Section 6 – Sustainable Management Criteria

Corning Subbasin
Groundwater Sustainability Plan

November 2021

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6 SUSTAINABLE MANAGEMENT CRITERIA

This section defines the conditions that constitute sustainable groundwater management, discusses the process by which the Corning Subbasin will characterize undesirable results, and establishes minimum thresholds and measurable objectives for each applicable sustainability indicator.

This is the fundamental section in the GSP that defines sustainability in the Subbasin and addresses significant regulatory requirements. The measurable objectives, minimum thresholds, and undesirable results detailed in this section define the Subbasin's future conditions and commits the GSA to actions that will meet these objectives. Defining these SMC requires a significant level of analysis and scrutiny, and this section includes adequate data to explain how SMC were developed and how they influence all beneficial uses and users in the Corning Subbasin. The section follows a consistent format that contains the following information required by Section 354.22 *et. seq* of the regulations and outlined in the SMC BMP (DWR, 2017):

- How locally defined significant and unreasonable conditions were developed
- How minimum thresholds were developed, including:
    - The information and methodology used to develop minimum thresholds (§354.28 (b)(1))
    - The relationship between minimum thresholds and the relationship of these minimum thresholds to other sustainability indicators (§354.28 (b)(2))
    - The effect of minimum thresholds on neighboring basins (§354.28 (b)(3))
    - The effect of minimum thresholds on beneficial uses and users (§354.28 (b)(4))
    - Relevant federal, state, or local standards (§354.28 (b)(5))
    - The method for quantitatively measuring minimum thresholds (§354.28 (b)(6))
- How measurable objectives were developed, including:
    - The methodology for setting measurable objectives (§354.30)
    - Interim milestones (§354.30 (a), §354.30 (e), §354.34 (g)(3))
- How undesirable results were developed, including:
    - The criteria for defining undesirable results (§354.26 (b)(2))
    - The potential causes of undesirable results (§354.26 (b)(1))
    - The effects of these undesirable results on the beneficial users and uses (§354.26 (b)(3))

6.1 Definitions

The SGMA Legislation and GSP Regulations contain a number of new terms relevant to the SMC. These terms are defined below using the definitions included in the GSP Regulations. Where appropriate, additional explanatory text is added in italics. This explanatory text is not part of the official definitions of these terms.

- **Interconnected surface water** refers to surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted.

  Interconnected surface waters are sections of streams, lakes, or wetlands where the groundwater table is at or near the ground surface.

- **Interim milestone** refers to a target value representing measurable groundwater conditions, in increments of five years, set by an Agency as part of a Plan.

  Interim milestones are targets such as groundwater elevations that should be achieved every five years to demonstrate progress towards sustainability.

- **Management area** refers to an area within a basin for which the Plan may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors.

  Management Areas are not required in the GSP, and it is possible to establish different SMC in different areas of a subbasin without identifying specific management areas.

- **Measurable objectives** refer to specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions that have been included in an adopted Plan to achieve the sustainability goal for the basin.

  Measurable objectives are goals that the GSP is designed to achieve.

- **Minimum threshold** refers to a numeric value for each sustainability indicator used to define undesirable results.

  Minimum thresholds are indicators of a significant and unreasonable condition. For example, the level of a pump in a well may be a minimum threshold because groundwater levels dropping below the pump level would be a significant and unreasonable condition.

- **Representative monitoring** refers to a monitoring point within a broader network of sites that typifies one or more conditions within the basin or an area of the basin.

- **Significant and unreasonable conditions**

  "Significant and unreasonable conditions" is a phrase used to identify conditions that lead to undesirable results but is not specifically defined in the GSP Regulations. This

expression is often confused with, or used interchangeably with, undesirable results. However, significant and unreasonable conditions are physical conditions to be avoided (such as declining groundwater levels that may dry up wells); an undesirable result is a quantitative assessment based on minimum thresholds. Defining significant and unreasonable conditions early in the process of developing SMC for each sustainability indicator helps set the framework by which the quantitative SMC metrics are determined.

- **Sustainability indicator** refers to any of the effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results, as described in Water Code Section 10721(x).

  There are six sustainability indicators defined by SGMA. The five sustainability indicators relevant to this Subbasin include chronic lowering of groundwater levels; reduction of groundwater storage; degraded water quality; land subsidence; and depletion of interconnected surface waters.

- **Uncertainty** refers to a lack of understanding of the basin setting that significantly affects an Agency's ability to develop sustainable management criteria and appropriate projects and management actions in a Plan, or to evaluate the efficacy of Plan implementation, and therefore may limit the ability to assess whether a basin is being sustainably managed.

- **Undesirable Result** means one or more of the following effects caused by groundwater conditions occurring throughout the basin per Water Code Section 10721:

  1. Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods.
  2. Significant and unreasonable reduction of groundwater storage.
  3. Significant and unreasonable seawater intrusion.
  4. Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.
  5. Significant and unreasonable land subsidence that substantially interferes with surface land uses.
  6. Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

Undesirable Result is not defined in the GSP Regulations. However, the description of undesirable result states that it should be a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the subbasin. An example undesirable result is more than 20% of the measured groundwater levels being lower than the minimum thresholds. Undesirable results should not be confused with significant and unreasonable conditions. Significant and unreasonable conditions are physical conditions to be avoided; an undesirable result is a quantitative assessment based on minimum thresholds.

6.2 Sustainability Goal

Per Section §354.24 of the GSP Regulations, the sustainability goal for the Subbasin has 3 parts:

- A description of the sustainability goal
- A discussion of the measures that will be implemented to ensure the Subbasin will be operated within sustainable yield
- An explanation of how the sustainability goal is likely to be achieved

Description of the Sustainability Goal for the Corning Subbasin:

The goal of the Groundwater Sustainability Plan is to ensure sufficient and affordable water of good quality be available on a sustainable basis to meet the unique needs of agricultural, residential, municipal, industrial, recreational, tribal and environmental users within the Corning Subbasin, both now and in the future. The GSAs recognize that sustainability can only be possible with the support of the public and coordination of local, state, tribal and federal agencies and the utilization of both surface and groundwater resources.

Measures to be implemented to ensure sustainability:

Projects and management actions the GSAs have identified as potential measures to be implemented to ensure sustainability are included in Section 7 of this GSP. While all of the identified measures may not be implemented, some combination of these measures will be implemented to ensure the Subbasin is operated within its sustainable yield and achieves sustainability through the avoidance of undesirable results. Section 7 describes the initial prioritization and sequencing of measures which are considered likely to be implemented in the early stages of GSP implementation. In particular, the GSAs intend to prioritize implementation of the identified management actions first, prior to initiating more complex projects, which are currently in the conceptual stage.

These management actions and project types include:

Management Actions:

- Well management
- Grower education on best management practices and water demand management
- Policy and ordinances that control pumping growth
- Water transfers and contracting

Projects:

- In-lieu recharge through direct surface water delivery for irrigation
- Indirect recharge through reduction of non-beneficial evapotranspiration (e.g., removal of invasive species) or increased percolation (e.g., stormwater capture)
- Direct recharge through use of unlined canals and ephemeral streams
- In-lieu recharge through use of off-stream surface water detention ponds

For each of these management actions and project types, a number of priority projects with specific conceptual designs are described in Section 7.

Description of how the sustainability goal will be achieved:

The measures listed above will help the GSAs achieve sustainability in the Subbasin within 20 years by the following means:

- Educating stakeholders, providing best management tools, and incentivizing changes in behavior to improve chances of achieving sustainability.
- Incentivizing growers within Water Districts to make use of their full CVP surface water allocation.
- Increasing awareness of groundwater pumping impacts to promote voluntary reductions in groundwater use through improved water use practices.
- Increasing basin recharge by capturing surface water under approved or modified permits.

As mentioned throughout the GSP sections, data gaps were identified during the development of this GSP, that will be resolved over time, as described in Section 8 Plan Implementation. Therefore, the GSAs reserve the right to adaptively manage the groundwater within the subbasin and to modify any of the SMCs in the future during the 20-year GSP implementation phase. This adaptive management approach allows the GSAs to better manage the groundwater in the subbasin as new data are collected, understanding of Subbasin conditions improves, and initial projects and management actions are implemented towards reaching sustainability in 2042.

6.3 General Process for Establishing Sustainable Management Criteria

The SMC presented in this section were developed using publicly available information, feedback gathered during public meetings, and recommendations of GSA staff and CSAB members. The general process included:

- Review of existing local management considerations
- Analysis of the historical datasets specific to the sustainability indicator
- Presentation of information at public meetings
- Discussion with the GSA staff, CSAB, and other local stakeholders on the SMC requirements and implications
- Consideration of feedback from the GSA staff, CSAB, and local stakeholders on potential SMC
- Modification of SMC based on input received

This general process resulted in the SMC presented in this section.

6.4 Management Areas

SGMA allows for the establishment of management areas within a basin or subbasin to distinguish different monitoring and management criteria and facilitate implementation of the GSP. Management areas have not been established in the Corning Subbasin at this time. However, the GSAs reserve the right to establish management areas, during future GSP updates, if deemed necessary.

6.5 Sustainable Management Criteria Summary

Table 6-1 provides a summary of the SMCs for each of the 5 sustainability indicators that are applicable in the Subbasin. Seawater intrusion, the sixth sustainability indicator presented in the GSP Regulations, is not applicable to the Corning Subbasin as discussed in Section 3.2. The rationale and background for developing these criteria are described in detail in the following sections.

Table 6-1. Sustainable Management Criteria Summary

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Interim Milestones	Undesirable Result
Chronic lowering of groundwater levels	Annual fall groundwater elevation measured in representative monitoring well network by county or DWR.	Stable wells: Minimum fall groundwater elevation since 2012 minus 20-foot buffer. Declining wells: Minimum fall groundwater elevation since 2012 minus 20% of minimum groundwater level depth.	Stable wells: Maximum fall groundwater elevation since 2012 Declining wells: Maximum fall groundwater elevation in 2015	Linear trend between current conditions and measurable objective.	20% of groundwater elevations measured at RMP wells drop below the associated minimum threshold during 2 consecutive years. If the water year type is dry or critically dry then levels below the MT are not undesirable if groundwater management allows for recovery in average or wetter years.
Reduction in groundwater storage	Using groundwater levels as a proxy, same as chronic lowering of groundwater levels network	Amount of groundwater in storage when groundwater elevations are at their minimum threshold – since groundwater levels are used as a proxy, same as chronic lowering of groundwater levels minimum thresholds	Amount of groundwater in storage when groundwater elevations are at their measurable objective - – since groundwater levels are used as a proxy, same as chronic lowering of groundwater levels measurable objectives	Linear trend between current conditions and measurable objective.	Same as chronic lowering of groundwater levels.
Degraded groundwater quality	Annual TDS measured by water providers at public supply wells in the Subbasin.	TDS concentration of 750 mg/L at public supply wells.	California lower limit SMCL concentration for TDS of 500 mg/L measured at public supply wells.	Identical to current conditions	At least 25% of representative monitoring sites exceed the minimum threshold for water quality for 2 consecutive years at each well where it can be established that GSP implementation is the cause of the exceedance.
Land Subsidence	Inelastic land subsidence measured by InSAR data available from DWR, and periodic measurements at the survey monuments	No more than 0.5 foot of cumulative subsidence over a five-year period (beyond the measurement error), solely due to lowered groundwater elevations	Zero inelastic subsidence, in addition to any measurement error. If InSAR data are used, the measurement error is 0.1 ft and any measurement of 0.1 ft or less would not be considered inelastic subsidence.	Identical to current conditions	Any exceedance of a minimum threshold that is irreversible and caused by lowering groundwater elevations.
Depletion of interconnected surface water	A subset of shallow wells used for monitoring the chronic lowering of groundwater levels, of DWR observation wells near interconnected streams.	Same as chronic lowering of groundwater levels.	Same as chronic lowering of groundwater levels.	Linear trend between current conditions and measurable objective.	Same as chronic lowering of groundwater levels.

6.6 Chronic Lowering of Groundwater Levels SMC

6.6.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable conditions were determined based on discussions with GSA staff, input from CSAB members, and other local stakeholders, and is defined as follows:

> *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 users in the Subbasin.*

6.6.2 Minimum Thresholds

Section §354.28(c)(1) of the GSP Regulations states that "The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results."

An approach for setting minimum thresholds at representative monitoring wells in the Subbasin was developed through review of recent historical data, understanding of Subbasin conditions, and discussions with CSAB and stakeholders at a number of CSAB public meetings.

Minimum thresholds were established as follows:

- For wells that had recent historical (between 2010 and 2019) stable groundwater elevations (stable wells): Minimum fall groundwater elevation since 2012 minus 20-foot buffer
- For wells that had recent historical (between 2010 and 2019) declining groundwater elevations (declining wells): Minimum fall groundwater elevation since 2012 minus 20% of minimum groundwater level depth.

Minimum thresholds and measurable objectives were not specifically assigned with the above approach to 5 new wells added to the RMP network in 2020 or later, including 24N05W23L001M and 4 new wells in the new grant-funded Glenn and Tehama County observation well clusters.The SMC for these observation wells were interpolated from nearby wells as described in the section below. The 2020 groundwater levels were used to define the SMC for 24N05W23L001M using a similar process for older monitoring wells described above.

6.6.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

The development of minimum thresholds and measurable objectives follow a similar process and are described concurrently in this section. The information used for establishing the chronic lowering of groundwater levels minimum thresholds and measurable objectives include:

- Historical groundwater elevation data from wells monitored in the Subbasin by DWR, Glenn County, and Tehama County
- Results of groundwater model simulations
- Feedback from discussions with GSA staff, CSAB members, and local stakeholders on challenges and goals within the Subbasin
- The definition of significant and unreasonable conditions developed based on local feedback

An initial estimate of preliminary minimum thresholds and measurable objectives was developed early in the process using the following approach:

- Review information from previous groundwater management planning efforts in the Subbasin prior to SGMA enactment. Previous groundwater elevation metrics were documented in the Tehama County Groundwater Management Plan as Trigger Levels and Awareness Actions and in Glenn County groundwater management planning process as BMOs. This review also included preliminary presentations for pre-SGMA revisions to the draft revised Glenn County BMOs given at the Glenn County Water Advisory Committee and Technical Advisory Committee meetings between 2014 and 2016
- Identify RMP wells for developing SMC in the shallow and deep portions of the principal aquifer of the Subbasin. This process is detailed in Section 5.2.3 of this GSP.
- Develop a methodology to identify potential impacts to the shallowest well users (primarily domestic wells) based on a set of key wells. The selected key wells were used in prior county-level groundwater management efforts. The locations were used in this analysis to determine how various water levels would impact beneficial uses and users of groundwater in the Subbasin
- Apply the methodology developed at key wells to the RMP network of wells
- Plot the draft minimum thresholds and measurable objectives on the respective monitoring well hydrographs.

Each of the main steps used to develop the preliminary minimum thresholds and measurable objectives is described in more detail in Appendix 6A.

The preliminary groundwater level minimum thresholds and measurable objectives were reviewed by the CSAB and stakeholders. Based on their feedback, the following revisions were incorporated into the minimum thresholds and measurable objectives.

Refine historical basis for minimum threshold and measurable objectives:

As detailed in Appendix 6A, the initial minimum thresholds were set at 2019 groundwater elevations. A review of groundwater elevations showed that since 2012, elevations have reached historical minimum levels due to drought, increased groundwater pumping, and limited surface water availability, but they did not always occur in 2019. Therefore, the minimum thresholds were modified to be based on data from the lowest groundwater levels measured since 2012.

Fall groundwater elevations were selected to establish minimum thresholds and measurable objectives. Using fall data to define water level goals allows for the management towards preventing significant and unreasonable conditions such as wells going dry or low water levels causing substantially increased pumping costs.

Establish approximate zones of similar water level trends:

A qualitative review of general water level trends at RMP wells was used to assign general approximate zones of similar water level trends within the Subbasin. Fall groundwater level data were reviewed to assess recent (2010 to 2019) general trends to identify zones of similar characteristics. Each well was assigned a trend qualitatively using one of the following 4 classifications:

1. Stable
2. Slight decline
3. Decline
4. Insufficient data

In general, groundwater elevations have declined in much of the Corning Subbasin since 2012 and have reached historical minimum levels in many wells. The reasons for this overall declining water level trend are drought, less reliable surface water supplies, and increased reliance on new wells due to increased reliance on groundwater by crops previously irrigated with surface water, and agricultural expansion which lead to increased groundwater pumping. In general, groundwater level declines are greater in wells west of I-5, and lesser in wells east of I-5. In some wells closest to the Sacramento River and Stony Creek the groundwater levels have been relatively stable since 2010. Thus, 3 general zones of similar water level trend characteristics were identified, from west to east. There are 8 RMP locations with insufficient data to assign a trend, but likely trends can be inferred in these locations based on nearby wells. Figure 6-1 and Figure 6-2 show the stable and declining zones used to define the minimum thresholds and measurable objectives in both the upper and lower portions of the principal aquifer, respectively. It should be noted that these approximate zones of similar groundwater level trends were only established for purposes of defining appropriate minimum thresholds for different areas in the subbasin, per stakeholder feedback, and do not constitute actual management areas or precise well characteristic or impact determinations. These approximate zones should not be used beyond the specific purpose as described herein and may not have a specific purpose in the GSP implementation or update. Water levels and minimum thresholds are assessed at each RMP well, and therefore these zones do not further influence how wells in some areas get assessed relative to SMC. Further, Figure 6-1 and Figure 6-2 provide a general visual representation of these approximate zones, but to not represent specific areas that fall into 1 or the other category.

