FINAL REPORT

Red Bluff Subbasin

Sustainable Groundwater Management Act

Groundwater Sustainability Plan

(Chapter 3 – Sustainable Management Criteria)

January 2022, Revised April 2024

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Tehama County Flood Control and Water Conservation District

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BMP	Best Management Practices
CASGEM	California Statewide Groundwater Elevation Monitoring
DMS	Data Management System
DO	Dissolve Oxygen
DQO	Data Quality Objective
DTW	Depth to Water

DWR	Department of Water Resources
EC	Electrical Conductivity
ft/yr	feet per year
GDE	Groundwater Dependent Ecosystem
GSA	Groundwater Sustainability Agency
GSE	Ground Surface Elevation
GSP	Groundwater Sustainability Plan
GWE	Groundwater Elevation
InSAR	Interferometric Synthetic Aperture Radar
MAs	Management Actions
Mg/L	Mlligrams per Liter
MOs	Measurable Objectives
MTs	Minimum Thresholds
NAVD88	North American Vertical Datum of 1988
NDVI	Normalized Difference Vegetation Index
ORP	Oxidation-Reduction Potential
PBO	Plate Boundary Observatory
PMAs	Projects and Management Actions
QA	Quality Assurance
QC	Quality Control
RMS	Representative Monitoring Sites
RP	Reference Point
RPE	Reference Point Elevation
SGMA	Sustainable Groundwater Management Act
SMC	Sustainable Management Criteria
SMCL	Secondary Maximum Containment Level
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
UNAVACO	University NAVSTAR Consortium

3 SUSTAINABLE MANAGEMENT CRITERIA

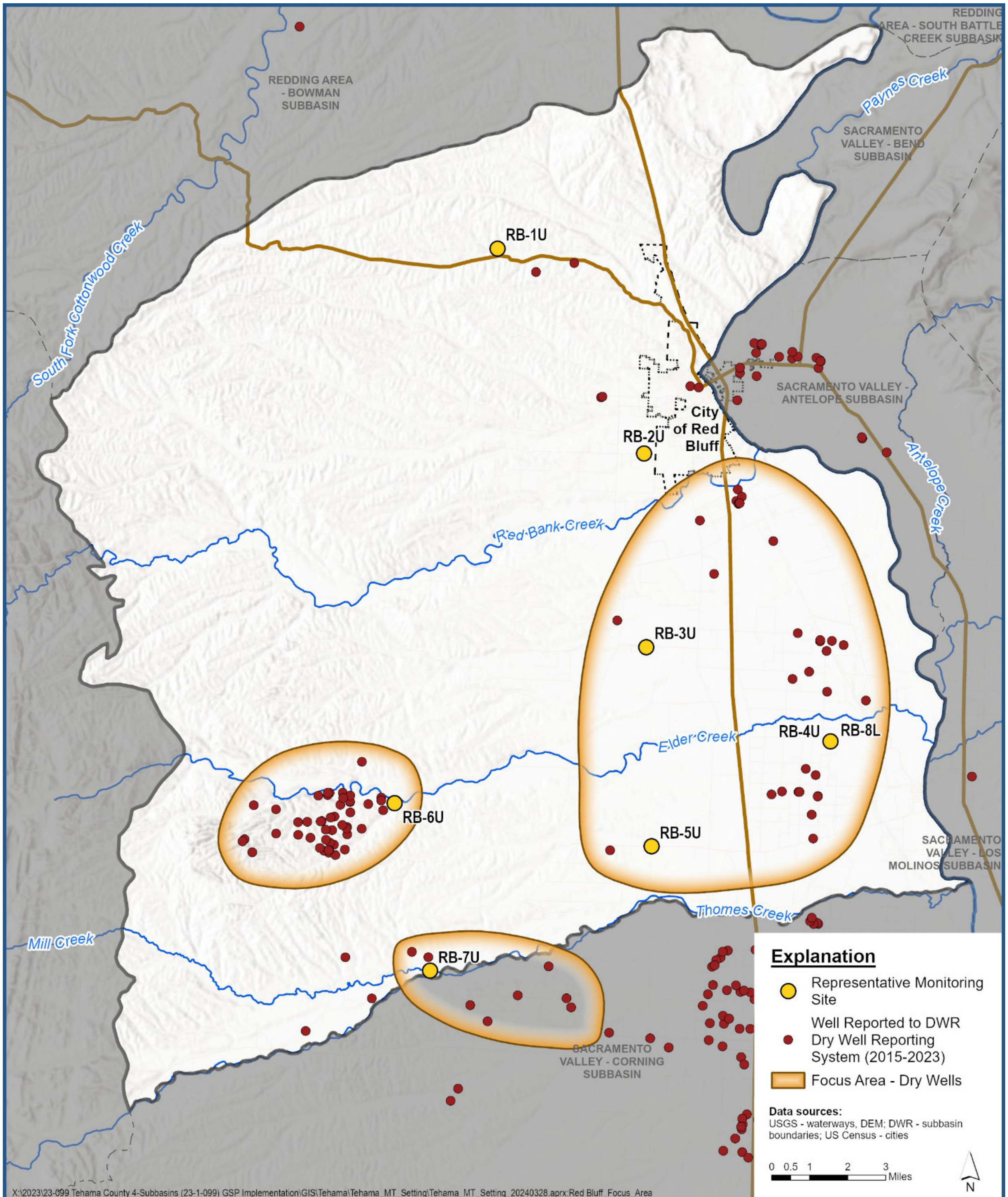
This chapter of the Groundwater Sustainability Plan (GSP or Plan) defines sustainability goals, measurable objectives, interim milestones, minimum thresholds, undesirable results, and the monitoring network for each sustainability indicator within the Plan Area encompassed by the Red Bluff Subbasin GSP. The SMC described in this chapter were developed and updated in 2023-2024 through the GSP revision process. They were developed through communication, outreach, and/or engagement with parties representing those beneficial uses and users to the extent possible given the limited time frame allowed under the 180-day response period. A webinar and open house were conducted on March 19th and 21, 2024, respectively. Tehama County Groundwater Commission and Tehama FCWCD meetings which discussed SMC were open to the public for comment.

The GSAs are implementing PMAs, monitoring, and other efforts described in the GSP to achieve and maintain sustainable groundwater management. However, it is possible that groundwater conditions may temporarily exceed MTs during the GSP implementation period while these actions are occurring. By 2042, GSP implementation is expected to achieve the Subbasin sustainability goal through implementation of PMAs, demonstration that the SMC have been met, and demonstration that no undesirable results are occurring. The sustainability goal will be maintained through proactive monitoring and management by the GSA.

The GSA recognizes that impacts to beneficial users have occurred in the Red Bluff Subbasin. These impacts coincided with the 2020 to 2022 groundwater elevation lows when dry conditions existed in the region. Consequently, groundwater extraction increased, and water levels correspondingly decreased. The 2021 and 2022 water year annual reports documented these conditions. The conditions during these years were markedly different in the subbasin based on location. Also, the effects of decreased water levels were a function of the number, type and location of wells that receive ground water. The beneficial use and users of that water were significantly adversely affected. Impacts to beneficial users during these years include but are not limited to:

- Reported dry wells,
- Reduction in pumping capacity,
- Deeping wells,
- And adverse effects on the surface water environment.

The areas that roughly define the experienced impacts to beneficial users is depicted in Figure 3-1. These areas are called Focus Areas.



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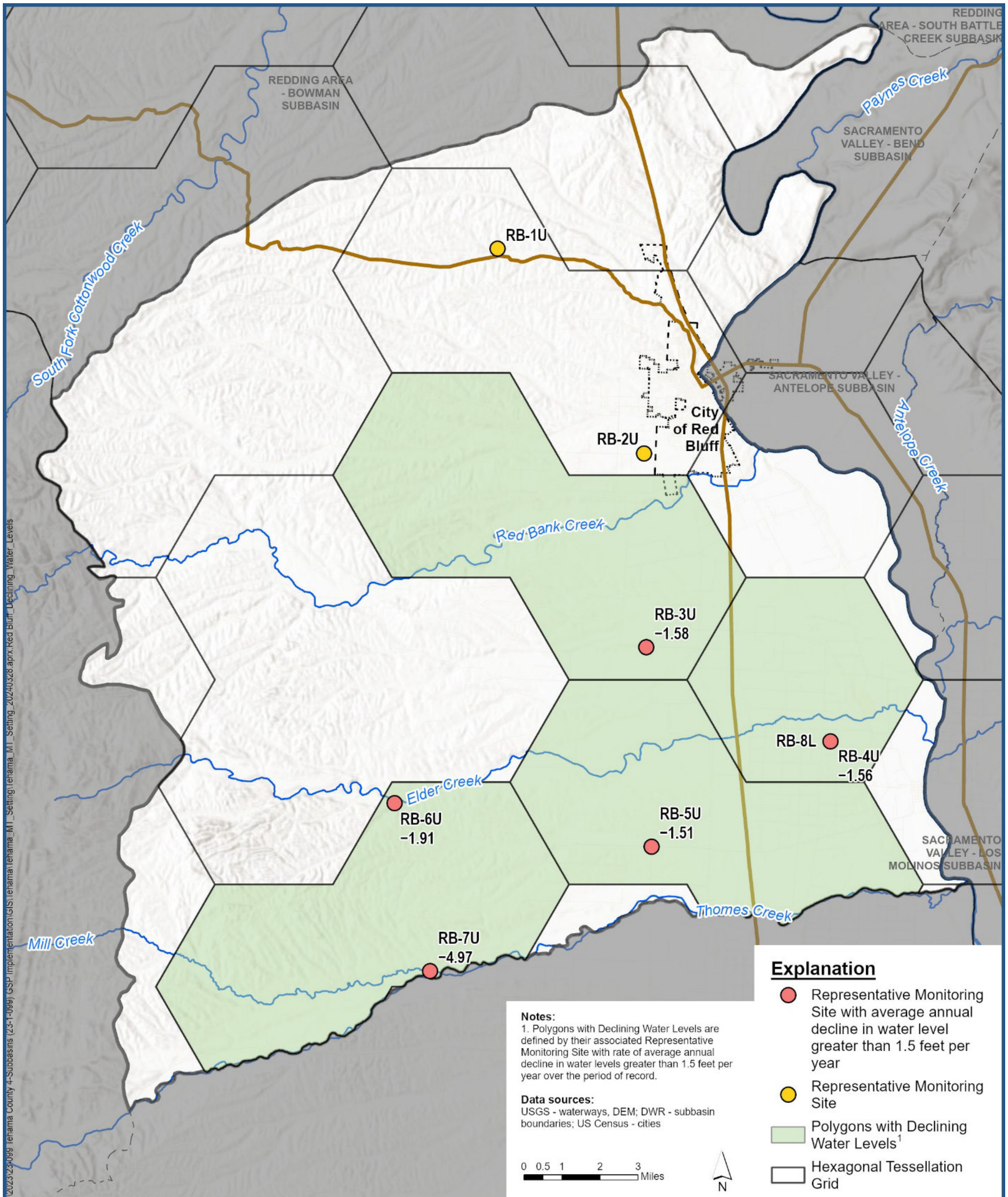
Focus Areas

Groundwater Sustainability Plan
Red Bluff Subbasin

Figure 3-1a



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Polygons with Declining Water Levels

Groundwater Sustainability Plan
Red Bluff Subbasin

Figure 3-1b

The boundary of the Focus Areas was made in consideration of reported dry wells (since 2015) and the hydrographs at RMS, especially their rate of decline (> 1.5 feet/year over the period of record). In the Red Bluff Subbasin there are three Focus Areas. The smallest Focus Area is at the southern end of the basin near Paskenta Road and Ashton Way. A few dry wells are reported in the area, and the RMS well, RB-7U shows a steep decline in water levels. The second Focus Area is roughly ellipsoid shaped, from the area where Elder Creek and Rancho Tehama Road are close to each other east of the Rancho Tehama Airport and extends about six miles west to southwest. It includes a community that relies on groundwater from wells. There is a cluster of reported dry wells within the Focus Area. The largest Focus Area is roughly ellipsoidal and trends north-south. Its approximate boundary locations from South, North, East and West are:

South: Approximately less than 0.5 miles south of the intersection of Hwy 99W and Gyle Rd, less than 1.5 miles north of the subbasin's boundary

North: Interstate I-5 near the St Elizabeth Community Hospital

East: approximately 0.5 miles east of Gerber

West: Approximately 4 miles west of Interstate 5.

Declining water levels indicate declining groundwater storage. When RMS are examined that have a period of record with 1.5 feet decline per year in Figure 6-1b, substantial portions of the subbasin appear to have an unsustainable water supply. The average rates are posted on the figure however short term averages are often steeper, as evidenced in the hydrographs.

This Focus Area also includes reported dry wells. In addition to dry wells the hydrographs from RMS (rate of decline greater than 1.5 feet/year for the period of record) were used to define the boundary. Since the GSA acknowledges uncertainty in the water level information, well information and the relationship between the two the boundary line was conservatively placed (made larger).

Focus Areas are areas that have observed impacts to beneficial users and as such we can use that information to define the MTs. MTs for chronic lowering of groundwater levels are "the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results"

Undesirable results occur when significant and unreasonable effects for any of the six sustainability indicators defined by SGMA are caused by chronic lowering of groundwater levels in the Subbasin. Chronic lowering of groundwater levels is considered to be locally significant and unreasonable if it results in insufficient water supply to meet the needs of beneficial uses and users in the Subbasin. The GSAs define the negative effects to beneficial uses and users that would be experienced at undesirable result conditions in the future as 1) 10 supply wells becoming dry (after the GSP revision) within each Tessellation Hexagon (Figure 3-2) or 2) when water levels at any RMS in the future decline 7.5 ft or more within a per year over five (5) year period at any RMS. The GSAs will address any adverse impacts through projects to supplement supplies of water and through a well mitigation program. The impacts to groundwater dependent ecosystems that may occur without rising to significant and unreasonable levels constituting undesirable results will be evaluated within the next three years of GSP implementation (by January 2027). The GSAs are actively addressing data gaps and conducting monitoring to establish the relationship between interconnected surface water and groundwater and evaluating the potential adverse effects of depletion of groundwater on interconnected surface water and related beneficial users. The GSAs will update the Undesirable Results definition to include depletion of interconnected surface water in the 5-

year GSP Periodic Evaluation due in January 2027, and following the release of DWR's guidance on interconnected surface water analysis and SMC setting.

All reported dry wells will be investigated by the GSAs. Reports will be considered factual until investigated and proven otherwise. The GSAs will the determine why each reported dry well no longer produces water. Reported dry wells will be confirmed to be dry wells if the cause is due to the GSA's management of the subbasin and declining water levels, instead of mechanical, electrical, or structural problems with the well and pump unrelated to declining water levels. The confirmation of dry wells and the subsequent solutions will be included in the Well Mitigation Program. The GSA will address the adverse impacts if any through projects to supplement supplies of water and through a well mitigation program. The impacts to groundwater dependent ecosystems that may occur without rising to significant and unreasonable levels constituting undesirable results has yet to be determined. The GSA is actively addressing data gaps and monitoring to establish the relationship between interconnected surface water and groundwater and the potential adverse effects of a depletion of groundwater. The GSA will update the Undesirable Results definition to include depletion of interconnected surface water in the 5-year Periodic Evaluation in January 2027.

The GSA selected this method for quantifying undesirable results because it addresses DWR's determination letter. "Refine the description of undesirable results to clearly describe the significant and unreasonable conditions the GSA is managing the Subbasin to avoid. This must include a quantitative description of the negative effects to beneficial uses and users that would be experienced at undesirable result conditions." It is the tangible adverse impact to beneficial uses and users. Quantifying and reporting on dry well conditions will increase awareness and dialogue among drillers, beneficial users, and the GSA. It should also have the ancillary effect of improving the GSA's well database, and DWR's dry well system database.

The GSA will manage the subbasin to avoid these undesirable results, and the significant and unreasonable conditions. PMAs discussed in chapter 4 are tools the GSA will use to manage the subbasin. Monitoring conditions that lead to undesirable results will help forecast and avoid those conditions. If beneficial uses and users of groundwater are adversely impacted by declining water levels then efforts will be made to accelerate PMAs including demand management.

The GSA will address the adverse impacts, if any, through projects to supplement supplies of water and through a well mitigation program. The impacts to groundwater dependent ecosystems that may occur without rising to significant and unreasonable levels constituting undesirable results has yet to be determined.

The GSA is aware of the hardship to well owners if their wells no longer provide water due to management of the subbasin and the related decline in water levels. Currently, in Tehama County, residents whose household wells or springs have gone dry can apply for free water deliveries through North Valley Community Foundation (NVCF). Water delivery is a temporary solution, and the GSA will implement a well mitigation program to provide a long-term solution. The GSA has adopted a resolution (Appendix 4-C) to commit to this program. The well mitigation program is a response to DWR's determination letter "Lastly, the GSA should explain how potential alternate supplies of water or well mitigation will be considered by the GSA during its management of the Subbasin in a project or management action as part of the GSP."

Sustainable Management Criteria are the quantitative metrics which collectively consist of sustainability goals, MOs, interim milestones, MTs, and undesirable results. The SMC definitions require considerable analysis and evaluation of many factors. This chapter presents the data and methods used to develop the

SMC and demonstrates how they relate to beneficial uses and users. The SMC presented in this chapter are based on current available data and applications of the best available science.

The Groundwater Sustainability Agency (GSA) will periodically evaluate this GSP, assess changing conditions in the Plan area that may warrant modifications of the GSP or management objectives, and may adjust components accordingly. The GSA will focus their evaluation on the efficacy of actions under the GSP to meet the Plan's management objectives and the sustainability goal of the Plan area.

This chapter is organized to address all the Sustainable Groundwater Management Act (SGMA) regulations regarding SMC and is organized in accordance with Department of Water Resources' (DWR) GSP annotated outline. This chapter includes a description of:

- Development of locally defined significant and unreasonable conditions related to the sustainability indicators that exist in the Subbasin
- How MTs were developed, including:
  - The information and methodology used to develop MTs,
  - The relationship between MTs and significant and unreasonable undesirable results,
  - The relationship between MTs other sustainability indicators,
  - The effect of MTs on neighboring basins,
  - The effect of MTs on beneficial uses and users,
  - How MTs are related to relevant federal, state, or local standards and
  - The method for quantifying measurable MTs.
- How MOs were developed, including:
  - The methodology for setting MOs and
  - The quantification of Interim milestones that represent the estimated pathway to sustainable management of groundwater resources in the Subbasin by 2040.
- How undesirable results were developed, including:
  - The criteria defining when and where the effect of the groundwater conditions cause undesirable results based on a quantitative description of MT exceedances,
  - The potential causes of undesirable results and
  - The effect of these undesirable results on the beneficial uses and users.

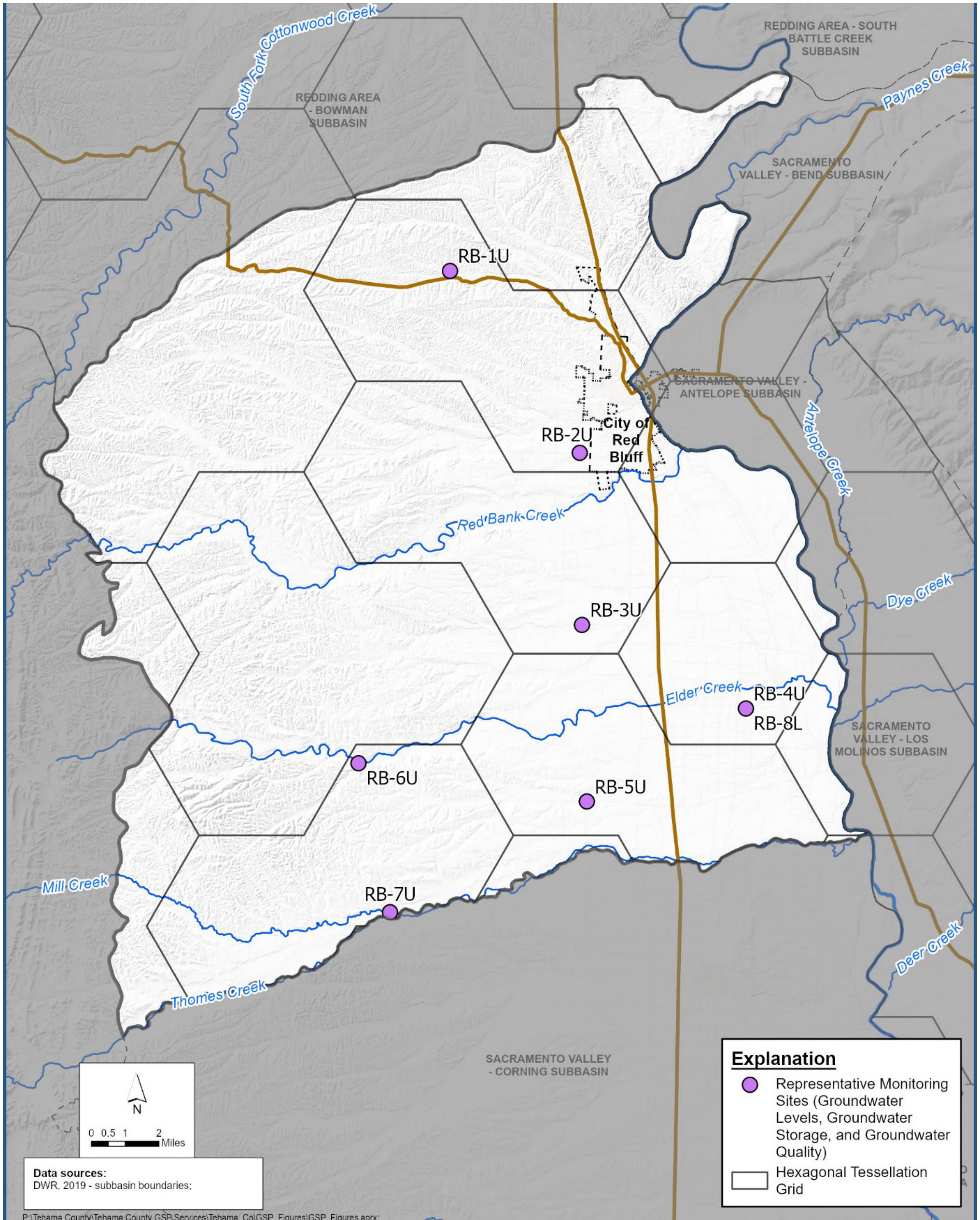
The SMC presented in this chapter were developed using information from stakeholder and public input, public meetings, hydrogeologic and groundwater dependent ecosystem analysis, meetings with GSA representatives, and meetings with DWR's technical experts during the consultation meetings held with DWR during the 180-day revision period. The general process for establishing SMC includes:

- GSA public meetings that outlined the GSP development process and introduced stakeholders to the SMC,
- Conducting GSA public meetings to present proposed methodologies to establish MTs and MOs and receive additional public input,
- Reviewing public input on preliminary SMC methodologies with GSA representatives,
- Providing a Draft GSP for public review and comment,
- Establishing and modifying MTs, MOs, and definition of undesirable results based on feedback from public meetings, public/stakeholder review of the Draft GSP, and input from GSA staff/technical representatives.

