SUSTAINABLE MANAGEMENT CRITERIA

(SUBTITLE PAGE)

11. INTRODUCTION TO SUSTAINABLE MANAGEMENT CRITERIA

§ 354.22. Introduction to Sustainable Management Criteria
This Subarticle describes criteria by which an Agency defines conditions in its Plan that constitute sustainable groundwater management for the basin, including the process by which the Agency shall characterize undesirable results, and establish minimum thresholds and measurable objectives for each applicable sustainability indicator.

☑ 23 CCR § 354.22

§ 356.4 Periodic Evaluation by Agency
Each Agency shall evaluate its Plan at least every five years and whenever the Plan is amended, and provide a written assessment to the Department. The assessment shall describe whether the Plan implementation, including implementation of projects and management actions, are meeting the sustainability goal in the basin, and shall include the following:
(c) Elements of the Plan, including the basin setting, management areas, or the identification of undesirable results and the setting of minimum thresholds and measurable objectives, shall be reconsidered and revisions proposed, if necessary.

☑ 23 CCR § 356.4 (c)

The Sustainable Groundwater Management Act (SGMA) legislation defines a "Sustainability Goal" as "the existence and implementation of one or more groundwater sustainability plans that achieve sustainable groundwater management by identifying and causing the implementation of measures targeted to ensure that the applicable basin is operated within its sustainable yield" (California Water Code [CWC] § 10721(u)). SGMA requires Groundwater Sustainability Agencies (GSAs) to develop and implement Groundwater Sustainability Plans (GSPs) to meet the Sustainability Goal (CWC § 10727(a)). The SGMA legislation and California Code of Regulations Title 23 (23 CCR) Division 2 Chapter 1.5 Subchapter 2 define terms related to achievement of the Sustainability Goal, including:

- Undesirable Result (UR) – "one or more of the following effects caused by groundwater conditions occurring throughout the basin:
  - (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." (CWC § 10721(x));

- Minimum Threshold (MT) – "a numeric value for each sustainability indicator used to define undesirable results" (23 CCR § 351(t)).
- Measurable Objective (MO) – "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" (23 CCR § 351(s)); and
- Interim Milestone (IM) – "a target value representing measurable groundwater conditions, in increments of five years, set by an Agency as part of a Plan" (23 CCR § 351(q))

Collectively, the Sustainability Goal, URs, MTs, MOs, and IMs are referred to herein as Sustainable Management Criteria (SMCs).

Each of the following are referred to as "Sustainability Indicators", which, as stated above, can constitute URs if they are "significant and unreasonable": (1) Chronic Lowering of Groundwater Levels, (2) Reduction of Groundwater Storage, (3) Seawater Intrusion, (4) Degraded Water Quality, (5) Land Subsidence, and (6) Depletions of Interconnected Surface Waters[32] (CWC § 10721(x)). The 23 CCR also specify how GSAs must establish SMCs for each applicable Sustainability Indicator. Further, in its July 2019 Alternative Assessment Staff Report, the California Department of Water Resources (DWR) provided the following recommended actions to The Alameda County Flood Control and Water Conservation District, Zone 7 (Zone 7 Water Agency or Zone 7) for consideration in the Five-Year Update to the Alternative GSP Update (Alt GSP).

1. Identify those groundwater levels, taken at representative monitoring sites, that are used to define the MTs for the Basin, to facilitate DWR evaluation.
2. Develop quantitative MTs for lowering of groundwater levels for the Fringe and Upland Management Areas to better align with requirements for management areas and definition of MTs.
3. Develop quantitative MTs for reduction of groundwater storage for the Fringe and Upland Management Areas to better align with the requirements for definition of MTs.
4. Include monitoring groundwater levels at additional locations in the Upland Management Area to monitor changes in groundwater conditions and manage the groundwater resources to prevent undesirable results in future updates to the Alt GSP. Zone 7 should identify the frequency and timing when groundwater levels would be collected at new monitoring stations, and other relevant monitoring well construction information in accordance with the GSP Regulations.

[32] Groundwater Dependent Ecosystems (GDEs) are considered under Depletions of Interconnected Surface Waters Sustainability Indicator.

As such, **Sections 12** and **13** of this Alt GSP describe the refined SMCs that have been developed for all applicable Sustainability Indicators in the Basin. As demonstrated herein (consistent with the approved 2016 Alt GSP and the requirements of CWC § 10733.6 (a)(3) and 23 CCR § 356.4), Zone 7 has continued to sustainably manage the Basin to avoid URs for at least 10 years. In fact, most of the datasets discussed in this Alt GSP date back to 1974 allowing for a comprehensive, long-term assessment of Zone 7's sustainable Basin management, including over three major droughts, see **Section 8**. **Table 11-A** below presents a summary of the applicable Sustainability Indicators and a summary of the Basin conditions for the last 10 years (i.e., from 2010 through 2020 Water Years [WY]) relative to the criteria used to identify potential URs.

Table 11-A: Summary of Sustainability Indicators and Ten Year Status

Sustainability Indicator	Undesirable Results Criteria	Minimum Threshold	Status 2010-2020 WY	Action Taken
Chronic Lowering of Groundwater Levels	Water levels in greater than 25% of the RMS-WLs decline below their respective MTs for two consecutive years that are categorized as non-drought years.	Historic low minus maximum annual rate of groundwater level change, or historic low if maximum annual rate of groundwater level change is not available.	• MTs were not exceeded at any RMS-WLs, see **Figure 8-8**. • Sustainable groundwater conditions over the long-term demonstrated in **Section 8**.	Continue to monitor and maintain artificial recharge operations.
Depletion of Groundwater Storage	Water Level SMCs used as proxy.	Water Level SMCs used as proxy.	• MTs were not exceeded at any RMS-WLs, see **Figure 8-8**. • Sufficient groundwater storage volume maintained above Reserve Storage, see **Figure 8-13.** • Sustainable groundwater conditions over the long-term demonstrated in **Section 8**.	Continue to monitor maintain artificial recharge operations.
Degradation of Groundwater Quality	If MTs are exceeded for any of the identified constituents of concern in greater than 25% of the RMS-WQs at least two (2) consecutive non-drought years as a result of SGMA-related groundwater management activities such that they cannot be managed to provide drinking water supply (i.e., that treatment or blending is not possible or practicable).	TDS > 1,000 mg/L or 2015 Baseline concentration plus maximum deviation, whichever is greater.	• TDS was not detected above the in any RMS-WQ, see **Figure 8-19** • Sustainable groundwater conditions over the long-term demonstrated in **Section 8**.	Continue to monitor and increase municipal supply pumping, implement SMP, increase operation of Mocho Groundwater Demineralization Plant (MGDP), and conduct artificial groundwater recharge with low TDS water.
		NO3 (as N) > 10 mg/L or 2015 Baseline concentration plus maximum deviation, whichever is greater.	• Nitrate was not detected above the MT in any RMS-WQs, see **Figure 8-25.** • Sustainable groundwater conditions over the long-term demonstrated in **Section 8**.	Continue to monitor and implement NMP.

Sustainability Indicator	Undesirable Results Criteria	Minimum Threshold	Status 2010-2020 WY	Action Taken
		Boron > 1.4 mg/L, or 2015 Baseline concentration plus maximum deviation, whichever is greater.	• Boron was not detected above the MT in any RMS-WQs, see **Figure 8-31**. • Sustainable groundwater conditions over the long-term demonstrated in **Section 8**.	Continue to monitor.
		Total Chromium > 0.050 mg/L, or 2015 Baseline concentration plus maximum deviation, whichever is greater.	• Chromium was not detected above the MT in any RMS-WQs, see **Figure 8-32.** • Sustainable groundwater conditions over the long-term demonstrated in **Section 8**.	Continue to monitor.
		SMCs for PFAS in development	• Zone 7 began sampling for PFAS compounds in the 2019 WY, see **Figure 8-35** and **Figure 8-36**.	Continue to monitor
Land Subsidence	Water Level SMCs used as proxy for Main Basin and Fringe Management Area, and no more than 0.4 ft of irreversible land surface elevation decrease in one year. Not applicable for Upland Management Area	Water Level SMCs used as proxy and irreversible land surface elevation decrease of 0.4 ft.	• MTs were not exceeded at any applicable RMS-WLs, see **Figure 8-8**. • Elastic fluctuations less than 0.04 ft for the year (see **Figure 8-40**). • Sustainable groundwater conditions over the long-term demonstrated in **Section 8**.	Continue to monitor
Depletion of Interconnected Surface Waters	If groundwater levels decline below their MTs in greater than 40% of the RMS-ICSWs for more than two consecutive non-drought years.	Historic low water levels or to be determined if historical water levels are not available.	• MTs were not exceeded at any RMS-ICSWs, see **Figure 13-1**. • Sustainable groundwater conditions over the long-term demonstrated in **Section 8**.	Continue to monitor

12. SUSTAINABILITY GOAL

§ 354.24 Sustainability Goal
Each Agency shall establish in its Plan a sustainability goal for the basin that culminates in the absence of undesirable results within 20 years of the applicable statutory deadline. The Plan shall include a description of the sustainability goal, including information from the basin setting used to establish the sustainability goal, a discussion of the measures that will be implemented to ensure that the basin will be operated within its sustainable yield, and an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation and is likely to be maintained through the planning and implementation horizon.

☑ 23 CCR § 354.24

The Sustainable Groundwater Management Act (SGMA) requires that a Sustainability Goal be defined for each medium- or high-priority basin (California Water Code [CWC] § 10727(a)). The California Code of Regulations Title 23 (23 CCR) Division 2 Chapter 1.5 Subchapter 2 further clarifies that the Sustainability Goal should culminate "in the absence of undesirable results within 20 years of the applicable statutory deadline" (23 CCR § 354.24).

The Alameda County Flood Control and Water Conservation District, Zone 7 (Zone 7 Water Agency or Zone 7) Organization-wide Goal "C" is to *manage and protect the groundwater basin as the state designated Groundwater Sustainability Agency* [GSA] and, as the GSA, has adopted the following Sustainability Goal for the Livermore Valley Groundwater Basin (Basin):

Continue to operate the Livermore Valley Groundwater Basin within its Sustainable Yield[33] and to manage the groundwater resources for the prevention of significant and unreasonable: (1) lowering of groundwater levels, (2) reduction in basin storage, (3) degradation of groundwater quality, (4) inelastic land subsidence, or (5) depletion of surface water supplies such that beneficial uses aren't adversely impacted.[34]

[33] Sustainable Yield is defined by SGMA as the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result.
[34] The significant and unreasonable seawater intrusion is not applicable for the Basin as it is situated inland and does not interface with seawater.

13. SUSTAINABILITY INDICATORS

13.1. Chronic Lowering of Groundwater Levels

As a wholesale municipal water supplier, The Alameda County Flood Control and Water Conservation District, Zone 7 (Zone 7 Water Agency or Zone 7) has existing policies and objectives relating to managing water levels in the Livermore Valley Groundwater Basin (Basin) (*Zone 7, 2016*e) and regularly monitors an extensive network of monitoring wells (see **Section 14**). Specifically, Zone 7 manages the Basin water levels for multiple objectives including:

- Maintaining groundwater emergency reserves for worst credible droughts and unplanned import outages supply interruption of imported surface water;
- Preserving storage capacity for recharge of available imported supplies;
- Keeping water levels sufficiently high to support beneficial uses; and,
- Minimizing impacts of high groundwater levels on gravel mining operations.

These objectives were directly considered as part of the development of the refined Sustainable Management Criteria (SMCs) described below.

13.1.1. Undesirable Results for Chronic Lowering of Groundwater Levels

§ 354.26. Undesirable Results

(a) Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.

(b) The description of undesirable results shall include the following:

(1) The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.

(2) The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.

(3) Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.

(c) The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.

(d) An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators.

☑ **23 CCR § 354.26(a)**

Per the Sustainable Groundwater Management Act (SGMA), Undesirable Results for the Chronic Lowering of Groundwater Levels means a "chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon" (California Water Code [CWC] § 10721(x)(1)). However, it is important to note that SGMA also states that "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" (CWC § 10721(x)(1)).

The Undesirable Result (UR) for Chronic Lowering of Groundwater Levels is in the Basin defined herein as follows:

Undesirable Results would be experienced if and when a chronic decline in groundwater levels over the course of the planning and implementation horizon significantly and unreasonably impairs the reasonable and beneficial use of, and access to, groundwater for beneficial uses and users within the Basin.

The primary beneficial users of groundwater within the Basin are groundwater pumpers (environmental beneficial users are addressed in **Section 13.6**). As such, the definition of URs is focused on potential well impacts. If lowering of regional water levels resulted in wells no longer being capable of supporting their beneficial uses, that condition would be viewed as an UR. However, it should be noted that other factors -- such as well-age, poor well-design and well-integrity related impacts – can also affect wells and should not be part of the "significant and unreasonable" determination. For example, 42% of existing Basin wells are more than 30 years old[32] and would reasonably have to be replaced in the next 20 years due to expected average life spans for wells regardless of SGMA implementation or lowering of groundwater levels. As such, careful assessment of local water level and well conditions is needed to determine if any observed well impacts are URs that are directly attributable to changes in the groundwater levels in the basin, and not to some other factor (for example, aging equipment).

Some fluctuations in groundwater levels are expected, and a reduction in the groundwater level alone would not constitute an UR. Rather, a decrease in groundwater level would be considered an UR if that decrease was both chronic over the long term, and if the depletion rose to the level of significant and unreasonable as defined by this Alternative GSP. For decades, Zone 7 has managed groundwater levels in to ensure that reductions in groundwater levels or storage during a period of drought/high demand are offset by increases in groundwater levels or storage during other periods. Consistent with the requirements of SGMA, overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed in this fashion.

13.1.1.1. Potential Causes of Undesirable Results

☑ **23 CCR § 354.26(b)(1)**

Potential causes of URs related to Chronic Lowering of Groundwater Levels could include increased pumping and/or reduced recharge.

