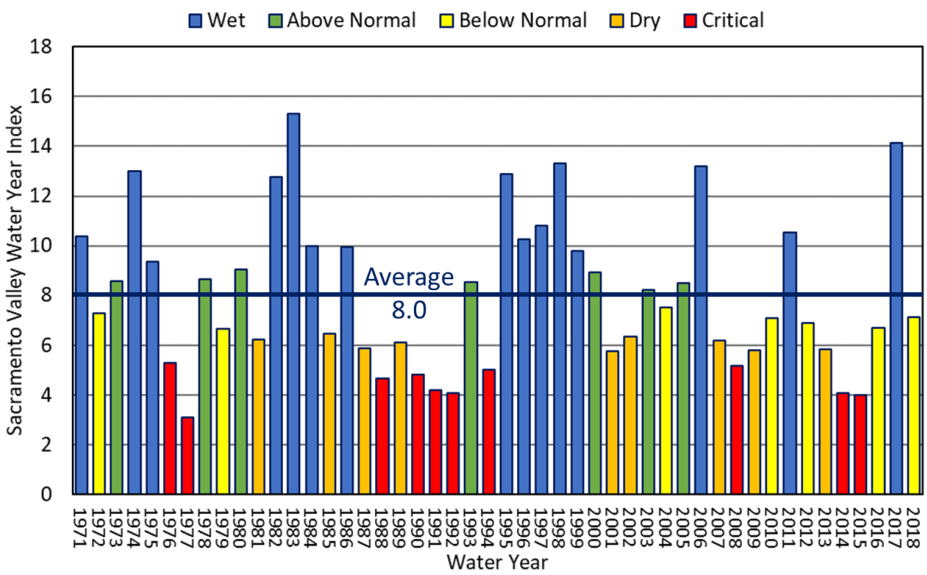


Figure 2-31: 1971 – 2018 Sacramento Valley Water Year Index and Water Year Types

2.3.2 Usage of the Butte Basin Groundwater Model

Development of the original BBGM began in 1992 under the direction and funding of the Butte Basin Water Users Association. The model has been updated over time to simulate historical conditions through water year 2018. The model performs calculations on a daily time step with some daily input (i.e., precipitation, stream inflow), some monthly input data (i.e., surface water diversions), and some annual input data (i.e., land use). Refinements to the model over time include additional crop types to better represent ponded crops (i.e., rice and wetlands), recalibrated soil parameters, and elemental land use. The development of the BBGM is described in more detail in (BCDWRC, 2021).

To prepare water budgets for this GSP, historical BBGM results for water years 2000 to 2018 have been relied upon, and four additional baseline scenarios have been developed to represent current and projected conditions utilizing 50 years of hydrology (described previously). Specific assumptions associated with these scenarios are described in the following section.

2.3.3 Water Budget Assumptions

Assumptions utilized to develop the historical, current, and projected water budgets are described below and summarized in Table 2-6.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Table 2-6: Summary of Water Budget Assumptions

Water Budget	Analysis Period	Hydrology	Land Use	Water Supplies
Historical Simulation	2000 – 2018	Historical	Historical	Historical
Current Conditions Baseline	1971 – 2018	Historical	Current (2015 and 2016)	Current (2015 and 2016 surface water diversions, 2016-2018 average urban demands)
Future Conditions, No Climate Change Baseline	1971 – 2018	Historical	Current, adjusted based on Butte County 2030 General Plan	Current (2015 and 2016 Surface water diversions and 2050 projected urban demands)
Future Conditions, 2030 Climate Change Baseline	1971 – 2018	Historical, adjusted based on 2030 climate change	Current, adjusted based on General Plan	Current, adjusted based on climate change
Future Conditions, 2070 Climate Change Baseline	1971 – 2018	Historical, adjusted based on 2070 climate change	Current, adjusted based on General Plan	Current, adjusted based on climate change

2.3.3.1 Historical

A historical water budget was developed to support understanding of past aquifer conditions, considering surface water and groundwater supplies utilized to meet demands. The historical water budget was developed using the BBGM and incorporates the best available science and information. Historical water supplies and aquifer response have been characterized by water year type based on DWR's Sacramento Valley Water Year Index,[10] which classifies water years as wet, above normal, below normal, dry, or critical based on Sacramento River unimpaired flows.

As described previously, water years 2000 to 2018 were selected to provide a minimum of 10 years across a range of hydrologic conditions. This period includes relatively wet years in 2006, 2011, and 2017, as well as dry conditions between 2007 and 2009 and between 2013 and 2015.

Information utilized to develop the historical water budget includes:

- Analysis Period – Water years 2000 to 2018.
- Stream Inflows – Inflows of surface water into the basin were estimated based on stream gage data from USGS and DWR where available (e.g., Butte Creek and Big Chico Creek). For un-gaged streams, inflows were estimated using the National Resource Conservation Service (NRCS) rainfall runoff method applied at the watershed scale, considering precipitation timing and amount, soil

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

[10] Sacramento Valley Water Year Index = 0.4 * Current Apr-Jul Runoff Forecast (in MAF) + 0.3 * Current Oct-Mar Runoff in (MAF) + 0.3 * Previous Water Year's Index (if the Previous Water Year's Index exceeds 10.0, then 10.0 is used). This index, originally specified in the 1995 SWRCB Water Quality Control Plan, is used to determine the Sacramento Valley water year type as implemented in SWRCB D-1641.

characteristics, and other factors. Additional detail describing stream inflows is described in the BBGM model report (BCDWRC, 2021).

- Land Use – Land use characteristics for agricultural, native, and urban (including rural residential) lands were estimated annually based on a combination of DWR land use surveys and county agricultural commissioner cropping reports. DWR land use data were available for 1994, 1999, 2004, 2011, 2014, 2015, and 2016. Additional detail describing the development of land use estimates can be found in the BBGM model report (BCDWRC, 2021).
- Agricultural Water Demand – Agricultural irrigation demands were estimated using the BBGM, which simulates crop growth and water use on a daily basis, considering crop type, evapotranspiration, root depth, soil characteristics, and irrigation practices. For ponded land uses (rice and managed wetlands), pond depths and pond drainage are also considered to simulate demands.
- Urban and Industrial Water Demand[11] – Urban and industrial demands were estimated based on a combination of pumping data provided directly by water suppliers (e.g., Cal Water) and estimates of population and per capita water use over time. Additional detail describing the development of urban demand estimates can be found in the BBGM model report (BCDWRC, 2021).
- Surface Water Diversions – Surface water diversions were estimated based on a combination of reported diversions by water suppliers and, in some cases, agricultural water demand estimates for areas known to receive surface water, but for which reported diversion data were not available.
- Groundwater Pumping – For urban water suppliers, historical pumping was estimated from reported pumping volumes over time. Pumping to meet agricultural and managed wetlands demands was estimated within the BBGM by first estimating the total demand and then subtracting surface water deliveries to calculate the estimated groundwater pumping required to meet the remaining demand.

2.3.3.2 Current Conditions

The current conditions water budget was developed as a baseline to evaluate projected water budgets considering future conditions and is based on 50 years of hydrology, along with the most recent information describing land use, urban demands, and surface water supplies. The 50-year hydrologic period was selected rather than the most recent year for which historical water budget information is available to allow for direct comparison of potential future conditions to current conditions. The use of a representative hydrologic period containing wet and dry cycles supports

Formatted: English (United States)

[11] Current estimates of industrial water use not supplied by urban water suppliers have not been explicitly included at this time and are identified as a data gap that could be filled as part of future GSP updates. These water uses are small relative to other water uses (i.e. agricultural and urban) and tend to be non-consumptive in nature. Additionally, future refinements of the BBGM to incorporate rural residential demands may also be made; these demands were estimated as part of the 2016 Water Inventory & Analysis and are also small relative to other uses.

the understanding of uncertainty in groundwater conditions over time, establishment of SMC, and development of projects and management actions to avoid undesirable results.

The current water budget estimates current inflows, outflows, and change in storage for the basin using 50 years of representative hydrology and the most recent water supply, water demand, and land use information.

Information utilized to develop the current conditions baseline water budget include:

Formatted: English (United States)

- Analysis Period – 50 years of historical hydrology were utilized representing the period from 1971 to 2018, with 2004 and 2005 repeated following 2018.
- Stream Inflows – Inflows of surface water into the basin were estimated utilizing the same information as for the historical water budget.
- Land Use – Land use for agricultural, native, and urban (including rural residential) lands was estimated annually using the most recent land use information. Specifically, 2015 and 2016 land use was mapped to the 50-year analysis period, with 2015 land use applied to extreme dry years and 2016 land use applied to all other years. Extreme dry years were identified based on April to July inflows of the Feather River to Lake Oroville, based on settlement agreements between Feather River water users and the State Water Project. April to July runoff to the Feather River is believed to be a reasonable indicator of surface water supplies and associated changes in cropping patterns within the basin. Land use and surface water supplies are relatively consistent in dry and normal years in the Vina Subbasin.
- Agricultural Water Demand – Agricultural irrigation demands were estimated using the BBGM, in the same manner as the historical water budget.
- Urban and Industrial Water Demand – Urban and industrial demands were estimated based on recent demands. Specifically, average demands for the period 2016 to 2018 were assumed.
- Surface Water Diversions – Similar to land use, surface water diversions were estimated based on 2015 and 2016 conditions, with 2015 diversions assumed for extreme dry years and 2016 diversions assumed for other years. For the current condition's scenario, reduced surface water was estimated for four years within the 50-year simulation period.
- Groundwater Pumping – Pumping to meet urban demands was estimated based on average 2016 to 2018 demands, as described above. Pumping to meet agricultural and managed wetlands demands was estimated using the BBGM, as described previously for the historical water budget.

2.3.3.3 Future Conditions

Three projected water budget scenarios were developed considering a range of future conditions in the Vina Subbasin that may occur, as documented in the Butte County 2030 General Plan. The scenarios consider future planned land use changes (i.e., development), along with changes in

Formatted: English (United States)

climate, including precipitation, surface water inflows, and evapotranspiration. These scenarios provide information regarding changes in basin conditions (e.g., groundwater storage) that may occur in the future over a series of wet and dry cycles.

The projected water budget estimates potential future inflows, outflows, and change in storage for the basin using 50 years of representative hydrology (including modifications based on climate change projections), the most recent water supply and water demand, and planned future land use information.

Information utilized to develop the future conditions water budgets include:

Formatted: English (United States)

- Analysis Period – 50 years of hydrology were utilized representing the period from 1971 to 2018, with 2004 and 2005 repeated following 2018.
- Stream Inflows:
  - Future Conditions, No Climate Change – Inflows of surface water into the basin were estimated utilizing the same information as for the historical water budget.
  - Future Conditions, 2030 Climate Change – Precipitation, evapotranspiration, and surface water supplies were adjusted to reflect climate change based on the 2030 Central Tendency climate change datasets provided by DWR to support GSP development.
    - For precipitation and evapotranspiration, monthly change factors were applied to historical values to estimate potential future conditions.
    - For streamflows, DWR estimates of stream inflows were utilized where available; for streams without direct estimates of inflows, inflows were estimated using streamflow change factors applied at the watershed scale.
  - Future Conditions, 2070 Climate Change – Precipitation, evapotranspiration, and surface water supplies were adjusted to reflect climate change based on the 2070 Central Tendency climate change datasets provided by DWR to support GSP development.
    - For precipitation and evapotranspiration, monthly change factors were applied to historical values to estimate potential future conditions.
    - For streamflows, DWR estimates of stream inflows were utilized where available; for streams without direct estimates of inflows, inflows were estimated using streamflow change factors applied at the watershed scale.
- Land Use – Land use for agricultural, native, and urban (including rural residential) lands was estimated annually using the most recent land use information and modified based on planned development according to the 2030 General Plan. Specifically, 2015 and 2016 land use was mapped to the 50-year analysis period, with 2015 land use applied to extreme dry years and 2016 land use applied to all other years. 2015 and 2016 land use data were modified to reflect planned development, generally resulting in an increase in urban land through development of previously undeveloped (i.e., native) lands.

- Future Conditions, No Climate Change – 2015 and 2016 land use data were mapped to the 50-year analysis period in the same manner as the current conditions water budget scenario, with modifications based on planned development based on the General Plan.
- Future Conditions, 2030 Climate Change – 2015 and 2016 land use data were mapped to the 50-year analysis period considering 2030 central tendency climate change projections, with 2015 land use used for extreme dry years and 2016 land use used for all other years.
- Future Conditions, 2070 Climate Change – 2015 and 2016 land use data were mapped to the 50-year analysis period considering 2070 central tendency climate change projections, with 2015 land use used for extreme dry years and 2016 land use used for all other years.
  - Agricultural Water Demand – Agricultural irrigation demands were estimated using the BBGM, in the same manner as the historical water budget.
  - Urban and Industrial Water Demand – Urban and industrial demands were estimated based on projected urban demands. Specifically, future urban demands were estimated based on preliminary draft demand estimates provided by urban water suppliers (e.g., Cal Water) as part of 2020 UWMP development.
  - Surface Water Diversions – Similar to land use, surface water diversions were estimated based on 2015 and 2016 conditions, with 2015 diversions assumed for extreme dry years and 2016 diversions assumed for other years.
- For the 2030 central tendency scenario, extreme dry conditions occurred for 11 years within the 50-year simulation period.
- For the 2070 central tendency scenario, extreme dry conditions occurred for 13 years within the 50-year simulation period.
  - Groundwater Pumping – Pumping to meet urban demands was estimated based on draft projections from UWMPs currently under development, as described above. Pumping to meet agricultural and managed wetlands demands was estimated using the BBGM, as described previously for the historical water budget.

2.3.4 Water Budget Estimates

As described previously, water budget estimates were developed using the BBGM. Primary components of the land and surface water system water budget include the following:

  - Inflows:
- Surface Water Inflows – Inflows at the land surface through streams, canals, or other waterways. These inflows may also include overland flow from upslope areas outside the basin. Although interactions with the Sacramento River along the boundary of the basin (i.e., diversions and stream-aquifer interaction) are accounted for, the flow in the stream is not considered an inflow to the basin. Inflows from streams that traverse the basin are accounted for explicitly.

- Precipitation – Rainfall intercepting the ground surface within the basin boundary.
- Groundwater pumping – Extraction of groundwater to meet agricultural, urban, managed wetlands, or other beneficial uses.
- Stream Accretions – Gains in streamflow from shallow groundwater occurring when the water level in the aquifer adjacent to the stream is greater than the water level in the stream.
  - Outflows:
- Surface Water Outflows – Outflows at the land surface through streams, canals, or other waterways. These outflows may also include overland flow to downslope areas outside of the basin.
- Evapotranspiration – Consumptive use of water including both evaporation and transpiration components.
- Deep Percolation – Recharge of the groundwater system through the vertical movement of precipitation and applied irrigation water below the root zone.
- Seepage (Also referred to as Losses or Leakage) – Recharge of the groundwater system from streams, canals, or other water bodies.
  - Change in Storage – Changes in soil moisture storage within the upper several feet of soil in the root zone, as well as changes in storage in surface water bodies within the basin. These changes are generally negligible on an annual basis but vary over the course of a year based on precipitation patterns and other factors.

Primary components of the groundwater system water budget include the following:

  - Inflows:
- Deep Percolation – Described above.
- Subsurface Inflows – Groundwater inflows from adjacent basins or from the foothill area.
- Seepage – Described above.
  - Outflows:
- Groundwater Pumping – Described above.
- Subsurface Outflows – Groundwater outflows to adjacent basins.
- Accretions – Described above.
  - Change in Storage – Changes in water storage in the aquifer system. These changes tend to be large compared to changes in root zone soil moisture storage and can vary substantially from year to year.

Many components of the water budget can be estimated based on measured data (e.g., precipitation, diversions, evapotranspiration, etc.) and are used to develop inputs to the BBGM to

Formatted: English (United States)

support water budget development. Other components are more difficult to measure or do not have measured values readily available (e.g., deep percolation, subsurface flows, groundwater pumping, surface water-groundwater interaction, etc.) and are estimated using the BBGM. Additional detail describing the BBGM is available in BCDWRC (2021).

Average annual water budget estimates for the historical water budgets and for the current and projected water budget scenarios are summarized in Table 2-7 for the land and surface water system and in Table 2-8 for the groundwater system.

As seen in Table 2-8, there is a significant difference in the calculated change in storage for the historical scenario (-19,600 AFY) versus the current and future scenarios (-1,200 to -2,700 AFY). The primary reason for this difference is the time period used for the calculations. As discussed above, the historical scenario only uses a 19-year period from 2000 to 2018; whereas. the other scenarios use a 50-year period as required by SGMA from 1971 to 2018 (2004 and 2005 repeated after 2018). Figure 2-32 illustrates the sensitivity to the time period selected for the calculation of change in storage using the current scenario graph of change in storage.

Formatted: English (United States)

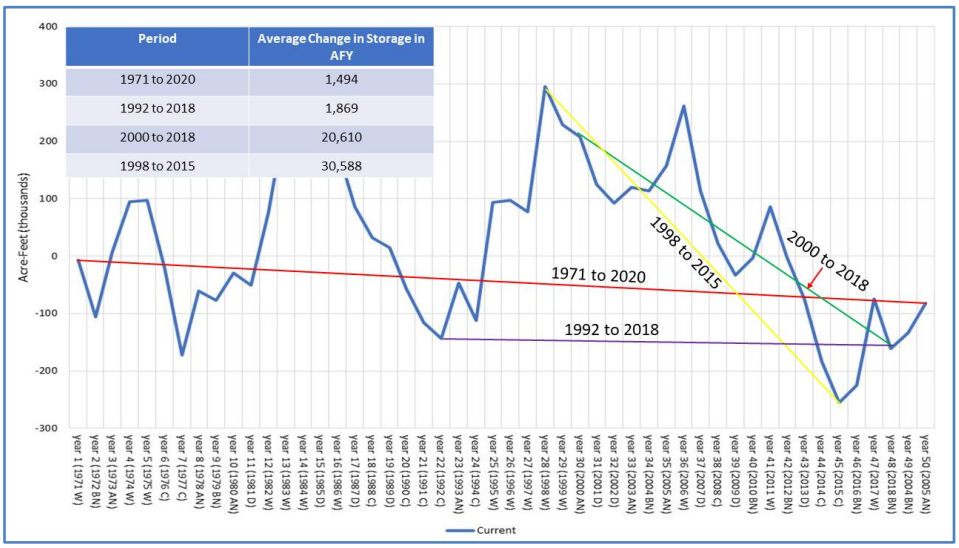


Figure 2-32: Sensitivity to the Change in Storage to the Time Period Selected for the Calculation.
Graph used is the current conditions scenario as discussed in Section 2.3.3.2.

As seen in this figure, a wide range of change in storage values are calculated depending on the time period selected. However, for development of the SMC, as discussed in Section 3, it is important to view these values in relationship to the total storage of the Vina Subbasin. As estimated by the BBGM, total storage of the Vina Subbasin is about 16-million acre-feet (MAF), indicating that the calculated annual change in storage values shown in Figure 2-32 is only 0.009

Formatted: English (United States)

to 0.2 percent of the total storage of the Vina Subbasin. The calculated change in storage values is also within the range of error for the BBGM.

Additional information and discussion regarding the water budgets are provided in the following subsections. It is anticipated that the water budgets will be refined and updated over time as part of GSP implementation in the basin.

Formatted: English (United States)

Table 2-7: Water Budget Summary: Land and Surface Water System

Component	Historical (AFY)	Current (AFY)	Future, No Climate Change (AFY)	Future, 2030 Climate Change (AFY)	Future, 2070 Climate Change (AFY)
Inflows					
Surface Water Inflows	**554,800**	**602,300**	**601,900**	**630,600**	**652,200**
Outside Diversions	*400*	*400*	*400*	*400*	*400*
Butte Creek	*298,100*	*324,900*	*324,900*	*339,200*	*348,700*
Big Chico Creek	*111,200*	*114,500*	*113,700*	*118,000*	*120,500*
Pine Creek	*13,400*	*14,200*	*14,200*	*14,800*	*15,000*
Dry Creek	*14,000*	*14,500*	*14,500*	*15,000*	*15,300*
Rock Creek	*16,600*	*17,200*	*17,200*	*17,700*	*17,700*
Little Chico Creek	*17,800*	*20,700*	*20,400*	*21,000*	*21,100*
Mud Creek	*14,400*	*17,400*	*17,300*	*17,800*	*17,900*
Singer Creek	*1,500*	*1,700*	*1,700*	*1,700*	*1,800*
Little Dry Creek	*3,200*	*5,800*	*5,800*	*6,000*	*5,900*
Precipitation Runoff from Upslope Lands	*61,600*	*69,000*	*69,900*	*77,500*	*86,300*
Applied Water Return Flows from Upslope Lands	*2,600*	*1,900*	*1,900*	*1,700*	*1,600*
Precipitation	**410,900**	**421,700**	**421,700**	**438,200**	**453,100**
Groundwater Pumping	**243,500**	**209,200**	**215,800**	**225,900**	**238,000**
Agricultural	*209,100*	*185,500*	*184,800*	*194,700*	*206,800*
Urban and Industrial	*26,500*	*20,100*	*27,500*	*27,500*	*27,500*
Managed Wetlands	*8,000*	*3,500*	*3,500*	*3,600*	*3,700*
Stream Gains from Groundwater	**3,700**	**1,100**	**1,000**	**1,000**	**1,000**
Total Inflow	***1,212,900***	***1,234,300***	***1,240,400***	***1,295,700***	***1,344,300***
Outflows					
Evapotranspiration	362,900	348,300	347,300	358,200	371,400
Agricultural	*253,500*	*243,000*	*242,000*	*250,700*	*262,300*
Urban and Industrial	*21,800*	*20,900*	*27,400*	*27,900*	*28,400*
Managed Wetlands	*6,000*	*3,000*	*3,000*	*3,100*	*3,100*
Native Vegetation	*81,200*	*80,900*	*74,400*	*76,100*	*77,200*

Component	Historical (AFY)	Current (AFY)	Future, No Climate Change (AFY)	Future, 2030 Climate Change (AFY)	Future, 2070 Climate Change (AFY)
Canal Evaporation	*400*	*500*	*500*	*400*	*400*
Deep Percolation	192,700	191,800	189,300	194,500	196,800
Precipitation	*120,200*	*125,400*	*120,400*	*123,500*	*123,600*
Applied Surface Water	*4,800*	*5,600*	*5,600*	*4,900*	*4,500*
Applied Groundwater	*67,600*	*60,900*	*63,300*	*66,100*	*68,700*
Seepage	24,000	27,700	27,800	27,800	27,400
Streams	*20,800*	*24,100*	*24,200*	*24,600*	*24,400*
Canals and Drains	*3,200*	*3,600*	*3,600*	*3,200*	*3,000*
Surface Water Outflows	633,300	666,300	675,900	715,100	748,700
Precipitation Runoff	*57,900*	*58,300*	*62,100*	*66,700*	*72,800*
Applied Surface Water Return Flows	*2,200*	*2,800*	*2,800*	*2,200*	*1,800*
Applied Groundwater Return Flows	*20,200*	*14,000*	*16,000*	*16,000*	*16,000*
Streams	*525,500*	*563,800*	*567,600*	*605,200*	*633,600*
Butte Creek Diversions to Butte Subbasin	*27,500*	*27,400*	*27,400*	*25,100*	*24,400*
Total Outflow	***1,212,900***	***1,234,100***	***1,240,300***	***1,295,600***	***1,344,300***
Change in Storage (Inflow - Outflow)	***0***	***200***	***100***	***100***	***0***

Notes:
AFY = Acre feet per year.
1. Totals are the sum of numbers in bold

Table 2-8: Water Budget Summary: Groundwater System

Component	Historical (AFY)	Current (AFY)	Future, No Climate Change (AFY)	Future, 2030 Climate Change (AFY)	Future, 2070 Climate Change (AFY)
Inflows					
Subsurface Inflows	**137,400**	**143,200**	**142,800**	**144,600**	**145,500**
Foothill Area	*45,700*	*50,100*	*49,700*	*50,600*	*50,600*
Los Molinos Subbasin	*63,000*	*67,000*	*67,300*	*67,900*	*68,100*
Butte Subbasin	*28,600*	*25,900*	*25,500*	*25,800*	*26,600*
Wyandotte Creek Subbasin	*200*	*300*	*200*	*300*	*300*
Deep Percolation	**192,700**	**191,800**	**189,300**	**194,500**	**196,800**
Precipitation	*120,200*	*125,400*	*120,400*	*123,500*	*123,600*
Applied Surface Water	*4,800*	*5,600*	*5,600*	*4,900*	*4,500*
Applied Groundwater	*67,600*	*60,900*	*63,300*	*66,100*	*68,700*
Seepage	**24,000**	**27,700**	**27,800**	**27,800**	**27,400**
Streams	*20,800*	*24,100*	*24,200*	*24,600*	*24,400*
Canals and Drains	*3,200*	*3,600*	*3,600*	*3,200*	*3,000*
Total Inflow	***354,100***	***362,700***	***359,900***	***366,900***	***369,700***
Outflows					
Subsurface Outflows	**70,400**	**76,200**	**72,000**	**70,700**	**67,800**
Foothill Area	*300*	*200*	*200*	*200*	*200*
Los Molinos Subbasin	*4,700*	*900*	*900*	*900*	*900*
Butte Subbasin	*65,400*	*75,100*	*70,800*	*69,500*	*66,600*
Wyandotte Creek Subbasin	*0*	*0*	*0*	*0*	*0*
Groundwater Pumping	**243,500**	**209,200**	**215,800**	**225,900**	**238,000**
Agricultural	*209,100*	*185,500*	*184,800*	*194,700*	*206,800*
Urban and Industrial	*26,500*	*20,100*	*27,500*	*27,500*	*27,500*
Managed Wetlands	*8,000*	*3,500*	*3,500*	*3,600*	*3,700*
Stream Gains from Groundwater	**3,700**	**1,100**	**1,000**	**1,000**	**1,000**
Western Boundary Net Outflows	**56,100**	**77,400**	**73,000**	**71,000**	**65,600**
Total Outflow	***373,700***	***363,900***	***361,800***	***368,600***	***372,400***
Change in Storage (Inflow - Outflow)	***-19,600***	***-1,200***	***-1,900***	***-1,700***	***-2,700***

Notes:
AFY = Acre feet per year.
1. Totals are the sum of numbers in bold

2.3.4.1 Historical

The historical water budget provides a foundation for how the basin has behaved historically, including insight into historical groundwater conditions (e.g., observed water levels). Also, in accordance with the GSP Regulations, the historical water budget covers a period of at least 10 years, is used to evaluate the availability and reliability of historical surface water supplies and provides insight into the ability to operate the basin within the sustainable yield. The Vina Subbasin opted to use the 19-year period from 2000 to 2018. The historical analysis period experienced somewhat less precipitation than the long-term average and included historic drought conditions from approximately 2007 to 2015.[12]

Average annual inflows to and outflows from the basin for the historical land and surface water system water budget were estimated to be 1.21 MAF per year. Average annual values were presented previously in Table 2-7 and are shown graphically in Figure 2-33.

Primary inflows to the land and surface water system include surface water inflows (555 TAF/year), precipitation (411 TAF/year), and groundwater pumping (243 TAF/year), with estimated stream gains from groundwater (i.e., accretions) of approximately 4 TAF/year. Surface water inflows include Butte Creek, Big Chico Creek, and several other streams, as well as overland runoff of precipitation and applied water from upslope lands.

Primary outflows from the land and surface water system include surface water outflows (633 TAF/year), evapotranspiration (363 TAF/year), deep percolation (193 TAF/year), and stream losses (also referred to as seepage) (24 TAF/year). Surface water outflows include outflows through Butte Creek, Big Chico Creek, and other streams, as well as overland runoff of precipitation and applied water to downslope lands. Additionally, water is diverted from Butte Creek for use in the Butte Subbasin. Evapotranspiration is primarily from agricultural lands but also from native vegetation, urban and industrial lands, managed wetlands, and canal evaporation. Deep percolation is primarily from precipitation, but also from applied water.

The average annual change in storage in the land and surface water system is negligible due to similar soil moisture content in the root zone, on average, across water years, and limited storage capacity exists in surface water bodies within the basin. Additional details describing the historical land and surface water system water budget are provided in Appendix 2-B.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

[12] For the 2000 to 2018 period, mean annual precipitation was 26.7 inches, compared to 23.1 inches for the 2007 to 2015 period.

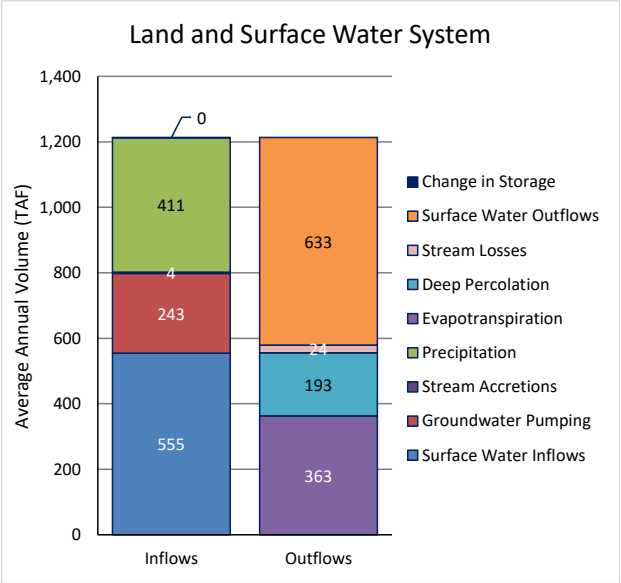


Figure 2-33: Average Annual Historical Land and Surface Water System Water Budget

Average annual inflows to and outflows from the groundwater system were estimated to be 838 TAF and 858 TAF, respectively, with an average decrease in groundwater storage of 20 TAF\year during the historical simulation period. Average annual values were presented previously in Table 2-8 and are shown graphically in Figure 2-34.

Inflows to the groundwater system include deep percolation (193 TAF/year [TAF/year]); subsurface inflows from the Los Molinos, Butte, and Wyandotte Creek subbasins and from the foothill area (137 TAF/year); and stream losses (24 TAF/year). Outflows from the groundwater system include groundwater pumping (243 TAF/year); subsurface outflows to the Butte, Los Molinos, and Wyandotte Creek Subbasins and to the foothill area (70 TAF/year); western boundary net outflows (56 TAF/year); and stream gains from groundwater (4 TAF/year).

Western boundary net outflows represent Sacramento River gains from groundwater and subsurface outflows to the Corning Subbasin. The split between these outflows is uncertain at this time and identified as a data gap. It is anticipated that this data gap will be addressed through future refinements to the BBGM and through coordination and collaboration with neighboring subbasins as part of GSP implementation.

Additional details describing the historical groundwater system water budget are provided in Appendix 2-B.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

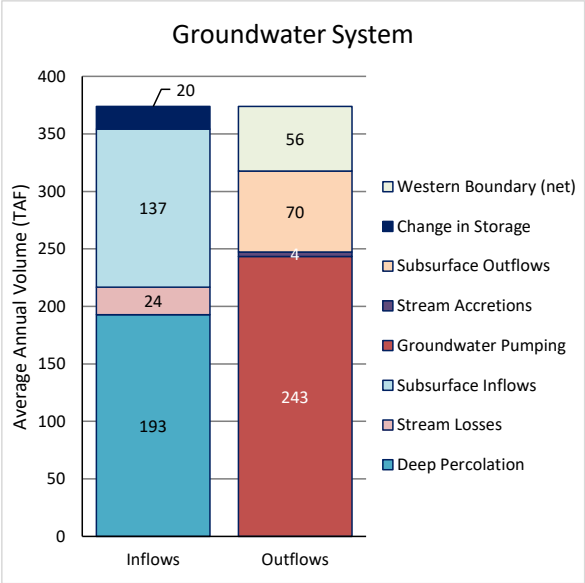


Figure 2-34: Average Annual Historical Groundwater System Water Budget

Historical water supplies and change in groundwater storage are summarized by water year type in Table 2-9 based on the Sacramento Valley Water Year Index, which classifies water years as wet, above normal, below normal, dry, or critical based on Sacramento River unimpaired runoff. Between 2000 and 2018, there were three wet years, three above normal years, five below normal years, five dry years, and three critical years. Historical surface water deliveries were greatest in wet years and least in critical years. Conversely, groundwater pumping has been least in wet years and greatest in critical years. Historically, groundwater storage in the basin has tended to increase in wet and above normal years and to decrease in below normal, dry, and critical years.

Table 2-9: Historical Water Supplies and Change in Groundwater Storage by Hydrologic Water Year Type

Water Year Type	Surface Water Deliveries (AFY)	Groundwater Pumping (AFY)	Total Supply (AFY)	Change in Groundwater Storage (AFY)
Wet	24,000	198,600	222,700	117,900
Above Normal	21,100	222,800	243,900	10,700
Below Normal	20,600	235,500	256,200	-19,200
Dry	17,300	266,600	284,000	-82,000
Critical	12,200	283,700	295,800	-84,500

Availability or Reliability of Historical Surface Water Supplies

As indicated in Table 2-9, historical surface water supplies for delivery to agricultural land vary based on water year type, with less availability in drier years. The primary source of surface water in the basin is Butte Creek, which is an undammed stream. Historically, water has been diverted to the Toadtown Canal from the West Branch of the Feather River for power generation and cold water for fish by PG&E. The Butte Canal carries Toadtown Canal and Butte Creek water to the De Sabla power plant forebay. Hydropower is also generated at several other locations. Operations at all of these sites affect the timing of water releases. At Oroville-Thermalito, Toadtown, and De Sabla-Centerville, water for power generation is transferred from the Feather River watershed to the Butte Creek watershed.

Despite the ability to convey water from the Feather River watershed to Butte Creek, flows during summer months are limited and perform important environmental functions, reducing the reliability of surface water to support other beneficial uses. Diversions claimed after 1914 including both riparian and appropriative surface water rights require permits from the State Board. Surface water rights are subject to curtailment by the State Board during drought conditions. Water rights holders are required to report surface water diversions to the State Board. Based on the State Board's electronic Water Rights Information Management System (eWRIMs), there are an estimated 60 points of diversion in the Vina Subbasin representing 53 water rights applications and statements of use.

Suitability of Tools and Methods for Planning

The water budgets presented herein have been developed using the best available information and best available science and structured in a manner consistent with the HCM of the basin. The BBGM, which is used to organize information for the water budgets, develop water budget scenarios, and perform water budget calculations, is currently the best available tool and is suitable for GSP development for the Vina Subbasin. The BBGM has been developed over the past several decades and updated over time to use updated model code, updated datasets, and updated input parameters through a series of efforts. Refinements to the BBGM have been made through extensive engagement with local stakeholders through a series of past efforts.

The water budgets developed using the BBGM support the development of SMC, evaluation of the monitoring network, and development of projects and management actions as part of GSP development. It is anticipated that the BBGM will be updated and refined in the future as part of GSP implementation. Additional information describing the BBGM is available in BCDWRC (2021).

2.3.4.2 Current Conditions

The current conditions baseline water budget provides a foundation to understand the behavior of the basin considering current land use and urban demands over a broad range of hydrologic conditions, as well as a basis for evaluating how groundwater conditions may change in the future based on comparison of water budget results to projected water budgets presented in the following section. A 50-year hydrologic period was selected, rather than a single, recent year to capture effects of long-term hydrologic variability.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Average annual inflows to and outflows from the basin for the current conditions land and surface water system baseline water budget were estimated to be 1.23 MAF per year. Average annual values were presented previously in Table 2-7 and are shown graphically in Figure 2-35.

Primary inflows to the land and surface water system include surface water inflows (602 TAF/year), precipitation (422 TAF/year), and groundwater pumping (209 TAF/year), with estimated stream gains from groundwater (i.e., accretions) of approximately one TAF/year. Surface water inflows include Butte Creek, Big Chico Creek, and several other streams, as well as overland runoff of precipitation and applied water from upslope lands. A minor inflow includes diversions of surface water that occur outside of the basin and are conveyed into the basin for use.

Primary outflows from the land and surface water system include surface water outflows (666 TAF/year), evapotranspiration (348 TAF/year), deep percolation (192 TAF/year), and stream losses (also referred to as seepage) (28 TAF/year). Surface water outflows include outflows through Butte Creek, Big Chico Creek, and other streams, as well as overland runoff of precipitation and applied water to downslope lands. Additionally, water is diverted from Butte Creek for use in the Butte Subbasin. Evapotranspiration is primarily from agricultural lands, but also from native vegetation, urban and industrial lands, managed wetlands, and canal evaporation. Deep percolation is primarily from precipitation, but also from applied water.

The average annual change in storage in the land and surface water system is negligible due to similar soil moisture content in the root zone, on average, across water years, and limited storage capacity exists in surface water bodies within the basin.

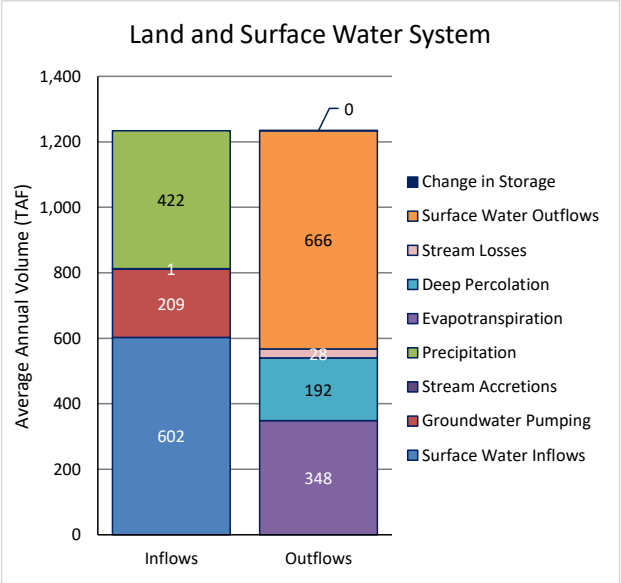


Figure 2-35: Average Annual Current Conditions Land and Surface Water System Water Budget

Average annual inflows to and outflows from the groundwater system were estimated to be 845 TAF and 846 TAF, respectively, with an average decrease in groundwater storage of one TAF per year during the 50-year simulation period. Average annual values were presented previously in Table 2-8 and are shown graphically in Figure 2-36.

Inflows to the groundwater system include deep percolation (192 TAF/year); subsurface inflows from the Los Molinos, Butte, and Wyandotte Creek Subbasins and from the foothill area (143 TAF/year); and stream losses (28 TAF/year). Outflows from the groundwater system include groundwater pumping (209 TAF/year); subsurface outflows to the Butte, Los Molinos, and Wyandotte Creek Subbasins and to the foothill area (76 TAF/year); western boundary net outflows (77 TAF/year); and stream gains from groundwater (1 TAF/year).

Formatted: English (United States)

Western boundary net outflows represent Sacramento River gains from groundwater and subsurface outflows to the Corning Subbasin. The split between these outflows is uncertain at this time and identified as a data gap. It is anticipated that this data gap will be addressed through future refinements to the BBGM and through coordination and collaboration with neighboring subbasins as part of GSP implementation.

Formatted: English (United States)

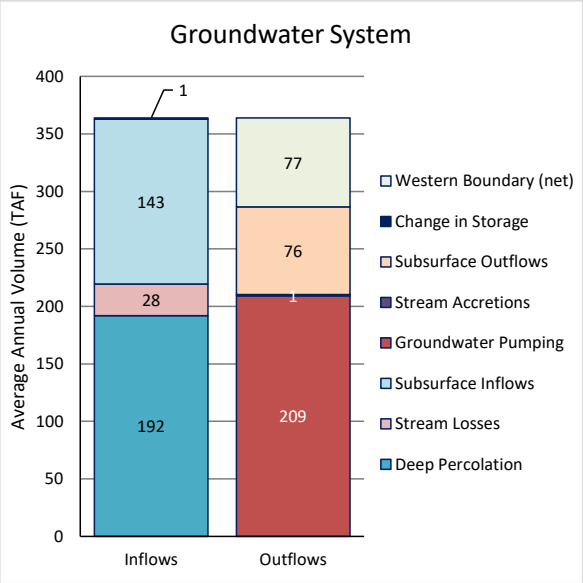


Figure 2-36: Average Annual Current Conditions Groundwater System Water Budget

2.3.4.3 Future Conditions

Three projected water budgets were developed for the basin to provide baseline scenarios representing potential future conditions considering planned development under the 2030 General Plan and climate change centered around 2030 and 2070 based on central tendency climate change datasets provided by DWR. The projected water budget scenarios provide a foundation to understand the behavior of the basin considering potential land use and urban demands over a broad range of hydrologic conditions, modified based on climate change projections). Use of a 50-year hydrologic period captures effects of long-term hydrologic variability.

Formatted: English (United States)

Future Conditions, No Climate Change

Average annual inflows to and outflows from the basin for the future conditions without climate change projected land and surface water system baseline water budget were estimated to be 1.24 MAF/year. Average annual values were presented previously in Table 2-7 and are shown graphically in Figure 2-37.

Primary inflows to the land and surface water system include surface water inflows (602 TAF/year), precipitation (422 TAF/year), and groundwater pumping (216 TAF/year), with estimated stream gains from groundwater (i.e., accretions) of approximately one TAF/year. Surface water inflows include Butte Creek, Big Chico Creek, and several other streams, as well as overland runoff of precipitation and applied water from upslope lands. A minor inflow includes diversions of surface water that occur outside of the basin and are conveyed into the basin for use.

Primary outflows from the land and surface water system include surface water outflows (676 TAF/year), evapotranspiration (347 TAF/year), deep percolation (189 TAF/year), and stream losses (also referred to as seepage) (28 TAF/year). Surface water outflows include outflows through Butte Creek, Big Chico Creek, and other streams, as well as overland runoff of precipitation and applied water to downslope lands. Additionally, water is diverted from Butte Creek for use in the Butte Subbasin. Evapotranspiration is primarily from agricultural lands but also from native vegetation, urban and industrial lands, managed wetlands, and canal evaporation. Deep percolation is primarily from precipitation, but also from applied water.

The average annual change in storage in the land and surface water system is negligible due to similar soil moisture content in the root zone, on average, across water years, and limited storage capacity exists in surface water bodies within the basin.

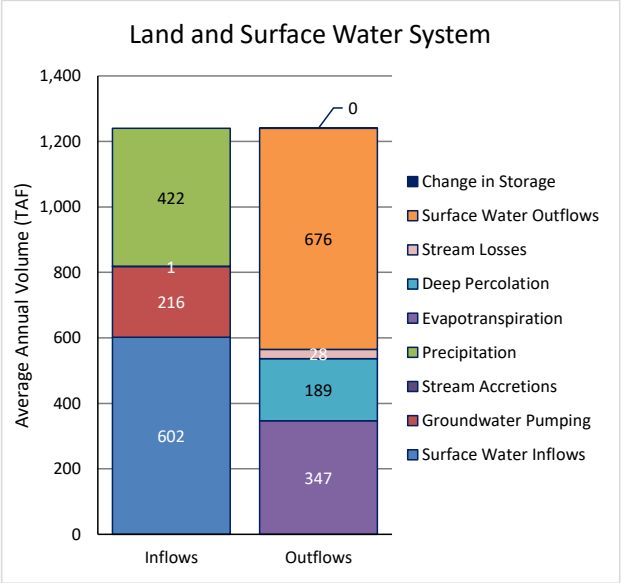


Figure 2-37: Average Annual Future Conditions without Climate Change Land and Surface Water System Water Budget

Average annual inflows to and outflows from the groundwater system were estimated to be 843 TAF and 845 TAF, respectively, with an average decrease in groundwater storage of two TAF/year during the 50-year simulation period. Average annual values were presented previously in Table 2-8 and are shown graphically in Figure 2-38.

Inflows to the groundwater system include deep percolation (189 TAF/year); subsurface inflows from the Los Molinos, Butte, and Wyandotte Creek Subbasins and from the foothill area (143 TAF/year); and stream losses (28 TAF/year). Outflows from the groundwater system include groundwater pumping (216 TAF/year); subsurface outflows to the Butte, Los Molinos, and

Formatted: English (United States)

Wyandotte Creek Subbasins and to the foothill area (72 TAF/year); western boundary net outflows (73 TAF/year); and stream gains from groundwater (1 TAF/year).

Western boundary net outflows represent Sacramento River gains from groundwater and subsurface outflows to the Corning Subbasin. The split between these outflows is uncertain at this time and identified as a data gap. It is anticipated that this data gap will be addressed through future refinements to the BBGM and through coordination and collaboration with neighboring subbasins as part of GSP implementation.

Formatted: English (United States)

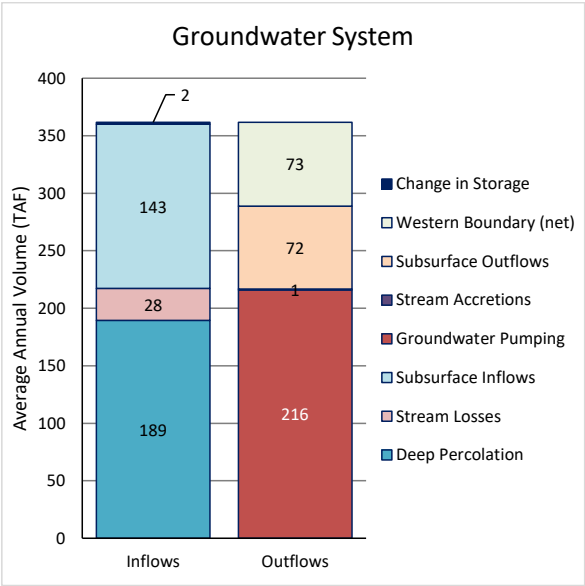


Figure 2-38: Average Annual Future Conditions without Climate Change Groundwater System Water Budget

Future Conditions, 2030 Climate Change

Average annual inflows to and outflows from the basin for the future conditions with 2030 climate change projected land and surface water system baseline water budget were estimated to be 1.30 MAF/year. Average annual values were presented previously in Table 2-7 and are shown graphically in Figure 2-39.

Primary inflows to the land and surface water system include surface water inflows (631 TAF/year), precipitation (438 TAF/year), and groundwater pumping (226 TAF/year), with estimated stream gains from groundwater (i.e., accretions) of approximately one TAF/year. Surface water inflows include Butte Creek, Big Chico Creek, and several other streams, as well as overland runoff of precipitation and applied water from upslope lands. A minor inflow includes diversions of surface water that occur outside of the basin and are conveyed into the basin for use.

Primary outflows from the land and surface water system include surface water outflows (715 TAF/year), evapotranspiration (358 TAF/year), deep percolation (194 TAF/year), and stream losses (also referred to as seepage) (28 TAF/year). Surface water outflows include outflows through Butte Creek, Big Chico Creek, and other streams, as well as overland runoff of precipitation and applied water to downslope lands. Additionally, water is diverted from Butte Creek for use in the Butte Subbasin. Evapotranspiration is primarily from agricultural lands, but also from native vegetation, urban and industrial lands, managed wetlands, and canal evaporation. Deep percolation is primarily from precipitation, but also from applied water.

The average annual change in storage in the land and surface water system is negligible due to similar soil moisture content in the root zone, on average, across water years, and limited storage capacity exists in surface water bodies within the basin.

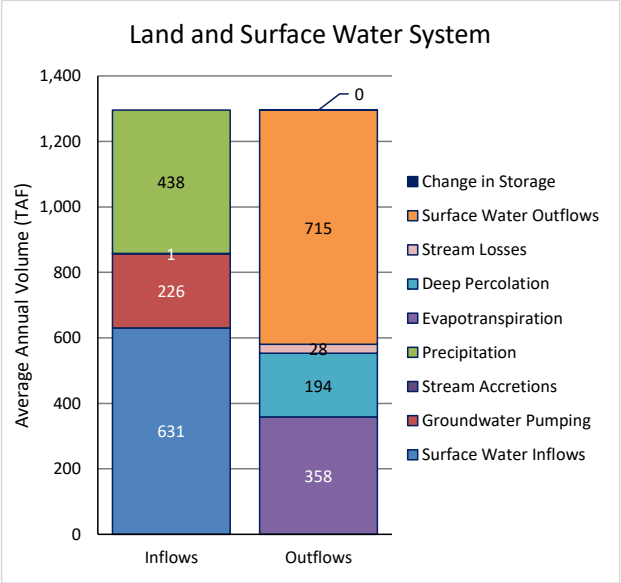


Figure 2-39: Average Annual Future Conditions with 2030 Climate Change Land and Surface Water System Water Budget

Average annual inflows to and outflows from the groundwater system were estimated to be 853 TAF and 854 TAF, respectively, with an average decrease in groundwater storage of two TAF/year during the 50-year simulation period. Average annual values were presented previously in Table 2-8 and are shown graphically in Figure 2-40.

Inflows to the groundwater system include deep percolation (193 TAF/year); subsurface inflows from the Los Molinos, Butte, and Wyandotte Creek Subbasins and from the foothill area (145 TAF/year); and stream losses (28 TAF/year). Outflows from the groundwater system include groundwater pumping (226 TAF/year); subsurface outflows to the Butte, Los Molinos, and

Formatted: English (United States)

Wyandotte Creek Subbasins and to the foothill area (71 TAF/year); western boundary net outflows (71 TAF/year); and stream gains from groundwater (one TAF/year).

Western boundary net outflows represent Sacramento River gains from groundwater and subsurface outflows to the Corning Subbasin. The split between these outflows is uncertain at this time and identified as a data gap. It is anticipated that this data gap will be addressed through future refinements to the BBGM and through coordination and collaboration with neighboring subbasins as part of GSP implementation.

Formatted: English (United States)

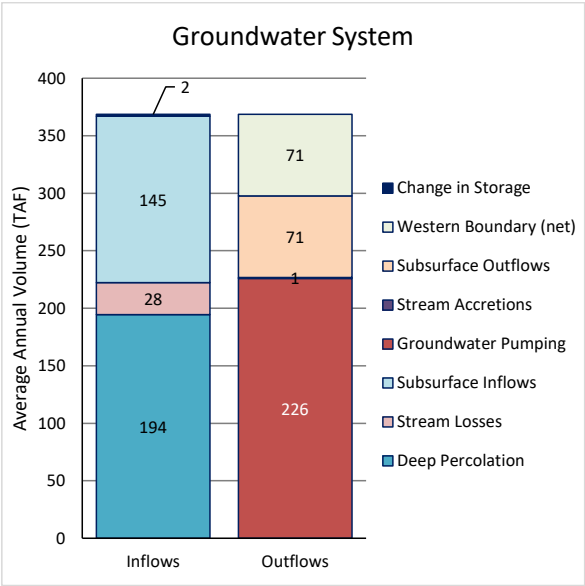


Figure 2-40: Average Annual Future Conditions with 2030 Climate Change Groundwater System Water Budget

Future Conditions, 2070 Climate Change

Average annual inflows to and outflows from the basin for the future conditions with 2070 climate change projected land and surface water system baseline water budget were estimated to be 1.34 MAF/year. Average annual values were presented previously in Table 2-7 and are shown graphically in Figure 2-41.

Primary inflows to the land and surface water system include surface water inflows (652 TAF/year), precipitation (453 TAF/year), and groundwater pumping (238 TAF/year), with estimated stream gains from groundwater (i.e., accretions) of approximately one TAF/year. Surface water inflows include Butte Creek, Big Chico Creek, and several other streams, as well as overland runoff of precipitation and applied water from upslope lands. A minor inflow includes diversions of surface water that occur outside of the basin and are conveyed into the basin for use.

Primary outflows from the land and surface water system include surface water outflows (749 TAF/year), evapotranspiration (371 TAF/year), deep percolation (197 TAF/year), and stream losses (also referred to as seepage) (27 TAF/year). Surface water outflows include outflows through Butte Creek, Big Chico Creek, and other streams, as well as overland runoff of precipitation and applied water to downslope lands. Additionally, water is diverted from Butte Creek for use in the Butte Subbasin. Evapotranspiration is primarily from agricultural lands but also from native vegetation, urban and industrial lands, managed wetlands, and canal evaporation. Deep percolation is primarily from precipitation, but also from applied water.

The average annual change in storage in the land and surface water system is negligible due to similar soil moisture content in the root zone, on average, across water years, and limited storage capacity exists in surface water bodies within the basin.

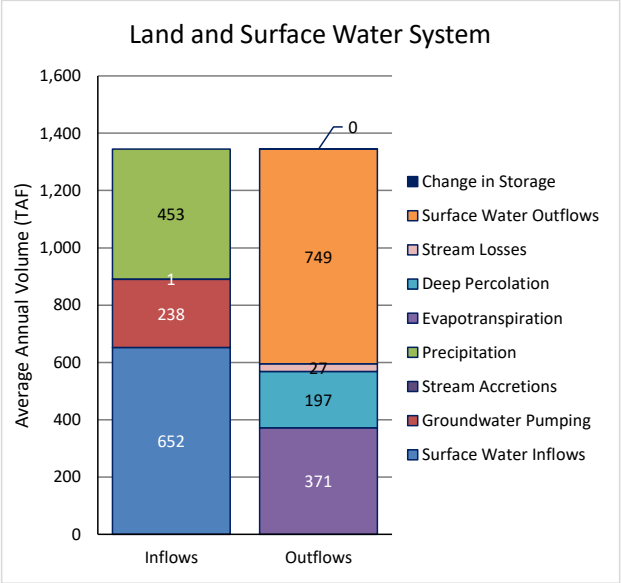


Figure 2-41: Average Annual Future Conditions with 2070 Climate Change Land and Surface Water System Water Budget

Average annual inflows to and outflows from the groundwater system were estimated to be 857 TAF and 860 TAF, respectively, with an average decrease in groundwater storage of three TAF/year during the 50-year simulation period. Average annual values were presented previously in Table 2-8 and are shown graphically in Figure 2-42.

Inflows to the groundwater system include deep percolation (197 TAF/year); subsurface inflows from the Los Molinos, Butte, and Wyandotte Creek Subbasins and from the foothill area (145 TAF/year); and stream losses (27 TAF/year). Outflows from the groundwater system include groundwater pumping (238 TAF/year); subsurface outflows to the Butte, Los Molinos, and

Formatted: English (United States)

Wyandotte Creek Subbasins and to the foothill area (68 TAF/year); western boundary net outflows (66 TAF/year); and stream gains from groundwater (one TAF/year).

Western boundary net outflows represent Sacramento River gains from groundwater and subsurface outflows to the Corning Subbasin. The split between these outflows is uncertain at this time and identified as a data gap. It is anticipated that this data gap will be addressed through future refinements to the BBGM and through coordination and collaboration with neighboring subbasins as part of GSP implementation.

Formatted: English (United States)

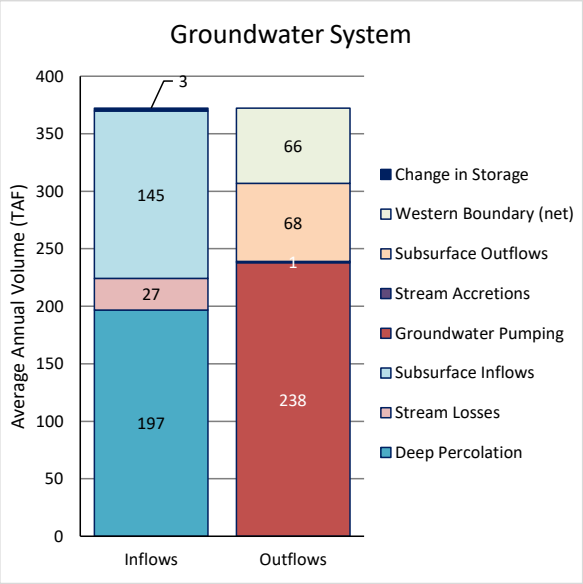
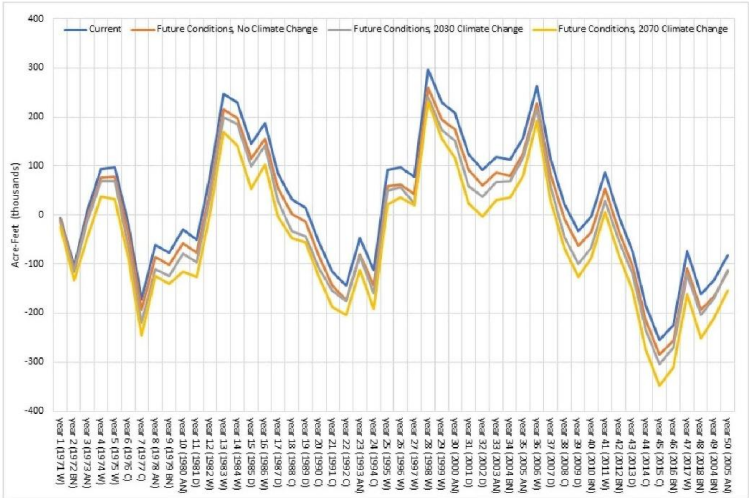


Figure 2-42: Average Annual Future Conditions with 2070 Climate Change Groundwater System Water Budget

Comparison of Water Budget Scenarios

A figure depicting cumulative change in storage for the current conditions and three future conditions baseline scenarios is provided on the following page (Figure 2-43). In the figure, the cumulative change in groundwater storage is shown for the 50-year hydrologic period. The -x-axis (horizontal axis) is labeled with the historical reference year along with the corresponding water year type based on the Sacramento Valley Water Year Index. Years are identified as wet (W), above normal (AN), below normal (BN), dry (D), or critical (C).

~~Figure 2-43 placeholder page~~



Cumulative Change in Groundwater Storage for Current and Future Conditions Baseline Scenarios
Vina Groundwater Subbasin GSP

Project No.: SAC282 | December 2021 | Figure 2-43

Figure 2-43: Cumulative Change in Groundwater Storage for Current and Future Conditions Baseline Scenarios

Estimated changes in storage are similar for each of the scenarios, with increased cumulative reduction in storage for the future conditions scenarios relative to the current conditions scenario. The 2070 climate change scenario suggests somewhat greater cumulative decrease in storage than the future conditions without climate change and 2030 climate change scenarios likely due to projected increases in temperature and associated irrigation demands within the Vina Subbasin.

Formatted: English (United States)

2.3.5 Water Budget Uncertainty

Uncertainty refers to a lack of understanding of the basin setting that significantly affects an agency's ability to develop SMC and appropriate projects and management actions in a GSP, or to evaluate the efficacy of plan implementation, and therefore may limit the ability to assess whether a basin is being sustainably managed. Uncertainty exists in all components of each water budget and in the assumptions used to project potential future conditions related to planned development and associated urban demands as well as projections of climate change. These uncertainties are not expected to substantially limit the ability to develop and implement a GSP for the basin, including the ability develop SMC and appropriate projects and management actions, nor the ability to assess whether the basin is being sustainably managed over time. It is anticipated that these uncertainties will be reduced over time through monitoring and additional data collection, refinements to the BBGM and other tools, and coordination with neighboring basins.

Formatted: English (United States)

2.3.6 Sustainable Yield Estimate

Sustainable yield refers to the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin, and including any temporary surplus that can be withdrawn annually from a groundwater supply without causing an undesirable result. As a result, determination of sustainable yield requires consideration of SGMA's six sustainability indicators (SIs). Historical water budget estimates indicate an average annual decrease in storage of 20,000 AFY for the period from 2000 to 2018. In general, decreased precipitation and increased groundwater pumping in dry years leads to decreases in groundwater levels and storage and may pose challenges to operating within the sustainable yield over multiple dry years. Operation of the basin within the sustainable yield will likely require incorporation of projects and management actions into the GSP and implementation over the 50-year SGMA planning and implementation horizon.

Formatted: English (United States)

For development of SMCs, as discussed in Section 3, the MO was developed to address the long-term trend of the "peaks and valleys" of the short-term cycles and stop the long-term decline in groundwater levels during dry years. Using this method, the average depth below the MO at compliance points (see Section 3 for discussion of representative monitoring sites [RMS]) if no actions are taken before the end of the implementation period in 2042 is about 21 feet. Using this value, a sustainable yield can be estimated based on the reduction in pumping needed to stop the observed decline in water levels across the Vina Subbasin. This value is sensitive to the specific storage. Specific storage is the parameter that translates the change in groundwater elevation to an associated change in volume (i.e., change in storage).

As discussed in Section 2.1.8.3, the average specific storage value used in the BBGM is 0.04 (unitless). Specific storage values estimated from pumping tests by Brown and Caldwell (2013)

Formatted: English (United States)

ranged from 0.001 to 0.00004. Table 2-10 provides estimates of sustainable yield to maintain the MO in 2042 using this range of storativity values and the average decline in water levels across the Vina Subbasin in 2042. The groundwater pumping rate for the historical scenario is used for the calculation of sustainable yield.

Table 2-10: Estimated Sustainable Yield Using Average Depth Below Measurable Objective in 2042 and Range of Storativity Values

Feet Below MO in 2042	Specific Storage	Area of Subbasin (square miles)	Volume Storage Below MO in 2042 (acre-feet)	Average Change in Storage Between 2030 and 2042 (AFY)	Groundwater Pumping[1] (AFY)	Estimated Sustainable Yield (AFY)
21	0.1	289	388,410	32,368	243,500	211,132
21	0.04	289	38,841	12,840	243,500	230,660
21	0.001	289	3,884	324	243,500	243,176
21	0.0001	289	388	32	243,500	243,468
21	0.00001	289	39	3	243,500	243,497

Note:
1. Historical scenario pumping.

As seen in the above discussions (Section 2.3.4), the calculated decrease in storage value is highly sensitive to the time period used to assess the annual average and the specific storage value used for calculations. The range of values for the decrease in storage based on the variations for time period is 1,700 to 19,600 AFY and for specific storage is 3 to 32,368 AFY as discussed above.

Formatted: English (United States)

Considering these variations, this GSP defines the estimate of the sustainable yield as 233,500 AFY based on average historical groundwater pumping of 243,500 AFY and a decrease in storage of 10,000 AFY. The historical groundwater pumping value is based on the average annual groundwater pumping that occurred between 2000 and 2018 as discussed in Section 2.3.4 and summarized in Table 2-8. The decrease in storage value of 10,000 AFY was selected based on the range of values shown in Table 2-10 and calculated for the Water budget as shown on Table 2-8.

2.3.7 Opportunities for Improvement to the Water Budget

2.3.7.1 Refine Surface Water Diversion Estimates

While many of the large diversions are continuously monitored and recorded, limited information is available for others. It is recommended that GSAs in the basin work with local stakeholders to better document surface water diversions, including investigation of riparian diversions in some area and additional information describing water supplies for managed wetlands. Diversion estimates developed as part of the water budgets provide a good basis to support discussion with diverters.

Formatted: English (United States)

2.3.7.2 Refine Groundwater Pumping Estimates

Groundwater pumping for irrigation has generally been estimated based on estimates of crop irrigation requirements in areas known to rely on groundwater. It is recommended that GSAs

Formatted: English (United States)

look for opportunities to verify and refine groundwater pumping estimates to improve water budget estimates by obtaining pumping data from cooperative landowners.

2.3.7.3 Refine Deep Percolation Estimates

Deep percolation in some areas may return to the surface layer through accretion in drains and natural waterways or may be consumed by phreatophytic vegetation. It is recommended that GSAs look for opportunities to further understand and investigate the ultimate fate of deep percolation from agricultural lands. Through modeling of specific waterways and shallow groundwater, the BBGM can help support these investigations.

Formatted: English (United States)

2.3.7.4 Refine Urban Lands Water Budgets

The relative proportion of non-consumed water returning as deep percolation or surface runoff does not explicitly account for percolation from stormwater retention ponds or releases from wastewater treatment plants to local waterways. There is an opportunity to refine water budgets for developed lands to verify and refine estimates of non-consumed water. Additionally, there is an opportunity to evaluate and develop refined water use estimates for industrial uses.

2.3.7.5 Refine Characterization of Interbasin Flows and Net Outflows along Western Boundary

Interbasin flows are dependent on conditions in adjacent basins. It is recommended that GSAs refine estimates of subsurface groundwater flows from and to neighboring basins through coordination with GSAs in neighboring basins during or following GSP development and through review of modeling tools that cover the Sacramento Valley region, including the C2VSim and SVSim integrated hydrologic model applications developed by DWR.

Formatted: English (United States)

2.3.7.6 Land Use Changes Due to the Camp Fire

In 2018, the Camp Fire destroyed 18,000 structures in Butte County displacing over 27,000 residents. While the Town of Paradise, Concow, and other areas destroyed by the Camp Fire rebuild, many residents have relocated to the City of Chico and other portions of the Vina Subbasin. The existing General Plans may not fully account for the relocation of Camp Fire survivors. A focused accounting of changes to residential land use and associated water demands as a result of the Camp Fire should be conducted.

Formatted: English (United States)

3. SUSTAINABLE MANAGEMENT CRITERIA

Sustainable management criteria (SMC) offer guideposts and guardrails for groundwater managers seeking to achieve sustainable groundwater management. (Figure 3-1). SGMA defines sustainable groundwater management as "the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results," where the planning and implementation horizon is 50 years with the first 20 years spent working toward achieving sustainable groundwater management and the following 30 years (and beyond) spent maintaining it (California Water Code §10721; Figure 3-1). For the Vina Subbasin, SMC were formulated by working with the Vina GSA and the Rock Creek Reclamation District GSA Boards of Directors, the SHAC, and members of the public. ~~This~~During development of the 2022 GSP, this stakeholder outreach process was facilitated by the Consensus Building Institute (CBI) with sessions documented on the Vina Subbasin GSA website. Outreach included a robust discussion and broad agreement on the Vina Subbasin sustainability goal as well as what constitutes locally defined undesirable results. The sustainability goal is meant to reflect the GSAs desired condition, maintained over time, for the groundwater basin. Similarly, public engagement supported the development of amendments to the GSP.

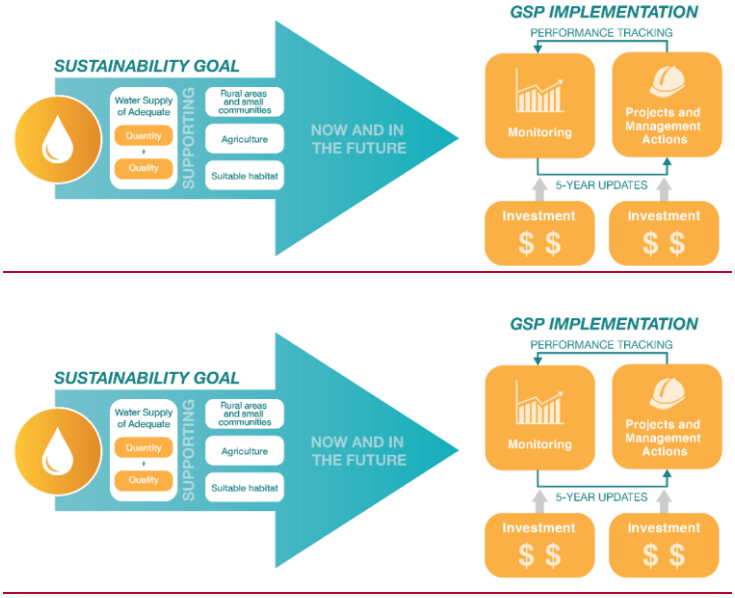


Figure 3-1: Flow Chart for Sustainability

Undesirable results are associated with up to six SIs, including groundwater levels, groundwater storage, water quality, seawater intrusion, land subsidence, and interconnected surface water.

Formatted: English (United States)

SGMA defines undesirable results as those having significant and unreasonable negative impacts. Failure to avoid undesirable results on the part of the GSAs may lead to intervention by the State. Once the sustainability goal and undesirable results have been locally identified, projects and management actions are formulated to achieve the sustainability goal and avoid undesirable results.

The Vina Subbasin is divided into three MAs: North, Chico, and South. The associated undesirable results for each SI have been defined similarly across the three MAs within the Vina Subbasin. In turn, the rationale and approach for determining MT and MO for each SI are the same across all MAs in the Vina Subbasin.

Formatted: English (United States)

The terminology for describing SMC is defined as follows:

- Undesirable Results – Significant and unreasonable negative impacts associated with each SI.
- MT– Quantitative threshold for each SI used to define the point at which undesirable results may begin to occur.
- MO – Quantitative target that establishes a point above the MT that allows for a range of active management to prevent undesirable results.
- Margin of Operational Flexibility – The range of active management between the MT and the MO.
- Interim Milestones (IMs) – Targets set in increments of five years over the implementation period of the GSP offering a path to sustainability.

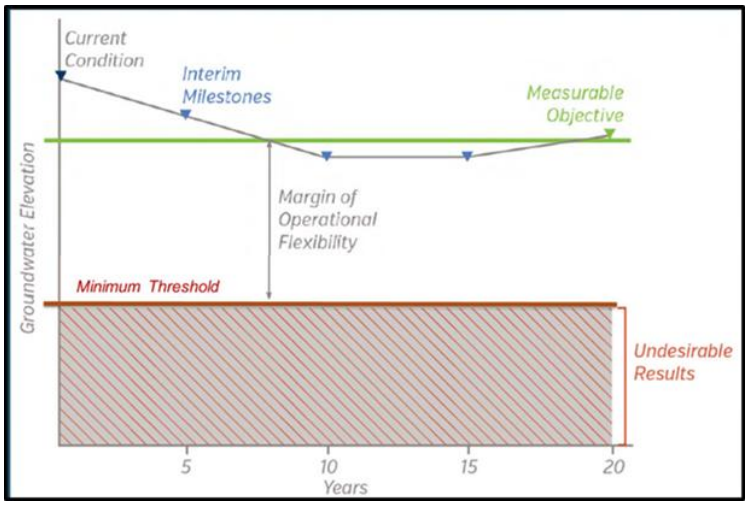


Figure 3-2: Illustration of Terms Used for Describing Sustainable Management Criteria Using the Groundwater Level ~~SI~~Sustainability Indicators

Figure 3-2 illustrates these terms for the groundwater level SI.

SIs are intended to be measured and compared against quantifiable SMC throughout a monitoring framework of RMS (Section 4.9). Ongoing monitoring of SI can:

- Determine compliance with the adopted GSP
- Offer a means to evaluate the effectiveness of projects and management actions over time
- Allow for course correction and adaptation in five-year ~~updates~~periodic evaluations
- Facilitate understanding among diverse stakeholders
- Support decision-making on the part of the GSAs into the future

To quantify SMC for the Vina Subbasin, information from the HCM (Section 2), descriptions of current and historical groundwater conditions and input from stakeholders have been considered.

3.1 Sustainability Goal

The sustainability goal for the Vina Subbasin is:

> *to ensure that groundwater is managed to provide a water supply of adequate quantity and quality to support rural areas and communities, the agricultural economic base of the region, and environmental uses now and in the future.*

Implementation of the Vina GSP may achieve sustainability before 2042; however, groundwater levels in the Vina Subbasin may continue to decline during the implementation period. As projects and management actions are implemented, sustainable groundwater management will be achieved. The Vina Subbasin will be managed to prevent undesirable results throughout the implementation period, despite the possible decline of groundwater levels. This sustainability goal is supported by locally defined MT that will avoid undesirable results. Demonstration of stable groundwater levels on a long-term average basis combined with the absence of undesirable results will ensure that the Vina Subbasin is operating within its sustainable yield and the sustainability goal will be achieved. SMC within the Vina Subbasin emphasize management objectives related to domestic, municipal, and agricultural wells as well as suitable habitat. Groundwater management has already been occurring throughout Butte County, and the Vina Subbasin will be managed within its sustainable yield by adapting existing management objectives and strategies to address current and future conditions, or by developing new ones. Sustainable yield means the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result. The Vina Subbasin intends to achieve its sustainability goal by implementing GSP projects and management actions that both augment water supply and increase efficiency of water application (see Section 5 for proposed projects and management actions and Section 6 for the implementation plan to achieve sustainability).

Formatted: English (United States)

The BCDWRC has been participating in groundwater management activities for many years, including within the Vina Subbasin. In the last several years, the BCDWRC has increased groundwater level and water quality monitoring and has worked with other entities to collect and disseminate water data. In addition, the BCDWRC assists with other locally driven groundwater management activities. The Vina Subbasin intends to build on this ongoing county-wide process and broadly shares the objective of long-term maintenance of high-quality groundwater resources within the region for domestic, agricultural, and environmental uses.

Formatted: English (United States)

3.2 Sustainability Indicators, Minimum Thresholds, and Measurable Objectives

3.2.1 Sustainability Indicators

Six SIs are defined by SGMA and are used to characterize groundwater conditions throughout a basin or subbasin. SGMA requires development of locally defined SMC for each SI and allows for identification of SI that are not applicable. For example, sea water intrusion is not applicable in the Vina Subbasin due to its distance from the Pacific Ocean.

SI and associated undesirable results, if significant and unreasonable

3.2.2 Minimum Thresholds

As noted earlier, MT are those quantitative thresholds for each SI used to define the point at which undesirable results may begin to occur. Undesirable results are those having significant and unreasonable negative impacts, avoidance of which is required by SGMA. Potential impacts and the extent to which they are considered "significant and unreasonable" were determined by the GSAs Boards of Directors with input from the SHAC and members of the public. The GSAs established MT intended to prevent such significant and unreasonable negative impacts from occurring. If observed data trend toward the locally defined MT, this will trigger action on part of the GSAs to reverse this trend before reaching the MT. For this reason, MT are like guardrails. Actions to reverse a trend toward a MT could be taken at any time during GSP implementation that will follow an adaptive management process working with stakeholders to ensure actions are implemented at appropriate times.

Formatted: English (United States)

3.2.3 Measurable Objectives / Interim Milestones

MO are those quantitative targets that establish a point above the MT that allows for a range of active management to achieve the sustainability goal and prevent undesirable results. This range of active management between the MT and the MO is referred to as the margin of operational flexibility.

Formatted: English (United States)

MO were determined by the GSAs Boards of Directors with input from the SHAC and members of the public. The GSAs established MO intended to preserve the desired condition throughout the Vina Subbasin while offering flexibility in GSP implementation. IM are targets set in increments of 5 years over the implementation period of the GSP offering a path to sustainability. For this reason, the MO and IM are like guideposts.

Formatted: English (United States)

3.3 Groundwater Levels Sustainable Management Criteria

Groundwater Levels SMC are those meant to address the chronic lowering of groundwater levels and avoid the depletion of supply at a given location that may lead to undesirable results caused by groundwater pumping. The locally defined undesirable result, MT, and MO are discussed in the next sections.

3.3.1 Undesirable Result

An undesirable result caused by the chronic lowering of groundwater levels is experienced if:

> *sustained groundwater levels are too low to provide a water supply of adequate quantity and quality to support rural areas and communities, and the agricultural economic base of the region, or if significant and unreasonable impacts to environmental uses of groundwater occur.*

3.3.2 Minimum Thresholds

The Groundwater Levels MT represent quantitative thresholds used to define the point at which undesirable results may begin to occur, avoidance of which is required under SGMA. To establish locally defined MT, the GSAs Boards of Directors, SHAC, and members of the public explored potential impacts of declining groundwater levels.

Formatted: English (United States)

Potential impacts identified by stakeholders from declining groundwater levels included:

Formatted: English (United States)

- Wells going dry
- Reduced pumping capacity of existing wells
- Need for deeper well installations and/or lowering of pumps
- Increased pumping costs due to greater lift
- Reduced flows in rivers and streams supporting aquatic ecosystems
- Water table depth dropping below the maximum rooting depth of Valley Oak or other deep-rooted tree species

Issues related to reduced flows in rivers and streams and/or water tables that support deep-rooted tree species are addressed in the Interconnected Surface Water SMC (Section 3.8).

In recent years, Butte County has documented a number of domestic wells that have "gone dry," meaning groundwater levels have fallen below the depth of the well installation and/or pump. This occurred during summer months of recent drought years and heightened concern among some stakeholders. For example, in the critically dry year of 2021, 44 wells were reported dry county-wide through the State's online reporting system. As a result, domestic well reliability and protection are the focus of the Groundwater Levels MT. From a policy perspective, sustainably constructed domestic wells going dry during non-dry year conditions would be a "significant and unreasonable" undesirable result of groundwater management. The quantitative Vina Subbasin Undesirable Result for the Chronic Lowering of Groundwater Levels occurs when:

Formatted: English (United States)

> *Two RMS wells within a management area reach their MT for two consecutive years of non-dry year-types.*

Non-dry year types include wet, above normal, and below normal as defined by the Sacramento Valley Water Year Index. Dry year types include dry and critical water year types. See Section 2.3.1 for more information on the Sacramento Water Year Index.

As shown in the figures presented in Appendix 3-A showing the average depth of domestic, irrigation, and public supply wells, domestic wells are generally shallower than other wells throughout the Vina Subbasin. These figures were constructed using data from DWR OSWRC. Protection of domestic wells was therefore deemed to be additionally protective of other well types, such as agricultural wells. In addition, the lowering of groundwater levels during two or more consecutive dry and/or critically dry year types is not considered significant and unreasonable and therefore not considered an undesirable result, as long as the groundwater levels rebound to levels greater than the MT following those consecutive dry and/or critically dry years.

The Vina Subbasin SMC for Chronic Lowering of Groundwater Levels is based on groundwater levels throughout the Vina Subbasin that would support sustainably constructed domestic wells. Sustainably constructed implies wells that have been installed following the relevant County Well standards within permeable aquifer material and the wells have been appropriately maintained (e.g., well problems are not due to clogging of well screens or silting of well). Exceeding the MT may lead to significant and unreasonable effects during drought years and impacts to domestic wells and other groundwater uses may occur and would not constitute an Undesirable Result. Local and state drought response play a role in addressing dry year impacts. However, once a drought period ends, it is anticipated that groundwater conditions should return to the MO levels. Year-type is defined according to the Sacramento Valley Water Year Hydrologic Classification and groundwater level is defined based on groundwater elevation above msl.

To establish appropriate MT levels protective of sustainably constructed domestic wells, a representative zone is established for each RMS well. The DWR domestic well database provides information on all submitted WCRs when a well is drilled. This database contains information on characteristics of the wells, including well location, groundwater surface elevation of the well, and total well depth. These well characteristics, however, are not always accurate or precise, and, unfortunately, it is not known which of the wells in the database are in use or have been abandoned or replaced.

To refine the dataset, wells installed before 1980 were removed. This removes the oldest wells and wells likely to have been replaced as a result of historically low groundwater conditions that occurred during the 1976-1977 drought. Wells that remain are more likely to be consistent with current well standards and currently serving domestic water needs. The 1980 cutoff is similar to the 1977 cutoff the State Water Resources Control Board uses to assess risks to State Small Water Systems and Domestic Well.[13] Still, there is much information that remains to be gathered to further refine the dataset given the unknowns previously identified, as well as relationships to changes in surface elevation. Therefore, additional characterization of active domestic wells within the subbasin may be considered during GSP implementation (see Section 5.4.3).

Using the refined data set, each MA was divided into polygons that represent proximate areas to each RMS well identified in the 2022 GSP (see figures in Appendix 3-B). Due to the size, the

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

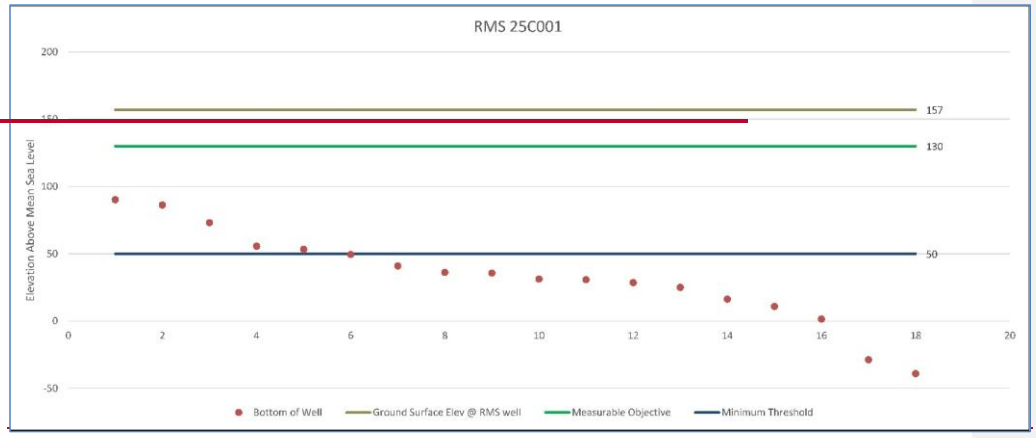
Formatted: English (United States)

[13] California Drinking Water Needs Assessment web link: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/needs.html

Chico MA was not separated into polygons and the MT was calculated using the entire domestic well data for each RMS well (i.e. the same MT is applied to all RMS wells within the Chico MA). Each point (or represented well) within each area is closer to its respective RMS well than any other RMS well. The size of each polygon depends on the density of the RMS network. For example, the higher the density of RMS wells in a MA, the smaller the polygons. Each polygon is a different shape and size, determined by the distribution of the RMS wells in the MA. Ground surface elevation change across the RMS polygon was also considered when establishing the MT. The result is a more refined dataset that more proximately reflects the relationship of domestic wells with each RMS well. In addition, rather than just looking at a percentage of domestic wells to protect, the elevation levels were examined in comparison to what would be considered sustainable domestic wells as defined above for the area (see individual graphs for each RMS well in Appendix 3-B). The result is setting an MT for each RMS well that corresponds with elevation changes and provides operational flexibility between the MO and the MT.

Figure 3-3 illustrates the graphing method for RMS well 25C001M within the Vina North MA. Each red point on the graph represents a domestic well and shows the elevation of the bottom of the well. All of the individual domestic wells are shown relative to the RMS well's ground surface elevation. The graphs were used to identify the MT that would be protective of the majority of the domestic wells in the RMS zone while recognizing the RMS well is not fully representative of wells within the zone due to changes in ground surface and water surface elevation throughout the area. Wells that plot above the MT elevation tend to be especially shallow (less than 100 feet deep) or have a significantly different (higher) ground surface elevation than the RMS well.

Formatted: English (United States)



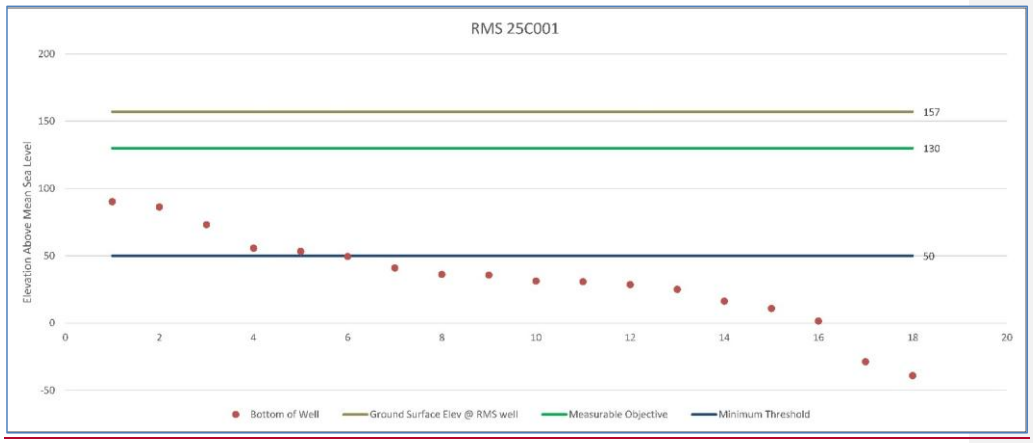


Figure 3-3: Graph Showing Graphing Method Used to Establish MTs for Each RMS Well. Red dots represent bottom elevation of each domestic well within the polygon associated with the RMS well (example is for well 25C001M in Vina North) relative to ground surface elevation at the RMS well

The 2022 GSP assigned MTs to the seventeen RMS wells using the method described above. The amended 2027 GSP expanded the number of RMS wells from seventeen wells to twenty-nine wells keeping eleven of the original RMS wells, removing five original RMS wells, and adding seventeen new RMS wells to make the network more representative of conditions relative to beneficial users (e.g., domestic wells and shallow groundwater relevant to potential groundwater dependent ecosystems). Representative areas were assigned to the RMS wells using three management areas: North, Chico, and South. MTs for the eleven original RMS wells are the same as presented in the 2022 GSP. New RMS wells in the North and South Management

Areas were assigned a comparable MT to those specified in the 2022 GSP. Under this comparability method, the average spring groundwater level (ASGWL) is calculated for each of the 29 RMS wells as the mean groundwater elevation from February, March, and April, excluding questionable measurements, across the available DWR record. For each management area, the average offset between the ASGWL and the adopted 2022 GSP MT is calculated using retained 2022 RMS wells. These management area offsets are then applied to each new 2027 RMS well based on its assigned management area. New RMS wells in the North and South Management Areas were assigned MTs 91 feet and 92 feet below the historical ASGWL, respectively. This approach is intended to provide consistent SMC values for newly added RMS wells while maintaining continuity with the adopted 2022 GSP framework.

Minimum thresholds for wells CMW-102A and SWMW-06A were developed with reference to the assumed rooting depth of Valley Oaks (e.g., 30 feet below ground surface) within the Chico Management Area.

3.3.3 Measurable Objectives

The Groundwater Levels MO represent quantitative targets that establish a point above the MT allowing for a range of active management to prevent undesirable results and reflect the desired state for groundwater levels at the year 2042. To establish the MO, the water-level hydrograph of observed groundwater levels at each RMS was evaluated. The historical record at these locations shows cyclical fluctuations of groundwater levels over a four- to seven-year cycle consistent with variations in water year type according to the Sacramento Valley Water Year Hydrologic Classification. Groundwater levels are typically lower during dry years and higher during wet years. Superimposed on this four- to seven-year short-term cycle is a long-term decline in groundwater levels. In other words, groundwater levels during more recent dry-year cycles are lower than groundwater levels in earlier dry-year cycles.

Formatted: English (United States)

The wet-dry cycles are climatically induced, and the GSAs have no ability to change this cyclical behavior; there will always be short-term cyclical fluctuations in groundwater levels. The MO are therefore intended to address the long-term trend of the "peaks and valleys" of the short-term cycles and stop the long-term decline in groundwater levels during dry years. Because the GSAs cannot immediately augment water supply and/or increase efficiency of water application, some continuation of the long-term decline in groundwater levels is possible in the near future. Currently (in 2021), the Vina Subbasin appears to be coming out of a wet period of a short-term cycle (2017 and 2019 being wet years) and beginning the next dry period of a short-term cycle starting in 2020. The MO was therefore based on the trend line of observed historical data extended to the year 2030. The year 2030 was chosen as a reasonable time frame in which the GSAs could implement projects and management actions to address long-term groundwater level decline while recognizing that groundwater levels may experience another dry period of the short-term cycle in the intervening years. The MO for the Groundwater Levels SMC is:

Formatted: English (United States)

> *the groundwater level based on the groundwater trend line of the RMS well for the dry periods (since 2000) of observed short-term climatic cycles extended to 2030.*

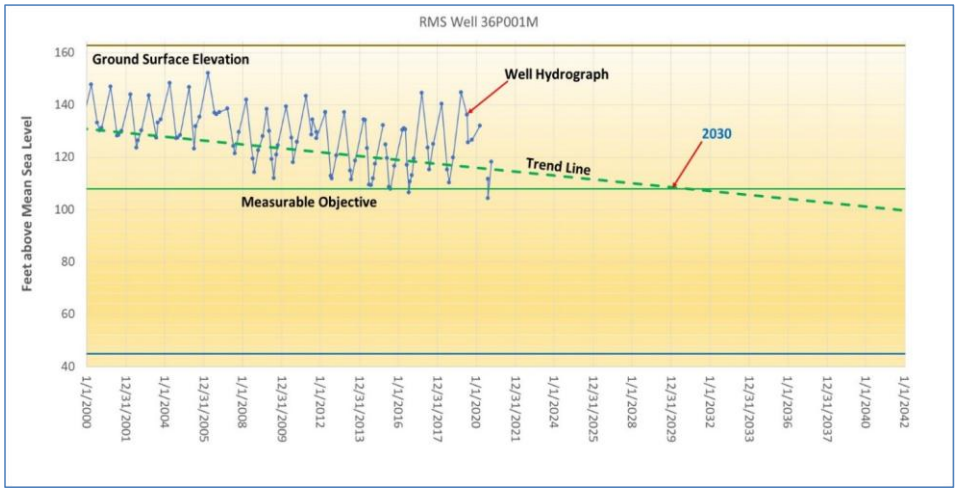


Figure 3-4: Illustration of Long-term Trend Using Historical Water Levels Extended to 2030 for Development of Measurable Objectives

The projection of groundwater levels for each RMS was based on a simple non-statistical linear projection of the observed data (Figure 3-3). Generally, the lowest groundwater levels of a given cycle were used for the projection, unless they appeared to be outliers relative to the general long-term trend of the non-dry years in the cycle.

Formatted: English (United States)

MOs for the eleven original RMS wells are the same as presented in the 2022 GSP using the method described above. Newly designated 2027 RMS wells in the North and South Management Areas were assigned a comparable MO to those specified in the 2022 GSP. New RMS wells in the North and South Management Areas were assigned MOs 24 feet and 30 feet below the historical ASGWL, respectively. For wells CMW-102A and SWMW-06A in the Chico Management Area, the measurable objective is set at the average of the historical data for the period of record.

IMs for groundwater levels between 2022 and 2042 were interpolated based on the linear projection of groundwater level at each RMS. By projecting based on the dry years in the cycle, the observed groundwater levels may be higher than the IM. This will be addressed in the annual reports and ~~interim GSP updates~~Periodic Evaluations based on what occurs with respect to the short-term cycles in the future.

IMs for the eleven original RMS wells are the same as presented in the 2022 GSP using the method described above. Newly designated 2027 RMS wells in the North and South Management Areas were assigned a comparable IM to those specified in the 2022 GSP. New RMS wells in the North and South Management Areas were assigned IMs 22 feet and 28 feet below the historical ASGWL, respectively. For wells CMW-102A and SWMW-06A in the Chico Management Area, the IMs were set to the MOs.

Appendix 3-C contains the hydrographs for each RMS.

Formatted: English (United States)

3.3.4 Local Management Levels

Local Management Levels (LMLs) were developed to provide an early warning mechanism to support proactive water management in the Vina Subbasin and ensure management of groundwater levels within a reasonable range of the IMs and MOs. LMLs have been designated on fourteen (14) RMS wells at 20 feet below the Measurable Objectives. LMLs are assigned to a subset of the RMS wells based on three criteria: 1. In potential GDE and shallow RMS well areas (09E001, 27L001, 36P001, 20K001, and 32E001) 2. In RMS areas near subbasin boundaries (25C001, 05M001, 10B003, 27D001, 02H003, 09G001, 24C001, and 33L001), and 3. In an RMS polygon with a relatively large number of domestic wells (29P002).

LMLs reflect conservative minimum groundwater levels, which may not necessarily constitute significant or unreasonable conditions. Set at shallower levels than minimum thresholds, LMLs serve as an early warning mechanism that triggers adaptive management and enables early intervention before minimum thresholds are reached. If observed groundwater level measurements reach the LML and persist through multiple observed groundwater measurements across differing seasons (i.e. spring, summer, or fall), then the following actions would occur:

- Staff will report the hydrograph of the well with measurements at or below the LML to the SHAC and Boards at their next meeting
- The technical team will investigate whether the condition is due to localized, isolated conditions (ex. well interference) or reflective of broader changes in aquifer conditions
- Staff/technical consultants would develop a technical report explaining the underlying cause to the GSA Boards to receive direction on appropriate next steps.
- Depending on the cause, the Board could consider or direct the following actions:
    - Expansion of existing monitoring (ex. increased frequency) or expansion of measurement locations
    - Evaluation of impacts occurring to domestic wells, shallow agricultural wells, or environmental uses of groundwater in the vicinity of the RMS well
    - Further technical evaluation of factors causing the LML and potential solutions to remedy the LML exceedance
    - Activation of a GSP Project or Management Action (see Chapter 5)
- Annual Reporting will document the condition and GSA response

Potential actions will be considered through a public process, including evaluation and recommendations from the SHAC, and ultimately decided by the GSA Boards. Actions may include additional studies or assessments and management modifications including demand management in areas experiencing groundwater declines that reach or fall below LMLs. Corrective actions or information-gathering efforts will be considered successful when monitoring data confirms groundwater conditions have returned above the LML, or the condition is attributed to localized, isolated conditions that have not resulted in significant and unreasonable impacts to beneficial users or uses of groundwater and is not a subbasin-wide issue.

~~3.3.4~~3.3.5 Summary

To achieve the sustainability goal and therefore preserve the desired condition for the groundwater basin over time, the GSAs, in setting Groundwater Levels SMC, will implement appropriate projects and/or management actions as necessary to maintain groundwater levels within operational flexibility to limit the decline in groundwater levels to certain values and manage groundwater levels within certain ranges at each RMS shown in Table 3-1. (See Section 4, Figure 4-5, and Table 4-6 for relevant information on the RMS for groundwater levels.)

Table 3-1: Groundwater Levels SMC by RMS in Feet Above Mean Sea Level

RMS Well ID	~~MT~~ LML	MO	IM			MT
			2027	2032	2037	
Vina Subbasin – North Management Area						
25C001M	~~50~~110	130	130	130	130	50
~~10E001M~~ 09E001M	~~80~~115	135	136	~~137~~135	~~136~~ 135	~~136~~ 68
~~07H001M*~~ 20K001M[a]	~~72~~95	~~136~~115	~~140~~117	~~136~~ 115	~~136~~ 115	48
05M001M	~~31~~95	115	116	115	115	31
28M004M	-	118	120	118	118	51
10M001M	-	138	140	138	138	71
27L001M	101	121	123	121	121	55
07H001M	-	136	140	136	136	72
14R002M	-	132	134	132	132	66
36P001M	~~45~~88	108	110	108-	108-	45
29P002M	107	127	129	127	127	61
~~33A001M~~ 33A001M[a]	~~72~~-	125	128	125-	125-	72
09B001M[a]	-	113	115	113	113	46
Vina Subbasin – Chico Management Area						
~~CWSCH01b~~ PWSCH01b	~~85~~-	106	107	106-	106-	
~~CWSCH02~~ PWSCH02	-	105	108	105-	105-	
~~CWSCH03~~ PWSCH03	-	108	109	108-	108-	85
~~CWSCH07~~ PWSCH07	-	95	97	95	95	
~~28J003M~~CMW-102A[b]	-	~~111~~188	~~113~~188	~~111~~188	~~111~~188	175
SWMW-06A[b]	-	173	173	173	173	160
Vina Subbasin – South Management Area						
~~21C001M~~	~~10~~	~~64~~	~~67~~	~~64~~-	~~64~~-	
~~18C003M~~	~~65~~	~~130~~	~~132~~	~~130~~-	~~130~~-	
~~10C002M~~ 10B003M	~~20~~72	92	~~93~~94	92-	92-	30
27D001M	64	84	87	84	84	23
13L004M	-	82	85	82	82	21
25K001M	-	83	85	83	83	21
02H003M	53	73	75	73	73	11
24C001M	~~18~~57	77	81	77-	77-	18
~~09L001M~~ 18C003M	~~30~~-	~~91~~130	~~93~~132	~~91~~ 130	~~91~~ 130	65
32E001M	67	87	89	87	87	25

~~26E005M~~ 26E006M	~~36~~ -	95	97	~~95~~ -	~~95~~ -	36
~~Note:~~ 09G001M	67	87	89	87	87	25
32B001M	-	195	197	195	195	133
33L001M	67	87	90	87	87	26

~~[a] MO is associated with GSP Well ID 18A001M.~~Notes:
[a] RMS well is located within Chico Management Area (MA) but is representative of a portion of North MA.
[b]RMS well added to protect GDEs within the Chico Management Area.

3.4 Groundwater Storage Sustainable Management Criteria

Groundwater Storage SMC are those meant to address the reduction of groundwater storage caused by groundwater pumping. The locally defined undesirable result, MT, and MO are discussed in the next sections.

3.4.1 Undesirable Result

An undesirable result coming from the reduction of groundwater storage is experienced if:

> *sustained groundwater storage volumes are insufficient to support rural areas and communities, the agricultural economic base of the region, and environmental uses.*

This undesirable result is closely related to that associated with groundwater levels. Because groundwater levels and groundwater storage are closely related, measured changes in groundwater levels can serve as a proxy for changes in groundwater storage. For this reason, the SMC developed for groundwater levels are used for groundwater storage to ensure avoidance of the undesirable result.

3.4.2 Minimum Thresholds

As Groundwater Levels SMC are used by proxy, the MT for groundwater storage is the same as for groundwater levels:

> *Two RMS wells within a management area reach their MT for two consecutive years of non-dry year-types.*

In the historical record, there are isolated incidences of shallow wells going dry during summer months of recent critically dry years. This was noted in the earlier section addressing the development of Groundwater Levels SMC. MT intended to prevent significant and unreasonable negative impacts related to the chronic lowering of groundwater levels are assumed adequate to protect against significant and unreasonable reductions of groundwater storage.

3.4.3 Measurable Objectives

As Groundwater Levels SMC are used by proxy, the MO for groundwater storage is the same as for groundwater levels:

> *the groundwater level based on the groundwater trend line of the RMS well for the dry periods (since 2000) of observed short-term climatic cycles extended to 2030.*

Formatted: Centered
Formatted Table
Inserted Cells
Formatted: Font color: Black
Formatted: Font color: Black
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Formatted: Font: Not Bold
Formatted: Centered
Formatted Table
Formatted: Font: Bold

The aquifer system in the Vina Subbasin generally has sufficient groundwater storage capacity to take additional groundwater recharge during wet periods and remain saturated during dry periods, allowing for a range of active management reflecting the desired state for groundwater storage at the year 2042.

Formatted: English (United States)

3.5 Water Quality Sustainable Management Criteria

Water Quality SMC are those meant to address degraded water quality caused by groundwater pumping. The locally defined undesirable result, MT, and MO are discussed in the next sections.

3.5.1 Undesirable Result

An undesirable result coming from degraded water quality is experienced if:

> *groundwater pumping that degrades water quality and compromises the long-term viability of rural areas and communities, the agricultural economic base of the region, and environmental uses for suitable habitat.*
>
> *This occurs in the Vina subbasin when two RMS wells exceed their MT for two consecutive non-dry years.*

Salinity is the only water quality constituent for which MT are established in the Vina Subbasin. Although no areas with naturally occurring high salinity have been identified in the Vina Subbasin, the potential exists for movement of underlying brackish water from greater depths into the freshwater pool where groundwater pumping for beneficial uses occurs. Other constituents, as discussed in Section 2.2.4, are managed through existing management and regulatory programs within the Vina Subbasin, such as the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) and the ILRP, which focus on improving water quality by managing septic and agricultural sources of salinity and nutrients. Additionally, point-source contaminants are managed and regulated through a variety of programs by the Regional Water Quality Control Board (RWQCB, DTSC, and the USEPA. Through coordination with existing agencies, the Vina Subbasin GSAs will know if existing regulations are being met or groundwater pumping activities in the Vina Subbasin are contributing to significant and unreasonable undesirable effects related to degraded water quality from these constituents.

Formatted: English (United States)

3.5.2 Minimum Threshold

The Water Quality MT represents a quantitative threshold used to define the point at which undesirable results may begin to occur, avoidance of which is required under SGMA. To establish a locally defined MT, the GSAs Boards of Directors, SHAC, and members of the public explored potential impacts of degraded water quality.

Formatted: English (United States)

Potential impacts identified by stakeholders were:

Formatted: English (United States)

- Aesthetic concerns for drinking water
- Reduced crop yield and quality
- Increased reliance on surface water for “blending”

To address the potential impacts of concern related to degraded water quality, the GSAs, in setting an MT, commits to avoiding a decline in water quality as it relates to specific conductance, a measure of the water's saltiness, which can impact the suitability of the water as a source for drinking water, agricultural irrigation, and other uses. An undesirable result is considered "significant and unreasonable" if groundwater quality degrades such that the specific conductance exceeds the upper limit of the Secondary Maximum Contaminant Level (SMCL) of 1,600 microsiemens per centimeter (µS/cm) based on State Secondary Drinking Water Standards. Values of specific conductance exceeding this number are typically unacceptable for drinking water. Secondary Drinking Water Standards are set on the basis of aesthetic concerns. For that reason, there is no public health goal or maximum contaminant level goal associated with specific conductance. The MT for the Water Quality SMCL is:

> *the upper limit of the SMCL for specific conductance based on the State Secondary Drinking Water Standards.*

Undesirable results related to water quality as a result of groundwater pumping in the Vina Subbasin have not occurred historically, are not currently occurring, and are not likely to occur in the future. Observations of specific conductance at RMS from 2008 through 2019 ranged between 148 and 364 µS/cm and demonstrated no trend (Figure 3-4).

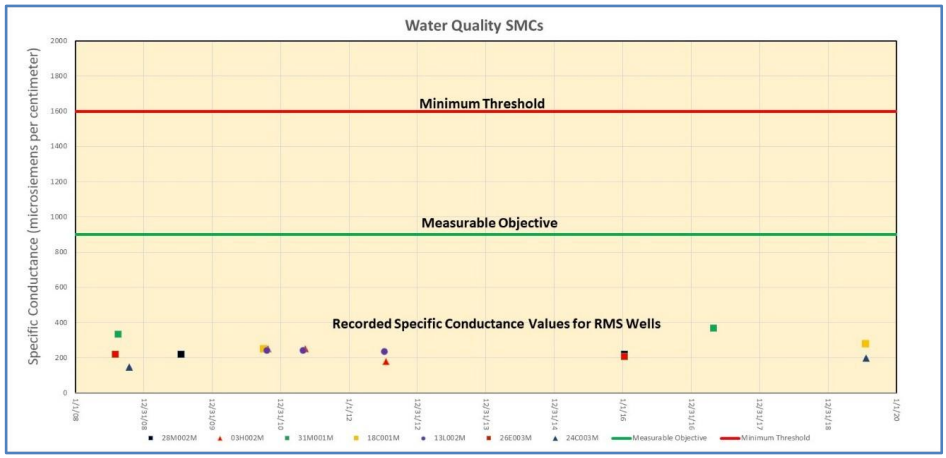


Figure 3-5: Water Quality Measurable Objectives and Minimum Thresholds in Relation to Reported Historical Specific Conductance for Representative Monitoring Site Wells

3.5.3 Measurable Objective

The Water Quality MO represents a quantitative target that establishes a point above the MT allowing for a range of active management to prevent undesirable results and reflect the desired state for groundwater quality at the year 2042. To address the potential impacts of concern related to degraded water quality, the MO was established for specific conductance at the

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

recommended SMCL of 900 µS/cm based on State Secondary Drinking Water Standards. The MO for the Water Quality SMC is:

> *the recommended SMCL for specific conductance based on the State Secondary Drinking Water Standards.*

Water quality monitoring implemented for compliance with SGMA will build upon Butte County's existing groundwater quality monitoring program. Additional monitoring by DWR and other agencies will continue to track constituents not managed by the GSAs, including minerals, metals, pesticides, and herbicides.

Formatted: English (United States)

3.5.4 Summary

To achieve the sustainability goal and therefore preserve the desired condition for the groundwater basin over time, the GSAs, in setting the Water Quality SMC, commits to managing groundwater quality in line with the State Secondary Drinking Water Standards at each RMS shown in Table 3-2. (See Section 4, Figure 4-6, and Table 4-8 for relevant information on the RMS for water quality.)

Table 3-2: Water Quality Sustainability Management Criteria by Representative Monitoring Site in µS/cm

GSP Well ID	MT	MO	IM		
			2027	2032	2037
Vina Subbasin – North Management Area					
28M002M	1,600	900	900	900	900
03H002M					
31M001M					
Vina Subbasin – Chico Management Area					
28J005M	1,600	900	900	900	900
Vina Subbasin – South Management Area					
18C001M	1,600	900	900	900	900
13L002M					
26E003M					
24C003M					

3.6 Seawater Intrusion Sustainable Management Criteria

Seawater intrusion is not applicable to the Vina Subbasin due to its distance from the Pacific Ocean (Figure 1-2) which is the source of saline intrusion to freshwater aquifers along coastal subbasins.

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 ~~SMC are those meant to address land subsidence~~ Best Management Practice (BMP), the Subbasin is characterized as having no documented history of significant inelastic land subsidence, but recognizes that ~~substantially interferes with surface land uses caused by~~ subsidence may occur if groundwater ~~pumping.~~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.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

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 and Minimum Thresholds

~~The SGMA regulations define the MT for significant and unreasonable land subsidence to be the "rate and the extent of land subsidence." The harmful effects of subsidence result from the damage it may cause to critical infrastructure and the costs of repairing or mitigating those damages. In the instance of the Vina Subbasin, critical~~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~~ that could be affected by subsidence includes federal state and county roads and~~ , namely highways, roads, drainage, irrigation~~ district infrastructure,~~ , or railroad infrastructure, ~~and~~ power transmission lines~~.~~

~~Based on this definition, the~~, or well casings. An undesirable result ~~coming from land~~ due to subsidence~~ for the Vina Subbasin is experienced if:~~

> ~~*groundwater pumping leads to changes in the ground surface elevation severe enough to disrupt critical infrastructure, development of projects that enhance the viability of rural areas, communities, and the agricultural economic base of the region.*~~

~~Land subsidence typically~~ occurs ~~concurrently or shortly after significant declines in~~as a result of declining groundwater levels~~; therefore, measured changes in groundwater~~ . Groundwater levels ~~can serve as a proxy for potential land subsidence. For this reason, the SMC developed for groundwater levels are used for land subsidence to ensure avoidance of the undesirable result~~are evaluated alongside InSAR data to assess risk of inelastic compaction and inform management actions.

~~As Groundwater Levels SMC are used by proxy, the quantitative Undesirable Result~~This occurs when:

> *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 ~~the same as for groundwater levels~~defined as:

> ~~*Two RMS wells within a management area reach their MT for two consecutive years of non-dry*~~*0.0 feet per year*~~ *types.*~~
>
> ~~*Undesirable results related to*~~ *of land subsidence* ~~*in the Vina Subbasin have not occurred historically, are not currently occurring, and are not likely to occur in the future. To assess land subsidence in the Sacramento Valley, a subsidence*~~*at representative monitoring*

Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: Quotation, Indent: Left: 0.33"

~~network was established consisting of observation stations and extensometers managed jointly by the United States Bureau of Reclamation (USBR) and DWR. This subsidence monitoring network includes 19 GPS monuments located within the Vina Subbasin, on the boundary between Butte and Tehama counties, or on the boundary between the Vina and Butte Subbasins. The subsidence monitoring network also includes three extensometers in Butte County with a period of record beginning in 2005. (There are no extensometers in the Vina Subbasin.) By 2019, a review of the data showed~~locations, recognizing that *~~changes in ground surface elevations were slight and remained at or above baseline levels, indicating that~~minor variation within measurement uncertainty does not indicate* inelastic *~~land subsidence has not been an observed in the Vina Subbasin. This is likely due to historically relatively stable groundwater levels and subsurface materials that are not conducive to compaction. For this reason, inelastic land subsidence due to groundwater pumping is unlikely to produce an undesirable result in the Vina Subbasin~~subsidence*.

~~**3.7.2 Measurable Objectives**~~

~~As Groundwater Levels SMC are used by proxy, the MO for land~~Since no subsidence has occurred in the subbasin, no interim milestone is ~~the same as for groundwater levels:~~

~~*the groundwater level based on the groundwater trend line of the RMS well for the dry periods (since 2000) of observed short-term climatic cycles extended to 2030*~~needed.

Formatted: Indent: Left: 0"

Formatted: Font: Not Italic,

3.8 Interconnected Surface Water Sustainable Management Criteria

Interconnected Surface Water SMC are those meant to address depletions of interconnected surface water caused by groundwater pumping. Relevant context, the Interconnected Surface Water SMC framework, and the locally defined undesirable result, MT, and MO are presented in the next sections.

3.8.1 Relevant Context

The objective of the Interconnected Surface Water SMC is to avoid significant and unreasonable adverse impacts on beneficial uses of the surface water. To address this SMC, DWR has provided various forms of guidance, including mapping of potential GDEs. GDEs are a sub-class of aquatic and riparian habitat that depend on groundwater for optimum ecological function. The distinction between an ecosystem's dependence on groundwater versus its dependence on surface water and the associated riparian zone or floodplain is important. In addition, the distinction between the shallow aquifer zone and the deep aquifer zone is also important. The deeper aquifer zone only influences surface water to the extent that it affects water levels in the shallow aquifer zone which then influences the shallow aquifer zone's connection to the stream. The Vina Subbasin includes upland streams (e.g., Big Chico Creek) and their associated riparian zones and the mainstem floodplain of the Sacramento River (Figure 3-6). The scales of the ecosystems and associated hydrologic dependencies in these two landscapes are quite different. Streamflow and adjacent narrow riparian areas in the upland stream systems are very sensitive to watershed and climatic conditions outside of the Vina Subbasin in the foothills of the Cascades and Sierra Nevada. The Sacramento River and its floodplain are affected by much larger and cumulative hydrologic processes, including operation of multiple reservoirs and the cumulative hydrology of multiple watersheds extending to the headwaters of the Cascades.

Formatted: English (United States)

Potential impacts of the depletion of interconnected surface water were discussed by stakeholders during technical discussions covering the fundamentals of groundwater-surface water interactions and mapping analysis of GDEs as discussed in Section 2.2.7. The GDE mapping analysis is presented in Chapter 2.2.7.

Potential impacts identified by stakeholders were:

Formatted: English (United States)

- Disruption to GDEs
- Reduced flows in rivers and streams supporting aquatic ecosystems and water right holders
- Degradation of "Urban Forest" habitat in the City of Chico
- Streamflow changes in upper watershed areas outside of the Vina Subbasin boundary
- Water table depth dropping below the maximum rooting depth of Valley Oak or other deep-rooted tree species
- Cumulative groundwater flow moving toward the Sacramento River from both the Vina Subbasin and surrounding GSAs on both the east and west side of the river

The Vina Subbasin acknowledges that overall function of the riparian zone and floodplain is dependent on multiple components of the hydrologic cycle that may or may not have relationships to groundwater levels in the principal aquifer. For example, hydrologic impacts outside of the Vina Subbasin, such as upper watershed development or fire-related changes in runoff, could result in impacts to streamflow, riparian areas, or GDEs that are completely independent of any connection to groundwater use or conditions within the Vina Subbasin.

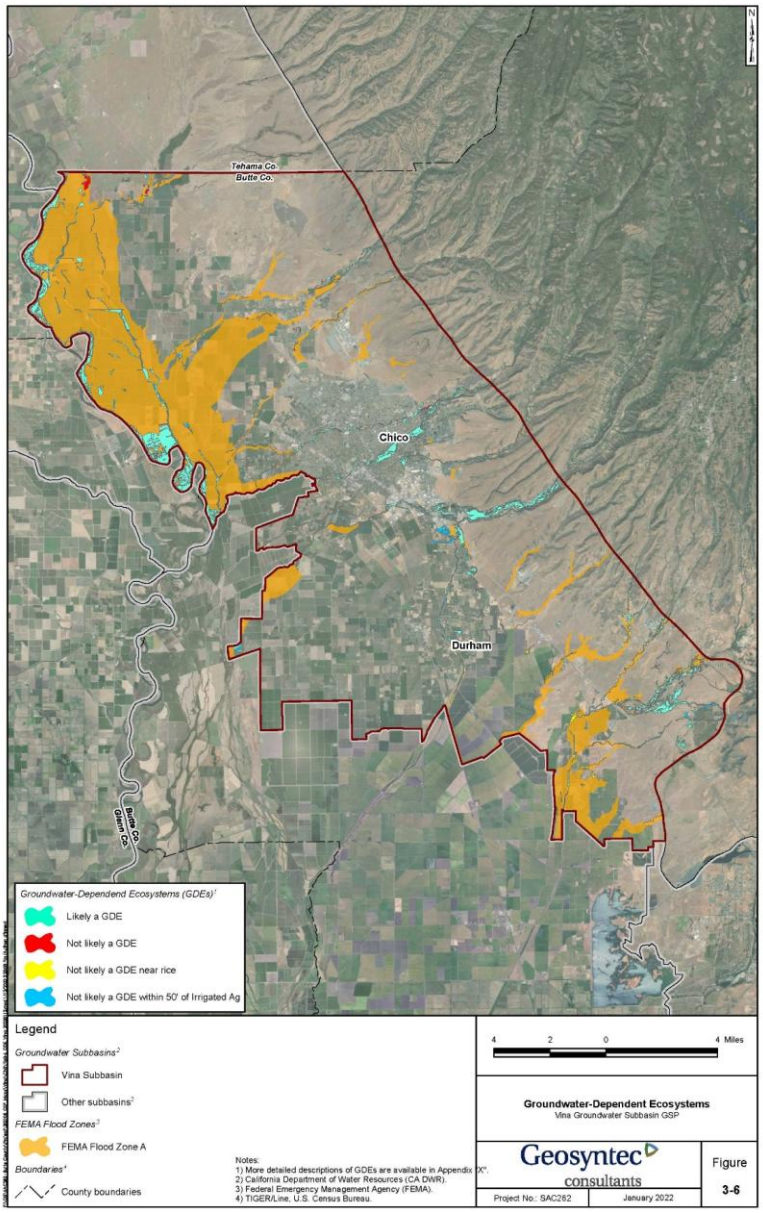


Figure 3-6 ~~placeholder page~~: Groundwater Dependent Ecosystems

Formatted: Caption,Caption1

Data needed to develop this SMC include definition of stream reaches and associated priority habitat; streamflow measurements to develop profiles at multiple time periods; and measurements of groundwater levels directly adjacent to stream channels, first water bearing aquifer zone, and deeper aquifer zones. These data are not available and are a data gap for the GSP. Section 2.2.6.2 discusses the limited information that is available that includes:

Formatted: English (United States)

- One nested monitoring well (23N01W31M001-004; Figure 2-22) that includes a well completed in the shallow aquifer zone and three wells within deeper zones. The hydrograph for the shallow wells suggests it is completed within what could be termed "floodplain sediments" and is in direct hydraulic communication with the Sacramento River. A nested well completed further away from the Sacramento River indicates that the shallow well is in clear connection with deeper zones and does not indicate any connection to the Sacramento River.
- Hydrographs for eight shallow wells located within the City of Chico have water levels below the elevation of adjacent stream channels, indicating that groundwater levels are not capable of interacting directly with the adjacent stream channel.

The GSAs in the Vina Subbasin intend to further evaluate this SMC to avoid undesirable results to aquatic ecosystems and GDEs. To that end, an Interconnected Surface Water SMC framework has been developed for the GSP as described below. This framework will guide future data collection efforts to fill data gaps, either as part of GSP projects and management actions or plan implementation. As additional data are collected and evaluated, the Vina Subbasin GSAs will evaluate the development of additional SMC, as appropriate, for specific stream reaches and associated habitat where there is a clear connection to groundwater pumping in the principal aquifer.

Formatted: English (United States)

3.8.2 Interconnected Surface Water Sustainable Management Criteria Framework

To evaluate the potential for depletion of interconnected streams, an integrated assessment of both surface water and groundwater is required that includes (see Figure 3-5 for illustration):

Formatted: English (United States)

- Definition of stream reaches and associated priority habitat. This is typically developed using a combination of geomorphic classification of the stream channel and ecological classification of the associated habitat.
- Multiple streamflow measurements in each stream reach to develop a profile of streamflow at multiple time periods over at least one year. Comparison of flow rates in each reach defines whether the reach is gaining (water moving from the groundwater system to the stream/river) or losing (water moving from the stream/river to the groundwater system). A reach can be both gaining and losing, depending on the time of year (i.e., losing during high flow periods and gaining during low flow periods).
- Measurement of groundwater levels directly adjacent to the stream channel in the adjacent riparian zone or floodplain. Groundwater measurement of this type is typically done with piezometers, or "mini-piezos," which may be very shallow

(less than 15 feet deep) and hand-driven (i.e., not requiring a drill rig). Groundwater levels are collected simultaneous to streamflow profiles.

- Measurement of groundwater levels in the first water bearing aquifer zone. This is the first regional or sub-regional aquifer that interacts with the stream by either discharging water into the stream or gaining water from the stream. These wells are typically between 20 and 100 feet deep and require a drill rig for installation. It is important for the screen interval of these wells to cross the water table. Groundwater levels are collected simultaneous to stage measurements along the streamflow profile. Water level differences between the shallow aquifer and the water surface elevation of the nearest stream reach are evaluated.
- Measurement of groundwater levels in deeper aquifer zones. These are typically regional or sub-regional aquifers that are used for regional supply. Water levels in these aquifers can be higher or lower than water levels in the overlying aquifer. The degree of connectivity to the nearest stream reach depends on how stratigraphically isolated the deeper zone is from the shallow zone. These wells are typically greater than 100 feet deep and require a drill rig for installation. It is important to conduct a pumping test of the deeper aquifer and measure water levels in the overlying aquifer to determine how hydraulically connected it is to the overlying aquifer. It is important to complete wells in the shallow aquifer across the water table. Groundwater levels are collected simultaneous to streamflow profiles. Additional AEM (geophysical) data would be valuable in further understanding the structure and potential interconnection of the aquifers in different zones.

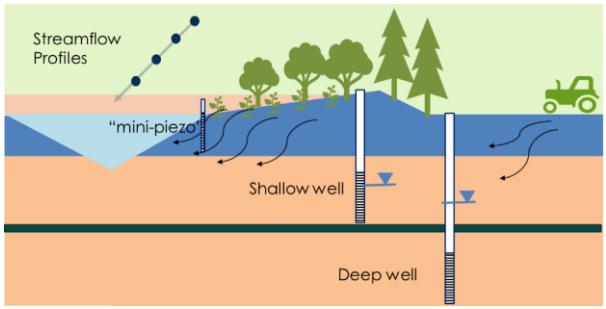


Figure 3-7: Illustration of Monitoring Points Needed to Develop Sustainability Management Criteria for Interconnected Surface Waters

This information is then integrated to define which surface water reaches are connected to the shallow aquifer zones and where those shallow aquifer zones are influenced by pumping of the deeper aquifer zones.

3.8.3 Undesirable Result

The undesirable result for this SMC is focused on connectivity where there is a measurable connection between groundwater levels in the principal aquifer and streamflow or associated aquatic habitat viability. The Vina Subbasin specifically recognizes deep-rooted tree species, such as Valley Oak, that are common along riparian corridors in both upland streams and the Sacramento River and found elsewhere throughout the subbasin as depicted in Appendix 2-A. This connectivity is not well measured or understood in the Vina Subbasin at this time. For now, an undesirable result coming from the depletion of interconnected surface water is simply defined as:

> *Avoiding significant and unreasonable depletion of surface water flows caused by groundwater pumping that significantly impacts beneficial uses*

For this reason, the SMC developed for groundwater levels are used as a proxy for interconnected surface water in an interim manner until data gaps are addressed. As outlined in Section 6, an aggressive schedule has been provided to fill these data gaps, and the GSAs are committed to addressing these issues and develop appropriate SMCs for the Vina Subbasin.

Formatted: English (United States)

3.8.4 Minimum Thresholds

The potential impact of groundwater levels on aquatic habitat or GDEs is typically specific to a certain stream reach or geographic area. Groundwater modeling conducted in association with the HCM (Section 2) incorporates the interaction of surface water and groundwater at a regional scale, including all the GSAs in Butte County. While the model is a useful tool for evaluating regional behavior of the groundwater system overall, there are significant data gaps that limit calibration of the groundwater response in the uppermost layer of the model, where the dynamics and "interconnectedness" between surface water and groundwater actually occur. Therefore, at this time, Groundwater Levels SMC are used by proxy and the MT for interconnected surface water is the same as for groundwater levels:

Formatted: English (United States)

> *Two RMS wells within a management area reach their MT for two consecutive years of non-dry year-types.*

3.8.5 Measurable Objectives

As Groundwater Levels SMC are used by proxy, the MO for interconnected surface water is the same as for groundwater levels:

> *the groundwater level based on the groundwater trend line of the RMS well for the dry periods (since 2000) of observed short-term climatic cycles extended to 2030.*

As described previously, the historical record of groundwater levels shows fluctuations over a four- to seven-year cycle consistent with variations in water year type according to the Sacramento Valley Water Year Hydrologic Classification. It is not known whether streamflow and associated aquatic habitat and GDEs that are connected to groundwater have also experienced a long-term decline. In the upland streams, it is likely that similar long-term declines have occurred, since the recharge that produces the groundwater level fluctuations likely correlates with streamflow in the upper watershed areas. However, long-term declines in Sacramento River streamflow may have been avoided by reservoir releases aimed at maintaining

Formatted: English (United States)

streamflow levels. As described previously, the wet-dry cycles are climatically induced, and the GSAs have no ability to change this cyclical behavior; there will always be short-term cyclical fluctuations in surface water availability, particularly in the upland streams. The MO are therefore intended to address the long-term trend of the "peaks and valleys" of the short-term cycles. A focus on long-term trends will be maintained as more data are collected to inform future MOs for the shallowest zone of the aquifer system.

4. MONITORING NETWORKS

4.1 Monitoring Network Objectives

The objective of the existing monitoring networks is to observe and record data on groundwater levels, quality, and related conditions, such as the interconnection of surface water and groundwater and subsidence. Wells included in the existing monitoring networks were selected with sufficient temporal frequency and spatial density to evaluate conditions related to the effectiveness of the GSP, specifically to detect short-term, seasonal, and long-term trends. Parameters that have been monitored provide historic baseline information for establishing the current status of relevant SI that will be useful in tracking these SIs as the GSP is being implemented. The complete list of SIs is presented below:

1. Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply, if continued
2. Significant and unreasonable reduction of groundwater storage
3. Significant and unreasonable seawater intrusion
4. Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies
5. Significant and unreasonable land subsidence that substantially interferes with surface land uses
6. Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water

The existing monitoring networks form a pool of monitoring locations that will serve as the backbone of the representative monitoring network used to assess SGMA compliance as discussed in Section 3. The existing network will support an improved understanding of conditions in the Vina Subbasin, inform ongoing management of the Vina Subbasin, and contribute to future updates to the GSP. These objectives will be implemented in a manner that will:

- Demonstrate progress toward achieving MOs, MTs, and IMs
- Monitor impacts to the beneficial uses or users of groundwater
- Monitor changes in groundwater conditions
- Quantify annual changes in water budget components

Data collected from the monitoring network will be used to track changes in groundwater elevations, water quality constituent concentrations, groundwater and surface water interactions, and rates of subsidence at monitoring locations throughout the Vina Subbasin. At locations where MO differ substantially from current conditions, the monitoring data from the RMS (discussed in Section 4.9) will be used to determine whether implementation of local projects and management actions are meeting IMs presented in the GSP as indicators of progress toward

Formatted: English (United States)

Formatted: English (United States)

attainment of the MO. Measurable objectives will be monitored directly through measurement of groundwater levels and water quality constituents.

Groundwater elevations will be used as a proxy for evaluating reduction in groundwater storage, depletions of interconnected surface waters, and for land subsidence where either of these potential undesirable results is associated with declining groundwater elevations. In each of these instances, "significant and unreasonable" reductions are the guideposts used to warn of unsustainable groundwater conditions. For interconnected surface waters, the GSAs in the Vina Subbasin intend to further evaluate this SMC to avoid undesirable results to aquatic ecosystems and GDEs. To that end, an Interconnected Surface Water SMC framework has been developed for the GSP, as described in Section 3.8. This framework will guide future data collection efforts to fill data gaps, either as part of GSP projects and management actions or as plan implementation. As additional data are collected and evaluated, the Vina Subbasin commits to developing additional SMC, as appropriate, for specific stream reaches and associated habitat where there is a clear connection to groundwater pumping in the principal aquifer.

Formatted: English (United States)

In addition to being central to SGMA compliance by enabling tracking of SI data collected through the monitoring network will be used to update inputs to the water budget and to guide interpretation of water budget results. Monitoring data will also be used to assess impacts of groundwater management on various categories of beneficial uses and users and to monitor overall groundwater conditions from local and Vina Subbasin-wide perspectives.

Formatted: English (United States)

The monitoring networks for groundwater levels, water quality, land subsidence, and depletions of interconnected surface water are described below. The BBGM and / or groundwater level data will be used to estimate changes in groundwater storage based on observed changes in groundwater levels. The BBGM covers the extent of the Vina, Butte, and Wyandotte Subbasins but can be used to estimate the storage within each individual subbasin.

Seawater intrusion is not considered to be an SI relevant to the Vina Subbasin as seawater intrusion is not present and is not likely to occur in the Vina Subbasin due to the distance from the Pacific Ocean, bays, deltas, or inlets. However, there is some evidence that connate groundwater of a quality characteristic of its ancient marine origins is present in the Vina Subbasin and that this water has the potential to affect beneficial uses due to brackish characteristics. Ancient marine layers pose a water quality (saline) risk by contaminating groundwater from groundwater pumping. This GSP will address this risk through the water quality SI.

The location of existing sites and the frequency of monitoring at each site are presented below as is the spatial density of locations in each of the monitoring networks. Data gaps and plans to fill these gaps are also discussed as part of the program for defining the representative monitoring network to be used in monitoring SI to ensure SGMA compliance. Explanations of how gaps identified in the monitoring network will be filled are provided in Section 4.10.

Formatted: English (United States)

The goal of defining the existing monitoring network, identifying gaps in the network, and developing and implementing a program to fill those gaps is to develop a representative monitoring network capable of collecting information needed to address:

Formatted: English (United States)

- Short-term trends in groundwater and related surface water conditions

- Seasonal trends in groundwater and related surface water conditions
- Long-term trends in groundwater and related surface water conditions
- Provide adequate coverage by establishing sufficient density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends listed above

4.2 Groundwater Level Monitoring

Groundwater level monitoring is conducted through a network of monitoring wells used for observation of groundwater levels and calculation of flow directions and hydraulic gradients in the principal aquifer of the Vina Subbasin. The network also allows for characterization of the groundwater table or potentiometric surface of the principal aquifer.

The ~~78 wells~~revised monitoring network identified 114 well completions (located across ~~59~~86 individual sites) included in the network were selected based on the degree to which data from these wells represents conditions in the area, use in existing monitoring programs, permission of the well owner to access the well, and the length and continuity of the monitoring record. Of the ~~78 wells, 25~~114 well completions, 34 are located in the Vina North MA, ~~14~~27 in the Vina Chico MA, and ~~39~~53 in the Vina South MA. Table 4-1 lists wells now used for monitoring in each MA, and Figure 4-1 shows the locations of these wells in their respective MAs. Multi-completion wells are sites where more than one monitoring well completion has been installed at a single location~~.~~ allowing for water levels in different zones of the aquifer to be monitored.

Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)

The wells are drilled and screened at different depths with each well designed to measure groundwater levels at a selected depth in the underlying aquifer. Groundwater level monitoring sites were analyzed and then classified to provide stratigraphic context for the well screened intervals to identify which aquifer zone each monitoring well is representative of. The stratigraphic framework developed for the Vina Subbasin GSP, Section 2.1, was utilized, which encompasses Pliocene-aged Tuscan and Tehama formations overlain by Quaternary formations. From oldest to youngest, screened intervals are classified within the following units: Lower Tuscan (LT), Upper Tuscan/Tehama 2 (UTT2), Upper Tuscan/Tehama 1 (UTT1), Quaternary 2 (Q2), and Quaternary 1 (Q1), with the southeastern area south of Chico combining UTT2 and LT into a single unit (UTT2/LT). Interpretations were further supported by over 460 additional boreholes and two vintages of Airborne Electromagnetic (AEM) data from the DWR W07 region and the Stanford Groundwater Aquifer Project (GAP) pilot survey. Table 4-1 identifies which aquifer zone each monitoring well is screened within (e.g., Shallow, Deep, or Both). Generally, wells screened in the Quaternary 1 and 2 layers are considered shallow (and likely representative of the first water bearing zone) and wells screened in the Tuscan and Tehama formations are considered deep. RMS wells were selected based on proximity to domestic wells, aquifer zone representative of domestic wells, and having at least five years of high-quality measurements (further discussed in Section 4.9.1). Typically, domestic wells are screened in the shallow zone and upper portion of the deep aquifer zones. Both shallow and deep wells were used as RMS wells as these wells are intended to monitor conditions for domestic wells as presented in Table 4-1.

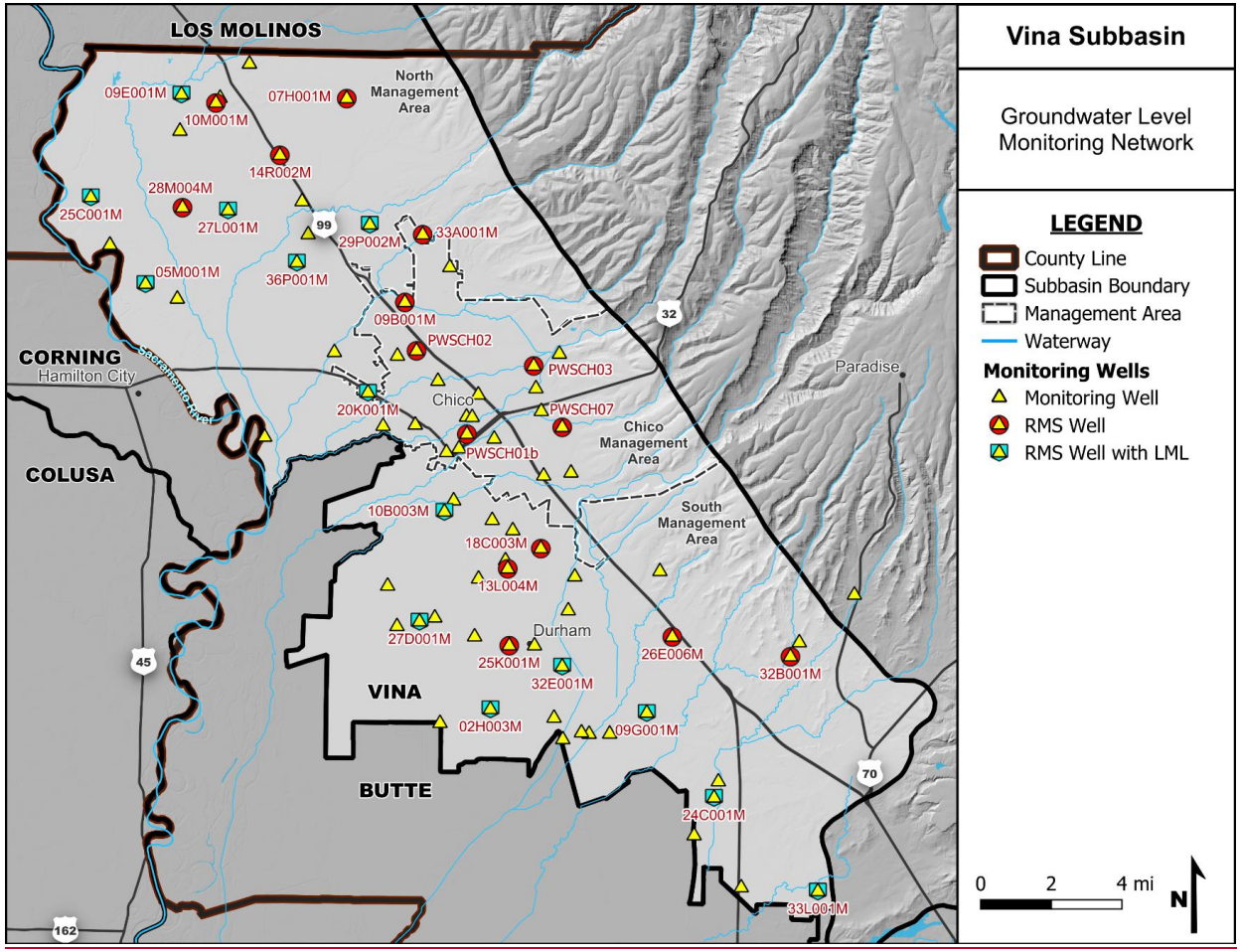

Vina Subbasin
Groundwater Level Monitoring Network
LEGEND
County Line
Subbasin Boundary
Management Area
Waterway
Monitoring Wells
Monitoring Well
RMS Well
RMS Well with LML
0 2 4 mi
N
LOS MOLINOS
CORNING
Hamilton City
COLUSA
VINA
BUTTE
Chico
Durham
Paradise
North Management Area
Chico Management Area
South Management Area
Sacramento River
09E001M
10M001M
07H001M
14R002M
28M004M
25C001M
27L001M
29P002M
33A001M
05M001M
36P001M
09B001M
PWSCH02
PWSCH03
20K001M
PWSCH07
PWSCH01b
10B003M
18C003M
13L004M
27D001M
25K001M
32E001M
26E006M
32B001M
02H003M
09G001M
24C001M
33L001M
99
32
45
70
162

Figure 4-1 ~~placeholder page~~: Groundwater Level Monitoring Network

Formatted: Font: Bold

Formatted: Font: Bold

Formatted: Normal, Centered

Table 4-1: Vina Subbasin Groundwater Level Broad Monitoring Network Well Locations

Well ID	State Well ~~ID~~ Number	Monitoring Frequency	Multi-Completion	Well Type	Aquifer Category	Drill Depth	Date of First Meas.	2022 RMS?
Vina ~~-~~ North Management Area								
~~22N01E20K001M~~		~~Quarterly~~	~~No~~	~~Residential~~				
05M001M	22N01W05M001M	Quarterly~~Hourly~~	No	Observation~~Irrigation~~	Both	200	4/1/1947	Yes
07H001M	23N01E07H001M	Quarterly	No	Residential	Deep	195	8/10/2018	Yes
36P001M	23N01W36P001M	Monthly	No	Residential	Shallow	165	8/20/1959	Yes
25C001M~~23N01E29P002M~~	23N02W25C001M	Quarterly	No	Irrigation	Both	243	2/28/1967	Yes
10E001M~~23N01E33A001M~~	23N01W10E001M	Quarterly	No	Irrigation	Deep	668	4/18/2001	No
29P002M	23N01E29P002M	Quarterly	No	Irrigation	Both	265	10/9/1990	Yes
03H004M	23N01W03H004M	Monthly	Yes	Observation	Shallow	115	3/30/2012	No
28M004M	23N01W28M004M	Hourly	Yes	Observation	Both	217	1/15/2009	Yes
03H002M	23N01W03H002M	Monthly~~Hourly~~	Yes	Observation	Deep	553	3/30/2012	No
03H003M	23N01W03H003M	Monthly~~Hourly~~	Yes	Observation	Deep	351	3/30/2012	No
~~23N01W03H004M~~		~~Hourly~~	~~Yes~~	~~Observation~~				
09E001M	23N01W09E001M	Quarterly	No	Irrigation	Shallow	110	2/7/1947	Yes
~~23N01W10E001M~~		~~Quarterly~~	~~No~~	~~Irrigation~~				
10M001M	23N01W10M001M	Hourly	No	Observation	Both	220	10/11/2001	Yes
14R002M	23N01W14R002M	Quarterly	No	Irrigation	Shallow	183	11/13/1985	Yes
16E001M	23N01W16E001M	Quarterly	No	Irrigation	Both	365	4/18/2001	No
25G001M	23N01W25G001M	Quarterly	No	Irrigation	Deep	660	6/29/2007	No

Formatted
Inserted Cells
Inserted Cells
Inserted Cells
Formatted
Formatted
Formatted
Inserted Cells
Inserted Cells
Formatted
Formatted
Formatted Table
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Formatted
Formatted
Formatted
Formatted Table
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted Table
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Formatted
Formatted

Well ID	State Well ~~ID~~ Number	Monitoring Frequency	Multi-Completion	Well Type	Aquifer Category	Drill Depth	Date of First Meas.	2027 RMS?
27L001M	23N01W27L001M	Quarterly	No	Residential	Shallow	102	3/10/1976	Yes
28M002M	23N01W28M002M	Hourly	Yes	Observation	Deep	1044	1/15/2009	No
28M003M	23N01W28M003M	Hourly	Yes	Observation	Deep	696	1/15/2009	No
~~23N01W28M004M~~	~~Hourly~~	~~Yes~~	~~Observation~~					
28M005M	23N01W28M005M	Hourly	Yes	Observation	Shallow	72	1/15/2009	No
31M001M	23N01W31M001M	Hourly	Yes	Observation	Deep	1200	7/2/2008	No
31M002M	23N01W31M002M	Hourly	Yes	Observation	Deep	616	7/4/2008	No
31M003M	23N01W31M003M	Hourly	Yes	Observation	Deep	245	7/4/2008	No
31M004M	23N01W31M004M	Hourly	Yes	Observation	Shallow	106	7/4/2008	No
TNC Well		Hourly	No	Observation	Shallow	70	11/10/2021	No
M1[b]		Hourly	Yes	Observation	Shallow / Deep / Deep		7/23/2026	No
S2[b]		Hourly	Yes	Observation	Shallow		7/28/2026	No
RP-MW01[b]		Hourly	No	Observation	Shallow	60	3/31/2026	No
09B001M[a]~~23N01W36P001M~~	22N01E09B001M	Quarterly	No	Residential	Shallow	156	5/9/2001	Yes
~~23N02W25C001M~~	~~Quarterly~~	~~No~~	~~Irrigation~~					
~~Vina – Chico Management Area~~								
20K001M[a]~~22N01E09B001M~~	22N01E20K001M	Quarterly	No	Residential	Shallow	110	5/10/1961	Yes
33A001M[a]~~22N01E28J001M~~	23N01E33A001M	Quarterly	~~Yes~~No	Observation	Both	506	10/14/2001	Yes
DW01		Hourly	No	Domestic	Shallow	80	9/30/2026	No

Formatted
Inserted Cells
Inserted Cells
Inserted Cells
Formatted
Formatted
Formatted
Inserted Cells
Inserted Cells
Formatted
Formatted
Formatted Table
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted Table
Formatted

Well ID	State Well ~~ID~~ Number	Monitoring Frequency	Multi-Completion	Well Type	Aquifer Category	Drill Depth	Date of First Meas.	2022 RMS?
Vina – Chico Management Area								
PWSCH01b		Tri-annually	No	Municipal	Deep	>600	2/1/1988	Yes
PWSCH02		Tri-annually	No	Municipal	Deep	>600	4/1/1988	Yes
PWSCH03		Tri-annually	No	Municipal	Deep	>600	4/1/1988	Yes
PWSCH07		Tri-annually	No	Municipal	Deep	<600	4/1/1991	Yes
28J003M	22N01E28J003M	Hourly~~Quarterly~~	Yes	Observation	Both	320	1/6/1958	No
PWSCH04		Tri-annually	No	Municipal	Deep		4/1/1988	No
PWSCH06		Tri-annually	No	Municipal	Deep		10/1/1988	No
PWSCH05		Tri-annually	No	Municipal	Both		4/1/1988	No
28J001M	22N01E28J001M	Hourly	Yes	Observation	Deep	660	1/16/1958	No
28J005M	22N01E28J005M	Hourly~~Quarterly~~	Yes	Observation	Deep	948	1/3/1958	No
~~22N01E35E001M~~		~~Hourly~~	~~No~~	~~Irrigation~~				
18J001M	22N02E18J001M	Quarterly	No	Residential	Shallow	180	4/6/2001	No
30C002M	22N02E30C002M	Hourly~~Quarterly~~	No	Observation	Shallow	203	12/19/2001	No
~~CWSCH01b~~ CMW-102A	~~Tri-annually~~	~~No~~Biannually	~~M&I*~~No	Observation	Shallow	36.5	8/16/2006	Yes
~~CWSCH02~~D MW-3	~~Tri-annually~~	~~No~~Biannually	~~M&I~~No	Observation	Shallow	55	11/17/1993	No
~~CWSCH03~~G W-4	~~Tri-annually~~	~~No~~Biannually	~~M&I~~No	Observation	Shallow	116	10/2/1990	No
~~CWSCH04~~F C-MW-2	~~Tri-annually~~	~~No~~Biannually	~~M&I~~No	Observation	Shallow	40	3/1/2007	No
~~CWSCH05~~M W-21	~~Tri-annually~~	~~No~~Biannually	~~M&I~~No	Observation	Shallow	25	6/28/2004	No
~~CWSCH06~~S WMW-06A	~~Tri-annually~~	~~No~~Biannually	~~M&I~~No	Observation	Shallow	35	8/29/2005	Yes

Formatted
Inserted Cells
Inserted Cells
Inserted Cells
Formatted
Formatted
Formatted
Inserted Cells
Inserted Cells
Formatted
Formatted
Formatted Table
Formatted
Formatted
Inserted Cells
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted Table
Formatted
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted Table
Inserted Cells
Formatted
Formatted
Formatted
Formatted Table

Well ID	State Well ~~ID~~ Number	Monitoring Frequency	Multi-Completion	Well Type	Aquifer Category	Drill Depth	Date of First Meas.	2027 RMS?
~~CWSCH07~~S1[b]	~~Tri-annually~~	Hourly~~No~~	~~M&I~~Yes	Observation	Shallow		7/28/2026	No
S4[b]		Hourly	Yes	Observation	Shallow			No
S9[b]		Hourly	Yes	Observation	Shallow			No
MWSB-25		Hourly	No	Observation	Shallow	32	2/13/2025	No
DW04		Hourly	No	Domestic	Shallow	120	3/19/2026	No
DW08		Hourly	No	Domestic	Shallow	120	3/18/2026	No
Vina ~~–~~ South Management Area								
18C003M~~20N01E02H003M~~	21N02E18C003M	Hourly	~~No~~Yes	Observation	Deep	240	7/8/2010	Yes
24C001M	20N02E24C001M	Hourly	Yes	Observation	Shallow	155	12/29/1999	Yes
10C002M	20N01E10C002M	Quarterly	No	~~Irrigation~~Observation	Both	210	3/31/1947	No
09L001M~~20N02E06Q001M~~	20N02E09L001M	Quarterly	No	Irrigation	Deep	710	10/29/1953	No
21C001M	21N01E21C001M	Quarterly	No	Irrigation	Deep	565	4/12/1993	No
26E005M	21N02E26E005M	Hourly	Yes	Observation	Deep	315	1/2/1970	No
02H003M	20N01E02H003M	Monthly	No	Observation	Both	201	10/11/2001	Yes
10B003M	21N01E10B003M	Quarterly	No	Observation	Deep	525	7/15/1995	Yes
13L004M	21N01E13L004M	Hourly	Yes	Observation	Deep	353	12/2/2011	Yes
27D001M	21N01E27D001M	Quarterly	No	Observation	Shallow	112	10/9/1946	Yes

Formatted
Inserted Cells
Inserted Cells
Inserted Cells
Formatted
Formatted
Formatted
Inserted Cells
Inserted Cells
Formatted
Formatted
Formatted Table
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted Table
Formatted
Formatted
Formatted
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Formatted
Inserted Cells
Formatted
Formatted
Formatted
Formatted
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Formatted
Formatted
Formatted
Formatted

Well ID	State Well ~~ID~~ Number	Monitoring Frequency	Multi-Completion	Well Type	Aquifer Category	Drill Depth	Date of First Meas.	2022 RMS?
26E006M	21N02E26E006M	Hourly	Yes	Observation	Shallow	179	9/13/2007	Yes
30L001M	21N02E30L001M	Monthly	No	Observation	Both	317	3/14/1995	No
29J003M	21N03E29J003M	Quarterly	No	Irrigation	Deep	513	8/7/2007	No
06Q001M	20N02E06Q001M	Monthly	No	Observation	Both	383	10/17/1947	No
08C001M	20N02E08C001M	Quarterly	No	~~Irrigation~~	Deep	660	8/7/2018	No
08H003M	20N02E08H003M	Quarterly	No	Residential	Deep	187	3/12/2008	No
09G001M	20N02E09G001M	Hourly	No	Observation	Deep	202	2/12/2002	Yes
~~20N02E09L001M~~	~~Quarterly~~	~~No~~	~~Irrigation~~					
~~20N02E24C001M~~	~~Hourly~~	~~Yes~~	~~Observation~~					
24C002M	20N02E24C002M	Hourly	Yes	Observation	Deep	390	12/29/1999	No
24C003M	20N02E24C003M	Hourly	Yes	Observation	Deep	520	12/30/1999	No
31M001M	20N03E31M001M	Hourly	No	Observation	Deep	201	2/12/2002	No
33L001M	20N03E33L001M	Hourly	No	~~Other~~Observation	Shallow	101	8/12/1999	Yes
~~21N01E10B003M~~	~~Quarterly~~	~~No~~	~~Irrigation~~					
12D001M	21N01E12D001M	Quarterly	No	Irrigation	Both	600	7/15/1995	No
12K001M	21N01E12K001M	Quarterly	No	Irrigation	Deep	465	8/12/1959	No
13F001M	21N01E13F001M	Quarterly	No	Observation~~Irrigation~~	Both	515	7/15/1995	No
13L002M	21N01E13L002M	Hourly	Yes	Observation	Deep	771	12/2/2011	No
13L003M	21N01E13L003M	Hourly	Yes	Observation	Deep	574	12/2/2011	No
~~21N01E13L004M~~	~~Hourly~~	~~Yes~~	~~Observation~~					
14Q002M	21N01E14Q002M	Quarterly	No	Irrigation	Both	290	7/15/1995	No
~~21N01E21C001M~~	~~Quarterly~~	~~No~~	~~Irrigation~~					

Formatted
Inserted Cells
Inserted Cells
Inserted Cells
Formatted
Formatted
Formatted
Inserted Cells
Inserted Cells
Formatted
Formatted
Formatted Table
Formatted
Formatted
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted Table
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Formatted
Formatted

Well ID	State Well ~~ID~~ Number	Monitoring Frequency	Multi-Completion	Well Type	Aquifer Category	Drill Depth	Date of First Meas.	2027 RMS?
25K001M	21N01E25K001M	Quarterly	No	Residential	Shallow	93	4/8/1993	Yes
26K001M	21N01E26K001M	Quarterly	No	Irrigation	Deep	462	4/8/1993	No
27B001M	21N01E27B001M	Hourly~~Quarterly~~	No	Observation~~Residential~~	Both	517	4/26/1994	No
~~21N01E27D001M~~	~~Quarterly~~	~~No~~	~~Residential~~					
28F001M	21N01E28F001M	Quarterly	No	Irrigation	Shallow	173	8/20/1998	No
18C001M	21N02E18C001M	Hourly	Yes	Observation	Deep	914	7/8/2010	No
18C002M	21N02E18C002M	Hourly	Yes	Observation	Deep	701	7/8/2010	No
~~21N02E18C003M~~	~~Hourly~~	~~Yes~~	~~Observation~~					
20P001M	21N02E20P001M	Quarterly	No	Irrigation	Deep	238	7/23/1995	No
26E003M	21N02E26E003M	Hourly	Yes	Observation	Deep	660	9/13/2007	No
26E004M	21N02E26E004M	Hourly	Yes	Observation	Deep	518	9/13/2007	No
~~21N02E26E005M~~	~~Hourly~~	~~Yes~~	~~Observation~~					
~~21N02E26E006M~~	~~Hourly~~	~~Yes~~	~~Observation~~					
~~21N02E30L001M~~	~~Hourly~~	~~No~~	~~Residential~~					
32E001M	21N02E32E001M	Quarterly	No	Irrigation	Shallow	184	3/26/2009	Yes
22C001M	21N03E22C001M	Quarterly	No	Residential	Shallow	143	3/19/2001	No
32B001M~~21N03E29J003M~~	21N03E32B001M	Quarterly	No	~~Residential~~Observation	Shallow	57	10/15/1999	Yes
MW-6		Biannually	No	Observation	Shallow	122	8/20/2012	No
S6[b]~~21N03E32B001M~~		Hourly	~~No~~Yes	Observation~~Irrigation~~	Shallow			No
S7[b]		Hourly	Yes	Observation	Shallow		7/28/2026	No
S8[b]		Hourly	Yes	Observation	Shallow		7/28/2026	No

Formatted
Inserted Cells
Inserted Cells
Inserted Cells
Formatted
Formatted
Formatted
Inserted Cells
Inserted Cells
Formatted
Formatted
Formatted Table
Formatted
Formatted
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted Table
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Formatted
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Formatted
Formatted

Well ID	State Well ~~ID~~ Number	Monitoring Frequency	Multi-Completion	Well Type	Aquifer Category	Drill Depth	Date of First Meas.	2027 RMS?
VP-MW01[b]		Hourly	No	Observation	Shallow	60	3/31/2026	No
WP-MW01[b]		Hourly	No	Observation	Shallow	60	3/31/2026	No
DW05		Hourly	No	Domestic	Unknown	120	3/19/2026	No
DW06		Hourly	No	Domestic	Shallow	80	3/2/2026	No
DW11		Hourly	No	Domestic	Unknown	140	3/3/2026	No
DW14		Hourly	No	Domestic	Shallow	130	9/30/2026	No
DW15		Hourly	No	Domestic	Unknown	170	12/9/2025	No

~~* M&I~~

Formatted: Font: 9 pt, Font color: Background 1, Ligatures: Standard + Contextual

Inserted Cells

Inserted Cells

Inserted Cells

Formatted: Font: 9 pt, Font color: Background 1, Ligatures: Standard + Contextual

Formatted: Font: 9 pt, Font color: Background 1, Ligatures: Standard + Contextual

Formatted: Font: 9 pt, Font color: Background 1

Formatted: Table Normal Text

Inserted Cells

Inserted Cells

Formatted: Font: 9 pt, Font color: Background 1, Ligatures: Standard + Contextual

Formatted: Font: 9 pt, Font color: Background 1

Formatted: Font: 9 pt, Font color: Background 1, Ligatures: Standard + Contextual

Formatted: Font: 9 pt, Font color: Background 1

Formatted Table

Formatted: Font: 9 pt, Font color: Background 1, Ligatures: Standard + Contextual

Formatted: Font: 9 pt, Font color: Background 1

Formatted: Table Normal Text

~~Municipal and Industrial~~

4.2.1 Density of Monitoring Sites and Frequency of Measurement

Each of the wells in the existing network is monitored either by Cal Water, Butte County, DWR, or the associated CASGEM collaborators in the Vina Subbasin. Changes and updates to the monitoring network will be reflected in Periodic Evaluations. For each MA, wells in the existing network are measured as follows~~:~~ (as of fall 2026):

- Vina North: ~~12~~thirteen wells / completions are measured manually on a quarterly basis, ~~and 13~~seven wells / sixteen completions are measured continuously / hourly using data loggers ~~on an hourly basis. Of the continuously monitored~~, and four wells ~~11~~/ two completions are ~~multi-completion wells at three different sites monitored by DWR or Butte County using pressure transducers and data loggers.~~measured monthly.
- Vina Chico: ~~Six wells are~~One well / completion is measured manually on a quarterly basis, seven wells are measured manually on a tri-annual basis by Cal Water, ~~and one well is~~six wells / eleven completions are measured continuously using a data logger on an hourly basis~~. Of the wells monitored manually on a quarterly basis, one is a multi-completed well consisting of three~~, and six wells / completions are measured biannually.
- Vina South: ~~20~~nineteen wells / completions are measured manually on a quarterly basis, ~~and 19~~twenty-five wells / thirteen completions are measured continuously using data loggers on an hourly basis~~. Of the continuously~~, one well / completion is monitored biannually, and three wells~~, 13~~ are ~~multi-completion wells at four different sites~~ monitored ~~by DWR or Butte County using pressure transducers and data loggers~~monthly.

For the purpose of SGMA compliance, water levels in the RMS (Section 4.9) in the Vina Subbasin will be monitored at least bi-annually (once in the spring and once in the fall). All wells will be measured within one calendar month following a schedule that will be developed for the Vina Subbasin in coordination with DWR, the County, and neighboring subbasins.

Groundwater pumping typically peaks during the summer growing season and slows in the fall and winter. Therefore, spring levels represent an annual high prior to summer irrigation demands while fall levels represent an annual low for static (non-pumping) conditions. In addition to the coordinated spring and fall elevation measurements made at all wells in the network, data will continue to be taken at wells now monitored at greater frequencies according to their existing monitoring schedules. For wells that cannot be observed on the regular monitoring schedule or for which readings are questionable, it will be noted in the standard data sheet that the well was unable to be measured or had a questionable measurement, as applicable.

Groundwater elevation data will be used to observe seasonal and annual changes and for analysis of short-term and long-term trends. Analysis of trends in groundwater levels together with data on surface water deliveries and groundwater extraction will be important tools for tracking the

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Vina Subbasin's progress in meeting its MO. It will also be important in determining the need for additional or modifications to projects and / or management actions to meet the MO.

A total of ~~59~~78 individual monitoring sites ~~(78 wells)~~with 106 well completions are included in the network for monitoring groundwater levels. These wells are distributed over the 289 square-mile area of the Vina Subbasin with a distribution equivalent to a spatial density of ~~21 sites and 31~~approximately 28 wells per 100 square miles, a network density that significantly exceeds those presented in the Best Management Practices (BMP) Monitoring Networks and Identification of Data Gaps. Table 4-2 is taken from the BMP and shows a range of recommended monitoring network densities.

Table 4-2: Monitoring Well Density Considerations

Reference	Well Density (wells per 100 square miles)
Heath (1976)	0.2 – 10
Sophocleous (1983)	6.3
Hopkins (1984)	
Basins pumping more than 10,000 AFY per 100 square miles	4.0
Basins pumping between 1,000 and 10,000 AFY per 100 square miles	2.0
Basins pumping between 250 and 1,000 AFY per 100 square miles	1.0
Basins pumping between 100 and 250 AFY per 100 square miles	0.7

Annual groundwater pumping presented in the water balance section of the GSP shows a historical rate of pumping in the Vina Subbasin of 243,500 AFY (84,256 AFY per 100 square miles) and a current condition pumping rate of 209,200 AFY (72,388 AFY per 100 square miles).

Each monitoring point is located in one of the Vina Subbasin's three MAs:

- Vina - North (~~17~~22 well sites [~~25 wells~~33 completions]) in an area of 112 square miles, spatial density of ~~15~~20 well sites and ~~22 wells~~29 completions per 100 square miles.
- Vina - Chico (~~12~~20 well sites [~~14 wells~~25 completions]) in an area of 46 square miles, spatial density of ~~26~~43 well sites and ~~30 wells~~54 completions per 100 square miles.
- Vina – South (~~30~~36 well sites [~~39 wells~~48 completions]) in an area of 130 square miles, spatial density of ~~23~~28 well sites and ~~30 wells~~37 completions per 100 square miles.

Formatted: English (United States)
Formatted: Keep with next, Keep lines together
Formatted: Keep with next, Keep lines together
Formatted: Keep with next, Keep lines together
Formatted: Keep with next, Keep lines together
Formatted: Keep with next, Keep lines together
Formatted: Keep with next, Keep lines together
Formatted: Keep with next, Keep lines together
Formatted: Keep with next, Keep lines together
Formatted: English (United States)

4.3 Groundwater Storage Monitoring

4.3.1 Background

The BMP for Groundwater Monitoring (DWR, 2016) notes:

> *While change in groundwater storage is not directly measurable, change in storage can be estimated based on measured changes in groundwater levels… and a clear understanding of the Hydrogeologic Conceptual Model…. The HCM describes discrete aquifer units and the specific yield values associated with these units. These data, together with information on aquifer thickness and connectivity, can be used to calculate changes in the volume of groundwater storage associated with observed changes in groundwater elevation.*

As suggested in the preceding passage from DWR's BMP on Groundwater Monitoring, measured changes in groundwater levels can serve as a proxy for changes in storage. For this reason, the network for monitoring changes in groundwater storage is the same as that used for monitoring changes in groundwater levels. Monitoring sites and wells included in this network are presented above in Table 4-1 with well locations shown in Figure 4-1. The updated groundwater level RMS wells will be used to calculate change in storage (unless otherwise noted) to improve spatial representation across the Subbasin. The two RMS wells within the Chico MA (e.g., CMW_102A and SWMW-06A) are excluded from the change in storage calculation.

4.3.2 Frequency of Measurement

The data from the bi-annual frequency of monitoring groundwater levels described above will enable observed changes in levels to serve as a proxy to indicate changes in groundwater storage. Data presented in the HCM on parameters such as aquifer layer composition and thickness and the specific yield and hydraulic conductivity of these layers are integrated in the BBGM and allow the model to be used to estimate changes in groundwater storage that result from observed changes in groundwater elevations. As data on aquifer characteristics and modeling capabilities improve, the methodologies used to relate changes in groundwater elevations with corresponding changes in storage will be updated.

4.4 Groundwater Quality

4.4.1 Background

Assessment of groundwater quality in the Vina Subbasin focuses on annual observation of salinity (through monitoring of specific conductance~~), temperature,~~) and ~~pH in~~temperaturein the principal aquifer. Each of these parameters is influenced by ambient conditions and the parent material of the principal aquifer. Specific conductance ~~and pH are~~is also influenced by human activity. While only salinity will be used to monitor attainment of MO and avoidance of breaches in MT, changes in ~~pH and~~ temperature may indicate shifting groundwater conditions that trigger additional investigation.

The groundwater quality monitoring network implemented for representative monitoring under SGMA ~~will build upon the County's existing program.~~consists of seven sites. Additional

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

monitoring will continue to be conducted by DWR and other agencies to track constituents not managed under this GSP including a variety of minerals, metals, pesticides, and herbicides. Data from the ongoing monitoring by various state and federal agencies will be available to the GSAs to augment local understanding of water quality in the Vina Subbasin and can be found on the State Board's GAMA program at https://www.waterboards.ca.gov/gama/. Water quality programs conducted by other agencies are discussed in Section 1.5. The locations of all water quality monitoring wells are in Figure 4-2.