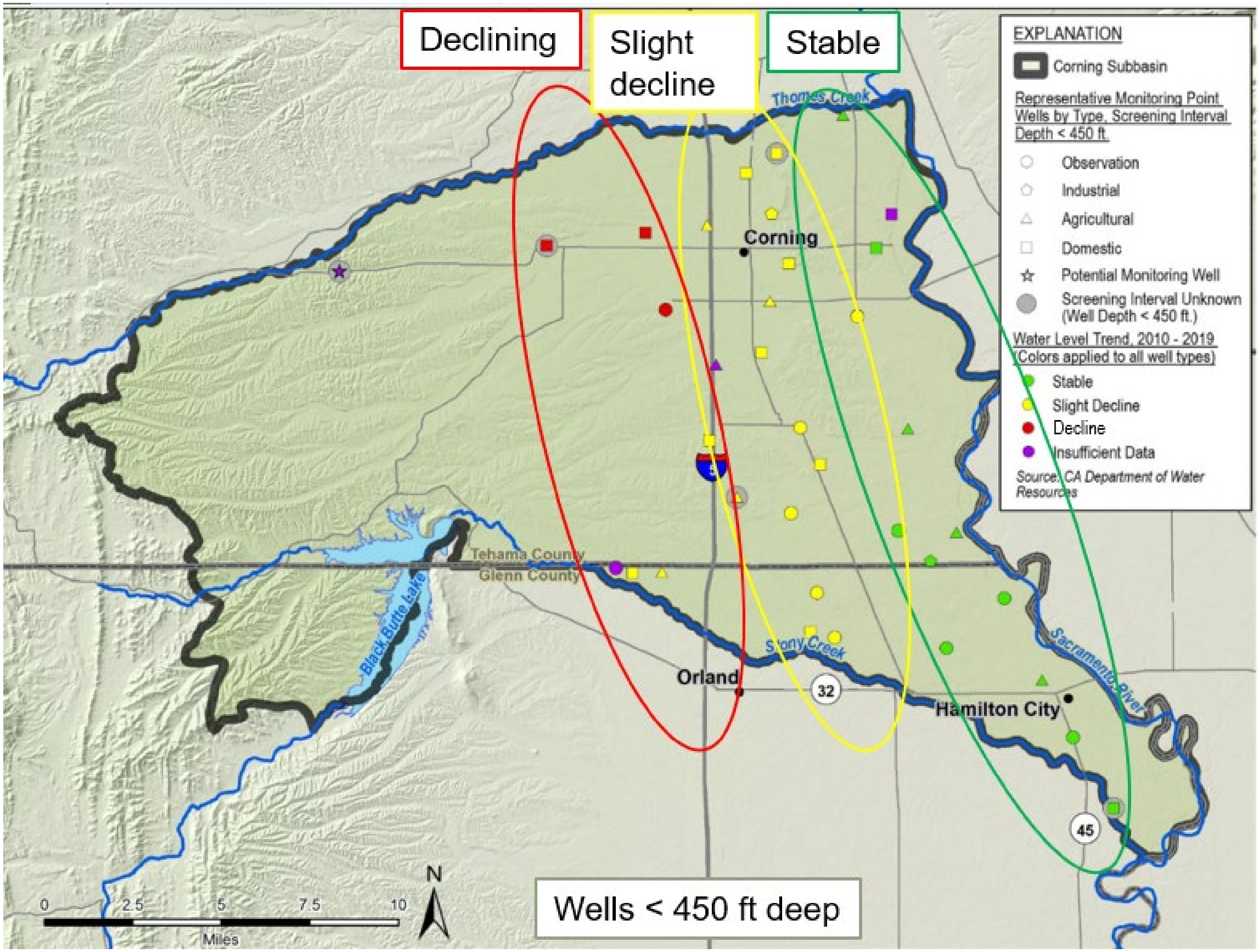

Figure 6-1. Qualitative Groundwater Level Trends at Shallow RMP Wells with Approximate Areas of Similar Trends

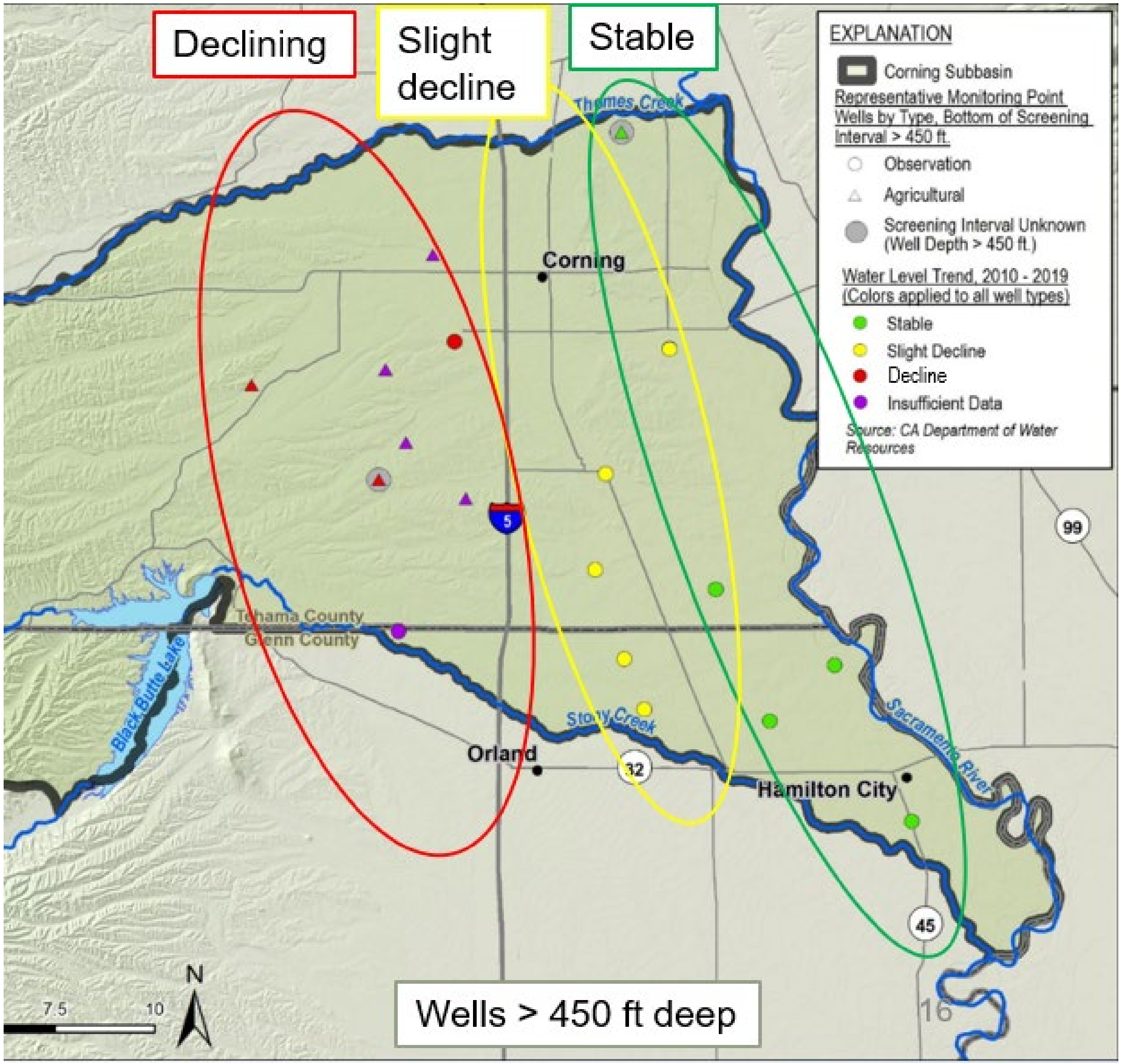

Figure 6-2. Qualitative Groundwater Level Trends at Deep RMP Wells with Approximate Areas of Similar Trends

Review projected model simulation results

Guidance on setting groundwater elevation minimum thresholds and measurable objectives were compiled from the projected baseline groundwater model simulations. The following summarizes the methodology for incorporating the simulation results into the SMC:

- The projected groundwater model was used to simulate groundwater elevations with current conditions (2015 surface water use, and 2015 to 2018 land use) and projected climate change at 2070 conditions (without any projects).
- Simulated groundwater levels with current operations and projected climate change show that there would be an average groundwater level decline of 10 feet (up to 20 feet in some areas).
- Less variation and decline in groundwater levels were projected closer to the Sacramento River due to surface water recharge.
- Generally, groundwater levels throughout the Subbasin are projected to stabilize at a new low level below the current conditions.
- The model results were used to establish buffers below associated historical groundwater levels to account for projected climate change impacts on Subbasin conditions.

Assign revised minimum thresholds and measurable objectives

Based on the model results, for the stable wells in the eastern portion of the Subbasin, a 20-foot buffer was added to the low groundwater levels selected in the previous activity to account for future climate change and irrigation practices. The measurable objective for wells with stable groundwater levels was set to the maximum fall groundwater elevation since 2012, consistent with the initially proposed measurable objective to allow for levels to go back to where they were prior to the 2012-2016 drought.

The minimum threshold for wells with declining groundwater levels was set to the minimum fall groundwater elevation since the 2012 measurement, minus 20% of the depth to water because a 20-foot buffer was considered too restrictive and not flexible enough to allow variation in depth based on how deep the wells are and local conditions. The measurable objective for wells with declining groundwater levels was set to maximum fall measurement since 2015 rather than the maximum fall measurement since 2012, because it may be impractical to rebound to fall 2012 measurements in those wells that have reached a newer low level.

Table 6-2 provides the depth to groundwater at the minimum threshold for each well, and the difference between the minimum threshold and the minimum groundwater elevation since 2012; the latter provides an indication of the additional drawdown allowed at each well before reaching the minimum threshold.

Table 6-2. Minimum Thresholds Development at Each Well

RMP Network	State Well Number	Well Type	Total Well Depth Feet	Groundwater Level Trend	Depth to Groundwater at Minimum Threshold Feet	Difference Between Minimum Threshold and Minimum GW Elevation Since 2012 Feet
Shallow	21N01W04N001M	Domestic	100	Stable	48.4	20.0
Shallow	22N01W19E003M	Irrigation	500	Stable	60.1	20.0
Shallow	22N01W29N003M	Observation	400	Stable	58.3	20.0
Shallow	22N02W01N003M	Observation	440	Stable	62.2	20.0
Shallow	22N02W15C004M	Observation	258	Stable	108.3	20.0
Shallow	23N02W16B001M	Irrigation	120	Stable	88.1	20.0
Shallow	23N02W28N004M	Observation	205	Stable	100.1	20.0
Shallow	23N02W34A003M	Irrigation	125	Stable	61.8	20.0
Shallow	23N02W34N001M	Industrial	100	Stable	74.1	20.0
Shallow	24N02W17A001M	Domestic	140	Stable	61.3	20.0
Shallow	24N02W20B001M	Domestic	120	Stable	73.1	20.0
Shallow	25N02W31G002M	Irrigation	115	Stable	54.5	20.0
Deep	22N01W29N002M	Observation	670	Stable	73.5	20.0
Deep	22N02W01N002M	Observation	730	Stable	86.8	20.0
Deep	22N02W15C002M	Observation	825	Stable	134.7	20.0
Deep	23N02W28N002M	Observation	580	Stable	104.4	20.0
Deep	25N03W36H001M	Irrigation	524	Stable	80.1	20.0
Shallow	22N02W18C003M	Observation	188	Slight Decline	93.9	15.7
Shallow	22N03W01R002M	Observation	314	Slight Decline	104.9	17.5
Shallow	22N03W05F002M	Irrigation	218	Slight Decline	121.0	20.2
Shallow	22N03W06B001M	Domestic	210	Slight Decline	71.9	12.0
Shallow	22N03W12Q003M	Domestic	124	Slight Decline	69.7	11.6
Shallow	23N03W04H001M	Irrigation	270	Slight Decline	81.5	13.6
Shallow	23N03W13C006M	Observation	182	Slight Decline	92.5	15.4
Shallow	23N03W16H001M	Domestic	150	Slight Decline	103.8	17.3
Shallow	23N03W22Q001M	Irrigation	380	Slight Decline	106.1	17.7
Shallow	23N03W24A003M	Domestic	199	Slight Decline	88.8	14.8
Shallow	23N03W25M004M	Observation	155	Slight Decline	114.7	19.1
Shallow	24N02W29N003M	Observation	388	Slight Decline	90.6	15.1
Shallow	24N03W02R001M	Domestic	270	Slight Decline	85.4	14.3
Shallow	24N03W03R002M	Domestic	132	Slight Decline	86.7	14.5
Shallow	24N03W14B001M	Industrial	140	Slight Decline	118.6	19.8
Shallow	24N03W16A001M	Irrigation	195	Slight Decline	108.4	18.1
Shallow	24N03W24E001M	Domestic	224	Slight Decline	161.8	27.0

RMP Network	State Well Number	Well Type	Total Well Depth Feet	Groundwater Level Trend	Depth to Groundwater at Minimum Threshold Feet	Difference Between Minimum Threshold and Minimum GW Elevation Since 2012 Feet
Shallow	24N03W26K001M	Irrigation	245	Slight Decline	110.9	18.5
Shallow	24N03W35P005M	Domestic	120	Slight Decline	71.4	11.9
Deep	22N02W18C001M	Observation	1,062	Slight Decline	161.1	26.9
Deep	22N03W01R001M	Observation	515	Slight Decline	111.6	18.6
Deep	23N03W13C004M	Observation	835	Slight Decline	108.7	18.1
Deep	23N03W25M002M	Observation	513	Slight Decline	126.1	21.0
Deep	24N02W29N004M	Observation	741	Slight Decline	88.6	14.8
Shallow	24N03W17M001M	Domestic	108	Decline	126.0	21.0
Shallow	24N03W29Q001M	Observation	372	Decline	136.9	22.8
Shallow	24N04W14N002M	Domestic	180	Decline	153.7	25.6
Deep	23N03W07F001M	Irrigation	790	Decline	126.0	21.0
Deep	23N03W17R001M	Irrigation	720	Decline	115.2	19.2
Deep	23N04W13G001M	Irrigation	560	Decline	201.0	33.5
Deep	24N03W17M002M	Irrigation	505	Decline	144.0	24.0
Deep	24N03W29Q002M	Observation	575	Decline	140.9	23.5
Deep	24N04W33P001M	Irrigation	780	Decline	241.1	40.2
Deep	24N04W34K001M	Irrigation	750	Decline	237.1	39.5
Deep	24N04W34P001M	Irrigation	535	Decline	256.6	30.8
Deep	24N04W36G001M	Irrigation	750	Decline	179.0	29.8

Hydrographs showing groundwater levels over time, minimum thresholds, and measurable objectives for each RMP well are included in Appendix 6B. The minimum threshold values for each RMP well are provided in Table 6-3.

Table 6-3. Chronic Lowering of Groundwater Levels Minimum Thresholds, Measurable Objectives, and Interim Milestones

State Well Number	RMP Network	Well Type	Minimum Threshold (ft NAVD88)	2027 Interim Milestone (ft NAVD88)	2032 Interim Milestone (ft NAVD88)	2037 Interim Milestone (ft NAVD88)	Measurable Objective (ft NAVD88)
21N01W04N001M	Shallow	Domestic	89.3	113.5	114.3	115.2	116.1
22N01W19E003M	Shallow	Irrigation	97.7	127.7	127.8	128.0	128.1
22N01W29N003M	Shallow	Observation	91.7	123.2	123.2	123.3	123.4
22N02W01N003M	Shallow	Observation	99.3	133.2	134.3	135.4	136.5
22N02W15C004M	Shallow	Observation	84.0	135.4	138.3	141.2	144.1
22N02W18C003M	Shallow	Observation	131.6	147.6	147.8	148.1	148.4
22N03W01R002M	Shallow	Observation	123.6	143.9	143.9	143.9	143.9
22N03W05F002M	Shallow	Irrigation	177.9	199.7	201.3	202.9	204.5
22N03W06B001M	Shallow	Domestic	238.0	253.5	257.1	260.6	264.1
22N03W12Q003M	Shallow	Domestic	163.2	174.8	174.8	174.8	174.8
23N02W16B001M	Shallow	Irrigation	98.4	132.8	133.6	134.5	135.3
23N02W28N004M	Shallow	Observation	104.3	139.3	140.4	141.6	142.7
23N02W34A003M	Shallow	Irrigation	109.2	135.1	135.2	135.4	135.5
23N02W34N001M	Shallow	Industrial	111.8	145.9	145.9	145.9	145.9
23N03W04H001M	Shallow	Irrigation	180.4	194.0	194.0	194.0	194.0
23N03W13C006M	Shallow	Observation	123.1	145.3	145.4	145.5	145.6
23N03W16H001M	Shallow	Domestic	174.3	193.4	193.4	193.4	193.4
23N03W22Q001M	Shallow	Irrigation	129.9	152.7	152.7	152.7	152.7
23N03W24A003M	Shallow	Domestic	118.6	137.4	137.4	137.4	137.4
23N03W25M004M	Shallow	Observation	122.7	150.3	150.3	150.3	150.3
24N02W17A001M	Shallow	Domestic	150.9	170.9	170.9	170.9	170.9
24N02W20B001M	Shallow	Domestic	150.3	173.3	173.3	173.4	173.4
24N02W29N003M	Shallow	Observation	123.2	146.9	150.6	154.4	158.1
24N03W02R001M	Shallow	Domestic	172.6	188.6	188.6	188.6	188.6
24N03W03R002M	Shallow	Domestic	192.8	207.3	207.3	207.3	207.3
24N03W14B001M	Shallow	Industrial	175.5	195.3	195.3	195.3	195.3
24N03W16A001M	Shallow	Irrigation	182.6	200.7	200.7	200.7	200.7
24N03W17M001M	Shallow	Domestic	190.5	216.3	216.3	216.3	216.3
24N03W24E001M	Shallow	Domestic	136.7	169.2	169.2	169.2	169.2
24N03W26K001M	Shallow	Irrigation	172.6	191.1	191.1	191.1	191.1
24N03W29Q001M	Shallow	Observation	179.3	210.5	210.9	211.2	211.6
24N03W35P005M	Shallow	Domestic	180.1	192.0	192.0	192.0	192.0
24N04W14N002M	Shallow	Domestic	221.8	247.4	247.4	247.4	247.4
24N05W23L001M #	Shallow	Stock	312.0	345.8	345.8	345.8	345.8
25N02W31G002M	Shallow	Irrigation	169.3	191.4	191.4	191.4	191.4
Glenn TSS Well ^	Shallow	Observation	237.5	262.8	262.8	262.8	262.8
Tehama CWT Well ^	Shallow	Observation	181.8	199.6	199.6	199.6	199.6
22N01W29N002M	Deep	Observation	77.2	120.0	120.6	121.3	121.9
22N02W01N002M	Deep	Observation	74.5	134.7	134.7	134.7	134.7
22N02W15C002M	Deep	Observation	57.7	119.7	120.3	121.0	121.6
22N02W18C001M	Deep	Observation	63.5	90.4	90.4	90.4	90.4

State Well Number	RMP Network	Well Type	Minimum Threshold (ft NAVD88)	2027 Interim Milestone (ft NAVD88)	2032 Interim Milestone (ft NAVD88)	2037 Interim Milestone (ft NAVD88)	Measurable Objective (ft NAVD88)
22N03W01R001M	Deep	Observation	116.6	135.2	135.2	135.2	135.2
23N02W28N002M	Deep	Observation	100.0	127.1	129.4	131.6	133.9
23N03W07F001M	Deep	Irrigation	188.4	209.9	209.9	209.9	209.9
23N03W13C004M	Deep	Observation	107.2	126.7	128.2	129.6	131.1
23N03W17R001M &	Deep	Irrigation	187.3	207.7	207.7	207.7	207.7
23N03W25M002M	Deep	Observation	111.6	145.3	147.3	149.4	151.5
23N04W13G001M	Deep	Irrigation	159.7	198.6	198.6	198.6	198.6
24N02W29N004M	Deep	Observation	124.9	147.0	149.8	152.7	155.5
24N03W17M002M	Deep	Irrigation	172.8	196.8	196.8	196.8	196.8
24N03W29Q002M	Deep	Observation	174.9	207.5	209.2	210.9	212.6
24N04W33P001M *	Deep	Irrigation	183.5	227.7	231.8	235.9	240.0
24N04W34K001M &	Deep	Irrigation	184.4	223.9	223.9	223.9	223.9
24N04W34P001M &	Deep	Irrigation	183.5	214.3	214.3	214.3	214.3
24N04W36G001M &	Deep	Irrigation	183.2	214.4	214.4	214.4	214.4
25N03W36H001M	Deep	Irrigation	160.9	183.3	183.3	183.3	183.3
Glenn TSS Well ^	Deep	Observation	149.3	184.0	184.0	184.0	184.0
Tehama CWT Well ^	Deep	Observation	160.3	186.1	186.1	186.1	186.1

Notes:

Well was first monitored in 2020. The initial minimum threshold is the 2020 fall measurement minus 20% of the depth to groundwater level and the measurable objective was defined as the fall 2020 groundwater level (24N05W23L001M).