To ensure the Plan area shows progress in meeting its sustainability goal by 2042, the GSA proposes projects and management actions (PMAs) to address undesirable results which are described in **Section 4**. The projects expected to be implemented can include recharge basins, flood water on agricultural land, and in-lieu recharge. Management actions may include revised well permit ordinances and demand management. Demand management is considered a necessary complement to recharge projects as they will take time to fully implement, and the effectiveness is limited in dry years and during droughts. The overarching sustainability goal and the absence of significant and unreasonable levels of undesirable results are expected to be achieved by 2042 through implementation of the PMAs. The sustainability goals will be maintained through proactive monitoring and management by the GSA as described in this and the following chapters. **Table 3-1** presents a summary of the six (6) undesirable results and whether each has occurred, is occurring, or is expected to occur in the future without GSP implementation. The table also presents a summary of the proposed PMAs that have been developed to address each of the undesirable results that may be presently occurring or have historically occurred in the Subbasin. Representative Monitoring Sites (RMS) are identified for monitoring of interim milestones, MOs, and MTs for each sustainability indicator, and are also known as sustainability RMS wells. Locations of all sustainability RMS wells are shown in **Figure 3-2.** The TSS wells are multi-screened wells intended to monitor both the upper and lower aquifers. TSS-1 is installed, and monitoring of its water levels has commenced, however TSS-2 and TSS-3 are yet to be installed.

Conditions within the Subbasin will be considered sustainable when all the following goals are met:

1. Long-term aggregate groundwater use is equal to the Subbasin's estimated sustainable yield.
2. The average annual volume of groundwater storage changes within the Subbasin, averaged across I the Subbasin is approximately zero, representing generally stable conditions coincident with the achievement of sustainable groundwater levels at MO groundwater elevations.
3. Groundwater levels are maintained at the set Mos. The MOs represent water levels present during sustainable conditions, including a margin of operational flexibility, and will avoid undesirable results, such as lowering groundwater levels that result in significant and unreasonable depletions of available water supply for beneficial uses available to groundwater users.
4. Groundwater quality will be maintained at constituent concentrations in those areas of the Subbasin where degraded water quality does not already exist prior to the 2015 baseline period. Groundwater extractions will be managed to ensure that beneficial users of groundwater can utilize groundwater that meets drinking water standards for urban and domestic users and agricultural guidelines for agricultural beneficial users without the implementation of PMAs.
5. Subsidence is maintained at current levels or below current levels to avoid undesirable results such as impacts to critical infrastructure and inelastic subsidence.
6. Interconnected surface waters are maintained at levels needed to avoid impacts to beneficial users and the degradation of groundwater dependent ecosystems.
7. Sustainability goals for seawater intrusion are not provided because this undesirable result is highly unlikely to occur in the Subbasin (the Subbasin is approximately 90 miles away from the Pacific Ocean and not connected to a coastal aquifer).



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Representative Monitoring Sites

Figure 3-2

Groundwater Sustainability Plan
Red Bluff Subbasin

Table 3-1. Summary of Experienced Undesirable Results Applicable to the Plan Area

SUSTAINABILITY INDICATOR	HISTORICAL PERIOD	EXISTING CONDITIONS	FUTURE CONDITIONS WITHOUT GSP IMPLEMENTATION	PROJECTS AND MANAGEMENT ACTIONS IMPLEMENTED TO MEET THE GSP SUSTAINABILITY GOAL
Chronic Lowering of Groundwater Elevations	Yes	Yes	Yes	See Chapter 4
Reduction of Groundwater Storage	Yes	Yes	Yes	See Chapter 4
Seawater Intrusion	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Degraded Water Quality	Limited	Limited	Limited	See Chapter 4
Land Subsidence	No	No	No	See Chapter 4
Depletion of Interconnected Surface Water	Data Gap	Data Gap	TBD	See Chapter 4

Note: Based on review of available data, characterization of hydrogeologic conditions related to the potential for ISW is currently based on very limited data. The GSA is filling data gaps and conducting monitoring to evaluate the sustainable indicator for Depletion of Interconnected Surface Water.

3.1. Sustainability Goal (Reg §354.24)

The sustainability goal for the Subbasin has three (3) sections:

1. A description of the sustainability goal,
2. A discussion of the measures that will be implemented to ensure the Subbasin will operate within the sustainable yield, and
3. An explanation of the Subbasin's pathway to achieve the sustainability goal within 20 years of GSP implementation and to maintain the goal through the planning and implementation horizon (through 2072)

3.1.1. Goal Description

The goal of this GSP is to develop PMAs that result in the sustainable management of the groundwater resources of the Subbasin for long-term community, financial, and environmental benefits of residents and businesses in the Subbasin. This GSP outlines the approach to achieve sustainable management of groundwater resources within 20 years, while maintaining the unique cultural, community, and agricultural aspects of the Subbasin. The GSA's sustainability goal is to ensure that by 2042, and thereafter within the planning and implementation horizon of this GSP (50 years to 2072), the Subbasin is operated within its sustainable yield and does not exhibit undesirable results considered significant and unreasonable.

3.1.2. Description of Measures

Meeting this goal requires achieving a balance of water demand with available water supply for all beneficial users in the Subbasin, while monitoring groundwater quality and working with beneficial users to ensure sustainable groundwater supplies, by the end of the GSP implementation timeframe, carrying through the SGMA planning and implementation horizon.

3.1.3. Description of Measures and Explanation of How the Goal Will Be Achieved in 20 Years

To ensure the Subbasin meets its sustainability goal by 2042, the GSA proposed several PMAs, described in Chapter 4, to address any undesirable results that may occur. The overarching sustainability goal as well as the absence of undesirable results are expected to be achieved by 2042 through implementation of the PMAs. The PMAs, listed below and described in detail in Chapter 4, were developed to ensure the sustainability goal is achieved by 2042.

1. The Multi-Benefit Recharge Program is a program developed with The Nature Conservancy (TNC) to provide a dual benefit of creating critical habitat for migrating bird species while recharging groundwater supplies.
2. The Grower Education Relating to On-Farm Practices Project will provide growers with educational resources to implement practices which will result in more efficient water use while improving agricultural productivity.
3. The Thomes Creek and Elder Creek Diversion Project would divert a portion of the flows along Thomes Creek and Elder Creek for either (1) off-stream storage and subsequent use for irrigation, or (2) direct groundwater recharge via flood managed aquifer recharge (Flood-MAR), dedicated recharge basins, recharge wells, or modified stream beds.
4. The Expanded Use of CVP Contract Supplies Projects would incentivize expanded use of CVP supply by irrigators in Proberta Water District and Thomes Creek Water District, with the goal of using the full contract supply available to each district.
5. The El Camino Restoration Project plans to restore and modernize its water supply infrastructure.
6. The Elder Creek Non-Native, Invasive Species Plant Control Project would identify and then strategically remove invasive plants in the Elder Creek watershed, with a focus on giant reed (Arundo donax) and salt cedar (Tamarisk).
7. The Tehama West Non-Native, Invasive Species Plant Control Project would identify and then strategically remove invasive plants in the riparian zones in watersheds on the western edge of the Subbasin.
8. Demand Management includes various measures to reduce demand on existing groundwater resources in the Subbasin.
9. The Well Mitigation Program will provide assistance to domestic, small water system, and municipal wells adversely impacted by declining groundwater levels since 2015 that interfere with groundwater production or quality.

The sustainability goal will be maintained through proactive monitoring and management by the GSA as described in this GSP.

3.2. Measurable Objectives and Interim Milestones *(Reg. § 354.30)*

Measurable objectives, as well as interim milestones that represent the path to sustainability in five (5)-year increments, are detailed below. Measurable objectives represent the quantified metric at each representative monitoring site for each sustainability indicator that is expected to occur under sustainable groundwater pumping conditions for the Subbasin. If the GSA successfully manages groundwater pumping which results in the achievement of the MOs described, the Subbasin will be operating sustainably. A description of the MOs and how they were established are provided, along with recognition of the anticipated fluctuations in basin conditions around the established MOs. In addition, this section describes how the GSP helps to meet each measurable objective, how each measurable objective is intended to achieve the sustainability goal for the Plan area for the long-term beneficial uses, and how the interim milestones are intended to reflect the anticipated progress toward the MOs during the 2022 to 2042 Implementation Period.

The GSP regulations (California Code Water Code - Division 6 - Conservation, Development, and Utilization of State Water Resources, Part 2.75 - Groundwater Management, Chapter 3 - Groundwater Management Plans) define MOs as specific, quantifiable goals for the maintenance or improvement of specific groundwater conditions that have been included in an adopted Plan to achieve the sustainability goal for the basin.

Per GSP Regulations (354.30):

1. Measurable objectives shall be established, "…including interim milestones in increments of five (5) years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon." (354.30.a)
2. "Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metric and monitoring sites as are used to define the MTs." (354.30.b)
3. "Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty." (354.30.c)
4. "…a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators…" may be established where "…the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual MOs as supported by adequate evidence." (354.30.d)
5. "Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of 5 years." (354.30.e)

The MOs developed for each applicable sustainability indicator in this GSP are based on the current understanding of the Plan Area and Basin Setting, as discussed in detail in Chapter 2. Representative Monitoring Sites (RMS) are identified for monitoring of interim milestones, measurable objectives, and minimum thresholds for each sustainability indicator, and are also referred to as sustainability indicator wells.

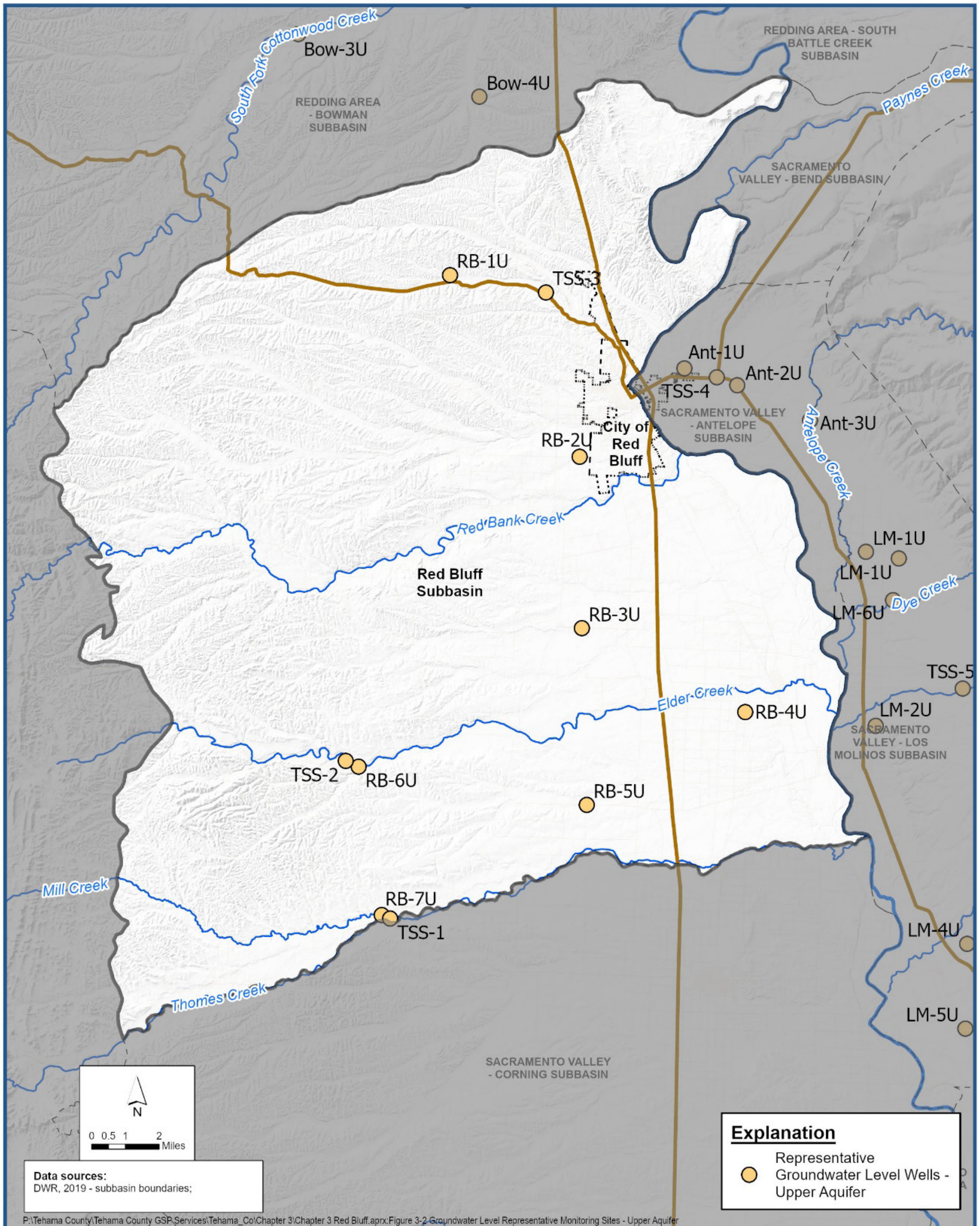
3.2.1. Measurable Objectives for Chronic Lowering of Water Levels

3.2.1.1. Description of Measurable Objectives

Measurable objectives for groundwater levels were established by analyzing historical groundwater level data. Both annual (variability from year to year) and seasonal variability were considered in the development of MOs. Groundwater elevation SMC were developed based on historic measurements and a sustainability goal of preventing negative impacts to domestic wells. Measurable objectives were set at each of the monitoring sites (**Table 3-2 through 3-3 and Figure 3-3 through 3-4**) These sites were selected to provide an even distribution of coverage over the Subbasin and based on each individual well's ability to capture the general groundwater trend for other wells in their vicinity.

To determine MOs, historical water elevations and projected water level trends were analyzed. The Subbasin aims to become sustainable by 2042 and therefore, MOs were set to spring 2042 projected elevations minus five (5) feet for wells with a decreasing projected trend and at spring 2015 water levels minus five (5) feet for wells with an increasing projected trend in water elevations or with no trend. These MOs allow for operational flexibility while maintaining sustainability within the Subbasin.

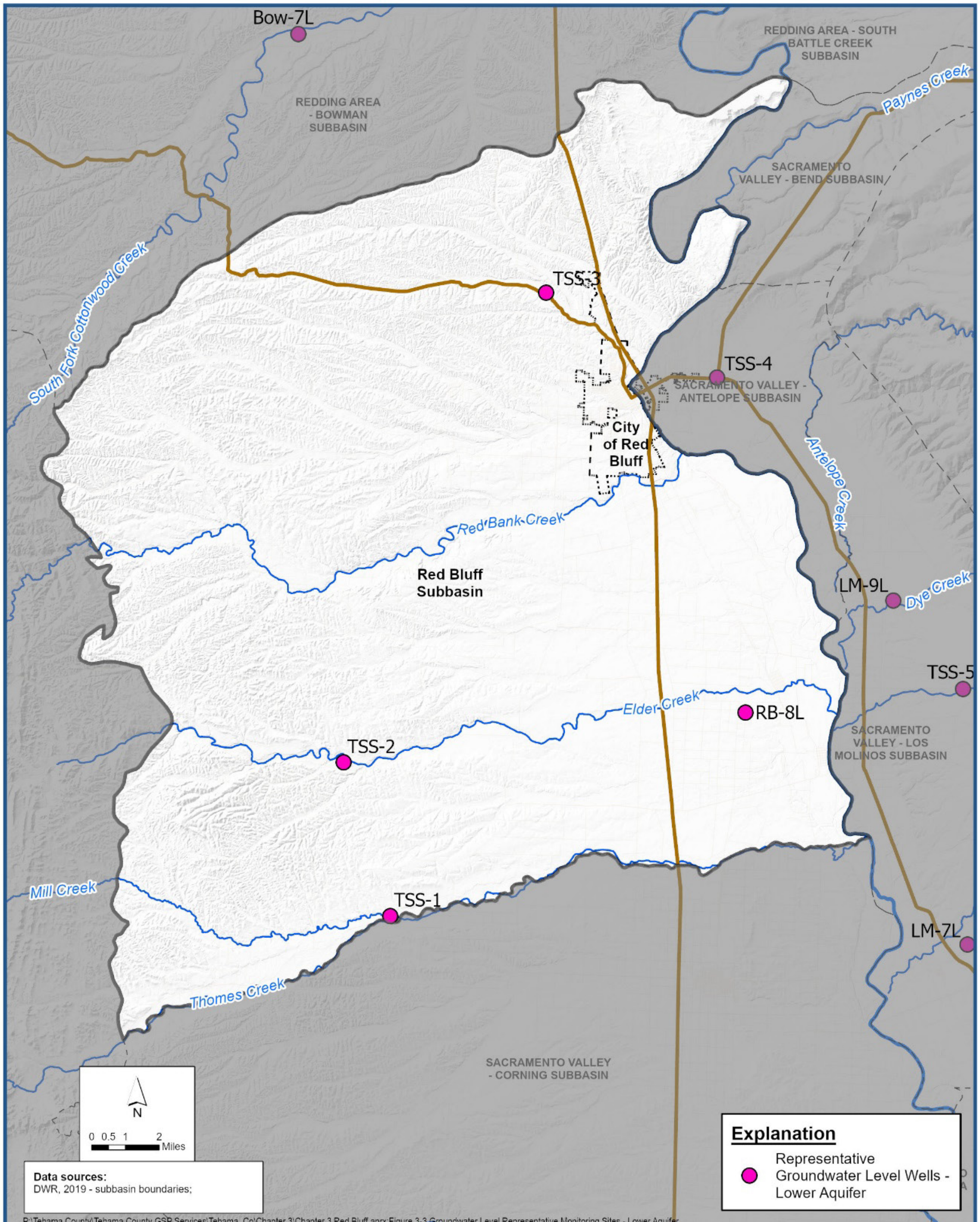
Groundwater level hydrographs showing MOs for each groundwater level sustainability indicator well are provided in **Appendix 3-B.** Measurable objectives for each groundwater level monitoring well in the upper and lower aquifers are summarized in **Tables 3-2 and 3-3.**



Groundwater Level Representative Monitoring Sites - Upper Aquifer

Figure 3-3

Groundwater Sustainability Plan
Red Bluff Subbasin



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Groundwater Level Representative Monitoring Sites - Lower Aquifer

Figure 3-4

Groundwater Sustainability Plan
Red Bluff Subbasin

Table 3-2. Measurable Objectives and Interim Milestones for the Chronic Lowering of Groundwater Elevations – Upper Aquifer

WELL NAME	STATE WELL NUMBER (SWN)	INTERIM MILESTONE 5 YEARS (FT NAVD88)	INTERIM MILESTONE 10 YEARS (FT NAVD88)	INTERIM MILESTONE 15 YEARS (FT NAVD88)	MEASURABLE OBJECTIVE (FT NAVD88)
RB-1U	27N04W05G002M	433.9	433.4	432.9	432.4
RB-2U	27N04W36G001M	245.8	244.4	243.0	241.5
RB-3U	26N04W25J001M	262.0	260.4	258.7	257.1
RB-4U	25N03W11B001M	213.9	210.2	206.6	203.0
RB-5U	25N03W19N001M	238.1	233.5	228.9	224.2
RB-6U	25N05W24D001M	408.5	406.1	403.7	401.3
RB-7U	N/A	347.6	341.5	335.3	329.1
TSS-1	TBD	TBD	TBD	TBD	TBD
TSS-2	TBD	TBD	TBD	TBD	TBD
TSS-3	TBD	TBD	TBD	TBD	TBD

Note: TSS-1 was installed prior to July of 2022, however insufficient water level data have been collected to establish SMC.

Table 3-3. Measurable Objectives and Interim Milestones for the Chronic Lowering of Groundwater Elevations - Lower Aquifer

WELL NAME	SWN	INTERIM MILESTONE 5 YEARS (FT NAVD88)	INTERIM MILESTONE 10 YEARS (FT NAVD88)	INTERIM MILESTONE 15 YEARS (FT NAVD88)	MEASURABLE OBJECTIVE (FT NAVD88)
RB-8L	25N03W11B002M	212.0	208.7	205.3	202.0
TSS-1	TBD	TBD	TBD	TBD	TBD
TSS-2	TBD	TBD	TBD	TBD	TBD
TSS-3	TBD	TBD	TBD	TBD	TBD

Note: TSS-1 was installed prior to July of 2022, however insufficient water level data have been collected to establish SMC

3.2.1.2. Interim Milestones (Reasonable Margin of Safety for Operational Flexibility)

Interim milestones at five (5), ten (10), and fifteen (15) years are summarized in **Table 3-2 and Table 3-3** above. Interim milestones demonstrate progress towards achieving sustainability as represented by the MO values. The 2021 spring measurement was used as the starting point in the development of interim milestones for all the wells. The interim milestones are the difference between the MOs and the starting point equally distributed over four interim milestones.