Formatted: English (United States)

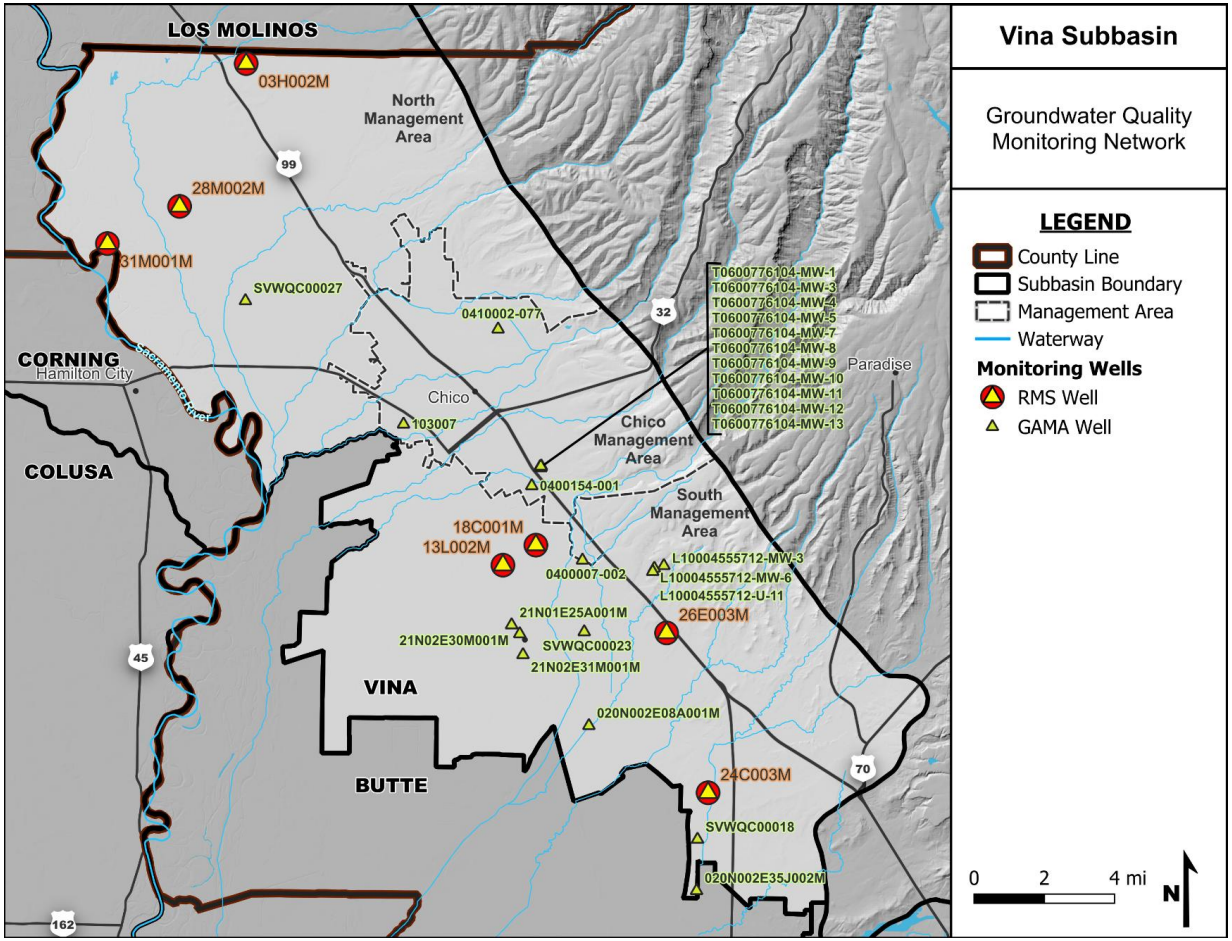


Figure 4-2 ~~placeholder page~~**: Groundwater Water Quality Monitoring Network**

Formatted: Font: Bold

Formatted: Font: Bold

Formatted: Normal, Centered

A total of seven sites are included in the County's ongoing water quality monitoring programs, with these wells having been selected based on ~~the existing period~~selection of ~~record, depth of~~a deep screened interval in a multi-completion well ~~screens,~~ and ~~the quality of data reported and subject to permission of the well owner to monitor the well~~reliable access for monitoring. . Water quality monitoring has historically been conducted by Butte County during the summer. Of the ~~seven~~7 wells, ~~one is~~three are located in the Vina North MA~~, one is in the Vina Chico MA,~~ and ~~five~~four are in the Vina South MA.

To study regional groundwater quality, DWR's Northern Region Office collects groundwater samples from DWR dedicated monitoring wells that are used exclusively for groundwater level and groundwater quality monitoring (DWR, 2020).

Table 4-3 ~~presents information on~~lists each of the wells monitored ~~by Butte County in~~for the Vina Subbasin groundwater quality monitoring network. Figure 4-2 shows the locations of the wells.

Table 4-3: Groundwater Quality Monitoring Locations

State Well ID Number	~~Local Name~~	Well Type	
Vina – North Management Area			
~~23N01E29L03M~~23N01W03H002M		~~Vina~~Observation	~~Irrigation~~
23N01W28M002M		Observation	
23N01W31M001M		Observation	
Vina – Chico Management Area			
~~n/a~~No RMS in MA		~~Chico Urban~~	~~Domestic~~
Vina – South Management Area			
~~20N02E24Q001M~~20N02E24C003M		~~Cherokee~~Observation	~~Irrigation~~
~~21N01E15E002M~~21N01E13L002M		~~Durham Dayton~~Observation	~~Irrigation~~
~~20N02E09M002M~~21N02E18C001M		~~Esquon~~Observation	~~Irrigation~~
~~22N01E15D002M~~21N02E26E003M		~~M & T~~Observation	~~Irrigation~~
~~21N03E29J003M~~		~~Pentz~~	~~Irrigation~~

4.4.2 Density of Monitoring Sites and Frequency of Measurement

Following the County's ongoing water quality monitoring program, data will be collected annually for monitoring the groundwater quality sustainability in August which is near the peak season for groundwater demand. The groundwater quality monitoring sites are distributed over the 289 square- mile area of the Vina Subbasin resulting in a monitoring network with a spatial density of ~~2.~~4.8 sites per 100 square miles.

4.5 Land Subsidence

4.5.1 Background

~~Inelastic land subsidence has the potential to be of major concern in areas of active groundwater extraction due to infrastructure damage, permanent reduction in the storage capacity of an~~

Formatted: Normal
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Deleted Cells
Formatted Table
Formatted: Font: Not Bold
Formatted: Left
Deleted Cells
Formatted: Font: Not Bold
Formatted: Left
Formatted Table
Deleted Cells
Formatted: Font: Not Bold
Formatted: Left
Deleted Cells
Formatted: Normal
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)

~~aquifer, well casing collapse, and increased flood risk in low lying areas. Inelastic subsidence typically occurs in the clay layers within aquifers and aquitards due to the withdrawal of water from storage within these layers. This water supports the structure of the clay layers, and dewatering permanently rearranges or collapses this structure, a process that cannot be reversed as groundwater cannot re-enter the clay structure after collapse.~~

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 ~~data indicate that inelastic land subsidence due to groundwater withdrawal has not occurred in the Vina Subbasin. This is likely due to relatively stable groundwater levels and subsurface materials that are not conducive to compaction.~~

~~The primary mechanism for subsidence monitoring in the Vina Subbasin is a group of GPS monuments established to create the Sacramento Valley~~ GPS ~~Subsidence Monitoring Network. This program has been developed jointly by DWR and Reclamation with cooperation and assistance from local entities, including Butte County. The locations of these monuments are shown in Figure 4-3. Monuments used to monitor subsidence in the Vina Subbasin network include 19 monuments located either in the interior of the Vina Subbasin or on the boundary between Butte and Tehama counties or the boundary between the Vina and Butte Subbasins. Data from this monitoring network is collected, analyzed, and reported by DWR as the data becomes available.~~

~~Data from monuments in the Vina Subbasin portion of the Sacramento Valley GPS Subsidence Monitoring Network have been~~monument (Chico station) used to ~~monitor cumulative subsidence in the Vina Subbasin in 2008 and 2017, a period used to satisfy the SGMA requirement to evaluate historical subsidence.~~

- ~~Observations from the GPS Subsidence Monitoring Network will be supplemented by InSAR data released by DWR. This information reports vertical ground surface~~corroborate InSAR-derived displacement ~~using data collected by the European Space Agency Sentinel-1A satellite and processed by NASA's JPL. Data released to date from DWR's InSAR program provides cumulative vertical ground surface displacements from June 2015 through September 2019 and is used in the GSP to fulfill the requirement to estimate the rate and extent of recent subsidence.~~estimates (one site in Vina);

~~InSAR data collection and mapping is regional and is not based on a defined network of monitoring locations. Therefore, no InSAR sites are shown in Figure 4-3.~~

4.5.2 Location and Density of Monitoring Sites and Frequency of Measurement

~~The Sacramento Valley GPS Monitoring Network includes monuments that were measured in 2008 and 2017, while the InSAR program monitors subsidence on a continual basis. Data~~

~~collected from both sources requires post processing and analysis, therefore the frequency of reporting is dependent on the work performed by DWR and by NASA's JPL. There are no extensometers in the Vina Subbasin.~~

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.

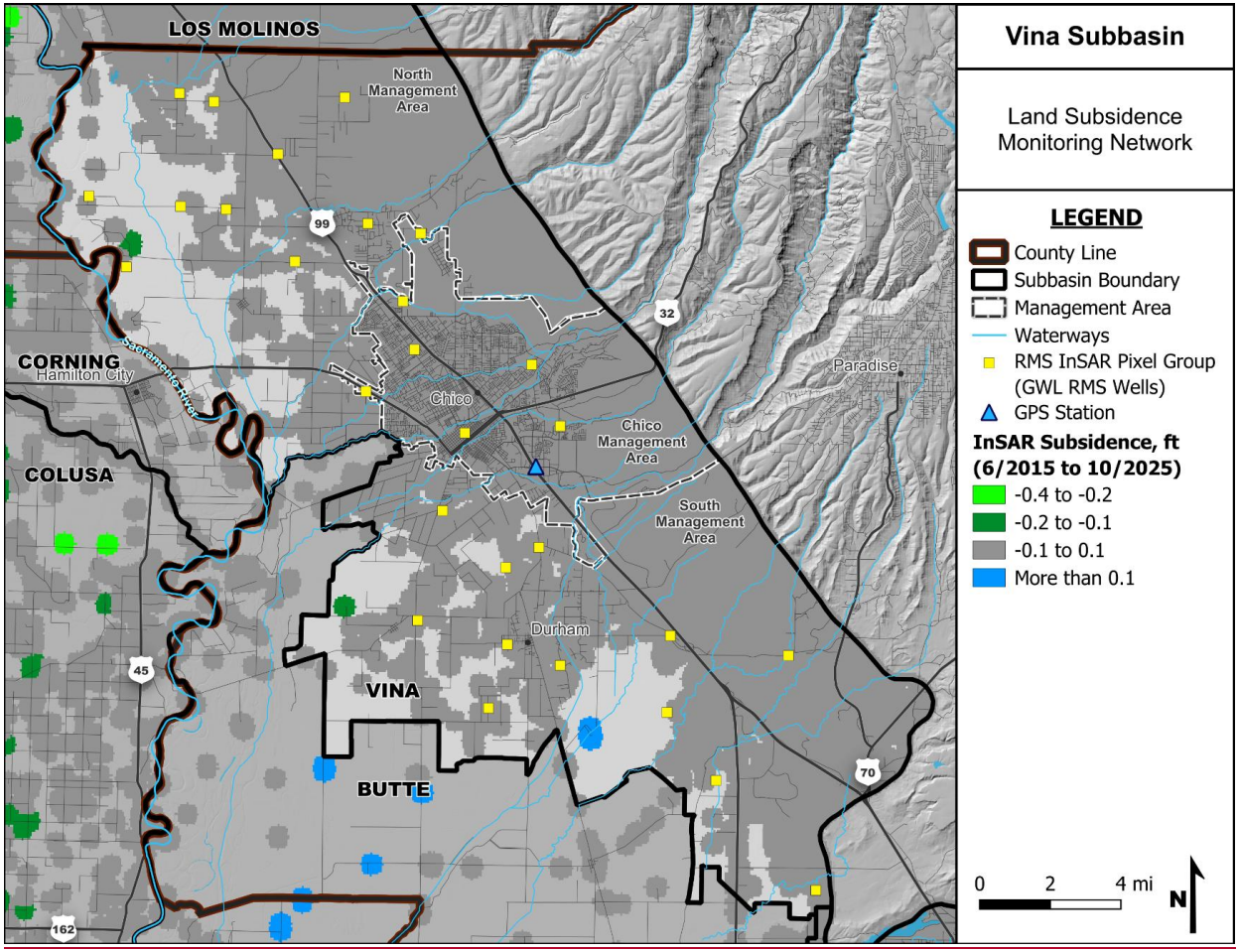

Vina Subbasin
Land Subsidence Monitoring Network
LEGEND
County Line
Subbasin Boundary
Management Area
Waterways
RMS InSAR Pixel Group (GWL RMS Wells)
GPS Station
InSAR Subsidence, ft (6/2015 to 10/2025)
-0.4 to -0.2
-0.2 to -0.1
-0.1 to 0.1
More than 0.1
0 2 4 mi
N
LOS MOLINOS
North Management Area
CORNING
Hamilton City
Sacramento River
COLUSA
Chico
Chico Management Area
South Management Area
Paradise
Durham
VINA
BUTTE
99
32
45
70
162

Figure 4-3: Subsidence Monitoring Network

4.6 Interconnected Surface Waters

4.6.1 Background

Monitoring depletions of interconnected surface water is conducted by monitoring water levels (stage) in streams and groundwater levels to characterize spatial and temporal exchanges between surface water and groundwater and to calibrate and apply the tools and methods necessary to estimate depletions. The existing monitoring network incorporates data from active stream gages reported to the California Data Exchange Center (CDEC), the WDL, and the USGS National Water Information System and groundwater level monitoring, utilizing a subset of the locations described under the Vina Subbasin's groundwater level monitoring network.

~~Figure 4-3 placeholder page~~

The monitoring sites for the Vina Subbasin include the stream gages found in Table 4-4 and Figure 4-4 and the groundwater quality monitoring sites shown above in Table 4-3 and Figure 4--2. The groundwater monitoring sites selected for observing groundwater and surface water interactions include the ~~entire array of existing~~shallow wells in the groundwater level monitoring network as described in Section 4.2, above, that form the pool of potential RMS used to assess surface water and groundwater interactions. As discussed in Section 4.1, the GSAs in the Vina Subbasin intend to further evaluate the SMC for interconnected surface waters to avoid undesirable results to aquatic ecosystems and GDEs. As additional data are collected and evaluated, the Vina Subbasin commits to developing additional SMC and installation of monitoring points, as appropriate, for specific stream reaches and associated habitat where there is a clear connection to groundwater pumping in the principal aquifer.
As with locations used for monitoring of other SIs, the network of stream gages and wells used to monitor interactions between groundwater and streamflow includes sites selected for their period of record, the quality of data reported and subject to permission of the landowner to monitor the well.

In addition to being used to identify relations between groundwater levels and streamflow, data from the network of stream gages and monitoring wells may be used to update and refine the calibration of the BBGM. This model will be used to combine data on groundwater levels and stream flows with data on aquifer parameters and water use to estimate the relation between groundwater conditions and stream flow and to identify instances where groundwater use depletes surface water.

Formatted: Normal

Formatted: English (United States)

Formatted: Font: Not Bold, English (United States)

Table 4-4: Vina Subbasin Surface Water Interaction Monitoring Sites

Stream Monitored	Gage ID	Gage Network	Measurement Frequency	Status	Start Date
~~Butte Creek Nr Durham~~	~~BCD~~	~~CDEC~~	~~hourly~~		
~~Butte Creek Nr Chico~~	~~11390000~~	~~USGS~~	~~daily~~		
~~Big Chico Creek Nr Chico~~	~~BIC~~	~~CDEC~~	~~hourly~~		
~~Parrot Div From Butte Creek~~	~~BPD~~	~~CDEC~~	~~hourly~~		
~~Lindo Canal Nr Chico~~	~~LCH~~	~~CDEC~~	~~event~~		
~~Deer Creek Nr Vina~~	~~11383500~~	~~USGS~~	~~daily~~		
~~Mud Creek Nr Chico~~	~~MUC~~	~~CDEC~~	~~event~~		
Vina - North Management Area					
Sacramento River	VIN	CDEC	Hourly	Active	1/1/1984
Sacramento River	HMC	CDEC	Hourly	Active	6/19/1991
Mud Creek	MUD CR NR AT WEST SACRAMENTO AVE	CDEC	Hourly	Active	10/1/2026
Pine Creek	PINE CR NR CANA PINE CREEK ROAD	CDEC	Hourly	Active	10/1/2026
Pine Creek	PINE CR ALONG NORD GIANELLA RD	CDEC	Hourly	Active	10/1/2026
Rock Creek	ROCK CR NR ROCK CREEK ROAD	CDEC	Hourly	Active	10/1/2026
Rock Creek	ROCK CR AT WEST SACRAMENTO AVE	CDEC	Hourly	Active	10/1/2026
Vina - Chico Management Area					
Big Chico Creek	BIC	CDEC	Hourly	Active	7/21/1997
Lindo Channel	LCH	CDEC	Hourly	Active	1/25/2027
Mud Creek	MUC	CDEC	Hourly	Active	1/25/2007
Butte Creek	BCD	CDEC	Hourly	Active	4/7/1997
Butte Creek	11390000	USGS	Hourly	Active	3/14/1997
Big Chico Creek	BIG CHICO CR AT ROSE AVE	GSA	Continuous	Active	10/1/1975

Formatted: Font: Arial, 10 pt, Font color: White, Ligatures: Standard + Contextual

Formatted: Normal, Centered, Space Before: 12 pt, After: 6 pt

Formatted Table

Inserted Cells

Inserted Cells

Formatted: Normal, Centered, Space Before: 12 pt, After: 6 pt

Formatted: Font: Arial, 10 pt, Font color: White, Ligatures: Standard + Contextual

Formatted: Normal, Centered, Space Before: 12 pt, After: 6 pt

Formatted: Font: Arial, 10 pt, Font color: White, Ligatures: Standard + Contextual

Comanche Creek	COMANCHE CR NR HONEY RUN ROAD	CDEC	Hourly	Active	10/1/2026
Little Chico Creek	NEW_LCC_US	GSA	Continuous	Active	8/15/2026
Vina - South Management Area					
Butte Creek[a]	BUTTE CK NR DURHAM BLW GORRILL DAM	GSA	Continuous	Active	10/29/2015
Dry Creek	DRY CR NR NELSON ROAD	CDEC	Hourly	Active	10/1/2026
Hamlin Slough	HAMLIN CR NR OROVILLE CHICO HWY	CDEC	Hourly	Active	10/1/2026
Little Chico Creek[a]	LITTLE CHICO CK AT TAFFEE AVE	GSA	Continuous	Active	2/10/2018

A total of ~~78~~forty-six (46) shallow monitoring wells and ~~seven~~twelve stream gages are included in the Vina Subbasin's network for monitoring groundwater and streamflow interactions. There are thirty-one (31) shallow monitoring wells within the Subbasin that have been preliminarily selected as representative of conditions near streams based on the following criteria: 1.) Reviewed data quality (e.g., presence of oil) and removed wells with questionable measurements, and 2.) Selected ISW monitoring wells within a half a mile of a stream.

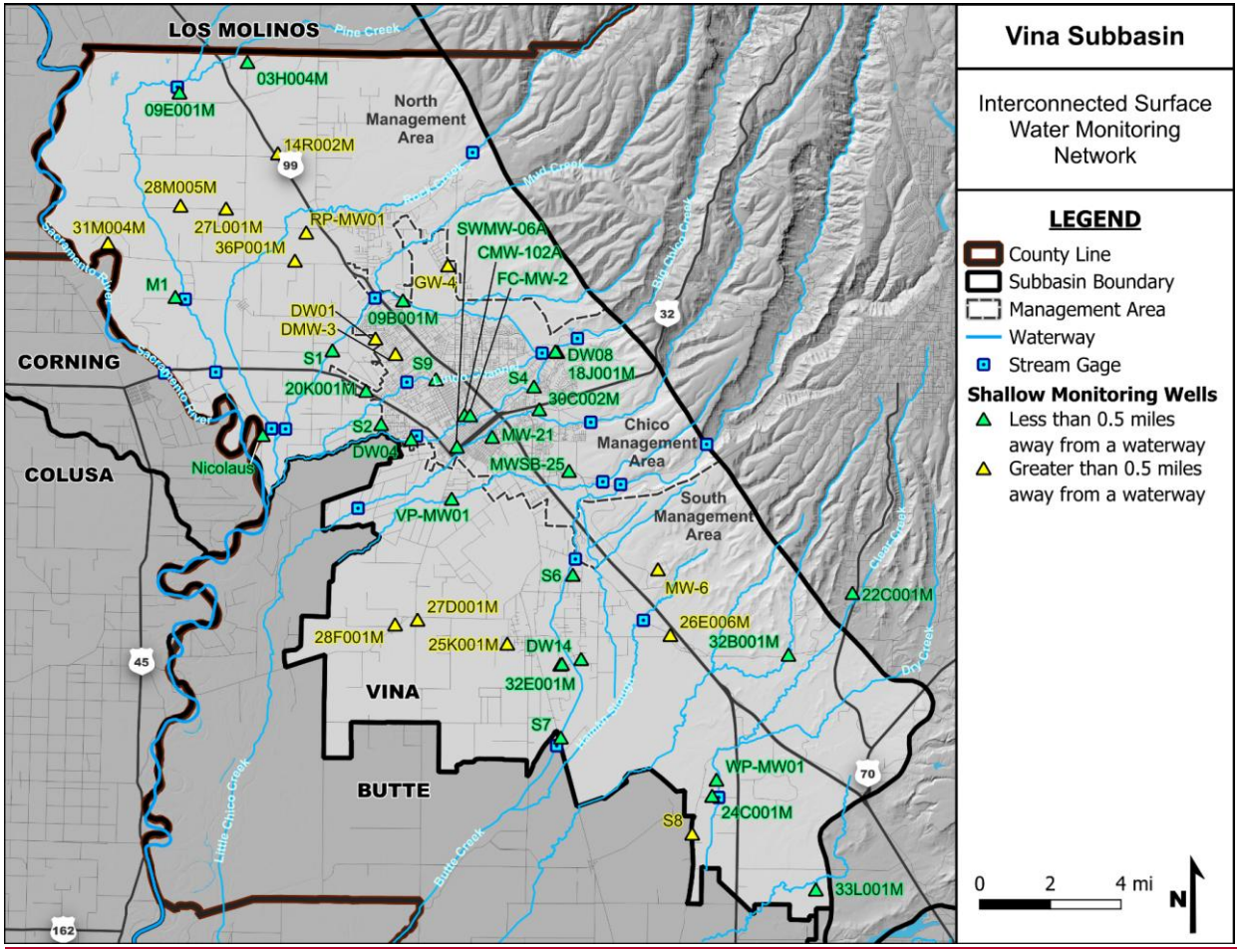


Figure 4-4 ~~placeholder page~~**: Stream Gage and Shallow Well Locations**

Formatted: Font: Bold

Formatted: Font: Bold

Formatted: Normal, Centered

4.7 Monitoring Protocols for Data Collection

4.7.1 Monitoring Protocols and Frequency for Groundwater Levels

Each well in the monitoring network is monitored either by Cal Water, Butte County, DWR, or the associated CASGEM entity. Access agreements, including written description of each site location, access instructions, and point of contact, will be arranged prior to initiation of field data collection.

Formatted: English (United States)

Monitoring for purposes of the GSP will be conducted in accordance with DWR guidelines (DWR, 2016) to ensure groundwater level data are:

Formatted: English (United States)

- Taken from the correct location, well ID, and screen interval depth
- Accurate and reproducible
- Representative of conditions that inform appropriate basin management data quality objectives
- Recorded with all salient information to correct, if necessary, and compare data
- Handled in a way that ensures data integrity
- Taken using a CASGEM-approved water-level measurement method to ensure consistency across measurements.
- Methods include:
  - Establishing a reference point
  - Using one of four approved methods (steel tape, electric sounding tape, sonic water-level meter, or pressure transducer) to measure groundwater levels

Groundwater level data will include, at a minimum, the well identification number, measurement date, depth to water (to the nearest 0.1 or 0.01 foot depending on equipment used) from the established reference point, total depth, measurement method, measurement quality descriptors (for no measurement or questionable measurement), and observations on well and/or site conditions (including modifications to the well). The equipment used to collect groundwater level data will be recorded to include the equipment manufacturer, model, and serial number, as applicable. Equipment used for data collection will be operated and maintained according the manufacturer's recommendations.

Formatted: English (United States)

Each well in the network has an established reference point in North American Vertical Datum 1988 (NAVD88).

The general procedure for groundwater level monitoring is as follows:

- The well port (cap, plug or lid) for access will be removed. Pressure inside the well casing will be allowed to equalize to ambient conditions prior to data collection.

- Non-dedicated equipment will be decontaminated by washing with a non-phosphate soap solution and triple rinse of distilled water.
- Groundwater level data (described above) will be recorded.
- Groundwater elevation will be recorded (Groundwater elevation = reference point elevation – depth to water).
- The well port (and lock, if applicable) will be replaced.

Groundwater level data will be entered into the data management system (DMS) as soon as possible following collection.

Monitoring frequency for each well will occur at a minimum of bi-annually, once during the Spring (March) and once during the Fall (October). Select wells are monitored more frequently via dataloggers, at an hourly basis, but will only be reported bi-annually. Each RMS will be monitored within one calendar month to ensure consistency for comparability over time. This monitoring frequency will achieve the goal of obtaining sufficient data to evaluate the seasonal, short-, and long-term trends in groundwater.

Formatted: English (United States)

4.7.2 Monitoring Protocols and Frequency for Water Quality

Each of the wells in the existing network is monitored for water quality by DWR and other agencies, both private and public, including Butte County.

Formatted: English (United States)

Monitoring for purposes of the GSP will be conducted in accordance with DWR guidelines (DWR, 2016) to ensure water quality data:

Formatted: English (United States)

- Are taken from the correct location
- Are accurate and reproducible
- Represent conditions that inform appropriate basin management and are consistent with the data quality objectives
- Are handled in a way that ensures data integrity
- Include pertinent information that is recorded to normalize, if necessary, and compare data

Water quality will be measured for compliance through monitoring of specific conductance. However, pH and temperature ~~will~~may also be recorded for informational purposes. Water quality samples will be assessed in the field and will not require laboratory analysis.

Groundwater quality data will include, at a minimum, the well identification number, sample time and date, groundwater elevation data (as described in Section 4.2), water quality values for ~~pH,~~ specific conductance~~, and temperature~~, sample quality descriptors (for no measurement or questionable measurement), and observations on well and/or site conditions (including modifications to the well). The equipment used to collect groundwater quality data will be recorded to include the equipment manufacturer, model and serial number, as applicable.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Equipment used for data collection will be operated and maintained according to the manufacturer's recommendations.

The general procedures for groundwater quality sampling include:

- For wells with dedicated pumps, the sample will be collected near the wellhead.
- The sampling port and/or sampling equipment will be decontaminated by washing with a non-phosphate soap solution and triple rinse of distilled water prior to sample collection.
- With the exception of observation wells, the well will be purged of three well casing volumes prior to sampling (if not equipped with dedicated low-flow or passive equipment).
- Samples will be collected under laminar flow conditions.
- Equipment will be calibrated in the field to assess drift.

Monitoring for water quality for each well will occur annually in July or August. Select wells may be monitored more frequently but will only be reported annually. Each RMS will be monitored within one calendar month to ensure consistency for comparability over time. This monitoring frequency will achieve the goal of obtaining sufficient data to evaluate the seasonal, short-, and long-term trends in groundwater.

Formatted: English (United States)

4.8 Representative Monitoring Sites

RMS are wells that are selected to represent conditions in the three specified MAs (North, Chico and South) within the Vina Subbasin. They are a subset of the ~~78~~114 Monitoring Network ~~wells~~well completions (across ~~59~~86 unique sites) shown in Figures 4-1 and 4-2. The monitoring objectives, protocols, and data reporting requirements for the RMS wells are the same as the Monitoring Network wells. The RMS wells are designated as the compliance points at which the five SIs (groundwater levels, groundwater storage, water quality, land subsidence, and interconnected surface water) are monitored, and for the quantitative values for MT, MO, and IM as defined in the SMC in Section 3.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

4.8.1 Selection Criteria for Representative Monitoring Sites

RMS wells are intended to be representative of general conditions within the area. This approach allows for a focused and specific monitoring location to effectively represent a larger geographical area. The data gathered from the RMS will be used to quantify the MA's groundwater conditions for the five SIs and evaluate GSP implementation.

Formatted: English (United States)

RMS wells were selected using the following criteria:

1. Adequate Spatial Distribution – Representative monitoring site were selected from the monitoring network to maximize the geographical coverage across each of the three MAs and avoid overlapping or redundant coverage.
2. Existing Data – Representative monitoring sites with a longer period of record and a greater number of historical measurements were selected to provide insight into long-

term trends that can provide information about groundwater conditions through varying climatic periods such a droughts and wet periods. Historical data may also show changes in groundwater conditions through anthropogenic effects as well. While some sites chosen may not have extensive historical data, they may still be selected because there are no wells nearby with longer records.

3. Increased Density in Heavily Pumped Areas – Selection of additional wells in heavily pumped areas such as within urban residential areas in the city of Chico will provide additional data where high groundwater use occurs.
4. Multi-Completion Wells – The utilization of wells with different screen intervals is important to collect data on the groundwater conditions at different elevations within the aquifer. This can be achieved by using wells with different screen depths that are close to one another, or by using multi-completion wells.
5. Consistency with BMPs – The BMPs provided by DWR encourage consistency across subbasins and compliance with established regulations.
6. Well Construction Data – Well data, such as perforation depths, construction date, and well depth, were considered for selection.
7. Accessibility – Consideration for accessibility to the physical well location and to the existing data was incorporated into the selection of RMS wells. RMS in the network include residential, municipal, agricultural, and governmental wells that are owned and operated by various private and public entities.
8. Professional Judgement – Professional judgement was used to make the final decision about each well, particularly when more than one suitable well exists in an area of interest.

4.9 Representative Monitoring Sites for Sustainability Indicators

Each of the associated SMC for each SI described in Section 3 have RMS wells identified for monitoring and evaluation with the exception of seawater intrusion as it is not applicable to the Vina Subbasin. The selected RMS wells for each SI are discussed in the following sections.

Formatted: English (United States)

4.9.1 Groundwater Levels

The RMS wells will be used as compliance points to record groundwater elevations for the evaluation of chronic lowering of groundwater levels. SGMA allows groundwater elevations to be used as proxy for monitoring other SI if a significant correlation exists between groundwater elevations and the other SI and if the MO for groundwater elevation include a reasonable margin of operational flexibility to avoid undesirable results.

Formatted: English (United States)

Groundwater storage is directly connected to groundwater elevation, and therefore the MO for groundwater levels will adequately serve as proxy for groundwater storage. ~~Land subsidence occurs when compressible subsurface soils are dewatered. Soil units in the Vina Subbasin have not historically been susceptible to compression during periods of declining groundwater elevations. Therefore, the MO for groundwater levels will adequately serve as proxy for land subsidence.~~

Surface waters may manifest a depletion in volume if groundwater levels fall below the established MO. Such depletion is not evident in the historical records available; however, more information may be required to adequately characterize interactions. See Section 3.8 for a discussion of interconnected surface water assessment. As indicated in this section, an Interconnected Surface Water SMC framework has been developed for the GSP. This framework will guide future data collection efforts to fill data gaps, either as part of GSP projects and management actions or plan implementation. As additional data are collected and evaluated, the Vina Subbasin commits to developing additional SMC and installation of RMS as appropriate, for specific stream reaches and associated habitat where there is a clear connection to groundwater pumping in the principal aquifer.

For the purposes of this GSP, groundwater elevations will be used as a proxy for monitoring of SMCs of groundwater storage~~, land subsidence,~~ and interconnected surface water.

A total of ~~17~~31 RMS wells were selected as compliance points for monitoring of groundwater levels (Figure 4-5~~). Six~~), which included 11 wells from the original RMS network and 20 added to the updated RMS network. Thirteen (13) RMS were selected from the ~~25~~34 Monitoring Network wells are for the North MA, ~~five~~six (6) RMS from the ~~14~~27 Monitoring Network Wells for the Chico MA, and ~~six~~12 RMS from the ~~39~~53 Monitoring Network wells for the South MA. Table 4-5 summarizes the well construction details, and Table 4-6 summarizes the well location details.

Formatted: English (United States)

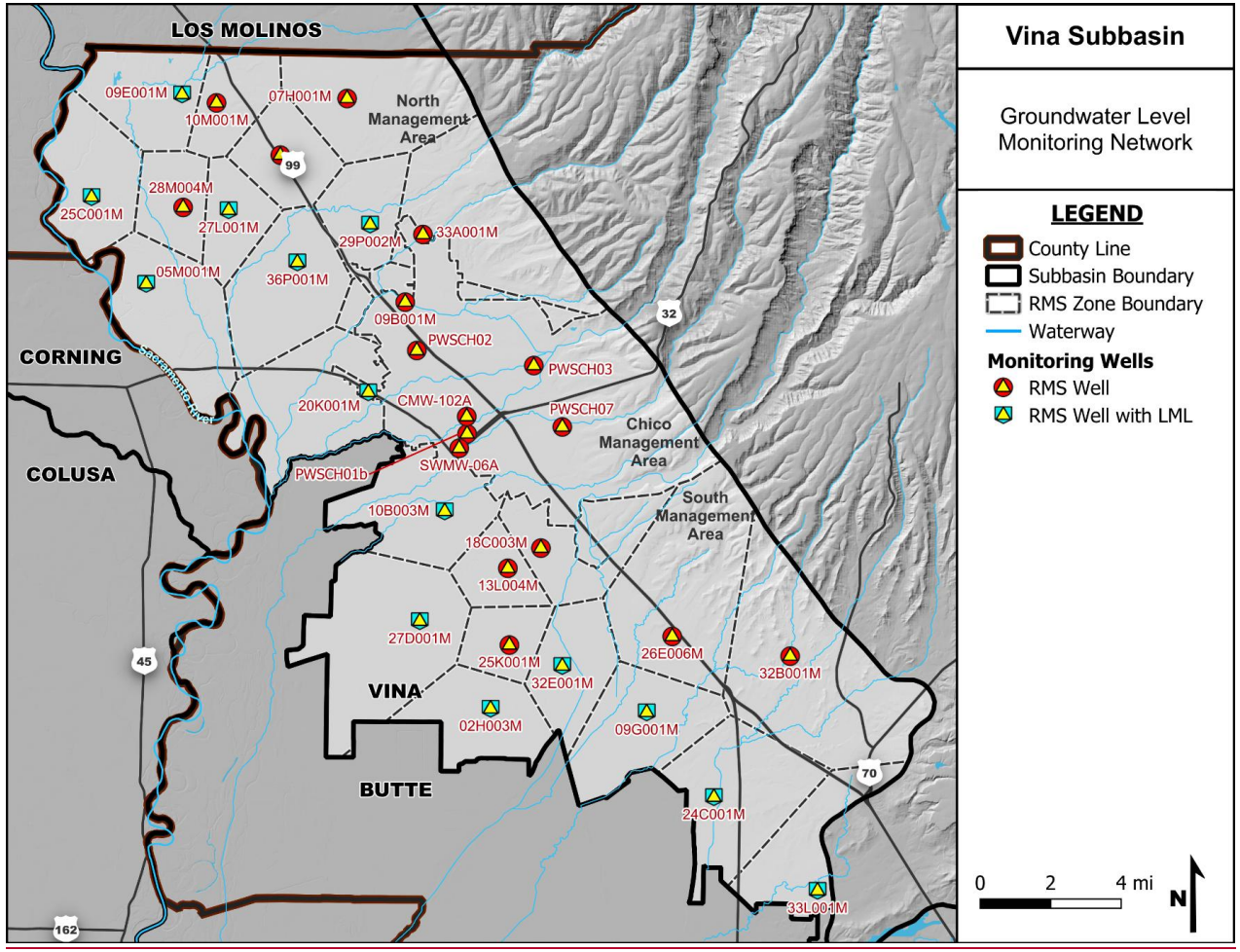

Vina Subbasin
Groundwater Level Monitoring Network
LEGEND
County Line
Subbasin Boundary
RMS Zone Boundary
Waterway
Monitoring Wells
RMS Well
RMS Well with LML
0 2 4 mi
N
LOS MOLINOS
CORNING
COLUSA
VINA
BUTTE
North Management Area
Chico Management Area
South Management Area
09E001M
10M001M
07H001M
28M004M
25C001M
27L001M
05M001M
36P001M
29P002M
33A001M
09B001M
PWSCH02
PWSCH03
20K001M
CMW-102A
PWSCH07
SWMW-06A
PWSCH01b
10B003M
18C003M
13L004M
27D001M
25K001M
32E001M
26E006M
32B001M
02H003M
09G001M
24C001M
33L001M
99
32
45
70
162

Figure 4-5 ~~placeholder page~~: Groundwater Level RMS Wells

Formatted: Font: Bold

Formatted: Normal, Centered, Tab stops: Not at 4.25"

Table 4-5: Groundwater Levels Representative Monitoring Site Well Construction Details

RMS Well ID	State Well Number (Site Name)	Total Depth (feet bgs)	Screened Interval (feet bgs)	Reference Point Elevation[1] (feet)	~~Reference Point Description~~	Ground Surface Elevation[1] (feet)	
Vina ~~Subbasin~~ - North Management Area							
25C001M	23N02W25C001M	243	~~N/A~~	161.~~2~~200	~~Hole cut inside of casing~~	157.~~4~~400	
09E001M	23N01W09E001M	110		183.890		183.390	
20K001M	22N01E20K001M	110		168.340		167.840	
05M001M	22N01W05M001M	200		153.280		151.480	
28M004M	23N01W28M004M	207	120-130 155-165	160.700		159.020	
~~10E001M~~10M001M	~~23N01W10E001M~~23N01W10M001M	~~668~~ 220	~~600-668~~ 90-100 190-200	190.~~68~~280		~~1-inch hole inside pump base~~187.380	~~189.38~~
27L001M	23N01W27L001M	102	65-102	163.370		162.370	
07H001M	23N01E07H001M	195	115-195	283.000	~~Top of casing, remove blue cap~~	282.000	
~~05M001M~~14R002M	23N01W14R002M~~22N01W05M001M~~	~~200~~ 183	~~N/A~~	~~153.28~~193.360		~~Hole in pump south side~~191.360	~~151.48~~
36P001M	23N01W36P001M	165	~~N/A~~	164.~~35~~350	~~Top of casing crack in north side~~	162.~~75~~750	
29P002M	23N01E29P002M	265		206.340		205.340	
33A001M	23N01E33A001M	506	53-506	252.~~34~~340	~~1-inch hole in top of casing~~	252.~~34~~340	
09B001M	22N01E09B001M	156	84-156	179.530		178.330	
Vina ~~Subbasin~~ - Chico Management Area							

Formatted: Tab stops: 4.25", Left
Deleted Cells
Formatted Table
Formatted: Font: Calibri
Formatted: Font: Calibri
Deleted Cells
Formatted: Normal
Deleted Cells
Formatted Table
Deleted Cells
Formatted: Font: Calibri
Formatted Table
Formatted: Font: Calibri
Formatted: Font: Calibri
Formatted: Font: Calibri
Deleted Cells
Deleted Cells
Formatted: Font: Calibri
Formatted: Font: Calibri
Formatted: Font: Calibri
Deleted Cells
Formatted: Font: Calibri
Formatted Table
Formatted: Font: Calibri
Formatted: Font: Calibri
Formatted: Font: Calibri
Formatted: Font: Calibri
Formatted: Font: Calibri
Formatted Table

RMS Well ID	State Well Number (Site Name)	Total Depth (feet bgs)	Screened Interval (feet bgs)	Reference Point Elevation[1] (feet)	~~Reference Point Description~~	Ground Surface Elevation[1] (feet)	
~~CWSCH01b~~PWSCH01b	~~CWSCH01b~~PWSCH01b	>600	---	200		~~N/A~~ ---	~~---~~
~~CWSCH02~~PWSCH02	~~CWSCH02~~PWSCH02	>600	---	183		~~N/A~~ ---	~~---~~
~~CWSCH03~~PWSCH03	~~CWSCH03~~PWSCH03	>600	---	258		~~N/A~~ ---	~~---~~
~~CWSCH07~~PWSCH07	~~CWSCH07~~PWSCH07	<600	---	270		~~N/A~~ ---	~~---~~
~~28J003M~~CMW-102A	~~22N01E28J003M~~CMW-102A	~~279~~36.5	~~200-279~~26.5-36.5	~~179.79~~201.98		~~Top of casing easterly 1-inch casing~~205.5	~~178.89~~
SWMW-06A	SWMW-06A	36	15-36	186.94		189.7	
Vina ~~Subbasin~~ - South Management Area							
10B003M	21N01E10B003M	525	320-360 367-407 483-503	170.730		170.330	
27D001M	21N01E27D001M	112		144.940		143.340	
13L004M	21N01E13L004M	353	240-340	182.060		179.850	
25K001M	21N01E25K001M	93		156.530		154.330	
~~21C001M~~02H003M	~~21N01E21C001M~~20N01E02H003M	~~565~~201	~~240-300~~ ~~448-508~~70-80 170-180	133.~~64~~790		~~Hole in pump base west side~~132.340	~~133.34~~

Deleted Cells

Formatted Table

Deleted Cells

Formatted: Font: Calibri

Formatted: Font: Calibri

Formatted: Font: Calibri

Formatted: Font: Calibri

Formatted: Font: Calibri

Formatted: Font: Calibri

Formatted: Font: Calibri

Formatted: Font: Calibri

Formatted Table

Deleted Cells

Formatted Table

RMS Well ID	State Well Number (Site Name)	Total Depth (feet bgs)	Screened Interval (feet bgs)	Reference Point Elevation[1] (feet)	~~Reference Point Description~~	Ground Surface Elevation[1] (feet)	
24C001M	20N02E24C001M	155	124-134	159.650		157.750	
18C003M	21N02E18C003M	240	130-140 160-170 190-200	191.~~15~~150	~~Top of shortest PVC casing~~	189.~~07~~070	
~~10C002M~~	~~20N01E10C002M~~	~~210~~	~~20-120~~	~~128.35~~		~~Top of casing south side~~	~~127.35~~
~~24C001M~~32E001M~~20N02E24C001M~~	21N02E32E001M~~20N02E24C001M~~	~~155~~ 184	~~62-92~~ ~~124-134~~	~~159.65~~158.130	~~Top of casing, northern-most piezo~~	157.~~75~~330	
~~09L001M~~	~~20N02E09L001M~~	~~710~~	~~460-710~~	~~143.83~~		~~Hole in pump base, southeast side~~	~~139.33~~
~~26E005M~~26E006M	~~21N02E26E005M~~21N02E26E006M	~~315~~ 179	~~265-275~~ ~~280-290~~ 105-115 140-150	184.~~44~~280	~~Top of next to shortest PVC casing~~	182.~~26~~260	
09G001M	20N02E09G001M	202	130-140 170-180	150.240		148.840	
32B001M	21N03E32B001M	57	13-57	242.330		238.430	
33L001M	20N03E33L001M	101	13-101	152.930		151.330	

Note:

1 – North American Vertical Datum 1988 (NAVD88)

~~N/A – Not available~~

~~PVC – polyvinyl chloride~~

~~--- Details~~ --- Depth and screened intervals of public supply wells not disclosed

Deleted Cells
Formatted Table
Deleted Cells
Formatted: Font: Calibri
Formatted: Font: Calibri
Formatted Table
Formatted: Font: Calibri, 10 pt
Formatted: Normal
Formatted: Font: Calibri
Formatted: Font: Calibri
Formatted: Font: Calibri
Deleted Cells
Formatted Table
Formatted: Font: Calibri
Deleted Cells
Formatted Table
Formatted: Font: Calibri
Formatted: Font: Calibri
Formatted Table
Formatted: Font: Calibri, 10 pt
Formatted: Normal

Table 4-6: Groundwater Levels Representative Monitoring Site Well Location Details

RMS Well ID	State Well Number (Site Name)	Latitude[1]	Longitude[1]
Vina Subbasin – North Management Area			
25C001M	23N02W25C001M	39.~~822~~82220	-122.~~0401~~04010
~~10E001M~~09E001M	~~23N01W10E001M~~23N01W09E001M	39.~~864~~86510	-121.~~97237~~499300
~~07H001M~~20K001M	22N01E20K001M~~23N01E07H001M~~	39.~~864821~~74450	-121.~~90493~~689050
05M001M	22N01W05M001M	39.~~787113~~78711	-122.~~01000~~01000
28M004M	23N01W28M004M	39.81877	-121.99119
10M001M	23N01W10M001M	39.86194	-121.97455
27L001M	23N01W27L001M	39.81800	-121.96690
07H001M	23N01E07H001M	39.86482	-121.90494
14R002M	23N01W14R002M	39.84105	-121.93992
36P001M	23N01W36P001M	39.~~797~~79720	-121.~~929~~79290
29P002M	23N01E29P002M	39.81332	-121.89133
33A001M	23N01E33A001M	39.~~809696~~80970	-121.~~86305~~486305
09B001M	22N01E09B001M	39.78180	-121.87180
Vina Subbasin – Chico Management Area			
~~CWSCH01b~~PWSCH01b	~~CWSCH01b~~PWSCH01b	---	---
~~CWSCH02~~PWSCH02	~~CWSCH02~~PWSCH02	---	---
~~CWSCH03~~PWSCH03	~~CWSCH03~~PWSCH03	---	---
~~CWSCH07~~PWSCH07	~~CWSCH07~~PWSCH07	---	---
~~28J003M~~CMW-102A	~~22N01E28J003M~~CMW-102A	39.~~731678~~73537	-121.~~864995~~83785
SWMW-06A	SWMW-06A	39.72232	-121.84152
Vina Subbasin – South Management Area			
~~21C001M~~10B003M	~~21N01E21C001M~~21N01E10B003M	39.~~665471~~69630	-121.~~878004~~84860

Formatted: Font: Calibri, 10 pt
Formatted: Normal
Formatted: Font: Calibri
Formatted: Font: Calibri, 10 pt
Formatted: Normal
Formatted: Font: Calibri, 10 pt
Formatted: Normal
Formatted: Font: Calibri, 10 pt
Formatted: Normal
Formatted: Font: Calibri
Formatted: Font: Calibri
Formatted: Font: Calibri
Formatted: Font: Calibri
Formatted: Font: Calibri, 10 pt
Formatted: Normal
Formatted: Font: Calibri
Formatted: Font: Calibri
Formatted: Font: Calibri
Formatted: Font: Calibri
Formatted: Font: Calibri
Formatted: Font: Calibri, 10 pt
Formatted: Normal

27D001M ~~18C003M~~	21N01E27D001M~~21N02E18C003M~~	39.~~68~~65110	-121.~~79~~786070
~~10C002M~~13L004M	~~20N01E10C002M~~21N01E13L004M	39.~~60965~~67348	-121.~~84876~~81440
25K001M	21N01E25K001M	39.64200	-121.81280
02H003M	20N01E02H003M	39.61576	-121.82216
24C001M	20N02E24C001M	39.~~5812~~58120	-121.~~70267~~026 0
~~09L001M~~18C003M	21N02E18C003M~~20N02E09L001M~~	39.~~6066~~68200	-121.~~75867~~9700
~~26E005M~~32E001M	~~21N02E26E005M~~21N02E32E001M	39.~~6468~~63383	-121.~~7263~~78447
26E006M	21N02E26E006M	39.64680	-121.72630
09G001M	20N02E09G001M	39.61546	-121.73913
32B001M	21N03E32B001M	39.63958	-121.66338
33L001M	20N03E33L001M	39.54357	-121.64667

Note:
1 – North American Datum 1983 (NAD83)
--- Location of public supply wells not disclosed

4.9.2 Water Quality

A total of ~~eight~~seven RMS wells were selected as compliance points for monitoring of water quality (Figure 4-~~5~~6). They will be monitored for the SMC listed in Section 3.5.~~ These wells were selected independently of the wells discussed in Section 4.5 and are not listed in Table 4-3.~~ Table 4-7 summarizes the well construction details, and Table 4-8 summarizes the well location details.

Formatted: Font: Calibri
Formatted: Font: Calibri, 9 pt, Ligatures: Standard + Contextual
Formatted: Font: Calibri, 10 pt
Formatted: Normal
Formatted: Font: Calibri
Formatted Table
Formatted: Font: Calibri
Formatted: Font: Calibri
Formatted: Font: Calibri, 10 pt
Formatted: Normal
Formatted: Font: Calibri
Formatted: Font: Calibri
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)
Formatted: English (United States)

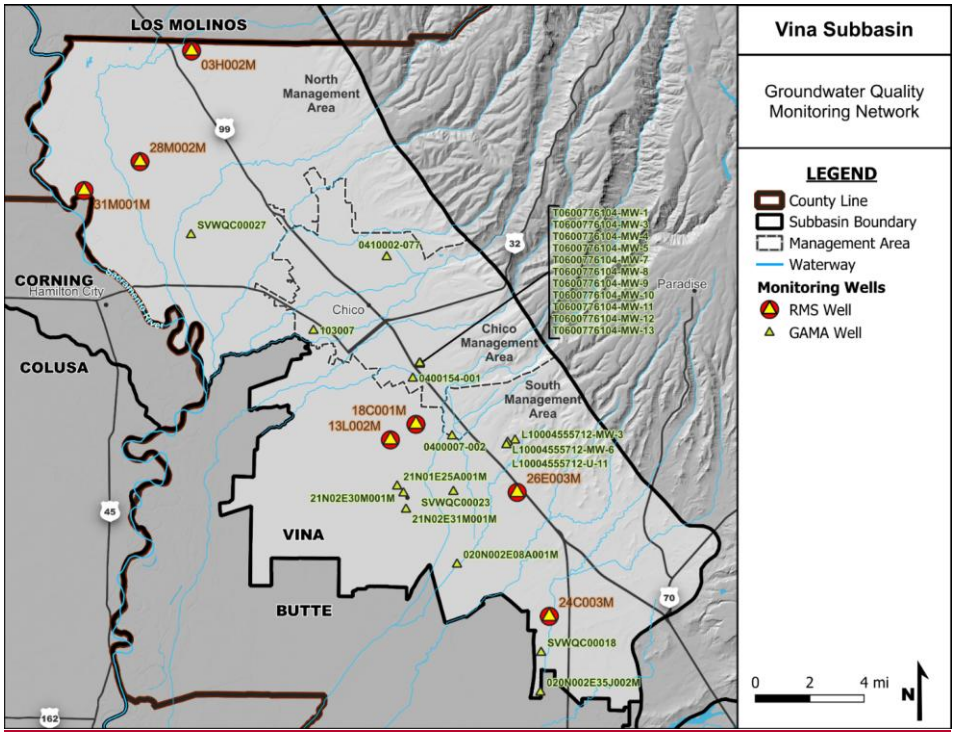


Figure 4-6: Water Quality RMS Wells

Formatted: Normal, Centered

Table 4-7: Water Quality Representative Monitoring Site Well Construction Details

RMS Well ID	State Well Number (GSP Number)	Total Depth (feet bgs)	Screened Interval (feet bgs)	Reference Point Elevation[1] (feet)	Reference Point Description	Ground Surface Elevation[1] (feet)
Vina Subbasin – North Management Area						
28M002M	23N01W28M002M	1044	791-801 881-891 951-961 1011-1021	160.33	Top of shortest PVC casing	159.02
03H002M	23N01W03H002M	553	510-540	218.84	Top of shortest PVC casing	216.88
31M001M	23N01W31M001M	1200	969-979 1020-1030	162.86	Top of highest PVC casing	154.75
~~Vina Subbasin – Chico Management Area~~						
~~28J005M~~	~~22N01E28J005M~~	~~948~~	~~740-800~~	~~179.79~~	~~Top of casing easterly 1-inch casing~~	~~178.89~~
Vina Subbasin – South Management Area						
18C001M	21N02E18C001M	914	770-780 800-810 830-840 870-880	191.56	Top of tallest PVC casing	189.07
13L002M	21N01E13L002M	771	735-760	181.9	Top of casing	179.85
26E003M	21N02E26E003M	660	610-620	184.97	Top of tallest PVC casing	182.27
24C003M	20N02E24C003M	520	484-505	159.14	Top of casing, middle (shortest) piezo	157.75

Note:
1 – North American Vertical Datum 1988 NAVD88

Formatted Table

Formatted Table

Formatted Table

Table 4-8: Water Quality Representative Monitoring Site Well Location Details

RMS Well ID	State Well Number	Latitude[1]	Longitude[1]
Vina Subbasin – North Management Area			
28M002M	23N01W28M002M	39.818773	-121.991188
03H002M	23N01W03H002M	39.878215	-121.95712
31M001M	23N01W31M001M	39.8028	-122.0294
~~Vina Subbasin – Chico Management Area~~			
~~28J005M~~	~~22N01E28J005M~~	~~39.731678~~	~~-121.864995~~
Vina Subbasin – South Management Area			
18C001M	21N02E18C001M	39.682	-121.797
13L002M	21N01E13L002M	39.67348	-121.8144
26E003M	21N02E26E003M	39.6468	-121.7263
24C003M	20N02E24C003M	39.5812	-121.7026

Note:
1 – North American Datum 1983 (NAD83)

4.9.3 Land Subsidence

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 4-9 (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.

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 29 representative monitoring locations consistent with the groundwater level sustainability indicator network, each consisting of a groundwater monitoring well and associated nine-pixel InSAR cluster as shown in Figure 4-7.

Table 4-9: 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[2]	Longitude[2]	Selection Criteria[3]
Vina Subbasin – North Management Area				
25C001M	Well/InSAR pixels	39.82220	-122.0401	GW Monitoring Site
36P001M	Well/InSAR pixels	39.79720	-121.9297	GW Monitoring Site
05M001M	Well/InSAR pixels	39.78711	-122.0100	GW Monitoring Site
07H001M	Well/InSAR pixels	39.86482	-121.9049	GW Monitoring Site
09E001M	Well/InSAR pixels	39.86510	-121.9930	GW Monitoring Site
28M004M	Well/InSAR pixels	39.81877	-121.9912	GW Monitoring Site
10M001M	Well/InSAR pixels	39.86194	-121.9746	GW Monitoring Site
27L001M	Well/InSAR pixels	39.81800	-121.9669	GW Monitoring Site
14R002M	Well/InSAR pixels	39.84105	-121.9399	GW Monitoring Site & Critical Infrastructure
29P002M	Well/InSAR pixels	39.81332	-121.8913	GW Monitoring Site
33A001M	Well/InSAR pixels	39.80970	-121.8631	GW Monitoring Site
20K001M	Well/InSAR pixels	39.74450	-121.8905	GW Monitoring Site & Critical Infrastructure
09B001M	Well/InSAR pixels	39.78180	-121.8718	GW Monitoring Site & Critical Infrastructure
Vina Subbasin – Chico Management Area				
PWSCH01b	Well/InSAR pixels	-	-	GW Monitoring Site
PWSCH02	Well/InSAR pixels	-	-	GW Monitoring Site
PWSCH03	Well/InSAR pixels	-	-	GW Monitoring Site
PWSCH07	Well/InSAR pixels	-	-	GW Monitoring Site
Vina Subbasin – South Management Area				

Site ID	Site Type[1]	Latitude[2]	Longitude[2]	Selection Criteria[3]
Vina Subbasin – North Management Area				
24C001M	Well/InSAR pixels	39.58120	-121.7026	GW Monitoring Site
18C003M	Well/InSAR pixels	39.68200	-121.7970	GW Monitoring Site
26E006M	Well/InSAR pixels	39.64680	-121.7263	GW Monitoring Site & Critical Infrastructure
10B003M	Well/InSAR pixels	39.69630	-121.8486	GW Monitoring Site
27D001M	Well/InSAR pixels	39.65110	-121.8607	GW Monitoring Site
13L004M	Well/InSAR pixels	39.67348	-121.8144	GW Monitoring Site
25K001M	Well/InSAR pixels	39.64200	-121.8128	GW Monitoring Site
02H003M	Well/InSAR pixels	39.61576	-121.8222	GW Monitoring Site
32E001M	Well/InSAR pixels	39.63383	-121.7845	GW Monitoring Site
09G001M	Well/InSAR pixels	39.61546	-121.7391	GW Monitoring Site
32B001M	Well/InSAR pixels	39.63958	-121.6634	GW Monitoring Site
33L001M	Well/InSAR pixels	39.54357	-121.6467	GW Monitoring Site

Note:

1 – "Well" site types are wells included in the broad groundwater level monitoring network.

2 – North American Datum 1983 (NAD83)

3 – Identified as Critical Infrastructure site in this table if located within ½ mile of Hwy 99 and Hwy 32

--- Location of public supply wells not disclosed

Formatted: Font: Bold

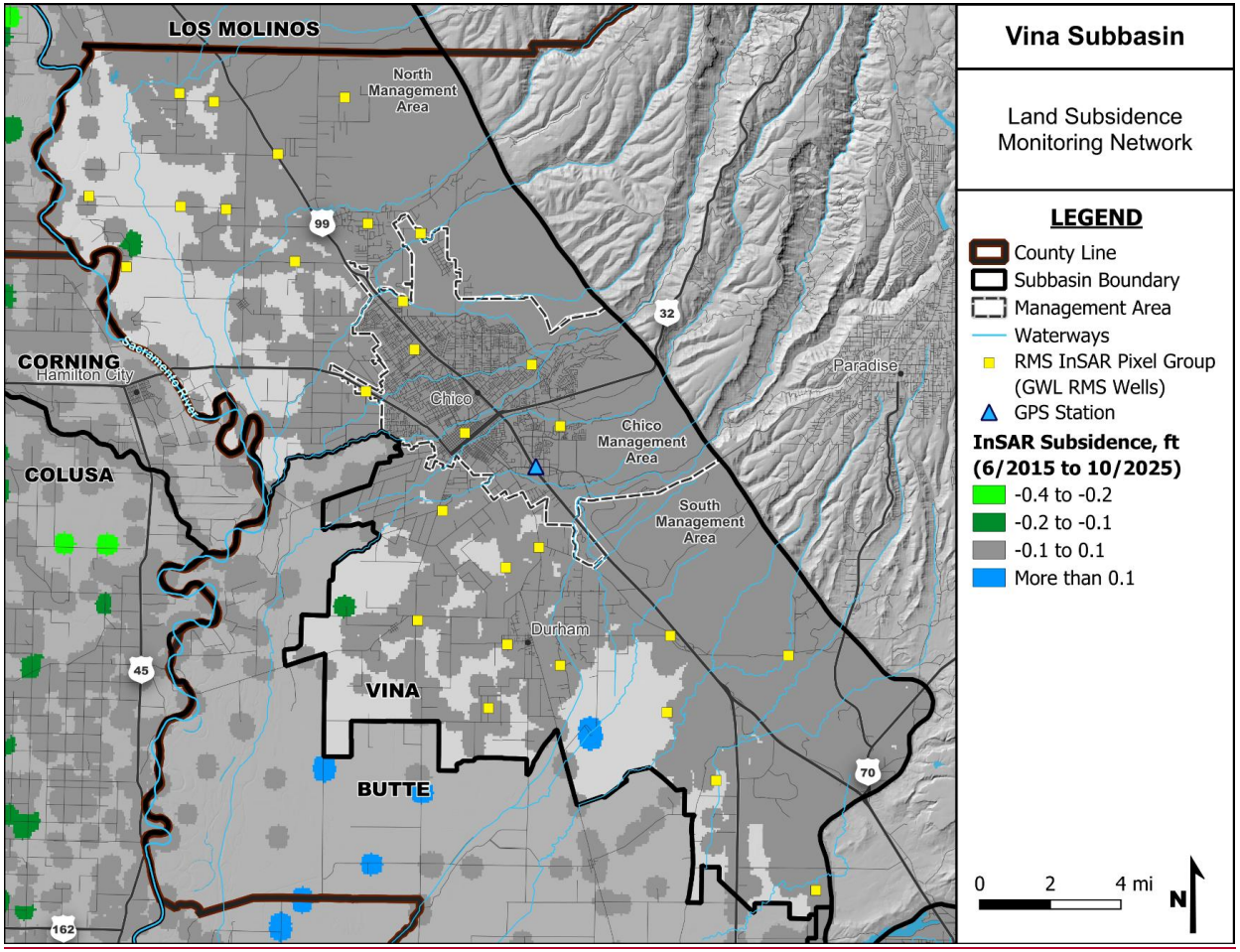

Vina Subbasin
Land Subsidence Monitoring Network
LEGEND
County Line
Subbasin Boundary
Management Area
Waterways
RMS InSAR Pixel Group (GWL RMS Wells)
GPS Station
InSAR Subsidence, ft (6/2015 to 10/2025)
-0.4 to -0.2
-0.2 to -0.1
-0.1 to 0.1
More than 0.1
0 2 4 mi
N
LOS MOLINOS
North Management Area
CORNING
Hamilton City
Sacramento River
COLUSA
Chico
Chico Management Area
South Management Area
Paradise
Durham
VINA
BUTTE
99
32
45
70
162

Figure 4-7: Subsidence RMS Locations

4.10 Network Assessment and Improvements

An assessment of the monitoring network is required to determine uncertainty and identify data gaps that could affect the achievement of sustainability goals. Improvements to the network to address data gaps will be planned and implemented to manage, focus, and prioritize monitoring.

Formatted: English (United States)

Data gaps can result from monitoring information that is not of sufficient quantity or quality. Monitoring network data gaps can influence the development and understanding of the basin setting, including the HCM, groundwater conditions, water budget, and proposed MT and MO. Updates to the data gaps will be included with the annual reporting and five-year assessment of the GSP.

The following data gaps and proposed resolutions have been identified in the Vina Subbasin:

Formatted: English (United States)

- Domestic Well Depths – The MT for groundwater levels is based on total depths of domestic wells. The dataset used for this assessment is poor and may include wells no longer in use or poorly maintained. To resolve this data gap, the GSAs will conduct surveys of active domestic wells to assess the actual total depth of these wells within the Vina Subbasin. The GSAs will also maintain a record of verifiable domestic wells that go dry during the implementation period that will include depth of these wells, screen intervals, and available maintenance records. These data will be used to modify the MT over the implementation period, as appropriate.
- Water Quality – Temporal data gaps exist for water quality samples collected within the RMS wells. However, existing data from other sites indicate that water quality in the Vina Subbasin is significantly below the MO. The frequency of sampling proposed in GSP is anticipated to provide consistent and comparable data to fill this data gap.
- Interconnected Surface Water/Associated impacts on GDEs – There is a lack of sufficient data to analyze interaction of streams and pumping within the primary aquifer system. Additional wells and other monitoring networks will be installed, as appropriate, following the framework discussed in Section 3.8.

~~Figure 4-6 placeholder page~~

Formatted: Font: Bold

5. PROJECT AND MANAGEMENT ACTIONS

This section includes relevant projects and management actions information to satisfy CCR Title 23 § 354.42 and 354.44. The projects and management actions described in this section will help achieve the Vina Subbasin's sustainability goal.

5.1 Projects, Management Actions, and Adaptive Management Strategies

The objective and purpose of the GSP is to achieve groundwater sustainability in the Vina Subbasin. This will require projects and management actions aimed at avoiding undesirable results, achieving measurable objectives, and responding to changing conditions in the basin. The Vina GSA and the RCRD GSA have identified projects and management actions tailored to benefit the Vina Subbasin's groundwater supply and quality for the benefit of rural areas, communities, agricultural users and the environment. The approach targets both identifying and increasing alternative sources of supply and reducing groundwater demand. The GSP identifies groundwater monitoring programs to monitor groundwater conditions, investigation of additional water sources to supplement the use of groundwater, and conservation and educational programs to reduce groundwater demand.

Formatted: English (United States)

5.2 Projects

5.2.1 Project Identification

Projects were identified through a lengthy outreach effort involving the SHAC and the GSAs. The process included soliciting input from governmental agencies, water purveyors, and local landowners. The Vina GSA's website allowed project proponents to input the available information on each project.

Formatted: English (United States)

The majority of projects submitted were proposed by the Vina GSA, with some being a joint effort with the RCRD GSA. Some of the projects also include other proponents, such as CSUC, PG&E, Cal Water, local agricultural farmers, and others. The list of proponents and other entities involved in the projects is included in Table 5-1 below. The schedule to implement the projects is likely to vary depending upon Subbasin conditions, and the expected benefits of PMAs may also vary year to year.

Formatted: English (United States)

The provided project information was compiled into an initial draft list with similar and overlapping projects combined as appropriate. The draft list was presented to the Vina GSA Stakeholder Advisory Committee in their July 15, 2021, meeting and to the GSA Boards at their August meetings. The projects were then evaluated based on the following criteria:

Formatted: English (United States)

- Project addresses one or more of the Undesirable Results
- Project is implementable with respect to technical complexity, regulatory complexity, institutional consideration, and public acceptance
- Project is implementable within the SGMA timeframe
- Project benefits Underrepresented Communities (URCs)

Formatted: Font: Bold

- Project is in an area where water quality is suitable for use

5.2.2 Project Implementation

The purpose of planning and implementing projects is to ensure the Vina Subbasin achieves sustainability. Projects are categorized in three categories - Planned, Potential, and Conceptual – based on current stage of planning or implementation. This section includes Planned, Potential, and Conceptual projects. Additional projects may be added in the future once identified. The specific projects included in the GSP will be implemented, operated, and owned by the individual project proponent(s). Through annual reports, GSP updates, and the evaluation of IMs, MT, and MO, the GSAs will evaluate whether the implementation of projects is sufficient to achieve sustainability. Depending on how projects are achieving sustainability, or otherwise impacting the ability of the Vina Subbasin to achieve sustainability, the GSAs may prioritize the development of projects, seek funding for prioritized projects, or develop guidelines for existing projects.

Formatted: English (United States)

5.2.2.1 List of Projects

Several projects to achieve the Vina Subbasin's sustainability goal were identified. The initial set of projects was reviewed by the SHAC. A final list of 15 possible projects is included in this GSP, and they are categorized into several project types, including direct and in-lieu recharge, intra-basin water transfers, water recycling, demand conservation, and monitoring. Projects are further classified into three categories based on project status: Planned, Potential, and Conceptual, as defined below. All projects, regardless of status, remain subject to available funding, any required CEQA compliance, and any required approvals. The list of possible projects identified in this GSP are an initial list that may be further expanded or modified as the GSAs work toward sustainability by 2042.

Formatted: English (United States)

- Planned Projects – Currently, five Planned Projects have been identified. Projects in this category are anticipated to move forward to help achieve the region's sustainability before 2042.
- Potential Projects – Currently, eight Potential Projects have been identified. Projects in this category are currently in the initial planning stages and may move forward as feasibility and project requirements are determined. Potential Projects represent a "menu of options" for the Vina Subbasin to achieve long-term sustainability and offset the remaining imbalance above and beyond implementation of the Planned Projects.
- Conceptual Projects – Currently, two Conceptual Projects have been identified. Projects in this category are in the early conceptual planning states and would require significant additional work to move forward. Conceptual Projects represent potential future projects that could conceptually provide a benefit to the Vina Subbasin in the future, but that would need to be further developed.

This subsection of the GSP satisfies the requirements of CCR title 23 § 354.44. Consistent with SGMA requirements, the project descriptions for projects contain information regarding:

Formatted: English (United States)

- The MO benefitted by the project

Formatted: Font: Bold

- Permitting and regulatory processes
- Timetable for initiation and completion
- Expected benefits
- How the project will be accomplished
- Legal authority
- Estimated costs and plans to meet costs
- Implementation circumstances
- Public noticing

Table 5-1 provides a summary of the 15 projects. Full descriptions are included below.

Table 5-1: List of Sustainable Groundwater Management Act Projects

Project Name	Project Type	Identified Project Proponent and Other Potential Participating Entities	Measurable Objective Expected to Benefit	Current Status	Timetable (initiation and completion)	Estimated Costs	Expected Groundwater Demand Reduction (Acre-Feet/year)
Planned Projects							
5.2.3.1 Agricultural Irrigation Efficiency	Conservation	Vina GSA; local landowners, other entities to be determined	Groundwater Levels, Groundwater Storage	Planning Stage	2024-2030	To be determined	Up to 4,000 (based on a reduction up to 2%)
5.2.3.2 Residential Conservation	Conservation	Cal Water Chico, Vina GSA, local landowners, other entities to be determined	Groundwater Levels	Planning Stage	2022-2025	To be determined	100
5.2.3.3 Scoping for Flood Managed Aquifer Recharge (FloodMAR)/Surface Water Supply and Recharge	Direct Recharge, In-lieu Recharge	Vina GSA, RCRCD GSA, local landowners, other entities to be determined	Groundwater Levels	Planning Stage	2022-2032	To be determined	Not applicable
5.2.3.4 Community Water Education Initiative	Education and Outreach	Vina GSA, CSUC, CWE, Chico State Enterprises, local landowners, other entities to be determined	Groundwater Levels, Groundwater Storage, Water Quality, Land Subsidence, Surface Water Depletion, Education and Outreach	Ready for Implementation	Currently ongoing, expansion by 2023 depending on funding	Component 1: $50-100K annually Component 2: $10,000-$200,000 annually Component 3: $10,000-$25,000 annually	To be determined
5.2.3.5 Fuels Management for Watershed Health	Conservation	Vina GSA, CSUC, Chico State Enterprises, local landowners, other entities to be determined	Groundwater Levels, Groundwater Storage, Water Quality, Surface Water Depletion	Part of project currently ongoing, rest in planning stage	450 acres ongoing; 4,000 acres 2021-2030; 6,000 to 10,000 acres 2025-2040	$8.0 million - $14.0 million	To be determined
Potential Projects							
5.2.4.1 Paradise Irrigation District Intertie	In-Lieu Recharge	Vina GSA; PID, Cal Water, local landowners, other entities to be determined	Groundwater Levels	Planning Stage	To be determined, after Spring 2022	To be determined	5,000
5.2.4.2 Agricultural Surface Water Supplies	Intra-Basin Water Transfer	Vina GSA, RCRD, local landowners, other entities to be determined	Groundwater Levels	Planning Stage	2025-2032	To be determined	2,000 – 3,000
5.2.4.3 Streamflow Augmentation	Direct Recharge, In-Lieu Recharge	Vina GSA, RCRD GSA, PID, PG&E, local landowners, other entities to be determined	Groundwater Levels, Surface Water Depletion	Initial Planning Stage	2022-2025	$50-$100 per acre-foot	1,000-5,000
5.2.4.4 Community Monitoring Program	Monitoring	Vina GSA, CSUC, Chico Ecological Reserves, local landowners, other entities To be determined	Groundwater Levels	Planning Stage	2022-2025	To be determined	Not applicable
5.2.4.5 Recycled Wastewater	Direct Recharge, Water Recycling	Vina GSA, City of Chico, local landowners, other entities to be determined	Groundwater Levels	Planning Stage	2030-2038	To be determined	5,000
5.2.4.6 Rangeland Management	Conservation	Vina GSA, CSUC, Chico State Enterprises, other entities to be determined	Groundwater Levels	Planning Stage	Baseline data collection (2021-2022) Development of Master Management Plan (2022-2024)	To be determined	To be determined

Project Name	Project Type	Identified Project Proponent and Other Potential Participating Entities	Measurable Objective Expected to Benefit	Current Status	Timetable (initiation and completion)	Estimated Costs	Expected Groundwater Demand Reduction (Acre-Feet/year)
5.2.4.7 Removal of Invasive Species	Conservation	Vina GSA, CSUC, Chico State Enterprises, other entities to be determined	Groundwater Levels, Groundwater Storage	Planning Stage	Inventory and mapping of properties: 2022-2023 Development of invasive management for water retention plan: 2023-2024 Identify and secure funding: 2022-2026 Implement projects and measure results: 2025 and beyond	To be determined	To be determined
5.2.4.8 Surface Water Supply and Recharge	Direct Recharge	Vina GSA, RCRD GSA, local landowners, other entities to be determined	Groundwater Levels	Planning Stage	Sand Creek / Lindo Channel – 2022-2032; Other projects – 2022 – 2042	To be determined	1,000 / project
Conceptual Projects							
5.2.5.1 Extend Orchard Replacement	Conservation	Vina GSA, local landowners, other entities to be determined	Groundwater Levels	Conceptual Planning Stage	To be determined	To be determined	4,000-8,000
5.2.5.2 Recharge from the Miocene Canal	Direct Recharge	Vina GSA PG&E, Butte County, local landowners, other entities to be determined	Groundwater Levels	Conceptual Planning Stage	After 2025	To be determined	2,000 based on 10,000 acre-feet available for recharge (20% efficiency)

5.2.3 Planned Projects

Projects categorized as Planned Projects are expected to move forward and be completed to achieve the Vina Subbasin's sustainability goal by 2042. The estimated groundwater supply from these projects is expected to offset the projected overdraft of 10,000 AFY.

5.2.3.1 Agricultural Irrigation Efficiency

A survey is currently being conducted in North and South Vina by the Vina GSA, Agricultural Groundwater Users of Butte County, and Butte County Farm Bureau in order to evaluate current irrigation methods and practices, identify opportunities and methods to improve irrigation efficiency, determine potential issues preventing the adoption of efficiency practices, and provide recommendations for increasing participation in these practices. The results of this survey are expected to be available in September 2022, with implementation of the project expected to be initiated between 2024 and 2030. Recommendations from the survey will be made available to the local agricultural community, and implementation of the practices will be voluntary. The Vina GSA along with participating partners will pursue grant funds to help implement these practices. It is estimated that the adoption of more efficient practices could reduce groundwater demand by up to 2%, which translates to a reduction in groundwater demand of up to 4,000 AFY.

Project Summary	
Identified project proponent(s) and other potential participating entities:	Vina GSA; local landowners, other entities to be determined
Project Type:	Conservation
Estimated Groundwater Offset and/or Recharge:	–Up to 4,000 acre-feet/year

Measurable Objective Expected to Benefit: This project will address declining water levels and the declining volume of groundwater stored in the aquifer. The main objective of the project is to reduce groundwater demand by modifying irrigation practices.

Project Status: This project is in the planning stages.

Required Permitting and Regulatory Process: None

Timetable for Initiation and Completion: Project will be initiated in 2024

Expected Benefits and Evaluation: A survey that consolidates data on the adoption of irrigation methods and practices by agricultural groundwater users will identify where more efficient practices can be implemented. This can help focus efforts and finances on areas where a reduction in overall groundwater demand is needed and feasible.

How Project Will Be Accomplished/Evaluation of Water Source: This project is a demand-side conservation project. No additional water source will be utilized for this project.

Legal Authority: The project would be under the authority of Vina GSA and potential future participating partners.

Estimated Costs and Plans to Meet Costs: To be determined, funding via Proposition 1, Proposition 68, USDA, Drought Resiliency Grants

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Circumstances for Implementation: This project is a Planned Project that is anticipated to move forward.

Trigger for Implementation and Termination: The project will be initiated after the recommendations from the initial survey results are available.

Process for Determining Conditions Requiring the Project to Occur: As mentioned above, the survey is already underway and once analysis is complete, recommendations based off the results will be made available for voluntary implementation.

5.2.3.2 Project: Residential Conservation

Cal Water Chico, which provides water to the City of Chico via groundwater, proposed a series of conservation projects under their 2020 UWMP, including toilet replacement, urinal valve and bowl replacement, clothes washer replacement, residential conservation kits, smart controllers, high efficiency irrigation nozzles, and turf buy-back.

Project Summary	
Identified project proponent(s) and other potential participating entities:	Cal Water Chico, Vina GSA, local landowners, other entities to be determined
Project Type:	Conservation
Estimated Groundwater Offset and/or Recharge:	100 AFY

Measurable Objective Expected to Benefit: Groundwater Levels

Project Status: This project is in the planning stages.

Required Permitting and Regulatory Process: None

Timetable for Initiation and Completion: 2022-2025

Expected Benefits and Evaluation: The implementation of several different conservation projects for residential areas is expected to reduce groundwater demand by 100 AFY in Chico.

How Project Will Be Accomplished/Evaluation of Water Source: This project is a demand-side conservation project implemented by Cal Water in residential areas. No additional water source will be utilized for this project.

Legal Authority: The project would be under the authority of Vina GSA and Cal Water Chico. Cal Water Chico would initiate the conservation programs.

Estimated Costs and Plans to Meet Costs: To be determined, funding via Proposition 1, Proposition 68, Drought Resiliency Grants, Cal Water.

Circumstances for Implementation: This project is a Planned Project that is anticipated to move forward.

Trigger for Implementation and Termination: Increased groundwater demand due to an increasing number of planned residential developments in Chico (according to the City of Chico and Butte County General Plans).

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Process for Determining Conditions Requiring the Project to Occur: This is a Planned Project that is anticipated to move forward.

Formatted: English (United States)

5.2.3.3 Project: Scoping for Flood MAR/Surface Water Supply and Recharge

Under this project, Vina GSA and RCRD GSA will expand on the Flood MAR initiative, which was originally developed by DWR to promote recharge programs that use fields, recharge basins, and/or recharge ponds to divert high flows in creeks and streams. Individual recharge projects will eventually occur, but this particular project will focus on the initial scoping and identify specific recharge opportunities in the Vina Subbasin. At first, Vina GSA and RCRD GSA will focus their efforts on areas with the greatest need for recharge and seek grants and other funding sources to implement the projects. Interested landowners would be identified and participation in the program would be voluntary.

Formatted: English (United States)

Project Summary	
Identified project proponent(s) and other potential participating entities:	Vina GSA, RCRCD GSA, local landowners, other entities to be determined
Project Type:	Direct Recharge, In-Lieu Recharge
Estimated Groundwater Offset and/or Recharge:	Not applicable

Estimated Groundwater Offset and/or Recharge: Not applicable. Future recharge projects are possible based on results of scoping.

Measurable Objective Expected to Benefit: Future increase of groundwater levels.

Project Status: This project is in the planning stages.

Required Permitting and Regulatory Process: Not applicable

Timetable for Initiation and Completion: 2022-2032

Expected Benefits and Evaluation: This project would develop the first steps of the Flood MAR initiative and recharge efforts for the Vina Subbasin region and identify specific groundwater recharge and management projects based on feasibility, need, and available funding. The initiation of this project would then lead to future recharge projects.

Formatted: English (United States)

How Project Will Be Accomplished/Evaluation of Water Source: This project will help to identify and develop specific recharge projects in the region, which will then individually determine recharge sources.

Formatted: English (United States)

Legal Authority: The project would be under the authority of the Vina GSA and RCRD GSA.

Estimated Costs and Plans to Meet Costs: To be determined, funding via Proposition 1 and Proposition 68.

Formatted: English (United States)

Circumstances for Implementation: This project is a Planned Project that is anticipated to move forward.

Formatted: English (United States)

Trigger for Implementation and Termination: None

e This is a Planned Project that is anticipated to move forward.

Formatted: English (United States)

5.2.3.4 Project: Community Water Education Initiative

The Community Water Education Initiative, proposed by CSUC's CWE, would consist of two main components:

Community Water Education Project – The CWE would lead this component of the project to expand on community outreach and education associated with water-related topics and issues of the region. CWE would focus on topics such as regional groundwater issues, connectivity of surface and groundwater, decision-making during drought years, basic aquifer knowledge, and more, and target agricultural well users, domestic well users, and municipal customers. The scope would also include technical seminars and field trips, as well as creating educational materials such as fact sheets, printed materials, and website content.

Formatted: English (United States)

Big Chico Creek Watershed Tour – CWE currently hosts a Big Chico Creek Watershed Tour every year that lasts for four days (2 weekends in March and April) and that takes participants from the watershed's headwaters to the Big Chico Creek Ecological Reserve, through CSUC campus, and to its confluence with the Sacramento River. During the program, participants learn about the watershed, explore various water issues, and help CSUC faculty research the health of the watershed. Under this project, CSUC proposes to expand the program to include community members and more groundwater education, with a focus on the Vina Subbasin, with the goal to help community members better understand their role in sustainable groundwater management.

Project Summary	
Identified project proponent(s) and other potential participating entities:	Vina GSA, CSUC, CWE, Chico State Enterprises, local landowners, other entities to be determined
Project Type:	Education and Outreach
Estimated Groundwater Offset and/or Recharge:	Not applicable

Measurable Objective Expected to Benefit: Groundwater Levels, Groundwater Storage, Water Quality, Land Subsidence, Surface Water Depletion, Education and Outreach

Project Status: This project is ready for implementation. Possible expansion by 2023 depending on funding.

Formatted: English (United States)

Required Permitting and Regulatory Process: None

Timetable for Initiation and Completion: Currently measuring and providing community education with the possibility of expansion by 2023 depending on funding.

Expected Benefits and Evaluation: This project would expand the education and outreach on important watershed and groundwater issues in the region, helping community members better understand their role in sustainable water management.

How Project Will Be Accomplished/Evaluation of Water Source: This is an education and outreach project provided through CSUC that does not require a water source.

Legal Authority: The project would be under the authority of CSUC's CWE.

Estimated Costs and Plans to Meet Costs: $50-100K annually (Component 1); $10,000-$200,000 annually (Component 2); $10,000-$25,000 annually (Component 3). Funding via Proposition 1 and Proposition 68

Circumstances for Implementation: This project is a Planned Project that is anticipated to move forward.

Formatted: English (United States)

As scenarios change, the Potential Projects can come online to bring additional resources for adaptive management. Implementation of Potential Projects will be based on long-term management or changing needs of the GSA or Subbasin. Trigger for Implementation and Termination: None

Formatted: English (United States)

Process for Determining Conditions Requiring the Project to Occur: Implementation of Potential Projects will be based on long-term management or changing needs of the GSAs or Subbasin.

5.2.3.5 Project: Fuel Management for Watershed Health

This project would involve fuel management in the Upper Watershed, including multiple sites on the 3,950-acre Big Chico Creek Ecological Reserve, 1,500 acres above the Reserve in the Big Chico Creek Watershed, and on private land within the watershed. Fuel reduction projects are currently ongoing at 460 acres. Further fuel reduction is planned for an additional 4,000 acres between 2021 and 2030 and another 6,000 to 10,000 acres for 2025 through 2040 with the City of Chico Parks Department and other private landowners.

Formatted: English (United States)

Project Summary	
Identified project proponent(s) and other potential participating entities:	Vina GSA, CSUC, Chico State Enterprises, local landowners, other entities to be determined
Project Type:	Conservation
Estimated Groundwater Offset and/or Recharge:	To be determined
Other Potential Participating Entities	CSUC, Chico State Enterprises

Measurable Objective Expected to Benefit: Groundwater Levels, Groundwater Storage, Water Quality, Surface Water Depletion

Project Status: Part of this project is currently ongoing, with other parts in the planning stages.

Required Permitting and Regulatory Process: CEQA

Timetable for Initiation and Completion: 450 acres have ongoing fuel reduction; 4,000 acres planned for 2021-2030; 6,000 to 10,000 acres planned for 2025-2040

Expected Benefits and Evaluation: Improved fuel management would prevent inadvertent spillage and the degradation of water quality.

How Project Will Be Accomplished/Evaluation of Water Source: This project is a demand-side conservation project conducted by CSUC. No additional water source will be utilized for this project.

Formatted: English (United States)

Legal Authority: The project would be conducted by CSUC.

Estimated Costs and Plans to Meet Costs: $8.0 million -$14.0 million (based on $2,000 and $3,500 per acre with a target of 4,000 acres); funding via CAL FIRE, Sierra Nevada Conservancy, California Fire Safe Council, other state, and federal funding agencies

Circumstances for Implementation: This project is a Planned that is anticipated to move forward.

Formatted: English (United States)

Trigger for Implementation and Termination: None

Process for Determining Conditions Requiring the Project to Occur: Implementation of Potential Projects will be based on long-term management or changing needs of the GSAs or Subbasin.

5.2.4 Potential Projects

Projects categorized as Potential Projects are currently in the initial planning stages and may move forward as feasibility and project requirements are determined. Potential Projects represent a "menu of options" for the Vina Subbasin to achieve long-term sustainability and offset the remaining imbalance above and beyond implementation of the Planned Projects.

Formatted: English (United States)

5.2.4.1 Project: Paradise Irrigation District Intertie

After the devastation of the 2018 Camp Fire in Paradise, California, PID lost 95% of their customers. To help PID sustain their business, this project proposes that PID supply Cal Water, which serves the City of Chico, with water from one of their surface waters sources. Currently, Chico's only water source is groundwater, and their annual demand is 25,000 AF. The additional water source would help offset the groundwater demand and help groundwater levels stabilize in the Vina Subbasin. The SWRCB is currently conducting a study through Spring 2022 to help PID evaluate their options for long-term sustainability. This study will include the feasibility of the PID-Cal Water Intertie project.

Formatted: English (United States)

Project Summary	
Identified project proponent(s) and other potential participating entities:	Vina GSA; PID, Cal Water, local landowners, other entities to be determined
Project Type:	In-Lieu Recharge
Estimated Groundwater Offset and/or Recharge:	5,000 AFY

Measurable Objective Expected to Benefit: Groundwater Levels

Project Status: This project is in the initial planning stages.

Formatted: English (United States)

Required Permitting and Regulatory Process: County encroachment permit, CEQA.

Timetable for Initiation and Completion: To be determined, after Spring 2022

Formatted: English (United States)

Expected Benefits and Evaluation: An additional source for Chico from surface water would help offset the demand on groundwater in the Vina Subbasin and allow groundwater levels to stabilize. In addition, this would help PID's business after they lost customers during the Camp Fire.

Formatted: English (United States)

How Project Will Be Accomplished/Evaluation of Water Source: This project will allow PID to provide a surface water source to the City of Chico to help offset groundwater demand. Groundwater is currently the only source of water for Chico.

Legal Authority: The project would be under the authority of Vina GSA, PID, and Cal Water.

Estimated Costs and Plans to Meet Costs: To be determined, funding via Proposition 1, Proposition 68, State Revolving Fund, Federal Infrastructure Funds

Formatted: English (United States)

Circumstances for Implementation: The decision to move forward with the project will based on discussions with PID.

Formatted: English (United States)

Trigger for Implementation and Termination: PID's loss of customers from the Camp Fire, decreasing groundwater levels in the Vina Subbasin, increasing groundwater demand in Chico

Process for Determining Conditions Requiring the Project to Occur: Implementation of Potential Projects will be based on long-term management or changing needs of the GSA or Subbasin.

5.2.4.2 Project: Agricultural Surface Water Supplies

Under this project, surface water from water right holders in the neighboring Butte Subbasin and the upper watershed would provide water for the Vina North and South areas. Some of these surface water sources would include the Sacramento River and Lake Oroville. Surface water would help agricultural users reduce their groundwater usage. Agricultural users may need to install a dual irrigation system that allows them to switch between groundwater and surface water depending on the availability of the surface water. Implementation of some of the projects could also lead to recharge opportunities, as additional water may be available during the off-peak irrigation season.

Formatted: English (United States)

Project Summary	
Identified project proponent(s) and other potential participating entities:	Vina GSA, RCRD, local landowners, other entities to be determined
Project Type:	Intra-Water Basin Transfer
Estimated Groundwater Offset and/or Recharge:	2,000 to 3,000 AFY

Measurable Objective Expected to Benefit: Groundwater Levels

Project Status: This project is in the initial planning stages.

Formatted: English (United States)

Required Permitting and Regulatory Process: Projects with diversions of surface water will require a SWRCB Water Right Permit, CEQA, others to be determined.

Formatted: English (United States)

Timetable for Initiation and Completion: 2025-2032

Expected Benefits and Evaluation: Surface water sources from neighboring basins would decrease the Vina Subbasin's dependence on groundwater and allow groundwater levels to stabilize.

How Project Will Be Accomplished/Evaluation of Water Source: The water sources for this project would include available surface water from the Butte Subbasin and upper watershed (Sacramento River, Lake Oroville, etc.).

Legal Authority: The project would be under the authority of Vina GSA, the RCRD GSA, local landowners or other entities to be determined.

Formatted: English (United States)

Estimated Costs and Plans to Meet Costs: To be determined, funding via Proposition 1 and Proposition 68.

Formatted: English (United States)

Circumstances for Implementation: This project is a Potential Project, meaning it is currently in the planning stages. Potential Projects represent a "menu of options" for the Vina Subbasin to achieve long-term sustainability and offset the remaining imbalance above and beyond implementation of the Planned Projects. As scenarios change, the Potential Projects can come online to bring additional resources for adaptive management.

Formatted: English (United States)

Trigger for Implementation and Termination: None

Process for Determining Conditions Requiring the Project to Occur: Implementation of Potential Projects will be based on long-term management or changing needs of the GSAs or Vina Subbasin.

5.2.4.3 Project: Streamflow Augmentation

Under the management of the Vina GSA, this project would transport excess untreated surface water from PID, PG&E, and / or other water right holders in the upper watershed to various parts of the Vina Subbasin through creeks and streams. The goal of the project would be to provide additional water sources to riparian water holders such as Durham Mutual, Rancho Esquon, M&T Ranch, and Gorrill Ranches as well as increase stream flows and direct and in-lieu recharge. Prior to the start of the project, Vina GSA would conduct an investigation and feasibility study to ensure that enough surface water would be available. The project would primarily take place at Comanche Creek, Butte Creek, Little Chico Creek, and Big Chico Creek.

Formatted: English (United States)

Project Summary	
Identified project proponent(s) and other potential participating entities:	Vina GSA, RCRD GSA, PID, PG&E, local landowners, other entities to be determined
Project Type:	Direct Recharge, In-Lieu Recharge
Estimated Groundwater Offset and/or Recharge:	1,000 – 5,000 acre-feet/year

Measurable Objective Expected to Benefit: Groundwater Levels, Surface Water Depletion

Project Status: This project is in the initial planning stages.

Formatted: English (United States)

Required Permitting and Regulatory Process: SWRCB Water Right Permit, CEQA

Timetable for Initiation and Completion: 2022-2025

Expected Benefits and Evaluation: Additional sources of surface water would help to increase surface water levels in creeks and streams, groundwater levels via direct and in-lieu recharge, and overall water availability for riparian water holders.

How Project Will Be Accomplished/Evaluation of Water Source: The additional water sources would come from any available surface water from PID, PG&E, and other water right holders in the upper watershed.

Legal Authority: The project would be under the authority of Vina GSA.

Estimated Costs and Plans to Meet Costs: $50 - $100/acre-foot, funding via California Wildlife Conservation Board, Resource Renewal Institute, Proposition 1, Proposition 68, Vina fees

Circumstances for Implementation: This project is a Potential Project. As scenarios change, the Potential Projects can come online to bring additional resources for adaptive management. Implementation of Potential Projects will be based on long-term management or changing needs of the GSA or Subbasin.

Trigger for Implementation and Termination: None

Process for Determining Conditions Requiring the Project to Occur: Implementation of Potential Projects will be based on long-term management or changing needs of the GSA or Subbasin.

5.2.4.4 Community Monitoring Program

This project would create routine water table monitoring programs for approximately 8,000 acres of Ecological Reserves in the region between lower Forest Ranch and Cohasset Road near Chico Airport, including the Big Chico Creek, Sheep Hollow, and Cabin Hollow tributaries.

Project Summary	
Identified project proponent(s) and other potential participating entities:	Vina GSA, CSUC, Chico Ecological Reserves, local landowners, other entities to be determined
Project Type:	Monitoring
Estimated Groundwater Offset and/or Recharge:	Not applicable

Measurable Objective Expected to Benefit: Groundwater Levels

Project Status: This project is in the initial planning stages.

Required Permitting and Regulatory Process: None.

Timetable for Initiation and Completion: The establishment of these new monitoring programs is planned to take place between 2022 and 2025.

Expected Benefits and Evaluation: Routine water table monitoring programs will track overall water table trends in the region and provide important, up-to-date data for making decisions on water management.

How Project Will Be Accomplished/Evaluation of Water Source: CSUC and Chico Ecological Reserves will implement the monitoring programs on a routine basis through their university programs. No additional water source will be utilized for this project.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Legal Authority: The project would be under the authority of CSUC and Chico Ecological Reserves.

Estimated Costs and Plans to Meet Costs: To be determined, funding sources to be determined.

Formatted: English (United States)

Circumstances for Implementation: This project is a Potential Project, meaning it is currently in the planning stages. Potential Projects represent a "menu of options" for the Vina Subbasin to achieve long-term sustainability and offset the remaining imbalance above and beyond implementation of the Planned Projects. As scenarios change, the Potential Projects can come online to bring additional resources for adaptive management.

Formatted: English (United States)

Trigger for Implementation and Termination: None

Process for Determining Conditions Requiring the Project to Occur: Implementation of Potential Projects will be based on long-term management or changing needs of the GSAs or Vina Subbasin.

5.2.4.5 Project: Wastewater Recycling

The City of Chico currently operates a wastewater treatment plant with a treatment capacity of 12 million gallons (36 AF) per day and discharges 13,000 AFY of the treated wastewater into the Sacramento River (in accordance with their waste discharge permit from the California Water Resources Control Board). Under this project, the city would review the feasibility of diverting some of their recycled wastewater from the Sacramento River to recharge ponds and/or non-crop vegetation in Chico. Existing regulations will be reviewed for the use of the recycled water for crop production.

Formatted: English (United States)

Project Summary	
Identified project proponent(s) and other potential participating entities:	Vina GSA, City of Chico, local landowners, other entities to be determined
Project Type:	Direct Recharge, Water Recycling
Estimated Groundwater Offset and/or Recharge:	5,000 AFY

Measurable Objective Expected to Benefit: Groundwater Levels

Project Status: This project is in the initial planning stages.

Formatted: English (United States)

Required Permitting and Regulatory Process: SWRCB Water Right permit, CEQA, National Pollutant Discharge Elimination System permit, others to be determined.

Formatted: English (United States)

Timetable for Initiation and Completion: 2030-2038

Expected Benefits and Evaluation: This project would divert treated wastewater, that would otherwise be pumped into the Sacramento River, towards recharge ponds and non-crop vegetation. This would increase groundwater recharge, decrease groundwater demand for farming, and help groundwater levels stabilize in the region.

How Project Will Be Accomplished/Evaluation of Water Source: This project would be initiated by the Vina GSA and the City of Chico, and the water source for this project would be the treated wastewater from the City of Chico's wastewater treatment plant.

Formatted: English (United States)

Legal Authority: The project would be under the authority of Vina GSA and the City of Chico.

Estimated Costs and Plans to Meet Costs: To be determined, funding via Proposition 1, Proposition 68, and SWRCB, and other sources to be determined.

Formatted: English (United States)

Circumstances for Implementation: This project is a Potential Project, meaning it is currently in the planning stages. Potential Projects represent a "menu of options" for the Vina Subbasin to achieve long-term sustainability and offset the remaining imbalance above and beyond implementation of the Planned Projects. As scenarios change, the Potential Projects can come online to bring additional resources for adaptive management.

Formatted: English (United States)

Trigger for Implementation and Termination: None

Process for Determining Conditions Requiring the Project to Occur: Implementation of Potential Projects will be based on long-term management or changing needs of the GSAs or Vina Subbasin.

5.2.4.6 Project: Rangeland Management and Water Retention

Under this project, CSUC and Chico State Enterprises would initiate a study of adaptive/ regenerative grazing practices on 2,000 or more acres in the region. The study, which would take place between 2021 and 2022, would measure soil compaction, erosion, groundwater retention, and biological diversity. If this study finds that water retention engineering projects would be feasible in the region, based on the collected data on local soil, then CSUC would create a master management plan and take necessary steps to complete the water retention projects.

Formatted: English (United States)

This project would take place in two locations across 3,850 acres of historical rangeland between Musty Buck Ridge and Cohasset Road.

Project Summary	
Identified project proponent(s) and other potential participating entities:	Vina GSA, CSUC, Chico State Enterprises, other entities to be determined
Project Type:	Conservation
Estimated Groundwater Offset and/or Recharge:	To be determined

Measurable Objective Expected to Benefit: Groundwater Levels

Project Status: This project is currently in the initial planning stages.

Formatted: English (United States)

Required Permitting and Regulatory Process: CEQA and/or National Environmental Policy Act (NEPA), depending on project impact.

Timetable for Initiation and Completion: Baseline data collection (2021-2022); Development of Master Management Plan (2022-2024).

Expected Benefits and Evaluation: This project would evaluate characteristics of local soil and the feasibility to initiate water retention projects. Water retention would help increase the overall water supply for the region.

How Project Will Be Accomplished/Evaluation of Water Source: This project is a demand-side conservation project through CSUC. No additional water source will be utilized for this project.

Legal Authority: The project would be conducted by CSUC.

Estimated Costs and Plans to Meet Costs: To be determined, funding via state funding through watershed health grants, federal funding through USDA, private funding sources to be determined.

Circumstances for Implementation: This project is a Potential Project, meaning it is currently in the planning stages. Potential Projects represent a "menu of options" for the Vina Subbasin to achieve long-term sustainability and offset the remaining imbalance above and beyond implementation of the Planned Projects. As scenarios change, the Potential Projects can come online to bring additional resources for adaptive management.

Trigger for Implementation and Termination: Once the study is complete on soil compaction, erosion, groundwater retention, and biological diversity, and it shows that water retention is feasible, then a master management plan will be developed.

Process for Determining Conditions Requiring the Project to Occur: Implementation of Potential Projects will be based on long-term management or changing needs of the GSAs or Vina Subbasin.

5.2.4.7 Project: Removal of Invasive Species

Invasive species negatively impact the natural ecosystem in several ways, including consuming water and hampering recharge. Under this project, invasive species and native grasses in meadows and oak savannahs would be mapped between 2022 and 2023. This would then be followed by the development of an invasive management for water retention plan between 2023 and 2024, the acquisition of funding between 2022 and 2026, and the implementation of invasive species removal projects after 2025. This project would take place in the Upper Watershed at approximately 8,000 acres between lower Forest Ranch and the Chico Airport, including the Big Chico Creek, Sheep Hollow, and Cabin Hollow drainages.

Project Summary	
Identified project proponent(s) and other potential participating entities:	Vina GSA, CSUC, Chico State Enterprises, other entities to be determined
Project Type:	Conservation
Estimated Groundwater Offset and/or Recharge:	To be determined

Measurable Objective Expected to Benefit: The project will address declining water levels and the declining volume of groundwater stored in the aquifer.

Project Status: This project is currently in the initial planning stages.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Required Permitting and Regulatory Process: CEQA and/or NEPA, depending on project location and impact.

Timetable for Initiation and Completion:

- Inventory and mapping of properties: 2022-2023
- Development of invasive management for water retention plan: 2023-2024
- Identify and secure funding: 2022-2026
- Implement projects and measure results**:** 2025 and beyond.

Expected Benefits and Evaluation: The removal of invasive species would benefit the natural ecosystem and prevent them from negatively affecting the amount of available water and the ability for water to recharge.

How Project Will Be Accomplished/Evaluation of Water Source: This project is a demand-side conservation project conducted through CSUC. No additional water source will be utilized for this project.

Legal Authority: The project would be conducted by CSUC.

Estimated Costs and Plans to Meet Costs: To be determined, funding via state and federal wildfire resiliency grants.

Circumstances for Implementation: This project is a Potential Project, meaning it is currently in the planning stages. Potential Projects represent a "menu of options" for the Vina Subbasin to achieve long-term sustainability and offset the remaining imbalance above and beyond implementation of the Planned Projects. As scenarios change, the Potential Projects can come online to bring additional resources for adaptive management.

Trigger for Implementation and Termination: None

Process for Determining Conditions Requiring the Project to Occur: Implementation of Potential Projects will be based on long-term management or changing needs of the GSAs or Vina Subbasin.

5.2.4.8 Project: Surface Water Supply and Recharge

Projects under this category would involve activities that increase the surface water supply to the Vina Subbasin through: 1) direct application of surface water to crops along the lines of the Agricultural Surface Water Supplies Project described above; 2) application of surface water and/or flood water to land surface (i.e. existing orchards) for recharge purposes, sometimes referred to as Flood MAR projects; 3) surface water and/or flood water application to recharge basins and/or recharge ponds; or 4) other applications.

The following are examples of potential projects in the Vina Subbasin:

Sand Creek Project – This project would take place in the North Chico and Nord areas and would involve obtaining data that would later be used to develop mitigation measures for flooding and recharge. The data may also be used to decide future actions towards habitat

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

restoration and runoff management to sustain groundwater. This project is currently developing a Decision Support Tool to determine future construction scope and feasibility.

Lindo Channel – This project would divert water from Big Chico Creek when flow exceeds 75 cfs and store the water in the Lindo Channel. The Lindo Channel can then be used as a recharge source for other areas and potentially provide 2,000 AF.

Formatted: English (United States)

Other additional recharge projects would be developed by the Vina GSA, the RCRD GSA, local landowners, and/or entities to be determined.

Formatted: English (United States)

Estimated Groundwater Offset and/or Recharge: 1,000 AFY per project.

Measurable Objective Expected to Benefit: increase of groundwater levels by enhancing in-lieu recharge opportunities.

Project Status: The Sand Creek project and Lindo Channel project are in the initial planning stages. Other projects to be developed in the future.

Formatted: English (United States)

Required Permitting and Regulatory Process: Projects with diversions of surface water will require a SWRCB permit; CEQA and others to be determined.

Formatted: English (United States)

Timetable for Initiation and Completion: Sand Creek and Lindo Channel – 2022-2032; Other projects – 2022 – 2042.

Expected Benefits and Evaluation: This project would reduce reliance on native groundwater supply.

How Project Will Be Accomplished/Evaluation of Water Source: Evaluate and analyze results of scoping project for potential locations of recharge activity. The Sand Creek project and Lindo Channel project are in the planning stages. The Lindo Channel project is anticipated to divert water from Big Chico Creek to the Lindo Channel, which can then be used as a recharge source on-site or at other locations. The Sand Creek project is anticipated to divert water from the creek to a recharge basin.

Formatted: English (United States)

Legal Authority: The projects would be under the authority of the Vina GSA, the RCRD GSA, local landowners and / or other entities to be determined.

Formatted: English (United States)

Estimated Costs and Plans to Meet Costs: To be determined, potential funding via Proposition 1 and Proposition 68.

Formatted: English (United States)

Circumstances for Implementation: These projects are Potential Projects to bring additional resources for adaptive management. Potential Projects represent a "menu of options" for the Vina Subbasin to achieve long-term sustainability and offset the remaining imbalance above and beyond implementation of the Planned Projects. As scenarios change, the Potential Projects can come online to bring additional resources for adaptive management.

Formatted: English (United States)

Trigger for Implementation and Termination: None

Process for Determining Conditions Requiring the Project to Occur: The Sand Creek project and Lindo Channel project are in the planning stages and will be implemented, assuming that

Formatted: English (United States)

feasibility is determined. Implementation of Potential Projects will be based on long-term management or changing needs of the GSAs or Vina Subbasin.

Project Summary	
Identified project proponent(s) and other potential participating entities:	Vina GSA, RCRD GSA, local landowners, other entities to be determined
Project Type:	Direct Recharge, In-Lieu Recharge
Estimated Groundwater Offset and/or Recharge:	1,000 acre-feet/project

5.2.5 Conceptual Projects

Projects categorized as Conceptual Projects are in the early conceptual stages and would require significant additional work to move forward. Conceptual Projects represent potential future projects that could conceptually provide a benefit to the Vina Subbasin in the future, but that would need to be further developed.

Formatted: English (United States)

5.2.5.1 Extend Orchard Replacement

Under this project, various funding sources would incentivize local growers to increase the duration of their current fallowing practice between orchard removal and replanting by one growing season. The extra time would allow the soil to fallow and decrease the overall demand on groundwater and other water sources. Additionally, this program may also reduce the need for soil treatments such as fumigation and expand recycling options for the previous orchard. This project has the potential to fallow between 1,600 and 3,200 acres per year in North and South Vina. As envisioned, this project would be dependent on the availability of financial incentives and willingness of landowners to participate. Participation in the program would be voluntary.

Formatted: English (United States)

Project Summary	
Identified project proponent(s) and other potential participating entities:	Vina GSA, local landowners, other entities to be determined
Project Type:	Conservation
Estimated Groundwater Offset and/or Recharge:	4,000 – 8,000 acre-feet/year

Measurable Objective Expected to Benefit: Groundwater Levels

Project Status: This project is still in the early conceptual planning stages.

Required Permitting and Regulatory Process: None

Timetable for Initiation and Completion: To be determined. The timetable would be dependent on the availability of financial incentives and willingness of farmers to participate.

Formatted: English (United States)

Expected Benefits and Evaluation: By increasing the time between orchard removal and replanting, the soil may be allowed to fallow, restoring its fertility, and decreasing its water demand. This would decrease the overall use of groundwater in the Subbasin.

How Project Will Be Accomplished/Evaluation of Water Source: This project is a demand-side conservation project. No additional water source will be utilized for this project.

Formatted: English (United States)

Legal Authority: The project would be under the Vina GSA, local landowners and other entities to be determined.

Estimated Costs and Plans to Meet Costs: To be determined; funding via Proposition 1, Proposition 68, USDA, National Resource Conservation Service (NRCS)

Circumstances for Implementation: This project is a Conceptual project in the early conceptual planning stages and would require significant additional work to move forward.

Trigger for Implementation and Termination: None

Process for Determining Conditions Requiring the Project to Occur: The project proponents are in the process of determining the feasibility of this project including the possibility of securing the necessary finances to move forward.

5.2.5.2 Recharge from the Miocene Canal

During the 2018 Camp Fire, the upper Miocene Canal, which is operated by PG&E, was destroyed. Under this project, the upper canal would be rebuilt and re-watered. Additionally, PG&E would sell the Miocene Canal system by mid-2022 and modify the system to increase water supply reliability. One such modification might include establishing recharge ponds along the west side of the Miocene Canal in areas conductive to recharging the Vina South Subbasin.

Project Summary	
Identified project proponent(s) and other potential participating entities:	Vina GSA PG&E, Butte County, local landowners, other entities to be determined
Project Type:	Direct Recharge
Estimated Groundwater Offset and/or Recharge:	2,000 acre-feet/year based on 10,000 acre-feet available for recharge (assuming a 20% efficiency)

Measurable Objective Expected to Benefit: Groundwater Levels

Project Status: This project is still in the early conceptual planning stages.

Required Permitting and Regulatory Process: CEQA, SWRCB Water Rights Permit

Timetable for Initiation and Completion: After 2025

Expected Benefits and Evaluation: Rebuilding the upper Miocene Canal and making improvements to the overall system would increase recharge into the Vina South Subbasin and surface water availability for other uses.

How Project Will Be Accomplished/Evaluation of Water Source: This project would be initiated by PG&E, who would obtain water from the same water sources that currently supply the Miocene Canal.

Legal Authority: The project would be under the authority of Vina GSA and PG&E.

Estimated Costs and Plans to Meet Costs: To be determined, funding via state and federal grants

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Circumstances for Implementation: This project is a Conceptual Project, meaning it is in the early conceptual planning stages and would require significant additional work to move forward. Conceptual Projects represent potential future projects that could conceptually provide a benefit to the Subbasin in the future. As scenarios change, Conceptual Projects can come online to bring additional resources for adaptive management. The project proponents are in the process of determining the feasibility of this project including the possibility of securing the necessary finances to move forward.

Trigger for Implementation and Termination: None

Process for Determining Conditions Requiring the Project to Occur: Implementation of Conceptual Projects will be based on long-term management or changing needs of the GSA or Subbasin.

5.2.6 Notification Process

The GSAs will continue to conduct public outreach and will be responsible for notification of the projects. Regular updates will be provided to the GSA Boards and presented on the websites ~~www.vinagsa.org~~www.vinagsa.org and rockcreekreclamation.com as projects are implemented. In addition, updates will be documented per Annual Reporting requirements on the DWR PMA Module.[14] Outreach is likely to include public notices, meetings, website, social media, and email lists.

5.3 Management Actions

To achieve sustainable groundwater management, management actions can be implemented to focus on reduction of groundwater demand. The management actions can include increased data collection, education and outreach, regulatory policies, incentive programs, and enforcement actions.

An evaluation of potential GSA actions (projects or management actions) will occur on an annual basis relying on information reported in the annual report. The following sections will present a suite of management action options that the GSA may consider during GSP implementation. The schedule to implement the management actions is likely to vary depending upon Vina Subbasin conditions and the expected benefits of PMAs may also vary year to year.

5.3.1 General Plan Updates

The GSA(s) will cooperate with Butte County and the City of Chico with updates to their General Plans. The GSA(s) will participate and collaborate as appropriate with land use agencies during general plan updates to ensure that land use planning recognizes the Vina GSP. The GSAs will collaborate to ensure that the important components of the GSP are addressed in the general plans. The recognition and use of groundwater sustainability practices would remain consistent.

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

[14] DWR PMA Module: https://sgma.water.ca.gov/portal/projects/submitted

5.3.2 Domestic Well Mitigation

If an increasing number of domestic groundwater wells go dry in the Vina Subbasin, the GSAs could propose a series of steps to help mitigate this issue. The following steps are proposed under this management action:

1. Establish a voluntary registry of domestic wells.
2. Compile domestic well logs, screen depths, and locations.
3. Secure financial resources to improve, deepen or replace select domestic wells.
4. Provide emergency response to homes with dry domestic wells, including supplying bottled water and potable water for sanitation. Priority would be given to disadvantaged communities dependent on groundwater as a drinking water resource.

Creating a registry of domestic wells in the region, with information on well location and screen depths, would help the GSAs compile important data into a centralized location. This would allow the GSAs to determine which wells need to be updated to the current standards and which may need to be deepened, as well as to help them prioritize certain communities for emergency response.

Formatted: English (United States)

5.3.3 Well Permitting Ordinance

According to the current Butte County code, domestic wells are required to be screened below the groundwater levels measured during the 1989 to 1994 drought. This management action proposes that the GSAs will work with Butte County to amend the well ordinance as it relates to small and large diameter wells to take into consideration the HCM based on best available data (i.e. AES data), adopted SMC, historical groundwater conditions, and impacts of new wells on existing wells. The code could be amended with requirements for well screens to account for MT established for the Vina Subbasin. This would improve water supply reliability of future agricultural and domestic wells.

Formatted: English (United States)

5.3.4 Landscape Ordinance

Butte County and/or the City of Chico would enact an ordinance requiring new residential, commercial, and industrial development to use drought-resistant species for landscaping and to limit the size of grass lawns that require regular irrigation. The ordinance would focus efforts and money on reducing the amount of water used for landscape irrigation and swimming pools while promoting xeriscaping. The reduction in irrigation for landscaping and swimming pools would allow groundwater use for other purposes in the Vina Subbasin.

5.3.5 Prohibition of Groundwater Use for Ski (Recreational) Lakes

In the Vina Subbasin, there are several ski lakes that are currently supplied with groundwater. The Vina GSA would encourage Butte County to amend the zoning ordinance to prohibit the use of groundwater for future ski lakes.

5.3.6 Expansion of Water Purveyors' Service Area

The Vina GSA would encourage the expansion of water purveyors' service area to areas across the Vina Subbasin that are reliant on private groundwater wells. This would require action by

individual water purveyors, support of residents, and governmental approval. By expanding the service area of water purveyors, areas that rely solely on groundwater would have another source of water and would reduce groundwater extraction.

5.3.7 Groundwater Allocation

SGMA requires that GSPs describe the projects and management actions to be implemented as part of bringing the Vina Subbasin into sustainability. As a last resort, in the event that the proposed projects fail to achieve IMs and the Vina Subbasin is projected to not be able to achieve sustainability goals by 2042, the GSAs may need to consider implementation of groundwater allocations to manage groundwater demand. If groundwater levels persistently reach Local Management Levels in two contiguous RMS wells and technical information indicates an allocation will remedy the LML, staff may bring forward groundwater allocation for consideration by the Boards. The implementation of this management action would be based on an evaluation by the Joint Management Committee. The consideration of groundwater allocation would be based on the groundwater budgets and updated monitoring data throughout the Vina Subbasin, as presented in annual reports.

Groundwater allocation management actions could include, but are not limited to, targeted maximum extraction levels to address specific MT violations or Vina Subbasin-wide adjustments to extractions to address overall chronic lowering of groundwater levels. Should the GSAs determine that groundwater allocation management actions are necessary, the GSAs will consider such management actions through a public process ultimately decided by the GSA Boards.

5.4 Data Collection

5.4.1 County Contour Mapping

As part of the efforts to collect the information necessary to fill the information needs and data gaps identified in Section 3, this project proposes to expand the existing monitoring program to include Butte, Glenn, Colusa, and Tehama counties and conduct these groundwater elevation surveys in the spring, summer, and fall. The monitoring program would gather data used to produce groundwater contours and estimates of lateral and vertical flow direction and volume. Producing these data for the four counties will help to identify interbasin flow patterns and influences on surface water flows and replenishment locations, thereby improving coordination between counties and water management decision-making.

Routine water table monitoring programs will track overall water table trends in the region and provide important, up-to-date data for making decisions on water management. Establishing these programs amongst the four counties will aid in the exchange of data and improve regional coordination on various water projects. The expanded water monitoring programs will be established by the Vina and RCRD GSAs, with assistance from the four counties.

5.4.2 Update the Butte Basin Groundwater Model

The existing BBGM covers the Vina, Butte, and Wyandotte Creek Subbasins. This project will help fill the identified data gaps by 1) updating the BBGM with newly acquired data; and 2) using the updated version of the model to run simulations to support evaluation of projects or

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

Formatted: English (United States)

GSP updates as appropriate and warranted. Some of the new data to be incorporated is the AEM data and data on the different hydraulic conductivities of each layer of the aquifer. The AEM data will be used, among other things, to adjust the various surfaces in the model to better represent the aquifer's hydrogeologic layers.

Once the model has been updated with the new data, it will be better suited for running simulations of different water or land use management scenarios as well as predictions for climate and precipitation fluctuations. Lateral and vertical connectivity between aquifer layers and connections to surface water features will be more accurate and help identify areas of the basin where groundwater recharge may be needed. Overall, this will help shape management actions by focusing efforts on those particular areas. Ongoing updates to the model will emphasize the importance of accurate and up-to-date data and help continue monitoring efforts such as measuring water levels and stream flows. It is expected that at least two updates to the model will be prepared as the GSP is implemented and additional data is collected.

Formatted: English (United States)

An updated groundwater model is vital for running accurate simulations that may be used to make important decisions regarding groundwater allocation, pumping, recharge, and other activities. The model should contain the most up-to-date data to represent the basin realistically and accurately.

Formatted: English (United States)

5.4.3 Community Monitoring Program

As discussed in Section 4.10, the MT for groundwater levels is based on the depths of domestic wells. The dataset used for this assessment is limited and likely includes wells no longer in use or poorly maintained wells. To resolve this data gap, the GSAs will conduct surveys of domestic wells within the Vina Subbasin to assess if the wells are still active and collect the well construction details. As domestic well construction information may be limited, selected wells may be video logged to obtain additional information.

Formatted: English (United States)

The GSAs will also maintain a record of verifiable domestic wells that go dry during the implementation period that will include depth of these wells, screen intervals, and available maintenance records. These data will be used to modify the MO and MT over the implementation period, as appropriate.

Formatted: English (United States)

5.4.4 Interconnected Surface Water/Associated Impacts on Groundwater Dependent Ecosystems

Also discussed in Section 4.10 and in Section 3.8 is the lack of sufficient data to analyze the interaction of streams and groundwater pumping within the primary aquifer system. Additional wells and other monitoring networks will be installed, as appropriate, following the framework discussed in Section 3.8.

Formatted: English (United States)

5.5 Adaptive Management Strategies

The GSAs will be requesting annual reports from the project proponents to evaluate progress on implementation. If the projects are not progressing or if monitoring efforts demonstrate that those projects are not achieving their targets, the GSAs will evaluate the need for additional or modified projects and to begin implementation of management actions. See section 3.3.4 for a

Formatted: English (United States)

description of activities that will occur if a Local Management Level is reached in a Groundwater Level RMS well.

Formatted: English (United States)

5.6 Potential Available Funding Mechanisms

As listed above in the individual project descriptions, several funding mechanisms have been identified to help with the planning and implementation of the GSP projects. The following is an abbreviated list of some of the funding mechanisms proposed:

Formatted: English (United States)

Project Type	Funding Type	Program	Dates
IRWM (projects included in an adopted IRWM Plan)	Implementation Grant	Proposition 1, Water Quality, Supply, and Infrastructure Improvement Act of 2014	Round 2 solicitation expected in late 2021
Recharge Projects	Planning and construction grants	Proposition 68, California Drought, Water, Parks, Climate, Coastal Protection, and Outdoor Access for All Act of 2018	Round 2 solicitation to be released early 2022
Wastewater treatment for underrepresented communities projects	Planning and construction grants	Small Community Grant Fund	Applications accepted continuously
Public water systems improvement	Planning and construction grants	Drinking water grants	Applications accepted continuously
Land Conservation	USDA Farm Service Agency	Conservation Reserve Program	Applications accepted continuously

6. PLAN IMPLEMENTATION

SGMA requires the GSAs to partner with groundwater users to develop and implement GSPs to achieve groundwater sustainability. SGMA requires the Vina Subbasin to be sustainable by 2042. The GSP includes provisions to evaluate current conditions in the Vina Subbasin (Section 2), establish SMC (Section 3), gather and analyze groundwater data (Section 4), and report findings. The provisions in the GSP will be evaluated every five years and updated as necessary. The Vina Subbasin GSAs are required to submit the GSP to DWR by January 31, 2022. DWR will evaluate the GSP within 24 months of submittal. Upon submittal of this GSP to DWR, GSP implementation will begin in the Vina Subbasin. The GSAs will continue their efforts with public engagement and to secure funding to monitor and manage groundwater resources. This section presents the manner in which the GSAs will execute the GSP consistent with the requirements in CCR Title 23 § 354.6(e).

Formatted: English (United States)

The GSP includes provisions for:

- Gathering data at RMS locations
- Evaluation of SMCs
- Report of findings and analysis
- Implementation of PMAs

Each of these provisions will require funding and schedule coordination to help achieve Vina Subbasin sustainability goals. The following sections describe the funding mechanisms and timetable for the GSP implementation.

6.1 Estimate of Groundwater Sustainability Plan Implementation Costs

Where feasible, the GSAs will use existing funding and/or programs for use in the GSP implementation. The GSAs, member agencies, and water purveyors will coordinate to implement the actions outlined in this GSP. The GSAs will fund the implementation of the GSP where other sources are not available. The cost of implementation of the GSP by activity is presented below.

Formatted: English (United States)

6.1.1 Administrative Costs

These include the cost of annually operating the GSAs, including staff expenses, audit, outreach, legal and other administrative costs. This does not include agency-specific project implementation costs. Costs are estimated to be in the range of approximately $200,000 to $400,000 annually.

Formatted: English (United States)

Table 6-1: Estimated Administrative Costs

GSP Implementation	Estimated Annual Costs
Public Outreach	$25,000
Staff	$150,00
Legal	$30,000
Other	$20,000
Total Estimate	**$225,000**

Public outreach efforts will continue during GSP implementation with a focus on progress updates particularly regarding the PMAs. Staff time will likely be in-kind contribution from member agencies of the Vina and RCRD GSAs. Outside counsel will continue to provide legal advice to the GSAs Boards. The budget also includes other miscellaneous costs such as printing and insurance.

Formatted: English (United States)

6.1.2 Monitoring

Monitoring for compliance with SGMA regulations will include semi-annual collection of groundwater levels at 17 RMS locations and annual collection of groundwater quality at 8 RMS locations. Monitoring activity costs will include labor (field data collection, surveying, laboratory analysis, project management) and equipment (vehicles, meters, pumps, field tools/supplies).

Table 6-2: Monitoring Activities and Estimated Cost

Monitoring Activity	Frequency	Estimated Annual Cost
Groundwater Levels	Semi-Annual, 2 events	$20,000
Groundwater Quality	Annual, one event	$8,000

Some RMS locations include wells that are monitored and funded under existing programs.

Formatted: English (United States)

6.1.3 Data Analysis

The data gathered from the ongoing monitoring program will be analyzed to assess trends for determination of undesirable results. Analysis of the data may lead to modifications in the RMS network, the hydrogeological conceptual model, and the priority of PMAs. Data gaps that arise from analysis may require installation of new RMS locations.

Table 6-3: Data Analysis Activities and Estimated Cost

Data Analysis Activity	Frequency	Estimated Annual Cost
Data Management System	Annual	$5,000
Review of Groundwater Data	Annual	$5,000

6.1.4 Reporting and Evaluation

Annual reports are required after GSP adoption to provide updates to general GSP information, basin conditions, and plan implementation progress. Section 6.5 discusses the annual reporting

Formatted: English (United States)

plan in more detail. GSAs are required to conduct an evaluation of the GSP and prepare a report every five years or whenever the GSP is amended. Section 6.6 discusses the evaluation report in more detail.

Table 6-4: Reporting and Evaluation Activities and Estimated Cost

Reporting Activity	Frequency	Estimated Cost
Annual Report	Annual	$30,000
5-year Evaluation Report	5 Years	$100,000

6.1.5 Data Collection

A discussion of the data collection needed to address identified data gaps is presented in Section 5.4, and the estimated costs are presented below.

Table 6-5: Estimated Costs for Implementing Data Gaps

Data Gaps	Estimated Costs
Interconnected Stream Monitoring	$100,000 – $250,000
Contour Mapping	$20,000 - $50,000
Community Monitoring	$50,000 - $150,000
Butte Basin Model Update 1	$50,000 - $100,000
Butte Basin Model Update 2	$50,000 - $100,000

6.1.6 Project and Management Actions

The PMAs and anticipated costs are presented in Section 5. The PMAs with a planned initiation date in or before 2032 are presented below.

Formatted: English (United States)

Table 6-6: Estimated Project Costs

Project Name	Capital Costs	Expected Groundwater Demand Reduction (AFY)
5.2.3.1 Agricultural Irrigation Efficiency	TBD **	Up to 4,000
5.2.3.2 Residential Conservation	TBD	100
5.2.3.3 Scoping for Flood MAR/Surface Water Supply and Recharge	TBD	NA
5.2.3.4 Community Water Education Initiative	Component 1: $50-100K annually Component 2: $10,000-$200,000 annually Component 3: $10,000-$25,000 annually	NA
5.2.3.5 Fuel Management for Watershed Health	TBD	TBD
5.2.4.1 Paradise Irrigation District Intertie	TBD	5,000
5.2.4.2 Agricultural Surface Water Supplies	TBD	2,000 – 3,000
5.2.4.3 Streamflow Augmentation	TBD	1,000 – 5,000
5.2.4.4 Community Monitoring Program	TBD	NA
5.2.4.5 Recycled Wastewater	TBD	5,000
5.2.4.6 Rangeland Management	TBD	TBD
5.2.4.7 Removal of Invasive Species	TBD	TBD
5.2.4.8 Surface Water Supply and Recharge	TBD	1,000 per project
5.2.5.1 Extend Orchard Redevelopment	TBD	4,000 – 8,000
5.2.5.2 Recharge from the Miocene Canal	TBD	2,000

Note:
**To be Determined (TBD)

6.2 Identify Funding Alternatives

The GSAs will seek to capitalize on existing funding and programs that overlap with GSP requirements. For example, Butte County, DWR, and other entities currently fund groundwater data collection programs at locations within the Vina Subbasin. The GSAs will ensure that the existing programs meet the technical requirements of the monitoring and reporting as outlined in the GSP.

Formatted: English (United States)

In cases where no funding or programs are established, the GSAs will be responsible for securing funding for the GSP implementation. The GSAs will coordinate funding with their respective constituent members within the Vina Subbasin. GSAs may fund the GSP through a cost-sharing collaboration to be determined after adoption of GSP.

Formatted: English (United States)

Funding is anticipated to be met from one or a combination of the following sources: direct contributions from the GSAs constituent members; state and federal grant funding, and taxes or assessments levied on landowners and groundwater users in accordance with local and state law.

Formatted: English (United States)

The GSAs are evaluating a variety of funding mechanisms, including Proposition 218 or Proposition 26, to support ongoing operational costs and to fund agency operations. These costs include retaining consulting firms and legal counsel to provide oversight and assist with SGMA compliance. Expenses consist of administrative support, GSP development, and GSP implementation.

Formatted: English (United States)

6.3 Schedule for Implementation

Figure 6-1 presents the estimated schedule for GSP implementation for the Vina Subbasin GSP starting in 2022 through 2042. Project schedules may shift or be altered by the GSAs Board of Directors based on funding opportunities and circumstances. Some activities such as monitoring, data analysis, and reporting will begin upon submittal of the GSP and will continue through GSP implementation. Other activities such as the PMAs will be completed by priority as funding and resources become available.

6.4 Data Management Systems

In development of this GSP, the GSAs developed a groundwater model that was calibrated to estimate future scenarios. The DMS plans to build on existing data inputs in the groundwater model and develop a more formalized approach to collecting and capturing data. As stated in Section 4, Monitoring Network, future data will be gathered to develop annual reports, as well as provide necessary information for future and ongoing updates to the groundwater model at five-year intervals upon GSP implementation. The DMS that will be used is a geographical relational database that will include information on water levels, land elevation measurements, and water quality testing. The DMS will allow the GSAs to share data and store the necessary information for annual reporting.

Formatted: English (United States)

The DMS will be on local servers and data will be transmitted annually to form a single repository for data analysis for the Vina Subbasin's groundwater, as well as to allow for preparation of annual reports. GSA representatives will have access to data and will be able to ask for a copy of the regional DMS. The DMS currently includes the necessary elements required by the regulations, including:

- Well location and construction information for the representative monitoring points (where available)
- Water level readings and hydrographs including water year type
- Land based measurements
- Water quality testing results
- Estimate of groundwater storage change, including map and tables of estimation
- Graph with Water Year type, Groundwater Use, Annual Cumulative Storage Change

ID	Task Name	Start	Finish
1	**GSP Implementation**	**1/31/22**	**4/1/42**
2	GSP Submittal	1/31/22	1/31/22
3	Public Outreach	2/1/22	4/1/42
4	Monitoring	2/1/22	4/1/42
5	Develop Intial DMS	2/1/22	2/1/23
6	**Annual Reports**	**4/1/22**	**4/1/42**
28	Interbasin Coordination	4/1/22	4/1/42
29	**Five Year Updates**	**4/1/27**	**4/1/42**
30	2027 Update	4/1/27	4/1/27
31	2032 Update	4/1/32	4/1/32
32	2037 Update	4/1/37	4/1/37
33	2042 Update	4/1/42	4/1/42
34	**Data Gaps**		
35	Interconnected Stream Monitoring	2/1/22	4/1/42
36	Contour Mapping	2/1/22	5/5/32
37	Community Monitoring	2/1/22	4/1/27
38	Update Butte Basin Model 1	1/1/23	1/3/27
39	Update Butte Basin Model 2	1/1/27	1/1/32
40	**Project Implementation**	**1/1/23**	**12/30/40**
41	Project 1: Ag Irrigation Efficiency	1/1/23	12/31/27
42	Project 2: Residential Conservation	1/1/23	12/31/25
43	Project 3: Scoping for Flood MAR	1/1/23	12/31/32
44	Project 4: Community Water Education	1/1/23	12/30/32
45	Project 5: Fuels Management for Watershed Health	1/1/25	12/30/40
46	**Adaptive Management**	**2/1/22**	**2/2/42**
47	Evaluate Potential Projects	2/1/22	2/2/42
48	Evaluate New Projects	2/1/22	2/2/42
49	Evaluate Management Actions	2/1/22	2/2/42

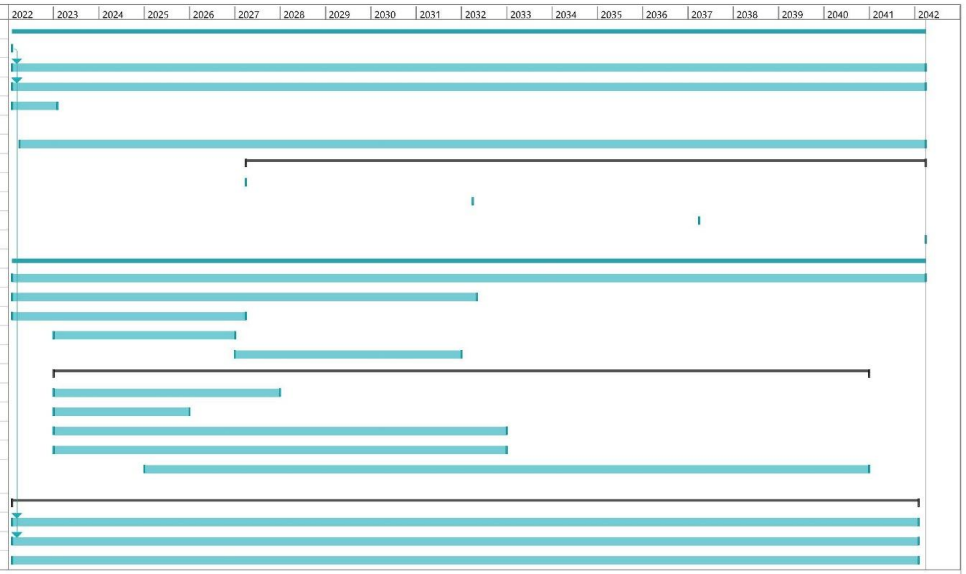


Figure 6-1
Vina Subbasin
Implementation Schedule

Summary
Project Summary
Manual Task
Manual Summary Rollup
Start-only
Finish-only

Figure 6-1 ~~placeholder page~~**: Implementation Schedule**

Formatted: Font: Bold

Formatted: Font: Bold

Formatted: Normal, Centered

Reporting generated from data from the GSAs will include, but is not limited to:

- Seasonal groundwater elevation contours
- Estimated groundwater extraction by category
- Total water uses by source

Additional items may be added to the DMS in the future as required. Data will be entered into the DMS. The majority of the data will then be aggregated to the entity that is responsible for the regional DMS and summarized for reporting to DWR. Groundwater contours will be prepared outside of the DMS because of the need to evaluate the integrity of the data collected and generate a static contour set that has been reviewed and will not change once approved. Groundwater storage calculations will be calculated in accordance with the method described in Section 2, outside of the DMS. Results are uploaded to the DMS for annual reporting and trend monitoring. Since most of the pumping in the Vina Subbasin is not currently measured, the groundwater pumping estimates are also calculated outside of the DMS using the methods developed by GSAs and uploaded to the DMS for annual reporting and trend analysis. The GSAs may choose to have their own separate system for additional analysis.

Formatted: English (United States)

The one-time cost of expanding the existing data systems is estimated between $50,000 to $200,000, as the system is still being evaluated. The Board has indicated a desire to make the data transparent and available to the public while respecting the privacy of individual landowners.

Formatted: English (United States)

6.5 Annual Reporting

Annual reports will be submitted by April 1 for the prior year's activities. The report will include a general update in the form of an executive summary with an accompanying map of the Vina Subbasin. The body of the report will include a detailed discussion and graphical representation of the following:

Formatted: English (United States)

- Groundwater elevation data, including contour maps at seasonal high and low conditions and hydrographs using water year type and historical data from at least 2015
- Groundwater extraction data divided into volume by water usage sectors with accompanying map, including a description of the methodology and accuracy of the groundwater extraction estimation
- Surface water volume used or available for use for groundwater recharge or in-lieu use, including a description of the water sources
- Total water volume use divided into water use sector and water source type, including a description of the methodology and accuracy of the water use estimation
- Changes in groundwater storage with accompanying map, including a graph with water year type, groundwater use, annual change in groundwater storage, and cumulative change in groundwater storage using historical data from at least 2015

The annual report will also include a discussion and update on the plan implementation, including the status of IMs and the execution of PMAs

6.6 Evaluation Report

The GSAs will evaluate the GSP and provide an evaluation report every five years or whenever the GSP is amended for submittal to DWR.

The assessment will include a detailed discussion of the following:

- Significant new information and whether the information warrants changes to the basin setting, MO, MT, and SIs, including completed or planned GSP amendments
- Current groundwater conditions relating to each MO, MT, and IMs
- Implementation of any project and management actions and the resulting effects on groundwater conditions
- Assessment of the basin setting, MAs, undesirable results, MO, and MT
- Evaluation of the basin setting and overdraft conditions to include changes in water use, along with overdraft mitigation measures (if applicable)
- Assessment of the monitoring network with analysis of data collected to date, including identification of data gaps and suggested improvements of the network
- Program to address data gaps, including timing and incorporation of data into the GSP, with prioritization on the installation of new data collection sites and analysis of new data based on the needs of the basin
- Relevant actions taken by the GSAs, including a summary of regulations, ordinances, legal enforcement or action related to the implementation of the GSP and sustainability goals

Summary of coordination by GSAs within the basin or within hydrogeologically connected basins and land use agencies.

Formatted: English (United States)

6.7 Inter-basin Coordination

The Vina Subbasin understands that in the Sacramento Valley inter-basin coordination is critical due to the interconnectedness of groundwater, as each Vina Subbasin prepares and implements its GSP. As such, the Vina Subbasin participated with the surrounding 10 subbasins (Antelope, Bowman, Butte, Colusa, Corning, Los Molinos, Red Bluff, Sutter, Wyandotte Creek, and Yolo). Inter-basin coordination efforts were focused on establishing a foundation and guidelines for sustained inter-basin coordination by identifying priorities and resources. The main objective of the coordination efforts is to identify any significant discrepancies in the GSPs, understand why those differences exist, and evaluate to the extent they need to be reconciled.

Formatted: English (United States)

As part of the coordination efforts, the Northern Sacramento Valley Inter-basin Coordination Report was prepared (Appendix 6-A). The report outlined a framework for inter-basin

Formatted: English (United States)

coordination for sustainable groundwater management in the Northern Sacramento Valley. It described a menu of options for ongoing communication and collaboration between and among groundwater subbasins over the 20-year implementation of SGMA. The framework is intended to be used by the GSAs to support GSP development and implementation.

The Vina Subbasin intends to coordinate in the following ways with its neighboring subbasins and with subbasins in the North Sacramento River Corridor group (Antelope, Los Molinos, Red Bluff, Corning, Butte, and Colusa Subbasins):

Formatted: English (United States)

1. Information Sharing

The Vina Subbasin will work with the GSA's staff of neighboring subbasins to identify lines of communication and methods for information sharing that would be agreed upon by the respective GSA Boards. This will continue throughout GSP implementation and may include:

Formatted: English (United States)

1. Informing each other on changing conditions (i.e., surface water cutbacks, land use changes, policy changes that inform groundwater management)
2. Sharing annual reports and interim progress reports
3. Sharing data and technical information and work towards building shared data across and/or along basin boundaries (e.g., monitoring data, water budgets, modeling inputs and outputs, and Groundwater Dependent Ecosystems)

2. Conducting Joint Analysis and Evaluation of GSPs

In the near term, the Vina Subbasin intends to pursue grant funding and collaboratively work with subbasins in the North Sac River Corridor group to:

1. Contract with a consultant to conduct this work
2. Evaluate and compare contents of GSPs with a focus on establishing a common understanding of basin conditions at boundaries
3. Identify significant differences, uncertainties, and potential issues of concern related to groundwater interaction at the boundaries
4. Engage in analysis and evaluation of SMCs between GSPs to assess impacts and identify significant differences and possible impacts between subbasins that could potentially lead to undesirable results

The North Sac River Corridor is the appropriate scale of coordination for these activities due to the shared boundary of the Sacramento River, shared data gaps, and the interconnectedness of the subbasins.

Formatted: English (United States)

3. Coordination on mutually beneficial activities

The Vina Subbasin will work collaboratively with North Sac River Corridor Subbasins to identify items in our GSPs that are ripe for a coordinated project and pursuit of funding such as Projects and Management Actions, Data Gaps (new monitoring wells, stream gaging etc.).

Formatted: English (United States)

1. GSAs Boards will jointly identify projects/programs to coordinate on.

2. Vina Subbasin will pursue partnerships to obtain grant funding to support a consultant to conduct this work.
3. Vina Subbasin will work collaboratively with entities such as the Northern California Water Association and others in their efforts to pursue funding and support local and state agency activities to identify and fill regional data gaps.

4. Coordinated Communication and Outreach

Staff of the Vina Subbasin GSAs will continue to participate in regional public engagement activities and efforts related to implementation of SGMA in the Northern Sacramento Valley. These efforts will include GSA Board members and will foster transparency of communications.

Formatted: English (United States)

This may include:

1. Coordinating and collaborating on regional-scale public engagement and communication strategies that promote awareness on groundwater sustainability, enhancing public trust, and maintaining institutional knowledge
2. Maintaining a list of GSP/subbasin staff contacts and websites

5. Issue Resolution Process

Vina Subbasin will pursue development of an issue-resolution process with neighboring subbasins in the North Sac River Corridor group.

Formatted: English (United States)

7. REFERENCES

AECOM. 2020. February 2020 Groundwater Monitoring Report, Chico Urban Area Nitrate Compliance Program. June.

Berkstresser, Jr., C.F. 1973. Base of fresh water in the Sacramento Valley and Sacramento-San Joaquin Delta, California. U.S. Geological Survey. Open File Report WRI 40. 73 pp.

Blake, M.C., D.S. Harwood, E.J. Helley, W.P. Irwin, A.S. Jayko, and D.L. Jones. 1999. Geologic Map of the Red Bluff 30' X 60' Quadrangle, California. U.S. Geological Survey Miscellaneous Investigations Series Map I-2542, scale 1:100000.

Brown and Caldwell. 2013. Lower Tuscan Aquifer Monitoring, Recharge, and Data Management Project. Final Report.

Brown and Caldwell. 2017. Stable Isotope Recharge Study. Final Report.

Butte County Department of Water and Resource Conservation. 2021. Model Documentation v 1.0. Butte Basin Groundwater Model. 30 November.

California Department of Water Resources (DWR). 1978. Evaluation of Ground Water Resources, Sacramento Valley. Prepared in cooperation with the U.S. Dept. of the Interior, U.S. Geological Survey. Sacramento CA: The Department. ix, 136 p.: [1] leaf of plates; ills.; maps (4-fold. in pocket); 28 cm. (Series title: Department of Water Resources. Bulletin 118-6.)

DWR. 1995. M & T Chico Ranch Groundwater Investigation, Phase II. Sacramento, California: The Department. Northern District Memorandum Report, 46 pp.

DWR. 2003. California's Groundwater. California Department of Water Resources Bulletin 118-Update 2003. 246 pp.

DWR. 2004. California's Groundwater Bulletin 118, Sacramento Valley Groundwater Basin, Vina Sub-basin. 27 February.

DWR. 2005. Butte County Groundwater Inventory Analysis: prepared by the California Department of Water Resources Northern Region Office, Division of Planning and Local Assistance. February.

DWR. 2014. Geology of the Northern Sacramento Valley: prepared by the California Department of Water Resources Northern Region Office, Groundwater and Geologic Investigations, updated September 2014.

DWR. 2016. Best Management Practices for the Sustainable Management of Groundwater, Monitoring Networks and Identification of Data Gaps. December.

DWR. 2018a. SGMA Groundwater Management. Retrieved from: https://water.ca.gov/Programs/Groundwater- Management/SGMA-Groundwater-Management

Formatted: English (United States)

DWR Sustainable Groundwater Management Program. 2018b. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer https://gis.water.ca.gov/app/NCDatasetViewer/.

DWR. 2018c. 2017 GPS Survey of the Sacramento Valley Subsidence Network Report.

DWR. 2019a. SGMA Data Viewer, https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#gwlevels.

DWR. 2019b. 2016 Statewide Land Use Mapping. https://data.cnra.ca.gov/dataset/statewide-crop-mapping.

DWR. 2020. Northern Sacramento Valley Dedicated Monitoring Well Groundwater Quality Assessment Report. Northern Region Office. January.

Davids, J., R. Bernal, C. Buck, K. Peterson. 2020. A Tale of Two Waters? Groundwater and Surface Water – An Interconnected Resource. Groundwater Resources Association of California, Northern Sacramento Branch. Webinar. 19 November.

Davids Engineering. 2016. Butte County Water Inventory and Analysis. Final Report.

Davids Engineering and West Yost. 2018. Hydrologic Conceptual Model Report, Colusa Subbasin. Prepared for County of Glenn and County of Colusa.

Garrison, L.E. 1962. "The Marysville (Sutter) Buttes, Sutter County, California." California Division of Mines and Geology Bulletin 181. p. 69-72.

Greene, T.J., and K. Hoover. 2015. Hydrostratigraphy and Pump-Test Analysis of the Lower Tuscan/Tehama Aquifer, Northern Sacramento Valley, CA: Chico, California, California State University, Center for Water and the Environment, 105 p.

Helley, E.J., and D.S. Harwood. 1985. "Geologic Map of the Late Cenozoic Deposits of the Sacramento Valley and Northern Sierran Foothills, California." U.S. Geological Survey Miscellaneous Field Studies Map MF-1790: 24 pp. 5 sheets, scale 1:62,500.

Ireland, R.L., J.F. Poland, and F.S. Riley. 1984. "Land Subsidence in the San Joaquin Valley, California, as of 1980." US Geol. Survey Professional Paper 437–I.

Kang, S., R. Knight, T. Greene, C. Buck, and G. Fogg. 2021. Exploring the model space of airborne electromagnetic data to delineate largescale structure and heterogeneity within an aquifer system. *Water Resources Research, 57*, e2021WR029699. https://doi.org/10.1029/2021WR029699

Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, and A. Lyons. 2018. Mapping Indicators of Groundwater dependent ecosystems in California.

LaHue, G.T., and B.A. Lindquist. 2019. The Magnitude and Variability of Lateral Seepage in California Rice Fields. *Journal of Hydrology*, 574, 202-210.

Formatted: English (United States)

Formatted: English (United States)

Lydon, P.A. 1968. "Geology and lahars of the Tuscan Formation, Northern California," in RR Coats, RL Hay, and CA Anderson, eds., Studies in volcanology, a memoir in honor of Howell Williams. Geological Society of America Memoir 116:441-475.

Marchand, D.E. and A. Allwardt. 1981. Late Cenozoic stratigraphic units, northeastern San Joaquin Valley, California. Washington: U.S. Government Printing Office. U.S. Geological Survey Bulletin 1470:170.

Olmsted, F.H. and G.H. Davis. 1961. Geologic features and ground-water storage capacity of the Sacramento Valley, California. Washington: U.S. Government Printing Office. U.S. Geological Survey Water- Supply Paper 1497. 241 pp.

Page, R.W. 1986. U.S. Geological Survey Professional Paper 1401-C, Geology of the Fresh Ground-Water Basin of the Central Valley, California with Texture Maps and Sections, Regional Aquifer System Analysis.

Rohde, M.M., S. Matsumoto, J. Howard, S. Liu, L. Riege, and E.J. Remson. 2018. Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans. The Nature Conservancy, San Francisco, California.

Russell, D.R. 1931. The Tehama formation of Northern California. University of California Library. Geology Ph.D. thesis. 133 pp.

Slade, Richard C. and Associates, LLC. 2000. Hydrogeologic Evaluation and Well Siting Feasibility Study, Del Oro Water Company, Butte County, California. 51 pp. October.

United States Department of Agriculture (USDA). 2020. CropScape - Cropland Data Layer, ~~https://nassgeodata.gmu.edu/CropScape/~~https://nassgeodata.gmu.edu/CropScape/.

Formatted: English (United States)

Formatted: English (United States)

APPENDIX 1-A

Preparation Checklist for Groundwater Sustainability Plan Submittal

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) in the GSP
Article 3. Technical and Reporting Standards				
352.2		Monitoring Protocols	• Monitoring protocols adopted by the GSA for data collection and management • Monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, inelastic surface subsidence for basins for which subsidence has been identified as a potential problem, and flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater extraction in the basin	4.7 4.7.1 4.7.2
Article 5. Plan Contents, Subarticle 1. Administrative Information				
354.4		General Information	• Executive Summary • List of references and technical studies	ES 7
354.6		Agency Information	• GSA mailing address • Organization and management structure • Contact information of Plan Manager • Legal authority of GSA • Estimate of implementation costs	1.1.3 1.1.4 1.1.4.1 1.1.4.2 6.1
354.8(a)	10727.2(a)(4)	Map(s)	• Area covered by GSP • Adjudicated areas, other agencies within the basin, and areas covered by an Alternative • Jurisdictional boundaries of federal or State land • Existing land use designations • Density of wells per square mile	1.1.4 1.2.1
354.8(b)		Description of the Plan Area	• Summary of jurisdictional areas and other features	1.2.1
354.8(c) 354.8(d) 354.8(e)	10727.2(g)	Water Resource Monitoring and Management Programs	• Description of water resources monitoring and management programs • Description of how the monitoring networks of those plans will be incorporated into the GSP • Description of how those plans may limit operational flexibility in the basin • Description of conjunctive use programs	1.3 1.4 1.3.5

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) in the GSP
354.8(f)	10727.2(g)	Land Use Elements or Topic Categories of Applicable General Plan	• Summary of general plans and other land use plans • Description of how implementation of the GSP may change water demands or affect achievement of sustainability and how the GSP addresses those effects • Description of how implementation of the GSP may affect the water supply assumptions of relevant land use plans • Summary of the process for permitting new or replacement wells in the basin • Information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management	1.3.1 1.3.2 1.3.3 1.3.4 1.3.5 1.3.6
354.8(g)	10727.4	Additional GSP Contents	**Description of Actions related to:** • Control of saline water intrusion • Wellhead protection • Migration of contaminated groundwater • Well abandonment and well destruction program • Replenishment of groundwater extractions • Conjunctive use and underground storage • Well construction policies • Addressing groundwater contamination cleanup, recharge, diversions to storage, conservation, water recycling, conveyance, and extraction projects • Efficient water management practices • Relationships with State and federal regulatory agencies • Review of land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity • Impacts on groundwater dependent ecosystems	1.3 1.4 1.5 2.2.7

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) in the GSP
354.10		Notice and Communication	• Description of beneficial uses and users • List of public meetings • GSP comments and responses • Decision-making process • Public engagement • Encouraging active involvement • Informing the public on GSP implementation progress	1.8.3 1.8.4 1.8.5 1.8.4.1 1.8.4.2 1.8.4.3 1.8.5
Article 5. Plan Contents, Subarticle 2. Basin Setting				
354.14		Hydrogeologic Conceptual Model	• Description of the Hydrogeologic Conceptual Model • Two scaled cross-sections • Map(s) of physical characteristics: topographic information, surficial geology, soil characteristics, surface water bodies, source and point of delivery for imported water supplies	2.1 2.1.6 2.1.2.1 2.1.2.2 2.1.2.3 2.1.3
354.14(c)(4)	10727.2(a)(5)	Map of Recharge Areas	• Map delineating existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas	2.1.2.4
	10727.2(d)(4)	Recharge Areas	• Description of how recharge areas identified in the plan substantially contribute to the replenishment of the basin	2.1.2.4
354.16	10727.2(a)(1) 10727.2(a)(2)	Current and Historical Groundwater Conditions	• Groundwater elevation data • Estimate of groundwater storage • Seawater intrusion conditions • Groundwater quality issues • Land subsidence conditions • Identification of interconnected surface water systems • Identification of groundwater-dependent ecosystems	2.2.2.1 2.2.2.3 2.2.3 2.2.4 2.2.5 2.2.6 2.2.7

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) in the GSP
354.18	10727.2(a)(3)	Water Budget Information	• Description of inflows, outflows, and change in storage • Quantification of overdraft • Estimate of sustainable yield • Quantification of current, historical, and projected water budgets	2.3.4 2.3.6 2.3.4.1 2.3.4.2 2.3.4.3
	10727.2(d)(5)	Surface Water Supply	• Description of surface water supply used or available for use for groundwater recharge or in-lieu use	2.3.4
354.20		Management Areas	• Reason for creation of each management area • Minimum thresholds and measurable objectives for each management area • Level of monitoring and analysis • Explanation of how management of management areas will not cause undesirable results outside the management area • Description of management areas	1.2.2 3.2.2 3.2.3 3.3.2 3.3.3 3.4.2 3.4.3 3.5.2 3.5.3 3.7.1 3.7.2 3.8.4 3.8.5 4.8 4.9
Article 5. Plan Contents, Subarticle 3. Sustainable Management Criteria				
354.24		Sustainability Goal	• Description of the sustainability goal	3.1
354.26		Undesirable Results	• Description of undesirable results • Cause of groundwater conditions that would lead to undesirable results • Criteria used to define undesirable results for each sustainability indicator • Potential effects of undesirable results on beneficial uses and users of groundwater	3.3.1 3.4.1 3.5.1 3.7.1 3.8.3

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) in the GSP
354.28	10727.2(d)(1) 10727.2(d)(2)	Minimum Thresholds	• Description of each minimum threshold and how they were established for each sustainability indicator • Relationship for each sustainability indicator • Description of how selection of the minimum threshold may affect beneficial uses and users of groundwater • Standards related to sustainability indicators	3.2.1 3.2.2 3.3.2 3.4.2 3.5.2 3.7.1 3.8.4
			• How each minimum threshold will be quantitatively measured	4.7 4.8 4.9
354.30	10727.2(b)(1) 10727.2(b)(2) 10727.2(d)(1) 10727.2(d)(2)	Measurable Objectives	• Description of establishment of the measurable objectives for each sustainability indicator • Description of how a reasonable margin of safety was established for each measurable objective • Description of a reasonable path to achieve and maintain the sustainability goal, including a description of interim milestones	3.2.3 3.3.3 3.4.3 3.5.3 3.7.2 3.8.5
Article 5. Plan Contents, Subarticle 4. Monitoring Networks				
354.34	10727.2(d)(1) 10727.2(d)(2) 10727.2(e) 10727.2(f)	Monitoring Networks	• Description of monitoring network • Description of monitoring network objectives • Description of how the monitoring network is designed to: demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features; estimate the change in annual groundwater in storage; monitor seawater intrusion; determine groundwater quality trends; identify the rate and extent of land subsidence; and calculate depletions of surface water caused by groundwater extractions • Description of how the monitoring network provides adequate coverage of Sustainability Indicators • Density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends • Scientific rational (or reason) for site selection • Consistency with data and reporting standards	4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) in the GSP
			• Corresponding sustainability indicator, minimum threshold, measurable objective, and interim milestone • Location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used • Description of technical standards, data collection methods, and other procedures or protocols to ensure comparable data and methodologies	
354.36		Representative Monitoring	• Description of representative sites • Demonstration of adequacy of using groundwater elevations as proxy for other sustainability indicators • Adequate evidence demonstrating site reflects general conditions in the area	4.9
354.38		Assessment and Improvement of Monitoring Network	• Review and evaluation of the monitoring network • Identification and description of data gaps • Description of steps to fill data gaps • Description of monitoring frequency and density of sites	4.10
Article 5. Plan Contents, Subarticle 5. Projects and Management Actions				
354.44		Projects and Management Actions	• Description of projects and management actions that will help achieve the basin's sustainability goal • Measurable objective that is expected to benefit from each project and management action • Circumstances for implementation • Public noticing • Permitting and regulatory process • Time-table for initiation and completion, and the accrual of expected benefits • Expected benefits and how they will be evaluated • How the project or management action will be accomplished. If the projects or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included. • Legal authority required	5 6

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) in the GSP
			• Estimated costs and plans to meet those costs • Management of groundwater extractions and recharge	
354.44(b)(2)	10727.2(d)(3)		• Overdraft mitigation projects and management actions	5 5.3
Article 8. Interagency Agreements				
357.4	10727.6	Coordination Agreements – Shall be submitted to the Department together with the GSPs for the basin and, if approved, shall become part of the GSP for each participating Agency.	**Coordination Agreements shall describe the following:** • A point of contact • Responsibilities of each Agency • Procedures for the timely exchange of information between Agencies • Procedures for resolving conflicts between Agencies • How the Agencies have used the same data and methodologies to coordinate GSPs • How the GSPs implemented together satisfy the requirements of SGMA • Process for submitting all Plans, Plan amendments, supporting information, all monitoring data and other pertinent information, along with annual reports and periodic evaluations • A coordinated data management system for the basin • Coordination agreements shall identify adjudicated areas within the basin, and any local agencies that have adopted an Alternative that has been accepted by the Department	NA

Note:

(a) The California Water Code and regulation sections, GSP requirements, and requirement descriptions listed in this table were taken verbatim from the California Department of Water Resources Guidance Document for the Sustainable Management of Groundwater: Preparation Checklist for GSP Submittal (December 2016).

APPENDIX 1-B
Cooperation Agreement and Notice of Intent

Jan 0 2 2020

MEMORANDUM OF UNDERSTANDING BETWEEN THE VINA GROUNDWATER SUSTAINABILTY AGENCY AND BUTTE COLLEGE RELATED TO THE SUSTAINABLE GROUNDWATER MANAGEMENT ACT

THIS MEMORANDUM OF UNDERSTANDING (MOU) is made and entered into between the Vina Groundwater Sustainability Agency and Butte College, each a "Party" and collectively the "Parties". The MOU becomes effective on the date of the last signature of the Parties.

WHEREAS, on January 1, 2015, the Sustainable Groundwater Management Act ("SGMA") went into effect; and

WHEREAS, the purpose of SGMA is to create a comprehensive management system in the State of California by creating a structure to manage groundwater at the local level, while providing authority to the State to oversee and regulate, if necessary, the local groundwater management system; and

WHEREAS, SGMA empowers local agencies to adopt groundwater sustainability plans that are tailored to the resources and needs of their communities to provide a buffer against drought and contribute to reliable water supply for the future; and

WHEREAS, Water Code Section 10723.6 authorizes a combination of local agencies overlying a groundwater basin to elect to become a Groundwater Sustainability Agency ("GSA") by using a memorandum of agreement or other agreement; and

WHEREAS, Butte County, the City of Chico, Durham Irrigation District, and Butte College were eligible local agencies and elected to become GSAs in the Vina subbasin (DWR Bulletin 118 basin number 5-021-57); and

WHEREAS, the Butte College agreed to relinquish its GSA status in exchange for assurances from Butte County that the Butte College would retain specific groundwater management decisions within their jurisdiction; and

WHEREAS, on April 9, 2019 Butte County, the City of Chico and Durham Irrigation District executed a Joint Powers Agreement which created the Vina GSA; and

WHEREAS, the Vina GSA has responsibility in the Vina subbasin within its jurisdictional boundary including the area overlying Butte College to carry out the requirements of SGMA including developing and implementing the groundwater sustainability plan; and

WHEREAS, the Butte College and the Vina GSA finds that developing a cooperative and ongoing working relationship will advance the purposes of SGMA and groundwater sustainability for the Vina subbasin; and

WHEREAS, the Vina GSA seeks the cooperation of the Butte College in the development and implementation of the Vina GSP; and

NOW THEREFORE, incorporating the above recitals herein and exhibits attached, it is mutually understood and agreed as follows:

1. The Vina GSA agrees to the following terms:

a. To not impose fees, assessments, or other charges pertaining to groundwater management and extraction to Butte College without the prior written consent of Butte College.
b. To not limit groundwater extraction by Butte College without the written consent of Butte College.
c. To not alter the current boundaries of the Vina Subbasin or consolidation of the subbasin without the advance written consent of Butte College.
d. To not directly or indirectly regulate or interfere with the surface water rights or groundwater rights of the Butte College without the written consent of Butte College.

2. Butte College agrees to the following terms:
   a. To support the efforts of the Vina GSA or its Member Agencies to obtain grant funding for the development of the GSP for the Vina subbasin.
   b. To provide to the Vina GSA associated data collected by the Butte College as related to the sustainability of the subbasin, which will be utilized in the development and implementation of the GSP for the Vina subbasin.
   c. To work cooperatively with the Vina GSA in the review, development and implementation of the GSP for the Vina subbasin.

3. **TERM**. This MOU shall remain in effect unless terminated by one of the Parties in writing and as allowed by State law.

4. **AMENDING THE MOU.** This MOU and Exhibits hereto may only be amended by a subsequent writing, approved and signed by all Parties.

5. **HOLD HARMLESS.** No Party, not any officer or employee of a Party, shall be responsible for any damage or liability occurring by reason of anything done or omitted to be done by another Party under or in connection with this MOU.

VINA GROUNDWATER SUSTAINABILITY AGENCY

By: Ann Schwab
Ann Schwab, Chair

DATE: 12/12/2019

BUTTE COLLEGE

By: _____

DATE: 1/23/2020

COOPERATION AGREEMENT
BETWEEN THE VINA GROUNDWATER SUSTAINABILITY AGENCY AND THE ROCK CREEK RECLAMATION DISTRICT GROUNDWATER SUSTAINABILITY AGENCY

THIS COOPERATION AGREEMENT is entered into and effective this 18th day of November, 2020 (**"Effective Date"**), by and among the Vina Groundwater Sustainability Agency ("Vina GSA") and the Rock Creek Reclamation District acting in the capacity of its Rock Creek Reclamation District Groundwater Sustainability Agency ("Rock Creek GSA") (collectively **"Parties"** or individually a **"Party"**).

RECITALS

A. On August 29, 2014, the California Legislature passed comprehensive groundwater legislation contained in SB 1168, SB 1319 and AB 1739. Collectively, those bills, as subsequently amended, enacted the "Sustainable Groundwater Management Act" ("SGMA"). Governor Brown signed the legislation on September 16, 2014 and it became effective on January 1, 2015.

B. Each of the Parties overlie the Sacramento Valley Groundwater Basin, Vina Subbasin, California Department of Water Resources ("DWR") Basin No. 5-21.57 as its boundaries may be modified from time to time in accordance with Water Code Section 10722.2 (the "Basin").

C. The Rock Creek GSA elected to manage the groundwater for its boundaries and act as the Groundwater Sustainability Agency ("GSA") pursuant to SGMA with the DWR on or about November 14, 2016.

D. The Vina GSA elected to manage the groundwater over the boundaries of its members and act as the GSA pursuant to SGMA with the DWR on or about June 5, 2019.

E. The Parties desire, through this Agreement, to cooperate in the work of the GSAs and the management of the Basin, in accordance with SGMA.

THEREFORE, in consideration of the mutual promises, covenants and conditions herein set forth, the Parties agree as follows:

ARTICLE 1: DEFINITIONS

1.1 **Definitions.** As used in this Agreement, unless the context requires otherwise, the meaning of the terms hereinafter set forth shall be as follows:

a. **"Agreement"** shall mean this Cooperation Agreement between the Rock Creek GSA and the Vina GSA.

b. **"Basin"** shall mean Vina Groundwater Subbasin, California Department of Water Resources Basin No. 5-21.57 as its boundaries may be modified from time to time in accordance with Water Code Section 10722.2.

c. "**Basin-Wide Activities**" shall mean those activities or actions that affect the Basin as a whole, or are otherwise required by SGMA to be determined as the Basin level.

d. **"Coordination Agreement"** shall mean a legal agreement adopted between two or more GSAs that provides the basis for intra-basin coordination for more than one groundwater sustainability plan ("GSP") within a single basin.

e. **"DWR"** shall mean the California Department of Water Resources.

f. **"Effective Date"** shall be as set forth in the Preamble.

g. **"Groundwater Sustainability Agency"** or **"GSA"** has the meaning set forth in Water Code § 10721(j).

h. **"Groundwater Sustainability Plan"** or **"GSP"** shall mean a plan of a Groundwater Sustainability Agency or Agencies adopted pursuant to SGMA.

i. "**Joint Management Committee**" shall mean a committee comprised of two representatives from the governing board and/or staff of both of the Parties.

j. **"Management Area"** shall mean the area within the boundaries of a GSA that are managed separately or differently than the remainder of the GSP for the Basin.

k. **"Members"** shall mean the member agencies of Vina GSA's Joint Powers Agreement.

l. **"Parties"** shall mean any of the signatories to this Agreement.

m. "**Project Agreement**" shall mean a separate Agreement amongst and between the Parties for a specific project, whose purpose, terms, or financial contributions are different than those set forth in this Agreement.

n. **"SGMA"** shall mean the Sustainable Groundwater Management Act of 2014 and all regulations adopted under the legislation (SB 1168, SB 1319 and AB 1739) that collectively comprise the Act, as that legislation and those regulations may be amended from time to time.

ARTICLE 2: KEY PRINCIPLES

2.1 The Parties intend to work together in mutual cooperation to develop a GSP in compliance with SGMA, for the sustainable management of groundwater for the Basin.

2.2 Subject to the terms and limitations of this Agreement, including reservation of rights and authorities set forth in Section 2.4, below, the Parties intend to mutually cooperate to the extent possible to implement the GSP within the Basin in a manner consistent with SGMA.