^ Groundwater level has not been measured yet so the minimum threshold and measurable objective were defined using the interpolated groundwater elevation from neighboring wells as shown on Figure 6-3, Figure 6-4, Figure 6-8, and Figure 6-9 (Glenn TSS Well and Tehama CWT Well).

& Well was first gauged after 2015; therefore, measurable objective was defined using 2016 to 2019 fall maximum level (23N03W17R001M, 24N04W34K001M, 24N04W34P001M, 24N04W36G001M).

* Well was not gauged in 2015; therefore, minimum threshold was defined using 2014 fall minimum groundwater level (24N04W33P001M).

The revised groundwater elevation minimum thresholds and measurable objectives were plotted at each RMP well, and contour maps were generated with the selected minimum thresholds and measurable objectives for shallow and deep RMP wells. The minimum threshold contour maps and wells are shown in Figure 6-3 for the shallower RMP wells, and in Figure 6-4 for the deeper RMP wells. Measurable objective contour maps are shown in Section 6.6.3.1. These maps were used to estimate minimum thresholds and measurable objectives at the new observation well clusters in Glenn County and Tehama County that do not have available groundwater level measurements yet. Estimated SMC for these new wells will be revisited during the first 2 annual reports to assess if they are reasonable groundwater elevation targets. A complete evaluation of all SMC will be conducted during the 5-year GSP update and modified if necessary.

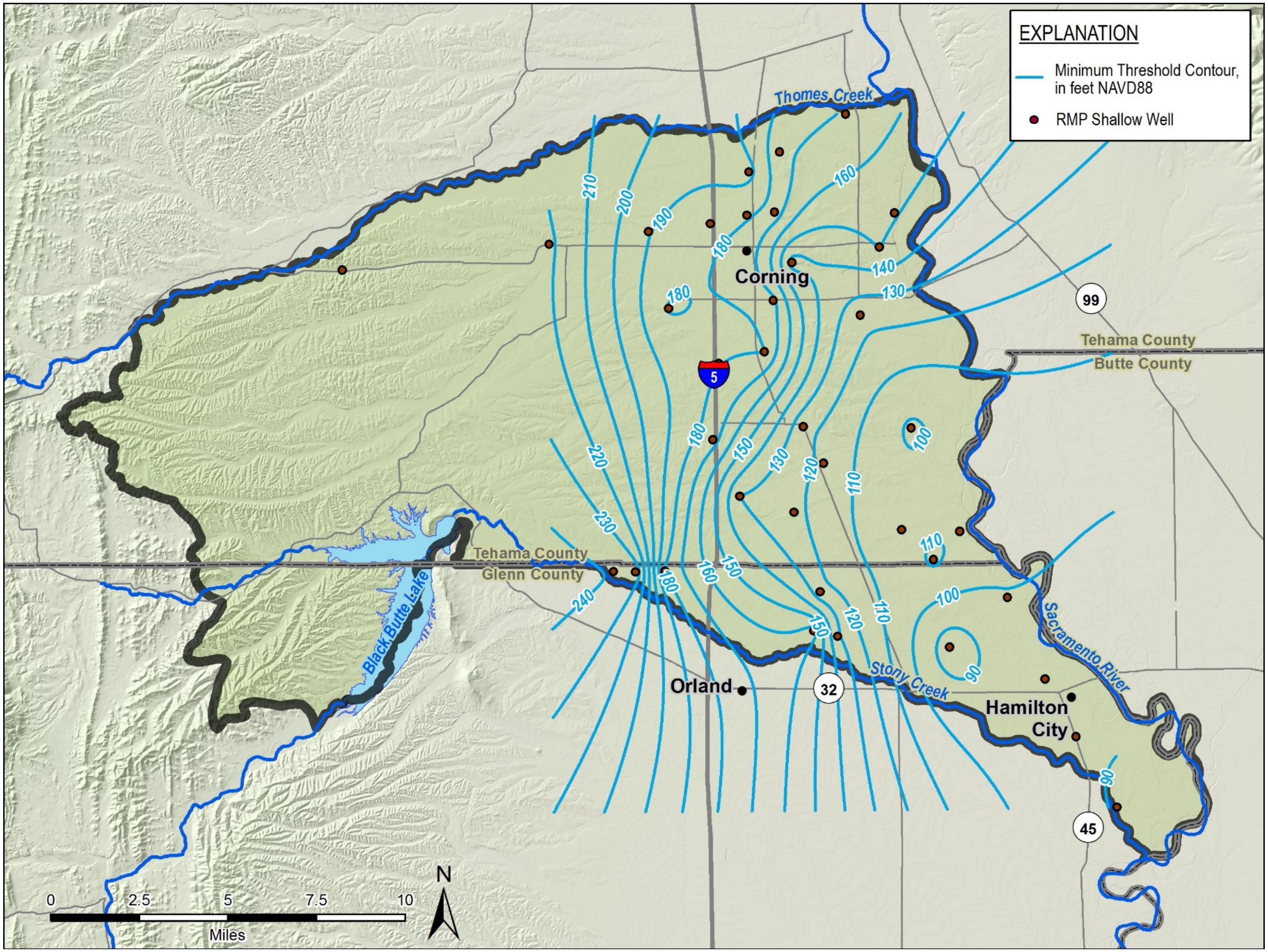

Figure 6-3. Groundwater Elevation Minimum Threshold Contour Map for the Shallow RMP Wells

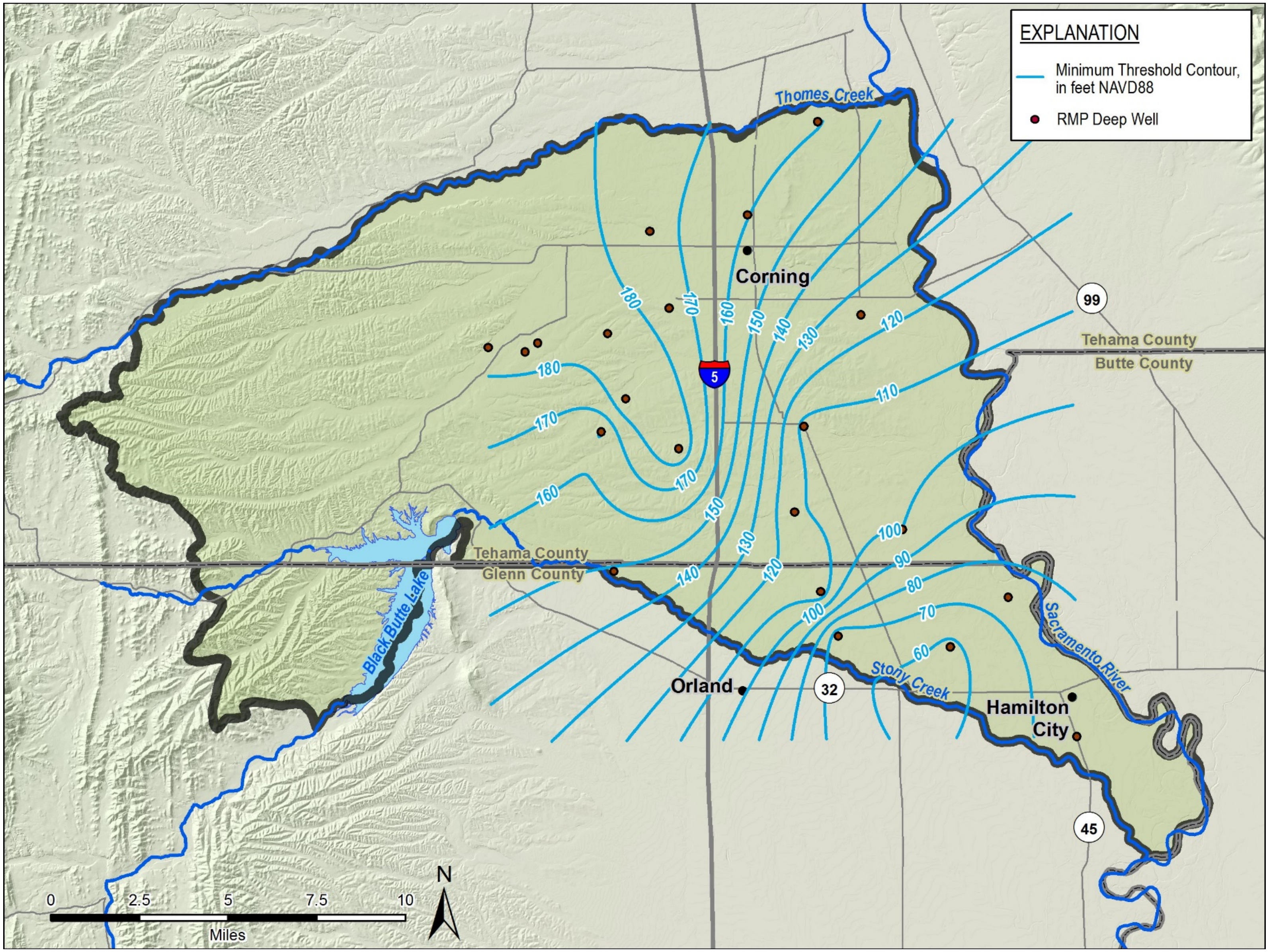

Figure 6-4. Groundwater Elevation Minimum Threshold Contour Map for the Deep RMP Wells

6.6.2.2 Minimum Thresholds Impact on Domestic Wells

A review of existing domestic well data from DWR's Online Well Completion Report Application established that there are currently a number of very shallow wells that are at risk of going dry in drought years. However, the DWR database of domestic wells does not have very accurate locations (many wells are shown at the center of a PLSS section), does not always include construction information, and does not have information about wells that are no longer in use. In addition, it is known that there are extremely shallow wells in the subbasin with depths of less than 50 feet that may not be in service anymore, or may not be viable any longer and were or should be replaced to comply with minimum health standards.

Recognizing this domestic well data uncertainty, an evaluation of potential domestic well impacts should groundwater levels reach the minimum threshold in all RMP wells, was developed following these assumptions and steps:

- Use currently available domestic well data for the 2 counties.
- Filter out wells drilled earlier than 1991, or 30 years old, which is a typical anticipated lifespan for low-carbon steel domestic wells (Glotfelty, 2017).
- Use a 25-foot safety factor on top of shallow domestic well depths to maintain sufficient water in domestic wells to operate pumps. This assumption provides for a very protective (or conservative) approach to estimating potential dry wells, given that many wells will still be able to function with less water in the well casing.
- Intersect domestic well depths (with 25-foot safety factor) with groundwater elevation contours of minimum thresholds for the shallow RMP wells (Figure 6-3) and calculate approximate percentage of wells that may be impacted.
- Review wells that were potentially dry in 2015 as a frame of reference.

Figure 6-5 shows the approximate location of domestic wells that are 30 years old or less, categorized by total depth. It is apparent that wells are shallower in the eastern portion of the Subbasin and deeper in the western portion of the Subbasin. Since the analysis only considered wells drilled within the last 30 years, it omits older wells that may still be used in the Subbasin. As a result, the total number of wells potentially at risk of going dry in this analysis may be lower than the actual number of wells affected. However, this approach was deemed appropriate for the current analysis given that it was meant to exclude older wells in the well database that are no longer used. The approach is also consistent with the approach used in neighboring GSPs, such as the Vina Subbasin, and other GSPs throughout the state. An accurate inventory of domestic wells is a data gap and included as an item to develop during Plan implementation (Sections 7 and 8). Also, the domestic well analysis is a conservative approach because it incorporates an additional 25-foot safety factor to factor in drawdown and the pump setting, which might not be needed for all wells to access water. Finally, this is a worst-case scenario situation, as it is not anticipated that all RMP wells would reach the minimum threshold at the same time, since that would violate the Subbasin's undesirable result.

When intersecting the groundwater elevation contours at the minimum threshold for shallow RMPs with the domestic wells, approximately 16% of domestic wells installed since 1991 are at risk of getting impacted (Figure 6-6).

As a comparison, fall 2015 groundwater elevation intersected with domestic wells depths showed approximately 4% of these domestic wells installed since 1991 were potentially dry, excluding a large data gap area to the west (Figure 6-7).

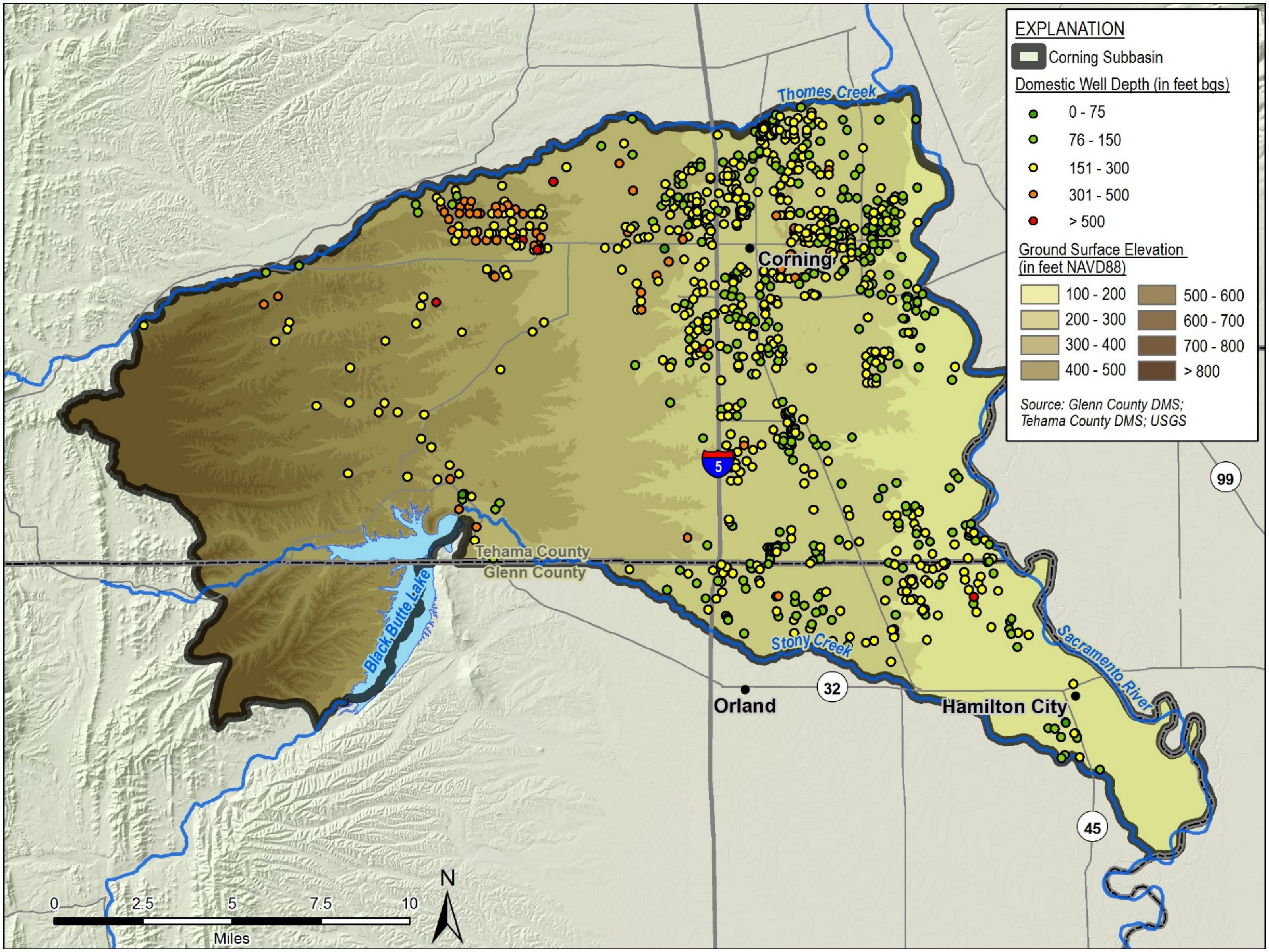

Figure 6-5. Approximate Location of Domestic Wells within Corning Subbasin

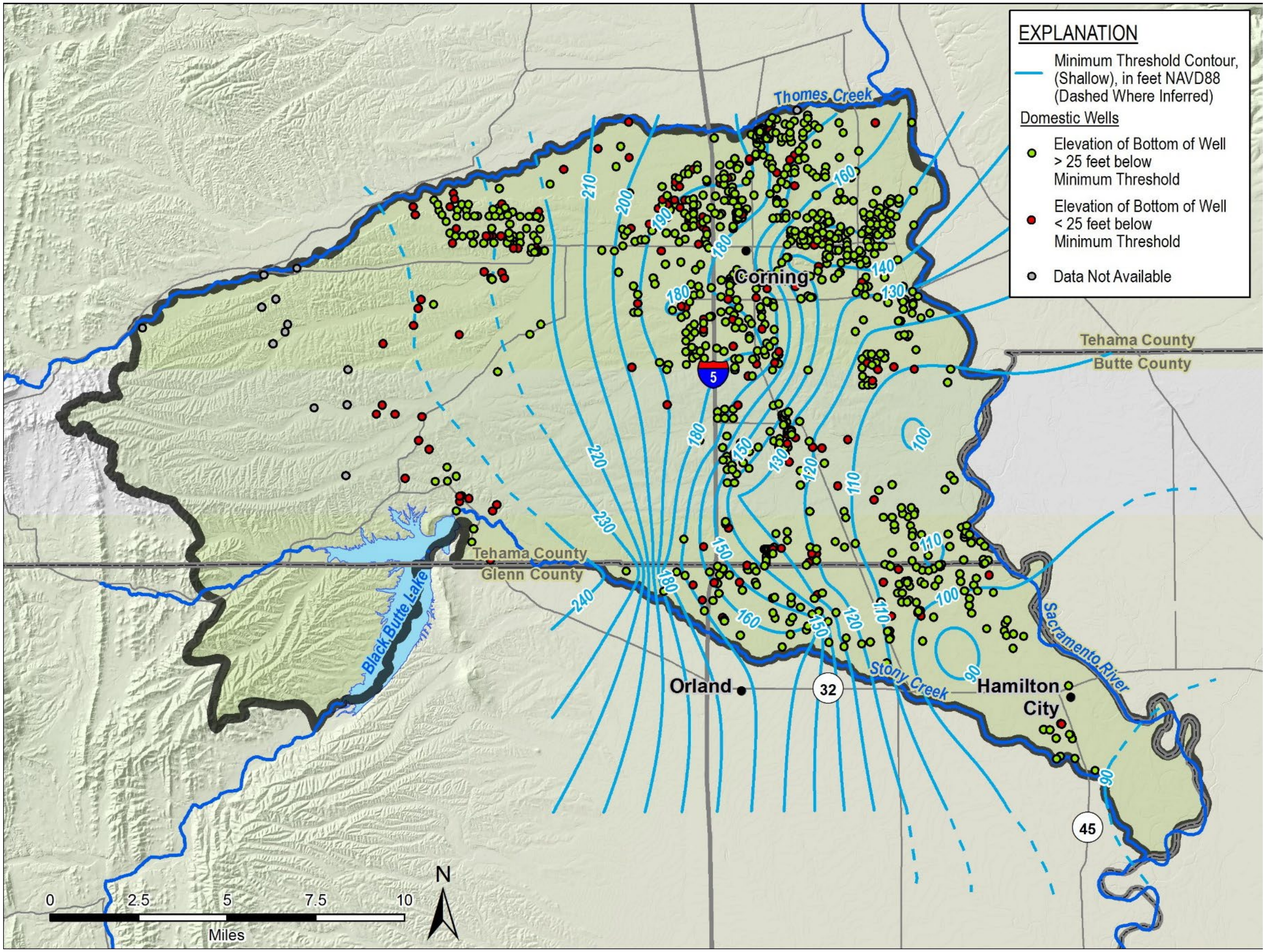

Figure 6-6. Domestic Wells at Risk of Being Impacted if Groundwater Levels Reach Minimum Thresholds