3.2.1.3. Path to Achieve and Maintain the Sustainability Goal

Considering historic trends, projected groundwater extraction and planned PMAs it appears that the subbasin will be on a reasonable path to maintain the sustainability goal with stable groundwater elevations. Recent water levels remain above the MOs. Since recent groundwater levels are higher than the MOs, a recovery of groundwater elevation is not needed to reach the sustainability goal. The interim milestones serve to maintain the existing sustainable conditions. Planned PMAs in conjunction with coordination of SMC with adjacent subbasins will ensure the MOs for groundwater elevations are met.

The combination of interim milestones and MOs reflect how the GSA anticipates achieving and maintaining sustainability. It should be noted that future projections require assumptions about future hydrologic conditions, including the sequence of wet, average, and dry climatic years. The future climatic assumptions for the Implementation Period (through 2042) used in this GSP incorporate sequences of wet, average, and dry years that represent overall long-term average historical climatic conditions over the Implementation Period, without any prolonged periods of extremely dry or extremely wet years.

3.2.1.4. Impact of Selected Measurable Objectives on Adjacent Basins

The MOs established for the Subbasin provide a good basis for evaluation of anticipated impacts on adjacent subbasins from implementation of the GSP. This is because MOs are set to reflect the average groundwater levels to be maintained during the Sustainability Period. Ultimately, the potential for impacts on adjacent subbasins will be primarily a function of average water levels in the Subbasin during the Sustainability Period, average water levels in adjacent subbasins during the Sustainability Period, and natural groundwater flow conditions that would be expected to occur at Plan area boundaries. The average groundwater levels expected for the Plan area are reflected in the Measurable Objectives. Tehama County is also the GSA for the surrounding Antelope, Bowman and Los Molinos Subbasins. The MOs for these surrounding subbasins were set in a concurrent fashion using the same methodology as the Red Bluff Subbasin. Furthermore, the GSA has also reviewed the MOs for the Vina and Corning subbasins during the development of the GSP. Red Bluff MOs were compared to those set for the northernmost wells in these two subbasins for consistency. Therefore, no adverse impact on adjacent basins is likely to occur.

3.2.2. Measurable Objectives for Reduction in Groundwater Storage

3.2.2.1. Description of Measurable Objectives

The MOs for reduction on groundwater storage were developed using the same methodology as the chronic lowering of groundwater elevations MOs. They are set to the amount of groundwater storage that exists when the groundwater elevations are at their MOs.

3.2.2.2. Interim Milestones (Reasonable Margin of Safety for Operational Flexibility)

Interim milestones at five (5), ten (10), and fifteen (15) years are summarized in **Table 3-2 and Table 3-3** for groundwater levels. The 2021 spring measurement was used as the starting point in the development of interim milestones for all the wells.

3.2.2.3. Path to Achieve and Maintain the Sustainability Goal

The combination of interim milestones and MOs reflect how the basin will achieve and maintain sustainability. Since groundwater levels serve as a practical proxy for evaluating reduction in groundwater storage, achieving, and maintaining sustainability relative to this indicator is similar to that described above in the groundwater level section.

3.2.2.4. Impact of Selected Measurable Objectives on Adjacent Basins

The groundwater model used for Red Bluff also encompasses the neighboring four (4) subbasins (Antelope, Bowman, Corning, and Los Molinos). Projections for future water levels in the Red Bluff Subbasin were generated while accounting for conditions at these surrounding subbasins. Furthermore, MOs for water elevations for Vina and Corning subbasins were compared with those set for Red Bluff and considered in the development of this GSP. Therefore, no adverse impact to surrounding subbasins is anticipated.

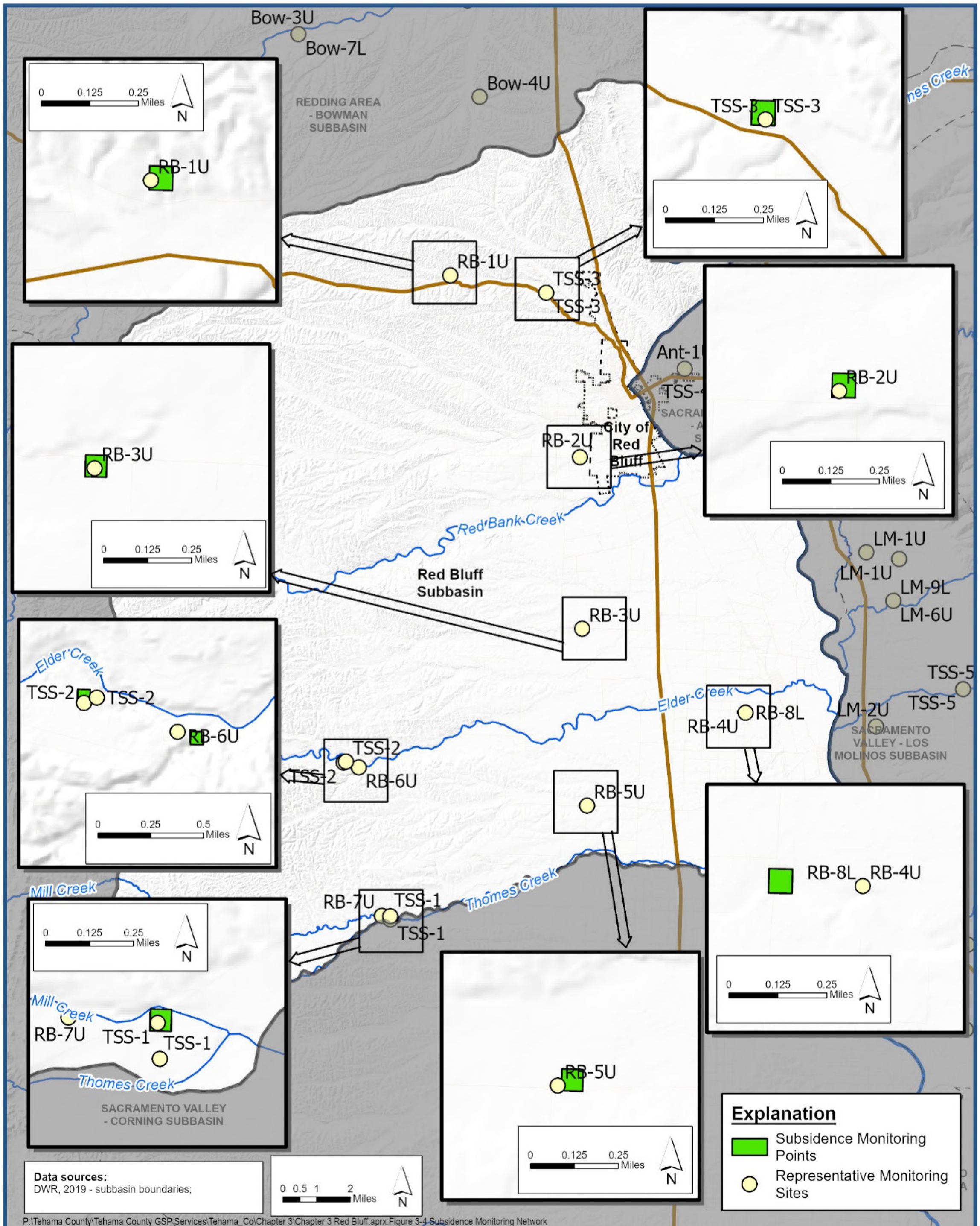
3.2.3. Measurable Objectives for Subsidence

3.2.3.1. Description of Measurable Objectives

The MOs for subsidence represent target subsidence rates in the Subbasin. The MOs were set to vertical displacements of 0.25 feet ever 5 years or one foot over 20 years at each (zero inelastic subsidence, in addition to any measurement error) in each InSAR pixel. If InSAR data are used, the measurement error is 0.1 feet and any measurement 0.1 feet or less would not be considered inelastic subsidence. Prior to determining this value, subsidence data from three (3) different sources (PBO, DWR, InSAR) was analyzed for historical and current trends. The MOs were set by examining the vertical displacement observed at the pixels from June 2015 to September 2019. The current subsidence monitoring InSAR pixels are shown on **Figure 3-5**. Based on the existing monitoring system the subsidence MOs are shown in **Table 3-4**. Note historical ground elevations for these pixels are presented in Appendix 3-C InSAR Subsidence Timeseries Data.

Table 3-4. Measurable Objectives and Interim Milestones for Subsidence

INSAR PIXEL	INTERIM MILESTONE 5 YEARS (FT)	INTERIM MILESTONE 10 YEARS (FT)	INTERIM MILESTONE 15 YEARS (FT)	MEASURABLE OBJECTIVE (FT)
DV3OYJD	-0.25	-0.5	-0.75	-1.0
DTP3463	-0.25	-0.5	-0.75	-1.0
DSC9KKE	-0.25	-0.5	-0.75	-1.0
DRPN3N0	-0.25	-0.5	-0.75	-1.0
DQY95R7	-0.25	-0.5	-0.75	-1.0
DR76NQR	-0.25	-0.5	-0.75	-1.0
DQ1IBER	-0.25	-0.5	-0.75	-1.0
DR8YYJU	-0.25	-0.5	-0.75	-1.0
DUZIXC8	-0.25	-0.5	-0.75	-1.0



Subsidence Monitoring Network

Groundwater Sustainability Plan
Red Bluff Subbasin

Figure 3-5

3.2.3.2. Interim Milestones (Reasonable Margin of Safety for Operational Flexibility)

Interim milestones at five (5), ten (10), and fifteen (15) years are summarized in **Table 3-4.**

3.2.3.3. Path to Achieve and Maintain the Sustainability Goal

Historic trends and planned groundwater extraction and PMAs provide a reasonable path to maintain the sustainability goal with levels of subsidence that will not exceed historical trends. As discussed in the basin setting, subsidence has not been an issue for the Red Bluff Subbasin. Even so, continued monitoring at InSAR pixel locations will highlight and help to mitigate any increases in subsidence through PMAs. The interim milestones served to maintain the existing sustainable conditions. The sustainability goal for subsidence is to prevent a trend of increasing rates of subsidence. Planned PMAs will ensure the MOs for subsidence are met.

3.2.3.4. Impact of Selected Measurable Objective on Adjacent Basins

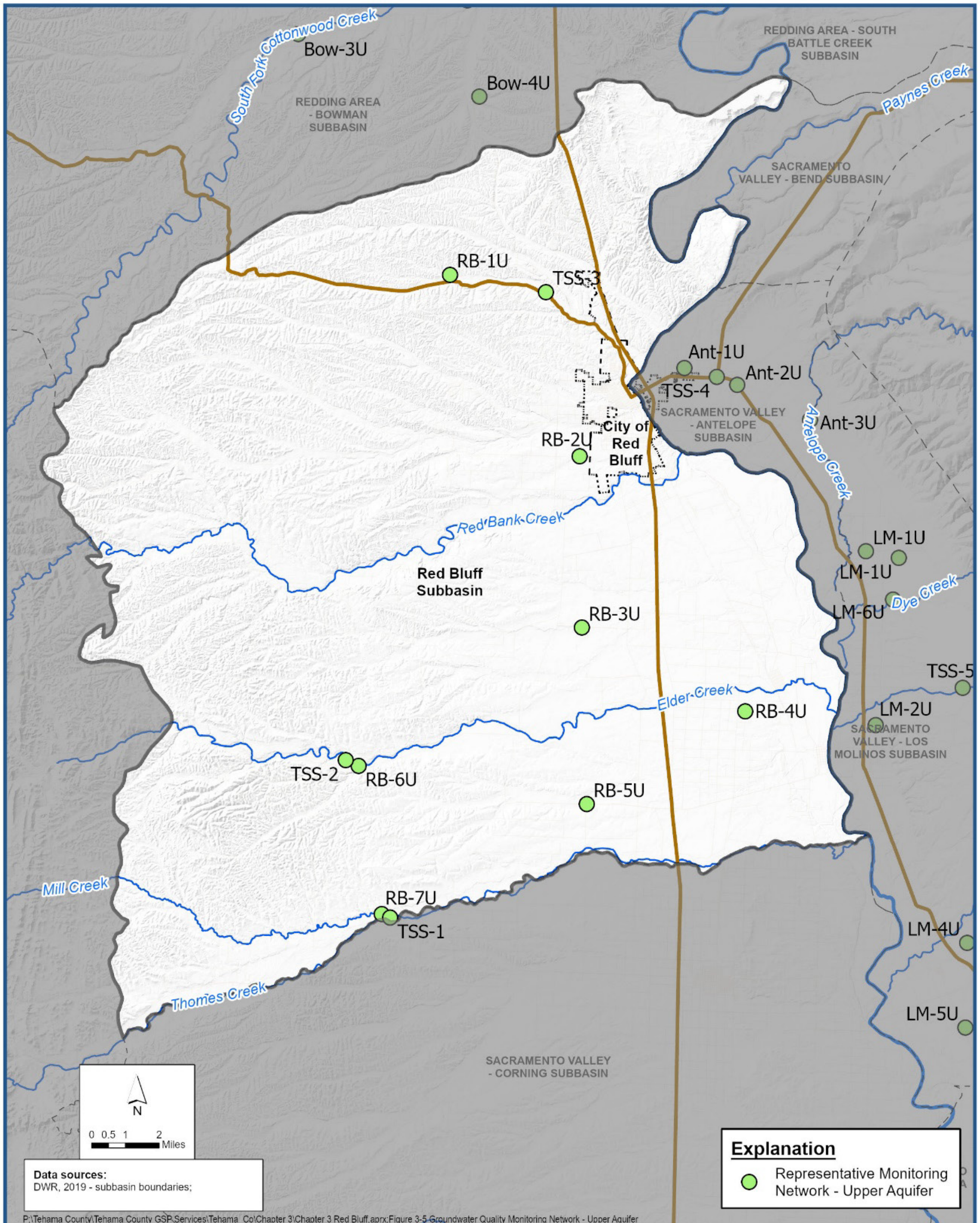
The anticipated effect of the subsidence MOs on each of the neighboring subbasins is not expected to be significant because of the following factors:

- The Subbasin has not been subject to large levels of subsidence in the past
- Three neighboring subbasins are also managed by the same GSA and sustainability efforts are to be coordinated between subbasins to avoid adverse impacts. The GSA has also reviewed the objectives set by the Vina and Corning subbasins for consistency in MOs

3.2.4. Measurable Objectives for Degraded Water Quality

3.2.4.1. Description of Measurable Objectives

The MOs for minimizing the degradation of groundwater quality are based on groundwater sample concentrations meeting water quality objectives and groundwater quality at concentrations similar to historical observations in the groundwater basin. Based on the review of groundwater quality in Chapter 2, the constituent being evaluated for all beneficial users is total dissolved solids (TDS). The basis for establishing the measurable objective is to minimize the additional contribution and migration of TDS. The GSA is aware of nitrate issues within the Subbasin, and TDS will be used to monitor the overall groundwater quality. Additional needs for nitrate monitoring will be evaluated on an ongoing basis and the plan will be modified as needed. Measurable objectives for wells in the monitoring network are summarized in **Table 3-5** and shown on **Figure 3-6.** All water quality monitoring wells are constructed in the upper aquifer as TDS is not a concern in the lower aquifer and more pumping occurs from the upper aquifer. The MOs for groundwater quality are concentrations of TDS that are generally representative of secondary drinking water standards for urban and domestic beneficial and tolerable for most crops grown in the Subbasin without blending with surface water supplies. The measurable objective is established at 500 mg/L which represents recommended secondary drinking water standards.



TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
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Groundwater Quality Monitoring Network - Upper Aquifer **Figure 3-6**

Groundwater Sustainability Plan
Red Bluff Subbasin

Table 3-5. Measurable Objectives and Interim Milestones for Groundwater Quality

Well Name	State Well Number (SWN)	Interim Milestone 5 Years (TDS mg/L)	Interim Milestone 10 Years (TDS mg/L)	Interim Milestone 15 Years (TDS mg/L)	Measurable Objective (TDS mg/L)
RB-1U[1]	27N04W05G002M	<500	<500	<500	500.0
RB-2U[1]	27N04W36G001M	<500	<500	<500	500.0
RB-3U	26N04W25J001M	TBD	TBD	TBD	500.0
RB-4U[1]	25N03W11B001M	<500	<500	<500	500.0
RB-5U	25N03W19N001M	TBD	TBD	TBD	500.0
RB-6U	TBD	TBD	TBD	TBD	500.0
RB-7U[1]	N/A	<500	<500	<500	500.0
TSS-1	TBD	TBD	TBD	TBD	500.0
TSS-2	TBD	TBD	TBD	TBD	500.0
TSS-3	TBD	TBD	TBD	TBD	500.0

1 = The current conditions are below the MO and thus the path forward (IMs) is to stay below the MO.

3.2.4.2. Interim Milestones (Reasonable Margin of Safety for Operational Flexibility)

Recent water quality data was not available in the Subbasin for establishing baseline conditions and calculating interim milestones over the GSP implementation period. To establish baseline water quality, samples were collected from RMS wells and were analyzed for TDS. Details of sampling activities and lab results are included in **Appendix 3-D**. Interim milestones were established using available lab results. This table will be updated as more results become available. Interim Milestones are summarized in **Table 3-5.**

3.2.4.3. Path to Achieve and Maintain the Sustainability Goal

The GSP monitoring program for groundwater quality will provide the GSA with a comprehensive understanding of groundwater quality in the Subbasin and identify areas with degraded water quality. This data will be used by the GSA to develop future PMAs, as necessary, to address areas with degraded water quality.

3.2.4.4. Impact of Selected Measurable Objectives on Adjacent Basins

Currently, the state of migration of TDS is unknown and therefore it is not possible to quantify the impact from the MOs on adjacent subbasins. As more data is collected, the impact to adjacent subbasins will be reassessed. However, the MOs for TDS have been set to the same limit as the surrounding subbasins of Antelope, Los Molinos and Corning and below those set for Vina so no negative impacts are anticipated.

3.2.5. Measurable Objectives for Interconnected Surface Waters

3.2.5.1. Description of Measurable Objectives

Interim MOs (**Table 3-6**) have been established for this indicator due to extensive data gaps which are discussed in **Section 3.7.8.7.** The MOs for the chronic lowering of groundwater elevations will be used as a proxy for interconnected surface waters. Wells within one mile of interconnected surface water features will be used for monitoring groundwater levels (**Figure 3-7**). Future shallow groundwater monitoring proposed in this plan will provide data to characterize stream-aquifer interaction and establish MOs for interconnected surface water. Until sufficient data is available, it is assumed that existing surface water – groundwater interactions will not considerably change when sustainable groundwater levels occur in the Subbasin.

3.2.5.2. Interim Milestones (Reasonable Margin of Safety for Operational Flexibility)

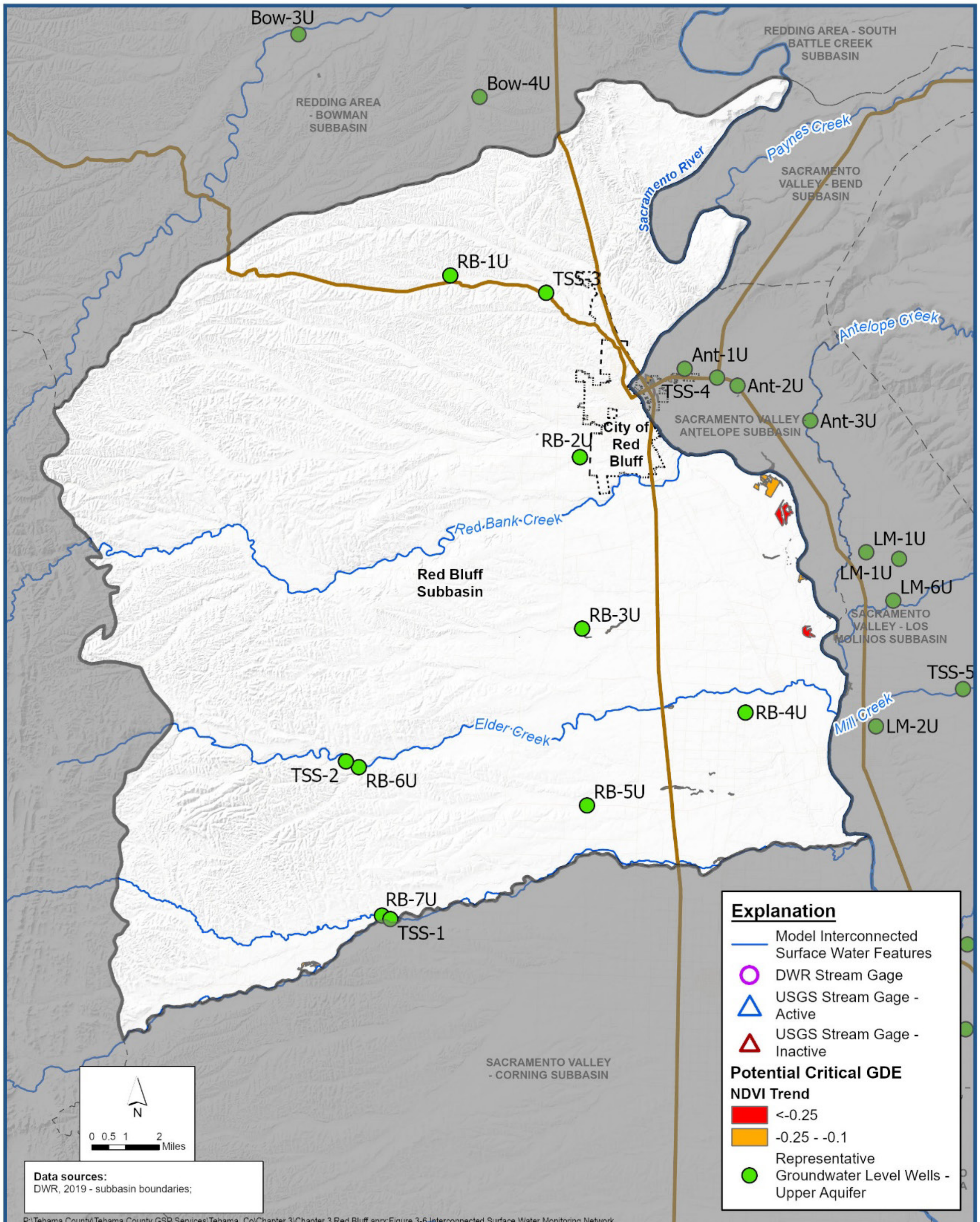
Temporary interim milestones have been established for this indicator due to extensive data gaps which are discussed in **Section 3.7.8.7**. The interim milestones for the chronic lowering of groundwater elevations will be used as a proxy for interconnected surface waters. Wells within one (1) mile of interconnected surface water features will be used for monitoring groundwater levels.

