Livermore Valley Groundwater Basin

Sustainable Groundwater Management Annual Report

Water Year 2021 (October 2020 – September 2021)

Submitted by:

ZONE 7 WATER AGENCY

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Abbreviations

ACEH	Alameda County Environmental Health
AF	acre-feet
AFY	acre-feet per year
ARM	Areal Recharge Spreadsheet Model
BBID	Byron-Bethany Irrigation District
CCR	California Code of Regulations
CIP	Capital Improvement Program
COC	Constituents of Concern
COL	Chain of Lakes
CWS	California Water Service
CY	calendar year
DDW	Division of Drinking Water
DSRSD	Dublin San Ramon Service District
DWR	Department of Water Resources
EIR	Environmental Impact Report
ft	feet
ft bgs	feet below ground surface
ft msl	feet above mean sea level
GAMA	Groundwater Ambient Monitoring and Assessment
GPQ	Groundwater Pumping Quota
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GWE	Groundwater Elevation
HCM	Hydrogeologic Conceptual Model
HI	Hydrologic Inventory
ICSW	Interconnected Surface Water
IDC	Integrated Water Flow Model Demand Calculator
LAVWMA	Livermore-Amador Valley Water Management Agency
mg/L	Milligrams per liter
MGDP	Mocho Groundwater Demineralization Plant
MO	Measurable Objective
MT	Minimum Threshold
NMP	Nutrient Management Plan
NO3	Nitrate Ion
OWTS	Onsite wastewater treatment system
PFAS	Per- and polyfluoroalkyl substances
RMS	Representative Monitoring Site
SBA	South Bay Aqueduct
SFPUC	San Francisco Public Utilities Commission
SGMA	Sustainable Groundwater Management Act
SMC	Sustainable Management Criteria
SMP	Salt Management Plan
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAF	thousand acre-feet
TDS	Total Dissolved Solid
UR	Undesirable Result
WMP	Well Master Plan
WY	Water Year

1. Executive Summary

The Livermore Valley Groundwater Basin (also referred to herein as "the Basin"), California Department of Water Resources (DWR) Basin No. 2-010, is classified as a "medium priority" basin (DWR, 2019). Alameda County Flood Control and Water Conservation District, Zone 7 (Zone 7 Water Agency or Zone 7) is the exclusive Groundwater Sustainability Agency (GSA) for the Basin and has managed local surface and groundwater resources for beneficial uses and users for more than 50 years.

Zone 7 submitted an Alternative Groundwater Sustainability Plan (Alternative GSP) for the Basin in December 2016. Subsequently, DWR reviewed and approved the Alternative GSP in July 2019. Zone 7 submitted the first Five-Year periodic evaluation to the Alternative GSP (2021 Alternative GSP) in December 2021, which is currently under review. This 2021 Water Year (WY) Annual Report for the Basin was prepared in compliance with California Code of Regulations (CCR) 23 §356.2 and covers the period from 1 October 2020 through 30 September 2021. **Appendix A** provides a summary of the required information and corresponding location(s) in the report. In addition to the required information included in this Annual Report, Zone 7 plans to provide supplemental information – including additional water quality, land subsidence, and water budget data – as **Appendix B** following the submittal of the Annual Report.

General information about the Basin is provided in **Section 2**. The Basin encompasses approximately 69,600 acres (109 square miles) in Alameda and Contra Costa counties, and includes three Management Areas, defined by varying geologic, hydrogeologic, and groundwater conditions: the Main Basin Management Area (Main Basin), the Fringe Management Area (Fringe Area), and the Upland Management Area (Upland Area), as shown in **Figure 1**. Principal Aquifer units include the Upper Aquifer and Lower Aquifer within the Main Basin, the Fringe Aquifer within the Fringe Area, and the Upland Aquifer within the Upland Area.

Recent groundwater elevation trends within the Basin are detailed in **Section 3**. Groundwater elevation contours are shown for Spring 2021 (seasonal high) and Fall 2021 (seasonal low) groundwater conditions by Principal Aquifer unit on **Figure 2** through **Figure 5**. As indicated by the contours, groundwater flow directions and magnitudes did not vary greatly between the seasonal high to seasonal low periods in 2021 WY.

The 2021 Alternative GSP established 12 Representative Monitoring Sites for Chronic Lowering of Groundwater Levels (RMS-WL) and 14 Representative Monitoring Sites for Depletions of Interconnected Surface Water (RMS-ICSW). Hydrographs comparing recent groundwater elevations to the Sustainable Management Criteria (SMCs) defined at each RMS-WL and RMS-ICSW location are shown on **Figure 6** and **Figure 7**, respectively. As shown in **Table 1**, groundwater levels at all RMS-WL locations continued to remain well above their respective Minimum Thresholds (MTs) and Measurable Objectives (MOs) throughout the 2021 WY**.** As shown in **Table 2**, groundwater levels dropped below their MTs at two RMS-ICSW (Wells 3S1E16P005 and 3S2E23E001) and below their MOs at three additional RMS-ICSW (Wells

3S2E30D002, 3S2E29F004, and 3S2E33C001) during the seasonal low (i.e., Fall) 2021 WY monitoring event; however, all measured water level data at the RMS-ICSW wells were recorded above their MTs and MOs during the seasonal high (i.e., Spring) monitoring event. As such, no Undesirable Results (URs) were observed within the Basin during the 2021 WY.