The URs may be experienced as water levels falling below pump intakes, falling below the top of screens, and/or reductions in well yields. These conditions could be triggered by the concurrence of a multi-year drought combined with severe cutbacks on imported supply and/or exacerbated by prior pumping in the Basin. Such conditions could result loss of water supply for groundwater users and a need for supplemental supplies at a time when they may be unavailable. Because the current primary use of groundwater in the Basin is for municipal purposes, increased groundwater pumping (up to the Groundwater Pumping Quota [GPQ]) could occur if demand for groundwater increases to supplement a shortage in imported surface water. Reduced recharge could occur due to increased agricultural irrigation efficiency, climate change that results in decreased precipitation, decreased natural surface water inflows, increased evapotranspiration (ET), and/or decreased deliveries of imported surface water supplies.

The above notwithstanding, it should be emphasized that wells located in the Fringe Management Area (Fringe Area) and Upland Management Area (Upland Area) rely mainly on natural recharge to maintain water supply. During below normal, dry, and critically dry hydrologic years, natural recharge may not be sufficient to maintain the groundwater levels in these wells and lack of sufficient natural recharge can potentially cause loss of production in these wells. In order to sustainably manage these management areas, groundwater pumping must be limited to available supply from natural recharge. Avoidance of well impacts under these natural conditions can likely only be managed through demand reduction efforts. Similarly, if the GPQ are reached in the Main Basin Management Area (Main Basin), demand reduction efforts would have to be implemented pursuant to the Water Shortage Contingency Plans (WSCPs) developed by Zone 7 and its Retailers.

To account for the uncertainty of how low water levels can be managed for in the Fringe and Upland Areas, any proposed new well construction (other than replacement wells) would need to be evaluated for the higher-density well areas (see well density discussion in **Section 5.1.5**). Zone 7's role in permitting new wells in the Basin allows an early assessment of any proposed wells to ensure that they are constructed to account for operating water levels in the Basin and do not result in over-pumping for any localized area of well clusters. Through its assigned authority to administer the Alameda County Water Wells Ordinance within the Zone 7 service area, Zone 7 can require, at its discretion, that a permit application be accompanied by a certified California Environmental Quality Act (CEQA) analysis supporting that the new well and its use would not significantly impact the local water levels. This requirement would reduce the uncertainty associated with new well constructions and pumping impacts in these areas.

In addition to the evaluation process for new wells, Zone 7 has authority to conduct numerous additional management actions to respond to URs for water level declines that are observed in the Basin through its Water Level Monitoring Program (see **Section 14**). Some of these actions include increased conjunctive use, provision of an alternative water supply, and/or a pumping (or replenishment) assessment. All these options would be considered in any recovery plan that may be developed to ensure continued sustainable groundwater conditions.

13.1.1.2. Criteria Used to Define Undesirable Results

☑ **23 CCR § 354.26(b)(2)**
☑ **23 CCR § 354.26(c)**

As discussed further below in **Section 13.1.2** and in **Section 14**, the Minimum Thresholds (MTs) for groundwater levels have been established at twelve (12) Representative Monitoring Sites for Chronic Lowering of Groundwater Levels (RMS-WLs). Per Section 354.26(b)(2) of the California Code of Regulations Title 23 (23 CCR) Division 2 Chapter 1.5 Subchapter 2, the description of URs must include the criteria used to define when and where the effects of groundwater conditions cause URs, based on a quantitative description of the number of MT exceedances that constitute an UR.

Based on the significant and unreasonable effects described above, the criteria for URs for Chronic Lowering of Groundwater Levels are as follows:

> *Undesirable Results for Chronic Lowering of Groundwater Levels would be experienced in the Basin if water levels in greater than 25% of the RMS-WLs decline below their respective MTs for two consecutive years that are categorized as non-drought years (normal, above-normal, or wet), according to the Sacramento Valley Water Year Hydrologic Classification.*[35]

Per **Appendix E**, the proposed water level MTs are estimated to represent conditions where approximately 50% of the Total Usable Storage volume of the Basin is actively managed and used. The remaining "Reserve Storage" can be accessed by pumping wells, but pursuant to Basin operating policies is only available during emergency conditions. The UR criteria that are based on the RMS-WLs reaching their MT means that significant Total Usable Storage volume above the Reserve Storage will still be maintained. This approach is conservative and justified based on understanding of historic low and water level variability conditions throughout the Basin that have occurred and could occur in the future without causing significant and unreasonable effects for any Sustainability Indicators (*Zone 7, 2016e*) and is consistent with Zone 7's on-going sustainable management of the Basin.

Further, the component of the criteria requiring two consecutive non-drought years[36] of MT exceedances provides for confirmation that the chronic lowering of groundwater levels is not drought related, consistent with the definition of URs for this Sustainability Indicator in CWC § 10721(x)(1).

13.1.1.3. Potential Effect of Undesirable Results

☑ **23 CCR § 354.26(b)(3)**

[35] The Sacramento Valley Water Year Hydrologic Classification is used to evaluate non-drought years because it is related to hydrologic conditions in the watersheds that contribute to the State Water Project, which is the main source of imported water for Zone 7.

[36] For purposes of these UR definitions, "non-drought" years means Water Years not classified as "dry" or "critical" by DWR's Sacramento Valley Hydrologic Indices or best available information provided by DWR.

The primary potential effect of URs caused by Chronic Lowering of Groundwater Levels on beneficial uses and users of groundwater in the Basin is groundwater well dewatering. Potential effects could include increased pumping lift and effects on correlated Sustainability Indicators. Increased pumping lift results in more energy use per unit volume of groundwater pumped and corresponding higher pumping costs, as well as increased wear and tear on well pump motors and reduced well efficiency. Declining groundwater levels could adversely affect current and projected municipal uses. Correlated Sustainability Indicators include Reduction on Groundwater Storage, Land Subsidence, and Depletion of Interconnected Surface Waters (ICSW), although the degree of correlation has not been determined with certainty and is a data gap that will continue to be explored as part of the Alternative Groundwater Sustainability Plan (Alt GSP) implementation. For example, while potential impacts of water levels in the Upper Aquifer unit on ICSW or Groundwater Dependent Ecosystems (GDEs) have not been observed to date in the Basin, the issue does warrant further study and future shallow groundwater monitoring efforts are discussed in **Section 14** and **15**.

13.1.2. Minimum Threshold for Chronic Lowering of Groundwater Levels

§ 354.28. Minimum Thresholds

(a) Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.

(b) The description of minimum thresholds shall include the following:

(1) The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by uncertainty in the understanding of the basin setting.

(2) The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.

(3) How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.

(4) How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.

(5) How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.

(6) How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.

(c) Minimum thresholds for each sustainability indicator shall be defined as follows:

(1) Chronic Lowering of Groundwater Levels. 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. Minimum thresholds for chronic lowering of groundwater levels shall be supported by the following:

(A) The rate of groundwater elevation decline based on historical trends, water year type, and projected water use in the basin.

(B) Potential effects on other sustainability indicators.

☑ 23 CCR § 354.28(a)
☑ 23 CCR § 354.28(b)
☑ 23 CCR § 354.28(c)(1)

Chronic Lowering of Groundwater Levels is arguably the most fundamental Sustainability Indicator, as it influences several other key Sustainability Indicators, including Reduction of Groundwater Storage, Land Subsidence, and potentially Depletions of Interconnected Surface Water and Degraded Water Quality. Groundwater levels are also the most readily available and measurable metrics of groundwater conditions, which allows for a systematic, data-driven approach to development of MTs to be applied. There are no state, federal, or local standards that relate to this Sustainability Indicator.

13.1.2.1. Minimum Threshold Development

Consistent with 23 CCR Division 2 Chapter 1.5 Subchapter 2 § 354.28(c), the definition of MTs for Chronic Lowering of Groundwater Levels in the Basin is based on consideration of trends in historical groundwater levels, projected water use in the Basin (i.e., by beneficial users), and the relationship to other Sustainability Indicators. This information was used to develop MT estimates using a quantitative algorithm that accounted for trends, historic lows, and water level variability (discussed below). This approach allowed for the most complete and representative historical water level information to inform the MTs.

For several decades, Zone 7 has operated the Basin to maintain water levels above historic low levels throughout the Main Basin – even during the 1970s, 1990s and recent droughts (see **Section 8**). Historic low water levels are therefore used as a starting point for MTs based on the fact that: (1) significant and unreasonable impacts to beneficial uses and users of groundwater are not known to have occurred when water levels were at their historic lows, and (2) Zone 7 wells are capable of pumping at or below historic low levels in localized areas if the need arises (*Zone 7, 2016e*).

As discussed in **Section 8.3.3.2**, historic low values are a function of both data availability and some variability in water levels during drought cycles. Zone 7 uses static water levels from local monitoring wells rather than pumping level data to evaluate the groundwater level height above the historic lows. Data used to create the composite historical contours for the Basin's Principal Aquifer units are typically from the 1960s, 1977, 1987-1992, or 2012-2015 drought periods. Outside of the Main Basin and Fringe Area, continuous aquifers may not be present and historic lows have not yet been definitively determined. However, water level hydrographs from various monitoring wells indicate it is Zone 7's understanding that water levels in the Upland Area have not fluctuated significantly over time, and no areas of significant downward trends have been identified (see **Figure 8-8**).

Variability in groundwater levels, due in large part to variations in water year type, is then accounted for by calculating a maximum annual rate of groundwater elevation change (i.e., the difference between the annual high and low water level data in a given year) based on the historical water level record at each RMS-WL. This maximum annual water level change value reflects the fact that different locations and

Principal Aquifer units within the Basin have experienced different amounts of water level variability over time in response to varied hydrologic conditions.

As discussed, to account for water level variations, the MTs for Chronic Lowering of Groundwater Levels are then established at each RMS-WL by subtracting the maximum annual rate of groundwater change from the historic low for each RMS-WL, as shown in the formula below. The resultant MTs for the RMS-WLs within the Basin are shown in **Table 13-A** and on **Figure 8-8**. Where maximum annual water level change is not available, the MT is set at the historic low. Because the water levels in the co-located Upper Aquifer and Lower Aquifer RMS-WLs show nearly equivalent values and trends, the same MT values are applied, based on water level data from the Lower Aquifer RMS-WLs.

$$MT = Historical\ Low - Maximum\ Annual\ Rate\ of\ Groundwater\ Level\ Change$$

Or if maximum annual rate of groundwater level change is not available:

$$MT = Historical\ Low$$

In addition to define the MT for each RMS-WL, Zone 7 also created a raster of the MTs for Chronic Lowering Groundwater Levels. As part of its SGMA Annual Report, Zone 7 compares water level surfaces with the MT raster regularly to assess the overall Basin conditions.

Table 13-A. SMCs for Chronic Lowering of Groundwater Levels

RMS[1] Well		Management Area/Unit			Historical Conditions (ft)			SMCs[3] Water Levels	
Well Name	Map	Area	Subarea	Aquifer	Historic Low	Maximum Decrease[2]	Historic Low + Max Decrease	Minimum Threshold[4]	Measureable Objective[5]
3S1E20C007	20C7	Main	Bernal	Upper	179.5	-34.7	144.8	144.8	179.5
3S1E20C008	20C8	Main	Bernal	Lower	179.5	-34.7	144.8	144.8	179.5
3S1E09P005	9P5	Main	Amador West	Upper	206.7	-26.9	179.8	179.8	206.7
3S1E09P010	9P10	Main	Amador West	Lower	206.7	-26.9	179.8	179.8	206.7
3S1E11G001	11G1	Main	Amador East	Upper	219.9	-38.9	181.0	181.0	219.9
3S1E12K003	12K3	Main	Amador East	Lower	219.9	-38.9	181.0	181.0	219.9
3S2E08K002	8K2	Main	Mocho II	Upper	293.1	-38.0	255.1	255.1	293.1
3S2E08H003	8H3	Main	Mocho II	Lower	293.1	-38.0	255.1	255.1	293.1
3S1E06F003	6F3	Fringe	Northwest	Upper	314.6	-9.7	305.0	305.0	314.6
2S2E34E001	34E1	Fringe	Northeast	Upper	491.2	-3.0	488.2	488.2	491.2
3S2E24A001	24A1	Fringe	East	Upper	678.3	-2.8	675.5	675.5	678.3
3S2E21K009[6]	21K9	Upland	Upland	Upper	470.1	No Data	No Data	470.1	470.1

[1] RMS = Representative Monitoring Site
[2] Maximum Single Year Seasonal Decrease (Spring to Fall)
[3] Sustainable Management Criteria
[4] Historic Low + Maximum Seasonal Decrease
[5] Measurable Objective = Historic Low
[6] Recently added; no historical data available. Criteria to be adjusted in future.

13.1.2.2. Consideration of Impacts to Beneficial Users

The relationship of water level historic lows to well construction in municipal wellfields was examined in Zone 7's 2003 Well Master Plan (WMP). That plan evaluated numerous alternatives for new Zone 7 wellfields to meet future demands when imported water supply allocations are reduced or during water supply emergencies. The plan confirmed that Zone 7 wells are capable of pumping at or below historic low levels in localized areas if the need arises. However, rather than allowing water levels to exceed MTs, more typically Zone 7 will employ the adaptive management of optimizing groundwater pumping to wells in other portions of the Basin to minimize local impacts at any given well. Further, as with current wellfields and their operations, new Zone 7 wellfields are to be sited and operated to optimize groundwater recovery while maintaining Basin water levels above historic lows most of the time and minimizing localized drawdown in other Basin wells.

Although average conditions (normal and dry years) would not warrant sustained pumping below historic lows, drawdown to the MTs would be adaptively managed to ensure that any localized drawdown would be monitored and, if appropriate, addressed with a recovery plan. Factors such as transmissivity and the ability to recharge that portion of the Basin would be considered in the recovery plan, as would the length of time to remain below historic lows during recovery.