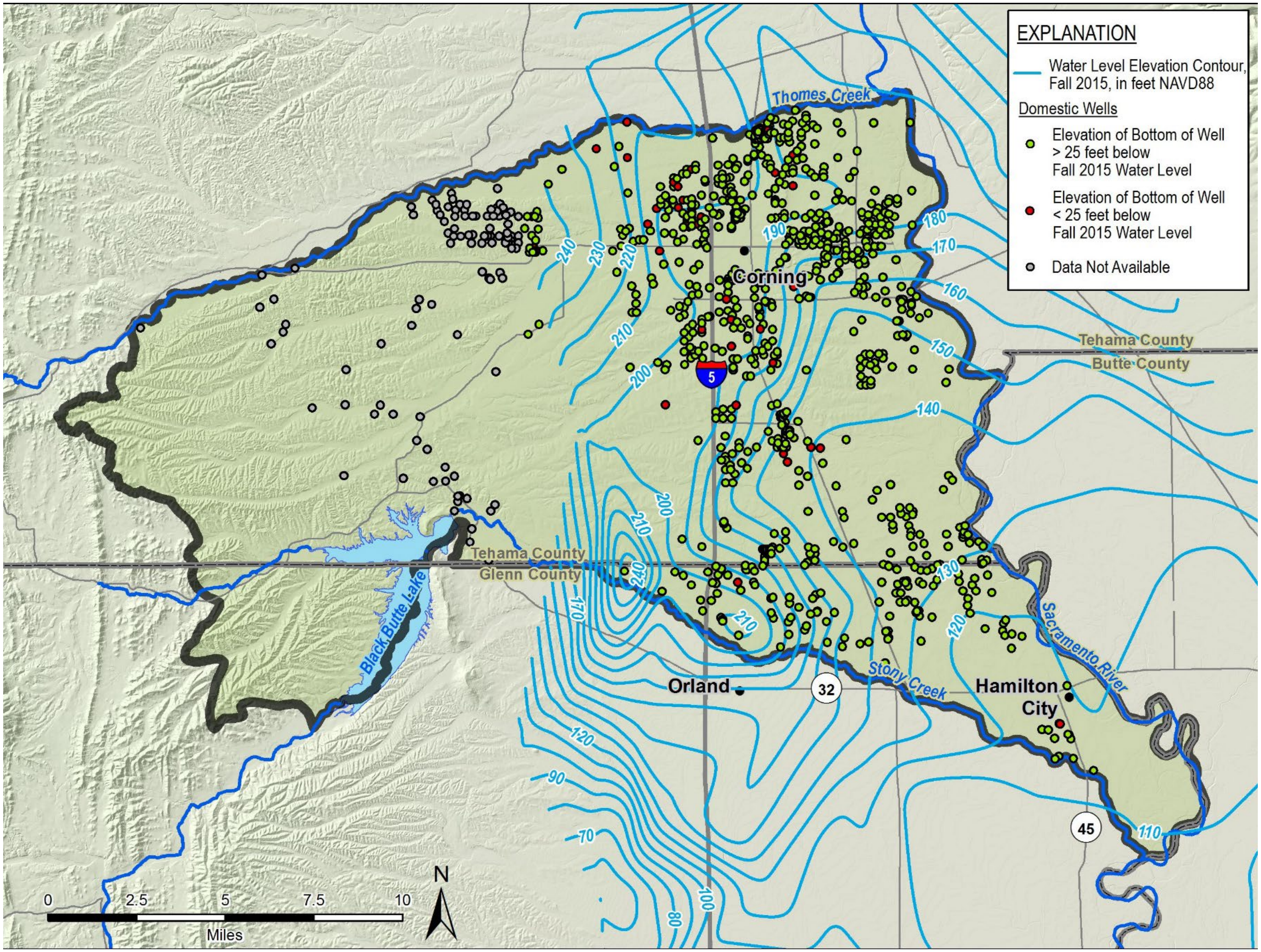

Figure 6-7. Domestic Wells that Likely were Impacted During 2015 Drought

The proposed minimum thresholds for groundwater elevation will not necessarily protect all domestic wells because it is impractical to manage a groundwater basin in a manner that fully protects the shallowest wells. However, the GSAs have included a domestic well management strategy in the Projects and Management Actions section that includes several actions (including a well impacts mitigation measure), as described in Section 7.3.2.1. During the 5-year update to this GSP, a more robust database of domestic wells may be available for the Subbasin in order to identify domestic wells at risk of going dry, estimate potential impacts of minimum thresholds on a well-by-well basis, and identify domestic wells that are no longer in use or should be replaced to comply with more recent well standards.

6.6.2.3 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

Section 354.28 of the GSP Regulations requires that the description of all minimum thresholds include a discussion about the relationship between the minimum thresholds for each sustainability indicator. In the SMC BMP (DWR, 2017), DWR has clarified this requirement. First, the GSP must describe the relationship between each sustainability indicator's minimum threshold (e.g., describe why or how a water level minimum threshold set at a particular representative monitoring site is similar to or different from water level thresholds in nearby RMP wells). Second, the GSP must describe the relationship between the selected minimum threshold and minimum thresholds for other sustainability indicators (e.g., describe how a water level minimum threshold would not trigger an undesirable result for land subsidence).

The groundwater elevation minimum thresholds and measurable objectives were plotted to check that they formed smoothly interpolated groundwater elevations in the Subbasin. The minimum thresholds are unique at every well, but when combined represent a reasonable and realistic groundwater elevation map. Because the underlying groundwater elevation map is a reasonably achievable condition, the individual minimum thresholds at RMPs do not conflict with each other.

Groundwater elevation minimum thresholds may influence other sustainability indicators, as described below.

- **Change in groundwater storage**. A significant and unreasonable condition for reduction in groundwater storage is pumping in excess of the sustainable yield for an extended period of years. If the sustainable yield is set at a level that will not create undesirable results for groundwater levels, and since the change in groundwater storage is tightly correlated with the groundwater elevation SMC, the change in storage indicator would not be negatively affected.

- **Degraded water quality**. A significant and unreasonable condition for degraded water quality is exceeding regulatory limits for COC in production wells due to actions proposed in the GSP.

  Changes in groundwater elevation due to actions implemented to achieve sustainability could change groundwater gradients, which could cause poor quality groundwater to flow towards production wells that would not have otherwise been impacted. However, water quality in the Corning Subbasin is very good. Therefore, the minimum threshold for groundwater elevations should not directly lead to a significant and unreasonable degradation of groundwater quality in production wells in most areas. TDS is the only water quality COC tracked by this GSP. If groundwater levels decline significantly in the western portion of the subbasin, it could induce movement of higher salinity groundwater into some areas.

- **Land subsidence**. A significant and unreasonable condition for subsidence is any measurable long-term inelastic subsidence that damages existing infrastructure or creates a significant reduction of groundwater storage. Groundwater level minimum thresholds are set lower than current conditions, and therefore may temporarily induce additional subsidence in some areas. However, pumping-induced subsidence should no longer occur when reaching the 20-year timeframe for achieving sustainability. Therefore, the groundwater elevations will not induce additional subsidence after sustainability is achieved.

- **Depletion of interconnected surface waters.** A significant and unreasonable condition for the depletion of interconnected surface waters is groundwater pumping-induced depletion of flow in the Sacramento River and Stony Creek, which are interconnected to groundwater. Lowering average groundwater elevations in areas adjacent to interconnected surface water bodies will likely increase depletion rates.

6.6.2.4 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The Corning Subbasin is bounded by 5 neighboring Sacramento Valley subbasins for which GSPs are being developed concurrently:

- Red Bluff Subbasin to the north
- Los Molinos Subbasin to the northeast
- Vina Subbasin to the east
- Butte Subbasin to the southeast
- Colusa Subbasin to the south

Coordination with the adjacent GSAs responsible for establishing minimum thresholds in neighboring subbasins occurred throughout the development of this GSP. In general, the neighboring subbasins used similar approaches to establish their minimum thresholds; therefore, maintaining groundwater levels above the Corning Subbasin minimum thresholds should not prevent the neighboring subbasins from achieving sustainability and vice versa. The Corning Sub-basin GSAs will continue to coordinate closely with the neighboring GSAs and Subbasins to ensure that the Northern Sacramento Valley area is managed sustainability throughout the GSP planning and implementation horizon.

Groundwater level analysis near the Corning Subbasin boundaries will be supplemented in GSP annual updates with data from neighboring subbasin wells, as necessary and applicable, while the GSAs evaluate and add new or existing wells to address data gaps in the RMP network.

6.6.2.5 Effects of Minimum Thresholds on Beneficial Users and Land Uses

The groundwater elevation minimum thresholds may have several effects on beneficial users and land uses in the Subbasin.

Agricultural land uses and users. The groundwater elevation minimum thresholds allow some lowering of groundwater levels in the Subbasin. This could have various effects on beneficial users and land uses:

- Agricultural land currently under irrigation may become more valuable as bringing new lands into irrigation becomes more difficult and expensive. Increased value of land and resulting higher taxes are largely outside the control of the GSA.
- Changes to crop types from annual crops to permanent crops is based on market value. Permanent crops provide less flexibility for irrigation during potential future droughts as the opportunity to fallow in dry periods does not exist. The groundwater elevation minimum threshold allows for groundwater irrigation within a reasonable operational range for current land use to help protect the permanent crops that are already planted.
- Agricultural land not currently under irrigation may become less valuable because it may be too difficult and expensive to irrigate.

Urban land uses and users. The Corning Subbasin has very limited municipal groundwater use, and extensive urban growth is not predicted. In fact, municipal pumping has decreased in recent years due to increased conservation measures which are expected to continue into the future. An analysis was conducted of the minimum thresholds in the area where City of Corning public supply wells are located, by verifying the depth of the public supply wells relative to the groundwater elevation contours for the minimum thresholds as depicted in Figure 6-3 and Figure 6-4. The analysis found that the minimum thresholds are well above the elevations of the bottom of the city’s public supply wells for all wells, meaning that the city’s public supply of groundwater should not be affected by the subbasin's minimum thresholds. In addition, tribal federally reserved water rights will be protected. Therefore, it is not anticipated that the groundwater elevation minimum threshold will impact urban areas.

Domestic land uses and users (including DACs). The groundwater elevation minimum thresholds may affect shallow domestic wells, specifically in drought years when more pumping from agricultural wells is anticipated. Shallow domestic wells may become dry, requiring owners to drill deeper wells. A well impact mitigation program may be developed to help shallow domestic well owners.

Ecological land uses and users. Groundwater elevation minimum thresholds may limit the amount of groundwater pumping in the Subbasin and may limit growth of industries requiring a substantial amount of groundwater usage. This outcome may benefit ecological land uses and users by curtailing the conversion of native vegetation to other land uses such as agricultural, domestic, or industrial uses, and by reducing pressure on existing ecological land caused by declining groundwater levels. Since groundwater elevation minimum thresholds near interconnected streams are lower than current groundwater elevations, there may be some impacts on GDEs in the Subbasin.

6.6.2.6 Relevant Federal, State, or Local Standards

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

6.6.2.7 Method for Quantitative Measurement of Minimum Thresholds

Groundwater elevation minimum thresholds will be directly measured in the shallow and deep RMP monitoring well networks. Fall measurements will be used to compare to the minimum thresholds and measurable objectives at each RMP well. Fall measurements are those taken between September and October. The groundwater level monitoring will be conducted in accordance with the monitoring protocols outlined in Section 5. Furthermore, the groundwater level monitoring will meet the requirements of the technical and reporting standards included in the GSP Regulations. For example, only static conditions will be considered when evaluating minimum thresholds; if a well is being actively pumped or a nearby well is being pumped, then a minimum threshold exceedance may not be an undesireable result.

6.6.3 Measurable Objectives

The measurable objectives for chronic lowering of groundwater levels represent target groundwater elevations that are higher than the minimum thresholds. These measurable objectives provide operational flexibility to ensure that the Subbasin can be managed sustainably over a reasonable range of hydrologic variability.

An approach for setting measurable objectives at RMP wells in the Subbasin was developed through review of recent historical data, understanding of subbasin conditions, and discussions with CSAB and stakeholders at a number of CSAB public meetings.

Measurable objectives were established as follows:

- For stable wells: maximum fall groundwater elevation since 2012
- For declining wells: maximum fall groundwater elevation in 2015

Measurable objectives for the chronic lowering of groundwater levels are summarized in Table 6-3. The measurable objectives are also shown on the hydrographs for each RMP well in Appendix 6B.

6.6.3.1 Methodology for Setting Measurable Objectives

The maximum groundwater levels measured in the fall, prior to the recent water level decline during the last major drought (2012-2016), were selected as being an achievable and desirable measurable objective for the Subbasin wells that show stable conditions, primarily near the Sacramento River. For wells with declining groundwater levels, there is a notable change in conditions in the last 15 years and a continued decline of groundwater levels since the 2012-2016 drought. Since fall groundwater levels were lower in recent years compared to 2015 levels, the fall maximum groundwater level from 2015 was deemed appropriate for an objective to reach for sustainability. The measurable objective contour maps are shown in Figure 6-8 for the shallow RMP wells, and in Figure 6-9 for the deep RMP wells.

An analysis of potential impacts on domestic wells when groundwater levels reach the measurable objective was completed using the same assumptions and steps described in section 6.6.2.2.

When intersecting the groundwater elevation contours at the measurable objective for shallow RMPs with the domestic wells, approximately 6% of domestic wells are at risk of getting impacted (Figure 6-10). This is an approximate percentage of wells in the well completion database that were likely unable to access water in recent years and therefore will likely need to be replaced should groundwater levels in the future be lower than or equal to 2015 levels. Wells installed prior to 1990 were not included in the analysis, so areas with older development may be impacted more than areas with newer developments by lowering groundwater levels. This percentage is in line with the approximate percentage of domestic wells that were likely impacted at the height of the 2012-2016 drought around the 2015 timeframe, and thus the measurable objectives will not worsen impacts to domestic wells in the Subbasin.

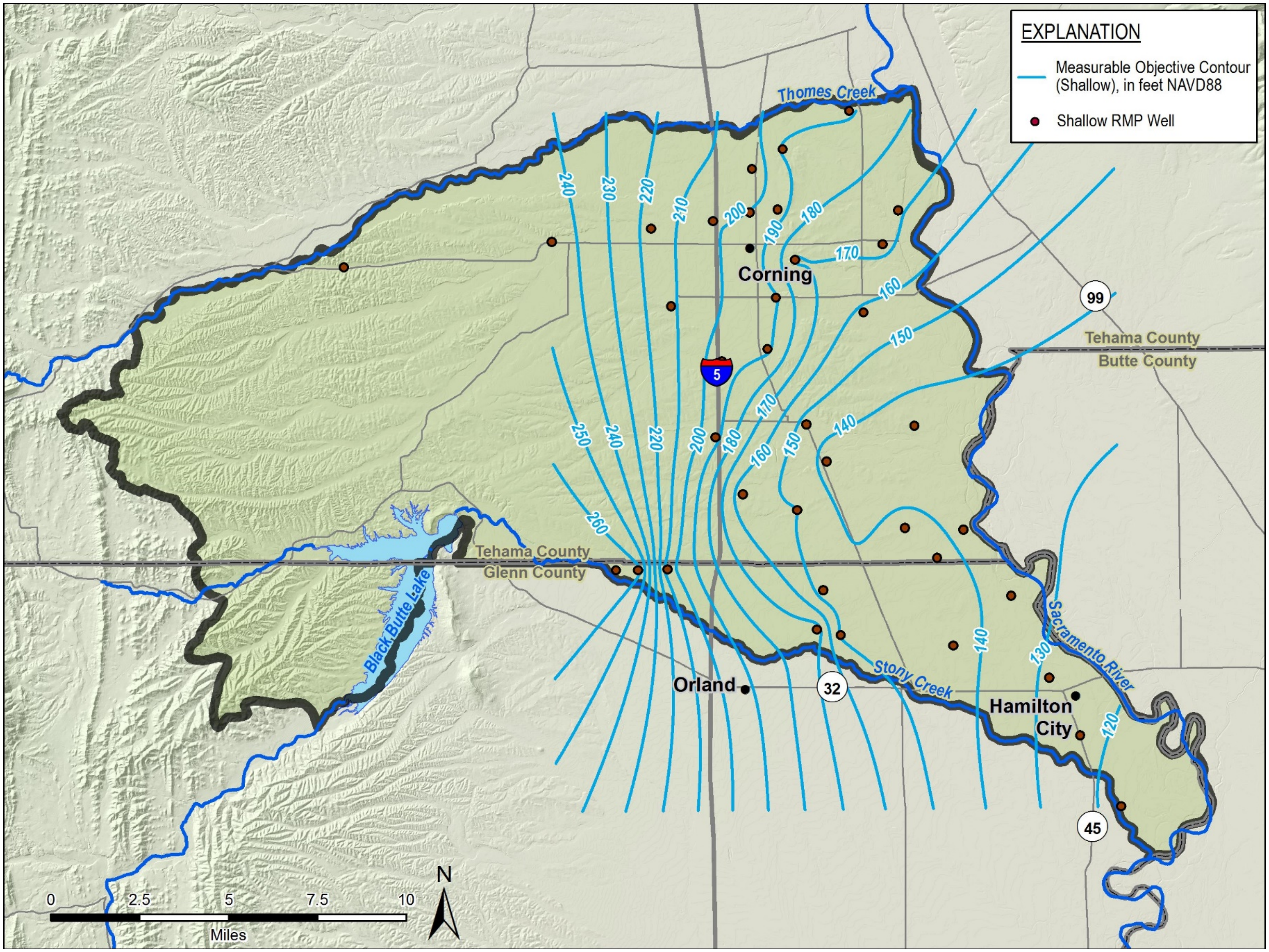

Figure 6-8. Groundwater Elevation Measurable Objective Contour Map for the Shallow RMP Wells