Table 3-6. Initial Measurable Objectives and Interim Milestones for Interconnected Surface Water

WELL NAME	SWN	INTERIM MILESTONE 5 YEARS (FT NAVD88)	INTERIM MILESTONE 10 YEARS (FT NAVD88)	INTERIM MILESTONE 15 YEARS (FT NAVD88)	MEASURABLE OBJECTIVE (FT NAVD88)
RB-1U	27N04W05G002M	433.9	433.4	432.9	432.4
RB-2U	27N04W36G001M	245.8	244.4	243.0	241.5
RB-3U	26N04W25J001M	262.0	260.4	258.7	257.1
RB-4U	25N03W11B001M	213.9	210.2	206.6	203.0
RB-5U	25N03W19N001M	238.1	233.5	228.9	224.2
RB-6U	25N05W24D001M	408.5	406.1	403.7	401.3
RB-7U	N/A	347.6	341.5	335.3	329.1
TSS-1	TBD	TBD	TBD	TBD	TBD
TSS-2	TBD	TBD	TBD	TBD	TBD
TSS-3	TBD	TBD	TBD	TBD	TBD

3.2.5.3. Path to Achieve and Maintain the Sustainability Goal

No MOs have been established for this indicator due to extensive data gaps which are discussed in **Section 3.7.8.7**. For the interim, MOs for the chronic lowering of groundwater elevations will be used as a proxy for interconnected surface waters. Wells within one (1) mile of interconnected surface water features will be used for monitoring groundwater levels.



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Interconnected Surface Water Monitoring Network

Groundwater Sustainability Plan
Red Bluff Subbasin

Figure 3-7

3.2.5.4. Impact of Selected Measurable Objectives on Adjacent Basins

No MOs have been established for this indicator due to extensive data gaps which are discussed in **Section 3.7.8.7**. For the interim, MOs for the chronic lowering of groundwater elevations will be used as a proxy for interconnected surface waters. Wells within the upper aquifer will be used for monitoring groundwater levels. As data gaps are bridged and more data becomes available, the GSA will continue to evaluate the MOs and their potential impacts on adjacent subbasins.

3.3. Minimum Thresholds (*Reg. § 354.28)*

The regulations define undesirable results as occurring when significant and unreasonable effects are caused by groundwater conditions occurring throughout the Plan area for a given sustainability indicator. Significant and unreasonable effects occur when MTs are exceeded for one or more sustainability indicators. Minimum thresholds refer to a numeric value for each sustainability indicator used to define undesirable results. A GSP must establish MTs that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site. The numeric value used to define the MTs shall represent a point in the Subbasin that, if exceeded may cause significant and unreasonable undesirable results. A GSA may establish a representative MTs, such as groundwater elevation (GWE) to serve as the value for multiple sustainability indicators, if the GSA can demonstrate the representative value is a reasonable proxy for multiple individual MTs, as supported by adequate evidence. Minimum thresholds are not required for sustainability indicators that are not present and not likely to occur in the Subbasin.

The description of MTs shall include the following:

1. The information and criteria relied upon to establish and justify the MTs for each sustainability indicator. The justification for the MTs shall be supported by information provided in the basin setting, and other data or models as appropriate and qualified by uncertainty in the understanding of basin setting.
2. The relationship between the MTs for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each MTs will avoid undesirable results from each sustainability indicator.
3. How MTs have been selected to avoid causing undesirable results in adjacent basins or affecting adjacent basin's ability to achieve sustainability goals.
4. How MTs may affect the interests of beneficial users and users of groundwater or land uses and property interests.
5. How state, federal, or local standards relate to the relevant sustainability indicator. If the MTs differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.
6. How each MTs will be quantitatively measured, consistent with the monitoring network requirements.

3.3.1. Minimum Thresholds for Chronic Lowering of Groundwater Elevations

3.3.1.1. Description of Minimum Threshold

Groundwater levels will be measured at existing or new monitoring wells to gauge if MTs are being met. The groundwater level monitoring will be conducted in accordance with the monitoring plan outlined in Section 3.11. Furthermore, the groundwater level monitoring will meet the requirements of the technical and reporting standards included in the GSP regulations. As noted in Section 3.11, the current groundwater monitoring network includes nine (9) wells in the Upper Aquifer and two (2) wells in the Lower Aquifer (**Figure 3-2 and Figure 3-3**). The GSA will also install two (2) nested monitoring wells (TSS 2-3) in the Subbasin which is included in this monitoring network (**Figure 3-1**). These wells are designed to monitor both the upper and lower aquifers.

The GSP regulations provide that the "MTs for chronic lowering of groundwater elevations shall be the groundwater level indicating a depletion of supply at a given location that may lead to undesirable results." Chronic lowering of groundwater elevations in the Subbasin cause significant and unreasonable declines if they are sufficient in magnitude to lower the rate of production of pre-existing groundwater wells below that necessary to meet the minimum required to support overlying beneficial use(s) where alternative means of obtaining sufficient water resources are not technically or financially feasible. In addition, GWEs will be managed at levels above the MTs to ensure the major aquifers in the Subbasin are not depleted in a manner to cause significant and unreasonable impacts to other sustainability indicators.

The MTs are intended to protect against significant and unreasonable levels of chronic groundwater storage declines, water quality degradation, and subsidence in areas where critical infrastructure is located. These MTs are also being utilized as initial MTs for interconnected surface waters and are intended to protect against negative impacts to GDEs and the depletion of interconnected surface waters. The development of MTs for chronic lowering of groundwater elevations included a review of historical groundwater levels. Minimum thresholds were established based on these historical and projected data and the GSA's consideration of undesirable results. The MTs for chronic lowering of groundwater elevations are based on documented screen intervals of key wells located both in the upper and lower aquifers in the Subbasin. MTs for chronic lowering of groundwater levels were developed and updated in 2023-2024 through the GSP revision process. As described below, the MT for groundwater levels is defined with recognition of experienced impacts to beneficial users (Focus Areas) and potential future impacts to beneficial users (outside the Focus Areas).

Focus Area MTs are set to the lowest water levels at RMS within the Focus Areas measured in the 2020 to 2022 timeframe since impacts to beneficial users occurred during this timeframe. One RMS well (RB-7U) is in the smallest Focus Area (just north of the Corning Subbasin and west of Henlyville). One RMS well (25N05W24D001M, RB-6U) is in the Rancho Tehama area Focus Area. TSS-2 is a multi-completion well expected to be installed by summer of 2024 that will be used as another RMS well. The SMC for TSS-2 wells will be defined once sufficient water level data are collected. The SMC for the upper aquifer screen (well) may be comparable to the nearby well RB-6U. Currently four RMS wells are in the larger Focus Area that straddles I-5, 26N04W25J001M (RB-3U), 25N03W19N001M (RB-5U), 25N03W11B001M (RB-4U) and 25N03W11B002M (RB-8L). If new RMS wells are installed in any Focus Area then 2020-2022 lows in those wells may be estimated from other wells. If existing wells in the Focus Areas become RMS, the 2020-2022 lows will be the MTs. The MTs outside the Focus Area are the 2020-2022 low water levels with a 20 ft operational margin below those levels, meaning, 2020-2022 lows -20 ft. The numerical values of each MT is simplistic, easy to understand and consistent within and outside the Focus Zone. RMS wells and the subsequent MTs are listed in **Table 3-7 and Table 3-8**. Groundwater level hydrographs are provided in **Appendix 3-B.**

The beneficial uses and users of groundwater were considered in setting the MTs outside the Focus Areas; shallower wells, typically domestic well users likely benefit from shallower MTs to be protective during dry hydraulic conditions whereas the deeper wells, typically agricultural and municipal users likely benefit from lower MTs for increased operational flexibility; the MTs are a compromise. The 20-foot cap on the depth below the 2020-2022 lows was established in recognition of the uncertainty in water levels, wells and the relationship between the conditions and the effects on wells.

Consistent with Subarticle 4, each minimum threshold will be quantitatively measured at each RMS well at least twice a year and compared to the lowest elevation each fall.

Hydrographs of each RMS well are contained in **Appendix 3-B**. An example of one hydrograph is presented as Figure 3-8. Both the MT and the MO are shown. The original (prior to this revision) MT is presented on the hydrographs in **Appendix 3-E**.

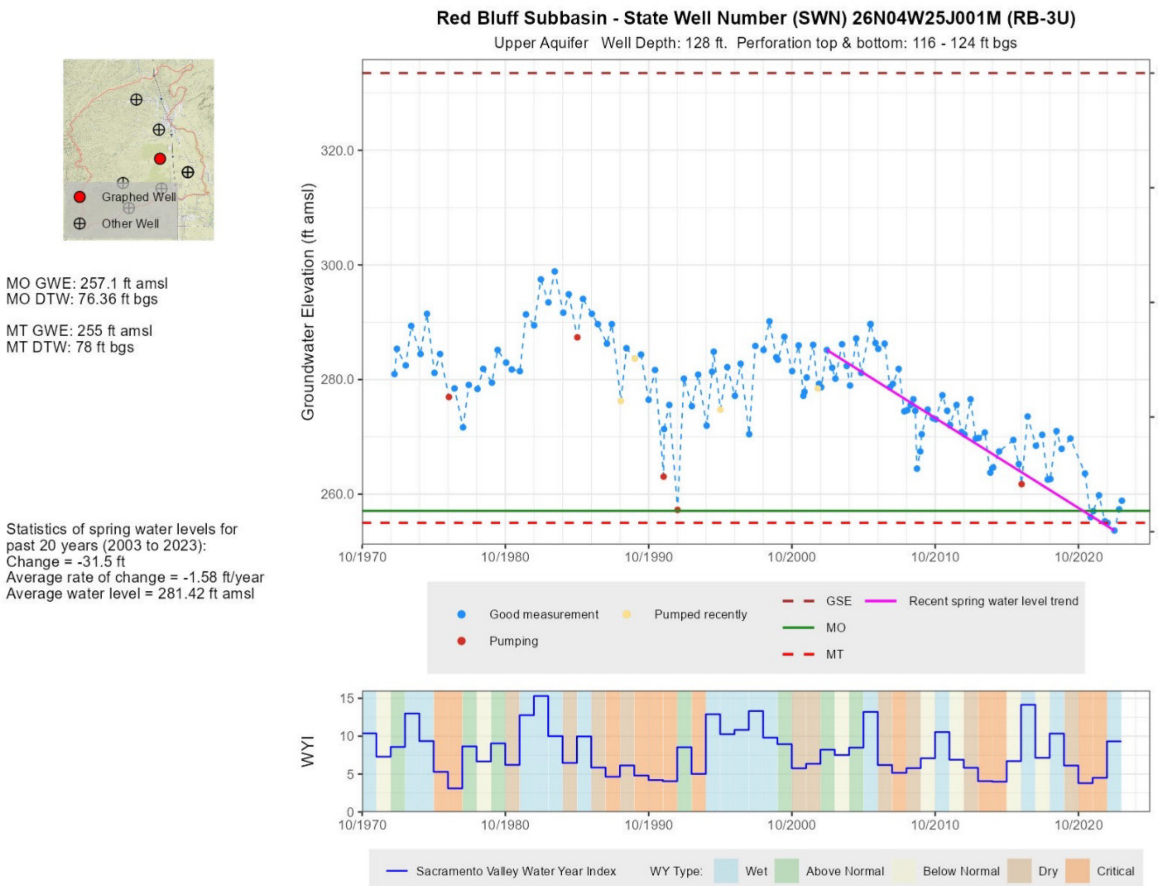


Figure 3-8. Example Hydrograph with MO and MT The original GSP included estimates of the potential number of dry domestic wells at different water levels at RMS and related them to MTs. In order to address the determination letter corrective action 1c (excerpt below) the GSA improved the well data set in three ways:

1. Added well records available since the GSP was written
2. Includes all well types instead of just domestic wells
3. Includes wells of all ages, instead of wells since 1980

"Provide an evaluation of how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests. Identify the number and location of wells that may be negatively affected when minimum thresholds are reached. Compare well infrastructure for all well types in the Subbasin with minimum thresholds nearby, suitably representative monitoring sites.

Document all assumptions and steps clearly so that it will be understood by readers of the GSP. Include maps of potentially affected well locations, identify the number of potentially affected wells by well type, and provide a supporting discussion of the effects."

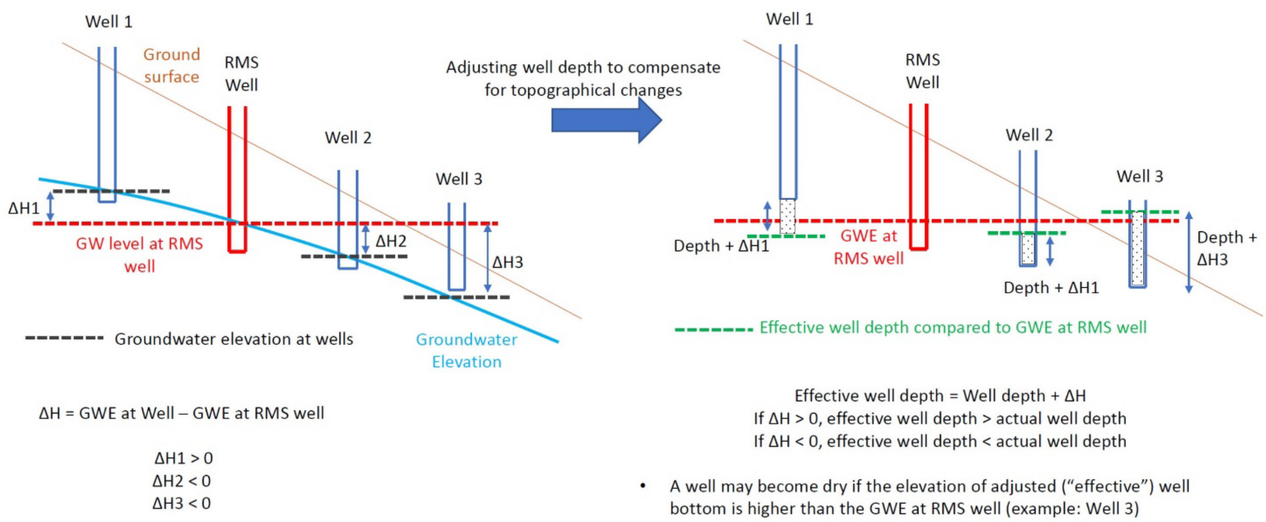
Even though the well data set is enhanced it still includes uncertainty as it likely includes wells that are destroyed or abandoned, lacks information about well construction and location, and is missing wells (well records were not provided to DWR or the local environmental health department). A well registration program is scheduled to be implemented in 2025 to refine this dataset. Calculations and graphics were created to associate potential dry wells with water levels at RMS. The estimates are in increments, 5%, 10%, 15%, 20% and so on. A small portion of these estimates appear to be illogical, for example the 10% estimate is above the land surface. Also a few RMS are associated with only a few wells in its Tessellation Hexagon, therefore the statistics are less reliable. As data becomes available through the well registration program, these calculations will be redone in early 2025 and MTs will be reevaluated as needed. The uncertainty in predictions in potential dry wells at lower water levels is the reason the GSA will use reported and confirmed dry wells in each Tessellation Hexagon as one of two metrics for undesirable results. The other metric being declining water levels greater than or equal to 7.5 ft over a five year period at RMS.

The number of wells expected to go dry when water levels are at the MT were calculated using depth values available well completion reports and estimating the variation in water levels using hydraulic and topographic variations determined from Chapter 2B. The well data information used in this evaluation was sourced from the State of California Department of Water Resources (DWR) Open Data Portal for Well Completion Reports (WCR) on January 8, 2024, and February 6, 2024. The downloaded WCR database was filtered to include wells that have total completed depth information and are located within or near the Subbasin boundary, resulting in a tabular dataset of wells in the Subbasin. To classify the planned use of the wells, the following categories were used: domestic, industrial, agricultural, public, and unknown.

The total completed depth of a well can be a critical metric in evaluating the potential impacts of lowering groundwater levels due to pumping within the Subbasin. For the well records with perforated interval information in the WCR database, the effective well depth was set to the bottom of the perforated interval. In contrast, for well records with no perforated interval information, the effective well depth was set to 10 ft less than the total completed depth as a buffer to account for the installed pump.

Methodology to estimate dry wells around RMS is presented below, and depicted in Figure 3-9

1. A representative horizontal hydraulic gradient was assumed based on water levels as wells are not collocated with the RMS
2. Well depths were adjusted based on the topographic gradient in areas with significant topographic land changes, since wells are not collocated with the RMS
3. The ratio between the two gradients gives an adjustment value that was then applied to the MT water level in the RMS to estimate the groundwater elevation at the location of the wells.
4. Comparing the groundwater elevations of wells to the bottom elevation of the well determines whether or not the well would be dry when water levels decline to the MT at the RMS.



Luhdorff & Scalmanini Consulting Engineers

Well Impact Analysis Well Depth Adjustment

Groundwater Sustainability Plan
Red Bluff Subbasin

Figure 3-9

Figure 3-9. Well Impact Well Depth Adjustment

The predicted number of dry wells at the MT is summarized in Table 3-7 and **Appendix 3-E**, however with the uncertainty in the data set the undesirable results will be monitored and reported as the number of new dry wells in each Tessellation Hexagon. Review of water level data generally indicate that water levels in deeper wells (depths typical for agricultural and municipal wells) are generally lower than groundwater levels in shallower domestic wells. This means that comparison of observed groundwater levels for RMS wells screened in deeper zones to average domestic well depths likely shows a worst-case scenario (i.e., groundwater levels for most nearby domestic wells will be higher than indicated on the hydrograph for a deep zone RMS well). An example Hydrograph with the estimated well impact is presented as Figure 3-10.

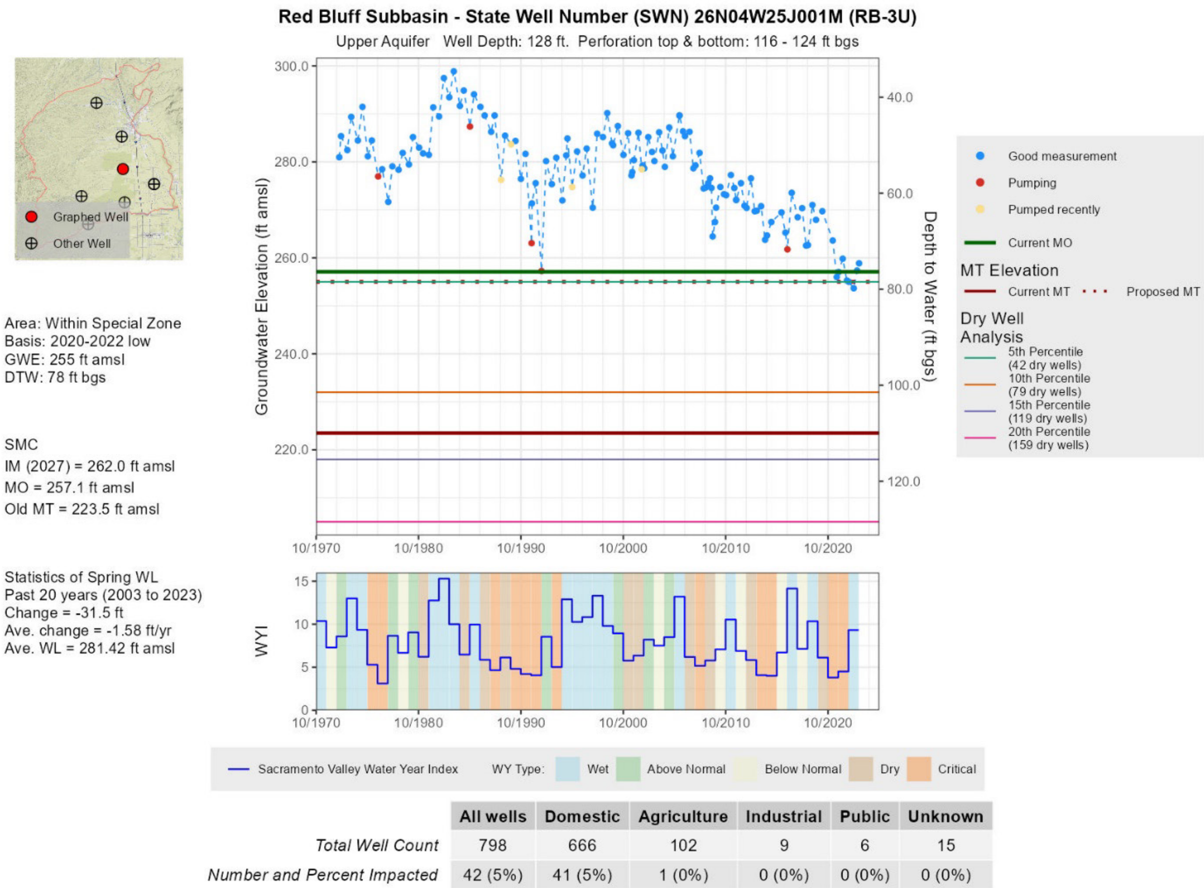


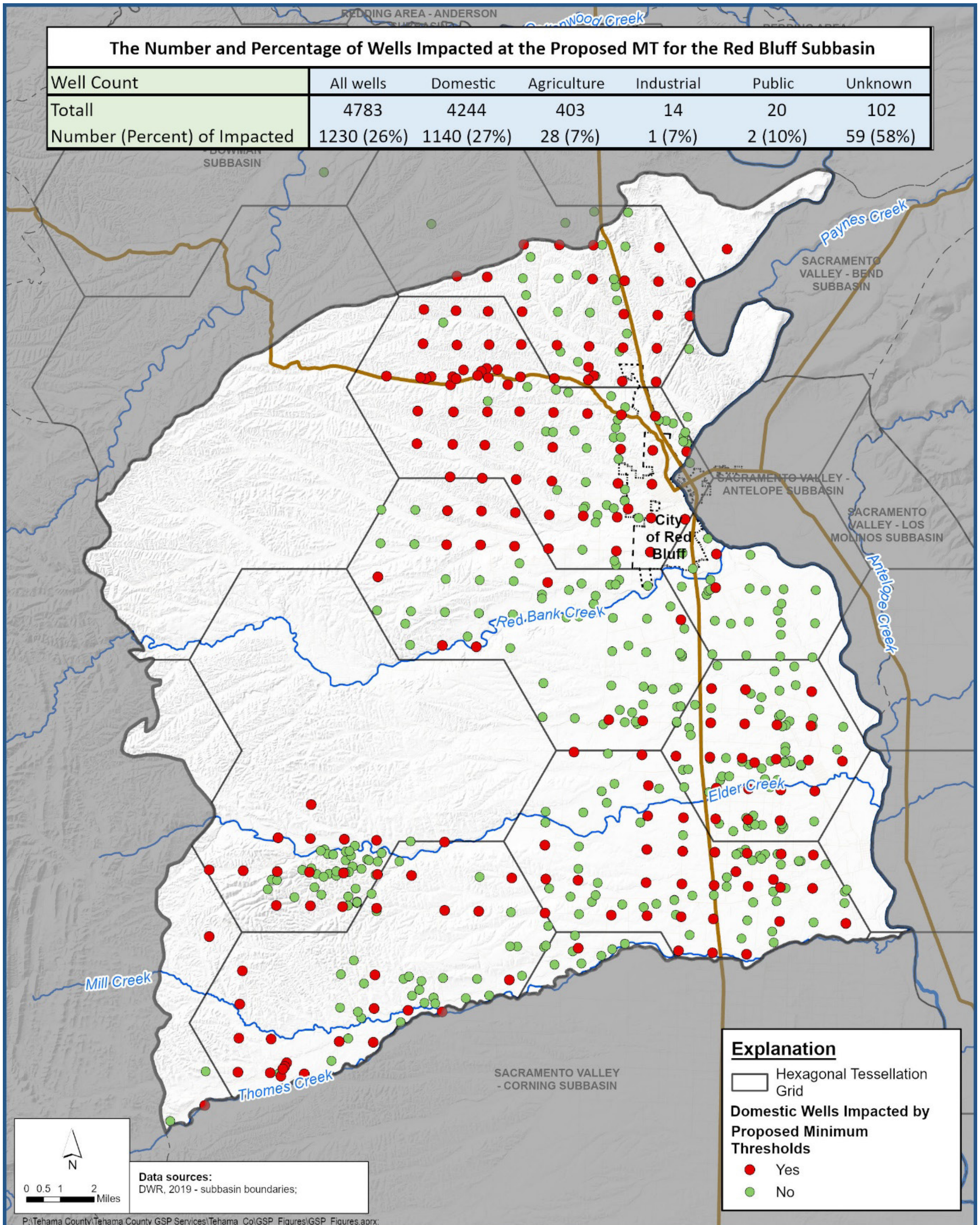
Figure 3-10. Example Hydrograph with Estimated Well Impact Analysis