2.3 The Parties expressly intend that this Agreement shall not limit or interfere with the respective Parties' rights and authorities over their own internal matters, including, but not limited

to, a Party's legal rights to surface water supplies and assets, groundwater supplies and assets, facilities, operations, water management and water supply matters. The Parties make no commitments by entering into this Agreement to share or otherwise contribute their water supply assets as part of the development or implementation of a GSP.

2.4 Nothing in this Agreement is intended to modify or limit a Party's police powers, land use authorities, or any other authority.

2.5 The Parties intend to collaborate in obtaining consulting, administrative and management services needed to efficiently and effectively develop a GSP, to conduct outreach to other Basin agencies and private parties, and to identify mechanisms for the management and funding commitments reasonably anticipated to be necessary for the purposes of this Agreement.

ARTICLE 3: FORMATION, PURPOSE AND POWERS

3.1 **Recitals:** The foregoing recitals are incorporated by reference.

3.2 **Certification.** Each of the Parties certifies and declares that it is a public agency that is designated as a GSA and authorized to manage groundwater for the portion of the Basin for which it, or its members overlie.

3.3 **Purpose of the Agreement.** The purposes of this Agreement are to:

a. Cooperatively carry out the purposes, goals and objectives of SGMA;

b. Provide for cooperation amongst and between the Parties to develop a GSP;

c. Implement, where consistent with the terms and limitations of this Agreement, a legally sufficient GSP in compliance with SGMA for the Basin; and

3.4 **Authority Under the Agreement.** To the extent authorized by governing boards of the Parties, subject to the limitations set forth in this Agreement and the limitations of all applicable laws, the Parties may:

a. Coordinate the implementation of projects and actions to be developed and included in the GSP;

b. Adopt coordinated actions, rules, regulations, policies, and procedures related to implementation of the GSP;

c. Perform all acts necessary or proper to carry out fully the purposes of this Agreement and to exercise all other powers necessary and incidental to the implementation of the powers set forth herein.

3.5 **Powers Reserved to Parties.** Each of the Parties will have the sole and absolute right, in its sole discretion, to:

a. Act as a GSA within its boundaries or the Management Area managed in whole or in part by such Parties;

b. Approve any portion, section or chapter of the GSP developed pursuant to this Agreement;

c. Exercise powers and authorities granted to each Party pursuant to SGMA or under that Party's enabling legislation;

d. Exercise authority to implement SGMA and any GSP adopted pursuant to this Agreement;

e. Defend any challenge to the adoption or implementation of a GSP developed pursuant to this Agreement; and

f. The right to terminate this Agreement pursuant to Article 7, below.

g. Notwithstanding anything to the contrary in this Agreement, this Agreement does not provide any Parties the authority to undertake any activities within the geographic or service area boundaries of any other Parties pursuant to the GSP developed or adopted hereunder, unless the Parties have formally and expressly consented and agreed in writing to the activity proposed.

3.6 **Term.** This Agreement shall be effective as of the Effective Date and shall remain in effect until terminated in accordance with Article 7.4 of this Agreement.

3.7 **Participation of Parties.** Each of the Parties agrees to undertake such additional proceedings or actions as may be necessary in order to carry out the terms of this Agreement, including the support of its Members, to participate in this Agreement. This support will involve the following types of actions:

a. Each Party agrees to designate two members of its governing body, staff, or other designated representative(s) to serve on the Joint Management Committee and to provide assistance to any third party facilitating the development of the GSP by making available staff time, information and facilities within available resources.

b. Each of the Parties may contribute public resources including but not limited to personnel, services, equipment or property to facilitate this Agreement. Such in-kind resource support is made in order to facilitate this Agreement and comply with SGMA; without a separate Project Agreement, the contributions shall not be made with the expectation of reimbursement from other Parties.

3.8 **Other Officers and Employees.** To the extent the Parties need support from employees, officers, consultants or otherwise need to hire employees, and such retention requires financial contribution of the Parties, the Parties may do so through amendment of this Agreement setting forth the terms and conditions of such support.

ARTICLE 4: GOVERNANCE

4.1 **Joint Management Committee.** Activities under this Agreement will be guided by the appointed management committees of each Party ("Joint Management Committee"), the composition of which is set forth in Section 3.7(a). The Joint Management Committee shall work collaboratively under this Agreement for the purpose of attempting to develop recommendations for technical and substantive Basin-wide issues. Recommendations from the Joint Management Committee that require approval or action of the Parties shall, upon unanimous consent of the Joint Management Committee, be provided to each Parties' respective governing boards for consideration of adoption, approval, or other recommended action. The Joint Management Committee may consider the following topics and make recommendations to the Parties governing boards:

a. Develop budget(s) for any project or program where joint funding from the Parties is proposed;

b. Draft reports or options with regard to decisions related to proposing new or enhanced taxes, assessments or property-related fees and charges;

c. Propose guidance and options for obtaining grant funding;

d. Recommend the adoption of rules, regulations, policies, and procedures related to the Agreement;

e. Recommend the approval of contracts with consultants or subcontractors that would undertake work on behalf of the Parties pursuant to this Agreement;

f. Update each Party's respective governing boards on specific issues, including the development of the GSP, when appropriate or requested;

g. Advise the Parties when the convening of an Ad Hoc committee is needed to resolve an impasse or inability to make a consensus recommendation;

h. Conduct outreach with stakeholder groups;

i. Participate and guide the development of GSP and materials in support thereof;

j. Recommend action and/or approval of a GSP; and

All other topics consistent with the terms of this Agreement.

4.2 **Meetings.** The Joint Management Committee shall provide for regular and special meetings in accordance with Chapter 9, Division 2, Title 5 of Government Code of the State of California (the "Ralph M. Brown Act" commencing at Section 54950), and any subsequent amendments of those provisions.

4.3 **Advisory Committees.** The Joint Management Committee may utilize existing advisory committees of each Party and/or establish other advisory committees, technical committees or other committees for any purpose, including but not limited to the GSP purposes in Water Code Section 10727.8.

4.4 **Impasse Resolution.** To the extent the Joint Management Committee is unable to make a unanimous recommendation on an issue for which their respective governing boards need to make a decision, the Joint Management Committee may recommend that the Parties convene an Ad Hoc committee comprised of not more than two members of each Parties' governing board members in an attempt to resolve the impasse.

ARTICLE 5: INFORMATION AND DATA SHARING

5.1 **Exchange of Information**. The Parties acknowledge and recognize pursuant to this Agreement and SGMA, the Parties may need to exchange information amongst and between the Parties and will do so through collaboration and/or informal requests made at the Joint Management Committee level or through working/stakeholder committees. To the extent it is necessary to make a written request for information to other Parties, it will be communicated in writing and transmitted in person or by mail, facsimile machine or other electronic means to the appropriate representative as named in this Agreement.

ARTICLE 6: FINANCIAL PROVISIONS

6.1 **Contributions and Funding.** The funding and implementation of the GSP will be initially funded through a grant award from the Department of Water Resources ("DWR"). Any funding not covered by grant shall be funded by separate unanimous agreement of the Parties.

6.2 **DWR Grant.** The DWR grant is being administered by Butte County on behalf of the Vina GSA, the Rock Creek GSA and all of the GSAs in adjoining Butte and Wyandotte Creek subbasins. To the extent practicable and consistent with this Agreement, the DWR grant will develop common components of the GSP. For GSP components subject to the independent discretion of the Parties, the Parties agree to utilize the DWR grant in an efficient and equitable manner.

6.3 **Funding Responsibility**. Each of the Parties shall be responsible to fund its participation in this Agreement. Each of the Parties will be solely responsible for raising funds for payment of the Parties' share of operating and administrative costs. The obligation of each of the Parties to make payments under the terms and provisions of this Agreement is an individual and severable obligation and not a joint obligation with those of the other Parties. Each of the Parties shall be individually responsible for its own covenants, obligations, and liabilities under this Agreement. No Parties shall be precluded from independently pursuing any of the activities contemplated in this Agreement. No Parties shall be the agent or have the right or power to bind any other Parties without such Parties' express written consent, except as expressly provided in this Agreement.

6.4 **Alternate Funding Sources.** The Parties may jointly seek to secure additional contributions of grant funding, state, federal, or county funding as funding or a portion of funding for implementation of the GSP, including projects and management actions that benefit the Basin.

ARTICLE 7: DISPUTE RESOLUTION, WITHDRAWAL AND TERMINATION

7.1 **Dispute Resolution.** It is the desire of the Parties to informally resolve all disputes and controversies related to this Agreement, whenever possible, at the least possible level of formality and cost. If a dispute occurs, one representative of each Party shall meet and confer in an attempt to resolve the matter. If informal resolution cannot be achieved, the matter will be referred to the Joint Management Committee for resolution. The Joint Management Committee may engage the services of a trained mediator or resort to all available legal and equitable remedies to resolve disputes.

7.2 **Withdrawal and Termination.** Either Party may, in its sole discretion, unilaterally withdraw and terminate its participation from this Agreement, effective upon thirty (30) days' prior written notice to the governing board of the other Party, provided that (a) the withdrawing Party will remain responsible for its proportionate share of any obligation or liability duly incurred while a Party to this Agreement and (b) the Parties will meet and confer to negotiate, a coordination agreement, if necessary, under SGMA.

7.3 **Disposition of Property Upon Termination.** Upon termination of this Agreement, the Joint Management Committee shall recommend the Parties distribute the assets between the successor entity and the Parties in proportion to how the assets were provided.

7.4 **Use of Data.** Upon withdrawal, a Party shall be entitled to use any data or other information developed during its time as a Party to the Agreement. Further, should a Party withdraw after completion of the GSP, it shall be entitled to utilize the GSP for future implementation of SGMA within its boundaries.

ARTICLE 8: MISCELLANEOUS PROVISIONS

8.1 **Amendments.** This Agreement may only be amended by a written instrument executed by all Parties.

8.2 **Binding on Successors.** Except as otherwise provided in this Agreement, the rights and duties of the Parties may not be assigned or delegated without a unanimous vote by the Parties. Any approved assignment or delegation shall be consistent with the terms of any contracts, resolutions, indemnities and other obligations then in effect. This Agreement shall inure to the benefit of, and be binding upon, the successors and assigns of the Parties hereto.

8.3 **Notice.** Any notice or instrument required to be given or delivered under this Agreement may be made by: (a) depositing the same in any United States Post Office, postage prepaid, and shall be deemed to have been received at the expiration of 72 hours after its deposit in the United States Post Office; (b) transmission by facsimile copy to the addressee; (c) transmission by electronic mail; or (d) personal delivery, as follows:

ROCK CREEK GSA

Hal Crain, Board Director
Rock Creek Reclamation District GSA
5556 Wilson Landing Road
Chico, CA 95973
530-345-3412
rockcreekreclamation@aol.com

VINA GSA

Paul Gosselin, Water and Resource Conservation
Vina GSA
308 Nelson Avenue
Oroville, CA 95965
530-552-3590
pgosselin@buttecounty.net
http://www.buttecounty.net/

With copy to: Valerie Kincaid
O'Laughlin & Paris LLP
2617 K Street, Suite 100
Sacramento, CA 95816
Email: vkincaid@olaughlinparis.com
Phone: 916.599.5498

Dustin Cooper
Minasian, Meith, Soares, Sexton & Cooper, LLP
1681 Bird Street
P.O. Box 1679
Oroville, CA 95965-1679
Email: dcooper@minasianlaw.com
Phone: 530-533-2885

8.4 **Counterparts.** This Agreement may be executed by the Parties in separate counterparts, each of which when so executed and delivered shall be an original. All such counterparts shall together constitute but one and the same instrument.

8.5 **Choice of Law.** This Agreement shall be governed by the laws of the State of California.

8.6 **Severability.** If one or more clauses, sentences, paragraphs or provisions of this Agreement are held to be unlawful, invalid or unenforceable, it is hereby agreed by the Parties that the remainder of the Agreement shall not be affected thereby. Such clauses, sentences, paragraphs or provisions shall be deemed reformed so as to be lawful, valid and enforced to the maximum extent possible.

8.7 **Headings.** The paragraph headings used in this Agreement are intended for convenience only and shall not be used in interpreting this Agreement or in determining any of the rights or obligations of the Parties to this Agreement.

8.8 **Construction and Interpretation.** This Agreement has been arrived at through negotiation and each of the Parties has had a full and fair opportunity to revise the terms of this Agreement. As a result, the normal rule of construction that any ambiguities are to be resolved against the drafting Parties shall not apply in the construction or interpretation of this Agreement.

8.9 **Entire Agreement.** This Agreement constitutes the entire agreement among the Parties and supersedes all prior agreements and understandings, written or oral.

IN WITNESS WHEREOF, the Parties have executed this Agreement on the day and year first above-written.

"VINA GSA"

Vina Groundwater Sustainability Agency

Ann Schwab

Ann Schwab, Chair

Date: 11/19/2020

"ROCK CREEK GSA"

Rock Creek Reclamation District Groundwater Sustainability Agency

Hal Crain, Board Director

Date: 12/31/20

Vina Groundwater Sustainability Agency
308 Nelson Avenue, Oroville, California 95965
(530) 552-3592 • VinaGSA@gmail.com

June 28, 2021

Paula Daneluk, Director
Butte County Department of Development Services
7 County Center Drive
Oroville, CA 95965

Re: Vina Groundwater Sustainability Plan

Director Daneluk:

Under the Sustainable Groundwater Management Act (SGMA), Groundwater Sustainability Agencies (GSA) must submit a Groundwater Sustainability Plan (Plan) that will assure groundwater is sustainable within 20 years. In Butte County, the Vina subbasin is required to have a Plan submitted by January 31, 2022. In the Vina subbasin, the two GSAs, Vina GSA and Rock Creek Reclamation District GSA, are jointly developing a single Plan. SGMA requires that the GSAs provide at least a 90 day notice to cities and counties prior to adoption of a Plan. Through this letter, we are providing notice of the Plan development and seek your review of the draft Plan. (Water Code §10728.2)

SGMA recognizes the linkage between land use and groundwater management. Many of the projects and actions include recommendations for changes to land use, general plans, zoning and ordinances under your jurisdiction. The Plan takes into account projected growth from existing general plans. In the future, anytime a city or county readopts or substantially amends their general plan the planning agency shall review and consider an adoption of, or update to, a groundwater sustainability plan. (Under Government Code § 65350.5) We look forward to collaborating with you on groundwater sustainability in the Vina subbasin.

Various chapters of the Vina subbasin Plan are in draft form. The entire Vina subbasin Plan is expected to be released for a 60 day comment period in September, with a hearing to be held in November. Adoption of the Plan is expected in December. When the entire draft Plan is prepared in September, we will provide you with a notice of its

availability. In the meantime, draft chapters are available for review at www.vinagsa.org.

If you have any questions or would like more information please contact me.

Thank you.

Paul Gosselin, Administrator

Cc: Andy Pickett, Butte County CAO

Vina Groundwater Sustainability Agency
308 Nelson Avenue, Oroville, California 95965
(530) 552-3592 • VinaGSA@gmail.com

June 28, 2021

Brendon Vieg, Director
Community Development, Planning & Housing
City of Chico
411 Main Street, 2nd Floor
Chico, CA 95928

Re: Vina Groundwater Sustainability Plan

Director Vieg:

Under the Sustainable Groundwater Management Act (SGMA), Groundwater Sustainability Agencies (GSA) must submit a Groundwater Sustainability Plan (Plan) that will assure groundwater is sustainable within 20 years. In Butte County, the Vina subbasin is required to have a Plan submitted by January 31, 2022. In the Vina subbasin, the two GSAs, Vina GSA and Rock Creek Reclamation District GSA, are jointly developing a single Plan. SGMA requires that the GSAs provide at least a 90 day notice to cities and counties prior to adoption of a Plan. Through this letter, we are providing notice of the Plan development and seek your review of the draft Plan. (Water Code §10728.2)

SGMA recognizes the linkage between land use and groundwater management. Many of the projects and actions include recommendations for changes to land use, general plans, zoning and ordinances under your jurisdiction. The Plan takes into account projected growth from existing general plans. In the future, anytime a city or county readopts or substantially amends their general plan the planning agency shall review and consider an adoption of, or update to, a groundwater sustainability plan. (Under Government Code § 65350.5) We look forward to collaborating with you on groundwater sustainability in the Vina subbasin.

Various chapters of the Vina subbasin Plan are in draft form. The entire Vina subbasin Plan is expected to be released for a 60 day comment period in September, with a hearing to be held in November. Adoption of the Plan is expected in December. When the entire draft Plan is prepared in September, we will provide you with a notice of its

availability. In the meantime, draft chapters are available for review at www.vinagsa.org.

If you have any questions or would like more information please contact me.

Thank you.

Paul Gosselin, Administrator

Cc: Mark Orme, City Administrator

APPENDIX 1-C
Joint Powers Agreement

JOINT EXERCISE OF POWERS AGREEMENT
ESTABLISHING THE VINA GROUNDWATER SUSTAINABILITY AGENCY

This JOINT EXERCISE OF POWERS AGREEMENT ("Agreement") establishing the Vina Groundwater Sustainability Agency is made and entered into and effective upon the date when the last Member Agency signs this Agreement ("Effective Date") by and among the public agencies listed on the attached Exhibit A ("Members") for the purpose of forming a Groundwater Sustainability Agency ("GSA") and achieving groundwater sustainability in a portion of the Vina Groundwater Subbasin ("Basin") within the jurisdictional boundaries of its Members.

Recitals

WHEREAS, in 2014, the California legislature adopted, and the Governor signed into law, three bills (SB 1168, AB 1739, and SB 1319) collectively referred to as the "Sustainable Groundwater Management Act" ("SGMA"), that initially became effective on January 1, 2015, and that has been amended from time-to-time thereafter; and

WHEREAS, the stated purpose of SGMA, as set forth in California Water Code section 10720.1, is to provide for the sustainable management of groundwater basins at a local level by providing local groundwater agencies with the authority, and technical and financial assistance necessary, to sustainably manage groundwater; and

WHEREAS, SGMA requires the designation of Groundwater Sustainability Agencies ("GSAs") for the purpose of achieving groundwater sustainability through the adoption and implementation of Groundwater Sustainability Plans ("GSPs") or an alternative plan for all medium and high priority basins as designated by the California Department of Water Resources ("DWR"); and

WHEREAS, each Member is a local agency, as defined by SGMA, duly organized and existing under and by virtue of the laws of the State of California, and each Member has water supply, water management or land use responsibilities within the Vina Subbasin, which is designated subbasin number 5-021.57 in the most recent edition of DWR Bulletin Number 118; and

WHEREAS, Section 10720.7 of SGMA requires all basins designated as high or medium priority basins by the DWR in its Bulletin 118 be managed under GSPs or coordinated GSPs pursuant to SGMA; and

WHEREAS, The Members have determined that the sustainable management of the Basin pursuant to SGMA may best be achieved through the cooperation of the Members operating through a joint powers agency; and

WHEREAS, the Joint Exercise of Powers Act (Chapter 5 (commencing with Section 6500) of Division 7 of Title 1 of the California Government Code; the "Act"), authorizes two or more public agencies to, by agreement, jointly exercise any power held in common by agencies entering into such an agreement and to exercise additional powers granted under the Act; and

WHEREAS, the Members desire, through this Agreement, to form the Vina Groundwater Sustainability Agency ("Agency"), a separate legal entity, for the purpose of acting as a GSA for the portion of the Basin within the jurisdictional boundaries of its Members; and

WHEREAS, the governing board of each Member has determined it to be in the Member's best interest and in the public interest that this Agreement be executed;

NOW THEREFORE, In consideration of the matters recited and the mutual promises, covenant, and conditions set forth in this Agreement, the Members hereby agree as follows:

TERMS OF AGREEMENT

ARTICLE 1. DEFINITIONS

As used in this Agreement, unless context requires otherwise, the meanings of the terms set forth below shall be as follows:

1.1. "Act" means the Joint Exercise of Powers Act, set forth in Chapter 5 of Division 7 of Title 1 of the Government Code, sections 6500, *et seq.*, including all laws supplemental thereto.

1.2. "Agency" means the Vina Groundwater Sustainability Agency.

1.3. "Agency Jurisdiction" means those areas in the Basin where the Agency is the exclusive GSA within the basin.

1.4. "Agreement" means this joint powers agreement, which creates the Vina Groundwater Sustainability Agency.

1.5. "Basin" means the Vina Subbasin, to reflect the most recent Bulletin 118 boundaries and as currently shown on the map attached to this Agreement as Exhibit B, which is incorporated herein by this reference.

1.6. "Board of Directors" or "Board" means the governing body of the Agency as established by Article 7 of this Agreement.

1.7. "Board Member" or "Director" shall mean a member of the Agency's Board of Directors.

1.8. "Committee" shall mean any committee established pursuant to Article 11 of this Agreement.

1.9. "Effective Date" means the date on which the last Member executes this Agreement.

1.10. "Fiscal Year" means July 1 through June 30.

1.11. "GSA" shall mean a groundwater sustainability agency.

1.12. "GSP" shall mean a groundwater sustainability plan.

1.13. "Member" means each party to this Agreement that satisfies the requirements of section 6.1 of this Agreement, including any new members as may be authorized by the Board pursuant to Section 6.2 of this Agreement.

1.14. "Member Director" means a director or alternate director appointed by the governing board of each Member pursuant to Article 7 of this Agreement.

1.15. "Member's Governing Body" means the board of directors, trustees or other voting body that controls the individual public agencies that are Members.

1.16. "SGMA" has the meaning assigned to it in the first Recital of the Agreement.

1.17. "Special Project" means a project undertaken by some, but not all Members of the Agency, pursuant to Article 14 of this Agreement.

1.18. "Stakeholder Director" means a Director appointed pursuant to Article 6 that represents stakeholder interests.

1.19. "Association" means Agricultural Groundwater Users of Butte County.

1.20. "State" means the State of California.

1.21. "Management Area" refers to an area within a basin for which a GSP may identify different minimum thresholds, measurable objectives, monitoring, and projects and actions based on unique local conditions or other circumstances as described in the GSP regulations. The GSP must describe each Management Area, including rationale for approach and demonstrate it can be managed without causing undesirable results inside the Management Area or outside of the Management Area.

1.22. "Coordination Agreement" means a legal agreement adopted between two or more GSAs that provides the basis for intra-basin coordination of the GSPs of multiple GSAs within a basin pursuant to SGMA.

ARTICLE 2. THE AGENCY

2.1. Upon the effective date of this Agreement, the Agency is hereby created. Pursuant to the provisions of the Act, the Agency shall be a public agency separate from its Members.

2.2. The Agency Jurisdiction boundaries shall be as shown on the map on Exhibit B, which is attached to this Agreement and incorporated herein by this reference. The Basin boundary will reflect the most recent Bulletin 118 boundaries as they become available. The Board of Directors may, upon a majority vote and without amendment to this Agreement, modify the boundaries of the GSA so as to continue serving as a GSA for the Vina Subbasin, as the same may be modified from time to time by DWR.

ARTICLE 3. PURPOSE OF THE AGENCY

3.1. The purpose of this Agreement is to create a joint powers agency (Agency) that will elect to be a GSA for the Basin. The purpose of the Agency is to (a) provide for the joint exercise of powers common to each of the Members and powers granted pursuant to SGMA (subject to the restrictions contained in this Agreement); (b) cooperatively carry out the purposes of SGMA; (c) become a GSA for purposes of management of the Basin in accordance with

SGMA; (d) develop, adopt, and implement a legally sufficient GSP for the Basin in order to implement SGMA requirements and achieve the sustainability goals outlined in SGMA; (e) to enter into a Coordination Agreement (as applicable) with other GSAs in the Vina subbasin to mutually achieve groundwater sustainability; and (f) to comply with any further legislative mandates that alter or amend SGMA within the Agency Jurisdiction. Additional organizing principles include (a) public involvement and stakeholder outreach and engagement in developing and implementing the Vina Subbasin Groundwater Sustainability Plan; and (b) mutual respect for the autonomy of individual Members and preservation of each Member's separate legal authorities, powers, duties and rights as separate public agencies, except as set forth in this Agreement.

ARTICLE 4. TERM

4.1. This Agreement shall become effective upon execution by each of the Parties and shall continue in full force and effect until terminated pursuant to the provisions of Article 17.

4.2. By execution hereof, each Member certifies and declares that it is a legal entity that is authorized to be a party to a joint exercise of powers agreement and to contract with each other for the joint exercise of a common power under Article 1, Chapter 5, Division 7, Title 1 of the Government Code, commencing with section 6500 or other applicable law including but not limited to California Water Code § 10720.3(c).

ARTICLE 5. POWERS OF THE AGENCY

5.1 Powers. To the extent authorized by the Members through the Board of Directors, and subject to the limitations of this Agreement, the Agency shall possess the ability to exercise those powers specifically granted by the Act and SGMA. Additionally, the Agency shall possess the ability to exercise the common powers of its Members related to the purposes of the Agency, including, but not limited to, the following:

5.1.1 To designate itself the GSA for the Agency Jurisdiction pursuant to SGMA.

5.1.2 To develop, adopt and implement a GSP for the Agency Jurisdiction pursuant to SGMA.

5.1.3 To adopt rules, regulations, policies, bylaws and procedures governing the operation of the Agency and adoption and implementation of a GSP for the Agency Jurisdiction.

5.1.4 To adopt ordinances within the Agency Jurisdiction consistent with the purpose of the Agency as necessary to implement the GSP and otherwise meet the requirements of the SGMA.

5.1.6 To obtain legal, financial, accounting, technical, engineering, and other services needed to carry out the purposes of this Agreement.

5.1.7 To perform periodic reviews of the GSP including submittal of annual

reports.

5.1.8 To require the registration and monitoring of wells within the Agency Jurisdiction.

5.1.9 To issue revenue bonds or other appropriate public or private debt and incur debts, liabilities or obligations.

5.1.10 To exercise the powers permitted under Government Code section 6504 or any successor statute.

5.1.11 To levy taxes, assessments, charges and fees as provided in SGMA or otherwise provided by law.

5.1.12 To regulate and monitor groundwater extractions within the Agency Jurisdiction as permitted by SGMA, provided that this Agreement does not extend to a Member's operation of its systems to distribute water once extracted or otherwise obtained, unless and to the extent required by other laws now in existence or as may otherwise be adopted.

5.1.13 To establish and administer projects and programs for the benefit of the Basin.

5.1.14 To cooperate, act in conjunction and contract with the United States, the State of California, federally recognized Tribes or any agency thereof, counties, municipalities, special districts, groundwater sustainability agencies, public and private corporations of any kind (including without limitation, Public Utilities Commission (PUC) regulated utilities and mutual water companies), and individuals, or any of them, for any and all purposes necessary or convenient for the full exercise of powers of the Agency.

5.1.15 To accumulate operating and reserve funds and invest the same as allowed by law for the purposes of the Agency and to invest funds pursuant to California Government Code section 6509.5 or other applicable State Law.

5.1.16 To apply for and accept grants, contributions, donations and loans under any federal, state or local programs for assistance in development or implementing any of its projects or programs for the purposes of the Agency.

5.1.17 To acquire by negotiation, lease, purchase, construct, hold, manage, maintain, operate and dispose of any buildings, property, water rights, works or improvements within and without the respective boundaries of the Members necessary to accomplish the purposes described herein.

5.1.18 To sue and be sued in the Agency's own name.

5.1.19 To exercise the common powers of its Members to develop, collect, provide and disseminate information that furthers the purposes of the Agency, including but not limited to the operation of the Agency and

adoption and implementation of a GSP for the Agency Jurisdiction to the Members' legislative, administrative, and judicial bodies, as well as the public generally.

5.1.20 To perform all other acts necessary or proper to carry out fully the purposes of this Agreement.

5.1.21 To enter into a Coordination Agreement with other GSAs in the Vina Basin who elect to develop and implement their own GSP.

5.2 Preservation of Powers. Each Member reserves the right, in its sole and absolute discretion and the Agency and all of its Members confirm that nothing contained herein shall grant the Agency any power to:

5.2.1 Alter any water right, contract right, or any similar right held by its Members or any Member's landowners or customers, or amend a Member's water delivery practice, course of dealing, or conduct without the express consent of the holder thereof.

5.2.2 Limit or interfere with the respective Members' rights and authorities over their own internal matters, including, but not limited to, an agency's legal rights to surface water supplies and assets, groundwater supplies and assets, facilities, operations, water management and water supply matters.

5.2.3 Modify or limit a Member's police powers, land use authorities, well permitting or any other authority.

5.2.4 Prevent an eligible local agency from becoming a GSA, and exercise the powers conferred to a GSA, within the Member's boundaries, except in the case of Butte County who shall have the right to become a GSA for those areas not overlapping other Members' boundaries;

5.3 Coordination within the Basin. Each Member acknowledges that SGMA requires that multiple GSAs within a Basin subject to SGMA must coordinate, and are required to use the same data and consistent methodologies for certain required technical assumptions when developing a GSP, and that the entire Basin must be managed under one or more GSP(s) to be deemed in compliance with SGMA.

5.4 Coordination between Basins. In order to maintain consistency and the efficient use of resources, to the extent feasible, the Agency shall strive to coordinate between and among the other adjoining subbasins for administration, matters involving public communication and outreach, and for developing frameworks to support groundwater management, which may include agreement to certain areas of coordination, provided that the Agency retain its own authority and that such recommendations are ratified by the Board. The Agency may clarify and acknowledge coordination among the other GSAs through a document or agreement if deemed appropriate.

ARTICLE 6. MEMBERSHIP

6.1. Initial Members. The initial Members of the Agency shall be the County of Butte, City of Chico, and Durham Irrigation District.

6.2. New Members. Additional Parties may join the Agency and become a Member provided that the prospective new member: (a) is eligible to join a GSA as provided by SGMA (Water Code §10723), (b) possesses powers common to all other Members, (c) pays its share of all previously incurred costs, if any, (d) pays all applicable fees and charges, if any, and (e) receives unanimous consent of the existing Members, evidenced by the execution of a written amendment to this Agreement signed by all Members, including the additional public agency.

6.3 Role of Members. Each Member agrees to undertake such additional proceedings or actions as may be necessary in order to carry out the terms and intent of this Agreement. The support of each Member is required for the success of the Agency in complying with and implementing SGMA. This support will involve the following types of actions:

6.3.1. The members will provide support to the Board of Directors and any third party facilitating the development of the GSP by making available staff time, information and facilities within available resources.

6.3.2. Each Member may contribute to the Agency.

6.3.3. Contributions of public funds and of personnel, services, equipment, or property may be made to the Agency by any Member for any of the purposes of this Agreement, provided that no repayment will be made for such contributions.

ARTICLE 7. AGENCY DIRECTORS AND OFFICERS

7.1. Formation of the Board of Directors. The Agency shall be governed and administered by a Board of Directors ("Board of Directors" or "Board") which is hereby established and which shall be initially composed of one (1) voting seat per Member. Without amending this Agreement, the composition of the Board may be altered from time to time to reflect the addition of stakeholder directors, the withdrawal of any Member and/or the admission of any New Member. The governing board shall be known as the "Board of Directors of the Vina Groundwater Sustainability Agency." All voting power shall reside in the Board. The Board shall consist of the following representatives, who shall be appointed in the manner set forth in Section 7:

7.1.1. One (1) representative appointed by the governing board of each Member, who shall be a member of the governing body of the Member (each, a "Member Director").

7.1.2. Two (2) Stakeholder Directors appointed by the Butte County Board of Supervisors. One Stakeholder Director shall be representative of agricultural groundwater user stakeholders and interests within the Agency Jurisdiction and one Stakeholder Director shall be representative of domestic well user stakeholders and interests within the Agency Jurisdiction. The two (2) Stakeholder Directors shall meet the following qualifications:

(a) One (1) Agricultural Stakeholder Director. The Agricultural Stakeholder Director shall meet the following criteria, determined at the sole discretion of the Butte County Board of Supervisors: (1) reside in the Agency Jurisdiction; (2) own/lease real property in active commercial agricultural production overlying the Agency Jurisdiction or be an employee of a commercial agricultural production operation overlying the Agency Jurisdiction involved with water use decisions; (3) the commercial agricultural production operation extracts groundwater from the Agency Jurisdiction for the irrigation/frost protection of at least fifty (50) acres of agricultural crops in commercial operation; and (4) the business entity that the

Agricultural Stakeholder represents has commercial agricultural interests solely within the Sacramento Valley region. The Agricultural Stakeholder, or the entity he/she represents, may not be a party to any pending litigation against the Agency or any of its Members.

(b) One (1) Non-Agricultural Domestic Well User Stakeholder Director. The Domestic Well User Stakeholder Director shall meet the following criteria, determined at the sole discretion of the Butte County Board of Supervisors: (1) reside in the Agency Jurisdiction and owns or leases residential real property in the Agency Jurisdiction; and (2) extracts groundwater from the Agency Jurisdiction for domestic water use only. The Domestic Well User Stakeholder may not be a party to any pending litigation against the Agency or any of its Members.

7.2. Duties of the Board of Directors. The business and affairs of the Agency, and all of the powers of the Agency, including without limitation all powers set forth in Article 5, are reserved to and shall be exercised by and through the Board of Directors, except as may be expressly delegated to others pursuant to this Agreement, Bylaws, or by specific action of the Board of Directors.

7.3. Appointment of Directors. The Directors shall be appointed as follows:

7.3.1. Member Directors. Each Member Director must sit on the governing board of the Member agency and be appointed by that governing board by notification, which shall be transmitted to the Chair of the Agency following adoption by the Member.

7.3.2. Stakeholder Directors. The two (2) Stakeholder Directors shall be appointed as follows:

(a) Agricultural Stakeholder Director. Butte County shall conduct an open application process and identify the qualified candidates. The Agricultural Groundwater Users of Butte County (Association) shall provide a list of four (4) nominees selected from the list of qualified candidates.

(b) Domestic Well User Stakeholder Director. Butte County shall conduct an open application process and identify the qualified candidates.

(c) Ad-hoc Nomination Committee. Member Agencies, excluding Butte County, shall form an ad-hoc nomination committee that shall provide recommendations on Stakeholder Directors' selection to the Butte County Board of Supervisors through an open, transparent public process.

(d) The Butte County Board of Supervisors shall consider the four (4) agricultural nominees, the domestic candidates and recommendations of the Ad-hoc Nomination Committee at a regular meeting and shall appoint the Stakeholder Directors and Alternates.

7.4. Alternate Directors. Each Member's governing body shall also appoint one Alternate Director to the Board of Directors. An Alternate Stakeholder Director shall be appointed by the Butte County Board of Supervisors for each Stakeholder Director. All Alternate Directors shall be appointed in the same manner as set forth in Section 7.3. Alternate Directors shall have no vote, and shall not participate in any discussions or deliberations of the Board unless appearing as a substitute for a Director due to absence or conflict of interest. If the

Director is not present, or if the Director has a conflict of interest which precludes participation by the Director in any decision-making process of the Board, the Alternate Director appointed to act in his/her place shall assume all rights of the Director, and shall have the authority to act in his/her absence, including casting votes on matters before the Board. Each Alternate Director shall be appointed prior to the third meeting of the Board. Alternate Directors are encouraged to attend all Board meetings and stay informed on current issues before the Board. Alternate Board Members have no vote at Board of Director meetings if the Board Member is present. If the Board Member is not present, the Alternate Board Member shall be entitled to participate in all respects as a regular Board Member.

7.5. Terms of Office. The term of office for each member of the Agency's Board of Directors is four (4) years and these individuals may be reappointed. Each Member Director and Alternate Member Director shall serve at the pleasure of the appointing Member's Governing Body and may be removed from the Board of Directors by the appointing Members' Governing Body at any time. If at any time a vacancy occurs on the Board of Directors, a replacement shall be appointed to fill the unexpired term of the previous Board Member pursuant to this Article 7 and within ninety (90) days of the date that such position becomes vacant.

7.6. Removal of Board Members. A Director that no longer meets the qualifications set forth in section 7.1.1 is automatically removed from the Agency Board of Directors. Upon removal of a Director, the Alternate Director shall serve as a Director until a new Director is appointed. Members must submit any changes in Member Director or Alternate Member Director positions to the Chair in writing with submissions signed by the Member. A Stakeholder Director may only be removed by the Butte County Board of Supervisors for failure to attend three (3) consecutive meetings or as a result of no longer meeting the qualifications set forth in Article 7 of this Agreement.

7.7. Vacancies. A vacancy on the Board of Directors shall occur when a Director resigns or reaches the end of that Director's term, as set forth in Section 7.5. For Member Directors, a vacancy shall also occur when he or she is removed by his or her appointing Member's governing body. For Stakeholder Directors, a vacancy shall also occur when the Stakeholder Director is removed, as set forth in Section 7.6. Upon the vacancy of a Director, the Alternate Director shall serve as Director until a new Director is appointed as set forth in Section 7.3 unless the Alternate Director is already serving as an Alternate Director in the event of a prior vacancy, in which case, the seat shall remain vacant until a replacement Director is appointed as set forth in Section 7.4. Members shall submit any changes in Director or Alternate Director positions to the Chair by written notice signed by an authorized representative of the Member.

ARTICLE 8. AGENCY MEETINGS

8.1. Initial Meeting. The initial meeting of the Agency's Board of Directors shall be called by the County of Butte and held in the Chico City Council Chambers, 421 Main Street Chico CA 95928, within 60 days of the effective date of this Agreement.

8.2. Time and Place. The Board of Directors shall provide in its adopted bylaws or by other means authorized or required by law for the time and place for holding regular meetings, at least annually, and at such other times as determined by the Board of Directors.

8.3. Conduct. All meetings of the Board shall be noticed, held, and conducted in

accordance with the Ralph. M. Brown Act to the extent applicable. Board Members and Alternate Board Members may use teleconferencing in connection with any meeting in conformance with and to the extent authorized by the applicable laws.

ARTICLE 9. BOARD OF DIRECTORS VOTING

9.1. Quorum. A majority of the members of the Board of Directors shall constitute a quorum for purposes of transacting business.

9.2. Director Votes. Each member of the Board of Directors of the Agency shall have one (1) vote. With the exception of the items in section 9.3 below, an affirmative vote by a majority of the Board of Directors is required to approve any item. Prior to taking a vote on any item of business, the Board of Directors shall strive for consensus of all members on items.

9.3. Supermajority Voting Requirement. A supermajority requires an affirmative vote of four or more Directors. Items that require a supermajority vote to pass consist of the following, which may be amended from time to time by the Board by a supermajority, or as may otherwise be required by this Agreement or by law:

- Bylaws adoption, modification or alteration
- GSP adoption, modification or alteration
- Adoption of assessments, charges and fees
- Adoption of regulations and ordinances
- Adoption or modification of annual budgets, including capital projects
- Property acquisition (excepting right of ways)
- Appointment of Treasurer, subject to the provisions in Article 12, Administrator, Plan Manager or General Counsel
- Modifications to the composition and number or removal of members of committees
- Acceptance of Management Area chapters submitted by Member(s).
- Establishment of new or modification to existing Management Areas
- Development of the Management Area chapter(s) and associated cost allocations to Members within such Management Area(s) in the event of a failure by a Member(s) to develop Management Area chapter(s) for their respective portion of the subbasin.

ARTICLE 10. OFFICERS

10.1. Officers. The Board of Directors shall select a Chair and Vice-Chair and any other officers as determined necessary by the Board of Directors.

10.1.1. The Chair shall preside at all Board Meetings.

10.1.2. The Vice-Chair shall act in place of the Chair at meetings should the Chair be absent.

10.1.3. All Officers shall be chosen at the first Board of Directors meeting of the calendar year. An Officer may serve for multiple consecutive terms. Any Officer may resign at any time upon written notice to the Agency.

ARTICLE 11. COMMITTEE FORMATION

11.1 Management Committee. There shall be established by the Board of Directors a committee comprised of at least one (1) staff representative from each Member. The Management Committee shall meet as directed by the Board of Directors, and shall recommend agenda items, proposed action for the Board of Directors, administer the Stakeholder Advisory Committee, establish and administer technical working groups, and bring staff reports to the Board of Directors.

11.2 Internal Committee Formation. There shall be established such internal committees as the Board of Directors shall determine from time to time. Each such internal committee shall be comprised of a minority number of the seated Directors, shall exist for the term specified in the action establishing the committee, shall meet as directed by the Board of Directors, and shall make recommendations to the Board of Directors on the various activities of the Agency.

11.3. Stakeholder Advisory Committee Formation. The Board of Directors shall establish an advisory committee comprised of diverse social, cultural, and economic elements of the population and area stakeholders within the Agency Jurisdiction. The Board of Directors shall encourage the active involvement of the advisory committee(s) prior to and during the development and implementation of the GSP. The Board of Directors will ensure that at least one (1) member from the Management Committee administers the advisory committee(s). The advisory committee(s) shall meet as directed by the Board of Directors and as specified in Appendix A, and shall make recommendations to the Board of Directors as requested.

11.4. Technical Working Groups. There may be established by the Management Committee technical working groups from time to time, the purpose of which shall be to provide advice to the Management Committee on issues of a technical nature related to the activities of the Agency. The Board of Directors will ensure that at least one (1) member from the Management Committee administers technical working groups.

ARTICLE 12. OPERATIONS AND MANAGEMENT

12.1 Administrator and Plan Manager

12.1.1 Administrator: The Board may appoint an Administrator, from time-to-time and when it seems appropriate. If appointed, the Administrator shall serve at the pleasure of the Board of Directors and his/her duties and responsibilities shall be set forth by the Board in their bylaws or actions.

12.1.2 Plan Manager: The Board shall appoint a Plan Manager. The Administrator and Plan Manager may be the same individual. The Plan Manager shall serve at the pleasure of the Board of Directors and his/her duties and responsibilities shall be set forth by the Board.

12. 2 Treasurer and Controller. The County of Butte shall act as treasurer and controller for the Agency. The controller of the Agency shall cause an independent audit of the Agency's finances to be made by a certified public accountant in compliance with California Government Code section 6505. The treasurer of the Agency shall be the depositor and shall have custody of all money of the Agency from whatever source. The controller of the Agency shall draw warrants and pay demands against the Agency when the demands have been approved by the Agency or any authorized representative pursuant to any delegation of Agency adopted by the

Agency. The treasurer and controller shall comply strictly with the provisions of statutes relating to their duties found in Chapter 5 (commencing with section 6500) of Division 7 of Title 1 of the California Government Code.

12.2. Legal Counsel and Other Consultants. The Board of Directors may appoint legal counsel who shall serve at the pleasure of the Board. Subject to the limits of the Agency's approved budget, the Board shall also have the power to appoint and contract for the services of other officers, consultants, advisers and independent contractors as it may deem necessary or convenient for the business of the Agency, all of whom shall serve at the pleasure of the Board. The appointed General Legal Counsel and other appointed officers of the Agency shall not be employees or contractors of one or more of the Members. Appointment of a General Legal Counsel shall be subject to all applicable Rules of Professional Responsibility, and notwithstanding anything to the contrary in this Agreement, each of the Members expressly reserve and do not waive their rights to approve or disapprove of potential conflicts of Agency General Legal Counsel.

12.3 Employees and Management. The Agency will not have any employees. In lieu of hiring employees, the Agency may engage one or more Members to manage any or all of the business of the Agency on terms and conditions acceptable to the Board of Directors. Any Member so engaged shall have such responsibilities as set forth in an agreement for such Member's services, which shall be approved by a super-majority vote of the Directors. The Agency shall have the power to employ competent registered civil engineers and other consultants to investigate and to carefully devise a plan or plans to carry out and fulfill the objects and purposes of SGMA, and complete a GSP.

12.4 Principal Office. At the initial meeting of the Board, the Board shall establish a principal office for the Agency, which shall be located at a place overlying the Agency Jurisdiction. The Board may change the principal office from time to time so long as that principal office remains at a location overlying the Agency Jurisdiction.

12.5 Bylaws. The Board shall adopt Bylaws governing the conduct of the meetings and the day-to-day operations of the Agency within six months of the Effective Date of this Agreement.

12.6 Official Seal and Letterhead. The Board may adopt, and/or amend, an official seal and letterhead for the Agency.

12.7 Conflict of Interest Code. The Board shall adopt and file a Conflict of Interest Code pursuant to the provisions of the Political Reform Act of 1974 within six months of the Effective Date. The Board may review and revise the Conflict of Interest Code from time to time as appropriate or when required by law.

ARTICLE 13. MANAGEMENT AREAS

13.1 Formation of Management Areas. There will be three Management Areas within the Agency's Jurisdiction. One Management Area overlies the Butte County area north of the City of Chico and Big Chico Creek, within the jurisdictional boundary of the Agency, referred to as the Vina North Management Area. The second Management Area encompasses the area that overlies the municipal area within and adjacent to the City of Chico as is, referred to as the Vina

Chico Management Area. The third Management Area overlies the Durham Irrigation District and the Butte County areas south of the City of Chico and is referred to as the Vina South Management Area. The final boundaries and titles of the Management Areas shall be determined by the Agency Board in consultation with the Vina Stakeholder Advisory Committee.

13.2 Management Areas Chapters. Management Areas refer to an area within a basin for which a GSP may identify minimum thresholds, measurable objectives, monitoring, and projects and actions based on unique local conditions. The Management Areas will be distinct "chapters" in the GSP that will include specific minimum thresholds, measurable objectives, monitoring and projects. All chapters must be consistent with the subbasin-wide sustainability goals.

13.3 Management Area Lead Responsibilities and Coordination. Subject to the reservation of authority in Article 13.5, each of the Members will have the responsibility to cooperatively develop their relevant Management Area chapter for inclusion into the GSP. The development of all Management Area chapters will be coordinated through the Management Committee to ensure consistency and efficiency. Butte County will be responsible for preparing the Vina North Management Area chapter within the Agency Jurisdiction. The City of Chico will be responsible for preparing the Vina Chico Management Area chapter for the municipal area within and adjacent to Chico. Butte County and Durham Irrigation District will be responsible for preparing the Vina South Management Area chapter.

13.4 Role of Agency. Subject to the reservation of authority set forth in Article 13.5, the Agency will serve a coordination and administrative role in the development of the Management Area chapters prepared by the applicable Member agencies. The Agency will be responsible for reviewing and accepting Management Area chapters which they determine to be compliant with SGMA and applicable regulations for inclusion into the GSP. Upon inclusion of Management Area chapters into the GSP, the Agency will be responsible for implementation and enforcement pursuant to Article 5.

13.5 Reservation of Authority. In the event of a failure by a Member to develop and submit a Management Area chapter within the deadline set by the Agency, the Agency reserves and retains all requisite authority to (1) develop and approve the Management Area chapter, and (2) allocate the cost of development of the Management Area chapter to Members within such Management Area.

13.6 Additional Management Areas. Additional Management Areas may be defined and established by the Board of Directors as set forth in 9.3.

ARTICLE 14. SPECIFIC PROJECTS

14.1. Projects. The Agency intends to carry out activities in furtherance of its purposes and consistent with the powers established by the Agreement with the participation of all Members.

14.2. Member Specific Projects. In addition to the general activities undertaken by all Members of the Agency, the Agency may initiate specific projects that involve less than all Members.

14.3. Project Agreement. Prior to undertaking any project that does not involve all Member Agencies, the Members electing to participate in the Project shall enter into a Project Agreement. A Member may elect not to participate in a specific project matter by providing notice and not entering into the Project Agreement specific to the matter in which the Member has elected not to participate. Each Project Agreement shall provide the terms and conditions by which the Members that enter into the Project Agreement will participate in the Project. All assets, rights, benefits, and obligations attributable to the Project shall be assets, rights, benefits, and obligations of those Members which have entered into the Project Agreement. Any debts, liabilities, obligations, or indebtedness incurred by the Agency in regard to a particular Project shall be the debts, liabilities, obligations, and indebtedness of those Members who have executed the Project Agreement in accordance with the terms thereof and shall not be the debts, liabilities, obligations, and indebtedness of those Members who have not executed the Project Agreement. Members that do not enter into Project Agreements will not receive or be entitled to any of the benefits accruing from the project.

14.4. Board of Directors Approval. The Board of Directors shall have the authority to disapprove any Project Agreement upon a determination that the Project Agreement has specific, substantial adverse impacts upon Members that have not executed the Project Agreement.

ARTICLE 15. FINANCIAL PROVISIONS

15.1. Agency Funding and Contributions. In order to provide the needed capital to initially fund the Agency, the Agency shall be initially funded through a GSP grant awarded by the DWR and through in-kind contributions of Members. In subsequent years and as needed, the Agency may be funded through additional voluntary contributions by Members and as otherwise provided in Chapter 8 of SGMA (commencing with section 10730 of the Water Code).

15.2. Budgets. Within ninety (90) days after the first meeting of the Board of the Agency, and thereafter prior to the commencement of each fiscal year, the Board of Directors shall adopt a budget for the Agency for the ensuing fiscal year.

15.3. Long-Term Funding. Upon formation of the Agency, the Board of Directors shall work on the development, adoption and implementation of a long-term funding plan to cover the operating and administrative expenses of the Agency.

ARTICLE 16. LIABILITY AND INDEMNIFICATION

16.1. Liability. The Members do not intend hereby to be obligated either jointly or severally for the debts, liabilities or obligations of the Agency, except as may be specifically provided for in California Government Code section 895.2, as amended or supplemented. Therefore, unless and to the extent otherwise required by law or agreed to herein by the Members, in accordance with California Government Code section 6507 the debts, liabilities and obligations of the Agency shall not be the debts, liabilities or obligations of the Member entities. The Agency shall own and hold title to all funds, property and works acquired by it during the term of this Agreement.

16.2. Indemnification. Funds of the Agency may be used to defend, indemnify, and hold harmless the Agency, each Member, each Director, and any officers, agents and employees of the Agency for their actions taken within the course and scope of their duties while acting on behalf of the Agency. Other than for gross negligence or intentional acts, to the fullest extent

permitted by law, the Agency agrees to save, indemnify, defend and hold harmless each Member from any liability, claims, suits, actions, arbitration proceedings, administrative proceedings, regulatory proceedings, losses, expenses or costs of any kind, whether actual, alleged or threatened, including attorney's fees and costs, court costs, interest, defense costs, and expert witness fees, where the same arise out of, or are in any way attributable in whole or in part to, negligent acts or omissions of the Agency officers or agents, or the employees, officers or agents of any Member, while acting within the course and scope of a Member relationship with the Agency.

Members participating in special project agreements if conducted by the Agency, shall hold each of the other parties to this Agreement who are not parties to the special project agreement free and harmless from and indemnify each of them against any and all costs, losses, damages, claims and liabilities arising from the special project agreement.

ARTICLE 17. WITHDRAWAL AND TERMINATION

17.1. Withdrawal. A Member may unilaterally withdraw from this Agreement without causing or requiring termination of this Agreement, effective upon sixty (60) days written notice to the remaining Members. The notice of withdrawal shall state whether the withdrawing Member will elect to serve as a GSA for all or any portion of the lands within its boundaries or if the Agency shall continue to serve as the GSA for the withdrawing Member's boundaries. In the event the withdrawing Member's notice of withdrawal would create an overlap of GSA boundaries with the boundaries of any other Member, not including Butte County, the affected Members will meet and confer in good faith to attempt to resolve the overlap. In the event Butte County withdraws, it will not create a GSA overlap with the boundaries of any of the other Members.

17.2. Termination of Agency. This Agreement may be rescinded and the Agency terminated by unanimous written consent of all Members, except during the outstanding term of any Agency indebtedness.

17.3. Involuntary Termination. The Members acknowledge that SGMA requires that multiple GSAs within a given subbasin must coordinate and are required to use the same data and consistent methodologies for certain required technical assumptions when developing a GSP and that the entire Basin must be implementing one or more GSPs for the Basin to be deemed in compliance with SGMA. As a result, upon a supermajority determination of the Board of Directors that the actions of a Member (1) fail to comply with the terms of this Agreement; or (2) conflict with or undermines the functioning of the Agency or the preparation and implementation of the requirements of the GSP, the Board of Directors may terminate that Member's membership in this Agency, provided that prior to any vote to remove a Member involuntarily all of the Members shall meet and confer regarding all matters related to the proposed removal.

17.4. Effect of Withdrawal or Termination. This Agreement may be terminated and the Agency dissolved by a unanimous vote of the Member Directors. Upon termination of this Agreement or unilateral withdrawal, a Member shall remain obligated to pay its share of all debts, liabilities and obligations of the Agency required of the Member pursuant to the terms of this Agreement which were incurred or accrued prior to the date of such termination or withdrawal, including without limitation, those debts, liabilities and obligations pursuant to Section 5. Any Member that withdraws from the Agency shall have no right to participate in the business and affairs of the Agency or to exercise any rights of a Member under this Agreement

or the Act, but shall continue to share in distributions from the Agency on the same basis as if such Member had not withdrawn, provided that a Member that has withdrawn from the Agency shall not receive distributions in excess of the contributions made to the Agency while a Member. The right to share in distributions granted under this section shall be in lieu of any right the withdrawn Member may have to receive a distribution or payment of the fair value of the Member's interest in the Agency.

17.5. Right of Member to Become GSA in Event of Withdrawal or Termination. Upon withdrawal or involuntary termination of a Member, or termination of this Agreement pursuant to section 17.2, regardless of its occurrence after June 30, 2017, the withdrawing or terminated Member will retain all rights and powers to become or otherwise participate in a GSA for the lands within its boundaries. A Member may, in its sole discretion, withdraw from the JPA, effective sixty (60) days after written notice to the Agency. In such an event, the Agency and its remaining Members will not object to or interfere with the lands in the withdrawing Member's boundaries; will facilitate such a transition to the extent necessary; and will withdraw from management that portion of the subbasin and so notify DWR. Upon withdrawal or termination, any Member shall be entitled to use data or other information developed by the Agency during its time as a Member. Further should a member withdraw from the Agency after completion of the GSP, it shall be entitled to utilize the GSP for future implementation of SGMA within its boundaries.

17.6. Disposition of Agency Assets upon Termination.

17.6.1. Surplus Funds. Upon termination of this Agreement, any reserves or surplus money on-hand shall be returned to the Members in the same proportion said Members have funded such reserves or surplus, in accordance with California Government Code section 6512.

17.6.2. Agency Property. The Agency shall first offer any assets of the Agency for sale to the Members on terms and conditions determined by the Board of Directors. If no such sale to Members is consummated, the Board shall offer the assets of the Agency for sale to any non-member for good and adequate consideration on terms and conditions determined by the Board of Directors.

ARTICLE 18. MISCELLANEOUS

18.1. No Predetermination or Irretrievable Commitment of Resources. Nothing in this Agreement shall constitute a determination by the Agency or any of its Members that any action shall be undertaken or that any unconditional or irretrievable commitment of resources shall be made, until such time as the required compliance with all local, state, or federal laws, including without limitation the California Environmental Quality Act, National Environmental Policy Act, or permit requirements, as applicable, has been completed.

18.2. Notices. Notices hereunder shall be sufficient if delivered via electronic mail, First-Class mail or facsimile transmission to the addresses below:

County of Butte: Department of Water and Resource Conservation, 308 Nelson Ave, Oroville, CA 95965

City of Chico: 411 Main Street, Chico, CA 95928

18.3. Amendment. This Agreement may be amended at any time, by unanimous agreement of the Members, provided that before any amendments shall be operative or valid, it shall be reduced to writing and signed by all Members hereto.

18.4. Agreement Complete. This Agreement constitutes the full and complete agreement of the Members. This Agreement supersedes all prior agreements and understandings, whether in writing or oral, related to the subject matter of this Agreement that are not set forth in writing herein.

18.5. Severability. If any provision of this Agreement is determined to be invalid or unenforceable, the remaining provisions will remain in force and unaffected to the fullest extent permitted by law and regulation.

18.6. Execution in Counterparts. The Parties intend to execute this Agreement in counterparts. It is the intent of the Parties to hold one (1) counterpart with single original signatures to evidence the Agreement and to thereafter forward four (4) other original counterparts on a rotating basis for all signatures. Thereafter, each Member shall be delivered an originally executed counterpart with all Member signatures.

18.7. Withdrawal by Operation of Law. Should the participation of any Member to this Agreement be decided by the courts to be illegal or in excess of that Member's authority or in conflict with any law, the validity of this Agreement as to the remaining Members shall not be affected thereby.

18.8. Assignment. The rights and duties of the Members may not be assigned or delegated without the written consent of all other Members. Any attempt to assign or delegate such rights or duties in contravention of this Agreement shall be null and void.

18.9. Binding on Successors. This Agreement shall inure to the benefit of, and be binding upon, the successors or assigns of the Members.

18.10. Other JPAs. Nothing in this Agreement shall prevent the Members from entering into other joint exercise of power agreements.

18.11. Venue. This Agreement shall be governed by and construed in accordance with the laws of the State of California, and any action related to the terms of this Agreement shall be brought and tried in Butte County Superior Court.

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective governing boards, have caused their names to be affixed by their proper and respective officers as of the date of execution of this Agreement.

County of Butte

By: _____ Date: 3/12/19

Chair
Board of Supervisors

City of Chico

By: _____ Date: 04/09/2019

Mayor
City Council

Durham Irrigation District

By: _____ Date: 3/12/19

President
Board of Directors

Exhibit A: List of Member Agencies

Exhibit B: Vina Subbasin Map

Appendix A: Stakeholder Advisory Committee to the Agency Board

EXHIBIT A

LIST OF MEMBERS

County of Butte
Department of Water and Resource Conservation
308 Nelson Ave
Oroville, CA 95973

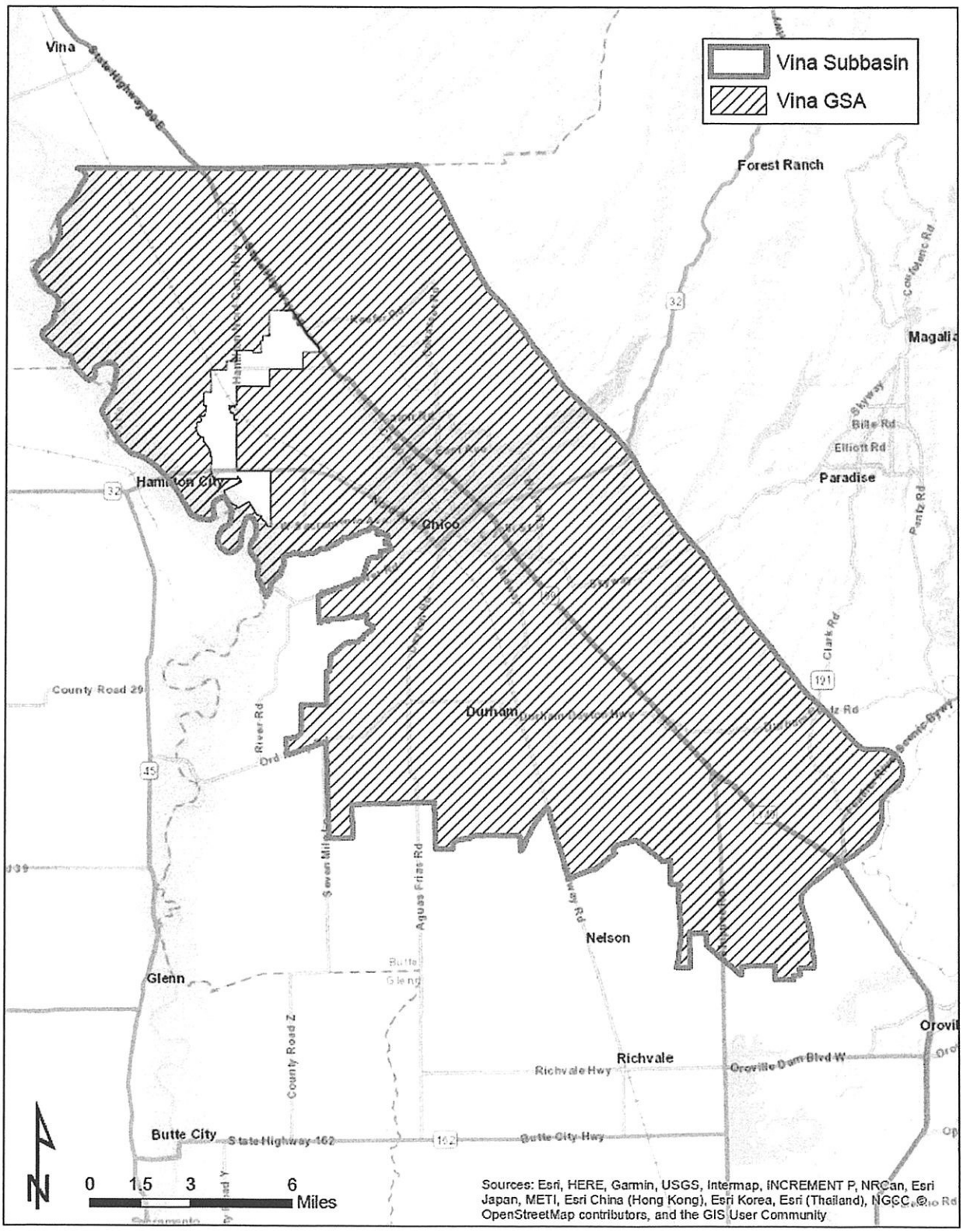
City of Chico
411 Main Street
Chico, CA 95928

Durham Irrigation District
9418-C Midway
Durham, CA 95938

EXHIBIT B

VINA SUBBASIN AND THE

BOUNDARY OF THE VINA GROUNDWATER SUSTAINABILITY AGENCY



APPENDIX A

Stakeholder Advisory Committee to the Agency Board

The purpose of the Advisory Committee (AC) is to provide input and recommendations to the Agency Board of Directors concerning GSP development and implementation and on matters of policy affecting the GSA. The intent of the AC is to provide community perspective and a forum for public/stakeholder participation in the GSA.

The AC will review and/or provide recommendations to the Agency Board on groundwater-related issues that may include:

- Development, adoption, amendment of the GSP
- Sustainability goals and objectives
- Best management practices
- Monitoring programs
- Annual work plans and reports (including mandatory 5-year milestone reports)
- Modeling scenarios
- Inter-basin coordination activities
- Projects and management actions to achieve sustainability
- Community outreach
- Local regulations to implement SGMA
- Fee proposals
- Other

The AC will not be involved in the Agency's day to day operations, such as contracting, budgeting, etc.

Membership

Composition of the AC is intended to represent the beneficial uses and users of groundwater identified in SGMA, as applicable in the Agency Jurisdiction. AC members may not serve concurrently on the Agency Board. Members must live or work within the Agency Jurisdiction or represent an organization with a presence in the Agency Jurisdiction.

The Agency Board will appoint representatives to the AC, for a total not to exceed 10 members. The following represents a draft, proposed list of possible AC representation:

- Cal Water-Chico (1)
- Agricultural groundwater users (3):
- At-large domestic well users (2):
- At-large environmental representative (1)
- At-large business representative (1)

The Agency Board may appoint other interests representing beneficial users and uses of groundwater as per Water Code Section 10723.3.

Member Appointment
The Agency Board will appoint At-large members to fill AC seats. Interested individuals from the community or organizations may apply to the Agency Board, designating in the application the seat that the applicant would intend to fill.

The Agency Board encourages candidates with experience and familiarity with groundwater and its management. The Agency Board will also give preference to applicants who have the backing of multiple organizations or individuals and/or have experience working with diverse community-based groups.

Application Timeline
The Agency Board will establish a timeline and process for appointment of the initial AC following Agency formation. In subsequent years, applicants will submit an application for vacant seats. The GSA will post applications on its website.

Advisory Committee Member Terms
AC member seats are four-year terms. AC members are not term-limited. However, each term AC members must resubmit an application to the Agency Board.

The Agency Board can only remove an AC member if the member fails to attend three consecutive meetings or if the AC member no longer meets the criteria for AC membership. The Agency Board will appoint alternates, if the Agency Board deems alternates necessary.

Decision Making and Governing Board Consideration
To inform Agency Board decision-making, the AC will provide written recommendations that will be included in Management Committee reports. The recommendations will identify areas of agreement and disagreement. The AC will strive for consensus when possible, but reaching consensus is not necessary. When unable to reach consensus on recommendations, the AC will outline the areas in which it does not agree, providing some explanation to better inform Agency Board decision-making.

Pursuant to Agency Board direction, the Management Committee will develop the annual work plan and schedule for AC meetings. The AC will adopt a charter describing their purpose, operating principles and ground rules that will be confirmed by the Agency Board.

The Agency Board will consider AC recommendations when making decisions. If the Agency Board does not agree with the recommendations of the AC, the Agency Board shall state the reasons for its decision.

Public Process
All AC meetings are subject to the Brown Act and will be noticed and open to the public.

APPENDIX 1-D

Groundwater Status Report for the 2020 Water Year

Butte County Department of Water and Resource Conservation

Groundwater Status Report

2020 Water Year

Prepared by Kelly Peterson, Water Resources Scientist

February 2021

Acronyms and Definitions

2020 WY – 2020 water year means the 2020 hydrological year spanning from October 1, 2019 – September 30, 2020 designated by the calendar year in which it ends.

BMOs - Basin Management Objectives means the levels which have been established for acceptable groundwater conditions in Butte County for groundwater elevations, groundwater quality related to saline intrusion and land subsidence. Measurements that fall outside of a BMO for a specific parameter can trigger a BMO Alert Stage.

CASGEM - California Statewide Groundwater Elevation Monitoring Program means the program developed by the California Department of Water Resources pursuant to Water Code Section 10920 et seq., or as amended, mandating statewide groundwater elevation monitoring to track seasonal and long-term trends in basins throughout the state.

Department - Butte County Department of Water and Resource Conservation means the Butte County department formed on July 1, 1999 with the mission to manage and conserve water and other resources for the citizens of Butte County.

DWR - California Department of Water Resources means the state agency established in 1956 by the California State Legislature to protect, conserve, develop and manage much of California's water supply.

GSA - Groundwater Sustainability Agency means one or more local agencies with water supply, water management, or land use responsibilities within a groundwater basin that implements the provisions of the Sustainable Groundwater Management Act.

GSP - Groundwater Sustainability Plan means a plan of a groundwater sustainability agency proposed or adopted pursuant to the Sustainable Groundwater Management Act.

SGMA - Sustainable Groundwater Management Act means a package of bills collectively signed into law September 16, 2014 requiring local sustainable management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results, and providing the state with broad oversight authority and the ability to intervene.

TAC - Butte County Water Commission Technical Advisory Committee means the seven-member committee nominated by the Water Commission and appointed by the Board of Supervisors as defined under Chapter 33 of the Butte County Code.

Executive Summary - 2020 Water Year

The 2020 water year (2020 WY) which ran from October 1, 2019 to September 30, 2020 started out with moderate precipitation in late-November, which continued into late-January. February was dry; however some precipitation fell from March into early April and again in May. A wet spring partially compensated for the dry winter months but was insufficient to reach average hydrologic conditions in Northern California. Average statewide precipitation on September 30, 2020 was 71%. Overall, the 2020 WY had below average rainfall, snow pack and runoff conditions. Water supply conditions led to a 20% allocation for State Water Project contractors statewide.

The 2020 WY was classified as a *dry* water year for the Sacramento Hydrologic Region. It followed a *wet* year, a *below normal* year, and another *wet* year. According to the Northern Sierra Precipitation 8 Station Index, the 2020 WY ended on September 30, 2020 with 31.7 cumulative inches of precipitation, 62% of the long-term average. Another way to characterize hydrologic conditions is to review the amount of runoff flowing into streams and rivers in a given year. The Sacramento River Region unimpaired runoff as of September 30, 2020 was 9.6 million acre-feet, which is about 54% of average and significantly lower than the previous year's runoff at the same time which was 139% of average. The snowpack statewide on April 1, 2020 was 50% of the April 1 average based on electric sensor readings and 53% of the April 1 average based on manual snow level measurements. In the beginning of the 2020 water year, there was good carryover storage in the reservoirs at 125% of average. Even with dry conditions throughout the year, statewide reservoir storage was 95% of average at the end of the 2020 WY.

The dry conditions in 2020 following the *wet* water year of 2019 brought modest decreases to groundwater levels, specifically in groundwater dependent areas of the county. The Butte County Department of Water and Resource Conservation (Department), in cooperation with the California Department of Water Resources (DWR) Northern Region Office, conducts four manual groundwater level measurements annually (spring, July, August and fall). Spring groundwater levels in 2020 were approximately 4 feet lower on average compared to the spring of 2019 (see Table 5). Close to 57% of the monitored wells with Alert Stages assigned to them remained in spring Alert Stage 1 or 2 levels and 76% were in a Fall Alert Stage 1 or 2, indicating that groundwater levels remained near historical lows in some areas (Table 9 and Table 10 and map in Appendix C).

The Department conducted its nineteenth year of groundwater quality trend monitoring for evidence of saline intrusion from July 29 – 31, 2020. All samples were within the acceptable range for electrical conductivity and pH, and temperatures remained relatively consistent. The 2020 Water Quality Trend Monitoring Report is Appendix D of this report and highlights are included in this report.

Subsidence is monitored by periodic land surveys and continuously by extensometers. No inelastic land subsidence was detected in Butte County from an evaluation of the available extensometer records.

Table of Contents

Acronyms and Definitions i
Executive Summary - 2020 Water Year ii
Foreword 1
Hydrologic Conditions 4
Precipitation 7
Feather River Surface Water Diversions 9
Groundwater Conditions 10
Monitoring Frequency 10
Groundwater Quality Trend Monitoring 10
Land Subsidence 12
Groundwater Level Monitoring 15
Change in Groundwater Levels: 2019 to 2020 17
Seasonal Groundwater Level Change 21
Basin Management Objectives 21

Well Numbering System — Appendix A
Butte County Monitoring and CASGEM Network Maps — Appendix B
Groundwater Level Alert Stage Maps — Appendix C
2020 Water Quality Trend Monitoring Report — Appendix D
Sacramento Valley Subsidence Monitoring Network — Appendix E
Spring, Summer, & Fall BMO Summary Tables — Appendix F
DWR Groundwater Level Contour & Change Maps — Appendix G

Foreword

This report presents the status of groundwater conditions and ground surface elevation monitoring based on data collected by Butte County and the California Department of Water Resources (DWR) during the 2020 Water Year (2020 WY), October 1, 2019 - September 30, 2020. The fall measurements taken in mid-October 2020 are also included since they reflect conditions and activities of the 2020 WY. The report gives general information regarding locations of wells and land subsidence monitoring sites, statistics related to groundwater level trends and historical precipitation information. The Butte County Department of Water and Resource Conservation (Department) with assistance from the DWR Northern Region Office and the Butte County Water Commission Technical Advisory Committee (TAC) prepared this report. This report complies with reporting requirements established in Chapter 33, Chapter 33A of the Butte County Code, and the California Statewide Groundwater Elevation Monitoring program (CASGEM).

In November 1996, the voters in Butte County approved "AN ORDINANCE TO PROTECT THE GROUNDWATER RESOURCES IN BUTTE COUNTY." One of the stated purposes of the ordinance was that "the groundwater underlying Butte County is a significant water resource which must be reasonably and beneficially used and conserved for the benefit of the overlying land by avoiding extractions which harm the Butte Basin aquifer, causing exceedance of the safe yield or a condition of overdraft." The ordinance is now codified as Chapter 33 of the Butte County Code relating to groundwater conservation. Section 3.01 – "Groundwater Planning Process" requires the preparation of a groundwater status report based upon the data gathered and analyzed pursuant to Section 3.02 – "Groundwater Monitoring". Until 2010, the Butte Basin Water Users Association completed this reporting.

In 2000, the Butte County Board of Supervisors amended Chapter 33, the Groundwater Conservation Ordinance, to require the delivery of the Groundwater Status Report by February of each year. In 2010, the Water Commission designated the Department as the entity responsible for creating and submitting the annual report. Over the years, as responsibilities and water resource programs including advisory committees have shifted more and more to the County, the Butte Basin Water Users Association participation declined. In 2012, its members voted to dissolve the organization after twenty years of serving the region.

In February 2004, the Butte County Board of Supervisors adopted the Groundwater Management Ordinance, which was codified as Chapter 33A of the Butte County Code. Chapter 33A calls for the establishment of a monitoring network and Basin Management Objectives (BMOs) for groundwater elevation, groundwater quality related to saline intrusion and land subsidence. The BMO concept was incorporated into California Water Code §10750 et. seq., as a component of AB 3030 Groundwater Management Plans. On September 28, 2004, the Butte County Board of Supervisors formally approved Resolution 04-181 adopting the countywide AB 3030 Groundwater Management Plan that includes components of the BMO program. In 2011, Chapter 33A was amended and retitled to "Basin Management Objectives" requiring a report each February describing conditions in the basin relative to established basin management objectives. The foregoing actions by the Board allow the consolidation of reporting of

groundwater conditions from both Chapter 33 and 33A into a single report submitted by the Department on an annual basis in February.

The Groundwater Status Report is in the process of undergoing revisions in recent years in order to meet requirements of the Sustainable Groundwater Management Act (SGMA). On September 16, 2014, Governor Brown signed into law a package of bills collectively called SGMA. SGMA requires local management of groundwater subbasins, and provides the state with broad oversight authority and the ability to intervene. Local management of subbasin(s) are the responsibility of a local public agency or combination of local agencies that designate themselves as the "Groundwater Sustainability Agency" (GSA) for all or a portion of their subbasin. Local public agencies eligible to be a GSA must have water supply, water management or land-use responsibilities. GSA formation was required by June 30, 2017, with the consequence of the California State Water Resources Control Board assuming management of any subbasin(s) unable to meet these requirements. All three of the existing groundwater subbasins within Butte County (Vina, Butte and Wyandotte Creek subbasins) have established GSAs covering the entirety of the subbasins. These subbasins are shown on the map in Appendix B.

Discussions among GSAs to establish governance structures to manage groundwater and develop Groundwater Sustainability Plans (GSPs) for these subbasins began in earnest in 2018. An executed Joint Powers Authority formed the Wyandotte Creek GSA in 2018 with a subsequent amendment signed into place in 2019. The Wyandotte Creek GSA is the exclusive GSA for the Wyandotte Creek subbasin. In 2019, an executed Joint Powers Authority formed the Vina GSA. The Vina GSA is responsible for groundwater management for the majority of the subbasin. The Rock Creek Reclamation District GSA is responsible for a smaller portion of the subbasin. The Butte subbasin governance was finalized in late 2019 with a Cooperation Agreement amongst the 11 GSAs in the subbasin who will work together to develop and implement one GSP for the subbasin. GSAs must prepare and implement GSPs for their subbasin or their portion of their subbasin or face the prospect of state intervention. Adoption of GSPs must occur by January 31, 2020 for subbasins that are in critical overdraft condition or by January 31, 2022, for all other subbasins. The Vina, Butte and Wyandotte Creek subbasin GSPs will be submitted by January 31, 2022 since they are not in critical overdraft. GSPs must contain the same elements as those in Groundwater Management Plans. Additionally, GSPs must include a water budget covering a 50-year planning horizon, measurable objectives, minimum thresholds and interim milestones (every five years) that will lead to sustainability in 20 years. GSPs must address "undesirable results" that include chronic lowering of groundwater levels and significant and unreasonable reduction in groundwater storage, degradation of water quality, land subsidence and surface water depletions. GSPs are exempt from the California Environmental Quality Act but projects or actions to implement the plan are not exempt. GSAs must submit annual reports to DWR by April 1st.

The annual report must include the following information:

- Groundwater elevation data
- Annual aggregated data identifying groundwater extraction for the preceding water year
- Surface water supply used for, or available for use for groundwater recharge or in-lieu use
- Total water use
- Change in groundwater storage

The first annual report will not be required until 2022. The approach will be to modify this County Annual Groundwater Status Report to meet the requirements of the annual reports for each subbasin.

In addition, in light of new requirements of SGMA, revisions to Chapter 33A were approved in 2019 to continue the transition of groundwater management in Butte County from the BMO program to implementation of SGMA in each of the three subbasins in Butte County. The BMO program has been a critical component of the County's water management effort over the past fifteen years. The BMO program has made enormous progress in developing, analyzing and disseminating information on local groundwater conditions. The strengths and benefits of the BMO program will be incorporated into the governance, GSPs and outreach established under SGMA. As a result, revisions to Chapter 33A include an expiration date for the ordinance of January 31, 2022 to align with the final deadline for submittal of GSPs to DWR under SGMA for subbasins in Butte County. In the meantime, monitoring and reporting of groundwater conditions (levels, water quality and land subsidence) will continue, but will become consistent with the extents of the three subbasins managed under SGMA and new revised Management Areas will replace the original 16 sub-inventory units for reporting purposes. This annual report continues to make this transition in the tables and maps included in the report and appendices. Revisions to Chapter 33-A of the Butte County Code in 2019 included the dissolution of the Water Advisory Committee as well as removal of the individual sub-inventory unit reports previously included as appendices in past annual reports.

The CASGEM program was amended to the Water Code in 2009 through the enactment of SBx7-6, Groundwater Monitoring, as part of the Comprehensive Water Package. CASGEM mandates statewide groundwater elevation monitoring to track seasonal and long-term trends in basins throughout the state. The legislation created a statewide program to collect groundwater elevation data, facilitate collaboration among monitoring entities, and develop a means of reporting groundwater data to the public. The Department has this responsibility as the monitoring and reporting entity for Butte County. As described in the Butte County CASGEM Monitoring Plan, the Butte County CASGEM program will utilize approximately 72 wells from the network for the CASGEM program. These 72 wells comprise primarily dedicated monitoring wells. A map of these locations can be located in Appendix B.

Data from published reports prepared for the Department are included throughout this document where relevant, and the referenced documents are listed in Appendices or as references, as well as being available on the Department's website at www.buttecounty.net/waterresourceconservation. All past years' Groundwater Status Reports and BMO documents are also available on the Department's website.

Hydrologic Conditions

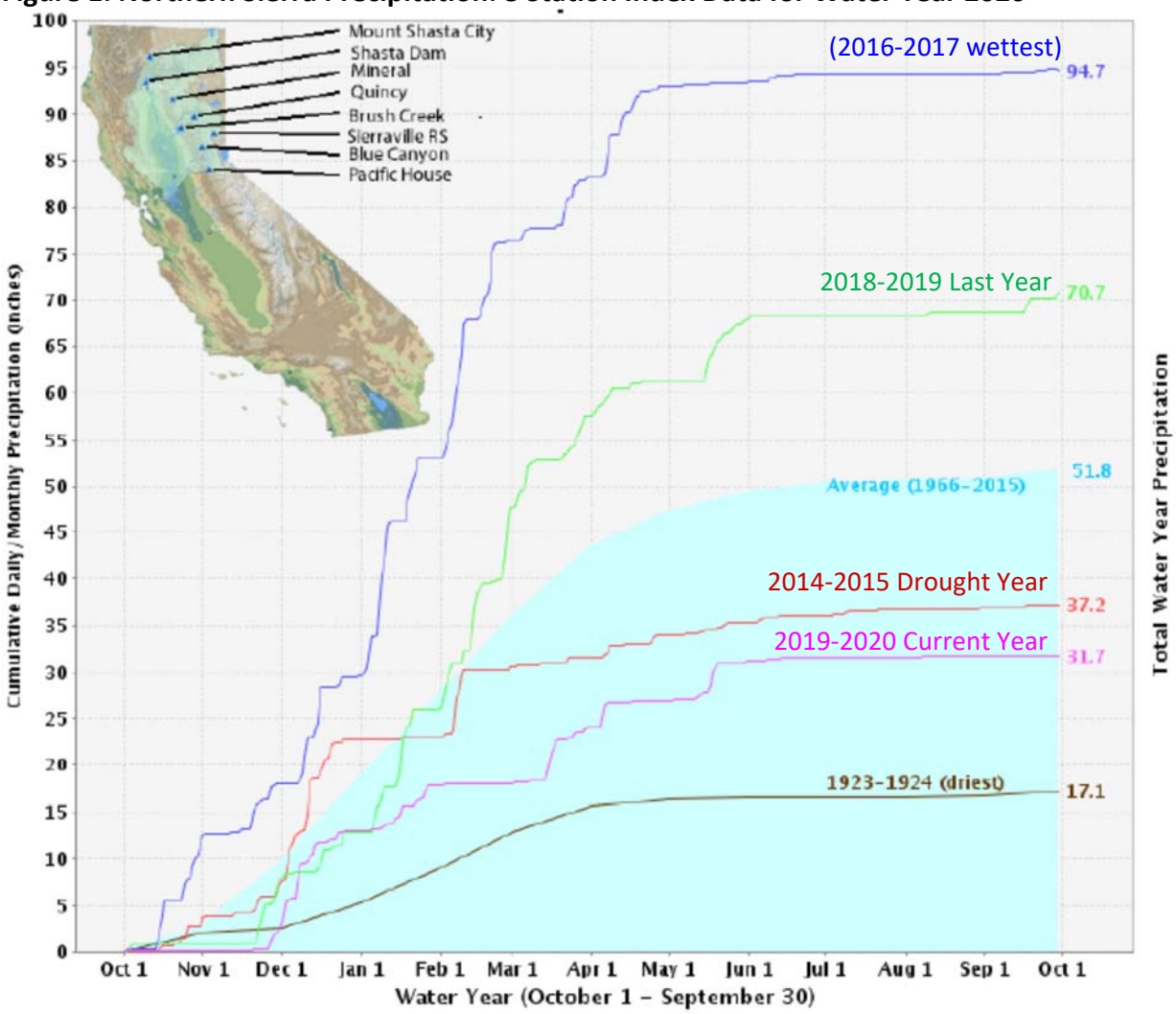
A number of data sources and indices are available to characterize and compare hydrologic conditions within or between particular years. The data sources typically report hydrologic data on a water year basis, or the 12-month period from October through September. The 2020 WY began on October 1, 2019 and ended on September 30, 2020. The 2020 WY was classified as a *dry* year for the Sacramento Hydrologic Region. At the end of the 2020 WY on September 30, 2020, statewide hydrologic conditions were as follows: precipitation was 62% of average; runoff was 54% of average; and reservoir storage, 95% of average. Sacramento River Region unimpaired runoff observed through September 30, 2020 was about 9.6 million acre-feet, which is about 54% of average. For comparison, Table 1 shows the volume and percent of average runoff for the previous water years from the *below normal* water year of 2012, through the 2020 WY. Colors represent the corresponding water year type as also depicted in Figure 2.

Table 1. Sacramento River Region Unimpaired Runoff (Million Acre-Feet)

WATER YEAR (TYPE)	2012 (BELOW NORMAL)	2013 (DRY)	2014 (CRITICAL)	2015 (CRITICAL)	2016 (BELOW NORMAL)	2017 (WET)	2018 (BELOW NORMAL)	2019 (WET)	2020 (DRY)
UNIMPAIRED RUNOFF (MILLION ACRE-FEET)	11.8	12.1	7.5	9.2	17.4	37.8	12.8	24.7	9.6
% OF AVERAGE	65%	67%	41%	52%	98%	212%	72%	139%	54%

The Northern Sierra 8-Station Precipitation Index (Figure 1) serves as a precipitation index for the Sacramento River hydrologic region by averaging measurements taken at the following precipitation stations: Blue Canyon, Brush Creek Ranger Station, Mineral, Mount Shasta City, Pacific House, Quincy Ranger Station, Shasta Dam, and Sierraville Ranger Station.[1] This index provides a representative sample of the region's major watersheds: the upper Sacramento, Feather, Yuba, and American Rivers, which produce inflow to some of California's largest reservoirs - the source of much of the state's water supply. The 2020 WY ended with 31.7 cumulative inches of precipitation, which is 62% of the long term (1966 - 2015) average of 51.8 inches. The 2020 WY curve is labeled "2019 - 2020 (current)" on Figure 1.

Figure 1. Northern Sierra Precipitation: 8 Station Index Data for Water Year 2020

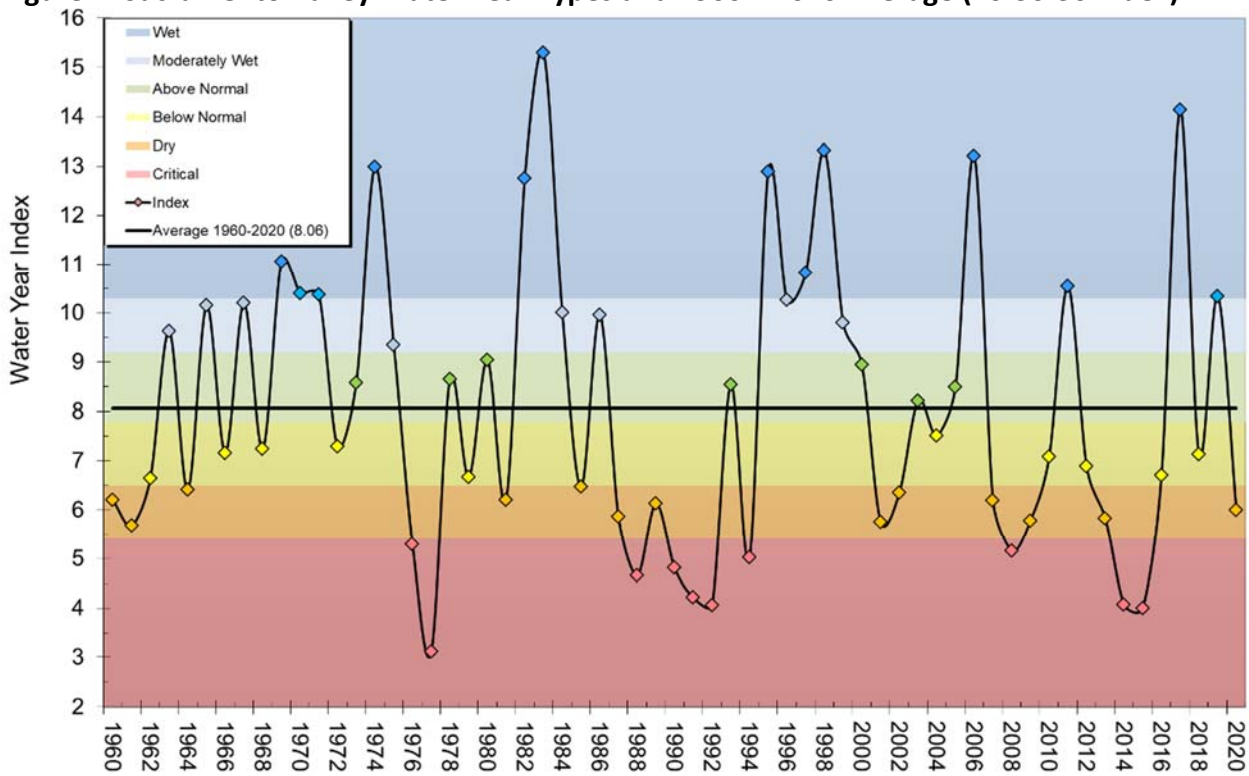


[1] http://cdec.water.ca.gov/cgi-progs/products/PLOT_ESI.pdf

Figure 2 shows the water year type classifications based on the Sacramento Valley 40-30-30 Index going back to 1960 along with the 1960 – 2020 average (8.06). The Sacramento Valley was classified as a *dry* year in 2020 with an index value of 6.0 (Figure 2). Water year classification systems provide a means to assess the amount of water originating in a watershed.

Water year classification systems are useful in water planning and management and have been developed for several hydrologic basins in California. The Sacramento Valley 40-30-30 Index was developed by the California State Water Resources Control Board for the Sacramento hydrologic basins, based on Sacramento River runoff. The Sacramento Valley 40-30-30 Index is computed as a weighted average of the current water year's April - July runoff forecast (40%), the current water year's October - March runoff (30%), and the previous water years index (30%). A cap of 10 million acre-feet is put on the previous year's index to account for required flood control reservoir releases during *wet* years. Sacramento River runoff is the sum of the Sacramento River flow at Bend Bridge, Feather River inflow to Lake Oroville, Yuba River at Smartville, and American River inflow to Folsom Lake[2].

Figure 2. Sacramento Valley Water Year Types and 1960 – 2020 Average (40-30-30 Index)



This system defines one *"wet"* classification, two *"normal"* classifications (*above normal* and *below normal*), and two *"dry"* classifications (*dry and critical*), for a total of five water year types as indicated in the background colors of the figure. The *wet* year background colors in the figure were further broken down into light and dark blue color bands by the Department to highlight

[2] http://cdec.water.ca.gov/cgi-progs/iodir/WSIHIST

variations between moderately wet and wet years to align with how the two *"dry"* classifications (*dry and critical*) are separated.

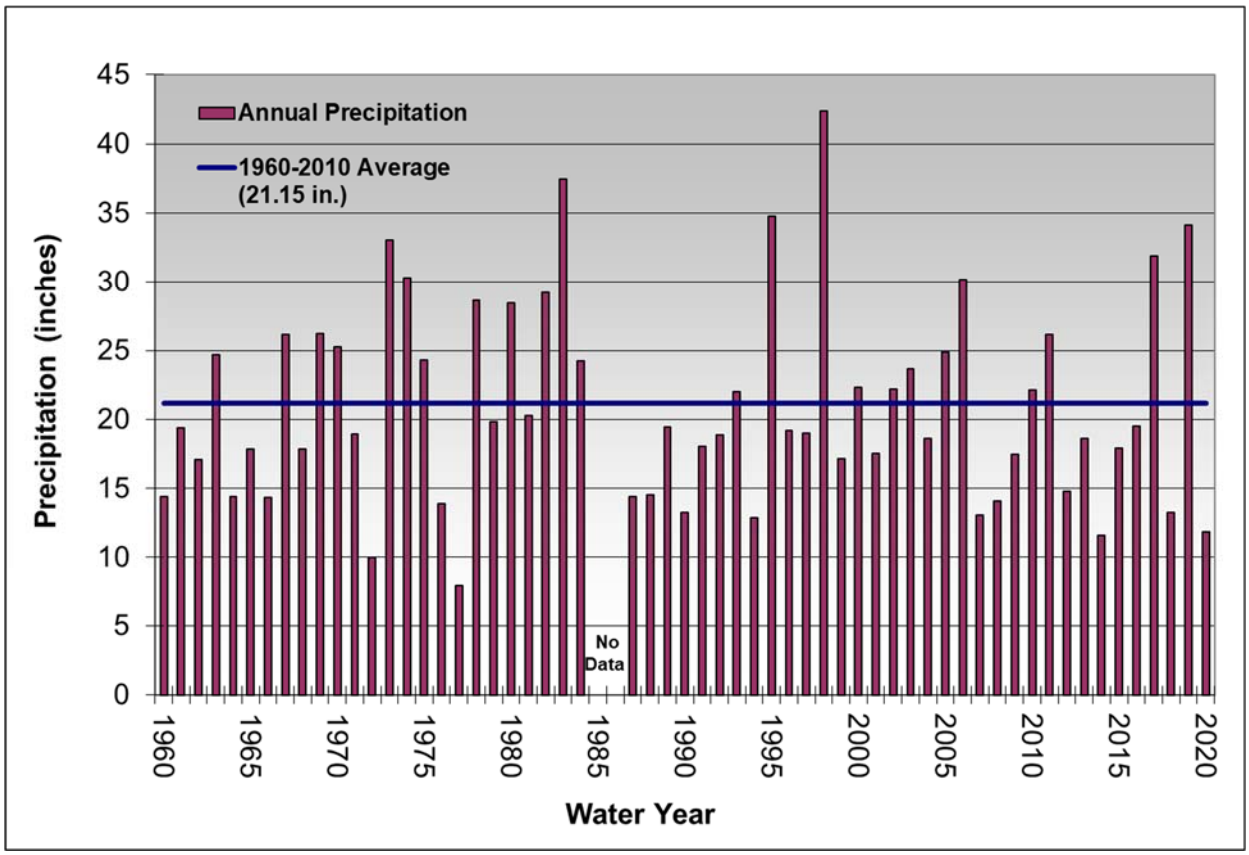
Sacramento Valley water year hydrologic classifications are as follows:

Water Year Type	**Water Year Index**
Wet	Equal to or greater than 9.2
Moderately Wet	Not an official DWR classification
Above Normal	Greater than 7.8, and less than 9.2
Below Normal	Greater than 6.5 and equal to or less than 7.8
Dry	Greater than 5.4, and equal to or less than 6.5
Critical	Equal to or less than 5.4

Precipitation

Figure 3 shows the total annual precipitation at the Western Canal Climatological Observation Station for the 60-year period of water years 1960 through 2020. Precipitation for the 2020 WY measured within the Western Canal Water District's jurisdiction totaled 11.88 inches. This was 9.27 inches below or 56% of the 50-year (1960-2010) average of 21.15 inches.

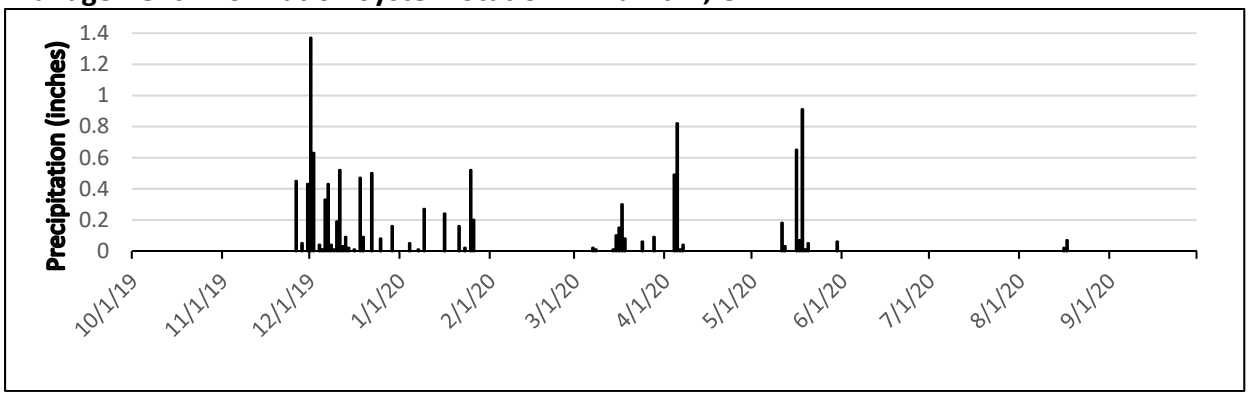
Figure 3. Annual Precipitation Observed from 1960 to 2020 at the Western Canal Climate Station



The timing of rainfall in the valley influences irrigation water use and the timing and volume of snowmelt and runoff. The daily precipitation in the 2020 WY reported from the California Irrigation Management Information System station in Durham provides an indication of when and how much rainfall occurred in order to understand how it may have affected the irrigation season (Figure 4).

Figure 4 shows daily precipitation and storm activity throughout the fall, winter and spring. Only one event measuring over one-inch of precipitation in a single day occurred in the 2020 WY. Due to the wet conditions from May rains, the irrigation season began later than usual, likely near the beginning of May in most areas throughout the County. According to discussions with growers in the Durham / Chico area, a small amount of water use was required for frost protection this water year as was the case in the previous year. While the requirements varied by specific site, approximately only two days were irrigated for frost protection in February.

Figure 4. Daily Precipitation during the 2020 Water Year at the California Irrigation Management Information System Station in Durham, CA



Feather River Surface Water Diversions

Surface water is an important component of the water supply and has benefits to aquifer recharge in the Butte subbasin. During the 2020 WY, a total of 988,390 acre-feet of surface water was diverted by Western Canal Water District and the Joint Water Districts Board. Diversions in the 2020 WY increased by 28,495 acre-feet from the 2019 water year amount and by approximately 346,344 acre-feet more than in 2015. Rice growers did not participate in fallowing water transfers in 2020 and May precipitation led to reductions in planted acreage and lower water deliveries than in years with dry conditions in the late spring. In the 2015 water year, Western Canal Water District and the Joint Water Districts Board had a 50% curtailment of their surface water deliveries due to the drought. It was the first curtailment in 23 years.

Reliable surface water supplies reduce or eliminate the need for groundwater pumping (except when curtailments occur) and provide some recharge to the subbasin. This results in generally shallow and stable groundwater conditions in these areas. Table 2 summarizes diversions in acre-feet to Western Canal Water District and the Joint Water Districts Board for water years 2000 to 2020.

Table **2**. Surface Water Diversions (acre-feet) for the Western Canal Water District and the Joint Water Boards for Water Years 2000 to 2020

Water Year	Western Canal Water District	Joint Water Districts Board*	Total
2000	314,737	707,018	1,032,392
2001	302,784	718,489	1,021,562
2002	305,460	597,529	902,989
2003	271,867	682,403	954,270
2004	329,700	790,663	1,120,363
2005	284,188	750,128	1,034,316
2006	294,898	743,345	1,038,243
2007	318,159	824,286	1,142,445
2008	332,500	740,748	1,073,248
2009	327,184	711,693	1,038,877
2010	313,196	689,518	1,002,714
2011	288,912	718,771	1,007,683
2012	309,213	706,671	1,015,884
2013	324,128	731,560	1,055,688
2014	319,073	654,696	973,769
2015**	249,965	392,091	642,056
2016	283,071	546,999	830,070
2017	263,179	617,454	880,633
2018	284,192	652,812	937,004
2019	282,389	677,506	959,895
2020	285,461	702,929	988,390

* The Joint Water Districts Board includes the Biggs-West Gridley Water District, the Butte Water District, the Richvale Irrigation District and the Sutter Extension Water District.

** 50% Curtailment of surface water deliveries occurred this year due to drought

Groundwater Conditions

Monitoring Frequency

Butte County Codes, Chapter 33 and 33A, call for the establishment of a monitoring network for groundwater quality related to saline intrusion, land subsidence and groundwater levels. The Groundwater Quality Trend Monitoring Program tracks single monitoring events throughout the county during the peak irrigation season on an annual basis. The data collected each July or August at the peak of irrigation season establishes baseline levels across the county to detect changes, which may require further investigation.

Land subsidence monitoring occurs on a continuous basis by extensometers. Groundwater level monitoring occurs four times per year. Sections 33-4 of the Butte County Code enacted in 1996 and 33A-8 of the Butte County Code enacted in 2004 state that groundwater level measurements shall be taken from all designated monitoring wells at least four times per year, during the months of March, July, August and October. DWR and the Department share the monitoring duties during each monitoring event.

Groundwater Quality Trend Monitoring

The groundwater quality well monitoring network includes thirteen wells throughout the county. Temperature, pH and electrical conductivity are tested on water samples from these wells on an annual basis. These parameters provide the basis to evaluate groundwater conditions for evidence of saline intrusion.

Program Background

The Butte County Groundwater Quality Trend Monitoring Program is required by the Groundwater Conservation Ordinance (Chapter 33 of the Butte County Code) and administered through the BMO Ordinance (Chapter 33A of the Butte County Code). Degraded water quality is a common effect of over-utilizing groundwater resources and can occur by saline intrusion from, among other sources, marine formations underlying freshwater aquifers in the Central Valley. In Butte County, the primary freshwater bearing formations include the Tuscan Formations, and overlying alluvium deposits, basin deposits and the Riverbank and Modesto Formations. A number of marine formations beneath the Tuscan Formation make up the underlying saline aquifer system.[3] Increasing salinity in groundwater wells could indicate over utilization of groundwater resources. To ensure sustainable management of local groundwater resources, monitoring efforts need to provide baseline trends related to salinity. This program is not designed to characterize specific groundwater contamination due to pollutants.

[3] Fulton, Allan. "Seeking an Understanding of the Groundwater Aquifer systems in the Northern Sacramento Valley: An Update". Article No. 1 – September 2005

Results are evaluated against established water quality standards and BMOs. Data that fall outside of a BMO for a specific parameter as described in Table 3 below can trigger a BMO Alert Stage. For example, if the temperature of groundwater from a well is more than 5 degrees Celsius (^{o}C) outside of the historical range of measurements of that well, a BMO Alert Stage is reached. If the pH of the groundwater at a well is below 6.5 or above 8.5, a BMO Alert Stage is reached for that well. A BMO Alert Stage for electrical conductivity is reached if a measurement is greater than 900 micro-Siemens per centimeter (µS/cm) for drinking water or greater than 700 µS/cm for water used for agricultural purposes. These ranges are based on secondary water quality standards established by the US Environmental Protection Agency. Secondary standards relate to the taste, odor, color, corrosivity, foaming and staining properties of water whereas primary standards are based on health considerations.

Table 3. Butte County Basin Management Objectives for Water Quality

Parameter	Basin Management Objective
Temperature	Within 5° Celsius of the historic range of temperatures for that well
pH	Between 6.5 and 8.5
Electrical Conductivity	< 900 µS/cm for drinking water < 700 µS/cm for agricultural water

Summary Highlights from 2020

- No BMO exceedances / Alert Stages were recorded for any of the monitoring wells for temperature, electrical conductivity or pH
- All 13 wells were sampled July 29, 2020 through July 31, 2020
- Temperatures remained relatively consistent in all water samples and were within acceptable ranges
- All measurements were within the acceptable range for pH
- All samples were within the acceptable range for electrical conductivity
- No evidence of saline intrusion was detected

Water quality parameters have naturally occurring variability, so year-to-year changes are expected and nothing in this year's measurements give cause for further investigation or analysis. Further investigation would be advisable if values were to fall outside of acceptable ranges. The 2020 Water Quality Trend Monitoring Report (Interdepartmental Memorandum) can be found in Appendix D.

2020 Results

To date, groundwater temperatures have been relatively consistent in all wells. Temperature is a standard parameter measured when assessing water quality and is important because it affects chemical reactions that may occur in groundwater. Also, considerable changes in temperature could be an indication of other source waters migrating into the aquifer system such as stream

seepage or flow from a different aquifer system. All 2020 groundwater quality measurements were within their respective temperature BMO and within 5° C of their historical ranges. All but one of the 2020 measurements were within 1.0° C of each wells average historic temperature. The Esquon well was 1.1° C lower than the well's recorded 19-year average. The lowest groundwater temperature reading was in the M & T well (17.7° C) and the highest was in the Pentz well (22.2° C).

Measurements for pH remained relatively stable compared to previous years in all groundwater sampled. The lowest pH was found in the Chico Urban area well (6.8) and the highest pH was found in the Llano Seco well (7.9). All measurements for pH were within the secondary water quality thresholds of 6.5 - 8.5.

Electrical conductivity measures the ability of a solution to conduct an electrical current due to the presence of ions. Observed readings for electrical conductivity can have a large range, up to 447 µS/cm at one particular well (Western Canal West), yet 2020 measurements were all well within the secondary water quality thresholds established by State and Federal regulatory agencies. The highest EC measurement was from the Esquon well (545 µS/cm) and the lowest was from the Llano Seco well (183 µS/cm). The greatest change compared to 2019 EC levels occurred in the Thermalito area well which decreased in value by 57 µS/cm while the largest increases in values (30 µS/cm) were observed in both the Esquon and Western Canal East area wells. Appendix D contains a monitoring network map, data tables and graphs.

Land Subsidence

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials often caused by groundwater or oil extraction. To date, no inelastic land subsidence has been recorded in Butte County. The potential effects of land subsidence include differential changes in elevation and gradients of stream channels, drain and water transport structures, failure of water well casings due to compressive stresses generated by compaction of aquifer system, and compressional strain in engineering structures and houses.

Land subsidence in the Sacramento River, San Joaquin River and Tulare Lake Basins would most likely occur as a result of aquitard consolidation. An aquitard is a saturated geologic unit that is incapable of transmitting significant quantities of water. As the pressure created by the height of water (i.e. head) declines in response to groundwater withdrawals, aquitards between production zones are exposed to increased vertical loads. These loads can cause materials in aquitards to rearrange and consolidate, leading to land subsidence. Factors that influence the rate and magnitude of consolidation in aquitards include mineral composition, the amount of prior consolidation, cementation, the degree of aquifer confinement and aquitard thickness. Subsidence has elastic and inelastic deformation components. As the head lowers in the aquifer, the load that was supported by the hydrostatic pressure is transferred to the granular skeletal framework of the formation. As long as the increased load on the formation does not exceed the pre-consolidation pressure, the formation will remain elastic. Under elastic conditions, the formation will rebound to its original volume as hydrostatic pressure is restored. However, when the head of the formation is lowered to a point where the load exceeds pre-consolidation

pressure, inelastic deformation may occur. Under inelastic consolidation, the formation will undergo a permanent volumetric reduction as water is expelled from aquitards[4].

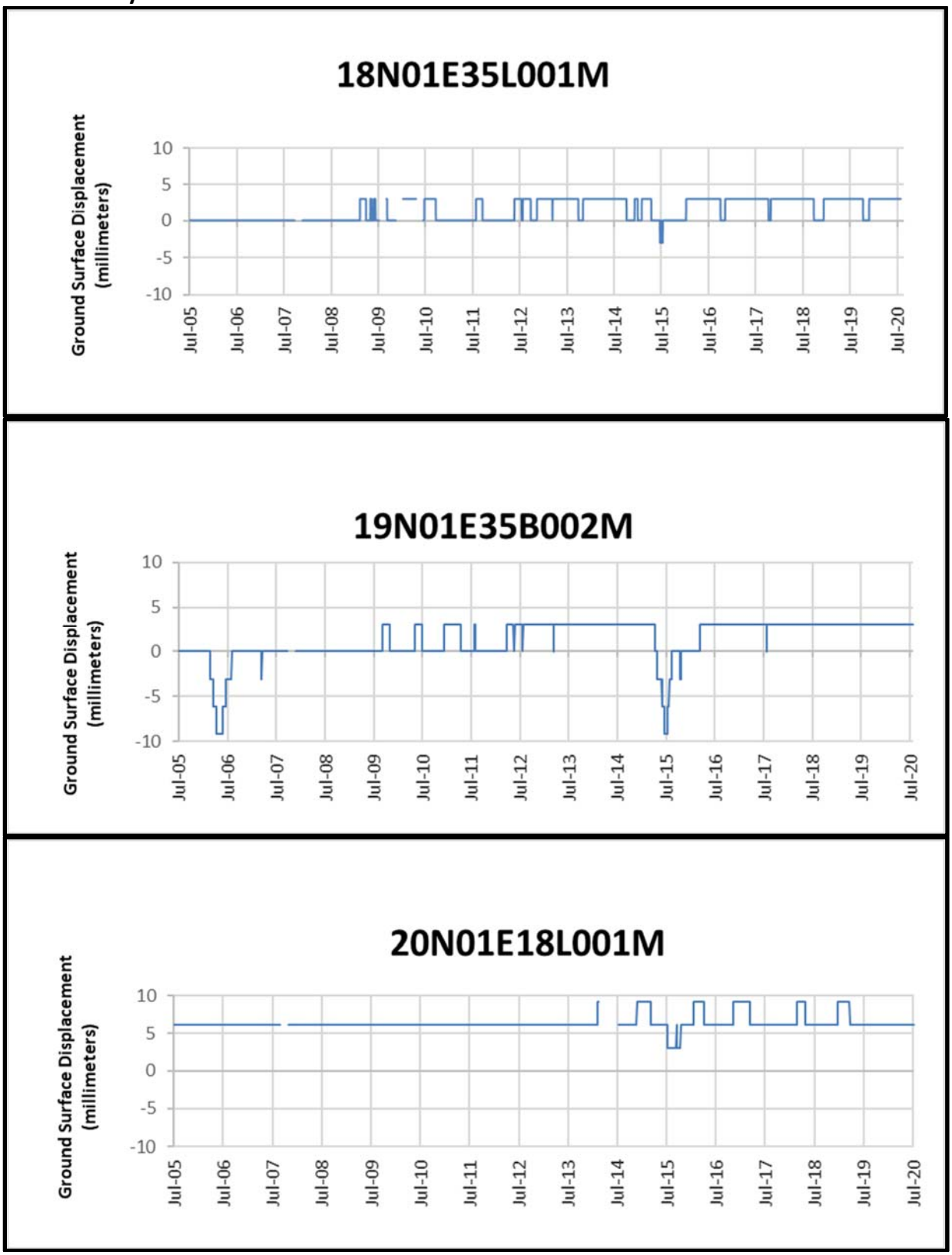
Butte County will prevent or limit inelastic subsidence as required through Chapter 33. To determine whether subsidence is occurring, a subsidence monitoring network has been established throughout Butte County consisting of observation stations (Appendix E) and extensometers (Appendix B) managed by DWR.

The observation stations are a result of DWR's efforts to establish a subsidence monitoring network across the valley to capture changes in the ground surface elevation. The observation stations are established monuments with precisely surveyed land surface elevations. They are distributed throughout the valley such that the entire county is well represented. In 2008, DWR along with numerous partners performed the initial GPS survey of the observation stations to establish a baseline measurement for future comparisons. The network was resurveyed in 2017 using similar methods and equipment as those used in the 2008 survey and results were analyzed to depict the change in elevation at each station between those years. Results of the survey are available here, https://water.ca.gov/News/News-Releases/2019/January/Survey-Shows-Areas-of-Land-Subsidence, and a map of the project observation station locations and results of the changes between both years are found in Appendix E. No significant changes in elevation were observed in Butte County.

Extensometers are installed in wells or boreholes and are a more site specific method of measuring land subsidence as they can detect changes in the thickness of the sediment surrounding the well due to compaction or expansion. These instruments are capable of detecting very slight changes in land surface elevation on a continuous basis with an accuracy of +/- 0.01 feet or approximately 3 millimeters (mm). The three extensometers in Butte County have a period of record beginning in 2005 and were chosen by DWR based on a high likelihood of seeing subsidence in these areas if it were to occur, based on the presence of known clay and other fine grained deposits in these areas. Data are available through July 2020 from the DWR Water Data Library[5]. While seasonal displacement of – 9.13 mm (+/- 0.3 mm) have been recorded at one of these extensometers (Figure 5) during 2006 a *wet* water year and 2015 a *critical* water year, changes in ground surface elevations are slight and remain at or above baseline levels in 2020. To date, no inelastic land subsidence has been recorded in Butte County.

4 http://water.usgs.gov/ogw/pubs/fs00165/
5 http://wdl.water.ca.gov/waterdatalibrary/docs/Hydstra/index.cfm

Figure 5. Ground Surface Displacement in Millimeters at the Extensometer Sites within Butte County



Well Permits

The Butte County Department of Public Health, Environmental Health Division issues well drilling permits for all wells drilled throughout the County. Although the number of well permit applications do not necessarily reflect the number of wells actually drilled, the numbers provide a general indication of the development of the groundwater resource and potential drilling activities. According to the 2016 Water Inventory and Analysis Report, Butte County had over 12,000 domestic wells and 2,500 irrigation wells in 2015. When combined with municipal, monitoring and other well types (stock water, test wells, abandoned or unidentified wells) the total well count in the county in 2015 was about 17,554[6]. Table 4 shows the number of well permit applications received by the Environmental Health Division for the following categories from 2006 – 2020: small diameter, large diameter and well repairs and deepening.

Table 4. Number of Well Permits Issued per Water Year in Butte County

Well Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Small Diameter	260	228	176	188	140	77	102	221	259	175	69	109	91	151	137
Large Diameter	14	24	36	29	16	16	21	28	71	68	38	21	20	18	5
Well Repair & Deepening	4	9	15	20	10	9	7	10	17	19	4	2	3	9	12

Note: Water years 2006, 2011, 2017 and 2019 were all *wet years*, all others are *below normal, dry,* or *critical years.*

Small Diameter wells have a casing diameter of eight inches or less.
Large Diameter wells have a casing diameter greater than eight inches, generally for irrigation.
Well Repairs & Deepening refers to an existing well deepened to access groundwater in a deeper zone of the aquifer likely because the water level in the well has fallen below the bottom of the well.

Well deepening permits are an indication that the existing well infrastructure is not sufficient given the current groundwater levels. During dry periods and drought, as water levels fall in areas with heavy groundwater use (i.e. Durham / Dayton, Vina and the Chico urban area etc.), shallower domestic wells become especially vulnerable and may "go dry." This means the groundwater level in the well falls below the elevation of the pump in the well or below the bottom of the well itself. A pump can be lowered further into a well if it is deep enough and accessible to do so without requiring a permit from the County. If the well is not deep enough to lower a pump, it may be possible to deepen the well. The County issues well permits for well owners to deepen wells; however homeowners should enlist a licensed well driller to conduct the work.

Groundwater Level Monitoring

Groundwater levels typically fluctuate seasonally amongst years. Seasonal fluctuation of groundwater levels occur in response to groundwater pumping and recovery, land and water use activities, recharge and natural discharge. Precipitation, applied irrigation water, local creeks and

[6] Butte County Water Inventory and Analysis, 2016

rivers and other water bodies such as the Thermalito Forebay and Afterbay all recharge groundwater in Butte County. Groundwater pumping for irrigation typically occurs from April to September although depending on the timing of rainfall, it may shift earlier and / or later into the season. Consequently, groundwater levels are usually highest in the spring and lowest during the irrigation season in the summer months.

Long-term fluctuations occur when there is an imbalance between the volume of water recharged into the aquifer and the volume of water removed from the aquifer, either by extraction or natural discharge to surface water bodies. If, over a period of years, the amount of water recharged to the aquifer exceeds the amount of water removed from the aquifer, then groundwater levels will increase. Conversely, if, over time, the amount of water removed from the aquifer exceeds the amount of water recharged then groundwater levels decline. These long-term changes can be linked to various factors including increased or decreased groundwater extraction or variations in recharge associated with wet or dry hydrologic cycles.

Data from groundwater level monitoring can be obtained through DWR and the Department's websites. The primary access to the data is through the CASGEM program (https://water.ca.gov/Programs/Groundwater-Management/Groundwater-Elevation-Monitoring--CASGEM). The CASGEM program was part of legislation passed in 2009, SBx7-6, which mandates statewide groundwater elevation monitoring to track seasonal and long-term trends in subbasins throughout the state. As a result of this legislation, DWR migrated the groundwater level data from the Water Data Library to the CASGEM database. DWR has reintroduced access to groundwater monitoring data through an updated Water Data Library (http://wdl.water.ca.gov/waterdatalibrary/). Groundwater level data is also available through DWR's online SGMA Data Viewer tool available at (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). Summary data tables of groundwater surface elevations from spring, summer and fall measurements are included in Appendix F and are available from the Department's website.

Currently 128 wells are monitored for groundwater levels in Butte County as part of the BMO program, 74 of them are assigned BMO spring Alert Stages and 64 are assigned fall Alert Stages. These wells consist of a mixture of domestic and irrigation wells, along with dedicated observation wells and 10 California Water Service Company municipal supply wells in Chico and Oroville. Approximately 59 of the wells measured by DWR and the Department are equipped with data loggers (i.e. transducers) which continuously monitor and record hourly changes in groundwater levels. These and the remaining wells are measured by hand four times per-year, in March, July, August and October. From 2014 to 2016, groundwater levels were measured monthly from April through October due to severe drought conditions. The approximate locations of groundwater level wells monitored in Butte County as part of the BMO program are shown in Appendix B as well as those designated as CASGEM wells to track long-term trends throughout the County. The groundwater level monitoring methods are consistent with the

procedures described in the California Department of Water Resources' Groundwater Elevation Monitoring Guidelines (December 2010)[7].

Groundwater elevations are measured using a steel tape, electric sounder or by pressure transducers. The accuracy of the groundwater level measurement range is either 0.01 feet or 0.1 feet depending on the equipment used. In addition to the groundwater level monitoring conducted by Butte County and DWR, California Water Service Company currently measures monthly groundwater levels in approximately 60 municipal groundwater supply wells in the Chico urban and Oroville areas. Ten of these wells are included in the BMO program and nine of them have Alert Stages assigned to them.

Change in Groundwater Levels: 2019 to 2020

The 2020 WY was classified as a *dry* year with relatively dry conditions as measured by the Northern Sierra 8 Station Index. Groundwater conditions responded as expected to the dry winter with generally lower groundwater levels in 2020 compared to 2019. The overall average change in observed groundwater levels from spring of 2019 to spring of 2020 was a decrease of -3.8 feet. Of the 114 comparable wells, eight had higher spring groundwater levels when compared to 2019. The average increase was 2.7 feet and of the 106 wells that had lower measurements in 2020 compared to 2019, the average decrease was -4.3 feet (Table 5). The dry winter conditions of the 2020 WY, led to lower groundwater levels particularly in the areas to the north and east of Chico and the Durham area, which also experienced some of the greatest declines during the 2012 - 2015 drought period.

Table 5. Spring of 2019 to Spring of 2020 - Groundwater Level (GWL) Elevation Change of all Butte County BMO program wells

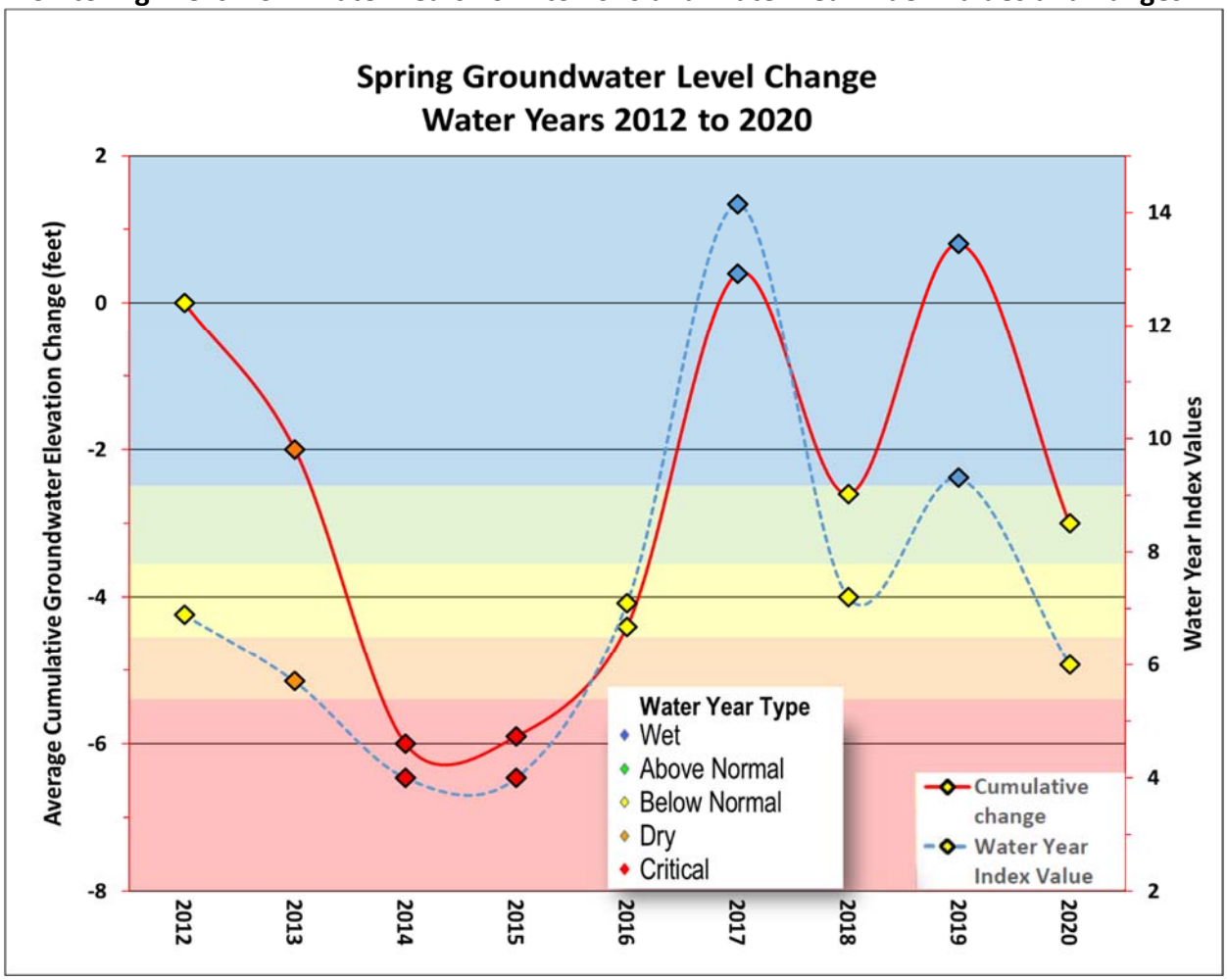
	Number of wells		Change (ft.)	Well Area
Wells with increasing GWLs	8	Average Increase	2.7	
		Median Increase	3.2	
		Max Increase	5.3	Vina South
Wells with decreasing GWLs	106	Average Decrease	-4.3	
		Median Decrease	-3.9	
		Max Decrease	-17.0	Vina Chico
Wells With No Change	0			
All wells	114	Average GWL Change	-3.8	County-wide
		Median GWL Change	-3.0	

Note: Groundwater level measurements characterized as "Questionable measurements" (i.e. measurements taken during pumping, when nearby pumps were operating or taken from wells pumped recently) were not included in these summary statistics.

[7] https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/CASGEM/Files/CASGEM-DWR-GW-Guidelines-Final-121510.pdf

Figure 6 depicts the context of the 2019 to 2020 WY change in spring groundwater levels and how the change between the 2019 and 2020 water years compares to changes between other recent years i.e. pre- and post-drought (2012 – 2016). The cumulative amount of groundwater level change on average between consecutive years was compiled for the last nine water years for all wells monitored in Butte County with high quality data. Figure 6 depicts this change beginning with the 2012 water year set as zero for the baseline change. The 2012 WY was a *below normal year* following a *wet year* (2011) prior to the drought of 2012 - 2016. The color in the points on the lines correspond to the water year type and the background colors in the graph correspond to the range of values that characterize each type of water year (*wet, above normal, below normal, dry and critical*) as described earlier.

Figure 6. Cumulative Average Change of the Spring Groundwater Level Change in all Monitoring Wells from Water Years 2012 to 2020 and Water Year Index Values and Ranges



As depicted in Figure 6, the overall average change in spring groundwater levels between water years 2012 and 2013 was a two-foot decline. Between 2013 and 2014, another four-foot decline was observed bringing the overall change from baseline (pre-drought) conditions down six feet. Over the next three years (2015 to 2017), groundwater levels increased along with the water year index values as expected. The very wet conditions of water year 2017 (the wettest year on

record) brought groundwater levels back up overall on average by almost five feet which left levels slightly higher (0.4 feet) than 2012 conditions. While the *below normal* year of 2018 brought additional declines, the *wet* 2019 WY brought levels back up 3.4 feet on average. The 2020 *dry* year WY brought additional declines on average of -3.8 feet resulting in groundwater levels three feet below 2012 conditions.

It is important to note that this is a broad picture of how Butte County's groundwater levels have changed. This is due to the fact that the data depicts an average change for all wells throughout the county and there can be wide variations in how groundwater levels respond to water year conditions over different areas of the county, between individual wells in the same area, amongst different types of wells and amongst wells with varying depths and screening intervals amongst other factors.

Summer measurements, as required by Chapter 33A, are conducted in July and August each year during periods of peak irrigation pumping. This results in more questionable measurements because measured wells and those nearby are more likely to be pumping during the irrigation season than in the spring or fall. However, a number of wells in certain areas have a qualitative BMO related to maintaining summer groundwater levels at a level that will assure an adequate and affordable irrigation groundwater supply. Therefore, even though the data is less consistent because of direct pumping effects on water elevations, it provides a baseline for summer groundwater conditions on a regional scale. Summer data is reported by averaging the July and August measurements for each well. Summer groundwater levels in 2020 were about five feet lower on average compared to groundwater levels in the summer of 2019 (Table 6). Even with questionable measurements included, these measurements and comparisons primarily reflect static (non-pumping) groundwater conditions.

Table 6. Summer 2019 to Summer 2020 - Average Groundwater Level (GWL) Elevation Change from in all Butte County BMO program wells

	Number of wells		Change (ft.)	Well Location
Wells with Increasing GWLs	11	Average Increase	6.2	
		Median Increase	0.6	
		Max Increase	25.2	Vina South
Wells with Decreasing GWLs	91	Average Decrease	-6.5	
		Median Decrease	-5.4	
		Max Decrease	-44.1	Vina South
Wells with No Change	1		0.0	
All Wells	**103**	**Average GWL Change**	**-5.1**	**County-wide**
		Median GWL Change	**-5.1**	

Note: Groundwater level measurements characterized as "Questionable measurements" (i.e. measurements taken during pumping, when nearby pumps were operating or taken from wells pumped recently) are included in the data due to the frequency of these observed field conditions.

Similar to spring of 2020, groundwater levels decreased in the fall of 2020 in most areas compared to 2019 fall levels by an overall average change of 4.4 feet (Table 7). Of the 114 comparable well measurements, nine of them had a higher 2020 fall level (average increase of 4.5 feet) than the corresponding 2019 fall measurement. Of the 104 measurements that were lower in 2020 compared to 2019, the average decrease was -5.2 feet. Hydrographs of individual groundwater level conditions in specific wells provide greater historical context for groundwater level trends (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer) and the groundwater level change maps (Appendix G) show where the greatest changes occurred.

Table 7. Fall of 2019 to Fall of 2020 - Groundwater Elevation Change in all Butte County BMO program wells

	Number of wells		Change (ft.)	Well Location
Wells with Increasing GWLs	9	Average Increase	4.5	
		Median Increase	1.4	
		Max Increase	18.7	Butte
Wells with Decreasing GWLs	104	Average Decrease	-5.2	
		Median Decrease	-4.5	
		Max Decrease	-15.0	Vina Chico
Wells with No Change	1			
All Wells	**114**	**Average GWL Change**	**-4.4**	**County-wide**
		Median GWL Change	**-4.0**	

Note: Groundwater level measurements characterized as "Questionable measurements" (i.e. measurements taken during pumping, when nearby pumps were operating or taken from wells pumped recently) are not included in the data.

Seasonal Groundwater Level Change

In areas dependent on groundwater supplies for irrigation, groundwater levels decline as pumps turn on and the irrigation season progresses. To capture the effect of irrigation season pumping on groundwater conditions, summer levels are compared to spring levels of the same year. Table 8 compares groundwater levels in spring 2020 to summer 2020. Overall, the average decrease from spring of 2020 to summer of 2020 was -10.3 feet.

Table 8. Spring of 2020 to Summer of 2020 - Groundwater Elevation Change from in all Butte County BMO program wells

	Number of wells		Change (ft.)	Well Location
Wells with Increasing GWLs	9	Average Increase	1.1	
		Median Increase	0.8	
		Max Increase	2.6	Butte
Wells with Decreasing GWLs	86	Average Decrease	-11.6	
		Median Decrease	-11.0	
		Max Decrease	-44.4	Vina South
Wells with No Change	1		0.0	
All Wells	**96**	**Average GWL Change**	**-10.3**	
		Median GWL Change	**-10.0**	

Note: Groundwater level measurements characterized as "Questionable measurements" (i.e. measurements taken during pumping, when nearby pumps were operating or taken from wells pumped recently) are included in the data due to the frequency of these observed field conditions.

Basin Management Objectives

The majority of the wells in the monitoring network have BMOs established for them; 58% of the wells measured in the spring and 51% of those monitored in the fall. BMOs are determined from historical data collected from each specific well as described in detail below. When a measurement fails to achieve the BMO for the well, a BMO Alert Stage of 1, 2 or 3 is reached depending on how much groundwater levels have declined. When a BMO Alert Stage is reached, the Department may increase outreach to stakeholders, seek an evaluation by the TAC and / or may conduct additional monitoring. **The BMO program has transitioned into a more SGMA relevant program and will sunset on the deadline for GSP submittals which is January 31, 2022.** In the meantime, BMOs provide a standardized way to evaluate spring and fall changes in groundwater levels relative to historical conditions. Two methods are used to determine BMOs, as described in Chapter 33A.

Historic Range Method

This method has two procedures depending upon the period of record for the well. The first procedure is for wells that have a period of record beginning any time before 1970. Measurements up through 2006 are used to set the Alert Stage 1 threshold by taking the historical low reading and adding 20% of the range of measurements, calculated from the first year on record through 2006. Measurements at or below this threshold and above the historical low would indicate an Alert Stage 1. Measurements at or below the historical low would indicate

an Alert Stage 2. Measurements taken after 2006 are for reference purposes only, and are not included in the calculation of the range.

The second procedure is for wells that have a period of record beginning after 1970. For these wells, the historical low measurement prior to 2006 indicates an Alert Stage 1. The historical low measurement minus the range of measurements indicates an Alert Stage 2. The measurements plotted after 2006 again are for reference purposes only, and are not included in the calculation of the range.

Specific Depth Method

For this method, the BMO is set at five feet below the average spring groundwater level calculated for the well. An Alert Stage 1 is reached if the spring measurement falls five feet below the average groundwater level (calculated from the first year on record through 2006). An Alert Stage 2 is reached if spring groundwater levels, for a second consecutive year, remain five feet below the average groundwater level established for the well. An Alert Stage 3 is reached if the spring groundwater level falls ten feet below the average spring groundwater level established for the well. All of the sub-inventory units previously established for this program utilize the historical range method, except for Richvale and Western Canal which use the specific depth method. The specific depth method does not have corresponding fall BMOs.

Summary of Alert Stages Reached

A number of wells reached Alert Stages for both spring and fall BMOs in 2020. No wells reached an Alert Stage 3 (specific depth method only). The number of wells at an Alert Stage for 2008 - 2020 with spring and fall BMOs assigned are shown in Table 9 and Table 10, respectively.

Table 9. Number of Wells in Spring BMO Alert Stages from 2008 to 2020

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Alert 1	27	33	25	24	25	20	26	22	17	13	19	16	23
Alert 2	0	6	3	0	4	15	21	25	25	11	19	9	16
Alert 3	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	27	39	28	24	29	35	47	47	42	24	38	25	39

Note: Alert Stage 3 only applies to spring measurements and are not established for fall measurements

Table 10. Number of Wells in Fall BMO Alert Stages from 2008 to 2020

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Alert 1	26	27	24	5	24	21	19	13	20	21	22	10	23
Alert 2	2	1	2	2	6	14	18	26	18	8	13	7	18
Total	28	28	26	7	30	35	37	39	38	29	35	17	41

Figures 7 and 8 provide a graphical representation of the number of wells in Alert Stages 1 or 2 in the spring and fall seasons throughout the past 13 years over the varying water year types. The percentage of wells in either an Alert Stage 1 or 2 of those with assigned Alert Stages are also depicted. Only half of all of all of the wells monitored in the fall every year have Alert

Stages assigned to them. This is because a significant number of wells added to the monitoring network between 1999 and 2001 did not have a sufficient period of record to establish Alert Stages and BMOs. During this time period, the 2011 water year, a *wet* water year, had the lowest percentage (13%) of wells in Alert Stage 1 or 2 in both spring and fall, followed by the 2019 WY which had the second lowest percentage of wells in Alert Stage (30%) of the years depicted for fall levels. The 2015 water year, a *critical* water year and the last year of the 2012 – 2015 drought, had the highest percentage (74%) of wells in Alert Stages 1 and 2 for spring groundwater levels. The current WY had the highest percentage (73%) of wells in Alert Stages 1 and 2 for fall groundwater levels.

Figure 7. Number and Overall Percentage of Wells with Spring Alert Levels 1 and 2 from 2008 to 2020 with corresponding Water Year Type

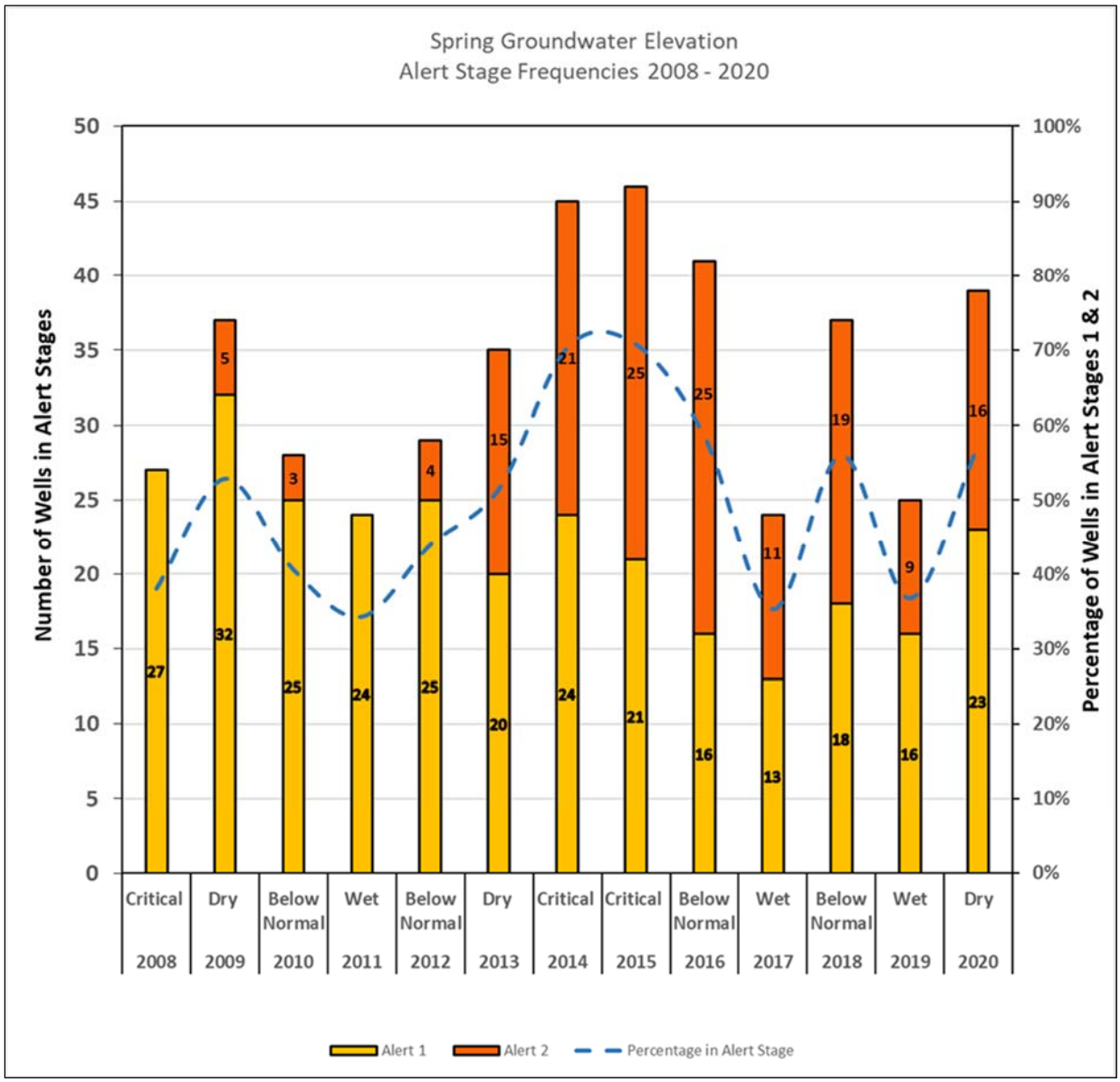
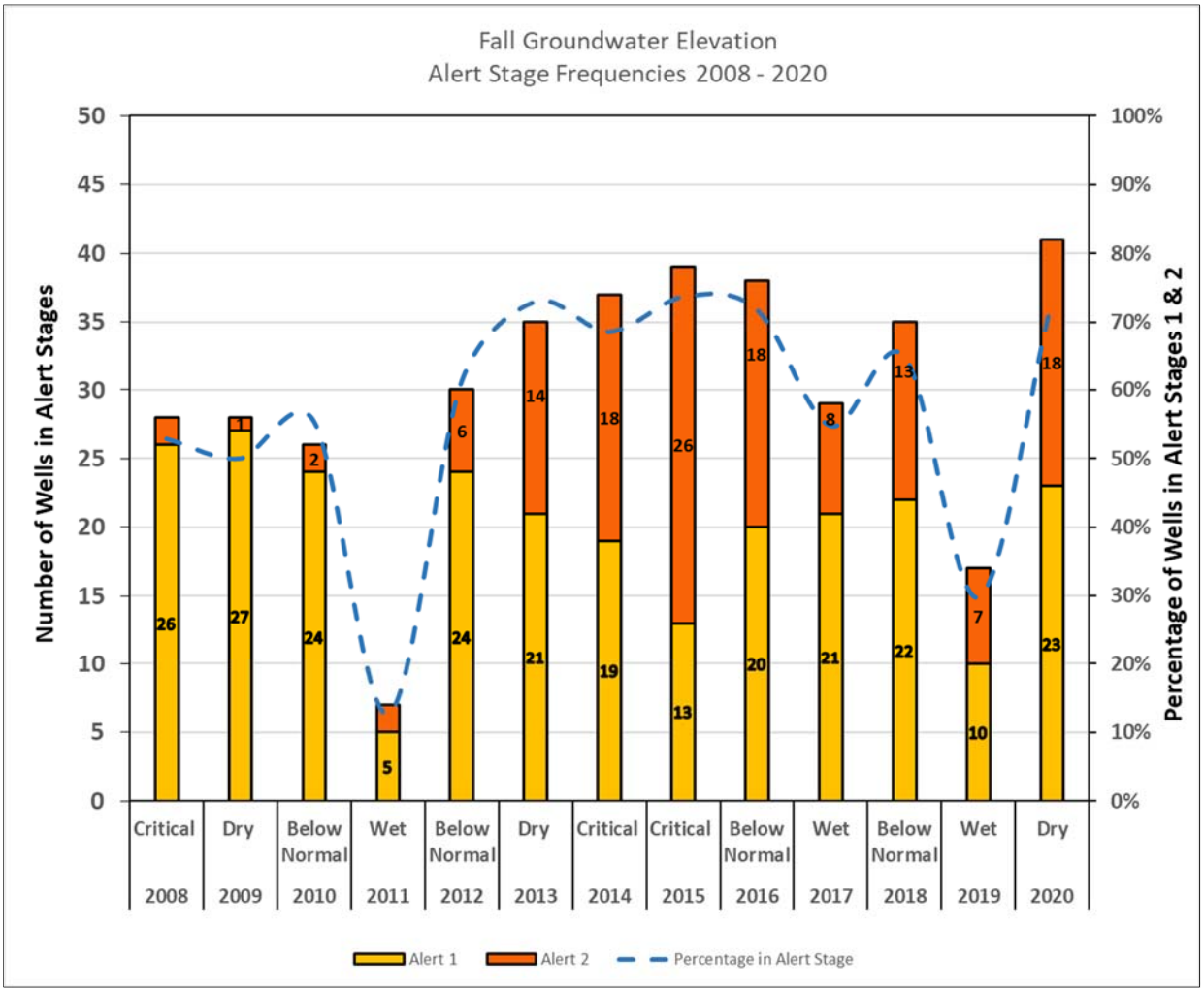


Figure 8. Number and Overall Percentage of Wells with Fall Alert Levels 1 and 2 from 2008 to 2020 with corresponding Water Year Type



Additional details on groundwater conditions for specific wells can be found in the DWR SGMA Data Viewer Tool (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). Past Annual Groundwater Status Reports included individual BMO reports prepared for the sixteen sub-inventory units in Butte County. As the Department continues to adaptively manage SGMA responsibilities and transition this Annual Groundwater Status Report to meet SGMA requirements for GSPs, changes to the BMO program are underway as described earlier, including the removal of individual sub-inventory units BMO reports from the annual report. Future annual reports / GSPs will provide additional information regarding groundwater conditions and the sustainability of current and future groundwater management will be not only be more relevant, but also more enforceable.

The BMO reports from previous annual reports can be accessed from the Department's website under 'REPORTS' then 'GROUNDWATER STATUS REPORT' and 'View Previous Reports' at: https://www.buttecounty.net/waterresourceconservation/viewpreviousyears

Groundwater Status Report

Appendix A

Well Numbering System

APPENDIX A
WELL NUMBERING SYSTEMS

To develop the groundwater level Basin Management Objectives (BMOs), all existing monitoring wells were identified for each BMO subinventory unit. These wells are currently monitored either by public or private entities, or they are monitored as part of the DWR, Northern District groundwater level monitoring program. To distinguish and locate these monitored wells an alphanumeric name, or identifier (ID), is used. All BMO wells are referenced by these unique ID's. Wells that are not part of the DWR monitoring network are typically assigned a local ID. Wells that are part of the DWR monitoring network are identified by the State Well Numbering System. This system is very useful in locating points on the ground, such as groundwater wells in areas with few identifying landmarks. Under this system, each well is assigned a unique number referred to as the State Well Number. This system is described further below.

State Well Numbering System

(Reference: Water Facts: Numbering Water Wells in California, No. 7, June 2000)

The State's well-numbering system is based on a rectangular system called the "United States System of Surveying in the Public Lands," commonly referred to as the "*Public Lands Survey*," established by the Continental Congress in 1784. The Public Lands Survey system has been employed by DWR, USGS, and other agencies for over 50 years. This system allows for a unique ID to be assigned to each well. These unique ID's are made up of several components, each of which is described below.

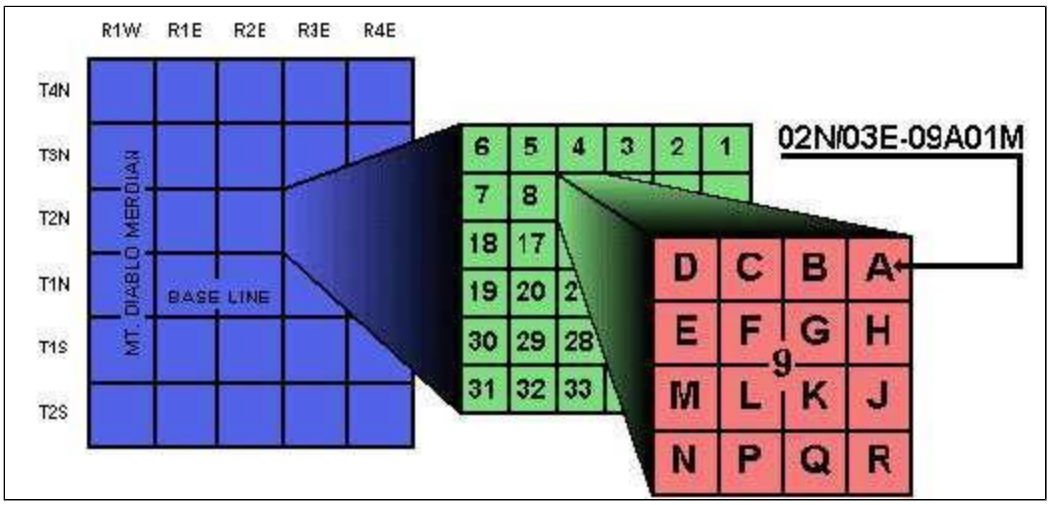
Initial Point and Corresponding Base & Meridian Pair. Under this system all tracts of land are referenced to an Initial Point. This Initial Point is defined by the intersection of a north-south line called the Meridian and an east-west line called the Base. In California there are three Initial Points each with a corresponding Base and Meridian Pair, and all of the BMO wells are referenced to the Mt. Diablo Base and Meridian.

Range and Township Lines. Longitudinal lines are established at six-mile increments from the Initial Point and are east or west of the Meridian. These longitudinal lines are called Range Lines. Latitudinal lines also set at six-mile increments from the Initial Point are parallel to, and north or south of the Base. These latitudinal lines are known as Township Lines. This pattern of longitudinal and latitudinal lines defines a grid pattern consisting of 36-square-mile parcels of land. These 36-square-mile parcels are referred to as Townships. Each Township is referenced to an Initial Point by the number of 36-square-mile parcels and direction from that Initial Point.

Sections. Every Township is further divided in to 36 parts called Sections. A Section is a square parcel of land one-mile on a side, containing 640 acres.

Tract. Each Section is further divided into sixteen 40-acre parcels called Tracts. Each Tract is labeled with a letter. Once the well's location is established in the 40-acre Tract it is assigned a Sequence Number. These Sequence Numbers are assigned in chronological order (see Figure G).

State Well Number. The State Well Number is composed of the various components described above, including Township, Range, Section, Tract, Sequence Number, and Base & Meridian Pair.

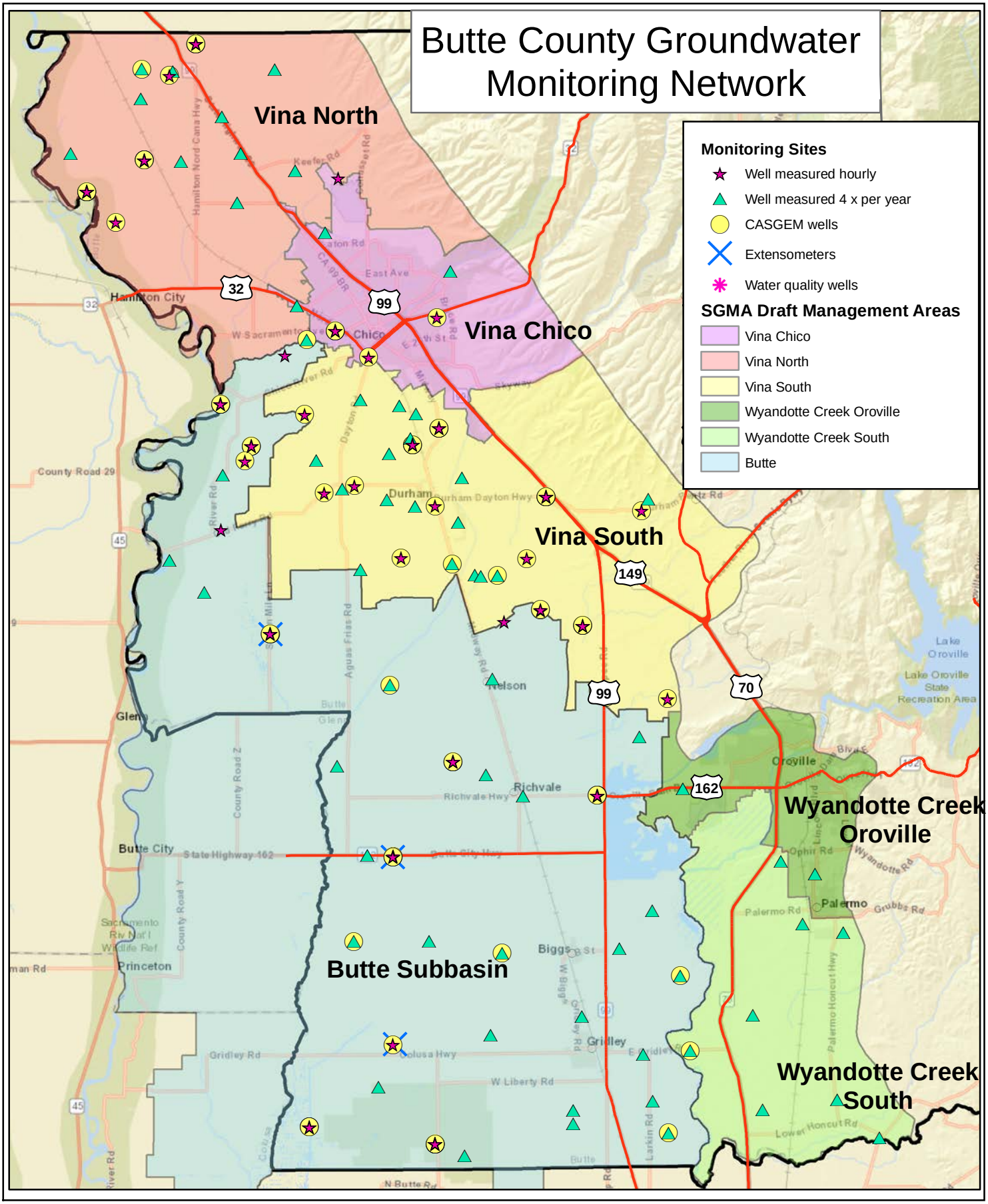


Groundwater Status Report

Appendix B

Butte County Monitoring & CASGEM Network

Butte County Groundwater Monitoring Network



revised 12/18/20 DWRC

0 2.5 5 10 Miles

N W E S

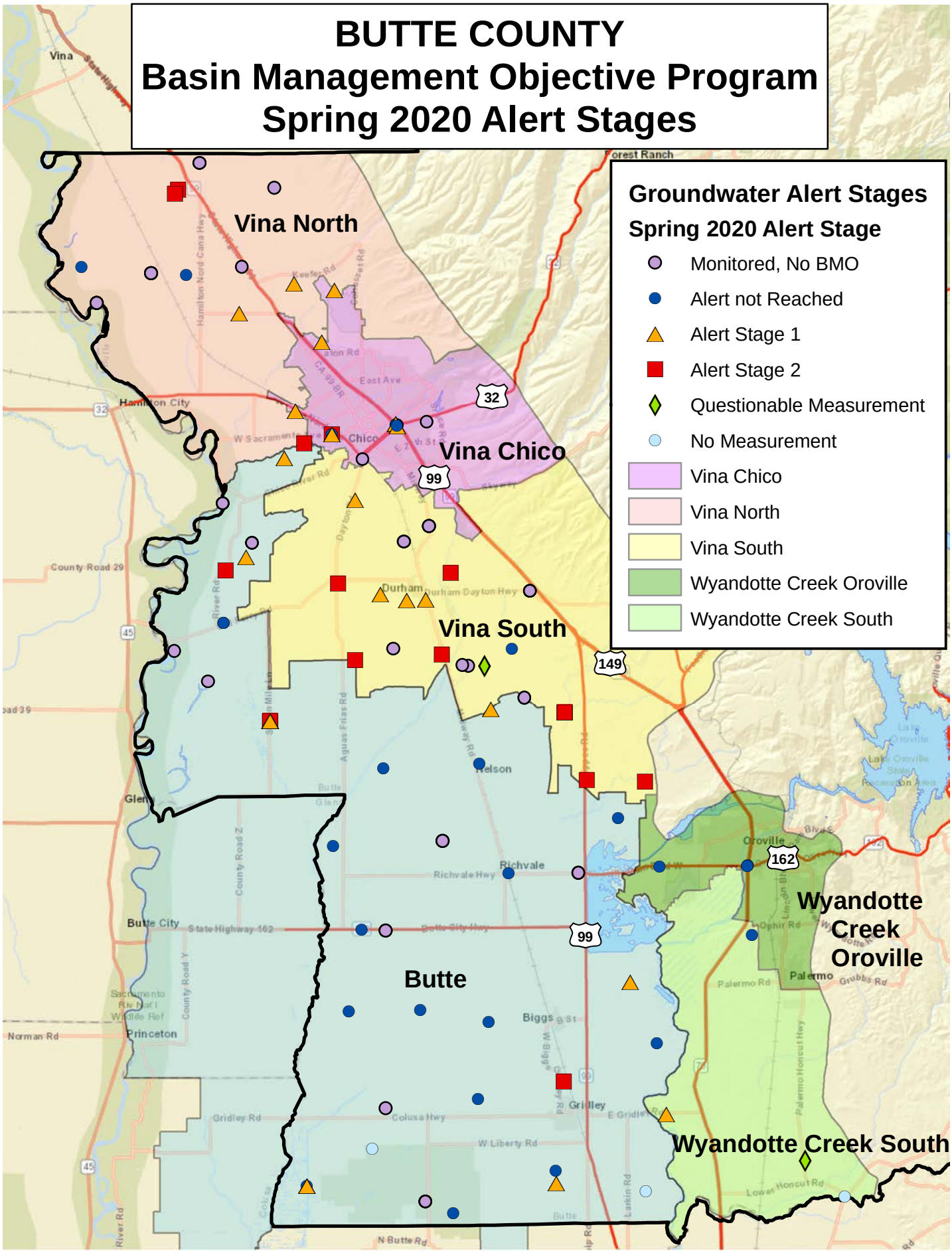
Butte County WATER & RESOURCE CONSERVATION

Groundwater Status Report

Appendix C

Groundwater Level Alert Stage Maps

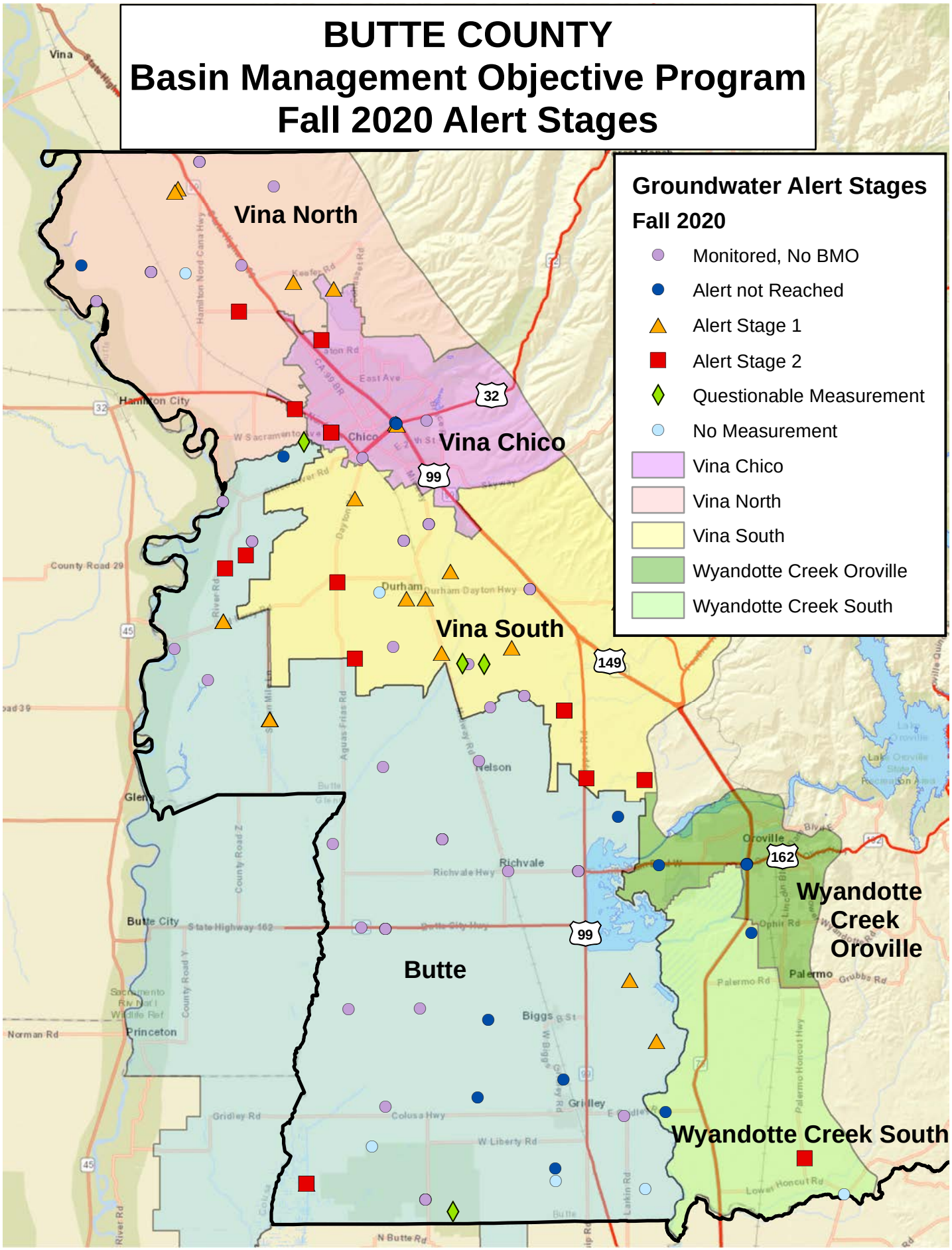
BUTTE COUNTY
Basin Management Objective Program
Spring 2020 Alert Stages



revised 6/2/2020

0 2.5 5 10 Miles

BUTTE COUNTY
Basin Management Objective Program
Fall 2020 Alert Stages



revised 12/21/2020

0 2.5 5 10 Miles

Groundwater Status Report

Appendix D

Water Quality Trend Monitoring Report

Butte County Water and Resource Conservation

Water and Resource Conservation Paul Gosselin, Director

308 Nelson Avenue
Oroville, California 95965

T: 530.538.4343
F: 530.538.3807

buttecounty.net/waterresourceconservation
bcwater@buttecounty.net

INTERDEPARTMENTAL MEMORANDUM

TO: Butte County Water Commission

FROM: Kelly Peterson, Water Resources Scientist

SUBJECT: 2020 Groundwater Quality Trend Monitoring Update

DATE: December 30, 2020

INTRODUCTION AND BACKGROUND

The Butte County Department of Water and Resource Conservation (Department) conducted its nineteenth year of groundwater quality trend monitoring within the county July 29 – 31, 2020. As required by Chapter 33A, the parameters monitored were temperature, pH, and electrical conductivity (EC). These parameters are the basic water quality characteristics needed to evaluate a basin for evidence of saline intrusion. The groundwater quality trend monitoring serves to establish baseline levels for these parameters throughout the county so that any future changes can be identified and further investigation and / or monitoring can subsequently be developed. In 2020, all samples fell within the acceptable range of water quality values set forth by State and Federal agencies and Basin Management Objectives (BMOs) defined in Chapter 33A and described in Table 1.

Table 1. Butte County Basin Management Objectives for Water Quality

Parameter	Basin Management Objective
Temperature	Within 5 ° Celsius of the historic range (all but current year) of temperatures for that well
pH	Between 6.5 and 8.5
Electrical Conductivity *	< 900 µS/cm for drinking water < 700 µS/cm for agricultural water

METHODOLOGY AND RESULTS

In 2013, Department purchased a Hach HQd portable meter with a pH and conductivity probe. This was the eighth year this meter was used to do the groundwater quality testing. The sites visited in Butte County are on private land and many of the wells are used for agricultural purposes (irrigating orchards, rice or pasture). However, the two Thermalito wells, the Chico Urban Area well, the Pentz well, the Vina well and the Llano Seco wells provide domestic water supply. The sampling grid spans from north of the Chico Urban area (Vina well), west towards the Sacramento River (Llano Seco and M&T wells), east towards the foothills (Pentz well), and south towards Gridley (Biggs-West Gridley well). Figure 1 shows the approximate locations of the water quality wells in relation to wells monitored four times per year for groundwater level in the Basin Management Objectives Program.

As in previous years, we are fortunate to have support and permission from local property owners who coordinate timing of sampling and allow access to their wells. We have provided them with the preliminary results from this year's monitoring.

All thirteen wells in the network were sampled this year. The Western Canal (West) well had been inaccessible in 2017 and 2018 due to irrigation infrastructure changes that prevented sampling; however it has been sampled the past two years. Following standard sampling procedures, a water sample is pulled from a discharge location at or near the well and values for temperature, pH and EC are recorded when the pH reading from three subsequent water samples stabilizes. Temperature is a standard parameter measured when assessing water quality, mostly to indicate that water being sampled is representative of aquifer water and not water standing in the well itself.

The US Environmental Protection Agency (US EPA) establishes drinking water quality standards using two categories, Primary Standards and Secondary Standards[1]. Primary Standards are based on health considerations and Secondary Standards are based on taste, odor, color, corrosivity, foaming, and staining properties of water. Secondary water quality thresholds for pH and EC compared to the range of 2020 values are presented in Table 2.

Table 2. US EPA Secondary Standards for measured parameters

Parameter	Secondary Standard or Secondary WQ Threshold	2020 Range of Values	Butte County Results
pH	6.5 to 8.5	6.8 – 7.9	Within range of secondary water quality thresholds
Electrical Conductivity *	< 900 µS/cm – drinking water < 700 µS/cm – ag water	183 – 545	Within range of secondary water quality thresholds

Temperature is an important parameter because it affects chemical reactions that may occur in groundwater. Also, considerable changes in temperature could be an indication of other source waters migrating into the aquifer system such as stream seepage or flow from a different aquifer system. To date, temperature has been relatively consistent in all wells. Chapter 33A states that "the BMO Alert Stage for temperature will be reached when the measurement is more than five (5) degrees (°) outside of the historic range of measurements." All 2020 well measurements were within their respective temperature BMO; within 5.0° Celcius (C) of their historic ranges. All but one of the 2020 measurements were within 1.0° C of each wells average historic temperature. The Esquon well was 1.1° C lower than the well's recorded 19-year average. The lowest groundwater temperature reading was in the M & T well (17.7° C) and the highest was in the Pentz well (22.2° C) as seen in Table 1, Table 2, and Figures 2-15.