Other areas of the Basin with private supply wells (primarily small irrigation wells) have typically high water levels due to conjunctive use and low pumping volumes locally. However, installing additional wells and increased pumping can change water levels in these areas. Those wells located around the municipal pumping centers would be expected to be the first wells impacted by declining water levels. However, given that most of these wells are within a water purveyor service area and only supply a small landscape demand, it is anticipated that municipal water would be available to replace the minor lost well supply.

Again, it is important to note that wells located in the Fringe Area and Upland Area rely mainly on natural recharge to maintain water supply. During below normal, dry, and critically dry hydrologic years, natural recharge may not be sufficient to maintain the groundwater levels in these wells and consequently, lack of sufficient natural recharge can potentially cause declining water level and thus, loss of production in these wells. Avoidance of well impacts under these natural conditions can likely only be managed through demand reduction efforts.

Under extreme conditions, such as a prolonged drought or full loss of imported water due to an earthquake in the Sacramento Delta, water levels may be drawn below the historic low surface in some areas and could exceed the MT at one or more RMS-WLs; these would be evaluated for a recovery plan. This is a part of Zone 7's adaptive management strategy for long-term groundwater sustainability and is demonstrated by the drought recovery periods in the historical hydrographs of the key wells within the Basin (see **Section 8**).

13.1.2.3. Consideration of Other Sustainability Criteria

Sections 13.2, 13.4, 0 and **13.6.** below analyze the SMCs for Chronic Lowering of Groundwater Levels relative to the other relevant Sustainability Criteria and determine that they are protective.

13.1.3. Measurable Objectives and Interim Milestones for Chronic Lowering of Groundwater Levels

§ 354.30. Measurable Objectives

(a) Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.

(b) Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.

(c) Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.

(d) An Agency may establish a representative measurable objective 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 measurable objectives as supported by adequate evidence.

(e) Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.

(f) Each Plan may include measurable objectives and interim milestones for additional Plan elements described in Water Code Section 10727.4 where the Agency determines such measures are appropriate for sustainable groundwater management in the basin.

(g) An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.

☑ **23 CCR § 354.30(a)**
☑ **23 CCR § 354.30(b)**
☑ **23 CCR § 354.30(c)**
☑ **23 CCR § 354.30(e)**

13.1.3.1. Measurable Objective Development

The Measurable Objectives (MOs) for Chronic Lowering of Groundwater Levels are similarly developed based on historical groundwater levels. Specifically, the MOs are set equal to the historic low for each RMS-WL, based on the fact that significant and unreasonable impacts to beneficial uses and users of groundwater are not known to have occurred since the time when water levels were at their historic low (*Zone 7, 2016e*). The resultant MOs for the RMS-WLs within the Basin are shown in **Table 13-A** and on **Figure 8-8**. Because the water levels in the co-located Upper Aquifer and Lower Aquifer RMS-WLs show nearly equivalent values and trends, the same MO values are applied, based on water level data from the Lower Aquifer RMS-WLs.

The MOs for Chronic Lowering of Groundwater Levels do not mean that Zone 7 will manage the water levels within the Basin toward the historic lows. Rather, as they have for several decades, Zone 7 will

continue to actively and sustainably manage the Basin to maintain water levels above historic low levels (i.e., at or above the MOs for Chronic Lowering of Groundwater Levels). The MOs are set to allow a reasonable Margin of Operational Flexibility to allow for on-going sustainable management of the Basin and are intended to accommodate droughts, climate change, conjunctive use operations, or other groundwater management activities.

13.1.3.2. Interim Milestones Development

The Interim Milestones (IMs) for Chronic Lowering of Groundwater Levels are not defined or applicable because, as demonstrated herein, Zone 7 has continued to manage the Basin sustainably and maintain water levels above the applicable SMCs.

13.1.4. Demonstration of Sustainability

Per CWC 10733.6 (a)(3), this Alt GSP must demonstrate that the Basin has been operating within its sustainable yield for at least 10 years. Relative to the Chronic Lowering of Groundwater Levels Sustainability Indicator, **Figure 8-8** demonstrates that water levels in the RMS-WLs have been maintained above the SMCs for the last 10 years, indicating long-term sustainability and absence of URs. Further, based on Zone's 7 expansive SGMA Monitoring Network (**Section 14**), sustainable groundwater conditions over the long-term are demonstrated in **Section 8**.

13.2. Reduction of Groundwater Storage

13.2.1. Undesirable Results for Reduction of Groundwater Storage

☑ **23 CCR § 354.26(a)**

Per SGMA, an UR for the Reduction of Groundwater Storage means a "significant and unreasonable reduction of groundwater storage" (CWC § 10721(x)(1)).

As further specified in CWC Section 10727.2(b)(4), a GSP or Alt GSP "may, but is not required to, address URs that occurred before, and have not been corrected by, January 1, 2015". In approving Zone 7's 2016 Alt GSP, the California Department of Water Resources (DWR) found that through 2015 Zone 7 had managed the Basin sustainably (i.e., absent of URs). As such it is appropriate to use groundwater conditions in 2015 as an effective "SGMA Baseline" to evaluate the reasonableness of any reductions in groundwater storage pursuant to the refined SMCs. In 2015 (considered the SGMA Baseline for purposes of this Alt GSP), the usable storage in the Basin was slightly less than the Total Usable Storage.

Zone 7 has historically operated the Basin such that groundwater in storage remains between the Total Usable Storage or "full basin" volume[37] and the historic low water levels. Historic low water levels are estimated to represent conditions where about 50% of the Total Usable Storage volume is actively managed and used. The remaining "Reserve Storage" is available only during emergency conditions. The

[37] Total Usable Storage is based on historic high water levels, see **Section 8.4 Groundwater Storage** and **Appendix E**.

Reserve Storage Volume is estimated to be approximately 52% of the SGMA Baseline Storage volumes in the Main Basin.

Zone 7 plans its operations to operate the Basin at or above historic lows (i.e., at or above the MOs for Chronic Lowering of Water Levels). Under emergency conditions, Reserve Storage may need to be accessed. In this case, assessment of any URs will be related to whether the storage loss can be recovered at some time in the future. Emergency conditions will be evaluated on a case-by-case basis to determine if they create URs and can be evaluated by the monitoring networks and computer modeling that Zone 7 has already put into practice.

Given the long-term sustainable management of the Basin, and in consideration of SGMA requirements, the UR for the Reduction of Groundwater Storage is defined herein as follows:

Undesirable Results would be experienced if and when a reduction in storage in the Principal Aquifers of the Basin negatively affects the long-term viable access to groundwater for the beneficial uses and users within the Basin. Specifically, significant and unreasonable effects would include an aggregate reduction in usable groundwater storage of more than 50% within the Basin relative to the SGMA Baseline Storage volume for two consecutive non-drought years.

The above definition is justified because it is consistent with Zone 7's policies which allow access Reserve Storage (which accounts for approximately 50% of the total storage volume of the Basin) under certain conditions.

13.2.1.1. Potential Causes of Undesirable Results

☑ **23 CCR § 354.26(b)(1)**

Reduction of Groundwater Storage is directly correlated to Chronic Lowering of Groundwater Levels. Therefore, the potential causes of URs due to Reduction of Groundwater Storage are generally the same as the potential causes listed above for URs due to Chronic Lowering of Groundwater Levels (i.e., increased groundwater pumping and reduced recharge). Because of the direct correlation between groundwater elevation and groundwater storage volume, groundwater levels are used to measure conditions for this Sustainability Indicator.

13.2.1.2. Criteria Used to Define Undesirable Results

☑ **23 CCR § 354.26(b)(2)**
☑ **23 CCR § 354.26(c)**

The criteria used to define URs for Reduction of Groundwater Storage are consistent with the criteria used to define URs for Chronic Lowering of Groundwater Levels, as follows:

Undesirable Results for Chronic Lowering of Groundwater Levels would be experienced in the Basin if water levels in greater than 25% of the RMS-WLs decline below their respective MTs for two consecutive years that are categorized as non-drought years (normal, above-normal, or wet), according to the Sacramento Valley Water Year Hydrologic Classification.

This approach is justified based on calculations of the "SGMA Baseline" storage volume in the Basin (approximately 343 – 583 TAF as of Fall 2015)[38] and the volume of storage depletion that would occur in the Principal Aquifer units if groundwater levels were to decline to the Chronic Lowering of Groundwater Levels MTs (approximately 28 – 95 thousand acre-feet [TAF]). These calculations are detailed in **Appendix E** and indicate that if all RMS-WLs were to decline from 2015 levels (i.e., the start of SGMA) to their respective Chronic Lowering of Groundwater Levels MTs, the percent of usable storage in the Basin would decrease by approximately 13%, which is less than the level deemed to be significant and unreasonable. Within the Main Basin, usable storage would decrease by 16% (23 – 84 TAF) relative to SGMA Baseline conditions (246 – 403 TAF), which is less than the level deemed to be significant and unreasonable. Within the Fringe Area, usable storage would decrease by 6% (5 – 11 TAF) relative to SGMA Baseline conditions (97 – 180 TAF), which is less than the level deemed to be significant and unreasonable.

Given the above analysis, the criteria set for Chronic Lowering of Groundwater Levels are considered protective against significant and unreasonable effects for Reduction of Groundwater Storage, and thus serve as a reasonable proxy.

13.2.1.3. Potential Effects of Undesirable Results

☑ 23 CCR § 354.26(b)(3)

The primary potential effect of URs caused by Reduction of Groundwater Storage on beneficial uses and users of groundwater in the Basin (i.e., groundwater pumpers) would be less groundwater supply reliability. The effect would be most significant during periods of surface water supply shortage due to, for example, natural drought conditions, regulatory restrictions, natural disasters, or other causes. However, as discussed below in **Section 13.2.2**, there is significant usable groundwater storage within the Basin, and continued sustainable management of the Basin will most likely to minimize these effects to less than unreasonable and significant over the Alt GSP planning and implementation horizon.

[38] The usable storage volume in the Basin is calculated as the volume of groundwater between the groundwater level at the time of assessment (i.e., Fall 2015) and base of the "usable" aquifer system, i.e., where the deepest wells in the Basin are constructed within the Upper Livermore Formation of the Lower Aquifer. See **Appendix E** for further discussion.

13.2.2. Minimum Threshold for Reduction of Groundwater Storage

§ 354.28. Minimum Thresholds
(c) Minimum thresholds for each sustainability indicator shall be defined as follows:
(2) Reduction of Groundwater Storage. 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.

☑ 23 CCR § 354.28(c)(2)

As discussed above, the UR definition for Reduction of Groundwater Storage equates to a volumetric decrease in storage amounting to a reduction in 50% of usable storage across the Basin over the planning and implementation horizon and the criteria for the URs are tied to groundwater levels measured in RMS-WLs and consistent with Zone 7's long-standing sustainable management of the Basin. It is logical to correlate these two Sustainability Indicators together, as the amount of groundwater in storage is directly, if not linearly, related to groundwater levels. Because of the close relationship between these two Sustainability Indicators, and because the MTs for Chronic Lowering of Groundwater Levels (discussed above) are protective of the beneficial uses and users of groundwater, the MTs for Chronic Lowering of Groundwater Levels are used as a proxy for the Reduction of Groundwater Storage Sustainability Indicator.

13.2.2.1. Use of Groundwater Levels as Proxy

§ 354.28. Minimum Thresholds
(d) 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.

☑ 23 CCR § 354.28(d)

Pursuant to the GSP Emergency Regulations (23 CCR § 354.28(d)) and as further described in the DWR Sustainable Management Criteria Best Management Practices #6[39], MTs for the Reduction of Groundwater Storage Sustainability Indicator may be set using groundwater levels as a proxy if it is demonstrated that a correlation exists between the two metrics and if the MTs for Chronic Lowering of Groundwater Levels are sufficiently protective to ensure prevention of significant and unreasonable occurrences. The resultant MTs for the RMS-WLs within the Basin are shown in **Table 13-B** and **Figure 8-8** and discussed in more detail in **Section 14.4**.

[39] DWR 2017, Sustainable Management Criteria Best Management Practices, dated November 2017, 38 pp.

Table 13-B. SMCs for Reduction of Groundwater Storage

RMS[1] Well		Management Area/Unit			Historical Conditions (ft)			SMCs[3] Water Levels				
Well Name	Map	Area	Subarea	Aquifer	Historic Low	Maximum Decrease[2]	Historic Low + Max Decrease	Minimum Threshold[4]	IM-5[5]	IM-10	IM-15	Measureable Objective[6]
3S1E20C007	20C7	Main	Bernal	Upper	179.5	-34.7	144.8	144.8	153.4	162.1	170.8	179.5
3S1E20C008	20C8	Main	Bernal	Lower	179.5	-34.7	144.8	144.8	153.4	162.1	170.8	179.5
3S1E09P005	9P5	Main	Amador West	Upper	206.7	-26.9	179.8	179.8	186.5	193.2	199.9	206.7
3S1E09P010	9P10	Main	Amador West	Lower	206.7	-26.9	179.8	179.8	186.5	193.2	199.9	206.7
3S1E11G001	11G1	Main	Amador East	Upper	219.9	-38.9	181.0	181.0	190.7	200.4	210.2	219.9
3S1E12K003	12K3	Main	Amador East	Lower	219.9	-38.9	181.0	181.0	190.7	200.4	210.2	219.9
3S2E08K002	8K2	Main	Mocho II	Upper	293.1	-38.0	255.1	255.1	264.6	274.1	283.6	293.1
3S2E08H003	8H3	Main	Mocho II	Lower	293.1	-38.0	255.1	255.1	264.6	274.1	283.6	293.1
3S1E06F003	6F3	Fringe	Northwest	Upper	314.6	-9.7	305.0	305.0	307.4	309.8	312.2	314.6
2S2E34E001	34E1	Fringe	Northeast	Upper	491.2	-3.0	488.2	488.2	489.0	489.7	490.5	491.2
3S2E24A001	24A1	Fringe	East	Upper	678.3	-2.8	675.5	675.5	676.2	676.9	677.6	678.3

[1] RMS = Representative Monitoring Site
[2] Maximum Single Year Seasonal Decrease (Spring to Fall)
[3] Sustainable Management Criteria
[4] Historic Low + Maximum Seasonal Decrease
[5] IM-# = Interim Milestone at # years
[6] Measurable Objective = Historic Low

To demonstrate that the updated MTs for Chronic Lowering of Groundwater Levels developed by Zone 7 as part of the 2021 Alt GSP are sufficiently protective, a calculation was performed to estimate the volume of groundwater that would be removed from storage in the Principal Aquifer units if groundwater levels were to decline from SGMA Baseline (i.e., Fall 2015) levels to their respective MTs for Chronic Lowering of Groundwater Levels (see **Appendix E**). This volume is then compared to the volume of total usable storage within applicable Management Areas of the Basin[40] at SGMA Baseline water level conditions. Based on the analysis presented herein, the total usable storage in the Basin will not be significantly impacted at MT water level conditions, indicating that the MTs for Chronic Lowering of Groundwater Levels are protective for the Reduction of Groundwater Storage Sustainability Indicator.