Groundwater and surface water supplies and uses within the Basin during the 2021 WY are detailed in **Sections 4, 5,** and **6**. Basin-wide groundwater extractions totaled approximately 22,747 acre-feet (AF) during the 2021 WY, 98% (22,249 AF) of which was used for municipal supplies. Zone 7 extracted 71% (16,440 AF, including 181 AF of pumping losses) of the total extraction (**Table 3** and **Table 4**). General locations of groundwater extractions are shown on **Figure 8**. In addition to groundwater extraction, Zone 7 imported a total of 27,547 AF of surface water supplies to the Basin in 2021 WY (**Table 5**). Total water use within the Basin for the 2021 WY consisted of 39% groundwater, 47% imported water, and 14% recycled water (**Table 6**, **Figure 9** and **Figure 10**).

Changes in groundwater storage over the 2021 WY were estimated using both the Groundwater Elevation (GWE) method and the Hydrologic Inventory (HI) method, as further described in **Section 7**. Taking an average of the two methods, the total groundwater in storage at the end of 2021 WY was calculated to be 222.7 thousand acre-feet (TAF), which is about 17.4 TAF less than the 2020 WY average total storage value (**Table 7**). **Figure 11** shows the change in storage from Fall 2020 to Fall 2021 for each Main Basin node. **Figure 12** shows the annual change in groundwater storage and cumulative change in groundwater storage for the Basin along with the water year type from 1974 WY through 2021 WY. DWR defined the 2021 WY as a critically dry water year (DWR, 2021), and the change in groundwater storage for the Basin (-17.4 TAF) was similar to that observed in other recent critically dry years.

Section 8 presents a summary of Alternative GSP Implementation during 2021 WY. The 2021 Alternative GSP outlined potential Projects and Management Actions (P/MAs) currently being implemented or otherwise proposed for future implementation. The P/MAs outlined in the 2021 Alternative GSP generally fall into the following four categories: (1) water supply augmentation, (2) water demand reduction, (3) improvement of groundwater quality, and (4) data gap-filling activities. A brief description of the status of each P/MA as through the 2021 WY is listed in **Section 8.2**.

Table 8 summarizes the SMCs and their 2021 WY status for each Sustainability Indicator defined for the Basin. As further detailed in **Table 8**, no URs occurred during the 2021 WY for any of the five Sustainability Indicators with SMCs defined in the 2021 Alternative GSP.

To avoid duplication, material included in the 2021 Alternative GSP has not been repeated here, but specific sections are referenced when more background detail may be desired.

2. General Information

☑ *§ 356.2 (a)*

Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:

(a) General information, including an executive summary and a location map depicting the basin covered by the report.

On 16 September 2014, the California legislature enacted the Sustainable Groundwater Management Act (SGMA), the primary purpose of which is to achieve and/or maintain sustainability within the state's high and medium priority groundwater basins. The Livermore Valley Groundwater Basin, DWR Basin No. 2-010, is classified as a "medium priority" basin (DWR, 2019) and is not subject to the critical conditions of overdraft. Under its authority as the exclusive GSA of the Basin, Zone 7 submitted an Alternative GSP for the Basin in December 2016, which was approved by DWR in July 2019, and the first Five-Year Update to the Alternative GSP in December 2021, which is currently under review.

This 2021 WY Annual Report for the Basin has been prepared in compliance with CCR 23 § 356.2. The 2021 WY includes the period from 1 October 2020 through 30 September 2021. This report also contains available and appropriate historical information back to Calendar Year (CY) 2015, as required by CCR 23 §356.2 (b), to provide information and data related to Basin conditions through the current reporting year. All the data included in this report are conveyed based on the 2021 WY (i.e., October 1, 2020 through September 30, 2021); however, due to other reporting obligations, some information in this report (e.g., retailer groundwater pumping quota and surface water supply volumes) is compiled and reported on a CY basis (i.e., January 1 through December 31, 2021).

Zone 7 provides water management in the Basin as part of its mission to deliver safe, reliable, efficient, and sustainable water services, and more specifically addresses Strategic Plan initiatives #7 - Manage as the GSA and implement the groundwater management plan and #8 - Study and refine knowledge of the groundwater basins. Zone 7 has managed local surface and groundwater resources for beneficial uses for more than 50 years.

The Zone 7 service area is located about 40 miles southeast of San Francisco and encompasses an area of approximately 425 square miles of the eastern portion of Alameda County, including the Livermore-Amador Valley, Sunol Valley, and portions of the Diablo Range (**Figure 1**). Zone 7 also serves a portion of Contra Costa County (Dougherty Valley in San Ramon) through an out-of-service-area agreement with Dublin San Ramon Service District (DSRSD).

As shown on **Figure 1**, the Basin encompasses approximately 69,600 acres (109 square miles) in Alameda and Contra Costa counties, and includes three Management Areas based on varying geologic, hydrogeologic, and groundwater conditions: the Main Basin, Fringe Area, and Upland Area. The Basin is boarded on the northwest by the San Ramon Valley Basin (Basin No. 2-07), a

very-low priority basin that extends to the northwest in Contra Costa County, and on the southwest by the Sunol Valley Basin (Basin No. 2-11), which is also a very-low priority basin.