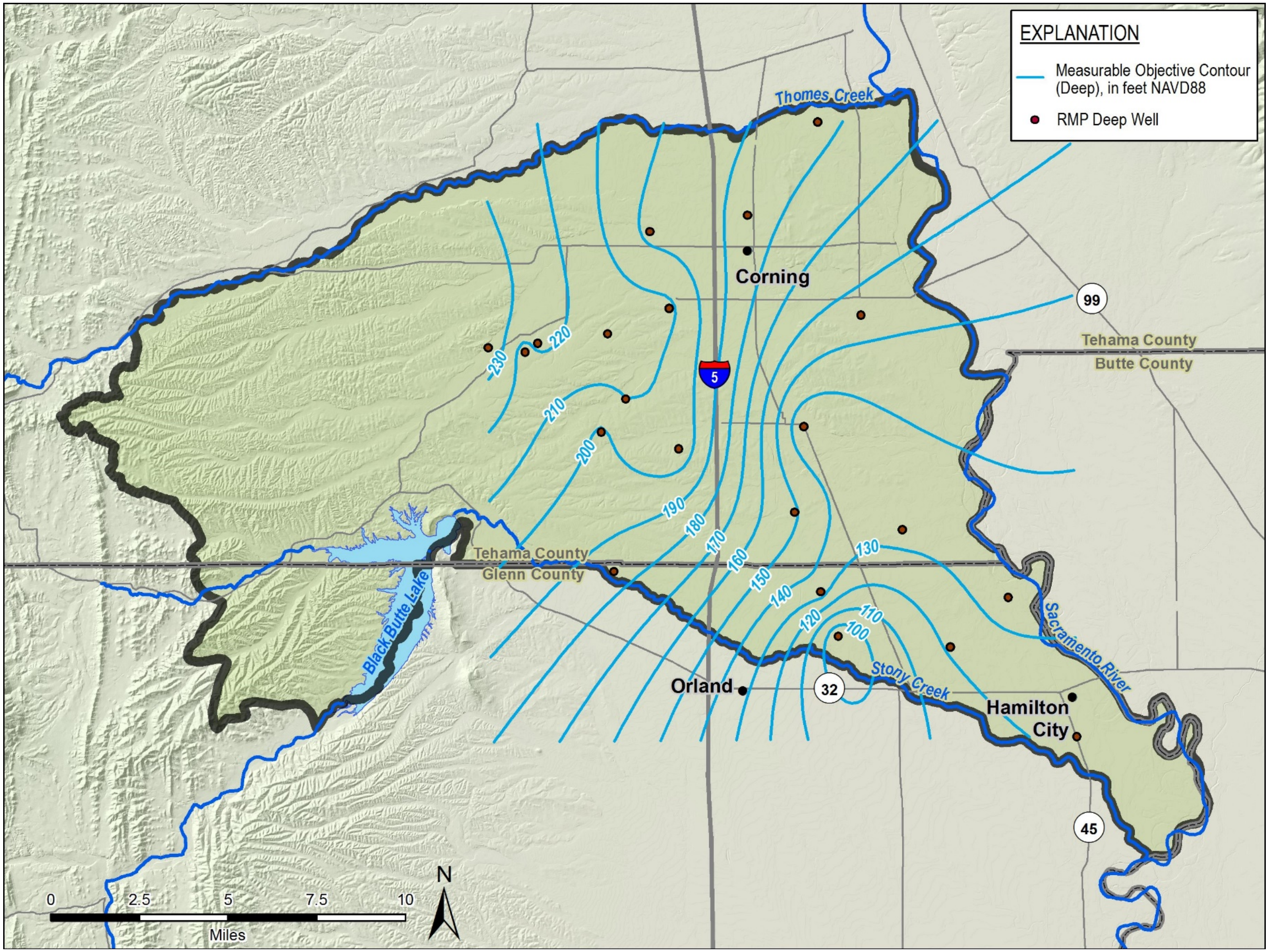

Figure 6-9. Groundwater Elevation Measurable Objective Contour Map for the Deep RMP Wells

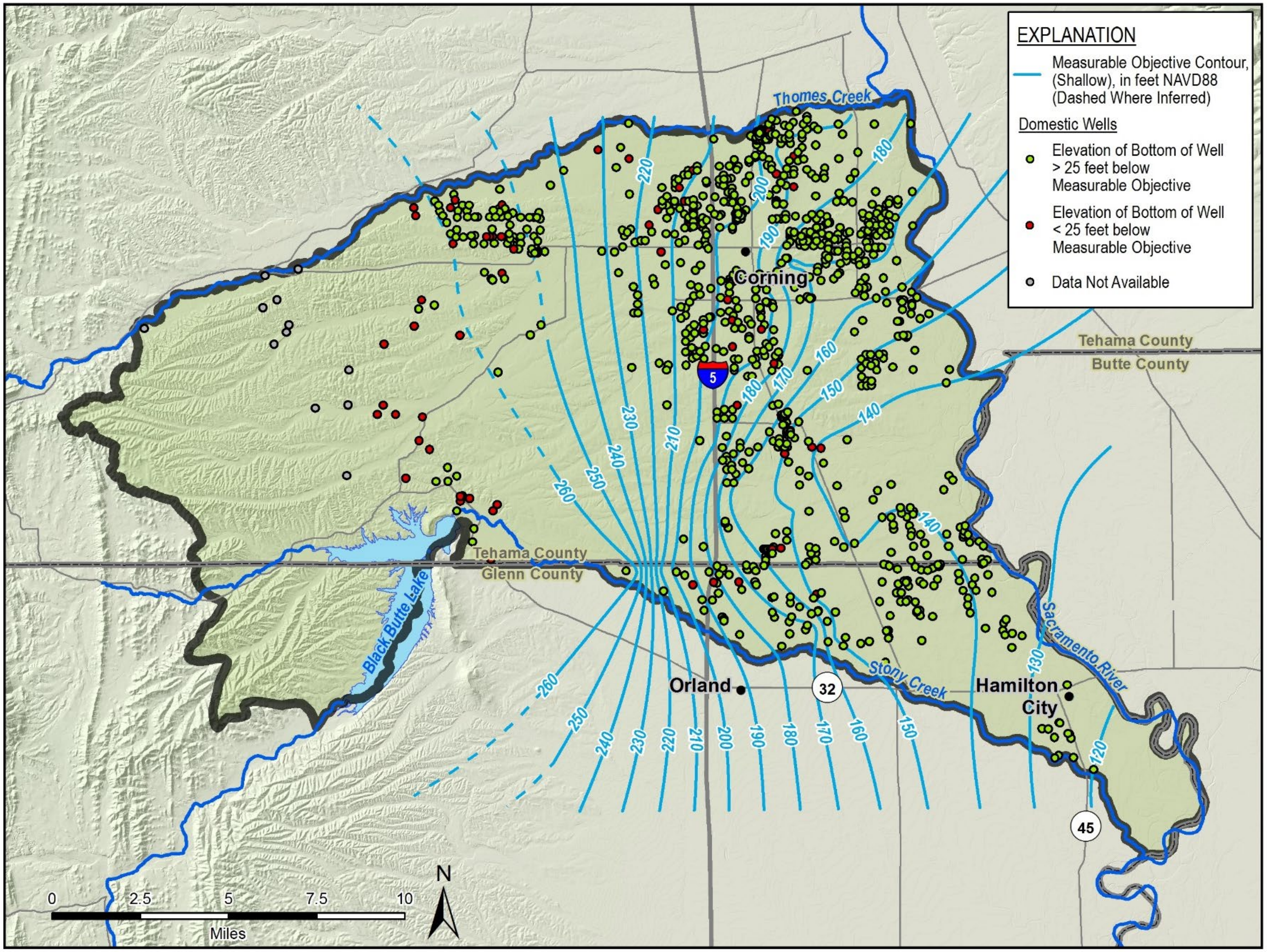

Figure 6-10. Domestic Wells at Risk of Being Impacted if Groundwater Levels Reach Measurable Objectives

6.6.3.2 Interim Milestones

Interim Milestones are quantifiable objectives set at RMP that are used to evaluate progress towards sustainability over time in 5-year increments until 2042, specifically in 2027, 2032, and 2037 (Table 6-3). Interim Milestones development is based on current groundwater elevation conditions as of 2020, with the most recent fall measurement being used as a baseline. Specifically, Interim Milestones are defined as follows:

- **If current groundwater elevations are at or above the measurable objective:** The Interim Milestones are equivalent to the measurable objective.
- **If current groundwater elevations are below the measurable objective:** Interim milestones are projected every five years on a linear trendline from the most recent fall measurement available to the measurable objective in 2042.

6.6.4 Undesirable Results

6.6.4.1 Criteria for Defining Chronic Lowering of Groundwater Levels Undesirable Results

The chronic lowering of groundwater levels undesirable result is a quantitative combination of groundwater elevation minimum threshold exceedances.

The SMC BMP (DWR, 2017) provides information on how droughts may affect the groundwater level SMC:

> *Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods.*

Since the Sacramento Valley groundwater subbasins have historically been able to recover after periods of drought conditions, and anticipating additional improved sustainable management in the Corning Subbasin, the undesirable result should take into account that the effects of droughts alone would not establish an undesirable result.

For the Subbasin, the groundwater elevation undesirable result is:

- *An undesirable result occurs when more than **20%** of groundwater elevations measured at RMP wells, drops below the associated minimum threshold during **two consecutive years**.*

- *In addition, if the water year type (defined as the Sacramento Valley Water Year Index developed by DWR, per the calculation as used in 2021) is dry or critically dry then levels below the minimum threshold are not undesirable if groundwater management allows for recovery in average or wetter years.*

There are currently 58 RMP wells with minimum thresholds in the Subbasin. Therefore, 20% of wells dropping below their minimum thresholds would mean 11 wells out of the entire network are allowed to drop below the minimum threshold before reaching an undesirable result. This allows for 11 exceedances of the minimum thresholds at the same wells two years in a row before triggering an undesirable result.

Undesirable results provide flexibility in defining sustainability. Increasing the percentage of allowed minimum threshold exceedances provides more flexibility but may lead to significant and unreasonable conditions for a number of beneficial users. Reducing the percentage of allowed minimum threshold exceedances ensures strict adherence to minimum thresholds but reduces flexibility due to unanticipated hydrogeologic conditions. The undesirable result was set at 20% to balance the interests of beneficial users with the practical aspects of groundwater management under uncertainty.

6.6.4.2 Potential Causes of Undesirable Results

An undesirable result for chronic lowering of groundwater levels does not currently exist since none of the most recent fall 2020 groundwater level measurements were below the minimum threshold of the existing RMP monitoring wells. Conditions that may lead to an undesirable result include the following:

- **Surface water shortages.** CVP water has become less reliable and more expensive in the last 10 years. If this continues, more pumping will occur to offset the lack of surface water availability, as described in Section 4.2.5.
- **Localized deep pumping clusters**. Even if regional pumping is maintained within the sustainable yield, clusters of high-capacity wells may cause excessive localized drawdowns that lead to undesirable results. This may be the result of irrigated agricultural land use expansions in areas that do not have access to surface water supplies.
- **Extensive, unanticipated drought**. Minimum thresholds were established based on historical groundwater elevations and reasonable estimates of future groundwater elevations with projected climate change estimates. Extensive, unanticipated droughts may lead to excessively low groundwater elevations and undesirable results if management actions cannot keep up with these extreme conditions. Undesirable results during future periods of extensive drought are addressed in Section 6.6.4.1.

- **Environmental conditions that affect groundwater recharge**. Extensive wildfires in the watersheds to the west of the subbasin may cause changes in rainfall runoff and recharge that affect the amount of groundwater recharge that can enter the deeper portions of the aquifer, resulting in a lower-than anticipated groundwater availability and lower groundwater levels.

6.6.4.3 Effects on Beneficial Users and Land Uses

The primary detrimental effect on beneficial users from allowing multiple exceedances occurs if more than 1 exceedance happens to be in a small geographic area. Allowing 20% exceedances is reasonable as long as the exceedances are spread out across the Subbasin, and as long as any one well does not regularly exceed its minimum threshold. If the exceedances are clustered in a small area, it will indicate that significant and unreasonable effects are repeatedly impacting the same few stakeholders.

6.7 Reduction in Groundwater Storage SMC

The intention of the GSAs is to have no long-term change in storage once sustainability is reached (at 2042). As such, the GSAs are committed to pumping at or less than the Subbasin's long-term sustainable yield in order to achieve sustainability. The long-term sustainable yield does not reflect actions or extraction limitations that may be necessary to reach sustainability during the GSP planning horizon through 2042.

6.7.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable conditions were determined based on discussions with GSA staff, input from CSAB members, and other local stakeholders.

Reduction of groundwater in storage that causes significant and unreasonable impacts to the long-term sustainable beneficial use of groundwater in the basin, are either:

- *Long-term reductions in groundwater storage; or*
- *Pumping exceeding the sustainable yield.*

6.7.2 Minimum Thresholds

Section 354.28(c)(2) of the GSP Regulations states that "The minimum threshold 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 supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin."

Section 354.28(c)(6)(d) of the GSP Regulations states that, "An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence." Groundwater in storage is directly proportional to groundwater elevation and holding groundwater elevation consistent throughout the Subbasin is equivalent to no change in storage. The advantage of using this metric is that it is simple to establish a minimum threshold and measurable objective amount of water in storage in the Subbasin by mimicking the groundwater elevation minimum thresholds and measurable objectives.

The following minimum threshold was defined for reduction in groundwater storage using groundwater elevation as a proxy:

The minimum threshold for reduction in groundwater storage is the amount of groundwater in storage when groundwater elevations are at their minimum thresholds. Since groundwater levels are used as a proxy, this would be the same as chronic lowering of groundwater levels minimum thresholds.

Therefore, at the minimum threshold groundwater elevations, the excess operational storage is zero.

Although not the metric for establishing change in groundwater storage, it is the intent of the beneficial users of groundwater in the subbasin to pump at or less than the Subbasin's long-term sustainable yield. This is the sustainable yield once the Subbasin has reached sustainability. It does not reflect actions or extraction limitations that may be necessary to reach sustainability. SGMA allows 20 years to reach sustainability.

6.7.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

The reduction in groundwater storage minimum threshold uses the chronic lowering of groundwater levels minimum thresholds as a proxy. This level is described in Section 6.6.2, summarized in Table 6-3, and shown on Figure 6-3and Figure 6-4.

6.7.2.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

The reduction in groundwater storage minimum thresholds has identical relationships to other sustainability indicators as the chronic lowering of groundwater levels sustainability indicator described in Section 6.6.2.3 since it uses groundwater levels as a proxy measurement.

6.7.2.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The selected minimum threshold for reduction in groundwater storage in the Corning Subbasin was designed to ensure that the neighboring subbasins can be managed sustainably. Since groundwater elevation measurements were used as a proxy for assessing reductions in groundwater storage, the same information applies to this section as summarized for chronic lowering of groundwater level minimum threshold in Section 6.6.2.4. In addition, all neighboring subbasins also use groundwater levels as a proxy to establish the reduction in groundwater storage minimum threshold.

6.7.2.4 Effects of Minimum Thresholds on Beneficial Users and Land Uses

The selected minimum threshold for reduction in groundwater storage in the Corning Subbasin may have several effects on beneficial users and land uses in the Subbasin. Since groundwater elevation measurements were used as a proxy for assessing reductions in groundwater storage, the same information applies to this section as summarized for chronic lowering of groundwater level minimum threshold in Section 6.6.2.5.

6.7.2.5 Relevant Federal, State, or Local Standards

No federal, state, or currently enforced local standards exist for reductions in groundwater storage.

6.7.2.6 Method for Quantitative Measurement of Minimum Thresholds

Groundwater storage will be measured by using groundwater elevations from the groundwater elevation monitoring network data as a proxy. The change in storage will be reported similarly to the groundwater elevation sustainability indicator: as the number of wells exceeding the minimum thresholds and then number of wells reaching the measurable objectives.

The approach for change in storage estimates will be reviewed every 5 years when the Corning Subbasin groundwater model is updated, during GSP 5-year assessments, or as needed.

6.7.3 Measurable Objectives

The measurable objective for reduction of groundwater in storage was defined using the chronic lowering of groundwater levels measurable objectives as a proxy.

The measurable objective is the amount of groundwater in storage when groundwater elevations are at their measurable objectives. Since groundwater levels are used as a proxy, this would be the same as chronic lowering of groundwater levels measurable objectives.

Another way to conceptualize the measurable objective for reduction in groundwater storage is that on average, the change in groundwater storage becomes 0 at sustainability, when the groundwater elevations are held at the groundwater level measurable objectives.

6.7.3.1 Methodology for Setting Measurable Objectives

The reduction in groundwater storage measurable objective uses the chronic lowering of groundwater levels measurable objective as a proxy. This level is described in Section 6.6.3, summarized in Table 6-3, and shown on Figure 6-8 and Figure 6-9.

6.7.3.2 Interim Milestones

Since groundwater levels are used as a proxy, the interim milestones for reduction in groundwater storage are the same as for chronic lowering of groundwater levels interim milestones, established as the linear trend between current conditions and measurable objective.

6.7.4 Undesirable Results

6.7.4.1 Criteria for Defining Chronic Lowering of Groundwater Levels Undesirable Results

The minimum threshold for groundwater storage uses the groundwater elevation minimum thresholds as a proxy. To retain consistency in all SMCs, the undesirable result for change in groundwater storage is the same as the undesirable result for groundwater levels:

- *An undesirable result occurs when more than **20%** of groundwater elevations measured at RMP wells, drops below the associated minimum threshold during **2 consecutive years**.*

- *In addition, if the water year type (defined as the Sacramento Valley Water Year Index developed by DWR, per the calculation as used in 2021) is dry or critically dry then levels below the minimum threshold are not undesirable if groundwater management allows for storage recovery in average or wetter years.*

Low quantities of groundwater in storage during unanticipated future droughts or unanticipated climatic conditions do not constitute an undesirable result. This is in alignment with the SMC BMP (DWR, 2017) which states, "Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods."

6.7.4.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result for the reduction in groundwater storage sustainability indicator include the following:

- **Expansion of agricultural, municipal, or industrial pumping**. Additional agricultural or municipal pumping may result in lowered groundwater elevations that reduce groundwater storage to an undesirable result.
- **Departure from the GSP's climatic assumptions, including extensive, unanticipated drought**. The undesirable result is established based on reasonable anticipated future climatic conditions and groundwater elevations. Departure from the GSP's climatic assumptions or extensive, unanticipated droughts may lead to excessively low groundwater recharge and unanticipated high pumping rates. Drier than expected conditions may reduce groundwater in storage to an undesirable result if groundwater levels do not recover during wetter periods.

6.7.4.3 Effects on Beneficial Users and Land Uses

Because the change in groundwater storage mimics the change in chronic lowering of groundwater levels SMC, the practical effects of the reduction in groundwater storage undesirable result are identical to the effects from the chronic lowering of groundwater levels undesirable results.

6.8 Degraded Groundwater Quality SMC

Groundwater in the Subbasin is generally of good quality and does not regularly exceed primary drinking water standards. Salinity was identified as the only COC in the Subbasin. Therefore, TDS will be used as a salinity indicator to measure groundwater quality in the Subbasin to assess potential effects of GSP implementation.

6.8.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable conditions were determined based on discussions with GSA staff, input from CSAB members, and other local stakeholders:

Significant and unreasonable water quality conditions occur if Corning Subbasin GSP projects or management actions cause an increase in the concentration of TDS in groundwater supply wells that leads to adverse impacts on beneficial users or uses of groundwater.

6.8.2 Minimum Thresholds

Per GSP Regulations §354.28(c)(4), the minimum threshold requirements for assessing degraded groundwater quality "shall be the degradation of water quality, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the Agency that may lead to undesirable results."

Per the GSP requirements, degraded groundwater quality SMC can be based on three different metrics:

1. Number of affected supply wells
2. Volume of contaminated water
3. Location of an isocontour that exceeds concentrations of COC

As stated in the GSP Regulations, local, state, and federal water quality standards applicable to the Subbasin need to be taken into consideration when setting water quality SMC. Also, existing water quality monitoring programs may be used by the GSA to help collect data during GSP implementation and establish consistency with other programs. Finally, groundwater quality minimum thresholds are based on a degradation of groundwater quality, not an improvement of groundwater quality. Therefore, the GSP needs to avoid taking any action that may inadvertently mobilize groundwater constituents that have already been identified in the Subbasin in such a way that the constituents have a significant and unreasonable impact that would not otherwise occur.

For this GSP, the most appropriate metric to develop SMC for degraded groundwater quality is the number of affected supply wells, since the volume of contaminated groundwater is more appropriate for large plumes (which do not exist in the Subbasin) and the isocontour method works best when many wells are known to be contaminated by a single COC, which is also not the case in this Subbasin.