The analysis presented herein notwithstanding, Zone 7 plans to upgrade the groundwater model for the Basin to integrate Fringe and Upland Areas into the model domain and calibrate the model to more accurately calculate Basin storage volume in coming years.

13.2.2.2. Main Basin Management Area

Table 13-C presents a summary of estimated available groundwater storage volumes for each Principal Aquifer unit within the Main Basin at MT water level conditions, along with their comparative SGMA Baseline storage volumes. Additional detail is provided in **Appendix E**.

[40] The Basin is divided into three Management Areas (Main, Fringe, and Upland). The Upland Area is not considered in this analysis as there are insufficient monitoring wells and groundwater elevation data available to inform comparisons of water level surfaces over time.

Table 13-C. Available Groundwater Storage Estimates at MT Water Levels – Main Basin

Principal Aquifer Unit	SGMA Baseline Groundwater Storage (TAF)	Available Groundwater Storage at MT (TAF)	Storage Volume at MT Relative to SGMA Baseline Storage (%)
Upper Aquifer	59 - 113 TAF	36 – 47 TAF	48%
Lower Aquifer (Quaternary Deposits)	102 - 120 TAF	102 TAF	92%
Lower Aquifer (Upper Livermore Formation)	85 – 170 TAF	85 – 170 TAF	100%
TOTAL (MAIN BASIN)	**246 – 403 TAF**	**223 – 319 TAF**	**84%**

As a whole, the Main Basin storage would remain no less than 84% under MT water levels relative to SGMA Baseline conditions, corresponding to a total reduction in groundwater storage of approximately 23 – 84 TAF (16%).

While groundwater storage in the Upper Aquifer unit appears to be most affected by groundwater level declines (23 – 66 TAF, or a 52% reduction), it is important to note that groundwater production in this unit is insignificant, and that SMCs in the Basin have been specifically designed to protect GDEs and prevent depletion of ICSW in the areas of the Basin where shallow groundwater conditions are known to occur (see **Section 13.1.2** and **Section 13.6.2**).

Within the quaternary deposits (i.e., "grey" and "purple" sequences) of the Lower Aquifer unit, an 18 TAF storage decline at MT water levels would still leave 92% of usable storage available relative to SGMA Baseline conditions. Meanwhile, the underlying Upper Livermore Formation portion of the Lower Aquifer unit retains 100% of its storage volume at the MT water levels relative to SGMA Baseline conditions, demonstrating that this portion of the Lower Aquifer unit is at virtually no risk of significant storage loss.

The above calculations thus demonstrate that the SMCs defined for the Chronic Lowering of Groundwater Levels Sustainability Indicator are sufficiently protective of URs for Reduction of Groundwater Storage and thus can serve as an effective proxy for defining Reduction of Groundwater Storage MTs in the 2021 Alt GSP.

13.2.2.3. Fringe Management Area

Table 13-D presents a summary of estimated available groundwater storage volumes for each Principal Aquifer unit within the Fringe Area at MT water level conditions, along with their comparative SGMA Baseline storage volumes. Also provided is an estimate of the percentage volume of each Principal Aquifer unit at MT water levels relative to the SGMA Baseline storage volumes.

Table 13-D. Available Groundwater Storage Estimates at MT Water Levels – Fringe Area

Fringe Subarea	SGMA Baseline Groundwater Storage (TAF)	Available Groundwater Storage at MT (TAF)	Storage Volume at MT Relative to SGMA Baseline Storage (%)
North Fringe	74 – 133 TAF	72 – 128 TAF	97%
Northeast Fringe	23 – 46 TAF	20 – 40 TAF	87%
East Fringe	0.3 – 0.6 TAF	0.2 – 0.4 TAF	67%
TOTAL (FRINGE AREA)	**97 – 180 TAF**	**92 – 168 TAF**	**94%**

As a whole, the Fringe Area storage volume would remain no less than 94% under MT water levels relative to SGMA Baseline conditions, corresponding to a total reduction in groundwater storage of approximately 5 – 11 TAF (6%). The North Fringe, Northeast Fringe, and East Fringe Subareas storage volumes will remain at least 97%, 87%, and 67% at MT water levels, respectively, relative to SGMA Baseline conditions, demonstrating that the SMCs defined for Chronic Lowering of Groundwater Levels will also be sufficiently protective of Reduction of Groundwater Storage within these areas of de minimis groundwater use.

13.2.2.4. Upland Management Area

The total groundwater storage of the Upland Area is unknown because it consists of semi-consolidated bedrock of highly variable specific yields and of unknown thickness. The Upland Area provides only very limited groundwater supply for domestic and agricultural uses, and thus there are currently insufficient monitoring wells and groundwater elevation data available to inform calculations of total available storage in the Upland Area at MT water level conditions.

13.2.3. Measurable Objective and Interim Milestones for Reduction of Groundwater Storage

☑ **23 CCR § 354.30(c)**
☑ **23 CCR § 354.30(d)**
☑ **23 CCR § 354.30(e)**

Consistent with the analysis presented in **Section 8.4**, a calculation was performed to estimate the volume of groundwater that would be removed from storage in the Principal Aquifer units if groundwater levels were to decline from SGMA Baseline (i.e., 2015) levels to their respective MOs for Chronic Lowering of Groundwater Levels (see **Appendix E**). The results of this analysis are presented below.

13.2.3.1. Main Basin Management Area

Table 13-E presents a summary of estimated available groundwater storage volumes for each Principal Aquifer unit within the Main Basin at MO water level conditions, along with their comparative SGMA Baseline storage volumes. Also provided is an estimate of the percentage of remaining storage volume of each Principal Aquifer unit at MO water levels relative to the SGMA Baseline storage volumes.

Table 13-E. Available Groundwater Storage Estimates at MO Water Levels – Main Basin

Principle Aquifer Unit	SGMA Baseline Groundwater Storage (TAF)	Available Groundwater Storage at Measurable Objective (TAF)	Storage Volume at MO Relative to SGMA Baseline Storage (%)
Upper Aquifer	59 - 113 TAF	47 - 67 TAF	67%
Lower Aquifer (Quaternary Deposits)	102 - 120 TAF	102 - 110 TAF	95%
Lower Aquifer (Upper Livermore Formation)	85 – 170 TAF	85 – 170 TAF	100%
TOTAL (MAIN BASIN)	**246 – 403 TAF**	**234 – 347 TAF**	**90%**

As a whole, the Main Basin storage volume would remain no less than 90% under MO water levels relative to SGMA Baseline conditions, corresponding to a total reduction in groundwater storage of approximately 12 – 56 TAF (10%).

13.2.3.2. Fringe Management Area

Table 13-F presents a summary of estimated available groundwater storage volumes for each Principal Aquifer unit within the Fringe Area at MO water level conditions, along with their comparative SGMA Baseline storage volumes. Also provided is an estimate of the percentage of each Principal Aquifer unit storage volume at MO water levels relative to the SGMA Baseline storage volumes.

Table 13-F. Available Groundwater Storage Estimates at MO Water Levels – Fringe Area

Fringe Subarea	SGMA Baseline Groundwater Storage (TAF)	Available Groundwater Storage at Measurable Objective (TAF)	Storage Volume at MO Relative to SGMA Baseline Storage (%)
North Fringe	74 – 133 TAF	73 – 131 TAF	99%
Northeast Fringe	23 – 46 TAF	21 – 43 TAF	91%
East Fringe	0.3 – 0.6 TAF	0.2 – 0.4 TAF	67%
TOTAL (FRINGE AREA)	**97 – 180 TAF**	**94 – 174 TAF**	**97%**

As a whole, the Fringe Area storage volume would remain no less than 97% under MO water levels relative to SGMA Baseline conditions, corresponding to a total reduction in groundwater storage of approximately 3 – 6 TAF (3%).

13.2.3.3. Upland Management Area

The total groundwater storage of the Upland Area is unknown because it consists of semi-consolidated bedrock of highly variable specific yields and of unknown thickness. The Upland Area provides only very limited groundwater supply for domestic and agricultural uses, and thus there are currently insufficient monitoring wells and groundwater elevation data available to inform calculations of total available storage in the Upland Area at MO water level conditions.

13.2.4. Demonstration of Sustainability

Per CWC 10733.6 (a)(3), this Alt GSP must demonstrate that the Basin has been operating within its sustainable yield for at least 10 years. Relative to the Reduction in Groundwater Storage Indicator, **Figure 8-8** demonstrates that water levels in the RMS-WLs have been maintained above the SMCs for the last 10 years, indicating long-term sustainability and absence of URs. **Figure 8-14** further demonstrates that groundwater storage volumes in the Basin have remained above Reserve Storage volumes, indicating sustainable conditions. Additionally, based on Zone's 7 expansive SGMA Monitoring Network (**Section 14**), sustainable groundwater conditions over the long-term are demonstrated in **Section 8**.

13.3. Seawater Intrusion

13.3.1. Undesirable Results for Seawater Intrusion

§ 354.26. Undesirable Results
(d) An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators.

☑ 23 CCR § 354.26(d)

The 23 CCR § 354.26(d) states that "An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators". Because the Basin is not located near any saline water bodies, seawater intrusion is not present and not likely to occur. The Seawater Intrusion Sustainability Indicator is therefore not applicable to the Basin, and no URs for this Sustainability Indicator are defined herein.

13.3.2. Minimum Threshold for Seawater Intrusion

§ 354.28. Minimum Thresholds

(c) Minimum thresholds for each sustainability indicator shall be defined as follows:

(3) Seawater Intrusion. The minimum threshold for seawater intrusion shall be defined by a chloride concentration isocontour for each principal aquifer where seawater intrusion may lead to undesirable results. Minimum thresholds for seawater intrusion shall be supported by the following:

(A) Maps and cross-sections of the chloride concentration isocontour that defines the minimum threshold and measurable objective for each principal aquifer.

(B) A description of how the seawater intrusion minimum threshold considers the effects of current and projected sea levels.

…

(e) An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators.

☑ **23 CCR § 354.28(c)(3)**
☑ **23 CCR § 354.28(e)**

The Seawater Intrusion Sustainability Indicator is not applicable for the Basin; thus, no MTs for this Sustainability Indicator are defined.

13.3.3. Measurable Objectives and Interim Milestones for Seawater Intrusion

The Seawater Intrusion Sustainability Indicator is not applicable for the Basin; thus, no MOs or IMs for this Sustainability Indicator are defined.

13.4. Degraded Water Quality

Section 8.6 provides a characterization of Basin groundwater quality spatially and over time since 1974, while **Sections 5.2, 8.6**, and **14.2** present information regarding Zone 7's extensive water quality monitoring and management programs, respectively, which include efforts to:

- protect and enhance the quality of the groundwater;
- halt degradation from salt buildup (offset current and future salt loading);
- reduce flow of poorer quality shallow groundwater into deep aquifers;
- offset impacts of water recycling and wastewater disposal through implementation of an integrated Salt Management Plan (SMP; *Zone 7, 2004*)[41] and Nutrient Management Plan (NMP; *Zone 7, 2015c*)[42];

[41] Salt Management Plan, 2004, https://www.zone7water.com/sites/main/files/file-attachments/smp_tocexec-summ.pdf?1619909420

[42] Nutrient Management Plan, Livermore Valley Groundwater Basin, Zone 7 Water Agency, July 2015

- active Basin recharge with relatively low total dissolved solids (TDS)/hardness imported or storm/local surface water; and
- minimize threats of groundwater pollution through implementation of coordinated groundwater protection programs.

Consistent with the above efforts and adaptive management principles, Zone 7 has actively responded to numerous groundwater quality issues over time in the Basin and is committed to working with applicable regulatory agencies to ensure on-going protection of the Basin to meet beneficial uses (e.g., drinking water and agriculture). Key water quality management programs that are either led by or coordinated with Zone 7 are summarized throughout this Alt GSP and will continue throughout the SGMA implementation horizon. As a compliment to the on-going efforts referenced above, this section discusses the development of SMCs for the following specific constituents of concern (COCs) in the Basin:

- TDS and Salt Loading
- Nitrate and Nutrient Loading
- Additional inorganic COCs (Boron and Hexavalent Chromium)
- Per- and polyfluoroalkyl substances (PFAS)

In general, as described in **Section 8.6** and other documents (e.g., the 2004 SMP; 2015 NMP; 2016 Alt GSP; 2020 WY Annual Report) elevated concentrations of these COCs in the Basin are:

- localized,
- being actively managed,
- often elevated due to ambient sources or historical conditions in the Basin,
- not affecting beneficial uses at primary drinking water wells (municipal wells) in the Main Basin (i.e., are reasonably treatable), and
- have not been caused or exacerbated by Basin-wide management for sustainability.

As such, the SMCs presented herein (which are largely based Primary or Secondary Maximum Contaminant levels [MCLs] and the Regional Water Quality Control Board's [RWQCB] Basin Management Objectives [BMOs] that were incorporated by Zone 7 in its 2005 Groundwater Management Plan [GWMP][43] and affirmed in subsequent documents) are designed to support Zone 7's continued sustainable management of the Basin's groundwater quality on a regional basis, while protecting groundwater quality for beneficial uses.