Available hydrogeologic information indicates that the Basin is bounded by the Calaveras Fault on the west, the Greenville Fault on the east, and bedrock deposits of the Plio-Pleistocene Tassajara and Livermore Formations to the north and south, respectively. Principal Aquifer units include the Upper Aquifer and Lower Aquifer within the Main Basin, the Fringe Aquifer within the Fringe Area, and the Upland Aquifer within the Upland Area. The Upper Aquifer consists of recent (Holocene) alluvial fill materials and extends continually across the Main Basin at depths up to 190 feet below ground surface (ft bgs), containing groundwater typically under unconfined conditions. The Lower Aquifer exists below a confining aquitard with thicknesses ranging from less than five feet up to 50 feet in the central and eastern parts of the Main Basin. The Lower Aquifer consists of Quaternary alluvial fill materials and the productive upper portion of the Livermore Formation, extending to depths of up to 800 ft bgs in the central Main Basin. A large majority of groundwater production occurs within the Lower Aquifer of the Main Basin. The Fringe Aquifer and Upland Aquifer are demonstrated to be of lower productivity and quality than the aquifers of the Main Basin, and groundwater production is limited to domestic and agricultural uses in these areas.

Sources of recharge to the Basin include rainfall recharge, applied water recharge, stream recharge, subsurface groundwater inflow, and pipe leakage. Groundwater outflows from the Basin include municipal pumping, agricultural pumping, mining use, and subsurface groundwater outflow. A historical water budget period (1974-2020 WYs) presented in the 2021 Alternative GSP shows that long-term sustainability has been maintained in the Basin for at least 45 years, as groundwater storage conditions have remained generally stable to increasing and have shown resilience following dry periods (Zone 7, 2021).

Detailed information regarding the Plan Area, Hydrogeologic Conceptual Model, and historical and recent Groundwater Conditions are provided in the 2021 Alternative GSP (Zone 7 GSA, 2021).

3. Groundwater Elevation Data

☑ *§ 356.2 (b) (1)*

Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:

(b) A detailed description and graphical representation of the following conditions of the basin managed in the Plan:

(1) Groundwater elevation data from monitoring wells identified in the monitoring network shall be analyzed and displayed as follows:

(A) Groundwater elevation contour maps for each principal aquifer in the basin illustrating, at a minimum, the seasonal high and seasonal low groundwater conditions.

(B) Hydrographs of groundwater elevations and water year type using historical data to the greatest extent available, including from January 1, 2015, to current reporting year.

Zone 7 has conducted an extensive program of groundwater level monitoring throughout the Basin for over 45 years. Background information regarding the Groundwater Elevation Monitoring Program is provided in *Section 14.2.1 Monitoring Network for Chronic Lowering of Groundwater Levels* of the 2021 Alternative GSP. This program includes the measurement of groundwater levels in monitoring and production wells to confirm that management objectives are met, to assess groundwater supplies, and to define any new management objectives needed to maintain sustainability. The program focuses on the Main Basin, where groundwater is pumped for municipal uses; however, water levels are also measured in the Fringe and Upland Areas.

Approximately 236 wells were included in Zone 7's Groundwater Elevation Monitoring Program during the 2021 WY. Groundwater elevations in most of these wells were measured at least two times throughout the water year, during both seasonal high (Spring) and seasonal low (Fall) groundwater conditions. Seasonal high (Spring) and seasonal low (Fall) 2021 WY groundwater elevation contour maps are presented in **Section 3.1** for each Principal Aquifer[1] in the Basin using water level measurements from the wells in the Groundwater Elevation Monitoring Program.

The Basin currently has 12 RMS-WLs and 14 RMS-ICSWs which represent a subset of the Groundwater Elevation Monitoring Program. Updated hydrographs of groundwater elevations are presented in **Section 3.2** for each of the wells included in the RMS-WL and RMS-ICSW monitoring networks. Seasonal high and seasonal low water levels at the RMS-WL and RMS-ICSW sites are compared to their corresponding SMCs in **Table 1** and **Table 2**.

[1] Insufficient monitoring wells currently exist in the Upland Area to prepare contour maps for the Upland Aquifer.

3.1. Groundwater Elevation Contour Maps

Upper Aquifer and Fringe Aquifer

Figure 2 and **Figure 3** show 2021 WY groundwater elevation contours in the Upper Aquifer and Fringe Aquifer during seasonal high (Spring) and seasonal low (Fall) conditions, respectively. The groundwater gradient in the Upper Aquifer was generally from east to west and ranged from 0.005 to 0.025 ft/ft. Flow directions and magnitudes indicated by the groundwater elevation contours did not vary greatly between the seasonal low and seasonal high conditions during the 2021 WY.

Table 1 compares water level measurements from the seasonal high (Spring) and seasonal low (Fall) 2021 WY monitoring events to the MTs and MOs defined at RMS-WL wells in the 2021 Alternative GSP. The table also shows the change in elevation from the previous year's seasonal low to this year's seasonal low. While groundwater elevations in all Main Basin RMS-WL wells in the Upper Aquifer dropped relative to 2020 WY conditions, especially in the western portion of the Basin, water levels at all RMS-WL wells continued to remain well above their respective MTs and MOs during both the seasonal high and seasonal low 2021 WY monitoring events.

Table 2 compares water level measurements from the seasonal high and seasonal low 2021 WY monitoring events to the MTs and MOs defined at RMS-ICSW wells in the 2021 Alternative GSP. The table also shows the change in elevation from the previous year's seasonal low to this year's seasonal low. Groundwater levels dropped below their MTs at two RMS-ICSW (Wells 3S1E16P005 and 3S2E23E001) and below their MOs at three additional RMS-ICSW (Wells 3S2E30D002, 3S2E29F004, and 3S2E33C001) during the seasonal low (i.e., Fall) 2021 WY monitoring event; however, all RMS-ICSW wells were measured above their MTs and MOs during the seasonal high (i.e., Spring) monitoring event. As further described in **Section 8.1**, the MT exceedances observed at Wells 3S1E16P005 and 3S2E23E001 do not currently constitute a UR per the definition provided in *Section 13.6.1 Undesirable Results for Depletions of Interconnected Surface Water* of the 2021 Alternative GSP.