Therefore, the minimum threshold for degraded groundwater quality is defined as:

The minimum threshold for degraded groundwater for TDS is 750 mg/L at public supply wells.

This minimum threshold is more protective than the upper limit SMCL of 1,000 mg/L.

6.8.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

The development of minimum thresholds and measurable objectives follows a similar process and is described concurrently in this section. The information used for establishing the groundwater quality minimum threshold and measurable objective includes:

- Historical groundwater quality data collected for programs managed by DWR, Glenn County, CVRWQCB, Tehama County, and USGS
- Feedback from discussions with GSA staff, CSAB members, and local stakeholders on challenges and goals within the Subbasin
- The definition of significant and unreasonable conditions developed based on local feedback

The general steps for developing minimum thresholds and measurable objectives were:

- Review and synthesize historical groundwater quality data collected in the Subbasin, described in Section 3.2.6
- Identify the type and location of groundwater quality issues in the Subbasin that would substantially interfere with beneficial water use or surface land uses and determine which COCs require SMC
- Identify a monitoring network for measuring groundwater quality in the Subbasin. For more information on this process, refer to Section 5.5.1 of the Monitoring Networks Section

Thorough review of groundwater quality historical data revealed that groundwater is generally of good quality in the Subbasin, and that it can be pumped from almost any location and depth and used for beneficial use without additional treatment. Salinity was identified as the only groundwater quality COC since all other constituents are routinely below the regulatory standards in supply wells in the Subbasin. Salinity is typically measured as TDS in public supply wells and historical TDS data are generally below the regulatory standard for TDS. However, groundwater quality data are not available for much of the western portion of the Subbasin where salinity tends to be higher.

During GSP implementation the GSAs will rely on existing agencies to continue administering groundwater quality programs that collect salinity and other groundwater quality data. The GSAs will routinely track progress towards sustainability by downloading TDS data available through existing public supply well sampling programs. TDS data from public supply wells are frequently collected by public water providers. The data are free and available to the GSAs through state and county databases and can easily be compared to existing regulatory standards.

In addition, the GSAs will continue to coordinate with other applicable agencies on current and future groundwater quality programs, such as the ILRP, to assess overall water quality conditions in the Subbasin and potential changes due to GSP implementation.

6.8.2.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

Since the Subbasin's groundwater quality is generally of good quality and below the TDS minimum threshold of 750 mg/L, the GSA's objective is to maintain groundwater quality at current conditions. Per the GSP Regulations, the GSAs will not be taking any actions to improve groundwater quality. Keeping groundwater quality at current conditions poses no threat to other sustainability indicators. However, preventing migration of poor-quality groundwater may limit projects or management actions needed to achieve minimum thresholds for other sustainability indicators. During the projects and actions permitting process, water quality monitoring will be implemented on a project-by-project basis to limit any potential water quality impacts to beneficial users.

6.8.2.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The Corning Subbasin is bounded by 5 neighboring Sacramento Valley subbasins for which GSPs are being developed concurrently:

- Red Bluff Subbasin to the north
- Los Molinos Subbasin to the northeast
- Vina Subbasin to the east
- Butte Subbasin to the southeast
- Colusa Subbasin to the south

Coordination with the adjacent GSAs responsible for establishing minimum thresholds in neighboring subbasins occurred throughout the development of this GSP. The selected degraded groundwater quality minimum threshold for the Corning Subbasin was designed to ensure that the neighboring subbasins can be managed sustainably. The selected minimum threshold was identical to the Tehama County subbasins to the north and northeast. Selected minimum thresholds for the other neighboring subbasins to the south and east (Butte, Colusa, and Vina Subbasins) were also defined for salinity COCs. Instead of using TDS as a salinity measure, these subbasins used electrical conductivity and the minimum thresholds are between 800 to 900 microsiemens per centimeter (µS/cm). The TDS minimum threshold of 750 mg/L is roughly equivalent to 1,150 µS/cm (Brown *et al.*, 1970). The minimum threshold in the Corning Subbasin is 250 µS/cm greater than the minimum threshold of 900 µS/cm for the Colusa and Butte Subbasins to the south and southeast and 450 µS/cm less than the minimum threshold of 1,600 µS/cm for the Vina Subbasin to the east. Through continued monitoring and inter-basin coordination, the Corning Subbasin will help maintain high quality groundwater for all beneficial users in the region.

6.8.2.4 Effects of Minimum Thresholds on Beneficial Users and Land Uses

In general, groundwater with TDS at concentrations less than or equal to the minimum threshold will be suitable for all beneficial use in the Subbasin. There may be some aesthetic concerns about groundwater with TDS concentrations at or above the lower limit SMCL of 500 mg/L, which is the measurable objective. However, maintaining TDS concentrations in groundwater below 750 mg/L, which is more stringent than the upper limit of this secondary regulatory standard of 1,000 mg/L, means that groundwater should be suitable for all intended beneficial users and land uses in the Subbasin:

- **Agricultural land uses and users**. Maintaining TDS concentrations at or below the minimum threshold will generally support beneficial water use for irrigation for the crops that are commonly grown in the Subbasin. Crop yields for salt sensitive crops may start to decrease at concentrations above the minimum threshold.
- **Urban land uses and users**. Maintaining TDS concentrations at or below the minimum threshold will support beneficial water use for public supply. Exceedance of the minimum threshold would impact public water supply for aesthetic and taste reasons.
- **Rural residential land uses and users (including DACs)**. Maintaining TDS concentrations at or below the minimum threshold will provide adequate potable water for residential water users. Exceedance of the minimum threshold would impact rural residential potable supplies for aesthetic and taste reasons.
- **Industrial land uses and users.** Maintaining TDS concentrations at or below the minimum threshold will support beneficial groundwater use for industrial purposes. Exceedance of the minimum threshold may impact industrial beneficial use of groundwater for some applications requiring water with TDS below the minimum threshold.
- **Environmental land uses and users**. Maintaining TDS concentrations at or below the minimum threshold will generally benefit the environmental water uses in the Subbasin. Exceedance of the minimum threshold may impact species of plants and animals that are reliant on shallow groundwater or interconnected surface water and are sensitive to salinity.

6.8.2.5 Relevant Federal, State, or Local Standards

The degraded groundwater quality minimum threshold specifically incorporates state and Local standards for TDS. The lower limit SMCL for TDS is a California regulatory standard per the State Water Code and was used to set the measurable objective. The minimum threshold is set at 750 mg/L, which is more stringent than the upper limit of this secondary regulatory standard of 1,000 mg/L.

6.8.2.6 Method for Quantitative Measurement of Minimum Thresholds

Groundwater quality will be directly measured by public water supply providers at the network of public supply wells shown in Figure 5-9.

Public supply well owners or agencies are responsible for collecting groundwater samples for analytical testing and reporting data to county and state drinking water agencies. Groundwater samples will be collected by public water suppliers in accordance with the monitoring protocols enforced by other agencies. The annual maximum concentration of TDS reported by the laboratory will be used to compare to the minimum threshold. Should a minimum threshold be exceeded, the GSAs will consider taking a secondary sample to confirm the exceedance and that is not due to sample collection or laboratory measurement errors. If the second sample is also above the minimum threshold, a review will be conducted to identify if the exceedance is due to GSP implementation.

6.8.3 Measurable Objectives

The measurable objective for groundwater quality represents target groundwater quality in the Subbasin.

The groundwater quality measurable objective is a TDS concentration of 500 mg/L measured in public supply wells.

6.8.3.1 Methodology for Setting Measurable Objectives

The groundwater quality measurable objective is defined as the lower limit SMCL for TDS. This limit is not a health based standard but is related to the water aesthetic and taste. TDS concentrations measured in supply wells in the Subbasin are historically less than the measurable objective, which means the water quality is not at risk to reaching the minimum threshold or causing an undesirable result. This TDS concentration measurable objective is the standard that the GSAs aim to maintain for groundwater quality in the Subbasin.

6.8.3.2 Interim Milestones

Current TDS concentrations in supply wells are less than the measurable objective. Therefore, the interim milestones are identical to the current conditions.

6.8.4 Undesirable Results

6.8.4.1 Criteria for Defining Chronic Lowering of Groundwater Levels Undesirable Results

By regulation, the degradation of groundwater quality undesirable result is a quantitative combination of groundwater quality minimum threshold exceedances. For the Subbasin, any groundwater quality degradation is undesirable as a direct result of GSP implementation. However, some groundwater quality changes are expected to occur independent of SGMA activities; because these changes are not related to SGMA activities they do not constitute an undesirable result. Therefore, the degradation of groundwater quality undesirable result is as follows:

The Undesirable Result occurs when at least 25% of representative monitoring sites exceed the minimum threshold for water quality for two (2) consecutive years at each location where it can be established that GSP implementation is the cause of the exceedance.

There are currently 15 groundwater quality RMP wells that are routinely monitored for TDS in the Subbasin. Therefore, 25% of wells dropping below their minimum thresholds would mean 3 wells out of the entire network are allowed to exceed the TDS minimum threshold before reaching an undesirable result. This allows for 3 exceedances of the minimum thresholds at the same wells two years in a row before triggering an undesirable result.

6.8.4.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result include changing pumping locations, depths, or volumes due to new wells being drilled, or GSP-related projects and management actions. For example, increased pumping in an area that is susceptible to poor groundwater quality could trigger groundwater quality degradation that has not been observed before. Also, active groundwater recharge projects could alter geochemical conditions or mobilize existing contaminants.

The following lists some general activities that the GSAs will conduct to evaluate if groundwater quality degradation occurred due to actions implemented by the GSAs:

- If the GSA has not implemented any projects or actions, then any groundwater quality degradation has not been caused by GSA activities
- If monitoring or production wells between a GSA's project and the impacted well do not show degradation, then any groundwater quality degradation has not been caused by GSA activities
- If the groundwater quality degradation is in close proximity to a GSA activity, the GSA could:
    - Evaluate monitoring data from any projects and actions in the vicinity of the exceedance
    - Review other available groundwater quality data in the vicinity of the exceedance including analysis of laboratory analytical data and laboratory quality assurance/quality control measures

- Resampling of wells if it is established that the GSA projects or actions may be the cause of minimum threshold exceedances
- For any projects and actions implemented under the GSP, additional groundwater quality monitoring in the vicinity of the project or management actions sites may be implemented to determine the possibility of causing undesirable results. Any needed mitigation measures to avoid the negative conditions will be included.

In addition, the GSAs will routinely coordinate with local and regional agencies that administer water quality sampling programs to ensure that GSP activities do not affect these programs, and to share data and information across programs.

6.8.4.3 Effects on Beneficial Users and Land Uses

The degradation of groundwater quality undesirable result only applies to groundwater quality changes directly caused by projects or management actions implemented as part of this GSP. This undesirable result does not apply to groundwater quality changes that occur due to other causes. If groundwater quality degradation due to GSP implementation activities is avoided, the GSA will have no impact on the use of groundwater in the Subbasin. However, if groundwater pumping changes, projects, or actions associated with GSP implementation are shown to cause the degradation of localized groundwater quality, beneficial users and land uses may be impacted. Adverse impacts of groundwater quality degradation include diminished supply due to non-compliance with drinking water standards or undue costs for wellhead treatment or well replacement.

6.9 Subsidence SMC

Land subsidence refers to the gradual lowering or sudden sinking of the land surface. There are many factors which can contribute to land subsidence, including groundwater pumping, drainage and decomposition of peatlands, underground mining, oil and gas extraction, hydrocompaction, natural compaction, sinkholes, and/or thawing permafrost. Amongst these causes of land subsidence, only aquifer-system compaction due to groundwater pumping is relevant to SGMA and is applicable to geology, water management, and land use in the Subbasin.

6.9.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable conditions were determined based on discussions with GSA staff, input from CSAB members, and other local stakeholders:

Inelastic land subsidence that adversely impacts fixed infrastructure and is caused solely by lowering of groundwater levels occurring in the Subbasin is significant and unreasonable.

6.9.2 Minimum Thresholds

Section 354.28(c)(5) of the GSP Regulations states that "The minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results."

The following minimum threshold was defined for subsidence:

The minimum threshold for subsidence solely due to lowered groundwater elevations is no more than 0.5 foot of cumulative subsidence over a 5-year period (beyond the measurement error).

6.9.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

The development of minimum thresholds and measurable objectives follow a similar process and are described concurrently in this section. The information used for establishing the subsidence minimum thresholds and measurable objectives include:

- Historical subsidence data collected by DWR, Glenn County, and Tehama County. This includes several land surface elevation surveys at 18 benchmarks, Subbasin-wide InSAR satellite surveys, and extensometer measurements
- Feedback from discussions with GSA staff, CSAB members, and local stakeholders on challenges and goals within the Subbasin
- The definition of significant and unreasonable conditions developed based on local feedback

The general steps for developing minimum thresholds and measurable objectives were:

- Review and synthesize historical subsidence data collected in the Subbasin, described in Section 3.2.5
- Identify the amount and location of subsidence in the Subbasin that would substantially interfere with surface land uses. Per the GSP Regulations, the subsidence impacts must be due to groundwater use and must be inelastic (irreversible) subsidence to be considered significant and unreasonable
- Identify a monitoring network for measuring subsidence in the Subbasin. For more information on this process, refer to Section 5.4.1 of the Monitoring Networks Section.

To date, there has been little to no historical inelastic subsidence observed in the Subbasin since monitoring began in 2004 (Section 3.2.5). This is despite overall declining groundwater levels in much of the Subbasin since 2008, changing land use, and curtailments to surface water allocations. There is one survey location in the Subbasin near the City of Orland and adjacent to the southern Subbasin boundary with greater land surface subsidence than other locations in the Subbasin. Land surface elevation decreased in this location by 0.29 foot between 2008 and 2017, while other land surface elevation declines during this same timeframe were less than 0.18 foot. Similarly, InSAR satellite data showed that less than or equal to 0.1 foot of subsidence occurred throughout the Subbasin between 2015 and 2019 (Section 3.2.5).

However, based on land subsidence and groundwater elevation data from the neighboring Colusa Subbasin to the south, there is the potential for future land subsidence in the Corning Subbasin in areas with clay-rich sedimentary layers at depth and lowering groundwater levels. The Sacramento Valley-wide land surface elevation survey performed in the Colusa Subbasin in 2008 and 2017 indicated lowering of the land surface to the south of the Corning Subbasin, near Orland, by up to 0.59 foot. Cumulative InSAR data from 2015 to 2019 similarly showed a lowering of the land surface of about 0.75 foot in parts of the Colusa Subbasin, near Artois (see Section 3.2.5 and Figure 6-11). The area with subsidence noted by both surveys and InSAR is centered about 4 miles south of the Corning Subbasin and mainly covers a north to south trending 6-mile by 2-mile area around I-5 between Orland and Artois.

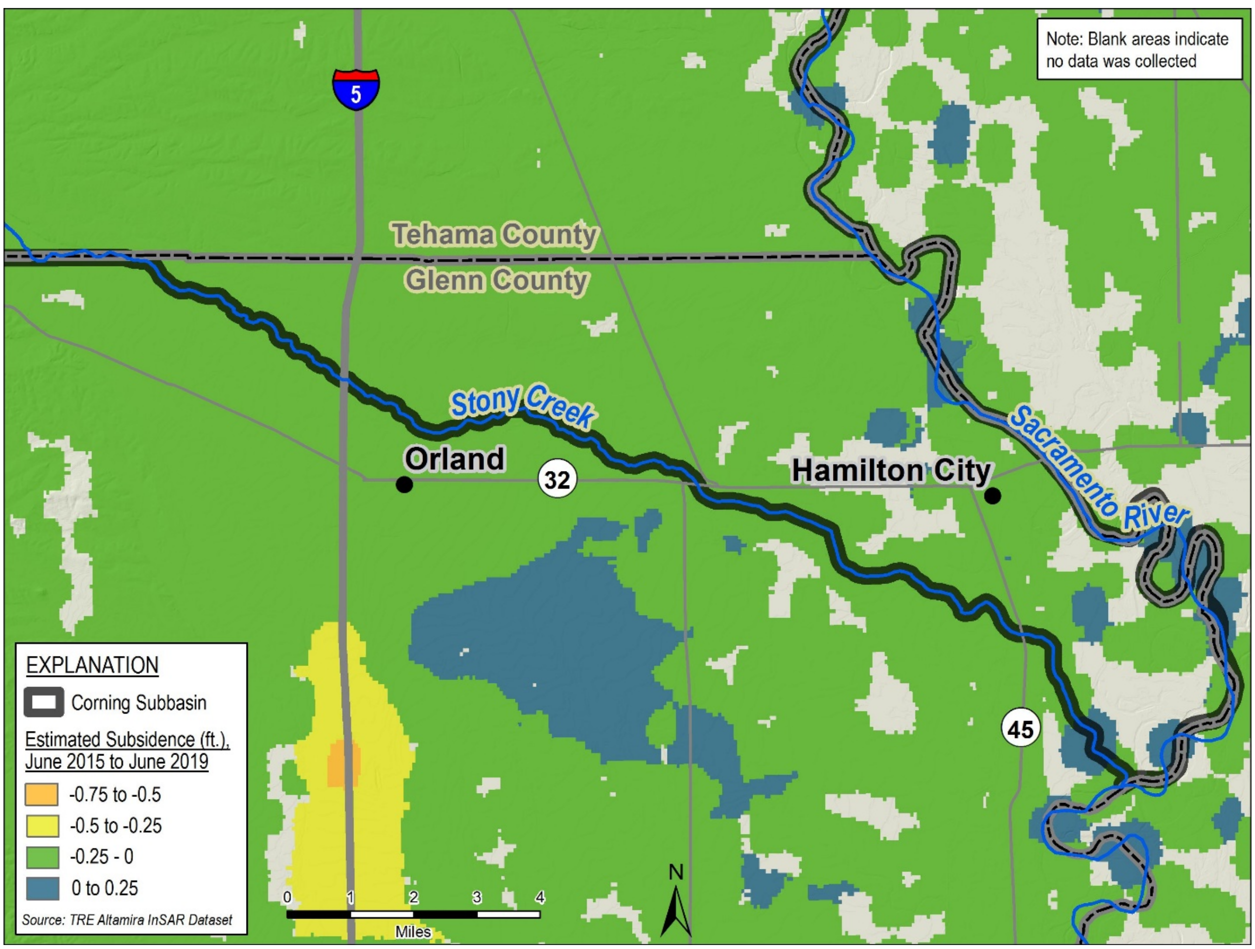

Figure 6-11. InSAR Data South of Corning Subbasin as shown on the DWR SGMA Data Viewer Mapping Interface

Groundwater level declines of up to 50 feet in this area near the Corning Subbasin have been measured since 2005 as shown in hydrographs on Figure 6-12 for the wells summarized in Table 6-4.