Measurements for pH remained relatively stable compared to previous years in all wells sampled. The lowest pH was found in the Chico Urban area well (6.8) and the highest pH was found in the Llano Seco well (7.9). All measurements for pH were within the secondary water quality thresholds of 6.5 - 8.5 (Table 1, Table 4 and Figures 2-15).

Electrical conductivity (EC) measures the ability of a solution to conduct an electrical current due to the presence of ions. Observed readings for electrical conductivity can have a large range, up to 447 µS/cm at one particular well (Western Canal-west), yet 2020 measurements were all well within the secondary water quality thresholds established by State and Federal regulatory agencies (Table 5, Table 6 and Figures 2-15). The highest EC measurement was from the Esquon well (545 µS/cm) and the lowest was from the Llano Seco well (183 µS/cm). The greatest change compared

[1] http://www.epa.gov/safewater/consumer/2ndstandards.html

to 2019 EC levels occurred in the Thermalito area well which decreased in value by 57 µS/cm while the largest increases in values (30 µS/cm) were observed in both the Esquon and Western Canal East area wells.

CONCLUSIONS

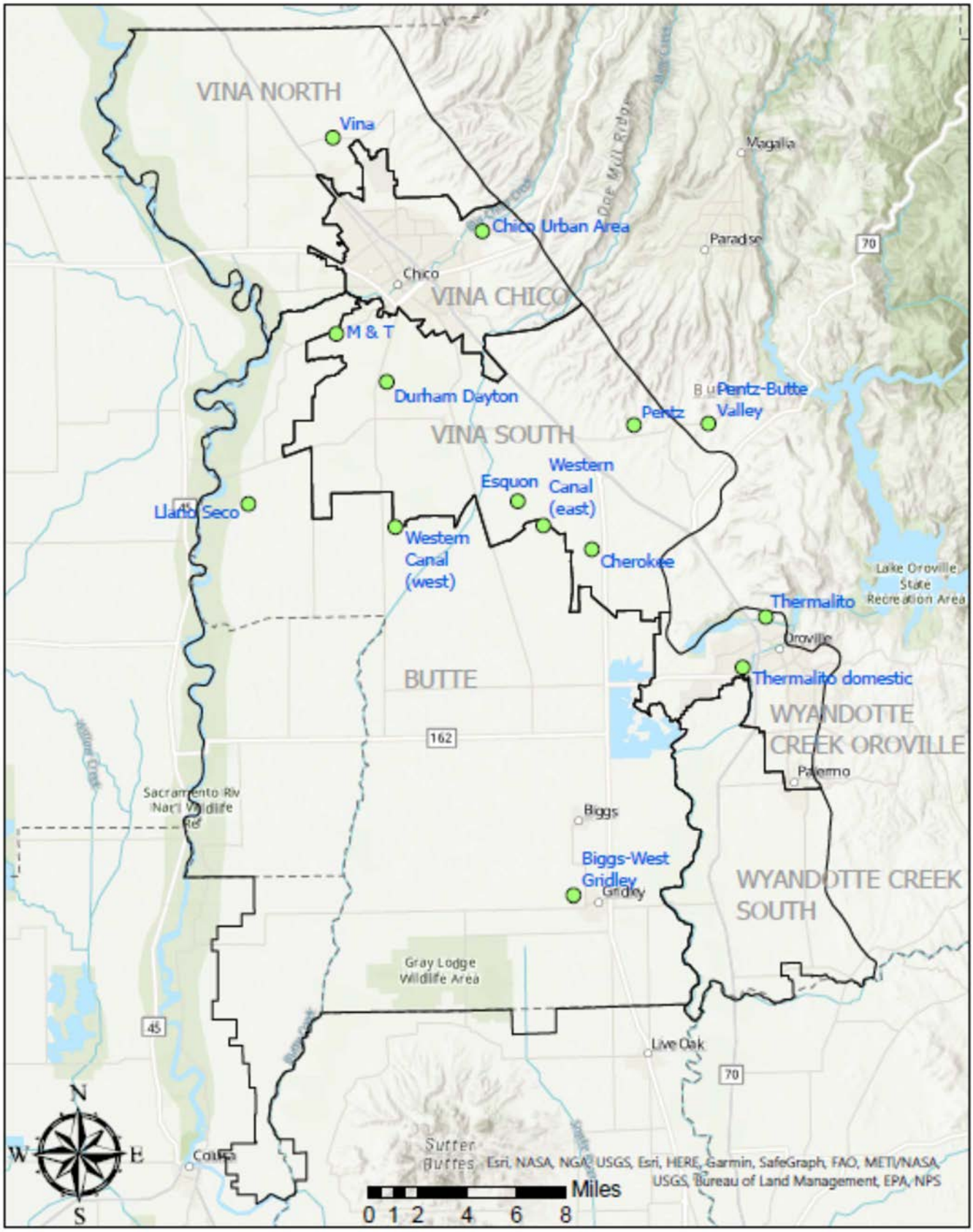
This was the nineteenth season the Department collected groundwater quality information. Overall, the results of the water quality sampling indicate no significant changes in groundwater quality with respect to temperature, pH or electrical conductivity. All samples were within the acceptable range for electrical conductivity and pH, and temperatures remained relatively consistent. The greatest change compared to 2019 was observed in the EC levels measured at the Thermalito well which decreased in value by 57 µS/cm.

Water quality parameters have naturally occurring variability, so year to year changes are expected and nothing in this year's measurements gives cause for concern or immediate further investigation or analysis. Further investigation would be advisable if values were to fall outside of the acceptable range.

The focus of this trend monitoring program is to evaluate the basin for evidence of saline intrusion. No major shifts occurred in the EC measurements in the sampled wells and the basin appears to be free of saline intrusion in these areas. This data continues to help establish baseline levels for these parameters across the county so that any future changes in water quality can be evaluated and further investigation and / or monitoring can be developed.

Further information on water quality standards for different constituents can be found at www.swrcb.ca.gov or in the *Compilation of Water Quality Goals*, published by the State Water Resources Control Board.

Figure 1. Approximate well locations for water quality wells



DATA TABLES AND GRAPHS

Table 1. Annual groundwater temperatures (°C)

Well / Area	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Biggs-West Gridley	18.5	18.5	18.1	20.5	18.2	18.3	18.7	19.0	19.2	20.1	18.0	18.4	19.0	18.5	18.4	18.6	19.3	18.9	19.0
Cherokee	22.4	21.9	21.2	21.4	21.1	20.7	21.0	20.9	21.9	21.8	21.8	21.3	21.9	21.2	20.8	21.2	21.3	21.1	21.2
Chico Urban Area						18.4	20.1	18.2	18.8	19.5	21.6	18.0	NM	18.4	17.8	19.0	22.6	18.0	18.5
Durham Dayton	18.8	19.9	21.8	20.4	17.4	NM	19.3	NM	18.9	18.0	NM	18.5	19.1	18.1	18.0	18.8	19.9	18.0	18.1
Esquon	19.7	18.9	19.6	20.1	20.7	19.0	19.6	19.0	19.1	20.0	21.4	18.1	20.2	18.9	18.0	19.1	18.6	18.4	18.3
Llano Seco							20.8	20.6	20.7	20.6	21.7	20.4	23.5	19.9	20.0	19.9	20.1	20.0	20.0
M & T	17.6	18.2	17.8	19.2	18.6	18.0	17.7	18.6	17.8	NM	18.3	17.9	NM	17.1	17.2	17.2	17.9	17.5	17.7
Pentz						22.2	21.5	21.3	21.5	23.9	21.9	21.9	21.9	21.5	21.5	21.6	22.1	21.2	22.2
Thermalito	18.3	17.9	17.1	17.1	18.4	17.7	18.9	17.6	NM	NM	17.8	17.3	17.5	17.3	17.4	17.5	17.8	17.6	18.1
Thermalito (domestic)							19.4	19.4	19.4	NM	NM	19.8	NM	19.9	19.8	20.0	20.3	22.6	20.2
Vina	19.6	20.3	19.2	19.2	19.6	18.9	19.6	18.9	18.8	22.8	18.8	20.2	21.4	19.5	19.8	19.5	20.5	19.6	20.0
Western Canal (East)	18.4	18.2	19.9	20.5	18.8	18.6	19.1	19.0	18.8	19.0	NM	18.3	18.9	18.5	19.1	18.6	20.1	19.5	19.0
Western Canal (West)	19.0	18.1	19.8	20.8	18.5	20.6	21.8	18.5	19.1	20.5	20.1	19.1	20.2	18.6	18.8	NM	NM	18.7	19.0

NM – No measurement

- Years wells were not included in the sampling effort

Table 2. Groundwater temperature years measured, historic averages, 2020 results and historic ranges (°C)

Well / Area	Years Measured	Average (°C)	2020 Results (°C)	Historic Range (°C)
Biggs-West Gridley	19	18.8	19.0	18.0 - 20.5
Cherokee	19	21.4	21.2	20.7 - 22.4
Chico Urban Area	13	19.1	18.5	17.8 - 22.6
Durham Dayton	16	18.9	18.1	17.4 - 21.8
Esquon	19	19.3	18.3	18.0 - 21.4
Llano Seco	13	20.6	20.0	19.9 - 23.5
M & T	17	17.9	17.7	17.1 - 19.2
Pentz	14	21.9	22.2	21.2 - 23.9
Thermalito	17	17.7	18.1	17.1 - 18.9
Thermalito (domestic)	10	20.1	20.2	19.4 - 22.6
Vina	19	19.8	20.0	18.8 - 22.8
Western Canal (East)	18	19.0	19.0	18.2 - 20.5
Western Canal (West)	17	19.5	19.0	18.1 - 21.8

Note – The historic range of measurements at each site represents data from all years measured except the current year.

Table 3. Annual groundwater pH

Well / Area	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Biggs-West Gridley	7.6	7.5	7.5	7.0	7.6	7.6	7.7	7.9	7.9	7.2	7.9	7.9	7.1	7.6	7.6	7.7	7.7	7.5	7.7
Cherokee	7.5	7.5	7.1	7.4	7.4	7.3	7.3	7.3	7.2	7.6	7.3	7.3	6.9	7.2	7.2	7.1	6.9	7.2	7.2
Chico Urban Area						6.9	6.9	6.9	7.0	7.5	7.3	7.1	NM	6.9	7.0	7.0	7.1	7.0	6.8
Durham Dayton	7.7	7.2	7.6	7.6	7.5	NM	7.5	NM	7.4	7.7	NM	7.5	NM	7.5	7.5	7.3	6.7	7.2	7.2
Esquon	7.3	7.5	7.1	7.4	7.5	7.4	7.2	7.4	7.4	7.6	7.2	7.3	5.9	7.4	7.2	7.3	6.9	7.2	7.1
Llano Seco							7.9	8.1	8.2	8.1	7.9	8.0	7.0	7.8	7.8	7.7	7.8	8.1	7.9
M & T	7.2	7.5	6.9	7.8	7.9	7.6	7.7	7.6	7.6	NM	7.2	7.9	NM	7.4	7.7	7.6	7.6	7.6	7.4
Pentz						7.6	7.4	7.5	7.4	7.3	7.8	7.5	6.7	7.0	7.4	7.2	7.3	7.2	7.1
Thermalito	7.0	6.5	7.1	7.1	7.9	7.4	7.4	7.4	NM	NM	8.0	7.7	7.5	7.1	7.1	7.1	7.4	7.4	7.4
Thermalito domestic							7.7	7.8	7.7	NM	NM	7.8	NM	6.9	7.6	7.6	7.4	7.5	7.6
Vina	7.5	7.6	6.9	6.2	7.7	7.5	7.5	7.4	7.6	8.0	7.3	7.8	7.9	7.1	7.4	7.3	7.4	7.6	7.5
Western Canal (East)	7.0	6.6	6.8	6.9	7.3	6.9	7.0	7.0	7.1	7.0	NM	7.2	6.5	7.1	7.0	7.0	7.0	6.9	6.9
Western Canal (West)	7.8	8.1	7.1	6.9	7.9	7.9	7.8	6.6	7.8	7.5	7.7	7.5	7.1	7.5	7.4	NM	NM	7.7	7.7

Note: Red values indicate a questionable measurement due to deviation in methodology from standard field methods.

NM - No measurement

- Years wells were not included in the sampling effort

Table 4. Groundwater pH years measured, historic averages, 2020 results and historic ranges

Well / Area	Years Measured	Historic Average	2020 Results	Historic Range
Biggs-West Gridley	19	7.6	7.7	7.0 - 7.9
Cherokee	19	7.3	7.2	6.9 - 7.6
Chico Urban Area	13	7.0	6.8	6.8 - 7.5
Durham Dayton	15	7.4	7.2	6.7 - 7.7
Esquon	19	7.2	7.1	6.9 - 7.6
Llano Seco	13	7.9	7.9	7.0 - 8.2
M & T	17	7.6	7.4	6.9 - 7.9
Pentz	14	7.3	7.1	6.7 - 7.8
Thermalito	17	7.3	7.4	6.5 - 8.0
Thermalito domestic	10	7.6	7.6	6.9 - 7.8
Vina	19	7.4	7.5	6.2 - 8.0
Western Canal (East)	18	7.0	6.9	6.5 - 7.3
Western Canal (West)	17	7.5	7.7	6.6 - 8.1

Note – The historic range of measurements at each site represents data from all years measured except the current year.

Table 5. Annual groundwater electrical conductivity [micro Siemens / centimeter (µS/cm)]

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Biggs-West Gridley	346	370	323	361	351	382	354	331	343	320	300	291	326	288	296	290	297	306	296
Cherokee	222	232	215	266	242	267	268	243	270	275	245	260	330	255	261	284	293	299	295
Chico Urban Area						280	291	260	249	250	248	217	NM	214	221	254	295	243	266
Durham Dayton	315	348	259	340	322	NM	327	NM	307	315	NM	298	304	322	316	322	355	358	343
Esquon	388	526	470	557	507	480	439	419	427	415	408	512	443	417	499	416	529	515	545
Llano Seco							204	195	196	198	192	184	240	180	182	179	186	188	183
M & T	418	551	678	504	465	451	667	445	592	NM	427	391	NM	362	333	498	337	360	385
Pentz						218	229	227	225	224	204	204	231	210	204	207	213	221	214
Thermalito	132	164	149	150	152	242	205	158	NM	NM	292	179	181	136	159	136	204	306	249
Thermalito domestic							374	350	354	NM	NM	342	NM	320	324	327	333	364	324
Vina	197	225	180	216	192	224	203	200	199	194	174	188	201	200	186	181	190	191	188
Western Canal (East)	447	344	400	524	492	471	482	488	465	459	NM	447	442	449	444	441	422	418	448
Western Canal (West)	464	248	407	501	309	477	469	462	455	460	630	629	695	428	581	NM	NM	450	425

Note: 2019 EC data reflect corrected values due to equipment calibration errors.

NM – No measurement

- Years wells were not included in the sampling effort

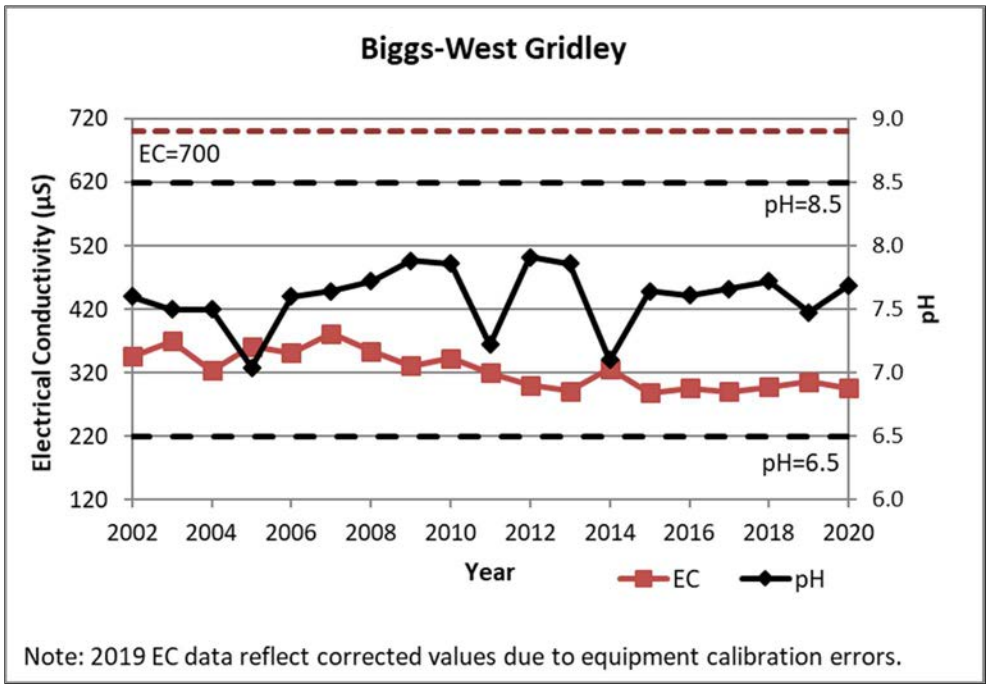
Table 6. 2020 Groundwater electrical conductivity years measured, historic averages, 2020 results and historic ranges and [micro Siemens / centimeter (µS/cm)]

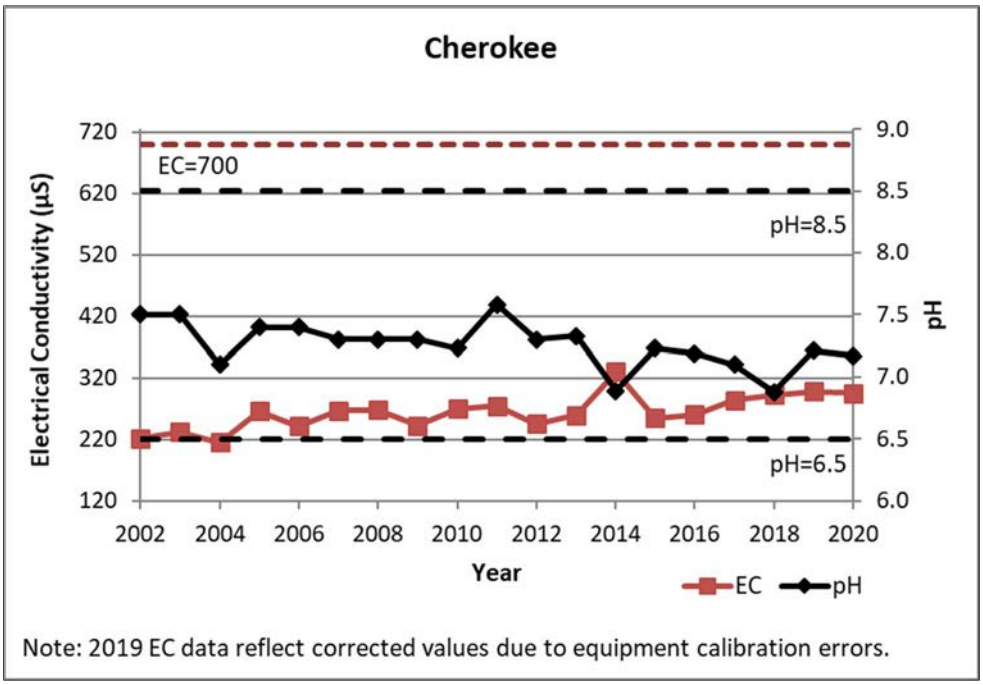
Well / Area	Years Measured	Historic Average (µS/cm)	2020 Results* (µS/cm)	Historic Range (µS/cm)
Biggs-West Gridley	19	326	296	288 - 382
Cherokee	19	263	295	215 - 330
Chico Urban Area	13	252	266	214 - 295
Durham Dayton	16	321	343	259 - 358
Esquon	19	465	545	388 - 557
Llano Seco	13	194	183	179 - 240
M & T	17	467	385	333 - 678
Pentz	14	217	214	204 - 231
Thermalito	17	184	249	132 - 306
Thermalito domestic	10	343	324	320 - 374
Vina	19	197	188	174 - 225
Western Canal (East)	18	449	448	344 - 524
Western Canal (West)	17	479	425	248 - 695

Note – The historic range of measurements at each site represents data from all years measured except the current year.

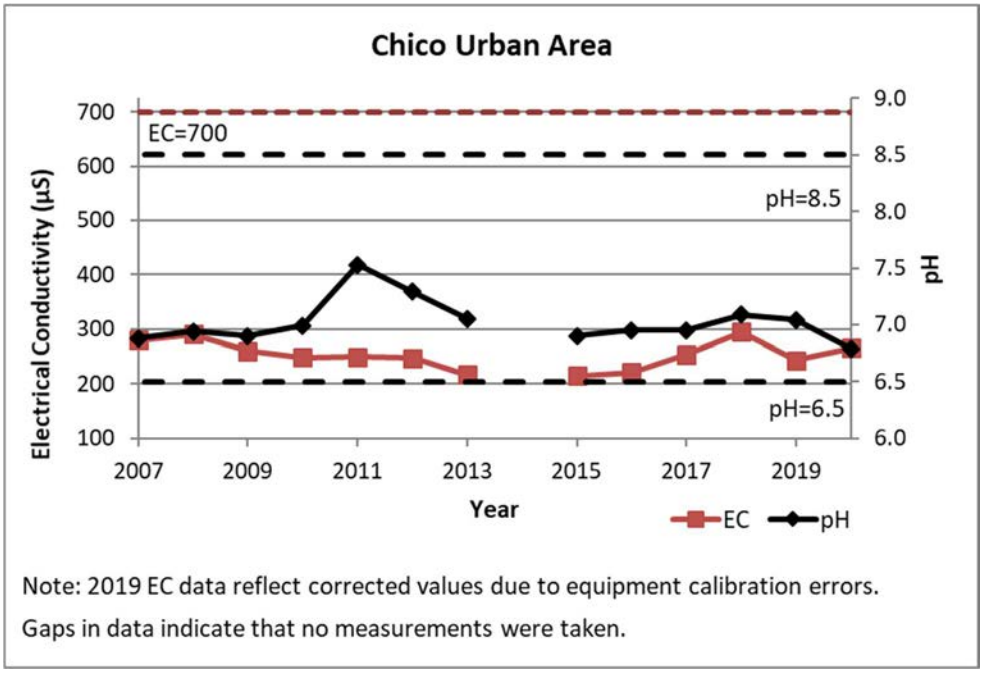
In the figures below, the red dashed line indicates the preferred maximum level for EC for agricultural uses (700 µS/cm) which is lower than the preferred maximum level for EC for drinking water (900 µS/cm). Therefore, when the red line of plotted EC values is below the red dashed line, the measured EC is within the EPAs limits for secondary standards for agricultural water (< 700 µS/cm), and drinking water (< 900 µS/cm). The black dashed lines bound the acceptable pH range of 6.5 - 8.5. To be within the acceptable pH range, the solid black line of plotted pH values should be within the black dashed lines.

Figures 2. – 15. Annual Electrical Conductivity (EC) [micro Siemens per centimeter (µS/cm)] and pH for each water quality sampling well.

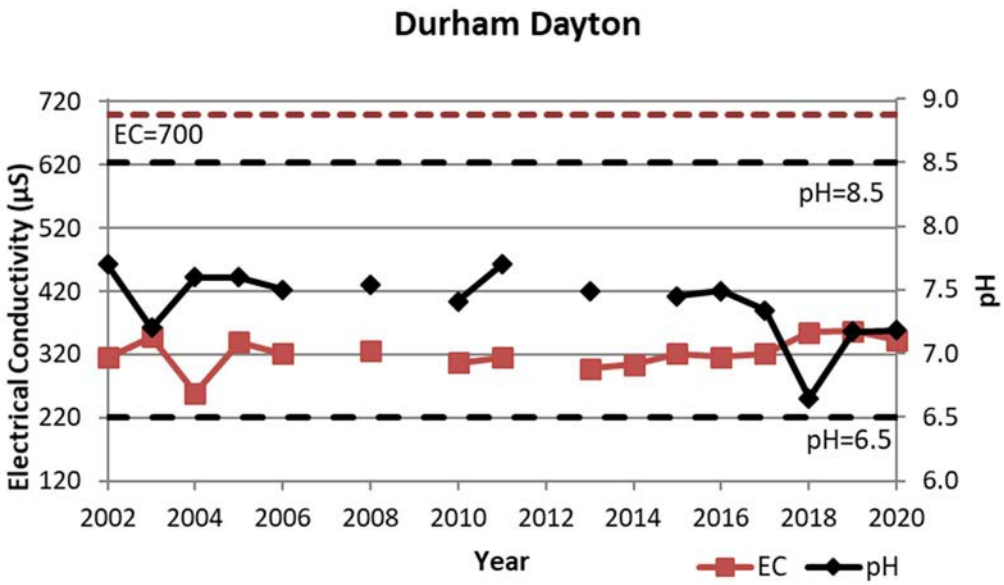




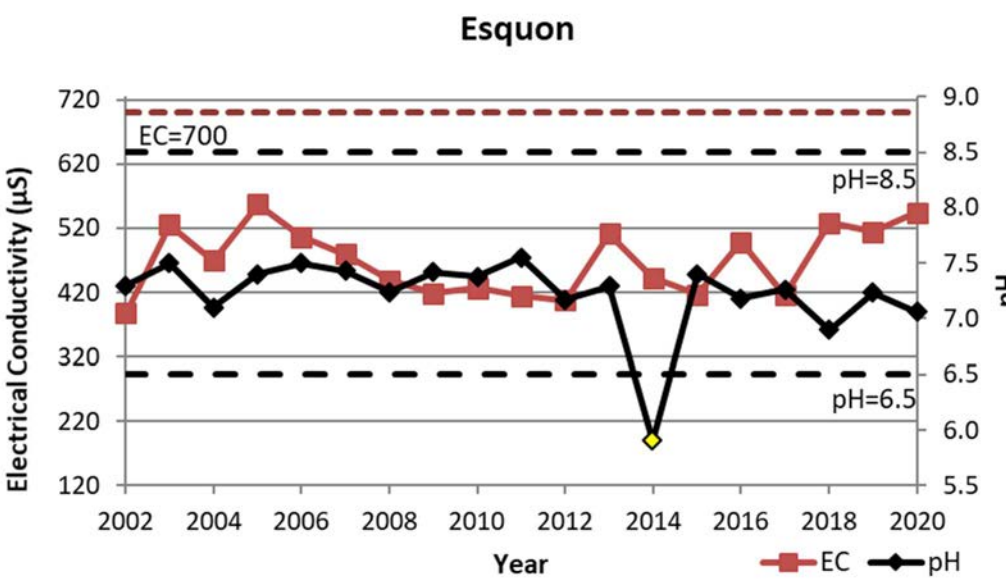
Note: 2019 EC data reflect corrected values due to equipment calibration errors.



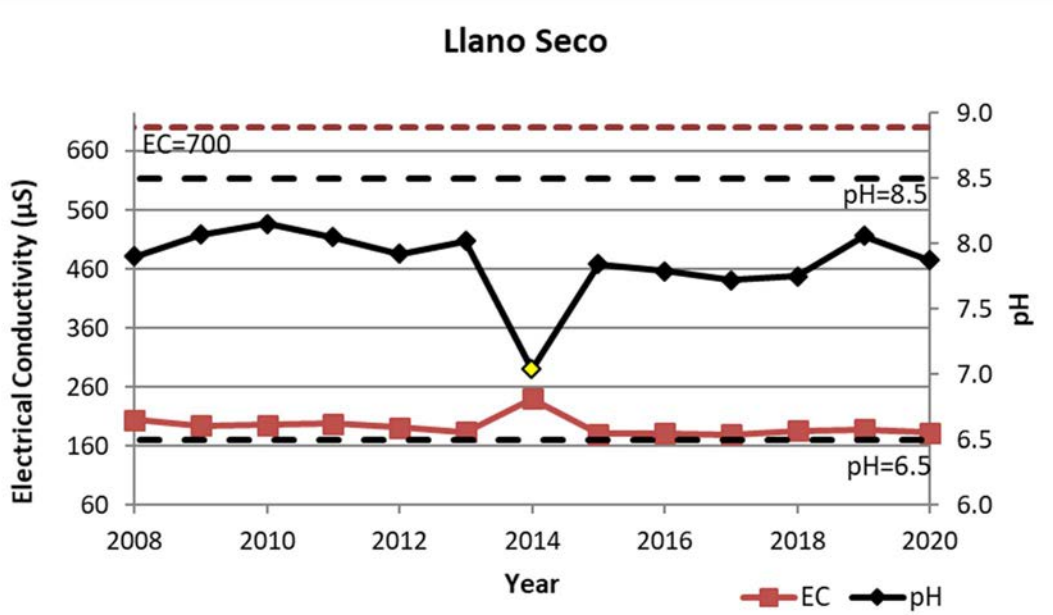
Note: 2019 EC data reflect corrected values due to equipment calibration errors.
Gaps in data indicate that no measurements were taken.



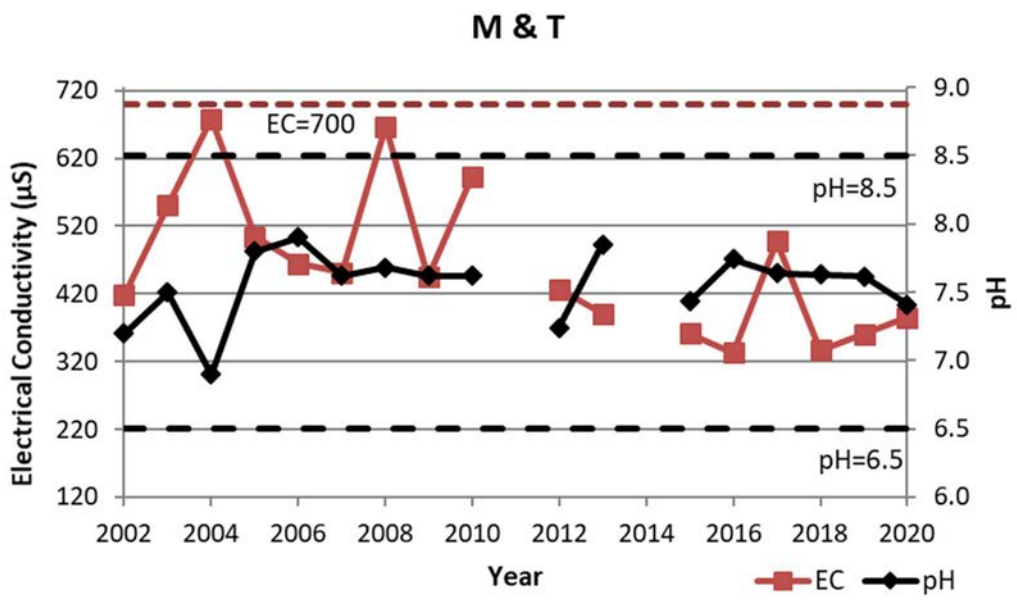
Note: 2019 EC data reflect corrected values due to equipment calibration errors. Gaps in data indicate that no measurements were taken.



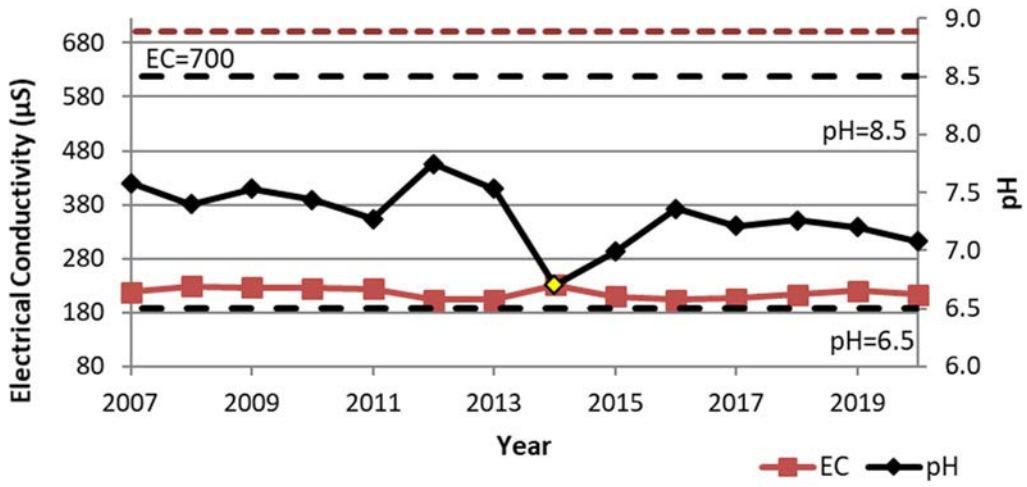
Note: Yellow data point indicates a questionable measurement due to deviation in methodology from standard field methods. 2019 EC data reflect corrected values due to equipment calibration errors.



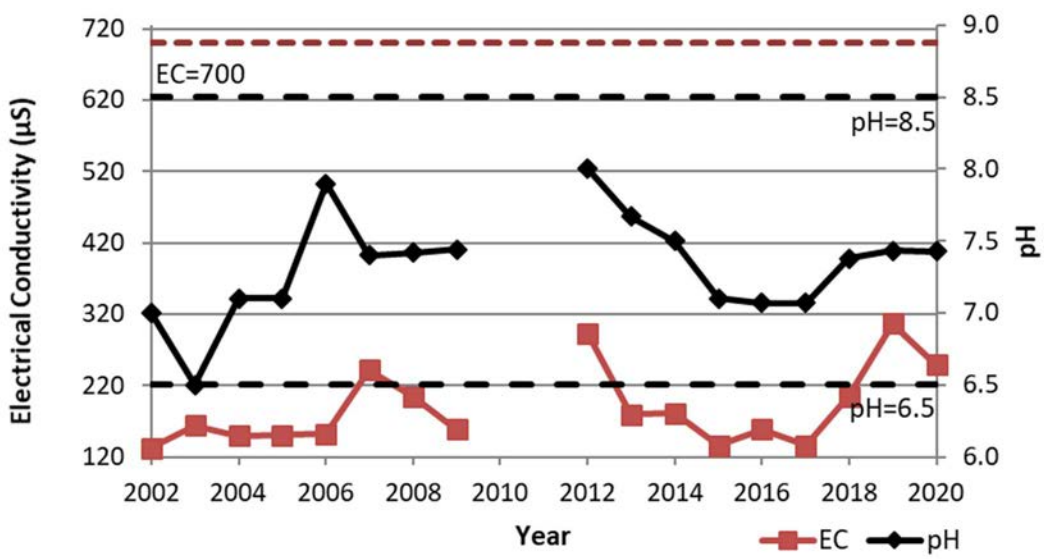
Note: Yellow data point indicates a questionable measurement due to deviation in methodology from standard field methods. 2019 EC datareflect corrected values due to equipment calibration errors.



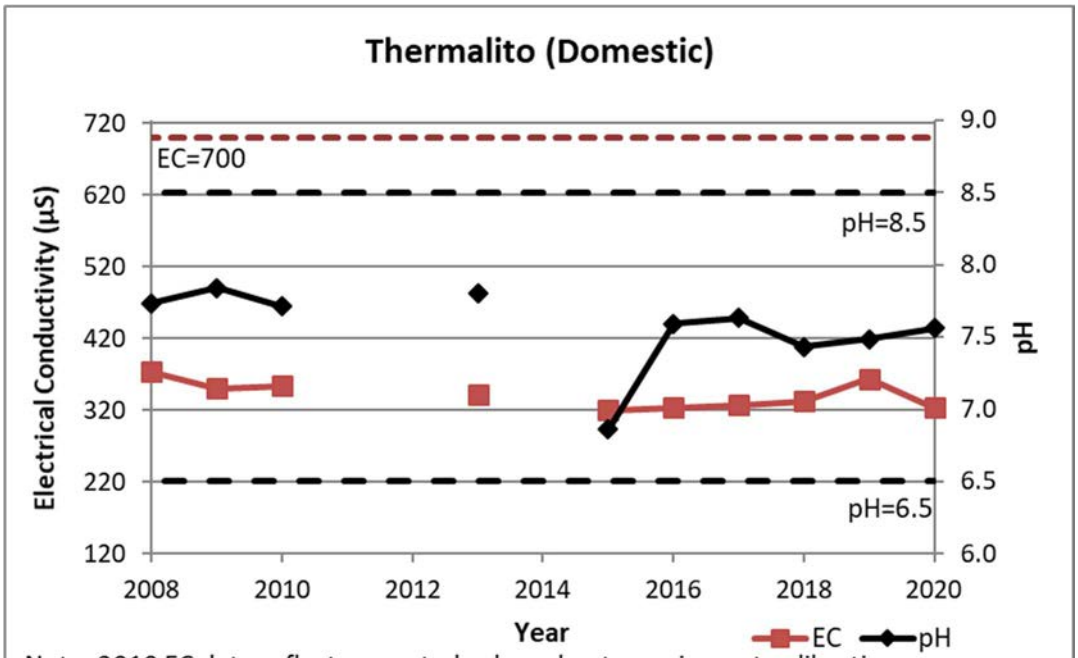
Note: 2019 EC data reflect corrected values due to equipment calibration errors. Gaps in data indicate that no measurements were taken.



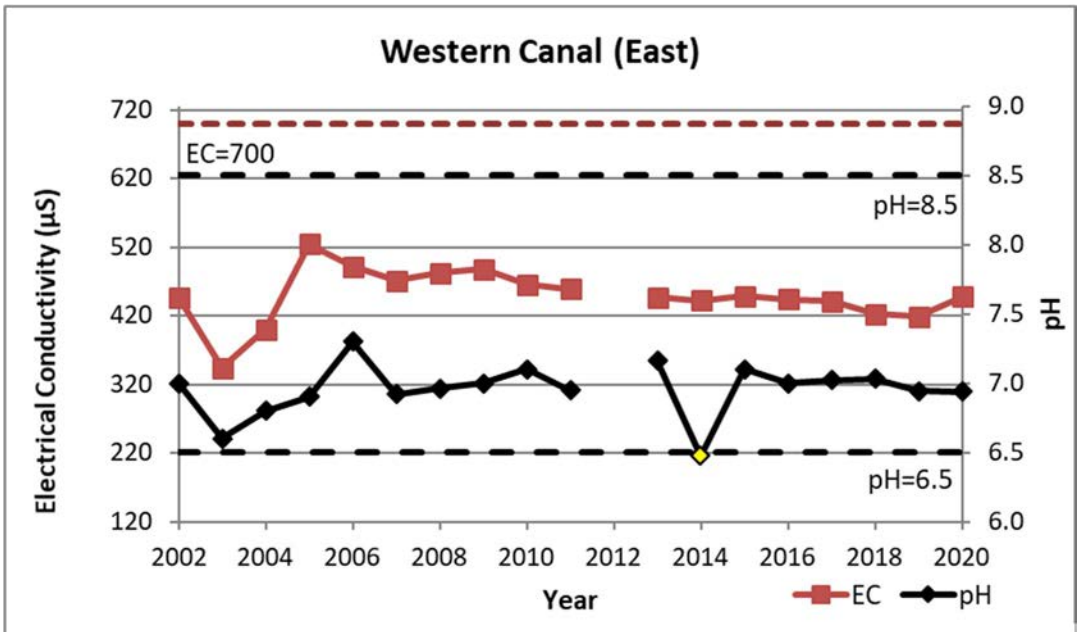
Note: Yellow data point indicates a questionable measurement due to deviation in methodology from standard field methods. 2019 EC data reflect corrected values due to equipment calibration errors.



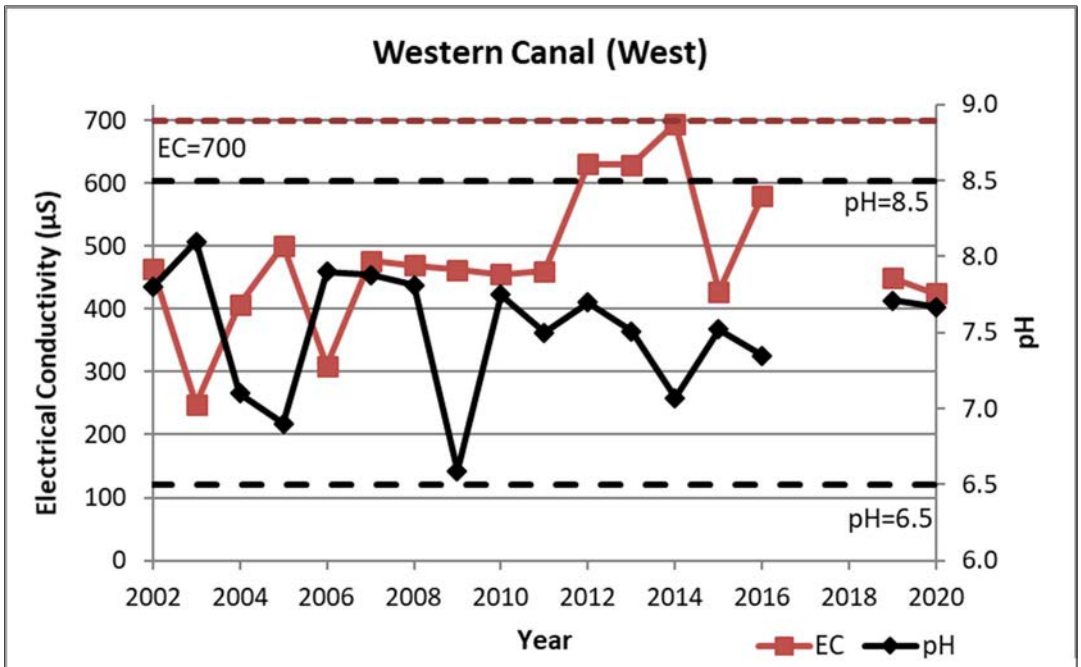
Note: 2019 EC data reflect corrected values due to equipment calibration errors. Gaps in data indicate that no measurements were taken.



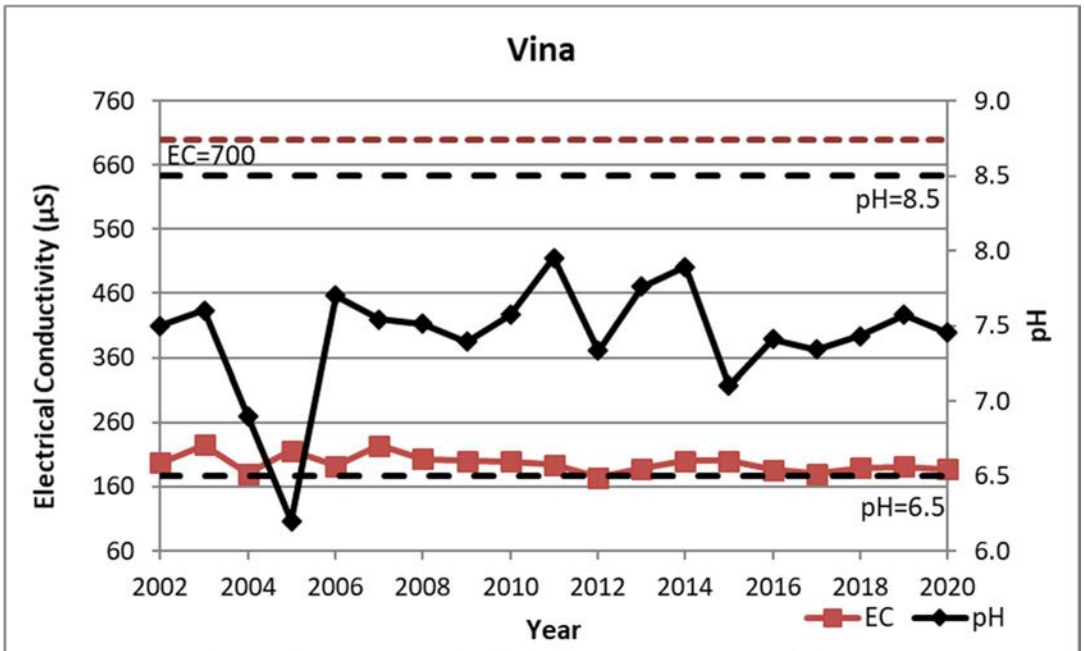
Note: 2019 EC data reflect corrected values due to equipment calibration errors. Gaps in data indicate that no measurements were taken.



Note: Yellow data point indicates a questionable measurement due to deviation in methodology from standard field methods. Gaps in data indicate that no measurements were taken. 2019 EC data corrected values due to equipment calibration errors.



Note: 2019 EC data reflect corrected values due to equipment calibration errors. Gaps in data indicate that no measurements were taken.



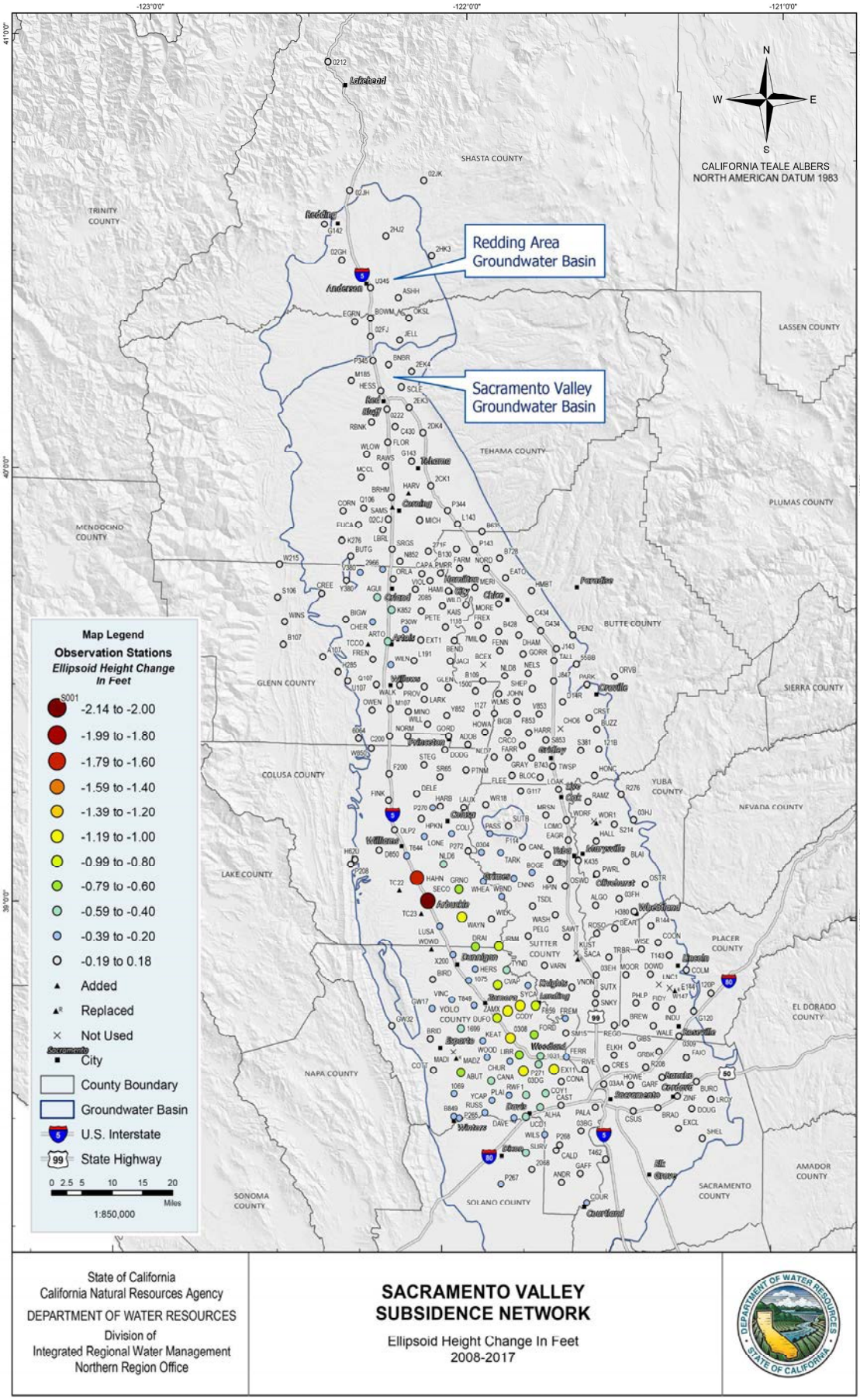
Note: 2019 EC data reflect corrected values due to equipment calibration errors.

Groundwater Status Report

Appendix E

Sacramento Valley Subsidence Monitoring Network Observation Stations

Figure ES-1 Height Change at Monuments between 2008 and 2017



Groundwater Status Report

Appendix F

Butte Spring, Summer, & Fall BMO Summary Tables

Spring 2008 - 2020 Groundwater Elevations - CASGEM

Sub Basin	Subregion	Monitoring Wells	Well Type	Well Depth	First Record	Groundwater Water Surface Elevations (WSEs) (feet)															Analysis		
						2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	BMO Alert 1 Level (feet)	BMO Alert 2 Level (feet)	Elevation Above (+) or Below (-) Alert Stage 1 (ft)	Change Spring 2019 to Spring 2020 (ft)	Spring 2020 Depth to Water (ft)
VINA	Vina North	22N01E09B001M	D	S	2001	144.9	140.7	141.0	145.0	142.6	138.0	131.5	131.6	130.6	137.9	137.2	138.4	138.6	146.0	138.2	-7.6	0.2	39.7
		22N01E20K001M	D	S	1961	132.9	129.0	134.1	138.2	134.6	130.5	NM	121.7	125.6	136.5	132.3	136.1	131.7	132.3	127.2	3.8	-4.4	36.1
		23N01E29P002M	D	S/I	1990	156.1	152.3	152.5	155.9	152.6	150.2	NM	141.5	143.4	152.4	146.4	150.2	145.4	148.4	131.9	1.8	-4.8	59.9
		23N01E33A001M	I	S/I	2001	154.6	151.4	150.5	152.6	151.5	149.5	144.6	142.2	141.7	144.3	144.2	144.6	145.5	155.3	144.1	-10.8	0.9	106.8
		23N01W10E001M	I	I	2001	165.7	163.2	164.7	166.6	163.6	159.0	153.4	153.5	155.9	162.7	157.2	164.7	159.2	166.8	160.9	-2.1	-5.5	30.2
		23N01W10M001M	M	S	2001	165.5	164.5	165.2	167.8	163.3	166.0	156.0	155.6	158.4	166.1	158.8	165.9	159.5	168.4	162.6	-2.5	-6.4	27.9
		23N01W27L001M	D	S	1976	145.2	142.4	145.3	NM	142.7	142.7	136.3	139.9	140.8	149.2	138.9	148.9	138.8	137.1	114.8	11.8	-10.1	23.6
		23N01W36P001M	D	S	1959	142.1	138.5	139.6	143.5	137.3	137.3	134.5	132.4	130.5	144.7	140.5	145.0	132.1	134.8	128.3	10.2	-12.9	30.7
		23N02W25C001M	I	S/I	1967	139.1	139.3	140.5	144.2	136.1	137.7	133.9	136.3	136.4	149.0	137.7	NM	138.0	136.3	133.0	NM	NM	19.4
		23N01W25G001M	I	I	2007	148.4	150.0	150.7	134.5	149.8	149.0	141.2	141.0	142.3	150.4	145.0	147.1	144.7	*	*		QM	35.7
		23N01W03H002M	M	I	2012					179.0	178.0	171.1	173.3	173.0	176.1	174.1	175.9	174.4	*	*		-1.4	42.4
		23N01W03H003M	M	I	2012					179.4	178.9	173.0	174.0	173.5	177.2	174.8	175.9	174.4	*	*		-1.6	42.5
		23N01W03H004M	M	S	2012					182.9	181.8	175.9	177.3	174.9	180.5	177.2	179.8	177.9	*	*		-1.9	39.0
		23N01W28M002M	M	D	2009		145.2	148.9	148.0	147.8	148.0	140.1	143.0	142.6	148.8	143.1	147.7	144.8	*	*		-2.9	14.2
		23N01W28M003M	M	D	2009		145.6	148.6	147.1	146.7	147.2	140.1	143.1	143.6	151.0	142.8	149.9	144.3	*	*		-5.6	14.8
		23N01W28M004M	M	S	2009		147.9	146.5	152.2	143.6	143.6	137.8	141.3	144.3	150.1	140.3	150.1	139.0	*	*		-11.1	20.0
		23N01W28M005M	M	S	2009		148.2	146.5	152.6	142.9	143.6	130.2	141.6	143.4	150.3	139.8	150.3	140.0	*	*		-10.3	19.1
		23N01W31M001M	M	D	2008		138.1	141.2	143.6	139.6	140.9	130.8	135.1	135.1	141.0	136.9	139.3	138.2	*	*		-1.1	16.6
		23N01W31M002M	M	I	2008		144.2	144.9	148.1	141.9	142.7	136.9	139.9	141.4	148.8	138.6	147.5	139.2	*	*		-8.3	15.6
		23N01W31M003M	M	S	2008		141.2	142.2	146.6	140.5	138.8	137.2	137.0	142.5	147.8	137.9	147.2	137.1	*	*		-10.2	17.7
		23N01E07H001M	D	S	2019												168.6	169.8	*	*		QM	112.2
		23N01W31M004M	M	S	2008		138.8	139.2	142.3	138.5	137.8	136.0	137.6	141.3	141.7	136.4	141.8	136.4	*	*		-5.4	18.3
	Vina Chico	CWSCH01b	M&I	U	1988	127.0	132.0	130.0	131.0	131.0	126.0	123.0	120.0	123.0	131.0	124.0	130.0	123.0	*	*		-7.0	77.0
		CWSCH02	M&I	U	1988	138.0	136.0	138.0	141.0	136.0	128.0	110.0	121.0	121.0	125.0	126.0	131.0	126.0	123.0	91.0	8.0	-5.0	57.0
		CWSCH03	M&I	U	1988	123.0	128.0	129.0	123.0	126.0	122.0	120.0	118.0	122.0	123.0	123.0	123.0	126.0	128.0	81.0	-5.0	3.0	132.0
		CWSCH04	M&I	U	1988	118.0	117.0	QM	123.0	119.0	122.0	105.0	NM	118.0	142.0	130.0	132.0	128.0	126.0	106.0	6.0	-4.0	84.0
		CWSCH05	M&I	U	1988	122.0	118.0	124.0	125.0	122.0	120.0	113.0	111.0	116.0	122.0	119.0	122.0	118.0	119.0	95.0	3.0	-4.0	97.0
		CWSCH06	M&I	U	1988	118.0	115.0	126.0	115.0	117.0	117.0	96.0	105.0	121.0	131.0	128.0	133.0	116.0	116.0	93.0	17.0	-17.0	65.0
		CWSCH07	M&I	U	1991	115.0	115.0	118.0	117.0	123.0	117.0	113.0	112.0	113.0	118.0	114.0	120.0	116.0	115.0	95.0	5.0	-4.0	154.0
		22N01E28J001M	M	I	1958	139.3	131.9	136.5	140.5	137.7	134.9	126.9	126.6	126.0	137.7	132.8	138.1	132.4	140.4	135.6	-2.3	-5.7	46.5
		22N01E28J003M	M	I	1958	143.8	138.9	140.7	145.2	141.7	139.4	131.1	130.5	129.2	141.6	136.5	143.1	137.6	136.2	130.2	6.9	-5.5	40.7
		22N01E28J005M	M	D	1958	136.6	131.3	133.0	135.9	133.7	134.2	123.3	125.0	123.6	132.8	128.6	132.5	131.1	135.1	130.8	-2.6	-1.4	47.8
		22N01E35E001M	I	S/I	2005	131.1	127.1	129.3	131.8	129.6	125.4	119.7	119.0	121.8	129.6	126.8	130.4	123.9	*	*		-6.5	58.5
		22N02E30C002M	M	S	2002	131.1	127.5	127.3	128.7	127.6	123.6	120.5	117.9	NM	126.5	126.2	126.6	128.0	*	*		1.4	115.7
	Vina South	20N02E24C001M	M	S	1999	121.0	119.5	118.9	121.2	119.3	115.4	109.7	107.0	105.8	109.5	112.1	111.0	109.2	122.8	117.6	-11.9	-1.8	48.6
		20N02E24C002M	M	I	1999	120.9	119.5	118.9	121.2	119.5	115.4	109.1	107.1	105.8	109.4	111.6	110.8	109.1	122.8	117.7	-12.0	-1.7	48.6
		20N02E24C003M	M	I	1999	121.0	119.6	118.9	121.2	119.4	115.4	109.4	107.1	105.8	109.9	111.1	110.8	109.1	122.5	117.0	-11.7	-1.8	48.7
		20N03E31M001M	M	S	2001	118.6	118.2	117.6	118.3	115.0	113.5	110.8	110.6	110.0	115.5	114.7	113.4	110.4	120.1	117.1	-6.7	-3.1	22.7
		20N03E33L001M	I	S	1999	124.0	122.3	120.9	123.6	119.1	118.8	116.5	115.1	NM	116.5	117.5	117.4	113.8	124.5	120.6	-7.2	-3.6	37.6
		21N03E22C001M	D	S	2001	380.9	381.7	382.7	381.8	381.2	380.2	373.9	367.0	360.0	373.5	NM	382.9	381.7	372.1	360.7	10.8	-1.2	0.7
		21N03E29J003M	D	S/I	2007	224.3	230.3	230.4	NM	NM	230.7	226.9	226.9	229.6	227.3	230.0	227.1	220.4	*	*		-6.7	54.0
		21N03E32B001M	I	S	1999	225.2	224.7	223.9	225.1	226.0	224.2	221.9	221.9	221.6	222.6	222.8	222.8	NM	225.8	224.5	-3.1	NM	NM
		20N02E08H003M	D	S	2008	123.3	121.5	122.6	122.8	120.7	116.5	116.1	114.5	117.3	121.1	116.2	122.3	114.6	*	*		-7.7	17.7
		20N02E09G001M	M	S	2001	124.4	121.7	121.9	124.7	120.4	116.7	114.4	110.7	113.6	116.8	115.6	118.8	116.7	114.5	99.8	4.3	-2.1	32.1
		20N02E09L001M	I	I	1953	123.8	123.5	122.9	125.3	122.4	118.6	116.9	114.0	117.7	121.0	118.0	123.9	113.0	125.5	122.7	-1.6	QM	26.3
		20N02E08C001M	I	D	2018												117.2	109.3	*	*		QM	24.7
		21N02E20P001M	I	S/I	1995	122.8	118.5	121.0	112.3	118.8	111.6	107.3	98.9	107.8	111.9	114.2	120.5	110.3	129.4	115.1	-8.9	-10.2	57.8
		21N02E26E003M	M	D	2007	124.3	121.4	121.0	122.9	123.3	118.4	115.1	113.6	112.5	114.1	115.5	115.6	119.3	*	*		3.7	63.0
		21N02E26E004M	M	I	2007	123.5	120.4	120.3	122.0	122.8	117.8	114.7	113.1	112.3	113.4	115.2	115.9	119.2	*	*		3.4	63.0
		21N02E26E005M	M	I	2007	122.6	119.4	119.2	120.8	121.6	116.6	113.9	112.1	111.1	112.2	114.3	114.9	118.4	*	*		3.5	63.9
		21N02E26E006M	M	S	2007	116.3	113.1	112.1	113.9	116.4	110.9	108.8	107.9	105.4	105.8	109.6	109.5	114.9	*	*		5.3	67.4
		20N01E02H003M	M	S	2001	108.8	104.8	106.5	109.5	106.8	103.7	96.0	95.0	96.2	105.9	100.5	107.0	104.1	*	*		-2.8	28.2
		20N01E10C002M	I	S	1947	110.9	104.0	108.5	110.7	108.6	NM	NM	102.3	98.1	108.8	104.2	110.3	104.0	110.3	106.1	0.0	-6.3	23.4
		20N02E06Q001M	I	S/I	1947	119.8	117.1	117.8	120.1	117.3	114.6	109.5	109.6	109.6	117.1	112.5	118.6	113.0	120.4	116.9	-1.8	-5.6	24.6

Spring 2008 - 2020 Groundwater Elevations - CASGEM

Sub Basin	Subregion	Monitoring Wells	Well Type	Well Depth	First Record	Groundwater Water Surface Elevations (WSEs) (feet)													BMO Alert 1 Level (feet)	BMO Alert 2 Level (feet)	Analysis		
						2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020			Elevation Above (+) or Below (-) Alert Stage 1 (ft)	Change Spring 2019 to Spring 2020 (ft)	Spring 2020 Depth to Water (ft)
Vina	Vina South	21N01E10B003M	I	I	1995	126.6	121.8	123.3	126.0	124.9	NM	113.7	111.6	114.6	123.2	119.0	124.1	119.4	128.2	110.6	-4.1	-4.7	50.9
		21N01E13L002M	M	D	2012					113.4	114.4	108.2	104.9	110.2	117.1	114.2	120.4	113.3	*	*		-7.1	66.6
		21N01E13L003M	M	I	2012					109.5	114.5	108.1	105.0	102.0	117.1	114.2	120.5	113.7	*	*		-6.8	66.2
		21N01E13L004M	M	I	2012					106.0	114.8	108.0	105.2	109.7	116.9	114.1	120.5	114.3	*	*		-6.3	65.6
		21N01E25K001M	D	S	1993	113.7	108.3	110.6	113.6	112.2	106.5	95.9	99.2	97.7	106.2	103.6	109.6	109.1	118.5	100.4	-8.9	-0.5	45.2
		21N01E26K001M	I	I	1993	111.2	104.3	101.1	106.7	103.4	102.9	93.9	95.7	94.9	107.1	103.1	110.8	102.1	115.9	97.4	-5.1	-8.7	50.7
		21N01E27D001M	D	S	1946	109.7	103.9	106.6	110.4	108.1	104.4	95.2	94.7	95.9	103.3	96.3	105.2	105.0	111.0	105.7	-5.8	-0.2	38.3
		21N02E18C001M	M	D	2010				120.2	121.4	114.7	109.1	104.8	111.0	116.2	113.5	118.9	113.7	*	*		-5.2	75.4
		21N02E18C002M	M	I	2010				117.7	121.8	115.2	109.0	104.1	111.2	116.5	113.9	119.4	114.9	*	*		-4.5	74.2
		21N02E18C003M	M	S	2010				160.8	149.0	150.7	142.4	149.7	151.7	167.4	158.3	171.5	159.4	*	*		-12.1	29.7
		21N02E30L001M	D	S/I	1995	120.8	115.8	118.0	120.0	118.7	113.8	105.7	105.0	105.7	NM	110.6	118.2	114.4	126.3	109.8	-8.1	-3.9	45.0
BUTTE	Butte*	17N01E10A001M	D	S	1953	59.6	59.2	59.7	60.5	63.7	57.7	59.8	58.9	61.0	59.6	58.9	59.5	NM	52.9	51.2	6.6	NM	NM
		17N03E05C003M	I	S	2001													86.7					
		18N01E35L001M	M	D	2005	74.7	74.6	74.7	75.1	74.1	74.1	NM	72.2	72.3	75.0	73.3	74.8	72.7	*	*		-2.0	-2.7
		18N02E16F001M	I	S	1947	76.7	76.4	76.6	77.2	76.5	75.8	76.9	76.0	78.8	77.4	77.8	77.8	76.1	75.3	74.6	2.5	-1.7	6.2
		18N02E25M001M	I	S	1959	83.4	83.4	82.9	84.6	82.4	67.1	NM	81.5	85.7	83.9	82.2	84.7	81.7	82.7	81.9	2.0	-3.0	7.6
		18N02E32H001M	D	S	2001	71.9	71.7	NM	72.9	71.4	70.9	72.0	72.7	75.4	71.8	71.8	72.9	71.2	70.8	68.2	2.1	-1.7	7.1
		17N02E14A001M	I	S	1947	81.5	81.5	81.3	81.2	80.4	79.6	80.8	78.9	82.8	81.9	79.7	82.6	79.7	78.5	77.0	4.1	-2.9	5.1
		17N02E14H001M	D	S	2000	79.8	80.0	79.8	82.2	79.5	78.5	79.0	79.4	80.6	80.7	77.6	NM	77.9	79.0	76.2	NM	NM	8.4
		17N03E16N001M	D	S	1953	77.3	77.4	77.6	79.6	75.9	76.1	75.7	NM	NM	NM	NM	NM	NM	74.3	72.2	NM	NM	NM
		17N01E17F001M	M	S	1992	54.8	54.7	54.8	56.0	54.8	54.3	54.8	53.8	56.3	56.7	56.0	57.2	55.1	54.1	51.3	3.1	-2.1	3.9
		17N01E17F002M	M	I	1992	57.2	57.1	57.0	58.0	56.7	56.5	56.7	55.5	57.1	57.8	57.0	58.2	56.0	56.9	54.9	1.3	-2.3	3.4
		17N01E17F003M	M	I	1992	58.4	57.9	58.1	58.7	57.6	57.5	57.4	56.3	57.2	59.0	58.0	59.3	56.9	57.5	55.0	1.8	-2.4	2.4
		17N01E24A003M	M	D	2007	75.2	74.7	74.4	74.8	74.4	74.3	73.1	71.7	71.0	74.9	73.4	74.1	72.7	*	*		-1.4	0.1
		17N01E24A004M	M	I	2007	65.8	65.4	66.0	67.2	65.2	64.0	63.7	61.9	62.5	64.5	62.6	65.7	61.5	*	*		-4.2	11.3
		17N01E24A005M	M	I	2007	65.8	65.4	65.9	67.1	65.2	64.0	63.0	61.7	62.1	64.5	62.4	65.6	61.5	*	*		-4.1	11.3
		17N01E24A006M	M	S	2007	68.1	68.1	68.2	69.2	68.3	68.7	69.5	67.8	69.3	68.7	68.3	68.8	68.1	*	*		-0.7	4.7
		17N02E19J001M	I	S/I	2000	64.1	66.2	66.9	67.2	66.7	66.6	66.1	66.6	66.2	67.1	66.8	66.9	66.1	66.0	62.8	0.9	-0.8	6.2
		18N01E13A002M	I	S/I	2001	75.7	75.3	75.6	75.6	75.1	75.0	75.6	74.8	77.3	76.0	75.2	76.5	75.0	70.7	65.7	5.8	-1.5	4.3
		18N01E15D002M	D	S	1976	70.8	70.4	70.6	70.8	68.2	70.5	70.8	70.3	72.4	71.3	71.3	71.8	70.9	65.3	60.3	6.5	-0.8	1.5
		19N01E27Q001M	M	I	1978	84.7	84.0	84.4	85.2	84.1	83.6	84.2	83.6	85.0	84.7	83.9	85.0	83.3	79.7	74.7	5.3	-1.6	4.0
		19N01E35B001M	M	S	2002	82.7	82.4	82.7	83.5	82.7	82.1	82.9	82.2	84.3	83.5	83.3	83.3	82.4	77.5	72.5	5.8	-0.9	4.1
		19N01E35B002M	M	D	2005	91.6	90.9	91.1	91.4	90.7	90.5	89.8	89.5	88.6	91.2	90.5	90.9	90.3	*	*		-0.6	-3.8
		19N01E35B003M	M	I	2005	86.0	85.2	85.7	86.4	85.3	84.9	85.2	84.5	85.2	86.2	85.2	86.2	84.7	*	*		-1.5	1.8
		19N02E15N002M	I	U	2000	102.9	102.5	102.8	103.3	102.4	101.4	102.8	101.9	103.9	103.4	103.6	103.5	102.2	98.2	93.2	5.3	-1.3	5.1
		18N03E08B003M	I	S/I	2001	101.0	95.8	100.7	102.3	99.9	97.9	99.6	99.7	NM	103.2	99.8	102.2	99.8	100.3	96.4	1.9	-2.4	12.5
		18N03E21G001M	I	S	1953	86.7	84.7	87.0	89.2	87.6	87.2	85.1	85.2	83.8	93.1	90.6	89.5	87.4	86.7	84.1	2.8	-2.1	18.9
		19N03E05N002M	D	S	1967	121.6	120.6	121.9	122.1	119.6	116.3	116.7	117.9	116.5	119.0	119.4	119.0	117.0	114.4	96.5	4.6	-2.0	25.3
		19N01E09Q001M	I	S	1991	89.5	88.8	88.3	89.4	88.8	NM	NM	87.8	NM	NM	88.9	88.4	87.9	84.5	79.5	3.9	-0.5	4.5
		19N02E07K002M	M	I	2006	NM	102.6	102.9	103.4	102.3	101.7	101.4	100.9	100.9	102.4	102.0	102.7	101.8	*	*		-0.9	0.9
		19N02E07K003M	M	I	2006	NM	99.4	99.5	100.0	99.8	99.0	99.5	98.8	100.7	99.9	100.4	100.0	99.2	*	*		-0.8	3.5
		19N02E07K004M	M	S	2006	NM	99.6	99.7	100.2	99.9	99.2	99.7	98.9	100.7	100.1	100.4	100.2	99.4	*	*		-0.8	3.3
		19N02E13Q001M	M	S	2002	115.8	114.1	114.7	115.5	114.8	114.3	115.4	116.2	116.9	117.0	115.9	116.8	116.2	*	*		-0.6	3.7
		19N02E13Q002M	M	I	2006	116.6	115.3	115.7	116.5	115.7	114.8	116.0	116.4	117.1	117.4	116.4	117.3	116.3	*	*		-1.0	3.6
		19N02E13Q003M	M	D	2006	117.0	115.7	116.1	117.0	116.0	115.2	116.3	116.6	117.2	117.7	116.7	117.5	116.5	*	*		-1.1	3.4
		20N01E35C001M	D	S	1947	99.4	98.5	98.4	99.9	NM	98.8	NM	NM	NM	NM	NM	99.9	98.4	94.3	89.3	5.6	-1.5	4.0
		20N02E15H001M	M	S	1995	124.0	122.9	122.2	124.5	122.1	118.8	NM	112.1	113.3	116.3	115.5	118.0	113.3	*	*		-4.7	30.7
		20N02E15H002M	M	S	1995	134.5	133.7	134.2	135.7	132.7	129.9	NM	122.7	122.3	130.6	121.6	130.3	121.5	*	*		-8.8	22.6
		20N02E16P001M	I	U	1990	123.0	122.2	NM	123.3	121.8	118.9	116.1	113.3	118.0	119.9	118.1	120.9	116.2	119.3	114.3	1.6	-4.7	15.6
		20N02E28N001M	D	S/I	1947	118.5	118.6	118.6	119.1	122.3	117.7	118.5	117.7	120.0	118.9	118.7	119.1	118.0	113.8	108.8	5.3	-1.1	5.4
		21N01W23J001M	I	S	1941	112.7	113.0	112.4	117.1	112.0	109.1	110.2	109.3	115.1	115.8	106.7	117.0	107.6	110.7	108.2	6.3	-9.4	13.8
		21N01W35K002M	I	S/I	1994	102.4	102.2	103.0	107.5	100.9	100.5	99.7	101.0	103.9	107.5	99.3	NM	98.2	94.9	80.9	NM	NM	16.2
		20N01E18L001M	M	D	2000	106.3	104.3	105.2	106.6	104.1	103.4	99.4	100.7	99.9	104.5	101.4	104.9	102.9	107.7	105.2	-2.9	-2.0	4.5
		20N01E18L002M	M	I	2001	103.0	102.4	102.6	104.3	102.1	101.8	101.0	101.1	102.3	103.9	101.3	104.3	100.6	102.9	100.2	1.4	-3.7	6.7
		20N01E18L003M	M	S	2001	104.2	103.6	104.0	104.7	103.4	103.2	103.1	102.8	105.5	104.3	104.3	104.9	103.3	103.6	101.5	1.3	-1.6	4.1

Spring 2008 - 2020 Groundwater Elevations - CASGEM

Sub Basin	Subregion	Monitoring Wells	Well Type	Well Depth	First Record	Groundwater Water Surface Elevations (WSEs) (feet)															Analysis		
						2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	BMO Alert 1 Level (feet)	BMO Alert 2 Level (feet)	Elevation Above (+) or Below (-) Alert Stage 1 (ft)	Change Spring 2019 to Spring 2020 (ft)	Spring 2020 Depth to Water (ft)
Butte	Butte*	20N01W04J001M	I	S	2008	82.9	82.8	82.8	91.1	82.9	82.1	81.8	81.5	86.1	NM	82.0	NM	81.2	*	*		NM	21.2
		20N01W11N002M	I	S	2008	96.9	96.6	97.4	101.7	95.8	94.4	95.9	96.3	97.5	NM	94.6	102.6	93.9	*	*		-8.7	13.5
		21N01W11A001M	M	D	2010				121.2	119.8	118.8	113.1	114.0	115.6	122.5	115.5	122.6	117.1	*	*		-5.5	12.2
		21N01W11A002M	M	S	2010				117.0	119.2	115.1	114.5	113.9	122.0	120.2	115.5	122.6	114.1	*	*		-8.5	15.2
		21N01W11A003M	M	S	2010				116.7	119.8	114.9	114.4	113.9	122.6	119.8	115.7	122.2	115.2	*	*		-7.0	14.1
		21N01W13J001M	M	D	2012					115.7	114.2	108.6	109.1	110.9	117.5	110.3	118.2	111.4	*	*		-6.8	16.2
		21N01W13J002M	M	I	2012					115.8	114.5	109.1	109.7	111.7	118.1	110.6	118.9	111.3	*	*		-7.6	16.4
		21N01W13J003M	M	I	2012					116.0	114.7	109.5	110.2	112.3	118.6	111.0	119.3	111.5	*	*		-7.8	16.2
		21N01W24B001M	M	D	1995	***115.7***	***113.0***	***114.4***	***114.9***	***113.0***	***111.9***	***106.7***	***107.4***	***108.9***	***115.2***	***108.0***	***115.8***	***108.9***	117.8	108.5	-1.9	-6.9	18.1
		22N01E29R001M	I	I	1947	***138.2***	***138.3***	***132.4***	***137.5***	***133.7***	***131.3***	***122.5***	120.6	***124.2***	***134.7***	***128.9***	***134.6***	***128.9***	140.6	136.6	-6.0	-5.8	34.9
		22N01E32E004M	D	S	1992	***127.1***	***125.5***	***124.6***	***126.6***	***126.7***	***125.4***	***117.4***	***117.5***	***119.8***	***129.4***	***123.0***	***128.6***	***122.4***	130.9	117.8	-2.3	-6.2	28.5
W CRK.	Wyandotte Creek Oroville	19N03E16Q001M	D	S	2000	138.7	136.7	138.7	139.8	139.0	138.1	NM	140.3	138.9	140.7	149.9	140.0	139.4	137.8	135.4	2.2	-0.6	39.9
		CWS-01	M&I	150	1978	***103.0***	124.0	129.0	128.0	122.0	124.0	123.0	124.0	128.0	139.0	135.0	137.0	133	119.0	99.0	18.0	-4.0	27.0
		CWS-02	M&I	180	1978	152.0	144.0	144.0	148.0	142.0	147.0	145.0	148.0	142.0	153.0	150.0	153.0	148	135.0	111.0	18.0	-5.0	30.0
		CWS-03	M&I	U	1978	163.0	***151.0***	165.0	159.0	163.0	159.0	***154.0***	***149.0***	155.0	174.0	168.0	173.0	166	154.0	135.0	19.0	-7.0	29.0
W. CRK.	Wyandotte Creek South	17N03E03D001M	I	S	1947	***72.6***	***71.5***	***72.4***	76.0	***70.2***	***67.8***	***71.1***	***71.1***	***71.3***	85.3	***72.2***	75.4	***70.6***	72.8	69.8	2.6	-4.8	26.7
		17N04E09N002M	I	S/I	2001	82.0	***77.9***	***76.2***	***78.5***	***78.6***	***78.1***	***74.9***	73.5	***74.7***	75.9	NM	NM	77.2	79.2	71.1	NM	QM	25.1
		17N04E22B001M	D	S	1976	104.8	103.3	101.3	106.1	103.6	104.2	101.8	103.4	104.3	106.8	NM	105.4	NM	98.6	96.1	6.8	NM	NM
		19N04E31F001M	D	S	2001	125.8	124.8	124.9	127.1	131.2	124.4	123.9	119.0	140.2	127.1	139.2	128.5	125.5	108.1	70.8	20.4	-3.0	133.8

Spring 2008 - 2020 Groundwater Elevations - CASGEM

* Wells that do not have alert levels established as detailed below:

Subregion	Well ID	Added to the Monitoring Network
Vina North	23N01W03H002M	2012
Vina North	23N01W03H003M	2012
Vina North	23N01W03H004M	2012
Vina North	23N01W25G001M	2007
Vina North	23N01W28M002M	2008
Vina North	23N01W28M003M	2008
Vina North	23N01W28M004M	2008
Vina North	23N01W28M005M	2008
Vina North	23N01W31M001M	2008
Vina North	23N01W31M002M	2008
Vina North	23N01W31M003M	2008
Vina North	23N01W31M004M	2008
Vina Chico	22N01E35E001M	2005
Vina Chico	22N02E30C002M	2002
Vina Chico	CWSCH01b (replacement for CWS 01)	2016
Vina South	20N01E02H003M	2001
Vina South	20N02E08C001M	2018
Vina South	20N02E08H003M	2008
Vina South	21N01E13L002M	2012
Vina South	21N01E13L003M	2012
Vina South	21N01E13L004M	2012
Vina South	21N02E18C001M	2010
Vina South	21N02E18C002M	2010
Vina South	21N02E18C003M	2010
Vina South	21N02E26E003M	2007
Vina South	21N02E26E004M	2007
Vina South	21N02E26E005M	2007
Vina South	21N02E26E006M	2007
Vina South	21N02E30L001M	1995
Vina South	21N03E29J003M	2007
Butte	17N01E24A003M	2007
Butte	17N01E24A004M	2007
Butte	17N01E24A005M	2007
Butte	17N01E24A006M	2007
Butte	18N01E35L001M	2005
Butte	19N01E35B002M	2005
Butte	19N01E35B003M	2005
Butte	19N02E07K002M	2006
Butte	19N02E07K003M	2006
Butte	19N02E07K004M	2006
Butte	19N02E13Q001M	2002
Butte	19N02E13Q002M	2006
Butte	19N02E13Q003M	2006
Butte	20N02E15H001M	1995
Butte	20N02E15H002M	1995
Butte	20N01W04J001M	2008
Butte	20N01W11N002M	2008
Butte	21N01W11A001M	2010
Butte	21N01W11A002M	2010
Butte	21N01W11A003M	2010
Butte	21N01W13J001M	2012
Butte	21N01W13J002M	2012
Butte	21N01W13J003M	2012

Depth Categories:

S- Shallow: indicates total well depth or screening interval is less than 200 feet below ground surface
I- Intermediate: total well depth or screening interval is 200-600 feet
S/I- Shallow/Intermediate: screened interval spans portions of the shallow and intermediate depth intervals
D- Deep: total well depth or screening interval is greater than 600 feet

Note: Red font indicates Questionable Measurement (QM), Yellow highlight is Alert Stage 1, Red higlight is Alert Stage 2
** Indicates subasin primarily served by surface water supplies versus groundwater

Alert Stage 1
Alert Stage 2

Alert Stage Count

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Alert 1	27	33	25	24	25	20	26	22	17	13	19	16	23
Alert 2	0	6	3	0	4	15	21	25	25	11	19	9	16
Total	27	39	28	24	29	35	47	47	42	24	38	25	39

Summer 2011 - 2020 Groundwater Elevations - CASGEM																				
						Groundwater Elevations												Analysis		
Sub Basin	Subregion	Monitoring Wells	Well Type	Well Depth	First Record	Summer 2011 Average WSE (ft)	Summer 2012 Average WSE (ft)	Summer 2013 Average WSE (ft)	Summer 2014 Average WSE (ft)	Summer 2015 Average WSE (ft)	Summer 2016 Average WSE (ft)	Summer 2017 Average WSE (ft)	Summer 2018 Average WSE (ft)	Summer 2019 Average WSE (ft)	Spring 2020 (WSE) (ft)	6/29/20 - 7/3/20 WSE (ft)	August 2020 WSE (ft)	2020 Average Summer WSE (ft)	Change Avg. Summer WSE 2019 to 2020 (ft)	Change Spring to Avg. Summer 2020 (ft)
VINA	Vina North	23N01E07H001M	D	S	2018									166.0	169.8	NM	NM	N/A	N/A	N/A
		23N01E29P002M	D	S/I	1990	145.6	139.4	128.0	138.7	133.3	132.4	139.7	131.0	140.6	145.4	NM	NM	N/A	N/A	N/A
		23N01W10E001M	I	I	2001	156.2	163.4	166.8	146.2	146.2	143.7	149.6	NM	152.5	159.2	148.5	141.9	145.2	-7.3	-14.0
		23N01W10M001M	M	S	2001	158.6	148.8	148.4	145.4	147.1	147.9	152.2	149.5	153.8	159.5	150.1	147.1	148.6	-5.2	-10.9
		23N01W27L001M	D	S	1976	137.2	128.7	125.1	126.5	121.1	123.5	NA	123.3	134.7	138.8	NM	NM	N/A	N/A	N/A
		23N01W36P001M	D	S	1959	131.6	112.4	113.2	109.6	108.4	108.6	119.5	112.8	131.0	132.1	NM	111.7	111.7	-19.4	-20.5
		23N02W25C001M	I	S/I	1967	136.8	137.3	132.3	130.0	131.1	133.9	137.1	123.0	138.2	138.0	133.7	133.5	133.6	-4.6	N/A
		23N01W25G001M	I	I	2007	125.5	134.1	134.4	132.8	127.4	121.9	131.7	126.6	134.3	144.7	125.9	130.1	128.0	-6.4	N/A
		23N01W03H002M	M	I	2012	NW	166.3	163.4	166.0	165.5	164.5	165.4	165.6	167.1	174.4	165.4	163.8	164.6	-2.5	-9.8
		23N01W03H003M	M	I	2012	NW	168.3	166.0	162.4	166.6	166.1	168.4	167.2	170.5	174.4	167.2	165.0	166.1	-4.4	-8.3
		23N01W03H004M	M	S	2012	NW	178.3	175.8	172.9	172.4	173.8	178.2	174.5	179.7	177.9	175.0	173.1	174.0	-5.7	-3.9
		23N01W28M002M	M	D	2009	141.1	135.3	129.8	127.2	125.1	130.0	136.0	129.6	139.8	144.8	130.9	127.9	129.4	-10.4	-15.4
		23N01W28M003M	M	D	2009	137.9	131.7	127.4	124.9	124.6	128.6	135.2	129.0	138.2	144.3	130.2	126.8	128.5	-9.7	-15.8
		23N01W28M004M	M	S	2009	137.1	127.7	127.6	125.3	124.1	128.0	134.6	128.8	137.8	139.0	130.4	126.9	128.6	-9.2	-10.4
		23N01W28M005M	M	S	2009	138.2	130.8	128.9	126.4	127.0	129.4	135.6	129.8	138.5	140.0	131.3	127.2	129.2	-9.2	-10.8
		23N01W31M001M	M	D	2008	133.4	127.8	111.4	118.7	106.6	123.8	131.0	121.7	134.4	138.2	123.3	118.7	121.0	-13.4	-17.2
		23N01W31M002M	M	I	2008	129.0	122.1	117.8	112.7	117.1	117.6	126.1	115.7	130.3	139.2	116.5	118.0	117.2	-13.0	-22.0
		23N01W31M003M	M	S	2008	123.1	120.1	119.9	118.5	118.7	116.9	121.2	116.9	127.4	137.1	116.4	117.6	117.0	-10.4	-20.1
		23N01W31M004M	M	S	2008	136.5	134.2	133.7	132.2	132.0	133.0	135.5	133.6	136.5	136.4	133.8	132.8	133.3	-3.2	-3.1
	Vina Chico	22N01E09B001M	D	S	2001	141.7	129.6	126.7	125.8	126.2	126.0	134.5	128.3	137.1	138.6	NM	NM	N/A	N/A	N/A
		22N01E20K001M	D	S	1961	130.4	121.8	121.7	125.1	115.5	116.2	127.6	119.6	133.5	131.7	NM	119.8	119.8	-13.7	-11.9
		23N01E33A001M	I	S/I	2001	147.8	144.1	141.7	138.9	136.8	136.5	141.2	139.8	143.2	145.5	140.3	138.6	139.5	-3.7	-6.0
		CWSCH01b	M&I	U	1988	NA	NA	NA	NA	NA	NA	NA	105.0	110.5	123.0	NM	105.0	105.0	-5.5	-18.0
		CWSCH02	M&I	U	1988	NA	NA	NA	NA	NA	NA	NA	104.5	109.5	127.0	NM	110.0	110.0	0.5	-17.0
		CWSCH03	M&I	U	1988	NA	NA	NA	NA	NA	NA	NA	108.5	113.5	126.0	NM	113.0	113.0	-0.5	-13.0
		CWSCH04	M&I	U	1988	NA	NA	NA	NA	NA	NA	NA	105.5	116.0	128.0	NM	110.0	110.0	-6.0	-18.0
		CWSCH05	M&I	U	1988	NA	NA	NA	NA	NA	NA	NA	103.5	107.5	118.0	NM	107.0	107.0	-0.5	-11.0
		CWSCH06	M&I	U	1988	NA	NA	NA	NA	NA	NA	NA	99.5	103.5	116.0	NM	101.0	101.0	-2.5	-15.0
		CWSCH07	M&I	U	1991	NA	NA	NA	NA	NA	NA	NA	102.0	95.5	117.0	NM	110.0	110.0	14.5	-7.0
		22N01E28J001M	M	I	1958	126.2	118.1	NM	118.1	116.9	115.5	124.6	120.1	128.7	132.4	NM	116.7	116.7	-12.0	-15.7
		22N01E28J003M	M	I	1958	132.7	125.9	NM	122.4	120.4	120.9	130.0	126.3	135.5	137.6	NM	124.3	124.3	-11.1	-13.3
		22N01E28J005M	M	D	1958	126.8	118.9	NM	114.2	114.8	119.0	125.2	119.2	129.6	131.1	NM	116.5	116.5	-13.1	-14.6
		22N01E35E001M	I	S/I	2005	116.2	103.7	104.2	104.5	105.7	105.6	112.7	107.0	116.5	123.9	NM	NM	N/A	N/A	N/A
		22N02E30C002M	M	S	2002	117.7	112.8	NM	111.8	NM	112.8	117.2	115.0	123.5	128.0	NM	NM	N/A	N/A	N/A
	Vina South	20N01E02H003M	M	S	2001	102.0	92.2	NM	87.1	81.8	86.0	94.2	89.8	99.0	104.1	94.0	NM	94.0	-5.1	-10.1
		20N01E10C002M	I	S	1947	NM	NM	NM	94.0	86.3	95.2	101.5	89.4	101.5	104.0	96.7	NM	96.7	-4.8	-7.3
		20N02E06Q001M	I	S/I	1947	112.7	101.4	99.2	98.5	92.5	96.6	105.2	94.0	109.7	113.0	102.3	NM	102.3	-7.4	-10.7
		20N02E08C001M	I	D	2018								89.5	N/A	109.3	NM	NM	N/A	N/A	N/A
		21N01E10B003M	I	I	1995	110.2	99.4	93.0	92.7	99.5	95.2	103.2	98.0	109.1	119.4	102.2	97.4	99.8	-9.3	-19.6
		21N01E13L002M	M	D	2012	NW	90.9	77.1	81.4	86.6	87.9	95.0	85.4	103.2	113.3	93.4	92.6	93.0	-10.3	-20.4
		21N01E13L003M	M	I	2012	NW	89.8	76.5	81.3	83.8	86.6	94.0	83.3	103.1	113.7	92.6	92.7	92.6	-10.5	-21.1
		21N01E13L004M	M	I	2012	NW	92.6	78.6	83.3	86.4	88.7	95.9	86.8	104.6	114.3	95.5	94.0	94.7	-9.9	-19.6
		21N01E25K001M	D	S	1993	104.1	NM	NM	83.8	83.5	85.7	95.8	91.1	105.0	109.1	NM	NM	N/A	N/A	N/A
		21N01E26K001M	I	I	1993	97.6	92.7	90.6	71.6	79.5	81.4	84.8	77.1	87.0	102.1	83.5	75.8	79.7	-7.4	-22.4
		21N01E27D001M	D	S	NM	102.0	91.4	88.6	82.1	80.2	81.5	91.3	84.0	N/A	105.0	NM	88.9	N/A	N/A	N/A
		21N02E18C001M	M	D	2010	104.4	95.5	86.6	90.0	89.5	91.9	97.5	89.7	102.8	113.7	97.6	94.1	95.9	-7.0	-17.8
		21N02E18C002M	M	I	2010	105.1	95.5	87.9	90.7	89.7	91.3	97.6	90.1	104.5	114.9	99.0	95.3	97.1	-7.3	-17.8
		21N02E18C003M	M	S	2010	154.4	145.4	143.6	140.4	142.9	149.2	162.8	158.0	165.8	159.4	157.6	155.3	156.4	-9.3	-3.0
		21N02E30L001M	D	S/I	1995	110.1	98.7	93.3	92.6	90.2	92.4	99.1	93.8	110.4	114.4	100.9	96.9	98.9	-11.5	-15.5
		20N02E24C001M	M	S	1999	104.6	103.7	98.1	94.2	89.9	92.3	101.4	97.2	101.5	109.2	98.3	93.4	95.8	-5.6	-13.4
		20N02E24C002M	M	I	1999	104.6	103.8	98.1	94.3	90.0	92.4	101.3	97.4	101.1	109.1	98.0	93.6	95.8	-5.4	-13.3

Summer 2011 - 2020 Groundwater Elevations - CASGEM

Sub Basin	Subregion	Monitoring Wells	Well Type	Well Depth	First Record	Groundwater Elevations												Analysis		
						Summer 2011 Average WSE (ft)	Summer 2012 Average WSE (ft)	Summer 2013 Average WSE (ft)	Summer 2014 Average WSE (ft)	Summer 2015 Average WSE (ft)	Summer 2016 Average WSE (ft)	Summer 2017 Average WSE (ft)	Summer 2018 Average WSE (ft)	Summer 2019 Average WSE (ft)	Spring 2020 (WSE) (ft)	6/29/20 - 7/3/20 WSE (ft)	August 2020 WSE (ft)	2020 Average Summer WSE (ft)	Change Avg. Summer WSE 2019 to 2020 (ft)	Change Spring to Avg. Summer 2020 (ft)
Vina	Vina South	20N02E24C003M	M	I	1999	107.6	103.3	98.0	94.4	90.0	92.4	101.3	97.5	101.1	109.1	97.8	93.6	95.7	-5.4	-13.4
		20N03E31M001M	M	S	2001	101.5	98.6	96.3	93.9	89.0	92.5	100.1	96.1	99.6	110.4	95.3	93.6	94.4	-5.2	-16.0
		20N03E33L001M	I	S	1999	97.2	94.6	94.4	91.1	89.0	91.0	96.6	89.3	89.6	113.8	88.1	86.1	87.1	-2.5	-26.7
		21N03E22C001M	D	S	2001	367.3	365.4	371.0	365.0	358.8	360.2	365.3	N/A	377.6	381.7	NM	NM	N/A	N/A	N/A
		21N03E29J003M	D	S/I	2007	NM	NM	NM	NM	206.8	208.3	208.3	203.4	224.4	220.4	NM	210.1	210.1	-14.3	-10.3
		21N03E32B001M	I	S	1999	224.0	221.7	222.0	217.8	217.9	217.9	220.8	219.3	223.4	NM	222.7	220.1	221.4	-2.0	N/A
		20N02E08H003M	D	S	2008	119.7	111.2	109.3	106.2	100.7	107.0	108.6	101.9	115.4	114.6	NM	NM	N/A	N/A	N/A
		20N02E09G001M	M	S	2001	114.8	97.1	93.4	92.2	89.0	94.8	97.9	95.7	114.3	116.7	93.4	96.8	95.1	-19.2	-21.6
		20N02E09L001M	I	I	1953	110.4	96.8	94.2	98.6	88.5	100.7	99.1	91.1	112.7	113.0	NM	68.6	68.6	-44.1	-44.4
		21N02E20P001M	I	S/I	1995	103.4	89.4	90.8	93.5	89.6	93.4	94.1	75.9	100.6	110.3	94.2	80.8	87.5	-13.1	-22.8
		21N02E26E003M	M	D	2007	112.0	102.5	95.4	98.8	100.8	97.7	106.4	102.6	116.0	119.3	106.4	96.9	101.7	-14.3	-17.6
		21N02E26E004M	M	I	2007	109.1	100.5	85.9	98.0	101.1	96.0	106.7	101.3	115.9	119.2	103.9	87.2	95.6	-20.3	-23.6
		21N02E26E005M	M	I	2007	106.3	97.8	90.0	95.6	99.9	94.1	106.0	98.9	115.2	118.4	102.1	91.6	96.9	-18.3	-21.5
		21N02E26E006M	M	S	2007	114.1	110.4	103.5	103.2	102.1	102.4	108.3	108.4	113.4	114.9	110.7	106.0	108.4	-5.1	-6.5
Butte	Butte	17N01E10A001M	D	S	1953	58.2	54.2	NM	59.6	35.0	58.4	58.3	59.4	57.1	NM	NM	NM	N/A	N/A	N/A
		17N01E17F001M	M	S	1992	52.3	51.7	51.6	47.1	45.1	50.9	51.7	49.9	52.2	55.1	50.7	51.3	51.0	-1.2	-4.1
		17N01E17F002M	M	I	1992	53.5	52.4	51.8	45.7	41.2	50.1	52.5	47.9	52.3	56.0	48.6	48.9	48.7	-3.6	-7.3
		17N01E17F003M	M	I	1992	54.2	53.3	52.5	44.6	38.9	50.3	53.4	47.3	53.0	56.9	47.8	47.9	47.9	-5.1	-9.1
		17N01E24A003M	M	D	2007	74.6	72.6	72.4	68.0	60.8	70.6	72.9	70.0	73.2	72.7	70.7	69.1	69.9	-3.4	-2.9
		17N01E24A004M	M	I	2007	51.6	52.7	47.3	47.7	42.1	51.6	52.8	46.5	50.3	61.5	44.9	43.7	44.3	-6.0	-17.2
		17N01E24A005M	M	I	2007	51.6	52.8	47.3	47.7	42.2	51.7	52.9	48.1	50.3	61.5	45.1	43.8	44.4	-5.9	-17.1
		17N01E24A006M	M	S	2007	66.3	66.7	66.3	64.8	65.0	66.7	65.6	65.8	67.0	68.1	65.6	65.8	65.7	-1.3	-2.4
		17N02E14A001M	I	S	1947	77.8	77.0	76.6	76.9	76.0	79.3	77.6	76.9	76.7	79.7	75.3	NM	75.3	-1.4	-4.4
		17N02E14H001M	D	S	2000	73.3	63.2	75.1	72.9	58.0	68.3	72.4	67.1	75.1	77.9	65.2	71.1	68.1	-7.0	N/A
		17N02E19J001M	I	S/I	2000	64.3	61.4	61.8	53.7	61.2	65.3	64.3	64.8	63.3	66.1	62.0	62.1	62.1	-1.2	-4.0
		17N03E05C003M	I	S	2001	86.3	N/A	N/A	N/A	67.8	85.0	85.8	83.5	86.6	86.7	NM	NM	N/A	N/A	N/A
		17N03E16N001M	D	S	1953	72.3	66.3	71.7	68.0	NM	NM	NM	66.3	65.7	NM	NM	NM	N/A	N/A	N/A
		18N01E13A002M	I	S/I	2001	77.2	76.5	76.7	76.5	55.0	76.5	76.7	76.8	76.1	75.0	76.4	76.9	76.7	0.6	1.7
		18N01E15D002M	D	S	1976	69.9	70.7	70.6	70.2	33.6	70.7	70.3	71.1	70.3	70.9	70.7	70.6	70.6	0.3	-0.3
		18N01E35L001M	M	D	2005	73.1	71.7	71.1	68.2	54.9	70.5	71.4	69.9	72.1	72.7	NM	NM	N/A	N/A	N/A
		18N02E16F001M	I	S	1947	78.3	77.5	77.9	78.1	74.3	78.5	78.5	78.0	78.4	76.1	78.4	78.9	78.7	0.3	2.6
		18N02E25M001M	I	S	1959	82.0	NM	80.6	80.3	79.3	79.9	79.4	80.5	60.8	81.7	79.9	79.6	79.8	19.0	-2.0
		18N02E32H001M	D	S	2001	75.4	73.8	75.5	70.6	73.5	76.0	73.8	75.3	74.1	71.2	NM	NM	N/A	N/A	N/A
		18N03E08B003M	I	S/I	2001	91.2	87.4	88.7	88.3	86.8	80.3	91.4	90.2	90.9	99.8	NM	84.0	84.0	-6.8	-15.8
		18N03E21G001M	I	S	1953	88.1	85.0	84.2	80.1	82.3	83.5	89.2	83.2	88.5	87.4	84.9	83.7	84.3	-4.3	-3.1
		19N01E09Q001M	I	S	1991	89.7	89.0	NM	NM	NM	NM	90.0	89.2	89.6	87.9	87.3	90.1	88.7	-0.9	0.8
		19N01E27Q001M	M	I	1978	84.0	83.0	83.4	83.2	72.3	83.6	83.2	83.2	84.0	83.3	83.2	83.5	83.3	-0.6	0.0
		19N01E35B001M	M	S	2002	84.0	83.6	84.0	83.4	74.7	84.2	84.1	83.7	83.9	82.4	NM	NM	N/A	N/A	N/A
		19N01E35B002M	M	D	2005	90.7	89.2	88.8	87.5	74.4	88.1	89.7	88.5	90.1	90.3	NM	NM	N/A	N/A	N/A
		19N01E35B003M	M	I	2005	85.2	84.1	84.2	83.3	67.6	84.0	84.3	84.0	84.9	84.7	NM	NM	N/A	N/A	N/A
		19N02E07K002M	M	I	2006	101.7	99.9	98.9	98.3	85.1	98.9	100.6	99.3	100.5	101.8	98.7	98.8	98.7	-1.7	-3.1
		19N02E07K003M	M	I	2006	100.7	100.1	100.3	100.3	92.3	100.5	100.5	100.1	100.3	99.2	100.0	100.3	100.1	-0.2	0.9
		19N02E07K004M	M	S	2006	99.7	100.0	100.2	106.2	90.6	100.4	100.5	100.1	100.2	99.4	99.9	100.3	100.1	-0.1	0.7
		19N02E13Q001M	M	S	2002	114.5	112.9	113.6	113.4	110.3	114.2	113.3	113.9	113.5	116.2	113.7	114.1	113.9	0.4	-2.3
		19N02E13Q002M	M	I	2006	114.7	113.3	113.2	113.2	109.4	114.0	114.3	113.7	113.7	116.3	113.2	113.6	113.4	-0.3	-2.9
		19N02E13Q003M	M	D	2006	115.0	113.6	113.2	113.4	109.2	114.1	114.7	113.7	113.9	116.5	113.1	113.5	113.3	-0.6	-3.2
		19N02E15N002M	I	U	2000	103.1	101.9	103.5	101.6	99.7	103.2	103.0	102.2	103.0	102.2	102.5	103.2	102.8	-0.2	0.6
		19N03E05N002M	D	S	1967	117.9	110.5	107.5	106.8	109.2	113.0	111.9	113.2	111.3	117.0	NM	110.9	110.9	-0.4	-6.1
		20N01E35C001M	D	S	1947	100.8	NM	NM	NM	98.2	100.1	NA	99.4	100.6	98.4	100.5	101.0	100.7	0.1	2.3
		20N01W04J001M	I	S	2008	82.9	83.0	82.2	80.1	80.4	81.0	81.9	81.8	82.1	81.2	82.0	81.7	81.8	-0.3	N/A
		20N01W11N002M	I	S	2008	95.7	93.1	93.5	91.4	91.6	92.1	93.0	91.1	93.9	93.9	92.2	92.0	92.1	-1.9	-1.8

Summer 2011 - 2020 Groundwater Elevations - CASGEM

Sub Basin	Subregion	Monitoring Wells	Well Type	Well Depth	First Record	Groundwater Elevations												Analysis		
						Summer 2011 Average WSE (ft)	Summer 2012 Average WSE (ft)	Summer 2013 Average WSE (ft)	Summer 2014 Average WSE (ft)	Summer 2015 Average WSE (ft)	Summer 2016 Average WSE (ft)	Summer 2017 Average WSE (ft)	Summer 2018 Average WSE (ft)	Summer 2019 Average WSE (ft)	Spring 2020 (WSE) (ft)	6/29/20 - 7/3/20 WSE (ft)	August 2020 WSE (ft)	2020 Average Summer WSE (ft)	Change Avg. Summer WSE 2019 to 2020 (ft)	Change Spring to Avg. Summer 2020 (ft)
Butte	Butte	20N02E15H001M	M	S	1995	113.5	102.7	97.9	90.9	89.4	94.7	96.1	92.6	97.8	113.3	86.2	91.5	88.8	-9.0	-24.5
		20N02E15H002M	M	S	1995	134.3	132.4	123.7	117.6	116.7	118.4	124.4	118.0	124.3	121.5	117.2	115.7	116.5	-7.8	-5.0
		20N02E16P001M	I	U	1990	117.1	NM	NM	103.2	88.8	100.0	102.5	102.9	112.2	116.2	95.2	92.5	93.9	-18.3	-22.3
		20N02E28N001M	D	S/I	1947	117.4	116.5	115.8	116.1	116.0	117.3	116.4	117.2	117.5	118.0	NM	117.9	117.9	0.4	-0.1
		21N01W11A001M	M	D	2010	108.2	107.5	104.2	102.8	99.2	104.1	111.6	107.3	113.5	117.1	109.0	105.6	107.3	-6.2	-9.8
		21N01W11A002M	M	S	2010	115.0	114.3	113.8	113.5	111.9	112.3	114.5	114.2	115.4	114.1	115.0	113.4	114.2	-1.2	0.1
		21N01W11A003M	M	S	2010	115.8	115.8	115.5	114.5	113.5	114.2	115.6	115.7	115.8	115.2	116.0	115.5	115.7	-0.1	0.5
		21N01W13J001M	M	D	2012	NW	101.5	97.8	96.3	92.5	97.0	103.9	99.6	106.8	111.4	101.1	99.3	100.2	-6.6	-11.2
		21N01W13J002M	M	I	2012	NW	103.1	101.3	97.1	95.0	98.6	105.1	100.0	106.4	111.3	102.4	100.8	101.6	-4.8	-9.7
		21N01W13J003M	M	I	2012	NW	104.9	97.2	87.9	96.4	100.2	106.4	91.0	97.1	111.5	103.6	102.1	102.8	5.8	-8.7
		21N01W23J001M	I	S	1941	107.6	107.4	106.5	102.0	102.8	103.5	106.2	103.5	105.0	107.6	104.7	103.5	104.1	-0.9	-3.5
		21N01W24B001M	M	D	1995	103.3	98.9	93.8	94.5	89.0	93.8	102.4	94.4	103.3	108.9	NM	NM	N/A	N/A	N/A
		21N01W35K002M	I	S/I	1994	98.9	97.0	95.2	94.1	94.9	95.4	96.9	96.0	98.4	98.2	96.3	95.5	95.9	-2.4	N/A
		21N01W35K002M	I	S/I	1994	98.9	97.0	95.2	94.1	94.9	95.4	96.9	96.0	98.4	98.2	96.3	95.5	95.9	-2.4	N/A
		22N01E29R001M	I	I	1947	126.5	121.2	113.0	100.0	94.8	107.3	123.0	127.1	124.7	128.9	120.4	115.8	115.8	-8.9	-13.1
		22N01E32E004M	D	S	1992	119.8	111.3	112.9	107.3	105.0	107.2	116.6	110.8	123.4	122.4	116.2	112.0	114.1	-9.3	-8.3
WYANDOTTE CREEK	Wyandotte Creek Oroville	CWS-01	M&I	U	1978	NA	NA	NA	NA	NA	NA	NA	132.0	130.5	133.0	NM	132.0	132.0	1.5	-1.0
		CWS-02	M&I	U	1978	NA	NA	NA	NA	NA	NA	NA	148.0	146.0	148.0	NM	146.0	146.0	0.0	-2.0
		CWS-03	M&I	U	1978	NA	NA	NA	NA	NA	NA	NA	166.0	165.5	166.0	NM	165.0	165.0	-0.5	-1.0
		19N03E16Q001M	D	S	2000	140.0	137.5	137.4	137.7	139.4	140.0	140.1	138.8	140.1	139.4	NM	138.8	138.8	-1.3	-0.6
	Wyandotte Creek South	17N03E03D001M	I	S	1947	73.0	71.0	69.8	67.9	70.8	72.8	75.2	68.8	72.6	70.6	68.9	70.9	69.9	-2.8	-0.7
		17N04E09N002M	I	S/I	2001	73.5	71.4	NM	59.1	NM	58.8	64.3	N/A	62.2	77.2	NM	54.9	54.9	-7.4	N/A
		17N04E22B001M	D	S	1976	99.0	96.6	67.5	81.4	63.7	93.9	93.5	N/A	N/A	NM	NM	68.8	N/A	N/A	N/A
		19N04E31F001M	D	S	2001	125.4	118.7	116.6	118.4	120.5	122.5	125.3	124.2	125.9	125.5	123.5	122.2	122.8	-3.1	-2.7

* Indicates subregion corresponding to an Irrigation District primarily served by surface water

Note: Red font indicates Questionable Measurement (QM)

NA- Not available, NM- No measurement, NW- New well

Depth Category

S- Shallow: indicates total well depth or screening interval is less than 200 feet below ground surface

I- Intermediate: total well depth or screening interval is 200-600 feet

S/I- Shallow/Intermediate: screened interval spans portions of the shallow and intermediate depth intervals

D- Deep: total well depth or screening interval is greater than 600 feet

Fall 2008 - 2020 Groundwater Elevations - CASGEM

Sub Basin	Subregion	Monitoring Wells	Well Type	Well Depth	First Record	Groundwater Water Surface Elevations (WSEs) (feet)															Analysis		
						2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	BMO Alert 1 Level (feet)	BMO Alert 2 Level (feet)	Elevation Above (+) or Below (-) Alert Stage 1 (ft)	Change Fall 2019 to Fall 2020 (ft)	Fall 2020 Depth to Water (ft)
VINA	Vina North	23N01E07H001M	D	S	2018											162.8	167.6	153.5	*	*		-14.1	128.5
		22N01E20K001M	D	S	1961	121.5	121.0	124.6	129.1	120.7	118.3	NM	114.1	114.3	126.5	119.6	130.1	115.8	124.9	120.0	-9.1	-14.3	52.0
		23N01E29P002M	D	S/I	1990	143.8	138.5	141.9	144.2	140.6	NM	136.5	134.9	133.9	140.4	136.6	142.2	129.8	129.8	100.8	0.0	-12.4	75.5
		23N01E33A001M	I	S/I	2001	146.7	145.4	145.3	147.5	143.5	140.5	NM	136.3	136.9	140.2	138.6	142.2	138.4	149.3	136.3	-11.0	-3.8	114.0
		23N01W10E001M	I	I	2001	149.3	156.3	157.2	159.9	NM	NM	142.7	141.9	145.1	NM	151.7	154.8	146.4	152.6	144.2	-6.2	-8.4	43.0
		23N01W10M001M	M	S	2001	153.6	155.6	157.1	159.9	NM	148.6	147.5	144.5	149.6	154.0	150.1	156.8	149.3	154.3	145.5	-5.0	-7.5	38.1
		23N01W27L001M	D	S	1976	140.3	133.4	135.3	137.4	130.7	NM	126.4	126.4	129.4	133.4	127.3	NM	NM	131.6	116.0	NM	NM	0.0
		23N01W36P001M	D	S	1959	122.8	124.7	125.9	129.8	120.7	118.7	117.5	116.8	119.6	125.2	119.9	126.7	118.4	128.9	124.1	-10.5	-8.3	44.4
		23N02W25C001M	I	S/I	1967	132.1	133.9	134.4	135.8	130.6	130.5	131.0	130.9	133.9	135.4	134.0	135.5	133.3	128.8	123.7	4.5	-2.2	24.1
		23N01W25G001M	I	I	2007	140.3	139.8	134.5	129.1	134.4	131.5	131.4	130.5	139.1	NM	133.7	137.2	131.1	*	*		QM	QM
		23N01W03H002M	M	I	2012					172.6	169.8	168.0	167.0	167.7	170.2	168.3	171.6	167.8	*	*		-3.8	49.0
		23N01W03H003M	M	I	2012					173.2	170.3	168.4	167.1	168.1	171.2	167.7	171.4	167.5	*	*		-3.9	49.4
		23N01W03H004M	M	S	2012					175.8	173.9	171.3	170.4	171.1	174.8	171.6	175.8	171.2	*	*		-4.6	45.7
		23N01W28M002M	M	D	2009		136.9	134.4	138.3	136.6	127.5	131.3	129.9	133.0	136.2	133.2	137.9	130.3	*	*		-7.6	28.7
		23N01W28M003M	M	D	2009		136.8	135.4	138.8	137.1	129.0	130.6	129.8	132.8	135.7	133.3	138.1	130.7	*	*		-7.5	28.4
		23N01W28M004M	M	S	2009		133.9	139.3	137.1	131.7	130.6	128.0	128.0	130.6	133.9	130.6	134.9	129.0	*	*		-5.9	30.1
		23N01W28M005M	M	S	2009		133.4	141.4	136.6	131.4	130.2	127.7	127.8	130.1	133.7	130.3	134.8	128.4	*	*		-6.4	30.6
		23N01W31M001M	M	D	2008	131.1	126.8	134.0	126.0	129.7	110.9	121.6	119.9	125.3	128.2	124.4	128.5	120.0	*	*		-8.5	34.7
		23N01W31M002M	M	I	2008	132.5	131.6	133.0	132.2	129.4	125.8	126.0	124.5	129.5	129.4	123.8	131.8	125.3	*	*		-6.4	29.4
		23N01W31M003M	M	S	2008	133.1	135.1	133.8	137.1	132.0	129.5	128.9	126.2	132.2	132.1	126.5	132.2	128.6	*	*		-3.6	26.2
		23N01W31M004M	M	S	2008	134.0	134.1	134.5	135.7	133.5	133.2	132.2	132.3	133.4	134.5	133.2	134.5	132.6	*	*		-1.9	22.2
	Vina Chico	CWSCH01b	M&I	U	1988	123.0	118.0	122.0	120.0	115.0	114.0	110.0	108.0	113.0	117.0	116.0	117.0	109.0	*	*		-8.0	91.0
		CWSCH02	M&I	U	1988	117.0	123.0	130.0	132.0	86.0	113.0	112.0	111.0	112.0	111.0	115.0	121.0	106.0	103.0	63.0	3.0	-15.0	77.0
		CWSCH03	M&I	U	1988	121.0	120.0	116.0	120.0	117.0	114.0	110.0	113.0	113.0	115.0	114.0	118.0	112.0	116.0	100.0	-4.0	-6.0	146.0
		CWSCH04	M&I	U	1988	107.0	91.0	NM	110.0	108.0	107.0	107.0	117.0	124.0	118.0	115.0	121.0	112.0	103.0	66.0	9.0	-9.0	100.0
		CWSCH05	M&I	U	1988	111.0	115.0	113.0	118.0	110.0	108.0	100.0	102.0	107.0	111.0	105.0	112.0	108.0	98.0	61.0	10.0	-4.0	107.0
		CWSCH06	M&I	U	1988	116.0	113.0	109.0	113.0	101.0	101.0	97.0	108.0	109.0	116.0	116.0	117.0	106.0	115.0	61.0	-9.0	-11.0	75.0
		CWSCH07	M&I	U	1991	111.0	106.0	110.0	114.0	105.0	103.0	101.0	105.0	105.0	110.0	114.0	111.0	106.0	103.0	80.0	3.0	-5.0	164.0
		22N01E09B001M	D	S	2001	131.7	131.0	132.0	136.1	129.5	128.0	125.6	125.5	126.5	132.0	128.6	134.5	129.8	143.5	136.3	-13.7	-4.7	48.5
		22N01E28J001M	M	I	1958	122.6	123.8	125.5	130.4	121.4	119.6	114.7	114.7	117.8	125.0	122.2	128.5	117.5	126.7	120.8	-9.2	-11.0	61.4
		22N01E28J003M	M	I	1958	126.5	128.0	129.7	135.0	126.7	124.7	119.8	118.2	121.0	129.4	126.8	133.7	123.0	129.1	123.7	-6.1	-10.7	55.3
		22N01E28J005M	M	D	1958	120.5	121.5	122.2	127.4	116.4	117.5	113.8	113.1	114.0	122.1	118.2	125.2	115.8	122.3	117.3	-6.5	-9.4	63.1
		22N01E35E001M	I	S/I	2005	116.3	116.0	116.0	122.4	112.5	110.8	107.5	107.5	NM	116.0	114.4	119.1	110.5	*	*		-8.6	71.9
		22N02E30C002M	M	S	2002	116.3	115.5	114.8	119.2	112.3	111.4	109.5	NM	113.4	116.0	115.9	120.4	115.3	*	*		-5.1	128.3
	Vina South	20N01E02H003M	M	S	2001	95.1	95.6	95.9	101.7	93.1	90.3	86.9	83.9	88.3	95.2	91.3	100.5	91.9	*	*		-8.6	40.4
		20N01E10C002M	I	S	1947	100.5	101.1	100.9	NM	96.0	94.4	94.4	90.1	94.7	100.7	94.6	101.3	93.4	101.5	97.6	-8.1	QM	34.0
		20N02E06Q001M	I	S/I	1947	109.5	108.3	108.1	113.9	106.8	103.9	102.1	95.9	100.4	108.0	104.7	110.3	105.0	106.2	101.2	-1.2	-5.3	32.6
		20N02E08C001M	I	D	2018											130.9	108.1	104.4	*** No Fall BMO			-3.7	29.6
		20N02E08H003M	D	S	2008	116.4	116.5	117.7	117.9	100.4	NM	109.9	NM	NM	110.0	110.7	113.9	NM	*	*		NM	NM
		20N02E09G001M	M	S	2001	105.7	NM	108.8	113.6	100.6	103.8	98.3	90.6	95.7	103.9	98.5	105.3	101.1	108.9	97.5	-7.8	-4.2	47.7
		20N02E09L001M	I	I	1953	109.7	108.6	110.9	112.5	109.7	106.4	105.1	97.2	104.4	109.9	104.2	111.0	108.9	112.1	106.8	-3.2	QM	30.4
		20N02E24C001M	M	S	1999	112.2	111.5	110.7	114.9	109.8	105.0	99.3	95.8	98.1	105.1	101.1	106.3	100.8	113.6	108.8	-12.9	-5.6	57.0
		20N02E24C002M	M	I	1999	112.1	111.6	112.1	115.0	109.9	105.1	99.4	96.0	98.3	105.0	101.2	106.3	101.0	113.4	107.8	-12.4	-5.3	56.7
		20N02E24C003M	M	I	1999	112.1	111.5	110.9	114.9	109.9	105.2	99.4	96.1	98.8	105.0	101.2	106.3	101.1	113.5	107.9	-12.5	-5.2	56.7
		20N03E31M001M	M	S	2001	109.2	108.1	105.7	105.6	106.0	104.2	103.9	99.3	103.8	108.9	104.9	107.0	103.5	111.4	106.5	-7.9	-3.5	29.5
		20N03E33L001M	I	S	1999	116.8	115.4	115.2	114.8	112.6	109.6	110.1	108.3	108.9	111.9	111.1	111.0	108.1	116.7	113.3	-8.6	-2.9	43.2
		21N01E10B003M	I	I	1995	110.6	111.8	112.4	119.1	107.1	104.2	100.7	96.3	102.2	109.9	106.6	116.5	105.3	114.7	93.2	-9.4	-11.2	65.0
		21N01E13L002M	M	D	2012					102.2	98.7	95.7	90.6	96.1	105.0	102.2	112.0	100.9	*	*		-11.1	79.0
		21N01E13L003M	M	I	2012					102.1	98.9	95.8	90.9	96.0	105.3	102.2	111.6	101.0	*	*		-10.6	78.9
		21N01E13L004M	M	I	2012					102.4	99.1	95.8	91.4	96.2	105.5	102.3	112.0	101.2	*	*		-10.8	78.7
		21N01E25K001M	D	S	1993	98.5	96.9	98.8	103.9	NM	90.4	87.5	85.6	87.9	95.9	92.0	103.5	92.1	99.6	74.5	-7.5	-11.4	62.2
		21N01E26K001M	I	I	1993	92.9	85.6	98.2	92.9	88.1	86.8	78.5	84.5	79.1	88.3	85.0	94.7	NM	95.9	72.3		NM	NM
		21N01E27D001M	D	S	1946	94.9	94.3	94.9	100.0	91.4	86.6	83.8	83.2	NM	94.5	89.0	98.1	90.6	97.1	90.9	-6.5	-7.5	52.7
		21N02E18C001M	M	D	2010				115.7	103.2	100.5	97.5	90.9	97.3	104.8	103.5	111.6	101.7	*	*		-9.9	87.4
		21N02E18C002M	M	I	2010				115.8	102.7	101.1	97.5	92.4	97.9	105.4	104.0	112.1	102.3	*	*		-9.8	86.8
		21N02E18C003M	M	S	2010				154.0	144.6	143.5	139.7	140.2	149.6	161.0	156.9	162.9	150.1	*	*		-12.8	39.0
		21N02E20P001M	I	S/I	1995	111.9	111.6	106.4	114.1	106.4	99.0	98.2	94.1	95.9	106.3	100.2	111.0	104.3	108.7	87.7	-4.4	-6.7	63.8
		21N02E26E003M	M	D	2007	107.9	109.4	107.0	119.1	105.5	111.3	108.3	103.4	106.4	110.5	110.0	114.9	111.8	*	*		-3.1	70.5

Fall 2008 - 2020 Groundwater Elevations - CASGEM

Sub Basin	Subregion	Monitoring Wells	Well Type	Well Depth	First Record	Groundwater Water Surface Elevations (WSEs) (feet)													BMO Alert 1 Level (feet)	BMO Alert 2 Level (feet)	Analysis		
						2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020			Elevation Above (+) or Below (-) Alert Stage 1 (ft)	Change Fall 2019 to Fall 2020 (ft)	Fall 2020 Depth to Water (ft)
VINA	Vina South	21N02E26E004M	M	I	2007	94.4	106.9	104.7	118.3	103.6	111.2	108.9	102.4	106.1	110.5	110.5	115.1	112.3	*	*		-2.8	70.0
		21N02E26E005M	M	I	2007	98.8	104.2	101.7	117.0	100.7	110.3	108.1	100.9	105.0	110.0	109.7	114.2	111.2	*	*		-3.0	71.0
		21N02E26E006M	M	S	2007	108.9	108.0	107.6	113.5	107.1	105.5	104.6	102.7	102.6	107.0	107.0	113.8	108.6	*	*		-5.3	73.7
		21N02E30L001M	D	S/I	1995	106.9	105.6	106.3	112.6	101.8	98.8	95.6	93.3	95.9	103.2	99.8	110.8	99.4	110.5	95.1	-11.2	-11.4	60.0
		21N03E22C001M	D	S	2001	361.5	366.0	367.1	363.2	354.3	366.9	358.8	360.0	366.0	371.9	375.2	375.9	372.8	357.9	347.9	14.9	-3.1	9.6
		21N03E29J003M	D	S/I	2007	NM	216.5	212.2	NM	NM	205.1	NM	217.6	NM	210.7	215.7	213.5	208.4	*	*		-5.1	56.7
		21N03E32B001M	I	S	1999	218.8	218.1	218.3	222.1	218.3	224.1	216.1	215.8	215.6	217.9	216.9	221.3	218.2	218.6	215.3	-0.4	-3.1	20.2
BUTTE	Butte*	17N03E05C003M	I	S	2001	85.2	85.5	NM	86.2	NM	NM	82.9	81.2	83.8	85.1	84.4	84.4	83.6	*** No Fall BMO			-0.8	13.7
		17N01E10A001M	D	S	1953	52.9	55.3	55.2	57.0	NM	56.1	57.5	52.8	57.2	56.3	54.3	57.0	NM	34.0	28.1		NM	NM
		18N01E35L001M	M	D	2005	69.2	67.2	68.0	71.8	69.0	69.7	67.8	60.0	69.9	69.9	68.8	70.3	68.4	*	*		-2.0	1.6
		18N02E16F001M	I	S	1947	75.9	75.9	75.7	76.5	77.8	76.3	76.6	75.4	76.7	75.9	75.6	75.9	75.3	74.8	74.2	0.5	-0.6	7.0
		18N02E25M001M	I	S	1959	80.7	81.7	80.8	82.1	80.9	81.1	80.1	78.9	80.5	80.0	79.7	80.6	79.9	67.9	64.0	12.0	-0.7	9.4
		18N02E32H001M	D	S	2001	NM	NM	NM	73.7	71.8	71.6	71.6	71.6	71.9	71.9	72.0	72.2	72.1	70.1	68.0	2.0	-0.1	6.2
		17N02E14A001M	I	S	1947	78.1	80.6	77.8	78.4	77.9	76.9	77.5	75.3	77.6	76.4	75.9	76.4	77.8	72.9	70.3	4.9	1.4	7.0
		17N02E14H001M	D	S	2000	75.3	75.8	75.4	76.9	74.9	NM	74.5	65.9	74.0	67.1	68.8	69.1	NM	66.0	54.3		NM	11.5
		17N03E16N001M	D	S	1953	74.8	74.1	74.5	75.7	74.4	73.7	72.5	NM	NM	NM	NM	NM	NM	74.0	73.2		NM	NM
		17N01E17F001M	M	S	1992	51.9	52.3	50.8	51.3	51.6	50.1	47.0	43.5	48.3	49.1	51.2	49.0	48.6	50.9	47.5	-2.4	-0.4	10.4
		17N01E17F002M	M	I	1992	50.6	51.0	48.9	49.8	51.7	47.2	44.2	38.2	44.9	46.1	47.2	44.8	43.3	51.1	47.4	-7.8	-1.5	16.1
		17N01E17F003M	M	I	1992	50.0	50.0	47.6	48.8	51.3	46.6	42.7	35.3	44.0	45.7	45.4	43.3	41.2	51.0	47.0	-9.8	-2.1	18.2
		17N01E24A003M	M	D	2007	70.7	67.4	68.6	72.5	71.1	68.3	66.7	62.9	70.1	71.6	67.5	71.1	66.8	*	*		-4.3	6.0
		17N01E24A004M	M	I	2007	28.2	22.9	27.2	51.7	41.7	30.0	23.3	21.0	49.1	37.7	38.9	32.9	38.5	*	*		5.6	34.3
		17N01E24A005M	M	I	2007	28.5	23.1	27.4	51.7	41.8	29.9	23.3	20.9	49.1	37.7	38.9	32.8	38.5	*	*		5.7	34.3
		17N01E24A006M	M	S	2007	68.4	68.3	67.3	67.1	69.1	68.6	67.7	66.4	67.2	66.7	68.2	68.1	67.5	*	*		-0.6	5.4
		17N02E19J001M	I	S/I	2000	NM	NM	66.1	67.2	NM	NM	NM	NM	66.7	NM	NM	NM	67.0	62.8	55.7	4.2	NM	5.3
		18N01E13A002M	I	S/I	2001	75.6	75.2	74.3	74.7	74.3	74.6	75.7	72.1	74.8	74.6	74.6	74.6	74.7				0.1	4.6
		18N01E15D002M	D	S	1976	68.7	62.9	40.5	41.2	52.8	68.1	61.2	35.3	70.0	70.2	69.9	51.4	70.1				18.7	2.3
		19N01E27Q001M	M	I	1978	83.1	82.6	82.2	83.1	81.2	82.7	83.0	76.8	82.1	82.2	81.8	82.4	82.0				-0.4	5.4
		19N01E35B001M	M	S	2002	83.6	83.4	81.7	82.2	81.5	82.0	83.6	80.1	81.8	82.0	82.5	82.0	81.5	*** No Fall BMO			-0.5	5.0
		19N01E35B002M	M	D	2005	88.8	88.3	88.6	89.9	88.3	88.3	87.1	81.9	87.8	88.9	87.6	89.1	87.4				-1.7	-0.9
		19N01E35B003M	M	I	2005	83.8	82.7	83.1	84.2	82.9	83.5	82.9	76.0	82.6	83.0	82.7	83.6	82.8				-0.8	3.7
		19N02E15N002M	I	U	2000	101.2	100.9	101.1	102.9	101.0	101.3	100.9	100.1	101.5	101.4	101.3	101.5	101.3				-0.2	6.1
		18N03E08B003M	I	S/I	2001	95.2	NM	89.6	99.0	97.3	96.4	94.6	94.8	96.8	97.4	87.2	98.2	85.6	91.7	83.8	-6.1	-12.6	26.7
		18N03E21G001M	I	S	1953	82.2	83.9	85.1	87.0	85.3	83.6	82.7	82.3	83.0	87.2	84.6	86.9	82.9	83.5	81.2	-0.6	-4.0	23.4
		19N03E05N002M	D	S	1967	119.7	117.0	115.1	119.8	117.9	114.7	113.6	113.7	114.2	117.6	113.9	116.9	111.9	109.2	92.4	2.7	-5.0	30.4
		19N01E09Q001M	I	S	1991	88.5	89.1	85.7	86.8	86.5	87.0	NM	NM	NM	87.0	NM	86.7	NM				NM	NM
		19N02E07K002M	M	I	2006	98.7	99.6	99.8	101.5	99.8	99.5	98.2	91.8	99.2	100.0	99.0	100.4	100.6				0.2	2.1
		19N02E07K003M	M	I	2006	96.3	98.4	98.4	99.4	98.2	97.7	98.1	96.1	99.4	98.2	98.1	98.2	98.0				-0.2	4.7
		19N02E07K004M	M	S	2006	95.7	98.4	98.5	99.5	98.3	98.2	99.3	95.4	99.2	98.3	98.1	100.5	98.1				-2.5	4.6
		19N02E13Q001M	M	S	2002	112.0	112.8	113.3	115.6	114.0	114.1	114.4	111.9	115.0	114.9	114.3	115.4	115.2				-0.1	4.7
		19N02E13Q002M	M	I	2006	113.2	113.3	114.1	115.9	114.5	114.3	114.7	112.3	115.4	115.3	114.5	115.6	115.0	*** No Fall BMO			-0.6	4.9
		19N02E13Q003M	M	D	2006	113.8	113.7	114.5	116.2	114.8	114.6	114.8	112.7	115.7	115.6	114.7	115.9	115.1				-0.8	4.8
		20N01E35C001M	D	S	1947	99.3	99.7	98.1	99.0	97.8	NM	NM	NM	NM	NM	97.4	98.3	98.4				0.1	4.0
		20N02E15H001M	M	S	1995	110.4	106.9	111.4	112.7	108.8	NM	100.4	96.6	96.8	102.8	99.7	107.2	102.8				-4.4	41.3
		20N02E15H002M	M	S	1995	129.6	128.1	131.0	144.1	129.1	NM	116.8	115.3	116.3	121.1	117.0	122.5	115.9				-6.6	28.2
		20N02E16P001M	I	U	1990	108.2	107.5	NM	109.2	112.7	111.6	109.0	105.0	107.3	110.9	109.1	112.7	110.6				-2.1	21.2
		20N02E28N001M	D	S/I	1947	114.4	115.2	117.9	118.5	117.5	117.2	116.8	117.5	117.5	117.3	117.0	117.1	117.3				0.2	6.1
		21N01W23J001M	I	S	1941	107.6	107.2	107.2	108.1	106.0	103.9	103.7	103.0	103.7	105.0	104.3	105.6	103.2	108.5	105.4	-5.3	-2.4	18.2
		20N01E18L001M	M	D	2000	99.4	99.3	100.7	101.0	97.1	95.5	95.0	90.7	96.0	104.5	96.4	100.1	96.4	99.4	94.1	-3.0	-3.7	10.9
		20N01E18L002M	M	I	2001	99.0	99.5	99.8	100.3	97.9	97.3	97.5	94.9	97.7	98.7	98.0	98.8	97.5	99.3	96.3	-1.8	-1.3	9.9
		20N01E18L003M	M	S	2001	101.3	102.0	102.4	102.9	100.7	100.4	100.2	99.3	101.0	101.2	100.9	101.6	100.7	101.2	98.5	-0.5	-0.8	6.6
		20N01W04J001M	I	S	2008	81.18	80.98	81.28	81.58	80.98	80.98	80.58	81.0	81.1	81.6	81.3	81.5	80.5	*	*		-1.0	21.9
		20N01W11N002M	I	S	2008	93.17	92.97	92.47	93.77	93.27	92.17	93.27	91.7	92.2	92.7	92.3	95.7	91.8	*	*		-3.9	15.6
		21N01W35K002M	I	S/I	1994	97.5	97.7	97.8	98.8	96.7	95.4	96.4	96.0	96.7	97.2	96.9	97.5	96.1	97.5	95.5	-1.4	-1.4	18.3
		21N01W11A001M	M	D	2010				112.4	110.0	105.8	105.6	104.0	106.6	111.1	108.7	113.7	107.6	*	*		-6.1	21.7
		21N01W11A002M	M	S	2010				114.8	113.4	113.2	112.8	113.3	113.4	113.4	113.2	114.1	113.8	*	*		-0.3	15.5
		21N01W11A003M	M	S	2010				114.4	113.8	113.7	113.4	114.1	114.1	115.3	114.8	115.4	114.5	*	*		-1.0	14.8
		21N01W13J001M	M	D	2012					105.9	103.1	102.0	98.6	101.3	103.9	102.7	107.8	101.9	*	*		-5.9	25.7
		21N01W13J002M	M	I	2012					107.0	104.7	102.3	100.0	102.5	103.4	103.5	108.1	103.0	*	*		-5.1	24.7
		21N01W13J003M	M	I	2012					107.7	105.7	103.4	101.1	103.2	103.8	104.1	108.5	103.9	*	*		-4.6	23.8

Fall 2008 - 2020 Groundwater Elevations - CASGEM

Sub Basin	Subregion	Monitoring Wells	Well Type	Well Depth	First Record	Groundwater Water Surface Elevations (WSEs) (feet)													BMO Alert 1 Level (feet)	BMO Alert 2 Level (feet)	Analysis		
						2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020			Elevation Above (+) or Below (-) Alert Stage 1 (ft)	Change Fall 2019 to Fall 2020 (ft)	Fall 2020 Depth to Water (ft)
Butte	Butte*	21N01W24B001M	M	D	1995	106.1	105.7	107.2	106.9	103.7	100.7	99.0	97.1	99.5	103.3	100.1	105.4	99.5	109.1	100.3	-9.6	-5.9	27.6
		22N01E29R001M	I	I	1947	118.1	119.3	123.0	127.4	118.3	115.9	90.2	110.1	113.4	121.9	118.0	126.5	95.6	118.6	109.4	-23.0	QM	68.1
		22N01E32E004M	D	S	1992	113.4	114.5	118.0	121.5	113.6	110.5	104.6	106.6	108.8	117.0	112.5	121.1	111.6	111.5	90.1	0.1	-9.5	39.3
W CRK.	Wyandotte Creek Oroville	CWS-01	M&I	U	1978	101.0	132.0	131.0	131.0	124.0	130.0	120.0	134.0	134.0	124.0	129.0	132.0	132.0	82.0	31.0	50.0	0.0	28.0
		CWS-02	M&I	U	1978	146.0	143.0	146.0	148.0	146.0	144.0	148.0	140.0	140.0	148.0	149.0	147.0	144.0	98.0	43.0	46.0	-3.0	34.0
		CWS-03	M&I	U	1978	163.0	165.0	164.0	164.0	161.0	163.0	149.0	165.0	165.0	161.0	163.0	162.0	170.0	123.0	78.0	47.0	8.0	25.0
		19N03E16Q001M	D	S	2000	137.4	138.0	138.4	139.3	138.8	137.6	139.3	139.4	140.0	NM	138.9	139.6	138.3	136.3	133.0	2.0	-1.3	41.0
W.C.	Wyandotte Creek South	17N03E03D001M	I	S	1947	71.5	70.5	72.3	73.2	72.6	71.4	69.6	70.3	71.5	73.9	72.7	73.8	71.1	68.4	66.9	2.7	-2.7	26.2
		17N04E09N002M	I	S/I	2001	69.9	66.0	64.4	72.5	NM	66.7	53.6	52.4	53.7	65.2	66.7	65.7	56.3	69.1	60.3	-12.8	QM	46.0
		17N04E22B001M	D	S	1976	88.4	85.4	95.1	100.4	98.2	95.7	84.3	93.2	94.8	NM	NM	NM	NM	81.3	76.3		NM	NM
		19N04E31F001M	D	S	2001	122.1	123.2	122.5	123.9	120.3	108.0	121.1	120.8	121.6	124.0	122.6	122.5	121.7	120.0	114.6	1.7	-0.8	137.6

* Wells that do not have alert levels established as detailed below:

Subregion	Well ID	Date Added to the Monitoring Network
Vina North	23N01E07H001M	2018
Vina North	23N01W03H002M	2012
Vina North	23N01W03H003M	2012
Vina North	23N01W03H004M	2007
Vina North	23N01W25G001M	2008
Vina North	23N01W28M002M	2008
Vina North	23N01W28M003M	2008
Vina North	23N01W28M004M	2008
Vina North	23N01W28M005M	2008
Vina North	23N01W31M001M	2008
Vina North	23N01W31M002M	2008
Vina North	23N01W31M003M	2008
Vina North	23N01W31M004M	2008
Vina Chico	CWSCH01b	2012
Vina Chico	22N01E35E001M	2002
Vina Chico	22N02E30C002M	2016
Vina South	20N01E02H003M	2001
Vina South	20N02E08H003M	2008
Vina South	21N01E13L002M	2012
Vina South	21N01E13L003M	2012
Vina South	21N01E13L004M	2012
Vina South	21N02E18C001M	2010
Vina South	21N02E18C002M	2010
Vina South	21N02E18C003M	2010
Vina South	21N02E26E003M	2007
Vina South	21N02E26E004M	2007
Vina South	21N02E26E005M	2007
Vina South	21N02E26E006M	2007
Vina South	21N03E29J003M	2007
Butte	17N03E05C003M	2001
Butte	17N01E24A003M	2007
Butte	17N01E24A004M	2007
Butte	17N01E24A005M	2007
Butte	17N01E24A006M	2007
Butte	18N01E13A002M	2001
Butte	18N01E15D002M	1976
Butte	18N01E35L001M	2008
Butte	19N01E09Q001M	1991
Butte	19N01E27Q001M	1978
Butte	19N01E35B001M	2002
Butte	19N01E35B002M	2005

Depth Categories:

S- Shallow: indicates total well depth or screening interval is less than 200 feet below ground surface
I- Intermediate: total well depth or screening interval is 200-600 feet
S/I- Shallow/Intermediate: screened interval spans portions of the shallow and intermediate depth intervals
D- Deep: total well depth or screening interval is greater than 600 feet

Note: Red font indicates Questionable Measurement (QM), Yellow highlight is Alert Stage 1, Red higlight is Alert Stage 2
** Indicates subregion primarily served by surface water supplies versus groundwater
***No Fall BMO - Wells within the Richvale Irrigation District and Western Canal District boundaries use the Specific Depth Method which establishes alert levels for spring only (per Chapter 33A)

Alert Stage Count

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Alert Stage **Alert 1**	26	27	24	5	24	21	19	13	20	21	22	10	18
Alert Stage **Alert 2**	2	1	2	2	6	14	18	26	18	8	13	7	23
Total	28	28	26	7	30	35	37	39	38	29	35	17	41

* Wells that do not have alert levels established as detailed below:

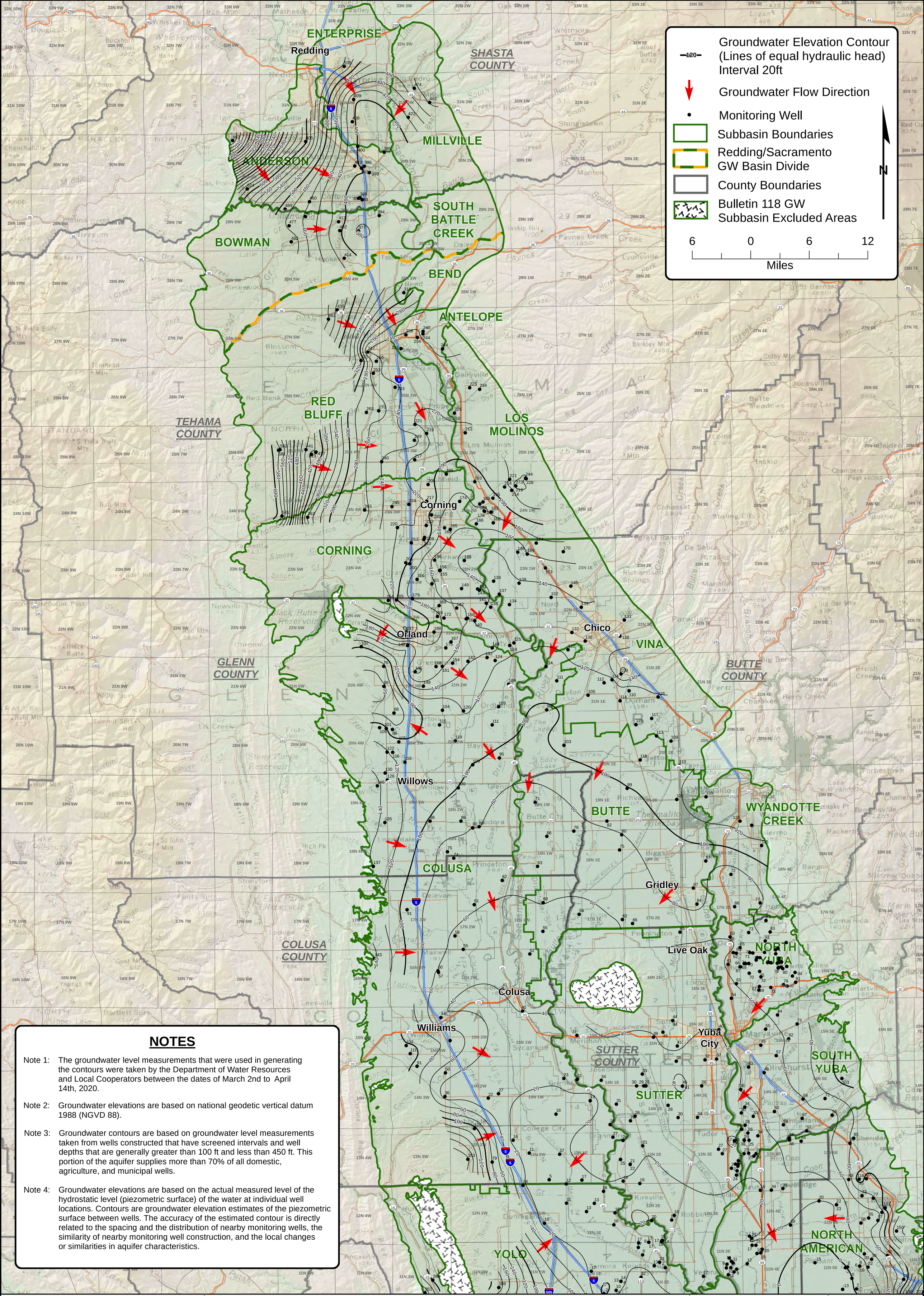
Subregion	Well ID	Date Added
Butte	N01E35B00	2005
Butte	N02E07K00	2006
Butte	N02E07K00	2006
Butte	N02E07K00	2006
Butte	N02E13Q00	2002
Butte	N02E13Q00	2006
Butte	N02E13Q00	2006
Butte	N02E15N00	2000
Butte	N01E35C00	1947
Butte	N01W04J00	2008
Butte	N01W11N00	2010
Butte	N01W11A00	2010
Butte	N01W11A00	2010
Butte	N01W11A00	2012
Butte	N01W13J00	2012
Butte	N01W13J00	2012
Butte	N01W13J00	2012
Butte	N02E15H00	1995
Butte	N02E15H00	1995
Butte	N02E16P00	1990
Butte	N02E28N00	1947

Groundwater Status Report

Appendix G

DWR Groundwater Level Contour and Change Maps

https://data.cnra.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps



NOTES

Note 1: The groundwater level measurements that were used in generating the contours were taken by the Department of Water Resources and Local Cooperators between the dates of March 2nd to April 14th, 2020.

Note 2: Groundwater elevations are based on national geodetic vertical datum 1988 (NGVD 88).

Note 3: Groundwater contours are based on groundwater level measurements taken from wells constructed that have screened intervals and well depths that are generally greater than 100 ft and less than 450 ft. This portion of the aquifer supplies more than 70% of all domestic, agriculture, and municipal wells.

Note 4: Groundwater elevations are based on the actual measured level of the hydrostatic level (piezometric surface) of the water at individual well locations. Contours are groundwater elevation estimates of the piezometric surface between wells. The accuracy of the estimated contour is directly related to the spacing and the distribution of nearby monitoring wells, the similarity of nearby monitoring well construction, and the local changes or similarities in aquifer characteristics.

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
NORTHERN REGION OFFICE
2440 Main Street
Red Bluff, California 96080
(530) 529-7300

NORTHERN SACRAMENTO VALLEY GROUNDWATER ELEVATION MAP

Spring 2020

100 to 450 ft Well Depths

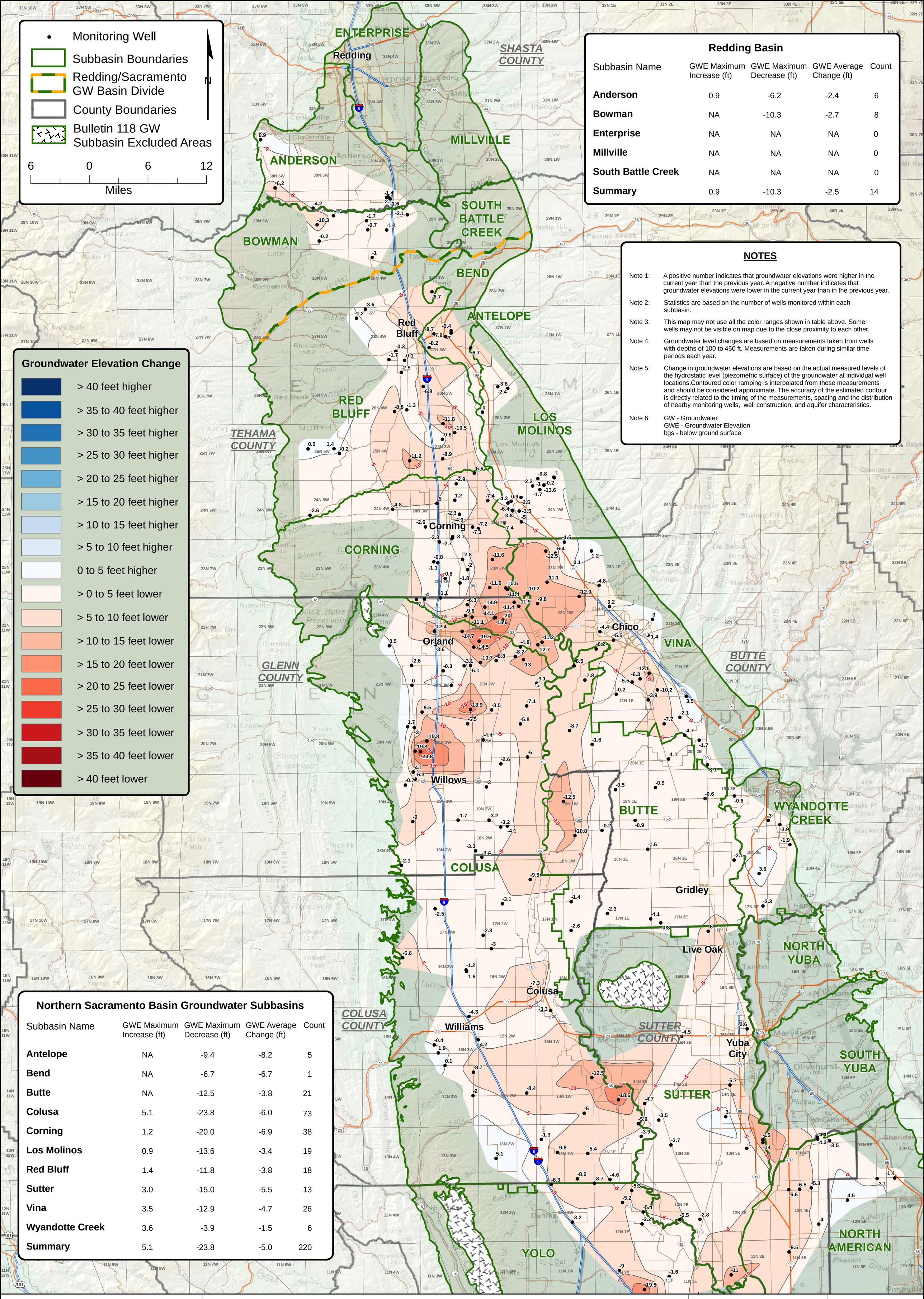
(Well depths greater than 100 ft and less than 450 ft deep bgs)

PLATE 1

Date: February 2021

BY: A. Scholzen

https://data.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps



Redding Basin

Subbasin Name	GWE Maximum Increase (ft)	GWE Maximum Decrease (ft)	GWE Average Change (ft)	Count
Anderson	0.9	-6.2	-2.4	6
Bowman	NA	-10.3	-2.7	8
Enterprise	NA	NA	NA	0
Millville	NA	NA	NA	0
South Battle Creek	NA	NA	NA	0
Summary	0.9	-10.3	-2.5	14

NOTES

Note 1: A positive number indicates that groundwater elevations were higher in the current year than the previous year. A negative number indicates that groundwater elevations were lower in the current year than in the previous year.

Note 2: Statistics are based on the number of wells monitored within each subbasin.

Note 3: This map may not use all the color ranges shown in table above. Some wells may not be visible on map due to the close proximity to each other.

Note 4: Groundwater level changes are based on measurements taken from wells with depths of 100 to 450 ft. Measurements are taken during similar time periods each year.

Note 5: Change in groundwater elevations are based on the actual measured levels of the hydrostatic level (piezometric surface) of the groundwater at individual well locations.Contoured color ramping is interpolated from these measurements and should be considered approximate. The accuracy of the estimated contour is directly related to the timing of the measurements, spacing and the distribution of nearby monitoring wells, well construction, and aquifer characteristics.

Note 6: GW - Groundwater
GWE - Groundwater Elevation
bgs - below ground surface

Groundwater Elevation Change

- > 40 feet higher
- > 35 to 40 feet higher
- > 30 to 35 feet higher
- > 25 to 30 feet higher
- > 20 to 25 feet higher
- > 15 to 20 feet higher
- > 10 to 15 feet higher
- > 5 to 10 feet higher
- 0 to 5 feet higher
- > 0 to 5 feet lower
- > 5 to 10 feet lower
- > 10 to 15 feet lower
- > 15 to 20 feet lower
- > 20 to 25 feet lower
- > 25 to 30 feet lower
- > 30 to 35 feet lower
- > 35 to 40 feet lower
- > 40 feet lower

Northern Sacramento Basin Groundwater Subbasins

Subbasin Name	GWE Maximum Increase (ft)	GWE Maximum Decrease (ft)	GWE Average Change (ft)	Count
Antelope	NA	-9.4	-8.2	5
Bend	NA	-6.7	-6.7	1
Butte	NA	-12.5	-3.8	21
Colusa	5.1	-23.8	-6.0	73
Corning	1.2	-20.0	-6.9	38
Los Molinos	0.9	-13.6	-3.4	19
Red Bluff	1.4	-11.8	-3.8	18
Sutter	3.0	-15.0	-5.5	13
Vina	3.5	-12.9	-4.7	26
Wyandotte Creek	3.6	-3.9	-1.5	6
Summary	5.1	-23.8	-5.0	220

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
NORTHERN REGION OFFICE
2440 Main Street
Red Bluff, California 96080
(530) 529-7300

NORTHERN SACRAMENTO VALLEY CHANGE IN GROUNDWATER ELEVATION MAP SPRING 2019 TO SPRING 2020

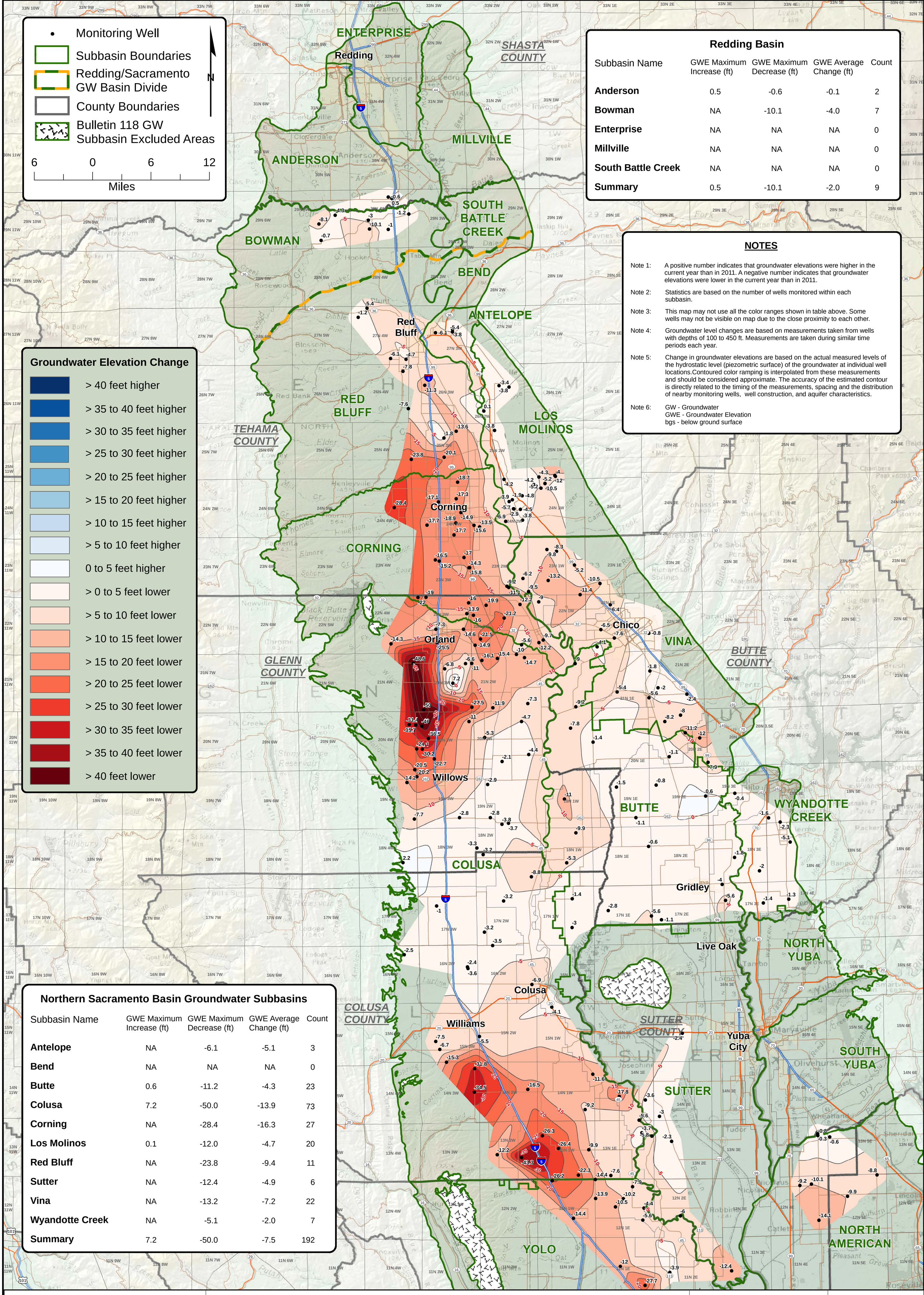
100 to 450 ft WELL DEPTHS

(Well depths greater than 100 ft and less than 450 ft deep bgs)

PLATE 1C-A

Date: September 2020

BY: A. Scholzen



Redding Basin

Subbasin Name	GWE Maximum Increase (ft)	GWE Maximum Decrease (ft)	GWE Average Change (ft)	Count
Anderson	0.5	-0.6	-0.1	2
Bowman	NA	-10.1	-4.0	7
Enterprise	NA	NA	NA	0
Millville	NA	NA	NA	0
South Battle Creek	NA	NA	NA	0
Summary	0.5	-10.1	-2.0	9

NOTES

Note 1: A positive number indicates that groundwater elevations were higher in the current year than in 2011. A negative number indicates that groundwater elevations were lower in the current year than in 2011.

Note 2: Statistics are based on the number of wells monitored within each subbasin.

Note 3: This map may not use all the color ranges shown in table above. Some wells may not be visible on map due to the close proximity to each other.

Note 4: Groundwater level changes are based on measurements taken from wells with depths of 100 to 450 ft. Measurements are taken during similar time periods each year.

Note 5: Change in groundwater elevations are based on the actual measured levels of the hydrostatic level (piezometric surface) of the groundwater at individual well locations.Contoured color ramping is interpolated from these measurements and should be considered approximate. The accuracy of the estimated contour is directly related to the timing of the measurements, spacing and the distribution of nearby monitoring wells, well construction, and aquifer characteristics.

Note 6: GW - Groundwater
GWE - Groundwater Elevation
bgs - below ground surface

Northern Sacramento Basin Groundwater Subbasins

Subbasin Name	GWE Maximum Increase (ft)	GWE Maximum Decrease (ft)	GWE Average Change (ft)	Count
Antelope	NA	-6.1	-5.1	3
Bend	NA	NA	NA	0
Butte	0.6	-11.2	-4.3	23
Colusa	7.2	-50.0	-13.9	73
Corning	NA	-28.4	-16.3	27
Los Molinos	0.1	-12.0	-4.7	20
Red Bluff	NA	-23.8	-9.4	11
Sutter	NA	-12.4	-4.9	6
Vina	NA	-13.2	-7.2	22
Wyandotte Creek	NA	-5.1	-2.0	7
Summary	7.2	-50.0	-7.5	192

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
NORTHERN REGION OFFICE
2440 Main Street
Red Bluff, California 96080
(530) 529-7300

NORTHERN SACRAMENTO VALLEY CHANGE IN GROUNDWATER ELEVATION MAP SPRING 2011 TO SPRING 2020

100 to 450 ft WELL DEPTHS

(Well depths greater than 100 ft and less than 450 ft deep bgs)

PLATE 1C-D

Date: September 2020

BY: A. Scholzen

https://data.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps

APPENDIX 1-E
Communication and Engagement Plan

Vina Subbasin Groundwater Sustainability Agency

Butte County Sustainable Groundwater Management Act (SGMA)

Implementation 2021-2023

Stakeholder Communications and Engagement Plan

Version: 11.09.21

Table of Contents

OBJECTIVES 2

BACKGROUND 2

DESIRED OUTCOMES & GOALS OF THE PLAN 3

OUTREACH ROLES 4

COMMUNICATIONS AND ENGAGEMENT FOR GSP PLANNING AND IMPLEMENTATION 5

FORUMS 6
MEMBER AGENCIES GOVERNANCE BRIEFINGS 6
STAKEHOLDER BRIEFINGS 6
PUBLIC MEETINGS/HEARING 6
PUBLIC WORKSHOPS 6
PUBLIC NOTICES 6
TOOLS 7
INTERESTED PARTIES LIST 7
INFORMATIONAL MATERIALS 7
WEBSITE 8
MAILINGS AND UTILITY BILL NOTIFICATIONS 8
SOCIAL MEDIA 8
SURVEYS 8
MEDIA PLAN 8

OUTREACH PARTNERS **8**

INTRA- AND INTER-BASIN COORDINATION **9**

INTRA-BASIN COORDINATION **9**
INTER-BASIN COORDINATION **9**

EVALUATION AND ASSESSMENT **9**

APPENDIX A: TRIBAL ENGAGEMENT IN BUTTE COUNTY: GUIDANCE DOCUMENT **11**

TRIBES IN BUTTE COUNTY **11**
OUTREACH CONDUCTED **11**
VINA SUBBASIN TRIBAL OUTREACH 11

APPENDIX B: MEDIA CONTACT LIST **12**

APPENDIX C: OUTREACH AND ENGAGEMENT MEETINGS ALREADY CONDUCTED **13**

WEBSITE UPDATED REGULARLY 13
GSP PUBLIC COMMENT WEB PAGE 13
WATER SOLUTIONS MONTHLY E-NEWSLETTERS 13
POSTCARDS SENT TO DOMESTIC WELL OWNERS 13
LIST OF RELEVANT PUBLIC MEETINGS 13

Objectives

The Vina Groundwater Sustainability Agency (GSA) Board, the GSA Management Committee, and the GSA Stakeholder Advisory Committee are committed to keeping the **public informed**, providing **balanced and objective information** to assist the public in understanding the Sustainable Groundwater Management Act (SGMA), and **creating an open process** for input on development and implementation of the Groundwater Sustainability Plan (GSP). The primary objective of this Communication and Engagement Plan (C&E Plan) is to identify and carry forward intentional, effective public outreach and engagement to facilitate widespread support and understanding of the GSP and its implementation. Additionally as part of GSP implementation, an important objective is to identify and engage underrepresented groups in the process using the *Guidance on Engagement and Communicating with Underrepresented Groundwater Users* developed by the California Department of Water Resources (DWR).

Background

Signed into law in 2014, the purpose of SGMA is to ensure local sustainable groundwater management in medium- and high- priority groundwater basins statewide. The DWR has determined that Butte County has three priority subbasins that are subject to SGMA implementation:

This C&E Plan applies only to the Vina Subbasin Groundwater Sustainability Agency.

SGMA Milestones: The subbasin achieved the first milestone in SGMA by the establishing two Groundwater Sustainability Agencies: the Vina Groundwater Sustainability Agency (GSA), a Joint Powers Authority, comprised of three (3) member agencies: Butte County; the City of Chico; and Durham Irrigation District; and 2) The Rock Creek Reclamation District GSA. These two GSAs are coordinating to develop and implement one Groundwater Sustainability Plan (GSP) for the subbasin. The second major milestone in SGMA is the adoption of a GSP by January 30, 2022. The GSP is prescribed by SGMA and contains required elements. The third milestone is achieving sustainability by 2042.

Figure 1. SGMA Milestones

Desired Outcomes & Goals of the Plan

Outcomes: The desired outcome of this C&E Plan is to achieve understanding and support for GSP adoption and implementation in consideration of the people, economy, and environment within the subbasin and in coordination with adjacent subbasins.