Quarry dewatering operations in the eastern Amador Subarea create groundwater depressions in pits where water is pumped and mounds in pits that are not clay-lined and where excess water is stored. The water from the dewatering of P42 and P46 (future Lakes B and J, respectively) was discharged into other adjacent clay-lined mining pits. The water from pit R28 (future Lake D) was eventually discharged into Cope Lake after which it was conveyed into Lake I and was recharged back into the Basin. Most of the groundwater elevation head change (the steepest groundwater gradient) occurs in the central area of the Basin, where mining pits are being excavated, and did not appear to vary significantly between the seasonal low and seasonal high periods of the 2021 WY.

Water levels in wells in the southwestern portion of the Basin near the Arroyo de la Laguna (as indicated primarily by the Bernal Upper Key Well 3S1E20C007 and Well 3S1E29M004) were below the upper threshold groundwater elevation at which Basin overflow occurs (i.e., about 295

feet above mean sea level [ft msl]). Consequently, no water overflowed from the Upper Aquifer into the Arroyo de la Laguna and exited the Basin during the 2021 WY.

Groundwater levels in the RMS-WL wells in the Fringe Aquifer stayed relatively constant throughout 2021 WY, generally varying by less than five feet compared to groundwater levels in 2020 WY. No data was available last year for the RMS-WL well in the Upland Area; however, the water level dropped about 2.2 feet from the seasonal high to the seasonal low in 2021 WY. For more information regarding historic groundwater elevations and trends observed for the Fringe Area, refer to *Section 8.3 Current and Historical Groundwater Conditions* of the 2021 Alternative GSP.

Lower Aquifer

Figure 4 and **Figure 5** show 2021 WY groundwater elevation contours in the Lower Aquifer during seasonal high (Spring) and seasonal low (Fall) conditions, respectively. Flow directions and magnitudes indicated by the groundwater elevation contours did not vary greatly between the seasonal low and seasonal high conditions during the 2021 WY. In general, the groundwater gradient runs toward the center of the Basin where there are piezometric depressions created around several municipal wellfields and two mining pits (P42 [Lake B] and R28 [Lake D]) that appear to extend into the Lower Aquifer. The lowest groundwater elevation in the Lower Aquifer was observed near the R28 (Lake D) mining excavation pond (166 ft msl).

Table 1 shows that groundwater elevations in all Main Basin RMS-WL wells in the Lower Aquifer also dropped relative to 2020 WY conditions, especially in the western portion of the Basin. However, as was the case in the Upper Aquifer, water levels at all RMS-WL wells continued to remain well above their respective MTs and MOs during both the seasonal high and seasonal low 2021 WY monitoring events.

As is usually the case, groundwater elevations in the Mocho II Subarea during the 2021 WY were about 140 to 160 ft higher than those to the west, across the Livermore Fault in the Amador Subarea. Deep groundwater elevations in the Dublin/Camp/Bishop Fringe Subareas were 50 to 70 ft higher than those across the Main Basin boundary to the south.

For more information on general groundwater gradient and water level trends, see *Section 8 Current and Historical Groundwater Conditions* of the 2021 Alternative GSP.

3.2. Groundwater Elevation Hydrographs

Groundwater levels for the 2021 WY followed a typical seasonal pattern observed from the historical data, rising in the beginning of the year with rainfall recharge and minimal pumping occurring, levelling off in late spring, and then dropping during the second half of the water year as rainfall ceased and pumping demands increased. Groundwater elevations generally decreased at all RMS-WL wells in the Main Basin compared to water levels during the 2020 WY when the Basin was largely full. For reference, the 2021 WY was designated as a critically dry water year by DWR. Historical water year types are provided in **Figure 12**.

Figure 6 and **Figure 7** show hydrographs of historical and recent groundwater elevations at all RMS-WL and RMS-ICSW wells, respectively. These hydrographs further demonstrate the seasonal trends observed in both the Upper/Fringe Aquifers and the Lower Aquifer. The seasonal fluctuations are greater in the Lower Aquifer where more pumping occurs to meet seasonal demands in the warmer months, and when surface water treatment plant outages occur.

Groundwater elevations will continue to be monitored at all RMS-WL and RMS-ICSW sites per the monitoring plans described in *Section 14 Monitoring Network* of the 2021 Alternative GSP.

4. Groundwater Extraction Data

☑ *§ 356.2 (b) (2)*

Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:

(b) A detailed description and graphical representation of the following conditions of the basin managed in the Plan:

(2) Groundwater extraction for the preceding water year. Data shall be collected using the best available measurement methods and shall be presented in a table that summarizes groundwater extractions by water use sector, and identifies the method of measurement (direct or estimate) and accuracy of measurements, and a map that illustrates the general location and volume of groundwater extractions.

Since the 1960s, Zone 7 has actively embraced a "conjunctive use" approach to Basin management by integrating local and imported surface water supplies with the local conveyance, storage, and groundwater recharge features. Zone 7's annual groundwater production and artificial recharge operations vary with the availability of surface water, treatment plant capacity, and the available groundwater storage space.

Table 3 below shows the Basin-wide, 2021 WY groundwater extraction data by water use sector and measurement method; reported units are in AF. Groundwater extractions within the Basin totaled approximately 22,747 AF during the 2021 WY, of which 98% was for the municipal sector.