[43] https://www.zone7water.com/sites/main/files/file-attachments/gw-mgmt-plan_2005.pdf?1619906741

13.4.1. Undesirable Results for Degraded Water Quality

☑ 23 CCR § 354.26(a)

SGMA defines an UR for Degraded Water Quality as "significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies" (CWC § 10721(x)). The UR for Degraded Water Quality is defined herein as follows:

An Undesirable Result for degraded water quality within the Basin is experienced if groundwater recharge or extraction causes significant and unreasonable degradation of water quality in the Basin, such that these changes impact to the long-term viability of domestic, agricultural, municipal, environmental, or other beneficial uses over the planning and implementation horizon of this Alt GSP.

Significant and unreasonable changes to water quality associated with Undesirable Results would include a significant increase, on a regional basis, in concentrations of identified COCs above applicable state and federal regulatory thresholds, as a result of groundwater recharge or extraction.

The component of the significant and unreasonable effects definition regarding a regional basis draws a distinction between localized or isolated (e.g., well specific) effects, that are not necessarily under the purview of Groundwater Sustainability Agencies (GSAs) to manage (especially if related to well location and design relative to naturally-occurring or anthropogenically-caused impacts that pre-date SGMA), and broader, groundwater management-related regional effects which can fall under a GSA's purview. This approach is both consistent with the SGMA's definition of URs meaning "…effects caused by groundwater conditions occurring throughout the basin" (emphasis added) (CWC § 10721(x)) and reflects the fact that SGMA does not require GSPs to address URs that occurred before, and have not been corrected by, January 1, 2015. (CWC § 10727.2(b)(4)). In approving Zone 7's 2016 Alt GSP, DWR found that through 2015 Zone 7 had managed the Basin sustainably (i.e., absent of URs). As such it is reasonable to use groundwater conditions in 2015 as an effective "SGMA Baseline" to evaluate any potential further degradation in groundwater quality. Therefore, the UR definition appropriately focuses on whether water quality conditions are significantly and unreasonably degraded as a result of changes in groundwater level or flow.

13.4.2. Potential Causes of Undesirable Results

☑ 23 CCR § 354.26(b)(1)

URs due to Degraded Water Quality are the result of increases in concentrations of COCs in groundwater in the Principal Aquifers of the Basin. These increases in concentration can occur through a variety of processes, some of which are causatively related to groundwater management activities (i.e., potentially under the purview of GSAs) and some of which are not. These can include:

- Declining water levels which can cause lateral migration from adjacent areas with contaminated or poorer quality groundwater, leaching from internal sources such as fine-grained, clay-rich interbeds, or upwards vertical flow from deeper zones below the bottom of the Basin;
- Salt loading from onsite wastewater treatment systems (OWTS) or recycled water use;

- Recharge from managed recharge projects;
- Contact with sediments with naturally-occurring elevated concentrations of a COC;
- Deep percolation of some portion of ineffective precipitation;
- Seepage from various natural and man-made channels;
- Irrigation system backflow into wells and flow through well gravel pack and screens from one formation to another; and/or
- Deep percolation of excess applied irrigation water and other water applied for cultural practices (e.g., for soil leaching).

13.4.3. Criteria Used to Define Undesirable Results

☑ **23 CCR § 354.26(b)(2)**

As discussed further below in **Section 13.4.4 and Section 14.2.5,** the MTs for Degraded Water Quality are established at twelve (12) Representative Monitoring Sites for Degraded Water Quality (RMS-WQs). Based on the significant and unreasonable effects described herein, the criteria for URs for Degraded Water Quality are as follows:

Undesirable Results for Degraded Water Quality are defined to occur within the Basin if and when MTs are exceeded for any of the identified COCs in greater than 25% the RMS-WQs at least two (2) consecutive non-drought years as a result of groundwater recharge or extraction, such that they cannot be managed to provide drinking water supply (i.e., that treatment or blending is not possible or practicable).

The above criteria are justified because they relate to impacts that corresponds to a regional, rather than a well-specific, water quality issue. Similar to the criteria for Chronic Lowering of Groundwater Levels, the component of the criteria requiring at least two consecutive non-drought years of MT exceedances provides for confirmation that the degraded water quality condition is not drought related. Further, the criteria acknowledge that URs only occur if the groundwater cannot be managed to provide drinking water supply (i.e., that treatment or blending is not possible or practicable). These criteria also acknowledge that the Fringe and Upland Areas already have poor water quality (as detailed in **Section 8.6**), so the focus is on preventing widespread contamination as a result of groundwater recharge or extraction that would further limit beneficial uses. For example, if a RMS-WQ already exceeded the MT in 2015, per the above definition, future detections above the MT would not count towards an UR unless the measured concentrations in groundwater at that RMW-WQ had increased *as a result of groundwater recharge or extraction.*

Similarly, and as discussed below, 23 CCR § 354.28 directs that "the Agency shall consider local, state, and federal water quality standards applicable to the basin" in setting the MT. In this Basin, the State Water Resources Control Board (SWRCB), RWQCB, and Alameda County Environmental Health (ACEH) each set regulatory standards and exercise enforcement authority related to water quality. It is important to note that while the standards set by those entities inform the development of the Degraded Water Quality MTs in this Alt GSP, the GSA is not the entity responsible for developing or enforcing those standards, or

remediating impacts of exceedances of those standards under their independent regulatory schemes. Rather, the exceedance levels set by those regulatory agencies serve as a helpful proxy and indicator, in some cases, to identify the circumstances under which degradation of water quality in the basin might arise to a UR under SGMA. Recognizing these overlapping regulatory schemes, and in the interest of avoiding duplication or conflicting requirements, this Alt GSP focuses its MTs on COCs traditionally associated with impairment to groundwater supply or interference with beneficial use.

13.4.3.1. Potential Effects of Undesirable Results

☑ 23 CCR § 354.26(b)(3)

The potential effects of URs caused by Degraded Water Quality on beneficial uses and users of groundwater may include: (1) increased costs to treat groundwater to drinking water standards if it is to be used as a potable supply source; (2) increased costs to blend relatively poor-quality groundwater with higher quality sources for drinking water users; (3) increased costs to purchase bottled water or water softeners; and/or (4) potential reduction in the usable volume of groundwater in the Basin if large areas are impaired to the point that they cannot be used to support beneficial uses and users.

13.4.4. Minimum Threshold for Degraded Water Quality

§ 354.28. Minimum Thresholds
(c) Minimum thresholds for each sustainability indicator shall be defined as follows:
(4) Degraded Water Quality. The minimum threshold for degraded water 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. The minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin. In setting minimum thresholds for degraded water quality, the Agency shall consider local, state, and federal water quality standards applicable to the basin.

☑ 23 CCR § 354.28(c)(4)

The 23 CCR § 354.28(c) states that the MT for Degraded Water Quality shall be the "degradation of water, 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". The regulations further state that the MT "shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin," and that "the Agency shall consider local, state, and federal water quality standards applicable to the basin." This language indicates that MTs for Degraded Water Quality can reasonably be based on concentrations of water quality COCs, as quantified by sampling measurements at the RMS-WQs.

13.4.4.1. Constituents of Concern

As described in **Section 8.6.1** and summarized below, several potential COCs have been identified in Basin groundwater. Per CWC Section 10725, the powers and authorities granted to GSAs to affect sustainable groundwater management under SGMA include, but are not limited to, conducting investigations, registration and metering of groundwater extraction facilities, acquiring surface water or groundwater,

reclaiming waters for subsequent beneficial use, regulating groundwater extraction, and establishing accounting rules for groundwater extraction allocations. SGMA does not empower GSAs to develop or enforce water quality standards; that authority rests with the State Water Resources Control Board (SWRCB), the RWQCB, and, in the case of this Basin, with the Alameda County Environmental Health (ACEH). Because of the non-exclusive purview of GSAs with respect to water quality, and the rightful emphasis on those constituents that may affect the supply and beneficial uses of groundwater, SMCs for water quality in the Basin are developed at the designated RMS-WQs for the following constituents of COCs:

- TDS and Salt Loading. TDS concentrations are measured in 233 wells throughout Basin and analyzed on an annual basis the as part of the Zone 7 Water Quality Monitoring Program and SMP (see **Sections 5.2** and **8.6**). As discussed in **Section 8.6.2**, with some exceptions, TDS concentrations generally meet the Basin Plan Water Quality Objectives (WQOs)/Secondary MCL (Recommended) standard of 500 milligrams per liter (mg/L) in the Main Basin. Any elevated TDS concentrations in drinking water supplies are managed through blending, increased artificial recharge with lower TDS imported water, and wellhead treatment (demineralization). In the Fringe and Upland Areas, TDS concentrations generally exceed the WQOs/Secondary MCL (Upper) of 1,000 mg/L. If TDS concentrations were to significantly increase relative to current conditions, the wells could become unusable for drinking water purposes without significant improvement or could impact the health of sensitive livestock and crops. However, based on historical trends, and the annual salt loading calculations conducted by Zone 7 as part of the SMP[44], it is not anticipated that TDS concentrations will increase significantly relative to current levels in these management areas.
- Nitrate and Nutrient Loading. Nitrate and nutrient (i.e., phosphate) concentrations are measured in 233 wells throughout Basin and analyzed on an annual basis the as part of the Zone 7 Water Quality Monitoring Program and NMP (see **Sections 5.2** and **8.6**). In addition, the municipal wellfields in the Basin have a rigorous groundwater sampling protocol as required by drinking water permits issued by the SWRCB Division of Drinking Water (DDW) to ensure that elevated Nitrate concentrations are not present in drinking water supplies. As discussed in **Section 8.6.3**, with some exceptions, Nitrate and nutrient concentrations in the Main Basin and Fringe Area are generally lower than the applicable regulatory thresholds and do not indicate water quality deterioration over time. Ten local Areas of Concern (AOCs)[45] have been identified with respect to Nitrate that are being addressed through ongoing monitoring of Nitrate in groundwater and

[44] Zone 7's salt loading calculations provide an annual estimate of salt loading to the Basin in tons. Recognizing that salt addition and removal changes from year to year, Zone 7 strives for no long-term net loading. The theoretical salt loading calculations indicate that TDS concentrations are relatively stable at about 700 mg/L throughout the Basin, with small projected decreases expected over time due to Zone 7 management actions.

[45] While a few of the AOCs are believed to have been caused by historical municipal wastewater practices, most high concentrations are caused by historical or ongoing use of onsite wastewater treatment systems (OWTS) and agriculture use including crop and livestock operations (e.g. vineyard fertilizers, cattle, poultry, horse stables) and leaching of decaying vegetation. The occurrence and causes of these nitrate AOCs are based on historical groundwater quality and ongoing sampling through the Zone 7 Groundwater Quality Monitoring Program, as well as Zone 7 investigations of local nitrate sources (including nitrate balances), and the Zone 7 NMP.

coordination with land use agencies for Best Management Practice (BMP) requirements to manage nitrogen loading to the Basin, plus coordination with ACEH on its management program for OWTS (including imposition of a moratorium on additional OWTSs).

- Boron. Boron concentrations are measured in 233 wells throughout Basin and analyzed on an annual basis the as part of the Zone 7 Water Quality Monitoring Program (see **Sections 5.2** and **8.6**). As discussed in **Section 8.6.4**, Boron is a naturally-occurring element in the Basin related to the occurrence of alkali/marine sediments (particularly prevalent in eastern watersheds). However, if elevated Boron concentrations are detected in the Basin's municipal wellfields, beneficial uses (drinking water and agriculture) could be affected. Potential effects could include potential health issues related to excessive boron in drinking water and potential adverse effects on sensitive crops and landscaping.
- Hexavalent Chromium. Chromium (Cr) concentrations are measured in 233 wells throughout Basin and analyzed on an annual basis the as part of the Zone 7 Water Quality Monitoring Program (see **Sections 5.2** and **8.6**As discussed in **Section 8.6.5**, Chromium is a heavy metal that occurs naturally throughout the environment, including the Basin, associated with serpentinite-containing rock or chromium-containing geologic formations. Given the occurrence of locally elevated chromium concentrations in the Basin (which Zone 7 conservatively assumes is entirely Cr VI)[46], Zone 7 (with approval of the SWRCB DDW) blends water produced from any affected wells with other sources of water as needed to minimize any potential risk of MCL exceedance in delivered water. This protects the municipal drinking water use of groundwater consistent with Zone 7 BMOs and avoids URs.
- PFAS. PFAS are a large group of human-made chemicals that do not occur naturally and are classified by the United States Environmental Protection Agency (USEPA) as "contaminants of emerging concern" (CECs). Zone 7 began sampling for PFAS compounds in the 2019 Water Year (WY). Based on the detections in some of the supply wells and the limited set of monitoring wells sampled, Zone 7 retained Jacobs Engineering, Inc. to conduct a PFAS Potential Source Investigation (*Jacobs, 2020*)[47]. The investigation, which concluded in December 2020, included recommendations for additional sampling of existing monitoring wells. Those wells will be incorporated into the 2021 WY sampling program.

As discussed in **Section 14.2.4**, drinking water wells are used as RMS-WQs so that they inherently consider groundwater quality effects on sensitive beneficial uses (i.e., drinking water users) and are also already sampled for constituents of health concern on a regular and known schedule (i.e., compliance with Title 22 CCR drinking water regulations for Primary MCLs). As part of Zone 7's overall management of the Basin,

[46] The Zone 7 Water Quality Monitoring Program monitors for total chromium without distinction of CrIII (a required nutrient with very low toxicity) from CrVI, which is more toxic. To be conservative, Zone 7 assumes that the total chromium concentration is exclusively CrVI.

[47] Jacob's PFAS Potential Source Investigation Report and other information on PFAS are located on the Zone 7 website: http://www.zone7water.com/pfas-information.

additional wells are regularly sampled and used for continued evaluation of groundwater quality trends within the Basin.