Table 3-7. The Number and Percentage of Wells Impacted at the Proposed MT

WELL Count	All Wells	Domestic	Agriculture	Industrial	Public	Unknown
Total	4783	4244	403	14	20	102
Number (Percent) Impacted	1230 (26%)	1140 (27%)	28 (7%)	1 (7%)	2 (10%)	59 (58%)

Nevertheless, the GSA plans to develop and implement a Well Mitigation Program. The Well Mitigation Program will provide assistance to domestic, agricultural, and municipal well owners adversely impacted by declining groundwater levels that interfere with groundwater production or quality. It is expected that the Well Mitigation Program would be implemented during the GSP implementation period, as needed, and continue until groundwater sustainability is achieved. After 2042, groundwater levels will stabilize at historical levels, avoiding undesirable results for groundwater users. The GSA will develop eligibility criteria, terms, and conditions in order to implement the program, no later than January 1, 2026. The Well Mitigation Program and the resolution are discussed in Chapter 4.

The approximate location of wells predicted to be adversely impacted if water levels are at the MTs at all RMS wells is presented in Figure 3-11. It is highly unlikely that the Subbasin will see conditions where the majority of RMS water levels are at MT. The GSA's management of the subbasin should prevent this scenario from occurring as this would lead to undesirable results.



The Number and Percentage of Wells Impacted at the Proposed MT for the Red Bluff Subbasin

Well Count	All wells	Domestic	Agriculture	Industrial	Public	Unknown
Totall	4783	4244	403	14	20	102
Number (Percent) of Impacted	1230 (26%)	1140 (27%)	28 (7%)	1 (7%)	2 (10%)	59 (58%)

TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

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Predicted Impacted Wells at Minimum Thresholds

Figure 3-11

Groundwater Sustainability Plan
Red Bluff Subbasin

Table 3-7. Minimum Thresholds and Interim Milestones for the Chronic Lowering of Water Elevations – Upper Aquifer

WELL NAME	SWN	INTERIM MILESTONE 5 YEARS (FT NAVD88)	INTERIM MILESTONE 10 YEARS (FT NAVD88)	INTERIM MILESTONE 15 YEARS (FT NAVD88)	MEASURABLE OBJECTIVE (FT NAVD88)	MINIMUM THRESHOLD (FT NAVD88)
RB-1U	27N04W05G002M	433.9	433.4	432.9	432.4	394.0
RB-2U	27N04W36G001M	245.8	244.4	243.0	241.5	221.0
RB-3U	26N04W25J001M	262.0	260.4	258.7	257.1	255.0
RB-4U	25N03W11B001M	213.9	210.2	206.6	203.0	169.0
RB-5U	25N03W19N001M	238.1	233.5	228.9	224.2	187.0
RB-6U	25N05W24D001M	408.5	406.1	403.7	401.3	396.0
RB-7U	N/A	347.6	341.5	335.3	329.1	328.0
TSS-1	TBD	TBD	TBD	TBD	TBD	TBD
TSS-2	TBD	TBD	TBD	TBD	TBD	TBD
TSS-3	TBD	TBD	TBD	TBD	TBD	TBD

Note: TSS-1 was installed prior to July of 2022, however insufficient water level data have been collected to establish SMC.

Table 3-8. Minimum Threshold and Interim Milestones for the Chronic Lowering of Water Elevations – Lower Aquifer

WELL NAME	SWN	INTERIM MILESTONE 5 YEARS (FT NAVD88)	INTERIM MILESTONE 10 YEARS (FT NAVD88)	INTERIM MILESTONE 15 YEARS (FT NAVD88)	MEASURABLE OBJECTIVE (FT NAVD88)	MINIMUM THRESHOLD (FT NAVD88)
RB-8L	25N03W11B002M	212.0	208.7	205.3	202.0	166.0
TSS-1	TBD	TBD	TBD	TBD	TBD	TBD
TSS-2	TBD	TBD	TBD	TBD	TBD	TBD
TSS-3	TBD	TBD	TBD	TBD	TBD	TBD

Note: TSS-1 was installed prior to July of 2022, however insufficient water level data have been collected to establish SMC.

3.3.1.2. Quantitative Measurement

The quantitative measurement for chronic lowering of groundwater elevations will be the annual fall measurements taken at the RMS wells. The data obtained will be appended to existing data to generate hydrographs for the wells. These hydrographs will be analyzed for changing trends in water elevations and compared to established MTs to ensure they are not exceeded.

3.3.1.3. Existing Local, State, or Federal Standards

No federal, other state, or local standards exist for chronic lowering of groundwater elevations.

3.3.1.4. Avoidance of Undesirable Results

A prolonged period of extracting groundwater greater than the sustainable yield can cause chronic lowering of groundwater elevations in the Subbasin and could cause an undesirable result in the future. Impacts of declining groundwater levels would be considered undesirable results if 1) 10 supply wells become dry (after the GSP revision) within each tessellation hexagon or 2) when water levels at any RMS in the future decline 7.5 ft or more over a five (5) year period. As described in Chapter 4, PMAs are included to avoid and mitigate undesirable results in the Subbasin.

3.3.1.5. Effects of the Beneficial Uses and Users of Groundwater

The GSA acknowledges that impacts to beneficial users have occurred in the Focus Area. The effects on Beneficial Uses and Users of Groundwater included

1. dry wells

2. deeping of wells

3. increased pumping costs and reduced capacity

4 potentially adverse affects on surface water that is interconnected to groundwater

3.3.2. Pumping during dry years will reduce the groundwater levels in areas outside the Focus Areas and could result in impacts on all beneficial uses and users of groundwater leading to undesirable results. However, the GSP is designed to promote conjunctive use in the Subbasin and acknowledges the sustainable yield as an average value that can experience annual variations in storage. Minimum Thresholds for Reduction in Groundwater Storage

3.3.2.1. Description of Minimum Threshold

GSP Regulation §354.28 (c)(2) states that the MTs for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be calculated based on historical trends, water year type and projected water use in the Subbasin. Reduction in groundwater storage is not a parameter that can be directly measured; rather, change in storage is calculated from change in groundwater levels and aquifer material storage coefficients. Change in groundwater storage will be regularly estimated based on either the Subbasin water budget or monitoring results derived from analysis of groundwater elevations and aquifer properties. The MTs for groundwater storage are set to the amount of groundwater storage when groundwater elevations are at their measurable objective.

3.3.2.2. Quantitative Measurement

The MTs for reduction in groundwater storage is a single value of average groundwater elevation over the entire Subbasin. Therefore, the potential conflict between MTs at different locations in the Subbasin is not applicable. The reduction in groundwater storage MTs was selected to avoid undesirable results for other sustainability indicators as outlined below:

1. Chronic lowering of groundwater elevations. Since groundwater elevation will be used for estimating changes in groundwater storage, the reduction in groundwater storage would not cause undesirable results for this sustainability indicator.
2. Degraded water quality. Exceedances of the MTs for declines in groundwater storage is not expected to lead to a degradation of groundwater quality.
3. Subsidence. Future average groundwater levels and changes in long-term aquifer storage will be stable and will not induce any additional subsidence within the Subbasin.
4. Interconnected surface water. Groundwater elevations will also be used for interconnected surface waters for the interim. Therefore, the MTs for groundwater storage is not anticipated to cause undesirable results for this indicator. The GSA will work to bridge the data gaps for this indicator and continue to reassess any potential impacts from the storage MTs.

Groundwater levels will be measured at existing and new monitoring wells. The groundwater level monitoring will be conducted in accordance with the monitoring plan outlined in Section 3.11. Furthermore, the groundwater level monitoring will meet the requirements of the technical and reporting standards included in the SGMA regulations. As noted in Section 3.11, the current groundwater monitoring network includes seven (7) wells in the Upper Aquifer and one (1) well in the Lower Aquifer. The GSA intends to install three nested monitoring wells which is included in the network. The change in groundwater elevations from year to year will be determined and multiplied by the storage coefficients associated with the specific aquifer being measured and multiplied by the areal extent of the Subbasin to derive the annual change in storage.

3.3.2.3. Existing Local, State, or Federal Standards

No federal, other state, or local standards exist for reduction in groundwater storage.

3.3.2.4. Avoidance of Undesirable Results

A prolonged period of extracting groundwater in excess of the sustainable yield can cause groundwater storage declines when coupled with reductions in imported water supplies and could lead to an undesirable result in the future. Conditions that may lead to an undesirable result include the following:

- Over-pumping of groundwater. High rates of extractions from the aquifers can cause excessive drawdowns that can lead to undesirable results by dropping monitoring well levels below the MTs.
- Extensive, unanticipated drought and associated drastic curtailments of imported surface water supplies. Minimum thresholds were established based on historical groundwater elevation and reasonable estimates of future groundwater elevations. Extensive, unanticipated droughts and associated curtailment of imported water supplies will likely lead to excessively low groundwater elevations and undesirable results.

As described in Chapter 4, PMAs are included to avoid and mitigate undesirable results in the Subbasin.

3.3.2.5. Effects of the Beneficial Uses and Users of Groundwater

The GSA acknowledges that impacts to beneficial users have occurred in the Focus Area. The observed effects on Beneficial Uses and Users of Groundwater included

1. dry wells

2. deeping of wells

3. increased pumping costs and reduced capacity

4 potentially adverse effects on surface water that is interconnected to groundwater

3.3.3. Pumping during dry years will reduce the amount of groundwater in storage in areas outside the Focus Area and could result in impacts from a reduction in groundwater in storage on all beneficial uses and users of groundwater leading to undesirable results. However, the GSP is designed to promote conjunctive use in the Subbasin and acknowledges the sustainable yield as an average value that can experience annual variations in storage. Minimum Thresholds for Subsidence

3.3.3.1. Description of Minimum Threshold

GSP regulations state that the MTs for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results. Information used to establish the land subsidence MTs include:

- Historical land surface elevation data from GPS locations in the Subbasin and satellite imagery of subsidence.

Subsidence monitoring in and adjacent to the Subbasin includes several different data collection programs:

- PBO UNAVCO continuous subsidence monitoring stations
- 2017 GPS survey of the Sacramento Valley Subsidence Network (DWR)
- InSAR satellite-based subsidence monitoring

Data collected by the programs listed above was evaluated against water levels observed at the monitoring network wells. The compiled data was also compared to observe historical trends against current conditions. This analysis showed that the Subbasin had experienced minimal levels of subsidence historically and there was no indication of changes in that trend in current conditions. Past subsidence is likely elastic. Minimum thresholds were set at InSAR pixel locations near water level monitoring network wells based on these trends. The InSAR pixel MTs was established by calculating the vertical displacement from June 2015 to September 2019 and doubling the value. These pixels and their corresponding monitoring wells are depicted in **Figure 3-5**. InSAR vertical displacement data is currently provided by DWR. The GSP anticipates that DWR will continue to provide this data in the future for use in GSP updates. The MTs for subsidence are set to two feet over 20 years (i.e., no more than 0.5 feet of cumulative subsidence over a five (5)-year period (beyond the measurement error), solely due to lowering of groundwater elevations.

These measurable thresholds are listed in **Table 3-9**.

Table 3-9. Minimum Thresholds and Interim Milestones for Subsidence

INSAR PIXEL	INTERIM MILESTONE 5 YEARS (FT)	INTERIM MILESTONE 10 YEARS (FT)	INTERIM MILESTONE 15 YEARS (FT)	MEASURABLE OBJECTIVE (FT)	MINIMUM THRESHOLD (FT)
DV3OYJD	-0.25	-0.5	-0.75	-1.0	-2.0
DTP3463	-0.25	-0.5	-0.75	-1.0	-2.0
DSC9KKE	-0.25	-0.5	-0.75	-1.0	-2.0
DRPN3N0	-0.25	-0.5	-0.75	-1.0	-2.0
DQY95R7	-0.25	-0.5	-0.75	-1.0	-2.0
DR76NQR	-0.25	-0.5	-0.75	-1.0	-2.0
DQ1IBER	-0.25	-0.5	-0.75	-1.0	-2.0
DR8YYJU	-0.25	-0.5	-0.75	-1.0	-2.0
DUZIXC8	-0.25	-0.5	-0.75	-1.0	-2.0

3.3.3.2. Quantitative Measurement

The quantitative metric for assessing compliance will be to continue to use vertical displacement data from InSAR at the individual pixels (**Table 3-9**) which will be downloaded annually. This data will be appended to existing data and plotted. Both quantitative and qualitative assessments of the data will be performed to assess if any trends are apparent, and if the annual subsidence is greater than the MTs.

3.3.3.3. Existing Local, State, or Federal Standards

No federal, other state, or local standards exist for currently exist for subsidence reduction.

3.3.3.4. Avoidance of Undesirable Results

Undesirable results are considered to occur at a 50% exceedance of a MTs over a five (5)-year period that is irreversible and is caused by lowering of groundwater elevations.

Conditions that may lead to an undesirable result of a significant and unreasonable amount for land subsidence arise due to groundwater extraction that causes reductions in the viability of the use of water conveyance and flood control infrastructure over the planning and implementation horizon of this GSP.

3.3.3.5. Effects of the Beneficial Uses and Users of Groundwater

The subsidence MTs are set to prevent subsidence that could lead to significant and unreasonable results. Unchecked subsidence can impact critical water conveyance and flood control infrastructure. Damages to water conveyance systems impacts all agricultural and urban users retrieving water from such systems. The impact is primarily manifested in increased cost and loss of flexibility in water conveyance operations. Higher levels of subsidence can also damage public infrastructure such as roadways and highways causing impacting populations outside of immediate beneficial users. Damages such as these can result in costly repairs and long-term traffic issues. Subsidence also has the capacity to increase flooding by causing damage to flood control infrastructure and creation of low elevation land. Potential impact on residents in flood prone areas may cause extensive financial hardships to those affected.

3.3.4. Minimum Thresholds for Groundwater Quality

3.3.4.1. Description of Minimum Threshold

The MTs for degraded water quality is protective of existing and potential beneficial uses and users in the Subbasin. SGMA's water quality objective focuses on a constituent's contribution due to activities at the land surface rather than on the presence of naturally occurring constituents. Based on the review of groundwater quality in Chapter 2, the constituent of concern for beneficial users in the Subbasin is TDS. TDS is being monitored as an overall indicator of groundwater quality within the Subbasin. The basis for establishing a MTs is to minimize the additional contribution and migration of high concentrations of TDS. The MTs for TDS is 750 milligrams per liter (mg/L). This threshold is lower than the California State Water Resources Control Board (SWRCB) upper secondary maximum containment level (SMCL) of 1,000 mg/L as set by SWRCB for taste and odor. Minimum thresholds for all wells are summarized in **Table 3-10.**

Table 3-10. Minimum Thresholds, Measurable Objectives, and Interim Milestones for Groundwater Quality

WELL NAME	INTERIM MILESTONE 5 YEARS (TDS MG/L)	INTERIM MILESTONE 10 YEARS (TDS MG/L)	INTERIM MILESTONE 15 YEARS (TDS MG/L)	MEASURABLE OBJECTIVE (TDS MG/L)	MINIMUM THRESHOLD (TDS MG/L)
RB-1U[1]	<500	<500	<500	500.0	750.0
RB-2U[1]	<500	<500	<500	500.0	750.0
RB-3U	TBD	TBD	TBD	500.0	750.0
RB-4U[1]	<500	<500	<500	500.0	750.0
RB-5U	TBD	TBD	TBD	500.0	750.0
RB-6U	TBD	TBD	TBD	500.0	750.0
RB-7U[1]	<500	<500	<500	500.0	750.0
TSS-1	TBD	TBD	TBD	500.0	750.0
TSS-2	TBD	TBD	TBD	500.0	750.0
TSS-3	TBD	TBD	TBD	500.0	750.0

1 = The current conditions are below the MO and thus the path forward (IMs) is to stay below the MO.

3.3.4.2. Quantitative Measurement

Groundwater quality will be monitored on an annual basis at representative monitoring wells (listed in **Table 3-10**). All measurements will comply with the Sampling and Analysis Plan and Quality Project Plan and be recorded in the GSA's data management system. The monitoring network and monitoring protocols are described in **Section 3.11** (Monitoring Network and Monitoring Protocols for Data Collection). **Table 3-10** includes each well being monitored in the GSP monitoring program for groundwater quality, along with the MTs, measurable objective, and interim milestones. The MTs of 750 milligrams per liter (mg/L) are tolerable for most crops grown in the Subbasin without blending with surface water supplies. However, the GSA will continue to monitor TDS concentrations and changes in spatial or temporal trends to ensure MTs are not being exceeded and undesirable results are not being experienced by beneficial users.

3.3.4.3. Existing Local, State, or Federal Standards

The MTs for TDS is based on current background data in the Subbasin and set at 750 mg/L. This threshold is lower than the SWRCB upper secondary maximum containment level (SMCL) set by SWRCB for taste and odor of 1,000 mg/L.

3.3.4.4. Avoidance of Undesirable Results

Undesirable results will have occurred when:

- at least 25% of RMS exceed the MTs for water quality for two (2) consecutive years at each well where it can be established that GSP implementation is the cause of the exceedance

Changes in land use practices involving increased leaching of TDS into the groundwater system or increased extractions leading to dropping water levels and migrations of elevate TDS waters can lead to undesirable results. Through the monitoring network, the GSA aims to prevent such outcomes by analyzing long-term trends in water quality and deploying appropriate projects and managements to mitigate or deter undesirable results.

3.3.4.5. Effects of the Beneficial Uses and Users of Groundwater

The effect of degraded groundwater quality on agricultural beneficial users is manifested in crop damage and reduced yields, and a reduction in the use of land for irrigated agriculture if the sole water supply is groundwater.

Urban and domestic beneficial uses are impacted if degraded water is the only source for potable use. The impacts include the need to use alternative sources of water that may be more expensive than groundwater and potential undesirable aesthetic qualities without pre-treatment of the degraded water prior to use.

3.3.5. Minimum Thresholds for Interconnected Surface Water Depletions

3.3.5.1. Description of Minimum Threshold

Minimum thresholds are interim and will be the same water levels used in for the chronic lowering of groundwater elevations described in **Section 3.3.1.1.** Extensive data gaps are discussed in **Section 3.7.8.7.** The GSA will continue to evaluate new monitoring information and determine these thresholds later. For the interim, MTs for the chronic lowering of groundwater elevations will be used as a proxy for interconnected surface waters. Wells within one mile of interconnected surface water features will be used. The MTs are summarized in **Table 3-11**.