Table 3. Summary of Groundwater Extractions by Source and Sector

Water Use Sector / Entity	2021 WY Groundwater Extractions (AF)	Measurement Method	Estimated Accuracy (AF)
Municipal Pumping			
Zone 7 (excluding DSRSD)	15,614	Metered by Zone 7	10
Zone 7 (for DSRSD)	645	DSRSD Groundwater Pumping Quota	1
City of Pleasanton	3,802	Metered by Pleasanton	10
California Water Service – Livermore (CWS)	1,475	Metered by CWS	10
San Francisco Public Utilities Commission (SFPUC)	360	Metered by SFPUC	10
Fairgrounds	353	Metered by Fairgrounds	10
Domestic Pumping	**107**	**Estimated**	**50**
Irrigated Agriculture	**122**	**Estimated**	**100**
Golf Courses	**269**	**Estimated**	**50**
Total	**22,747**	**-**	**-**

Approximately 26% of the municipal pumping comes from groundwater pumped by Zone 7's retailers (i.e., the City of Pleasanton, City of Livermore, CWS, and DSRSD). The retailers are permitted by contract to pump a Groundwater Pumping Quota (GPQ) (accounted for on a CY basis) without having to pay a replenishment fee to Zone 7. They can carry forward any unpumped GPQ (up to 20% of their GPQ). The retailer's GPQ and total pumping for the 2021 CY (in AF) are shown in **Table 4** below. None of the retailers pumped more than their respective GPQ in 2021 CY.

Table 4. Retailer Groundwater Extractions vs. Groundwater Pumping Quota*

Retailer	GPQ (AF)	Carryover from 2020 (AF)	Pumped in CY 2021 (AF)	Carryover to 2022*** (AF)
City of Pleasanton	3,500	391	3,331	168
Cal Water Service	3,069	614	1,389	614
DSRSD (pumped by Zone 7)	645	0	645	0
City of Livermore (not used)**	31	-	-	-
Total	**7,214**	**1,005**	**5,365**	**782**

* = All values accounted for and reported on a CY basis
** = Livermore no longer pumps groundwater, GPQ not included in totals or carryover.
*** = Maximum of 20% of GPQ can be carried over

Figure 8 shows the general location and volume of groundwater extractions occurring throughout the Basin in 2021 WY. A large majority of groundwater production is municipal pumping and occurs within the Lower Aquifer of the Main Basin. There are no municipal supply wells within the Fringe and Upland Areas. There are domestic wells within the Basin, but the pumping volumes from these domestic wells are minimum (i.e., less than 2 acre-feet per year [AFY] per well). Agricultural pumping is estimated by the Areal Recharge Model, which is discussed in detail in *Section 9 Water Budget Information* of the 2021 Alternative GSP.

5. Surface Water Supply

☑ *§ 356.2 (b) (3)*

Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:

(b) A detailed description and graphical representation of the following conditions of the basin managed in the Plan:

(3) Surface water supply used or available for use, for groundwater recharge or in-lieu use shall be reported based on quantitative data that describes the annual volume and sources for the preceding water year.

Zone 7 ensures that local water supplies (e.g., groundwater) are not depleted by importing approximately 80% of the Basin's water supply from the State Water Project (SWP) to be delivered to Zone 7's retailers and agricultural customers, and by recharging the Main Basin with surplus surface water when available ("artificial recharge"). Details regarding the surface water supply sources and contract amounts are provided in *Section 7.7.6 Source and Point of Delivery for Imported Water Supplies* of the 2021 Alternative GSP.

In accordance with DWR's accounting time-interval of SWP water, the allocation totals are accounted for by Calendar Year. The SWP allocation for the 2021 CY was 5% of Zone 7's maximum allocation (80,619 AF). **Table 5** shows Zone 7's imported water supplies for 2021 CY and the amounts being carried over to the 2022 CY. All deliveries of imported surface water are measured with electromagnetic flow meters and are accurate to within 1%.

Table 5. Summary of Surface Water Supplies by Source and Sector*

Source	Available at end of 2020 (AF)	Added in 2021 * (AF)	Used in 2021 (AF)	Carryover to 2022 (AF)
State Water Project	**8,860**	**5,831**	**8,700**	**5,991**
Table A	*0*	*4,031*	*0*	*4,031*
To San Luis from Semitropic	*0*	*1,800*	*0*	*1,800*
Article 56	*8,860*	*0*	*8,700*	*160*
Byron-Bethany Irrigation District†	**0**	**0**	**0**	**0**
Kern Groundwater Basin	**116,075**	**0**	**10,400**	**105,675**
Semitropic Delivered	*86,170*	*0*	*8,600*	*77,570*
Semitropic to San Luis	*0*	*0*	*1,800*	*-1,800*
Cawelo Delivered	*29,905*	*0*	*0*	*29,905*
Other	**0**	**9,327**	**9,327**	**0**
Yuba/Dry Year Transfer Program	*0*	*1,237*	*1,237*	*0*
Mojave Water Agency Transfer	*0*	*8,090*	*8,090*	*0*
Lake Del Valle (AV Water Rights)	**20**	**3,200**	**920**	**2,300**
Total	***124,955***	***18,358***	***29,347***	***113,966***

* = All values accounted for and reported on a CY basis
** = 5% State Water Project Allocation for 2021 CY
† = BBID Agreement terminated in 2021 CY
AV = Arroyo Valle