Plan Goals: SGMA requires the GSA to consider the interests of all beneficial uses and users of groundwater and encourage involvement of diverse social, cultural, and economic elements of the population within the subbasin during GSP preparation and implementation. The goals of the Communications & Engagement Plan are to:

1. **Enhance understanding** and inform the public about water and groundwater resources in the Vina Subbasin, the purpose and need for sustainable groundwater management, the benefits of sustainable groundwater management, and the need for a GSP.
2. **Engage diverse interested parties** and stakeholders and promote informed feedback from stakeholders, the community, and groundwater-dependent users throughout the GSP preparation and implementation process.
3. **Coordinate communication** and involvement between the GSA (Board, Stakeholder Advisory Committee and Management Committee), Rock Creek Reclamation District GSA, and other local agencies, elected and appointed officials, and the general public.
4. **Rely on the Stakeholder Advisory Committee** to facilitate a comprehensive public engagement process.
5. **Employ a variety of outreach methods** that make public participation accessible and that encourage broad participation.
6. Respond to public concerns.

7. Provide accurate and up-to-date information.
8. **Create public value and use GSA resources wisely** by managing communications and engagement in a manner that is resourceful and efficient.

Time Period: This C&E Plan is intended to cover communications and engagement for September 2021 through December 2023. In September of 2021, the GSA Board released the draft GSP for a 40-day review. As required and planned, the GSA Boards held a formal public hearing(s) on the Draft GSP in the fall and then adopted the GSP in December for submittal to DWR in January 2022 as the law requires. This Plan will also support the first two years of implementation. Since this is a multi-year effort, the key activities needed to achieve these goals will be broken down into annual work plans, and may be amended, as needed.

Interested Parties and other stakeholders: SGMA calls for consideration of all interested parties that the GSA must consider when developing and implementing the GSP, including, but not limited to:

- Agricultural users of water
- Domestic well owners
- Municipal well operators
- Public water systems
- Land use planning agencies
- Environmental users of groundwater
- Surface water users
- The federal government
- California Native American tribes (see DWR Guidance Documents) for Tribal Outreach Guidance Document)
- Disadvantaged communities and historically underrepresented groundwater users (including those served by private domestic wells or small community water systems).

Outreach Roles

The **Vina GSA Board** is comprised of elected officials from each of the member agencies and two stakeholder board members appointed by the Butte County Board of Supervisors, representing commercial agricultural and domestic well users in the subbasin. As required by the Joint Powers Authority agreement that created the GSA, the Board will consider the recommendations of the Stakeholder Advisory Committee.

In regard to outreach, the Board is responsible for:

- Adopting and overseeing implementation of the C&E Plan;
- Entering into Memoranda of Understanding with other public agencies such as Rock Creek Reclamation District GSA and Butte College to codify engagement activities for the development and implementation of the GSP;
- Receiving public comments made verbally and in writing;
- Considering the recommendations of the Stakeholder Advisory Committee.

In addition, the Board may choose to play a more active role in outreach through communication with the public, stakeholder groups, and the entities it represents.

The **Management Committee,** established by the Board, is comprised of at least one staff representative from each of the public agencies that are members of the GSA. As required by the Joint Powers Authority agreement, the Management Committee shall recommend agenda items, administer the Stakeholder Advisory Committee, establish and administer technical working groups, and bring staff reports before the Board.

In regard to outreach, the Management Committee is responsible for:

- Development and implementation of the C&E Plan with Board approval and oversight;
- Administering the Stakeholder Advisory Committee and ad hoc technical advisory committees;
- Documenting the recommendations of the Stakeholder Advisory Committee in staff reports to the Board.

The **Stakeholder Advisory Committee** is comprised of members appointed by the GSA Board. The Stakeholder Advisory Committee is charged with actively engaging with the public for input and feedback.

This charge will be carried out through various activities, but generally includes:

- Actively seeking input from represented stakeholder groups on groundwater-related issues before the GSA, as described in the Vina SHAC Charter adopted by the GSA Board;
- Sharing input and feedback at Stakeholder Advisory Committee meetings;
- Making recommendations to the Board.

When evaluating the options identified in the GSP and making decisions, the Board, Management Committee, and Stakeholder Advisory Committee will **solicit public input** through a range of methods, including public workshops, written and verbal comments, meetings with stakeholder organizations, and other opportunities. Input is always welcome and can be provided verbally during public comment periods at the Stakeholder Advisory Committee and Board meetings or in writing. Written comments can be sent to the Management Committee via the GSA website or email, which will be distributed to the Stakeholder Advisory Committee and/or Board, as appropriate.

Communications and Engagement for GSP Planning and Implementation

To truly engage the public in development of a GSP that is science-based, complex, technical, and includes achievable outcomes, the GSA will strive to meet these overall objectives:

- Educate the public in meaningful ways. Communicate what may often be complex concepts in straightforward, comprehensible ways;
- Show how the input received has been incorporated into the plan or process; and
- Remain focused on results.

The GSA carried out community engagement during the development of the GSP, which included public meetings and presentation materials to inform the public. The GSP has been revised to incorporate public feedback. This C&E Plan builds on that foundation to now engage the community, interested parties, stakeholders, organizations, and agencies as the GSA Boards considers adopting the GSP and initiating GSP implementation. The GSA Boards released the draft GSP for a 40-day public review period in September of 2021. The GSA held a formal public hearings in the fall. Then, the Boards adopted the GSP in December of 2021 for a January 2022 submittal to DWR. The Vina GSA and Rock Creek Reclamation

District GSA will hold joint board meetings, when possible, to conduct the formal GSP review and adoption process.

Implementing the GSP will begin at the end of January 2022. Implementation will involve advancing projects, addressing data gaps, monitoring, and developing additional needed projects as part of adaptive management. The GSA will prepare annual reports and provide five-year updates to DWR to demonstrate progress toward sustainability. Public outreach will inform each of these activities.

Forums

Member Agencies Governance Briefings

Member Agency board members may brief their councils or boards regularly on GSA activities and may work with the GSA Management Committee to provide additional briefings on sensitive or important topics.

Stakeholder Briefings

Stakeholder Advisory Committee members will meet with and communicate regularly with individuals and organizations comprised of the stakeholder groups they represent. To promote consistent messaging, all briefings will be coordinated with the GSA Management Committee.

Public Meetings/Hearing

Public meetings or hearings are formal opportunities for people to provide official comments on programs, plans and proposals. The Vina GSA Board meetings and the Stakeholder Advisory Committee meetings constitute regular public meetings that will be noticed and conducted in accordance with the Ralph M. Brown Act. SGMA requires that a public meeting be held prior to the adoption of a fee and that public hearings are held for the adoption of GSP elements and the final GSP plan. There are also constitutional requirements for public hearings for some fee/rate options. Public meetings and hearings are an important forum for people to share viewpoints and concerns, but often occur at the end of a process, when only one option is under consideration. The GSA will hold required public meetings and hearings, but will also use less formal public workshops to solicit feedback and information early in the process.

Public Workshops

Public educational workshops provide less formal opportunities for people to learn about groundwater, SGMA, and GSP elements. Workshops can be organized in a variety of ways, including webinars, open houses, the use of “stations” where people can ask questions one-on-one, and traditional presentations with facilitated question and answer sessions. In order to solicit feedback from people who may not be comfortable speaking in public, workshops can include small group breakout discussions, comment cards and other techniques. Workshops will be designed to maximize opportunities for public input.

Public Notices

Public notices, often required by law, aim to notify agencies and the public about activities that may affect the public. As outlined in this C&E Plan, the GSA will sponsor a variety of opportunities for people to participate in the development and implementation of the GSP, including workshops, public hearings, and providing comments at Board and Stakeholder Advisory Committee meetings, and through written comments. The agency will comply with public noticing requirements.

Prior to GSP adoption or amendment, SGMA requires that the GSA:

- Provide notice to cities and counties within Plan area
- Consider comments provided by the cities and counties
- Accommodate requests for consultation received from the cities and counties within 30 days
- No sooner than 90 days following public notice, hold public hearing(s)

In addition, when the GSA considers any fees to support implementation of the GSP, the GSA will provide public notice and other engagement activities.

Tools

The Vina GSA will use a variety of communications and engagement tools to keep the public informed, including the following.

Interested Parties List

The GSA maintains an interested parties list, consistent with SGMA requirements. The list is broad and includes anyone who would like to stay informed about SGMA activities. The Management Committee coordinates the distribution of periodic updates to the interested parties list. The GSA also relies on the list for sharing information on public workshops, public meetings, and other activities. Interested parties may sign up to receive email updates at the following link [Access Here].

Note, SGMA did not specify the type of list (email versus hard copy mailing) that should be used to inform interested parties. The first preference for information sharing is the email list to distribute information quickly and to reduce costs. In addition, the GSA may periodically distribute public notices in the form of post cards and/or published notices.

Member agencies, Board members, the Stakeholder Advisory Committee, and the Management Committee will encourage potential organizations, agencies, and individuals to sign up on the interested parties list.

Informational Materials

Developing a variety of informational materials is critical to successful education and necessary to circulate consistent, accurate information. The Management Committee, with input from the Stakeholder Advisory Committee, may develop a range of materials, which may include:

- **Talking Points:** Clear, concise messages to be used by Board and Stakeholder Advisory Committee members and Management Committee when communicating with media, organizations, and stakeholders.
- **Milestone Fact Sheets:** For initiating the GSP and completion of elements of the GSP.
- **Periodic Updates:** As stated above, the Management Committee will coordinate on the distribution of periodic updates that can then be used by Stakeholder Advisory Committee for distribution to the groups and organizations they represent using existing communications tools, such as newsletters, social media, list serves, etc.
- **Newspaper Editorials:** Authored by the Management Committee, Board, or Stakeholder Advisory Committee members (after review and approval of the full Board, Advisory Committee and Management Committee) for submittal to local news sources.

- **Briefing Packets:** For milestone briefings to the public and stakeholders. Packets will include standard talking points, and other materials to assist in educational outreach and for soliciting feedback.

Website

The Vina GSA website [www.vinagsa.org] is a tool for distributing and archiving meeting and communication materials as well as a repository for any studies, general information, and educational materials. The Management Committee coordinates to ensure that the website is updated on a consistent basis to ensure up to date, timely information. The website includes the following information:

- Home page: summary, calendar of meetings and events, highlighted topics
- Groundwater basics, SGMA background including links to existing sources of relevant information, such as https://www.groundwaterexchange.org.
- Vina Subbasin specific information
- Board of Directors information: Board members, agendas, meeting materials, and meeting recordings
- Stakeholder Advisory Committee information: Stakeholder Advisory Committee members, agendas, and meeting materials
- Library and GSP Chapters

Mailings and Utility Bill Notifications

Individual member agencies may utilize postcards and include updates and relevant GSP development information in utility bills.

Social Media

Existing Facebook, Twitter, Next Door and other emerging social media technologies may be leveraged to provide updates on milestone progress to interested parties.

Surveys

Online tools, such as Survey Monkey, may be used periodically to gather stakeholder ideas and to provide feedback on key issues.

Media Plan

The Management Committee will develop press releases and Public Service Announcements (if appropriate) at each milestone and for meetings and workshops. The press releases will be distributed to local and regional media and elected officials. See Appendix C for a media contact list.

Outreach Partners

In addition to the communication tools listed above, the Vina GSA can partner with other organizations to ensure that it achieves its communications and engagement goals including. Other partners include, but are not limited to:

a. Butte County Farm Bureau;
b. Butte County Environmental Health;
c. Butte County Planning Department;
d. City of Chico;
e. California Water Service Chico;

f. Rock Creek Reclamation District;
g. Agricultural Groundwater Users of Butte County (AGUBC)
h. Butte County Water Commission;
i. Butte Environmental Council;
j. Butte College;
k. California State University, Chico;
l. Upper Feather River Integrated Regional Water Management (IRWM) and the North Sacramento Valley (NSV) Integrated Regional Water Management (IRWM) group;
m. Butte County Resource Conservation District;
n. Chico Chamber of Commerce (calendar); and
o. Service Clubs and other professional organizations.

Intra- and Inter-Basin Coordination

For more information, please reference the Inter-Basin Coordination Report on the Vina GSA website.

Intra-Basin Coordination

There are two GSAs in the Vina Subbasin: The Vina GSA and Rock Creek Reclamation District GSA. The Vina GSA Board of Directors entered into an agreement with Rock Creek Reclamation District specifying the parameters of the two agencies' coordination on the development and implementation of one GSP for the subbasin. Further, the Vina GSA Management Committee will coordinate with Rock Creek Reclamation District's designated representative(s) and the two GSAs will hold joint board meetings, when possible, to provide a shared venue for public engagement and to ensure basin-wide sustainability. The Vina GSA has also entered into a Memorandum of Understanding with Butte College to coordinate on GSP development and implementation.

Inter-Basin Coordination

While inter-basin agreements are optional under SGMA, the Vina GSA participated in the development of the inter-basin coordination framework described in the Inter-basin Coordination Report, linked above, which will also be appended to the GSP. The GSA intends to coordinate on some level, with 11 subbasins in the Northern Sacramento Valley. During GSP development, the subbasins developed an inter-basin coordination directory, a technical information-sharing template, an outreach presentation, an outreach fact sheet, and an inter-basin coordination webpage and held regular inter-basin agency staff meetings. Management Committee staff established a framework for coordination during GSP implementation including information sharing, joint analysis and evaluation, coordination on mutually beneficial activities, coordination on communication and outreach, and an issue-resolution process which will be further developed and instituted during GSP implementation. More information about inter-basin coordination in the Northern Sacramento Region can be found at:
http://www.buttecounty.net/waterresourceconservation/Sustainable-Groundwater-Management-Act/Inter-basin-Coordination

Evaluation and Assessment

Any communication strategy should include opportunities to check in at various points during implementation to ensure that it is meeting the communication and engagement goals and complying with SGMA. These check-ins will occur as needed.

Appendix A: Tribal Engagement in Butte County: Guidance Document

Tribes in Butte County

There are four[1] federally-recognized Native American tribes in Butte County. Three of the four Native American tribes are located in subbasins subject to SGMA. The tribes include:

- Mechoopda Indian Tribe of Chico Rancheria – *located in Vina Subbasin*
- Concow-Maidu Tribe of the Mooretown Rancheria – *partially located in the Wyandotte Creek subbasin*
- Tyme Maidu Tribe of the Berry Creek Rancheria – *partially located in the Wyandotte Creek Subbasin*
- Enterprise Rancheria of Maidu Indians of California – *are not located in a subbasin subject to SGMA*

The KonKow Valley Band of Maidu Indians is also recognized by the County and the State and has applied for federal recognition.

Meaningful Tribal outreach, dialogue, and consultation is a shared obligation of all the GSAs in the applicable subbasin where Tribal lands exist. However, since Tribal lands are predominately in unincorporated portions of Butte County, the County will lead SGMA-related outreach and consultation efforts with the Mechoopda Indian Tribe.

Outreach Conducted

During development of the GSPs, Butte County staff reached out to tribes in the County to discuss interest in participating as members of the Joint Powers Agreement (Wyandotte/Vina) or Advisory Committees within any of the three subbasins even those outside of tribal boundaries. The GSAs reserved a tribal seat within the advisory committee charters in Wyandotte Creek and Vina subbasins. To date, tribes are not participating in the JPA or Advisory Committee.

Vina Subbasin Tribal Outreach

Butte County staff coordinated with the Mechoopda Indian Tribe of Chico Rancheria first through communications with the tribal chair and administrative officer in 2018 and later via in-person meetings with other tribal members and staff. The tribal chairman designated a tribal staff member to represent the tribe during GSP development and has elected to participate as a member of the Vina GSA Management Committee since 2019. As a Management Committee member, the tribal representative participates in Management Committee, Board meetings and Vina Stakeholder Advisory Committee meetings. The purpose of this informal engagement is to maintain consistent coordination with the Tribe and identify opportunities for longer-term collaboration during GSP implementation.

[1] Source: https://www.ihs.gov/california/index.cfm/tribal-consultation/resources-for-tribal-leaders/links-and-resources/list-of-federally-recognized-tribes-in-ca/?mobileFormat=0

Appendix B: Media Contact List

Media Outlet			
Organization	Name	Email	Phone
Action News Now		news@actionnewsnow.com	
Chico Enterprise Record		localnews@chcioer.com	
Chico News and Review		chiconewstips@newsreview.com	
Forest Ranch Post		Forestranchpost@gmail.com	
Gridley Herald		publisher@gridleyherald.com	
KCHO News		kchonews@csuchico.edu	
KHSL TV Channel 12		news@khsltv.com	
KRCR Channel 7		ksaam@krcrtv.com	
KRBS		krbs@cncnet.com	
KZFR		Marc.68@gmail.com	
NCEN		tsullivanhames@ncen.org	
News 10		desk@news10.net	
Oroville Mercury Register (Legals)		(Same as Chico Enterprise Record)	
Paradise Post		rsilva@paradisepost.com	
Plumas News		info@plumasnews.com	
211		211resourceteam@helpcentral.com	
Other			

Appendix C: Outreach and Engagement Meetings already Conducted

The GSA has engaged in a range of public engagement activities since GSA formation in 2017, including maintaining a website, monthly newsletters, and numerous public meetings. The GSA also sent post cards to all domestic well owners to raise awareness about SGMA and GSA planning. Lastly, here is the list of meetings that have taken place since forming the GSAs as the Groundwater Sustainability Plan has been developed.

Website updated Regularly

https://www.vinagsa.org

GSP Public Comment Web Page

Vina: https://www.vinagsa.org/public-comment-period-now-open

Water Solutions Monthly E-Newsletters

http://www.buttecounty.net/waterresourceconservation/Water-Education/Newsletters-2021

Postcards sent to Domestic Well Owners

3,948 postcards on 4/22/18
6,229 postcards on 8/7/18
6,228 postcards on 2/24/19
5,426 postcards on 4/5/21

List of Relevant Public Meetings

Date	Subbasin	Meeting
2/27/18	All Subbasins in Butte County	Butte County Board of Supervisors
3/13/18	All	Board of Supervisors
3/22/18	All	Board of Supervisors
6/12/18	All	Board of Supervisors
6/26/18	All	Board of Supervisors
7/24/18	All	Board of Supervisors
8/1/18	All	Water Commission
8/14/18	All	Board of Supervisors
8/15/18	Vina Subbasin	Public Hearing
9/5/18	All	Water Commission
9/11/18	Vina	Public Hearing-BOS
9/17/18	All	Groundwater Pumper Advisory Committee
9/25/18	All	Board of Supervisors
10/3/18	All	Water Commission
10/9/18	All	Board of Supervisors
10/23/18	All	Board of Supervisors
11/5/18	All	Groundwater Pumper Advisory Committee
11/7/18	All	Water Commission
1/2/19	All	Water Commission

1/17/19	All	Technical Advisory Committee
1/29/19	All	Board of Supervisors
2/6/19	All	Water Commission
2/25/19	All	Groundwater Pumper Advisory Committee
3/6/19	All	Water Commission
3/7/19	Vina	SMC Workshop
3/12/19	Vina	Public Hearing-BOS
4/3/19	All	Water Commission
4/23/19	All	Board of Supervisors
5/1/19	All	Water Commission
5/21/19	All	Board of Supervisors
6/5/19	All	Water Commission
6/6/19	All	Technical Advisory Committee
6/11/19	All	Board of Supervisors
6/25/19	All	Board of Supervisors
7/23/19	All	Board of Supervisors
7/24/19	All	Groundwater Pumper Advisory Committee
8/7/19	All	Water Commission
8/27/19	Vina	Board of Supervisors
9/4/19	All	Water Commission
9/12/19	Vina	GSA Board of Directors
10/2/19	All	Water Commission
10/10/19	Vina	GSA Board of Directors
11/5/19	All	Board of Supervisors
11/6/19	All	Water Commission
11/14/19	Vina	GSA Board of Directors
11/19/19	All	Board of Supervisors
11/21/19	All	Technical Advisory Committee
12/4/19	All	Water Commission
12/12/19	Vina	GSA Board of Directors
12/17/19	All	Water Policy Workshop- Board of Supervisors
12/17/19	Vina	Stakeholder Advisory Committee
1/8/20	All	Water Commission
1/14/20	All	Technical Advisory Committee
2/5/20	All	Water Commission
2/18/20	Vina	Stakeholder Advisory Committee
3/4/20	All	Water Commission
3/11/20	Vina	GSA Board of Directors
3/17/20	Vina	Stakeholder Advisory Committee
3/24/20	All	Board of Supervisors
5/19/20	Vina	Stakeholder Advisory Committee

6/3/20	All	Water Commission
6/9/20	Vina	Technical Webinar
6/10/20	Vina	GSA Board of Directors
6/16/20	Vina	Stakeholder Advisory Committee
8/5/20	All	Water Commission
8/12/20	Vina	GSA Board of Directors
8/18/20	Vina	Stakeholder Advisory Committee
8/19/20	All	Groundwater Pumper Advisory Committee
9/2/20	All	Water Commission
9/9/20	Vina	GSA Board of Directors
9/15/20	Vina	Stakeholder Advisory Committee
10/14/20	Vina	GSA Board of Directors
10/20/20	Vina	Stakeholder Advisory Committee
10/27/20	All	Board of Supervisors
11/4/20	All	Water Commission
11/10/20	All	Technical Advisory Committee
11/17/20	Vina	Stakeholder Advisory Committee
11/18/20	Vina	GSA Board of Directors
12/2/20	All	Water Commission
12/9/20	Vina	GSA Board of Directors
12/15/20	Vina	Stakeholder Advisory Committee
1/4/21	All	Technical Advisory Committee
1/6/21	All	Water Commission
1/13/21	Vina	GSA Board of Directors
1/19/21	Vina	Stakeholder Advisory Committee
2/3/21	All	Water Commission
2/10/21	Vina	SMC GSA Board Workshop
2/16/21	Vina	Stakeholder Advisory Committee
3/3/21	All	Water Commission
3/10/21	Vina	GSA Board of Directors
3/10/21	All	Brown Bag Seminar
3/16/21	Vina	Stakeholder Advisory Committee
3/23/21	All	Board of Supervisors
4/7/21	All	Water Commission
4/14/21	Vina	GSA Board of Directors
4/20/21	Vina	Stakeholder Advisory Committee
5/5/21	All	Water Commission
5/12/21	Vina	GSA Board of Directors
5/18/21	Vina	Stakeholder Advisory Committee
5/24/21	All	Technical Advisory Committee
5/25/21	All	Board of Supervisors

6/2/21	All	Water Commission
6/9/21	Vina	GSA Board of Directors
6/15/21	Vina	Stakeholder Advisory Committee
6/22/21	All	Board of Supervisors
6/28/21	All	Brown Bag Seminar
7/14/21	Vina	GSA Board of Directors
7/20/21	Vina	Stakeholder Advisory Committee
8/2/21	Vina	Stakeholder Advisory Committee
8/4/21	All	Water Commission
8/11/21	Vina	GSA Board of Directors
8/17/21	Vina	Stakeholder Advisory Committee
9/1/21	All	Water Commission
9/8/21	Vina	GSA Board of Directors
10/4/21	Vina	Vina GSA Public Workshop
10/6/21	All	Water Commission
10/13/21	Vina	GSA Board of Directors
10/19/21	Vina	Stakeholder Advisory Committee
10/26/21	All	Board of Supervisors
11/3/21	All	Water Commission
11/15/21	Vina	GSA Board of Directors
11/16/21	Vina	Stakeholder Advisory Committee
12/1/21	All	Water Commission
12/14/21	All	Board of Supervisors
12/15/21	Vina	GSA Board of Directors

APPENDIX 1-F

Comments to the Draft **2022** Groundwater Sustainability Plan and Responses

Response to Comments Summary and Master Responses to
Public Review Draft of the Vina Subbasin Groundwater Sustainability Plan
Released September 2021

Overview

The Vina Groundwater Sustainability Agency (GSA) and the Rock Creek Reclamation District (RCRD) GSA (GSAs) in the Vina Subbasin would like to thank the public, partner agencies, and interested parties for their participation in the development of the Vina Subbasin Groundwater Sustainability Plan (GSP). During the public review period, a total of seven entities and eight individuals submitted comment letters on the draft GSP. In addition, numerous members of the public also submitted comments using the comment tracking sheet format. Each of these comments are included in this Appendix in a comment tracking table that also includes the GSAs' response. Comment letters and associated attachments are included following the comment tracking table.

Submitted public comments describe a variety of issues, some of which have been acknowledged and incorporated into the GSP. The GSAs acknowledge that the GSP is a living-breathing document and subject to revision and update in the future as data gaps are filled, projects and management actions (PMAs) are refined and completed, resource management responds to changing conditions, and to continue compliance with SGMA.

The specified Measurable Objectives (MOs) and Minimum Thresholds (MTs) (and resulting definitions of Undesirable Results) were developed through an iterative process with GSAs, technical consultant, and the Stakeholder Advisory Committee (SHAC) using best available information. They are based on local input and a balance of local concerns. Over the last two years, discussions were held during the Vina SHAC meetings, at public workshops, and by the individual GSA boards throughout GSP development. Protection of domestic wells, and those within the subbasin who are dependent on them (including Disadvantaged Communities), was an important criteria for establishing MTs for groundwater levels. Although the Vina Subbasin benefits from the historical Butte Basin Groundwater Model, additional data is needed to understand and analyze impacts to beneficial uses and users regarding interconnected surface waters and Groundwater Dependent Ecosystems (GDEs). This was identified as a data gap, and the GSP includes a specific Project to help fill this data gap (described in Section 5.4). Understanding subbasin condition effects on these uses and users of groundwater is expected to improve through new information as GSP implementation proceeds. Sustainable Management Criteria (SMC) may be modified in future versions of the GSP.

Several comment topics from the received public comments/comment letters are addressed in the Master Responses, further below, which are referred to in the individual responses to comments in the comment tracking sheet.

Commenters seeking further clarification of issues or questions raised in individual comments or by agency letters are encouraged to address them with the Vina GSA Management Committee or RCRD GSA manager. The GSAs will continue to seek to foster participation and partnerships with the public, NGOs, agencies, and interested parties as the GSP is implemented.

Public Review Period

The Draft GSP was released for a 40-day public review period beginning on September 10, 2021 and ending October 19, 2021. As part of the public review process, the GSAs held two public workshops 1) an in-person workshop on October 4, 2021 and 2) a virtual workshop on October 13, 2021. In addition, the Vina GSA Stakeholder Advisory Committee (SHAC) also met on October 19 and November 4, 2021 to provide comments to the Vina GSA Management Committee and Geosyntec (consultant team) for review and consideration for incorporation into the GSP, as appropriate, prior to finalizing the document for review by the GSA Boards. The GSAs heard additional comments and considered final revisions during the Public Hearing of the GSP on November 15, 2021.

Comments Received / Comment Tracking Table

The comment tracking table identifies all of the comments received during the 40-day public comment period. The comment tracking table tabulates approximately 175 comments on the GSP and clarifying questions posed during public workshops. The comment tracking table also identifies eight letters submitted by members of the public (identified as P1 through P8) and seven letters submitted by agencies and organizations (identified as A1 through A7). These seven agencies and organizations include:

1. Audubon California, Clean Water Action, Clean Water Fund, Local Government Commission, The Nature Conservancy, American Rivers and Union of Concerned Scientists.
2. California Department of Fish and Wildlife (CDFW)
3. Agriculture Groundwater Users of Butte County (AGUBC)
4. Audubon California
5. Butte Environmental Council (BEC)
6. AquAlliance
7. Glenn-Colusa Irrigation District (GCID)

The comment letters are cross-referenced in the table and included in their entirety as an attachment to the comment tracking table.

The Vina GSA Management Committee in coordination with the consultant team reviewed all comments received and responded accordingly. Comments that resulted in edits, additions, or deletions to the GSP were documented in tracked changes for ease of review by the GSA Boards prior to adoption. These revisions are also noted in the comment tracking table.

Master Responses

Master Response – Measurable Objectives and Minimum Thresholds (MO/MT)

Comments express concern that the MT and MO are set too low to protect against undesirable results to domestic well owners, groundwater dependent ecosystems, and stream flows. Other comments express support for the established SMC for groundwater levels.

The specified Measurable Objectives (MOs) and Minimum Thresholds (MTs) (and resulting definitions of Undesirable Results) were developed through an iterative process with GSAs and local stakeholders and using best available information. The MO and MT are based on local input and a balance of local concerns. Over the past year, discussions were held during Vina GSA Stakeholder Advisory Committee

meetings, at public workshops, and by joint meetings of the GSA boards throughout GSP development. Protection of domestic wells, and those within the subbasin who are dependent on them (including Disadvantaged Communities), was an important criteria for establishing MTs for groundwater levels. However, the GSP identifies an important data gap related to establishing this MT:

> *"The MT for groundwater levels is based on total depths of domestic wells. The dataset used for this assessment is poor and may include wells no longer in use or poorly maintained. To resolve this data gap, the GSAs will conduct surveys of active domestic wells to assess the actual total depth of these wells within the Vina Subbasin. The GSAs will also maintain a record of verifiable domestic wells that go dry during the implementation period that will include depth of these wells, screen intervals, and available maintenance records. These data will be used to modify the MT over the implementation period, as appropriate." - Section 4.10*

The GSP includes a specific Project, the Community Monitoring Program, to help fill this data gap (described in section 5.4.3). Understanding subbasin condition effects on all uses and users of groundwater is expected to improve through new information as GSP implementation proceeds. As a result, Sustainable Management Criteria (SMC) may be modified in future versions of the GSP.

The methodology for establishing the MT is described in Section 3.3.2. and Appendix 3 shows graphs of the distribution of domestic well depths associated with each Representative Monitoring Site (RMS) well. These graphs along with consideration of ground surface elevation changes within the RMS zone were used to establish the MT. The GSA Boards gave direction to use this approach at their July 14, 2021 Joint GSA Board meeting.

In response to comments, Section 3.3 was revised to clarify and better describe the methodology used to establish the MT for each RMS well. Maps have been added to Appendix 3 to show average depths of wells throughout the subbasin. Graphs in Appendix 3 show the Elevation of the Bottom of each domestic well located within the RMS Zone relative to the RMS well's ground surface elevation. Each red point on the graph represents a domestic well in the RMS zone. The elevation of the MO and MT established at the RMS well is shown relative to the elevation of the bottom of all domestic wells (post 1980 from the well database) within the zone. The graphs were used to identify the MT that would be protective of the majority of the domestic wells in the RMS zone while recognizing the RMS well is not fully representative of wells within the zone due to changes in ground surface and water surface elevation throughout the RMS zone. Wells above the MT elevation tend to be especially shallow (less than 100 feet deep) or have a significantly different (higher) ground surface elevation than the RMS well. The proposed MTs for groundwater elevation do not necessarily protect all domestic wells because it is impractical to manage a groundwater basin in a manner that fully protects the shallowest wells. However, the GSP describes a management action, Domestic Well Mitigation (Section 5.3.2), that describes a number of steps the GSAs would take to mitigate impacts if an increasing number of domestic groundwater wells go dry in the Vina subbasin.

Comments express concern that the MT is set too low, "below the 80 foot maximum rooting depth of Valley Oaks" and therefore do not sufficiently consider groundwater dependent ecosystems (GDEs). It is important to note the RMS wells were selected to be representative of domestic wells and the GSP identifies a data gap related to the lack of shallow groundwater monitoring that is needed to characterize the water table (depth to first groundwater). This shallow monitoring data is needed to evaluate

groundwater conditions in relation to rooting depths and GDEs. The GSP describes a framework (Section 3.8.2) to address this data gap which has application both to characterizing interconnected surface water and GDEs throughout the Vina Subbasin. For additional details, see GDE Master Response.

Comments also express concern that the MO for groundwater levels is set too low. The methodology for establishing the MO is described in Section 3.3.3 and was considered through extensive public dialogue via Vina GSA Stakeholder Advisory Committee meetings, public workshops, and discussions by the GSA Boards since at least February 2021. In response to the received public comments on the Public Review draft of the GSP (contained in the attached comment tracking sheet), the management committee proposed an alternative MO based on 2010-2020 average groundwater levels in each RMS well for the GSAs' consideration. At a Public Hearing of the GSP on November 15, 2021 the GSA Boards considered input from the Vina GSA SHAC and public members. The GSA Boards decided to utilize the 2030 trend of groundwater conditions for each RMS well to establish the MO, as originally described in the public review draft.

The GSAs acknowledge that the SMC are subject to revision and update in the future as data gaps are filled, projects and management actions (PMAs) are refined and completed, and implementation of the GSP responds to changing conditions.

Master Response – Groundwater Dependent Ecosystems (GDE)

Comments discussed the benefits of protecting Groundwater Dependent Ecosystems (GDEs), the analysis process for identifying GDEs, and potential impacts to GDEs associated with changing groundwater levels.

Groundwater Dependent Ecosystems are defined in the SGMA regulations as "ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface." The GSP acknowledges that GDEs exist within the Vina Subbasin largely where vegetation accesses shallow groundwater for survival; and in areas with streams and creeks where a connection to groundwater exists. The extent of where these conditions occur is largely unknown in the Vina subbasin at this time due to the lack of shallow groundwater monitoring to characterize water table conditions. To address this, a framework is described in the GSP in Section 3.8.2 and a Project (5.4.4) to obtain the needed data identified in the framework to monitor and characterize groundwater conditions in relation to beneficial uses and users of groundwater, including GDEs. This will be an important activity of early GSP implementation.

A distinction between an ecosystem's dependence on groundwater versus its dependence on surface water and the associated riparian zone or floodplain is important and not well understood in the Vina subbasin at this time. The Vina Subbasin acknowledges that overall function of the riparian zone and floodplain is dependent on multiple components of the hydrologic cycle that may or may not have relationships to groundwater levels in the principal aquifer and may or may not be impacted by pumping in the subbasin. For example, hydrologic impacts outside of the Vina Subbasin, such as upper watershed development or fire-related changes in run-off, could result in impacts to streamflow, riparian areas, or GDEs that are completely independent of any connection to groundwater use or groundwater conditions within the Vina Subbasin.

While only limited data from a few monitoring wells exist to understand these connections, the following is an example of one nested monitoring well (23N01W31M; Figure 2-22) that includes a well completed in the shallow aquifer zone and three wells within deeper zones. The hydrograph for the shallow wells suggests it has a total depth within what could be termed “floodplain sediments” and is in direct hydraulic communication with the Sacramento River. This means that groundwater conditions in this location are likely tied closer to streamflow conditions from the adjacent river than groundwater use. Another nested well completed further away from the Sacramento River indicates that the shallow well in the group is in clear connection with deeper zones and does not indicate any connection to Sacramento River dynamics.

The subbasin does not have a sufficient amount of wells at differing appropriate distances from surface waters (with streamflow monitoring devices already installed on them) with differing depths to be able to sufficiently characterize the spatial or temporal conditions relating to how surface water and groundwater in this subbasin are connected, nor the impacts of groundwater use on potential GDEs. This lack of monitoring wells is identified in the GSP as a data gap. The RMS wells in the subbasin which are used to monitor groundwater levels are not indicative of shallow groundwater (i.e.. water table) conditions, as the majority of them have a total depth of over 150’ deep, or are not screened at depths, which when monitored would allow for an accurate representation of the shallow water table elevations to provide a way to monitor impacts to GDEs. For this reason groundwater level monitoring wells are not evaluated in relation to potential GDEs. As discussed in Section 4.10 sufficient data is lacking at this time to analyze the interaction of streams and pumping within the principle aquifer system. These data are not available and are identified as a data gap for the GSP with a clear plan on how it will be addressed. The GSAs in the Vina Subbasin intend to further evaluate this the groundwater level and interconnected surface water SMC to avoid undesirable results to aquatic ecosystems and GDEs. Additional wells and other monitoring networks will be installed, as appropriate, following the framework discussed in Section 3.8.

As additional data are collected and evaluated, the Vina Subbasin GSAs will evaluate the development or refinement of additional SMC, as appropriate, for specific stream reaches and associated habitat where priority GDEs are identified, where there is a clear connection to groundwater pumping in the principal aquifer.

The GSAs will focus on connectivity where there is a measurable connection between groundwater levels in the principal aquifer and streamflow or associated aquatic habitat viability. The Vina Subbasin specifically recognizes deep-rooted tree species, such as Valley Oak, that are common along riparian corridors in both upland streams and the Sacramento River. This connectivity is not well measured or understood in the Vina Subbasin at this time. As these conditions are better understood the GSAs will determine if GDEs are being adversely impacted by groundwater management and adjust management actions accordingly. In the interim, an undesirable result defined for interconnected surface waters is defined as:

> *Avoiding significant and unreasonable depletion of surface water flows caused by groundwater pumping that significantly impacts beneficial uses.*

The SMC developed for groundwater levels are used as a proxy for interconnected surface water in an interim manner until data gaps are addressed. As outlined in Section 6, an aggressive schedule has been provided to fill these data gaps and the GSAs are committed to addressing these issues and will refine and develop appropriate SMCs for the Vina Subbasin through implementation of the GSP.

Additionally, it is important to note that SGMA does not require GSAs to identify species present in GDEs. The NCCAG dataset provides the dominant species per polygon and can be referenced online. The approach to the initial analyses of GDEs was developed through discussions with staff of The Nature Conservancy, a locally formed GDE working group, County staff, GSA managers and staff from other subbasins in the region. As additional data are collected and evaluated, the Vina Subbasin GSAs will evaluate the development of additional criteria for identifying GDEs including but not limited to comparing water depths in representative monitoring sites to the rooting depths of nearby potential GDE communities. These and other updates will be provided in the periodic evaluations of the GSP provided to the Department of Water Resources.

Master Response – Interconnected Surface Waters (ISW)

Comments expressed concern regarding lack of consideration of stream-groundwater interactions and impacts of groundwater extractions on stream depletions and associated beneficial uses and users in development of Sustainable Management Criteria (SMC) for this sustainability indicator.

Section 4.10 describes a significant data gap discussed earlier in Section 3.8 as it pertains to development of Sustainable Management Criteria (SMC) for Interconnected Surface Water (ISW):

"Data needed to develop this SMC include definition of stream reaches and associated priority habitat, streamflow measurements to develop profiles at multiple time periods, and measurements of groundwater levels directly adjacent to stream channels, first water bearing aquifer zone, and deeper aquifer zones. These data are not available and are a data gap for the GSP."

The GSP acknowledges additional data is needed to characterize the relationship between shallow groundwater conditions, groundwater pumping, and surface water depletions to evaluate impacts to environmental users, such as listed aquatic species, river flows and timing, or water temperatures. The Plan demonstrates a thorough understanding of where data gaps exist and demonstrates a commitment to eliminate those data gaps. In particular, increasing monitoring in shallow aquifer zones will lead to a better overall understanding of the dynamics and impacts of depletions of interconnected surface water.

Section 3.8.2 describes an "ISW SMC Framework" that outlines the specific data needs required to address the identified data gap. Section 5.4.4 describes a data collection project to address this data gap as the GSP is implemented. The GSA intends to seek grant funds and/or Technical Support Services to install additional monitoring wells and may partner with neighboring subbasins to address shared data gaps and monitoring needs (see Inter-basin Coordination Master Response).

Additionally, through local partnerships with Chico State, studies such as the Butte Creek Stream-Aquifer Interaction Study is underway in 2021. Butte County and other GSAs in the Butte Subbasin are investing in data and analyses needed to improve understanding of the timing, location, and extent of stream-aquifer interactions along Butte Creek. This study will benefit the Vina Subbasin since Butte Creek traverses the Vina South management area. In addition, the Interconnected Stream Monitoring project (see Section 6.1.5) will include additional monitoring of shallow groundwater conditions throughout the subbasin, and future Airborne Electromagnetic (AEM) data collection conducted by the Department of Water Resources will help inform understanding of vertical connectivity between shallow and deeper zones of the aquifer system. This will improve understanding of groundwater extraction impacts on

shallow groundwater conditions in space and over time which is critical for analyzing impacts of stream depletions, both on environmental uses and users and on senior water right holders.

The GSP was developed with best available data and tools. Identified data gaps as they relate to ISW will be addressed during the implementation phase of the GSP, and the Vina GSA Boards recognize that SMC may need to be revisited as data gaps are filled and improved information is available. Understanding stream-groundwater interactions in the Vina Subbasin is expected to improve through new information as GSP implementation proceeds.

Master Response – Projects and Management Actions/Timing of Implementation

Comments discussed various opinions pertaining to the projects and management actions, including timing of implementation, identified in the GSP.

The projects and management actions, described in Section 5 of the Plan, are reasonable and commensurate with the level of understanding of the Subbasin setting and designed to improve adaptive management practices. The GSP describes several project and management actions to further its monitoring networks and understanding of the Subbasin. In addition revisions were made to Section 5, based on direction of the Vina GSA and RCRD Boards at the November 15, 2021 Joint Board meeting.

Master Response – Inter-basin Coordination

Several comments identified the importance of inter-basin coordination with regard monitoring programs and data collection for groundwater levels and subsurface flows patterns and influences between basins as well as water supplies and demand.

Section 6.7 of the GSP notes that Inter-basin Coordination is critical due to the interconnectedness of groundwater. The Northern Sacramento Valley Inter-basin Coordination Report, Appendix 6-A, describes coordination efforts. An overview and the intent and purpose of the Coordination Report is provided herein:

> Inter-basin coordination is critical in the Northern Sacramento Valley as GSAs develop and implement Groundwater Sustainability Plans (GSPs). Since groundwater subbasins in the Northern Sacramento Valley are hydrologically interconnected, water management decisions and actions in subbasins (i.e., groundwater pumping and processes affecting recharge, water demand, and supply including climate change) could change aquifer conditions. Understanding and accounting for these processes is important towards achieving sustainability in all subbasins.
>
> Inter-basin coordination is described in the GSP Regulations in Article 8. Under the regulations, GSAs must describe how they coordinate with adjoining subbasins to demonstrate implementation will not adversely affect adjoining subbasins. The Department of Water Resources (DWR) is required to evaluate whether a GSP adversely affects the ability of an adjacent basin to implement their GSP or impedes achievement of sustainability goals in an adjacent basin (Water Code 17033(c)). Coordination among GSAs can be formalized in different ways and inter-basin agreements are voluntary.
>
> Inter-basin coordination discussions among staff representatives from 11 subbasins (Antelope, Bowman, Butte, Colusa, Corning, Los Molinos, Red Bluff, Sutter, Vina, Wyandotte Creek, and

Yolo), with facilitation support from the Consensus Building Institute (CBI) began during the summer of 2020. While efforts focused on these subbasins, coordination will occur, as warranted, with other neighboring subbasins (Anderson and North Yuba).

After an initial attempt to compile technical information to better understand basin conditions at respective boundaries, staff realized differing timelines for the completion of Basin Setting content in each subbasin meant there would not be sufficient time during initial GSP development to fully characterize or address major inconsistencies. Therefore, the goal for regional inter-basin coordination shifted towards establishing a framework for long-term inter-basin coordination and dialogue (post GSP submittal in 2022). Informal coordination discussions among staff and consultants between neighboring subbasins continued during the GSP development process.

Inter-basin coordination efforts in the Northern Sacramento Valley are focused on establishing a foundation and guidelines for sustained inter-basin coordination through GSP implementation, following the initial submittal of GSPs by January 31, 2022. GSAs intend to:

1. Establish a framework allowing for continued dialogue and a venue to address issues and discrepancies during the implementation of the GSPs;
2. Coordinate on consistent messaging and communicate shared expectations at a regional level;
3. Demonstrate regional coordination efforts and outcomes; and
4. Leverage existing agreements and arrangements in the region (e.g., Northern Sacramento Valley Integrated Regional Water Management (NSV IRWM), the Six County Memorandum of Understanding among Butte, Colusa, Glenn, Tehama, Shasta, and Sutter).

Five foundational pillars that comprise the framework for inter-basin coordination under SGMA between and among subbasins in the Northern Sacramento Valley were identified. These pillars build upon a long-standing history of regional collaboration and embody a commitment for continued coordination, collaboration, and communication for successful groundwater management in the region. These pillars represent a menu of options neighboring subbasins can draw upon, based on individual or neighboring subbasins' needs and challenges.

1. Information-sharing
2. Joint analysis and evaluation
3. Coordination on mutually beneficial activities
4. Coordinated communication and outreach
5. Issue-resolution process

Ongoing and continued inter-basin coordination will assist in ensuring that implementation of the GSPs do not adversely affect the ability of an adjacent basin to implement their GSP nor impede achievement of sustainability goals in an adjacent basin.

Groundwater Sustainability Plan
Public Review Draft- September 2021
Comment Tracking Table

References are made throughout the Comment Tracking Table to various Master Responses included in the Responses to Comments Summary and Master Responses memo. Provided below is a list of the Master Responses and a key to the Master Response abbreviations:

- Groundwater Dependent Ecosystems Master Response, GDE Master Response
- Measurable Objectives/Minimum Thresholds Master Response, MO/MT Master Response
- Inter-basin Coordination Master Response
- Interconnected Surface Waters Master Response
- Projects and Management Actions/Timing of Implementation Master Response

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
1	Eric Lundberg	Public Comments	GSP 3.2.2		3370	Managers should not have the flexibility to implement actions at "any time". Actions should have deadlines associated with seasons and agricultural activities. Actions should be taken before crops are planted, or at the beginning of an irrigation season.	Comment noted.
2	Eric Lundberg	Public Comments	GSP 3.3.1		3392 - 3393	Change "environmental uses of groundwater occur" to "the environment and ecosystems within the GSA". Pumped groundwater has many benefits to the environment and ecosystems. For many crops, pumped groundwater offers as many benefits to the environment as GDEs. MTs and MOs should not be managed exclusively for the benefit of GDEs, but should also take into consideration the improvements and benefits that pumped groundwater offers to the ecosystem. "... environmental uses of groundwater" should not only consider the GDE but also the impacts pumped groundwater has on the ecosystem. An orchard has as much benefit to the environment as the urban forest.	Thank you for this recommendation. The GSAs will consider this suggestion when GSP updates are made in the future.
3	Eric Lundberg	Public Comments	GSP 3.3.2		3412 - 3414	It is unreasonable for the VINA GSA to guarantee a well owner that his/her well will not go dry. By setting an MT and MO, well owners can know that a source of water will be protected, but that some additional well development to the MT or MO levels might be needed. Managers should encourage well owners to develop wells with the MT and MO levels in mind for a protected water source. "Sustainably constructed domestic wells" should take into consideration the MT and MO levels. It is the responsibility of the well owner for the maintenance of its well, not the GSA.	Comment noted. Butte County Department of Water and Resource Conservation provides well owner materials to the public through email notices, newsletter articles, and flyers, especially during periods of drought.
4	Eric Lundberg	Public Comments	GSP 5.2.3.4		4508 - 4515	I support storing flood water into storage locations. I would encourage the development of more ponds and lakes to capture flood water coming off the many creeks and rivers in the Vina GSA. However, I do not support the complexities associated with "recharge", so I would encourage the flood water storage to be utilized as a surface water supply for the Vina GSA.	Comment noted. The commenter provides a suggestion and does not raise specific technical or policy issues with the Plan.
5	Eric Lundberg	Public Comments	GSP 5.2.4.1		4544 - 4551	When PID has extra surface water, it seems only prudent for Vina GSA to utilize that excess.	Comment noted. The commenter provides a suggestion and does not raise specific technical or policy issues with the Plan.
6	Eric Lundberg	Public Comments	GSP 5.2.4.2		4573 - 4580	I support Vina GSA trying to utilize extra surface water from water right holders from outside of our GSA.	Comment noted. The commenter identifies their support to utilize extra surface water and does not raise specific technical or policy issues with the Plan.
7	Eric Lundberg	Public Comments	GSP 5.2.4.4		4635 - 4639	Utilizing the Miocene Canal as a way of capturing surface water is both practical and sensible.	Comment noted. The commenter provides an opinion regarding the capture of surface water and does not raise specific technical or policy issues with the Plan.
8	Eric Lundberg	Public Comments	GSP 5.2.4.6		4692 - 4697	I support utilizing all available water coming out of the wastewater treatment plant.	Comment noted. The commenter provides support for utilizing wastewater and does not raise specific technical or policy issues with the Plan.
9	Eric Lundberg	Public Comments	GSP 5.2.4.11		4871 - 4876	I support trying to increase the surface water supply to the Vina Subbasin.	Comment noted. The commenter provides support for trying to increase surface water supplies and does not raise specific technical or policy issues with the Plan.
10	Eric Lundberg	Public Comments	GSP 5.3		4939	The timing of the "schedule to implement the management actions" must be appropriate for the pumpers affected by these actions. I would like to have the Vina GSA board be directed by a written policy as to when these actions can be taken.	The GSA Boards will decide in a public process on the timing and schedule of PMAs based on a variety of considerations including but not limited to subbasin conditions, PMA readiness and funding availability.
11	Eric Lundberg	Public Comments	GSP 5.3.2		4949 - 4962	It is valuable to gather more information to understand the domestic well situation. However, I do not support the Vina GSA becoming involved by funding the improvement and deepening of domestic wells. It is the responsibility of the well owner for the maintenance of its well, not the GSA. The GSA should not be responsible for providing bottled water and potable water for sanitation. The responsibility of the GSA is to protect the water under our land and not the means to acquire it. I recommend omitting # 3 and # 4 from the PMA and the last sentence of the PMA.	Comment noted. The commenter provides support for gathering more information regarding domestic wells and an opinion regarding well owners' responsibilities pertaining to well maintenance. The commenter also recommends changes to Project and Management Actions. Although not specific to their comment, the commenter is referred to the changes that have been made to Section 5, Project and Management Actions.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
12	Eric Lundberg	Public Comments	GSP 5.3.3		4970 - 4972	I do not support the amendment "requirements for well screens to account for MT" to the BC code. Well drillers need to understand the risks and consequences, but as long as they understand these risks, allow them to drill the well to the depth they think is best.	Comment noted. The commenter notes their lack of support for changes to the Butte County code and does not raise specific technical or policy issues with the Plan.
13	Eric Lundberg	Public Comments	GSP 5.3.5		4981 - 4983	Ponds and lakes are good for the environment, GDEs, and other shallow water systems. Ideally, they should be filled with surface water, but even if they are not, the water still stays inside the Vina GSA in some form. I do not support the Vina GSA encouraging Butte County to amend the zoning ordinance to prohibit the use of groundwater for ski lakes or any recreation that land owners desire on their property, such as swimming, fishing, water habitat, water plants, beauty, wading, floating, sailing, rowing, etc. I recommend omitting GSP 5.3.5.	Comment noted. The commenter notes their lack of support for changes to the Butte County zoning ordinance pertaining to water ski lakes. The commenter does not raise specific technical or policy issues with the Plan.
14	Eric Lundberg	Public Comments	GSP 5.3.7		4991 - 5004	I recommend omitting GSP 5.3.7 and that the VINA GSA board support the development of groundwater irrigation districts like Tuscan Irrigation District that could deal more effectively with ground water level issues.	Comment noted. The commenter provides a suggestion and does not raise specific technical or policy issues with the Plan.
15	Eric Lundberg	Public Comments	GSP 5.5		5061	There does not seem to be any specific schedule requirements to "begin implementation of management actions". For some actions a schedule isn't important, but other actions may have serious negative effects on those who rely upon pumping. It should be clear when certain actions can be taken and when they cannot.	Comment noted. The GSA Boards will decide in a public process on the timing and schedule of PMAs based on a variety of considerations including but not limited to subbasin conditions, PMA readiness and funding availability.
16	Eric Lundberg	Public Comments	GSP 6.1		5096 - 5131	These costs seem to be a duplication of the work that Butte County Water Resources already does. I would reduce these costs and work with BCWR department.	Comment noted. The County is a member agency of the Vina GSA and serves on the GSA management committee. The County will work with the GSA to clarify its role and minimize duplication of work efforts, as appropriate.
17	Eric Lundberg	Public Comments	GSP 6.5		5210	I would recommend annual reports to be submitted by February 1 instead of April 1. April 1 reporting does not allow adequate time for management actions to be taken before seasonal irrigation begins.	Comment noted. The content of the Annual Report and timing of its submission may be considered in the future by the GSA Boards.
18	Ernest & Sharon Robinson	Public Comments				Thank you for giving us an opportunity to support the sustainable groundwater management act up for the required adoption by January 30, 2022. We are residents of Durham since 2007 and have our own well. We hope our support will help but our senior years hopefully will continue here in Durham.	Comment noted. Thank you for participating.
19	Scott Brady	Public Comments			ES 8	Figure ES 8 suggests that management of the aquifer will deplete the aquifer more rather than restore it to a higher level. The draft plan's measurable 20objective is too low. Our objective should be to restore the aquifer to a level close to its historical average, ideally 120 feet above mean sea level, not further deplete it.	Comment noted. The commenter notes their concern that the Measurable Objective is too low and should be more in line with historical conditions. See MO/MT Master Response.
20	Scott Brady	Public Comments			Executive Summary	The attachment from page 10 of the Executive summary identifies the sustainable yield of pumping for agricultural use at 233,000 AF/year. This is not sustainable. While less than the current rate of pumping, 244,000 AF/year, there is a strong possibility/ probability that pumping at this level will further deplete the aquifer. This is especially true if the so-called "drought" really reflects the "new abnormal" of climate in the North Valley. Restoring and carefully stewarding this irreplaceable resource should lead to a more conservative estimate of sustained yield. Perhaps an 18% reduction in the existing pumping rate to around 200,000 AF/year would be a reasonable starting point. After all, Californians have been asked by Gov Newsom to reduce water use by 18% due to the drought. Let's start there as a sustainable yield.	Comment noted. Historical groundwater level data and observed declines were used to estimate the volume of water associated with the 20-year declining trend. Section 2.3.6 describes the data and approach used to estimate Sustainable Yield. Although water budget estimates are useful, sustainability of the subbasin is *demonstrated* through monitoring and the avoidance of undesirable results relative to each sustainability indicator. Future work and updates to the GSP may refine the Sustainable Yield.
21	Cliff Jacobson	Public Comments				Please review your use of the proposed PID intertie language in your plan. At this point, there is no planned PID Intertie. By your organization and everyone else, including the proposed Tuscan water district, constantly referring to available surface water from the Campfire, you are doing a big disservice to the residents of Paradise. Please stop	Comment noted. The suggestion will be considered in future revisions or updates of the GSP.
22	Grace Marvin	Public Comments				Do not see view any failure of wells as acceptable, i.e., 10 % of wells going dry is unacceptable. We should have minimum groundwater levels that improve over the years to protect humans and nature.	Comment noted. See MO/MT Master Response
23	Grace Marvin	Public Comments				We need to protect the ownership of water by the county. Therefore, we cannot accept artificial recharge, since those doing the recharging come to own the groundwater. We do not want the profit motive, e.g., through private or corporate ownership, since that would mean that there would be an incentive to transfer water out of our county and the north state.	Comment noted.
24	Susan Schrader	Public Comments			3306, Figure 3-2	First of all, I appreciate how thorough this document is. It is evidence of hard work and effort. However, i do have concern about the Minimum Threshold. When I look at Figure 3-2, Line 3306, our "current conditions" seem safely above the Measurable Objective (MO) and significantly above the Minimum Threshold (MT) where undesirable results may begin to occur. I think that by the time we get to the MT two years in a row in non-dry years, it will be too late. I notice adverse effects already as domestic wells dry up and trees die around town.	Comment noted. See MO/MT Master Response.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
25	Susan Schrader	Public Comments				I've heard that the reason to set the MT so low is so that it will never be reached and, therefore DWR won't come in and take over. I think that is dangerous reasoning if true. We need to have a contingency plan as to what steps will be taken to mitigate undesirable results long before we get to the MT. This prediction for rain this year is tenuous for our area. La Nina will bring drier, warmer temperatures to the southwest and colder, wetter weather to the north. 26We are in the middle and given an even chance for either to occur in our area. I think the MT needs to be set higher to avert water shortage disaster.	Comment noted. See MO/MT Master Response
26	Julian Zener	Public Comments				At the October 4th workshop on the Vina public draft GSP, Dr. Christina Buck indicated that approximately 40 residential wells had already gone dry in the Vina sub basin. I fail to understand the rational or humanity of intentionally letting this number increase, probably exponentially, in the next year or two before any of the proposed GSP mitigation actions are taken. Yes, I understand that it takes time to implement structural portions of the GSP but conservations measures can be enacted almost immediately. Agricultural irrigation efficiency and if needed fallowing would achieve more than half of the needed 10,000 acre feet projected to reach sustainability. Please increase the measurable objective ground water level to avoid major hardship for residential well users and potential harm to our urban forest. Most likely, the drought will continue.	Comment noted. See Master Response MT/MO
27	Kathy Watje (1)	Public Comments				I attended the Public Review Groundwater mtg. on Oct. 4, 2021 last Monday at the Masonic Lodge. The audience was invited to submit comments. I learned if "we" don't come up with anything doable the State will come in and dictate to Northern Californians what to do. We certainly don't need any more government overreach than we already have. Since this is supposed to be a 20-year sustainability plan and regardless of weather conditions, droughts, etc. we are supposed to figure out how to keep our groundwater levels at a level so all people have water who need it; whether it's the farmers or homeowners. I don't see how that can be done if the State of California, as a whole, keeps importing hundreds of thousands of people into our state and building more and more housing for them. This is a statewide issue and it becomes Northern California's issue because it is my understanding that we either sell or give water to the southern part of the state. As far as Northern California, Chico in particular, the city planning department or city council (I don't know which entity makes these decisions) has allowed hundreds if not close to a thousand new homes to be built in Butte County. There has to be a limit as to how many more homes can be built in these Northern Californian counties over the next 20 years if we are to maintain the water levels we say will be sustainable in our reports.My guess is it is all political and people trying to capitalize on making millions of dollars, particularly developers, by purchasing vacant land that is either not farmable for one reason or another or that the green belt lines are being ignored by the politicians. These developers need water for the homes they are building and I assume they dig massively deep wells in order to provide that water. There seems to be Zero regulation regarding this and that has to stop or we will never have enough water in Butte County or Northern California to be sustainable.Thank you and I hope your committee receives a good number of comments that help in this very important decision ahead for Northern California.	Comment noted.
28	Pam Stoesser (1)	Public Comments	3			I would like to speak to the subject of Minimum Threshold (MT) and what is shown in Section three of your Draft Plan. During the Public Workshop held in Chico on Monday Oct 4, the audience was told that the current groundwater sustainability MT for the Vina Subbasin is to be set at 50 feet below our historical lows. The chart doesn't show that number but it was told to us verbally by the staff. We were also told those historical lows are now, during this current severe drought. Many people spoke out in opposition to this setting. Here is how you bullet point the MT in your Plan: *MT– Quantitative threshold for each SI used to define the point at which undesirable results may begin to occur.* This is not accurate. We are already seeing undesirable results at our current groundwater levels. So I take great issue with the idea that what is happening now, at our current groundwater levels (not the MT set at 50 feet lower), i.e. domestic wells going dry, streams and rivers extremely low, and our struggling and dying trees, would not be considered undesirable results under this setting. That before the alarm goes off, things would have to get a lot worse. If the MT setting remains at 50 ft below current levels, I believe the wording of that definition needs to change to something like: *MT– Quantitative threshold for each SI used to define the point at which the level of undesirable results already occurring is unacceptable* (and then expressly state that actions are to be taken to insure we do not reach that point). I would rather see the MT set higher. I understand the argument against moving this number up, something to do with alarming the state to step in too soon. But if the number isn't moved up, there needs to be additional clarification added about what happens within the Margin of Operational Flexibility. Specifically what actions start happening when, as soon as we get below the green line into the Margin of Operational Flexibility. We cannot allow ourselves the chance of taking our	Comment noted. See MO/MT Master Response

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
						groundwater levels down another 50 feet! A statement providing the intention of not reaching the MT is nowhere to be found. Please add.	
29	Pam Stoesser	Public Comments				See Vina DRAFT GSP Comment P2	Comment noted. The commenter notes their concern about the effects of water management on the environment. The commenter also provides suggestions on the prioritization of the projects and management actions identified in Section 6 of the GSP. However, the commenter does not raise specific technical or policy issues with the Plan; no changes have been made to the GSP.
29	Pam Stoesser	Public Comments				See Vina DRAFT GSP Comment P3	Comment noted. Thank you for providing the article. It has been included as part of the Responses to Comments documentation.
30	J. Pablo Ortiz-Partida, Ph.D.	NGO Consortium				See Vina DRAFT GSP Comment A1 1. Beneficial uses and users are not sufficiently considered in GSP development (DACs, tribes, Domestic well information) nor are the indirect impacts on them described or analyzed sufficiently. 2. Interconnected Surface Waters - lack of supporting information provided for the ISW analysis, lack of clarity regarding which stream segments are retained as ISWs or potential ISWs in the GSP. 3. GDE – lack of analysis of groundwater data to verify the NC dataset polygons, some incorrectly removed in areas adjacent to irrigated fields or due to the presence of surface water supplies, lack of discussion regarding the flora or fauna species present in potential GDEs 4. Water Budget - the current and projected water demands for managed wetlands, (approximately half the historical water demands) need justification and the water budget model documentation is not provided 5. Stakeholder Engagement – A description of the active and targeted outreach to engage DAC members, drinking water users, environmental stakeholders and consultation to tribes during all phases of the GSP process is lacking. 6. Water Quality - Comments expressed the opinion that Water Quality MTs should address other constituents, rather than just electrical conductivity and discuss impacts on beneficial users. 7. Potential impacts on environmental beneficial uses and users, GDEs and instream habitats from the MOs/MTs need to be considered when defining undesirable results. 8. Climate change is not sufficiently considered. 9. Data gaps are not sufficiently identified and the GSP does not have a plan to eliminate them. 10. Projects and Management Actions do not sufficiently consider potential impacts or benefits to beneficial uses and users.	1. Thank you for these recommendations, a map of tribal lands and a map showing domestic well depths have been added to the GSP. Additional suggestions will be considered in future revisions or updates of the GSP. 2. Please see Interconnected Surface Waters Master Response. 3. Please see GDE Master Response. 4. The Butte Basin Groundwater Model (BBGM) documentation has been updated as part of the GSP development effort and is now available. The BBGM model documentation is included as a reference document of the GSP. Land use data, other than 2014 and 2016, is based on Department of Water Resources ground-based surveys from the Northern Region Office. For 2014 and 2016, satellite-based land use mapping developed by LandIQ was used. A significant reduction in managed wetland acreage occurs in the land use estimates beginning in 2016. This drives the drop reduction in ET and groundwater pumping associated with managed wetlands. If corrections or refinements are needed to model inputs, these can be addressed through model updates which are a planned activity of GSP implementation. 5. Thank you for your comment, additional refinements will be considered in future revisions or updates of the GSP. 6. Thank you for your comment, additional refinements will be considered in future revisions or updates of the GSP. 7. The GSP is not intended to address all groundwater quality conditions in the Subbasin; rather it sets a baseline to assess whether future actions taken by the GSAs may impact groundwater quality. Thank you for the additional specific recommendations regarding consideration of beneficial uses and users. The GSA Board(s) will consider these recommendations as the GSP is implemented and as updates to the GSP are made in the future. 8. Please see the MO/MT, GDE and Interconnected Surface Waters Master Responses. 9. The GSA Boards will consider these recommendations to the GSP in the future. 10. Thank you for this recommendation. Staff have included revisions to this section in the final GSP based on the GSA Boards direction provided in November 2021. The GSA Boards may consider additional updates to the plan in the future.
31	April Dorman	CDFW				See Vina DRAFT GSP Comment A2 <u>GDE Comments</u> 1. Potential GDE areas were classified as "Not Likely a GDE" if the areas were located within 150 feet of perennial surface water supplies, 150 feet of rice fields, 50 feet of other irrigated agriculture, or 150 feet of agricultural-dependent surface waters. This GDE-elimination method may disregard a GDE's adaptability and opportunistic approach to accessing water in which the vegetation may rely on both surface water and groundwater between seasons and years.	GDE Comments - See GDE Master response. SMC Comments – See SMC Master response Monitoring Network Comments - See GDE Master response PMA Comments - Thank you for this recommendation. Staff have included revisions to this Section in the final GSP based on the GSA Boards direction provided in

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
						2. The GDE analysis also classifies potential GDEs from the NCCAG dataset as "Not Likely a GDE" if the vegetation "did not indicate surviving conditions" over the four drought years reviewed for the analysis. During drought years, it is likely that GDEs were experiencing adverse impacts due to combined groundwater depletion and reduced surface water availability 3. The GSP does not identify or discuss species that may be present within the subbasin that rely on groundwater, groundwater dependent ecosystems, or interconnected surface waters. 4. In discussing potential impacts of groundwater depletions on GDEs or interconnected surface waters, the GSP refers to "deep rooted tree species" (lines 189, 3406, 3698). This phrasing is narrow and excludes consideration of all vegetation types that may be groundwater dependent or supported by interconnected surface waters apart from tree species. 5. In discussing potential impacts of groundwater depletions on GDEs or interconnected surface waters, the GSP refers to "deep rooted tree species" (lines 189, 3406, 3698). This phrasing is narrow and excludes consideration of all vegetation types that may be groundwater dependent or supported by interconnected surface waters apart from tree species. <u>SMC Comments</u> 1. Use of groundwater levels as a proxy metric for ISW depletions may misinform groundwater management activities and poorly predict instream habitat conditions for fish and wildlife species 2. ISW Framework does not discuss the methods that will be used to identify the number or locations of groundwater monitoring wells or stream gages. 3. Minimum thresholds (MTs) and measurable objectives (MOs) for groundwater levels, and by proxy for depletions of interconnected surface water, are not likely to prevent undesirable results for environmental beneficial uses and users of groundwater and interconnected surface water, including groundwater dependent ecosystems. 4. The GSP does not include any discussion or analysis of whether the established SMCs sufficiently avoid identified potential impacts to GDEs or environmental users of interconnected surface waters, and proposed indicators of undesirable results (i.e., SMC) for groundwater levels. Depletions of interconnected surface water effectively do not exist for dry water years. no groundwater management accountability during increasingly prevalent and challenging periods of dryness. 5. The GSP states that for the established SMCs, if observed data "trend toward the locally defined MT, this will trigger action on part of the GSAs." It is unclear over what time period data will need to be collected in order to establish a 'trend' toward the SMCs, and what action will be triggered. <u>Monitoring Network Comments</u> 1. It is unclear whether any of the selected groundwater level monitoring wells are located near areas with likely groundwater dependent ecosystems and if plan implementation will involve comparing water depths in representative monitoring sites to the rooting depths of nearby GDE communities. <u>PMA Comments</u> 1. The GSP should include details on specific metrics, targets, and timelines that if not reached with implementation of the planned PMAs will trigger the implementation of additional PMAs. <u>Interconnected Surface Water Comments</u> 1. No discrete time schedule is provided for installation of necessary groundwater wells and stream gages, refinement of the characterization of interconnected surface waters within the subbasin, and updates to the SMCs.	November 2021. The GSA Boards may consider additional updates to the plan in the future. Interconnected Surface Water Comments - See Interconnected Surface Water Master response.
32	Vita Segalla	Public Comments				See Vina DRAFT GSP Comment P1	Comment noted. The commenter notes their support for changing the minimum threshold and a suggestion for changing agricultural management practices. However, the commenter does not raise specific technical or policy issues with the Plan.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
33	Darren Rice	RCRD		5.2.3.4		PMA regarding Flood MAR. RCRD requests that methods of MAR considered under this PMA include direct injection via wells as a method of MAR. We recognize that this form of MAR may include additional characterization and impacts analysis as part of scoping. Flood MAR/Surface Water Supply and Recharge Scoping Under this project, Vina GSA and RCRD GSA will expand on the Flood MAR initiative, which was originally developed by the DWR to promote recharge programs that use fields, recharge basins, new or existing well structures and/or recharge ponds to divert high flows in creeks and streams. Individual recharge projects will eventually occur, but this particular project will focus on the initial scoping and identify specific recharge opportunities in the Vina Subbasin. At first, Vina GSA and RCRD GSA will focus their efforts on areas with the greatest need for recharge and seek grants and other funding sources to implement the projects. Interested landowners would be identified and participation in the program would be voluntary. Estimated Groundwater Offset and/or Recharge: Not applicable. Future recharge projects are possible based on results of scoping. Measurable Objective Expected to Benefit: Future increase of groundwater levels Project Status: This project is in the planning stages. Required Permitting and Regulatory Process: N/A Timetable for Initiation and Completion: 2022-2032 Expected Benefits and Evaluation: This project would develop the first steps of the Flood MAR initiative and recharge efforts for the Vina Subbasin region and identify specific groundwater recharge and management projects based on feasibility, need, and available funding. The initiation of this project would then lead to future recharge projects. How Project Will Be Accomplished/Evaluation of Water Source: This project will help to identify and develop specific recharge projects in the region, which will then individually determine recharge sources. Legal Authority: The project would be under the authority of the Vina GSA and RCRD GSA. Estimated Costs and Plans to Meet Costs: TBD, funding via Proposition 1 and Proposition 68 Circumstances for Implementation: This project is a Planned Project that is anticipated to move forward. Trigger for Implementation and Termination: None Process for Determining Conditions Requiring the Project to Occur: This is a Planned Project that is anticipated to move forward.	Comment noted. Projects or Management Actions can be included or amended in the GSP by the GSA Boards in the future after initial GSP adoption.
34	Rich McGowan	AGUBC				See Vina DRAFT GSP Comment A3 1. Support provided for the MOs/MTs for groundwater levels 2. Data gaps exist and should be discussed in the future with stakeholders, including but not limited to the SHAC, Butte County Farm Bureau and the AGUBC 3. Additional clarity regarding Groundwater Allocation should be included in the GSP along with an updated Appendix number and a description of the decision making process the GSA Boards will take in regards to this Management Action. 4. The GSP should remove the use of the phrase " suitable habitat" and provide clarity regarding the use of the term "environmental uses" with specific language proposed in the letter, Additional clarification is needed as indicted in the comment tracking sheet provided, with the comments re: Section 2 lines 3212-3225 and Section 5 lines 4477-4506 highlighted.	1.Thank you for your comments. 2. Thank you for your comment. The GSAs will continue to engage and encourage stakeholder participation and input throughout GSP implementation. 3. Staff have included revisions to this Section in the final GSP based on the GSA Boards direction provided in November 2021. The GSA Boards may consider additional updates to the plan in the future. 4. Thank you for this recommendation. The GSA Boards will consider this suggestion when GSP updates are made in the future. 5. Please see individual responses to each comment noted above.
35	Rich McGowan	AGUBC	ES		Lines 223 - 225	The draft GSP states that undesirable results occur if Minimum Thresholds (MTs) are exceeded in "… an established percentage of sites in the Subbasin's representative monitoring network." Have the GSAs established that percentage? If so, we request that the GSP include that percentage. If not, the GSAs should determine a percentage. Upon review of other draft GSPs in the Northern Sacramento Valley, we have found GSAs that suggest 25% for this purpose.	The GSAs did not establish the MT based on a specified percentage of wells being less than a certain depth. The methodology for establishing the MT is described in Section 3.3.2. See MO/MT Master Response.
36	Rich McGowan	AGUBC	ES		Table ES-1	We are generally supportive of the methodology used to determine the Measurable Objectives (MO) and MTs for groundwater levels in the Vina North and Vina South management areas, as stated. However, there is only 20 feet of operational flexibility for Representative Monitoring Sites (RMS) 21C001M for the Vina South management area. We recommend that this area be re-visited to consider lowering the MT to allow for more operational flexibility, recognizing that the goal is the MO.	Thank you for your comment. In the public review draft, there are errors in Table ES-1. It should be consistent with Table 3-1. These corrections have been made to the final document and result in an operational range of 54 feet for well 21C001.
37	Rich McGowan	AGUBC	ES		Figure ES-10	This figure appears to depict 16 RMS wells instead of 17 RMS wells, as noted preceding page. We request that the GSAs verify the correct number of RMS wells and correct, if needed.	Thank you for your comment. The GSP defines 17 RMS wells. In the public review draft, one is missing from Figure ES-10. This has been corrected in the final document.
38	Rich McGowan	AGUBC	Ch. 2		Lines 2902 - 2903	This section considers 243,000 AFY of groundwater pumping as "outflows" but the figure on this page seems to categorize this amount as "inflows." We request that the GSAs verify this amount and correct the information, if needed.	There is a figure for the Land and Surface Water System (Figure 2-33) and one for the Groundwater System (Figure 2-34). Groundwater pumping is an "inflow" to the land and surface water system (due to irrigation, groundwater is used to meet water demands in this system) and an outflow from the groundwater system. Although easily confusing, the text and figures describe this correctly.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
39	Rich McGowan	AGUBC	Ch. 2		Lines 3212 - 3225	We do not disagree with the draft GSP's conclusion that the sustainable yield is 233,000 AFY and the decrease of storage is 10,000 AFY. However, the explanation of the average specific storage value and range of storativity values is unclear, especially because Table 2-11 does not have a value of 233,000 AFY to point to as the estimated sustainable yield. We request that the GSAs revise this language to clarify the explanation regarding average specific storage value.	Thank you for this recommendation language was added to clarify the explanation regarding average specific storage value.in the final GSP.
40	Rich McGowan	AGUBC	Ch. 5		Lines 4388 - 4398	The following bullet points should be inserted in this section: (1) "Project Status" should be added after "The Measurable Objective benefitted by the project." (2) "Process to Determine conditions requiring project to occur" should be added after "Implementation circumstances." Finally, the "Public noticing" bullet point at Line 4398 is not included in the project descriptions, so it should either be added to each description or removed as a bullet point in this section.	Thank you for this recommendation. The GSA Boards will consider this suggestion when GSP updates are made in the future.
41	Rich McGowan	AGUBC	Ch. 5		Lines 4399 – 4400	Figures 5-1 and 5-2 show locations of planned and potential projects, but the figures do not seem very useful for that purpose as many projects seem to apply throughout the Subbasin. If the figures are left in, then the concept that no specific location applies at this time needs to be better described and presented in Figures 5-1 and 5-2.	Thank you for this recommendation. Staff agree the PMA figures should not be included and have made this revision in the final GSP.
42	Rich McGowan	AGUBC	Ch. 5		Figure 5-1	The project number in the table on the bottom left-hand side of this figure should reflect the same order as they are listed in Section 5. We request that the GSAs revise this figure to reflect this ordering. Further, we recommend that the GSAs revise "Flood-MAR" to "Flood-MAR Scoping" and "Additional Water to Creeks and Streams" to "Streamflow Augmentation." The names of the projects should be the same as listed in Section 5. Finally, two of the five projects identified in this figure (Agricultural Irrigation Efficiency and Flood-MAR Scoping) seem to apply throughout the Subbasin as opposed to specific locations, but the representation in this figure does not make that clear. We request that the GSAs revise this figure, accordingly.	Thank you for this recommendation. Staff agree the PMA figures should not be included and have made this revision in the final GSP.
43	Rich McGowan	AGUBC	Ch. 5		Figure 5-2	We recommend that the GSAs add the following projects to the table on the bottom left-hand side of this figure: (1) "Community Monitoring Program" should be added after "Recharge from the Miocene Canal;" and (2) "Surface Water Supply and Recharge" should be added after "Removal of Invasive Species". Further, it is unclear whether the position of Numbers 10, 11, 12 and 13 at the northwest part of the Subbasin indicate that these projects would occur throughout the Subbasin. If so, then we recommend that the GSAs clarify that information. If not, then we do not believe that those will necessarily occur in that location or that their implementation will be limited to that location. If the position of these numbers is to identify projects that may occur throughout the Subbasin and/or do not have specific locations at this time, that should be applied to "Extend Orchard Redevelopment" and "Surface Water Supply and Recharge" as well, if not others. In addition, the location identified in the figure for "Agricultural Surface Water Supplies" is misleading because it would only be a *possible* location while there is a very real possibility that it could occur in other locations.	Thank you for this recommendation. Staff agree the PMA figures should not be included and have made this revision in the final GSP.
44	Rich McGowan	AGUBC	Ch. 5		Line 4418	The results of the survey mentioned in this section were not made available in September 2021. The GSAs should revise this language to reflect the month when the GSAs reasonably expect the results of this survey to be available.	Thank you for this recommendation language was added to clarify this in the final GSP.
45	Rich McGowan	AGUBC	Ch. 5		Lines 4477 – 4506	The "Streamflow Augmentation" project should be categorized as a "potential project" instead of a "planned project." The draft GSP expressly provides that this project is "in the planning stages." (Pg. 144, Line 4488.) Further, the draft GSP provides that before the project is started, a feasibility study must first be performed to "ensure that enough surface water would be available." Therefore, until this feasibility study is performed and its results are evaluated, it is premature to include this project as a "planned project."	Thank you for this recommendation. Staff have included revisions to this Section in the final GSP based on the GSA Boards direction provided in November 2021. The GSA Boards may consider additional updates to the plan in the future.
46	Rich McGowan	AGUBC	Ch. 5		Line 4479	The project references transportation of excess untreated surface water from PID. Is this the same as what is contemplated by the PID Intertie project described later as a Potential Project? If so, it should either be removed here or the PID Intertie project should be removed since the references are duplicative.	Thank you for this recommendation. Staff have included revisions to this Section in the final GSP based on the GSA Boards direction provided in November 2021. The GSA Boards may consider additional updates to the plan in the future.
47	Rich McGowan	AGUBC	Ch. 5		Line 4498	Regarding the "Streamflow Augmentation" project, it is unclear how the GSA determined an estimated fee of $50 to $100 per acre-foot for surface water supplies when a feasibility study has yet to be performed. If the GSA has not determined whether surface water is even available, how can it determine the fees associated with its purchase? Until this feasibility study is performed, we request that this estimated fee be removed.	Thank you for this recommendation. Staff have included revisions to this Section in the final GSP based on the GSA Boards direction provided in November 2021. The GSA Boards may consider additional updates to the plan in the future.
48	Rich McGowan	AGUBC	Ch. 5		Lines 4639 - 4640	This section is not clear as to the sources of the 20% efficiency number. We request that the GSAs provide additional clarity regarding its establishment of this number.	Thank you for this recommendation. Staff have included revisions to this Section in the final GSP based on the GSA Boards direction provided in November 2021. The GSA Boards may consider additional updates to the plan in the future. The project recharge estimates will be refined in the future once implemented.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
49	Rich McGowan	AGUBC	Ch. 5		Lines 4695 – 4697	Why does this section limit the use of recycled wastewater to "non-crop vegetation in Chico?" Is there an established rule against this by the Regional Water Quality Control Board?	Thank you for this recommendation language was added to clarify this in the final GSP.
50	Rich McGowan	AGUBC	Ch. 6		Figure 6-1	We request that the GSAs change "Floor MAR," at ID 42, to ""Flood MAR Scoping." Further, we request that the GSAs amend the timeline associated with this project. Because this project is only a study, we do not believe that it should take eight to nine years to complete.	Thank you for this recommendation. Staff have included revisions to this Section in the final GSP based on the GSA Boards direction provided in November 2021. The GSA Boards may consider additional updates to the plan in the future.
51	Monroe Sprague	Public Comments	Chap 5	5.1	pg. 374	Public Vina GSP Comments This citizen of Butte County, Vina GSA, requests a paragraph be added to our GSP for an Interim Milestone Action Plan (IMAC) with more specific and earlier triggers for adjustment actions as recommended by Kamie Loeser, Director, Butte County Department of Water and Resource Conservation. The purpose would be to define smaller segments in Operating Range on the hydrologic graph, example page 374, and raise our effective or functioning Minimum Threshold level. Our Real Objective should be to continue in the water level range we have had since 1975, which is above the Measurable Objective. Why would we want to use up or kill part of the goose that is giving us our golden aquifer? If we want to grow, increase productivity, etc., we need to use our eggs better. Thank you for working to maintain our public natural resource.	Thank you for this recommendation. Staff have included revisions to this Section in the final GSP based on the GSA Boards direction provided in November 2021. The GSA Boards may consider additional updates to the plan in the future.
52	Samantha Arthur	Audubon California				See Vina DRAFT GSP Comment A4 1. The GSP identifies managed wetlands in maps and water budgets, yet details regarding assumed acres and ET rates are lacking. 2. Concerns that future conditions inadequately account for the water needs of managed wetlands 3. Lack of information regarding water needs for managed wetlands should be identified as a data gap. 4. Reduction in water from the historic to current and future water budgets for managed wetlands point to a serious reduction in habitat acreage or function	The comment letter refers to their review of documentation of the Butte Basin Groundwater Model (BBGM) and a lack of detail in the GSP regarding ET rates and acreages for managed wetlands. The BBGM documentation has been updated as part of the GSP development effort. Some of the details requested by the comment letter are available in this updated report. Land use data other than 2014 and 2016 is based on Department of Water Resources ground-based surveys from the Northern Region Office. For 2014 and 2016, satellite-based land use mapping developed by LandIQ was used. A significant reduction in managed wetland acreage occurs in the land use estimates beginning in 2016. This drives the drop off of ET and groundwater pumping associated with managed wetlands. If corrections or refinements are needed to model inputs, these can be addressed through model updates which are a planned activity of GSP implementation. It should be noted the GSP is a planning document to achieve groundwater sustainability; the GSAs are not responsible for developing water supplies to meet demands of managed wetlands. For the updated model documentation, the commenter is referred to: Butte County Department of Water and Resource Conservation. 2021. Model Documentation v 1.0. Butte Basin Groundwater Model. 30 November. The GSAs thank Audubon for their offer to participate in scoping Flood MAR/Surface Water Supply and Recharge projects. The GSA Board(s) will consider their recommendations as the GSP is implemented and as updates to the GSP are made in the future.
53	Annette Faurote	Public Comments				See Vina DRAFT GSP Comment P4	Please MO/MT Master Response. The commenter opines that the GSP does not adequately address sustainability, that the operational range between the measurable objective and the minimum objective is too large, and identifies concerns for domestic wells and loss of urban forests due to lowering groundwater levels. However, the commenter does not raise specific technical or policy issues with the Plan. The commenter also asks if an environmental impact report (EIR) has been prepared for the GSP. Pursuant to Water Code Division 6, Part 2.74, Section 6, Section 10728.6, the California Environmental Quality Act (CEQA) is not applicable to the development of a groundwater sustainability plan. However, the implementation of subsequent projects and management actions will be subject to the California Environmental Quality Act (CEQA) and the appropriate environmental studies and documents will be prepared as part of the approval process of future projects and actions.
54	Holly Dawley	GCID				See Vina DRAFT GSP Comment A7	Please see the Interconnected Surface Waters Master Response and Inter-basin Coordination Master Response. The commenter, a member of three GSAs, confirms

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
							their support of the GSPs. However, they express concerns about groundwater and surface water interactions and a particular area of concern regarding stream-aquifer interactions and the potential impacts from unrestricted groundwater pumping. Specifically, the commenter states that there is over 1 million acre-feet per year of groundwater pumping from adjacent subbasins. The commenter requests that the GSA consider their concerns but does not specifically identify, or ask for, revisions be made to the GSP.
55	Margaret Scarpa	Butte Environmental Council				See Vina DRAFT GSP Comment A5 1. Concerned that the basin setting does not take into account climate change and the changing water supply and overestimates the water supply available for recharge. 2. Concerned that the City of Chico Urban Forest is not included as a potential Groundwater Dependent Ecosystem 3. Demand management and reuse of water need to be prioritized demand management projects need to be implemented before any water supply expansion projects are implemented. 4. Other – Support for the following projects (Wastewater Recycling Project, Residential Conservation Project, Agricultural Irrigation Efficiency Project, Community Monitoring Program and Community Water Education Initiative, Rangeland Management and Fuel Management for Watershed Health Projects, Removal of Invasive Species Project) and Inclusion of Valley Oaks in the Sustainability Indicators.	1. Comment noted. Although water budget estimates are useful, sustainability of the subbasin is *demonstrated* through monitoring and the avoidance of undesirable results relative to each sustainability indicator. The GSA Board(s) will consider these concerns as the GSP is implemented. 2. Please see GDE Master Response 3. Thank you for this recommendation. Staff have included revisions to this Section in the final GSP based on the GSA Boards direction provided in November 2021. The GSA Boards may consider additional updates to the plan in the future. 4. Comment noted
56	Michael Bolzowski	Cal Water	1	1.3.5.2	941	The GSP references that Cal Water published our UWMP in 2007 as written in the Chico 2030 General Plan, which was published in 2010. We may want to have a line added that the latest UWMP was just published in 2020.	Thank you for this recommendation language was added to clarify this in the final GSP.
57	Michael Bolzowski	Cal Water	1	1.3.5.2	944	The Master Plan will be updated in the near future along with a Reliability Study being planned for 2023 for the Cal Water Districts in the region.	Thank you for this recommendation language was added to clarify this in the final GSP.
58	Michael Bolzowski	Cal Water	2	2.3.8	3226	The GSP does not specify a sustainable pumping yield. Line 82, the estimated sustainable yield for the Subbasin is 233,000 acre-feet per year and from Line 1392, Vina Subbasin Sum of Acres is 184,918 acres, This will give a pumping yield of 1.26 AF/acre. It may be good to have this shown in the report, though this maybe an oversimplification of the current conditions.. This can be added to eh recommendation of next steps as a future refinement.	Comment noted. The GSP Regulations require an estimate of Sustainable Yield which is provided and described in Section 2.3.6.
59	Anne Dawson	Vina SHAC	Exec Summ.		254	The Vina Chico area MTs are established in accordance with the statement on Line 223. But the methodology used to establish the MTs for Vina North and Vina South are not discussed. What led to choosing a level of, say, 70ft bgs instead of 60ft? Was a percentage of domestic wells included in this? The word "majority" is included but not defined.	The statement was revised in the GSP to accurately reflect the methodology for establishing the MT. The Methodology for establishing the MT is described in Section 3.3.
60	Anne Dawson	Vina SHAC	Exec Summ.		Table ES-1	Vina North has 2 RMS wells demonstrating Operating Margins of 80+ ft. This is excessive and unnecessary.	Comment noted. See MO/MT Master Response. The commenter notes their concern with the large Operational Range due to the level of the MT.
61	Anne Dawson	Vina SHAC	Exec Summ.			The first well in Vina South has the wrong number attached to the MT.	Table ES-1 has been corrected to be consistent with Table 3-1
62	Anne Dawson	Vina SHAC	Exec Summ.			Again the Operating margins in Vina South are mostly over 60 ft.	Comment noted. See MO/MT Master Response. The commenter notes their concern with the large Operational Range due to the level of the MT.
63	Anne Dawson	Vina SHAC	Exec Summ.			I believe these massive operating ranges will come back to haunt us. We may be inviting the state to encourage surrounding basins to surrender their surface water and use GW. That depletes our aquifer, but it would have little effect on our GSP which will likely remain in compliance because the MO and MT are separated by such a large margin. Bottom line, I think we are risking a state takeover of our GW.	Comment noted. The commenter notes their concern with the large Operational Range due to the level of the MT.
64	Anne Dawson	Vina SHAC	Chap 5	5.3.2	4948	I suspect the info described will be difficult to obtain. I believe we need to define a "sustainable" well. Perhaps current Butte County rules and well standards might be used to establish what is sustainable. Pre-1980 wells may have been deepened and are functioning just fine. They should be included. I would like to see a plan to financially help ALL domestic well owners impacted by SGMA. We use 4% of the GW but are being landed with almost 100% of the costs.	Comment noted. The Domestic Well Mitigation Management Action applies to all domestic wells and is based on voluntary participation.
65	Anne Dawson	Vina SHAC	Chap 3	3.1	3341-44	Demand reduction is absent.	Sections 5.3 and 5.4 describes the full suite of projects and management actions, including Groundwater Allocation, that will be considered by the GSA Boards in the future to meet the Sustainability Goal.
66	Anne Dawson	Vina SHAC	Chap 3	3.3.2	3414	Please consider changing this line to read "going dry or remaining dry during non-dry year conditions"	Thank you for your review and suggestion. See MO/MT Master Response.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
67	Anne Dawson	Vina SHAC	Chap 5	5.5		This plan has very generous operating margins. We are putting all our faith in a plan that will undoubtedly have shortcomings, and drought remains unpredictable. I am concerned that we have no backstop. If the plan is failing our remedies will have to employ demand reduction. This would be a contentious topic. It already takes a long time to get updated GW levels, it will take months to establish what to do if we are at risk of failing, and probably years to agree on the details. None of us wants to have to resort to demand reduction. But we don't want to have a delay of years in implementing a remedy. So let's put in place some guidelines to trigger a response. Then, if we have to act on it, we'll be able to proceed faster and those demand reductions would be lifted sooner.	Comment noted. The GSA Boards will decide in a public process on the timing and schedule of PMAs based on a variety of considerations including but not limited to subbasin conditions, PMA readiness and funding availability.
68	Jim Graydon	Private Well Owner	3. Sustainable Management Criteria	3.3 Groundwater Levels Sustainable Management Criteria	Table 3-1	Proposed MT and MO for Lowering Groundwater Levels in the Chico Management Area are too low to protect against undesirable results. Consider revising definition of MT and MO to derive more protective trigger values. I am aware of four domestic supply wells within 1 mile of CWSCH02 which were constructed in 1986 to County standards and are less than 100-ft total depth bgs (approx. 88-ft amsl). The current water level in the localized area as of October 2021 is at the MO of 105-ft elevation amsl. The operational flexibility range gives approximately 1 more drought year before these wells go dry at an elevation above the MT.	Comment noted. See MO/MT Master Response.
69	Jim Graydon	Private Well Owner	3. Sustainable Management Criteria	3.5 Water Quality Sustainable Management Criteria	Table 3-2	The water quality in the Chico Management Area has been documented to be high quality as it relates to dissolved solids. With specific conductance typically below 300 uS/cm, the proposed MO of 900 uS/cm allows an unacceptable level of degradation before action is initiated. Recommend setting MO to at a level such that action is taken before water quality approaches the secondary MCL. Setting the MO somewhere between 500-600 uS/cm with an MT between 900-1,000 uS/cm is warranted to protect agricultural water quality.	Comment noted. The GSAs, in setting the Water Quality SMC, committed to managing groundwater quality in line with the State Secondary Drinking Water Standards at each RMS Secondary standards relate to aesthetic verses primary standards which are even higher values established to address health considerations. The RMS wells are screened at deeper depths below domestic wells and most agricultural wells and should provide an acceptable warning before water quality issues occur in these zones. Evaluations of these trends will be evaluated annually and re-assessed during the first 5-year review to evaluate if changes to the MO and MT should be proposed.
70	Jim Graydon	Private Well Owner	3. Sustainable Management Criteria	3.8 Interconnected Surface Water Sustainable Management Criteria		I encourage completion of the necessary studies to determine the principal factors impacting groundwater dependent ecosystems in the Chico Management Area. With additional local documentation, more specific and protective MT and MO can be set. Without riparian woodland and adjacent seasonal wetlands, Chico is a very different place.	Comment noted.
71	Jim Graydon	Private Well Owner	Section 4: Monitoring Network	4.9: Representative Monitoring Sites for Sustainability Indicator	Table 4-5.	The RMS Well Construction Details for the 5 wells chosen for monitoring in the Chico Management Area are lacking total depth and screened interval information. 4 of the 5 wells are CWS production wells that are no doubt screened across multiple aquifer zones. There are numerous wells in the total depth range of 100 to 400 feet within the Chico Management Area that have known depths and screened intervals that would better represent the conditions in the basin (See DTSC's EnviroStor database at https://www.envirostor.dtsc.ca.gov/public/). Consider adding 2-3 additional RMS wells with known construction to the monitoring program in the Chico Management Area.	Thank you for this recommendation. The RMS network may be reevaluated in the future per the Boards direction when GSP updates are made in the future.
72	Jim Graydon	Private Well Owner	Section 5: PMAs	5.2.3.3: Streamflow Augmentation	Line 4484-4485	Add Lindo Channel to the list of surface water drainages that would receive augmented flow to disperse the groundwater benefits throughout the basin	Thank you for this recommendation. Staff have included revisions to this Section in the final GSP based on the GSA Boards direction provided in November 2021. The GSA Boards may consider additional updates to the plan in the future.
73	Jim Brobeck (1)	Aqualliance	02 Executive summary	Section	49-51	"The interests and vulnerability of stakeholders and groundwater uses in these Management Areas vary based on the nature of the water demand (agricultural, domestic, municipal)" Water demand for the environment must be included. GDEs include upland and riparian valley oak groves, small stream flow, GD urban forests.	Comment noted. Thank you for participating.
74	Jim Brobeck (2)	Aqualliance	2		143-144	"groundwater use has increased and as forces ranging from population growth to climate change play out," This sentence ignores the fact that increased cross-boundary flows that may result from expanded demand west of the river (primarily agriculture and water-market-driven aquifer exercise) is at play. This threat to meeting our management goals must be acknowledged and addressed in inter-basin coordination/communication process yet to be developed.	Comment Noted.
75	Jim Brobeck (3)	Aqualliance			153-154	"Groundwater storage in Subbasin is relatively stable except in the areas noted above with depressions." The identification of localized hydrograph trends is relevant, but it is important to recognize long-term basin declines that occur due to cross-boundary flows influence the baseline water levels. In general (depending on soil conditions and strata) the greater the distance or depth of groundwater pumping and water levels in the VGSA, the lower the magnitude but the longer the timescale of depletions. As a consequence, the ultimate effects in the Vina of pumping in nearby sgma subbasins can occur significantly after pumping starts, or even after pumping has ceased. The timescales involved in aquifer responses to pumping and other stresses can be on the order of decades, making it difficult to associate cause with effect. As such,	This section was revised to be more consistent with descriptions of groundwater level trends and storage in the Basin Setting (Section 2). Available monitoring data and water budget estimates as described in the Basin Setting (Section 2) clearly indicate the Vina Subbasin is experiencing a declining trend in groundwater levels and corresponding storage due to pumping activities occurring within the subbasin. Water Budget analysis presented to the Vina GSA Board in May 2021 suggests a slight imbalance of pumping and recharge based on vertical flows

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
						monitoring must account for this lag in impacts. In general, the longer the timeframe for effects to be observed at a given monitoring point once they become evident, the longer those effects will persist.	alone. The GSP outlines projects and management actions to address this and the GSAs are committed to managing groundwater sustainably in the subbasin. Additional analysis is needed to characterize the temporal and spatial impacts of neighboring subbasins. This is acknowledged in the GSP and Inter-basin Coordination will be critical for establishing the facts and the appropriate actions to address any identified inter-basin impacts. See Inter-basin Coordination Master Response.
76	Jim Brobeck (4)	Aqualliance			166-167	165 "If the water table beneath the stream lowers as a result of groundwater pumping, the stream may disconnect entirely from the underlying aquifer." A stream that ceases to flow once it enters the alluvial basin is entering the aquifer at that point. The deeper the aquifer level the more of the streambed is dewatered and the earlier. So while a stretch of the creek may be "disconnected" the creek itself is still connected. Mr. Toccoy Dudley, a Department hydrogeologist with the Northern District in Red Bluff, wrote in 2000: At any location in the basin, the gradient between the surface water and groundwater system is directly proportional to the head differences (water surface elevation difference) between the two hydrologic systems. The larger the head differences the higher the gradient and the higher the recharge rate....The shorter the horizontal distance over which the head change occurs increases the recharge rate dramatically. An example of this would be pumping next to a river would induce a much higher recharge rate from the surface water system than the same pumping many miles away.....increased extraction causes the groundwater levels to decline, which increases the head difference between the groundwater and surface water systems, and consequently increases the gradient and recharge rate. In short, the more you pump, the more you can pump, to a point. Anecdotal and archeological evidence indicates the small streams of the Vina SB were perennial during pre-pumping eras.	Comment noted. Commenter provides an opinion pertaining to stream-groundwater interaction and does not raise specific technical or policy issues with the Plan.
77	Jim Brobeck (5)	Aqualliance			249 figure ES-7	249 The sample hydrograph is one of several that I have reviewed in other parts of the GSP that have disturbing MO and MT levels. The MO is below the historic low, not the appropriate level to designate the top of the operational range. The MT as defined in other parts of the GSP, is purported to designate "the point at which Undesirable Results may BEGIN to occur." But undesirable results will begin much earlier in the operational range. The historic low of this hydrograph is above the 80' max rooting depth of native phreatophytes. The MT is significantly lower than 80' bgs. Furthermore, the lower water table will dewater longer reaches of streams earlier in the season and persist later in the year. The operational range proposed is pessimistic in meeting goals that would avoid triggering Undesirable Results. Wise resource management strives to improve conditions that have been degraded by human development. Accepting degraded status quo or planning for increased degradation may be realistic given the human inclination to ambitiously convert resources into useful products. But the term "sustainable" implies we have the capacity to identify and honor carrying capacity while devising demand flexibility strategies to meet evolving climate conditions. Robust Management Objectives reduce the probability of careening toward Management Thresholds. Our MO levels can strive to improve conditions without risk of State management takeover. § 354.30. Measurable Objectives (g) An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.	Comment noted. See MO/MT Master Response and GDE Master Response
78	Jim Brobeck (6)	Aqualliance	Section 2 Basin setting			Section 2 Basin setting	*Heading-Not a Comment*
79	Jim Brobeck (7)	Aqualliance				3251 The failure of the GSP to attempt an estimate of Inter-basin subsurface flow along the Western Boundaries invalidates the Water Budget on which much of the GSP uses as a foundation. It is inappropriate to explain that "Characterization of Inter-basin Flows and Net Outflows along Western Boundary" is placed in the "Next Steps" category. Water Code § 354.16 explains "Groundwater Conditions Each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes the following: (a) Groundwater elevation data demonstrating flow directions, lateral and vertical gradients, and regional pumping patterns, including: (1) Groundwater elevation contour maps depicting the groundwater table or potentiometric surface associated with the current seasonal high and seasonal low for each principal aquifer within the basin." Code § 354.18. "Water Budget (a) Each Plan shall include a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions...	The Water Budget described in the GSP (Section 2.3) provides a complete accounting of total annual volume of groundwater and surface water entering and leaving the subbasin. It is acknowledged that the western boundary of the Butte Basin Groundwater Model (BBGM, the tool used to estimate water budgets in the GSP) is defined by the Sacramento River which is also associated with a boundary between groundwater subbasins. The GSP and BBGM documentation acknowledge that this introduces uncertainty in evaluating Sacramento River stream-aquifer interactions separately from subsurface inter-basin boundary flows between Vina and the Corning subbasin. As a result, model results are reported as Net Western Boundary outflows which is the combination of estimated Sac River inflow/outflow to the groundwater system and subsurface flows. The BBGM is an excellent tool for evaluating subsurface boundary flows between Vina's other neighboring subbasins.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
80						(3) Outflows from the groundwater system by water use sector, including ... subsurface groundwater outflow." Early basin-setting drafts of the Vina, Butte and Colusa sub-basins showed large discrepancies in the modeled subsurface aquifer outflow patterns. The Butte Basin Groundwater Model has no capacity to quantify subsurface GW flow out of the western boundary of the sub-basin. The present draft recognizes the data gap and inadequacy of regional modeling that characterizes the water budget of inflow and outflow. The Butte County Drought Task Force recognizes that Groundwater extractions outside the Vina boundaries such as the past and present Water Transfer Programs and Supplemental Groundwater Pumping Operations in the Northern Sacramento Valley may have enduring cumulative impacts on Vina's water budget. SGMA regulations require Each Plan to contain a water budget for the basin that identifies discharges including subsurface groundwater outflow.	Although water budget estimates are useful, sustainability of the subbasin is *demonstrated* through monitoring and the avoidance of undesirable results relative to each sustainability indicator. Therefore, the water budget is not the foundation upon which defining sustainability rests. However, refining characteristics of inter-basin boundary flows and dynamics will be an important component of GSP implementation. See Inter-basin Coordination Master Response.
81	Jim Brobeck (8)	Aqualliance				"2.1.2.4 Groundwater Recharge Areas 1415 "Groundwater recharge is the downward movement of water from the surface to the groundwater system." Some recharge occurs from upward movement. Piezometric pressure from the semi-confined portions of the Tuscan System allows water to move upward recharging into or supporting alluvial unconfined aquifers if sufficient pressure exists. Line 1940 explains; "In locations where groundwater levels in the shallower wells are lower than in the deeper wells, the gradient indicates upward movement of groundwater, with a similar relationship defining the volume of upward flow." Conversely the alluvial shallow aquifer can leak downwards if the piezometric elevation is reduced. Line 1937: "When groundwater levels in the shallower wells are higher than in the deeper completions, the gradient indicates downward movement of groundwater. The volume of downward flow is proportional to the gradient and the hydraulic conductivity between the shallow and deep measurement points." The USDA groundwater atlas [https://pubs.usgs.gov/ha/ha730/ch_b/B-text3.html] explains this well-known water fact: "By the early 1960's, intensive ground-water development had significantly lowered water levels and altered ground-water flow patterns in the Central Valley aquifer system. By far the most dramatic impact of development was in the San Joaquin Valley, where water-level declines in the confined part of the aquifer system were locally more than 400 feet (fig. 82). Although predevelopment flow was toward the San Joaquin River throughout most of the basin, large withdrawals from deep wells in the western and southern parts of the aquifer system changed the direction of horizontal flow in the confined part of the system until the water moved toward the withdrawal centers (fig. 83). Also, because the magnitude of the withdrawals caused hydraulic heads in the confined parts of the aquifer system to fall far below the altitude of the water table (fig. 84), the vertical hydraulic gradient was reversed over much of the San Joaquin Valley. Where these wells are open to the unconfined and confined aquifers, they allow virtually unrestricted vertical flow through the well bore (fig. 87). The amount of water that flows downward through one large-diameter well has been estimated to be equivalent to the natural leakage through the "E-clay" over an area of approximately 7 square miles. During the peak of the withdrawal season, the net downward flow may be, on average, as much as 0.3 cubic foot per second per well." Significant Depressurization of the regional confined aquifer can take place within and outside of the Vina sub basin. Well-casings that have perforations at shallow and deep levels increase the vertical flow. Lines 1456-1460 indicate there is this type of potentially inter-basin leakage in the Vina SB "Aquifer testing conducted as part of the Lower Tuscan Aquifer study (Brown and Caldwell, 2013) indicated there is also the potential for Upper Watershed recharge in the shallow aquifer interval to move down to greater depths due to irrigation pumping, causing a mixing of recharge sources in the intermediate and possibly deeper aquifer zones in the Vina South Management Area." Line 1469 discusses "Additional recharge through management activities of flood flows or irrigation practices has potential in the Vina Subbasin..." but does not discuss how the recharged water can migrate	Comment noted. The GSP recognizes the need for additional shallow monitoring to better characterize vertical gradients in the groundwater system (Section 2.1.8).

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
						through the deep aquifer into adjacent sub-basins that are being pumped. As a result, much of the water in the upper unconfined zone of the aquifer system that flowed laterally toward the river under predevelopment conditions leaked downward through the confining beds into the lower confined aquifer after development...Ground-water development in the San Joaquin Valley has reduced the effectiveness of the confining beds within the aquifer. Thousands of wells with casings perforated for much of their length have been drilled through the clay confining units.	
83	Jim Brobeck (9)	Aqualliance				1522 2.1.5 Groundwater Producing Formations presents an incomplete overview of the producing geology and fails to quantify the robust yields of the Tuscan even while quantifying the production amounts available in less important aquifer units, line 1614: "Wells penetrating the sand and gravel units of the Riverbank and Modesto Formations produce up to about 1,000 gallons per minute (gpm)" The Update on the Stony Creek Fan aquifer Performance Testing [http://cetehama.ucdavis.edu/files/135217.pdf] indicated that that Lower Tuscan can produce 2,500-3,000 gpm. The GCID and others are exploiting/depressurizing this extremely productive aquifer. The cumulative yield of the wells exercising the lower Tuscan is undoubtedly impacting water levels in all aquifer layers in the 4-county basin.	Comment noted.
84	Jim Brobeck (10) Jim Brobeck (10-continued)	Aqualliance Aqualliance				Line 1736 2.1.8.2 Beneficial Uses "Water produced from the principal aquifer is primarily used to meet irrigation, domestic, and municipal water demand." This sentence should include "environmental demand". Groundwater and surface water are historically and, in many cases, currently connected. Beneficial uses must include the benefits to ecosystems including Groundwater Dependent upland vegetation. According to the State Water Board delineation of beneficial uses [https://www.waterboards.ca.gov/rwqcb2/water_issues/programs/planningtmdls/basinplan/web/bp_ch2.html] 2.1.3 COLD FRESHWATER HABITAT (COLD)Uses of water that support cold water ecosystems, including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.2.1.14 PRESERVATION OF RARE AND ENDANGERED SPECIES (RARE)Uses of waters that support habitats necessary for the survival and successful maintenance of plant or animal species established under state and/or federal law as rare, threatened, or endangered.2.1.18 FISH SPAWNING (SPWN) Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish. 2.1.19 WARM FRESHWATER HABITAT (WARM) Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates. 2.1.20 WILDLIFE HABITAT (WILD) Uses of waters that support wildlife habitats, including, but not limited to, the preservation and enhancement of vegetation and prey species used by wildlife, such as waterfowl. Beneficial uses of streams that have intermittent flows, as is typical of many streams in the region, must be protected throughout the year and are designated as "existing."	Thank you for this recommendation. Groundwater Dependent Ecosystems and stream flows supported by relatively shallow groundwater in the subbasin are mentioned as beneficial uses in the GSP as well as a lack of a thorough understanding of how groundwater conditions influence each of them. The Vina GSA will consider this suggestion when GSP updates are made in the future. Also, please see GDE Master Response.
85	Jim Brobeck (11)	Aqualliance				1866 2.2 Groundwater Conditions; • "Wells showing depths to first encountered groundwater deeper than 500 feet were eliminated from the data set." The rationale behind this limitation is unclear. If there is significant piezometric pressure identified in the water encountered below 500' it should be included in the analysis. The hydrographs in this section measure a shallow portion of the system. It is likely that groundwater flow volumes would be stimulated when the pressurized portion of the aquifer is depressurized by major production operations. The cumulative effect of these extractions may be the cause of the decline in the seasonally fluctuating regional aquifer levels. The failure to evaluate the effect of confined/semi-confined piezometric pressure dynamics on groundwater conditions must be remedied. Line 2143 identifies the existence and importance of this pressure in relation to subsidence but there is no other mention of piezometric pressure. "As the pressure created by the height of water (i.e., head) declines in response to groundwater withdrawals, aquitards between production zones are exposed to increased	Comment noted. Confined and unconfined conditions and associated vertical gradients in the Vina Subbasin is discussed in Section 2.2.2.2 and the need for additional data to better characterize vertical gradients within the principle aquifer is discussed in Section 2.1.8. These descriptions clearly acknowledge the pressurized nature of the aquifer system in some areas and the lack of vertical gradients and relative vertical connectivity in others.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
						vertical loads." The measurement of piezometric pressure is important for groundwater monitoring. It allows us to determine the level and flow patterns of the groundwater. Omitting a discussion of piezometric pressure when discussing groundwater conditions in our region is like ignoring blood pressure during a human physical exam.	
86	Jim Brobeck (12)	Aqualliance				1996 "Since the year 2000, there has been a cumulative decline in March 1 groundwater storage of about 400,000 acre-feet (AF). This indicates the cycles of groundwater pumping are not in balance with the cycles of recharge that replenish the aquifer, and that groundwater depletion has occurred consistent with long-term decline in groundwater levels." Without a regional GW model and a record of pumping throughout the Tuscan basin it is impossible to identify pumping in the VGSB as the sole demand resulting in the decline in GW storage.	See response to comment 75.
87	Jim Brobeck (13)	Aqualliance				2017 "Development of groundwater quality-related Sustainable Management Criteria for the Vina Subbasin is not intended to duplicate or supplant the goals and objectives of ongoing programs including those by Butte County, the SVWQC and the State Drinking Water Information System (SDWIS) [SWRCB Geotracker/GAMA website, the California Department of Toxic Substances Control (DTSC) EnviroStor website, and the Environmental Protection Agency's (EPA) National Priorities List (NPL)]." GW pumping stimulates the movement of toxic plumes through the aquifer system. Advection is the movement of dissolved solute with flowing groundwater. The amount of contaminant being transported is a function of its concentration in the groundwater and the quantity of groundwater flowing, and advection will transport contaminants at different rates in each stratum. Who are the personnel in the VGSA that will be tracking these data and correlating it to various GW pumping regimes and flow patterns?	The GSA Board(s) will be responsible for completing periodic evaluations every five year and providing written assessments to DWR. The first evaluation will be due to DWR in 2027. The five-year evaluation will include but is not limited to a description of current groundwater conditions for each applicable sustainability indicator relative to measurable objectives, interim milestones and minimum thresholds. Is it not feasible to identify individuals or organizations whom will be directly working on these assessments at this time.
88	Jim Brobeck (14)	Aqualliance				2268 Figure 2-23: "Hydrographs for Nested Well Located Near Feather River" is the description of the figure but the text explains "As seen in this figure, the hydrograph for the nested well located adjacent to the Sacramento River…" Typographical error?	Question noted. Staff also noticed this and have made appropriate revisions in the final GSP.
89	Jim Brobeck (15)	Aqualliance				<u>Surface Depletion Comment</u> 2298 "There is no indication in the streamflow data to suggest groundwater interactions that contribute to the streamflow behavior. Similar conditions would be expected for other creeks that traverse the Vina Subbasin (Little Chico, Sycamore, Rock, and Butte Creek) since they flow across a similar fan topography and similar shallow subsurface geology. The overall conclusion from this study in relation to interconnected surface water is that, for significant portions of the year, the upland creeks in the Vina Subbasin would be classified as disconnected streams and the surface water would be considered "completely depleted" as defined under SGMA." Water code chapter 23 explains "(o) "Interconnected surface water" refers to surface water that is hydraulically connected <u>at any point by</u> a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted." As I read Water Code it is clear that streams flowing out of the foothills are hydraulically connected until they reach a point where the aquifer has been depleted below stream level at which point the stream loses as it recharges the evacuated aquifer. As the GW level declines the stretch of dewatered stream expands. Spatial and temporal dewatering monitoring is a critical GDE function of a GSA. The California Department of Fish and Wildlife has specific GDE recommendations that must be implemented in the VGSA [https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=170185&inline] "GROUNDWATER DEPENDENT ECOSYSTEMS (GDES) 1. How will groundwater plans identify GDEs and address GDE protection? 2. How will GSAs determine if GDEs are being adversely impacted by groundwater management? 3. If GDEs are adversely impacted, how will groundwater plans facilitate appropriate and timely monitoring and management response actions? INTERCONNECTED SURFACE WATERS (ISW) 1. How will groundwater plans document the timing, quantity, and location of ISW depletions attributable to groundwater extraction and determine whether these depletions will impact fish and wildlife? 2. How will GSAs determine if fish and wildlife are being adversely impacted by groundwater management impacts on ISW? 3. If adverse impacts to ISW-dependent fish and wildlife are observed, how will GSAs facilitate appropriate and timely monitoring and management response actions." According to a study on small streams flowing through the Vina SB: "Nonnatal rearing of juvenile Chinook salmon was documented in several intermittent tributaries to the Sacramento River. Condition factors and length measurements of juvenile chinook captured in the intermittent tributaries were compared with those captured in the mainstem Sacramento River. The data suggests that juvenile chinook rearing in the tributaries grew faster and were heavier for their length than	Thank you for your comments. Please see the GDE and ISW Master Responses.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
						those rearing in the mainstem. Faster growing fish smolt earlier, and may enter the delta earlier in the year before low water and pumping degrade rearing habitat." Intermittent Streams as Rearing Habitat for Sacramento River Chinook Salmon. https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/docs/exhibits/swrcb/swrcb_maslin1997.pdfThe unregulated streams that flow into the Sacramento River are leaking into drained aquifers. Dan Wendell of The Nature Conservancy, a panelist at a workshop held by the California Natural Resources Agency, explained "since the 1940s, groundwater discharge to streams in the Sacramento Valley has decreased by about 600,000 acre-feet per year due to groundwater pumping, and it's going to decrease an additional 600,000 acre-feet in coming years under status quo conditions due to the time it takes effects of groundwater pumping to reach streams." https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/docs/CSPA%20et%20al/part2/aqua_282.pdf	
90	Jim Brobeck (16)	Aqualliance				2.2.7 Groundwater Dependent Ecosystems 2488 Not Likely a GDE Due to Adjacency to Irrigated Agricultural Fields 2504 Not Likely a GDE Due to Dependence on Agricultural-dependent Surface Water GDEs were incorrectly removed in areas adjacent to irrigated fields due to the presence of surface water. However, GDEs can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields - simultaneously and at different temporal/spatial scales. Basins with a stacked series of aquifers may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow principal aquifers, that support springs, surface water, and groundwater dependent ecosystems. Areas in proximity to irrigated land can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on their proximity to irrigated fields.	Please see GDE Master Response.
91	Jim Brobeck (17)	Aqualliance				2.3.4 Water Budget Estimates2831 "Other components are more difficult to measure or do not have measured values readily available (e.g., deep percolation, subsurface flows, groundwater pumping, surface water-groundwater interaction, etc.) and are estimated using the BBGM." It is unclear how the BBGM estimates Western Boundary Net Outflows 56,100- 65,000 AFY. This map from the first draft of the Vina Water Budget presentation last year estimated a total of 200k AFY flowing from the east out of Butte into Colusa. The first draft of the Butte Subbasin Preliminary Basin Setting Results indicated 261k AFY of water flow from the west into the Butte basin from Colusa. These large discrepancies in outflow estimates do not inspire confidence in the Water Budget, the identification of who is responsible for GW declines or the efficacy of proposed recharge efforts. "The ultimate effects of pumping can occur significantly after pumping starts, or even after pumping has ceased. The timescales involved in aquifer responses to pumping and other stresses can be on the order of decades, making it difficult to associate cause with effect. As such, monitoring must account for this lag in impacts. In general, the longer the timeframe for effects to be observed at a given monitoring point once they become evident, the longer those effects will persist, even if the pumping causing the effects is halted immediately." Davids Engineering 2014. Prepared for NCWA, Sacramento Valley Groundwater Assessment Active Management – Call to Action, pp. 14-15. We know that Inter-basin flows are dependent on conditions in adjacent basins. "3014 Western boundary net outflows represent Sacramento River gains from groundwater and subsurface outflows to the Corning Subbasin. The split between these outflows is uncertain at this time and identified as a data gap." This significant data gap will present challenges as the impacts of GW pumping are not immediate and can take months or years to occur. The emerging California Water Market is a factor that is going to complicate regional water budget estimates. BCWRC's Drought Task Force intention to evaluate the cumulative impacts of Water Transfer Programs (including GW Substitution water market transactions) and Supplemental Groundwater Pumping Operations in the Northern Sacramento Valley is essential to understand sub basin water budgets.	Comment noted. Although water budget estimates are useful, sustainability of the subbasin is *demonstrated* through monitoring and the avoidance of undesirable results relative to each sustainability indicator. Therefore, the water budget is not the foundation upon which defining sustainability rests. However, refining characteristics of inter-basin boundary flows and dynamics will be an important component of GSP implementation. See Master Response Inter-basin Coordination. It should be noted that the preliminary Basin Setting water budgets results for the Butte Subbasin broke out stream accretions/depletions from subsurface flows. When these were combined for the Sacramento River along the model boundary/subbasin boundary and reported as Net Western Boundary Outflows, the net flow became an outflow. This is largely driven by significantly large accretions of groundwater to the Sacramento River (considered an outflow of groundwater from the subbasin). The Butte Subbasin GSP discusses these dynamics in more detail. A description of how the BBGM represents and estimates boundary conditions can be found in the model documentation: Butte County Department of Water and Resource Conservation. 2021. Model Documentation v 1.0. Butte Basin Groundwater Model. 30 November.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
92	Jim Brobeck (18)	Aqualliance				3014 "Western boundary net outflows represent Sacramento River gains from groundwater and subsurface outflows to the Corning Subbasin. The split between these outflows is uncertain at this time and identified as a data gap." The subsurface outflow analysis must be expanded to include outflows into other nearby sub basins including Butte and Colusa. Increased GW extractions due to crop changes, "emergency" supplemental GW pumping and GW substitution transfers is likely to increase subsurface flows over time. Butte Counties nascent Drought Impacts Analysis Study plans to compile the 2021 water transfer programs (April 2021-December 2021) from Butte, Tehama, Glenn, Colusa, Yuba and Sutter counties. The report will include a brief description of the programs, amount of water transferred, recipient of water, whether surface water or groundwater substitution is utilized, destination of transferred water, etc. including maps. Analysis of the transfer programs will evaluate the cumulative impacts of the programs' impacts on water supplies and demands. This type of annual evaluation must be ongoing as demand/supply conditions evolve and consider "timescales involved in aquifer responses to pumping and other stresses can be on the order of decades, making it difficult to associate cause with effect. As such, monitoring must account for this lag in impacts. In general, the longer the timeframe for effects to be observed at a given monitoring point once they become evident, the longer those effects will persist, even if the pumping causing the effects is halted immediately." [1] [1] Davids Engineering 2014. Prepared for NCWA, Sacramento Valley Groundwater Assessment Active Management – Call to Action.	Comment noted. Please refer to the response to comment 75 and 91 above. The commenter refers to a Drought Impacts Analysis Study, a contract for which is expected to be awarded to a consultant by the Butte County Board of Supervisors in December 2021. The study will include some of the information, as identified by the commenter, with regard to water diversions, transfers, and programs and will also analyze the associated economic impacts to the County resulting from the drought.
93	Jim Brobeck (19)	Aqualliance				Line 3016 Water Banking Stimulation of sub surface flows "It is anticipated that this data gap [sub surface flows] will be addressed through future refinements to the BBGM and through coordination and collaboration with neighboring subbasins as part of GSP implementation." The coordination and collaboration with neighboring subbasins is, at best, a forthright sharing of information and unbiased evaluation of model results. However, the VGSA would be naïve to ignore the special interests of key players in the Northstate Water World that may inspire some purveyors to profitably engage in the emerging California Water Market with less regard to the interests of GDEs and water users that are not participating in Transfer/sales that "exercise" the shared regional aquifer while promising to use PMAs to refill drained aquifer water banks.	Comment noted. Please see the Inter-basin Coordination Master Response. The commenter acknowledges the importance of inter-basin coordination and provides opinions that do not raise specific technical issues with the Plan.
94	Jim Brobeck (20)	Aqualliance				3181 "It is anticipated that these uncertainties will be reduced over time through monitoring and additional data collection, refinements to the BBGM and other tools, and coordination with neighboring basins." The DGSP is deficient because significant monitoring infrastructure has yet to be funded and built in the shallowest portion of the aquifer system that GDEs rely upon. According to the 2007 DWR/NCWA Sacramento Valley Water Resource Monitoring, Data Collection and Evaluation Framework; "The long-term health of riparian vegetation, wetland species, and number of other native habitat are commonly associated with maintaining a minimum range of groundwater levels and an appropriate level of interaction between surface water and groundwater resources. The lowering of groundwater levels due to natural climatic changes or the interception of groundwater underflow to surface water systems due to the increased groundwater extraction associated with water management programs, have the potential to impact the native habitat areas. Baseline habitat monitoring is an important data collection objective because it allows for a better understanding of the existing water resource requirements of the native habitat and the evaluation of potential impacts associated with potential changes in water resource management practices. In order to identify potential habitat impacts associated with potential changes in water management practices, a program-specific network of shallow monitor monitoring wells should be developed to detect changes in water levels over the shallowest portion of the aquifer. In evaluating impacts to certain wetlands species, it is important to discern both the rate of groundwater level change, as well as the cumulative change over the entire year. Data collection and monitoring frequency should be appropriately selected to support the temporal and long-term evaluations." https://www.waterboards.ca.gov/waterrights//water_issues/programs/bay_delta/california_waterfix/exhibits/docs/CSPA%20et%20al/part2/aqua_280.pdf	Please see GDE Master Response.
95	Jim Brobeck (21)	Aqualliance				3266 3. SUSTAINABLE MANAGEMENT CRITERIA	

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
96	Jim Brobeck (22)	Aqualliance				3298 • "MT– Quantitative threshold for each Sustainability Indicator used to define the point at which undesirable results may begin to occur." The stated definition is the most egregious violation of common sense in the DGSP. Undesirable results BEGIN to occur even before historic low levels (the approximate upper reach of the operational range) are occur. Domestic well failures, destruction of GDEs and chronic lowering of groundwater levels occur at historic GW levels and would be exacerbated if the aquifer is managed within the Operational Ranges being proposed. I find the Plan to be deficient in protecting beneficial uses. Historic low GW levels shown in most of the Appendix 3-B hydrographs are still above the 80' max rooting depth of native and urban forest trees. The Minimum Threshold as defined in the GSP, is purported to designate "the point at which Undesirable Results may BEGIN to occur." But undesirable results will begin much earlier in the proposed operational range shown in most of the hydrographs. These MTs are significantly deeper than 80' bgs. Furthermore, the lower water table will dewater longer reaches of streams earlier in the season and persist later in the year. Dan Wendell of The Nature Conservancy, a panelist at a workshop held by the California Natural Resources Agency, explained "since the 1940s, groundwater discharge to streams in the Sacramento Valley has decreased by about 600,000 acre-feet per year due to groundwater pumping, and it's going to decrease an additional 600,000 acre-feet in coming years under status quo conditions due to the time it takes effects of groundwater pumping to reach streams." The operational range proposed will not avoid triggering this and other significant irreversible Undesirable Results.SGMA Regulations define "Measurable objectives" as "specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions..." Setting GW level MOs below historic low levels does not meet this requirement. Most of the proposed MOs are below historic low levels. This is not the appropriate level to designate the top of the operational range. SGMA Water Code § 354.30 explains "An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan." The managers assure the public that the goal of the VGSP is to maintain GW levels above or near the MOs or that if the MT is approached/transgressed PMAs would be employed to bring water levels back to the MO or higher. The definition of the MT shows the "Operational Range" as the defined goal. The proposed broad operational ranges fit the prescription for market driven groundwater banking but would result in many undesirable impacts to water users not participating in the rapidly emerging California Water Market.	Comment noted. See GDE Master Response and MO/MT Master Response.
97	Jim Brobeck (23)	Aqualliance				3415 "The quantitative Vina Subbasin Undesirable Result for the Chronic Lowering of Groundwater Levels occurs when: Two RMS wells within a management area reach their MT for two consecutive years of non-dry year-types." Two years of operating at the MT level would destroy GDEs including the urban forest of Chico. The insulting caveat that it would be acceptable to forgive the extreme MT levels if they occur during 2 consecutive dry years would allow GW levels to decline below the MT and implies that artificial recharge during "wet" years is a mitigating option. This is another example of an operation prescription for conjunctive use water bank marketing.	Comment noted.
98	Jim Brobeck (24)	Aqualliance				3477 "Groundwater levels are typically lower during dry years and higher during wet years. Superimposed on this four- to seven-year short-term cycle is a long-term decline in groundwater levels. In other words, groundwater levels during more recent dry-year cycles are lower than groundwater levels in earlier dry-year cycles." The DGSP fails here to identify the cumulative impacts of increased pumping in the regional shared Tuscan aquifer system that is driving the long-term trend in driving down the fluctuating hydrograph record. Management of connected groundwater systems is challenging for several reasons. First, the cumulative GW depletions caused by pumping depends on the spatial scale: in general (depending on soil conditions and strata) the greater the distance or depth between groundwater pumping and a monitoring well, the lower the magnitude but the longer the timescale of depletions. Consequently, the ultimate effects of pumping can occur significantly after pumping starts, or even after pumping has ceased. The timescales involved in aquifer responses to pumping and other stresses can be on the order of decades.	Comment noted. Please refer to response to comment 75. The GSP is a planning document and it establishes thresholds and objectives that will be monitored to determine if undesirable results, as identified in the Plan, are occurring. The Plan identifies projects and management actions that will be implemented to maintain or improve conditions, as warranted, in order to meet interim milestones and achieve sustainability.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
99	Jim Brobeck (25)	Aqualliance				3703 Outside Hydrologic Influence "hydrologic impacts outside of the Vina Subbasin, such as upper watershed development or fire-related changes in run-off, could result in impacts to streamflow, riparian areas, or GDEs that are completely independent of any connection to groundwater use or conditions within the Vina Subbasin." Since the deep Tuscan Aquifer System is recharged from the eastern basin foothills it is certainly appropriate to recognize impacts to groundwater use and conditions within the Vina SB resulting from fire related soil conditions and streamflow in the recharge area. [https://www.buttecounty.net/waterresourceconservation/SpecialProjects/StableIsotopeRechargeProject.aspx] Additionally, conditions in the down-gradient portion of the Tuscan System are worthy of evaluation as the VGSP evolves. The lower Tuscan Aquifer system is being developed as a water source west of the Sacramento River and is being evacuated with vigor especially during dry years. This may accelerate the rate of subsurface flow out of the Vina SB. The Glenn Colusa Irrigation District board pumped over 25K af of Tuscan groundwater for 2-3 months this summer to supplement their river allocation. This is on top of 10k af of groundwater substitution water transfers and even more surface water sales from "willing sellers" to "willing buyers" South Of Delta. The 35k/a/f is more water in 3 months than the Chico Urban Area pumps in a year. The State emergency declaration allows water purveyors like GCID to sidestep laws that require environmental review. GCID used district wells located 5-10 miles west of Chico that can pump 3KAF/minute. The Butte County Drought Task Force recognizes the importance of evaluating cumulative impacts of programs on water supplies and demands on the Vina SB may be significant and is initiating a "Drought Impacts Analysis Study" that will compile and analyze the 2021 Water Transfer Programs and the Supplemental Groundwater Pumping Operations in the Northern Sacramento Valley. https://buttecounty.granicus.com/MetaViewer.php?view_id=2&clip_id=1006&meta_id=157029	Comment noted. The GSP is a Plan that establishes baseline conditions using historical conditions. See response to comment 98 above.
100	Jim Brobeck (26)	Aqualliance				3776 Upland GDE Designation "The Vina Subbasin specifically recognizes deep-rooted tree species, such as Valley Oak, that are common along riparian corridors in both upland streams and the Sacramento River. This connectivity is not well measured or understood in the Vina Subbasin at this time." The failure of the DGSP to accept the well-documented fact that deep rooted trees are not exclusively located along riparian corridors but are nonetheless dependent on the shallow aquifer. US Forest Service Index of Species Information for Valley Oak explains the wide distribution of the Valley Oak ecosystem: https://www.fs.fed.us/database/feis/plants/tree/quelob/all.html"Valley oak typically has several vertical roots that tap groundwater and extensive horizontal root branches. Vertical root depth has been measured as deep as 80 feet (262m) in some individuals. Best growth is attained when water tables are about 33 feet (10 m) below the surface. Historically, these forests extended 0.6 to 5.0 miles (1-8 km) on each side of major rivers. Valley oak cover was once extensive, extending through lowlands and into foothills." Limiting GDE evaluation to measurable impacts to interconnected streamflow is insufficient. California Code of Regulations, Title 23 § 351. Definitions. "(g) Identification of groundwater dependent ecosystems within the basin, utilizing data available from the Department, as specified in Section 353.2, or the best available information. (m) "Groundwater dependent ecosystem" refers to ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface." The DGSP, like other planning documents, promises on line 3785 "to fill these data gaps and the GSAs are committed to addressing these issues and develop appropriate SMCs for the Vina Subbasin." But like other co-equal goals that assure balancing water supply with ecosystem health it is meeting the demand that takes precedence. In 2007 the DWR, NCWA and the State Water Board recognized the importance of habitat monitoring in their Sacramento Valley Water Resource Monitoring, Data Collection and Evaluation Framework https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/docs/CSPA%20et%20al/part2/aqua_280.pdf "The lowering of groundwater levels due to natural climatic changes or the interception of groundwater underflow to surface water systems due to the increased groundwater extraction associated with water management programs, have the potential to impact the native habitat areas….In order to identify potential habitat impacts associated with potential changes in water management practices, a program-specific network of shallow monitor monitoring wells should be developed to detect changes in water levels over the shallowest portion of the aquifer." But there has been no investment in creating the network needed to collect baseline conditions or to monitor declines in this critical GDE preservation goal.	Thank you for this recommendation to indicate acknowledgment of Valley Oak species in non-riparian areas as indicated in the NCCAG database. Staff agrees and have made this revision in the final GSP. Please also see the GDE Master Response regarding future steps to address data gaps.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
101	Jim Brobeck (27)	Aqualliance				5. PROJECT AND MANAGEMENT ACTIONS4412 5.2.3.1 Agricultural Irrigation Efficiency4414 Butte County agriculture is a keystone feature of culture in the Vina SB. The importance of maintaining the viability of irrigated agriculture is of paramount importance. The results of the Vina GSA, Agricultural Groundwater Users of Butte County, and Butte County Farm Bureau survey to evaluate current irrigation methods and practices, identify opportunities and methods to improve irrigation efficiency, determine potential issues preventing the adoption of efficiency practices, and provide recommendations for increasing participation in these practices were expected to be available in September 2021. A summary of the results would be helpful in evaluating opportunities to stabilize or reduce demand. Incentives to invest in efficient GW irrigation through grant funding and tax rebates are needed to maximize benefits. According to Valerie Kincaid "A project proponent maintains the right to water that is recharged whether it results from recharge projects or groundwater demand reduction projects (e.g., conservation, recycling)." Why is this not listed as a recharge project?	Thank you for your comment. This project is not characterized as a recharge project because it focuses on water demand reduction through water use and conveyance efficiency as opposed to a traditional understanding of the term recharge which in most cases (other than in-lieu recharge) implies application of surface to the ground surface. When the GSA Board(s) decide to implement projects, a more-thorough analysis of the legal implications of the project(s) will be completed as part of the environmental review process.
102	Jim Brobeck (28)	Aqualliance				4449 5.2.3.2 Project: Residential Conservation The Estimated Groundwater Offset and/or Recharge: 100 acre-feet/year is certainly below the potential for urban efficiency. The voluntary expansion of xeriscape replacement of turf is evident and the adoption of efficient water using appliances is inevitable. The managers should review the successful urban conservation data from last decade to evaluate more realistic estimates of potential offset amounts.	Comment noted. The project proponent provided the estimate of groundwater offset.
103	Jim Brobeck (29)	Aqualliance				4079 " As discussed in Section 4.1, the GSAs in the Vina Subbasin intend to further evaluate the SMC for interconnected surface waters to avoid undesirable results to aquatic ecosystems and GDEs. As additional data are collected and evaluated, the Vina Subbasin commits to developing additional SMC and installation of monitoring points, as appropriate, for specific stream reaches and associated habitat where there is a clear connection to groundwater pumping in the principal aquifer." Restricting monitoring points and GDE considerations to riparian proximities is insufficient for the protection of deep-rooted vegetation, both native trees and the Chico urban forest. According to the USDA Forest Service "Urban forests help to filter air and water, control storm water, conserve energy, and provide animal habitat and shade. They add beauty, form, and structure to urban design. By reducing noise and providing places to recreate, urban forests strengthen social cohesion, spur community revitalization, and add economic value to our communities." [https://www.fs.usda.gov/managing-land/urban-forests] The shallowest portion of the aquifer system that sustains this vegetation extends beyond riparian corridors. The Sacramento Valley Water Resource Monitoring, Data Collection and Evaluation Framework [2007 DWR NCWA https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/docs/CSPA%20et%20al/part2/aqua_280.pdf] recognizes the importance of establishing a monitoring network in the shallowest portion of the aquifer for this purpose: "The long-term health of riparian vegetation, wetland species, and number of other native habitat are commonly associated with maintaining a minimum range of groundwater levels and an appropriate level of interaction between surface water and groundwater resources. The lowering of groundwater levels due to natural climatic changes or the interception of groundwater underflow to surface water systems due to the increased groundwater extraction associated with water management programs, have the potential to impact the native habitat areas. Baseline habitat monitoring is an important data collection objective because it allows for a better understanding of the existing water resource requirements of the native habitat and the evaluation of potential impacts associated with potential changes in water resource management practices. In order to identify potential habitat impacts associated with potential changes in water management practices, a program-specific network of shallow monitor monitoring wells should be developed to detect changes in water levels over the shallowest portion of the aquifer. In evaluating impacts to certain wetlands species, it is important to discern both the rate of groundwater level change, as well as the cumulative change over the entire year. Data collection and monitoring frequency should be appropriately selected to support the temporal and long-term evaluations."	Thank your comment. Please see the GDE Master Response regarding future steps to address data gaps.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
104	Jim Brobeck (30)	Aqualliance				Section 4: MONITORING NETWORKS 4218 Well "Construction Data – Well data such as perforation depths, construction date, and well depth was considered for selection." Many of the selected wells to not meet the above criteria for selection: 4262 Table 4-5. Groundwater Levels RMS Well Construction Details North MA: 3/6 of the wells do not have listed screen intervals. This makes it difficult to know what layer of aquifer is being monitored. Scientifically constructed multi-completion wells with defined screen depths/elevations is needed. The other 3 have screen intervals ranging from about 70' to almost 500'. While this type of well construction is suitable for production it is unsuitable for transparent depth/elevation monitoring of the aquifer system. Chico MA The well depths are undefined as are the screen depths. There is a notable lack in monitoring the shallow aquifer that supports the unirrigated Chico Urban forest. South MA: The screen intervals on two of the MC wells have appropriate 10' spacing allowing for better scientific analysis of monitoring data.	Total well depth is included for all RMS wells in the GSP. Wells < 200 feet deep are considered representative of groundwater conditions for domestic wells.
105	Jim Brobeck (31)	Aqualliance				5. PROJECT AND MANAGEMENT ACTIONS [cont.] 4477 5.2.3.3 Project: Streamflow Augmentation"The project would primarily take place at Comanche Creek, Butte Creek, Little Chico Creek, and Big Chico Creek." It is unclear how Little Chico Creek and Big Chico Creek would be integrated into this program since they are, apart from flood control infrastructure, unregulated by dams. If a project includes the application for a new right to recharge water, it will need to obtain a water right permit from the State Water Resources Control Board (SWRCB) through a surface water right application and a supplemental groundwater recharge form. The water right permit application would need to identify the "beneficial use" that the project intends to meet. Recharging groundwater is not considered a beneficial use, however, meeting the sustainable management criteria in a GSP may be determined to be a beneficial use. Since this project is in the "Planned" category and is expected to move forward and be completed there must be more detailed information available to the public. The project description should be clear on permits that would be required to be negotiated with regulatory agencies such as CFW and the State Water Board.	Thank you for this recommendation. Staff have included revisions to this Section in the final GSP based on the GSA Boards direction provided in November 2021. The GSA Boards may consider additional updates to the plan in the future.
106	Jim Brobeck (32)	Aqualliance				4507 5.2.3.4 Flood MAR/Surface Water Supply and Recharge Scoping This planned scoping project must include a detailed evaluation of the efficacy of up-gradient recharge efforts that may enhance extraction opportunities in down-gradient sub-basins that are developing new groundwater exploitation infrastructure to supply expanding permanent crop acres and engaging in water transfers that integrate the shared aquifer system into their transfer portfolio and have a history of using the same aquifer as an "emergency" supplemental water supply. The legal consequences of attempting MAR have been summarized by Ms. Kincaid and issues of aquifer privatization and potential water bank extirpation of Butte Section 33 protection remain unresolved and exacerbated by the expert analysis presented by the Public Policy Institute of California. "County export ordinances prevent beneficial trades. In the absence of state regulation of groundwater, county ordinances have protected local parties against injury from groundwater-related exports. But their export permitting hurdles are so high that they impede any transfers, including those that present no significant risk to local groundwater sustainability. In Butte County, for instance, it would take 18 months to go through all the steps to obtain a permit for a same-year groundwater substitution transfer. Once GSAs establish sustainability plans that address undesirable impacts of pumping, it should be possible to ease the coarser restrictions on this practice found in most county ordinances—which effectively preclude trades if they entail water leaving the county. If counties with restrictive groundwater export ordinances fail to amend their laws to conform to SGMA, the legislature should consider preempting local laws that discriminate against out-of-county uses or place undue burdens on groundwater and groundwater-substitution transfers that would not jeopardize sustainable groundwater management of the source aquifer." https://www.ppic.org/publication/improving-californias-water-market/	Thank you for this recommendation. Staff have included revisions to this Section in the final GSP based on the GSA Boards direction provided in November 2021. The GSA Boards may consider additional updates to the plan in the future.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
107	Jim Brobeck (33)	Aqualliance				All the projects outlined in lines 4408-4663, as well as 4870 5.2.4.11 Project: Surface Water Supply and Recharge, whether they are conservation (demand reduction) or recharge (supply augmentation) projects have the potential to carry the legal consequences of artificial recharge efforts. According to Kincaid [https://www.vinagsa.org/files/4441577c7/PMA+Legal+Implications+Discussion+Paper.pdf] "A project proponent maintains the right to water that is recharged whether it results from recharge projects or groundwater demand reduction projects (e.g., conservation, recycling). If a project uses or obtains a surface water supply and recharges into the aquifer, the project proponent would have a legal right to the recharged water. Water does not legally become "common" or "native" supply available to overlying groundwater right holders unless it is abandoned by the project proponent." The contentious issue of privatization of the aquifer that is used as a water bank must be resolved at the State level because local ordinances may be overridden by SGMA jurisdiction. The strategy of integrating the Tuscan Aquifer System into the State Water Supply is a long-standing threat to the balance of uses required to maintain the quality of life in the Vina SB. According to the Public Policy Institute of California [https://www.ppic.org/publication/improving-californias-water-market/] County export ordinances prevent beneficial trades. In the absence of state regulation of groundwater, county ordinances have protected local parties against injury from groundwater-related exports. But their export permitting hurdles are so high that they impede any transfers, including those that present no significant risk to local groundwater sustainability. In Butte County, for instance, it would take 18 months to go through all the steps to obtain a permit for a same-year groundwater substitution transfer. "Streamline transfer reviews while maintaining protections. Approval delays by federal, state, and local authorities often reflect uncertainties about the physical impact of a surface or groundwater transfer on other water users or the environment. Yet there are various ways to streamline the process while maintaining protections, for instance by conducting more up-front analysis of impacts through programmatic reviews, developing a "fast lane" for transfers below a certain size, developing a structured evaluative process for reviews, and establishing an after-the-fact process for balancing accounts to enable quicker approvals of time-sensitive activities. "Develop more equitable local rules for groundwater substitution transfers. Well-run groundwater substitution programs can expand long-term water availability by more actively using local groundwater storage. Once GSAs establish sustainability plans that address undesirable impacts of pumping, it should be possible to ease the coarser restrictions on this practice found in most county ordinances—which effectively preclude trades if they entail water leaving the county. If counties with restrictive groundwater export ordinances fail to amend their laws to conform to SGMA, the legislature should consider preempting local laws that discriminate against out-of-county uses or place undue burdens on groundwater and groundwater-substitution transfers that would not jeopardize sustainable groundwater management of the source aquifer." The State may use emergency proclamation or legislative action to neutralize local control of water policy such as the Section 33 ordinance in Butte County. The broad operating range and historic low-level starting point (MO) that the VGSA consultants and staff have inserted into the VGSP will create the storage space needed to bank/sell water stored in the Butte Basin. The Kincaid white paper explains that Potential Management Actions "would allow the Vina GSA to protect the Vina subbasin and the implementation of the GSP from negative implications from artificial recharge projects through enactment of rules, ordinances and/or policies." But her estimation that ordinances or policies that the GSA may adopt to ensure recharge projects are operating without adverse impact to the basin offer no assurance that the VGSA would have the capacity to successfully navigate the State prerogative to manipulate the emerging water market that intends to "Streamline groundwater substitution and water transfer permitting and approval processes by allowing consolidated basin-level environmental reviews to facilitate water market transactions," [https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118]	Staff have included revisions to this Section in the final GSP based on the GSA Boards direction provided in November 2021. When the GSA Board(s) decide to implement projects, a more-thorough analysis of the legal implications of the project(s) will be completed as part of the environmental review process.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
108	Jim Brobeck (34)	Aqualliance				4664 5.2.4.5 Community Monitoring Program "This project would create routine water table monitoring programs for approximately 8,000 acres of Ecological Reserves in the region between lower Forest Ranch and Cohasset Road near Chico Airport, including the Big Chico Creek, Sheep Hollow, and Cabin Hollow tributaries." This project should be required to be implemented yesterday! Baseline habitat monitoring is an important data collection objective because it allows for a better understanding of the existing water resource requirements of the native habitat and the evaluation of potential impacts associated with potential changes in water resource management practices. To identify potential habitat impacts associated with potential changes in water management practices, a program-specific network of shallow monitor monitoring wells should be developed to detect changes in water levels over the shallowest portion of the aquifer. In evaluating impacts to certain GDE species, it is important to discern both the rate of groundwater level change, as well as the cumulative change over the entire year. Data collection and monitoring frequency should be appropriately selected to support the temporal and long-term evaluations.	Comment noted.
109	Jim Brobeck (35)	Aqualliance				4691 5.2.4.6 Project: Wastewater Recycling While this project requires time consuming permitting and coordination with regulatory agencies as well as significant infrastructure installations it will be helpful in keeping Chico's GW demand from expanding along with the urban development that is anticipated. Focusing purple pipe infrastructure on athletic field irrigation is a good target during dry seasons.	Comment noted.
110	Jim Brobeck (36)	Aqualliance				4722 5.2.4.7 Project: Community Water Education Initiative A population that is well informed on watershed health, water use conservation and water policy is an excellent education goal. This project should identify regional responsible water use and climate responsive flexibility. The political science portion should dive into the history of California water policy; how it has shaped regional water infrastructure and the need for local vigilance in defending the hydrologic balance from insatiable demand from unfettered urban and agricultural expansion south of the Delta.	Comment noted
111	Jim Brobeck (37)	Aqualliance				4768 5.2.4.8 Project: Rangeland Management and Water Retention4802 5.2.4.9 Project: Fuel Management for Watershed Health4833 5.2.4.10 Project: Removal of Invasive Species Investments in the health of ecosystems that provide the water recharge for the Tuscan Aquifer System have been, like in the rest of the Sierra Cascade watershed, unwisely underfunded. An excerpt from the Sierra Nevada Ecosystem Project lays out the imbalance of resource extraction vs reinvestment. These projects would begin to address that imbalance. "Based on estimates of direct resource values as one input (not the total revenue produced by resource dependent activities), the Sierra Nevada ecosystem produces approximately $2.2 billion worth of commodities and services annually. Water accounts for more than 60% of that total value. Other commodities [timber and grazing] account for 20% as do services. "Public timber and private recreation are the largest net contributors of funds to countygovernments both in total dollars and as a percentage of their total value. Around 2% of all resource values are presently captured and reinvested into the ecosystem or local communities through taxation or revenue sharing arrangements. The declining status of some aspects of the Sierra Nevada ecosystem suggests that this level of reinvestment is insufficient to ensure sustainable utilization of the ecosystem." https://pubs.usgs.gov/dds/dds-43/VOL_III/VIII_C23.PDF	Comment noted.
112	Jim Brobeck (38)	Aqualliance				4870 5.2.4.11 Project: Surface Water Supply and Recharge While it is suggested that these projects will require a SWRCB permit; CEQA and others the State is on a path of "streamlining and acceleration of managed aquifer recharge and groundwater banking permitting processes" and to "Streamline groundwater substitution and water transfer permitting and approval processes to optimize the economic value of groundwater". [https://data.ca.gov/dataset/californias-groundwater-update-2020-bulletin-118/resource/94f3a5f6-23f3-4aec-ab84-b546bf211bab] It is unclear if the legal and environmental consequences of this project will be adequately considered. The preservation of undisturbed critical vernal pool habitat is an ecological priority in some of the presumed areas of inundation.	Comment noted.
113	Jim Brobeck (39)	Aqualliance				4973 5.3.4 Landscape Ordinance 4980 5.3.5 Prohibition of Groundwater Use for Ski (Recreational) Lakes These two common sense regulations would help meet our goals.	Comment noted.
114	Jim Brobeck (40)	Aqualliance				4984 5.3.6 Expansion of Water Purveyors' Service Area Assuming that this is exclusively for residential development it is critical that service area expansion does not stimulate urban sprawl that intrudes on either green-line or gold-line open space.	Comment noted.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
115	Jim Brobeck (41)	Aqualliance				4990 5.3.7 Groundwater Allocation The consideration of groundwater allocation must be scientifically connected to the actual cause of failure to achieve sustainability goals by 2042. If cross-boundary water flows are causing declining levels in up-gradient portions by extractions in the down-gradient portion of the shared regional aquifer system there must be well designed/implemented monitoring/modeling systems in place that have the confidence of all involved.	Comment noted.
116	Jim Brobeck (42)	Aqualliance				5005 5.4 Data Collection 5006 5.4.1 County Contour Mapping "As part of the efforts to collect the information necessary to fill the data gaps identified in Section 3, this project proposes to expand the existing monitoring program to include Butte, Glen, Colusa, and Tehama counties and conduct these groundwater elevation surveys in the spring, summer, and fall. The monitoring program would gather data used to produce groundwater contours and estimates of lateral and vertical flow direction and volume. Producing this data for the four counties will help to identify Inter-basin flow patterns and influences on surface water flows and replenishment locations, thereby improving coordination between counties and water management decision-making." This inter-basin effort must be implemented ASAP! A reliable inter-basin GW modeling is also at the top of the management list.	Comment noted.
117	Jim Brobeck (43)	Aqualliance				6. PLAN IMPLEMENTATION 5135 Table 6-5: Estimated Costs for Implementing Data Gaps "Interconnected Stream Monitoring $100,000 – $250,000" As mentioned in previous comments the immediate implementation of a network of shallow monitor monitoring wells should be developed to detect changes in water levels over the shallowest portion of the aquifer. Baseline habitat monitoring is an important data collection objective because it allows for a better understanding of the existing water resource requirements of the native habitat and the evaluation of potential impacts associated with potential changes in water resource management practices. The long-term health of riparian vegetation, wetland species, and number of other native habitat are commonly associated with maintaining a minimum range of groundwater levels. Limiting the data gap to Interconnected Stream Monitoring would leave out GDEs that are outside of designated riparian zones. The shallow aquifer has an important role to play in keeping deep rooted trees, including the large trees in the Chico Urban Forest, that survive the regional dry months without supplemental irrigation. The USDA also recognizes that Urban Forests such as exists in Chico and other Butte County towns provide a range of valuable ecosystem services. I posit that the groundwater dependent trees of our towns ARE ecosystems. Many environmental challenges are exacerbated within the urban landscape, such as stormwater runoff and flood risk, chemical and particulate pollution of urban air, soil and water, the urban heat island, and summer heat waves. Chico's urban forest canopy mitigates these challenges. Research shows that urban trees are integral to the environmental quality of cities and towns. In April of 2007 Butte County resolved to adopt an oak woodlands management plan. http://www.buttecounty.net/Portals/10/Docs/Planning/Projects/OakWoodland/Section53_ButteCounty_OakWoodlandMitigationOrd_2018-10-29.pdf?ver=2018-10-29-165211-350 "Butte County supports significant acreage of oak woodland habitat. The historical importance of oaks is apparent in the names of towns, cities, streets and residential complexes throughout California. Butte County's oak woodlands enhance the natural and scenic beauty of the area, provide forage and shelter for more than 300 species of wildlife, facilitate nutrient cycling, moderate temperature extremes, reduce soil erosion, sustain water quality and increase the monetary and ecological value of property." Water Code § 113It is the policy of the state that groundwater resources be managed sustainably for long-term reliability and multiple economic, social, and environmental benefits for current and future beneficial uses.	Please see GDE Master Response.
118	Jim Brobeck (44)	Aqualliance				5253 6.7 Inter-basin Coordination 5271 1. Information Sharing "This will continue throughout GSP implementation and may include: 1. Inform each other on changing conditions (i.e., surface water cutbacks, land use changes, policy changes that inform groundwater management) 2. Share annual reports and interim progress reports 3. Share data and technical information and work towards building shared data across and/or along basin boundaries (e.g., monitoring data, water budgets, modeling inputs and outputs, and Groundwater Dependent Ecosystems)" Information Sharing must include the water-market/emergency GW pumping volumes/locations/timing that members of the North Sac River Corridor group intend to implement and a report on the final v/l/t of these extra demands on the shared aquifer system. These extra pumping	Please see the Inter-basin Coordination Master Response. With regard to the Drought Impacts Analysis Study, please refer to the response to comment number 92 in this comment tracking table.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
						demands are not unprecedented and have become a routine component of California's plan to use the Northern Sacramento Valley as a "reliable" source of supply. Butte County is on the verge of conduction a Drought Impacts Analysis Study that will evaluate the numerous 2021 Water Transfer Programs in Northern Sacramento Valley including the Supplemental Groundwater Pumping Operations. The study portends to accomplish an evaluation of cumulative impacts of programs on water supplies and demands in the inter-basin, but focus on the Vina Subbasin" https://buttecounty.granicus.com/MetaViewer.php?view_id=2&clip_id=1006&meta_id=157029 pdf Pg. 42-43 The report will include a brief description of the programs, amount of water transferred, recipient of water, whether surface water or groundwater substitution is utilized, destination of transferred water, etc. including maps. This report should be conducted every year, funded by SGMA Inter-basin coordination parties and be included in the VGSA Annual report submitted by April 1 for the prior year's activities.	
119	Jim Brobeck (45)	Aqualliance				5295 3. Coordinate on mutually beneficial activities GSAs that overlie the Tuscan Aquifer Formation should provide cooperative funding for mutually beneficial watershed management in the recharge areas located in the foothills east of the valley floor.	Comment noted.
120	Jim Brobeck (46)	Aqualliance				5314 5. Issue Resolution Process"Vina Subbasin will pursue development of an issue-resolution process with neighboring subbasins in the North Sac River Corridor group."This single sentence belies the potential for regional conflict over water management issues. The drama surrounding the nascent Tuscan Water District and the unpopular "Operational Range[s]" proposed in the DVGSP are examples of "issues" that have already emerged in this process. Conflict arising from expanded GW demand in the North Sac River Corridor group are being litigated between stakeholders and agencies. Achieving sustainability requires local agencies, stakeholders, and water users to make many difficult and potentially contentious decisions. These decisions are prone to conflict, particularly when pumping restrictions are viewed as infringing on property rights, or when fees are charged to support local management. Newly formed GSAs have additional layers of potential conflict. Questions regarding authority, streamlined legal and regulatory timelines, a lack of existing precedents and the need to represent agency and constituent interests have the potential to exacerbate conflicts under SGMA. In some cases, where authoritative interpretations of legal authority and limits have not been established yet, litigation may be necessary and warranted. The State prefers the Northern Sacramento Valley to quietly comply with the myth that this region is a source of "surplus" water that can peacefully serve the accelerating water market through conjunctive-use water banking. However, it is likely that conjunctive-use water banking would degrade the groundwater basin and groundwater users who are not involved in conjunctive use but are reliant on the same groundwater basin.	Please refer to the Inter-basin Coordination Master Response. The commenter provides opinions on various topics related to groundwater, water management issues, and water banking but does not specifically identify the technical or policy issue that should be addressed in the Plan.
121	Jim Brobeck (47)	Aqualliance				See Vina Draft GSP Comment A6	Comment Letter A-6 contains the same comments included in this comment tracking spreadsheet for comments 74 through 120. See responses to these individual comments above.
122	Bruce Smith	Public Comments	BaS	1.1.6.1	553, 554 Fig. 1-9A	Important to note electric logs us1 To define formation boundaries in AEM cross section	Comment noted.
123	Bruce Smith	Public Comments	BaS	1.1.8, 1.1.8.1	599-605	There are four principal aquifers in The Vina Subbasin. The shallow Aquifer, the intermediate aquifer And the upper and lower deep Aquifers. This data gap needs to Be better defined using well logs and cross sections and conceptual models that show flow paths. This section from 599-605 implies one principal aquifer. Gives the false impression that surface recharge then recharges other/lower aquifers. They may not be connected.	Comment noted. The GSP acknowledges the need for new data to better characterize vertical gradients and connectivity between shallow and deeper zones in the aquifer system.
124	David Eaton	Public Comments				See Vina Draft GSP Comment P5	Thank you for providing your comments. The commenter addresses concerns regarding the MO, sustainable yield, and reduction of groundwater levels. However, the commenter does not specifically identify changes or alterations that should be made to the Plan pertaining to these topics.
125	Debra Lucero	Public Comments				See Vina Draft GSP Comment P6	Thank you for providing your comments. The commenter identifies their concerns regarding several topics discussed in the GSP and is referred to the Master Responses provided as part of this responses to comments documentation for further discussion and clarification. However, the commenter does not specifically identify technical changes or alterations that should be made to the Plan pertaining to these topics.
126	Lisa Creamer O'Donnell	Public Comments				See Vina Draft GSP Comment P7	Thank you for providing your comments. The commenter identifies their concerns regarding several topics discussed in the GSP and is referred to the Master

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
							Responses provided as part of this responses to comments documentation for further discussion and clarification. However, the commenter does not specifically identify technical changes or alterations that should be made to the Plan pertaining to these topics.
127	Nancy Gillard-Bartels	Public Comments				See Vina Draft GSP Comment P8	Thank you for providing your comments. The commenter provides an opinion pertaining to groundwater rights and injected surface water, but does not raise specific technical or policy issues with the Plan.
128	Jim Grayden	Self	3-SMC			Why are Cal Water wells in Chico the only ones chosen in the monitoring network as there are others available, particularly shallower monitoring wells. Also, Management objectives are probably not protective enough. Total Dissolved Solids and Electrical conductivity (TDS/EC) levels aren't protective as should be, need more that secondary MCLs	Thank you for your comment. Please see Section 4.8.1 Selection Criteria for Representative Monitoring Sites for information on the criteria used to identify the RMS wells.
129	Commenter 5	Self	3-SMC			Already at a record low. MO is too low! We need to be better than where we are now	Comment noted. See MO/MT Master Response
130	Todd Green	SHAC/Self	3-SMC			If Measurable Objectives level is the desirable level seem you are more talking it being a more strategic objective vs measurable. Why not use the average of historical lows the way the Butte Subbasin did where they take an average of levels?	Comment noted. See MO/MT Master Response
131	Anne Dawson	SHAC/Self	3-SMC			Basing SMCs on the Minimum Thresholds (MT) vs desirable levels. How were they developed? . How was it decided? Need to stop using the word sustainable. More detail is needed on how the line was determined. Where wells are in relation to measuring use/topography etc. Need more data to show how you got there.	Comment noted. Revisions were made to section 3.3 to clarify the methodology for establishing the Groundwater Level SMC. Additionally, please see MO/MT Master Response.
132	Jim Brobeck	SHAC/Self	3-SMC			In the draft GSP, the MT is the point where undesirable levels begin but undesirable results will occur earlier. Will the operational levels in the hydrographs in Appendix result in domestic wells going dry? Concerned about data gaps. I do not think that the hydrographs were shared with the Stakeholder Advisory Committee.	Comment noted. Hydrographs were made available to the GSA Boards and the public when the MT was considered by the GSA Boards in July 2021.
133	Bruce Smith	SHAC/Self	3-SMC			They say our aquifer is healthy but wells are going dry. There is massive groundwater pumping occurring on the other side of the Sacramento River. Well data needs to be posted on the DWR and County websites. On the verge of a crisis and need to take it seriously.	Comment noted. Butte County is partnering with other agencies as appropriate to respond to the current drought emergency. This includes outreach and education to private well owners as well as providing an Emergency Water Filling Station for drinking water access for households whose domestic well has gone dry or is experiencing well reliability issues.
134	Commenter	Self	5-PMAs			Why not use the average of 5 years for the MO used by the Butte Subbasin?	See MO/MT Master Response.
135	Jim Brobeck	SHAC/Self	5-PMAs			Please summarize the legal ramifications of In-lieu and direct recharge scoping project. What incentives are available to encourage conservation on family farms? Residential conservation estimate of 100 AF is too low.	When the GSA Board(s) decide to implement projects, a more-thorough analysis of the legal implications of the project(s) will be completed as part of the environmental review process as well as a determination of any incentives included for voluntary participation in projects as applicable . The project proponent provided the estimate of groundwater offset for the residential conservation project. Staff have included revisions to the PMA Section in the final GSP based on the GSA Boards direction provided in November 2021. The GSA Boards may consider additional updates to the plan in the future.
136	Gary Cole	SHAC/Self	5-PMAs			My experience is instream augmentation and recharge projects to address the 10,000 Acre Feet deficit will be hindered by the DWR permit process. Also concerned about ownership of recharge water.	Comment noted.
137	Bill Loker	Self	Monitoring and Evaluation			Speakers have frequently mentioned that the measurable objective and sustained yield are "best Guesses" and subject to revisions with more data and experience. In my experience, initial numbers become benchmarks that are difficulty to change. At the least, a very contentious process. I think a more conservation approach with more robust measurable objective and higher levers are needed.	Comment noted.
138	Jim McCabe	Self	PMAs	pg. 5 line 557/5-PMAs		Statement the "Vina GSA does not and will not have employees" the words "will not" \needs to be removed. For PMAs, Paradise intertie should be removed as there are cheaper solutions available, such as the diversion of PID water to Butte Creek, Butte County Section 33 has never been audited or enforced to determine noncompliance with the groundwater transfers laws. Enforcement of Section 33 could be a PMA that may fix the 10,000 AF deficiency	Thank you for your comment. The Joint Powers Agreement forming the Vina GSA states that the GSA will not have employees. Staff have included revisions to the PMA Section in the final GSP based on the GSA Boards direction provided in November 2021. The GSA Boards may consider additional updates to the plan in the future.
139	Norah Todenhagen	Self	3-SMC/MO	3-SMC/Exec Summary ES-7 on pg. 13		Unacceptable to set a MO below what we know are dangerous levels. Move the line to a more acceptable and representative level so that it is truly a measurable objective. Why aren't there identified alert levels in the GSP such as those found in the Best Management Objectives in the County's Section 1? Also trees won't survive at levels suggested	Comment noted. See GDE Master Response.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
140	Joseph Connell	Self	PMAS			Legal issues related to who owns water when it is recharged must be dealt with by the State Water Board and the legislature. Without clarity on this topic, recharge projects could be non-starters by the GSA's. This is a statewide issue.	Comment noted.
141	J.W. Cook	Senate				Great work. Use science. Thanks.	Comment noted.
142	Marty Dunlap	public interest attorney	MO			The MO needs to be higher to reflect desired goals for a healthy aquifer (not based on historical lows and disregarding drought effects)	Comment noted. See MO/MT Master Response.
143	Marty Dunlap	public interest attorney	MTs			The MTs need to be raised to avoid long-term and irreversible impacts to the basin/aquifer.	Comment noted. See MO/MT Master Response.
144	Marty Dunlap	public interest attorney	MO/MT			The Section 33 of Butte County code delineates the Basin Management Objectives (BMOs) with alert levels and these protections need to be incorporated into the MO & MT.	Comment noted. More specific triggers for project and management actions may be identified through GSP implementation.
145	Bill Loker	self	MA			Meter all wells that use groundwater, especially the largest groundwater users	Comment noted.
146	Bill Loker	self	MO			MO needs to be set higher to protect our groundwater. Drought is not a transient feature of our area. Drought is potentially the "new abnormal." We need to be CAREFUL STEWARDS of our groundwater for TRUE SUSTAINABILITY.	Comment noted. See MO/MT Master Response.
147	Bill Loker	Self	MO/MT			The MO and sustainable yield allow too much exploitation of groundwater. Presenters say these "best guesses" can be modified with "more data." What is the process for changing these? In my experience, changing these benchmarks will be a very contentious process. Ag users are often more well represented and have more political access than domestic users. I have little confidence that change will be easy or more protective of the aquifer. Change the MO- raise it! Change the sustainable yield- lower it!	Comment noted.
148	Pam Stoesser	Self	MO			Please explain the logic behind setting minimum groundwater levels below historic lows. This makes no sense!! Does this have to do with recharge?	Comment noted.
149	Pam Stoesser	Self	MTs			Minimum groundwater level thresholds must be above historic lows. This plan must protect domestic wells, streams, our urban forest, trees and wildlife. Conservation, conservation, conservation. Domestic well failure must not be acceptable. Implement groundwater pumping reductions up front, not last. No to "recharge" and ownership of our public water.	Comment noted.
150	Richard Harriman	NCEDC	Funding			SGMA is a state-mandated program that should be paid for by the state with regular funding.	Comment noted. The commenter provides an opinion pertaining to SGMA funding and does not raise specific technical or policy issues with the Plan.
151	Richard Harriman	NCEDC	Mas			The GSP should adopt Management Actions that implement a Project that provides for measurement via electronic system to record pumping for all major groundwater pumpers for agriculture and commercial business.	Thank you for this recommendation. Staff have included revisions to this Section in the final GSP based on the GSA Boards direction provided in November 2021. The GSA Boards may consider additional updates to the plan in the future.
152	Pam Stoesser	Self	3-SMC			1) How are we regulating people digging deeper wells? Is there a safety net in this plan to make it harder for people to do that? 2) She expressed that she was most bothered by the minimum threshold, exclaiming, "this bothers me the most," particularly the way this topic was presented. She related that when she attended the in-person workshop, it was confirmed that right now our groundwater is at historic lows. We learned and that the MT is set 50 feet below the historic low. This graph doesn't show that. 3) She addressed interconnectedness with aquifers and surface water. She stated, "it bothers me that there isn't more understanding about this before we move forward with the plan…I would like our urban forest to be prioritized as much or even more than agriculture moving forward."	Thank you for your comments. The commenter provides an opinion pertaining to MTs, interconnected surface water and groundwater and urban forests and does not raise specific technical or policy issues with the Plan. Please see section 1.3.5.3 Permitting of New Wells for the question posed related to well regulation.
153	Kathy Faith	Self	PMAs			I appreciate all of the brains and perspectives involved, but this effort seems too late. For those whose wells go dry, that will be a huge deal. The MT line is too low. Would be possible for that line to be raised at some point in the process?	Comment noted. See MO/MT Master Response.
154	Anne Dawson	Self	PMAs			Although this subbasin isn't critical, it is high priority, and despite that, the board decided that they were not going to develop groundwater allocations. They have also said they will not implement triggers to institute groundwater allocation discussion. I am worried that with the drought and continued pumping, lots of domestic wells will go dry and there is no plan to stop it.	Comment noted. The commenter expresses their concern that domestic wells will go dry as a result of continued pumping.
155	Anne Dawson	Self	PMAs			My primary concern is that there are no triggers in place to make allocation happen. it seems we are being left with the bill. We are the ones who will be spending thousands of dollars digging new and deeper wells, whereas agriculture will continue as before, unimpacted. There should be a better effort to spread the pain among all groups, rather than having domestic well owners shoulder the cost.	Comment noted. The commenter expresses their concern that the GSP does not address water allocation for agricultural well users and that domestic well owners will be forced to deepen their wells, which is costly.
156	Jim Brobeck (A)	Self	MTs			I am reviewing the Vina GSP and I appreciate the work that has gone into its preparation. However, I find the Plan to be deficient in protecting beneficial uses. Historic low GW levels shown in most of the Appendix 3-B hydrographs are above the 80' max rooting depth of native and urban forest trees. The Minimum Threshold as defined in the GSP, is purported to designate "the point at which Undesirable Results may BEGIN to occur." But undesirable results will begin much earlier in the proposed operational range shown	Please see the MO/MT Master Response. The commenter discusses the minimum threshold, undesirable results, and the operational range described in the GSP, but does not specifically identify how they would like the information to be changed.