Table 3-11. Initial Minimum Thresholds and Interim Milestones for Interconnected Surface Water Depletions

WELL NAME	SWN	INTERIM MILESTONE 5 YEARS (FT NAVD88)	INTERIM MILESTONE 10 YEARS (FT NAVD88)	INTERIM MILESTONE 15 YEARS (FT NAVD88)	MEASURABLE OBJECTIVE (FT NAVD88)	MINIMUM THRESHOLD (FT NAVD88)
RB-1U	27N04W05G002M	433.9	433.4	432.9	432.4	394.0
RB-2U	27N04W36G001M	245.8	244.4	243.0	241.5	221.0
RB-3U	26N04W25J001M	262.0	260.4	258.7	257.1	255.0
RB-4U	25N03W11B001M	213.9	210.2	206.6	203.0	169.0
RB-5U	25N03W19N001M	238.1	233.5	228.9	224.2	187.0
RB-6U	25N05W24D001M	408.5	406.1	403.7	401.3	396.0
RB-7U	N/A	347.6	341.5	335.3	329.1	328.0
TSS-1	TBD	TBD	TBD	TBD	TBD	TBD
TSS-2	TBD	TBD	TBD	TBD	TBD	TBD
TSS-3	TBD	TBD	TBD	TBD	TBD	TBD

Note: TSS-1 was installed prior to July of 2022, however insufficient water level data have been collected to establish SMC.

3.3.5.2. Quantitative Measurement

No MTs have been established for this indicator due to data gaps. For the interim, MTs for the chronic lowering of groundwater elevations will be used as a proxy for interconnected surface waters. Wells within one mile of interconnected surface water features will be used.

3.3.5.3. Existing Local, State, or Federal Standards

No current local, other state, or federal standards currently exist for this indicator.

3.3.5.4. Avoidance of Undesirable Results

Undesirable results have not been established for this indicator due to data gaps. For the interim, MTs for the chronic lowering of groundwater elevations will be used as a proxy for interconnected surface waters. Wells within one mile of interconnected surface water features will be used.

3.3.5.5. Effects of the Beneficial Uses and Users of Groundwater

No MTs have been established for this indicator due to data gaps. For the interim, MTs for the chronic lowering of groundwater elevations will be used as a proxy for interconnected surface waters. Wells within one mile of interconnected surface water features will be used.

3.3.6. Relationship Between the Established Minimum Threshold and Sustainability Indicator(s)

The monitoring sites described in **Tables 3- 2** through **Table 3-9** are in locations that reflect a wide cross section of Subbasin groundwater conditions. These locations are representative of the overall Subbasin conditions because they are spatially distributed throughout the Subbasin both vertically (across the upper and lower aquifers) and laterally. The GSA determined that use of the minimum elevation thresholds at each of the listed wells will help avoid the undesirable results of chronic lowering of groundwater elevations because it should preserve access to adequate water resources for beneficial users within the Subbasin.

Groundwater elevation MTs can influence other sustainability indicators. The groundwater elevation MTs were selected to avoid undesirable results for other sustainability indicators.

1. Change in groundwater storage. A significant and unreasonable condition for change in groundwater storage is a decrease in the total volume of groundwater that can be withdrawn without causing undesirable results. The sustainable yield of the Subbasin can be affected by excess pumping leading to the chronic lowering of groundwater elevations. Minimum thresholds have been set at levels to avoid a decline in sustainable yield. This Subbasin has not yet been fully developed and MTs reflect this lack of development. However, the MTs also account for the maintenance of groundwater storage.
2. Degraded water quality. Preserving groundwater quality is important to the groundwater resource. A significant and unreasonable condition of degraded water quality is exceeding regulatory limits for constituents of concern in groundwater due to actions proposed in the GSP. Water quality could be affected by low groundwater elevations if they caused deeper, poor-quality groundwater (saline groundwater located below the base of freshwater) to flow upward into existing wells.
3. Subsidence. A significant and unreasonable condition for subsidence is any measurable permanent subsidence that results in severe impacts to the operations of existing infrastructure to a degree that would require design and construction projects to mitigate the impact. Subsidence is caused by dewatering and compaction of clay-rich sediments in response to lowering groundwater levels. Continued exceedances of water level MTs could result in subsidence over time. Minimum thresholds have been established based on historical data and GSA consideration of unreasonable and significant results and are not expected to lead to increased levels of subsidence.
4. Depletion of interconnected surface waters. Due to data gaps, MTs for interconnected surface waters have been established at groundwater level monitoring wells within one mile of these sites. Chronic lowering of groundwater can sever the connection between groundwater and surface water. Water level declines can also result in the depletion of these surface waters. Interim MTs have been established at groundwater level monitoring sites in the vicinity of interconnected surface waters. Once data gaps are filled, MTs will be established at new monitoring sites to prevent undesirable results.

3.3.7. Minimum Thresholds Impacts to Adjacent Basins

The MTs established at the Red Bluff Subbasin are not expected to impact the surrounding subbasins. The GSPs for three (3) of the surrounding subbasins in the (Antelope, Bowman and Los Molinos) are being developed simultaneously by the same GSA. These subbasins were accounted for when establishing MTs. Furthermore, the GSA also compared MTs set for Red Bluff with those set for the Vina and Corning subbasins and were found to be similar to those set by these two subbasins. Due to this coordination with other subbasins and the interconnectedness of the GSPs, MTs in Red bluff are not likely to have adverse impacts on adjacent subbasins. Instead, the co-development of the GSPs will result in cooperative sustainability goals.

3.3.8. Minimum Thresholds Impacts on Beneficial Users

The GSA recognizes that impacts to beneficial users have occurred in the Red Bluff Subbasin. These impacts to beneficial users coincided with the 2020 to 2022 lows when dry conditions existed in the region. Consequently, groundwater extraction increased, and water levels correspondingly decreased. The 2021, 2022 water year annual reports documented these conditions. The conditions at this time were markedly different in the subbasin based on location. Also, the effects of decreased water levels were a function of the number, type and location of wells that receive ground water. The beneficial use and users of that water were significantly adversely affected. impacts to beneficial users at this time include but are not limited to:

- reported dry wells,
- reduction in pumping capacity,
- deepening wells, and
- adverse effects on the surface water environment

Historical water level trends, future water level projections, and domestic well water levels were all considered when establishing MTs.

3.4. Undesirable Results *(Reg. § 354.26)*

According to GSP Regulations, the GSP’s description of undesirable results is to include the following:

1. The cause of groundwater conditions occurring throughout the basin that would lead to or has led to the undesirable results based on information described in the basin setting, and other data or models as appropriate.
2. The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of MTs exceedances that cause significant and unreasonable effects in the basin.
3. 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.

Under SGMA, undesirable results occur when the effects caused by groundwater conditions occurring throughout the basin cause significant and unreasonable impacts from any of the six (6) sustainability indicators on beneficial users of groundwater. That is “significant and unreasonable occurrence of any of the six (6) sustainability indicators constitutes an undesirable result”. These sustainability indicators are:

1. Chronic lowering of groundwater elevations,
2. Reduction of groundwater storage,
3. Seawater intrusion,
4. Degraded water quality,
5. Land subsidence, and
6. Depletion of interconnected surface water

A summary of criteria used to quantify undesirable results is provided below in **Table 3-12**, and detailed discussion of each sustainability indicator is provided in subsequent sections of this chapter.

Table 3-12. Summary of Minimum Thresholds, Measurable Objectives, and Undesirable Results

SUSTAINABILITY INDICATOR	MINIMUM THRESHOLD	MEASURABLE OBJECTIVE	QUANTIFICATION OF UNDESIRABLE RESULT
Chronic Lowering of Groundwater Elevations	**Focus Areas:** 2020-2022 groundwater lows **Outside Focus Areas:** 2020-2022 lows minus 20 feet	**Upper & Lower Aquifer:** Spring 2015 groundwater elevation minus 5 feet (for wells with increasing or no groundwater trends) or projected Spring 2042 groundwater elevation minus 5 feet for wells with declining groundwater elevations	10 supply wells becoming dry (after the GSP revision) within a tessellation hexagon, or when water levels at any RMP in the future decline 7.5 ft or more over a five (5) year period.
Reduction of Groundwater Storage	**Upper & Lower Aquifer:** Amount of groundwater in storage when groundwater elevations are at their MTs	**Upper & Lower Aquifer:** Amount of groundwater storage when groundwater elevations are at their measurable objective	25% of groundwater elevations measured at same RMS wells exceed the associated MT for two consecutive fall measurements.
Land Subsidence	Two feet over 20 years (i.e., no more than 0.5 feet of cumulative subsidence over a five-year period (beyond the measurement error), solely due to lowering of groundwater elevations	One foot over 20 years (Zero inelastic subsidence, in addition to any measurement error). If InSAR data are used, the measurement error is 0.1 feet and any measurement 0.1 feet or less would not be considered inelastic subsidence	50% of RMS exceed the MTs over a 5-year period that is irreversible and is caused by lowering of groundwater elevations
Seawater Intrusion	Not Applicable	Not Applicable	Not Applicable
Degraded Water Quality	**Upper & Lower Aquifer:** TDS concentration of 750 mg/L at all RMS wells	**Upper & Lower Aquifer:** California lower limit secondary MCL concentration for TDS of 500 mg/L measured at RMS wells	At least 25% of RMS exceed the MTs for water quality for 2 consecutive years at each well where it can be established that GSP implementation is the cause of the exceedance

SUSTAINABILITY INDICATOR	MINIMUM THRESHOLD	MEASURABLE OBJECTIVE	QUANTIFICATION OF UNDESIRABLE RESULT
Depletion of Interconnected Surface Water	Same as chronic lowering of groundwater levels (Initial)	Same as chronic lowering of groundwater levels (Initial)	25% of groundwater elevations, measured at the same RMS wells, exceed the associated MTs for 2 consecutive fall measurements.

3.4.1.1. Groundwater Elevation

Significant and unreasonable levels of the chronic lowering of groundwater elevations is defined as 1) 10 supply wells becoming dry (after the GSP revision) within a tessellation hexagon or 2) when water levels at any RMP in the future decline 7.5 ft or more over a five (5) year period.

3.4.1.2. Groundwater Storage

Undesirable results for the levels of groundwater storage would occur when 25% of groundwater elevations measured at same RMS wells exceed the associated MTs for two (2) consecutive fall measurements. For the Red Bluff Subbasin, this exceedance will result significant and undesirable levels of groundwater level declines that could impact the use of existing wells and beneficial users of groundwater. The significant and unreasonable decline in storage would result in limiting the volume of groundwater available for agriculture, municipal, industrial, and domestic uses without any PMAs to mitigate the impact by new and deeper wells.

3.4.1.3. Subsidence

For the Red Bluff Subbasin, historical data indicates minimal levels of subsidence has occurred and this trend has not changed when analyzing current conditions. Therefore, undesirable results are considered to occur at a 50% of RMS exceed the MTs over a five (5)-year period that is irreversible and is caused by lowering of groundwater elevations.

3.4.1.4. Groundwater Quality

Water quality degradation will lead to an undesirable result when at least 25% of RMS wells exceed the MTs for water quality for two (2) consecutive years at each well where it can be established that GSP implementation is the cause of the exceedance. This result will be considered unreasonable and significant if it causes reduction in the long-term viability of domestic, agriculture, municipal wells, or environmental uses over the planning and implementation of the GSP.

3.4.1.5. Interconnected Surface Waters

Initial undesirable results for depletion of interconnected surface water were developed for this GSP due to data gaps. These interim undesirable results mirror those established for chronic lowering of groundwater elevations. Therefore, undesirable results will occur when 25% of groundwater elevations measured at RMS wells drop below the associated threshold during two (2) consecutive fall measurements.

3.4.2. Potential Effects on the Beneficial Users of Groundwater

For agricultural beneficial users of groundwater, the most significant undesirable results are groundwater levels, groundwater storage, groundwater quality, and subsidence. The undesirable results for interconnected surface waters will not have a direct impact on agriculture. Undesirable results for any of the sustainability indicators of concern will limit the ability of agricultural users to extract groundwater and irrigate crops.

For domestic beneficial users of groundwater, the most significant undesirable results are groundwater levels, groundwater storage, and groundwater quality. Undesirables results for any of these three (3) sustainability indicators could potentially restrict the ability of households to use water for domestic purposes. Subsidence and interconnected surface waters will not have direct impact on domestic users.

For environmental beneficial uses of groundwater in the Subbasin, the most significant undesirable results are subsidence and the depletion of interconnected surface water. Significant subsidence can damage flood control infrastructure which can cause damage to the surrounding environment through landslides and soil loss. The depletion of interconnected surface waters could damage groundwater dependent ecosystems and other vegetation and native species reliant on these surface water sources.

3.5. Management Areas

Management areas have not been established in the Subbasin.

3.6. Monitoring Network

This section describes the proposed monitoring network, including GSA monitoring objectives monitoring protocols, and data reporting requirements. This section has been prepared in accordance with GSP Regulations. The monitoring network has been developed to collect enough data to characterize groundwater and related surface water conditions in the Subbasin and evaluate changing conditions and GSP implementation. The monitoring network has been designed to collect data to allow for the analysis of short- and long-term trends, seasonal variations and estimate annual changes in aquifer storage. The monitoring sites have been distributed across the Subbasin to provide a comprehensive analysis of current and ongoing conditions within the plan area. This widespread distribution coupled with the monitoring frequency will allow the GSA to chart its progress towards the established sustainability goals and ensure real time tracking of any impacts on beneficial users. Specifically, the monitoring program will allow the GSA to quantify changes in groundwater storage, elevations, and quality and assess the efficacy of any implemented management programs. This data will facilitate changes to management programs to maintain continued progress towards the GSA's sustainability objectives.

The GSP regulations require monitoring networks to be developed to promote the collection of a data set of enough quality, frequency, and spatial distribution to characterize groundwater and related surface water conditions in the Subbasin and to evaluate changing conditions that occur through implementation of the GSP. The monitoring network should accomplish the following:

- Demonstrate progress towards achieving MOs described in the GSP;
- Monitor impacts to the beneficial uses and users of groundwater;
- Monitor changes in groundwater conditions relative to MOs and MTs; and
- Quantify annual changes in water budget components

The MTs and MOs for the network are described above.

GSP regulations require that if management areas are established, the quantity and density of monitoring sites in those areas shall be sufficient to evaluate conditions of the Subbasin setting sustainable management criteria specific to that area. At this time, management areas have not been defined for the Subbasin. If management areas are developed in the future, the monitoring network will be reevaluated to ensure that there is sufficient monitoring to evaluate conditions.

3.6.1. Description of Monitoring Network (*Reg. § 354.34*)

The GSP monitoring network is composed of aquifer specific wells that are screened in the Upper or Lower Aquifers. The network will not include composite wells that span both the Upper and Lower aquifers. The network will enable the collection of data to assess sustainability indicators, the effectiveness of PMAs to achieve sustainability and evaluate the MOs of each applicable sustainability indicator (i.e., chronic lowering of groundwater elevations, reduction in groundwater storage, degraded water quality, land subsidence, interconnected surface water depletion). The Subbasin is isolated from the Pacific Ocean; therefore, this GSP does not provide monitoring for seawater intrusion sustainability indicators.

Within the Red Bluff Subbasin, 270 monitoring wells were found to have water level data. However, for the purposes of the GSP monitoring program, a subset of these wells was identified that represent geographical variation along with a historical data record if possible. This effort resulted in the selection of nine (9) wells in the Upper Aquifer and two (2) wells in the Lower Aquifer as documented in **Table 3-13** (the selection process is described further below) in addition to the two (2) new TSS wells. The GSA has complete well construction information for these wells, which allows the GSA to determine the aquifer being monitored with certainty. Furthermore, composite wells that span both the upper and lower aquifers were not selected for this GSP monitoring program to provide aquifer specific data. The same representative monitoring wells were selected as part of the groundwater quality monitoring network **(Table 3-13).** As previously described in this Chapter, subsidence monitoring will be conducted using InSAR satellite data. Nine (9) pixels from the satellite data have been selected for subsidence monitoring. Currently, the groundwater level monitoring network is serving as a proxy for interconnected surface waters, using wells within the upper aquifer. This proxy network was established due to extensive data gaps in the availability of monitoring sites. This data gap is discussed further in Section 3.7.8.7.

These wells are distributed throughout the Red Bluff Subbasin to provide ample coverage of the entire area. This coverage allows for the collection of data to evaluate groundwater gradients and flow directions over time and the annual change in storage. Furthermore, the monitoring frequency of the wells will allow for the monitoring of seasonal highs and lows. Because wells were chosen with the existing length of historical data record in mind, future groundwater data will be able to be compared to historical data.

Table 3-13. Proposed Monitoring Network

WELL NAME	LATITUDE	LONGITUDE	AQUIFER	GROUNDWATER ELEVATION	GROUNDWATER STORAGE	GROUNDWATER QUALITY	SUBSIDENCE	INTER-CONNECTED SW
RB-1U SWN: 27N04W05G002M	40.2273	-122.3376	Upper	X	X	X		X
RB-2U SWN: 27N04W36G001M	40.150704	-122.262514	Upper	X	X	X		X
RB-3U SWN: 26N04W25J001M	40.077036	-122.258963	Upper	X	X	X		X
RB-4U SWN: 25N03W11B001M	40.042815	-122.166514	Upper	X	X	X		X
RB-5U SWN: 25N03W19N001M	40.0013	-122.254	Upper	X	X	X		X
RB-6U SWN: 25N05W24D001M	40.0147	-122.3785	Upper	X	X	X		X
RB-7U	39.951929	-122.362222	Upper	X	X	X		X
TSS-1	TBD	TBD	Upper	X	X	X		X
TSS-2	TBD	TBD	Upper	X	X	X		X
TSS-3	TBD	TBD	Upper	X	X	X		X
RB-8L SWN: 25N03W11B002M	40.042815	-122.166514	Lower	X	X			
TSS-1	TBD	TBD	Lower	X	X			

WELL NAME	LATITUDE	LONGITUDE	AQUIFER	GROUNDWATER ELEVATION	GROUNDWATER STORAGE	GROUNDWATER QUALITY	SUBSIDENCE	INTER-CONNECTED SW
TSS-2	TBD	TBD	Lower	X	X			
TSS-3	TBD	TBD	Lower	X	X			
DV3OYJD	40.2274	-122.3371	Upper				X	
DTP3463	40.1509	-122.2623	Upper				X	
DSC9KKE	40.0771	-122.2589	Upper				X	
DRPN3N0	40.0429	-122.1705	Lower				X	
DQY95R7	40.0015	-122.2532	Upper				X	
DR76NQR	40.0150	-122.3802	Upper				X	
DQ1IBER	39.9520	-122.3620	Lower				X	
DR8YYJU	40.017737	-122.3903	Lower				X	
DUZIXC8	40.2210	-122.2838	Lower				X	

3.6.2. Groundwater Elevation Monitoring Network

The MTs and MOs for the chronic lowering of groundwater elevations sustainability indicator are evaluated by monitoring groundwater levels. The SGMA GSP Regulations require a network of monitoring wells to demonstrate groundwater occurrence, flow direction and hydraulic gradients between principal aquifer and surface water features.

The objectives of the groundwater level monitoring program include the following:

- Improve the understanding of the occurrence and movement of groundwater; monitor local and regional groundwater levels including seasonal and long-term trends; and identify vertical hydraulic head differences in the aquifer system and aquifer-specific groundwater conditions, especially in areas where short-term and long-term development of groundwater resources are planned;
- Detect the occurrence of, and factors attributable to, natural recharge (e.g., direct infiltration of precipitation), irrigation, and surface water seepage to groundwater or recharge project and management actions (recharge basins, aquifer storage and recovery) that affect groundwater levels and trends;
- Identify appropriate monitoring sites to further evaluate groundwater-surface water interaction, and recharge/discharge mechanisms, including whether groundwater utilization is affecting surface water flows;
- Establish a monitoring network to aid in the assessment of changes in groundwater storage; and
- Generate data to better estimate groundwater basin conditions and assess local current and future water supply availability and reliability; update analyses as additional data become available.

Figures 3-3 and **3-4** illustrate the locations of the wells selected for monitoring of groundwater levels in the upper and lower aquifers, respectively. **Tables 3-14** and **3-15** list the well identification, location, monitoring frequency, well construction data (which includes well depth, perforation intervals, and ground surface elevation (GSE)), and measurement years, and number of measurements for the Upper and Lower Aquifer, respectively.

In order to assist local agencies with the preparation of their GSP's, DWR released a series of best management practices (BMPs). The BMPs document for monitoring networks provides guidance on determining an appropriate number of monitoring wells. The method developed by Hopkins (1984) was applied to the Red Bluff Subbasin. This methodology states that for districts pumping more than 10,000 ac-ft/yr per 100 square miles, they should have one (1) monitoring wells for every 25 square miles. The Red Bluff Subbasin is approximately 425 square miles, yielding two (2) monitoring wells at the minimum per aquifer. Additional wells were added based on informational needs resulting from PMAs and historical trends in groundwater levels.

After computing the appropriate number of monitoring wells for the Subbasin based on the Hopkins method, a hexagonal tessellation was generated in ArcPro for the Red Bluff and three (3) adjacent subbasins (Bowman, Los Molinos, and Antelope) **(Figure 3-2)**. Portions of 22 different hexagons overlapped with the Red Bluff Subbasin.