6. Total Water Use

☑ *§ 356.2 (b) (4)*

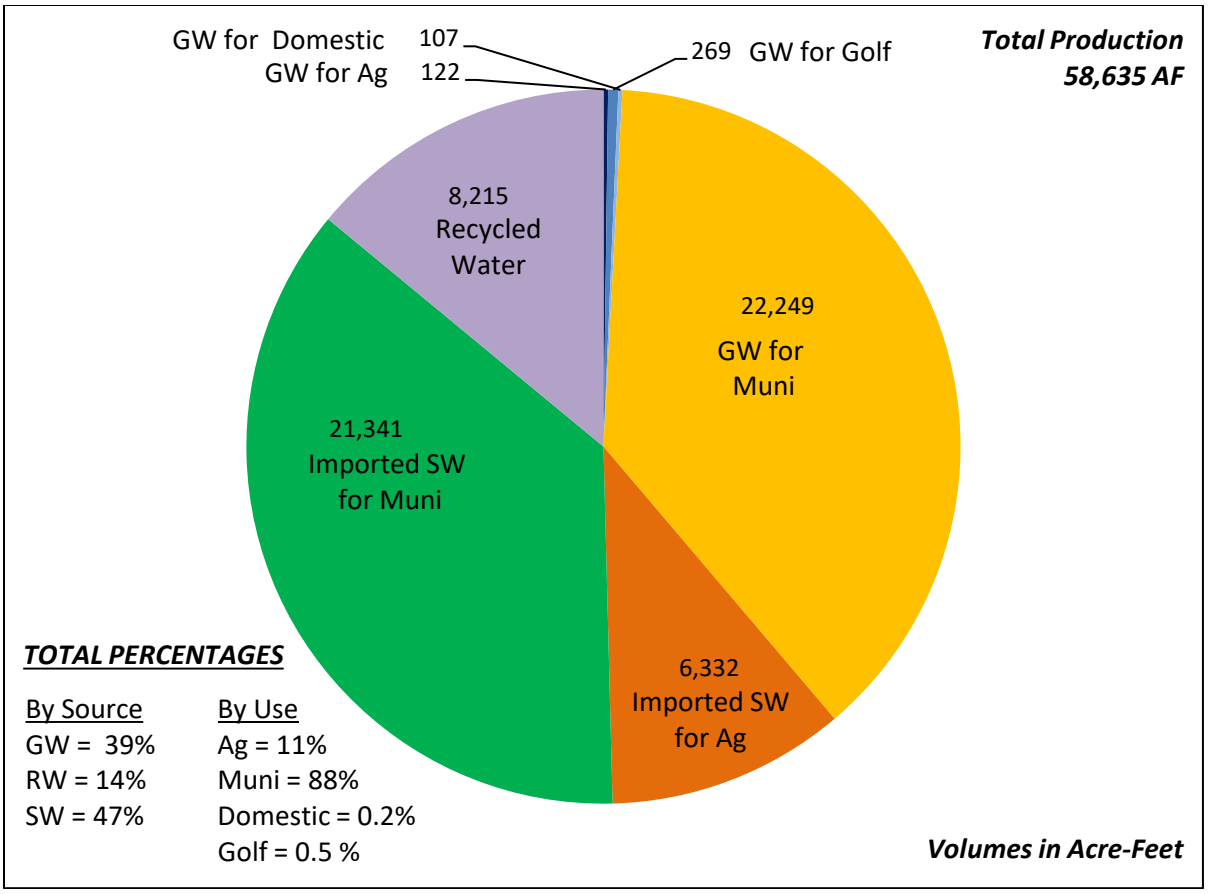
Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:

(b) A detailed description and graphical representation of the following conditions of the basin managed in the Plan:

(4) Total water use shall be collected using the best available measurement methods and shall be reported in a table that summarizes total water use by water use sector, water source type, and identifies the method of measurement (direct or estimate) and accuracy of measurements. Existing water use data from the most recent Urban Water Management Plans or Agricultural Water Management Plans within the basin may be used, as long as the data are reported by water year.

The volume of water produced and used in the Basin over the 2021 WY is shown by water source type and by water use sector in **Figure 9** and **Table 6** below.

Figure 9: Pie-Chart Summary of Total Water Use by Source and Sector



Ag = Agriculture; Muni = Municipal; GW= Groundwater; RW = Recycled Water; SW = Surface Water

Total groundwater production in the Basin (including by Zone 7, retailers, agriculture, domestic, etc.) supplied about 39% of the total Basin-wide water demand in the 2021 WY. Total surface water used in the Basin supplied about 47% of the total Basin-wide water demand, which allowed 27,673 AF of groundwater to be conserved instead of being pumped to meet this demand. The final 14% of water demands were satisfied by recycled water supplies, 100% of which were used for urban irrigation.

Of the total water use within the Basin during the 2021 WY (including groundwater, surface water, and recycled water), about 88% was used by the municipal sector, 11% was used by the agricultural sector, 0.5% was used for golf courses, and 0.2% was used by the domestic sector. A more detailed breakdown of water supply and uses by source and sector within the Basin is provided in **Figure 10**.

Table 6. Summary of Total Water Use by Source and Sector

Water Use Sector	Water Source	2021 WY Water Use (AF)
Municipal	Groundwater	22,249
	Imported Surface Water	21,341
	Recycled Water	8,215
Agriculture	Groundwater	122
	Imported Surface Water	6,332
Golf	Groundwater	269
Domestic	Groundwater	107
Total		**58,635**

Methods of measurement and accuracy of measurements for groundwater extraction and surface water data are summarized in **Section 4** and **Section 5** respectively.