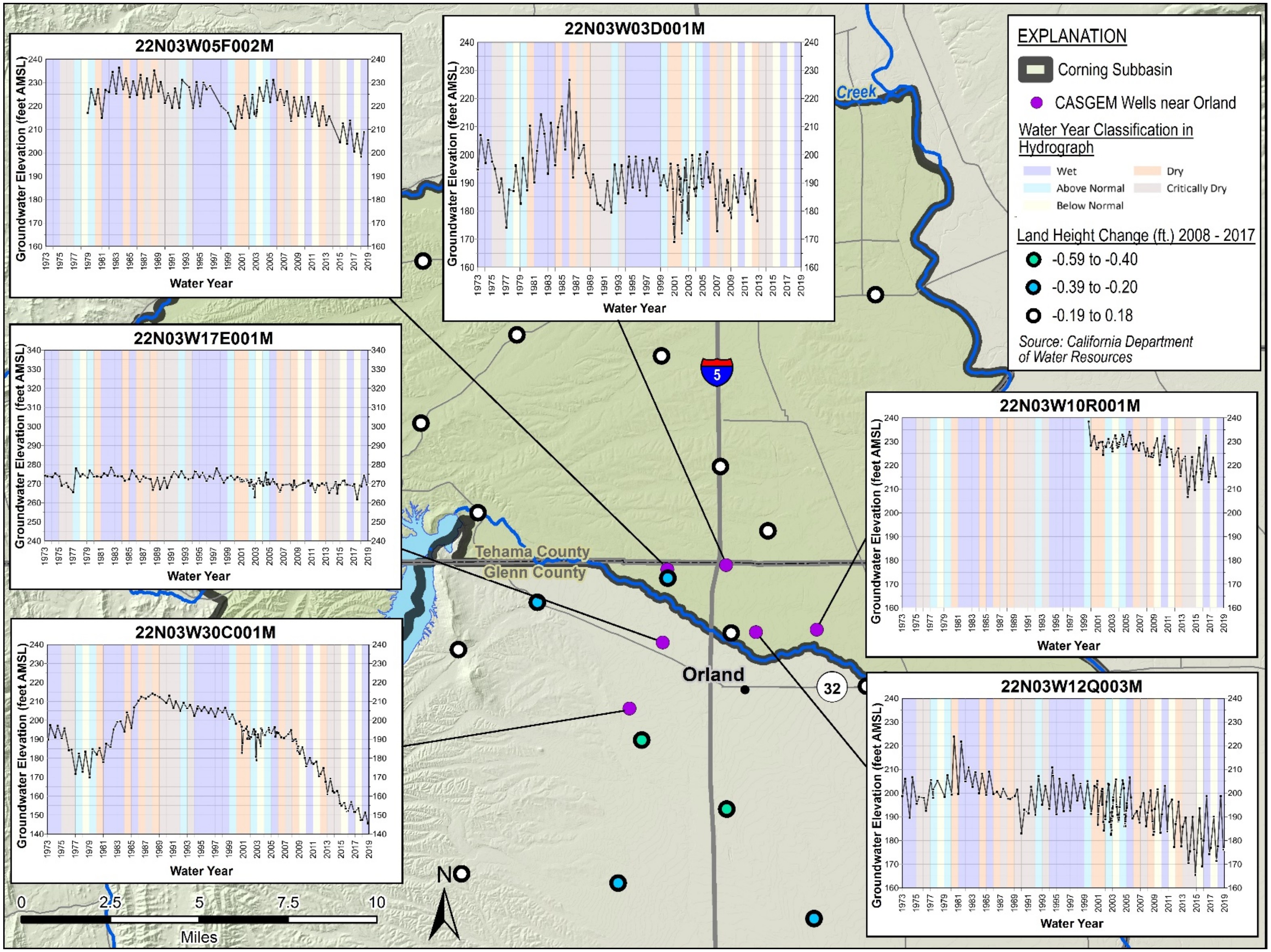

Figure 6-12. Historical Subsidence and Groundwater Elevation Near Orland

Table 6-4. Well Completion Information for Groundwater Level Monitoring Wells near Subsidence Area

Subbasin	State Well Number	Well Type	Total Well Depth (feet bgs)	Perforated Interval (feet bgs)	Latitude (NAD 83)	Longitude (NAD 83)	Reference Point Elevation (feet AMSL)
Corning	22N03W05F002M	Irrigation	218	188 - 218	39.7956	-122.2278	298.89
Corning	22N03W12Q003M	Domestic	124	112 - 123	39.7705	-122.1491	232.94
Corning	22N03W03D001M	Domestic	104	90 - 102	39.797195	-122.196687	270.97
Colusa	22N03W17E001M	Domestic	72	58 - 60	39.765795	-122.230487	283.0
Colusa	22N03W30C001M	Domestic	176	160 - 172	39.738995	-122.248387	285.0
Corning	22N03W10R001M	Domestic	131	111 - 131	39.769695	-122.181187	259.46

Based on the data, extensive subsidence has not occurred in the Subbasin since monitoring began in 2004. However, conditions exist that could potentially induce future land subsidence particularly along the southern Subbasin boundary and other areas where groundwater levels are declining due to groundwater pumping. Major infrastructure in the Corning Subbasin that could be impacted by future subsidence near this area includes not only I-5, but also the OUWUA Canal System and Tehama Colusa-Canal. Numerous roads, bridges, and overpasses could also be affected. It is difficult to assess where subsidence may interfere with surface land uses and infrastructure; therefore, a single minimum threshold was recommended for the entire Subbasin.

The minimum threshold for subsidence was defined as 0.5 foot over a 5-year period. This amount of subsidence is approximately equal to the sum of historical subsidence and potential measurement error in the Subbasin since 2008:

- The historical subsidence data suggest less than 0.4 foot of subsidence has occurred in the Subbasin since 2008, with maximum measurements of 0.29 foot measured by land surface survey between 2008 and 2017 and 0.1 foot measured by InSAR between 2015 and 2019.
- The InSAR data provided by DWR is subject to measurement error of approximately 0.1 foot. DWR has stated that, on a statewide level, for the total vertical displacement measurements between June 2015 and June 2019, the errors are as follows (DWR, 2019 and Towill, Inc., 2020):
    1. The error between InSAR data (>185 million measurement points total) and continuous GPS data (137 locations used as validation points) is 16 millimeters (0.052 foot) with a 95% confidence level.
    2. The measurement accuracy when converting from the raw InSAR data to the raster map provided by DWR, which was calculated by comparing the point data, is 0.048 foot with 95% confidence level. (Note that errors for this Subbasin could be different).

By adding the errors 1 and 2, the combined error is 0.1 foot. While this is not a robust statistical analysis, it does provide an estimate of the potential error in the InSAR maps provided by DWR. A land surface change of less than 0.1 foot is therefore within the noise of the data and is equivalent to no subsidence in the Subbasin.

Since no subsidence impacts to critical infrastructure have been noted to date, 0.5 foot of subsidence in a 5-year period was not considered to be significant or unreasonable in the Subbasin.

6.9.2.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

The subsidence minimum threshold has little or no impact on other minimum thresholds, as described below.

- **Chronic lowering of groundwater levels**. The subsidence minimum threshold will not decrease groundwater elevations and therefore will not result in significant or unreasonable groundwater elevations.
- **Change in groundwater storage**. The subsidence minimum threshold will not change the amount of pumping and therefore will not result in a significant or unreasonable change in groundwater storage.
- **Degraded water quality**. The subsidence minimum threshold does not promote decreasing groundwater elevations that lead to exceedance of water quality minimum thresholds and therefore will not result in significant of unreasonable degradation of water quality.
- **Depletion of interconnected surface waters**. The subsidence minimum threshold does not promote additional pumping or lower groundwater elevations adjacent to interconnected surface waters. Therefore, the subsidence minimum threshold will not result in a significant or unreasonable depletion of interconnected surface waters.

6.9.2.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The Corning Subbasin is bounded by 5 neighboring Sacramento Valley subbasins for which GSPs are being developed concurrently:

- Red Bluff Subbasin to the north
- Los Molinos Subbasin to the northeast
- Vina Subbasin to the east
- Butte Subbasin to the southeast

- Colusa Subbasin to the south

Coordination with the adjacent GSAs responsible for establishing minimum thresholds in neighboring basins occurred throughout the development of this GSP. The subsidence minimum threshold for the Corning Subbasin was selected to maintain consistency with neighboring subbasins.

Since the greatest subsidence in the Subbasin is found on the southern border with the Colusa Subbasin, interbasin coordination will be instrumental for managing subsidence between subbasins. The Corning Sub-basin GSAs will coordinate with the Colusa Subbasin GSAs during GSP implementation to assess if groundwater pumping in the area near Orland leads to an increase in magnitude or area of known subsidence due to groundwater pumping. Groundwater pumping in this neighboring Subbasin has the potential to impact the ability of the Corning Sub-basin GSAs to meet the subsidence minimum thresholds established in this plan. The Colusa Subbasin GSP minimum threshold also allows for up to 0.5 feet of subsidence over 5 years in the area south of the Corning Subbasin, which is identical to the minimum threshold for this Subbasin. Consequently, the selected minimum thresholds should not interfere with the Corning and Colusa subbasins' ability to achieve the subsidence minimum thresholds. The other neighboring subbasins to the east and north do not appear as prone to subsidence as the Colusa Subbasin and use similar minimum thresholds to this GSP; therefore, subsidence minimum thresholds in other neighboring subbasins should not prevent the Corning Subbasin from achieving sustainability and vice versa.

6.9.2.4 Effects of Minimum Thresholds on Beneficial Users and Land Uses

Available data indicate that there is very little historical long-term subsidence in the Subbasin. If little to no subsidence continues in the future as anticipated, beneficial users and land uses should not be impacted by the subsidence minimum threshold. If subsidence is noted in the future at levels greater than the minimum threshold, reductions in pumping or modifications to current practices could be necessary. Reductions in pumping and/or changes to current practices would mainly impact agricultural land use and beneficial use of groundwater in the Subbasin. Reductions to pumping in the future may need to occur in adjacent areas to the Corning Subbasin in order to effectively manage regional subsidence.

6.9.2.5 Relevant Federal, State, or Local Standards

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

6.9.2.6 Method for Quantitative Measurement of Minimum Thresholds

The minimum threshold for subsidence will be assessed quantitatively using DWR-provided InSAR data. InSAR data are collected at many points and composited by DWR into average measurements in a grid pattern made up of approximately 2.5-acre cells. Each InSAR cell measurement is the average of many discrete vertical displacement point measurements. Subsidence data from InSAR cells for the previous water year (from October of one year to October of the following year) will be analyzed and compared to minimum thresholds. Annual comparison of data and review of monthly values will help the GSAs isolate elastic subsidence related to seasonal groundwater pumping from inelastic subsidence caused by chronic groundwater level decline (Figure 3-34 and Figure 3-35).

Important considerations related to the minimum threshold and satellite based InSAR data provided by DWR include the following:

- InSAR measures the total subsidence and does not distinguish between elastic and inelastic subsidence. While it is difficult to compensate for elastic subsidence, visual inspection of monthly changes in ground elevations suggest that elastic subsidence is largely seasonal (Figure 3-34 and Figure 3-35).

- InSAR measurements do not distinguish whether any observed total subsidence is caused by lowered groundwater levels due to pumping.

The InSAR dataset may be supplemented by GPS benchmark elevation surveys which are planned on a 5-year interval by DWR.

6.9.3 Measurable Objectives

The measurable objective for subsidence represents target subsidence rates in the Subbasin.

The measurable objective for inelastic subsidence solely due to lowered groundwater elevations is zero throughout the subbasin, in addition to any measurement error.

If the InSAR dataset is used, the measurement error is 0.1 ft, and measured annual subsidence of 0.1 ft or less would not be considered measurable inelastic subsidence.

6.9.3.1 Methodology for Setting Measurable Objectives

The subsidence measurable objective is essentially no subsidence when sustainability is reached in 2042, after accounting for potential measurement error.

6.9.3.2 Interim Milestones

The subsidence measurable objective is set at current conditions of no long-term subsidence. There is no change between current conditions and sustainable conditions. Therefore, the interim milestones are identical to current conditions of zero long-term subsidence, and annual subsidence of no more than 0.1 foot.

6.9.4 Undesirable Results

6.9.4.1 Criteria for Defining Chronic Lowering of Groundwater Levels Undesirable Results

By regulation, the ground surface subsidence undesirable result is a quantitative combination of subsidence minimum threshold exceedances. A subsidence undesirable result for the Subbasin is:

Any exceedance of a minimum threshold is an undesirable result if the exceedance is irreversible and caused by lowering groundwater elevations.

If subsidence is observed in the future, the GSAs will first assess whether the subsidence may be due to elastic subsidence. If the subsidence is inelastic, the GSAs will further evaluate the data to assess whether the subsidence is caused by lowered groundwater elevations. The first step in the assessment will be to check if groundwater elevations near the subsidence measurement have dropped below historical lows. If groundwater elevations remain above historical lows, the GSAs shall assume that any observed subsidence was not caused by lowered groundwater levels. If groundwater levels have dropped below historical lows, the GSAs will attempt to correlate the observed subsidence with measured groundwater elevations. In addition, if the subsidence occurs in the Southern portion of the Subbasin near Orland, subsidence and water level data will be reviewed in coordination with the Colusa Subbasin GSAs to establish if the subsidence was triggered by actions in the adjacent subbasin. Lastly, if the Subbasin experiences subsidence in multiple consecutive years that are due to InSAR measurement error, the GSAs will confirm if the error is not actually net long-term subsidence.

6.9.4.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result include changing pumping locations, depths, or volumes. For example, increased pumping in an area that is susceptible to subsidence could trigger subsidence that has not been observed before. The following lists some general activities that the GSAs will conduct to evaluate if land subsidence was inelastic and occurred due to groundwater pumping:

- Review other subsidence datasets for the Subbasin if available, including land surface elevation surveys and extensometer data; this could also include limited benchmark surveys
- Review groundwater elevation measurements and trends in water level RMPs (established as part of the declining groundwater level SMC) and other nearby wells being monitored, including an assessment as to whether groundwater levels are below historical lows
- Evaluate known or estimated groundwater pumping near observed land subsidence

6.9.4.3 Effects on Beneficial Users and Land Uses

The undesirable result for subsidence allows for no more than 0.5 foot of cumulative subsidence in the Subbasin during a 5-year period. This amount of subsidence is not likely to impact beneficial users and land uses such as highways, canals, and pipelines as it is about equal to the total subsidence in one portion of the Subbasin and no impacts to infrastructure have been reported to date. No other beneficial users or land uses are anticipated to be impacted by subsidence in the Subbasin.

6.10 Depletion of Interconnected Surface Water SMC

Per Section §354.28(C)(6) of the GSP Regulations, the GSAs are responsible for assessing the location, quantity, and timing of depletions of interconnected surface water due to groundwater pumping. The depletion of interconnected surface water SMC only applies to locations in the Subbasin where interconnected surface water exists, similar to the conditions shown on panel A and B of Figure 6-13. This SMC does not apply to disconnected surface water shown on panel C of Figure 6-13. As such, large areas of the Subbasin are not considered in this SMC, where streams, if present, are disconnected from groundwater.

Additionally, per Section §354.16(g) of the GSP Regulations, GDEs are beneficial users of interconnected surface water and should be considered in the surface water depletion SMC specifically when using groundwater levels as a proxy.

While SGMA does not require the Plan to address California's public trust doctrine, a 2018 California Court of Appeal ruling found that groundwater pumping that reduces the flow or volume of water in a navigable stream (and tributaries that supply navigable streams) may violate the public trust.

The public trust doctrine is a balancing document, requiring that water rights balance the needs of private water users with the needs of public users, including environmental users. The various beneficial uses and users of surface waters were addressed when setting the interconnected surface water depletion minimum thresholds including riparian rights holders, ecological surface water users, and recreational surface water users. This is a reasonable review of all uses and users in an attempt to balance all interests. This is not an assessment about what constitutes a reasonable beneficial use under Article X, Section 2 of the California Constitution.

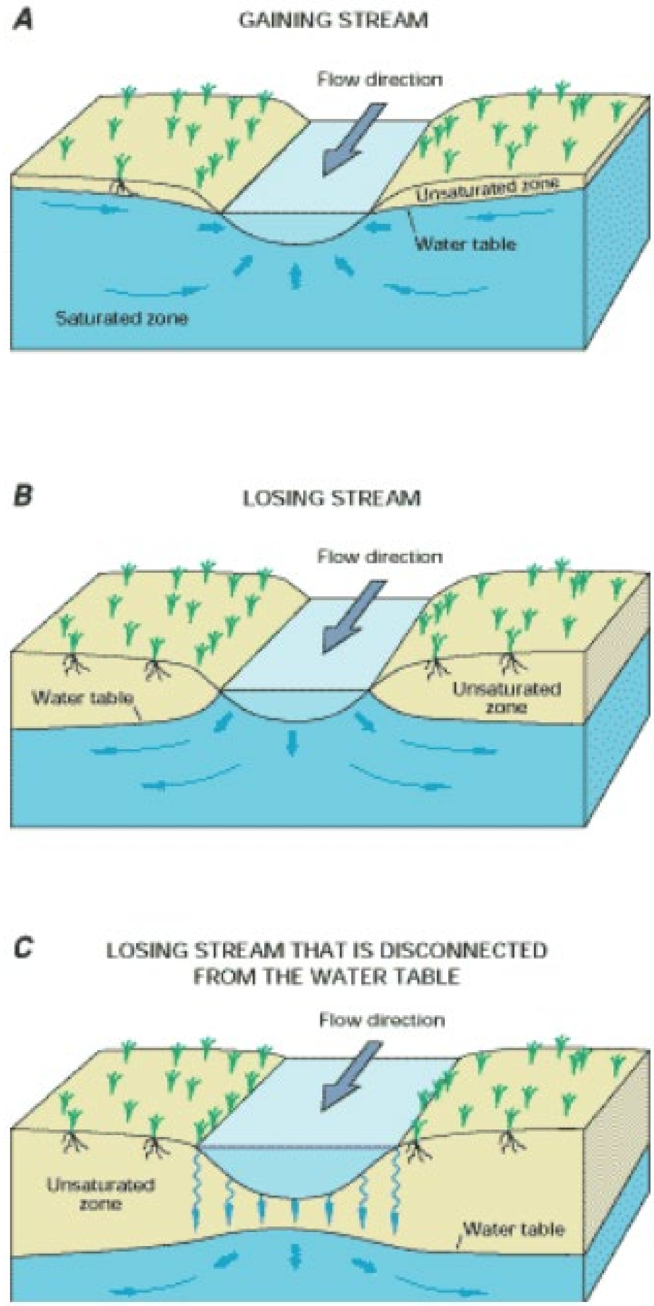

Figure 6-13. Conceptual Representation of Interconnected Surface Water (Winter *et al.*, 1999)

6.10.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable conditions for depletion of interconnected surface water were determined based on discussions with GSA staff, interbasin coordination meetings with other Sacramento Valley GSP teams and general Sacramento Valley input from TNC and the Environmental Defense Fund (EDF), input from CSAB members, and other local stakeholders. Water Code Section 10727.2(b)(4) specifies that if surface water depletion is considered significant and unreasonable, then conditions should not be allowed to worsen relative to January 1, 2015, when SGMA was enacted.

Three major streams occur in the Subbasin: Thomes Creek forms the northern boundary of the Subbasin, the Sacramento River forms the eastern boundary of the Subbasin, and Stony Creek (including Black Butte Dam) partially forms the southern boundary of the Subbasin (Figure 6-14).

Each of these streams have unique conditions and surface water management regimes, as discussed in Section 3.2.7. Surface water and groundwater is likely only connected in eastern portions of the Subbasin along the Sacramento River and possibly in some areas near Thomes Creek and Stony Creek, as described further below. Several ephemeral streams that originate through rainstorms in the western coastal range foothills and run dry in the summer are not considered in the setting of SMC, as they are not likely connected to groundwater at any point.