All available wells with complete construction data and aquifer assignment were then mapped onto this grid. Water level data from each well was evaluated on the following criteria:

- evidence of recent monitoring
- length of historical record
- overlap with model timeframe

The wells were then plotted against the hexagons and each hexagon was examined separately for both the upper and lower aquifers. Wells were selected based on the evaluation criteria listed above. When possible, preference was given to wells that not only met the criteria but were also apart of either the California State Groundwater Elevation Monitoring (CASGEM) or Tehama County Monitoring Network. The final selection of wells for the monitoring network is presented in **Tables 3-14 and 3-15** for the upper and lower aquifers, respectively. The selection rationale for all water level monitoring wells is summarized in **Table 3-16.**

Table 3-14. Groundwater Level Monitoring Well Network – Upper Aquifer

WELL ID	LATITUDE	LONGITUDE	MONITORING FREQUENCY	WELL DEPTH	WELL SCREEN INTERVAL	GROUND SURFACE ELEVATION	FIRST YEAR OF DATA	LAST YEAR OF DATA	YEARS MEASURED	NUMBER OF MEASUREMENTS
RB-1U SWN: 27N04W05G002M	40.2273	-122.3376	Bi-annual (Fall/Spring)	260 (ft, bgs)	231 - 251 (ft, bgs)	482.53	12/7/1983	3/9/2020	38	146
RB-2U SWN: 27N04W36G001M	40.150704	-122.262514	Bi-annual (Fall/Spring)	155 (ft, bgs)	135 - 155 (ft, bgs)	TBD	9/8/1989	3/10/2020	31	192
RB-3U SWN: 26N04W25J001M	40.077036	-122.258963	Bi-annual (Fall/Spring)	128 (ft, bgs)	116 - 124 (ft, bgs)	333.46	1/3/1973	3/9/2020	48	120
RB-4U SWN: 25N03W11B001M	40.042815	-122.166514	Bi-annual (Fall/Spring)	255 (ft, bgs)	150 – 180 (ft, bgs)	252.1	6/23/2004	3/11/2020	17	94
RB-5U SWN: 25N03W19N001M	40.0013	-122.254	Bi-annual (Fall/Spring)	370 (ft, bgs)	135 – 358 (ft, bgs)	327.49	5/12/1965	3/9/2020	56	127
RB-6U SWN: 25N05W24D001M	40.0147	-122.3785	Bi-annual (Fall/Spring)	N/A	N/A	515.6	9/15/1988	10/15/2020	32	45
RB-7U	39.951929	-122.362222	Bi-annual (Fall/Spring)	N/A	N/A	466	6/30/2013	4/4/2021	8	16
TSS-1	TBD	TBD	Bi-annual (Fall/Spring)	TBD	TBD	TBD	N/A	N/A	N/A	N/A
TSS-2	TBD	TBD	Bi-annual (Fall/Spring)	TBD	TBD	TBD	N/A	N/A	N/A	N/A
TSS-3	TBD	TBD	Bi-annual (Fall/Spring)	TBD	TBD	TBD	N/A	N/A	N/A	N/A

Table 3-15. Groundwater Level Monitoring Well Network – Lower Aquifer

WELL ID	LATITUDE	LONGITUDE	MONITORING FREQUENCY	WELL DEPTH	WELL SCREEN INTERVAL	GROUND SURFACE ELEVATION	FIRST YEAR OF DATA	LAST YEAR OF DATA	YEARS MEASURED	NUMBER OF MEASUREMENTS
RB-8L SWN: 25N03W11B002M	40.042815	-122.166514	Bi-annual (Fall/Spring)	789 (ft, bgs)	680 – 750 (ft, bgs)	252.03	6/23/2004	3/11/2020	17	95
TSS-1	TBD	TBD	Bi-annual (Fall/Spring)	TBD	TBD	TBD	N/A	N/A	N/A	N/A
TSS-2	TBD	TBD	Bi-annual (Fall/Spring)	TBD	TBD	TBD	N/A	N/A	N/A	N/A
TSS-3	TBD	TBD	Bi-annual (Fall/Spring)	TBD	TBD	TBD	N/A	N/A	N/A	N/A

Table 3-16. Summary of Rationale for Selection for Wells Using Groundwater Levels

SITE	AQUIFER	BASIS FOR SELECTION
RB-1U SWN: 27N04W05G002M	Upper	Period of record, CASGEM and TC Well
RB-2U SWN: 27N04W36G001M	Upper	Period of record, CASGEM and TC Well
RB-3U SWN: 26N04W25J001M	Upper	Period of record, CASGEM and TC Well
RB-4U SWN: 25N03W11B001M	Upper	Period of record, CASGEM and TC Well
RB-5U SWN: 25N03W19N001M	Upper	Period of record, CASGEM and TC Well
RB-6U SWN: 25N05W24D001M	Upper	Period of record, CASGEM and TC Well
RB-7U	Upper	Period of record, CASGEM and TC Well
TSS-1	Upper	Location, New Well
TSS-2	Upper	Location, New Well
TSS-3	Upper	Location, New Well
RB-8L SWN: 25N03W11B002M	Lower	Period of record, CASGEM and TC Well
TSS-1	Lower	Location, New Well
TSS-1	Lower	Location, New Well
TSS-1	Lower	Location, New Well

3.6.3. Groundwater Storage Monitoring Network

The objectives of the monitoring program are:

- Use groundwater level data and knowledge of aquifer storage coefficients to calculate changes in groundwater storage.
- Improve the understanding of the occurrence and movement of groundwater.
- Monitor local and regional groundwater levels including seasonal and long-term trends.
- Monitor groundwater levels where projects and s are planned.

Changes in groundwater storage cannot be measured directly, therefore this GSP adopts groundwater levels as a proxy for assessing change in storage, as described previously in Chapter 3. Change in storage will be estimated using the changes of groundwater levels measured at monitoring wells and storage coefficients of aquifer materials. The wells selected for monitoring changes in groundwater storage will be the same wells used for groundwater level monitoring. **Figures 3-3** and **3-4** illustrate the locations of the wells selected for monitoring of groundwater levels for the Upper and Lower Aquifers, respectively. **Tables 3-17** and **3-18** list the well identification, location, monitoring frequency, well construction data, and measurement years, and number of measurements for the Upper and Lower Aquifer, respectively. The same wells for water level monitoring are proposed for groundwater storage monitoring and the selection process and rationale for selection is consistent with section 3.11.1.1 (**Table 3-19**).

Table 3-17. Groundwater Storage Monitoring Network – Upper Aquifer

WELL ID	LATITUDE	LONGITUDE	MONITORING FREQUENCY	WELL DEPTH	WELL SCREEN INTERVAL	GROUND SURFACE ELEVATION	FIRST YEAR OF DATA	LAST YEAR OF DATA	YEARS MEASURED	NUMBER OF MEASUREMENTS
RB-1U SWN: 27N04W05G002M	40.2273	-122.3376	Bi-annual (Fall/Spring)	260 (ft, bgs)	231 - 251 (ft, bgs)	482.53	12/7/1983	3/9/2020	38	146
RB-2U SWN: 27N04W36G001M	40.150704	-122.262514	Bi-annual (Fall/Spring)	155 (ft, bgs)	135 - 155 (ft, bgs)	TBD	9/8/1989	3/10/2020	31	192
RB-3U SWN: 26N04W25J001M	40.077036	-122.258963	Bi-annual (Fall/Spring)	128 (ft, bgs)	116 - 124 (ft, bgs)	333.46	1/3/1973	3/9/2020	48	120
RB-4U SWN: 25N03W11B001M	40.042815	-122.166514	Bi-annual (Fall/Spring)	255 (ft, bgs)	150 – 180 (ft, bgs)	252.1	6/23/2004	3/11/2020	17	94
RB-5U SWN: 25N03W19N001M	40.0013	-122.254	Bi-annual (Fall/Spring)	370 (ft, bgs)	135 – 358 (ft, bgs)	327.49	5/12/1965	3/9/2020	56	127
RB-6U SWN: 25N05W24D001M	40.0147	-122.3785	Bi-annual (Fall/Spring)	N/A	N/A	515.6	9/15/1988	10/15/2020	32	45
RB-7U	39.951929	-122.362222	Bi-annual (Fall/Spring)	N/A	N/A	466	6/30/2013	4/4/2021	8	16
TSS-1	TBD	TBD	Bi-annual (Fall/Spring)	TBD	TBD	TBD	N/A	N/A	N/A	N/A
TSS-2	TBD	TBD	Bi-annual (Fall/Spring)	TBD	TBD	TBD	N/A	N/A	N/A	N/A
TSS-3	TBD	TBD	Bi-annual (Fall/Spring)	TBD	TBD	TBD	N/A	N/A	N/A	N/A

Table 3-18. Groundwater Storage Monitoring Network – Lower Aquifer

WELL ID	LATITUDE	LONGITUDE	MONITORING FREQUENCY	WELL DEPTH	WELL SCREEN INTERVAL	GROUND SURFACE ELEVATION	FIRST YEAR OF DATA	LAST YEAR OF DATA	YEARS MEASURED	NUMBER OF MEASUREMENTS
RB-8L SWN: 25N03W11B002M	40.042815	-122.166514	Bi-annual (Fall/Spring)	789 (ft, bgs)	680 – 750 (ft, bgs)	252.03	6/23/2004	3/11/2020	17	95
TSS-1	TBD	TBD	Bi-annual (Fall/Spring)	TBD	TBD	TBD	N/A	N/A	N/A	N/A
TSS-2	TBD	TBD	Bi-annual (Fall/Spring)	TBD	TBD	TBD	N/A	N/A	N/A	N/A
TSS-3	TBD	TBD	Bi-annual (Fall/Spring)	TBD	TBD	TBD	N/A	N/A	N/A	N/A

Table 3-19. Summary of Rationale for Selection for Wells Used for Storage

SITE	AQUIFER	BASIS FOR SELECTION
RB-1U SWN: 27N04W05G002M	Upper	Period of record, CASGEM and TC Well
RB-2U SWN: 27N04W36G001M	Upper	Period of record, CASGEM and TC Well
RB-3U SWN: 26N04W25J001M	Upper	Period of record, CASGEM and TC Well
RB-4U SWN: 25N03W11B001M	Upper	Period of record, CASGEM and TC Well
RB-5U SWN: 25N03W19N001M	Upper	Period of record, CASGEM and TC Well
RB-6U SWN: 25N05W24D001M	Upper	Period of record, CASGEM and TC Well
RB-7U	Upper	Period of record, CASGEM and TC Well
TSS-1	Upper	Location, New Well
TSS-2	Upper	Location, New Well
TSS-3	Upper	Location, New Well
RB-8L SWN: 25N03W11B002M	Lower	Period of record, CASGEM and TC Well
TSS-1	Lower	Location, New Well
TSS-2	Lower	Location, New Well
TSS-3	Lower	Location, New Well

3.6.4. Subsidence Monitoring Network

Data from different monitoring programs for subsidence is available for the Red Bluff Subbasin. These programs include four (4) PBO stations within the vicinity of the Subbasin, 2017 GPS Survey Data from DWR, and InSAR satellite vertical displacement data. None of the PBO stations exist inside the Subbasin so these sites were not selected for the monitoring program. The data collected by DWR showed minor levels of subsidence, but these readings fell within their margin of error of 0.17 ft. These stations were also not included in the final monitoring program. Lastly, InSAR data spanned the entirety of the Subbasin, and data pixels were available at or near each groundwater level monitoring well. This data has a relatively small error margin (18 mm or 0.06 ft) and is available to download on a monthly or annual basis with continuous measurements.

Therefore, the sustainability indicator for land subsidence is evaluated by monitoring land surface elevation at select InSAR data pixels near groundwater level monitoring wells. Specifically, nine (9) pixels are monitored for vertical displacement. Selecting pixels near the groundwater monitoring wells will allow the GSA 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 3-20 and Table 3-21.**

Table 3-20. Land Subsidence Monitoring Network

SITE ID	SITE TYPE	MEASUREMENT TYPE	YEARS OF RECORD
DV3OYJD	InSAR pixel	Vertical Ground Surface Displacement	2015 - 2019
DTP3463	InSAR pixel	Vertical Ground Surface Displacement	2015 - 2019
DSC9KKE	InSAR pixel	Vertical Ground Surface Displacement	2015 - 2019
DRPN3N0	InSAR pixel	Vertical Ground Surface Displacement	2015 - 2019
DQY95R7	InSAR pixel	Vertical Ground Surface Displacement	2015 - 2019
DR76NQR	InSAR pixel	Vertical Ground Surface Displacement	2015 - 2019
DQ1IBER	InSAR pixel	Vertical Ground Surface Displacement	2015 - 2019
DR8YYJU	InSAR pixel	Vertical Ground Surface Displacement	2015 - 2019
DUZIXC8	InSAR pixel	Vertical Ground Surface Displacement	2015 - 2019

Table 3-21. Summary of Rationale for Selection of Subsidence Monitoring Sites

SITE	SITE TYPE	BASIS FOR SELECTION
DV3OYJD	InSAR pixel	Proximity to GWL well
DTP3463	InSAR pixel	Proximity to GWL well
DSC9KKE	InSAR pixel	Proximity to GWL well
DRPN3N0	InSAR pixel	Proximity to GWL well
DQY95R7	InSAR pixel	Proximity to GWL well
DR76NQR	InSAR pixel	Proximity to GWL well
DQ1IBER	InSAR pixel	Proximity to GWL well
DR8YYJU	InSAR pixel	Proximity to GWL well
DUZIXC8	InSAR pixel	Proximity to GWL well

3.6.5. Groundwater Quality Monitoring Network

The sustainability indicator for degraded water quality is evaluated by monitoring groundwater quality at a network of existing monitoring wells.

The objectives of the groundwater quality monitoring program for the Subbasin include the following:

- Evaluate groundwater quality conditions in the various areas of the basin, and identify differences in water quality spatially between areas in the aquifer system;
- Detect the occurrence of and factors attributable to natural (e.g., general minerals and trace metals) constituents of concern as represented by total dissolved solids (TDS);
- Assess the changes and trends in groundwater quality (seasonal, short- and long-term trends); and
- Identify the natural and human factors that affect changes in water quality

Figures 3-6 illustrates the locations of the wells selected for monitoring of groundwater quality.

Table 3-22. Groundwater Quality Monitoring Network

WELL ID	LATITUDE	LONGITUDE	MONITORING FREQUENCY	WELL DEPTH	WELL SCREEN INTERVAL	GROUND SURFACE ELEVATION	FIRST YEAR OF DATA	LAST YEAR OF DATA	YEARS MEASURED	NUMBER OF MEASUREMENTS
RB-1U SWN: 27N04W05G002M	40.2273	-122.3376	Bi-annual (Fall/Spring)	260 (ft, bgs)	231 - 251 (ft, bgs)	482.53	6/27/1985	8/27/2021	2	2
RB-2U SWN: 27N04W36G001M	40.150704	-122.262514	Bi-annual (Fall/Spring)	155 (ft, bgs)	135 - 155 (ft, bgs)	TBD	8/19/2021	8/19/2021	1	1
RB-3U SWN: 26N04W25J001M	40.077036	-122.258963	Bi-annual (Fall/Spring)	128 (ft, bgs)	116 - 124 (ft, bgs)	333.46	N/A	N/A	N/A	N/A
RB-4U SWN: 25N03W11B001M	40.042815	-122.166514	Bi-annual (Fall/Spring)	255 (ft, bgs)	150 – 180 (ft, bgs)	252.1	6/29/2005	8/27/2021	4	6
RB-5U SWN: 25N03W19N001M	40.0013	-122.254	Bi-annual (Fall/Spring)	370 (ft, bgs)	135 – 358 (ft, bgs)	327.49	N/A	N/A	N/A	N/A
RB-6U SWN: 25N05W24D001M	40.0147	-122.3785	Bi-annual (Fall/Spring)	N/A	N/A	515.6	8/19/2021	8/19/2021	1	1
RB-7U	39.951929	-122.362222	Bi-annual (Fall/Spring)	N/A	N/A	466	8/19/2021	8/19/2021	1	1
TSS-1	TBD	TBD	Bi-annual (Fall/Spring)	TBD	TBD	TBD	N/A	N/A	N/A	N/A
TSS-2	TBD	TBD	Bi-annual (Fall/Spring)	TBD	TBD	TBD	N/A	N/A	N/A	N/A
TSS-3	TBD	TBD	Bi-annual (Fall/Spring)	TBD	TBD	TBD	N/A	N/A	N/A	N/A

Table 3-22 lists the well identification, location, monitoring frequency, well construction data, and measurement years, and number of measurements for the monitoring wells.

Similar to the approach for groundwater level monitoring above, monitoring wells were distributed across the Subbasin using the Hopkins method to provide thorough coverage. Although spatial and temporal data gaps exist in groundwater quality data, this network will allow for a comprehensive mapping of TDS trends. Continuous monitoring at the sites selected will establish a temporal record moving forward and assist in evaluating PMAs implemented moving forward. The distribution of wells across the Subbasin will not only help delineate spatial differences in TDS concentration but will also highlight areas in need of project and management actions in the future. Subsequent updating of the groundwater quality constituents will be developed in future GSP updates based on annual evaluation of TDS concentrations. The groundwater quality monitoring wells were ultimately chosen to be the same wells as the groundwater level monitoring wells. This approach will allow for ease of sampling and allow for future comparisons of changing water levels with water quality.

The selection rationale for groundwater quality monitoring wells is summarized in **Table 3-23.** Each site will comply with the data and reporting standards that are described in **Section 3.5.2.**

Table 3-23. Summary of Rationale for Selection for Wells Used Groundwater Quality

SITE	AQUIFER	BASIS FOR SELECTION
RB-1U SWN: 27N04W05G002M	Upper	CASGEM and Tehama County Well
RB-2U SWN: 27N04W36G001M	Upper	CASGEM and Tehama County Well
RB-3U SWN: 26N04W25J001M	Upper	CASGEM and Tehama County Well
RB-4U SWN: 25N03W11B001M	Upper	CASGEM and Tehama County Well
RB-5U SWN: 25N03W19N001M	Upper	CASGEM and Tehama County Well
RB-6U SWN: 25N05W24D001M	Upper	CASGEM and Tehama County Well
RB-7U	Upper	CASGEM and Tehama County Well
TSS-1	Upper	Location, New Well
TSS-2	Upper	Location, New Well
TSS-3	Upper	Location, New Well

3.6.6. Interconnected Surface Water Monitoring Network

Groundwater level monitoring wells within 1 mile of water bodies will be used as a proxy for monitoring. These wells are summarized in **Table 3-24** below. The basis for the selection of these wells in the interim is summarized in **Table 3-25**. There are extensive data gaps in the availability of monitoring sites. This data gap is discussed further in **Section 3.7.8.7.**

Table 3-24. Interconnected Surface Water Monitoring Network

WELL ID	LATITUDE	LONGITUDE	MONITORING FREQUENCY	WELL DEPTH	WELL SCREEN INTERVAL	GROUND SURFACE ELEVATION	FIRST YEAR OF DATA	LAST YEAR OF DATA	YEARS MEASURED	NUMBER OF MEASUREMENTS
RB-1U SWN: 27N04W05G002M	40.2273	-122.3376	Bi-annual (Fall/Spring)	260 (ft, bgs)	231 - 251 (ft, bgs)	482.53	12/7/1983	3/9/2020	38	146
RB-2U SWN: 27N04W36G001M	40.150704	-122.262514	Bi-annual (Fall/Spring)	155 (ft, bgs)	135 - 155 (ft, bgs)	TBD	9/8/1989	3/10/2020	31	192
RB-3U SWN: 26N04W25J001M	40.077036	-122.258963	Bi-annual (Fall/Spring)	128 (ft, bgs)	116 - 124 (ft, bgs)	333.46	1/3/1973	3/9/2020	48	120
RB-4U SWN: 25N03W11B001M	40.042815	-122.166514	Bi-annual (Fall/Spring)	255 (ft, bgs)	150 – 180 (ft, bgs)	252.1	6/23/2004	3/11/2020	17	94
RB-5U SWN: 25N03W19N001M	40.0013	-122.254	Bi-annual (Fall/Spring)	370 (ft, bgs)	135 – 358 (ft, bgs)	327.49	5/12/1965	3/9/2020	56	127
RB-6U SWN: 25N05W24D001M	40.0147	-122.3785	Bi-annual (Fall/Spring)	N/A	N/A	515.6	9/15/1988	10/15/2020	32	45
RB-7U	39.951929	-122.362222	Bi-annual (Fall/Spring)	N/A	N/A	466	6/30/2013	4/4/2021	8	16
TSS-1	TBD	TBD	Bi-annual (Fall/Spring)	TBD	TBD	TBD	N/A	N/A	N/A	N/A
TSS-2	TBD	TBD	Bi-annual (Fall/Spring)	TBD	TBD	TBD	N/A	N/A	N/A	N/A
TSS-3	TBD	TBD	Bi-annual (Fall/Spring)	TBD	TBD	TBD	N/A	N/A	N/A	N/A

Table 3-25. Summary of Rationale for Selection for Wells for Interconnected Surface Waters

SITE	AQUIFER	BASIS FOR SELECTION
RB-1U SWN: 27N04W05G002M	Upper	Upper aquifer well
RB-2U SWN: 27N04W36G001M	Upper	Upper aquifer well
RB-3U SWN: 26N04W25J001M	Upper	Upper aquifer well
RB-4U SWN: 25N03W11B001M	Upper	Upper aquifer well
RB-5U SWN: 25N03W19N001M	Upper	Upper aquifer well
RB-6U SWN: 25N05W24D001M	Upper	Upper aquifer well
RB-7U	Upper	Upper aquifer well
TSS-1	Upper	Upper aquifer well
TSS-2	Upper	Upper aquifer well
TSS-3	Upper	Upper aquifer well

3.7. Description of Monitoring Protocols (*Reg. § 354.34)*

3.7.1. Protocols for Monitoring Sites

The monitoring protocols that will be used by the GSA as part of implementing this Groundwater Sustainability Plan are largely based on the *Best Management Practices for the Sustainable Management of Groundwater: Monitoring Protocols, Standards, and Sites* produced by the DWR. The recommended monitoring protocols were adjusted and added to fit the specific monitoring needs of the Subbasin to achieve sustainability. Monitoring protocols for interconnected surface waters are the same as those for groundwater levels due to the proxy network. Also, monitoring protocols for seawater intrusion were not necessary as the Subbasin is not connected to the coast. The monitoring protocols that are described in this document will provide the necessary data to track the MTs and MOs for each of the sustainability indicators. The monitoring protocols established herein will be reviewed every five (5) years as a part of periodic GSP updates. The following protocols will be applied to all monitoring sites:

- Long-term access agreements. Access agreements should include year-round site access to allow for increased monitoring frequency.
- A unique identifier that includes a written description of the site location, date established, access instructions, type(s) of data to be collected, latitude, longitude, and elevation.
- A modification log is to be kept to track all modifications to the monitoring site.

All data collected and acquired should be added to the GSA's data management system or DMS. A description of the DMS is in **Appendix 3-A**.