	Commenter Name	Commenter Organization	Section #	Section	Line #(s) or Figure #	Comment	Response
						in most of the hydrographs. These MTs are significantly deeper than 80' bgs. Furthermore, the lower water table will dewater longer reaches of streams earlier in the season and persist later in the year. Dan Wendell of The Nature Conservancy, a panelist at a workshop held by the California Natural Resources Agency, explained "since the 1940s, groundwater discharge to streams in the Sacramento Valley has decreased by about 600,000 acre-feet per year due to groundwater pumping, and it's going to decrease an additional 600,000 acre-feet in coming years under status quo conditions due to the time it takes effects of groundwater pumping to reach streams." The operational range proposed will not avoid triggering this and other significant irreversible Undesirable Results. SGMA Regulations define "Measurable objectives" as "specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions.." Setting GW level MOs below historic low levels does not meet this requirement. Most of the proposed MOs are below historic low levels, not the appropriate level to designate the top of the operational range. SGMA Water Code § 354.30 explains "An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan." The managers assure the public that the goal of the VGSP is to maintain GW levels above or near the MOs. But I have not seen this intention in writing. Instead, I see the term "Operational Range" as the defined goal. The proposed broad operational ranges fit the prescription for market driven groundwater banking but would result in many undesirable impacts to water users not participating in the rapidly emerging California Water Market.	
157	Debra Lucero	Self				I am concerned that there may be a false sense of protection and local control, but that the reality may be quite different when SGMA takes full affect. I am worried that people will be able to pump groundwater simply by claiming it is from initial rainfall that fell on their property.	Comment noted. The comment does not specifically address items in the GSP.
158	Eric Wright	Self				I request that the climatic patterns and trends are incorporated by looking at the original areas around the subbasin.	Comment noted. The GSP discusses the climate scenario used to evaluate future conditions. It is unclear what the commenter is referring to with regard to "the original areas around the subbasin."
159	Richard Harriman	Self	MTs			I agree with the comments of Jim Brobeck and Debra Lucero. If one looks at the MT's and then looks at the analysis in regard to trees in Chico area, this is the canary in the coal mine. The MT's have been set so low as to allow the canary in the mine to die before we even act. Sustainability, by definition, means that one learns to use what one has before one tries to bring in more to replace what has been overused. An analytical inconsistency exists in the model, in that there is a default towards supply before even exhausting conservation remedies. Conservation should be prioritized before seeking to bring in water from outside the aquifer. It is very challenging to make changes once bureaucratic action has been put in motion; "works like the titanic. It has a lot of momentum going in one way. Once you want to slow it down, it takes a long time before you can get it to reverse."	Comment noted. The commenter notes their agreement with other commenters regarding Measurable Thresholds being set too low, but does not raise specific technical or policy issues with the Plan; no changes to the GSP were made. The commenter is referred to the MO/MT Master Response.
160	Tasha Levinson	Self				California Water Commission hosted a Zoom meeting today (with another tomorrow) about groundwater trading within each basin. A key element for anything workable was that fair and equitable groundwater allocations be made in the Groundwater Sustainability Plan. Such allocations were particularly important to assure that (a) water as a human right, (b) protection for disadvantaged communities, and (c) protection for groundwater dependent ecosystems, ALL are protected. I have attended many of the meetings of each of our sub-basins and, to the best of my knowledge, none of the 3 sub-basins have made any groundwater allocations. If they have not then any plans involving trading or banking are pre-mature until such allocations are made. Thank you to all of you for your attention.	There is a Management Action for Groundwater Allocation included in the PMA Section of the GSP.

GSP Workshops October 4 and October 13, 2021 - Clarifying Questions – Responded to During Workshop						
160	Jim Brobeck	SHAC/Self	Introduction/S GMA Overview			How are comments to be incorporated into the Final Groundwater Sustainability Plan (GSP).
162	Commenter 1	Self	Introduction/S GMA Overview			When and how was authority to enforce GSPs given to DWR? Relationship of the Vina GSA JPA between Chico, Durham Irrigation District and the County? Is Rock Creek Reclamation District (RCRD) its own Management Area or part of the Vina GSA?
163	Commenter 2	Self	Introduction/S GMA Overview			No trust in the public process and not confident comments will be heard.
164	Jim Brobeck	SHAC/Self	2-Basin Setting			Given the data gaps, are you confident that the Butte Basin Groundwater Model (BBGWM) is adequate to set the water budget?
165	Commenter 3		2-Basin Setting			Who will fund and monitor all the data so that we get better information?
166	Commenter 1		2-Basin Setting			Is the Primary Aquifer the Lower Tuscan Aquifer? What is the definition of sustainable yield? Does what comes in equal what goes out?
167	Bruce Smith	SHAC/Self	2-Basin Setting			Is the Butte Basin Groundwater Model (BBGWM) based on DWR's cross sections? Will the AEM information be used and incorporated in the BBGWM?
168	Bill Loker	Self	3-SMC			How was the Measurable Objective (MO) set? Why is it so low? Concerned about how Management objectives in different Management Areas will be reconciled since we share one aquifer?
169	Commenter 4		3-SMC			Isn't salinity considered the same as seawater under SMC? Does the plan to gain more data mean drilling more wells?
170	Commenter 1	Self	3-SMC			What is the definition of shallow wells? You say that we have no projects going on right now. Who is "we"? Isn't groundwater being pumped now, aren't they projects?
171	Commenter 2	Self	3-SMC			Aren't our groundwater levels at historical levels? 60 wells have gone dry, correct? Are we at Minimum Threshold now? How Close? What about conservation?
172	Commenter 6		3-SMC			Heard there might be moratorium on wells? How many new wells are being drilled?
173	Commenter 2	Self	3-SMC			How long will projects take to raise the groundwater levels and fix the problem? Will we not do anything for 20 years?
174	Commenter 3	Self	3-SMC			Why are there no Chico residential wells in the monitoring network? Should we drill shallower wells for monitoring?
175	Richard Harriman	Self	3-SMC			Concerned with the definition of irreversible results such as subsidence? How do you determine the probability of overshooting the operational flexibility? If allow water levels to go too low you may overshoot the "operational flexibility" based on assumptions of duration of droughts. How would you prevent overshooting to avoid irreversible results to groundwater dependent ecosystems?
176	Richard Coon		5-PMAs			In regards to the Flood-Mar project, if Rock Creek Reclamation District implement recharge projects who owns the water? What percentage of the water is considered native? Does the GSA set the percentages?
177	Commenter		5-PMAs			Does residential conservation include metering domestic wells?
	Commenter 3		6-Implementatio n			Ag conservation is considered voluntary, what if they don't care? Does the plan have a big stick to enforce conservation?
178	Public Comment Period (see speaker cards)					
179	Lynn Haskell	self				Why are comments regarding the formation of the Tuscan Water District not being considered by the Vina GSA, the Board of Supervisors and LAFCo?
180	Richard Coon		Butte Co Section 33 & water transfers under SGMA			See Comment in Q&A Session - Mr. Coon left the meeting before the public comment session.
181	Bruce Smith	SHAC/Self	3-SMC	3.8	Slide page 11	Statement on the interconnected streams slide states that "groundwater does not appear to be connected to upland streams" is incorrect and flawed.
182	Comment Cards					
183	Jeanne Christopherson	Self				All this work assumes we have time to react and that the future will continue to reflect patterns of water supply from the past. It is apparent that this is not so-- from unprecedented momentum of global warming. We have no choice. To wait for "voluntary" conservation, to wait for more data...Are we going to wait for a water crisis as large as the fires to descend upon us? We need to look at worst cast scenarios... water

						retention- universal cisterns at every house, mandatory conservation...swimming pools in every backyard and gardens, credits for these measures. And social urgency. Let's mobilize and stop tiptoeing.
184	Marty Dunlap	public interest attorney				Q: How do we ensure that the Vina GSA sustainability efforts to keep our region's groundwater robust are not integrated into statewide efforts to increase supply to areas that are depleted of adequate water?
185	Marty Dunlap	public interest attorney	PMAs			Q: What are the skills that qualify the Vina GSA Board to evaluate the data that impacts the project being considered under the GSP?
186	Bill Loker	self	Administration/ Plan Area			Agricultural pumping affects City of Chico water. The citizens of Chico are not well represented in this process. City of Chico is 21,000 acres/100K people and should have proportional say in water use decisions! How will the City and their domestic water users be represented in these discussions?
187	Debra Lucero	Self	Introduction/S GMA Overview			Will public comments go to GSA staff first and which body, according to the statute, is required to provide answers to comments?
188	Grace Marvin	Self	Introduction/S GMA Overview			Will SHAC members know what the public is asking and will there will be a summary sheet provided before the plan is adopted?
189	Richard Harriman	Self	Introduction/S GMA Overview			Is the GSA's duty to the local area or is it to implement what DWR wants?
190	Debra Lucero	Self	2-Basin Setting			The draft states that there are 16 million acre feet of storage in the aquifer and asked, 'How can we know what is currently in the aquifer?'
191	Commenter		2-Basin Setting			How many acre feet are used for a 4-person household?
192	Pam Stoesser	Self	2-Basin Setting			The presentation touched on salinity and claimed that we don't have that issue here, but we would if wells were dug deep enough. How deep would that need to be? 1500-2000 ft.? Is that what farmers are doing?
193	Todd Greene	Self	2-Basin Setting			DWR bases their estimates on gas and oil electric wells, which is a concern is when you get to the east, where the marine units get closer.
194	Pam Stoesser	Self	2-Basin Setting			If there anything in place to ensure that people aren't drilling down far enough to compromise water quality?
195	Eric Wright	Self	2-Basin Setting			If the subbasin study accounts for what watersheds are percolating and recharging the subbasin, as well as what impacts property development at upper elevation is having on the water?
196	Eric Wright	Self	2-Basin Setting			How does different vegetation and different land use affects the subbasin storage capacity and sustainability?
197	Amy Raymond	Self	2-Basin Setting			There are 16 million acre feet in the 'bathtub,' and it may have taken 10,000 years to fill the bathtub.
198	Amy Raymond	Self	2-Basin Setting			A more interesting number might be the answer to how much water comes in and out of the bathtub over a year or multi-year period? What is the volume relative to what's recharging on an annual basis against what we're using?
200	Debra Lucero	Self	3-SMC			How deep are the wells are that are being monitored for water quality? Is it known how many wells in Butte County are more than 800 feet deep?
201	Nancy	Self	PMAs			Is the concept of equity being used in water reduction targeting?
202	Commenter	Self	PMAs			Who owns our groundwater now and how might that be altered? What dangers are in store for controlling the groundwater that we have?"
203	Grace Marvin	Self	PMAs			Will we no longer have the same rights to the water once somebody else owns it?
204	Debra Lucero	Self	PMAs			How is this playing out elsewhere in the state with domestic well owners whose wells have gone dry, with GSA's in charge of setting MT's, are they bringing those cases into the courts?
205	Pam Stoesser	Self	PMAs			What would trigger that last resort, groundwater allotment?
206	Commenter	Self				There was an article on the front page of the (didn't get the name of the publication) talking about the exceptional drought occurring in Butte County, where fields are left fallow, vegetable yields are low, fire season is costly, food aid is needed, etc. I am not surprised that the GSP is not spreading the pain more between big agriculture and residential. The reason for this is that the people writing these plans are the same people approving these plans. It seems like a real conflict of interest. How are we supposed to have confidence in our plan?"

From:	NGO Consortium
To:	VinaGSA@gmail.com
Cc:	Pablo Ortiz; Melissa Rohde; ddolan@lgc.org; E. J. Remson; Ngodoo Atume; Arthur, Samantha; amerrill@americanrivers.org; kculbert@americanrivers.org
Subject:	Comments on Draft Groundwater Sustainability Plan for Vina Subbasin
Date:	Friday, October 15, 2021 10:24:32 AM
Attachments:	Public Comment Letter_DraftGSP_Vina.pdf

ATTENTION: This message originated from outside **Butte County**. Please exercise judgment before opening attachments, clicking on links, or replying.

Hello,

I am writing on behalf of Audubon California, Clean Water Action, Clean Water Fund, Local Government Commission, The Nature Conservancy, American Rivers and Union of Concerned Scientists with the attached comments on the draft Groundwater Sustainability Plan for this basin.

We know that SGMA plan development and implementation is a major undertaking, and we want every basin to be successful. We would be happy to meet with you to discuss our evaluation as you finalize your Plan for submittal to DWR. Feel free to contact us at ngos.sgma@gmail.com for more information or to schedule a conversation.

Sincerely,

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

October 19, 2021

Vina GSA
308 Nelson Avenue
Oroville, CA 95965

Submitted via email: VinaGSA@gmail.com

Re: Public Comment Letter for Vina Subbasin Draft GSP

Dear Christina Buck,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Vina Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Vina Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Amy Merrill, Ph.D.
Acting Director, California Program
American Rivers

Kristan Culbert
Associate Director, California Central Valley River Conservation
American Rivers

Attachment A

Specific Comments on the Vina Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. The GSP provides information on DACs, including identification by name and location on a map. However, the plan fails to clearly document the population of each DAC. In addition, the GSP fails to include the population dependent on groundwater as their source of drinking water in the subbasin.

Appendix 1-D of the GSP states that the Mechoopda Indian Tribe of Chico Rancheria is located in Vina Subbasin. The location and map of tribal lands, however, is not provided.

While the plan provides a density map of domestic wells in the subbasin (Figure 1-9), the GSP fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin.

These missing elements are required for the GSAs to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS

- Provide the population of each identified DAC. Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).
- Provide a map of tribal lands and describe the tribal population within the subbasin.
- Include a map showing domestic well locations and average well depth across the subbasin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. GSP Section 2.2.6.2 (Evaluation of Surface Water Connectivity) describes well locations, proximity to streams, and screening depths that were used to evaluate surface water connectivity. However, Section 2.2.6.3 (Estimates of Surface

Water Connection Based on BBGM [Butte Basin Groundwater Model]) does not describe the data used in the BBGM model, such as the groundwater level monitoring well data and stream gauge data that were incorporated into the model. Additionally, no description was provided of the temporal (seasonal and interannual) variability of the data used to calibrate the model. This information should be provided in the GSP to support the conclusions presented.

Figure 2-26 presents a map of stream reaches in the subbasin, showing the percentage of months of either a gaining or losing condition in the subbasin as predicted by the BBGM model. Based on the color coding it appears that all surface water is considered to be connected, but the percentage of connection for many of the upland streams and tributaries in the subbasin are labeled 0%. Therefore it is not clear what is an ISW and what is not based on this map. We recommend that these labels are clarified in the text so it is more clear which stream segments are retained as ISWs or potential ISWs in the GSP and to include a description of the logic behind determining which reaches are and are not ISWs. Note the regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

RECOMMENDATIONS

- Describe the legend labels used on Figure 2-26 in the GSP text to make clear which stream segments are retained as ISWs or potential ISWs in the GSP.
- Further describe the groundwater elevation data and stream flow data used in the BBGM analysis. Ensure depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) are used to determine the range of depth and capture the variability in environmental conditions inherent in California's climate.
- To confirm and illustrate the results of the groundwater modeling, overlay the stream reaches shown on Figure 2-26 with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis.
- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.
- Describe data gaps for the ISW analysis in the ISW section, in addition to the discussion in the HCM section (2.1.9.2). On Figure 2-26, include reaches with data gaps as potential ISWs.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP does not discuss how the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) was verified with the use of groundwater data from the shallow aquifer. Without an analysis of groundwater data to verify the NC dataset polygons, it will be difficult or impossible to adequately monitor and manage the subbasin's GDEs throughout GSP implementation.

The GSP took initial steps to identify and map GDEs using the NC dataset and other sources. However, we found that some mapped features in the NC dataset were improperly disregarded. NC dataset polygons were incorrectly removed in areas adjacent to irrigated fields or due to the presence of surface water supplies. However, this removal criteria is flawed since GDEs, in addition to groundwater, can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields – simultaneously and at different temporal/spatial scales. NC dataset polygons adjacent to irrigated land or surface water supplies can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on their proximity to irrigated fields or surface water.

The GSP did not discuss the flora or fauna species present in the subbasin's GDEs, except to acknowledge the presence of Valley oak (*Quercus lobata*) in the subbasin. We commend the GSAs for retaining all Valley oak polygons in the NC dataset based on the recognition that they can access groundwater at deeper depths.

RECOMMENDATIONS

- Provide a comprehensive set of maps for the subbasin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained, removed, or added to/from the NC dataset (include the removal reason if polygons are not considered potential GDEs, or include the data source if polygons are added). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network. It is not clear from the description in the GSP whether NC dataset polygons labeled as 'Not Likely a GDE' are retained as potential GDEs.

- Include an inventory of the fauna and flora present within the subbasin's GDEs (see Attachment C of this letter for a list of freshwater species located in the Vina Subbasin). Note any threatened or endangered species.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[1,2] to be included in the water budget. The integration of these ecosystems into the water budget is **sufficient** because the groundwater demands of native vegetation and managed wetlands are included in the historical, current, and projected water budgets. Additional clarification is needed on why the current and projected water demands for managed wetlands are approximately half the water demands represented in the historical water budget (Table 2-7). These ecosystems will have continued or higher water needs in the future to provide habitat for migratory birds.

RECOMMENDATION

- Revisit the current and projected water demands for managed wetlands, which are represented in the GSP as approximately half the historical water demands. Provide a justification for these water budget values for managed wetlands in Table 2-7. Also, provide the water budget model documentation referenced in the GSP (BCDWRC 2021).

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the Communication and Engagement Plan (Appendix 1-D).

The Communication and Engagement Plan documents representation of tribal and environmental interests during the GSP development process. A tribal staff member from the Mechoopda Indian Tribe of Chico Rancheria has represented the tribe during GSP development and participates as a member of the Vina GSA Management Committee. Additionally, there is an environmental representative on the GSA Advisory Committee.

However, we note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement with DACs and drinking water users are described in very general terms. They include meetings open to the public, including GSA Board meetings, meetings in conjunction with the Reclamation District,

[1] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[2] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[3] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

subbasin-wide technical meetings, Farm Bureau Water Forum meeting, City of Chico meetings, and Regional Water Management Group meetings. No specific outreach targeted to DACs is described in the GSP.

- The GSP describes an Engagement Matrix in Appendix 1-F for engaging with DACs, tribes, and environmental stakeholders through the implementation phase. However, Appendix 1-F was not included in the Draft GSP.

RECOMMENDATION

- In the Communication and Engagement Plan, describe active and targeted outreach to engage DAC members, drinking water users, environmental stakeholders and consultation to tribes through the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[4] and establishing minimum thresholds.[5,6]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP discusses minimum thresholds impact on domestic wells (see Section 3.3.2 Minimum Thresholds). The GSP states (p. 103): *"In recent years, Butte County has documented a number of domestic wells that have "gone dry," meaning groundwater levels have fallen below the depth of the well installation and/or pump. This occurred during summer months of recent drought years and heightened concern among some stakeholders. As a result, domestic well reliability and protection are the focus of the Groundwater Levels MT."* The GSP discusses the use of the DWR domestic well database and sets minimum threshold levels protective of domestic wells by establishing a representative zone for each RMS well.

The GSP does not however, sufficiently describe or analyze direct or indirect impacts on DACs or tribes when defining undesirable results, nor does it describe how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results to DACs and tribes in the subbasin.

[4] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[5] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[6] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

For degraded water quality, salinity is the only constituent of concern (COC) for which SMC are established in the Vina Subbasin. The minimum threshold is set to the upper limit of the Secondary Maximum Contaminant Level (SMCL) for specific conductance based on the state secondary drinking water standards. The GSP states (p. 108): *"Other constituents, as discussed in Section 2.2.4, are managed through existing management and regulatory programs within the Subbasin, such as the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) and the Irrigated Lands Regulatory Program (ILRP), which focus on improving water quality by managing septic and agricultural sources of salinity and nutrients. Additionally, point-source contaminants are managed and regulated through a variety of programs by the Regional Water Quality Control Board (RWQCB), Department of Toxic Substances Control (DTSC), and the U.S. Environmental Protection Agency (EPA)."* However, SMC should be established for all COCs including chemicals of emerging concern (CEC) in the subbasin impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

The GSP only includes a very general discussion of impacts to drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs, drinking water users or tribes when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on beneficial users.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels (in addition to describing impacts to drinking water users).

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[7]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes.

- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that can be impacted and/or exacerbated as a result of groundwater use or groundwater management. Ensure they align with drinking water standards[8].

[7] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[8] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts to GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC for chronic lowering of groundwater levels.

The GSP recognizes a data gap with respect to the interconnected surface water SMC. The GSP states (p. 113): *"The GSAs in the Vina Subbasin intend to further evaluate this SMC to avoid undesirable results to aquatic ecosystems and GDEs. To that end, an Interconnected Surface Water SMC framework has been developed for the GSP as described below. This framework will guide future data collection efforts to fill data gaps, either as part of GSP projects and management actions or plan implementation."*

While the data gap is being filled, the SMC for depletion of interconnected surface water are established by proxy using groundwater levels. The GSP states (p. 115): *"Therefore, at this time, Groundwater Levels SMC are used by proxy and the MT for interconnected surface water is the same as for groundwater levels: Two RMS wells reach their MT for two consecutive non-dry year-types."* However, no analysis or discussion is presented to describe how the SMC will affect GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- Define chronic lowering of groundwater SMC directly for environmental beneficial users of groundwater. When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[9] in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds[10] can be determined.

- When establishing SMC for the basin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs should include "impacts on groundwater dependent ecosystems".

[9] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[10] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached[11]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,12].

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[13] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

The GSP includes climate change into key inputs (e.g., precipitation, evapotranspiration, and surface water flow) of the projected water budget. However, the sustainable yield is based on historic pumping rates instead of the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, tribes, and domestic well owners.

---

[11] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[12] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[13] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, tribes, GDEs, and ISWs in the subbasin.

Figure 4-5 (Groundwater Level RMS Wells) and Figure 4-6 (Water Quality RMS Wells) show that no monitoring wells are located across portions of the subbasin near DACs, domestic wells, and tribes (see maps provided in Attachment E). Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[14].

The GSP provides some discussion of data gaps for GDEs and ISWs in Sections 4.10 (Network Assessment and Improvements) and Section 6.1.3 (Data Analysis), however does not provide specific plans, such as locations or a timeline, to fill the data gaps.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, tribes, GDEs, and ISWs to clearly identify potentially impacted areas. Increase the number of RMSs in the shallow aquifer across the subbasin as needed to adequately monitor all groundwater condition indicators. Prioritize proximity to DACs, domestic wells, tribes, and GDEs when identifying new RMSs.
- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

[14] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, drinking water users, and tribes. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

The GSP includes projects and management actions with explicit benefits to the environment. The plan also includes a domestic well mitigation program. However, the mitigation program is described as a potential project instead of a proposed project that will be implemented within the GSP planning horizon.

RECOMMENDATIONS

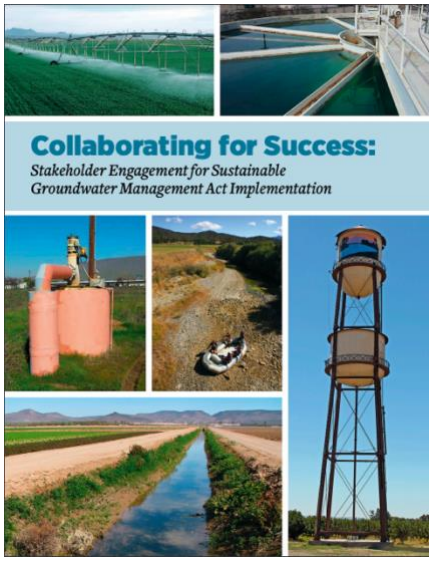
- Clarify the planning horizon of the described domestic well mitigation program to ensure that it will proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.
- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSAs plans to mitigate such impacts.
- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the “Multi-Benefit Recharge Project Methodology Guidance Document”[15].
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[15] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



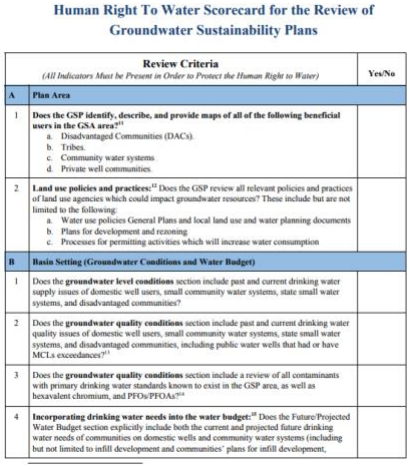
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

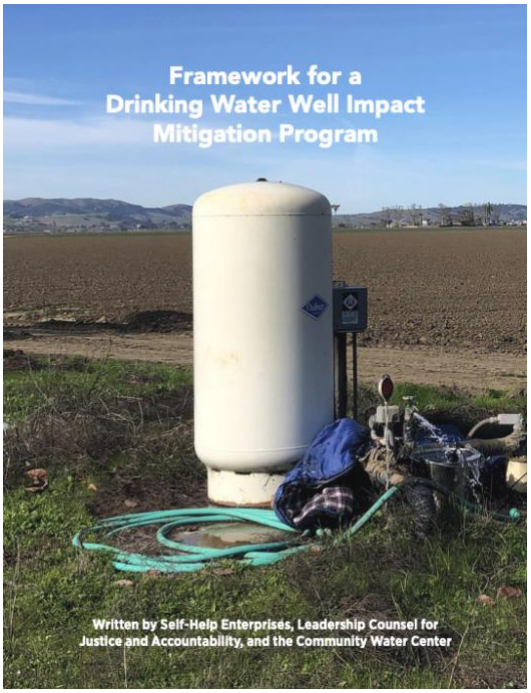


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[13] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[14] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[15]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[16]	
4	**Incorporating drinking water needs into the water budget:**[18] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

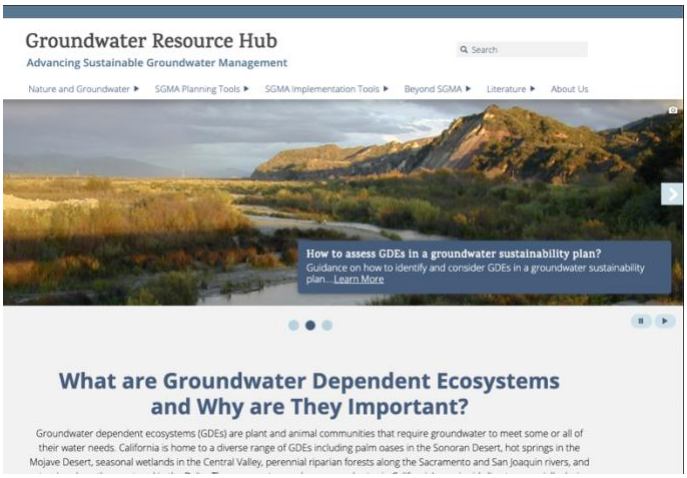
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

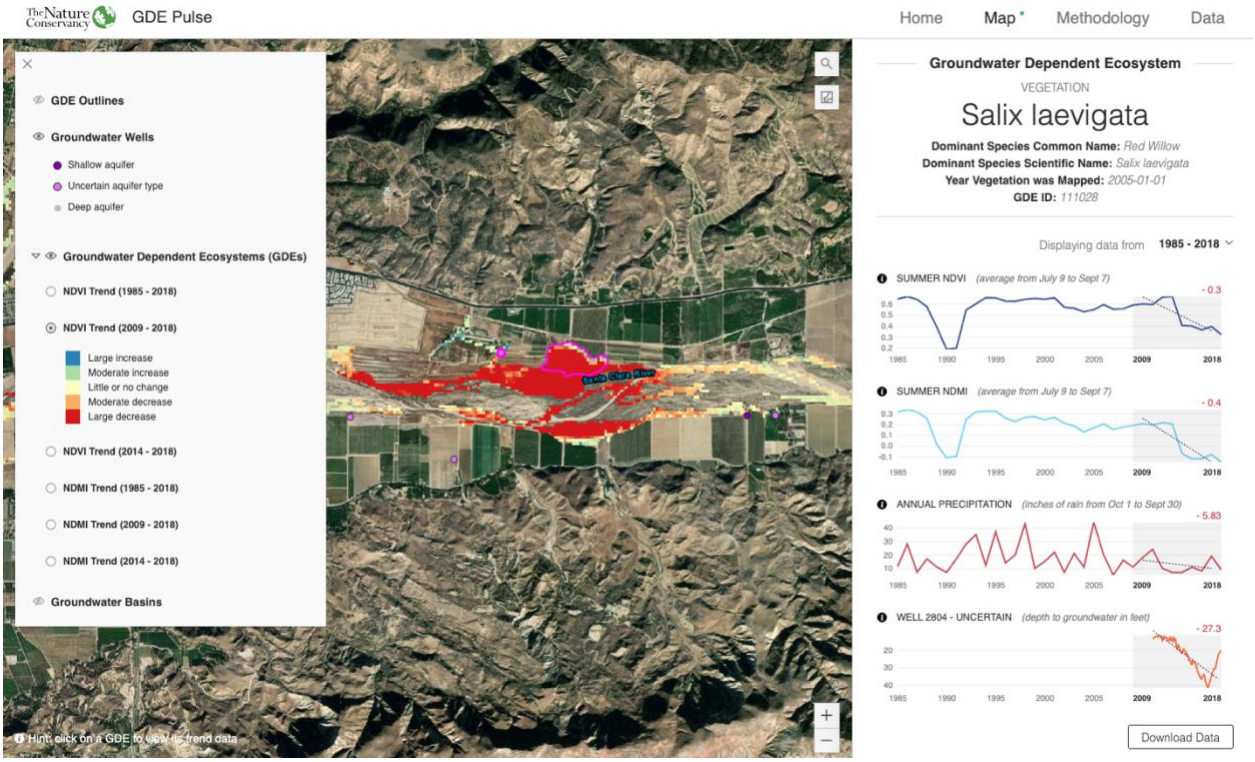
How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

---

[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

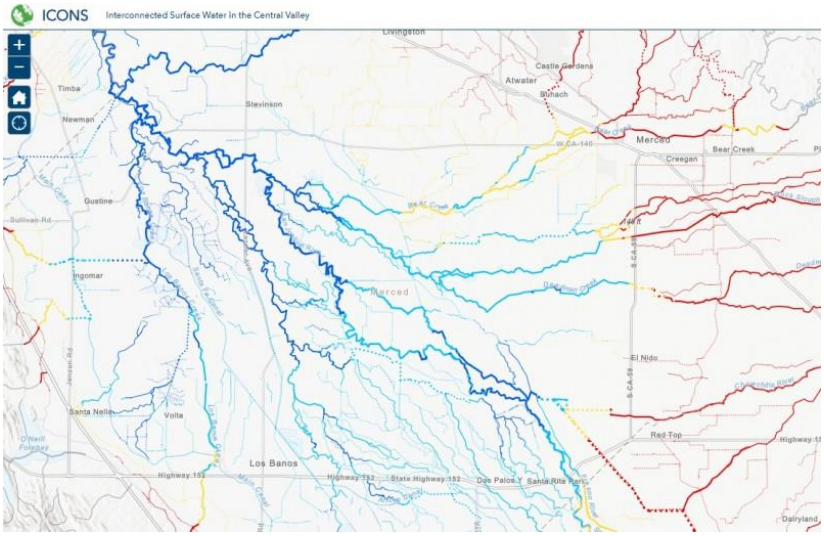
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Vina Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Vina Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	Candidate - Threatened	Endangered	
Riparia riparia	Bank Swallow		Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Laterallus jamaicensis coturniculus	California Black Rail	Bird of Conservation Concern	Threatened	
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Recurvirostra americana	American Avocet			

Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta conservatio	Conservancy Fairy Shrimp	Endangered	Special	IUCN - Endangered
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
Branchinecta mackini	Alkali Fairy Shrimp			
Branchinecta mesovallensis	Midvalley Fairy Shrimp		Special	
Cambaridae fam.	Cambaridae fam.			
Hyalella spp.	Hyalella spp.			
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV winter	Central Valley winter Chinook salmon	Endangered	Endangered	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			

Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Ablabesmyia spp.	Ablabesmyia spp.			
Acentrella turbida	A Mayfly			
Ambrysus spp.	Ambrysus spp.			
Anax junius	Common Green Darner			
Antocha spp.	Antocha spp.			
Apedilum spp.	Apedilum spp.			
Argia agrioides	California Dancer			
Argia emma	Emma's Dancer			
Argia lugens	Sooty Dancer			
Argia nahuana	Aztec Dancer			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Asioplax spp.	Asioplax spp.			
Baetidae fam.	Baetidae fam.			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Berosus spp.	Berosus spp.			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Brillia spp.	Brillia spp.			
Caenis latipennis	A Mayfly			
Caenis spp.	Caenis spp.			
Callibaetis spp.	Callibaetis spp.			
Camelobaetidius warreni	A Mayfly			
Cardiocladius spp.	Cardiocladius spp.			
Centroptilum spp.	Centroptilum spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chimarra spp.	Chimarra spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Cladotanytarsus spp.	Cladotanytarsus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corixidae fam.	Corixidae fam.			
Cricotopus nostocicola				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Despaxia augusta	Smooth Needleflyl			
Dicrotendipes spp.	Dicrotendipes spp.			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Dolophilodes spp.	Dolophilodes spp.			
Dytiscidae fam.	Dytiscidae fam.			

Ecdyonurus criddlei	A Mayfly			
Elmidae fam.	Elmidae fam.			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Enallagma cyathigerum				Not on any status lists
Epeorus spp.	Epeorus spp.			
Ephemerellidae fam.	Ephemerellidae fam.			
Erythemis collocata	Western Pondhawk			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Glossosoma spp.	Glossosoma spp.			
Gomphus kurilis	Pacific Clubtail			
Gumaga spp.	Gumaga spp.			
Helicopsyche spp.	Helicopsyche spp.			
Helochares normatus				Not on any status lists
Heptageniidae fam.	Heptageniidae fam.			
Hetaerina americana	American Rubyspot			
Hydrobius fuscipes				Not on any status lists
Hydropsyche californica	A Caddisfly			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ischnura cervula	Pacific Forktail			
Ischnura denticollis	Black-fronted Forktail			
Ischnura perparva	Western Forktail			
Labrundinia spp.	Labrundinia spp.			
Laccobius spp.	Laccobius spp.			
Larsia spp.	Larsia spp.			
Lepidostoma spp.	Lepidostoma spp.			
Leptoceridae fam.	Leptoceridae fam.			
Leptohyphidae fam.	Leptohyphidae fam.			
Leucotrichia pictipes	A Micro Caddisfly			
Libellula forensis	Eight-spotted Skimmer			
Libellula luctuosa	Widow Skimmer			
Libellula pulchella	Twelve-spotted Skimmer			
Libellula saturata	Flame Skimmer			
Libellulidae fam.	Libellulidae fam.			
Liodessus obscurellus				Not on any status lists
Macromia magnifica	Western River Cruiser			
Microcylloepus similis				Not on any status lists
Microcylloepus spp.	Microcylloepus spp.			
Micropsectra spp.	Micropsectra spp.			
Microtendipes spp.	Microtendipes spp.			

Mideopsis spp.	Mideopsis spp.			
Mystacides alafimbriatus	A Caddisfly			
Mystacides spp.	Mystacides spp.			
Nanocladius spp.	Nanocladius spp.			
Nectopsyche spp.	Nectopsyche spp.			
Nilothauma spp.	Nilothauma spp.			
Ochrotrichia spp.	Ochrotrichia spp.			
Oecetis disjuncta	A Caddisfly			
Oecetis spp.	Oecetis spp.			
Ophiogomphus bison	Bison Snaketail			
Optioservus spp.	Optioservus spp.			
Oxyethira spp.	Oxyethira spp.			
Pachydiplax longipennis	Blue Dasher			
Paltothemis lineatipes	Red Rock Skimmer			
Pantala hymenaea	Spot-winged Glider			
Parakiefferiella spp.	Parakiefferiella spp.			
Paraleptophlebia spp.	Paraleptophlebia spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Peltodytes spp.	Peltodytes spp.			
Pentaneura spp.	Pentaneura spp.			
Petrophila spp.	Petrophila spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Plathemis lydia	Common Whitetail			
Polycentropus spp.	Polycentropus spp.			
Polypedilum spp.	Polypedilum spp.			
Procloeon spp.	Procloeon spp.			
Progomphus borealis	Gray Sanddragon			
Protoptila spp.	Protoptila spp.			
Psectrocladius spp.	Psectrocladius spp.			
Psephenus falli				Not on any status lists
Pseudochironomus spp.	Pseudochironomus spp.			
Pseudosmittia spp.	Pseudosmittia spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhyacophila spp.	Rhyacophila spp.			
Sanfilippodytes spp.	Sanfilippodytes spp.			
Serratella micheneri	A Mayfly			
Sialis spp.	Sialis spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Stenochironomus spp.	Stenochironomus spp.			
Stenocolus scutellaris				Not on any status lists
Stictotarsus spp.	Stictotarsus spp.			
Sympetrum corruptum	Variegated Meadowhawk			
Tanypus spp.	Tanypus spp.			
Tanytarsus spp.	Tanytarsus spp.			

Telebasis salva	Desert Firetail			
Tinodes spp.	Tinodes spp.			
Tramea lacerata	Black Saddlebags			
Tricorythodes spp.	Tricorythodes spp.			
Tvetenia spp.	Tvetenia spp.			
Zaitzevia spp.	Zaitzevia spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Ferrissia spp.	Ferrissia spp.			
Gonidea angulata	Western Ridged Mussel		Special	
Gyraulus spp.	Gyraulus spp.			
Helisoma spp.	Helisoma spp.			
Lymnaea spp.	Lymnaea spp.			
Margaritifera falcata	Western Pearlshell		Special	
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Sphaeriidae fam.	Sphaeriidae fam.			
PLANTS				
Limnanthes floccosa californica	Shippee Meadowfoam	Endangered	Endangered	CRPR - 1B.1
Limnanthes floccosa floccosa	Woolly Meadowfoam		Special	CRPR - 4.2
Orcuttia pilosa	Hairy Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Orcuttia tenuis	Slender Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Rhynchospora californica	California Beakrush		Special	CRPR - 1B.1
Sagittaria sanfordii	Sanford's Arrowhead		Special	CRPR - 1B.2
Tuctoria greenei	Green's Awnless Orcutt Grass	Endangered	Rare	CRPR - 1B.1
Alisma triviale	Northern Water-plantain			
Alnus rhombifolia	White Alder			
Alnus rubra	Red Alder			
Alopecurus aequalis aequalis	Short-awn Foxtail			
Alopecurus carolinianus	Tufted Foxtail			
Alopecurus geniculatus geniculatus	Meadow Foxtail			
Alopecurus saccatus	Pacific Foxtail			

Ammannia coccinea	Scarlet Ammannia			
Ammannia robusta	Grand Redstem			
Arundo donax	NA			
Azolla filiculoides	NA			
Baccharis salicina				Not on any status lists
Bacopa rotundifolia	NA			
Bergia texana	Texas Bergia			
Boehmeria cylindrica	NA			Not on any status lists
Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Carex densa	Dense Sedge			
Carex feta	Green-sheath Sedge			
Carex nudata	Torrent Sedge			
Carex vulpinoidea	NA			
Cephalanthus occidentalis	Common Buttonbush			
Ceratophyllum demersum	Common Hornwort			
Chamaecyparis lawsoniana				Not on any status lists
Cicendia quadrangularis	Oregon Microcala			
Crassula aquatica	Water Pygmyweed			
Crypsis vaginiflora	NA			
Cyperus bipartitus	Shining Flatsedge			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus flavescens	NA			
Cyperus fuscus	NA			
Cyperus squarrosus	Awned Cyperus			
Damasonium californicum				Not on any status lists
Darmera peltata	Umbrella Plant			
Datisca glomerata	Durango Root			
Downingia bella	Hoover's Downingia			
Downingia bicornuta	NA			
Downingia cuspidata	Toothed Calicoflower			
Downingia ornatissima	NA			
Downingia pusilla	Dwarf Downingia		Special	CRPR - 2B.2
Echinochloa oryzoides	NA			
Echinodorus berteroi	Upright Burhead			
Elatine brachysperma	Shortseed Waterwort			
Elatine californica	California Waterwort			
Elatine heterandra	Mosquito Waterwort			
Elatine rubella	Southwestern Waterwort			

Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis acicularis gracilescens	Least Spikerush			
Eleocharis acicularis occidentalis				Not on any status lists
Eleocharis atropurpurea	Purple Spikerush			
Eleocharis bella	Delicate Spikerush			
Eleocharis coloradoensis				Not on any status lists
Eleocharis engelmannii engelmannii	Engelmann's Spikerush			Not on any status lists
Eleocharis flavescens flavescens	Pale Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis parishii	Parish's Spikerush			
Eleocharis quadrangulata	NA			
Eleocharis radicans	Rooted Spikerush			
Eleocharis rostellata	Beaked Spikerush			
Elodea canadensis	Broad Waterweed			
Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Epipactis gigantea	Giant Helleborine			
Eryngium aristulatum aristulatum	California Eryngo			
Eryngium articulatum	Jointed Coyote-thistle			
Eryngium castrense	Great Valley Eryngo			
Eryngium vaseyi vallicola				Not on any status lists
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euphorbia hooveri	NA			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Fimbristylis autumnalis	NA			
Gratiola ebracteata	Bractless Hedge-hyssop			
Gratiola heterosepala	Boggs Lake Hedge-hyssop		Endangered	CRPR - 1B.2
Hypericum anagalloides	Tinker's-penny			
Isoetes howellii	NA			
Isoetes nuttallii	NA			
Isoetes orcuttii	NA			
Juncus acuminatus	Sharp-fruit Rush			
Juncus dubius	Mariposa Rush			
Juncus effusus pacificus				
Juncus uncialis	Inch-high Rush			

Juncus usitatus	NA			Not on any status lists
Lasthenia fremontii	Fremont's Goldfields			
Lasthenia glabrata coulteri	Coulter's Goldfields		Special	CRPR - 1B.1
Leersia oryzoides	Rice Cutgrass			
Lemna minor	Lesser Duckweed			
Lemna minuta	Least Duckweed			
Limnanthes alba alba	White Meadowfoam			
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limnanthes douglasii rosea	Douglas' Meadowfoam			
Limosella acaulis	Southern Mudwort			
Lindernia dubia	Yellowseed False Pimpernel			
Lipocarpha micrantha	Dwarf Bulrush			
Ludwigia palustris	Marsh Seedbox			
Ludwigia peploides montevidensis	NA			Not on any status lists
Ludwigia peploides peploides	NA			Not on any status lists
Lycopus americanus	American Bugleweed			
Lythrum portula	NA			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus glaucescens	Shield-bract Monkeyflower		Special	CRPR - 4.3
Mimulus guttatus	Common Large Monkeyflower			
Mimulus latidens	Broad-tooth Monkeyflower			
Mimulus pilosus				Not on any status lists
Mimulus tricolor	Tricolor Monkeyflower			
Myosurus minimus	NA			
Myosurus sessilis	Sessile Mousetail			
Myriophyllum aquaticum	NA			
Najas gracillima	NA			
Najas guadalupensis guadalupensis	Southern Naiad			
Navarretia heterandra	Tehama Navarretia			
Navarretia intertexta	Needleleaf Navarretia			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Panicum acuminatum acuminatum				Not on any status lists
Panicum dichotomiflorum	NA			
Paspalum distichum	Joint Paspalum			
Perideridia kelloggii	Kellogg's Yampah			

Persicaria hydropiper	NA			Not on any status lists
Persicaria hydropiperoides				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phyla lanceolata	Fog-fruit			
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys austiniae	Austin's Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys humistratus	Dwarf Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Pogogyne douglasii	NA			
Pogogyne zizyphoroides				Not on any status lists
Potamogeton diversifolius	Water-thread Pondweed			
Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton nodosus	Longleaf Pondweed			
Potamogeton pusillus pusillus	Slender Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Ranunculus aquatilis aquatilis	White Water Buttercup			
Ranunculus aquatilis diffusus				Not on any status lists
Ranunculus hystriculus				Not on any status lists
Ranunculus pusillus pusillus	Pursh's Buttercup			
Ranunculus sardous	NA			
Ranunculus sceleratus	NA			
Rorippa palustris palustris	Bog Yellowcress			
Rotala ramosior	Toothcup			
Rumex conglomeratus	NA			
Sagittaria latifolia latifolia	Broadleaf Arrowhead			
Sagittaria longiloba	Longbarb Arrowhead			

Sagittaria montevidensis calycina				Not on any status lists
Salix babylonica	NA			
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix melanopsis	Dusky Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus mucronatus	NA			
Schoenoplectus tabernaemontani	Softstem Bulrush			
Sequoia sempervirens				
Sidalcea calycosa calycosa	Annual Checker-mallow			
Sidalcea hirsuta	Hairy Checker-mallow			
Spirodela polyrhiza	NA			
Stachys stricta	Sonoma Hedge-nettle			
Stuckenia pectinata				Not on any status lists
Symphyotrichum bracteolatum				Not on any status lists
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Utricularia macrorhiza	Greater Bladderwort			
Utricularia minor	Lesser Bladderwort		Special	CRPR - 4.2
Veronica anagallis-aquatica	NA			
Wolffia brasiliensis	Pointed Watermeal		Special	CRPR - 2B.3
Zannichellia palustris	Horned Pondweed			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

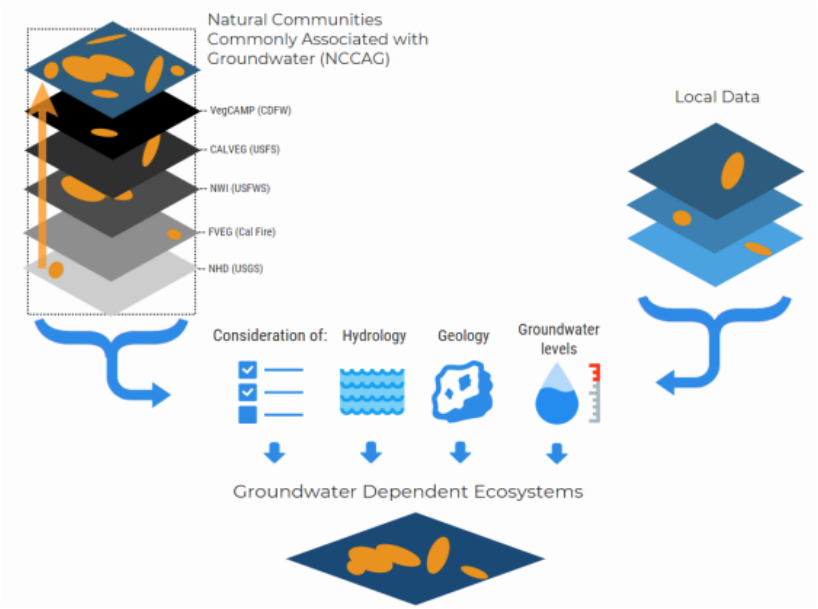


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

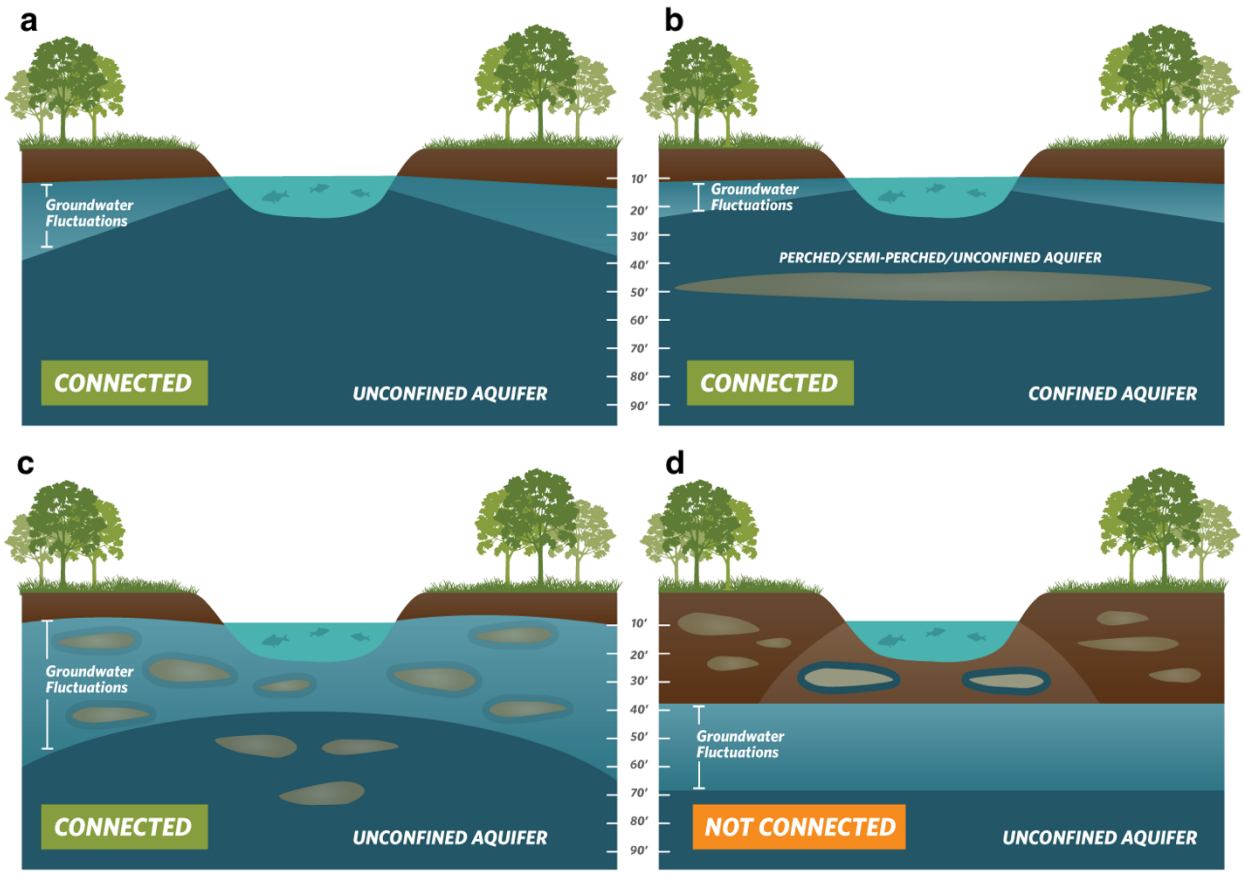


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

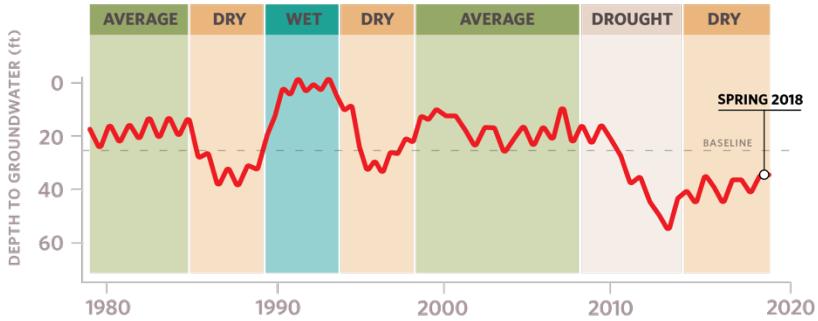


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

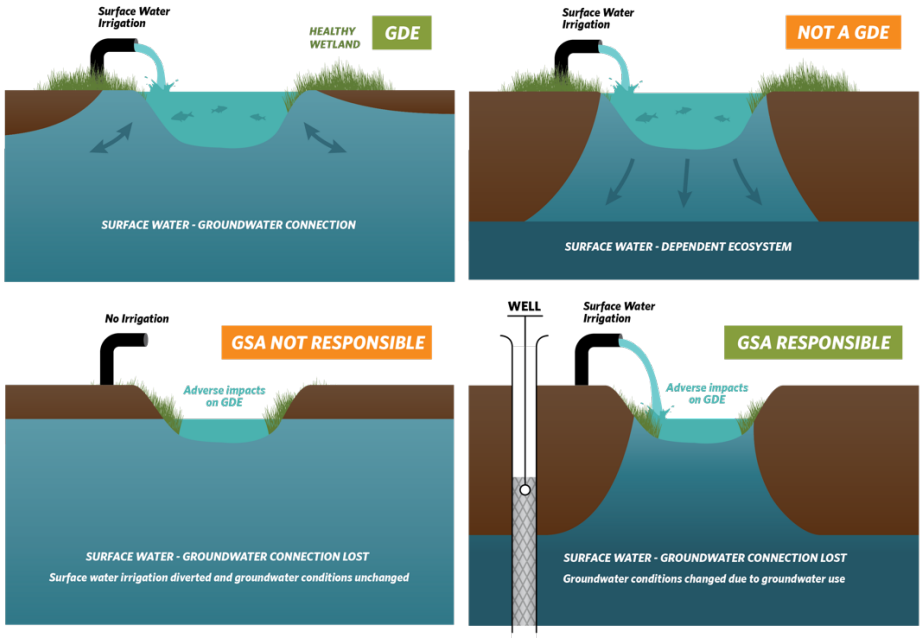


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

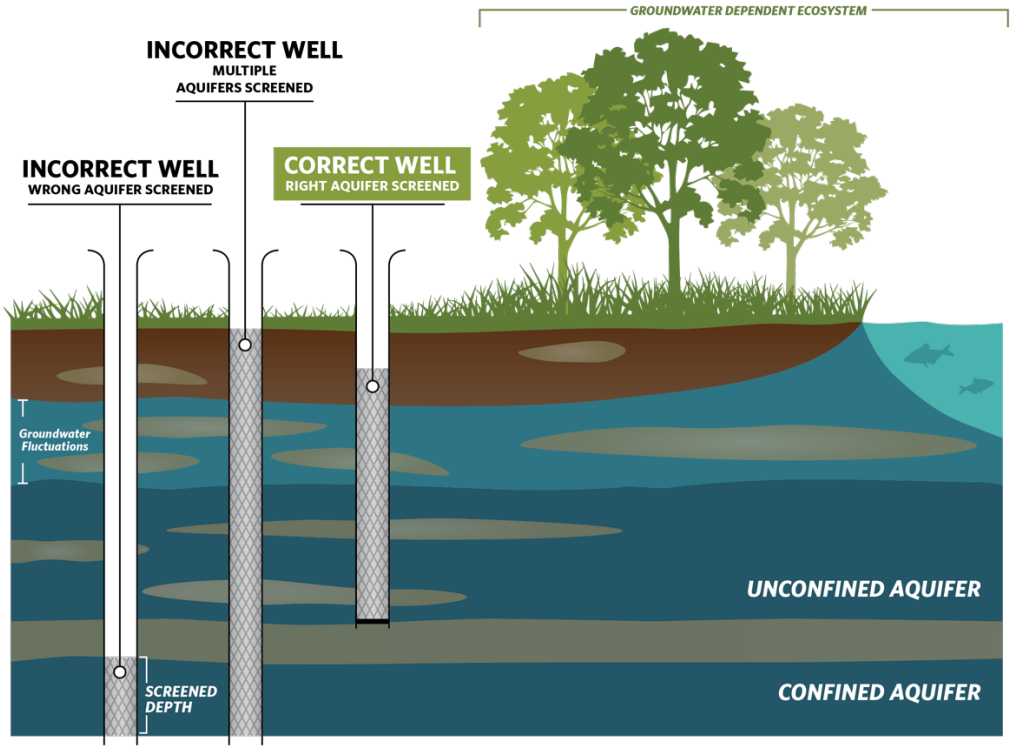


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

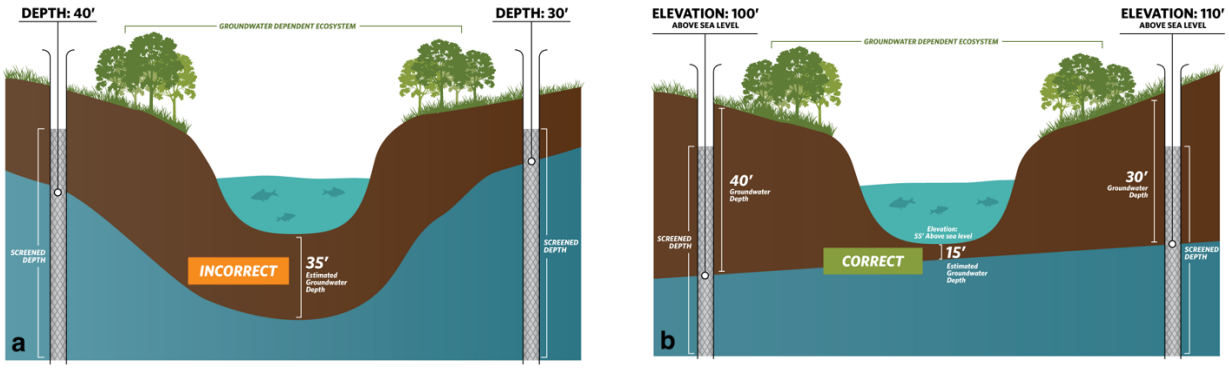


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

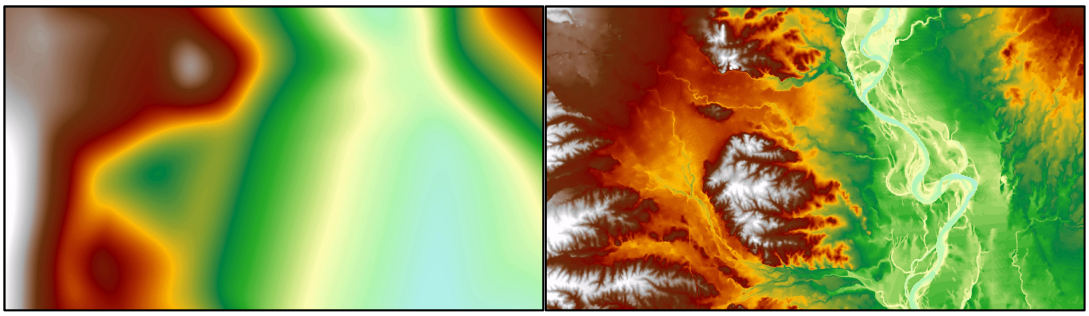


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

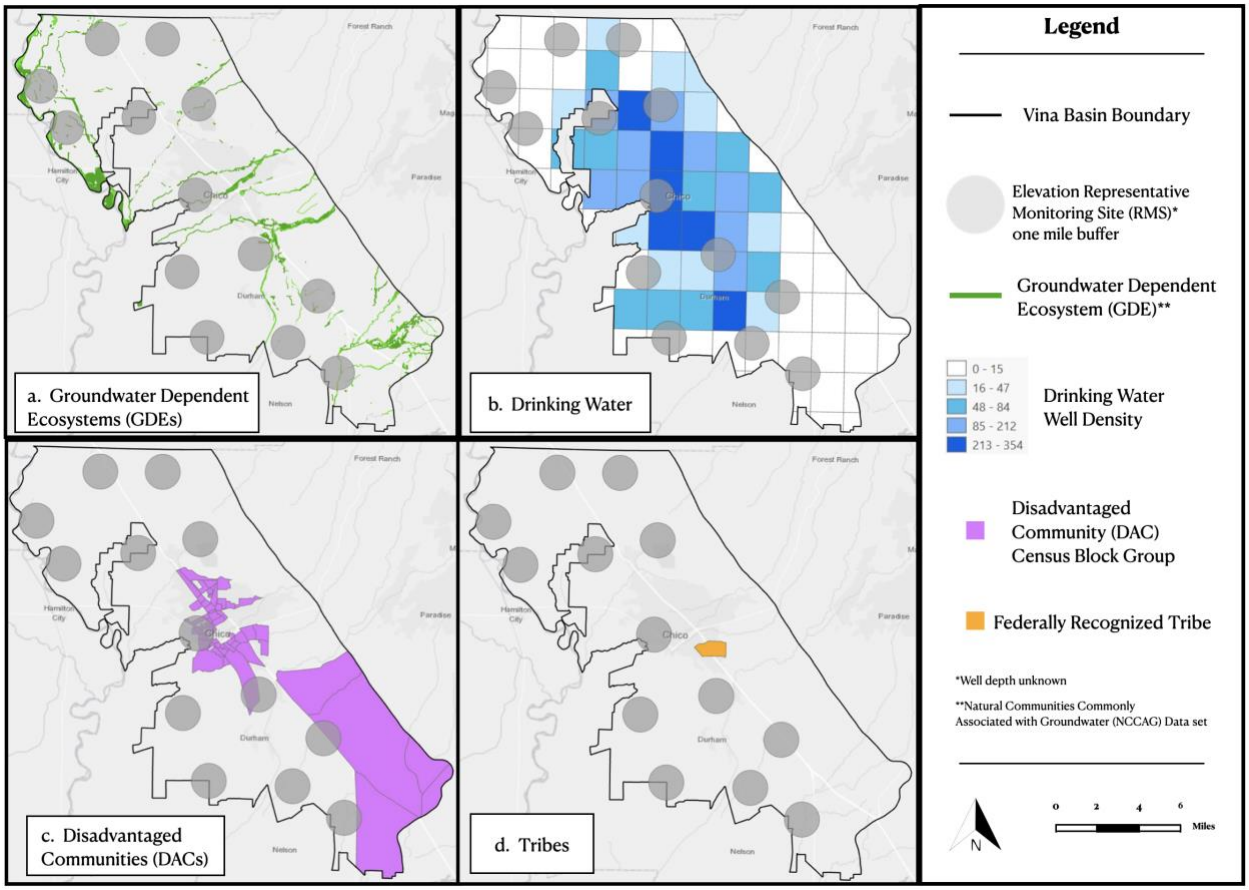


Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

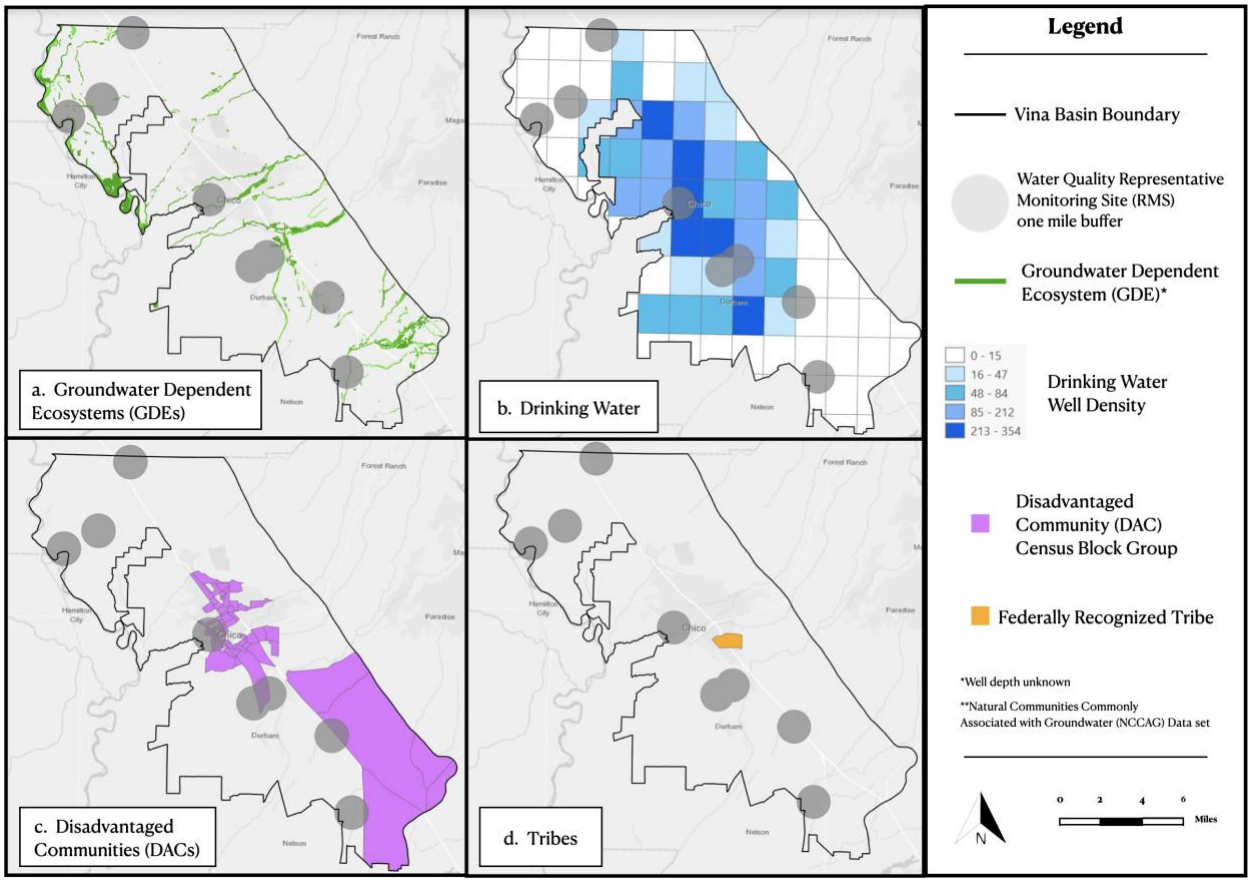


Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

Vina DRAFT GSP
Comment A2

From:	Dorman, April@Wildlife
To:	VinaGSA@gmail.com
Cc:	Grover, Joshua@Wildlife; Holmes, Robert@Wildlife; Murvine, Angela@Wildlife; Garcia, Jennifer@Wildlife; Seapy, Briana@Wildlife; Gibbons, Bridget@Wildlife; Altare, Craig@DWR; Spangler, Debbie@DWR; Durham, Winley; Stork, Natalie@Waterboards; Rick.Rogers@noaa.gov
Subject:	Vina Subbasin Draft Groundwater Sustainability Plan
Date:	Thursday, October 7, 2021 2:47:19 PM
Attachments:	image001.png Vina_DraftGSP_CDFW_10-4-21.pdf

ATTENTION: This message originated from outside **Butte County**. Please exercise judgment before opening attachments, clicking on links, or replying.

Hello,

Please see the attached document regarding CDFW comments on the Vina Subbasin Draft Groundwater Sustainability Plan.

Sincerely,

April Dorman - Office Technician
Timberland Conservation Program
North Central Region
1701 Nimbus Road
Rancho Cordova, CA 95670
April.Dorman@wildlife.ca.gov

DocuSign Envelope ID: 913875DE-0495-4606-A7D1-A99E7236C2A5

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
North Central Region/Region 2
1701 Nimbus Road
Rancho Cordova, CA 95670
www.wildlife.ca.gov
(916) 358-2900

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

October 7, 2021

Butte County Department of Water & Resource Conservation
Vina Subbasin
308 Nelson Avenue
Oroville, CA 95965
Email: VinaGSA@gmail.com

Subject: COMMENTS ON THE VINA SUBBASIN DRAFT GROUNDWATER SUSTAINABILITY PLAN

The California Department of Fish and Wildlife's (Department) North Central Region is providing comments on the Vina Subbasin Draft Groundwater Sustainability Plan (GSP) prepared by the Vina Groundwater Sustainability Agency (GSA) and Rock Creek Reclamation District GSA pursuant to the Sustainable Groundwater Management Act (SGMA).

As trustee agency for the State's fish and wildlife resources, the Department has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of such species (Fish & Game Code §§ 711.7 and 1802).

Development and implementation of GSPs under SGMA represents a new era of California groundwater management. The Department has an interest in the sustainable management of groundwater, as many sensitive ecosystems and species depend on groundwater and interconnected surface waters, including ecosystems on Department-owned and -managed lands within SGMA-regulated basins.

SGMA and its implementing regulations afford ecosystems and species specific statutory and regulatory consideration, including the following as pertinent to Groundwater Sustainability Plans:

- GSPs must **consider impacts to groundwater dependent ecosystems** (GDEs) (Water Code § 10727.4(l); see also 23 CCR § 354.16(g));
- GSPs must consider the interests of all beneficial uses and users of groundwater, including environmental users of groundwater (Water Code § 10723.2) and GSPs must **identify and consider potential effects on all beneficial uses and users of groundwater** (23 CCR §§ 354.10(a), 354.26(b)(3), 354.28(b)(4), 354.34(b)(2), and 354.34(f)(3));
- GSPs must **establish sustainable management criteria that avoid undesirable results** within 20 years of the applicable statutory deadline, including **depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water** (23 CCR § 354.22 *et seq*. and Water Code §§ 10721(x)(6) and 10727.2(b)) and describe monitoring networks that can identify adverse

DocuSign Envelope ID: 913875DE-0495-4606-A7D1-A99E7236C2A5

impacts to beneficial uses of interconnected surface waters (23 CCR § 354.34(c)(6)(D)); and

- GSPs must **account for groundwater extraction for all water use sectors,** including managed wetlands, managed recharge, and native vegetation (23 CCR §§ 351(al) and 354.18(b)(3)).

Furthermore, the Public Trust Doctrine imposes a related but distinct obligation to consider how groundwater management affects public trust resources, including navigable surface waters and fisheries. Groundwater hydrologically connected to navigable surface waters and surface waters tributary to navigable surface waters are also subject to the Public Trust Doctrine to the extent that groundwater extractions or diversions affect or may affect public trust uses (Environmental Law Foundation v. State Water Resources Control Board (2018), 26 Cal. App. 5th 844). Accordingly, groundwater plans should consider potential impacts to and appropriate protections for navigable interconnected surface waters and their tributaries, and interconnected surface waters that support fisheries, including the level of groundwater contribution to those waters.

In the context of SGMA statutes and regulations, and Public Trust Doctrine considerations, the Department values SGMA groundwater planning that carefully considers and protects groundwater dependent ecosystems (GDEs) and fish and wildlife beneficial uses and users of groundwater and interconnected surface waters.

COMMENT OVERVIEW

The Department is writing to support ecosystem preservation in compliance with SGMA and its implementing regulations based on Department expertise and best available information and science.

The Department recognizes and appreciates the effort of the GSAs to characterize subbasin groundwater conditions based on the data available. However, the Department believes the GSP could improve its consideration of environmental users of groundwater and establish more protective management criteria. Accordingly, the Department recommends that Vina Subbasin GSAs address the following comments before submitting the GSP to the Department of Water Resources (DWR).

COMMENTS AND RECOMMENDATIONS

The Department comments are as follows:

1. **Comment #1 Groundwater Dependent Ecosystems** (Groundwater Conditions, 2.2 Groundwater Dependent Ecosystems, starting page 67): GDE identification, required by 23 CCR § 354.16(g), is based on methods that risk exclusion of ecosystems that may depend on groundwater.

DocuSign Envelope ID: 913875DE-0495-4606-A7D1-A99E7236C2A5

a. *Issues*:

i. "Not Likely a GDE" Area Identification: The methodology used to classify potential GDE areas within the Natural Communities Commonly Associated with Groundwater (NCCAG) dataset primarily involved desktop review of aerial imagery from four drought years: 2007, 2009, 2013, and 2015 (line 2515). Potential GDE areas were classified as "Not Likely a GDE" if the areas were located within 150 feet of perennial surface water supplies, 150 feet of rice fields, 50 feet of other irrigated agriculture, or 150 feet of agricultural-dependent surface waters. This GDE-elimination method may disregard a GDE's adaptability and opportunistic approach to accessing water in which the vegetation may rely on *both* surface water and groundwater between seasons and years. Without additional analysis that compares the potential rooting depths of groundwater dependent vegetation with the depth to groundwater below the ground surface, there is insufficient information to categorize these potential GDE areas as "Not Likely a GDE." The GDE analysis also classifies potential GDEs from the NCCAG dataset as "Not Likely a GDE" if the vegetation "did not indicate surviving conditions" over the four drought years reviewed for the analysis. During drought years, it is likely that GDEs were experiencing adverse impacts due to combined groundwater depletion and reduced surface water availability. For instance, in 2015, groundwater extraction increased to replace more than 70% of lost agricultural water supplies (Lund 2018); additional groundwater pumping during drought years may have lowered the groundwater table below the rooting zone of GDEs that had previously been able to access groundwater, leading to significant impacts or mortality. The GSP states that impacts or minimum threshold exceedances that occur during dry water year types would not constitute an undesirable result (See Comment #2(iv)). It is inappropriate to simultaneously abdicate management responsibility for impacts to groundwater users during dry water year types (see Comment #2(iv)) while at the same time relying on impacts that occurred during drought years to categorize potential GDE areas as "Not Likely a GDE."

ii. Special Status Species: SGMA defines GDEs as ecological communities *or species* that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface [23 CCR § 351 (m)]. The GSP does not identify or discuss species that may be present within the

DocuSign Envelope ID: 913875DE-0495-4606-A7D1-A99E7236C2A5

subbasin that rely on groundwater, groundwater dependent ecosystems, or interconnected surface waters.

iii. Tree Species: In discussing potential impacts of groundwater depletions on GDEs or interconnected surface waters, the GSP refers to "deep-rooted tree species" (lines 189, 3406, 3698). This phrasing is narrow and excludes consideration of all vegetation types that may be groundwater dependent or supported by interconnected surface waters apart from tree species.

b. *Recommendations*:

i. "Not Likely a GDE" Area Identification: To assess potential GDE areas located near surface waters or irrigated areas, the GSP should incorporate a comparison of potential rooting depths with the groundwater surface elevation. Analysis of groundwater surface elevations should include multiple years that are representative of multiple water year types. The GDE analysis as it relates to survivability during drought years should consider the impacts of drought and increased pumping on groundwater elevation and compare those levels to GDE rooting depths. A more robust analysis would also incorporate other metrics of GDE health, including Normalized Difference Vegetation Index (NDVI) to compare between potential GDE areas and known non-groundwater dependent vegetation, rather than simply reviewing aerial imagery for indications of survival. Until sufficient information is presented to support the classification of these areas as "Not Likely a GDE," the areas should be conservatively classified as "Uncertain." The Department appreciates the GSP's acknowledgement that Valley Oak (*Q. lobata*) can access groundwater at a variety of depths and inclusion of areas containing Valley Oak communities as "Likely GDE."

ii. Special Status Species: The Department recommends the GSP include a list of special status species that may be present within the Vina Subbasin and an assessment of each species' likely groundwater dependence. The GSP should also include a spatial assessment of special status species within the subbasin to characterize which surface waters or GDE areas provide these species habitat or forage; this level of GDE-species-relationship assessment enables GSAs to prioritize GDE monitoring and management decisions.

iii. Tree Species: The Department recommends the GSP language referring to "deep-rooted tree species" be updated to be inclusive of groundwater dependent vegetation more broadly.

DocuSign Envelope ID: 913875DE-0495-4606-A7D1-A99E7236C2A5

2. **Comment #2 Sustainable Management Criteria** (Sustainable Management Criteria; 3.3 Groundwater Levels Sustainable Management Criteria, 3.8 Interconnected Surface Water Sustainable Management Criteria): Interconnected surface water (ISW) sustainable management criteria (SMC) is unlikely to protect against undesirable results for groundwater dependent ecosystems and fish and wildlife beneficial uses and users of groundwater and interconnected surface waters.
    a. *Issues*:
        i. Groundwater Level Proxy Metric: The GSP identifies a data gap related to interconnected surface waters within the subbasin and therefore defaults to using groundwater levels as a proxy metric. However, the GSP does not provide evidence that "significant correlation exists between groundwater level elevations" and depletions of interconnected surface waters [23 CCR § 354.36(b)(1)]. In its discussion of available monitoring data from nested or multi-completion wells within the subbasin, the GSP identifies well 23N01W31M, located adjacent to the Sacramento River (page 47, line 1947). The GSP indicates that the shallowest of the 4 nested wells, screened from 65 to 75 feet below ground surface (bgs), is likely in direct continuity with river levels, while the deeper three wells display greater fluctuation and generally track one another, indicating less direct continuity with the river. While the Department recognizes the lack of available data and uncertainty surrounding aquifer heterogeneity as it relates to vertical conductivity between aquifer zones, if a significant correlation is lacking between the shallower aquifer zones that are likely interconnected with surface waters and deeper zones where pumping occurs and that are monitored for the groundwater level sustainable management criteria (SMCs), use of groundwater levels as a proxy metric for ISW depletions may misinform groundwater management activities and poorly predict instream habitat conditions for fish and wildlife species.
        ii. ISW Framework: The Department acknowledges the GSP's identification of the data gap related to interconnected surface water and appreciates the development of a framework to guide data collection efforts. However, while the ISW Framework identifies the types of measurements and data necessary to better characterize groundwater-surface water interactions within the subbasin, it does not discuss the methods that will be used to identify the number or locations of groundwater monitoring wells or stream gages.

DocuSign Envelope ID: 913875DE-0495-4606-A7D1-A99E7236C2A5

iii. Minimum Thresholds and Measurable Objectives: Minimum thresholds (MTs) and measurable objectives (MOs) for groundwater levels, and by proxy for depletions of interconnected surface water, are not likely to prevent undesirable results for environmental beneficial uses and users of groundwater and interconnected surface water, including groundwater dependent ecosystems. For representative monitoring sites, measurable objectives are set to the groundwater level projected to occur in 2030 based on the trendline of historical data; management to this level would result in groundwater levels falling below historic lows for many of the monitoring wells. The GSP states that the year 2030 was chosen due to the assumption that it would take until this date to implement projects and management actions (line 3490). While the Department acknowledges that some planned PMAs involving supply augmentation may require this length of time to implement, other projects or management actions related to conservation could be implemented in a shorter timeframe, allowing the GSAs to establish more protective MOs rather than defaulting to the trend of long-term groundwater decline, which SGMA was designed to combat. MTs for groundwater levels, which the GSP asserts are designed to be protective of domestic wells, are set far below MOs, and would allow groundwater levels to fall significantly before experiencing what the GSP considers an undesirable result. For instance, within the Vina North Management Area, the MT for representative monitoring site 25C001M is set 80 feet below the MO (Table 3-1, page 107). In setting groundwater level SMCs as proxy metrics for the depletion of interconnected surface waters, the GSP fails to analyze or discuss potential impacts of the established criteria on the rate or volume of surface water depletions or on groundwater dependent ecosystems in areas that have historically demonstrated shallow groundwater levels accessible to environmental users. Under the established SMCs that allow for continued groundwater decline from current conditions, the Department expects that fish and wildlife beneficial uses and users of groundwater and interconnected surface waters could lose access to shallow groundwater water supplies and experience significant and unreasonable impacts prior to the minimum thresholds being reached, including decline of GDEs and ISW habitat suitable for cold water fisheries. The established SMCs would allow groundwater levels to drop well below levels that occurred in 2015, which was the second of back-to-back critically dry water years in the

DocuSign Envelope ID: 913875DE-0495-4606-A7D1-A99E7236C2A5

Sacramento Valley during which time vegetated and aquatic GDEs experienced adverse impacts including stressed or dying riparian vegetation, poor instream habitat availability, and increased water temperatures (DFW 2019). The Department does not believe groundwater levels above the proposed minimum thresholds and below the proposed measurable objectives (in the margin of operational flexibility) will allow the basin to achieve sustainability, particularly with respect to avoiding undesirable results for fish and wildlife beneficial uses and users of groundwater and interconnected surface water.

iv. Undesirable Results: The GSP defines an undesirable result for depletions of interconnected surface waters as "avoiding significant and unreasonable depletion of surface water flows caused by groundwater pumping that significantly impacts beneficial uses." Though the GSP includes a list of potential impacts to environmental uses and users as identified by stakeholders (page 113, line 3692), the GSP does not include any discussion or analysis of whether the established SMCs sufficiently avoid these identified potential impacts to GDEs or environmental users of interconnected surface waters. Additionally, the GSP notes that groundwater levels that fall below the minimum threshold during hydrologically dry or critically dry years are not considered to be an indicator of undesirable results (page 104, line 3424). This means proposed indicators of undesirable results (i.e., SMC) for groundwater levels and depletions of interconnected surface water effectively do not exist for dry water years. This absence of undesirable results indicators for certain water years means beneficial users of groundwater and interconnected surface water may experience significant and unreasonable effects throughout the duration of dry or critical water years before the undesirable results are 'identified' and managed. Accordingly, there is no groundwater management accountability during the most challenging of years for water resource managers and fish and wildlife beneficial users alike. Moreover, the frequency and intensity of dry water year types is expected to increase in California (Mann & Gleick, 2015), meaning if accepted as is, this GSP would have no groundwater management accountability during increasingly prevalent and challenging periods of dryness without the certainty of subsequent wet periods.

v. SMC Triggers: The GSP states that for the established SMCs, if observed data "trend toward the locally defined MT, this will trigger action on part of the GSAs." It is unclear over what time period data will need to be

DocuSign Envelope ID: 913875DE-0495-4606-A7D1-A99E7236C2A5

collected in order to establish a 'trend' toward the SMCs, and what action will be triggered.

b. *Recommendations*:

i. Groundwater Level Proxy Metric: To justify use of groundwater elevations as a proxy metric for depletions of interconnected surface water until additional data can be collected, the GSP should specify how groundwater elevations are significantly correlated to surface water depletions. Alternatively, if groundwater elevation is not a defensible proxy, the GSP should: 1) specify their plans for better approximating the volume and timing of ISW depletions attributable to groundwater extraction [23 CCR § 354.28(c)(1)] using the anticipated data collection that will fill the ISW data gap (See Comment #5); and 2) select more conservative interim SMC to protect ISW until such time as more information is available.

ii. ISW Framework: The Department recommends that the GSP identify discrete timing and locations for planned groundwater and streamflow monitoring sites as needed to address the identified ISW data gap. Installation of wells and gages and data collection should be completed prior to the first 5-year plan update (See Comment #5).

iii. Minimum Thresholds and Measurable Objectives: The Department recommends the GSP identify representative monitoring sites located near interconnected surface waters and/or groundwater dependent ecosystems and reselect minimum thresholds that would better protect environmental uses and users of groundwater, rather than enabling immense declines in groundwater over the implementation horizon.

iv. Undesirable Results: The Department recommends that the GSP include additional information related to how environmental beneficial users of groundwater may experience the effects of undesirable results. For instance, the GSP should explicitly discuss the relationship between the proxy groundwater level SMCs, modeled monthly depletions of interconnected surface waters, water temperatures, and the impacts of lowering groundwater levels below historic lows on groundwater dependent ecosystems. The GSP should also identify undesirable results indicators for dry and critically dry water years for all sustainability indicators.

v. SMC Triggers**:** While the Department appreciates that the GSP includes discussion of triggers that will initiate GSA action to avoid reaching minimum thresholds, the Department recommends establishing specific

DocuSign Envelope ID: 913875DE-0495-4606-A7D1-A99E7236C2A5

trigger metrics for each sustainability indicator that when reached, would initiate GSA action, and defining the actions to be taken. For environmental users of groundwater, including groundwater dependent ecosystems, triggers should include not only groundwater levels but also physical indicators such as NDVI.

3. **Comment #3 Monitoring Network** (Monitoring Networks, 4.9.1 Groundwater Levels, 4.10 Network Assessments and Improvements): The groundwater level monitoring network may not sufficiently monitor impacts to groundwater dependent ecosystems.
    a. *Issue*: The GSP uses both the groundwater level SMCs and representative monitoring network as a proxy for evaluating impacts to interconnected surface waters and GDEs until additional information can be collected. The GSP primarily considered domestic well protection when establishing SMCs for groundwater levels and selecting representative monitoring sites. It is unclear whether any of the selected groundwater level monitoring wells are located near areas with likely groundwater dependent ecosystems and if plan implementation will involve comparing water depths in representative monitoring sites to the rooting depths of nearby GDE communities.
    b. *Recommendation*: The Department recommends that the GSP assess the groundwater level monitoring network, and by proxy, the monitoring network for interconnected surface waters, for its ability to characterize potential impacts and undesirable results for groundwater dependent ecosystems (See Comment 2(iv)). If wells within the representative monitoring network are not located near identified groundwater dependent ecosystems, a discrete number of groundwater monitoring wells should be installed to capture groundwater trends that would affect priority GDEs. Additional analysis related to the locations of special status species within the subbasin and the groundwater dependent ecosystems that support them can be used to prioritize areas for increased monitoring (See Comment 1(ii)).

4. **Comment #4 Project and Management Actions** (Project and Management Actions; 5.2.2 Project Implementation; starting page 138): Project and management actions (PMAs) may not be sufficient to achieve sustainability, and timelines for pursuing additional PMAs are needed.
    a. *Issue*: The Department recognizes that the GSP identifies Potential Projects that are in the planning phase and may be implemented in addition to the four Planned Projects if necessary to achieve sustainability in the subbasin. However, the GSP fails to identify specific metrics or timelines that would trigger the

DocuSign Envelope ID: 913875DE-0495-4606-A7D1-A99E7236C2A5

implementation of additional PMAs. The Streamflow Augmentation project (5.2.3.3, page 144) relies on excess surface water being made available from the Upper Watershed and would involve potentially lengthy permitting and regulatory review to change water rights as necessary. The GSP states that this project is expected to reduce groundwater demand by 1,000 to 5,000 acre-feet per year, or up to half of the projected 10,000 acre-foot per year overdraft within the subbasin. Should unexpected delays occur, or if sufficient surface water is unavailable in the Upper Watershed, additional PMAs will be necessary.

b. *Recommendation*: The GSP should include details on specific metrics, targets, and timelines that if not reached with implementation of the planned PMAs will trigger the implementation of additional PMAs. The Department recommends identifying the projects, including those aimed at reducing demand through conservation, that could be implemented on shorter timescales if needed for the subbasin to achieve sustainability.

5. **Comment # 5 Interconnected Surface Water Data Gap** (Plan Implementation; 6.3 Schedule for Implementation; starting page 167): A more detailed time schedule for collecting additional data and revising the sustainable management criteria for depletion of interconnected surface water is needed.
   a. *Issue*: The GSP identifies information related to the depletion of interconnected surface water as a data gap, and the plan proposes a framework to collect additional information needed to revise the ISW SMCs. The GSP states that “an aggressive schedule” has been provided to fill the data gap in Section 6. However, the only time schedule related to filling identified data gaps identified during Department review is in Figure 6-1, which displays an “Interconnected Stream Monitoring” Data Gap filling effort start date of February 1, 2022, and an end date of April 1, 2042. No discrete time schedule is provided for installation of necessary groundwater wells and stream gages, refinement of the characterization of interconnected surface waters within the subbasin, and updates to the SMCs.
   b. *Recommendation*: The GSP should include a detailed time schedule for completing each action as outlined in the ISW SMC Framework to characterize interconnected surface waters in the subbasin and establish appropriate SMCs. The ISW SMC Framework should be completed prior to the first 5-year plan update so that management criteria can be effectively established to protect environmental users of groundwater and interconnected surface waters throughout the implementation period.

DocuSign Envelope ID: 913875DE-0495-4606-A7D1-A99E7236C2A5

CONCLUSION

In conclusion, though the draft GSP accurately identifies the need to improve monitoring of shallow groundwater and interconnected surface water systems, the GSP lacks a robust analysis of potential impacts to environmental beneficial users and should establish more protective management criteria. The Department recommends that the Vina Subbasin GSAs address the above comments before GSP submission to DWR to best prepare for the following regulatory criteria for plan evaluation:

1. The assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are not reasonable and/or not supported by the best available information and best available science. [23 CCR § 355.4(b)(1)] (See Comments #1, 2, 3)
2. The GSP does not identify reasonable measures and schedules to eliminate data gaps. [23 CCR § 355.4(b)(2)] (See Comments #3, 5)
3. The interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have not been considered. [23 CCR § 355.4(b)(4)] (See Comments #1, 2, 3)
4. The projects and management actions are not feasible and/or not likely to prevent undesirable results and ensure that the basin is operated within its sustainable yield. [23 CCR § 355.4(b)(5)] (See Comment #4)

The Department appreciates the opportunity to provide comments on the Vina Subbasin Draft GSP. Please contact Bridget Gibbons, Environmental Scientist, by email at Bridget.Gibbons@wildlife.ca.gov with any questions.

Sincerely,

DocuSigned by:
Jennifer Garcia
B35A7660DD7848B...

Kevin Thomas
Regional Manager, North Central Region

Enclosures (Literature Cited)

ec:

California Department of Fish and Wildlife

Joshua Grover, Branch Chief

DocuSign Envelope ID: 913875DE-0495-4606-A7D1-A99E7236C2A5

Water Branch
Joshua.Grover@wildlife.ca.gov

Robert Holmes, Environmental Program Manager
Statewide Water Planning Program
Robert.Holmes@wildlife.ca.gov

Angela Murvine, Statewide SGMA Coordinator
Groundwater Program
Angela.Murvine@wildlife.ca.gov

Jennifer Garcia, Environmental Program Manager
North Central Region
Jennifer.Garcia@wildlife.ca.gov

Briana Seapy, Water Program Supervisor
North Central Region
Briana.Seapy@wildlife.ca.gov

Bridget Gibbons, Environmental Scientist
North Central Region
Bridget.Gibbons@wildlife.ca.gov

California Department of Water Resources

Craig Altare, Supervising Engineering Geologist
Groundwater Sustainability Plan Review Section Chief
Craig.Altare@water.ca.gov

Debbie Spangler, Vina Subbasin SGMA Point of Contact
Northern Region Office
Debbie.Spangler@water.ca.gov

Groundwater Sustainability Agencies

Vina GSA
VinaGSA@gmail.com

Rock Creek Reclamation District GSA
rockcreekreclamation@gmail.com

State Water Resources Control Board

Natalie Stork, Chief

DocuSign Envelope ID: 913875DE-0495-4606-A7D1-A99E7236C2A5

Groundwater Management Program
Natalie.Stork@waterboards.ca.gov

NOAA National Marine Fisheries Service

Rick Rogers, Fish Biologist
West Coast Region
Rick.Rogers@noaa.gov

Literature Cited

Department of Fish and Wildlife. 2019. Statewide Drought Response: Stressor Monitoring.

Lund, Jay, et al. Lessons from California's 2012-2016 Drought. 2018. *Journal of Water Resources Planning and Management*. *144*(10). https://doi.org/10.1061/(ASCE)WR.1943-5452.0000984

Mann, Michael E. & Gleick, Peter H. 2015. Climate change and California drought in the 21st century. *Proceedings of the National Academy of Sciences of the United States of America*. *112*(13): 3858-3859.

Vina DRAFT GSP
Comment A3

AGUBC

Agriculture Groundwater Users
of Butte County

October 19, 2021

VIA E-MAIL AND U.S. MAIL

Board of Directors
Vina GSA
308 Nelson Avenue
Oroville, CA 95965
VinaGSA@gmail.com

Board of Directors
Rock Creek Reclamation District GSA
5130 Anita Road
Chico, CA 95973
rockcreekreclamation@gmail.com

Re: Comments to Draft Groundwater Sustainability Plan

Dear Board Members:

The purpose of this letter is to provide Vina Groundwater Sustainability Agency (Vina GSA) and Rock Creek Reclamation District Groundwater Sustainability Agency (Rock Creek GSA), collectively the "GSAs," with the comments of the Agricultural Groundwater Users of Butte County (AGUBC) to the GSAs' draft groundwater sustainability plan (GSP). In addition, this letter reiterates some of the past comments AGUBC submitted to the GSAs that remain unresolved.

First and foremost, we appreciate the dedication and hard work by the GSAs' management staff and Ad Hoc Committees, as well as their consultants, in putting together this draft GSP. Further, we appreciate the previous opportunities to comment on individual draft chapters of the GSP as they were developed, as well as this opportunity to comment on the comprehensive draft GSP. It is clear that the GSAs have taken past comments into consideration. We hope the following comments are constructive and will likewise be considered in finalizing the draft GSP for submission to the Department of Water Resources (DWR). In considering the following comments, we recognize that this draft GSP is a "living" document and will undergo updates and modifications as more information is gathered to help the Vina Subbasin reach sustainability by 2042 and beyond.

Provided are our specific comments:

1. We support the overall approach for Minimum Thresholds (MT) and Measurable Objectives (MO) for the Chronic Lowering of Groundwater Levels.

The polygon approach to define areas related to the selected representative monitoring sites (RMS) helps to avoid overlap of information and tie in land and aquifer characteristics with the RMS. We anticipate that this polygon approach may be further refined with more information. Further, the MTs and MOs that have been established for the Vina North and Vina South management areas provide sufficient operating flexibility to help the landowners realistically achieve the goal of the MOs and protect sustainably constructed domestic wells, while allowing for flexibility to weather the next 20 years as we endeavor together to reach sustainability. Consequently, we concur with the approach taken in establishing the Sustainable Management Criteria (SMC) for chronic lowering of groundwater levels and encourage continued application of the methodologies expressed in the draft GSP for all management areas.

2. The draft GSP contains numerous data gaps affecting future GSP implementation.

While we appreciate the time and effort the GSAs have committed to preparing this draft GSP, there are still numerous data gaps that must be addressed, which is acknowledged in several places in the draft GSP. Moreover, some of these data gaps exist in crucial areas of the draft GSP. For example, Section 3.8 of the SMC chapter regarding the Interconnected Surface Water SMC lacks: (1) the "definition of stream reaches and associated priority habitat;" (2) "streamflow measurements to develop profiles at multiple time periods;" and (3) "measurements of groundwater levels directly adjacent to stream channels, first water bearing aquifer zone, and deeper aquifer zones." (Pg. 113; Lines 3707 – 3711.) This one section alone is missing three crucial points of information that will likely dramatically change this SMC once developed. Furthermore, the draft GSP acknowledges in the SMC chapter that additional data regarding domestic well information will be needed to refine the data set in monitoring the chronic lowering of groundwater levels criteria. (Pg. 104; Lines 3445 – 3454.) These are just two examples of the data gaps contained (and acknowledged) throughout the draft GSP.

We look forward to the GSAs addressing and filling in the data gaps throughout the draft GSP and request that the GSAs provide ample opportunity for stakeholders to engage with the GSAs as they address these data gaps and revise the GSP in the coming years. Such engagement should not be limited to discussions with the Vina Stakeholder Advisory Committee (Vina SHAC) but should involve workshops and targeted discussions with stakeholder groups, where

applicable (such as the Butte County Farm Bureau and the AGUBC), to get important feedback. To that end, the draft GSP should be revised to reflect that commitment.

3. The draft GSP should provide additional clarity regarding how groundwater allocations will be imposed, if at all.

We thank the GSAs for including a public review component as part of the groundwater allocation implementation process. While we understand that implementation of groundwater allocations is a "last resort" (Pg. 160, Line 4992), we believe that public participation will be a crucial component of this management action, should it ever be explored.

Currently, Section 5.3.7 of the Projects and Management Actions chapter regarding Groundwater Allocations provides, in relevant part, that "[t]he implementation of [groundwater allocations] would be based on an evaluation by the Joint Management Committee (see Appendix X)." (Pg. 160, Lines 4995 – 4996.) This section then goes on to provide that "the GSAs will consider [groundwater allocations] through a public process ultimately decided by the GSA Boards." (Pg. 160, Lines 5002 – 5004.)

While we are supportive of this process, we note that the draft GSP does not include an "Appendix X." We assume that "Appendix X" was meant as a placeholder until the GSAs knew exactly which appendix number would be used for the coordination agreement between the two GSAs. We request that the GSAs confirm whether this assumption is correct, and, if so, that the GSAs revise the draft GSP to reflect the correct appendix number. If, however, this assumption is not correct, then we are left unsure as to the contents of this document. And to the extent that "Appendix X" describes the factors the Joint Management Committee will evaluate in making its determination regarding this management action and how the Joint Management Committee will weigh those evaluations, we request that the GSAs include that information in the draft GSP.

4. The draft GSP should remove its use of the phrase "suitable habitat."

In our August 23, 2021 letter, we brought to the GSAs' attention its use of the undefined phrase "suitable habitat." In that letter, we requested that the GSAs remove this phrase and instead reflect the language used in other GSPs that DWR has already approved. In response to that letter, the GSAs removed this phrase from Section 3.4 of the SMC chapter regarding the Groundwater Storage SMC. While we appreciate that revision, we believe additional language is necessary to provide clarity regarding the scope of the term "environmental uses." To alleviate this concern, we recommend that the GSAs revise Section 3.4 to provide as follows:

Revised Section 3.4

> "Sustained groundwater storage volumes are insufficient to support rural areas and communities, the agricultural economic base of the region, and environmental uses *of groundwater*."

Further, the phrase "suitable habitat" is still used in two other sections of the draft GSP. In describing the emphasis of management objectives for SMCs, Section 3.1 provides that:

> "Sustainable management criteria within the Vina Subbasin emphasize management objectives related to domestic, municipal, and agricultural wells as well as *suitable habitat*."
>
> (Pg. 101; Lines 3333 – 3335; emphasis added.)

Additionally, Section 3.5 of the SMC chapter regarding the Water Quality SMC still relies on this phrase in describing undesirable results. Specifically, Section 3.5.1 provides, in relevant part, that an undesirable result coming from degraded water quality is experienced if:

> "Groundwater pumping compromises the long-term viability of rural areas and small communities, the agricultural economic base of the region, and environmental uses for *suitable habitat*. . . ."
>
> (Pg. 108, Lines 3556 – 3558; emphasis added.)

We again request that the GSAs remove the phrase "suitable habitat" from both Sections 3.1 and 3.5.1. As an alternative, we recommend that the GSAs revise these two sections to reflect the recommended revision to Section 3.4:

Revised Section 3.1

> "Sustainable management criteria within the Vina Subbasin emphasize management objectives related to domestic, municipal, and agricultural wells as well as *environmental uses of groundwater*."

Revised Section 3.5.1

> "Groundwater pumping compromises the long-term viability of rural areas and small communities, the agricultural economic base of the region, and *environmental uses of groundwater*."

While not a perfect resolution, we believe these recommended revisions would help focus the issue and allow for further discussion as data gaps are filled and monitoring conducted as described in the draft GSP.

5. There are some portions of the draft GSP that require further clarification and/or modification to avoid confusion.

Finally, there are several additional areas of the draft GSP that require further clarification and/or modification. Attached is a "comment tracking sheet," as provided by the GSAs, detailing these requests for clarification and/or modification. Of these comments, we believe the two following comments deserve highlight:

(i) Comment Regarding Chapter 2, Lines 3212 – 3225; and
(ii) Comment Regarding Chapter 5, Lines 4477 0 4506.

Thank you for the opportunity to provide these comments. We appreciate the significance of the considerations and decisions the GSAs must undertake, and we look forward to working with you further regarding these matters.

Very truly yours,

Richard McGowan,
On behalf of the AGUBC Board of Directors

Vina DRAFT GSP
Comment A4

Audubon | CALIFORNIA

October 19, 2021

Butte County Department of Water & Resource Conservation
RE: Vina Subbasin GSP
308 Nelson Avenue
Oroville, CA 95965

Sent via email to: VinaGSA@gmail.com

Re: Comments on the Draft Groundwater Sustainability Plan for the Vina Groundwater Sustainability Agency

To Vina Subbasin Groundwater Sustainability Agencies,

Audubon California appreciates the opportunity to provide public comment on the draft Groundwater Sustainability Plan (GSP) for the Vina Subbasin. Audubon California is a statewide nonprofit organization with a mission to protect birds and the places they need. Our organization has a long history of solutions-focused work in the Central Valley in collaboration with state and federal agencies, water districts, non-profits, and landowners. Audubon is reviewing draft GSPs as a stakeholder for the environment with a particular focus on managed wetlands. We are commenting on draft GSPs to provide technical assistance to Groundwater Sustainability Agencies (GSAs) to improve their GSPs prior to their final submission to the Department of Water Resources in January 2022. Audubon would also like to identify areas of opportunity to partner with landowners and GSAs to provide groundwater and wildlife habitat benefits in the implementation of the Sustainable Groundwater Management Act (SGMA).

Over 90 percent of historic wetlands in the Central Valley have been replaced with agriculture or urban development. Disconnected from natural water sources as a consequence of surface water diversions and groundwater over-pumping, wetland landowners must utilize surface water deliveries or pump groundwater to provide flooded habitat. But managed wetlands provide outsized public trust benefits for their minor water use.

The remaining wetlands in the Central Valley are a critical component of the Pacific Flyway, supporting millions of migratory waterfowl, hundreds of thousands of shorebirds, and state listed species like the Tricolored Blackbird. Central Valley managed wetlands are part of California's commitment to national and international Pacific Flyway agreements and provide significant public trust benefits, including habitat for migratory birds, recharge of overdrafted aquifers, carbon sequestration, and recreation opportunities for birders, hunters, and disadvantaged communities.

Managed wetlands require specific consideration in GSPs under SGMA statute and regulations, as detailed below. GSAs are required to identify managed wetlands as beneficial users of groundwater and as land uses and property interests and should recognize this land use consistent with other active users of surface and groundwater. The overall basin water budget must include managed wetlands as a specific water use sector and the GSP is required to consider the effects of the GSP on managed wetlands as a beneficial user or land use.

When GSPs fail to adequately consider the water needs and recharge contributions of managed wetlands, projects and management actions may ignore managed wetlands, their need for protection as public trust resources, and their potential to be part of sustainability solutions. If future actions include groundwater allocations, managed wetlands face the potential of being excluded if not recognized in the GSP, risking further loss in critical wetland acreage.

SGMA Requirements Related to Managed Wetlands

A primary requirement for GSAs during GSP development is the consideration of the interests of "all beneficial uses and users of groundwater" [Water Code Section 10723.2], which includes "[e]nvironmental users of groundwater" [Water Code Section 10723.2(e)].

Articulated into the SGMA regulations, the concept of beneficial uses and users of groundwater is first represented in CCR, Title 23, Section 354.10. Notice and Communication, which directs the GSP to "…include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following: (a) A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties." [emphasis added].

Furthermore, the SGMA regulations provide a definition that explicitly includes managed wetlands as a beneficial user where:

> "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." CCR, Title 23, Section 351(al) [emphasis added].

GSAs are then directed to include all water user sectors in the description of the GSP area and to quantify groundwater use by these sectors in the historic, current and projected budgets [emphasis added]:

> CCR §354.8. Description of Plan Area: Each Plan shall include a description of the geographic areas covered, including the following information:
>
> (a) One or more maps of the basin that depict the following, as applicable:
>
> (4) Existing land use designations and the identification of water use sector and water source type.
>
> and,
>
> CCR §354.18. Water Budget:
>
> (b) The water budget shall quantify the following, either through direct measurements or estimates based on data:
>
> (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.

Given these explicit requirements, GSAs are required to identify and map managed wetlands and include their water needs in water budgets in the GSP.

Furthermore, each GSP is also required to describe "undesirable results" where such included:

> "Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." CCR, Title 23, Section 354.26(b)(3) [emphasis added]

Comment Overview

GSAs are required to consider public trust resources in their GSPs, including managed wetlands. In reviewing the Vina Subbasin draft GSP, we see VGSA is working hard to minimize the impacts to it growers in the subbasin. It is essential these efforts also include the managed wetlands. As beneficial users of water these habitats provide essential waterbird food and critical habitat, often requiring the application of surface or groundwater similar to cropped lands.

While the Butte Basin Groundwater Model (BBGM) used to prepare historic, current and future water budgets includes reference to managed wetlands acreage and demand (a draft version of the BBGM model documentation, as provided in October 2021, was reviewed), the resulting representation in the GSP is limited and leads to confusion regarding the future of managed wetlands in the Vina Subbasin. This is most prominently represented in *Table 2-7: Water Budget Summary: Land and Surface Water System*, on page 80, but further described for the historic and current conditions in Table 2A-1, on page A-3.[1] As represented in both the inflow and outflow portions of the table, quantities listed for managed wetlands under the "historical" heading are significantly greater than quantities listed under the "current" and various future conditions. We are unable to find any basis for this reduction beyond anecdotal references in the BBGM about a recent model update affecting hydraulic conductivity.[2]

Absent additional explanation as to why these quantities are significantly lower, the GSP appears to anticipate a reduction in managed habitat acres and function. Clarification regarding total assumed acres and expected applied water requirements would address this concern.

Our comments are summarized as follows:

1. Identification of managed wetlands: Audubon appreciates that VGSA has identified and specifically included managed wetlands in maps and water budgets. However, details regarding managed wetland acres and assumed evapotranspiration (ET) rates are lacking.
2. Water budget: Inclusion of managed wetlands as a specific component of the water budgets (e.g. Table 2-7) is appreciated. While reference is made to the BBGM regarding assumptions, review of the BBGM model documentation did not reveal details regarding the assumed managed wetland acres within the Vina subbasin under historic, current, or future water budgets nor the assumed ET and related details that would drive the calculation. As such, Audubon is concerned that the future conditions inadequately account for the water needs of managed wetlands, which are likely increasing under climate change.
3. Identification of data gaps: The lack of information regarding the water needs for managed wetlands should be identified as a data gap in the GSP. Specifically, on page 74, the GSP notes that agricultural demands (including managed wetlands) and groundwater pumping were estimated using the BBGM. The BBGM indicates ET was determined using remote sensing data

[1] Table 2A-1 provides annual values for the water budget for 2000 through 2018. Inflow and outflow quantities for managed wetlands are consistent across this period until 2015 through 2018 when values are significantly reduced with no explanation.

[2] "…*a reduced hydraulic conductivity value was assigned to each element for ponded land uses (rice and wetlands) to avoid unreasonably high applied water estimates due to high deep percolation rates*." Butte Basin Groundwater Model: Model Documentation v1.0, August 2021, page 18.

and corresponding crop coefficients, but does not list a crop coefficient for managed wetlands. The appropriate water needs of managed wetlands do not appear to have been adequately represented in the water budgets, particularly given the unexplained reduction in water demands for managed wetlands in current and future water budgets.

4. Consideration of managed wetlands: While managed wetlands are appropriately included in the GSP separate from groundwater dependent ecosystems, there is no discussion of the impacts of the GSP on managed wetlands. Again, the reduction in water from the historic to current and future water budgets points to a serious reduction in habitat acreage or function, but there is no discussion of wetland impacts. The GSP would also be strengthened by including information on the role managed wetlands can have as part of projects and management action solutions. Managed wetlands provide opportunities for multi-benefit recharge and need to be part of any investigations into groundwater allocations and resulting policies.

Draft Groundwater Sustainability Plan Page-by-Page Comments

Additional page-by-page comments on VGSA's draft GSP are detailed below. We welcome any follow up questions and look forward to seeing the issues raised below addressed in the final GSP submission in January 2022.

Figure 1-6: Land use map should also show the location of managed wetlands.

P. 22: Does the category "surface water users" include any managed wetlands that apply surface water to meet the managed wetland water needs or are managed wetlands only included in the category "environmental users of groundwater"?

P. 68: The category "Not Likely a GDE Due to Supplemental Water Supplies" indicates a determination was made for managed wetlands that rely on supplemental water to meet applied water needs. Elsewhere in the GSP, information regarding whether this supplemental water is pumped groundwater or applied surface water is lacking (see related comment for page 22). Additional details regarding the managed wetland acres, applied water needs, and water sources should be referenced. As noted previously in this comment letter, review of the BBGM indicates the information is not clearly documented in this referenced document either.

P. 73, Table 2-6: Why were surface water diversions for the current condition baseline water budget limited to 2015 and 2016? These years reflect low surface water availability due to drought constraints and State Water Resources Control Board imposed water right curtailments. For managed wetlands that may rely on surface water, this would be a misrepresentation of current and long-term needs. Combined with information in Table 2-7 and Table 2A-1 where the water budgets for these two years show significantly lower inflow and outflow quantities for managed wetlands than for prior years, there is concern that the current budget underestimates managed wetland water needs. Since the current condition assumptions regarding water supplies are carried forward to the future conditions, the misrepresentation of managed wetland water supplies due to limiting to 2015 and 2016 may incorrectly affect future water budgets and results.

P. 74: The bullets explaining the water budget procedures do not provide the necessary details regarding assumptions specifically made for managed wetlands. For instance, groundwater pumping is estimated by estimating total demand then subtracting applied surface water quantities – referencing the BBGM as the source document for the assumptions. Upon reviewing the BBGM draft documentation, the details regarding these assumptions are also not provided so it is

unclear what assumptions were made to calculate managed wetland demands and what surface water quantities were available. There needs to be improved documentation in the BBGM if it is a primary source for the water budgets presented in the GSP.

P. 80, Table 2-7: Inflow and outflow components for the row labeled "managed wetlands" shows a significant decrease in quantities between the historic water budget and the current and future water budgets. As noted in prior comments, the basis for this significant reduction in unclear and raises concerns that the total acres or the total water needs are misrepresented or otherwise artificially decreased.

P. 82, Table 2-8: The same concern as expressed for Table 2-7 is presented in this table.

P. 83: The GSP notes that evapotranspiration (ET) is from several beneficial uses, including managed wetlands. However, details regarding the ET assumptions for managed wetlands are lacking. These special habitats can have several different water needs depending on how they are managed and the target species they are intended to benefit (e.g. fall flood up for habitat versus spring irrigation for waterbird feed). This same statement is repeated for each water budget condition on subsequent pages in the GSP (e.g. future conditions). This comment applies to each.

P. 145, Flood MAR/Surface Water Supply and Recharge Scoping: Please include Audubon as a participant in scoping for recharge opportunities. Managed wetlands can provide unique opportunities to create recharge and habitat benefits.

P. 160, Groundwater Allocation: This potential action should indicate that considerations of public benefit needs, such as managed wetlands, will be included when evaluating any groundwater extraction limits.

Thank you for your consideration of Audubon California's comments. If you would like to discuss these comments as you update your GSP, please do not hesitate to contact me at (916) 737-5707 or via email at samantha.arthur@audubon.org.

Sincerely,

Samantha Arthur
Working Lands Program Director
Audubon California

October 19, 2021

Vina DRAFT GSP
Comment A5

Butte County Department of Water & Resource Conservation
RE: Vina Subbasin GSP
308 Nelson Avenue
Oroville, CA 95965
VinaGSA@gmail.com

Thank you for the opportunity to comment on the Vina GSA GSP.

The Butte Environmental Council (BEC) represents hundreds of members, most of whom are Butte County voters, and thousands of followers on digital media. BEC's stance on the issue is outlined below, and also speaks for the thousands of local voters and stakeholders that will be affected by this issue should it come to pass.

Below please find the details addressing the **matters of concern** of the Vina GSA GSP submitted on behalf of the Butte Environmental Council:

1. **Overestimating Water Supply**

   The Butte Environmental Council is concerned that the basin settings does not take into account climate change and the changing water supply. With warmer weather, we will have reduced water supply from the Sierra Snowpack, with up to 48-65% by the end of the century[1]. Droughts will likely become more frequent and persistent in the 21st century. With precipitation changes, and extreme events, there are projected to be more intense rainfall, and more intense flooding that will change how much water percolates down into our aquifers. With these changes, the Vina GSA needs to be conservative with the estimates of water that the subbasin will recharge annually. With the potential overestimation of the water supply, undesirable results will occur.

2. **Groundwater Dependent Ecosystem & the City of Chico Urban Forest**

   The Butte Environmental Council is concerned that the City of Chico Urban Forest is not included as a potential Groundwater Dependent Ecosystem, to be protected and ensure healthy groundwater levels. The Urban Forest, which is a climate change adaptation and mitigation strategy, used to draw down carbon, shield residents from the scorching heat on sidewalks, and reduce residents energy bills, utilizes the shallow portion of the Tuscan Aquifer after establishment. This critical green infrastructure needs to be protected and the groundwater levels need to reach the roots of the Urban Forest.

3. **Prioritization of Demand Management**

   Demand management and reuse of water need to be prioritized and a central part of our groundwater management toolkit, not just supply expansion. The Butte Environmental Council does not support taking surface water to use instead of groundwater, especially from PID. There could be complications once the Town of Paradise has rebuilt, and has the increased water demand. With the fact that the subbasin is only in 10,000 acre feet of overdraft, and that the Chico residents

[1] https://water.ca.gov/Programs/All-Programs/Climate-Change-Program/Climate-Change-and-Water

were able to conserve 32% during the last drought, demand management projects need to be implemented before any water supply expansion projects are implemented.

Below please find the details addressing the **matters of support** of the Vina GSA GSP submitted on behalf of the Butte Environmental Council:

1. **Wastewater Recycling Project**

   Wastewater recycling is a great project that reduces the demand and stress on the groundwater supply, and needs less treatment than water used for potable use.

2. **Residential Conservation Project**

   Demand management through residential conservation is an excellent strategy to stay within the groundwater supply boundaries of the basin. The City of Chico/CalWater was able to reduce their water consumption by 32%[2] by way of residential conservation.

3. **Agricultural Irrigation Efficiency Project**

   Agricultural irrigation efficiencies can also protect water quality, and reduce demand on the aquifer. Water conservation and efficiencies within agriculture in the subbasin needs to be a key component of reaching groundwater sustainability. With adoption of efficient irrigation practices that could reduce groundwater demand up to 4,000 acre feet annually, and that the Vina subbasin is in overdraft of 10,000 acre feet, this project alone could be a major element of getting the basin to sustainable groundwater levels.

4. **Community Monitoring Program and Community Water Education Initiative**

   Educating the community on what is happening with water and bringing awareness to the importance of water in Butte County is critical to creating buy-in on water conservation practices, and ensuring groundwater sustainability.

5. **Rangeland Management and Fuel Management for Watershed Health Projects**

   Regenerative grazing practices improve water holding capacity and can improve recharge ability within the basin by increasing organic matter in the soil. Regenerative farming practices, such as cover cropping, no-till, and compost application can further improve water utilization on farmland. The Butte Environmental Council supports the rangeland management, but encourages the Vina GSA to include regenerative farming practices in the menu of projects to get to sustainable groundwater levels. Each 1% increase in soil organic matter would increase water holding capacity by 27,000 gallons of water per acre, thereby improving water utilization and reducing water demand on both rangeland and farmland[3].

   Fuel reduction and management can improve groundwater recharge and water quality.

6. **Removal of Invasive Species Project**

   This is an excellent project. Removal of high water consuming invasive species like arundo can reduce water demand, increasing the amount of water available for groundwater recharge.

---

[2] http://projects.scpr.org/applications/monthly-water-use/california-water-service-company-chico-district/
[3] https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1082147.pdf

7. **Inclusion of Valley Oaks in the Sustainability Indicators**

Groundwater-dependent ecosystems are an important consideration under SGMA, and it is important to protect the shallowest positions of the aquifer upon which critical groundwater dependent ecosystems rely. The valley oaks are a keystone species in the area, and the canopy of the urban forest is vital for climate adaptation and mitigation. We seek to ensure that groundwater dependent ecosystems are protected in the region, and support the inclusion of Valley Oaks in the minimum thresholds for declining groundwater levels in the Vina GSA GSP.

Butte Environmental Council (BEC) has been a leading 501(c)(3) environmental non-profit in Butte County since 1975, dedicated to environmental issues that threaten the land, air, and water of our communities. BEC is a grassroots organization supported by over 200 paying members, hundreds of volunteers and donors, dozens of local business sponsors, over 3,500 followers on social media, and over 4,000 subscribers to our monthly electronic newsletter. Throughout each year, BEC offers citizens many chances to engage in environmental education, advocacy and stewardship. BEC provides position statements when the organization's leaders recognize a regional environmental threat to citizens.

Thank you for the opportunity to provide comments on this important project. Please contact our Executive Director, Caitlin Dalby, at caitlin.dalby@becnet.org with any questions.

Board of Directors
Butte Environmental Council
(530) 891-6424
www.becnet.org

AQUALLIANCE
DEFENDING NORTHERN CALIFORNIA WATERS

October 17, 2021

Vina GSA
Vinagsa.org

RE: Comments on the draft *Vina Groundwater Sustainability Plan*

Executive Summary
The summary states:
"*The interests and vulnerability of stakeholders and groundwater uses in these Management Areas vary based on the nature of the water demand (agricultural, domestic, municipal)*" Water demand for the environment must be included. GDEs include upland and riparian valley oak groves, small stream flow, GD urban forests.
"*groundwater use has increased and as forces ranging from population growth to climate change play out*," This sentence ignores the fact that increased cross-boundary flows that may result from expanded demand west of the river (primarily agriculture and water-market-driven aquifer exercise) is at play. This threat to meeting our management goals must be acknowledged and addressed in interbasin coordination/communication process yet to be developed.
"*Groundwater storage in Subbasin is relatively stable except in the areas noted above with depressions.*" The identification of localized cones of depression is valid but it is important to recognize long-term basin declines that occur due to cross-boundary flows influence the baseline water levels. In general (depending on soil conditions and strata) the greater the distance or depth of groundwater pumping and water levels in the VGSA, the lower the magnitude but the longer the timescale of depletions. Consequently, the ultimate effects in the Vina of pumping west of the river can occur significantly after pumping starts, or even after pumping has ceased. The timescales involved in aquifer responses to pumping and other stresses can be on the order of decades, making it difficult to associate cause with effect. As such, monitoring must account for this lag in impacts. In general, the longer the timeframe for effects to be observed at a given monitoring point once they become evident, the longer those effects will persist.
"*If the water table beneath the stream lowers as a result of groundwater pumping, the stream may disconnect entirely from the underlying aquifer.*" A stream that ceases to flow once it enters the alluvial basin is entering the aquifer at that point. The deeper the aquifer level the more of the streambed is dewatered and the earlier. So while a stretch of the creek may be "disconnected" the creek itself is still connected. Mr. Toccoy Dudley, a Department hydrogeologist with the Northern District in Red Bluff, wrote in 2000:At any location in the basin, the gradient between the surface water and groundwater system is directly proportional to the head differences (water surface elevation difference) between the two hydrologic systems. The larger the head differences the higher the gradient and the higher the recharge rate....The shorter the horizontal distance over which the head change occurs increases the recharge rate dramatically. An example of this would be pumping next to a river would induce a much higher recharge rate from the surface water system than the same pumping many miles away.....increased extraction causes the groundwater levels to decline, which increases the head

difference between the groundwater and surface water systems, and consequently increases the gradient and recharge rate. In short, the more you pump, the more you can pump, to a point. Anecdotal and archeological evidence indicates the small streams of the Vina SB were perennial during pre-pumping eras.

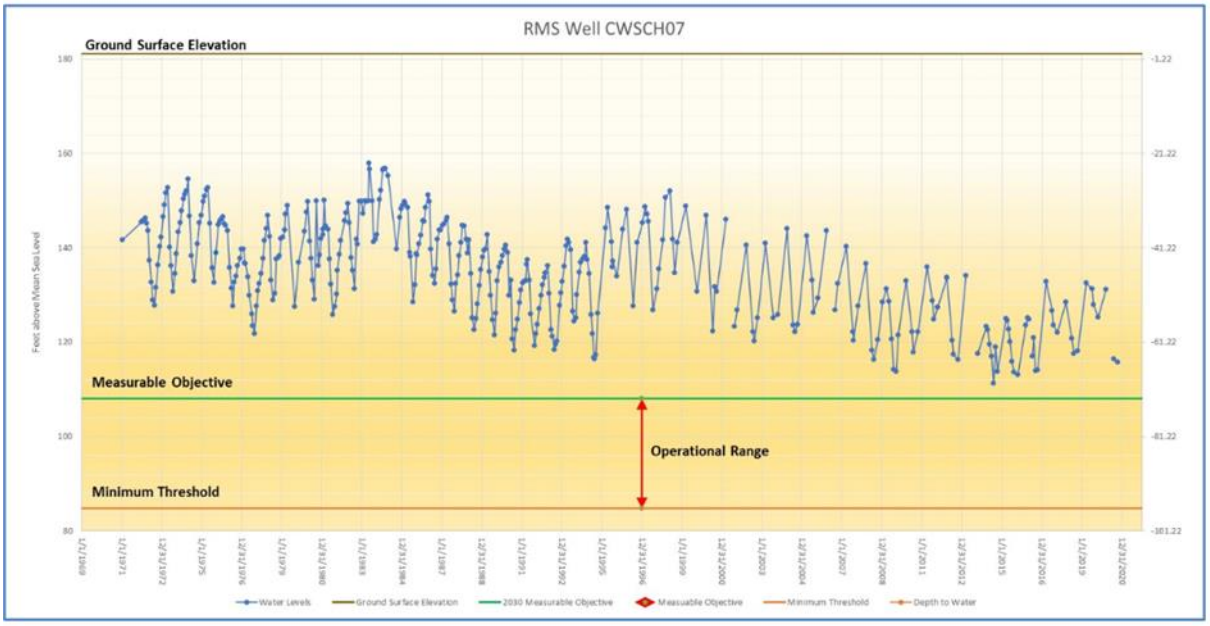


Figure ES-7: Representative Monitoring Site For Groundwater Levels With Relationship Of Measurable Objectives, Minimum Thresholds and Operational Range

The sample hydrograph is one of several that I have reviewed in Appendix 3-b of the GSP that have disturbing MO and MT levels. The MO is below the historic low, not the appropriate level to designate the top of the operational range. The MT as defined in other parts of the GSP, is purported to designate "*the point at which Undesirable Results may BEGIN to occur.*" But undesirable results will begin much earlier in the operational range. The historic low of this hydrograph is above the 80' max rooting depth of native phreatophytes. The MT is significantly lower than 80' bgs. Furthermore, the lower water table will dewater longer reaches of streams earlier in the season and persist later in the year. The operational range proposed is pessimistic in meeting goals that would avoid triggering Undesirable Results. Wise resource management strives to improve conditions that have been degraded by human development. Accepting degraded status quo or planning for increased degradation may be realistic given the human inclination to ambitiously convert resources into useful products. But the term "sustainable" implies we have the capacity to identify and honor carrying capacity while devising demand flexibility strategies to meet evolving climate conditions. Robust Management Objectives reduce the probability of careening toward Management Thresholds. Our MO levels can strive to improve conditions without risk of State management takeover. Water code § 354.30. Measurable Objectives (g) An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.

Chapter 2 Basin Setting

2.3.4 Water Budget Estimates

2831 “Other components are more difficult to measure or do not have measured values readily available (e.g., deep percolation, subsurface flows, groundwater pumping, surface water-groundwater interaction, etc.) and are estimated using the BBGM.” It is unclear how the BBGM estimates Western Boundary Net Outflows 56,100- 65,000 AFY.

This map from the first draft of the Vina Water Budget presentation last year estimated a total of 200k AFY flowing from the east out of Butte into Colusa. The first draft of the Butte Subbasin Preliminary Basin Setting Results indicated 261k AFY of water flow from the west into the Butte basin from Colusa. These large discrepancies in outflow estimates do not inspire confidence in the Water Budget, the identification of who is responsible for GW declines or the efficacy of proposed recharge efforts.

“the ultimate effects of pumping can occur significantly after pumping starts, or even after pumping has ceased. The timescales involved in aquifer responses to pumping and other stresses can be on the order of decades, making it difficult to associate cause with effect. As such, monitoring must account for this lag in impacts. In general, the longer the timeframe for effects to be observed at a given monitoring point once they become evident, the longer those effects will persist, even if the pumping causing the effects is halted immediately.” Davids Engineering 2014. Prepared for NCWA, Sacramento Valley Groundwater Assessment Active Management – Call to Action, pp. 14-15.

We know that interbasin flows are dependent on conditions in adjacent basins. "3014 Western boundary net outflows represent Sacramento River gains from groundwater and subsurface outflows to the Corning Subbasin. The split between these outflows is uncertain at
this time and identified as a data gap." This significant data gap will present challenges as the impacts of GW pumping are not immediate and can take months or years to occur. The emerging California Water Market is a factor that is going to complicate regional water budget estimates.

BCWRC’s Drought Task Force intention to evaluate the cumulative impacts of Water Transfer Programs (including GW Substitution water market transactions) and Supplemental Groundwater Pumping Operations in the Northern Sacramento Valley is essential to understand sub basin water budgets.3251

The failure of the GSP to attempt an estimate of interbasin subsurface flow along the Western Boundaries invalidates the Water Budget on which much of the GSP uses as a foundation. It is inappropriate to explain that "*Characterization of Interbasin Flows and Net Outflows along Western Boundary*" is placed in the "Next Steps" category. Water Code § 354.16 explains "Groundwater Conditions Each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes the following: (a) Groundwater elevation data demonstrating flow directions, lateral and vertical gradients, and regional pumping patterns, including: (1) Groundwater elevation contour maps depicting the groundwater table or potentiometric surface associated with the current seasonal high and seasonal low for each principal aquifer within the basin." Code § 354.18. “Water Budget (a) Each Plan shall include a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions...(3) Outflows from the groundwater system by water use sector, including ... subsurface groundwater outflow." Early basin-setting drafts of the Vina, Butte and Colusa sub-basins showed large discrepancies in the modeled subsurface aquifer outflow patterns. The Butte Basin Groundwater Model has no capacity to quantify subsurface GW flow out of the western boundary of the sub-basin. The present draft recognizes the data gap and inadequacy of regional modeling that characterizes the water budget of inflow and outflow.

SGMA regulations require Each Plan to contain a water budget for the basin that identifies discharges including subsurface groundwater outflow. The Butte County Drought Task Force recognizes that Groundwater extractions outside the Vina boundaries such as the past and present Water Transfer Programs and Supplemental Groundwater Pumping Operations in the Northern Sacramento Valley may have enduring cumulative impacts on Vina's water budget.

2.1.2.4 **Groundwater Recharge Areas**

"*Groundwater recharge is the downward movement of water from the surface to the groundwater system*." Some recharge occurs from upward movement. Piezometric pressure from the semi-confined portions of the Tuscan System allows water to move upward recharging into or supporting alluvial unconfined aquifers if sufficient pressure exists. Line 1940 explains; "*In locations where groundwater levels in the shallower wells are lower than in the deeper wells, the gradient indicates upward movement of groundwater, with a similar relationship defining the volume of upward flow*." Conversely the alluvial shallow aquifer can leak downwards if the piezometric elevation is reduced. Line 1937: "*When groundwater levels in the shallower wells are higher than in the deeper completions, the gradient indicates downward movement of groundwater. The volume of downward flow is proportional to the gradient and the hydraulic conductivity between the shallow and deep measurement points*." The USDA groundwater atlas [https://pubs.usgs.gov/ha/ha730/ch_b/B-text3.html] explains this well-known water fact: "By the early 1960's, intensive ground-water development had significantly lowered water levels and altered ground-water flow patterns in the Central Valley aquifer system. By far the most dramatic impact of development was in the San Joaquin Valley, where water-level declines in the confined part of the aquifer system were locally more than 400 feet. Although predevelopment flow was toward the San Joaquin River throughout most of the basin, large withdrawals from deep wells in the western and southern parts of the aquifer system changed the direction of horizontal flow in the confined part of the system until the water moved toward the withdrawal centers. Also, because the magnitude of the withdrawals caused hydraulic heads in the confined parts of the aquifer system to fall far below the altitude of the water table, the vertical hydraulic gradient was reversed over much of the San Joaquin Valley. As a result, much of the water in the upper unconfined zone of the aquifer system that flowed laterally toward the river under predevelopment conditions leaked downward through the confining beds into the lower confined aquifer after development...Ground-water development in the San Joaquin Valley has reduced the effectiveness of the confining beds within the aquifer. Thousands of wells with casings perforated for much of their length have been drilled through the clay confining units. Where these wells are open to the unconfined and confined aquifers, they allow virtually unrestricted vertical flow through the well bore. The amount of water that flows downward through one large-diameter well has been estimated to be equivalent to the natural leakage through the "E-clay" over an area of approximately 7 square miles. During the peak of the withdrawal season, the net downward flow may be, on average, as much as 0.3 cubic foot per second per well." Significant Depressurization of the regional confined aquifer can take place within and outside of the Vina sub basin. Well-casings that have perforations at shallow and deep levels interrupt the confining layers and increase the vertical flow. Lines 1456-1460 indicate there is this type of potentially interbasin leakage in the Vina SB "*Aquifer testing conducted as part of the Lower Tuscan Aquifer study (Brown and Caldwell, 2013) indicated there is also the potential for Upper Watershed recharge in the shallow aquifer interval to move down to greater depths due to irrigation pumping, causing a mixing of recharge sources in the intermediate and possibly deeper aquifer zones in the Vina South Management Area.*" Line 1469 discusses "*Additional*

recharge through management activities of flood flows or irrigation practices has potential in the Vina Subbasin..." but does not discuss how the recharged water can migrate through the deep aquifer into adjacent sub-basins that are being pumped.

2.1.5 Groundwater Producing Formations presents an incomplete overview of the producing geology and fails to quantify the robust yields of the Tuscan even while quantifying the production amounts available in less important aquifer units, line 1614: "*Wells penetrating the sand and gravel units of the Riverbank and Modesto Formations produce up to about 1,000 gallons per minute (gpm)*" The Update on the Stony Creek Fan aquifer Performance Testing [http://cetehama.ucdavis.edu/files/135217.pdf] indicated that that Lower Tuscan can produce 2,500-3,000 gpm. The GCID and others are exploiting/depressurizing this extremely productive aquifer. The cumulative demand of the wells exercising the lower Tuscan is undoubtably impacting water levels in all aquifer layers in the 4-county basin.

2.1.8.2 Beneficial Uses "*Water produced from the principal aquifer is primarily used to meet irrigation, domestic, and municipal water demand*." This sentence should include "*environmental demand*". Groundwater and surface water are historically and, in many cases, currently connected. Beneficial uses must include the benefits to ecosystems including Groundwater Dependent upland vegetation. According to the State Water Board delineation of beneficial uses:
[https://www.waterboards.ca.gov/rwqcb2/water_issues/programs/planningtmdls/basinplan/web/bp_ch2.html]
2.1.3 COLD FRESHWATER HABITAT (COLD)
Uses of water that support cold water ecosystems, including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
2.1.14 PRESERVATION OF RARE AND ENDANGERED SPECIES (RARE)
Uses of waters that support habitats necessary for the survival and successful maintenance of plant or animal species established under state and/or federal law as rare, threatened, or endangered.
2.1.18 FISH SPAWNING (SPWN)
Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.
2.1.19 WARM FRESHWATER HABITAT (WARM)
Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
2.1.20 WILDLIFE HABITAT (WILD)
Uses of waters that support wildlife habitats, including, but not limited to, the preservation and enhancement of vegetation and prey species used by wildlife, such as waterfowl.
Beneficial uses of streams that have intermittent flows, as is typical of many streams in the region, must be protected throughout the year and are designated as "existing."

2.2 Groundwater Conditions; • "*Wells showing depths to first encountered groundwater deeper than 500 feet were eliminated from the data set*." The rationale behind this limitation is unclear. If there is significant piezometric pressure identified in the water encountered below 500' it should be included in the analysis. The hydrographs in this section measure a shallow portion of the system. It is likely that the groundwater flow volumes would be stimulated when the pressurized portion of the aquifer is

depressurized by major production operations. The cumulative effect of these extractions may be the cause of the decline in the seasonally fluctuating regional aquifer levels. The failure to evaluate the effect of confined/semi-confined piezometric pressure dynamics on groundwater conditions must be remedied. line 2143 identifies the existence and importance of this pressure in relation to subsidence but there is no other mention of piezometric pressure. "*As the pressure created by the height of water (i.e., head) declines in response to groundwater withdrawals, aquitards between production zones are exposed to increased vertical loads*." The measurement of piezometric pressure is important for groundwater monitoring. It allows us to determine the level and flow patterns of the groundwater. Omitting a discussion of piezometric pressure when discussing groundwater conditions in our region is like ignoring blood pressure during a human physical exam.

Line 1996

"*Since the year 2000, there has been a cumulative decline in March 1 groundwater storage of about 400,000 acre-feet (AF). This indicates the cycles of groundwater pumping are not in balance with the cycles of recharge that replenish the aquifer, and that groundwater depletion has occurred consistent with long-term decline in groundwater levels*." Without a regional GW model and a record of pumping throughout the Tuscan basin it is impossible to identify pumping in the VGSB as the sole demand resulting in the decline in GW storage.

Line 2017

"Development of groundwater quality-related Sustainable Management Criteria for the Vina Subbasin is not intended to duplicate or supplant the goals and objectives of ongoing programs including those by Butte County, the SVWQC and the State Drinking Water Information System (SDWIS) [SWRCB Geotracker/GAMA website, the California Department of Toxic Substances Control (DTSC) EnviroStor website, and the Environmental Protection Agency's (EPA) National Priorities List (NPL)]." GW pumping stimulates the movement of toxic plumes through the aquifer system. Advection is the movement of dissolved solute with flowing groundwater. The amount of contaminant being transported is a function of its concentration in the groundwater and the quantity of groundwater flowing, and advection will transport contaminants at different rates in each stratum. Who are the personnel in the VGSA that will be tracking these data and correlating it to various GW pumping regimes and flow patterns?

Line 2298

"*There is no indication in the streamflow data to suggest groundwater interactions that contribute to the streamflow behavior. Similar conditions would be expected for other creeks that traverse the Vina Subbasin (Little Chico, Sycamore, Rock, and Butte Creek) since they flow across a similar fan topography and similar shallow subsurface geology. The overall conclusion from this study in relation to interconnected surface water is that, for significant portions of the year, the upland creeks in the Vina Subbasin would be classified as disconnected streams and the surface water would be considered "completely depleted" as defined under SGMA*." Water code chapter 23 explains "(o) "Interconnected surface water" refers to surface water that is hydraulically connected <u>at any point</u> by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted." As I read Water Code it is clear that streams flowing out of the foothills are hydraulically connected until they reach a point where the aquifer has been depleted below stream level at which point the stream looses as it recharges the evacuated aquifer. As the GW level declines the stretch of dewatered stream expands. Spatial and temporal dewatering monitoring is a critical GDE function of a GSA. The California

Department of Fish and Wildlife has specific GDE recommendations that must be implemented in the VGSA: [https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=170185&inline]
"GROUNDWATER DEPENDENT ECOSYSTEMS (GDES)
1. How will groundwater plans identify GDEs and address GDE protection?
2. How will GSAs determine if GDEs are being adversely impacted by groundwater management?
3. If GDEs are adversely impacted, how will groundwater plans facilitate appropriate and timely monitoring and management response actions?
INTERCONNECTED SURFACE WATERS (ISW)
1. How will groundwater plans document the timing, quantity, and location of ISW depletions attributable to groundwater extraction and determine whether these depletions will impact fish and wildlife?
2. How will GSAs determine if fish and wildlife are being adversely impacted by groundwater management impacts on ISW?
3. If adverse impacts to ISW-dependent fish and wildlife are observed, how will GSAs facilitate appropriate and timely monitoring and management response actions."
According to a study on small streams flowing through the Vina SB: "Nonnatal rearing of juvenile Chinook salmon was documented in several intermittent tributaries to the Sacramento River. Condition factors and length measurements of juvenile chinook captured in the intermittent tributaries were compared with those captured in the mainstem Sacramento River. The data suggests that juvenile chinook rearing in the tributaries grew faster and were heavier for their length than those rearing in the mainstem. Faster growing fish smolt earlier, and may enter the delta earlier in the year before low water and pumping degrade rearing habitat." Intermittent Streams as Rearing Habitat for Sacramento River Chinook Salmon.
https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/docs/exhibits/swrcb/swrcb_maslin1997.pdf

The unregulated streams that flow into the Sacramento River are leaking into drained aquifers. Dan Wendell of The Nature Conservancy, a panelist at a workshop held by the California Natural Resources Agency, explained "since the 1940s, groundwater discharge to streams in the Sacramento Valley has decreased by about 600,000 acre-feet per year due to groundwater pumping, and it's going to decrease an additional 600,000 acre-feet in coming years under status quo conditions due to the time it takes effects of groundwater pumping to reach streams."
https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/docs/CSPA%20et%20al/part2/aqua_282.pdf

2.2.7 Groundwater Dependent Ecosystems
2488 Not Likely a GDE Due to Adjacency to Irrigated Agricultural Fields
2504 Not Likely a GDE Due to Dependence on Agricultural-dependent Surface Water
GDEs were incorrectly removed in areas adjacent to irrigated fields due to the presence of surface water. However, GDEs can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields - simultaneously and at different temporal/spatial scales. Basins with a stacked series of aquifers may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage

groundwater resources in shallow principal aquifers, that support springs, surface water, and groundwater dependent ecosystems. Areas in proximity to irrigated land can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on their proximity to irrigated fields.

3014 "*Western boundary net outflows represent Sacramento River gains from groundwater and subsurface outflows to the Corning Subbasin. The split between these outflows is uncertain at this time and identified as a data gap*." The subsurface outflow analysis must be expanded to include outflows into other nearby sub basins including Butte and Colusa. Increased GW extractions due to crop changes, "emergency" supplemental GW pumping, and GW substitution transfers is likely to increase subsurface flows over time. Butte Counties nascent Drought Impacts Analysis Study plans to compile the 2021 water transfer programs (April 2021-December 2021) from Butte, Tehama, Glenn, Colusa, Yuba and Sutter counties.
The report will include a brief description of the programs, amount of water transferred, recipient of water, whether surface water or groundwater substitution is utilized, destination of transferred water, etc. including maps. Analysis of the transfer programs will evaluate the cumulative impacts of the programs' impacts on water supplies and demands. This type of annual evaluation must be ongoing as demand/supply conditions evolve and consider "timescales involved in aquifer responses to pumping and other stresses can be on the order of decades, making it difficult to associate cause with effect. As such, monitoring must account for this lag in impacts. In general, the longer the timeframe for effects to be observed at a given monitoring point once they become evident, the longer those effects will persist, even if the pumping causing the effects is halted immediately." [1]
[1] Davids Engineering 2014. Prepared for NCWA, Sacramento Valley Groundwater Assessment Active Management – Call to Action.

Line 3016 **Water Banking Stimulation of sub surface flows** "*It is anticipated that this data gap* [sub surface flows] *will be addressed through future refinements to the BBGM and through coordination and collaboration with neighboring subbasins as part of GSP implementation*." The coordination and collaboration with neighboring subbasins is, at best, an forthright sharing of information and unbiased evaluation of model results. However, the VGSA would be naïve to ignore the special interests of key players in the Northstate Water World that may inspire some purveyors to profitably engage in the emerging California Water Market with less regard to the interests of GDEs and water users that are not participating in Transfer/sales that "exercise" the shared regional aquifer while promising to use PMAs to refill drained aquifer water banks.

3181 **Habitat Monitoring Deficit** "It is anticipated that these uncertainties will be reduced over time through monitoring and additional data collection, refinements to the BBGM and other tools, and coordination with neighboring basins." The DGSP is deficient because significant monitoring infrastructure has yet to be funded and built in the shallowest portion of the aquifer system that GDEs rely upon. According to the 2007 DWR/NCWA Sacramento Valley Water Resource Monitoring, Data Collection and Evaluation Framework; "The long-term health of riparian vegetation, wetland species, and number of other native habitat are commonly associated with maintaining a minimum range of groundwater levels and an appropriate level of interaction between surface water and groundwater resources. The lowering of groundwater levels due to natural climatic changes or the interception of

groundwater underflow to surface water systems due to the increased groundwater extraction associated with water management programs, have the potential to impact the native habitat areas. Baseline habitat monitoring is an important data collection objective because it allows for a better understanding of the existing water resource requirements of the native habitat and the evaluation of potential impacts associated with potential changes in water resource management practices. In order to identify potential habitat impacts associated with potential changes in water management practices, a program-specific network of shallow monitor monitoring wells should be developed to detect changes in water levels over the shallowest portion of the aquifer. In evaluating impacts to certain wetlands species, it is important to discern both the rate of groundwater level change, as well as the cumulative change over the entire year. Data collection and monitoring frequency should be appropriately selected to support the temporal and long-term evaluations."
https://www.waterboards.ca.gov/waterrights//water_issues/programs/bay_delta/california_waterfix/exhibits/docs/CSPA%20et%20al/part2/aqua_280.pdf

3266 3. SUSTAINABLE MANAGEMENT CRITERIA

3298 • "*MT– Quantitative threshold for each Sustainability Indicator used to define the point at which undesirable results may begin to occur.*" The stated definition is the most egregious violation of common sense in the DGSP. Undesirable results BEGIN to occur even before historic low levels (the approximate upper reach of the operational range) are occur. Domestic well failures, destruction of GDEs and chronic lowering of groundwater levels occur at historic GW levels and would be exacerbated if the aquifer is managed within the Operational Ranges being proposed. I find the Plan to be deficient in protecting beneficial uses. Historic low GW levels shown in most of the Appendix 3-B hydrographs are still above the 80' max rooting depth of native and urban forest trees. The Minimum Threshold as defined in the GSP, is purported to designate "the point at which Undesirable Results may BEGIN to occur." But undesirable results will begin much earlier in the proposed operational range shown in most of the hydrographs. These MTs are significantly deeper than 80' bgs. Furthermore, the lower water table will dewater longer reaches of streams earlier in the season and persist later in the year. Dan Wendell of The Nature Conservancy, a panelist at a workshop held by the California Natural Resources Agency, explained "since the 1940s, groundwater discharge to streams in the Sacramento Valley has decreased by about 600,000 acre-feet per year due to groundwater pumping, and it's going to decrease an additional 600,000 acre-feet in coming years under status quo conditions due to the time it takes effects of groundwater pumping to reach streams." The operational range proposed will not avoid triggering this and other significant irreversible Undesirable Results.
SGMA Regulations define "Measurable objectives" as "specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions.." Setting GW level MOs below historic low levels does not meet this requirement. Most of the proposed MOs are below historic low levels. This is not the appropriate level to designate the top of the operational range. SGMA Water Code § 354.30 explains "An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan." The managers assure the public that the goal of the VGSP is to maintain GW levels above or near the MOs or that if the MT is approached/transgressed PMAs would be employed to bring water levels back to the MO or higher. The definition of the MT shows the "Operational Range" as the defined goal. The proposed broad

operational ranges fit the prescription for market driven groundwater banking but would result in many undesirable impacts to water users not participating in the rapidly emerging California Water Market.

3415 **Water Bank Prescription** "*The quantitative Vina Subbasin Undesirable Result for the Chronic Lowering of Groundwater Levels occurs when: Two RMS wells within a management area reach their MT for two consecutive years of non-dry year-types.*" Two years of operating at the MT level would destroy GDEs including the urban forest of Chico. The insulting caveat that it would be acceptable to forgive the extreme MT levels if they occur during 2 consecutive dry years would allow GW levels to decline below the MT and implies that artificial recharge during "wet" years is a mitigating option. This is another example of an operation prescription for conjunctive use water bank marketing.

3477 **Cumulative impacts of regional pumping** "*Groundwater levels are typically lower during dry years and higher during wet years. Superimposed on this four- to seven-year short-term cycle is a long-term decline in groundwater levels. In other words, groundwater levels during more recent dry-year cycles are lower than groundwater levels in earlier dry-year cycles*." The DGSP fails here to identify the cumulative impacts of increased pumping in the regional shared Tuscan aquifer system that is driving the long-term trend in driving down the fluctuating hydrograph record. Management of connected groundwater systems is challenging for several reasons. First, the cumulative GW depletions caused by pumping depends on the spatial scale: in general (depending on soil conditions and strata) the greater the distance or depth between groundwater pumping and a monitoring well, the lower the magnitude but the longer the timescale of depletions. Consequently, the ultimate effects of pumping can occur significantly after pumping starts, or even after pumping has ceased. The timescales involved in aquifer responses to pumping and other stresses can be on the order of decades.

3703 **Outside Hydrologic Influence** "*hydrologic impacts outside of the Vina Subbasin, such as upper watershed development or fire-related changes in run-off, could result in impacts to streamflow, riparian areas, or GDEs that are completely independent of any connection to groundwater use or conditions within the Vina Subbasin.*" Since the deep Tuscan Aquifer System is recharged from the eastern basin foothills it is certainly appropriate to recognize impacts to groundwater use and conditions within the Vina SB resulting from fire related soil conditions and streamflow in the recharge area. [https://www.buttecounty.net/waterresourceconservation/SpecialProjects/StableIsotopeRechargeProject.aspx]
Additionally, conditions in the down-gradient portion of the Tuscan System are worthy of evaluation as the VGSP evolves. The lower Tuscan Aquifer system is being developed as a water source west of the Sacramento River and is being evacuated with vigor especially during dry years. This may accelerate the rate of subsurface flow out of the Vina SB. The Glenn Colusa Irrigation District board pumped over 25K af of Tuscan groundwater for 2-3 months this summer to supplement their river allocation. This is on top of 10k af of groundwater substitution water transfers and even more surface water sales from "willing sellers" to "willing buyers" South Of Delta. The 35k/a/f is more water in 3 months than the Chico Urban Area pumps in a year. The State emergency declaration allows water purveyors like GCID to sidestep laws that require environmental review. GCID used district wells located 5-10 miles west of Chico that can pump 3KAF/minute. The Butte County Drought Task Force recognizes the importance of evaluating cumulative impacts of programs on water supplies and demands on the Vina SB may be significant and is

initiating a "Drought Impacts Analysis Study" that will compile and analyze the 2021 Water Transfer Programs and the Supplemental Groundwater Pumping Operations in the Northern Sacramento Valley. https://buttecounty.granicus.com/MetaViewer.php?view_id=2&clip_id=1006&meta_id=157029

3776 Upland GDE Designation "*The Vina Subbasin specifically recognizes deep-rooted tree species, such as Valley Oak, that are common along riparian corridors in both upland streams and the Sacramento River. This connectivity is not well measured or understood in the Vina Subbasin at this time.*" The failure of the DGSP to accept the well-documented fact that deep rooted trees are not exclusively located along riparian corridors but are nonetheless dependent on the shallow aquifer.
US Forest Service Index of Species Information for Valley Oak explains the wide distribution of the Valley Oak ecosystem: https://www.fs.fed.us/database/feis/plants/tree/quelob/all.html
"Valley oak typically has several vertical roots that tap groundwater and extensive horizontal root branches. Vertical root depth has been measured as deep as 80 feet (262m) in some individuals. Best growth is attained when water tables are about 33 feet (10 m) below the surface. Historically, these forests extended 0.6 to 5.0 miles (1-8 km) on each side of major rivers. Valley oak cover was once extensive, extending through lowlands and into foothills."
Limiting GDE evaluation to measurable impacts to interconnected streamflow is insufficient.
California Code of Regulations, Title 23 § 351. Definitions.
"(g) Identification of groundwater dependent ecosystems within the basin, utilizing data available from the Department, as specified in Section 353.2, or the best available information.
(m) "Groundwater dependent ecosystem" refers to ecological communities or species that depend on groundwater emerging from aquifers <u>or on groundwater occurring near the ground surface</u>."
The DGSP, like other planning documents, promises on line 3785 "to fill these data gaps and the GSAs are committed to addressing these issues and develop appropriate SMCs for the Vina Subbasin." But like other co-equal goals that assure balancing water supply with ecosystem health it is meeting the demand that takes precedence. In 2007 the DWR, NCWA and the State Water Board recognized the importance of habitat monitoring in their Sacramento Valley Water Resource Monitoring, Data Collection and Evaluation Framework
https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/docs/CSPA%20et%20al/part2/aqua_280.pdf
"The lowering of groundwater levels due to natural climatic changes or the interception of groundwater underflow to surface water systems due to the increased groundwater extraction associated with water management programs, have the potential to impact the native habitat areas….In order to identify potential habitat impacts associated with potential changes in water management practices, a program-specific network of shallow monitor monitoring wells should be developed to detect changes in water levels over the shallowest portion of the aquifer."
But there has been no investment in creating the network needed to collect baseline conditions or to monitor declines in this critical GDE preservation goal.

5. PROJECT AND MANAGEMENT ACTIONS

4412 5.2.3.1 **Agricultural Irrigation Efficiency**
4414 Butte County agriculture is a keystone feature of culture in the Vina SB. The importance of maintaining the viability of irrigated agriculture is of paramount importance. The results of the Vina GSA,

Agricultural Groundwater Users of Butte County, and Butte County Farm Bureau survey to evaluate current irrigation methods and practices, identify opportunities and methods to improve irrigation efficiency, determine potential issues preventing the adoption of efficiency practices, and provide recommendations for increasing participation in these practices were expected to be available in September 2021. A summary of the results would be helpful in evaluating opportunities to stabilize or reduce demand. Incentives to invest in efficient GW irrigation through grant funding and tax rebates are needed to maximize benefits. According to Valerie Kincaid "A project proponent maintains the right to water that is recharged whether it results from recharge projects or groundwater demand reduction projects (e.g., conservation, recycling)." Why is this not listed as a recharge project?

4449 5.2.3.2 Project: Residential Conservation The Estimated Groundwater Offset and/or Recharge: 100 acre-feet/year is certainly below the potential for urban efficiency. The voluntary expansion of xeriscape replacement of turf is evident and the adoption of efficient water using appliances is inevitable. The managers should review the successful urban conservation data from last decade to evaluate more realistic estimates of potential offset amounts.

4079 " *As discussed in Section 4.1, the GSAs in the Vina Subbasin intend to further evaluate the SMC for interconnected surface waters to avoid undesirable results to aquatic ecosystems and GDEs. As additional data are collected and evaluated, the Vina Subbasin commits to developing additional SMC and installation of monitoring points, as appropriate, for specific stream reaches and associated habitat where there is a clear connection to groundwater pumping in the principal aquifer*." Restricting monitoring points and GDE considerations to riparian proximities is insufficient for the protection of deep-rooted vegetation, both native trees and the Chico urban forest. According to the USDA Forest Service "Urban forests help to filter air and water, control storm water, conserve energy, and provide animal habitat and shade. They add beauty, form, and structure to urban design. By reducing noise and providing places to recreate, urban forests strengthen social cohesion, spur community revitalization, and add economic value to our communities."
[https://www.fs.usda.gov/managing-land/urban-forests]
The shallowest portion of the aquifer system that sustains this vegetation extends beyond riparian corridors. The Sacramento Valley Water Resource Monitoring, Data Collection and Evaluation Framework 2007 DWR NCWA
https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/docs/CSPA%20et%20al/part2/aqua_280.pdf] recognizes the importance of establishing a monitoring network in the shallowest portion of the aquifer for this purpose: "The long-term health of riparian vegetation, wetland species, and number of other native habitat are commonly associated with maintaining a minimum range of groundwater levels and an appropriate level of interaction between surface water and groundwater resources. The lowering of groundwater levels due to natural climatic changes or the interception of groundwater underflow to surface water systems due to the increased groundwater extraction associated with water management programs, have the potential to impact the native habitat areas. Baseline habitat monitoring is an important data collection objective because it allows for a better understanding of the existing water resource requirements of the native habitat and the evaluation of potential impacts associated with potential changes in water resource management practices. In order to identify potential habitat impacts associated with potential changes in water management practices, a program-specific network of shallow monitor monitoring wells should be

developed to detect changes in water levels over the shallowest portion of the aquifer. In evaluating impacts to certain wetlands species, it is important to discern both the rate of groundwater level change, as well as the cumulative change over the entire year. Data collection and monitoring frequency should be appropriately selected to support the temporal and long-term evaluations."

4477 5.2.3.3 Project: Streamflow Augmentation

"*The project would primarily take place at Comanche Creek, Butte Creek, Little Chico Creek, and Big Chico Creek*." It is unclear how Little Chico Creek and Big Chico Creek would be integrated into this program since they are, apart from flood control infrastructure, unregulated by dams. If a project includes the application for a new right to recharge water, it will need to obtain a water right permit from the State Water Resources Control Board (SWRCB) through a surface water right application and a supplemental groundwater recharge form. The water right permit application would need to identify the "beneficial use" that the project intends to meet. Recharging groundwater is not considered a beneficial use, however, meeting the sustainable management criteria in a GSP may be determined to be a beneficial use.

Since this project is in the "Planned" category and is expected to move forward and be completed there must be more detailed information available to the public. The project description should be clear on permits that would be required to be negotiated with regulatory agencies such as CFW and the State Water Board.

4507 **5.2.3.4 Flood MAR/Surface Water Supply and Recharge Scoping**

This planned scoping project must include a detailed evaluation of the efficacy of up-gradient recharge efforts that may enhance extraction opportunities in down-gradient sub-basins that are developing new groundwater exploitation infrastructure to supply expanding permanent crop acres and engaging in water transfers that integrate the shared aquifer system into their transfer portfolio and have a history of using the same aquifer as an "emergency" supplemental water supply. The legal consequences of attempting MAR have been summarized by Ms. Kincaid and issues of aquifer privatization and potential water bank extirpation of Butte Chapter 33 protection remain unresolved and exacerbated by the expert analysis presented by the Public Policy Institute of California. "**County export ordinances prevent beneficial trades.** In the absence of state regulation of groundwater, county ordinances have protected local parties against injury from groundwater-related exports. But their export permitting hurdles are so high that they impede any transfers, including those that present no significant risk to local groundwater sustainability. In Butte County, for instance, it would take 18 months to go through all the steps to obtain a permit for a same-year groundwater substitution transfer. Once GSAs establish sustainability plans that address undesirable impacts of pumping, it should be possible to ease the coarser restrictions on this practice found in most county ordinances—which effectively preclude trades if they entail water leaving the county. If counties with restrictive groundwater export ordinances fail to amend their laws to conform to SGMA, the legislature should consider preempting local laws that discriminate against out-of-county uses or place undue burdens on groundwater and groundwater-substitution transfers that would not jeopardize sustainable groundwater management of the source aquifer."
https://www.ppic.org/publication/improving-californias-water-market/

All the projects outlined in lines 4408-4663, as well as 4870 5.2.4.11 Project: Surface Water Supply and Recharge, whether they are conservation (demand reduction) or recharge (supply augmentation)

projects have the potential to carry the legal consequences of artificial recharge efforts. According to Kincaid [https://www.vinagsa.org/files/4441577c7/PMA+Legal+Implications+Discussion+Paper.pdf]

“A project proponent maintains the right to water that is recharged whether it results from recharge projects or groundwater demand reduction projects (e.g., conservation, recycling). If a project uses or obtains a surface water supply and recharges into the aquifer, the project proponent would have a legal right to the recharged water. Water does not legally become “common” or “native” supply available to overlying groundwater right holders unless it is abandoned by the project proponent.” The contentious issue of privatization of the aquifer that is used as a water bank must be resolved at the State level because local ordinances may be overridden by SGMA jurisdiction. The strategy of integrating the Tuscan Aquifer System into the State Water Supply is a long-standing threat to the balance of uses required to maintain the quality of life in the Vina SB. According to the Public Policy Institute of California, “County export ordinances prevent beneficial trades. In the absence of state regulation of groundwater, county ordinances have protected local parties against injury from groundwater-related exports. But their export permitting hurdles are so high that they impede any transfers, including those that present no significant risk to local groundwater sustainability. In Butte County, for instance, it would take 18 months to go through all the steps to obtain a permit for a same-year groundwater substitution transfer.

“Streamline transfer reviews while maintaining protections. Approval delays by federal, state, and local authorities often reflect uncertainties about the physical impact of a surface or groundwater transfer on other water users or the environment. Yet there are various ways to streamline the process while maintaining protections, for instance by conducting more up-front analysis of impacts through programmatic reviews, developing a “fast lane” for transfers below a certain size, developing a structured evaluative process for reviews, and establishing an after-the-fact process for balancing accounts to enable quicker approvals of time-sensitive activities.

"Develop more equitable local rules for groundwater substitution transfers. Well-run groundwater substitution programs can expand long-term water availability by more actively using local groundwater storage. Once GSAs establish sustainability plans that address undesirable impacts of pumping, it should be possible to ease the coarser restrictions on this practice found in most county ordinances—which effectively preclude trades if they entail water leaving the county. If counties with restrictive groundwater export ordinances fail to amend their laws to conform to SGMA, the legislature should consider preempting local laws that discriminate against out-of-county uses or place undue burdens on groundwater and groundwater-substitution transfers that would not jeopardize sustainable groundwater management of the source aquifer."