7. Change in Groundwater Storage

☑ *§ 356.2 (b) (4)*

Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:

(b) A detailed description and graphical representation of the following conditions of the basin managed in the Plan:

(4) Change in groundwater in storage shall include the following:

(A) Change in groundwater in storage maps for each principal aquifer in the basin.

(B) A graph depicting water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater in storage for the basin based on historical data to the greatest extent available, including from January 1, 2015, to the current reporting year.

To avoid significant depletion of groundwater storage, Zone 7 operates the Basin such that groundwater storage remains between a full Basin volume (254 TAF) and the historic low storage volume (128 TAF), or about one half of total storage volume. This 126 TAF (254 TAF – 128 TAF) is considered the Operational Storage. Groundwater below this historic low storage volume is regarded as Reserve Storage that is unavailable during nonemergency conditions. Most of the groundwater storage is contained in the Main Basin, which is characterized by the largest saturated thickness of aquifer materials.

Zone 7 uses two methods for calculating groundwater storage in the Basin: The GWE method and the HI method. The GWE method uses groundwater level data and storage coefficients for "nodes" (originally developed by DWR in 1974) to estimate the total volume of water in the Basin (see *Sections 8.4, Groundwater Storage,* in the 2021 Alternative GSP). The HI method, also known as the Water Budget, involves an accounting of all inflows and outflows and derivation of the change in storage as the residual of the water budget equation (see *Sections 8.4, Groundwater Storage, in the 2021 Alternative GSP*). Storage volumes from the two methods are averaged to quantify the total storage of the Basin.

The GWE method yielded a total storage of 218.5 TAF at the end of 2021 WY, which is 14.4 TAF less than the GWE value calculated for the 2020 WY. **Figure 11** shows the change in storage from Fall 2020 to Fall 2021 for each Main Basin node.

The HI method produced a total storage value of 226.9 TAF for the end of 2021 WY, which is 20.3 TAF less than the end of 2020 WY HI value. **Figure 12** shows the annual change in groundwater storage and cumulative change in groundwater storage for the Basin along with the water year type from 1974 WY to 2021 WY.

The total groundwater storage for the Basin is computed by averaging the storage estimates from the GWE and HI methods. As shown in **Table 7** below, the average total groundwater in storage at the end of 2021 WY was calculated to be 222.7 TAF, which is about 17.4 TAF less than the 2020

WY average total storage value. This equates to approximately 94.7 TAF of groundwater available as Operational Storage, which is about 75% of the total operational storage capacity (i.e., 126 TAF).

Table 7: Groundwater Storage Summary, 2021 WY (in Thousand AF)

Storage Calculation Method	End of 2020 WY	End of 2021 WY	Change in Storage
GWE Method	232.9	218.5	-14.4
HI Method	247.2	226.9	-20.3
TOTAL STORAGE (Average of GWE and HI Methods)	**240.1**	**222.7**	**-17.4**
Operational Storage	112.1	94.7	-17.4

In the past the groundwater storage values calculated by both the GWE and HI Methods have typically been within about 6 TAF. However, the difference between the HI and GWE methods was 14,313 AF in the 2020 WY and 8,425 AF in the 2021 WY. The reason for this divergence is unclear; however, there have been significant differences between the two methods in the past that converged a few years later (e.g., 1992 and 2008/2009). Zone 7 staff continues to investigate possible reasons for this significant difference.

8. Plan Implementation

☑ *§ 356.2 (b) (4)*

Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:

(c) A description of progress towards implementing the Plan, including achieving interim milestones, and implementation of projects or management actions since the previous annual report.

8.1. Progress Towards Interim Milestones for Chronic Lowering of Groundwater Levels

Table 8 summarizes the five Sustainability Indicators for which SMCs are defined within the Basin[2], their associated URs, and MTs as presented in the 2021 Alternative GSP. The table also includes the 2021 WY status for each indicator and any action taken in the 2021 WY or planned for the upcoming water year.

As described in **Section 3** and shown in **Table 1**, water levels at all RMS-WL wells continued to remain well above their respective MTs and MOs during both the seasonal high and seasonal low 2021 WY monitoring events.

As described in **Section 3** and shown in **Table 2**, groundwater levels dropped below their MTs at two RMS-ICSW (by ≤1.03 feet) and below their MOs at three additional RMS-ICSW (also by ≤1.03 feet) during the seasonal low (i.e., Fall) 2021 WY monitoring event; however, all measured water level data at RMS-ICSW wells were recorded above their MTs and MOs during the seasonal high (i.e., Spring) monitoring event. As described in *Section 13.6.1. Undesirable Results for Depletions of Interconnected Surface Water* of the 2021 Alternative GSP, URs for Depletions of ICSW *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 years.* Thus, the two MT exceedances experienced in the RMS-ICSW monitoring network during the Spring 2021 monitoring event do not constitute a UR per the definition in the 2021 Alternative GSP.

For land subsidence monitoring, MTs were not exceeded at any applicable proxy RMS-WL sites, and elastic fluctuations in ground surface elevations were measured at less than 0.04 ft throughout the 2021 WY.