13.4.4.2. Toxic Sites

As discussed in **Section 8.6.7**, multiple toxic sites—where groundwater has been contaminated from anthropogenic sources—pose a potential threat to drinking water. Primary responsibility for toxic site regulation, investigation, monitoring and remediation lies with federal and state agencies. Nonetheless, these sites are addressed by Zone 7 in its BMO to minimize threats of groundwater pollution through groundwater protection and its ongoing sustainable groundwater management. This includes its Toxic Sites Surveillance (TSS) Program wherein Zone 7 gathers information on toxic sites from state, county, and local agencies, as well as from Zone 7's well permitting program and the SWRCB's GeoTracker website. The information is compiled in a geographic information systems (GIS) database, which serves as a basis for inter-agency coordination. In general, the TSS Program has found two basic causes of contamination threatening groundwater in the Basin, releases of petroleum-based fuel products (e.g., from gas stations) and releases of industrial chemical contaminants (e.g., dry cleaners and electronics and automotive industries). These sites are addressed by state and federal agencies, in cooperation with Zone 7, at a site-specific level. Given those overlying authorities, and the fact that programs are already in place to address these sites, no additional or specific SMCs have been developed to target these sites, which will be addressed on a case-by-case basis as they are identified by the TSS Program and referred to appropriate enforcement agencies.

13.4.4.3. Consideration of State, Federal and/or Local Standards

The State of California and the USEPA set Primary MCLs for constituents that may pose potential human health risks. Secondary MCLs are also established to address aesthetic concerns. As discussed above, although the GSA is not the entity responsible for developing or enforcing the MCLs, the Primary and Secondary MCLs serve as a useful quantitative tool to consider when establishing MTs under SGMA for Degraded Water Quality. g. The WQOs specified in the RWQCB's Basin Plan are also used to inform MT development, as well as other pertinent regulatory criteria.

13.4.4.4. Minimum Thresholds for Degraded Water Quality

As described below, to account for pre-2015 (i.e., SGMA Baseline) background concentrations and variations in groundwater quality data, the MTs for Degraded Water Quality are set for the applicable COCs at the greater of: (1) their respective MCLs or other appropriate regulatory criteria, or (2) the SGMA Baseline concentration plus maximum historical data range. The final MTs are shown in **Table 13-G**. It should be noted that monitoring for these and other water quality parameters will continue to be conducted at all water quality monitoring well locations as part of the Zone 7 Water Quality Monitoring Program, as discussed further in **Section 14.2.4**.

$$MT = MCL \text{ or } Other\ Regulatory\ Criteria$$

$$or$$

$$MT = SGMA\ Baseline\ plus\ Maximum\ Annual\ Rate\ of\ Water\ Quality\ Change$$

- TDS and Salt Loading. The MT for TDS is established at the Upper Secondary MCL (based on aesthetics, such as taste and odor) of 1,000 mg/L or the SGMA Baseline concentrations plus maximum historical data range, whichever is greater, for all Management Areas in the Basin. These MTs are consistent with state and federal standards for drinking water quality, and background, pre-SGMA concentrations. Trends toward the MT or exceedances that are correlated to Zone 7 management actions will trigger management responses by Zone 7 in collaboration with the other municipal pumpers in the Basin. The responses can involve short-term actions including further investigation (e.g., resampling or investigation of causes) and reduction of pumping of the affected well along with redistribution of pumping or provision of other supplies to maintain a high-quality supply to customers. Longer-term actions include the salt management strategies identified in the SMP, such as artificially recharging the Basin with low TDS imported water when available; pumping and delivering additional groundwater to customers so more salts are exported as wastewater; and operating the Mocho Groundwater Demineralization Plant. Overall, the MTs will protect groundwater quality for beneficial uses and users of groundwater and, given the resultant reliable high quality water supply, will protect land uses and property interests.
- Nitrates and Nutrient Loading. The concentration of 10 mg/L for Nitrate (as N) or the SGMA Baseline concentrations plus maximum historical data range, whichever is greater, serves as the MT for all Management Areas within the Basin. This approach is consistent with the federal and state Primary MCL for drinking water, the Basin WQOs, and the expectations of SGMA. Zone 7 conducts ongoing monitoring of Nitrate in groundwater and coordinates with land use agencies for BMP requirements to manage nitrogen loading to the Basin and with ACEH on its management program for OWTS. Overall, the MT will protect groundwater quality for beneficial uses and users of groundwater (most notably domestic well owners). Such protection of rural water supply will support land uses and property interests, although a local moratorium on OWTS may require some landowners to seek alternatives to OWTS (e.g., local community wastewater systems).
- Boron. While there is no MCL for boron, the USEPA has identified a Health Reference Level (HRL) of 1,400 micrograms per liter [µg/L] (1.4 mg/L). Boron also becomes a problem for certain irrigated crops when present at levels above 1,000 or 2,000 µg/L, depending on the crop sensitivity. As such, the MT is set at 1,400 µg/L or the SGMA Baseline concentrations plus maximum historical data range, whichever is greater, for all Management Areas within the Basin. This is a conservative threshold that is protective of human health as well as sensitive crops and landscaping plants. Boron is a naturally-occurring constituent, but its distribution can be affected by Basin-wide management activities. Management actions for Boron are included in the salt management strategies identified in the SMP, such as artificially recharging the Basin with low TDS imported water when available; pumping and delivering additional groundwater to customers so more salts are exported as wastewater; and operating the Mocho Groundwater Demineralization Plant.
- Hexavalent Chromium. For hexavalent chromium (CrVI), the MCL of 50 µg/L (0.05 mg/L) or the SGMA Baseline concentrations plus maximum historical data range, whichever is greater, serves

as the MT for all Management Areas within the Basin[48]. It is noted that this approach is conservative as some uncertainty exists with regard to concentrations of CrVI in the Basin. Specifically, the Zone 7 Water Quality Monitoring Program monitors for total chromium without distinction of CrIII (a required nutrient with very low toxicity) from CrVI, which is more toxic. To be conservative, Zone 7 assumes that the total chromium concentration is exclusively CrVI. When excessive concentrations are detected in one or more municipal supply well(s), Zone 7 (with approval of the SWRCB DDW) blends water produced from the affected well(s) with other sources of water as needed to minimize any potential risk of MCL exceedance in delivered water. This protects the municipal drinking water use of groundwater consistent with Zone 7 BMOs and avoids URs.

- PFAS. There are currently no federal or state regulatory standards (e.g., MCLs) for PFAS. As such, Zone 7 has not established any SMCs for PFAS. This issue will be addressed in the next Alt GSP update once additional data have been collected and regulatory criteria established.

Table 13-G. SMCs for Degraded Water Quality

RMS-WQ	TDS and Salt Loading (mg/L)		Nitrates and Nutrient Loading (mg/L)		Boron (µg/L)		Hexavalent Chromium (µg/L)	
	MT	MO	MT	MO	MT	MO	MT	MO
3S1E20C007	800	500	10	10	1,400	1,400	50	50
3S1E20C008	754	500	10	10	1,400	1,400	50	50
3S1E09P005	1,308	500	10	10	1,400	1,400	50	50
3S1E09P010	617	500	10	10	1,400	1,400	50	50
3S1E11G001	962	500	19	10	1,400	1,400	50	50
3S1E12K003	596	500	10	10	1,400	1,400	50	50
3S2E08K002	696	500	16	10	1,400	1,400	50	50
3S2E08H003	718	500	15	10	1,400	1,400	50	50
3S1E06F003	3,655	1,000	10	10	4,590	1,400	50	50
2S2E34E001	1,000	1,000	10	10	4,720	1,400	50	50
3S2E24A001	1,179	1,000	38	10	2,400	1,400	50	50
3S2E21K009	1,000	1,000	10	10	1,400	1,400	50	50

[48] Prior to August 2017, the Basin BMO and the MT in the 2016 Alternative GSP had been set at the MCL for hexavalent chromium (CrVI), which was 10 µg/L. In August 2017, under orders of the Superior Court, the SWRCB withdrew the CrVI regulation from the California Code of Regulations (CCR). Until the SWRCB establishes a new MCL for CrVI, they have returned to using the more general total Cr MCL of 50 µg/L to ensure public water systems are safe. Since all the minimum thresholds in the Alternative GSP have been set based on the State's drinking water standards, Zone 7 adjusted the MT and MO for Cr to match the State's Cr MCL that is in effect; currently 50 µg/L.

13.4.5. Measurable Objectives and Interim Milestones for Degraded Water Quality

☑ 23 CCR § 354.30(c)
☑ 23 CCR § 354.30(e)

As with the MTs, the MOs for Degraded Water Quality are defined at the RMS-WQ in the Basin for the identified COCs, considering appropriate regulatory criteria while maintaining concentrations at approximately current levels, see **Table 13-G**. As current concentrations are below the MOs in most cases (i.e., meaning current water quality is better than MO), setting IMs for Degraded Water Quality based on extrapolation between current concentrations and the MOs would suggest that current water quality needs improvement to achieve MO. Therefore, setting variable IMs is not considered applicable unless current concentrations at the RMS-WQ are greater than the MO, in which case the IMs represent a linear interpolation between current concentrations and the MO.

- TDS and Salt Loading. For the Main Basin, the MO for TDS is established at the Recommended Secondary MCL (based on aesthetics, such as taste and odor) of 500 mg/L. For the Fringe and Upland Areas, the MO for TDS is established at the Upper Secondary MCL of 1,000 mg/L or 2015 concentrations, whichever is greater. These MOs reflect the historical variation in water quality across the Basin and are consistent with state and federal standards for drinking water quality, as well as background, pre-SGMA concentrations.
- Nitrates and Nutrient Loading. The concentration of 10 mg/L for Nitrate (as N) is established as the MO for all Management Areas within the Basin, which the Federal and State Primary MCL for drinking water.
- Boron. The HRL of 1,400 µg/L is established as the MO for all Management Areas within the Basin.
- Hexavalent Chromium. The Primary MCL of 50 µg/L is established as the MO for all Management Areas within the Basin.
- PFAS. There are currently no federal or state regulatory standards (e.g., MCLs) for PFAS. As such, Zone 7 has not established any SMCs for PFAS. This issue will be addressed in the next Alt GSP update once additional data have been collected and regulatory criteria established. However, Zone 7 manages and treats groundwater to meet current regulatory requirements for drinking water supply and plans to be in compliance with future water quality standards.

13.4.6. Demonstration of Sustainability

Per CWC 10733.6 (a)(3), this Alt GSP must demonstrate that the Basin has been operating within its sustainable yield for at least 10 years. Relative to the Degradation of Water Quality Sustainability Indicator, **Figure 8-19,Figure 8-25, Figure 8-31,** and **Figure 8-34** demonstrate that water quality in the RMS-WQs have been maintained below the corresponding MTs, or consistent with background levels, for the last 10 years, indicating long-term sustainability and absence of URs (i.e., there is no indication that water quality conditions have been significantly and unreasonably degraded *"as a result of groundwater recharge or extraction."*). TDS was detected above the MT in one RM-WQs, see **Figure 8-19**, but not as a result of groundwater recharge or extraction.

13.5. Land Subsidence

Generally, land subsidence is the lowering of land surface over a large area. It is most often the result of artificial causes such as excessive groundwater pumping, fracking, or mining activities. Natural phenomenon such as earthquakes and tectonic movement can also cause land subsidence. Two distinct types of land subsidence could occur from groundwater pumping: (1) the elastic (recoverable) subsidence that is temporary and reversible as groundwater levels recover, and (2) inelastic (permanent) subsidence, which results in the permanent lowering of the land surface even after pumping stops.

Although, there are no historical records of significant and unreasonable land subsidence within the Basin that has substantially interfered with surface land uses to date, Zone 7 Water Agency has recognized subsidence as a potential UR. For example, the 2005 GWMP includes a BMO that has been implemented by Zone 7 over the past ten years, that calls for monitoring and prevention of inelastic land surface subsidence as a result of groundwater withdrawals and specified that Zone 7:

- Protect the storage capacity of aquifer;
- Maintain water levels above historic lows;
- Monitor and minimize any identified impacts of gravel mining on the upper aquifer by encouraging the implementation of mitigation measures by mining companies; and
- Monitor benchmark elevations and shift pumping to other wells if inelastic subsidence is detected.

In addition, the adoption of the Well Master Plan Environmental Impact Report in 2005 (*Zone 7 WMP EIR, 2005b*) required the continuation of Zone 7's Land Surface Elevation Monitoring Program (see **Section 14.2.5**), as did the 2016 Alt GSP.

13.5.1. Undesirable Results for Land Subsidence

☑ 23 CCR § 354.26(a)

SGMA defines an UR for Land Subsidence as "significant and unreasonable land subsidence that substantially interferes with surface land uses" (CWC § 10721(x)). The UR for Land Subsidence is defined herein as follows:

An Undesirable Result for land subsidence would be experienced if the occurrence of land subsidence substantially interferes with beneficial uses of groundwater and infrastructure within the Basin during the planning and implementation horizon of this Alt GSP.

The above definition of significant and unreasonable effects is developed recognizing that small amounts of subsidence could occur without negatively affecting the ability to use the critical infrastructure, and that only to the extent that subsidence causes a loss of functional capacity does it qualify as significant and unreasonable.

13.5.1.1. Potential Causes of Undesirable Results

☑ 23 CCR § 354.26(b)(1)

Land subsidence can be caused by several mechanisms, but the mechanism most relevant to sustainable groundwater management activities under the authority of GSAs is the depressurization of aquifers and aquitards due to lowering of groundwater levels, which can lead to compaction of compressible strata and lowering of the ground surface. Therefore, the potential causes of URs due to Land Subsidence are generally the same as the potential causes listed above for URs due to Chronic Lowering of Groundwater Levels (i.e., increased pumping and/or reduced recharge).