3.7.2. Groundwater Level Elevation

3.7.2.1. Protocols for Measuring Groundwater Levels

Protocols for measuring groundwater levels including the following:

- Measure depth to water in the well using procedures appropriate for the measuring device. Equipment must be operated and maintained in accordance with manufacturer's instructions. Groundwater levels should be measured to the nearest 0.01 foot relative to the Reference Point (RP).
- For measuring wells that are under pressure, allow time for the groundwater levels to stabilize. In these cases, multiple measurements should be collected to ensure the well has reached equilibrium such that no significant changes in water level are observed. Every effort should be made to ensure that a representative stable depth to groundwater is recorded. If a well does not stabilize, the quality of the value should be appropriately qualified as a questionable measurement. If a well is artesian, site-specific procedures should be developed to collect accurate information and be protective of safety conditions associated with a pressurized well. In many cases, an extension pipe may be adequate to stabilize head in the well. Record the dimension of the extension and document measurements and configuration.
- The groundwater elevation should be calculated using the following equation.

  GWE= RPE−DTW

  Where:
  GWE = Groundwater Elevation in NAVD88 datum
  RPE = Reference Point Elevation in NAVD88 datum
  DTW = Depth to Water

- The measurements of depth to water should be consistent in units of feet, to an accuracy of tenths of feet or hundredths of feet.
- The well caps or plugs should be secured following depth to water measurement.
- Groundwater level measurements are to be made on a semi-annual basis at a minimum during periods which will capture seasonal highs and lows.

3.7.2.2. Recording Groundwater Level Measurements

- The sampler should record the well identifier, date, time (24-hour format), RPE, height of RP above or below ground surface, DTW, GWE, and comments regarding any factors that may influence the depth to water readings such as weather, nearby irrigation, flooding, or well condition. If there is a questionable measurement or the measurement cannot be obtained, it should be noted. Standardized field forms should be used for all data collection.
- All data should be entered into the GSA data management system (DMS) as soon as possible. Care should be taken to avoid data entry mistakes and the entries should be checked by a second person.

3.7.2.3. Installing Pressure Transducers and Downloading Data

The following procedures will be followed in the installation of a pressure transducer and periodic data downloads:

- The sampler must use an electronic sounder or chalked steel tape and follow the protocols listed above to measure the groundwater level and calculate the groundwater elevation in the monitoring well to properly program and reference the installation. It is recommended that transducers record measured groundwater level to conserve data capacity; groundwater elevations can be calculated later after downloading.
- The sampler must note the well identifier, the associated transducer serial number, transducer range, transducer accuracy, and cable serial number.
- Transducers must be able to record groundwater levels with an accuracy of at least 0.1 foot. Professional judgment will be exercised to ensure that the data being collected is meeting the Data Quality Objectives (DQO) and that the instrument is capable. Consideration of the battery life, data storage capacity, range of groundwater level fluctuations, and natural pressure drift of the transducers should be included in the evaluation.
- The sampler must note whether the pressure transducer uses a vented or non-vented cable for barometric compensation. Vented cables are preferred, but non-vented units provide accurate data if properly corrected for natural barometric pressure changes. This requires the consistent logging of barometric pressures to coincide with measurement intervals.
- Follow manufacturer specifications for installation, calibration, data logging intervals, battery life, correction procedure (if non-vented cables used), and anticipated life expectancy to assure that DQOs are being met for the GSP.
- Secure the cable to the well head with a well dock or another reliable method. Mark the cable at the elevation of the reference point with tape or an indelible marker. This will allow estimates of future cable slippage.

- The transducer data should periodically be checked against hand measured groundwater levels to monitor electronic drift or cable movement. This should happen during routine site visits, at least annually to maintain data integrity.
- The data should be downloaded as necessary to ensure no data is lost and entered into the basin's DMS following the quality assurance/quality control (QA/QC) program established for the GSP. Data collected with non-vented data logger cables should be corrected for atmospheric barometric pressure changes, as appropriate. After the sampler is confident that the transducer data have been safely downloaded and stored, the data should be deleted from the data logger to ensure that adequate data logger memory remains.

3.7.3. Groundwater Storage Measurements

The monitoring protocols for evaluating change in groundwater storage are the same as the protocols described above for groundwater levels.

3.7.4. Groundwater Quality Measurements

Annual monitoring of groundwater quality will include sampling and laboratory analysis of TDS. Additional constituents will be considered in the future as additional information becomes available. During the first sampling event, these wells will also be tested for major anions (carbonate, bicarbonate, chloride, sulfate) and major cations (boron, calcium, sodium, magnesium, potassium). Following the first sampling event, these anions and cations will be tested for every five (5) years. During sampling events, measurement of select water quality parameters will take place in the field. These field parameters should be measured at an annual frequency and include electrical conductivity at 25 °C (EC) in µS/cm, pH, temperature (in °C), and dissolved oxygen (DO) in mg/L. The annual testing is summarized in **Table 3-26**.

The GSP monitoring program will use the following protocols for collecting groundwater quality samples:

- Prior to sampling, the analytical laboratory will be contacted to schedule laboratory time, obtain appropriate sample containers, and clarify any sample holding times or sample preservation requirements.
- Each well used for groundwater quality monitoring will have a unique identifier. This identifier will appear on the well housing or the well casing to verify well identification.
- In the case of wells with dedicated pumps, samples should be collected at or near the wellhead following purging.
- Prior to sampling, the sampling port and sampling equipment will be cleaned of any contaminants. The equipment will be decontaminated between each sampling locations or wells to avoid cross-contamination.
- The groundwater elevation in the well should be measured following appropriate protocols described above in the groundwater level measuring protocols.
- For any well not equipped with low-flow or passive sampling equipment, an adequate volume of water should be purged from the well to ensure that the groundwater sample is representative of ambient groundwater and not stagnant water in the well casing. Purging three (3) well casing volumes is generally considered adequate. Professional judgment should be used to determine the proper configuration of the sampling equipment with respect to well construction such that a representative ambient groundwater sample is collected. If pumping causes a well to be

evacuated (go dry), document the condition and allow well to recover to within 90 percent of original level prior to sampling.

- Field parameters of pH, electrical conductivity and temperature should be collected during purging and prior to the collection of each sample. Field parameters should be evaluated during the purging of the well and should stabilize prior to sampling. Measurements of pH should only be measured in the field; lab pH analysis are typically unachievable due to short hold times. Other parameters, such as Oxidation-Reduction Potential (ORP), Dissolved Oxygen (DO) (in situ measurements preferable), or turbidity, may also be useful for assessing purge conditions. All field instruments will be calibrated daily and evaluated for drift throughout the day.
- Sample containers should be labeled prior to sample collection. The sample label must include sample ID (often well ID), sample date and time, sample personnel, sample location, preservative used, and analytes and analytical method.
- Samples should be collected under laminar flow conditions. This may require reducing pumping rates prior to sample collection.
- All samples requiring preservation must be preserved as soon as practically possible, ideally at the time of sample collection. Ensure that samples are appropriately filtered as recommended for the specific analyte. Entrained solids can be dissolved by preservative leading to inconsistent results of dissolve analytes. Specifically, samples to be analyzed for metals should be field filtered prior to preservation; do not collect an unfiltered sample in a preserved container.
- Samples should be chilled and maintained at 4 °C to prevent degradation of the sample. The laboratory's Quality Assurance Management Plan should detail appropriate chilling and shipping requirements.
- Samples must be shipped under chain of custody documentation to the appropriate laboratory promptly to avoid violating holding time restrictions.
- Groundwater quality samples shall be collected annually.
- All data will be entered into the GSA data management system (DMS) as soon as possible. Data entries should be checked by a second person to avoid incorrect data.

Table 3-26. Summary of Groundwater Quality Monitoring Constituents and Measurement Frequency for Representative Monitoring Sites

SITE	FIELD MEASUREMENTS	LABORATORY MEASUREMENTS (ANNUAL)	LABORATORY MEASUREMENTS (5-YEAR)
All Wells	Specific Conductance pH Dissolved Oxygen ORP Temperature	TDS	Carbonate Bicarbonate Chloride Sulfate Calcium Sodium Magnesium Potassium Nitrate

3.7.5. Subsidence Measurements

Subsidence monitoring will include the following protocols:

- Download and review subsidence data from the nine (9) pixels designated as monitoring points for subsidence.
- Review groundwater level data collected at monitoring wells near each pixel. Analyze both datasets to determine if any meaningful correlations can be identified.

3.7.6. Interconnected Surface Water Measurements

Groundwater level monitoring wells within the upper aquifer will be used as a proxy for this indicator.

3.7.7. Representative Monitoring (*Reg. § 354.36*)

Representative Monitoring Sites (RMS) are defined in the GSP regulations as a subset of monitoring sites that are representative of conditions in the Subbasin. All the monitoring sites in this section are considered RMS using methods of selection consistent with best management practices described above under the groundwater level protocols. Groundwater elevation monitoring will be used to determine changes in groundwater storage. As previously stated in Chapter 3, reduction in groundwater storage cannot be directly measured. However, groundwater level data will be used in conjunction with aquifer parameters and the groundwater model to compute changes in groundwater storage subbasin wide. In the case of subsidence, no highly susceptible areas exist in the Subbasin. However, nine (9) InSAR pixels will be monitored for vertical displacement and over time, the GSA will examine this data in conjunction with water level data collected to determine whether changes in water levels can be used as an early detection method for compaction, if possible.

3.7.8. Assessment and Improvement of Monitoring Network ((*Reg. § 354.38*)

As described in section 354.38 of the GSP Regulations, each agency is required to analyze the monitoring network for improvements as follows:

- Each GSA shall review the monitoring network and include an evaluation in the Plan and each five (5)-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.
- Each GSA shall identify data gaps wherever the basin does not contain enough monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the GSA.
- If the monitoring network contains data gaps, the Plan shall include a description of the following:
    - The location and reason for data gaps in the monitoring network
    - Local issues and circumstances that limit or prevent monitoring
- Each GSA shall describe steps that will be taken to fill data gaps before the next 5-year assessment, including the location and purpose of newly added or installed monitoring sites

- Each GSA shall adjust the monitoring frequency and distribution of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of PMAs under circumstances that include the following:
    - Minimum threshold exceedances
    - Highly variable spatial or temporal conditions
    - Adverse impacts to beneficial uses and users of groundwater
    - The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin

Monitoring frequency and density of sites for all sustainability indicators are described in previous sections in Chapter 3 of this Plan.

3.7.8.1. Review and Evaluation of the Monitoring Network

The monitoring networks described above for each of the applicable sustainability indicators will be evaluated on a yearly basis. This evaluation will involve a review of the described MTs and MOs and their comparison to observed trends in the networks. Furthermore, a more comprehensive review of the monitoring networks will be conducted every five (5) years as part of the GSP updates. During this review, projects and actions will be evaluated, and the monitoring networks will be assessed for their efficacy in tracking progress based on the actions and projects. These evaluations and assessments will also highlight any additional data gaps and recommended changes to the monitoring networks.

3.7.8.2. Identification and Description of Data Gaps

Identification and description of data gaps for the monitoring networks described above for each of the applicable sustainability indicators are described below.

3.7.8.3. Groundwater Elevation

Groundwater elevation data has been extensively collected within the Subbasin over the past several decades therefore no data gaps were identified for this indicator.

3.7.8.4. Groundwater Quality

Data gaps in water quality monitoring exist on a temporal basis but not a spatial basis. During well selection, the limiting criteria was the record of TDS measurements. Historical data related to TDS was not continuously collected for a long period of time at any monitoring wells and no wells had TDS data spanning the base period of the model. The RMS wells were chosen to monitor groundwater quality within the Subbasin. The GSA plans to monitor these wells on a yearly basis and will establish a continuous monitoring record moving forward. This data collection will enable the GSA to identify any additional data gaps or noticeable trends in water quality.

3.7.8.5. Groundwater Storage

Groundwater storage data gaps are described in the groundwater elevation section as water levels are being used as a proxy for groundwater storage.

3.7.8.6. Subsidence

No data gaps are presently evident in the Subbasin for subsidence monitoring; however, the network will be reevaluated on a yearly basis for any emerging data gaps.

3.7.8.7. Interconnected Surface Waters

The interconnected surface water indicator had the most prominent data gaps compared to all other indicators. The two (2) contributors to this data gap were the lack of shallow (< 50 feet) monitoring wells in the vicinity of interconnected surface waters and critical groundwater dependent ecosystem (GDEs) and the lack of stream gages. Additionally, shallow well and stream gage based historical measurements were another form of data gap.

All GDEs within the Red Bluff Subbasin were examined and high priority GDEs were identified based on the change in the normalized difference vegetation index (NDVI). The high priority GDEs were mapped alongside shallow monitoring wells (**Figure 3-12**). However, no suitable monitoring wells for these GDEs could be identified due to the distance of wells from the GDEs (> 1 mile), the depth of the wells (> 50 feet), or the lack of correlation between the water level data to GDE health indicators.

Model results were used to identify interconnected surface waters within the Subbasin. The locations of these surface waters were compared to shallow monitoring wells. However, this analysis did not yield any viable monitoring wells within a one-mile radius of the surface waters (**Figure 3-13**). Furthermore, many surface water features lacked stream gages. Therefore, no meaningful comparisons could be made between surface water feature levels and groundwater levels if shallow monitoring wells were available.

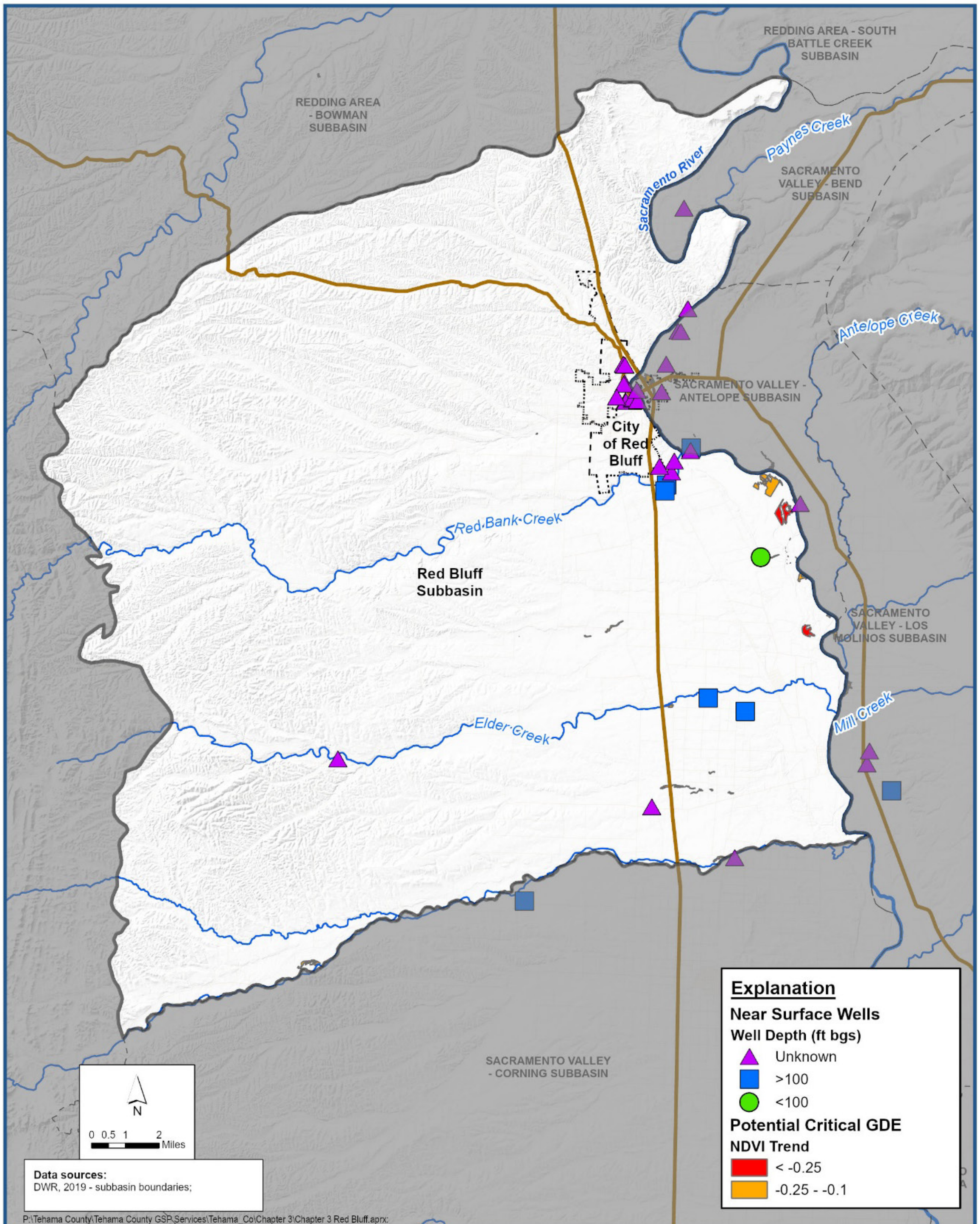
Due to these extensive data gaps, groundwater level monitoring wells within the upper aquifer will be used as a proxy for monitoring.

3.7.8.8. Description of Steps to Remedy Data Gaps

Data gaps have been presented in the groundwater elevation, groundwater quality, and groundwater storage monitoring networks. The GSA will take the following steps, prior to the first five (5)-year GSP Periodic Evaluation in 2027 to address these data gaps:

- The GSA will install three new aquifer-specific nested monitoring wells within the Subbasin. This new well has been included as part of the groundwater level monitoring program. Being a nested well, this well will provide valuable data from both aquifers from the same location which can be used to directly compare conditions in both aquifers.
- Sampling events will be coordinated with well owners to prevent pumping and access issues.
- Although no monitoring network is currently in place for interconnected surface water, the GSA will look at the data gaps brought forth in the GDE and surface water data assessment and aim to bridge these gaps through the installation of shallow monitoring wells and stream gages near areas of concern. Also, it will consider conducting synoptic stream gaging where conditions are safe to do so.

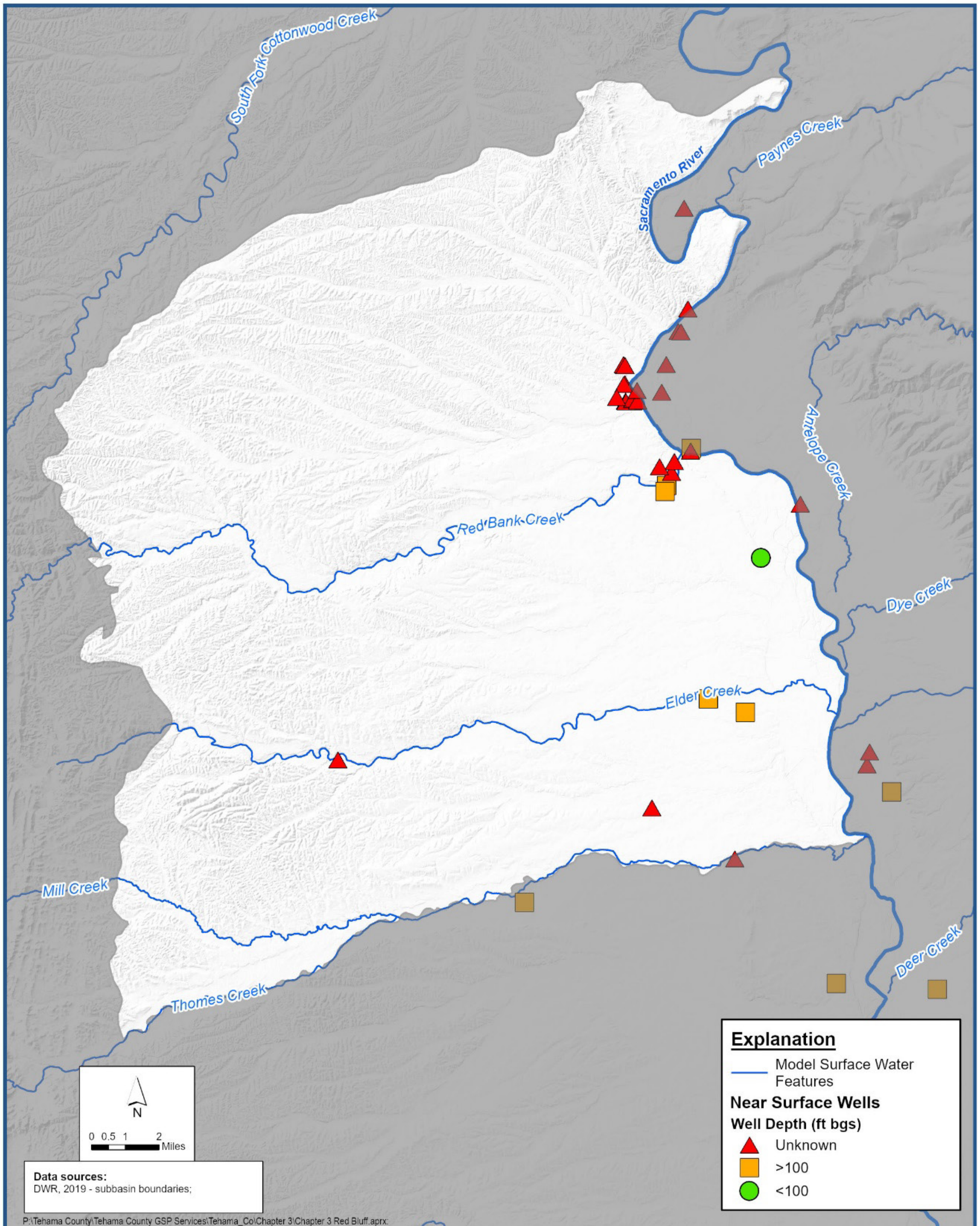
In addition to these steps, the monitoring networks will be evaluated on a yearly and five (5)-year basis. If additional data gaps arise, the GSA will consider the implications of these gaps, associated costs, and importance to the continued implementation of the GSP and take appropriate actions to address the gaps.



Identification of Data Gaps (GDE)

Groundwater Sustainability Plan
Red Bluff Subbasin

Figure 3-12



Identification of Data Gaps (Surface Water Features) **Figure 3-13**

Groundwater Sustainability Plan
Red Bluff Subbasin