The State may use emergency proclamation or legislative action to neutralize local control of water policy such as the Chapter 33 ordinance in Butte County. The broad operating range and historic low-level starting point (MO) that the VGSA consultants and staff have inserted into the VGSP will create the storage space needed to bank/sell water stored in the Butte Basin. The Kincaid white paper explains that Potential Management Actions “would allow the Vina GSA to protect the Vina subbasin and the implementation of the GSP from negative implications from artificial recharge projects through enactment of rules, ordinances and/or policies.” But her estimation that ordinances or policies that the GSA may adopt to ensure recharge projects are operating without adverse impact to the basin offer no assurance that the VGSA would have the capacity to successfully navigate the State prerogative to manipulate the emerging water market that intends to “Streamline groundwater substitution and water transfer permitting and approval processes by allowing consolidated basin-level environmental reviews

to facilitate water market transactions," [https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118]

4664 **5.2.4.5 Community Monitoring Program** "*This project would create routine water table monitoring programs for approximately 8,000 acres of Ecological Reserves in the region between lower Forest Ranch and Cohasset Road near Chico Airport, including the Big Chico Creek, Sheep Hollow, and Cabin Hollow tributaries.*" This project should be required to be implemented yesterday! Baseline habitat monitoring is an important data collection objective because it allows for a better understanding of the existing water resource requirements of the native habitat and the evaluation of potential impacts associated with potential changes in water resource management practices. To identify potential habitat impacts associated with potential changes in water management practices, a program-specific network of shallow monitor monitoring wells should be developed to detect changes in water levels over the shallowest portion of the aquifer. In evaluating impacts to certain GDE species, it is important to discern both the rate of groundwater level change, as well as the cumulative change over the entire year. Data collection and monitoring frequency should be appropriately selected to support the temporal and long-term evaluations.

4691 **5.2.4.6 Project: Wastewater Recycling**

While this project requires time consuming permitting and coordination with regulatory agencies as well as significant infrastructure installations it will be helpful in keeping Chico's GW demand from expanding along with the urban development that is anticipated. Focusing purple pipe infrastructure on athletic field irrigation is a good target during dry seasons.

4722 **5.2.4.7 Project: Community Water Education Initiative**

A population that is well informed on watershed health, water use conservation and water policy is an excellent education goal. This project should identify regional responsible water use and climate responsive flexibility. The political science portion should dive into the history of California water policy; how it has shaped regional water infrastructure and the need for local vigilance in defending the hydrologic balance from insatiable demand from unfettered urban and agricultural expansion south of the Delta.

4768 **5.2.4.8 Project: Rangeland Management and Water Retention**

4802 **5.2.4.9 Project: Fuel Management for Watershed Health**

4833 **5.2.4.10 Project: Removal of Invasive Species**

Investments in the health of ecosystems that provide the water recharge for the Tuscan Aquifer System have been, like in the rest of the Sierra Cascade watershed, unwisely underfunded. An excerpt from the Sierra Nevada Ecosystem Project lays out the imbalance of resource extraction vs reinvestment. These projects would begin to address that imbalance.

"Based on estimates of direct resource values as one input (not the total revenue produced by resource dependent activities), the Sierra Nevada ecosystem produces approximately $2.2 billion

worth of commodities and services annually. Water accounts for more than 60% of that total value. Other commodities [timber and grazing] account for 20% as do services.
"Public timber and private recreation are the largest net contributors of funds to county governments both in total dollars and as a percentage of their total value. Around 2% of all resource values are presently captured and reinvested into the ecosystem or local communities through taxation or revenue sharing arrangements. The declining status of some aspects of the Sierra Nevada ecosystem suggests that this level of reinvestment is insufficient to ensure sustainable utilization of the ecosystem."
https://pubs.usgs.gov/dds/dds-43/VOL_III/VIII_C23.PDF

4870 **5.2.4.11 Project: Surface Water Supply and Recharge** While it is suggested that these projects will require a SWRCB permit; CEQA and others the State is on a path of "streamlining and acceleration of managed aquifer recharge and groundwater banking permitting processes" and to "Streamline groundwater substitution and water transfer permitting and approval processes to optimize the economic value of groundwater".
https://data.ca.gov/dataset/californias-groundwater-update-2020-bulletin-118/resource/94f3a5f6-23f3-4aec-ab84-b546bf211bab
It is unclear if the legal and environmental consequences of this project will be adequately considered. The preservation of undisturbed critical vernal pool habitat is an ecological priority in some of the presumed areas of inundation.

4973 **5.3.4 Landscape Ordinance**
4980 **5.3.5 Prohibition of Groundwater Use for Ski (Recreational) Lakes**
These two common sense regulations would help meet our goals.

4984 **5.3.6 Expansion of Water Purveyors' Service Area**
Assuming that this is exclusively for residential development it is critical that service area expansion does not stimulate urban sprawl that intrudes on either green-line or gold-line open space.

4990 5.3.7 Groundwater Allocation
The consideration of groundwater allocation must be scientifically connected to the actual cause of failure to achieve sustainability goals by 2042. If cross-boundary water flows are causing declining levels in up-gradient portions by extractions in the down-gradient portion of the shared regional aquifer system, there must be well designed/implemented monitoring/modeling systems in place that have the confidence of all involved.

5005 5.4 Data Collection

5006 5.4.1 County Contour Mapping
"*As part of the efforts to collect the information necessary to fill the data gaps identified in Section 3, this project proposes to expand the existing monitoring program to include Butte, Glen, Colusa, and Tehama counties and conduct these groundwater elevation surveys in the spring, summer, and fall. The monitoring program would gather data used to produce groundwater contours and estimates of lateral and vertical flow direction and volume. Producing this data for the four counties will help to identify interbasin flow patterns and*

influences on surface water flows and replenishment locations, thereby improving coordination between counties and water management decision-making." This inter-basin effort must be implemented ASAP! A reliable inter-basin GW modeling is also at the top of the management list.

6. PLAN IMPLEMENTATION

5135 Table 6-5: Estimated Costs for Implementing Data Gaps

"*Interconnected Stream Monitoring $100,000 – $250,000*" As mentioned in previous comments the immediate implementation of a network of shallow monitor monitoring wells should be developed to detect changes in water levels over the shallowest portion of the aquifer. Baseline habitat monitoring is an important data collection objective because it allows for a better understanding of the existing water resource requirements of the native habitat and the evaluation of potential impacts associated with potential changes in water resource management practices. The long-term health of riparian vegetation, wetland species, and number of other native habitat are commonly associated with maintaining a minimum range of groundwater levels. Limiting the data gap to Interconnected Stream Monitoring would leave out GDEs that are outside of designated riparian zones. The shallow aquifer has an important role to play in keeping deep rooted trees, including the large trees in the Chico Urban Forest, that survive the regional dry months without supplemental irrigation.

The USDA also recognizes that Urban Forests such as exists in Chico and other Butte County towns provide a range of valuable ecosystem services. I posit that the groundwater dependent trees of our towns ARE ecosystems. Many environmental challenges are exacerbated within the urban landscape, such as stormwater runoff and flood risk, chemical and particulate pollution of urban air, soil and water, the urban heat island, and summer heat waves. Chico's urban forest canopy mitigates these challenges. Research shows that urban trees are integral to the environmental quality of cities and towns.
In April of 2007 Butte County resolved to adopt an oak woodlands management plan.
"Butte County supports significant acreage of oak woodland habitat. The historical importance of oaks is apparent in the names of towns, cities, streets and residential complexes throughout California. Butte County's oak woodlands enhance the natural and scenic beauty of the area, provide forage and shelter for more than 300 species of wildlife, facilitate nutrient cycling, moderate temperature extremes, reduce soil erosion, sustain water quality and increase the monetary and ecological value of property."
http://www.buttecounty.net/Portals/10/Docs/Planning/Projects/OakWoodland/Chapter53_ButteCounty_OakWoodlandMitigationOrd_2018-10-29.pdf?ver=2018-10-29-165211-350

Water Code § 113: "It is the policy of the state that groundwater resources be managed sustainably for long-term reliability and multiple economic, social, and environmental benefits for current and future beneficial uses."

5253 6.7 Interbasin Coordination
5271 1. Information Sharing
"*This will continue throughout GSP implementation and may include:*

1. Inform each other on changing conditions (i.e., surface water cutbacks, land use changes, policy changes that inform groundwater management)
2. Share annual reports and interim progress reports
3. Share data and technical information and work towards building shared data across and/or along basin boundaries (e.g., monitoring data, water budgets, modeling inputs and outputs, and Groundwater Dependent Ecosystems)"

Information Sharing must include the water-market/emergency GW pumping volumes/locations/timing that members of the North Sac River Corridor group intend to implement and a report on the final v/l/t of these extra demands on the shared aquifer system. These extra pumping demands are not unprecedented and have become a routine component of California's plan to use the Northern Sacramento Valley as a "reliable" source of supply.

Butte County is on the verge of conduction a Drought Impacts Analysis Study that will evaluate the numerous 2021 Water Transfer Programs in Northern Sacramento Valley including the Supplemental Groundwater Pumping Operations. The study portends to accomplish an evaluation of cumulative impacts of programs on water supplies and demands in the inter-basin, but focus on the Vina Subbasin"
https://buttecounty.granicus.com/MetaViewer.php?view_id=2&clip_id=1006&meta_id=157029 pdf Pg 42-43
The report will include a brief description of the programs, amount of water transferred, recipient of water, whether surface water or groundwater substitution is utilized, destination of transferred water, etc. including maps. This report should be conducted every year, funded by SGMA interbasin coordination parties and be included in the VGSA Annual report submitted by April 1 for the prior year's activities.

5295 3. **Coordinate on mutually beneficial activities**
GSAs that overlie the Tuscan Aquifer Formation should provide cooperative funding for mutually beneficial watershed management in the recharge areas located in the foothills east of the valley floor.

5314 **5. Issue Resolution Process**
"Vina Subbasin will pursue development of an issue-resolution process with neighboring subbasins in the North Sac River Corridor group."

This single sentence description of the process to identify and resolve "issues" belies the potential for regional conflict over water management issues. The drama surrounding the nascent Tuscan Water District and the unpopular "Operational Range[s]" proposed in the DVGSP are examples of "issues" that have already emerged in this process. Conflict arising from expanded GW demand in the North Sac River Corridor group are being litigated between stakeholders and agencies. Achieving sustainability requires local agencies, stakeholders, and water users to make many difficult and potentially contentious decisions. These decisions are prone to conflict, particularly when pumping restrictions are viewed as infringing on property rights, or when fees are charged to support local management. Newly formed GSAs have additional layers of potential conflict. Questions regarding authority, streamlined legal and regulatory timelines, a lack of existing precedents and the need to represent agency and constituent interests have the

potential to exacerbate conflicts under SGMA. In some cases, where authoritative interpretations of legal authority and limits have not been established yet, litigation may be necessary and warranted. The State prefers the Northern Sacramento Valley to quietly comply with the myth that this region is a source of "surplus" water that can peacefully serve the accelerating water market through conjunctive-use water banking. However, it is likely that conjunctive-use water banking would degrade the groundwater basin and groundwater users who are not involved in conjunctive use but are reliant on the same groundwater basin.

Chapter 4: MONITORING NETWORKS

4218 Well "Construction Data – Well data such as perforation depths, construction date, and well depth was considered for selection." Many of the selected wells to not meet the above criteria for selection:
4262 Table 4-5. Groundwater Levels RMS Well Construction Details
North MA: 3/6 of the wells do not have listed screen intervals. This makes it difficult to know what layer of aquifer is being monitored. Scientifically constructed multi-completion wells with defined screen depths/elevations is needed. The other 3 have screen intervals ranging from about 70' to almost 500'. While this type of well construction is suitable for production it is unsuitable for transparent depth/elevation monitoring of the aquifer system.
Chico MA The well depths are undefined as are the screen depths. There is a notable lack in monitoring the shallow aquifer that supports the unirrigated Chico Urban Forest.

In summary:
The VGSP must strive to develop and use the best modeling/monitoring processes that recognize the influence of the upland recharge area and the downslope aquifer extraction that influences the ability of this GSA to achieve a robust sustainability goal that does not collapse during the inevitable dry periods that the historic record reveals and the climate destabilization models predict. The hydrologic and geologic science used must not be cast aside by the political science that drives California Water Policy that views the Butte County as an underutilized export source that can be "exercised" by conjunctive water banking. The environment, the urbanites and the rural community require a reliable water table that can't be displaced, even during consecutive dry years.

Jim Brobeck, Water Policy Analyst, AquAlliance

Glenn-Colusa Irrigation District
Serving Our Lands and Environment Sustainably
Water Rights Established in 1883

BOARD OF DIRECTORS
Donald R. Bransford, President
Peter Knight, Vice President
John Amaro
Logan Dennis
Blake Vann

GENERAL MANAGER
Thaddeus L. Bettner, P.E.

DATE: October 25, 2021

TO: Colusa Groundwater Authority
Glenn Groundwater Authority
Corning Subbasin Groundwater Sustainability Agency
Tehama County Flood Control & Water Conservation District Groundwater Sustainability Agency
Butte Subbasin Groundwater Sustainability Agencies (all eleven)
Vina and Rock Creek Reclamation District Groundwater Sustainability Agencies

FROM: Holly Dawley, GCID Water Resources Manager

SUBJECT: Support for Groundwater Sustainability Plans and Concern about Groundwater Surface Water Interactions

---

Glenn-Colusa Irrigation District (GCID) is located in the heart of the Sacramento Valley; we are the largest and one of the oldest diverters of water from the Sacramento River. GCID diverts water from the Sacramento River through a 65-mile long irrigation canal into a complex system of nearly 500 miles of laterals. The water is delivered to more than 1,200 families who farm approximately 141,000 acres of valuable, productive agricultural land. More than $270 million of agricultural products are produced annually on Glenn-Colusa Irrigation District farms, helping to sustain an estimated 12,000 jobs in the region. GCID is also the sole source of surface water deliveries for three wildlife refuges – the Sacramento, Delevan and Colusa National Wildlife Refuges that comprise over 20,000 acres of critical wildlife habitat. Winter water supplied by GCID to thousands of acres of rice land also provides a rich oasis for migrating waterfowl.

GCID is an active member of the Colusa Groundwater Authority, the Glenn Groundwater Authority, and the Corning Subbasin Groundwater Sustainability Agency.

Support for Groundwater Sustainability Plans

GCID appreciates the opportunity to provide comment to your agency for Groundwater Sustainability Planning in the Sacramento Valley (Valley). As a member of three Groundwater Sustainability Agencies (GSAs) within the Valley, GCID staff have valued our participation in the development of two Draft Groundwater Sustainability Plans (GSPs) and support a collaborative approach to management across a shared resource. We support the adoption of the GSPs by each of the GSAs to meet the January 31, 2022, deadline and we look forward to continued participation during implementation.

Concern about Groundwater Surface Water Interactions

While we support the adoption of the GSPs, this communication serves as a formal written comment to highlight and express a particular area of concern that could lead

to the development of an incomplete decision framework and compromise the stability afforded to groundwater users in the various Sacramento Valley subbasins and more specifically to surface water users and senior water right holders which includes our District. We are writing to express deep concern regarding the lack of consideration in the GSPs about stream-aquifer interactions and impacts from unrestricted groundwater pumping.

This year in response to historically dry conditions, GCID and our fellow Sacramento River Settlement Contractors (SRSCs) took a multitude of voluntary actions significantly reducing the supply to our water users. These actions collaboratively supported watershed objectives in the face of declining storage and identified environmental concerns. While GCID and its partners were working daily for months with Central Valley Project (CVP) operators and State resource agencies to reduce surface water use and stabilize flows in the Sacramento River to help with Delta outflows and environmental needs, groundwater pumpers accessed the resource unabated impacting the stream flows we were actively working to stabilize.

As a significant contributor to groundwater recharge within the Valley, we only utilize that resource in years of shortage. We contribute every year to over 100,000 acre-feet (*Colusa GSP Draft, Appendix 3D, pg. 27*) of groundwater recharge even in Shasta critically dry years. However, we only utilize the resource when our surface water supplies are diminished by drought. Even with all of our voluntary surface water reductions in 2021, we only utilized 20,000 ac-ft of groundwater, while taking over 20,000 acres of land out of production to balance our supply and demand.

According to the Draft GSPs for Vina, Butte, Corning, and Colusa Subbasins, current year estimates of groundwater pumping, summarized in the table below, are over 1 million acre-feet per year (ac-ft/yr) in the region that surrounds our District.

Table 1, Groundwater Pumping in Subbasins in and around GCID (TAF)

	Historical	Current	Future, No Climate Change	Future, 2030 Climate Change	Future, 2070 Climate Change
Butte[a]	142.2	162.8	162.6	189.4	210.5
Vina[b]	243.5	209.2	215.8	225.9	238
Colusa[c]	502	499	499	525	559
Corning[d]	132.3	153		159.3	167.3
Totals (TAF)	***1020***	***1024***	***877.4***	***1099.6***	***1174.8***

Notes

[a]Butte Groundwater Sustainability Plan, Public Review Draft, Section 2, pg. 2-65

[b]Vina Groundwater Sustainability Plan, Public Final Draft, Section 2, pg. 82

[c]Colusa Groundwater Sustainability Plan, Final Draft Report, Section 3, pg. 3-96

[d]Corning Groundwater Sustainability Plan, Public Review Draft, Section 4, pg. 4-69

This groundwater pumping impacts groundwater storage as evidenced by declining groundwater levels and impacts surface-groundwater interactions as evidenced by decreased streamflow and more reaches becoming losing streams. These numbers

indicate a need to understand the origin of groundwater pumping and the potential impacts to the subbasins as water users pull from a shared resource. In looking at these pumping numbers, a particular concern that becomes palpable is that all the GSPs identify increased groundwater pumping which will result in groundwater storage impacts and will result in increased streamflow depletion.

After reviewing the documents, senior surface water rights holders and their operations seem to be a minor share of the use of the resource, but a significant contributor to the replenishment of the resource. We ask that as GSAs move from planning to implementation and continue to look for opportunities to leverage surface water over groundwater, you consider those members and partners with senior water rights and stable contracts that contribute to our shared aquifers and provide high quality environmental habitat. We look forward to better identifying and quantifying this benefit for the subbasins during implementation. Further, we ask that GSAs work with their County partners to consider land use planning and accountability.

Thank you for your consideration of these concerns. We urge you to consider language to address or at least acknowledge this issue in the GSPs. We look forward to working through this issue during implementation.

From: Vita Segalla
To: VinaGSA@gmail.com
Subject: GSP comment
Date: Thursday, October 14, 2021 2:20:47 PM

ATTENTION: This message originated from outside **Butte County**. Please exercise judgment before opening attachments, clicking on links, or replying.

Hello -

I attended the public zoom meeting last night - 10/13. I am in agreement with those who spoke regarding the idea that the minimum threshold is too severe/low. That current suggested minimum threshold could easily present problems - and not only for those with wells. Plants and wildlife have to have accessible water. We need to preserve our urban forest and landscape and the integrity and beauty of our local region - all of which is linked to our groundwater levels and how they are accessed. Natural recharge takes time and we are in a drought period and global warming which threatens the ability to recharge an aquifer that is being extensively drained. Artificial recharging as a proposed possible option is not desirable and would become a giant legal circus.

I also would like to suggest that agriculture - our biggest user of the aquifer - be cut back to meet the need for water retention in the groundwater table. We, the residents, are modifying our usage and so should ag businesses.

Thank you -
Vita Segalla
1448 Normal Ave
Chico, CA 95928

From: Pam Stoesser
To: Vina Groundwater Sustainability Agency & Rock Creek Reclamation District
Cc: Pam Stoesser
Subject: Re: Vina GSP Comments
Date: Monday, October 18, 2021 5:26:46 PM

ATTENTION: This message originated from outside **Butte County**. Please exercise judgment before opening attachments, clicking on links, or replying.

On Monday, October 18, 2021, 05:07:41 PM PDT, Pam Stoesser <pam.chico@sbcglobal.net> wrote:

Get Tough on Cutbacks & Conservation

I am so worried as I read through your Vina Draft GSP. So much manipulation of our water can't be good. I firmly believe that the more we mess with nature, moving our water here and there, the more damage we are creating. Please stop and reconsider that some of these damaging actions would be better achieved through conservation measures. It's time we all acknowledge the fact that there is less to go around, and we all need to cut back...especially the biggest users, agriculture. The pain of cutbacks must be shared proportionately.

Please prioritize and fund all of the proposed Conservation PMAs presented to the Vina GSA on 02 Sept 2021, including:

- Agricultural Irrigation Efficiency - mandatory
- Residential Conservation - mandatory
- Streamflow Augmentation - so good for the salmon!
- Extend Orchard Replacement - use this incentive now
- Water Recycling - make it happen asap
- Community Water Education Initiative Education and Outreach - mandatory
- Rangeland Management and Water Retention Conservation - mandatory
- Fuels Management for Watershed Health - mandatory
- Removal of Invasive Species Conservation - gradual
- Agricultural Water Allocations - phase in immediately - no pain no gain!

Please make these conservation actions mandatory where noted...NOT voluntary. A voluntary program is really an insult to the precious resource we are trying to save. Show us you are serious...because this is serious, including water allocations for large farmers.

As Amer Hussain discussed at the virtual public workshop, once a goal is set, it's awfully difficult for even the most severely over-drafted districts to reset those goals. There's too much push-back at that point. This plan needs to be tough on standards out-of-the-gate, and then ease up restrictions as we can see our plan is effective....not the reverse.

Respectfully,

Pam Stoesser
Chico Resident

From: Pam Stoesser
To: Vina Groundwater Sustainability Agency & Rock Creek Reclamation District
Subject: Vina GSP Comment
Date: Tuesday, October 19, 2021 12:35:00 PM

ATTENTION: This message originated from outside **Butte County**. Please exercise judgment before opening attachments, clicking on links, or replying.

Very interesting concept...we already pay certain farmers not to grow. Why not try it to reduce demand on water? This could be one of the PMAs.

As drought worsens, California farmers are being paid not to grow crops

As drought worsens, California farmers are being paid not to grow crops

As Colorado River levels continue to drop, water agencies are working with local growers to leave some fields fa...

As drought worsens, California farmers are being paid not to grow crops

Agricultural fields lie across the Palo Verde Valley in Blythe, Calif.

Agricultural fields lie across the Palo Verde Valley in Blythe, Calif. The Metropolitan Water District of Southern California is working with local growers to leave some fields fallow in exchange for cash payments.(Luis Sinco / Los Angeles Times)

Facebook

Twitter

Show more sharing options

BY IAN JAMES STAFF WRITEROCT. 10, 2021 6 AM PT

BLYTHE, Calif. — Green fields of alfalfa and cotton rolled past as Brad Robinson drove through the desert valley where his family has farmed with water from the Colorado River for three generations. Stopping the truck, he stepped onto a dry, brown field where shriveled remnants of alfalfa crunched under his boots.The water has been temporarily shut off on a portion of Robinson's land. In exchange, he's receiving $909 this year for each acre of farmland left dry and unplanted. The water is instead staying in

Lake Mead, near Las Vegas, to help slow the unrelenting decline of the largest reservoir in the country.

Robinson and other growers in the Palo Verde Irrigation District are taking part in a new $38-million program funded by the federal Bureau of Reclamation, the Metropolitan Water District of Southern California and other water agencies in Arizona and Nevada. The farmers are paid to leave a portion of their lands dry and fallow, and the water saved over the next three years is expected to translate into 3 feet of additional water in Lake Mead, which has declined to its lowest levels since it was filled in the 1930s following the construction of Hoover Dam.

"Honestly, I think I could make more money farming. But for the sake of the Colorado River, I think it's the right thing to do," Robinson said. "The river's going through a bad time right now."

ADVERTISEMENT

The arrangement is one of a growing number of programs that are springing up along the river to find water savings in agricultural areas. As reservoirs continue to decline, managers of water districts are looking to start or scale up similar land-fallowing programs in other areas, paying farmers not to farm temporarily on some fields and using the water to ease shortages.

Although the program in the Palo Verde Valley amounts to a minuscule boost for the shrinking Colorado River, the approach has been praised by water officials and local growers as one way of adapting to a river that yields less after years of severe drought intensified by the warming climate. Robinson and other growers in Palo Verde say they hope their participation may encourage other water agencies to start similar initiatives and enlist more farmers to fallow land to help address the increasingly dire condition of the river.

Even as they take part in the program, some farmers remain suspicious of the powerful Metropolitan Water District and its intentions in their community. The MWD has bought thousands of acres of farmland around the town of Blythe over the years and has recently agreed to buy more land, eliciting fears among farmers that the water agency in Los Angeles could one day seek to take more water and dry up a larger portion of their valley.

"They've got a large portion of this valley. Why do they need more?" asked farmer Charles Van Dyke.

The Colorado River has long been chronically over-allocated, with so much water diverted to supply farms and cities that the river has for decades rarely reached the sea in Mexico. Most of that diverted water — approximately 70% — irrigates farmland, and much of that water flows to thirsty crops such as hay and cotton, which are exported in large quantities.

Brad Robinson walks on a field

Brad Robinson walks on a field that he has left fallow in Blythe as part of a program between area growers and the Metropolitan Water District.(Luis Sinco / Los Angeles Times)

ADVERTISEMENT

SINCE 2000, THE RIVER'S FLOW HAS SHRUNK DURING ONE OF THE DRIEST 22-YEAR PERIODS IN CENTURIES. SCIENTISTS HAVE DESCRIBED THE LAST TWO DECADES AS A MEGADROUGHT, AND ONE THAT'S BEING WORSENED BY THE HEATING OF THE PLANET WITH THE BURNING OF FOSSIL FUELS. RESEARCHERS HAVE WARNED THAT LONG-TERM "ARIDIFICATION" OF THE COLORADO RIVER BASIN MEANS THE REGION MUST ADAPT TO A RIVER THAT PROVIDES LESS WATER.

Supercharged by climate change, 'megadrought' points to drier future in ...

Global warming turned what would have been a moderate 19-year drought into one of most severe 'megadroughts' of ...

The water level in Lake Mead has declined 27 feet since January 2020. The reservoir now stands at just 34% of full capacity, placing it at a shortage level that will trigger mandatory water cutbacks next year for Arizona, Nevada and Mexico.

A boater gets an up-close view of previously submerged surfaces at Lake Mead.

A boater gets a view of previously submerged surfaces at Lake Mead. The lake's water level has dropped 27 feet since January 2020.(Allen J. Schaben / Los Angeles Times)

The lake's water level is projected to continue falling. The latest estimates from the federal government show the water in Lake Mead could drop an additional 30 feet by August 2023, a level that would require water cuts in California.

Since 2005, Robinson and other farmers in the Palo Verde Valley have left portions of their lands dry and unplanted under a 35-year deal with the Metropolitan Water District, which has paid them more than $180 million for water that was sent flowing through the Colorado River Aqueduct to cities in Southern California. Under the new deal, much of the water will instead be left in Lake Mead to try to reduce risks of the reservoir falling to critically low levels.

For managers of the MWD, the program offers flexibility, enabling them to pay for more land-fallowing in years when they need more water.

Each year, the MWD calls for a certain percentage of the valley's farmlands, up to a maximum of 28%, to be left fallow. Starting this year, the water from a portion of those lands is staying in Lake Mead.

Old farm equipment stands at the edge of a field in Blythe.

Old farm equipment stands at the edge of a field in Blythe. Since 2005, farmers in the Palo Verde Valley have left portions of their lands dry and unplanted under a 35-year deal with the Metropolitan Water District.(Luis Sinco / Los Angeles Times)

Similar programs have taken shape in several areas along the Colorado River.

Last year, the MWD began paying farmers in the smaller Bard Water District not to plant water-intensive crops such as alfalfa in the spring and summer, while they continue growing higher-value winter crops such as lettuce, broccoli and cauliflower.

ADVERTISEMENT

And the MWD's board is considering paying for seasonal fallowing under another proposed agreement with the Quechan Indian Tribe, whose reservation borders Arizona, California and Mexico, and includes farms that produce hay and vegetable crops.

Other initiatives are underway across the river in Arizona. Under agreements aimed at slowing the decline of Lake Mead, leaders of the Colorado River Indian Tribes have been leaving some farmlands dry, and landowners in the Mohave Valley Irrigation and Drainage District have also been forgoing some water in exchange for payments.

Colorado River water irrigates a farm field in Blythe.

Colorado River water irrigates a farm field in Blythe.(Luis Sinco / Los Angeles Times)

To support more fallowing of land in the Palo Verde Valley, the federal government is contributing half the funding — $19 million — while the rest is coming from the Central Arizona Project, the Southern Nevada Water Authority and the MWD.

“This is just the beginning,” MWD General Manager Adel Hagekhalil said when the deal was announced in August. “We’re working to develop other innovative ideas to keep as much water as possible in Lake Mead.”

The program demonstrates how urban and agricultural water districts can work together to deal with shortages, said Bill Hasencamp, MWD’s manager of Colorado River resources.

“A lot of other states and other regions are looking to those programs as examples of what can be done elsewhere,” Hasencamp said. “We want to set a good example of how farmland can be productive in the era of shrinking water supplies.”

Reducing reliance on the Colorado River, he said, will require bigger water-saving efforts in cities and farming communities alike. The MWD supplies water to cities and water districts across Southern California that serve about 19 million people. The agency’s figures show that between 2011 and 2020, its water use declined about 7% — in part thanks to the lasting effects of conservation campaigns during the 2012-2016 drought.

Because the latest estimates show Lake Mead is likely to continue declining, Hasencamp said, “we’re going to need to do more.”

The Colorado River churns through the Palo Verde Diversion Dam near Blythe. Some river water is channeled from the dam to local farm fields.(Luis Sinco / Los Angeles Times)

ADVERTISEMENT

Robinson, who is a board member of the Palo Verde Irrigation District, runs a family business that his grandfather founded in 1960. He now farms on about 3,200 acres around Blythe, including land he owns and leases. His fields produce cotton that is exported, alfalfa that is trucked to dairies in California, Bermuda grass that is baled to feed horses, and honeydews and other melons that are sold in supermarkets.

Farmer Brad Robinson looks over his cotton crop in the fields near Blythe.

Farmer Brad Robinson looks over his cotton crop in the fields near Blythe.(Luis Sinco / Los Angeles Times)

“In a perfect world, a farmer wants to farm,” Robinson said. “But the reality of the situation is that we have a certain amount of population and people, and don’t have unlimited water. So ... the two sides are going to have to work together.”

The fields that are left dry are rotated every one to five years. And for the farmers, the cash payments provide a stable chunk of income that isn’t subject to price swings.

“We’re not getting rich off this. But it helps enough on the bad years,” when crop prices are low, Robinson said. “I’ve never laid anybody off because of the fallow program, and I never intend to do so.”

The program is far from a cure-all, and will need to be combined with other steps, said Chuck Cullom, manager of Colorado River programs at the Central Arizona Project. For example, water agencies in Arizona and Nevada have offered to invest in a proposed water recycling project in Southern California. And Cullom’s agency has been investing in testing water-saving irrigation technologies on Arizona farms.

“We all share the river. We all share risk,” Cullom said. “As the system becomes more vulnerable, we need all of the sectors to work together.”

The sorts of deals that temporarily leave farmland dry help by adding flexibility to the water system, but they also raise questions as the West grapples with the effects of climate change, including hotter, more intense droughts, said Newsha Ajami, director of urban water policy at Stanford University.

“If you’re experiencing drought after drought, and the droughts are getting hotter and drier, how long can you fallow land?” Ajami said. “I think it’s a Band-Aid. It’s a temporary solution to a more long-term problem we are having.”

Ned Hyduke, left, and Bart Fisher

Ned Hyduke, left, general manager of the Palo Verde Irrigation District, looks at a map of fallow farm fields around Blythe with Bart Fisher, the vice president of the irrigation district board.(Luis Sinco / Los Angeles Times)

ADVERTISEMENT

Some Arizona farmers are already facing cutbacks in water deliveries from the river because they hold the lowest-priority water rights.

The farmers in Blythe, in contrast, hold some of the oldest water rights on the river, dating to 1877, when investor Thomas Blythe filed a claim to use water from the river. Based on that history, the growers of the Palo Verde Valley have a first-priority position among California water districts and would be among the last in line for cuts.

Farmer Bart Fisher shares a laugh with a worker while looking over seeding operations at one of his fields in Blythe.(Luis Sinco / Los Angeles Times)

“We should be the last ones to worry about water,” said Bart Fisher, a farmer who is vice president of the irrigation district board. “But if there’s no water in the river, it really doesn’t matter.”

Fisher, who runs a farming business that his grandfather founded in 1917, said even with such solid water rights, he and other growers have reason to be concerned about the river’s worsening crisis.

“It looks grim, actually. I was born in Blythe and I’ve been here all my life, and we’ve never been so threatened,” Fisher said, looking across a dry field where bits of garlic, remnants of the last harvest, were scattered in the soil.

He also grows broccoli, melons, wheat and hay, all of which rely on Colorado River water flowing through the canals.

“We could conceivably come to a place on the Colorado River where there is not water for anybody’s needs,” Fisher said. “We’re going to diminish reservoir levels to levels that we haven’t seen before, and the question then is, how do we respond?”

He said he hopes to see more deals emerge. If four or five other agricultural water districts pitch in, he said, their contributions could quickly add up to 10 feet or 15 feet of additional water in Lake Mead, which would make a big difference.

ADVERTISEMENT

A formerly sunken bench rests on the shore near the Hemenway Harbor launch ramp amid signs of the drought's effect on Lake Mead in Nevada.(Allen J. Schaben / Los Angeles Times)

But even as Fisher and other farmers continue to participate in the MWD program and receive payments, they've also voiced concerns.

Under the deal, the MWD provided $6 million to establish a locally run community improvement fund in Blythe that has provided grants and business loans in an effort to boost the local economy. Fisher said in retrospect, that one-time payment hasn't been enough.

Fisher drove down the main avenue, Hobsonway, where he passed shuttered businesses, including a motel, gas station, restaurant and several stores, all with boarded-up windows.

"I think we would do it a little differently today," Fisher said. "We would ask for more community support" from the MWD.

Irrigation pipes and sprinklers sit on a trailer at the side of a road in Blythe.

Irrigation pipes and sprinklers sit on a trailer at the side of a road in Blythe.(Luis Sinco / Los Angeles Times)

To the farmers' dismay, the MWD has bought large pieces of farmland in the Palo Verde Valley. The largest purchase, 12,000 acres in 2015, made the MWD the largest landowner in the irrigation district. The MWD says it now owns about 29,000 acres in the area.

The agency leases the land that isn't left dry to growers, offering reduced rent to farmers who plant crops that consume less water.

The problem with the MWD owning so much land, Fisher said, is that it ends up paying less to landowners in the valley. He said this deprives the area of approximately $6 million to $8 million annually that would otherwise be going to local businesses and fueling the economy.

"When [the MWD] fallows their own land, they keep the money. So it doesn't make its way into our community. And it's a lot for a little community like this," Fisher said.

Worried by the MWD's land dealings, leaders of the Palo Verde Irrigation District sued the agency in 2017, but then dropped the lawsuit in 2018.

ADVERTISEMENT

Recently, farmers objected when they learned of an MWD proposal to buy an additional 702-acre property from Cox Family Farms. The MWD board endorsed the purchase last month.

"We've told them that we think it's a very bad idea. It's bad for the community, and frankly, it's a predatory practice on their part," Fisher said. "It's just disappointing. It's sort of counter to the spirit by which we originally engaged with them to negotiate the fallow program."

At the MWD, however, officials have discussed the potential for additional purchases of farmland along the river in areas with high-priority senior rights as a way to reduce water use in agriculture and free up water for urban Southern California in dry times.

"It would allow us to play a long game with climate change by holding and leasing land for decades," Brad Coffey, manager of water resources management, said during a September committee meeting.

Board members discussed whether to actively pursue future land purchases.

"I believe that if someone wants to sell us that land, that we should always answer the door," board member Larry Dick said. "We'll do it responsibly. We're not going to take that land and take it out of production forever."

Russell Lefevre, another board member, asked how the land purchases are viewed by the farmers.

"They did express concern about us buying land," said Hasencamp, MWD's manager of Colorado River resources. "We are working with them to try to alleviate some of those concerns."

Lefevre said he would support seeking out other land deals. He said he wonders "if we can move this methodology to other areas," such as the Coachella and Imperial valleys.

Thomas, Autum

From: Annette Faurote <afaurote@gmail.com>
Sent: Tuesday, October 19, 2021 3:16 PM
To: vinagsa@gmail.com
Subject: Vina GSP Comments

ATTENTION: This message originated from outside **Butte County**. Please exercise judgment before opening attachments, clicking on links, or replying.

Thank you for considering our comments. Please make these comments part of the permanent public record.

I am concerned that the Vina GSA proposal doesn't go far enough in addressing sustainability. In contrast to the Vina GSA proposal, serious sustainability begins now, today. Not after we have pumped down our water table to dangerous depths. We need to seriously consider the direction we are heading with climate change and longer droughts. (Currently, next year is predicted to be a La Nina year refer to: https://www.climate.gov/news-features/blogs/enso/july-2021-enso-update-la-ni%C3%B1a-watch) which means next year will also likely be a drought). The current VINA proposal does not fully address the climate change reality and the prolonged droughts that accompany climate change.

The figures **on page 107** discussing water surface elevation shows that our water table is trending downward. It discusses the MO and MT. As defined here **the "operation range" is too deep.** With this proposed "operational range" there is the very real possibility that we could lose deep rooted trees, part of the Chico Urban forest. And also, and very seriously, we would lose too many domestic wells. **The operational range is much too deep and should be based on early levels (perhaps 2000 or 2005, at least 2010) before we pumped our aquifer to the current low levels.**

The current proposals heavily favour agriculture, which we all know is important, but equally important are our human community, our domestic wells and urban forest.

Has there been an Environmental Impact Report (EIR)? It would seem by substantially lowering the aquifer as proposed in VINA GSA we are affecting the local ecosystems as well as disrupting homeowners that use wells.

As said in comments by The Nature Conservancy,

> "Potential Effects on Environmental Beneficial Users. SGMA requires that potential effects on GDEs and environmental surface water users be described when defining undesirable results. " Because effects on plants and animals are difficult and sometimes impossible to reverse, we recommend erring on the side of caution to preserve sufficient groundwater conditions to sustain GDEs and ISWs."
>
> 215.5 Says "Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of surface water" must be seriously considered. I don't feel this has been adequately addressed. The report says in line 1740: "Relatively shallow groundwater in some areas of the subbasin support Groundwater Dependent Ecosystems and stream flows".
>
> **Thus, an EIR must be completed to understand the changes we are considering.**

Thank you for addressing all of the above issues.

Sincerely,

Annette Faurote
Chico, Ca 95928

Sent from Mail for Windows

From: David A Eaton
To: vinagsa@gmail.com
Cc: David A Eaton
Subject: comments | draft of Vina Basin Sustainable Groundwater Plan (SGP)
Date: Tuesday, October 19, 2021 11:02:56 PM

ATTENTION: This message originated from outside **Butte County**. Please exercise judgment before opening attachments, clicking on links, or replying.

Greetings colleagues. Below are my comments on the draft **Vina Basin Sustainable Groundwater Plan** (SGP).
Thank you for the chance to contribute to these deliberations.
Sincerely, David Eaton (1080 East Lassen Avenue, Chico CA 95928)

COMMENTS

A. The "Measurable Objective" of 100 feet above mean sea level for the groundwater level is too LOW. The level of the past twenty years is already diminished from historical 'normals'. The downward trend of the aquifer is evident in the materials provided.
We should not be depleting the aquifer *more* under the Draft SGP. Rather **let us restore our aquifer to** something resembling its historic average: let us say something like **140 feet above sea level**.

B. The hydrological consultants cited estimate **current pumping from the Vina sub-basin is 244k acre-feet per year**, with all but 20k acre-feet for agricultural use. They estimate the **current overdraft as about 10k acre-feet per year**.
They then propose a **sustainable yield estimate at 233k acre-feet per year**. BUT this is **dangerously high**. This estimate is based on a recent period in which the aquifer has been in continued decline, and especially if recent and projected climatic trends continue, pumping at this level will bring **further reduction of the groundwater level**.
Please, **let us adopt a more conservative estimate for this sustained yield**! Using a modest ballpark figure of eighteen percent reduction in overall water use going forward, for example, as recently proposed by Governor Newsom, this could be about **200,000 acre-feet per year**.
Our groundwater is an irreplaceable, finite, and precious resource in our part of California. **Let us protect it effectively for generations to come.**
Thank you for your time and consideration! I look forward to learning what steps the members of your commission take to protect our shared resources, and in the meantime I thank you for your time and consideration.
Sincerely, David Eaton, PhD, MPH (Department of Anthropology, CSU Chico, email daeaton@csuchico.edu)

Thomas, Autum

From: Debra Lucero <debra@debralucero.us>
Sent: Tuesday, October 19, 2021 5:37 PM
To: VinaGSA@gmail.com
Subject: Comments on the Vina GSA Plan

ATTENTION: This message originated from outside **Butte County**. Please exercise judgment before opening attachments, clicking on links, or replying.

1. I remain concerned about the low levels of the MO's and the MT's in this plan.
This is not an aspirational plan and perhaps one that will further be a detriment to our shared aquifer. It is quite concerning that our beloved valley oaks and other heritage trees that are non-irrigated and are icons of Butte County are not being considered. There will be domestic well failures, chronic lowering of groundwater levels, die-off of groundwater dependent ecosystems.

2. I remain concerned about the 10,000AF water budget.
I would like to understand how this number was arrived at; I was told it was set via DWR's climate change model that actually predicts more rainfall in the upcoming years. I would like to see a drier model utilized as well as a wetter model. We should have at least two options but irregardless - a complete understanding as to how this water budget was set is needed.

3. **I remain concerned about the undue influence of the Rock Creek Reclamation District on the Vina GSA Board when joint meetings are held.**
The balance of power is clearly out of whack - leaning heavily toward industrial agriculturalists leaving 110,000 residents in the City of Chico with little to no voice and small farmers and domestic well owners with even less voice.

4. I remain concerned there are no "triggering" conditions to initiate conservation or demand reduction PMA's.
These need to be spelled out.

5. I remain concerned that the current drought has had no forbearance on this process.
We are told by technical staff and others that this need not be a concern since this is a long-range planning process yet it has been mentioned that we've already hit some of our lowest MT's. Is this true?

6. I remain concerned about the lack of current well data and the timeliness of the data.
There needs to be better coordination between environmental health, BC Water & Resource Conservation Department and DWR.

7. I remain concerned about the lack of current and fluid data regarding output of local water via groundwater transfers, riparian rights, SGMA credits, etc.

8. I remain concerned about the two consecutive dry years in a row to trigger MT's.
This seems irresponsible - particularly in a drought like we're in now. How many domestic wells have to go dry? Is this a loophole? Who is responsible for dry domestic well users or farmers? Who pays for this in the end if the Vina GSA sets MO's and MT's that are so low we begin to see negative effects?

9. I remain concerned about the one well for groundwater quality management in the North Vina subbasin.
Is this enough?

10. I remain concerned there is no mention of the groundwater markets being discussed up and down the state.
There is no analysis of this in the Vina GSP and it is critical to our area. It will be a reality to us in the north state to supply those in the San Joaquin Valley and Southern California with water. How will it affect pumping in our subbasins? How will water rights holders in Butte County participate? What are the possibilities? How will this affect our outflows and our modeling?

11. I remain concerned about the Vina SHAC process.
There have been at least two occasions where significant material was presented to the Vina GSA Board of Directors without review by the SHAC. Several members have expressed discontent with this process.

Debra Lucero
Butte County Supervisor District 2
dlucero@buttecounty.net
www.debralucero.us
530-552-2030

Thomas, Autum

From: gracefultherapy@aol.com
Sent: Tuesday, October 19, 2021 6:44 PM
To: VinaGSA@gmail.com
Subject: Vina GSP Comments

ATTENTION: This message originated from outside **Butte County**. Please exercise judgment before opening attachments, clicking on links, or replying.

To whom this is directed:

1. I remain concerned about the low levels of the MO's and the MT's in this plan.

This is not an aspirational plan and perhaps one that will further be a detriment to our shared aquifer. It is quite concerning that our beloved valley oaks and other heritage trees that are non-irrigated and are icons of Butte County are not being considered. There will be domestic well failures, chronic lowering of groundwater levels, die-off of groundwater dependent ecosystems.

2. I remain concerned about the 10,000AF water budget.
I would like to understand how this number was arrived at; I was told it was set via DWR's climate change model that actually predicts more rainfall in the upcoming years. I would like to see a drier model utilized as well as a wetter model. We should have at least two options but irregardless - a complete understanding as to how this water budget was set is needed.

3. I remain concerned about the undue influence of the Rock Creek Reclamation District on the Vina GSA Board when joint meetings are held.
The balance of power is clearly out of whack - leaning heavily toward industrial agriculturalists leaving 110,000 residents in the City of Chico with little to no voice and small farmers and domestic well owners with even less voice.

4. I remain concerned there are no "triggering" conditions to initiate conservation or demand reduction PMA's. These need to be spelled out.

5. I remain concerned that the current drought has had no forbearance on this process.
We are told by technical staff and others that this need not be a concern since this is a long-range planning process yet it has been mentioned that we've already hit some of our lowest MT's. Is this true?

6. I remain concerned about the lack of current well data and the timeliness of the data.
There needs to be better coordination between environmental health, BC Water & Resource Conservation Department and DWR.

7. I remain concerned about the lack of current and fluid data regarding output of local water via groundwater transfers, riparian rights, SGMA credits, etc.

8. I remain concerned about the two consecutive dry years in a row to trigger MT's.
This seems irresponsible - particularly in a drought like we're in now. How many domestic wells have to go dry? Is this a loophole? Who is responsible for dry domestic well users or farmers? Who pays for this in the end if the Vina GSA sets MO's and MT's that are so low we begin to see negative effects?

9. I remain concerned about the one well for groundwater quality management in the North Vina subbasin.
Is this enough?

10. I remain concerned there is no mention of the groundwater markets being discussed up and down the state.
There is no analysis of this in the Vina GSP and it is critical to our area. It will be a reality to us in the north state to supply those in the San Joaquin Valley and Southern California with water. How will it affect pumping in our

subbasins? How will water rights holders in Butte County participate? What are the possibilities? How will this affect our outflows and our modeling?

11. I remain concerned about the Vina SHAC process.
There have been at least two occasions where significant material was presented to the Vina GSA Board of Directors without review by the SHAC. Several members have expressed discontent with this process.

Thomas, Autum

From: Giovanna Bartels <vannanancy@yahoo.com>
Sent: Tuesday, October 19, 2021 5:43 PM
To: VinaGSA@gmail.com
Subject: Vina GSP Comments

ATTENTION: This message originated from outside **Butte County**. Please exercise judgment before opening attachments, clicking on links, or replying.

As a participant in Vine GSA's. Groundwater Sustainability Plans (Plan) October 13, 2021 Zoom meeting I offer the follow:

Protecting residential wells from running dry should be a top concern of the GSA, yet the Plan actually sets acceptable percentages for their failures. This is unacceptable. Thereby, instituting across the board water conservation actions and raising the Plan's "minimum groundwater level thresholds" to protect residents and the environment must be facilitated. With water conservation plans and methods celebrating decades of use and success it is shocking and absurd that the GSA representatives seemed opposed in supporting them and were solely focused on the Plan.

I was disturbed by the GSA representatives inability to answer a question as to whether groundwater rights holders would have equal access to injected surface water into the aquifer. Clearly, the public is not properly informed on this important issue.

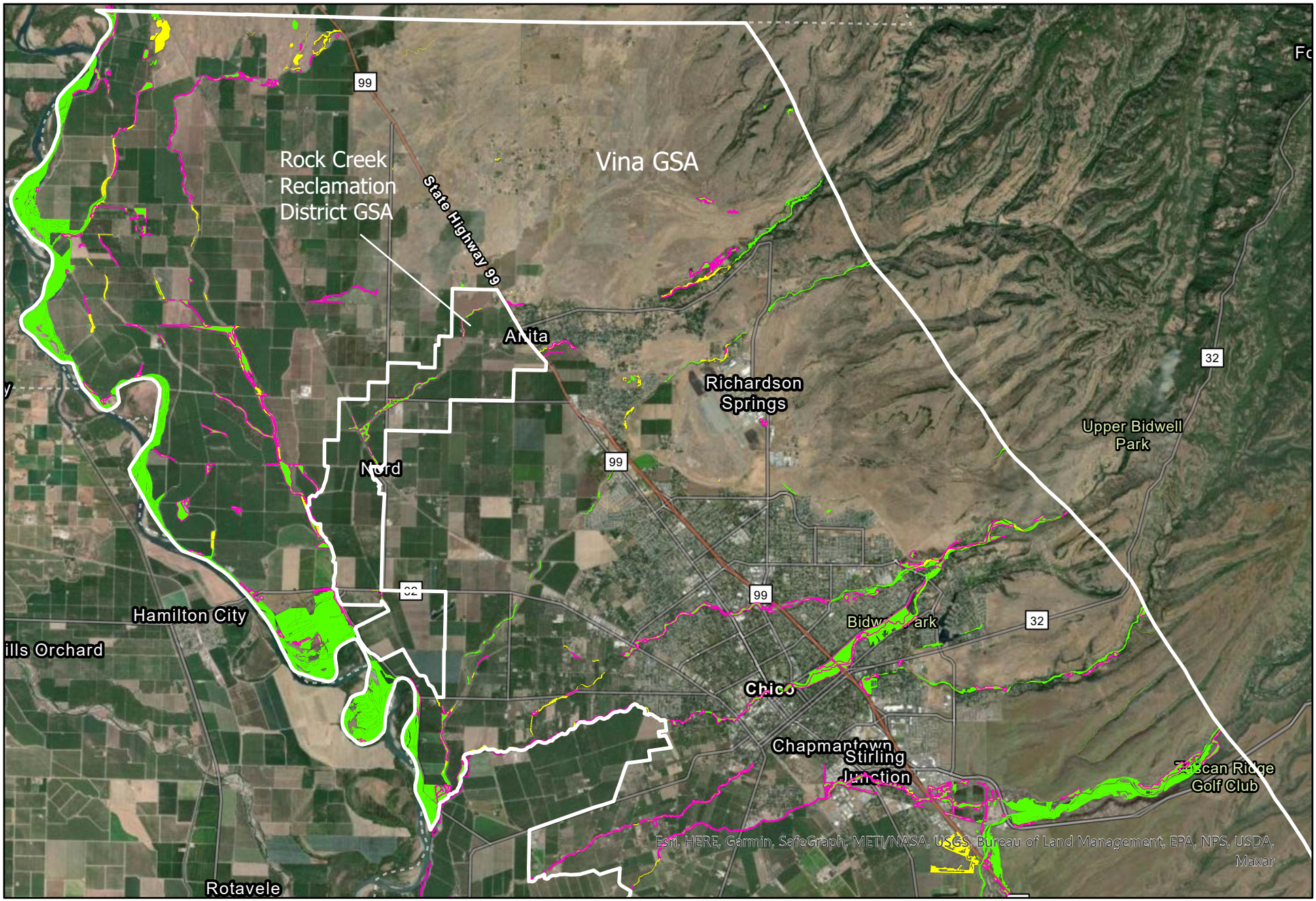
Finally, the public was left confused as to who could be in charge of handling future Plans and updates. It was said several times that residents would have a voice in future plans during review periods,however this would not be the case if a private water district should take over this duty and Institute a 1-vote per acre system. Knowing who and how a public trust resource is managed is essential to the public's rights and it should be mandatory that this be spelled out to current water right's holders.

Respectfully,
Nancy Gillard-Bartels
10754 Lone Pine Ave
Chico, CA 95928
530-966-5234

Sent from Yahoo Mail on Android

APPENDIX 2-A
Groundwater Dependent Ecosystems Maps

Figure 3 - Potential Groundwater Dependent Ecosystems in the Vina Subbasin



N
W E
S

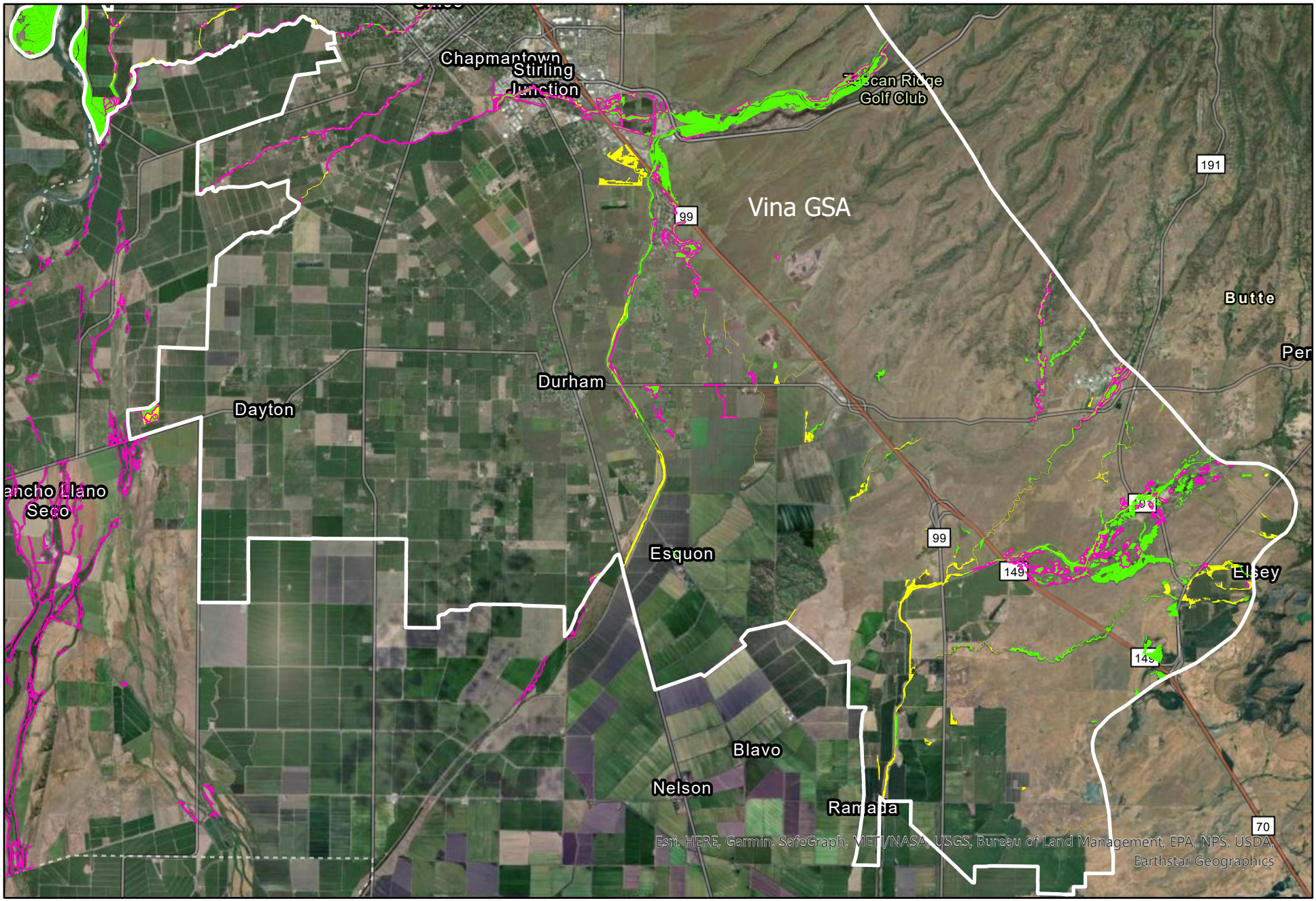
0 2 4 8 Miles

Likely a GDE

Not Likely a GDE

iGDEs Dominated by Valley Oak

Figure 4 - Potential Groundwater Dependent Ecosystems in the Vina Subbasin



N
W E
S

0 2 4 8 Miles

Likely a GDE

Not Likely a GDE

iGDEs Dominated by Valley Oak

APPENDIX 2-B
Historical Annual Water Budget Estimates

Appendix 2-B – Historical Annual Water Budget Estimates

This appendix contains detailed annual water budget results for the land and surface water system (**Table 2B-1**) and for the groundwater system (**Table 2B-2**).

Table 2B-1. Historical Land and Surface Water System Water Budget, 2000-2018.

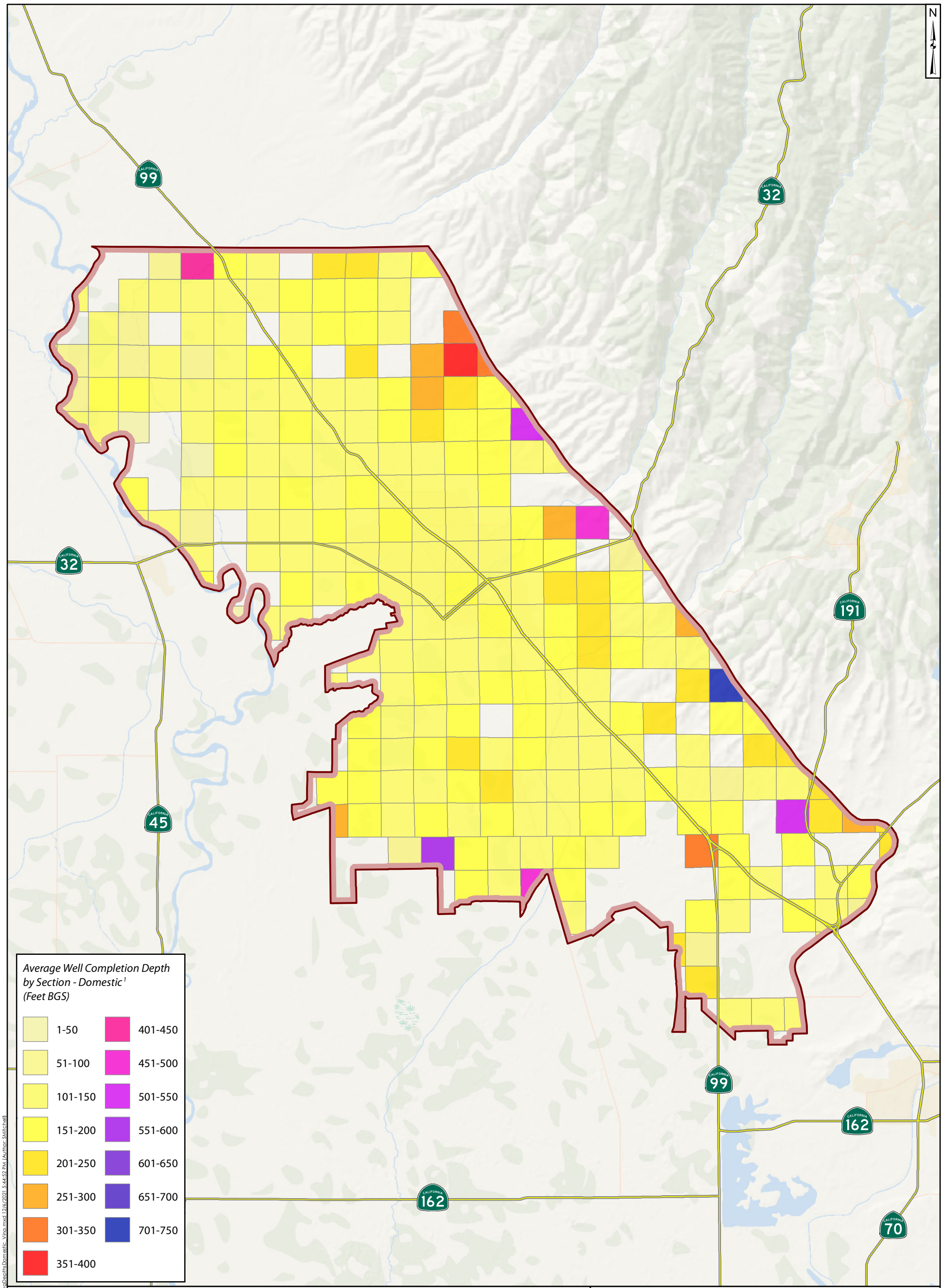
Component	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Inflows (AFY)																			
Surface Water Inflows	593,800	321,200	464,700	845,000	571,000	545,700	1,185,700	324,000	309,300	434,300	532,900	770,800	390,700	438,700	260,400	304,400	550,000	1,268,300	429,400
Outside Diversions	*1,400*	*800*	*300*	*400*	*400*	*400*	*400*	*500*	*500*	*500*	*400*	*500*	*500*	*500*	*300*	*300*	*200*	*0*	*300*
Butte Creek	*343,400*	*183,600*	*253,600*	*426,800*	*320,100*	*302,900*	*652,500*	*184,500*	*161,600*	*226,000*	*289,300*	*439,300*	*208,400*	*238,300*	*133,200*	*145,900*	*285,500*	*629,900*	*238,700*
Big Chico Creek	*103,800*	*57,400*	*87,100*	*214,100*	*108,400*	*107,500*	*261,100*	*48,700*	*60,500*	*85,700*	*102,700*	*159,300*	*67,100*	*65,700*	*32,700*	*37,800*	*91,800*	*351,100*	*69,400*
Pine Creek	*13,800*	*7,500*	*11,800*	*20,100*	*12,000*	*12,800*	*23,600*	*7,700*	*7,300*	*12,100*	*12,600*	*17,700*	*10,500*	*12,700*	*8,100*	*9,300*	*16,500*	*27,200*	*11,200*
Dry Creek	*14,200*	*7,500*	*13,300*	*18,100*	*13,100*	*14,900*	*23,900*	*10,100*	*8,300*	*11,600*	*13,800*	*15,600*	*12,500*	*10,600*	*10,300*	*10,900*	*15,400*	*26,800*	*14,000*
Rock Creek	*18,000*	*14,100*	*16,300*	*20,400*	*16,200*	*16,900*	*23,100*	*14,100*	*13,200*	*15,500*	*15,800*	*19,400*	*14,800*	*15,600*	*12,500*	*12,600*	*17,000*	*24,000*	*15,300*
Little Chico Creek	*17,600*	*12,000*	*15,800*	*22,200*	*17,600*	*18,200*	*28,500*	*13,100*	*12,300*	*15,700*	*18,000*	*23,500*	*15,000*	*15,500*	*12,100*	*13,200*	*19,900*	*31,500*	*16,300*
Mud Creek	*12,800*	*8,700*	*12,000*	*17,600*	*13,600*	*14,800*	*22,900*	*10,400*	*10,100*	*12,900*	*14,700*	*19,000*	*12,400*	*13,400*	*10,500*	*11,400*	*16,900*	*25,700*	*13,700*
Singer Creek	*1,600*	*800*	*1,100*	*2,300*	*1,500*	*1,300*	*3,000*	*900*	*800*	*1,200*	*1,300*	*1,900*	*1,100*	*1,500*	*1,000*	*1,200*	*1,900*	*3,300*	*1,200*
Little Dry Creek	*2,700*	*1,800*	*2,700*	*3,300*	*2,800*	*2,900*	*4,300*	*2,100*	*2,300*	*2,700*	*3,200*	*4,300*	*2,900*	*3,100*	*2,700*	*3,000*	*4,100*	*6,400*	*3,600*
Precipitation Runoff from Upslope Lands	*62,200*	*24,800*	*49,000*	*96,100*	*62,100*	*50,400*	*137,700*	*29,000*	*30,400*	*47,800*	*57,700*	*66,500*	*43,700*	*58,300*	*35,700*	*57,700*	*79,700*	*137,800*	*43,400*
Applied Water Return Flows from Upslope Lands	*2,400*	*2,100*	*1,700*	*3,500*	*3,300*	*2,800*	*4,600*	*2,900*	*1,900*	*2,700*	*3,200*	*3,800*	*1,800*	*3,400*	*1,300*	*1,100*	*1,000*	*4,600*	*2,400*
Precipitation	418,400	325,600	382,800	506,200	415,600	521,800	652,400	275,500	301,000	342,300	470,800	562,700	339,900	338,900	250,000	326,800	433,300	647,900	295,500
Groundwater Pumping	246,600	245,200	248,900	223,500	267,200	198,400	214,400	288,400	297,100	263,000	232,700	196,500	261,000	287,600	293,000	260,900	205,100	185,000	211,400
Agricultural	*210,500*	*209,300*	*211,800*	*186,700*	*227,100*	*161,100*	*175,700*	*248,300*	*257,300*	*224,500*	*196,800*	*162,400*	*224,400*	*251,600*	*257,600*	*235,300*	*182,800*	*161,800*	*187,400*
Urban and Industrial	*27,700*	*28,000*	*29,000*	*28,300*	*31,700*	*29,000*	*30,000*	*30,700*	*30,500*	*29,300*	*26,700*	*25,700*	*26,900*	*27,000*	*24,800*	*18,800*	*18,700*	*19,600*	*20,100*
Managed Wetlands	*8,400*	*7,900*	*8,000*	*8,500*	*8,400*	*8,300*	*8,700*	*9,300*	*9,300*	*9,100*	*9,300*	*8,500*	*9,700*	*9,100*	*10,600*	*6,800*	*3,600*	*3,600*	*3,900*
Stream Gains from Groundwater	8,600	5,200	4,900	5,000	5,900	6,300	10,400	3,500	2,600	1,800	2,700	4,100	2,400	1,500	500	800	1,200	2,500	700
Total Inflow	***1,267,400***	***897,200***	***1,101,300***	***1,579,700***	***1,259,800***	***1,272,100***	***2,062,900***	***891,400***	***910,000***	***1,041,300***	***1,239,100***	***1,534,100***	***994,000***	***1,066,700***	***804,000***	***892,800***	***1,189,600***	***2,103,800***	***937,000***
Outflows (AFY)																			
Evapotranspiration	357,500	354,500	342,800	354,700	345,300	364,000	353,200	401,200	371,500	374,800	361,300	370,700	389,500	371,400	380,700	341,600	352,100	352,500	356,400
Agricultural	*245,200*	*244,400*	*239,500*	*238,500*	*251,400*	*232,200*	*237,800*	*279,600*	*272,800*	*264,000*	*247,700*	*244,300*	*272,800*	*280,300*	*280,700*	*254,500*	*245,600*	*239,900*	*245,200*
Urban and Industrial	*21,400*	*21,200*	*21,200*	*21,800*	*21,200*	*23,200*	*22,200*	*24,900*	*22,300*	*22,900*	*22,600*	*23,300*	*22,200*	*20,700*	*21,300*	*17,600*	*21,100*	*21,700*	*21,600*
Managed Wetlands	*6,300*	*5,800*	*6,000*	*6,800*	*6,200*	*6,900*	*6,700*	*7,400*	*6,400*	*6,900*	*7,100*	*7,300*	*7,100*	*6,600*	*7,600*	*4,200*	*2,800*	*3,000*	*3,100*
Native Vegetation	*84,200*	*82,700*	*75,900*	*87,300*	*66,100*	*101,100*	*85,900*	*89,000*	*69,700*	*80,700*	*83,500*	*95,300*	*86,900*	*63,500*	*70,900*	*65,100*	*82,000*	*87,400*	*86,100*
Canal Evaporation	*400*	*400*	*400*	*500*	*400*	*500*	*500*	*400*	*300*	*400*	*400*	*500*	*400*	*400*	*300*	*100*	*500*	*500*	*500*
Deep Percolation	218,600	158,300	203,500	229,900	235,800	248,300	315,100	100,500	156,100	141,900	221,300	265,600	130,900	155,000	104,700	152,100	205,800	321,000	96,500
Precipitation	*133,600*	*88,300*	*123,700*	*154,000*	*144,600*	*173,900*	*226,700*	*46,100*	*80,900*	*76,200*	*143,900*	*187,800*	*70,100*	*81,200*	*46,300*	*83,000*	*133,900*	*234,800*	*55,900*
Applied Surface Water	*5,400*	*4,500*	*4,500*	*5,500*	*5,400*	*6,300*	*7,000*	*3,000*	*3,600*	*4,100*	*5,600*	*7,400*	*4,000*	*3,800*	*2,400*	*1,800*	*5,800*	*7,700*	*4,100*
Applied Groundwater	*79,600*	*65,500*	*75,300*	*70,400*	*85,800*	*68,100*	*81,400*	*51,400*	*71,600*	*61,600*	*71,900*	*70,400*	*56,800*	*70,000*	*56,000*	*67,300*	*66,100*	*78,400*	*36,500*
Seepage	23,800	19,000	22,500	29,000	24,000	26,000	33,400	19,300	19,100	22,000	25,600	31,900	21,200	22,000	16,500	16,500	24,200	37,800	23,100
Streams	*20,500*	*15,900*	*19,600*	*25,500*	*20,900*	*22,200*	*29,600*	*16,400*	*16,300*	*18,700*	*22,500*	*28,000*	*17,900*	*19,100*	*14,300*	*15,000*	*20,700*	*33,800*	*19,300*
Canals and Drains	*3,400*	*3,100*	*2,900*	*3,500*	*3,100*	*3,700*	*3,800*	*2,900*	*2,800*	*3,300*	*3,100*	*4,000*	*3,300*	*2,900*	*2,200*	*1,500*	*3,600*	*4,000*	*3,800*
Surface Water Outflows	668,400	367,100	536,500	961,000	656,700	631,100	1,359,800	366,400	370,700	499,500	626,700	865,000	457,200	508,700	304,900	387,400	611,700	1,391,600	462,600
Precipitation Runoff	*52,600*	*32,800*	*51,700*	*84,500*	*59,600*	*65,300*	*119,700*	*29,800*	*40,200*	*46,200*	*67,000*	*81,400*	*46,500*	*47,900*	*27,700*	*51,400*	*55,600*	*103,100*	*37,500*
Applied Surface Water Return Flows	*2,400*	*1,900*	*1,700*	*2,700*	*1,900*	*3,200*	*3,300*	*1,600*	*1,600*	*1,900*	*2,800*	*3,600*	*2,200*	*1,700*	*1,100*	*100*	*1,800*	*3,700*	*3,000*
Applied Groundwater Return Flows	*21,300*	*21,300*	*21,200*	*19,800*	*22,300*	*20,700*	*21,300*	*24,400*	*24,600*	*23,400*	*23,400*	*19,800*	*23,100*	*22,600*	*23,000*	*12,600*	*12,500*	*12,600*	*13,100*
Streams	*567,100*	*279,800*	*432,200*	*817,800*	*539,600*	*513,200*	*1,185,800*	*284,700*	*280,800*	*401,300*	*498,600*	*728,800*	*358,200*	*421,400*	*240,600*	*299,300*	*512,700*	*1,243,100*	*379,900*
Butte Creek Diversions to Butte Subbasin	*25,000*	*31,300*	*29,600*	*36,300*	*33,300*	*28,800*	*29,700*	*25,900*	*23,600*	*26,700*	*34,900*	*31,300*	*27,200*	*15,100*	*12,600*	*23,900*	*29,100*	*29,100*	*29,100*
Total Outflow	***1,268,400***	***898,700***	***1,105,200***	***1,574,700***	***1,261,800***	***1,269,300***	***2,061,400***	***887,400***	***917,400***	***1,038,100***	***1,235,000***	***1,533,300***	***998,800***	***1,057,100***	***806,800***	***897,600***	***1,193,800***	***2,102,800***	***938,600***
Change in Storage (Inflow - Outflow)	***-1,000***	***-1,500***	***-3,900***	***5,000***	***-2,000***	***2,800***	***1,500***	***4,000***	***-7,400***	***3,200***	***4,100***	***800***	***-4,800***	***9,600***	***-2,800***	***-4,800***	***-4,200***	***1,000***	***-1,600***

Table 2B-2. Historical Groundwater System Water Budget, 2000-2018.

Component	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Inflows (AFY)																			
Subsurface Inflows	146,300	140,400	136,000	132,900	138,800	134,300	140,200	147,200	142,300	135,300	131,500	131,600	139,000	139,100	136,800	130,900	131,100	136,500	141,000
Foothill Area	*49,700*	*47,100*	*46,100*	*45,400*	*46,800*	*47,000*	*50,400*	*51,200*	*46,800*	*44,100*	*42,800*	*45,800*	*46,100*	*44,300*	*41,600*	*39,100*	*38,900*	*45,300*	*48,800*
Los Molinos Subbasin	*66,600*	*64,600*	*62,400*	*60,700*	*62,200*	*61,800*	*63,100*	*66,000*	*64,600*	*61,000*	*60,000*	*60,900*	*63,200*	*64,000*	*62,500*	*61,800*	*61,800*	*63,600*	*65,600*
Butte Subbasin	*29,800*	*28,400*	*27,300*	*26,500*	*29,600*	*25,300*	*26,400*	*29,800*	*30,700*	*29,900*	*28,400*	*24,500*	*29,400*	*30,500*	*32,500*	*29,800*	*30,000*	*27,300*	*26,400*
Wyandotte Creek Subbasin	*200*	*200*	*200*	*200*	*200*	*200*	*300*	*200*	*200*	*200*	*200*	*200*	*200*	*200*	*200*	*200*	*300*	*300*	*200*
Deep Percolation	218,600	158,300	203,500	229,900	235,800	248,300	315,100	100,500	156,100	141,900	221,300	265,600	130,900	155,000	104,700	152,100	205,800	321,000	96,500
Precipitation	*133,600*	*88,300*	*123,700*	*154,000*	*144,600*	*173,900*	*226,700*	*46,100*	*80,900*	*76,200*	*143,900*	*187,800*	*70,100*	*81,200*	*46,300*	*83,000*	*133,900*	*234,800*	*55,900*
Applied Surface Water	*5,400*	*4,500*	*4,500*	*5,500*	*5,400*	*6,300*	*7,000*	*3,000*	*3,600*	*4,100*	*5,600*	*7,400*	*4,000*	*3,800*	*2,400*	*1,800*	*5,800*	*7,700*	*4,100*
Applied Groundwater	*79,600*	*65,500*	*75,300*	*70,400*	*85,800*	*68,100*	*81,400*	*51,400*	*71,600*	*61,600*	*71,900*	*70,400*	*56,800*	*70,000*	*56,000*	*67,300*	*66,100*	*78,400*	*36,500*
Seepage	23,800	19,000	22,500	29,000	24,000	26,000	33,400	19,300	19,100	22,000	25,600	31,900	21,200	22,000	16,500	16,500	24,200	37,800	23,100
Streams	*20,500*	*15,900*	*19,600*	*25,500*	*20,900*	*22,200*	*29,600*	*16,400*	*16,300*	*18,700*	*22,500*	*28,000*	*17,900*	*19,100*	*14,300*	*15,000*	*20,700*	*33,800*	*19,300*
Canals and Drains	*3,400*	*3,100*	*2,900*	*3,500*	*3,100*	*3,700*	*3,800*	*2,900*	*2,800*	*3,300*	*3,100*	*4,000*	*3,300*	*2,900*	*2,200*	*1,500*	*3,600*	*4,000*	*3,800*
Total Inflow	***388,700***	***317,700***	***362,000***	***391,800***	***398,600***	***408,600***	***488,700***	***267,000***	***317,500***	***299,200***	***378,400***	***429,100***	***291,100***	***316,100***	***258,000***	***299,500***	***361,100***	***495,300***	***260,600***
Outflows (AFY)																			
Subsurface Outflows	92,000	84,700	81,400	82,500	80,200	86,200	92,300	80,300	67,900	58,800	62,000	71,300	66,400	55,800	46,200	50,000	50,800	65,000	64,400
Foothill Area	*300*	*300*	*300*	*300*	*300*	*300*	*400*	*300*	*300*	*300*	*300*	*300*	*300*	*200*	*200*	*200*	*200*	*400*	*200*
Los Molinos Subbasin	*5,700*	*5,900*	*5,700*	*5,200*	*5,400*	*5,900*	*5,200*	*6,100*	*5,600*	*5,200*	*5,000*	*4,800*	*5,800*	*4,800*	*4,200*	*3,000*	*2,200*	*2,000*	*2,400*
Butte Subbasin	*86,000*	*78,500*	*75,400*	*77,000*	*74,400*	*80,000*	*86,700*	*73,900*	*62,000*	*53,400*	*56,700*	*66,100*	*60,400*	*50,700*	*41,800*	*46,700*	*48,500*	*62,700*	*61,800*
Wyandotte Creek Subbasin	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Groundwater Pumping	246,600	245,200	248,900	223,500	267,200	198,400	214,400	288,400	297,100	263,000	232,700	196,500	261,000	287,600	293,000	260,900	205,100	185,000	211,400
Agricultural	*210,500*	*209,300*	*211,800*	*186,700*	*227,100*	*161,100*	*175,700*	*248,300*	*257,300*	*224,500*	*196,800*	*162,400*	*224,400*	*251,600*	*257,600*	*235,300*	*182,800*	*161,800*	*187,400*
Urban and Industrial	*27,700*	*28,000*	*29,000*	*28,300*	*31,700*	*29,000*	*30,000*	*30,700*	*30,500*	*29,300*	*26,700*	*25,700*	*26,900*	*27,000*	*24,800*	*18,800*	*18,700*	*19,600*	*20,100*
Managed Wetlands	*8,400*	*7,900*	*8,000*	*8,500*	*8,400*	*8,300*	*8,700*	*9,300*	*9,300*	*9,100*	*9,300*	*8,500*	*9,700*	*9,100*	*10,600*	*6,800*	*3,600*	*3,600*	*3,900*
Stream Gains from Groundwater	8,600	5,200	4,900	5,000	5,900	6,300	10,400	3,500	2,600	1,800	2,700	4,100	2,400	1,500	500	800	1,200	2,500	700
Western Boundary Net Outflows	72,200	65,100	61,600	63,200	61,200	72,300	77,100	49,600	43,900	37,700	55,400	68,600	49,300	46,200	26,200	39,100	52,300	72,000	53,300
Total Outflow	***419,400***	***400,200***	***396,800***	***374,200***	***414,500***	***363,200***	***394,200***	***421,800***	***411,500***	***361,300***	***352,800***	***340,500***	***379,100***	***391,100***	***365,900***	***350,800***	***309,400***	***324,500***	***329,800***
Change in Storage (Inflow - Outflow)	***-30,700***	***-82,500***	***-34,800***	***17,600***	***-15,900***	***45,400***	***94,500***	***-154,800***	***-94,000***	***-62,100***	***25,600***	***88,600***	***-88,000***	***-75,000***	***-107,900***	***-51,300***	***51,700***	***170,800***	***-69,200***

APPENDIX 3-A

Figures Showing Average Depth of Domestic, Irrigation, and Public Supply Wells



Legend

Groundwater Subbasin[1]

Vina Groundwater Subbasin

Roads[2]

Highways

Notes:
1) California Department of Water Resources (CA DWR).
2) TIGER/Line, U.S. Census Bureau.

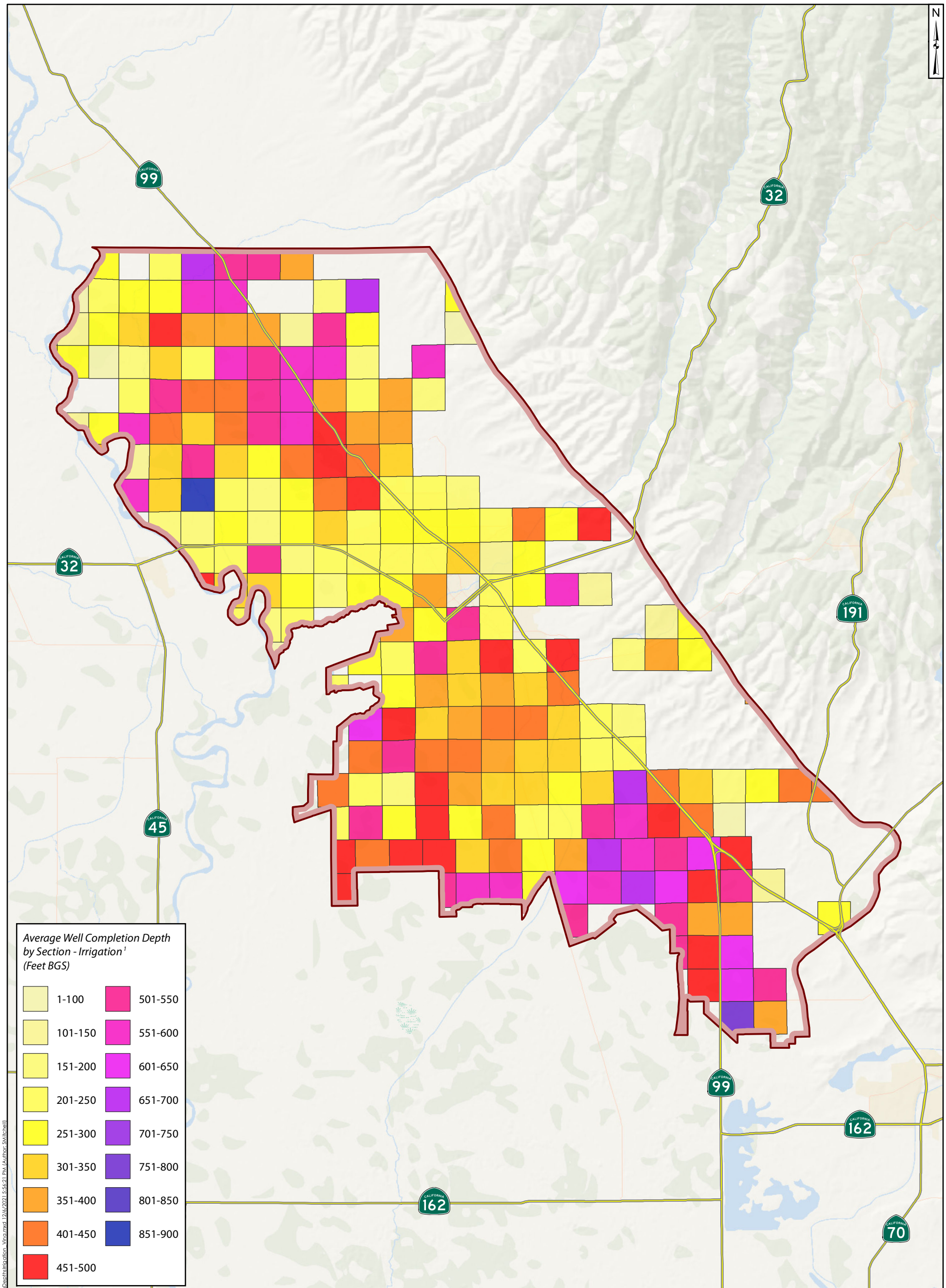
2 1 0 2 Miles

Average Completion Depth of Domestic Wells per Section
Vina Groundwater Subbasin GSP

Geosyntec consultants

Project No.: SAC282 | December 2021

P:\GIS\SAC282 - Butte County\Project\202108_GSP_Maps\Vina\Appendix\WellsAvgDepthsDomestic_Vina.mxd 12/6/2021 5:44:52 PM (Author: SMitchell)



Legend

Groundwater Subbasin[1]

Vina Groundwater Subbasin

Roads[2]

Highways

Notes:
1) California Department of Water Resources (CA DWR).
2) TIGER/Line, U.S. Census Bureau.

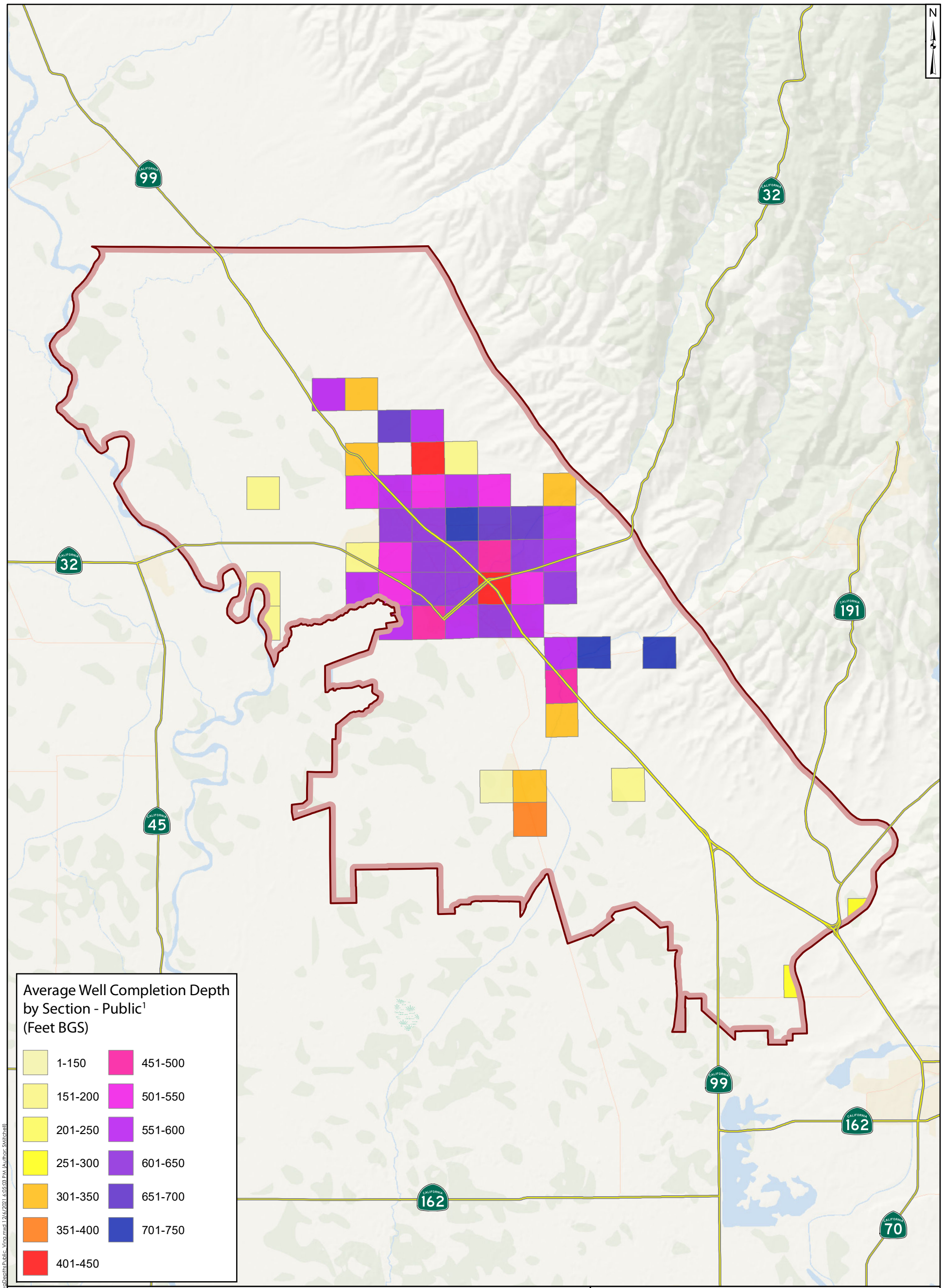
2 1 0 2 Miles

Average Completion Depth of Irrigation Wells per Section
Vina Groundwater Subbasin GSP

Geosyntec consultants

Project No.: SAC282 | December 2021

P:\GIS\SAC282 - Butte County\Project\202108_GSP_Maps\Vina\Appendix\WellsAvgDepthIrrigation_Vina.mxd 12/6/2021 5:56:21 PM (Author: SMitchell)



Legend

Groundwater Subbasin[1]

Vina Groundwater Subbasin

Roads[2]

Highways

Notes:
1) California Department of Water Resources (CA DWR).
2) TIGER/Line, U.S. Census Bureau.

4 2 0 4 Miles

Average Completion Depth of Public Wells per Section
Vina Groundwater Subbasin GSP

Geosyntec consultants

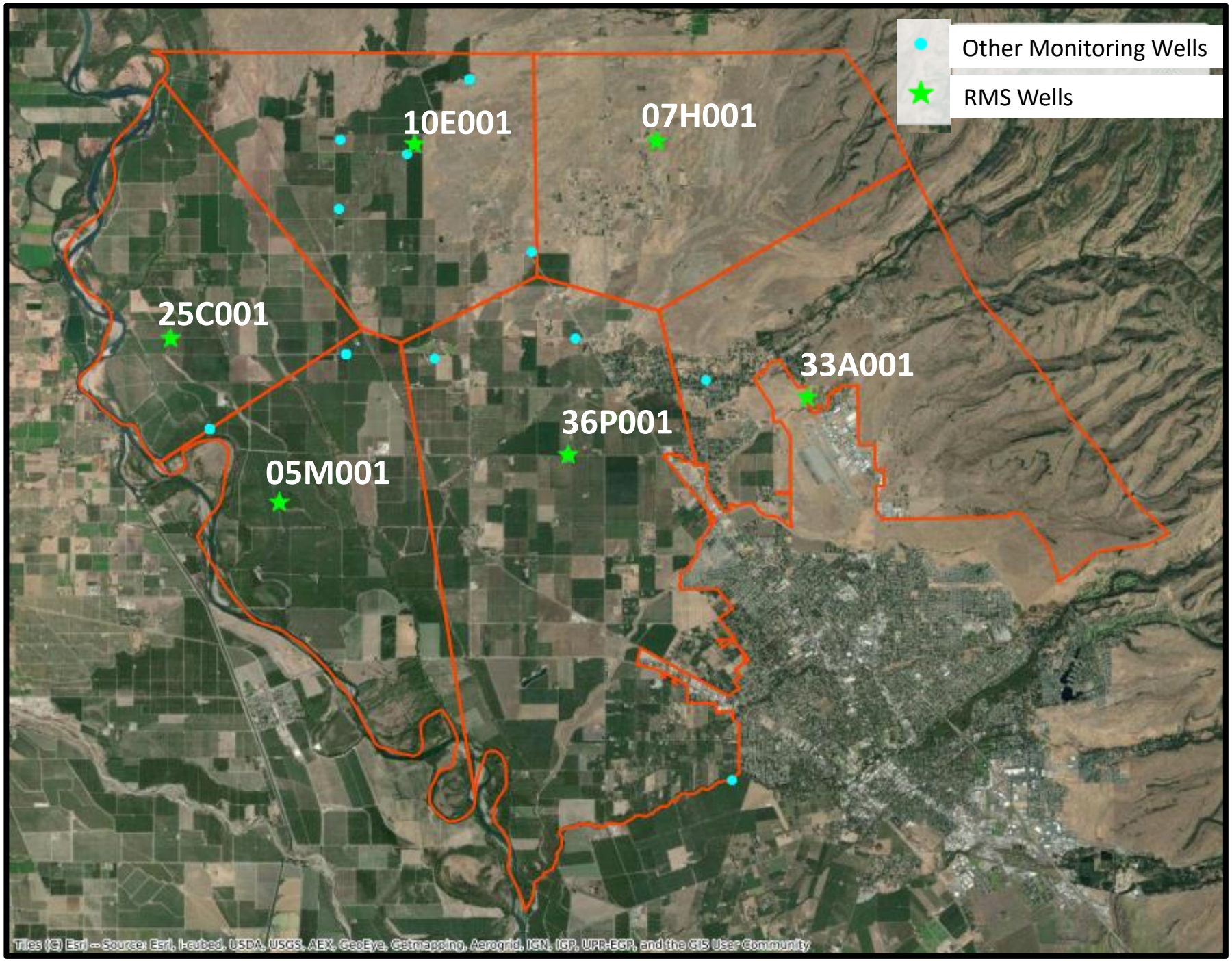
Project No.: SAC282 | December 2021

P:\GIS\SAC282 - Butte County\Project\202108_GSP_Maps\Vina\Appendix\WellsAvgDepths\Public_Vina.mxd 12/6/2021 6:05:03 PM (Author: SMitchell)

APPENDIX 3-B

Figures of Representative Monitoring Sites

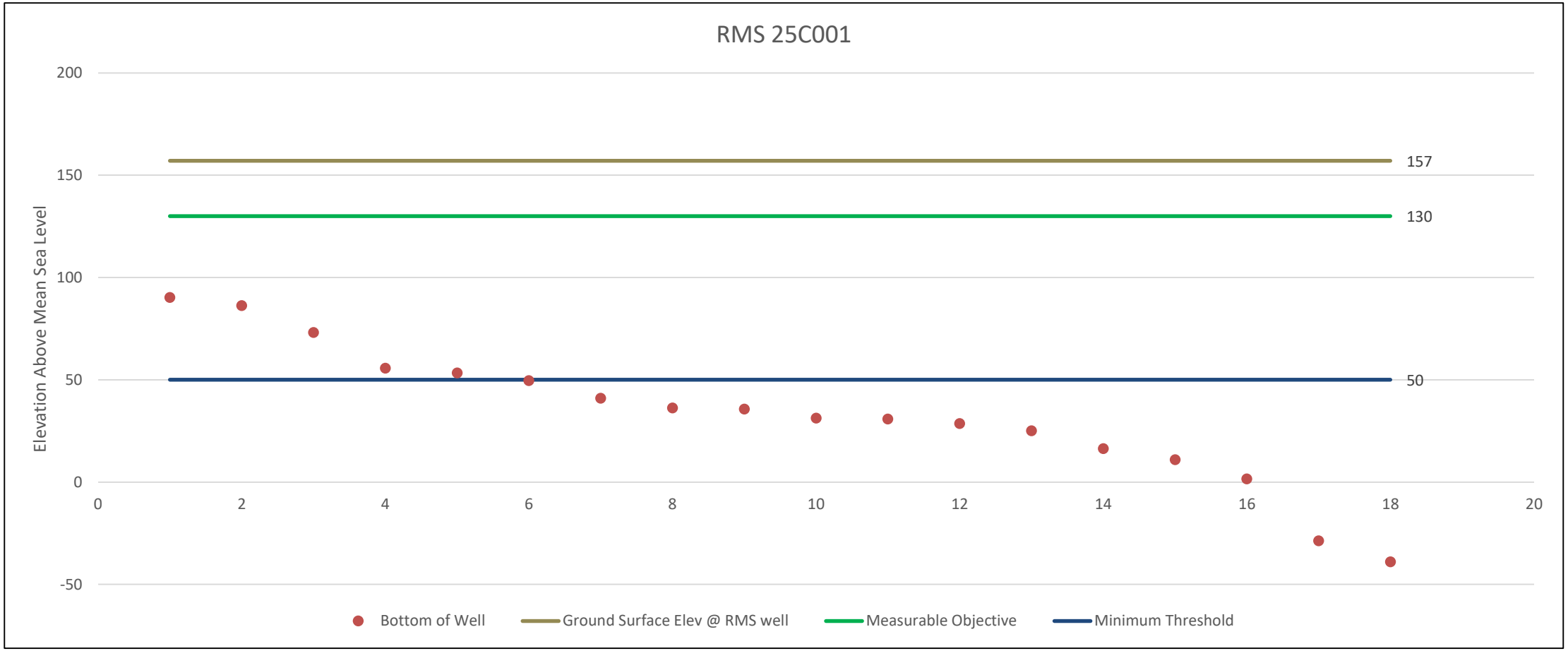
(Removed graphs for wells no longer RMS wells)

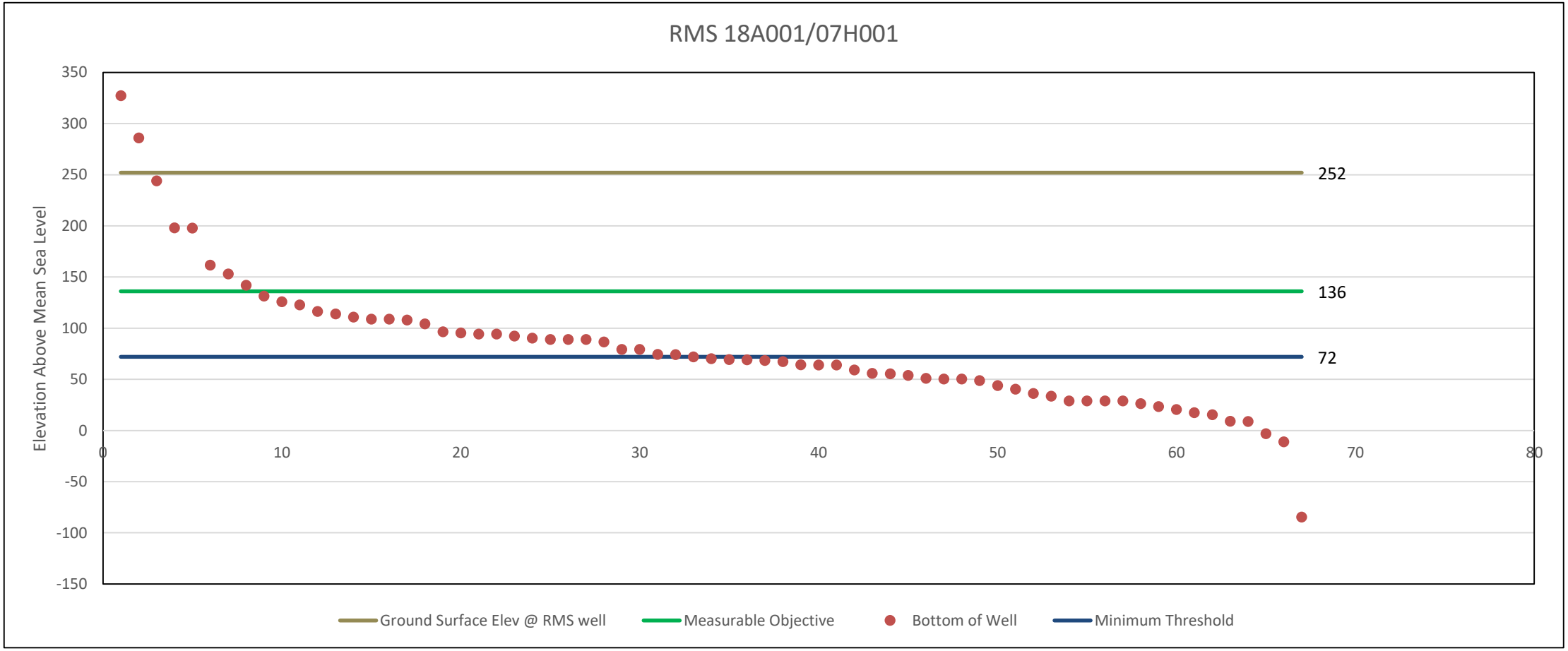


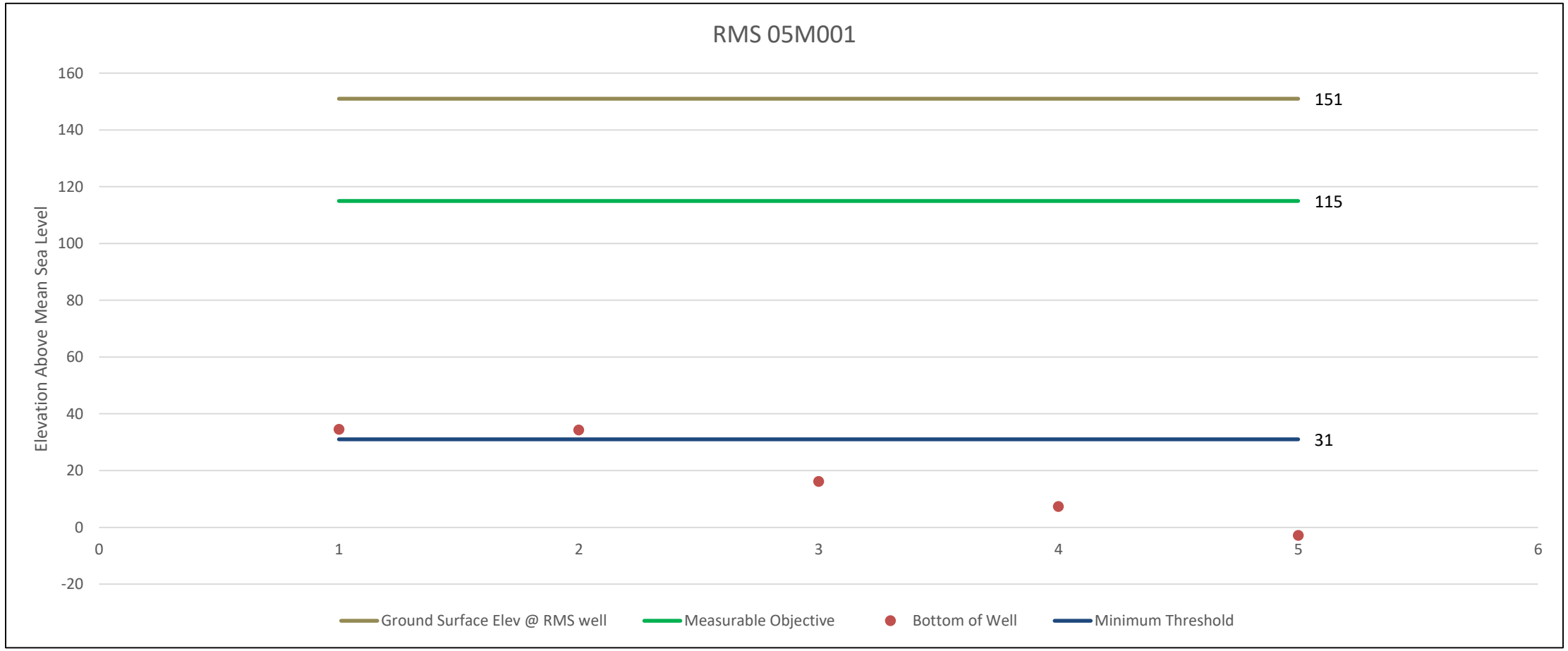
Vina North Management Area
RMS Wells and Polygons

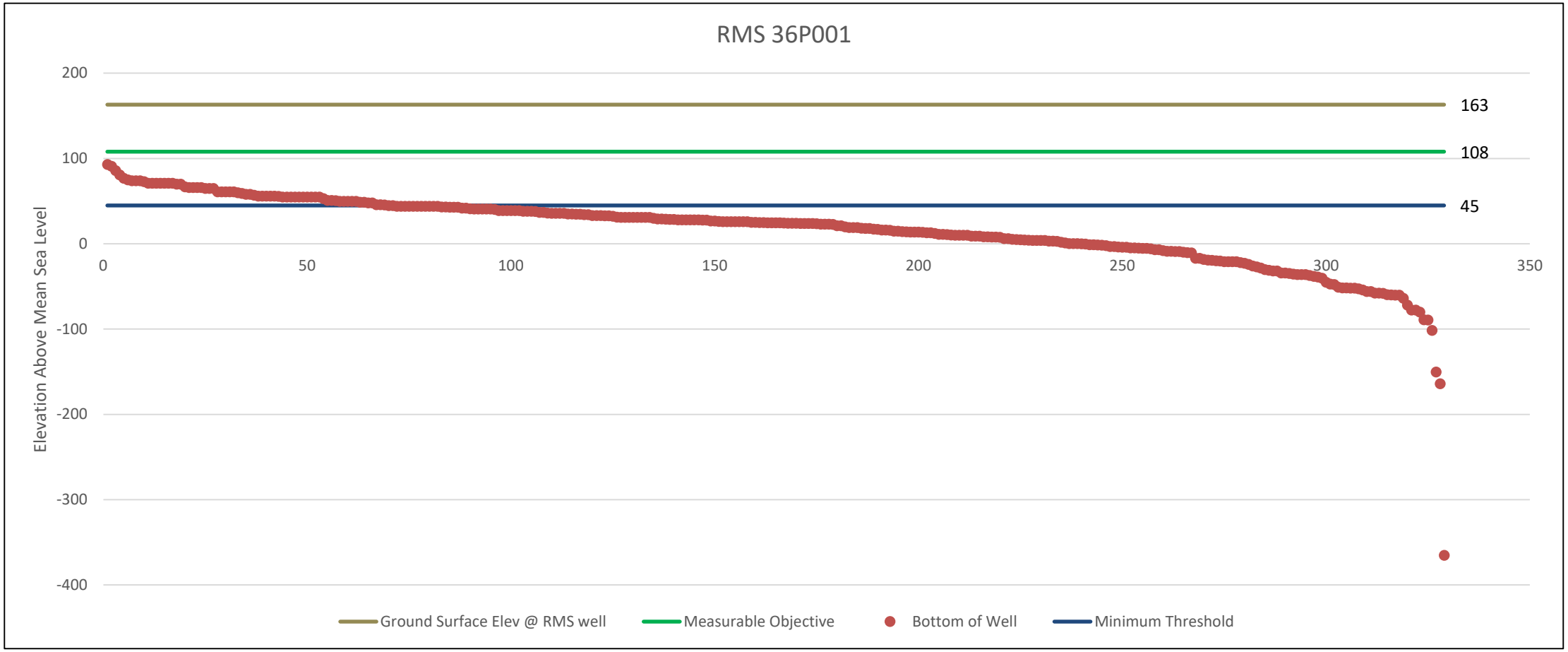
Graphs show the Elevation of the Bottom of domestic wells in the RMS Zone relative to the RMS well's ground surface elevation. Each point on the graph represents a domestic well in the RMS zone. Everything is converted to elevation above mean sea level in feet. The elevation of the Measurable Objective and Minimum Threshold established at the RMS well is shown relative to the elevation of the bottom of all domestic wells (post 1980 from the well database) within the zone.

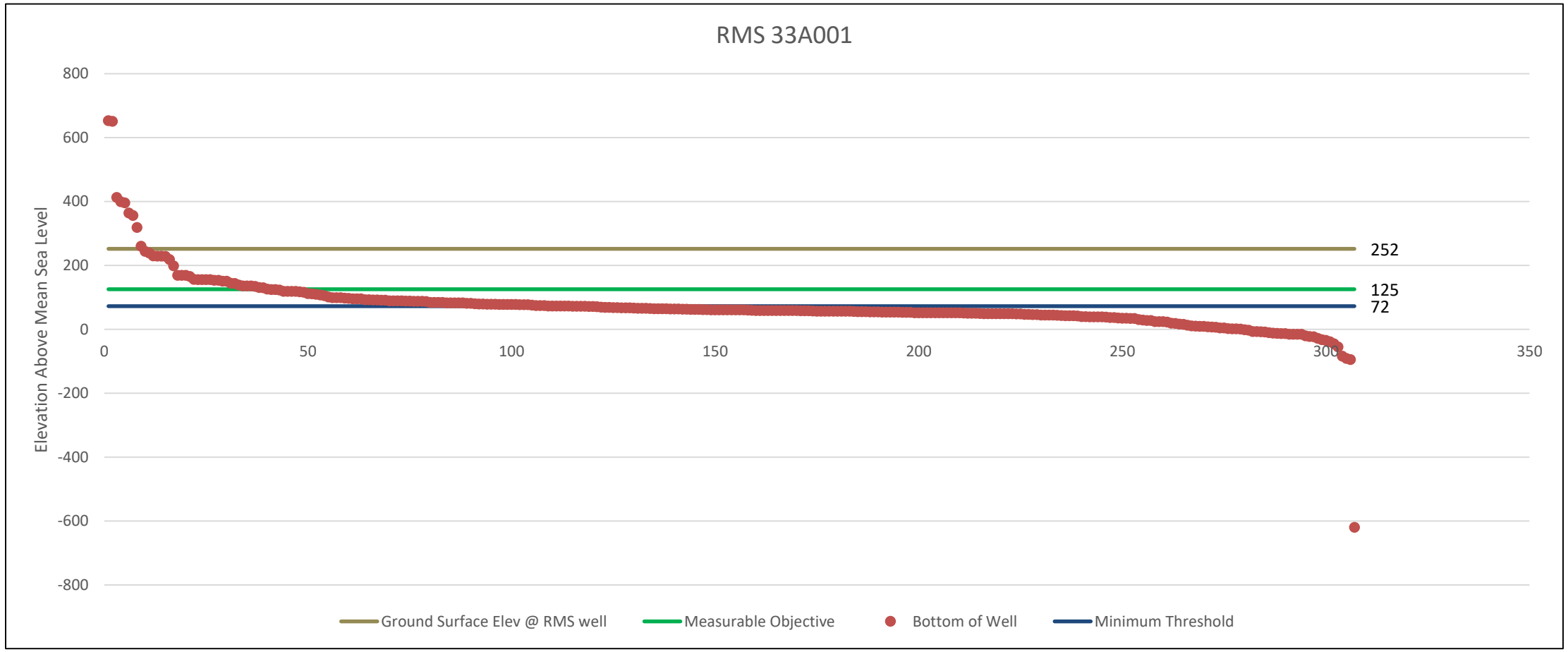
The graphs were used to identify the Minimum Threshold that would be protective of the majority of the domestic wells in the RMS zone while recognizing the RMS well is not fully representative of wells within the zone due to changes in groundwater surface and water surface elevation throughout the area. Wells above the Minimum Threshold elevation tend to be especially shallow (less than 100 feet deep) or have a significantly different (higher) ground surface elevation than the RMS well.

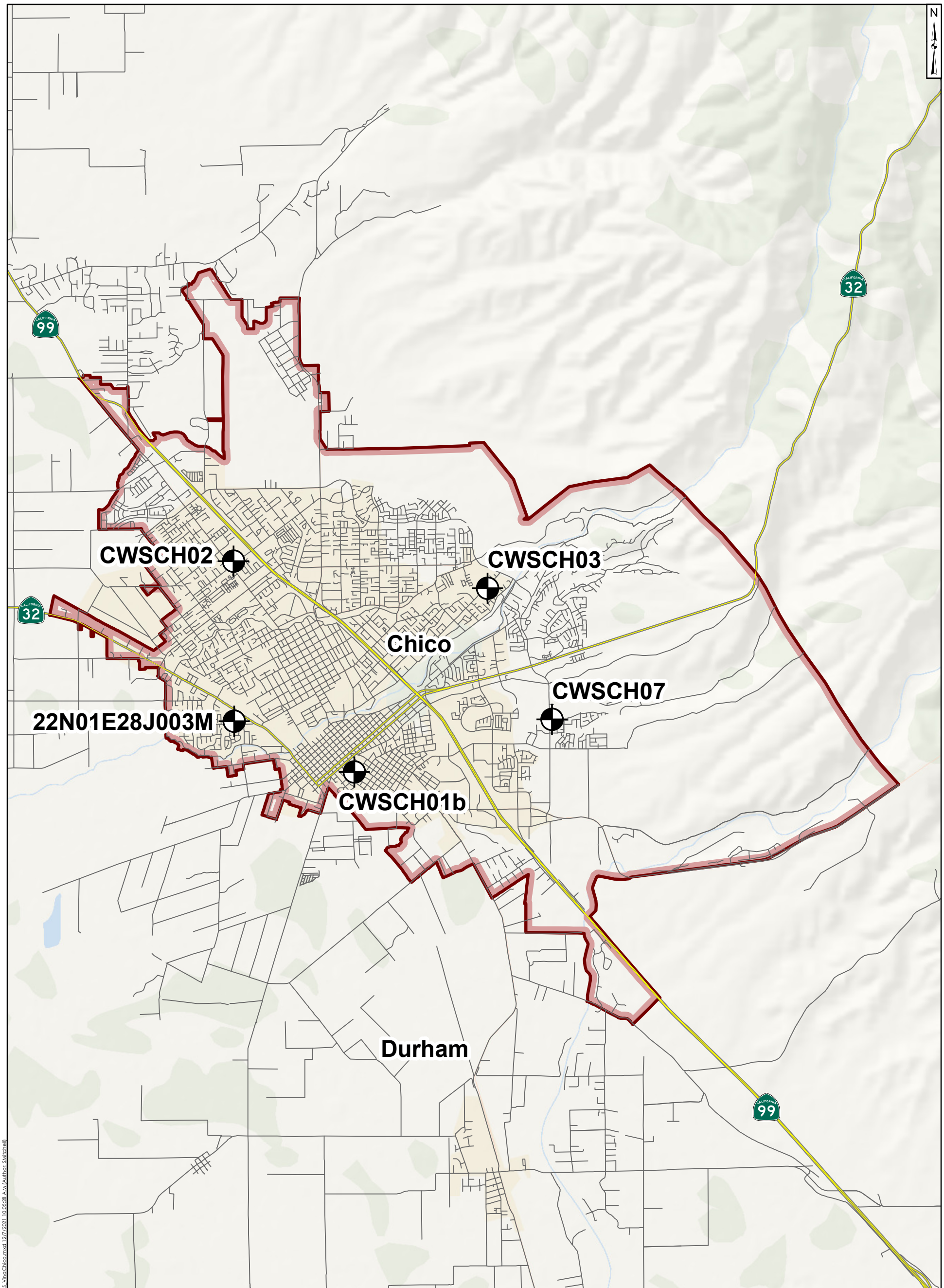

RMS 25C001
Elevation Above Mean Sea Level
200
150
100
50
0
-50
0
2
4
6
8
10
12
14
16
18
20
157
130
50
Bottom of Well
Ground Surface Elev @ RMS well
Measurable Objective
Minimum Threshold


RMS 18A001/07H001
Elevation Above Mean Sea Level
350
300
250
200
150
100
50
0
-50
-100
-150
0
10
20
30
40
50
60
70
80
252
136
72
Ground Surface Elev @ RMS well
Measurable Objective
Bottom of Well
Minimum Threshold


RMS 05M001
Elevation Above Mean Sea Level
160
140
120
100
80
60
40
20
0
-20
0
1
2
3
4
5
6
151
115
31
Ground Surface Elev @ RMS well
Measurable Objective
Bottom of Well
Minimum Threshold


RMS 36P001
Elevation Above Mean Sea Level
200
100
0
-100
-200
-300
-400
0
50
100
150
200
250
300
350
163
108
45
Ground Surface Elev @ RMS well
Measurable Objective
Bottom of Well
Minimum Threshold


RMS 33A001
Elevation Above Mean Sea Level
800
600
400
200
0
-200
-400
-600
-800
0
50
100
150
200
250
300
350
252
125
72
Ground Surface Elev @ RMS well
Measurable Objective
Bottom of Well
Minimum Threshold



Legend

Wells

RMS Wells

Vina Groundwater Subbasin Management Areas[1]

Vina Chico Management Area

Roads[2]

Highways

Other roads

Boundaries[2]

County boundaries

1 ½ 0 1 Miles

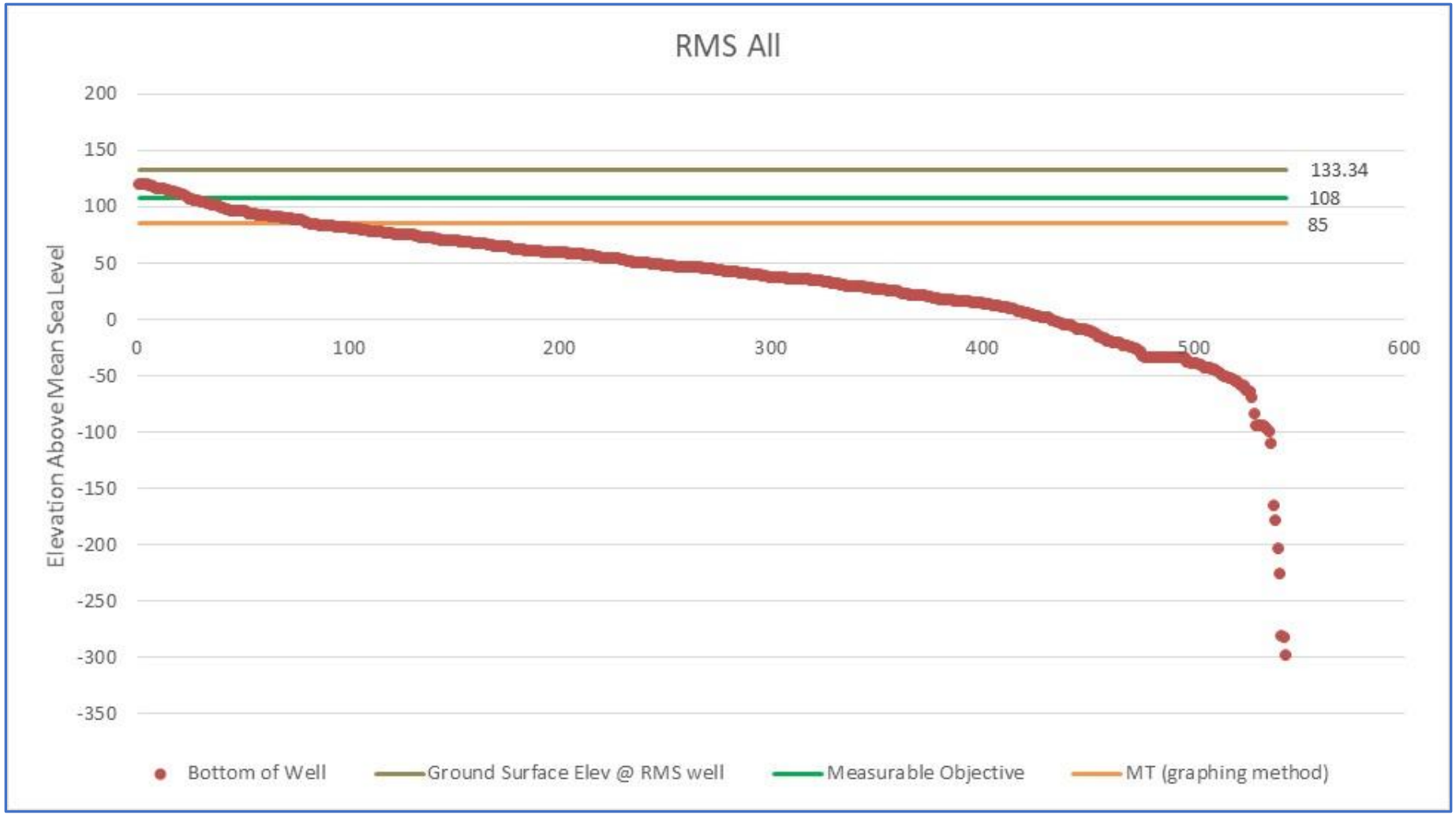
RMS Wells
Vina Chico Management Area
Vina Groundwater Subbasin GSP

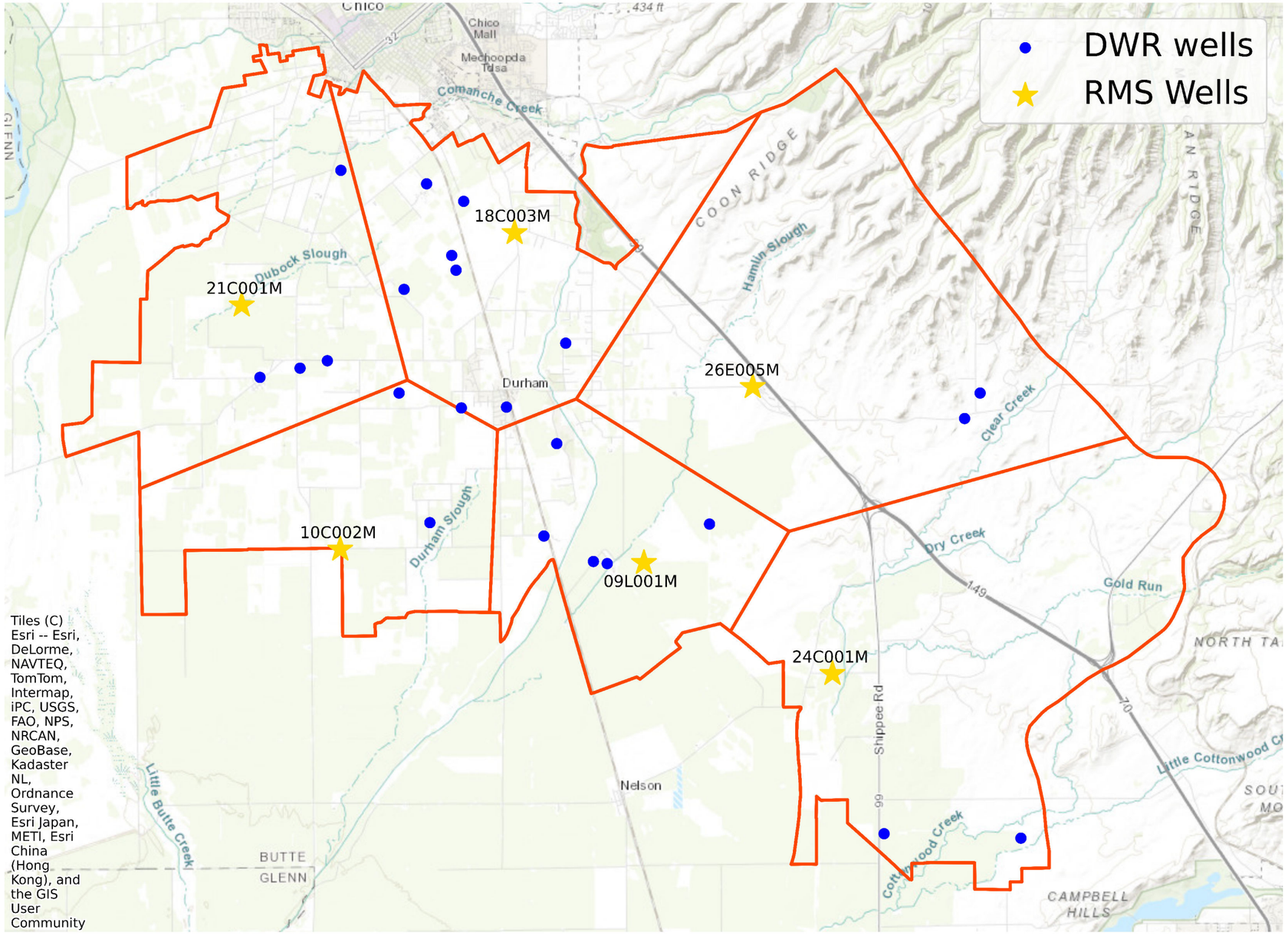
Geosyntec consultants

Project No.: SAC282 | December 2021

Notes:
1) California Department of Water Resources (CA DWR).
2) TIGER/Line, U.S. Census Bureau.

P:\GIS\SAC282 - Butte County\Project\202108_GSP_Maps\Vina\Appendix\WellsRMS_VinaChico.mxd 12/7/2021 10:05:28 AM (Author: SMitchell)

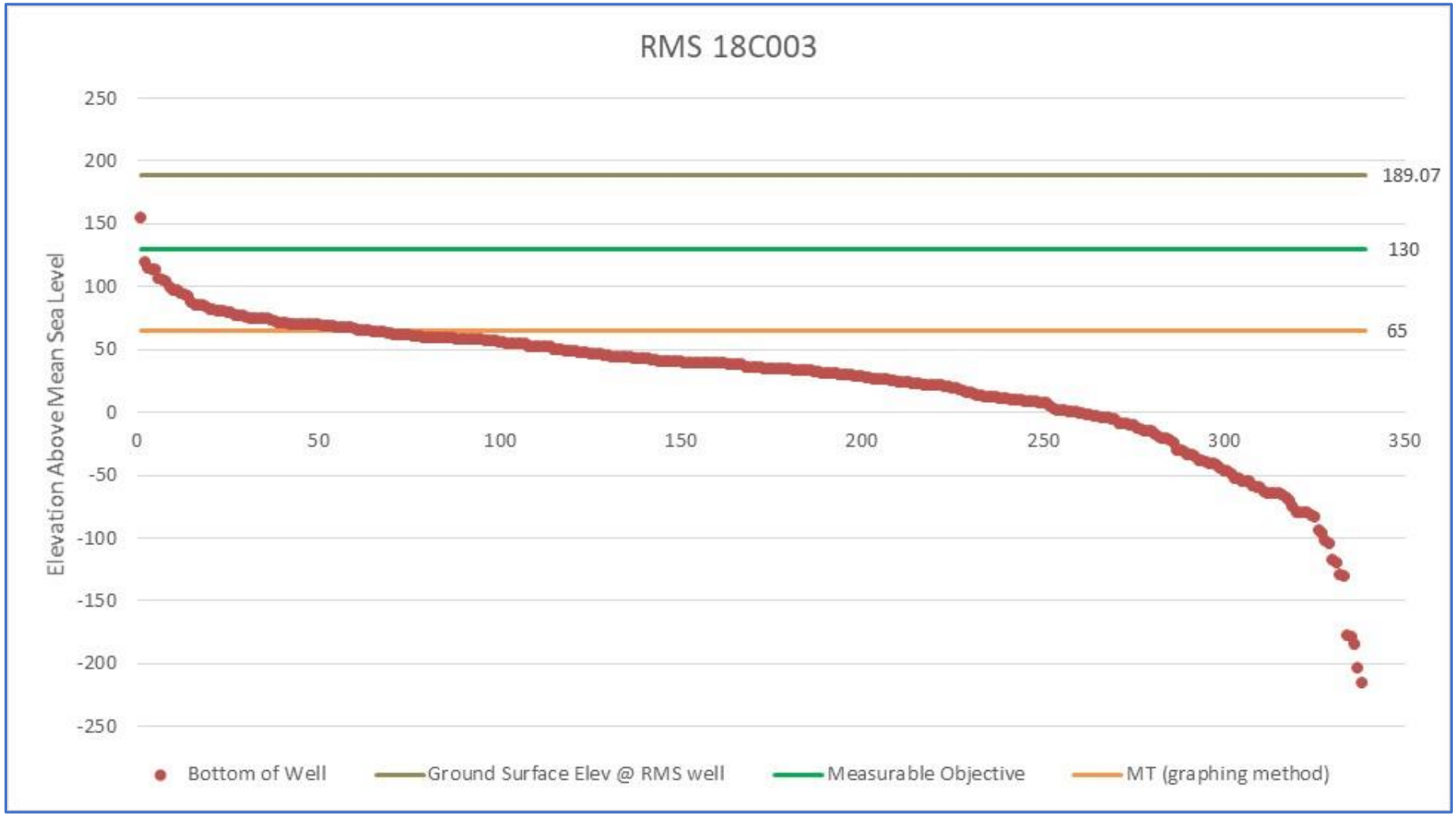

RMS All
Elevation Above Mean Sea Level
200
150
100
50
0
-50
-100
-150
-200
-250
-300
-350
0
100
200
300
400
500
600
133.34
108
85
Bottom of Well
Ground Surface Elev @ RMS well
Measurable Objective
MT (graphing method)



Vina South Management Area
RMS Wells and Polygons
Vina Groundwater Subbasin GSP

Geosyntec consultants

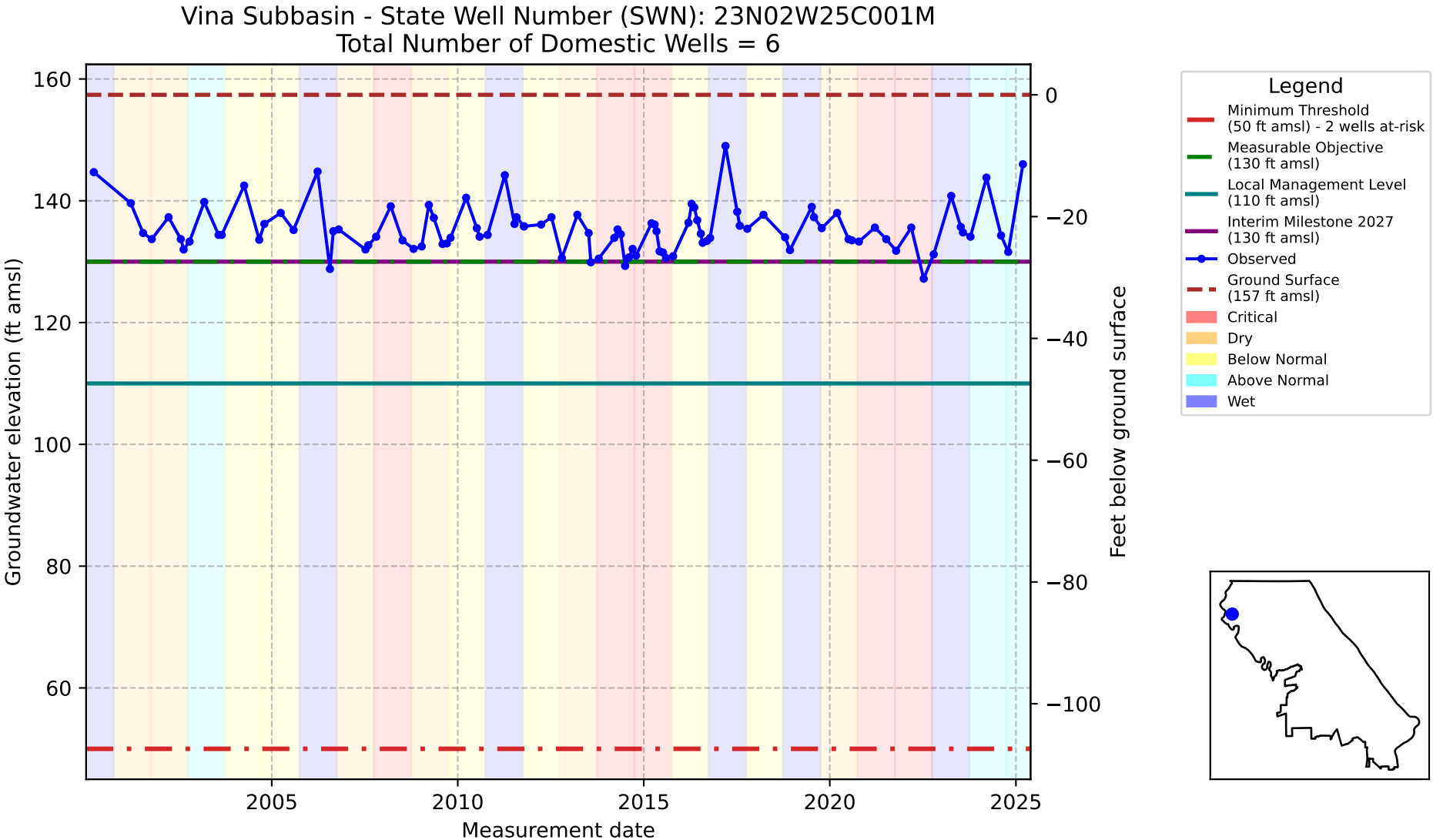
Project No.: SAC282 | January 2022

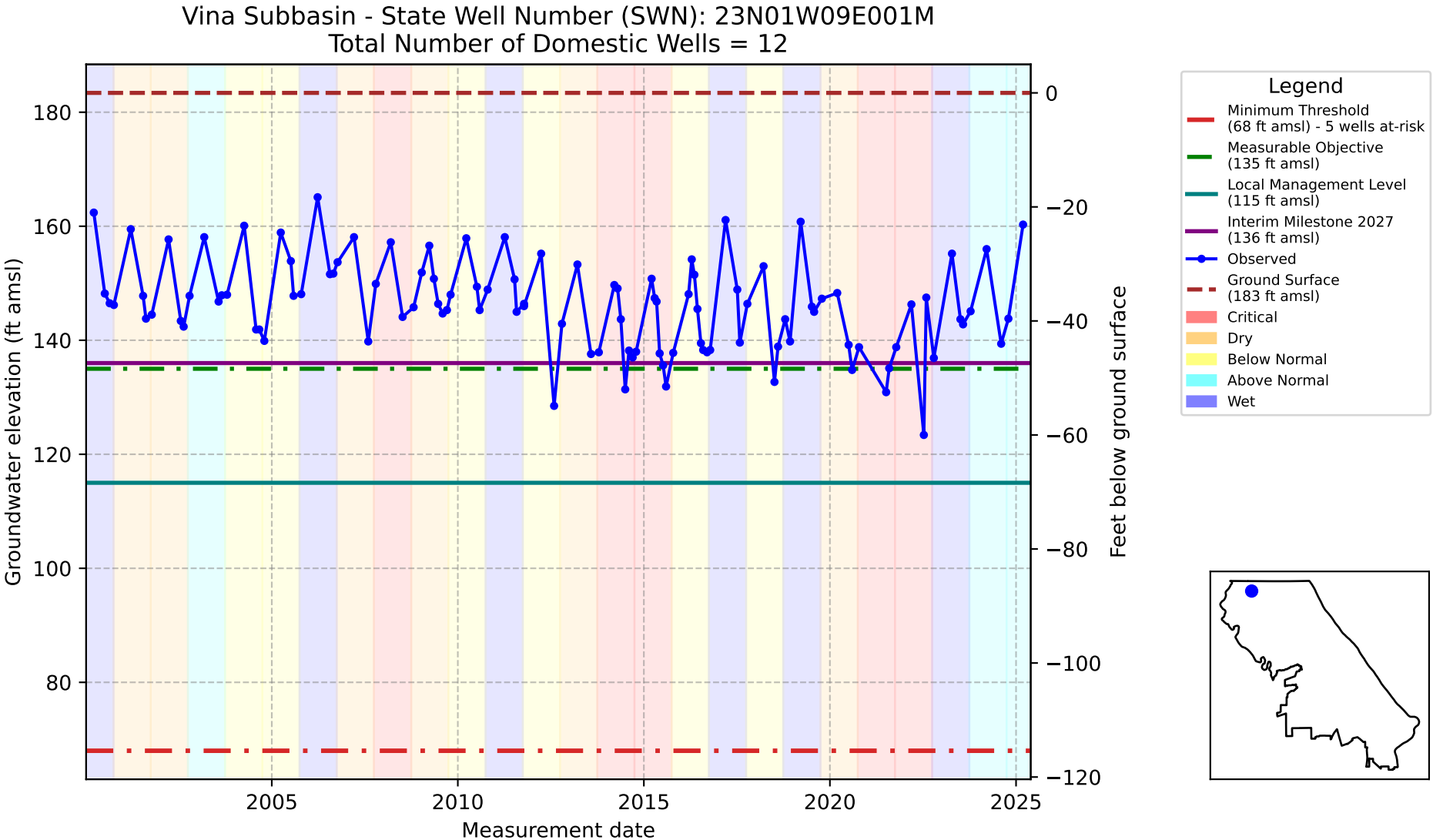

RMS 18C003
Elevation Above Mean Sea Level
250
200
150
100
50
0
-50
-100
-150
-200
-250
0
50
100
150
200
250
300
350
189.07
130
65
Bottom of Well
Ground Surface Elev @ RMS well
Measurable Objective
MT (graphing method)

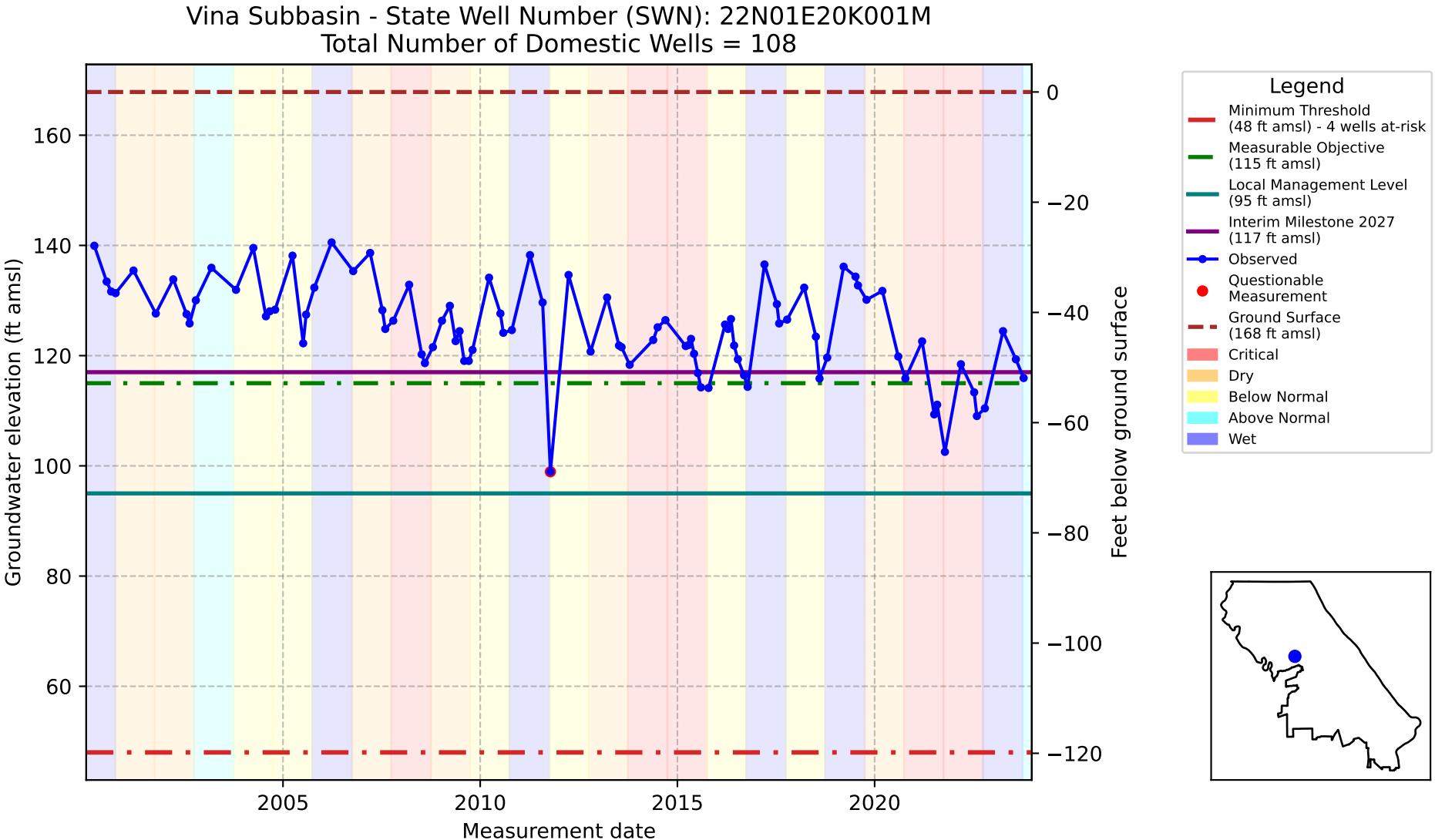
RMS 24C001
Elevation Above Mean Sea Level
200
150
100
50
0
-50
-100
-150
-200
0
2
4
6
8
10
12
14
157.75
77
Ground Surface Elev @ RMS well
Measurable Objective
Bottom of Well
MT (graphing method)

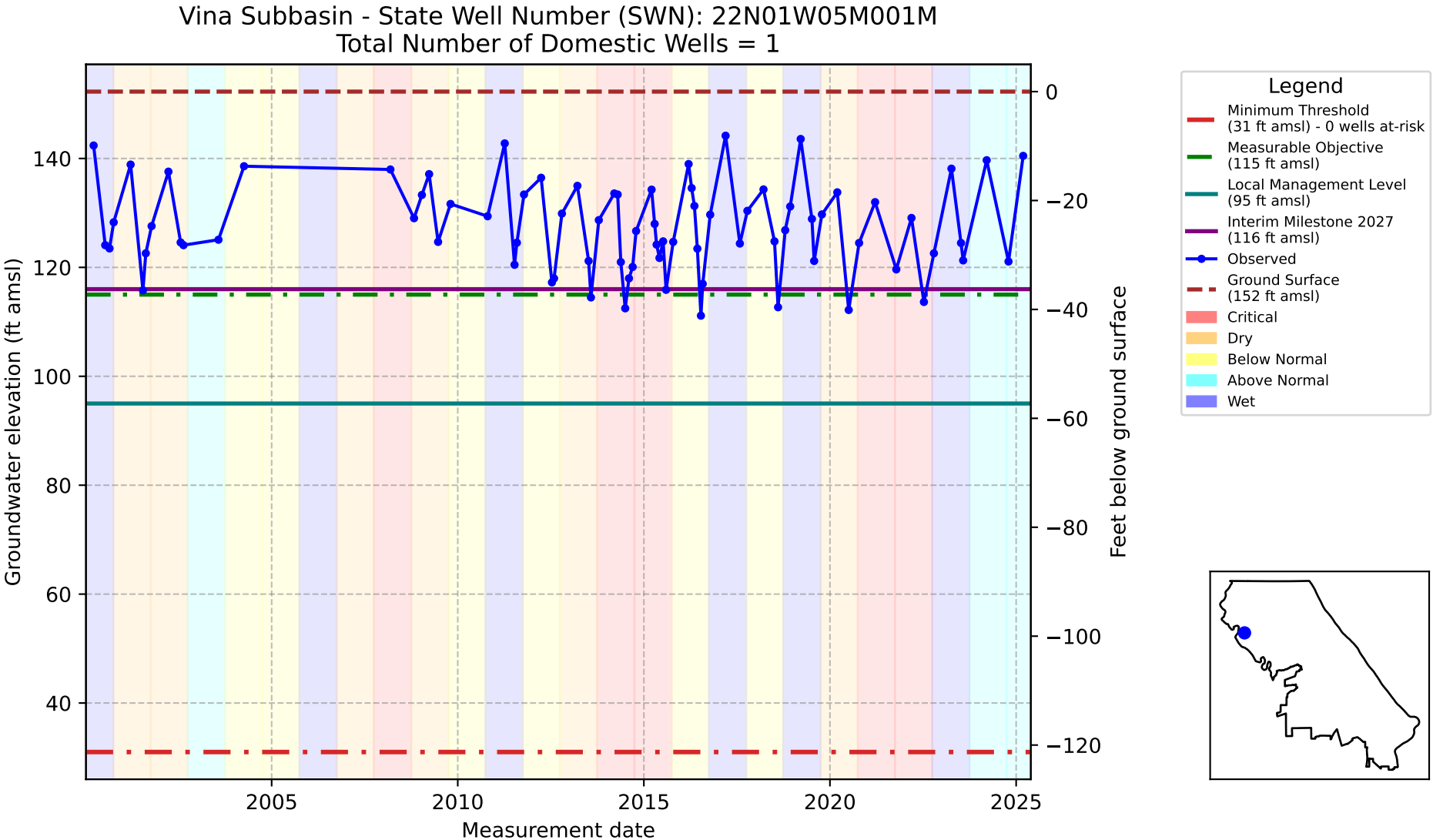
APPENDIX 3-C
Representative Monitoring Site Well Hydrographs

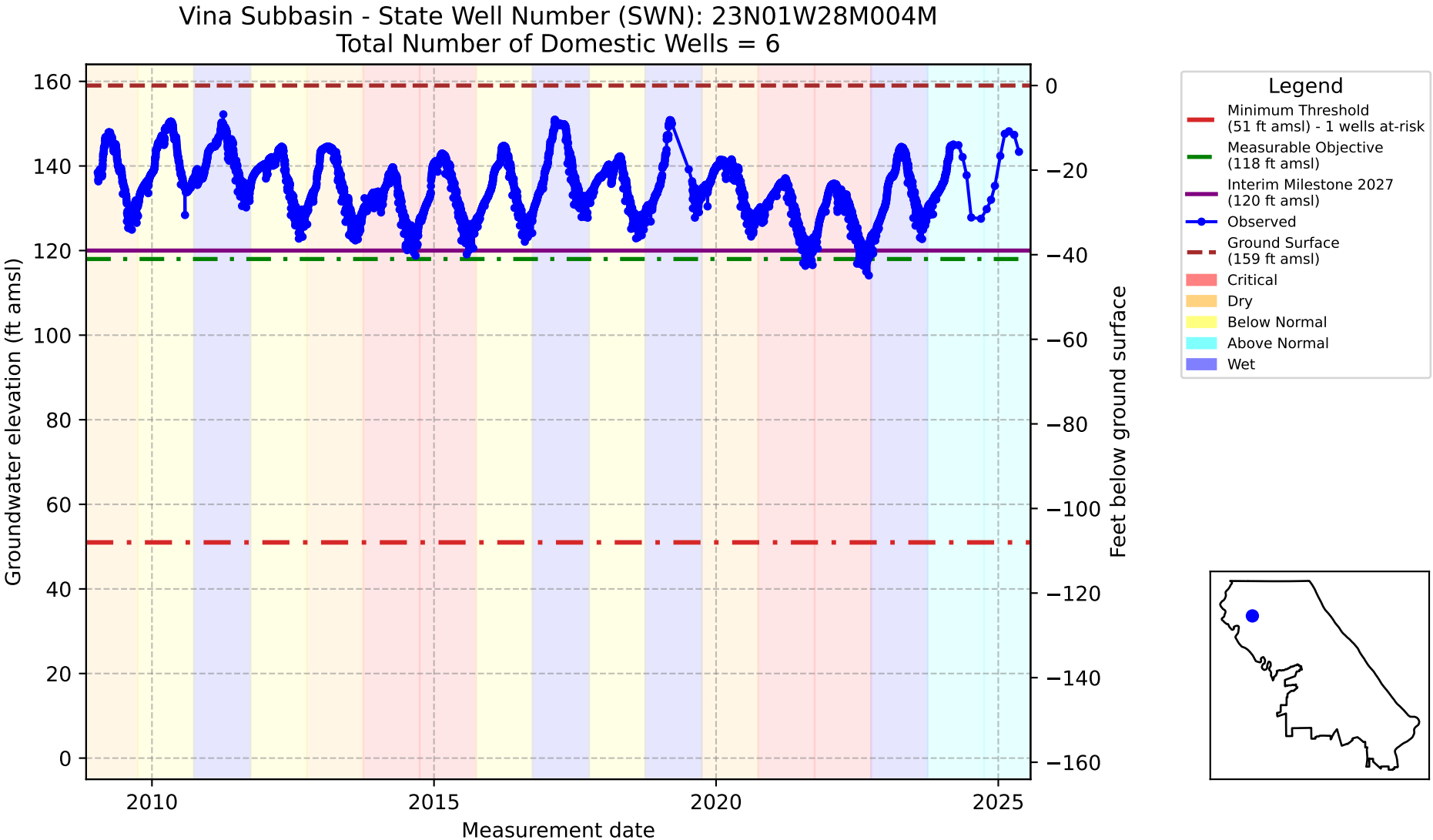
(Updated hydrographs using 2027 groundwater level RMS wells)

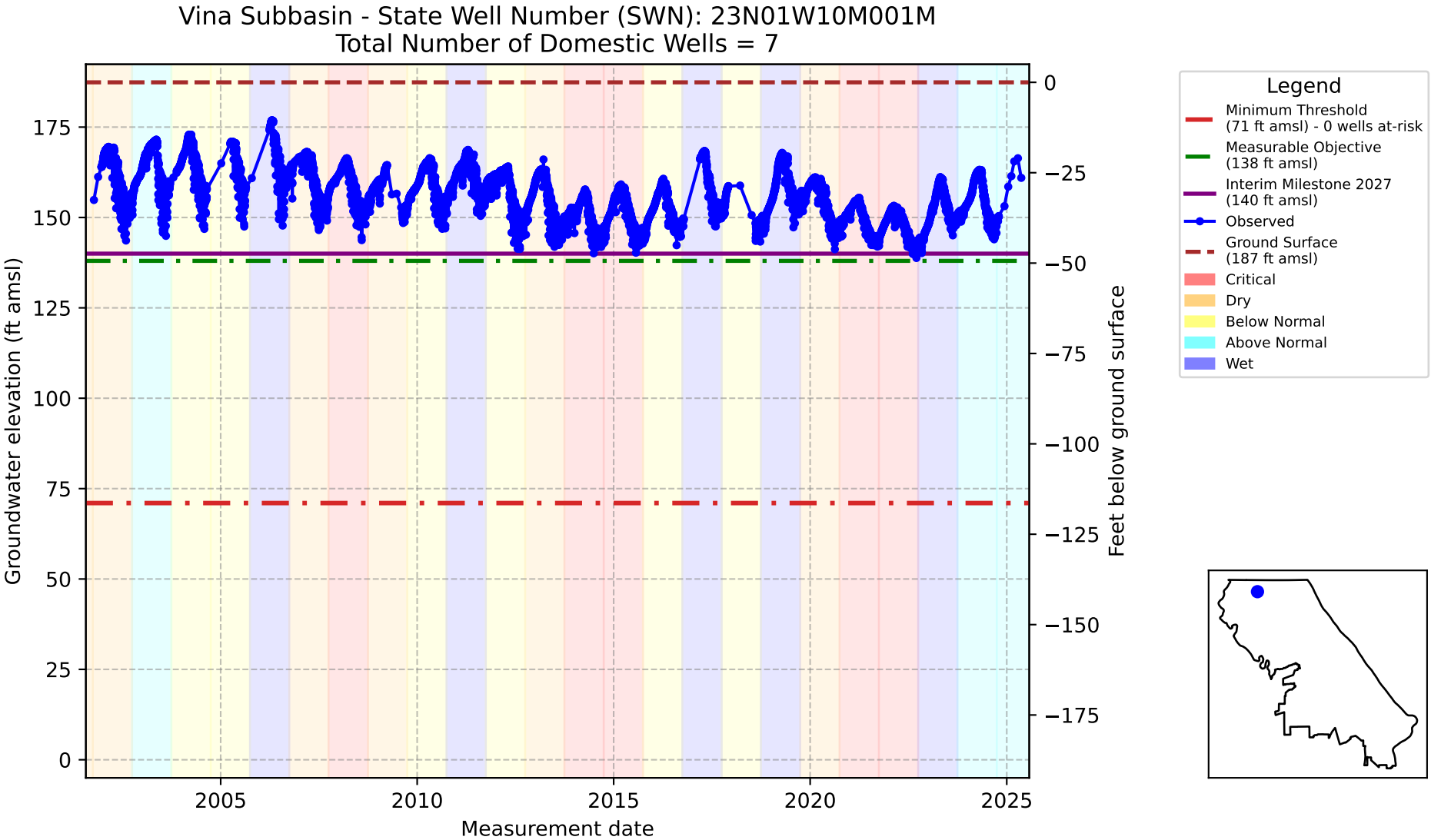

Vina Subbasin - State Well Number (SWN): 23N02W25C001M
Total Number of Domestic Wells = 6
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
160
140
120
100
80
60
0
−20
−40
−60
−80
−100
2005
2010
2015
2020
2025
Legend
Minimum Threshold (50 ft amsl) - 2 wells at-risk
Measurable Objective (130 ft amsl)
Local Management Level (110 ft amsl)
Interim Milestone 2027 (130 ft amsl)
Observed
Ground Surface (157 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

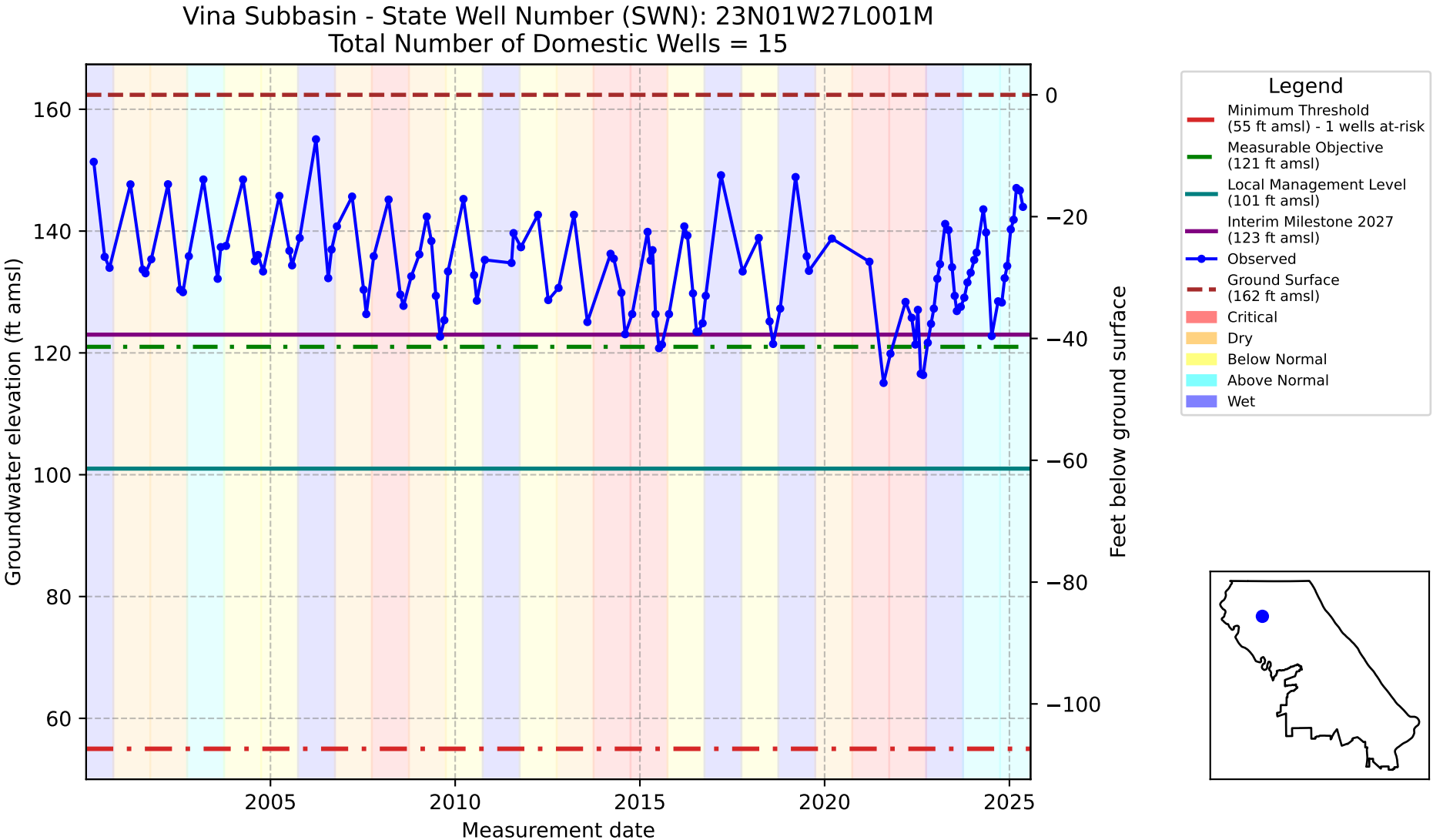

Vina Subbasin - State Well Number (SWN): 23N01W09E001M
Total Number of Domestic Wells = 12
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
180
160
140
120
100
80
0
−20
−40
−60
−80
−100
−120
2005
2010
2015
2020
2025
Legend
Minimum Threshold (68 ft amsl) - 5 wells at-risk
Measurable Objective (135 ft amsl)
Local Management Level (115 ft amsl)
Interim Milestone 2027 (136 ft amsl)
Observed
Ground Surface (183 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

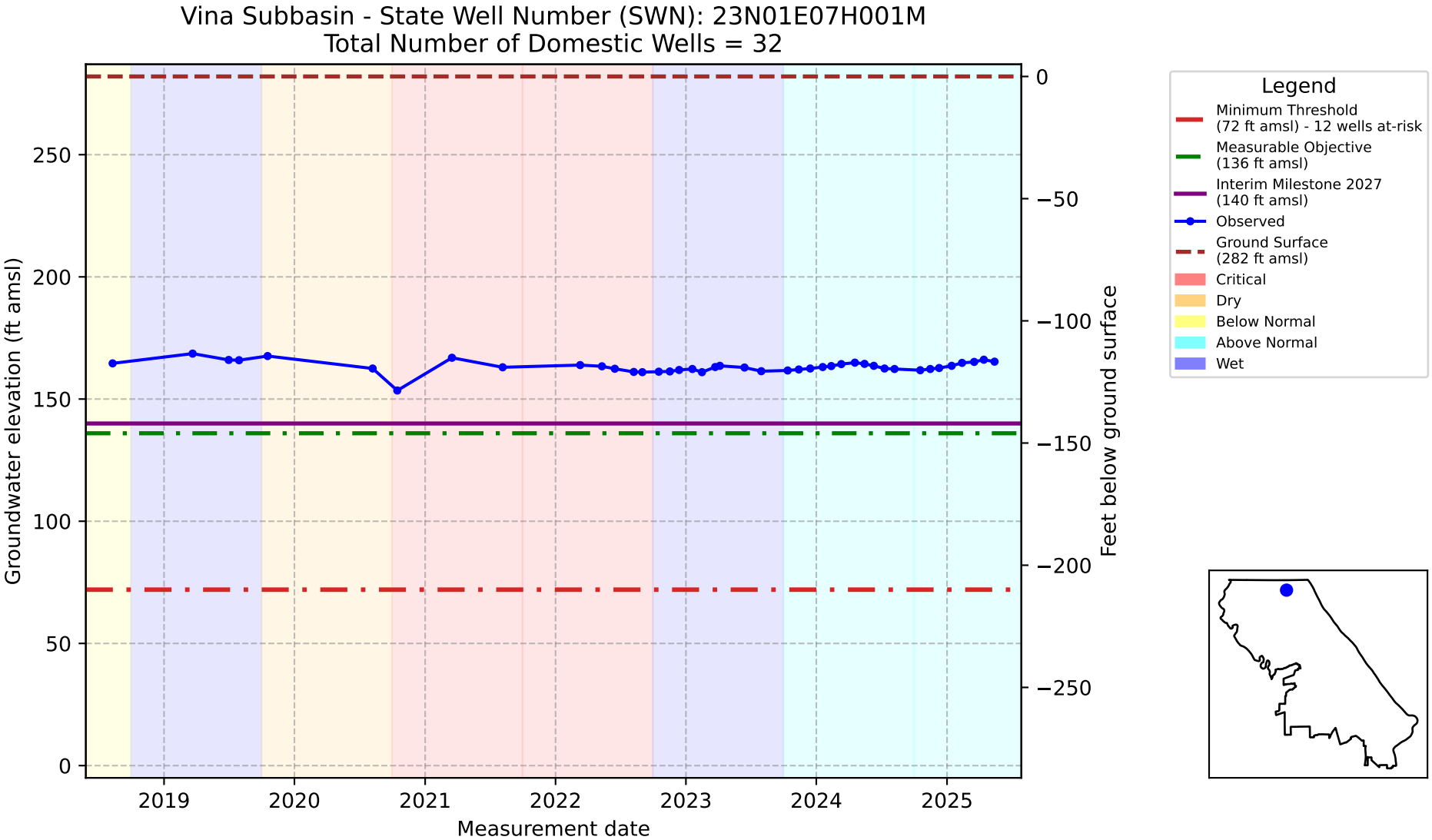

Vina Subbasin - State Well Number (SWN): 22N01E20K001M
Total Number of Domestic Wells = 108
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
160
140
120
100
80
60
0
−20
−40
−60
−80
−100
−120
2005
2010
2015
2020
Legend
Minimum Threshold (48 ft amsl) - 4 wells at-risk
Measurable Objective (115 ft amsl)
Local Management Level (95 ft amsl)
Interim Milestone 2027 (117 ft amsl)
Observed
Questionable Measurement
Ground Surface (168 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