13.5.1.2. Criteria Used to Define Undesirable Results

☑ 23 CCR § 354.26(b)(2)

As discussed in **Section 8.7**, measured vertical displacement in the Basin has been minor to date indicating that land subsidence and damage to critical infrastructure is not a significant concern in the Basin, based on the best available information. Furthermore, observed land surface elevation changes is within the range Zone 7 considers to be "elastic deformation" (i.e., rebounds to the original elevation when groundwater levels return to previous levels). Given that land subsidence and lowering of groundwater levels are closely related, it is reasonable to expect that the MTs for Chronic Lowering of Groundwater Levels will be protective to prevent significant and unreasonable effects from land subsidence in the Basin (*Zone 7 WMP EIR, 2005b*).

As such, the criteria used to define URs for Land Subsidence are consistent with the criteria used to define URs for Chronic Lowering of Groundwater Levels, as follows, with one addition:

Undesirable Results for Chronic Lowering of Groundwater Levels would be experienced in the Basin if water levels in greater than 25% of the RMS-WLs decline below their respective MTs for two consecutive years that are categorized as non-drought years (normal, above-normal, or wet), according to the Sacramento Valley Water Year Hydrologic Classification, that result in a confirmed decrease of 0.4 feet of land surface in any given cycle with a goal of experiencing no inelastic subsidence spatially and temporally.

Publicly available subsidence data including Interferometric Synthetic Aperture Radar (InSAR) data will continue to be evaluated as part of Alt GSP implementation. Should any indication of subsidence begin to be observed in the Basin, that issue will be addressed in future Alt GSP updates, as needed.

13.5.1.3. Potential Effects of Undesirable Results

☑ 23 CCR § 354.26(b)(3)

As documented in **Section 8.7**, no inelastic land subsidence has been observed in the Basin during the duration of the current Land Surface Elevation Monitoring Program includes 18 years of data (i.e., 2002 to 2020), nor anytime covered by two historical research efforts: 1992-2016 (*TRE, 2016*) and 1947-1980 (*Altamont Land Surveyors, 1994*). However, because alluvial aquifers are present under the urban area of the Basin, significant and unreasonable inelastic subsidence would represent a potential UR, with

several potential effects on beneficial uses and users of groundwater and on land uses and property interests. These could include:

- Potential differential subsidence affecting the gradient of surface drainage channels, locally reducing the capacity to convey floodwater and causing potential nuisance ponding and seepage; the westernmost portion of the Basin is crossed by a system of engineered stream channels and canals the grades of which are constructed and maintained to minimize flooding problems.
- Potential differential subsidence affecting the grade of other infrastructure such as transportation facilities; the western Basin is urbanized, crossed by two interstate highways and BART.
- Potential differential subsidence affecting State Water Project (SWP) South Bay Aqueduct (SBA) and other conveyance facilities such that conveyance capacities are impacted.
- Potential subsidence around a pumping well, disrupting wellhead facilities or resulting in casing failure.
- Potential non-recoverable loss of groundwater storage as fine-grained layers collapse.

13.5.2. Minimum Threshold for Land Subsidence

§ 354.28. Minimum Thresholds
(c) Minimum thresholds for each sustainability indicator shall be defined as follows:
(5) Land Subsidence. 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. Minimum thresholds for land subsidence shall be supported by the following:
(A) Identification of land uses and property interests that have been affected or are likely to be affected by land subsidence in the basin, including an explanation of how the Agency has determined and considered those uses and interests, and the Agency's rationale for establishing minimum thresholds in light of those effects.
(B) Maps and graphs showing the extent and rate of land subsidence in the basin that defines the minimum threshold and measurable objectives.

☑ **23 CCR § 354.28(c)(5)**

13.5.2.1. Main Basin and Fringe Management Areas

The GSP regulations allow GSAs to use groundwater levels as a proxy metric for the land subsidence sustainability indicator if there is a correlation between groundwater levels and the land subsidence. The 2005 WMP EIR indicated that the potential for inelastic (permanent) subsidence in the Main Basin increases as groundwater levels approach historic lows. There is limited potential for subsidence in the Fringe Area due to the prevalence of semi-consolidated bedrock. Therefore, Zone 7 has long concluded that groundwater elevations in the Main Basin and Fringe Management Areas can be used as a guide for subsidence prevention. The resultant MTs for the RMS-WLs within the Basin are shown in **Table 13-H** and **Figure 8-8** and discussed in more detail in **Section 14.4**.

Table 13-H. SMCs for Land Subsidence

RMS[1] Well		Management Area/Unit			Historical Conditions (ft)			SMCs[3] Water Levels				
Well Name	Map	Area	Subarea	Aquifer	Historic Low	Maximum Decrease[2]	Historic Low + Max Decrease	Minimum Threshold[4]	IM-5[5]	IM-10	IM-15	Measureable Objective[6]
3S1E20C007	20C7	Main	Bernal	Upper	179.5	-34.7	144.8	144.8	153.4	162.1	170.8	179.5
3S1E20C008	20C8	Main	Bernal	Lower	179.5	-34.7	144.8	144.8	153.4	162.1	170.8	179.5
3S1E09P005	9P5	Main	Amador West	Upper	206.7	-26.9	179.8	179.8	186.5	193.2	199.9	206.7
3S1E09P010	9P10	Main	Amador West	Lower	206.7	-26.9	179.8	179.8	186.5	193.2	199.9	206.7
3S1E11G001	11G1	Main	Amador East	Upper	219.9	-38.9	181.0	181.0	190.7	200.4	210.2	219.9
3S1E12K003	12K3	Main	Amador East	Lower	219.9	-38.9	181.0	181.0	190.7	200.4	210.2	219.9
3S2E08K002	8K2	Main	Mocho II	Upper	293.1	-38.0	255.1	255.1	264.6	274.1	283.6	293.1
3S2E08H003	8H3	Main	Mocho II	Lower	293.1	-38.0	255.1	255.1	264.6	274.1	283.6	293.1
3S1E06F003	6F3	Fringe	Northwest	Upper	314.6	-9.7	305.0	305.0	307.4	309.8	312.2	314.6
2S2E34E001	34E1	Fringe	Northeast	Upper	491.2	-3.0	488.2	488.2	489.0	489.7	490.5	491.2
3S2E24A001	24A1	Fringe	East	Upper	678.3	-2.8	675.5	675.5	676.2	676.9	677.6	678.3

[1] RMS = Representative Monitoring Site
[2] Maximum Single Year Seasonal Decrease (Spring to Fall)
[3] Sustainable Management Criteria
[4] Historic Low + Maximum Seasonal Decrease
[5] IM-# = Interim Milestone at # years
[6] Measurable Objective = Historic Low

As such, it is reasonable to relate the Land Subsidence Sustainability Indicator with the Chronic Lowering of Groundwater Levels Sustainability Indicator, with the additional constraint that no more than 0.4 feet of inelastic subsidence can occur in any year.

If these MTs are triggered, an analysis of the factors influencing the ground surface elevation will be undertaken. Other preventative actions may include shifting groundwater extraction to other wells and/or placing a moratorium on all new well construction in the area of concern until levels recover or the investigation determines that other factors are likely causing subsidence (such as fault movement or shallow expansive soils). Two factors fundamental to assessing and preventing the exceedance of these MTs are: (1) land surface monitoring, and (2) groundwater level monitoring. Both are included in Zone 7's Monitoring Program (see **Section 14**).

13.5.2.2. Upland Management Area

In the Upland Area the prevalence of semi-consolidated bedrock means that there is very limited potential for subsidence. As such, no MTs for subsidence are established in the Upland Area.

13.5.3. Measurable Objectives and Interim Milestones for Land Subsidence

☑ **23 CCR § 354.30(c)**
☑ **23 CCR § 354.30(d)**
☑ **23 CCR § 354.30(e)**

13.5.3.1. Main Basin and Fringe Management Areas

As discussed in **Section 13.5.2**, the Land Subsidence Sustainability Indicator and the Chronic Lowering of Groundwater Levels Sustainability Indicator are closely linked. As with the MTs, the MOs and IMs for Chronic Lowering of Groundwater Levels are used as proxy for the Land Subsidence Sustainability Indicator and would provide an adequate Margin of Operational Flexibility. It is therefore unnecessary to set a unique MO and IM for Land Subsidence in the Main Basin and Fringe Area.

13.5.3.2. Upland Management Area

In the Upland Area the prevalence of semi-consolidated bedrock means that there is very limited potential for subsidence. As such, no MOs for Land Subsidence are established in the Upland Area.

13.5.4. Demonstration of Sustainability

Per CWC 10733.6 (a)(3), this Alt GSP must demonstrate that the Basin has been operating within its sustainable yield for at least 10 years. Relative to the Land Subsidence Sustainability Indicator, **Figure 8-8** demonstrates that water levels in the RMS-WLs have been maintained above the SMCs for the last 10 years, indicating long-term sustainability and absence of URs. **Figure 8-B** further demonstrates that land subsidence rates have not exceeded 0.4 feet. Additionally, based on Zone's 7 expansive SGMA Monitoring Network (**Section 14**), sustainable groundwater conditions over the long-term are demonstrated in **Section 8**.

13.6. Interconnected Surface Water

This section describes the proposed SMCs for Depletions of Interconnected Surface Water, including the URs, MOs and MTs for areas of the Basin that have likely ICSW and/or GDEs. These SMCs were developed in consideration of the CWC §10727.2(b)(4) which states that the Plan may, but is not required to, address URs that occurred before, and have not been corrected by, January 1, 2015. It is further noted that the GSP Emergency Regulations (23-CCR § 354.28(c)) state that the SMCs for a given Sustainability Indicator can be set by using groundwater levels as a proxy, which is the approach utilized herein.

13.6.1. Undesirable Results for Interconnected Surface Water

☑ 23 CCR § 354.26(a)

URs are defined in the SGMA as "when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin". For Depletions of ICSW, SGMA defines an UR as "depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water".[49]

[49] CWC § 10721(x) (6)

As shown in **Appendix F**, based on information provided by The Nature Conservancy (TNC),[50] the area-weighted average change in the size of the GDE areas between 2014 and 2018 within the Basin was approximately 40% (i.e., the mapped GDE area in 2014 was 40% smaller than the GDE areas mapped in 2018).[51] Based on this change in GDE area analysis, a 40% reduction in GDE area is within the historical range of GDE area fluctuation under recently-observed, post-SGMA hydrologic conditions.

As such, the URs for Depletions of ICSW would be experienced in the Basin when groundwater extractions in the Basin cause significant and unreasonable depletions of hydrologically connected surface water, such that beneficial uses and users of the surface water (including the likely GDEs and protected species) are significantly and unreasonably harmed. Specifically, a significant and unreasonable negative effect would be experienced if the health of the GDE areas in the Basin are adversely impacted by mechanisms that can be directly attributed to pumping-related lowering of groundwater levels over time, rather than effects of natural or climactic processes and/or unfavorable hydrologic conditions or land use changes.

This UR definition is preliminary pending the collection of additional data. At this time, as described above, the relationship between ICSW, GDE health and groundwater conditions has not been definitively determined and the ability of Zone 7 to manage the ICSW and GDE areas is limited given the significant other factors that impact their occurrence and health (e.g., climate, hydrology, invasive species, land development, etc.). Furthermore, if groundwater levels in the vicinity of ICSW (and the co-located GDEs) remain too high, Zone 7's ability to actively manage the Basin through recharge operations will be negatively impacted. Consideration of all the above was included as part of the development of the SMCs. Zone 7 will continue to monitor the ICSW and GDE areas and may refine the definition of URs once the information regarding the relationship between the occurrence of ICSW and GDEs and the management of the Basin is better understood.

13.6.1.1. Potential Causes of Undesirable Results

☑ 23 CCR § 354.26(b)(1)

Depletions of ICSW are generally correlated to Chronic Lowering of Groundwater Levels in a system of ICSW and groundwater. Therefore, the potential causes of URs for the Depletions of ICSW are generally the same as the potential causes for URs due to Chronic Lowering of Groundwater Levels, including increased groundwater pumping and reduced recharge. Additional causes directly related to surface

[50] Statewide raster data that show Normalized Derived Vegetation Index (NDVI) trends are provided by TNC on 30 August 2021. Since NDVI is used to estimate vegetation greenness and provides a proxy for vegetation growth, change in GDE area can be estimated using TNC GDE Pulse raster data that shows the NDVI trends between 2014 and 2018. Moderate to large increases in NDVI trends represent an increase in the GDE area and moderate to large decreases in NDVI trends represent a decrease in the GDE area. Therefore, the change in GDE area can be estimated by subtracting GDE area with decreasing NDVI trends from GDE area with increasing NDVI trends.

[51] Since the Plan is not required to address undesirable results that occurred before, and have not been corrected by January 1, 2015 (Water Code Section 10727.2 (b)(4)), 2014 is selected as the start of the analysis timeframe. 2018 is selected as the end of the analysis timeframe since it is a recent wet year when GDE conditions might be above average.

water bodies can also influence depletions including, but not limited to, hydrology, increased diversions, reduced return flows, and water consumption by riparian vegetation. Additional causes related to GDEs can include hydrology, land use changes and the occurrence of invasive species, among other things. Currently there are little to no quantitative data regarding the impacts from these potentially contributing causes to ICSW and GDEs within the Basin.

13.6.1.2. Criteria Used to Define Undesirable Results

☑ 23 CCR § 354.26(b)(2)

Per Section 354.26(b)(2) of the GSP Emergency Regulations, the description of URs must include a quantitative description of the combination of MT exceedances that constitute an UR. The MTs for Depletions of ICSW are described below in **Section 13.6.2**.

Based on application of the MTs at the Representative Monitoring Sites for Interconnected Surface Water (RMS-ICSW) and the significant and unreasonable negative effect discussed above, URs will be experienced if and when Depletions of Interconnected Surface Water occur as a result of unsustainable groundwater extraction such that groundwater levels decline below their MTs in greater than 40% of the RMS-ICSW for more than two consecutive non-drought years.