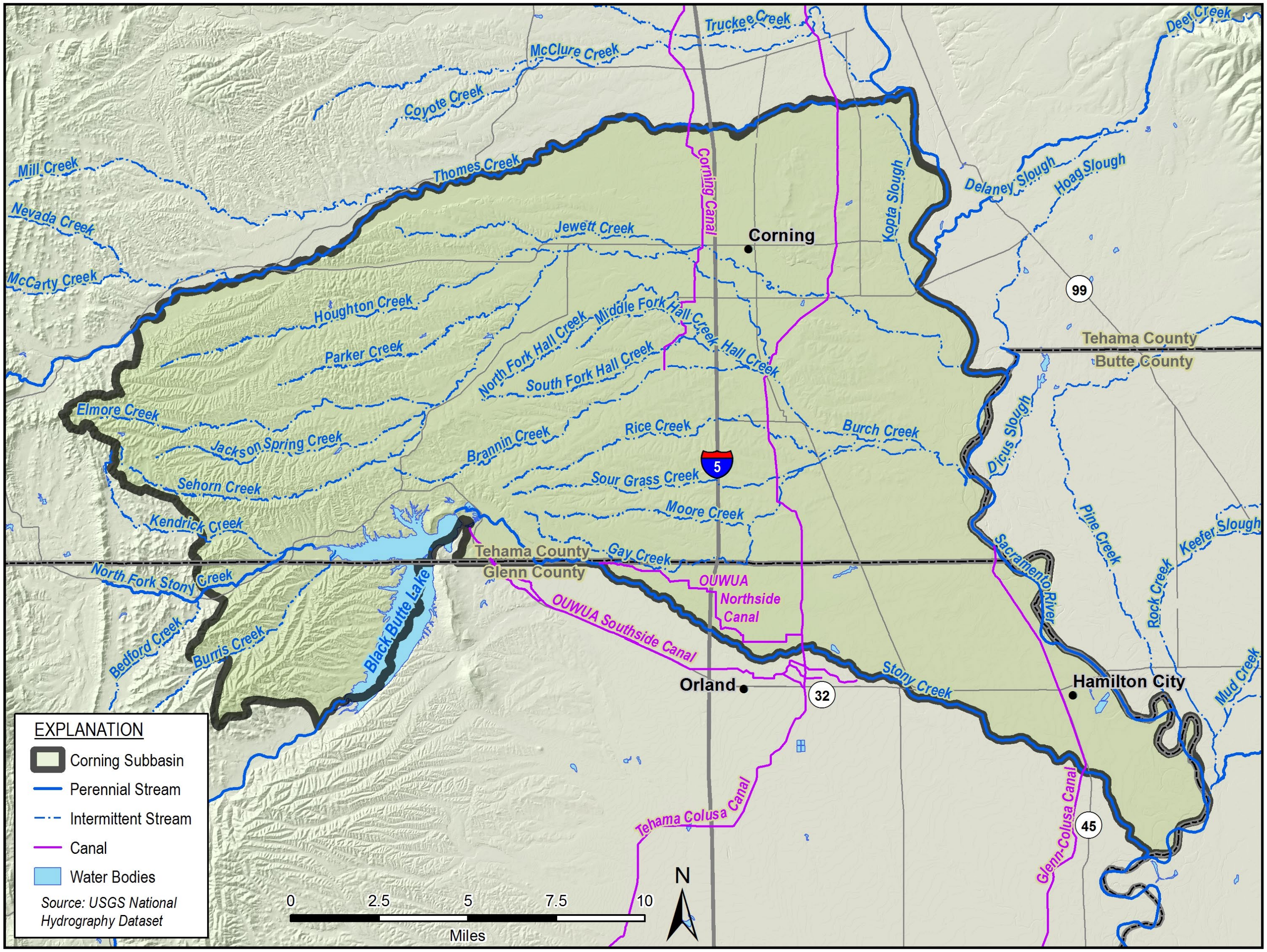

Figure 6-14. Major Surface Water Features in the Corning Subbasin

Locally defined significant and unreasonable conditions were defined individually for the Sacramento River, Stony Creek, and Thomes Creek streams as follows:

Sacramento River

- *Significant and unreasonable depletion of interconnected surface water on the Sacramento River occurs if surface water beneficial users are impacted, such as surface water diverters, riparian habitat, and potential GDEs. The GSAs do not have authority to manage Shasta Lake reservoir releases and are not required to manage surface waters. In addition, impacts on the Sacramento River occurring in Subbasins upstream or adjacent to the Corning Subbasin may occur. Interbasin coordination will be necessary to assess overall impacts, should they occur.*
- *Significant and unreasonable streamflow depletion on the Sacramento River within the Corning Subbasin does not currently occur.*

Stony Creek

- *Significant and unreasonable depletion of interconnected surface water on Stony Creek occurs if groundwater pumping affects streamflow and impacts any beneficial users (except invasive species) beyond depletions observed in 2015.*
- *Stony Creek is fully adjudicated, and the GSAs do not have authority to manage Black Butte Dam releases and are not required to manage surface waters.*
- *Stony Creek does not provide extensive riparian habitat beyond invasive species (primarily arundo); invasive species are not protected species and should not be considered a beneficial user.*

Thomes Creek

- *Significant and unreasonable depletion of interconnected surface water on Thomes Creek occurs if groundwater pumping affects streamflow beyond depletions observed in 2015.*
- *Thomes Creek is mostly a disconnected stream and is seasonally dry in lower reaches and does not support significant surface water diversions; invasive species are also prevalent on Thomes Creek and should not be considered beneficial users.*

6.10.2 Minimum Thresholds

Section 354.28(c)(5) of the GSP Regulations states that "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." Section §354.36(b) of the GSP Regulations provide an option for using groundwater elevations as a proxy metric for depletions of interconnected surface water minimum thresholds and measurable objectives.

To use groundwater elevations as a proxy for depletions of interconnected surface water, the GSP must demonstrate significant correlation between groundwater elevations and depletions of interconnected surface water caused by groundwater use. Correlation between groundwater levels and surface water depletion was determined to be significant based on the results of groundwater model simulations discussed in the Section 3.2.7. Therefore, groundwater elevations are an appropriate proxy for defining the depletion of interconnected surface water minimum thresholds and measurable objectives. In addition, a conceptual method was proposed by EDF and is widely regarded in the Sacramento Valley to be an approach of choice, given the documented and important interconnection of the major Sacramento Valley streams to groundwater: the basic concept is that as water levels drop, it increases the vertical gradient at streams and leads to potential streamflow depletion.

Groundwater elevation minimum thresholds were established in depletion of interconnected surface water RMP wells near interconnected stream reaches shown in Figure 5-10. This network of 8 wells, which is a subset of the shallow wells for the chronic lowering of groundwater levels RMP, and only includes shallow wells from the DWR observation well clusters, will be refined with the addition of dedicated monitoring wells closer to and in data gap areas of the interconnected streams, as described in the plan implementation section. The minimum thresholds for groundwater levels at surface water depletion RMPs are identical to minimum thresholds for chronic lowering of groundwater RMPs in shallow wells defined in Section 6.6.2. Since the shallow wells near the streams were categorized as stable wells in the chronic lowering of groundwater levels SMC, the minimum threshold at these wells is the minimum fall groundwater elevation since 2012 minus a 20-foot buffer. The minimum thresholds and measurable objectives for individual RMP wells are summarized in Table 6-5.

Table 6-5. Surface Water Depletion Minimum Thresholds, Measurable Objectives, and Interim Milestones

State Well Number	Well Type	Minimum Threshold (ft NAVD88)	2027 Interim Milestone (ft NAVD88)	2032 Interim Milestone (ft NAVD88)	2037 Interim Milestone (ft NAVD88)	Measurable Objective (ft NAVD88)
22N01W29N003M	Observation	91.7	123.2	123.2	123.3	123.4
22N02W01N003M	Observation	99.3	133.2	134.3	135.4	136.5
22N02W15C004M	Observation	84.0	135.4	138.3	141.2	144.1
22N02W18C003M	Observation	131.6	147.6	147.8	148.1	148.4
22N03W01R002M	Observation	123.6	143.9	143.9	143.9	143.9
23N02W28N004M	Observation	104.3	139.3	140.4	141.6	142.7
24N02W29N003M	Observation	123.2	146.9	150.6	154.4	158.1
Glenn TSS Well	Observation	237.5	262.8	262.8	262.8	262.8

6.10.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

The minimum thresholds for depletion of interconnected surface waters are developed using the definition of significant and unreasonable conditions described above, public information about critical habitat, locations of interconnected surface water derived from the integrated hydrologic model, and public information about water rights.

Beneficial Users of Interconnected Surface Water

The various beneficial uses and users of surface waters were addressed when setting the interconnected surface water depletion minimum thresholds. The categories of beneficial uses and users that were reviewed include:

- Riparian water rights holders on the Sacramento River. On Thomes Creek, it is uncertain if any riparian water is still being diverted from this low flow stream.
- CVP water rights holders on the Sacramento River:
  - River flow controlled upstream at Shasta Dam to satisfy Delta outflows and exports, fish habitat, and surface water rights holders
  - TCCA Diversion to TCC and Corning Canal
  - Diversion at Glenn-Colusa Canal
- Stony Creek adjudicated stream with federal water contract holders
- Ecological surface water users, including GDEs, but also invasive species along much of the Stony Creek corridor
- Recreational surface water users (including protected riparian habitat areas that constitute parks and recreational areas along the Sacramento River)

Location of interconnected surface water

The NSac integrated hydrologic model was used to identify the location of interconnected surface waters and to develop an estimate of areas that may be losing or gaining reaches. Shallow groundwater and surface water levels simulated by the NSac model are used to identify the location of interconnection and evaluate the frequency with which different stream reaches are connected with groundwater in the underlying aquifer. The magnitude of stream depletions in relation to shallow groundwater elevations in interconnected reaches are evaluated in Section 3.2.7. In general:

- Sacramento River is fully connected to groundwater and mostly gaining water from groundwater
- Thomes Creek is mostly disconnected from groundwater and mostly losing water to groundwater
- Stony Creek is likely partially or seasonally connected to groundwater and may gain or lose water depending on water year type and seasons
- Ephemeral streams are likely disconnected from groundwater

The minimum thresholds for depletion of interconnected surface water are based on the concept that as groundwater levels decrease, the vertical gradient at streams increase and lead to potential streamflow depletion. Considering all the beneficial uses and users, the CSAB determined that surface water depletion was not significant and unreasonable in 2015 for the Subbasin stream reaches of the Sacramento River, Stony Creek, or Thomes Creek. The Sacramento River flows in the Corning Subbasin are managed through releases from Shasta Dam. These flows are specifically timed for the benefit of endangered fish species in the River. During the 2015 drought, agricultural surface water providers did not receive any of their allocations, to leave enough water in the River to protect environmental flows. The majority of groundwater pumping in the subbasin occurs further away from the Sacramento River. Stony Creek and Thomes Creek regularly go dry in the summer and early fall, and therefore do not likely provide habitat for endangered fish species.

Furthermore, it is likely that slightly lower groundwater elevations near streams will not suddenly cause significant and unreasonable conditions to occur. As such, the groundwater elevation minimum thresholds and measurable objectives were established using identical methods developed for the chronic lowering of groundwater level SMC, considering the same factors addressed in developing these criteria presented in Section 6.6.2.1.

There are data gaps in the surface water depletion RMP network that will be addressed during GSP implementation, particularly along Thomes Creek. There are several recent additions to the groundwater level monitoring network near Thomes Creek in the Red Bluff Subbasin to the north that will be tracked and discussed as needed in GSP annual updates until the RMP network in the Subbasin can be expanded. Minimum thresholds and measurable objectives will be defined for new RMP locations when added to the GSP monitoring networks during GSP annual updates. Therefore, as the data gaps are addressed, the GSAs reserve the right to modify the surface water depletion SMCs and RMPs to better represent local conditions.

6.10.2.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

The depletion of surface water minimum threshold could influence other sustainability indicators as follows:

- **Chronic lowering of groundwater levels**. The depletion of interconnected surface water minimum thresholds is developed using the same approach as the chronic lowering of groundwater levels minimum thresholds. Most of the RMP network for streamflow depletion is included in the chronic lowering of groundwater levels RMP network; therefore, minimum threshold exceedances in surface water depletion RMPs will also be minimum threshold exceedances in chronic lowering of groundwater level RMPs.
- **Change in groundwater storage**. The depletion of interconnected surface water minimum thresholds is developed using the same approach as the change in groundwater storage minimum thresholds. Most of the RMP network for streamflow depletion is included in the change in groundwater storage RMP network; therefore, minimum threshold exceedances in surface water depletion RMPs will also be minimum threshold exceedances in change in groundwater storage RMPs.
- **Degraded water quality**. The depletion of interconnected surface water minimum thresholds does not promote increased groundwater pumping near interconnected streams to an extent that should cause exceedance of the water quality minimum threshold.
- **Subsidence**. The depletion of interconnected surface water minimum thresholds does not promote increased groundwater pumping near interconnected streams to an extent that should cause exceedance of the subsidence minimum threshold.

6.10.2.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The Corning Subbasin is bounded by 5 neighboring Sacramento Valley subbasins for which GSPs are being developed concurrently:

- Red Bluff Subbasin to the north
- Los Molinos Subbasin to the northeast
- Vina Subbasin to the east

- Butte Subbasin to the southeast
- Colusa Subbasin to the south

Coordination with the adjacent GSAs responsible for establishing minimum thresholds in neighboring subbasins occurred throughout the development of this GSP. Given that stream reaches form the boundaries between the Corning Subbasin and the neighboring subbasins, interbasin coordination is especially critical for this SMC. The depletion of interconnected surface water minimum threshold for the Corning Subbasin was selected to not substantially lower groundwater levels or impact streamflow depletion, thereby allowing for the neighboring subbasins to be managed sustainably. The neighboring subbasins all selected to use groundwater levels as a proxy to assess the streamflow depletion SMCs. The methods used to select the minimum thresholds were slightly different in each case but generally result in minimum thresholds that are equivalent to or slightly lower than the historical minimum measured groundwater levels. Therefore, the Corning Subbasin should not impede neighboring Subbasins from meeting their minimum thresholds by maintaining streamflow depletion within or close to the historical range. Additional inter-basin coordination during GSP implementation will help refine montioring networks. SMC may be refined, as necessary, when data gaps are filled with a more robust interconnected streamflow monitoring network.

Groundwater level analysis near the Corning Subbasin boundaries will be supplemented in GSP annual updates with groundwater level data from neighboring subbasin wells, as necessary, while the GSAs evaluate and add new or existing wells to address data gaps in the RMP network. The primary data gaps are near the Red Bluff Subbasin boundary along Thomes Creek.

6.10.2.4 Effects of Minimum Thresholds on Beneficial Users and Land Uses

The depletion of interconnected surface water minimum thresholds may have variable effects on beneficial users and land uses in the Subbasin.

Agricultural land uses and users. The depletion of interconnected surface water minimum threshold prevents lowering of groundwater elevations adjacent to certain parts of streams and rivers. This has the effect of limiting the amount of groundwater pumping in these areas. Limiting the amount of groundwater pumping may limit the quantity and type of crops that can be grown adjacent to streams and rivers.

Urban land uses and users. The depletion of interconnected surface water minimum threshold prevents lowering of groundwater elevations adjacent to certain parts of streams and rivers. This may limit the amount of urban pumping near rivers and streams such as Hamilton City, which could limit urban growth in this area. The City of Corning is not adjacent to interconnected surface water and therefore should not be impacted by these minimum thresholds.

Domestic land uses and users (including DACs). The depletion of interconnected surface water minimum threshold may benefit existing domestic land users and uses near streams. The minimum threshold maintains groundwater elevations near streams at levels slightly below historical levels, thus protecting the operability of relatively shallow domestic wells. However, these minimum thresholds may limit the number of new domestic wells that can be installed near rivers or streams to limit the additional drawdown from the new wells.

Ecological land uses and users. The depletion of interconnected surface water minimum thresholds should limit impacts to ecological beneficial uses and users by preventing significant and unreasonable depletions. However, some additional impacts may occur because groundwater levels, and the associated stream depletions, may be greater than current conditions.

6.10.2.5 Relevant Federal, State, or Local Standards

No federal, state, or currently enforced local standards exist for depletion of interconnected surface water.

6.10.2.6 Method for Quantitative Measurement of Minimum Thresholds

Groundwater elevation will be directly measured at RMP wells for comparison to the depletion of interconnected surface water minimum thresholds. The annual minimum groundwater elevation collected in the fall will be compared to the minimum threshold for depletion of interconnected surface water. Groundwater level monitoring will be conducted in accordance with the monitoring protocols outlined in Section 5.

6.10.3 Measurable Objectives

The measurable objective for depletion of interconnected surface water was defined using the chronic lowering of groundwater levels measurable objectives as a proxy. Since the shallow wells near the streams were categorized as stable wells in the chronic lowering of groundwater levels SMC, the measurable objective at these wells is the maximum fall groundwater elevation since 2012. The measurable objectives for each depletion of interconnected surface water RMP are listed in Table 6-5.

6.10.3.1 Methodology for Setting Measurable Objectives

The measurable objective for depletion of interconnected surface water is identical to the chronic lowering of groundwater level measurable objectives, for the subset of wells in both RMP networks. The measurable objectives are either the fall maximum groundwater elevation since 2012 for wells with stable water level trends or the fall 2015 maximum groundwater level for wells with declining groundwater level trends. Using either method, the measurable objective for depletion of interconnected surface water is greater than or equal to the groundwater level in the fall of 2015. Using shallow groundwater levels of 2015 for the measurable objective has regulatory backing; in most shallow wells near the streams, fall groundwater levels have either increased slightly since 2015, or in some instances, groundwater levels declined slightly and then recovered, indicating stable groundwater levels near the streams.

6.10.3.2 Interim Milestones

The interim milestone for depletion of interconnected surface water are identical to the chronic lowering of groundwater levels interim milestones.

6.10.4 Undesirable Results

6.10.4.1 Criteria for Defining Chronic Lowering of Groundwater Levels Undesirable Results

By regulation, the depletion of interconnected surface water undesirable result is a quantitative combination of minimum threshold exceedances. For the Subbasin, the undesirable result is:

> *An undesirable result occurs if 20% of RMP wells exceed the minimum threshold during 2 consecutive years.*

This percentage will be reevaluated when the monitoring network is fully established. Depletion of interconnected surface water during unanticipated future droughts or unanticipated climatic conditions do not constitute an undesirable result. This is in alignment with the SMC BMP (DWR, 2017) which states, “Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods.”

6.10.4.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result for the depletion of interconnected surface waters include the following:

- **Localized pumping increases**. Even if the Subbasin is adequately managed at the Subbasin scale, increases in localized pumping near interconnected surface water bodies could unreasonably increase surface water depletion.
- **Departure from the GSP’s climatic assumptions, including extensive, unanticipated drought**. Minimum thresholds were established based on anticipated future climatic conditions. Departure from the GSP’s climatic assumptions or extensive, unanticipated droughts may lead to excessively low groundwater elevations that increase surface water depletion rates.

6.10.4.3 Effects on Beneficial Users and Land Uses

During average hydrologic conditions and over the long term, the undesirable result will not have a negative effect on the beneficial users and uses of groundwater. However, pumping during dry years could temporarily increase rates of surface water depletions. Therefore, there could be short-term impacts on all beneficial users and uses of surface water during dry years.