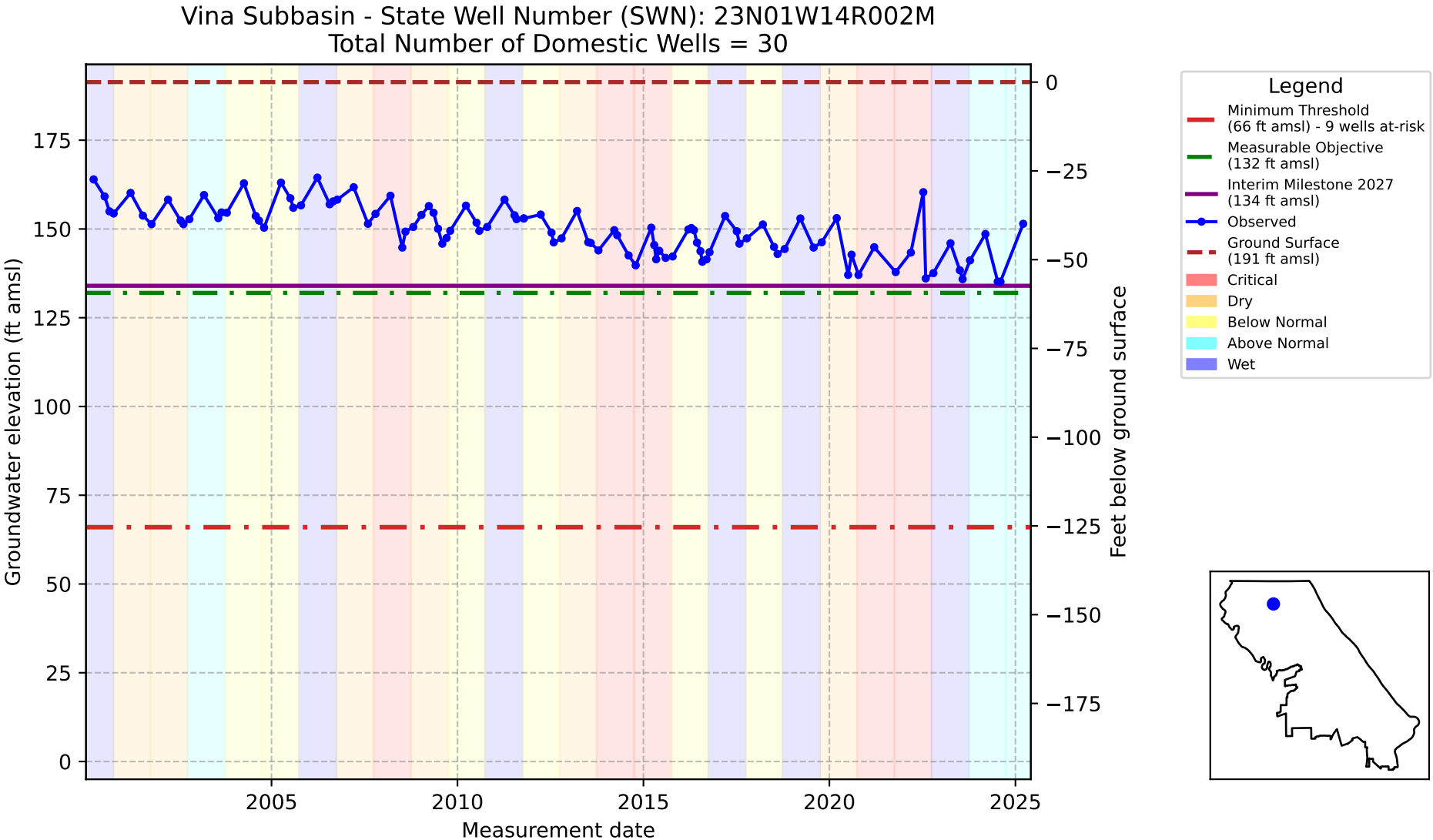

Vina Subbasin - State Well Number (SWN): 22N01W05M001M
Total Number of Domestic Wells = 1
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
Legend
Minimum Threshold (31 ft amsl) - 0 wells at-risk
Measurable Objective (115 ft amsl)
Local Management Level (95 ft amsl)
Interim Milestone 2027 (116 ft amsl)
Observed
Ground Surface (152 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

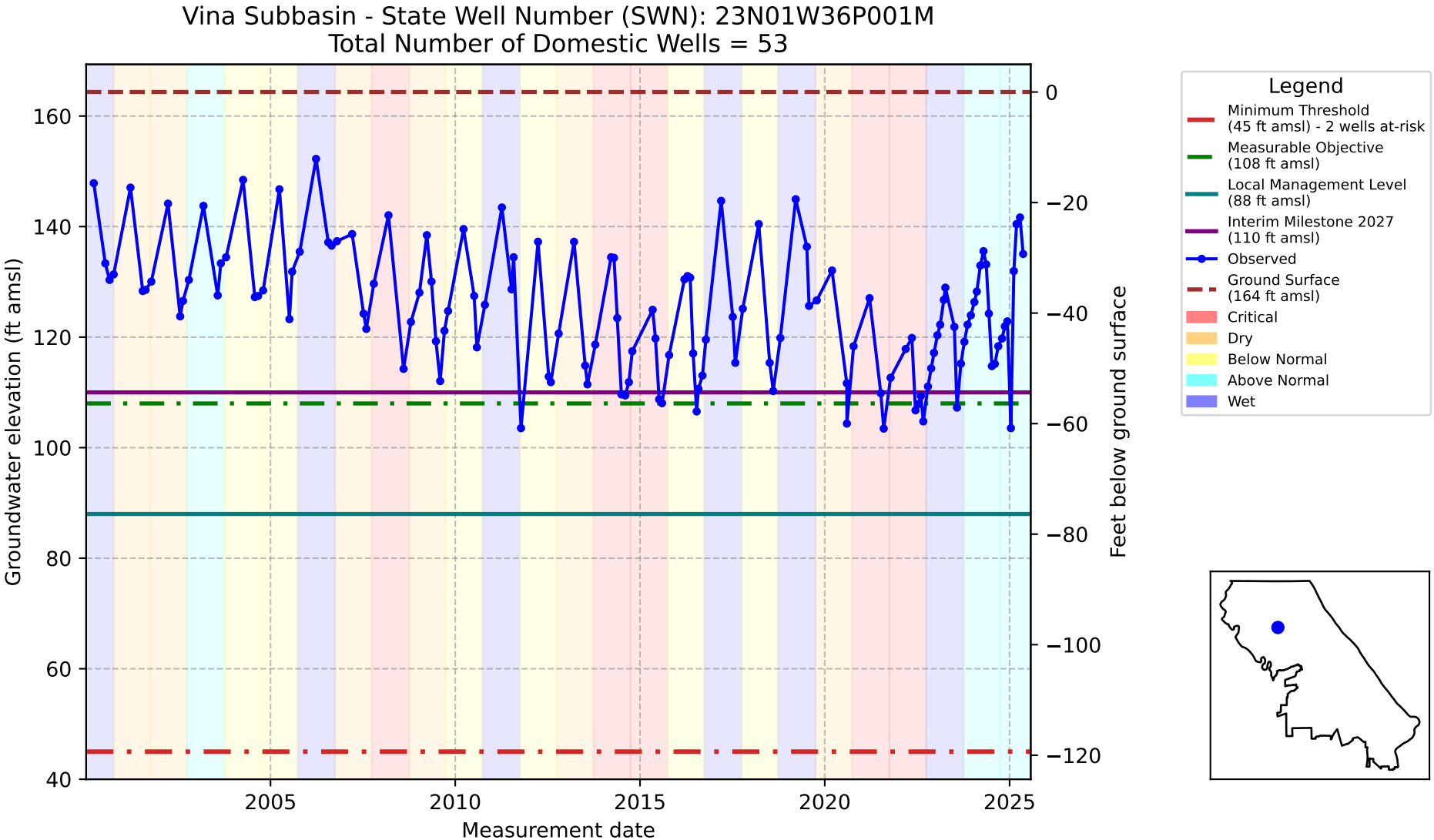

Vina Subbasin - State Well Number (SWN): 23N01W28M004M
Total Number of Domestic Wells = 6
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
Legend
Minimum Threshold (51 ft amsl) - 1 wells at-risk
Measurable Objective (118 ft amsl)
Interim Milestone 2027 (120 ft amsl)
Observed
Ground Surface (159 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

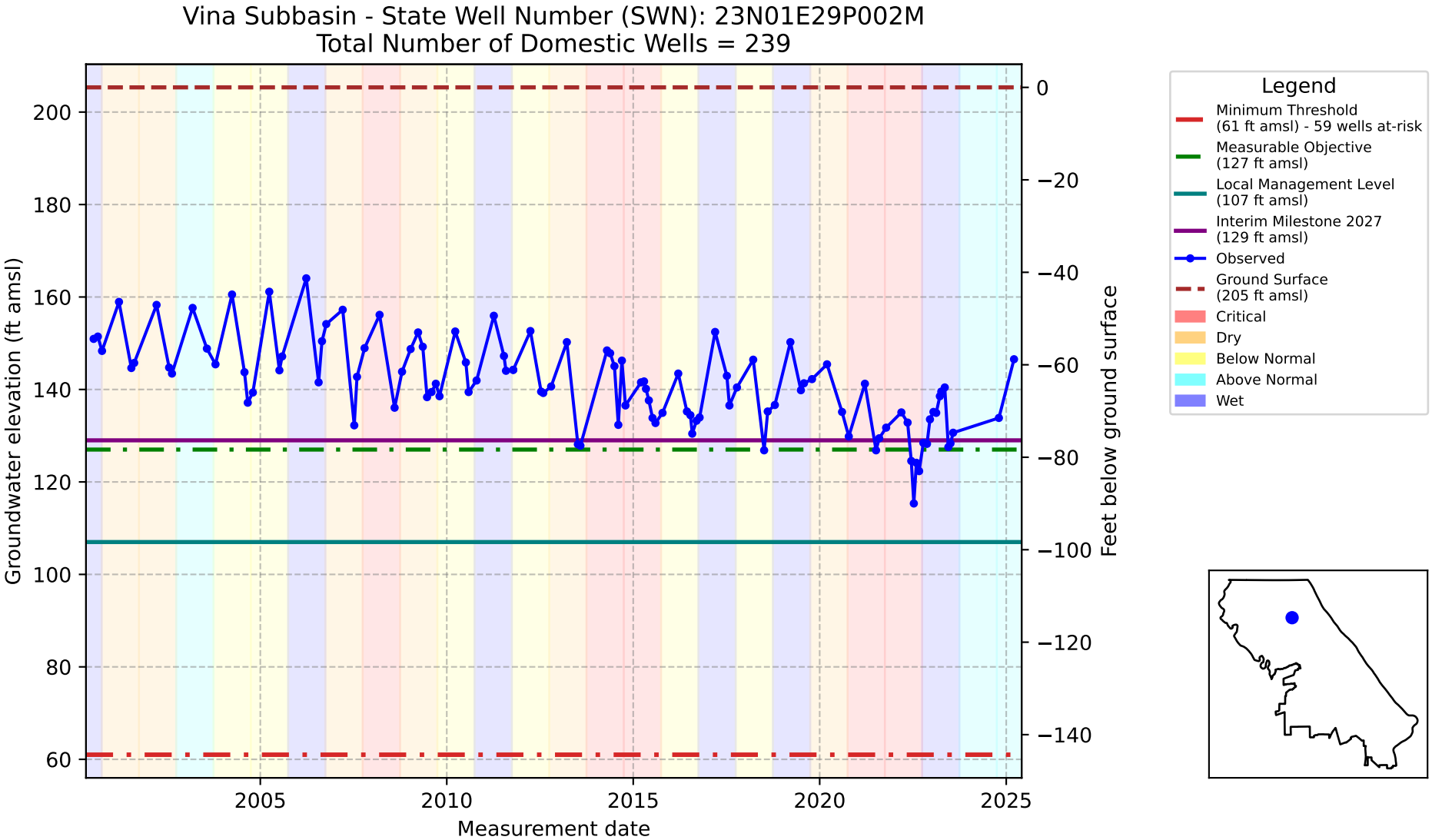

Vina Subbasin - State Well Number (SWN): 23N01W10M001M
Total Number of Domestic Wells = 7
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
175
150
125
100
75
50
25
0
−25
−50
−75
−100
−125
−150
−175
2005
2010
2015
2020
2025
Legend
Minimum Threshold (71 ft amsl) - 0 wells at-risk
Measurable Objective (138 ft amsl)
Interim Milestone 2027 (140 ft amsl)
Observed
Ground Surface (187 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

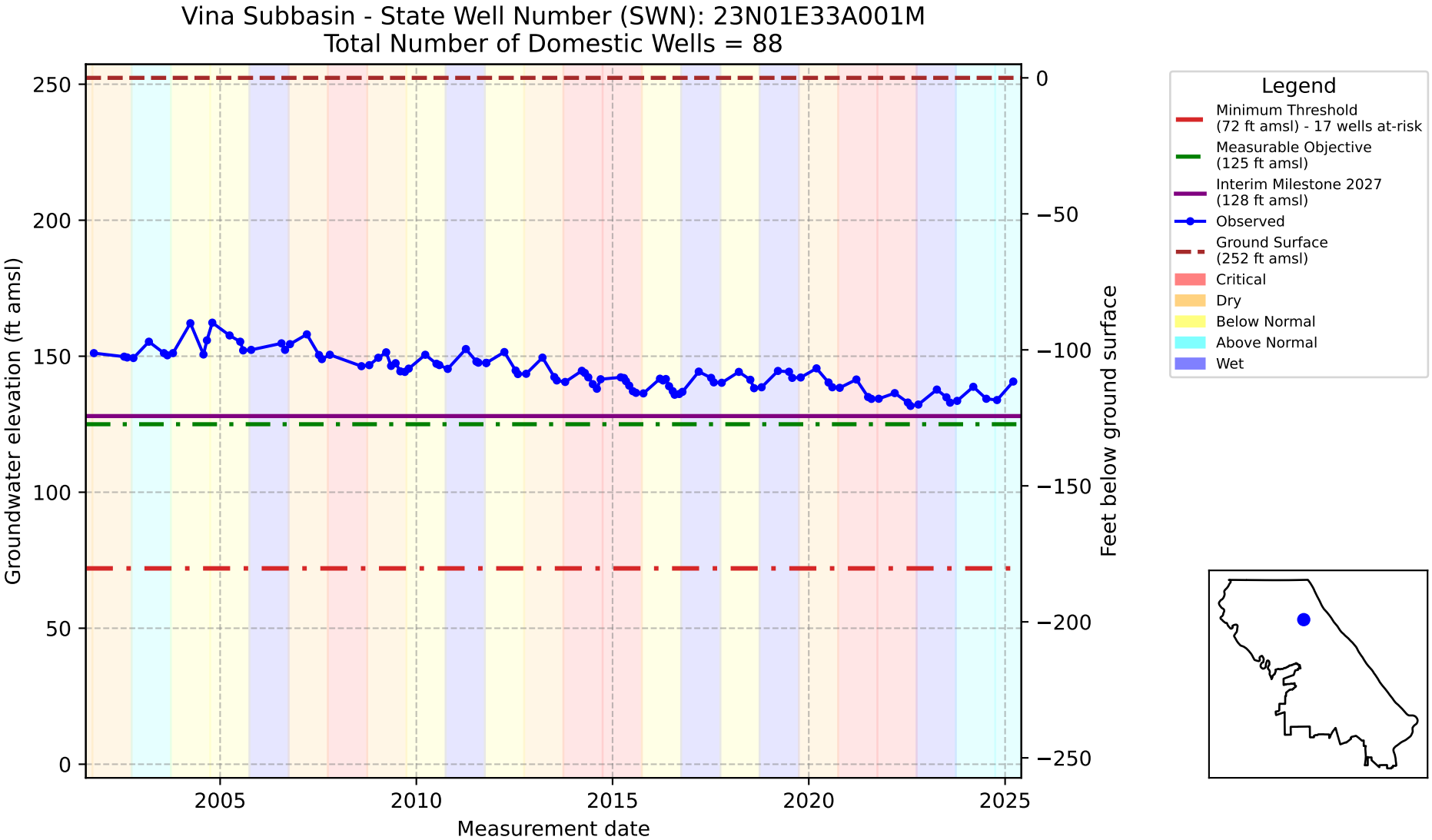

Vina Subbasin - State Well Number (SWN): 23N01W27L001M
Total Number of Domestic Wells = 15
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
160
140
120
100
80
60
0
−20
−40
−60
−80
−100
2005
2010
2015
2020
2025
Legend
Minimum Threshold (55 ft amsl) - 1 wells at-risk
Measurable Objective (121 ft amsl)
Local Management Level (101 ft amsl)
Interim Milestone 2027 (123 ft amsl)
Observed
Ground Surface (162 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

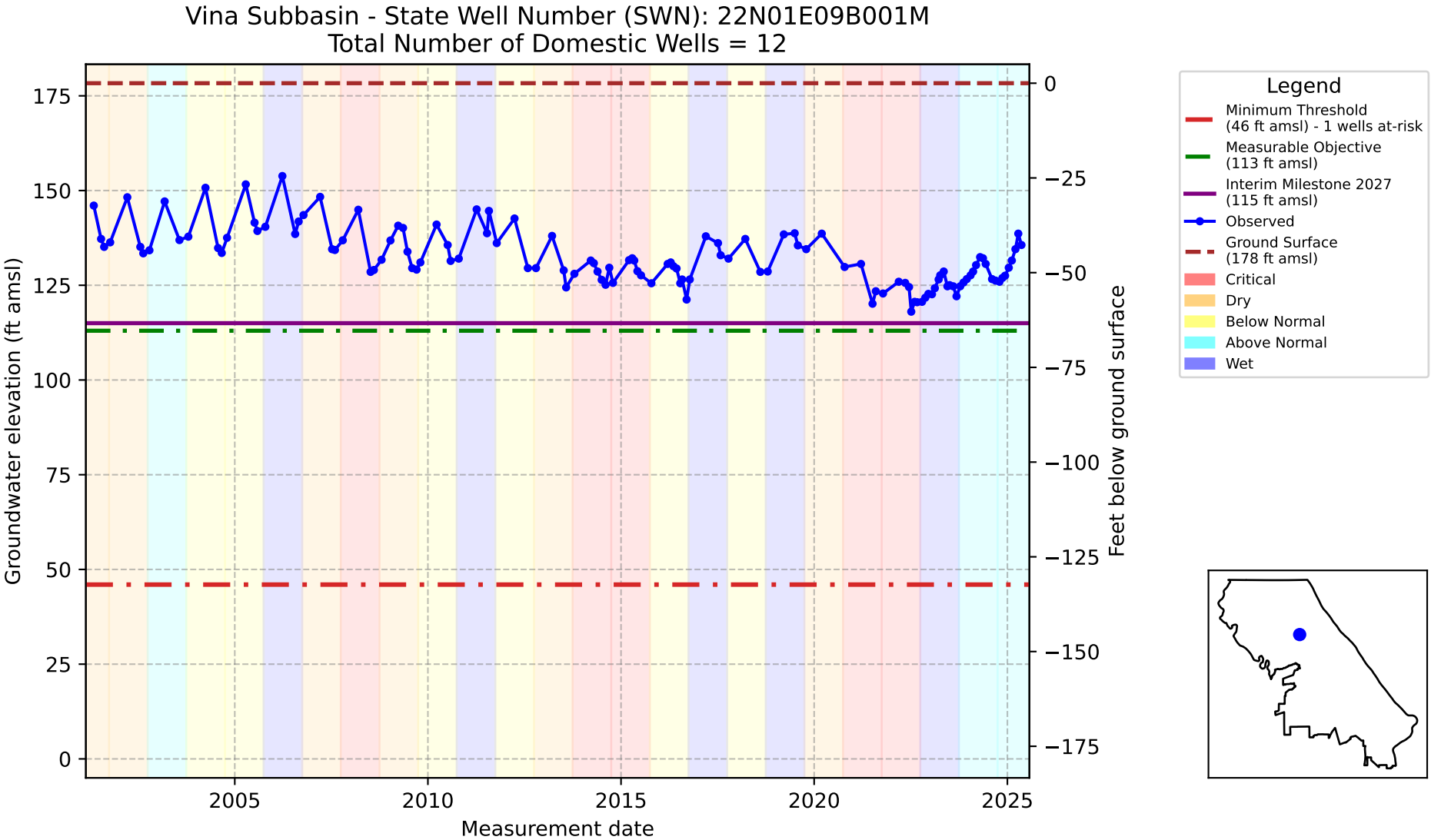

Vina Subbasin - State Well Number (SWN): 23N01E07H001M
Total Number of Domestic Wells = 32
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
0
50
100
150
200
250
−50
−100
−150
−200
−250
2019
2020
2021
2022
2023
2024
2025
Legend
Minimum Threshold (72 ft amsl) - 12 wells at-risk
Measurable Objective (136 ft amsl)
Interim Milestone 2027 (140 ft amsl)
Observed
Ground Surface (282 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

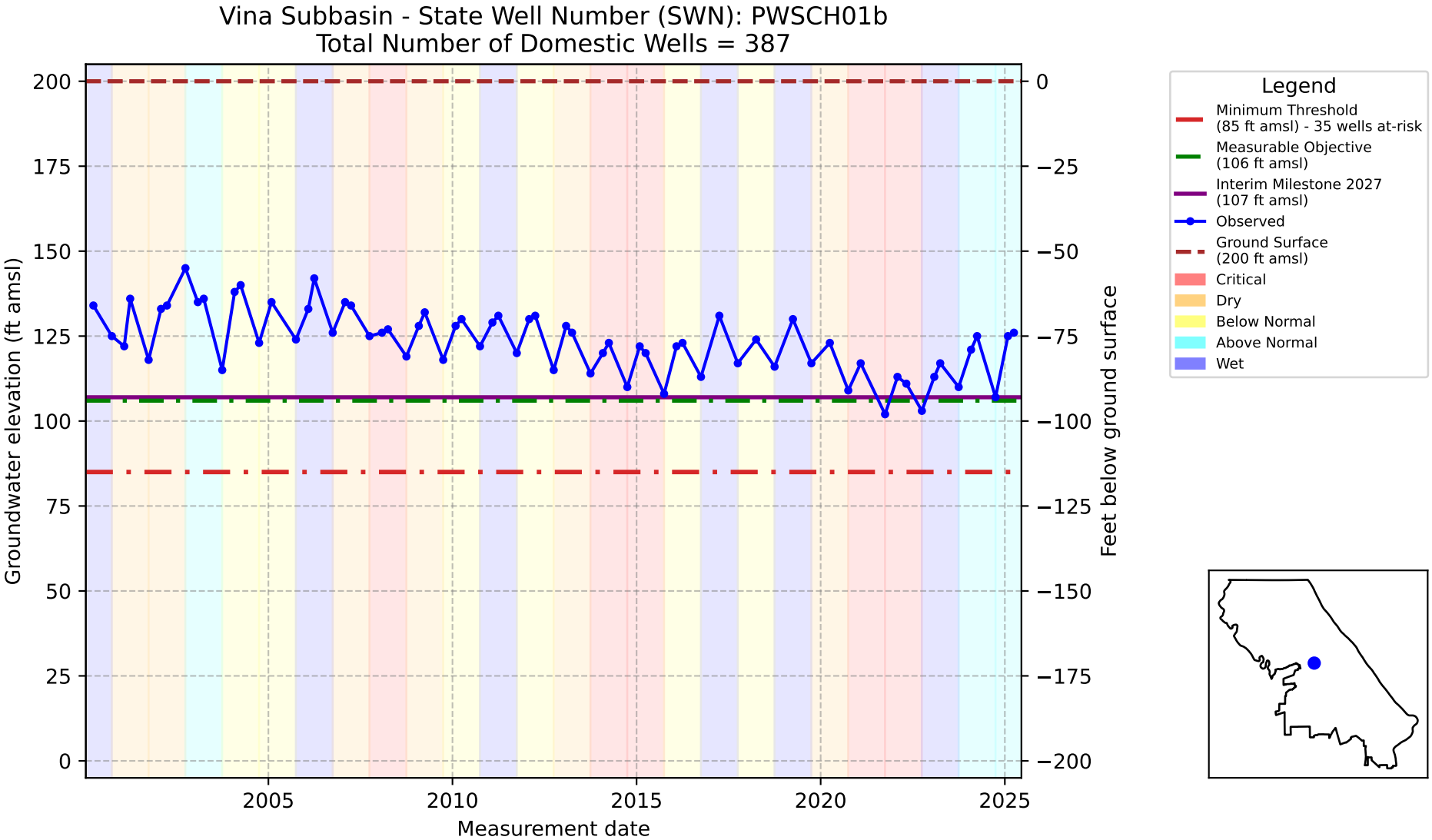

Vina Subbasin - State Well Number (SWN): 23N01W14R002M
Total Number of Domestic Wells = 30
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
Legend
Minimum Threshold (66 ft amsl) - 9 wells at-risk
Measurable Objective (132 ft amsl)
Interim Milestone 2027 (134 ft amsl)
Observed
Ground Surface (191 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

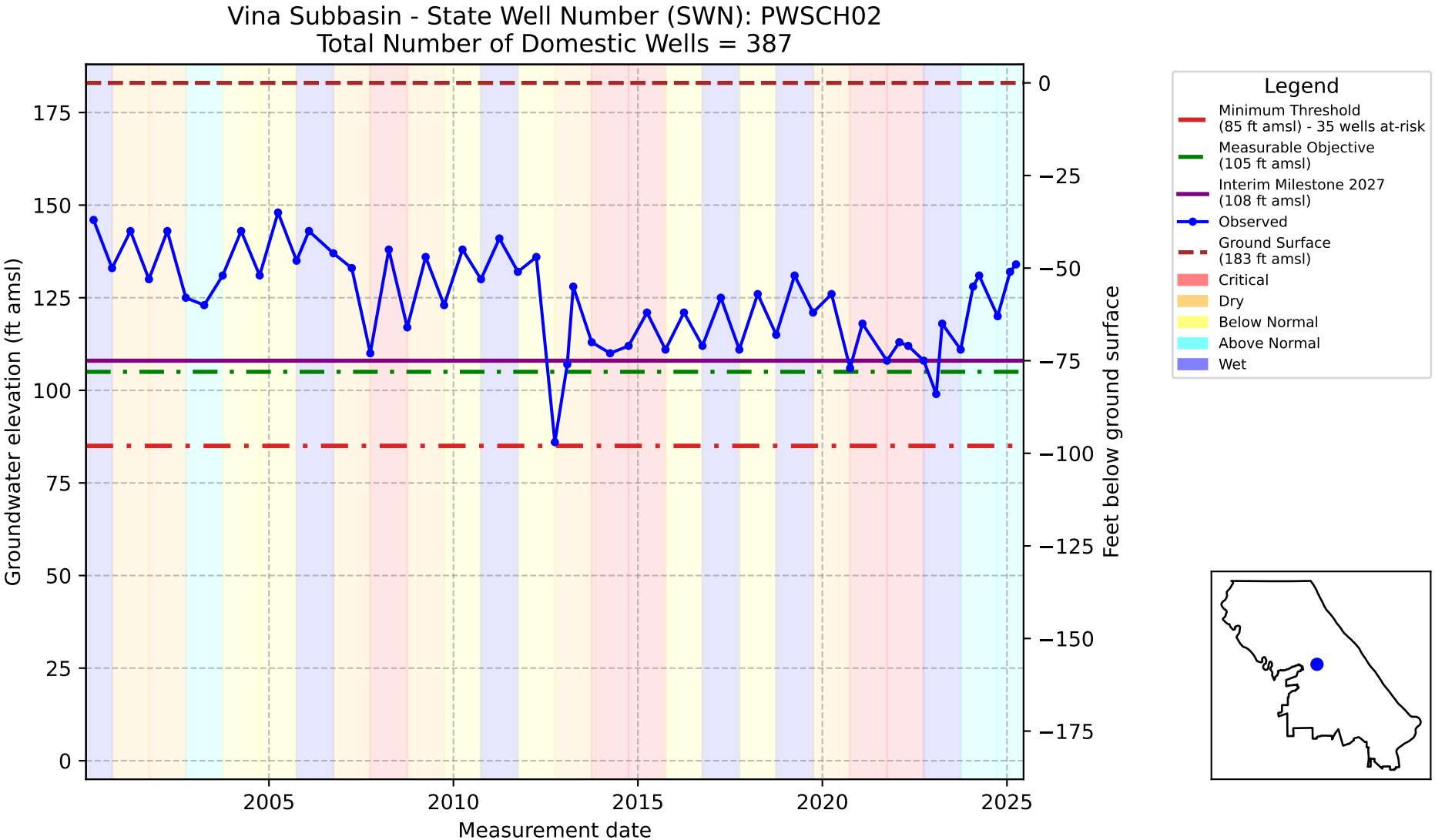

Vina Subbasin - State Well Number (SWN): 23N01W36P001M
Total Number of Domestic Wells = 53
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
Legend
Minimum Threshold (45 ft amsl) - 2 wells at-risk
Measurable Objective (108 ft amsl)
Local Management Level (88 ft amsl)
Interim Milestone 2027 (110 ft amsl)
Observed
Ground Surface (164 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

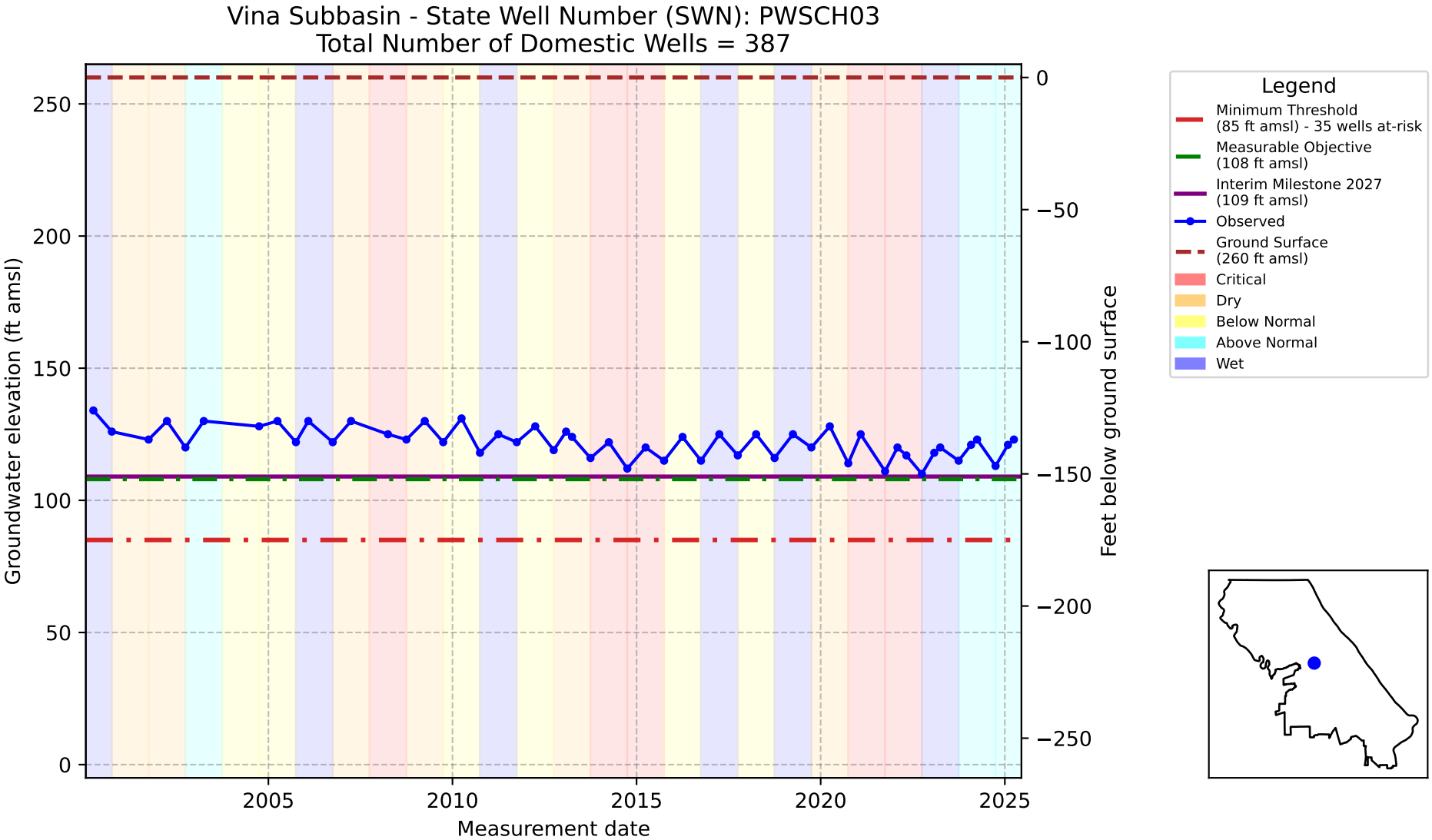

Vina Subbasin - State Well Number (SWN): 23N01E29P002M
Total Number of Domestic Wells = 239
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
Legend
Minimum Threshold (61 ft amsl) - 59 wells at-risk
Measurable Objective (127 ft amsl)
Local Management Level (107 ft amsl)
Interim Milestone 2027 (129 ft amsl)
Observed
Ground Surface (205 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

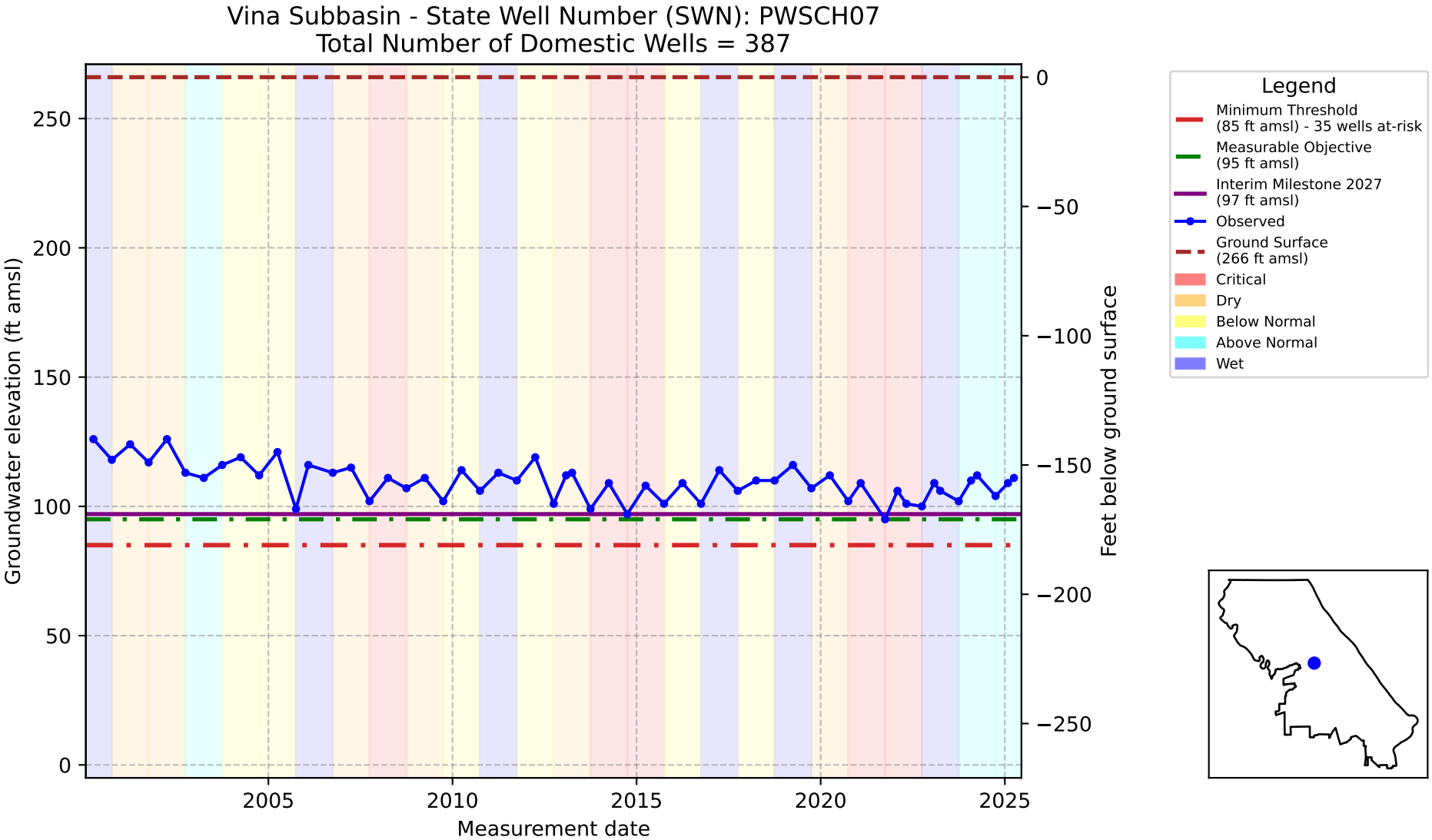

Vina Subbasin - State Well Number (SWN): 23N01E33A001M
Total Number of Domestic Wells = 88
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
250
200
150
100
50
0
−50
−100
−150
−200
−250
2005
2010
2015
2020
2025
Legend
Minimum Threshold (72 ft amsl) - 17 wells at-risk
Measurable Objective (125 ft amsl)
Interim Milestone 2027 (128 ft amsl)
Observed
Ground Surface (252 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

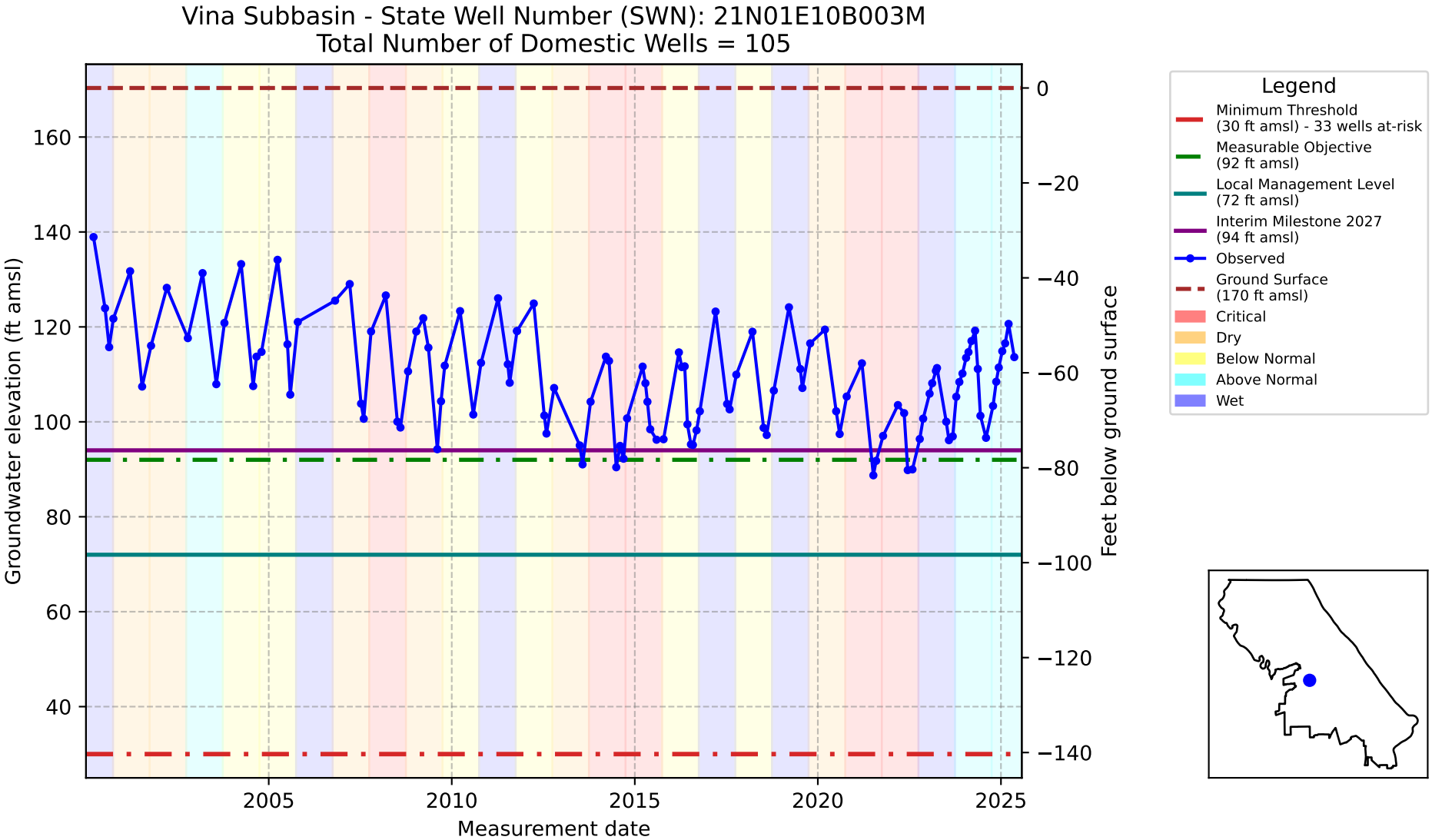

Vina Subbasin - State Well Number (SWN): 22N01E09B001M
Total Number of Domestic Wells = 12
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
175
150
125
100
75
50
25
0
−25
−50
−75
−100
−125
−150
−175
2005
2010
2015
2020
2025
Legend
Minimum Threshold (46 ft amsl) - 1 wells at-risk
Measurable Objective (113 ft amsl)
Interim Milestone 2027 (115 ft amsl)
Observed
Ground Surface (178 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

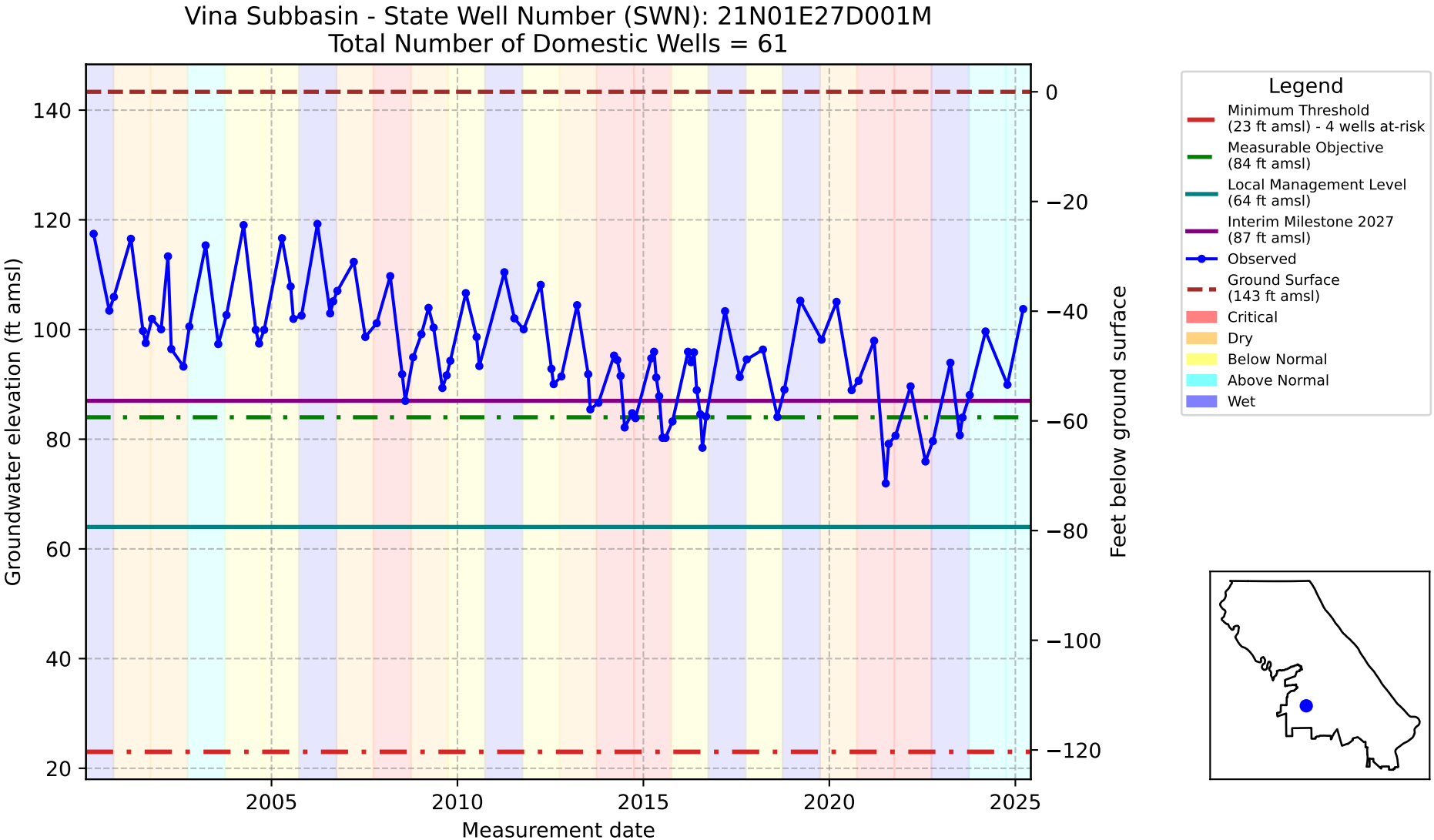

Vina Subbasin - State Well Number (SWN): PWSCH01b
Total Number of Domestic Wells = 387
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
200
175
150
125
100
75
50
25
0
−25
−50
−75
−100
−125
−150
−175
−200
2005
2010
2015
2020
2025
Legend
Minimum Threshold (85 ft amsl) - 35 wells at-risk
Measurable Objective (106 ft amsl)
Interim Milestone 2027 (107 ft amsl)
Observed
Ground Surface (200 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

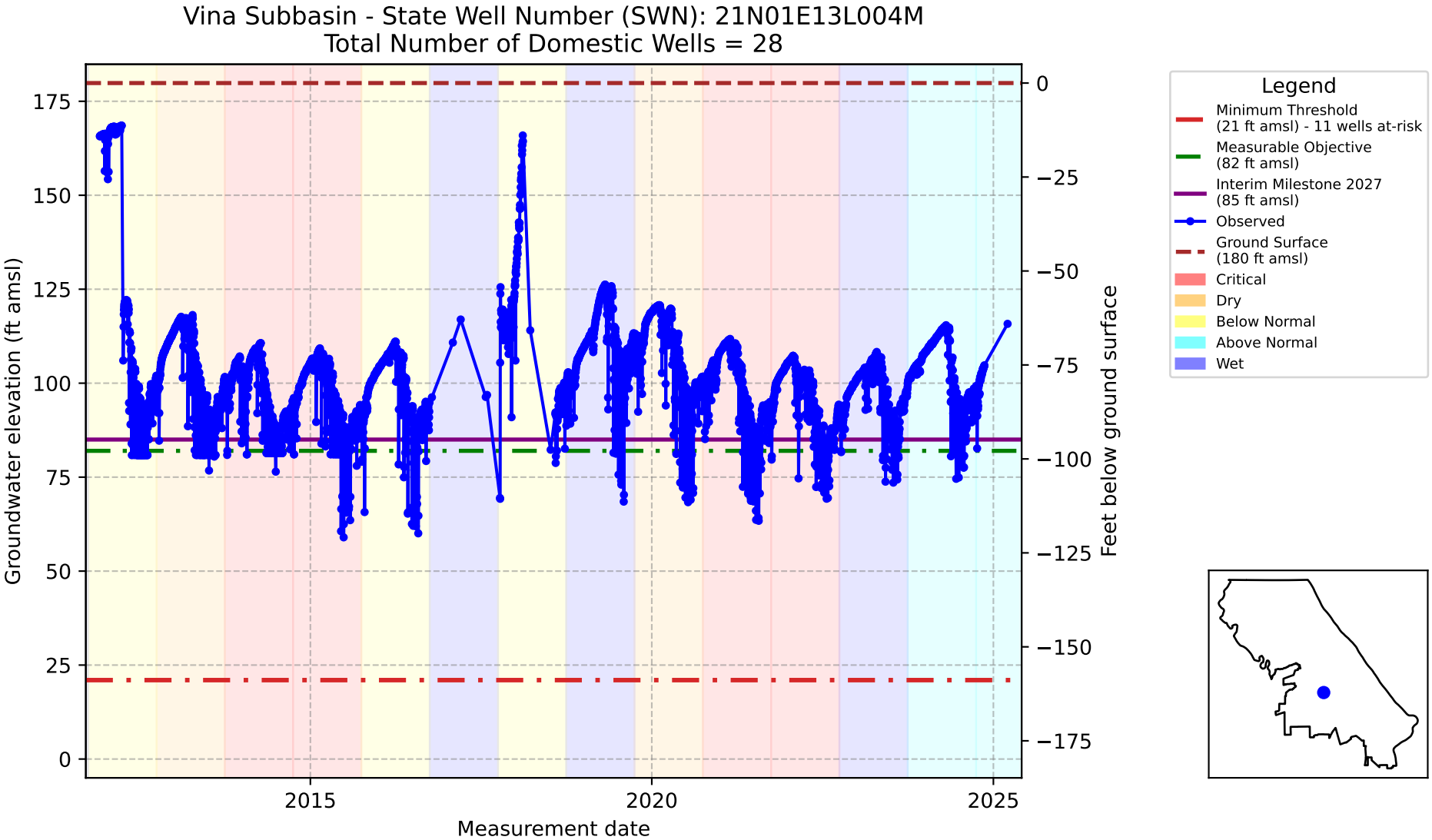

Vina Subbasin - State Well Number (SWN): PWSCH02
Total Number of Domestic Wells = 387
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
175
150
125
100
75
50
25
0
−25
−50
−75
−100
−125
−150
−175
2005
2010
2015
2020
2025
Legend
Minimum Threshold (85 ft amsl) - 35 wells at-risk
Measurable Objective (105 ft amsl)
Interim Milestone 2027 (108 ft amsl)
Observed
Ground Surface (183 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

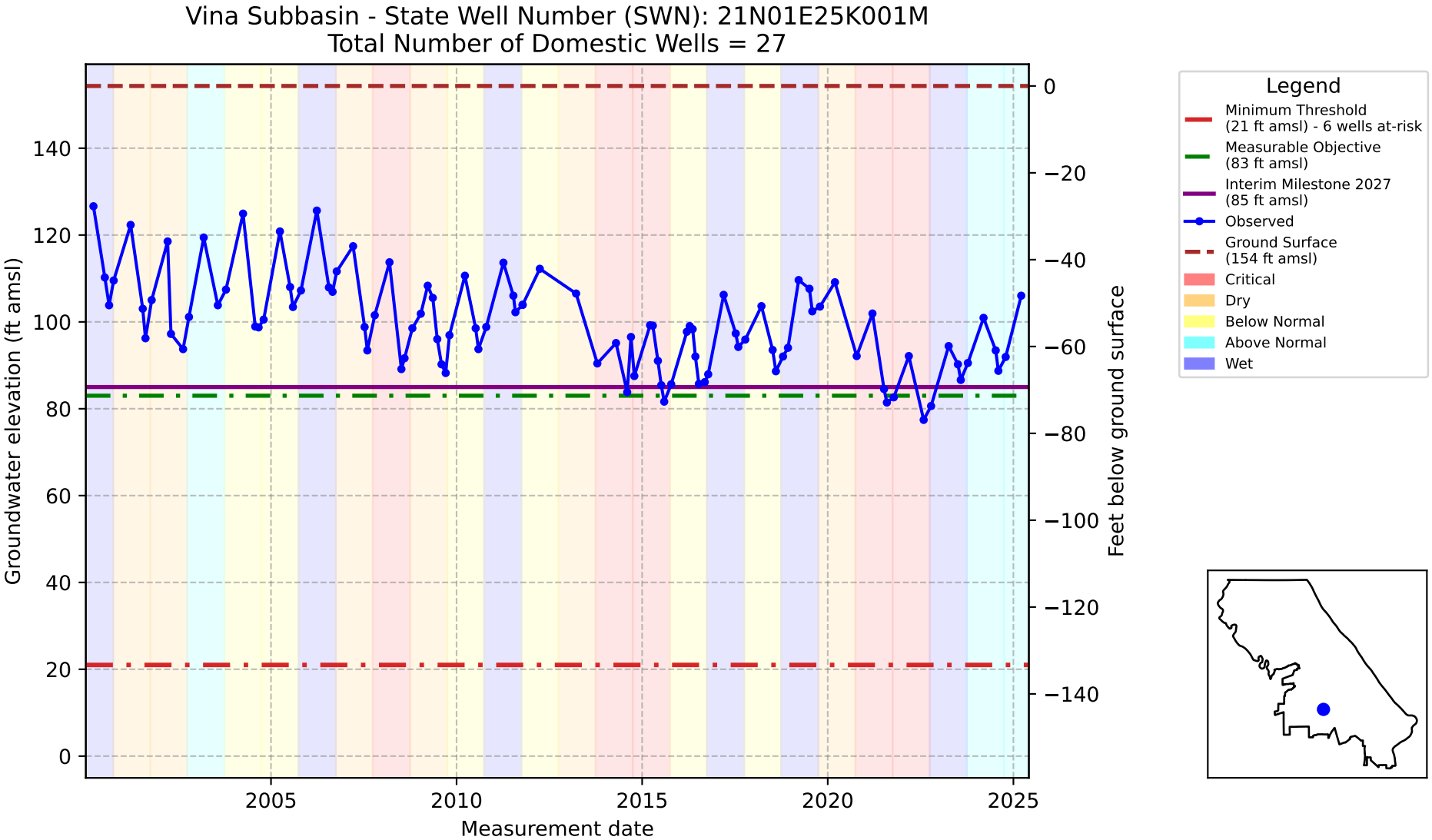

Vina Subbasin - State Well Number (SWN): PWSCH03
Total Number of Domestic Wells = 387
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
250
200
150
100
50
0
0
−50
−100
−150
−200
−250
2005
2010
2015
2020
2025
Legend
Minimum Threshold (85 ft amsl) - 35 wells at-risk
Measurable Objective (108 ft amsl)
Interim Milestone 2027 (109 ft amsl)
Observed
Ground Surface (260 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

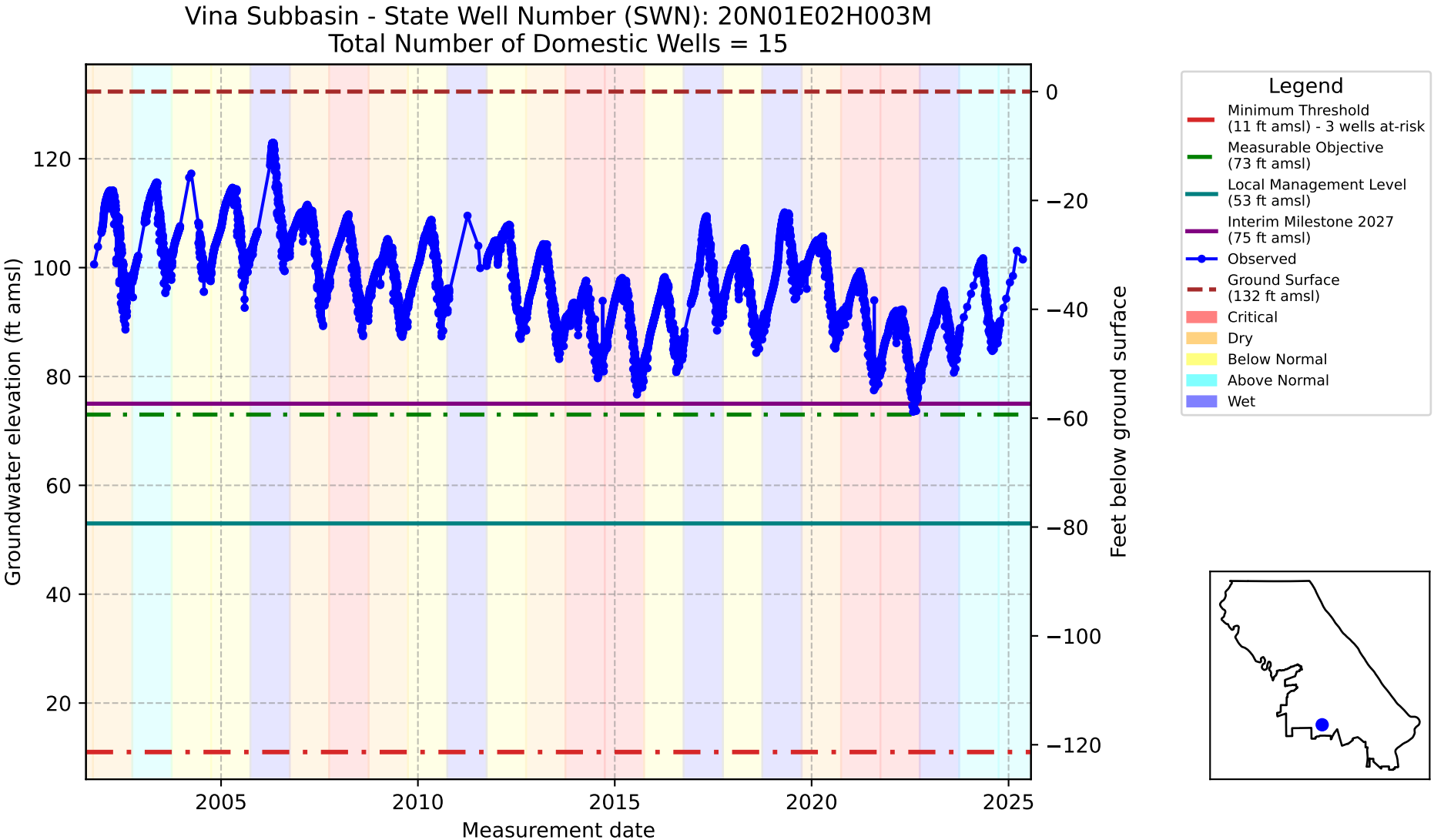

Vina Subbasin - State Well Number (SWN): PWSCH07
Total Number of Domestic Wells = 387
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
250
200
150
100
50
0
−50
−100
−150
−200
−250
2005
2010
2015
2020
2025
Legend
Minimum Threshold (85 ft amsl) - 35 wells at-risk
Measurable Objective (95 ft amsl)
Interim Milestone 2027 (97 ft amsl)
Observed
Ground Surface (266 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

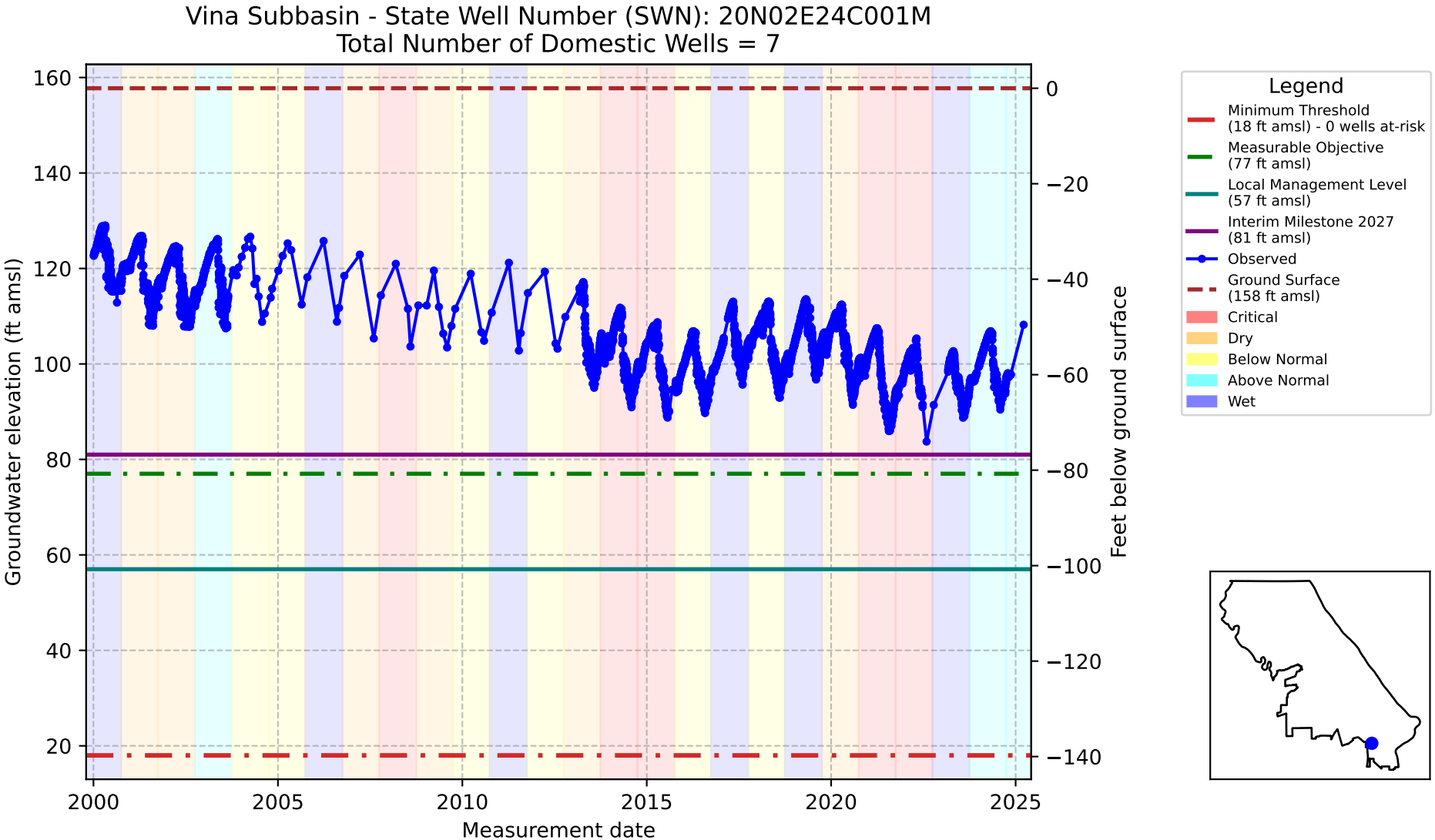

Vina Subbasin - State Well Number (SWN): 21N01E10B003M
Total Number of Domestic Wells = 105
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
160
140
120
100
80
60
40
0
−20
−40
−60
−80
−100
−120
−140
2005
2010
2015
2020
2025
Legend
Minimum Threshold (30 ft amsl) - 33 wells at-risk
Measurable Objective (92 ft amsl)
Local Management Level (72 ft amsl)
Interim Milestone 2027 (94 ft amsl)
Observed
Ground Surface (170 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

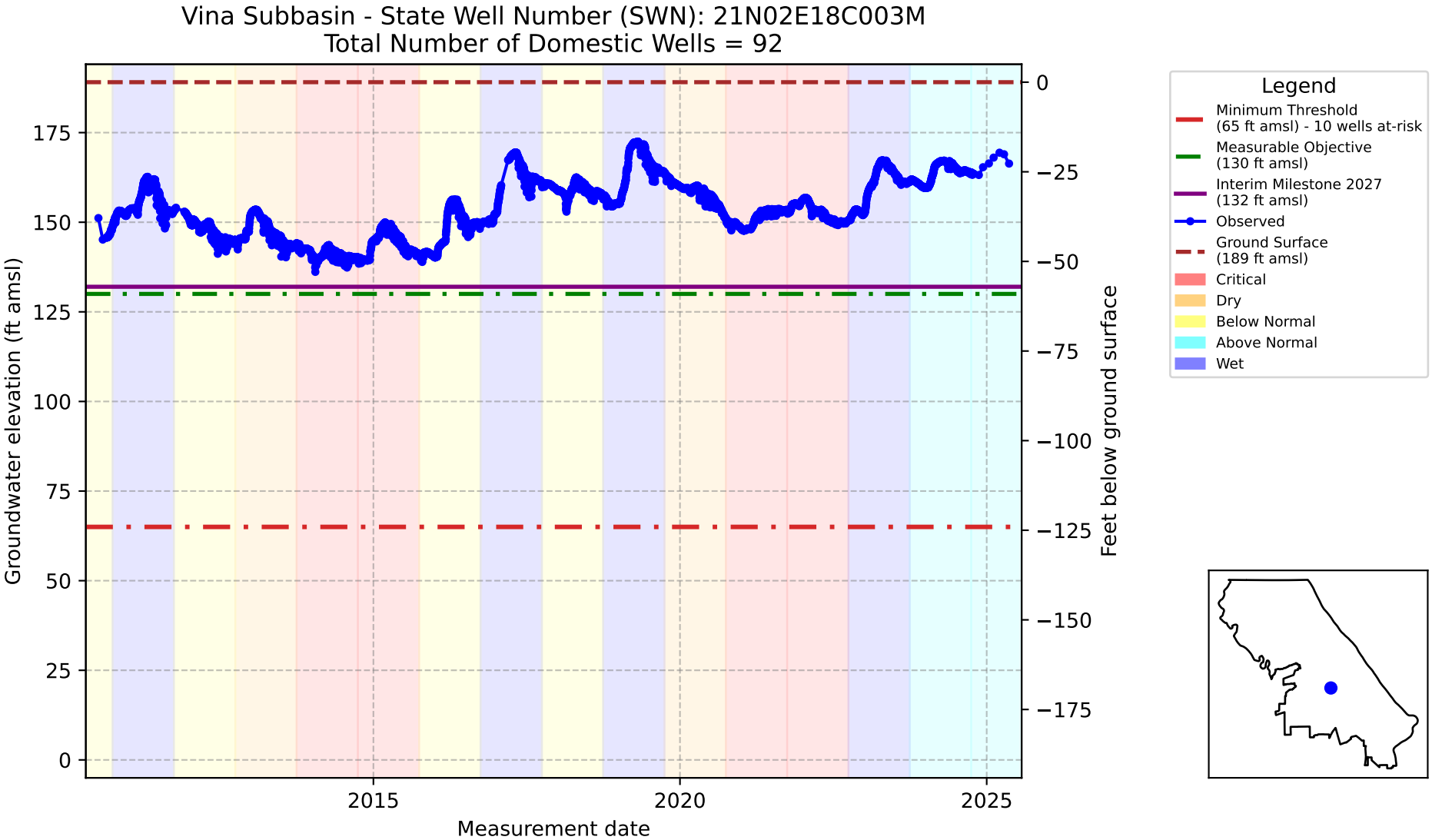

Vina Subbasin - State Well Number (SWN): 21N01E27D001M
Total Number of Domestic Wells = 61
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
140
120
100
80
60
40
20
0
−20
−40
−60
−80
−100
−120
2005
2010
2015
2020
2025
Legend
Minimum Threshold (23 ft amsl) - 4 wells at-risk
Measurable Objective (84 ft amsl)
Local Management Level (64 ft amsl)
Interim Milestone 2027 (87 ft amsl)
Observed
Ground Surface (143 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

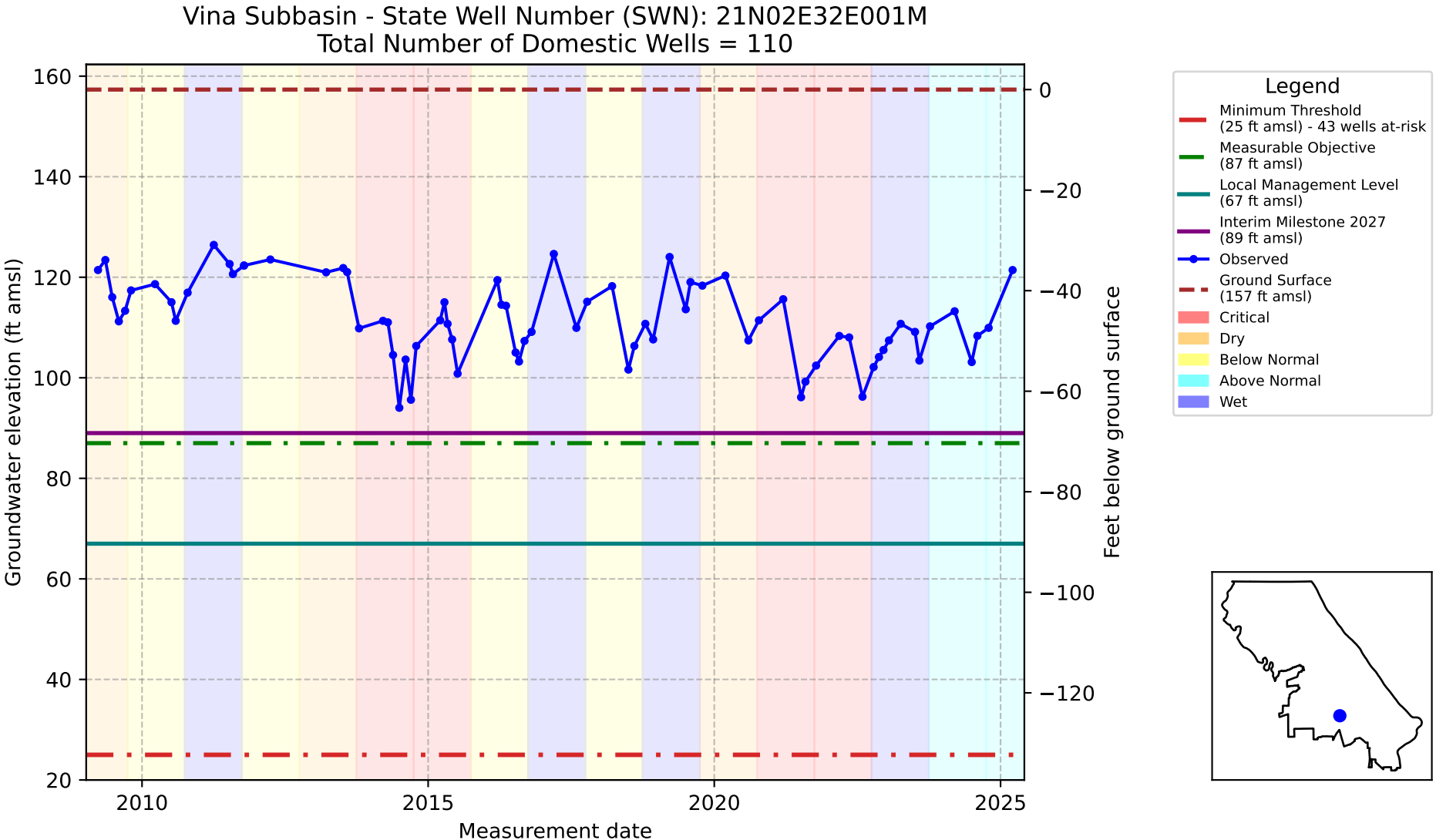

Vina Subbasin - State Well Number (SWN): 21N01E13L004M
Total Number of Domestic Wells = 28
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
175
150
125
100
75
50
25
0
−25
−50
−75
−100
−125
−150
−175
2015
2020
2025
Legend
Minimum Threshold (21 ft amsl) - 11 wells at-risk
Measurable Objective (82 ft amsl)
Interim Milestone 2027 (85 ft amsl)
Observed
Ground Surface (180 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

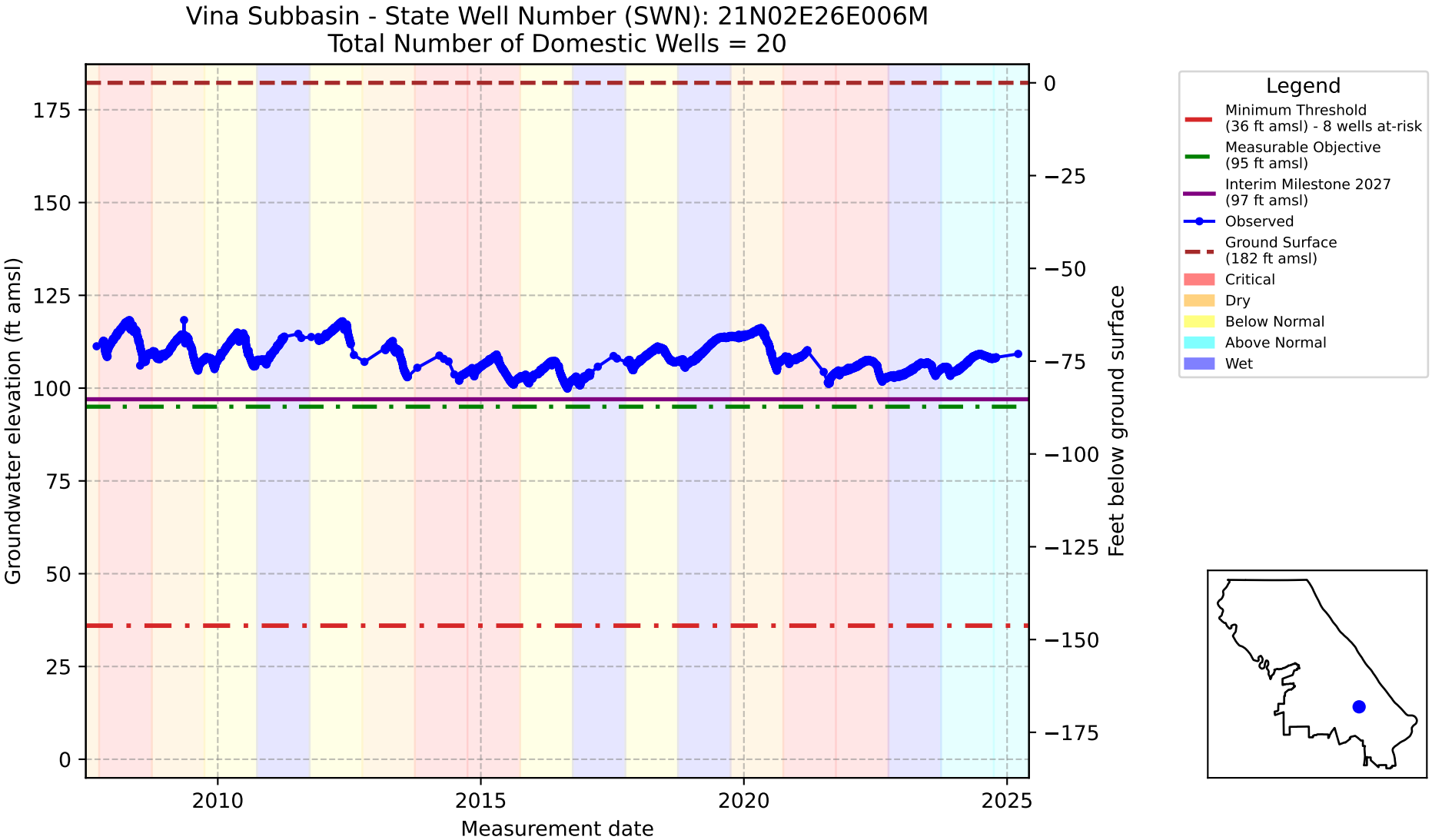

Vina Subbasin - State Well Number (SWN): 21N01E25K001M
Total Number of Domestic Wells = 27
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
Legend
Minimum Threshold (21 ft amsl) - 6 wells at-risk
Measurable Objective (83 ft amsl)
Interim Milestone 2027 (85 ft amsl)
Observed
Ground Surface (154 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

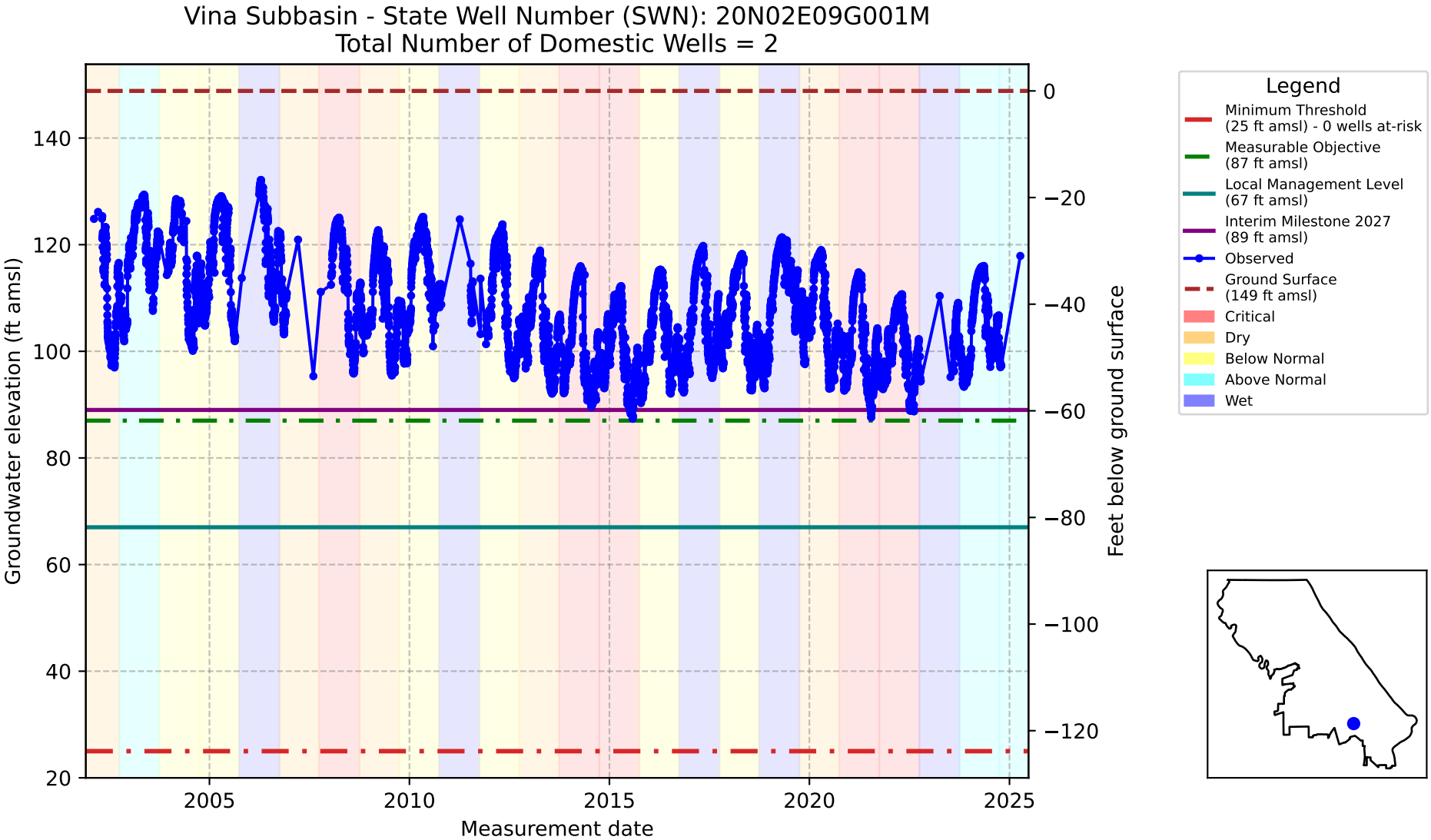

Vina Subbasin - State Well Number (SWN): 20N01E02H003M
Total Number of Domestic Wells = 15
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
Legend
Minimum Threshold (11 ft amsl) - 3 wells at-risk
Measurable Objective (73 ft amsl)
Local Management Level (53 ft amsl)
Interim Milestone 2027 (75 ft amsl)
Observed
Ground Surface (132 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

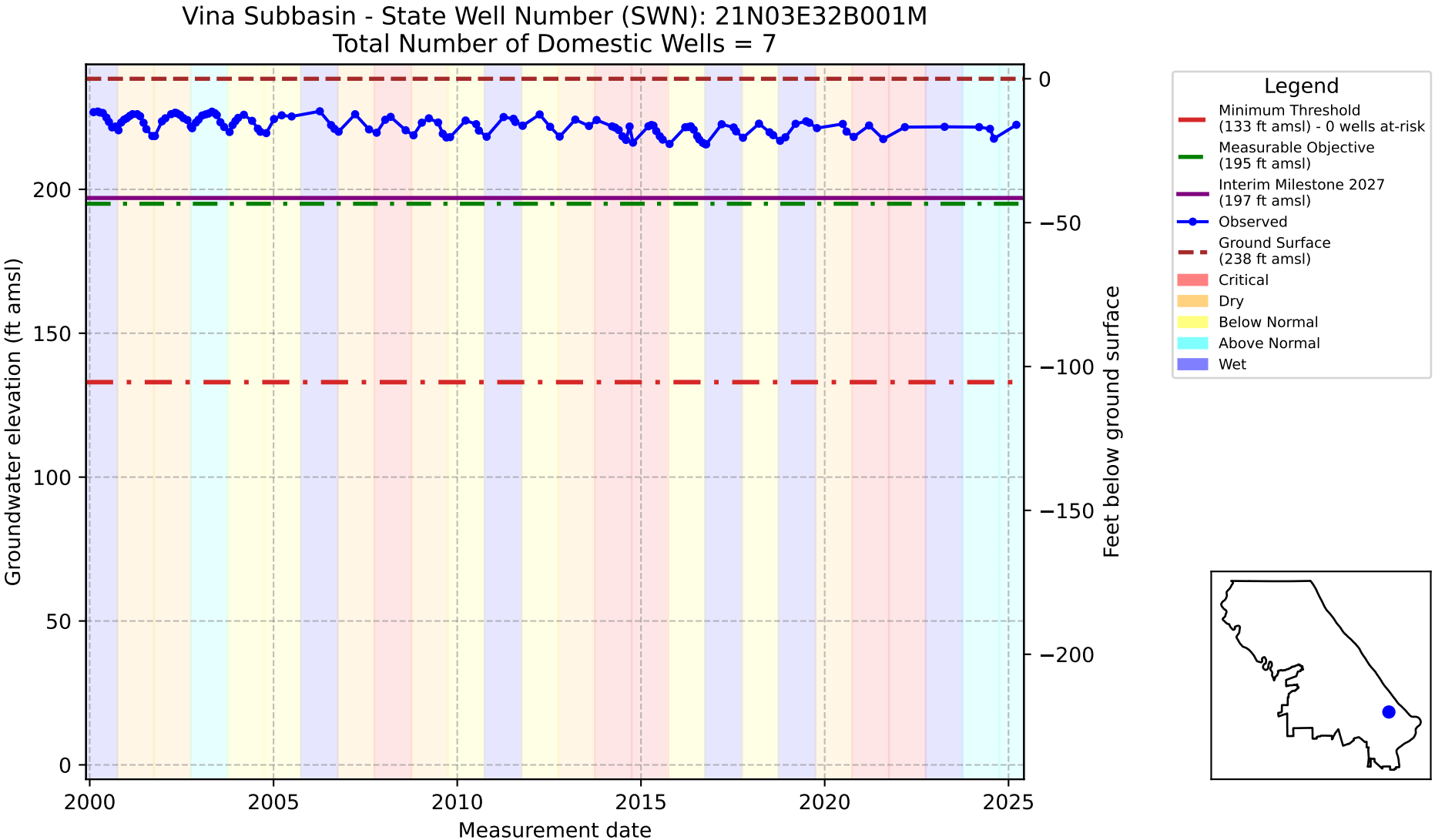

Vina Subbasin - State Well Number (SWN): 20N02E24C001M
Total Number of Domestic Wells = 7
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
Legend
Minimum Threshold (18 ft amsl) - 0 wells at-risk
Measurable Objective (77 ft amsl)
Local Management Level (57 ft amsl)
Interim Milestone 2027 (81 ft amsl)
Observed
Ground Surface (158 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

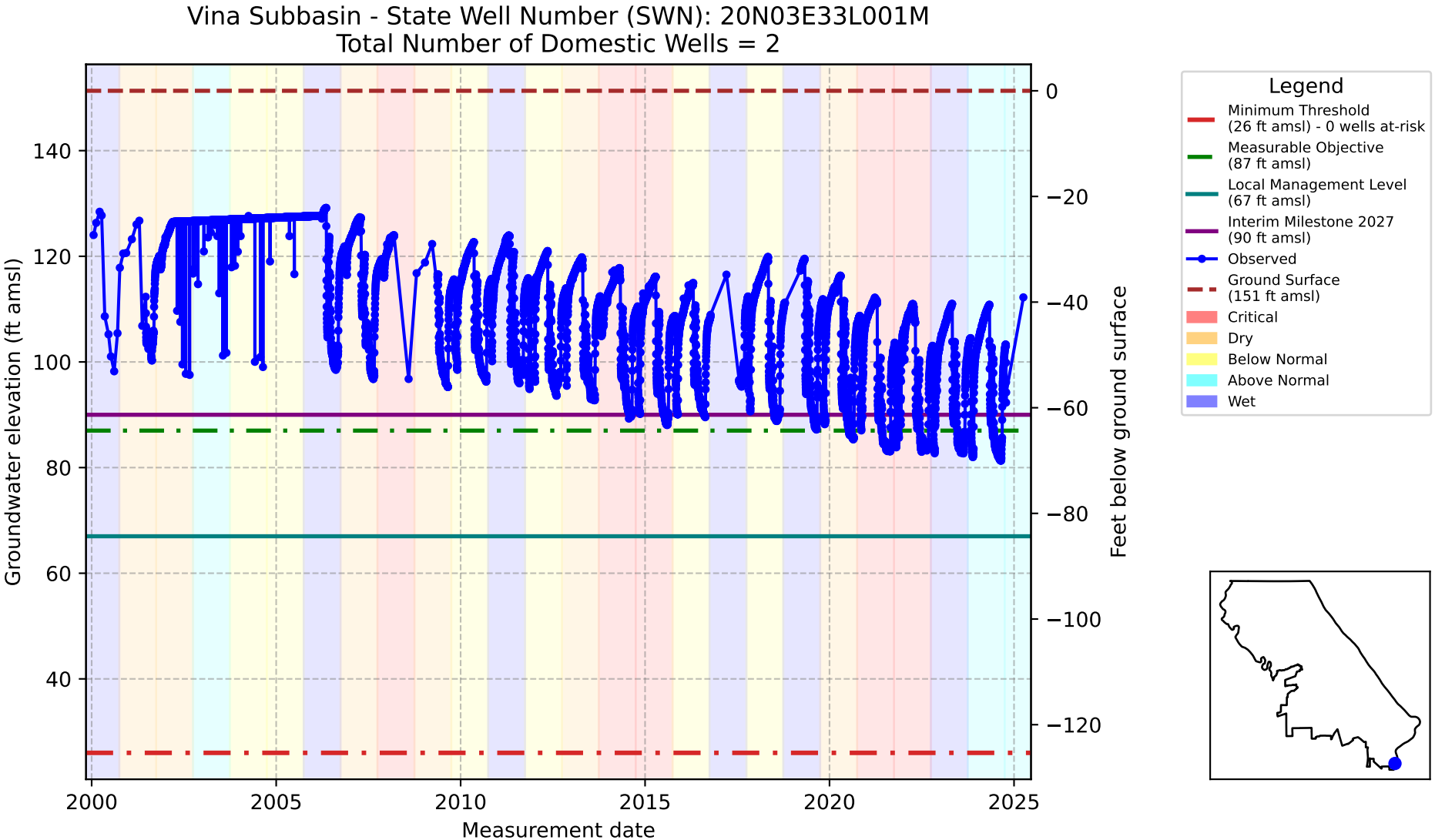

Vina Subbasin - State Well Number (SWN): 21N02E18C003M
Total Number of Domestic Wells = 92
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
0
25
50
75
100
125
150
175
−25
−50
−75
−100
−125
−150
−175
2015
2020
2025
Legend
Minimum Threshold (65 ft amsl) - 10 wells at-risk
Measurable Objective (130 ft amsl)
Interim Milestone 2027 (132 ft amsl)
Observed
Ground Surface (189 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet


Vina Subbasin - State Well Number (SWN): 21N02E32E001M
Total Number of Domestic Wells = 110
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
−100
−120
2010
2015
2020
2025
Legend
Minimum Threshold (25 ft amsl) - 43 wells at-risk
Measurable Objective (87 ft amsl)
Local Management Level (67 ft amsl)
Interim Milestone 2027 (89 ft amsl)
Observed
Ground Surface (157 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

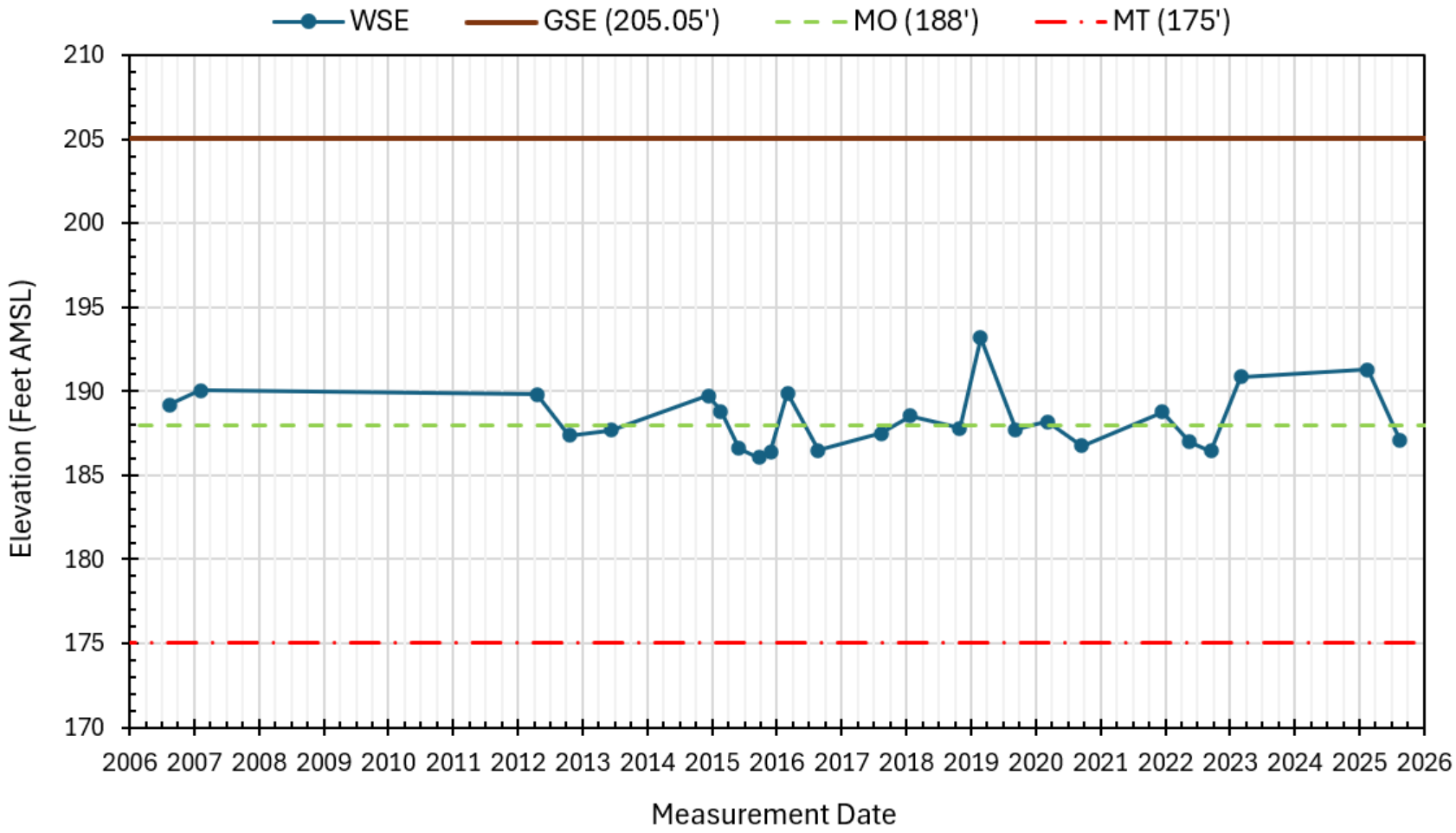

Vina Subbasin - State Well Number (SWN): 21N02E26E006M
Total Number of Domestic Wells = 20
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
175
150
125
100
75
50
25
0
−25
−50
−75
−100
−125
−150
−175
2010
2015
2020
2025
Legend
Minimum Threshold (36 ft amsl) - 8 wells at-risk
Measurable Objective (95 ft amsl)
Interim Milestone 2027 (97 ft amsl)
Observed
Ground Surface (182 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet


Vina Subbasin - State Well Number (SWN): 20N02E09G001M
Total Number of Domestic Wells = 2
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
Legend
Minimum Threshold (25 ft amsl) - 0 wells at-risk
Measurable Objective (87 ft amsl)
Local Management Level (67 ft amsl)
Interim Milestone 2027 (89 ft amsl)
Observed
Ground Surface (149 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

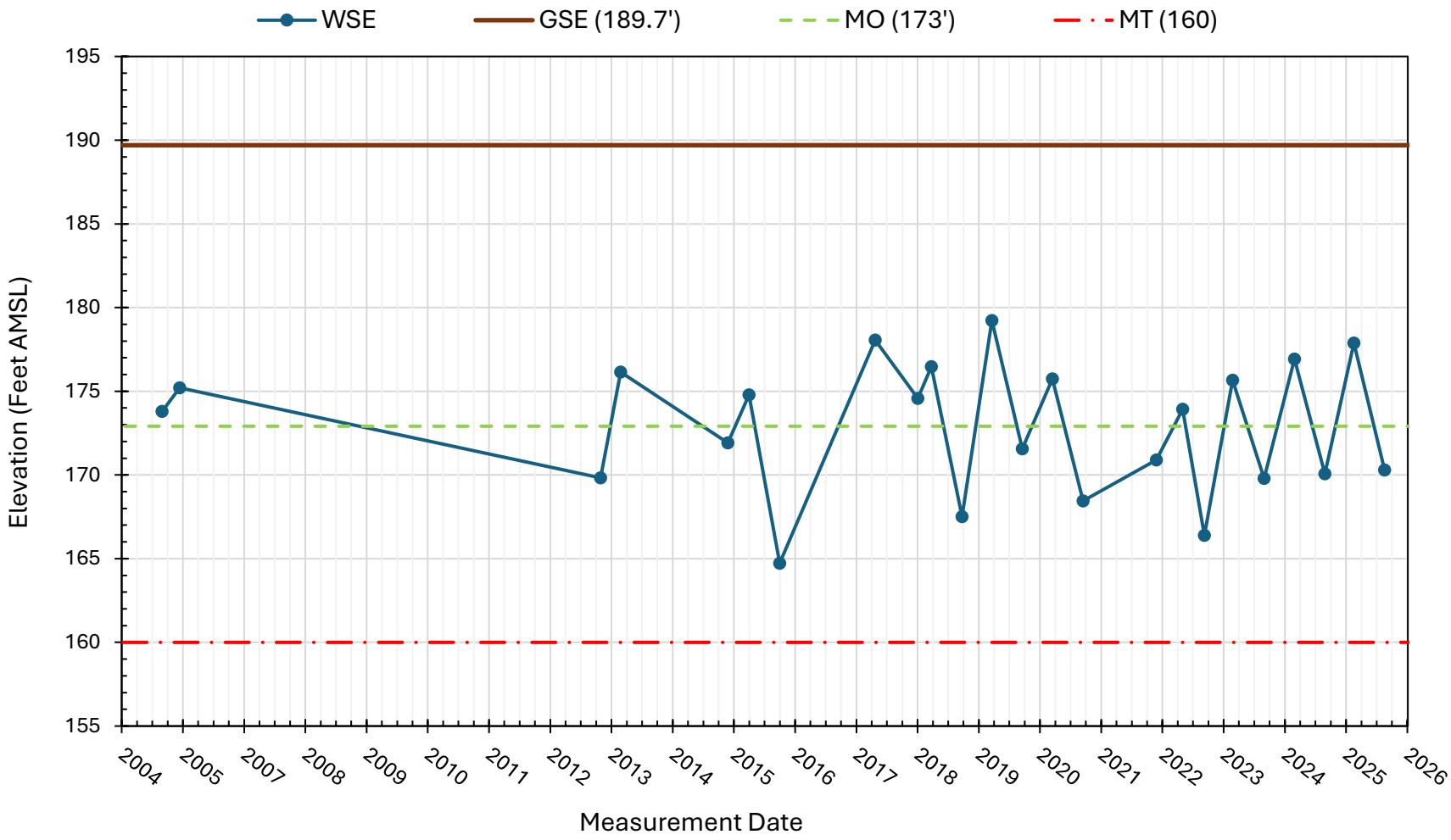

Vina Subbasin - State Well Number (SWN): 21N03E32B001M
Total Number of Domestic Wells = 7
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
0
50
100
150
200
0
−50
−100
−150
−200
2000
2005
2010
2015
2020
2025
Legend
Minimum Threshold (133 ft amsl) - 0 wells at-risk
Measurable Objective (195 ft amsl)
Interim Milestone 2027 (197 ft amsl)
Observed
Ground Surface (238 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet


Vina Subbasin - State Well Number (SWN): 20N03E33L001M
Total Number of Domestic Wells = 2
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
Legend
Minimum Threshold (26 ft amsl) - 0 wells at-risk
Measurable Objective (87 ft amsl)
Local Management Level (67 ft amsl)
Interim Milestone 2027 (90 ft amsl)
Observed
Ground Surface (151 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

CMW-102A


WSE
GSE (205.05')
MO (188')
MT (175')
Elevation (Feet AMSL)
210
205
200
195
190
185
180
175
170
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026
Measurement Date

SWMW-06A


WSE
GSE (189.7')
MO (173')
MT (160)
Elevation (Feet AMSL)
195
190
185
180
175
170
165
160
155
2004
2005
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Measurement Date

APPENDIX 6-A

Northern Sacramento Valley Inter-basin Coordination Report

Northern Sacramento Valley Inter-basin Coordination Report

Antelope | Bowman | Butte | Colusa | Corning | Los Molinos | Red Bluff | Sutter | Vina | Wyandotte Creek | Yolo

Table of Contents

Glossary of Acronyms ***1***

1. Introduction & Background ***2***

2. Intent & Purpose ***3***

3. Evolution of Inter-basin Coordination Efforts ***4***

4. Inter-basin Coordination Framework ***6***

4.1. Inter-basin Coordination Groups **7**

5. Conclusion and Next Steps ***8***

Appendices ***9***

Glossary of Acronyms

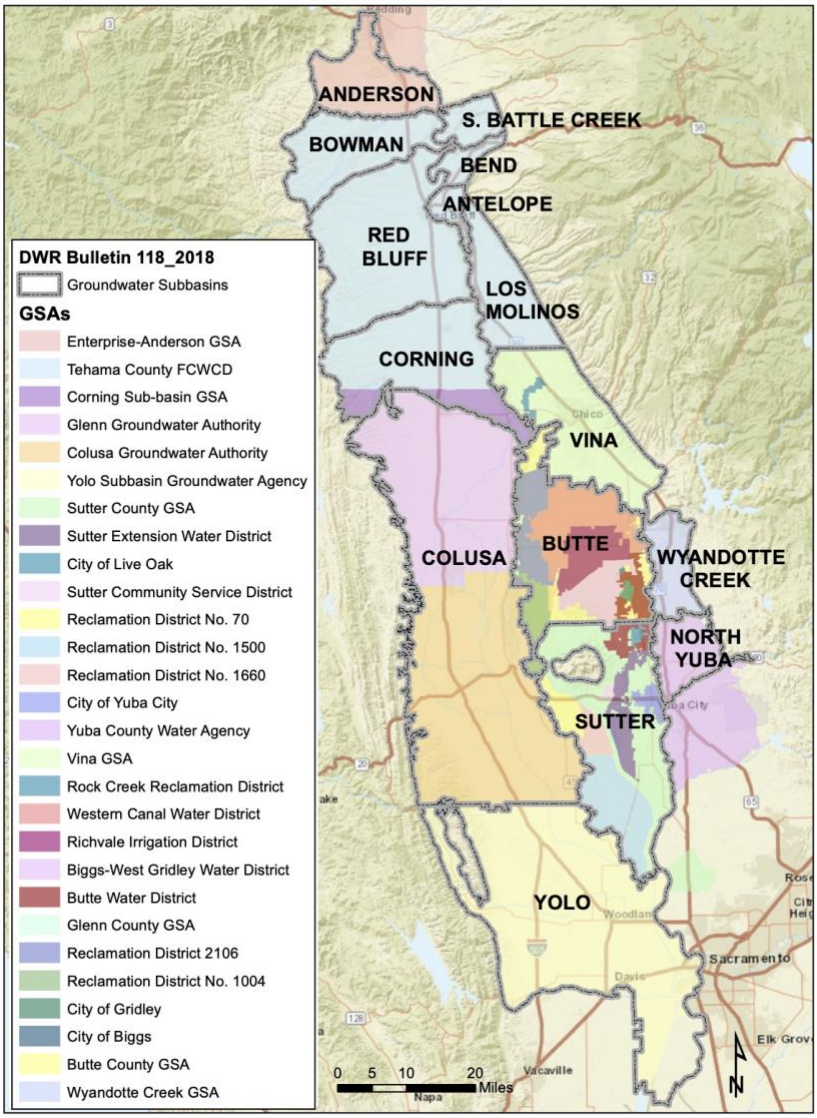
- ***CBI*** *– Consensus Building Institute [link]*
- ***DWR*** *– California Department of Water Resources*
- ***GSA*** *– Groundwater Sustainability Agency*
- ***GSP*** *– Groundwater Sustainability Plan*
- ***MOU*** *– Memorandum of Understanding*
- ***NCWA*** *– Northern California Water Association*
- ***NSV IRWM****– Northern Sacramento Valley Integrated Regional Water Management*
- ***PMAs*** *– Projects and Management Actions*
- ***SGMA*** *– Sustainable Groundwater Management Act*
- ***SMC*** *– Sustainable Management Criteria*

1. Introduction & Background

The content of the report is the result of staff recommendations resulting from regional inter-basin coordination staff meetings in the Northern Sacramento Valley (2020-2021). The content will be presented to inform discussions among Groundwater Sustainability Agencies (GSAs) and gather public input through existing public venues, such as advisory committees, groundwater commissions, and GSA Board meetings.

Inter-basin coordination is critical in the Northern Sacramento Valley as GSAs develop and implement Groundwater Sustainability Plans (GSPs). Since groundwater subbasins in the Northern Sacramento Valley are hydrologically interconnected, water management decisions and actions in subbasins (i.e., groundwater pumping and processes affecting recharge, water demand, and supply including climate change) could change aquifer conditions. Understanding and accounting for these processes is important towards achieving sustainability in all subbasins.

Figure 1. Map of the Northern Sacramento Valley



Inter-basin coordination is described in the GSP Regulations in Article 8. Under the regulations, GSAs must describe how they coordinate with adjoining subbasins to demonstrate implementation will not adversely affect adjoining subbasins. The Department of Water Resources (DWR) is required to evaluate whether a GSP adversely affects the ability of an adjacent basin to implement their GSP or impedes achievement of sustainability goals in an adjacent basin (Water Code 17033(c)). Coordination among GSAs can be formalized in different ways and inter-basin agreements are voluntary. Appendix A describes components of Sec 357.2.

Inter-basin coordination discussions among staff representatives from 11 subbasins (Antelope, Bowman, Butte, Colusa, Corning, Los Molinos, Red Bluff, Sutter, Vina, Wyandotte Creek, and Yolo), with facilitation support from the Consensus Building Institute (CBI) began during the summer of 2020. While efforts have focused on these subbasins, coordination will occur, as warranted, with other neighboring subbasins (Anderson and North Yuba).

Initial stages of inter-basin coordination efforts (May-December 2020) were closely aligned with the GSP Regulations in Article 8 components and delineated in Section 3 *Evolution of Inter-basin Coordination Efforts*. After an initial attempt to compile technical information to better understand basin conditions at respective boundaries, staff realized differing timelines for the completion of Basin Setting content in each subbasin meant there would not be sufficient time during initial GSP development to fully characterize or address major inconsistencies. Therefore, the goal for regional inter-basin coordination shifted towards establishing a framework for long-term inter-basin coordination and dialogue (post GSP submittal in 2022). Informal coordination discussions among staff and consultants between neighboring subbasins continued during the GSP development process.

This report outlines the intent and purpose of inter-basin coordination in the Northern Sacramento Valley. It describes the process followed and materials developed throughout the process. It also outlines foundational elements, referred to as "key pillars," of a framework for sustained coordination through GSP implementation.

2. Intent & Purpose

Inter-basin coordination efforts in the Northern Sacramento Valley are focused on establishing a foundation and guidelines for sustained inter-basin coordination through GSP implementation, following the initial submittal of GSPs by January 31, 2022. GSAs intend to:

1. *Establish a framework allowing for continued dialogue and a venue to address issues and discrepancies during the implementation of the GSPs;*
2. *Coordinate on consistent messaging and communicate shared expectations at a regional level;*
3. *Demonstrate regional coordination efforts and outcomes; and*
4. *Leverage existing agreements and arrangements in the region (e.g., Northern Sacramento Valley Integrated Regional Water Management (NSV IRWM), the Six County Memorandum of Understanding among Butte, Colusa, Glenn, Tehama, Shasta, and Sutter).*

The proposed deliverable from this effort is the development of a common approach and draft language for incorporation into each subbasin's GSP. This narrative describes the facilitated effort as well as the framework and scope for long-term coordination during plan implementation. The public will have opportunities to weigh in and provide input on the proposed framework through each subbasin's existing public venues, such as advisory committees, groundwater commissions, and GSA board meetings.

3. Evolution of Inter-basin Coordination Efforts

Inter-basin coordination efforts, facilitated by the Consensus Building Institute (CBI) began in summer 2020 among Subbasin staff from Antelope, Bowman, Butte, Colusa, Corning, Los Molinos, Red Bluff, Vina, and Wyandotte Creek subbasins to identify priorities and resources available for inter-basin coordination. Soon after, staff representatives from the Sutter and Yolo subbasins joined the meetings. To date, CBI has facilitated nine inter-basin coordination meetings with staff and periodically with technical consultants from the subbasins. Subbasin staff and/or CBI communicated regular updates to GSA Boards and advisory committees in each of the subbasins regarding the status of inter-basin coordination activities [Access Webpage Here].

Initial stages of inter-basin coordination efforts were closely aligned with the GSP Regulations in Article 8:

1. ***General information*** *of subbasins, plans and agencies participating in the coordination agreement,*
2. ***Technical information*** *including consistent and coordinated data or methodology for inter-basin boundary flows and stream-groundwater interactions at basin boundaries, and information on sustainable management criteria and monitoring that would confirm that no adverse impacts of implementing the GSPs would result to any party to the agreement,*
3. *A description of the* ***process for identifying and resolving conflicts*** *between Agencies that are parties to an inter-basin coordination agreement.*
   Reference: *Sections 10727.2, 10733, and 10733.2, Water Code.*

The goal at the initial stage was to compile general and technical information identified by DWR in a consistent manner to establish an accurate basis of comparison and to identify any significant inconsistencies that may need to be addressed or resolved. This included developing a series of information-sharing documents and outreach materials, summarized below.

1. ***Inter-basin Coordination Directory****– This document provides an updated and centralized directory with contact information for GSA managers, technical consultants, and facilitators in the various subbasins. This document seeks to facilitate communication among the various representatives leading GSP development [Access Here].*
2. ***Technical Information-Sharing Template****– This template was developed among the managers and technical consulting teams to compile and compare information on modeling tools and water budget results for inter-basin flows, stream-aquifer interactions, and hydro-geologic conditions in the subbasins. Potentially, this document could be used to compile information about Sustainable Management Criteria and Monitoring Networks [Access Draft Template Here]. The first output from the technical information-sharing template summarizes the highlights of compiled model information across the subbasins [Access Here].*
3. ***Outreach Presentation****–This PowerPoint presentation provides updates on inter-basin coordination activities to the various SGMA public venues (GSA boards, advisory committees, etc.) and an overview of the scope and timeline of inter-basin coordination efforts. This presentation is continuously updated*

after each inter-basin coordination staff meeting for use in consistently communicating with GSA Boards/advisory committees and the public throughout the region [Access Here].

4. ***Outreach Factsheet–*** *The inter-basin coordination factsheet aims to support public outreach and information sharing in the various subbasins. This two-page flier or factsheet summarizes why regional coordination is important under SGMA, who is involved in ongoing efforts, what the coordination priorities are, and includes a table with links to each subbasin's website for additional subbasins' specific information [Access Here].*
5. ***Inter-basin Coordination Webpage****– Butte County hosts a webpage to provide the most up-to-date information on inter-basin coordination efforts in the Northern Sacramento Valley. The webpage provides an overview of the scope and makes available documentation and results of the inter-basin coordination work, including meeting agendas, summaries, and outputs [Access Here].*
6. ***Meeting Summaries****–CBI develops meeting summaries after each regional inter-basin coordination staff meeting to summarize key discussion themes, action items, and next steps. These summaries are publicly available on the inter-basin coordination webpage [Access Here].*

After an initial attempt to compile technical information, staff realized the broad aspirations were not feasible during the initial stages of GSP development. The process of compiling and comparing modeling outputs from the diverse regional hydrological models required a significant amount of time, resources, and varying levels of data. Further, subbasins were at different stages of GSP development and GSAs were facing tight timelines, competing priorities, and capacity limitations to meet the regulatory deadline. While communication on a neighbor-to-neighbor basis on technical components was encouraged through GSP development, subbasin staff representatives realized more robust technical analysis and coordination between and among subbasins was not possible until initial plans (including water budgets) were more fully developed or after adoption of the initial GSPs.

Following reflection from the separate inter-basin efforts and priorities moving forward, subbasin staff recommended shifting the focus of regional coordination meetings to establishing a framework for long-term inter-basin coordination and dialogue following GSP submission in January 2022. To do so, subbasin staff identified desired outcomes in the short-term (during initial GSP development), mid-term (first 5-year update), and long-term (GSP Implementation through 2042) [Access Here]. This approach recognizes adoption of the 2022 GSPs as an initial step in sustainable groundwater management, not the final step. Subbasin staff acknowledged while model outputs may not match perfectly, the main objective is to identify and acknowledge significant discrepancies, understand why those differences exist, and evaluate to the extent they need to be reconciled. Inter-basin coordination has been characterized as "a marathon not a sprint," and current efforts will serve to pave the path for long-term collaboration. Further, GSAs can take advantage of annual reporting and five-year GSP updates to identify and address discrepancies. Lastly, subbasin staff representatives acknowledge public participants are interested in inter-basin coordination efforts and concerns from some subbasins can easily affect others. Subbasin staff understand the need to share and educate the public on what is in the various GSPs, and the SGMA requirements for inter-basin coordination. Staff will continue to provide updates and gather GSA Board and public input related to the direction of current efforts and desired priorities, shared concerns, and possible ideas for inter-basin coordination during GSP implementation.

4. Inter-basin Coordination Framework

This section outlines the foundational pillars that comprise the framework for inter-basin coordination under SGMA between and among subbasins in the Northern Sacramento Valley. These pillars build upon a long-standing history of regional collaboration and embody a commitment for continued coordination, collaboration, and communication for successful groundwater management in the region. Honoring the individual authorities of the GSAs, these pillars represent a menu of options neighboring subbasins can draw upon, based on individual or neighboring subbasins' needs and challenges. GSA Boards can decide which of these options they would like to support and implement, acknowledging circumstances may change over time.

Pillars	Scale(s)	Timing
1. Information-sharing a. Inform each other on changing conditions (i.e., surface water cutbacks, land use changes, policy changes that inform groundwater management) b. Share annual reports and interim progress reports c. Share data and technical information and work towards building shared data across and/or along basin boundaries (e.g., monitoring data, water budgets, modeling inputs and outputs, and Groundwater Dependent Ecosystems)	• Neighbor-to-neighbor • Coordination groups [Refer to section 4.1 below]	• *Ongoing (GSP Development)* • *Near-term (5-year update)* • *Long-term (GSP implementation)*
2. Joint analysis & evaluation a. Evaluate and compare contents of GSPs with a focus on establishing a common understanding of basin conditions at boundaries b. Identify significant differences, uncertainties, and potential issues of concern related to groundwater interaction at the boundaries c. Engage in analysis and evaluation of SMCs between GSPs to assess impacts and identify significant differences and possible impacts between subbasins that could potentially lead to undesirable results	• Neighbor-to-neighbor • Coordination groups [Refer to section 4.1 below]	• *Near-term (5-year update)* • *Long-term (GSP implementation)*
3. Coordination on mutually beneficial activities a. Communicate, coordinate, and collaborate on mutually beneficial activities, which could include joint monitoring, joint reporting, regional modeling, and other efforts to address data gaps at subbasin boundaries b. Collectively pursue funding and collaborate on mutually agreed upon projects and management actions that provide benefits across boundaries c. Leverage existing collaboratives (NSV IRWM, NCWA etc.)	• Neighbor-to-neighbor • Coordination groups • Regional: NSV IRWM, NCWA Groundwater Task Force	• *Ongoing (GSP Development)* • *Near-term (5-year update)* • *Long-term (GSP implementation).*
4. Coordinated communication and outreach a. Coordinate and collaborate on regional-scale public engagement and communication strategies that promote awareness on groundwater sustainability, enhance public trust, and maintain institutional knowledge b. Maintain list of GSP/subbasin staff contacts and websites	• Regional: NSV IRWM and NCWA Groundwater Task Force	• *Ongoing (GSP Development)* • *Near-term (5-year update)* • *Long-term (GSP implementation)*
5. Issue-resolution process a. Establish and follow an agreed-upon process for identifying and resolving conflicts between GSAs by the first five-year update [Refer to Appendix D for more details and discussion prompts on issue resolution processes]	• Neighbor-to-neighbor • Coordination groups	• *Near-term (5-year update)* • *Long-term (GSP implementation).*

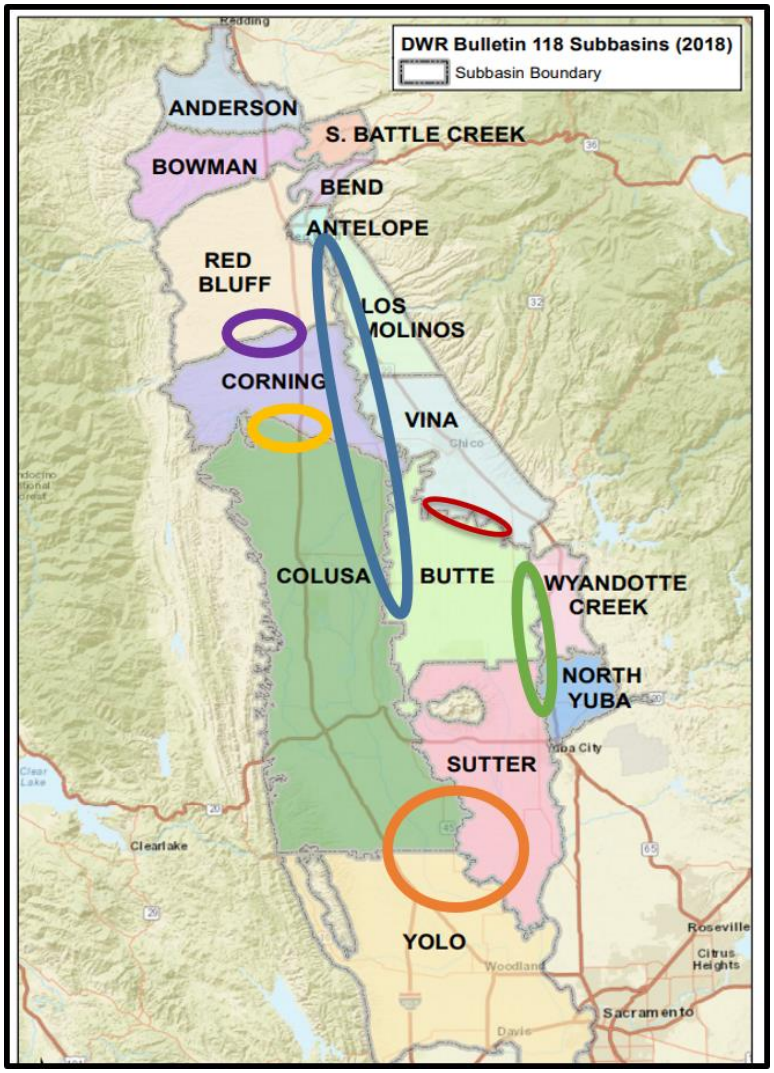
4.1. Inter-basin Coordination Groups

Inter-basin coordination efforts, as outlined in the pillars above, would require resources and technical support. Subbasin staff recommend organizing inter-basin coordination priorities by specific subbasin boundaries. One suggested approach identifies specific "Coordination Groups" (see Figure 3 and list below). Some of these groups are pairs and others include multiple subbasins around a river boundary.

1. ***Feather River Corridor***- *Butte, Wyandotte Creek, North Yuba, Sutter*
2. ***North Sacramento River Corridor***- *Antelope, Los Molinos, Red Bluff, Corning, Vina, Butte, Colusa*
3. ***South Sacramento Corridor***- *Colusa, Sutter, Yolo*

Neighbor to Neighbor, examples:

4. ***Stony Creek***- *Corning, Colusa*
5. ***Thomes Creek***- *Red Bluff, Corning*
6. ***Butte/Vina***- *Vina, Butte*



5. Conclusion and Next Steps

In sum, this report outlines a framework for inter-basin coordination for sustainable groundwater management in the Northern Sacramento Valley. The inter-basin coordination framework describes a menu of options for ongoing communication and collaboration around substantive issues over the twenty-year implementation of SGMA.

The pillars and other content from this report could be used by GSAs to support GSP development and implementation in a number of ways. This inter-basin coordination report could be included as an Appendix to the GSP and could be updated on a yearly basis. Individual subbasins can incorporate sections of the report into the body of the GSP, depending upon specific boundary conditions at adjoining subbasins. Finally, subbasins could draw on the inter-basin coordination framework if they would like to consider entering into one or more voluntary inter-basin agreements during GSP implementation.

The content of the report is the result of staff recommendations resulting from regional inter-basin coordination staff meetings. Staff will present the framework as a supporting document to guide and inform discussions with the GSA Boards and other existing public venues, such as advisory committees or groundwater commissions. GSAs in turn will discuss the menu of options for inter-basin coordination outlined in this report to determine their priorities and desired approach to draw on the inter-basin coordination framework in their individual GSPs. Lastly, Subbasin staff will come together to share input received and determinations from their respective GSAs.

Subbasin staff acknowledge that while this report builds upon a long-standing history of regional collaboration, this is just the beginning of inter-basin coordination efforts under SGMA. Therefore, this framework and inter-basin coordination activities will be continually refined throughout GSP implementation.

Appendices

Appendix A: GSP Emergency Regulations, Article 8: Interagency Agreements §357.2

§ 357.2. Inter-basin Agreements (access here)

Two or more Agencies may enter into an agreement to establish compatible sustainability goals and understanding regarding fundamental elements of the Plans of each Agency as they relate to sustainable groundwater management. Inter-basin agreements may be included in the Plan to support a finding that implementation of the Plan will not adversely affect an adjacent basin's ability to implement its Plan or impede the ability to achieve its sustainability goal. Inter-basin agreements should facilitate the exchange of technical information between Agencies and include a process to resolve disputes concerning the interpretation of that information. Inter-basin agreements may include any information the participating Agencies deem appropriate, such as the following:

(a) General information:
  (1) Identity of each basin participating in and covered by the terms of the agreement.
  (2) A list of the Agencies or other public agencies or other entities with groundwater management responsibilities in each basin.
  (3) A list of the Plans, Alternatives, or adjudicated areas in each basin.

(b) Technical information:
  (1) An estimate of **groundwater flow across basin boundaries**, including consistent and coordinated data, methods, and assumptions.
  (2) An estimate of **stream-aquifer interactions** at boundaries.
  (3) A **common understanding of the geology and hydrology** of the basins **and the hydraulic connectivity** as it applies to the Agency's determination of groundwater flow across basin boundaries and description of the different assumptions utilized by different Plans and how the Agencies reconciled those differences.
  (4) **Sustainable management criteria and a monitoring network** that would confirm that no adverse impacts result from the implementation of the Plans of any party to the agreement. If minimum thresholds or measurable objectives differ substantially between basins, the agreement should specify how the Agencies will reconcile those differences and manage the basins to avoid undesirable results. The Agreement should identify the differences that the parties consider significant and include a plan and schedule to reduce uncertainties to collectively resolve those uncertainties and differences.

(c) A description of the **process for identifying and resolving conflicts** between Agencies that are parties to the agreement.

(d) Inter-basin agreements submitted to the Department shall be posted on the Department's website.

Note: Authority cited: Section 10733.2, Water Code.
Reference: Sections 10727.2, 10733, and 10733.2, Water Code.

Appendix B: Inter-basin Coordination Fact Sheet

Northern Sacramento Valley | Sustainable Groundwater Management Act

Regional Coordination Between Subbasins

Antelope | Bowman | Butte | Colusa | Corning | Los Molinos | Red Bluff | Sutter | Vina | Wyandotte Creek | Yolo

Sustainable Groundwater Management Act

What is SGMA? California enacted the Sustainable Groundwater Management Act (SGMA) in 2014 to better manage groundwater over the long term. Sustainability is achieved by avoiding significant and unreasonable conditions for the six "sustainability indicators."

- Lowering of Groundwater Levels
- Reduction of Groundwater Storage
- Land Subsidence
- Surface Water Depletion
- Water Quality Degradation
- Sea Water Intrusion

Why is regional coordination important? In the Sacramento Valley, inter-basin coordination is critical as Groundwater Sustainability Agencies (GSA) develop their Groundwater Sustainability Plans (GSP). Since groundwater subbasins in the Northern Sacramento Valley (NSV) are hydrologically interconnected, water management decisions and actions in one subbasin (e.g. groundwater pumping) and processes like climate change could change aquifer conditions and affect flows to other subbasins. Understanding and accounting for these processes is key to achieve sustainability in all subbasins.

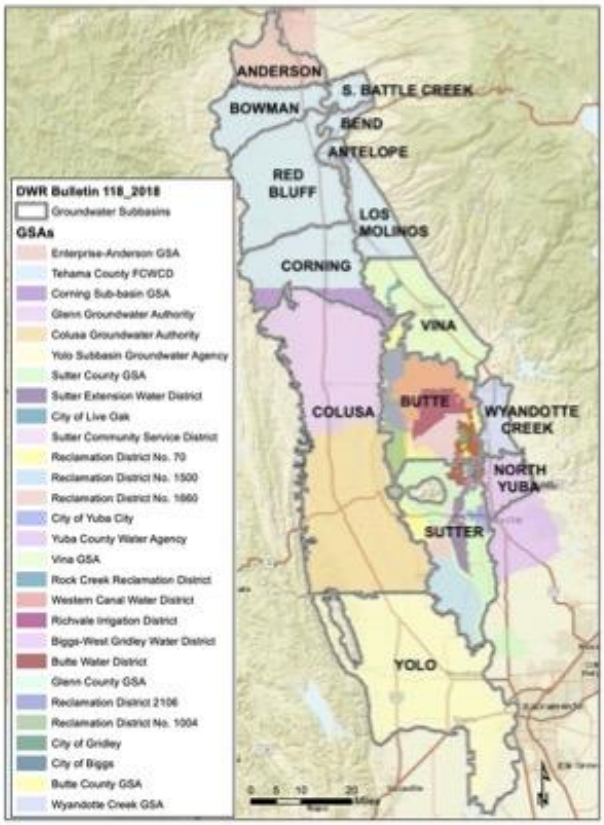
Who is involved in ongoing efforts?

Collaborative efforts have begun among representatives from 11 subbasins (Antelope, Bowman, Butte, Colusa, Corning, Los Molinos, Red Bluff, Sutter, Vina, Wyandotte Creek, Yolo), with facilitation support from the Consensus Building Institute. While efforts have focused on the subbasins mentioned, coordination will occur, as warranted, with other neighboring subbasins (Anderson and North Yuba).

What are the coordination priorities?

Groundwater Sustainability Agencies are working together to establish a foundation for open and transparent inter-basin coordination and communication by developing tools to:

- SHARE & COMPILE INFORMATION IN A CONSISTENT WAY
- OUTLINE A PROCESS TO IDENTIFY & RESOLVE ISSUES
- DOCUMENT COORDINATION EFFORTS



CBI
CATALYZING COLLABORATION

Learn More & Get Involved

Receive Updates
Sign up for your GSA's interested parties list.

Contact Your GSA
Talk to your GSA representative

Attend Meetings
Attend public workshops, Advisory Board, and GSA Board meetings

Subbasin	GSA(s)	Website
Antelope	Tehama County Flood Control and Water Conservation District (FCWCD)	Website
Bowman	Tehama County FCWCD	Website
Butte	Biggs West Gridley WD, Butte County, Butte WD, City of Biggs, City of Gridley, Colusa Groundwater Authority, Glenn County, RD 1004, RD 2106, Richvale ID, Western Canal WD	Website
Los Molinos	Tehama County FCWCD	Website
Red Bluff	Tehama County FCWCD	Website
Corning	Corning Sub-basin GSA, Tehama County FCWCD	Website
Colusa	Glenn Groundwater Authority; Colusa Groundwater Authority	Websites (Glenn) I (Colusa)
Sutter	Butte WD, City of Live Oak, Sutter Community Service District, Sutter County, Sutter Extension Water District, RD 70, RD 1660, RD 1500, City of Yuba City	Website
Vina	Rock Creek Reclamation District, Vina GSA	Websites (Vina) I (RCDC)
Wyandotte Creek	Wyandotte Creek GSA	Website
Yolo	Yolo Subbasin Groundwater Agency	Website

Find more information about regional inter-basin coordination at:
ButteCounty.net/waterresourceconservation/Sustainable-Groundwater-Management-Act/Inter-basin-Coordination

APPENDIX C

Memorandum of Understanding
Four County (Butte, Colusa, Glenn, and Tehama Counties)
Regional Water Resource Coordination, Collaboration, and Communication

Memorandum of Understanding
Four County (Butte, Colusa, Glenn, and Tehama Counties) Regional Water Resource Coordination, Collaboration, and Communication

1. BACKGROUND
The counties of Butte, Colusa, Glenn, and Tehama share common surface water and groundwater resources. Based on these common resources, local water resource managers understand that regular coordination, collaboration, and communication can result in an improved water resource understanding at both the county and regional level.

2. PURPOSE
The purpose of this document is to establish the mutual understandings of the four counties with respect to their voluntary joint efforts toward regional coordination, collaboration, and communication.

3. GOALS
The goals of the Four County Memorandum of Understanding (MOU) are:

2.1. To foster coordination, collaboration and communication between the four counties on water-related issues, to achieve greater efficiencies, and enhance public services.

2.2. To provide a framework for the management and disbursement of funding associated with activities pursued jointly under this MOU.

2.3. To improve competitiveness for State and Federal grant funding.

4. DEFINITIONS
4.1. Four County. Participants including the counties of Butte, Colusa, Glenn, and Tehama, with representation by the following:

- Butte County: Department of Water and Resource Conservation
- Colusa County: Department of Planning and Building
- Glenn County: Department of Agriculture
- Tehama County: Flood Control and Water Conservation District

4.2. Project Manager. A project manager will be determined by the Counties signatory to this MOU for any given project regardless of funding source to meet the goals set forth in this MOU.

5. MUTUAL UNDERSTANDINGS
5.1. Participation. Signatories to this MOU constitute the current participants. Participation is strictly on a voluntary basis and may be

terminated at any time without recourse. Neighboring counties who share water resources common to the participating counties and who are engaged in similar activities will be invited to be signatory to this MOU. Signatories aspire to work collaboratively with other regional programs and technical outreach efforts.

5.2. Activities. Efforts pursued under this agreement will remain consistent with and will not exceed the current authority for any individual participating county. Efforts will include the study and investigation of water resources common to participants, monitoring and reporting, information dissemination and sharing between counties and with other county departments, public outreach and education, and other activities at the agreement and direction of individual county governing bodies.

5.3. County Funding. Counties are not required to commit funding associated with activities completed under this MOU. It is understood that activities under this MOU may result in the more efficient use of existing and future department funding resulting from improved collaboration and coordination.

5.4. External Funding. Signatories will work collaboratively in pursuit of external funding associated with common interest activities based on voluntary participation and agreement. When required, a mutually agreed upon County representative will serve as the Project Manager for activities completed under a contract with an external funding source. Existing county contracting mechanisms will be utilized where available for contractual and invoicing purposes between participating counties. Nothing in this MOU precludes individual counties from the individual pursuit, contracting and completion of work from an externally funded source regardless of a real or perceived regional interest.

5.5. Decision-making. Consensus will be sought when the need for a decision arises.

5.6. Non-binding nature. This document and participation under this MOU are nonbinding, and in no way suggest that a county may not continue its own activities as each county is expected to continue its own policies and procedures and undertake efforts to secure project funding from any source. A county may withdraw from participation at any time.

5.7. Termination. Because the MOU will require periodic review and updating for use into the future, it is envisioned that the joint efforts of those involved will be ongoing in maintaining a living document. Thus this document will remain as a reflection of the understandings of the participants. Individual signatories of this MOU may terminate their involvement at any time with no recourse.

6. SIGNATORIES TO THE MEMORANDUM OF UNDERSTANDING

We, the undersigned representatives of our respective counties, acknowledge the above as our understanding of how the Four County Coordination, Collaboration, and Communication MOU will be implemented.

MAR 1 4 2006 APPROVED JAN 2 4 2006

Date

Curt Josiassen, Chairman
Butte County Board of Supervisors

2/28/06

Approved As To Form:
Bruce Alpert, Butte County Counsel

6. SIGNATORIES TO THE MEMORANDUM OF UNDERSTANDING
We, the undersigned representatives of our respective counties, acknowledge the above as our understanding of how the Four County Coordination, Collaboration, and Communicative MOU will be implemented.

April 4, 2006
Date

Christy Scofield

Christy Scofield, Chairperson
Colusa County Board of Supervisors

Approved As To Form:
Henry Rodegerdts, Colusa County Counsel

EXHIBIT B
PAGE 3 OF 3

6. SIGNATORIES TO THE MEMORANDUM OF UNDERSTANDING

We, the undersigned representatives of our respective counties, acknowledge the above as our understanding of how the Four County Coordination, Collaboration, and Communication MOU will be implemented.

12-13-05

Date

Vice Chairman, Tehama County Flood Control And Water Conservation District

Approved As To Form:

by

County Counsel, Tehama County

Date

By Board Chair

County
Approved As To Form:

County Counsel

Date

By Board Chair

County
Approved As To Form:

County Counsel

Date

By Board Chair

County
Approved As To Form:

TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT MINUTE ORDER

December 13, 2005

8. Approval of Four-County Regional Water Resource Coordination- MOU: Ernie Ohlin reviewed that in August 2004, the Board authorized staff to participate in the four county water effort. The MOU attached is allowing all counties to participate together in water resource collaboration and communication. This non-binding voluntary MOU recognizes coordination among Butte, Colusa, Glenn and Tehama County.

Roger Sherrill encouraged the four-county groups to participate and noted in Item 5.1 "Participation" is strictly voluntary. Shasta County provides a major part of the recharge for the northern part of the Sacramento Valley and to move forward could only make for a stronger overall group.

Mark Black, Ag Commissioner for Glenn County, added this will be presented to Glenn County next Tuesday for support. Discussions with Sutter and Yuba County brings interest and they are awaiting the outcome of the four counties. This is a good collaborative effort, giving us strength of possible capturing of funding.

Motion by Director Warner to approve the MOU for signature.

Director Willard questioned if this has been reviewed by County Counsel. Upon his approval, signature will be completed.

Motion revised by Director Warner to approve the MOU for signature by the Chair upon review of County Counsel. Second by Director Avilla and carried by those present 3-0 with 2 absent.

Ayes: Directors':, Charles Willard; Ron Warner; Gregg Avilla
Noes: None
Absent or Not Voting: Director's: Ross Turner, George Russell

STATE OF CALIFORNIA)
) ss
COUNTY OF TEHAMA)

I, Gary Antone, Director of the Tehama County Flood Control and Water Conservation District of the County of Tehama, State of California, hereby certify the above and foregoing to be full, true and correct copy of an order adopted by said Tehama County Flood Control and Water Conservation District on this **13th day of December, 2005**

Dated: This 13th day of **December, 2005**.

Gary Antone
Director of the Tehama County Flood Control and Water Conservation District of the County of Tehama, State of California

By Linda Madea
Linda Madea, Deputy

F:\ADMIN\MEETING\MINORDER\05MinOrd\Dec.wpd

FOUR COUNTY MEMORANDUM OF UNDERSTANDING
ADDENDUM ONE:
Statement of Principles Regarding Water Related Programs and Projects

In recognition that certain activities related to water resources do not recognize jurisdictional boundaries and require regional solutions, the parties identified in the Four County Memorandum of Understanding hereby agree to adhere to the following Statement of Principles Regarding Water Related Programs and Projects:

1. Programs and projects related to groundwater level and water quality monitoring shall be conducted in a cooperative manner and related data shall be shared between the participants to prevent negative impacts to our constituents.
2. Environmental documents associated with water projects and programs will automatically be circulated to all four counties for review and comment.
3. Incidents of abnormal water level or water quality readings will be immediately communicated to all participating counties resulting in a collaborative review and dissemination of related information.
4. Project and program related information will be disseminated on a regional basis through the independent county websites, augmented by regional public outreach meetings.
5. The parties will work cooperatively to acquire grant funding to conduct aquifer studies that further identify the linkages of the common groundwater resources.
6. Efforts pursued under this agreement will remain consistent with and will not exceed the current authority of any participating county.

We, the undersigned representatives of our respective counties, agree to adhere to the conditions of **Addendum One to the Four County MOU: Statement of Principles Regarding Water Related Programs and Projects.** The original MOU was signed by the Counties of Butte, Glenn, Colusa and Tehama in 2006.

Chair, Butte County Board of Supervisors	3/8/07 Date	County Counsel Approved As to Form	2/23/07 Date
Chair, Glenn County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Tehama County Board of Supervisors	Date	County Counsel Approved As to Form	Date

Vice-Chair, Colusa County
Board of Supervisors

4-17-07
Date

County Counsel
Approved As to Form

Date

EXHIBIT A
PAGE 2 OF 2

COUNTY CONTRACT
1788

FOUR COUNTY MEMORANDUM OF UNDERSTANDING
ADDENDUM ONE:
Statement of Principles Regarding Water Related Programs and Projects

In recognition that certain activities related to water resources do not recognize jurisdictional boundaries and require regional solutions, the parties identified in the Four County Memorandum of Understanding hereby agree to adhere to the following Statement of Principles Regarding Water Related Programs and Projects:

1. Programs and projects related to groundwater level and water quality monitoring shall be conducted in a cooperative manner and related data shall be shared between the participants to prevent negative impacts to our constituents.
2. Environmental documents associated with water projects and programs will automatically be circulated to all four counties for review and comment.
3. Incidents of abnormal water level or water quality readings will be immediately communicated to all participating counties resulting in a collaborative review and dissemination of related information.
4. Project and program related information will be disseminated on a regional basis through the independent county websites, augmented by regional public outreach meetings.
5. The parties will work cooperatively to acquire grant funding to conduct aquifer studies that further identify the linkages of the common groundwater resources.
6. Efforts pursued under this agreement will remain consistent with and will not exceed the current authority of any participating county.

We, the undersigned representatives of our respective counties, agree to adhere to the conditions of **Addendum One to the Four County MOU: Statement of Principles Regarding Water Related Programs and Projects.** The original MOU was signed by the Counties of Butte, Glenn, Colusa and Tehama in 2006.

Chair, Butte County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Glenn County Board of Supervisors	4/3/2007 Date	County Counsel Approved As to Form	3/26/07 Date
Chair, Tehama County Board of Supervisors	Date	County Counsel Approved As to Form	Date

FOUR COUNTY MEMORANDUM OF UNDERSTANDING
ADDENDUM TWO:
Adding Sutter County to the Four County MOU

In recognition that certain activities related to water resources do not recognize jurisdictional boundaries and therefore require regional solutions, the parties identified in the original Four County Memorandum of Understanding: Counties of Butte, Colusa, Glenn and Tehama are hereby joined by Sutter County in the regional efforts discussed in the Four County MOU and the Statement of Principles Regarding Water Related Programs and Projects as discussed in Addendum One to the Four County MOU.

We, the undersigned as representative of our respective counties, agree to adhere to the conditions of the **Four County Memorandum of Understanding; Addendum One to the Four County MOU: Statement of Principles Regarding Water Related Programs and Projects. And Addendum Two: Adding Sutter County to the Four County MOU.**

The original MOU was signed by the Counties of Butte, Glenn, Colusa and Tehama in 2006. Through approval of this addendum, Sutter County makes the same commitment to regional cooperation and coordination that is outlined in the original MOU.

Bill Connelly	05 MAY 2009	Bruce L. Alpert	
Chair, Butte County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Glenn County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Tehama County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Colusa County Board of Supervisors	Date	County Counsel Approved As to Form	Date

C09-082

FOUR COUNTY MEMORANDUM OF UNDERSTANDING
ADDENDUM TWO:
Adding Sutter County to the Four County MOU

In recognition that certain activities related to water resources do not recognize jurisdictional boundaries and therefore require regional solutions, the parties identified in the original Four County Memorandum of Understanding: Counties of Butte, Colusa, Glenn and Tehama are hereby joined by Sutter County in the regional efforts discussed in the Four County MOU and the Statement of Principles Regarding Water Related Programs and Projects as discussed in Addendum One to the Four County MOU.

We, the undersigned as representative of our respective counties, agree to adhere to the conditions of the **Four County Memorandum of Understanding; Addendum One to the Four County MOU: Statement of Principles Regarding Water Related Programs and Projects. And Addendum Two: Adding Sutter County to the Four County MOU.**

The original MOU was signed by the Counties of Butte, Glenn, Colusa and Tehama in 2006. Through approval of this addendum, Sutter County makes the same commitment to regional cooperation and coordination that is outlined in the original MOU.

Chair, Butte County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Glenn County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Tehama County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Colusa County Board of Supervisors	5/5/09 Date	County Counsel Approved As to Form	Date 5/5/09

C09-082

FOUR COUNTY MEMORANDUM OF UNDERSTANDING
ADDENDUM TWO:
Adding Sutter County to the Four County MOU

In recognition that certain activities related to water resources do not recognize jurisdictional boundaries and therefore require regional solutions, the parties identified in the original Four County Memorandum of Understanding: Counties of Butte, Colusa, Glenn and Tehama are hereby joined by Sutter County in the regional efforts discussed in the Four County MOU and the Statement of Principles Regarding Water Related Programs and Projects as discussed in Addendum One to the Four County MOU.

We, the undersigned as representative of our respective counties, agree to adhere to the conditions of the **Four County Memorandum of Understanding; Addendum One to the Four County MOU: Statement of Principles Regarding Water Related Programs and Projects. And Addendum Two: Adding Sutter County to the Four County MOU.**

The original MOU was signed by the Counties of Butte, Glenn, Colusa and Tehama in 2006. Through approval of this addendum, Sutter County makes the same commitment to regional cooperation and coordination that is outlined in the original MOU.

Chair, Butte County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Glenn County Board of Supervisors	5/21/09 Date	County Counsel Approved As to Form	Date
Chair, Tehama County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Colusa County Board of Supervisors	5/5/09 Date	County Counsel Approved As to Form	5/5/09 Date

Chair, Sutter County Board of Supervisors	Date	William J. Vanasek County Counsel Approved as to Form	4/14/09 Date

FOUR COUNTY MEMORANDUM OF UNDERSTANDING
ADDENDUM TWO:
Adding Sutter County to the Four County MOU

In recognition that certain activities related to water resources do not recognize jurisdictional boundaries and therefore require regional solutions, the parties identified in the original Four County Memorandum of Understanding: Counties of Butte, Colusa, Glenn and Tehama are hereby joined by Sutter County in the regional efforts discussed in the Four County MOU and the Statement of Principles Regarding Water Related Programs and Projects as discussed in Addendum One to the Four County MOU.

We, the undersigned as representative of our respective counties, agree to adhere to the conditions of the **Four County Memorandum of Understanding; Addendum One to the Four County MOU: Statement of Principles Regarding Water Related Programs and Projects. And Addendum Two: Adding Sutter County to the Four County MOU.**

The original MOU was signed by the Counties of Butte, Glenn, Colusa and Tehama in 2006. Through approval of this addendum, Sutter County makes the same commitment to regional cooperation and coordination that is outlined in the original MOU.

Chair, Butte County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Glenn County Board of Supervisors	Date	County Counsel Approved As to Form	Date
George Russell Chair, Tehama County Flood Control & Water Conservation District	6-23-09 Date	County Counsel Approved As to Form	Date
Chair, Colusa County Board of Supervisors	Date	County Counsel Approved As to Form	Date

FOUR COUNTY MEMORANDUM OF UNDERSTANDING:
ADDENDUM THREE
Expression of a Commitment to Begin An
Integrated Regional Water Management Planning Process
Within the Counties of Butte, Colusa, Glenn, Tehama and Sutter

Through adoption of this addendum, the signatories agree to begin a regional water management planning process pursuant to the Four County MOU, geographically covering the area of Butte, Colusa, Glenn, Tehama and Sutter Counties. The planning process shall utilize and incorporate existing plans and processes. The California legislature has recently adopted new criteria associated with the Integrated Regional Water Management Planning process. This new legislative criteria requires that acceptance and approval of the composition of all Integrated Regional Water Management Planning Areas be completed prior to accepting public funding associated with IRWMP grant funds. All IRWMP planning Regions and Plans must comply with the requirements as set forth in the Final Regional Acceptance Process Program Guidelines.

We, the undersigned as representative of our respective counties, agree to adhere to the conditions of **The Four County Memorandum of Understanding; Addendum One to the Four County MOU: Statement of Principles Regarding Water Related Programs and Projects; Addendum Two: Adding Sutter County to the Four County MOU; Addendum Three: Expression of a Commitment to Begin An Integrated Regional Water Management Planning Process Within the Counties of Butte, Colusa, Glenn, Tehama and Sutter.**

Bill Connelly Chair, Butte County Board of Supervisors	05 MAY 2009 Date	Bruce L. Alpert County Counsel Approved As to Form	Date
Chair, Glenn County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Tehama County Board of Supervisors	Date	County Counsel Approved As to Form	Date

Chair, Colusa County Board of Supervisors	5/5/09 Date	County Counsel Approved As to Form	5/5/09 Date
Chair, Sutter County Board of Supervisors	Date	County Counsel Approved as to Form	Date

C09-095
5-5-09

FOUR COUNTY MEMORANDUM OF UNDERSTANDING:
ADDENDUM THREE
Expression of a Commitment to Begin An
Integrated Regional Water Management Planning Process
Within the Counties of Butte, Colusa, Glenn, Tehama and Sutter

Through adoption of this addendum, the signatories agree to begin a regional water management planning process pursuant to the Four County MOU and geographically covering the area of Butte, Colusa, Glenn Tehama and Sutter Counties. The planning process shall utilize and incorporate existing plans and processes. The California legislature has recently adopted new criteria associated with the Integrated Regional Water Management Planning process. This new legislative criteria requires that acceptance and approval of the composition of all Integrated Regional Water Management Planning Areas be completed prior to accepting public funding associated with IRWMP grant funds. All IRWMP planning Regions and Plans must comply with the requirements as set forth in the Final Regional Acceptance Process Program Guidelines.

We, the undersigned as representative of our respective counties, agree to adhere to the conditions of **The Four County Memorandum of Understanding; Addendum One to the Four County MOU: Statement of Principles Regarding Water Related Programs and Projects; Addendum Two: Adding Sutter County to the Four County MOU; Addendum Three: Expression of a Commitment to Begin An Integrated Regional Water Management Planning Process Within the Counties of Butte, Colusa, Glenn, Tehama and Sutter.**

Chair, Butte County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Glenn County Board of Supervisors	5/21/09 Date	County Counsel Approved As to Form	Date
Chair, Tehama County Board of Supervisors	Date	County Counsel Approved As to Form	Date

CBI
CATALYZING COLLABORATION

Chair, Colusa County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Sutter County Board of Supervisors	Date	County Counsel Approved as to Form	4/14/09 Date

FOUR COUNTY MEMORANDUM OF UNDERSTANDING:
ADDENDUM THREE
Expression of a Commitment to Begin An
Integrated Regional Water Management Planning Process
Within the Counties of Butte, Colusa, Glenn, Tehama and Sutter

Through adoption of this addendum, the signatories agree to begin a regional water management planning process pursuant to the Four County MOU and geographically covering the area of Butte, Colusa, Glenn, Tehama and Sutter Counties. The planning process shall utilize and incorporate existing plans and processes. The California legislature has recently adopted new criteria associated with the Integrated Regional Water Management Planning process. This new legislative criteria requires that acceptance and approval of the composition of all Integrated Regional Water Management Planning Areas be completed prior to accepting public funding associated with IRWMP grant funds. All IRWMP planning Regions and Plans must comply with the requirements as set forth in the Final Regional Acceptance Process Program Guidelines.

We, the undersigned as representative of our respective counties, agree to adhere to the conditions of **The Four County Memorandum of Understanding; Addendum One to the Four County MOU: Statement of Principles Regarding Water Related Programs and Projects; Addendum Two: Adding Sutter County to the Four County MOU; Addendum Three: Expression of a Commitment to Begin An Integrated Regional Water Management Planning Process Within the Counties of Butte, Colusa, Glenn, Tehama and Sutter.**

Chair, Butte County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Glenn County Board of Supervisors	Date	County Counsel Approved As to Form	Date
George Russell Chair, Tehama County Flood Control & Water Conservation District	6-23-09 Date	County Counsel Approved As to Form	Date

FOUR COUNTY MEMORANDUM OF UNDERSTANDING:
ADDENDUM FOUR
Expression of a Commitment to Begin An
Integrated Regional Water Management Planning Process
Within the Counties of Butte, Colusa, Glenn, Tehama, Sutter and Shasta

Through adoption of this addendum, the signatories agree:

1. Shasta County shall join the parties involved in the original Four County Memorandum of Understanding (MOU) and Addendum Two;

2. Signatories to the MOU and its addenda shall be called the Northern Sacramento Valley Integrated Regional Water Management Planning Group; and,

3. Begin a regional water management planning process pursuant to the Four County MOU, geographically covering the area of Butte, Colusa, Glenn, Tehama, Sutter and Shasta Counties. The planning process shall utilize and incorporate existing plans and processes. The California legislature has recently adopted new criteria associated with the Integrated Regional Water Management Planning process. This new legislative criteria requires that acceptance and approval of the composition of all Integrated Regional Water Management Planning Areas be completed prior to accepting public funding associated with IRWMP grant funds. All IRWMP planning Regions and Plans must comply with the requirements as set forth in the Final Regional Acceptance Process Program Guidelines.

4. The signatories to the MOU and its addenda reaffirm the provisions of section 5.6 of the MOU that the MOU and its addenda and participation under the MOU and its addenda are nonbinding.

We, the undersigned as representative of our respective counties, agree to adhere to the conditions of **The Four County Memorandum of Understanding; Addendum One to the Four County MOU: Statement of Principles Regarding Water Related Programs and Projects; Addendum Two: Adding Sutter County to the Four County MOU; Addendum Three: Expression of a Commitment to Begin An Integrated Regional Water Management Planning Process Within the Counties of Butte, Colusa, Glenn, Tehama and Sutter; Addendum Four: Expression of a Commitment to Begin An Integrated Regional Water Management Planning Process Within the Counties of Butte, Colusa, Glenn, Tehama, Sutter and Shasta.**

Bill Connelly	APR 13 2010		4.9.10
Chair, Butte County Board of Supervisors	Date	County Counsel Approved As to Form	Date

Chair, Glenn County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Tehama County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Colusa County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Sutter County Board of Supervisors	Date	County Counsel Approved as to Form	Date
Chair, Shasta County Board of Supervisors	4/27/10 Date	County Counsel Approved as to Form	5/6/10 Date

Chair, Glenn County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Tehama County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Colusa County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Sutter County Board of Supervisors	4/20/10 Date	County Counsel Approved as to Form	4/13/10 Date
Chair, Shasta County Board of Supervisors	Date	County Counsel Approved as to Form	Date

Appendix D: Issue Resolution Process for Discussion Purposes

This document aims to guide discussions and provide pertinent information as subbasins consider inclusion of an issue resolution process in the Northern Sacramento Valley inter-basin coordination framework. These discussions will take place in the period leading up to the first five-year GSP update.

Discussion Prompts

1. *What are potential benefits/challenges or concerns of including an issue/dispute resolution process in the inter-basin coordination framework?*
2. *What are shared expectations between and among subbasins?*
3. *What are the GSAs preferences for addressing conflicts if/when they arise?*

Background

The Groundwater Sustainability Plan Regulations in Article 8 recommend including a "description of a process for identifying and resolving conflicts between Agencies" as a part of inter-basin coordination (Sections 10727.2, 10733, and 10733.2, Water Code). A recent study by Tara Moran, Janet Martinez, and William Blomquist, part of Stanford University's Water in the West found that the ability of interagency coordination "to solve complex challenges will be contingent on the ability of these organizations to effectively prevent and manage conflicts before they arise and to resolve these conflicts equitably and efficiently when they do." (Moran, Martinez, and Blomquist, 2021). Further, given how likely it is for disagreements at a local level to occur during SGMA implementation, the study suggests investing in establishing issue resolution processes before disagreements arise. Meanwhile, deferring their development could complicate the resolution process in times of conflict. Given these recommendations, consider the following questions for reflection and discussion.

Purposes of issue resolution processes

There are many options to identify and resolve issues that involve different parties, goals/objectives, and resources. Ideally, issue resolution processes are thoughtfully designed and tailored to specific contexts. **The broader goal for such a process can be to meet the agencies' long-term needs, considering local dynamics, desired outcomes, and expected uses**. Goals can include keeping things simple and efficient, maintaining relationships, ensuring quality of the process, fostering participation and community engagement, etc.

The figure below shows different types of dispute resolution processes. In some cases, agencies draft clauses that outline a tiered approach. They often begin with negotiation, which gives the parties control over the process and outcomes. Then, mediation, which brings in a neutral third-party (mediator) to facilitate the discussion and help parties work towards resolving issues. Often, negotiation and mediation lead to "non-binding" outcomes, non-enforceable by courts. Parties could opt to move towards arbitration or litigation, which are controlled by a third party (arbitrator or judge/jury) and can lead to binding and non-binding outcomes (Moran, Martinez, and Blomquist, 2019).

Figure 2. The spectrum of dispute resolution process. Modified from Amsler et al. (2020a).

Negotiation	Mediation	Arbitration	Trial
• No third party	• Third part (mediator)	• Third party (arbitrators)	• Third party (judge/jury)
• Non-binding	• Non-binding	• Non-binding or binding	• Binding

From Moran, Martinez, and Blomquist, 2019

Examples

1. Example from Moran, Martinez, and Blomquist, 2019

Box 2. A Draft Dispute Resolution Clause.

The blue text notes indicate how each of the preceding five questions are incorporated into the dispute resolution language.

In the event that any dispute [Q1: Provides instruction on what disputes can be addressed. Additional process goals, while not explicit should be subject to discussion.] arises among the Members relating to (i) this Agreement, (ii) the rights and obligations arising from this Agreement, (iii) a Member proposing to withdraw from membership in the Agency, or (iv) a Member proposing to initiate litigation within the Basin or the management of the Basin, the aggrieved Member or Members proposing to withdraw from membership shall provide written notice to the other Members of the controversy or proposal to withdraw from membership [Q2: Provides instruction on who can initiate and participate in the process.]. Within forty-five (45) days after such written notice, the Members shall attempt in good faith to resolve the controversy through informal negotiation [Q3: Describes a series of processes for dispute resolution, beginning with negotiation. Also includes a timeline for process stages.]. If the Members cannot agree upon a resolution of the controversy within forty-five (45) days from the providing of written notice specified above, the dispute shall be submitted to mediation prior to commencement of any legal action or prior to withdrawal of a Member proposing to withdraw from membership. The mediation shall be no less than a full day (unless agreed otherwise among the Members) and the cost of mediation shall be paid in equal proportion among the Members [Q4: Provides instruction on who will pay for dispute resolution processes.]. The mediator shall be either voluntarily agreed to or appointed by the Superior Court upon a suit and motion for appointment of an impartial mediator [Q3a: Provides a clear process for choosing an impartial mediator.]. Upon completion of mediation, if the controversy has not been resolved, any Member may exercise all rights to bring a legal action relating to the controversy or withdraw from membership as otherwise authorized pursuant to this Agreement. The Agency may, at its discretion, participate in mediation upon request by a stakeholder [to be defined by the parties to the Agreement] concerning a dispute alleged by the stakeholder concerning the management of the Basin or rights to extract groundwater from the Basin, with the terms of such mediation to be determined in the sole discretion of the Member Directors [Q2: Allows third-party participation in the dispute resolution process].

Note: This above dispute resolution clause is not intended to serve as an endorsement or illustration of effective practice.

2. Example from Butte Subbasin Cooperation Agreement

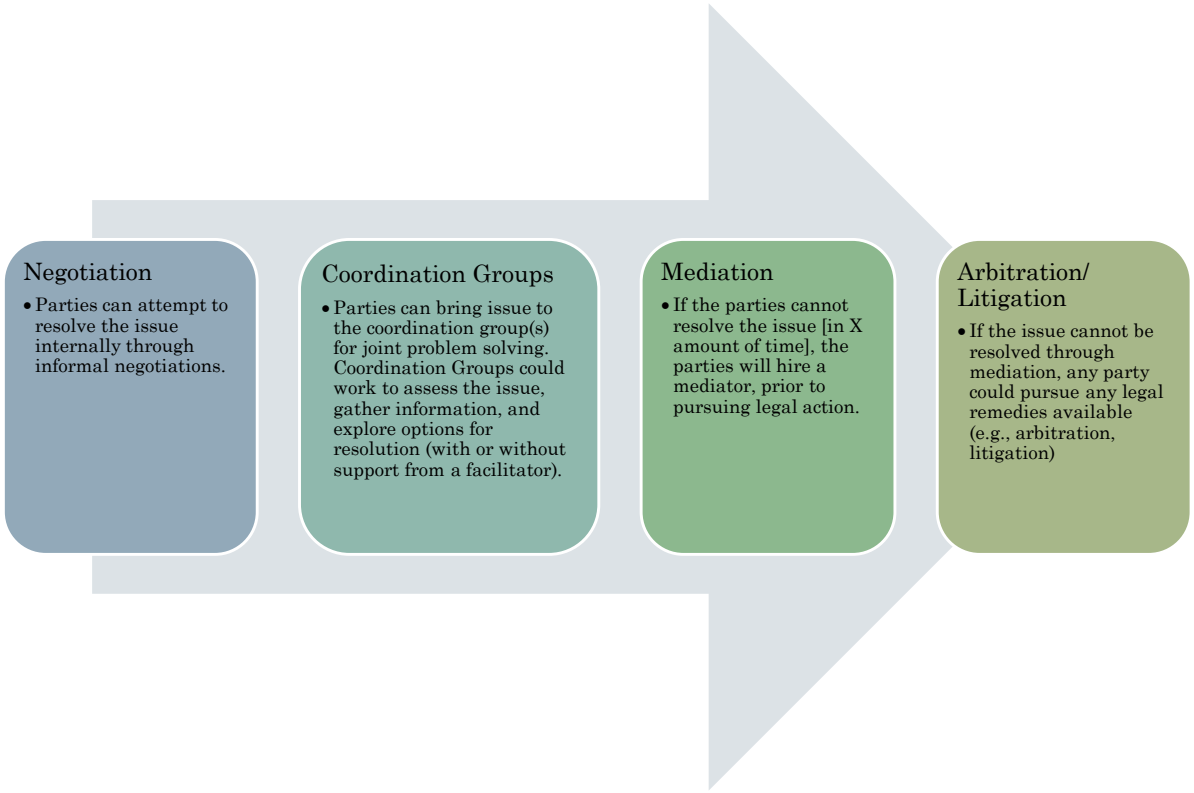
Note: This example doesn't provide much specificity. However, acknowledges shared intent to resolve disputes.

ARTICLE 9. DECISION-MAKING AND DISPUTE RESOLUTION

9.1. Decision-making Authority. Topics where the Members desire coordinated decision-making will be considered by the Advisory Board, and the Member Directors will strive for unanimous recommendations that will be presented to each Member's governing body for consideration. Such topics include, but are not limited to, development and implementation of the GSP, and associated financial arrangements. When unable to reach unanimous recommendations, the Advisory Board will outline the areas in which it does not agree, providing some explanation to inform the respective GSAs' governing bodies. Despite the recommendations of the Advisory Board, ultimate decision-making authority for topics considered by the Advisory Board resides with each Member's governing body.

9.2. Dispute Resolution. It is the desire of Members to informally resolve all disputes and controversies related to this Agreement, whenever possible, at the least possible level of formality and cost. If a dispute occurs, the disputing Members shall meet and confer in an attempt to resolve the matter. If informal resolution cannot be achieved, the matter will be referred to the Advisory Board for resolution. The Advisory Board may engage the services of a trained mediator or resort to all available legal and equitable remedies to resolve disputes.

Possible Process in the Northern Sacramento Valley



Worksheet: Key Questions and Considerations for Issue Resolution Process

The questions below could be used to guide the development of a specific issue resolution process in the context of inter-basin coordination in the Northern Sacramento Valley by the first 5-year GSP update. These questions could help to clarify the level of specificity that subbasins would find beneficial and mutually agreeable when/if conflict occurs.

Adapted from Moran, Martinez, and Blomquist, 2019

1) What are the process goals? a) Consider what disputes the process aims to address – all disputes arising at basin boundaries or only a subset? b) Consider inclusivity and transparency of the process, cost efficiency for parties and the GSA(s), timeframes, and other factors important to your agency(ies). c) Other potential objectives include dispute prevention, enhanced relationships, procedural and substantive fairness, legal compliance, durability of resolution and organizational improvement.	
2) Who can initiate and participate in the dispute resolution process? a) Consider what parties can initiate the dispute resolution process – is it only parties to the agreement or can external parties invoke it? There are pros and cons to both choices, so discussing this in advance will ensure thoughtful consideration.	
3) What processes are used to make decisions related to dispute resolution and what information is necessary? a) What is the process for selecting a mediator, facilitator, lawyer or other impartial party? b) Consider including a range of processes beginning with internal negotiations and escalating based on clear timelines.	
4) Who pays for the dispute resolution process? a) Consider who will pay for the mediator, facilitator, lawyer or other impartial party. Will it be paid for by the disputing parties, the GSA(s) or through a state-funded program? b) How could you assess whether the outcome of the dispute resolution process was successful?	

Other Resources

- Dutton, A. SGMA Updates, Coordination Considerations, and Potential Next Steps, Cosumnes Subbasin Working Group. February 21, 2018. http://cosumnes.waterforum.org/wp-content/uploads/2018/02/EKI_Cosumnes_TAC_meeting_2018-02-21.pdf
- Moran T., Martinez, J., and Blomquist W. Dispute Resolution Processes: Thinking through SGMA Implementation. Water in the West. Fall, 2019. https://waterinthewest.stanford.edu/publications/dispute-resolution-processes-thinking-through-sgma-implementation
- Moran T. Basin-scale Coordination is Key to SGMA's Success: Thoughts on DWR's Draft GSP Regulations. March 1, 2016. Stanford University. Water in the West. https://waterinthewest.stanford.edu/news-events/news-press-releases/basin-scale-coordination-key-sgma%E2%80%99s-success-thoughts-dwr%E2%80%99s-draft-gsp
- Moran et al. Dispute Resolution Clauses in Interorganizational Coordination Agreements: A Comparative Analysis. 2021. pending publication.
- Butte County. 2017. Technical Collaboration on Interconnected Subbasins to Advance Sustainable Groundwater Management: Assessment of Interconnected Subbasins. Available at: https://www.buttecounty.net/wrcdocs/Reports/SpecialProjects/InterbasinGWFlow/InterbasinSBAssessment-FINAL.pdf
- Butte County. 2017. Inter-basin Groundwater Flows Fact Sheet. Available at: https://www.buttecounty.net/wrcdocs/Reports/SpecialProjects/InterbasinGWFlow/FactSheet.pdf
- Buck, Christina. 2017. Butte County Inter-Basin Groundwater Flows Presentation, https://www.buttecounty.net/wrcdocs/Reports/SpecialProjects/InterbasinGWFlow/NSVBoardAssessment20170615.pdf