This UR criteria is preliminary pending the collection of additional data. At this time, as described above, the relationship between ICSW, GDE health and groundwater conditions has not been definitively determined and the ability of Zone 7 to manage the ICSW and GDE areas is limited given the significant other factors that impact their occurrence and health (e.g., climate, hydrology, invasive species, land development, etc.). Furthermore, if groundwater levels in the vicinity of ICSW (and the co-located GDEs) remain too high, Zone 7's ability to actively manage the Basin through recharge operations will be negatively impacted. Consideration of all the above was included as part of the development of the SMCs. Zone 7 will continue to monitor the ICSW and GDE areas and may refine the criteria used to determine URs once the data gaps are filled, additional information are gathered and the relationship between the occurrence of ICSW and GDEs and the management of the Basin is better understood.

13.6.1.3. Potential Effects of Undesirable Results

☑ 23 CCR § 354.26(b)(3)

Potential effects of URs for Depletion of Interconnected Surface Water may include impacts to environmental users, such as likely GDEs, critical habitat for federally listed species, special-status plants, and special-status terrestrial and aquatic wildlife species, as discussed in **Section 8.7**. Furthermore, there may be reduced surface water flows to support downstream or in-stream uses. Conversely, if groundwater levels in the vicinity of ICSW (and the co-located GDEs) remain too high, Zone 7's ability to actively manage the Basin through recharge operations will be negatively impacted. Consideration of all the above was included as part of the development of the SMCs.

13.6.2. Minimum Threshold for Depletions of Interconnected Surface Water

§ 354.28. Minimum Thresholds
(6) Minimum thresholds for each sustainability indicator shall be defined as follows:
(7) Depletions of Interconnected Surface Water. 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. The minimum threshold established for depletions of interconnected surface water shall be supported by the following:
(A) The location, quantity, and timing of depletions of interconnected surface water.
(B) A description of the groundwater and surface water model used to quantify surface water depletion. If a numerical groundwater and surface water model is not used to quantify surface water depletion, the Plan shall identify and describe an equally effective method, tool, or analytical model to accomplish the requirements of this Paragraph.

☑ **23 CCR § 354.28(c)(6)**

The sections below discussed the development of MOs, IMs, and MTs for Depletions of ICSW.

The GSP Emergency Regulations (23 CCR 354.28(c)) state that the MT for Depletions of ICSW "shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial users of the surface water and may lead to undesirable results". Based on the analysis presented in **Sections 8.7**and **8.8**, where sufficient data are available, a reasonable correlation exists between groundwater levels in the monitoring wells included in the RMS-ICSW and the ICSW and GDE conditions. As such, for the purposes of developing SMCs, water levels in those monitoring wells are used as a proxy for developing the MTs.

13.6.2.1. Minimum Threshold Development

☑ **23 CCR § 354.28(c)(6)(A)**
☑ **23 CCR § 354.28(c)(6)(B)**

MTs are the numeric criteria for each Sustainability Indicator that, if exceeded, may cause URs for that indicator or for other indicators by proxy. This section describes the MTs that have been developed to avoid URs related to the of Depletions of ICSW in the Basin.

Water levels are considered reasonably effective (and the best available) criteria because they can be utilized to help maintain conditions and instream flows that support environmental water users and, in the case of Zone 7, Basin recharge operations. A composite map of historic lows observed in the Upper Aquifer, as shown on **Figure 8-9**, has been prepared by Zone 7. For several decades, Zone 7 has operated the Basin to maintain water levels above historic low levels throughout the Main Basin [without causing URs] (*Zone 7, 2016e*). Water levels outside of the Main Basin have not fluctuated significantly over time, and no areas of significant downward trends [or areas with URs] have been identified (*Zone 7, 2016e*).

Generally consistent with the definition used for the SMCs for the Chronic Lowering of Groundwater Levels, the MT for the Depletions of ICSW is defined as the historic low water level at the wells included

in the Representative Monitoring Sites for Interconnected Surface Water (RMS-ICSW). The resultant MTs for the RMS-ICSW within the Basin are shown in **Table 13-I** and **Figure 13-1**. Where historical water level measurements are not available, estimated values at the RMS-ICSWs are sourced from the groundwater elevation rasters developed by Zone 7 as discussed in **Section 8.3**. **Appendix F** shows the hydrograph and SMC for the Depletions of ICSW for each RMS-ICSW.

Currently there are no significant quantitative data representing negative impacts from the contributing causes identified in **Section 13.6.1.1** to ICSW and GDEs within the Basin. Therefore, historical groundwater conditions are concluded to be sufficient to sustain ICSW and GDEs within the Basin.

As discussed in **Section 14.2.6**, the 10 stream stations located along the potential ICSW within the Basin (as shown in **Table 14-4**) will record either flow rates and/or gauge heights. These data, combined with water level measurements from the RMS-ICSW wells, will better quantify relationships between measured changes in groundwater levels and surface water flows that can help ensure that these MTs are protective and will allow for refinement of the SMC approach over time.

Table 13-I. SMCs for Depletions of Interconnected Surface Water

Well Name	Minimum Thresholds (ft msl)	Interim Milestones (ft msl)			Measurable Objectives (ft msl)
		IM-5	IM-10	IM-15	
2S2E27P002	501.0	501.0	501.0	501.0	501.0
2S2E34E001	491.2	492.1	492.4	492.7	493.0
3S1E05K006	326.0	328.2	328.2	328.2	328.2
3S2E30D002	401.0	403.8	404.7	405.6	406.5
3S1E16P005	285.2	285.2	285.2	285.2	285.2
3S2E33G001	501.0	501.1	501.2	501.2	501.3
3S2E29F004	437.8	441.2	442.3	443.5	444.6
3S2E33C001	482.1	484.2	484.8	485.5	486.2
3S1E02R001	345.3	349.4	350.8	352.2	353.6
3S1E02N006	331.5	333.9	333.9	333.9	333.9
3S2E16E004	466.9	466.9	466.9	466.9	467.0
3S2E23E001	595.4	595.4	595.4	595.4	595.4
4S2E01A001	781.2 *	781.2 *	781.2 *	781.2 *	781.2 *
3S2E32E007	591.4	591.4	591.4	591.4	591.4

* RMS 4S2E01A001 is a new well and there are insufficient water level data to establish an MT, MO, and IM based on historical water levels. As such, initial MT, MO, and IM for this RMS are based on the minimum water level values sourced from 2014 to 2020 groundwater elevation rasters developed by Zone 7 for the Basin.

13.6.3. Measurable Objectives and Interim Milestones for Depletions of Interconnected Surface Water

☑ 23 CCR § 354.30(c)
☑ 23 CCR § 354.30(d)
☑ 23 CCR § 354.30(e)

13.6.3.1. Measurable Objective Development

As described in the SMC Best Management Practices document, "Measurable Objectives should be set such that there is a reasonable margin of operation flexibility (or 'margin of safety'), between the minimum threshold and measurable objective that will accommodate droughts, climate change, conjunctive use operations, or other groundwater management activities" (*DWR, 2017*).

The MOs for Depletion of ICSW were similarly developed based on measured groundwater levels in the monitoring wells included in the RMS-ICSW. Specifically, the MOs are equal to the minimum water levels measured between 2014 and 2020 at each RMS-ICSW, which represents the recent groundwater conditions that sustain ICSW and GDEs following the adoption of SGMA. Where water level measurements between 2014 and 2020 are not available, estimated values at the RMS-ICSWs are sourced from the

groundwater elevation rasters developed by Zone 7 as discussed in **Section 8.3**. The hydrographs and SMCs for the Depletions of ICSW at each monitoring well in the RMS-ICSW are shown in **Appendix F**.

Based on the defined MOs and MTs (**Table 13-I**), Zone 7 considers there to be a sufficient Margin of Operational Flexibility at each monitoring well in the RMS-ICSW. Data collected regularly from the RMS-ICSW will better quantify relationships between measured changes in groundwater levels, surface water flows and GDE areas that can help ensure that these MOs are protective and will allow for refinement of the SMC approach over time.

13.6.3.2. Interim Milestones Development

The IMs for Depletion of ICSW are defined herein based on an estimated trajectory for groundwater levels informed by the groundwater level trends since 2015, and the MOs and MTs. If the RMS-ICSWs have decreasing groundwater level trends since 2015, the IM for the first 5-year period is set as the average between MOs and MTs, and the IMs for the following three 5-year periods are set as groundwater elevations that are linearly interpolated between IM for the first 5-year period and the MO. This trajectory allows for and assumes a continuation of current groundwater level trends for the first 5-year period, and recovery towards the MOs over the following three 5-year periods. Conversely, if the RMS-ICSWs have increasing groundwater level trends since 2015, the subsequent IMs are all equal to the MOs. The IMs are presented in **Table 13-I** and the methodology used to develop them is shown in **Table 13-J**.

Table 13-J. Interim Milestone Trajectory for Depletion of Interconnected Surface Water

Calendar Year	Interim Milestone for Depletion of Interconnected Surface Water	Basis for Interim Milestone
2022	Not applicable	Not applicable
2027	IM-5	½ * (MO + MT)
2032	IM-10	IM-5 + 1/3 * (MO -IM-5)
2037	IM-15	IM-5 + 2/3 * (MO -IM-5)
2045	MO	MO

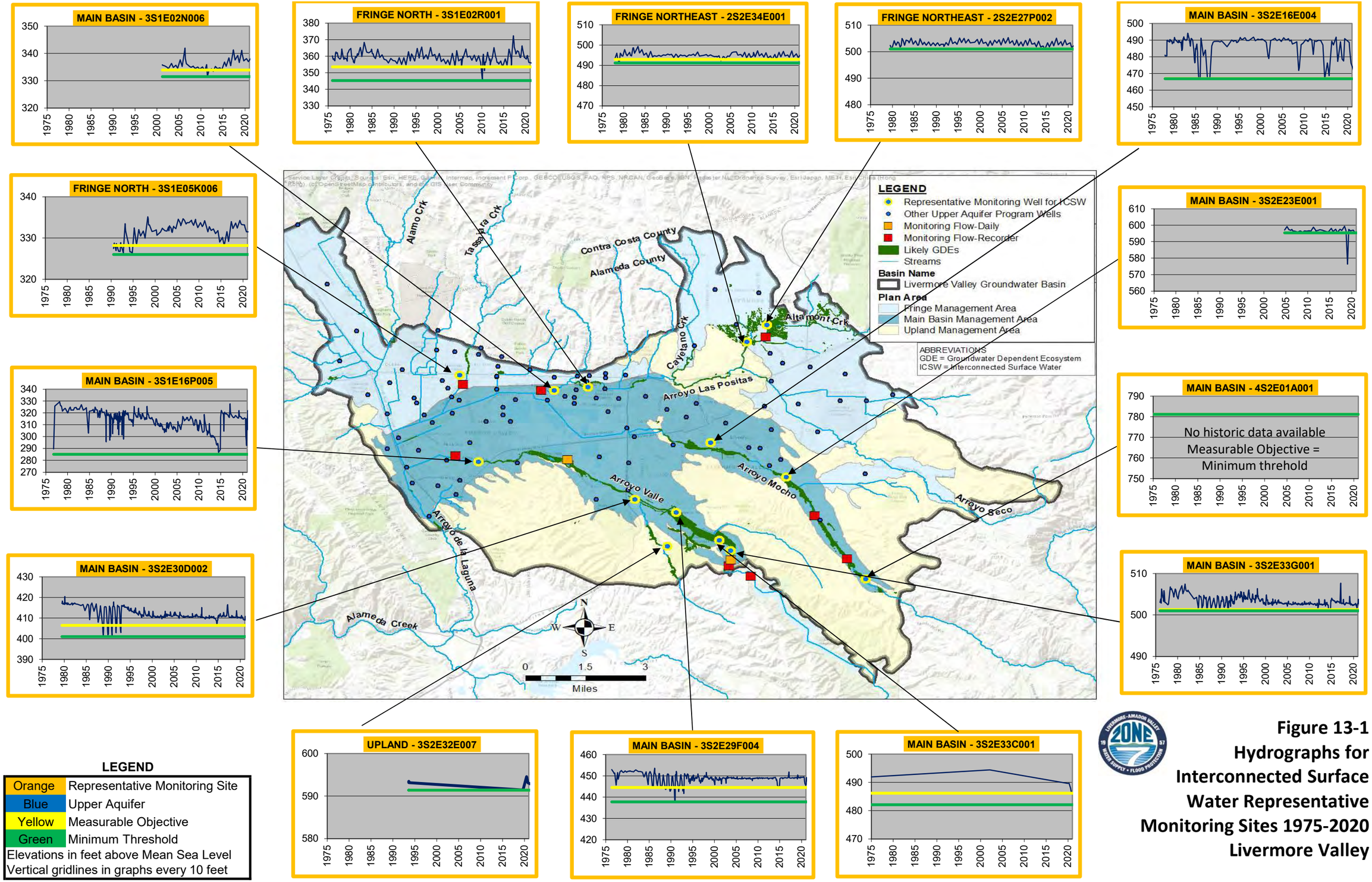
Where:

IM-5, IM-10, and IM-15 are the IM for Depletion of ICSW after 5 years, 10 years and 15 years respectively; and
MO and MT are the MO and MT for Depletion of ICSW defined previously.

13.6.4. Demonstration of Sustainability

Per CWC 10733.6 (a)(3), this Alt GSP must demonstrate that the Basin has been operating within its sustainable yield for at least 10 years. Relative to the Depletions of the Interconnected Surface Water Sustainability Indicator, **Figure 13-1** demonstrates that water levels in the RMS-ICSWs have been maintained above the MO/MT for the last 10 years, indicating long-term sustainability and absence of

URs. Further, based on Zone's 7 expansive SGMA Monitoring Network (**Section 14**), sustainable groundwater conditions over the long-term are demonstrated in **Section 8**.



LEGEND

Orange	Representative Monitoring Site
Blue	Upper Aquifer
Yellow	Measurable Objective
Green	Minimum Threshold

Elevations in feet above Mean Sea Level
Vertical gridlines in graphs every 10 feet

Figure 13-1
Hydrographs for Interconnected Surface Water Representative Monitoring Sites 1975-2020
Livermore Valley