Constituents of Concern (COCs) within the Basin, including Total Dissolved Solid (TDS), Nitrate, Boron, and Chromium, were not detected above the corresponding MTs in any RMS-WQs. SMCs for per- and polyfluoroalkyl substances (PFAS) have not been established. Zone 7 will continue to sample for PFAS compounds, identify possible sources, and perform PFAS groundwater modeling. SMCs for PFAS will be addressed in the next Alternative GSP update once additional

[2] Seawater intrusion is not occurring in the Basin and thus no SMCs have been defined for this Sustainability Indicator.

data have been collected and regulatory criteria established. Zone 7 will continue to monitor the other COCs within the Basin and implement the Salt Management Plan (SMP) and Nutrient Management Plan (NMP).

Table 8: Sustainable Management Criteria Status, 2021 WY

Sustainability Indicator	Undesirable Results Criteria	Minimum Threshold	2021 WY Status	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.	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 6**.	Continue to monitor and maintain artificial recharge operations.
Depletion of Groundwater Storage	Water levels in greater than 25% of the RMS-WLs decline below their respective MTs for two consecutive years. Not applicable to Upland Management Area.	Water Level SMCs used as proxy.	MTs were not exceeded at any RMS-WLs, see **Figure 6**.	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 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 milligrams per liter (mg/L) or 2015 Baseline concentration plus maximum deviation, whichever is greater.	TDS was detected above the MT (by 19 mg/L) in RMS-WQ 3S2E08H003. TDS was not detected above the MT in any other RMS-WQs.	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	Continue to monitor and implement NMP.
		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	Continue to monitor.
		Total Chromium > 0.050 mg/L, or 2015 Baseline	Chromium was not detected above the MT in any RMS-WQs	Continue to monitor.

Sustainability Indicator	Undesirable Results Criteria	Minimum Threshold	2021 WY Status	Action Taken
Degradation of Groundwater Quality (continued)		concentration plus maximum deviation, whichever is greater.		
		SMCs for PFAS in development	Zone 7 continued to sample for PFAS compounds, investigated possible sources, and performed PFAS groundwater modeling	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 to 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 and Elastic fluctuations less than 0.04 ft for the year	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 years.	Historic low water levels or to be determined if historical water levels are not available.	Two MT exceedances were recorded RMS-ICSWs (Wells 3S1E16P005 and 3S2E23E001) during the seasonal low (fall) monitoring event (see **Table 2** and **Figure 7**); however no URs have been triggered within the Basin.	Continue to monitor

8.2. Implementation of Projects and Management Actions

This section provides an update on the P/MAs described in *Section 15 Projects and Management Actions* of the 2021 Alternative GSP. As demonstrated in the 2021 Alternative GSP and in this Annual Report, Zone 7 continues to sustainably manage the Basin through numerous interrelated programs to assess, manage, monitor, and protect groundwater supplies. Using information from its robust monitoring programs, Zone 7 adaptively manages its groundwater supplies in consideration of and with regard to current hydrologic conditions, water demands, water quality conditions, and future water supply/demand forecasts. In addition to continuing the monitoring programs that are critical to Zone 7's sustainable groundwater management, Zone 7 is also working to improve long-term surface water supply reliability, maximize conjunctive use opportunities, provide watershed protection, and support water recycling operations.

Water Supply Augmentation Projects

Existing Imported Water Supplies

Imported surface water supplies secured by Zone 7 for the 2021 WY are shown in **Table 5** and **Figure 10** and are summarized below include:

- The State Water Project (SWP deliveries via the South Bay Aqueduct [SBA] allocation for the 2021 CY was 5% of Zone 7's maximum allocation (80,619 AF) for 4,031 AF.
- Zone 7 imported 8,600 AF of its total 116,075 AF banked in the Kern Groundwater Basin (care of the Semitropic Water Storage District the Cawelo Water District) and transferred 1,500 AF from the Kern Groundwater Basin to San Luis Reservoir.
- Zone 7 transferred 1,237 AF from the Lover River Yuba Accord (Yuba) and 8,090 AF from the Mojave Water Agency.
- Total imported surface water supplies in the 2021 met 47% of regional water demands.
- Total groundwater production in the Basin (including by Zone 7, retailers, agriculture, domestic, etc.) supplied about 39% of the total Basin-wide water demand in the 2021 WY.
- Of the 16,440 AF of groundwater pumped by Zone 7 during the 2021 WY, about 16,259 AF went into production; the remainder of which is accounted for in pumping losses and exported brine from the groundwater demineralization process.
- Zone 7's total produced groundwater was about 43% of the total treated water production that Zone 7 delivered to its retailers during the 2021 WY (on average, groundwater makes up about 15% of Zone 7's annual treated water deliveries).

Future Water Supply Projects

Zone 7 continued its strategy of securing the long-term reliability of the water supply system to meet the needs of both existing and future customers as summarized below:

- In 2021, Zone 7 continued its petition to extend Zone 7's water rights permit for diverting surface water captured in Lake Del Valle from the upper Arroyo Valle. Under the existing permit, Zone 7's average annual yield from the upper Arroyo Valle is about 7,300 AFY. A diversion structure from Arroyo Valle into Lake A, and a pipeline connecting Lake A to other lakes in the Chain of Lakes (COLs), are included in Zone 7's Capital Improvement Plan (CIP, 2018-2028). Once constructed, these projects will facilitate the capture and storage of additional water from the Del Valle Watershed up to about 3,000 AFY on average.

- Zone 7 continues to support the Delta Conveyance Project, the State of California's proposed project to upgrade the SWP system infrastructure and operations and improve its long-term reliability while protecting the Sacramento-San Joaquin Delta (Delta) ecosystem. At this time, while the project's design is still being re-evaluated, Zone 7 is assuming that some form of the Delta Conveyance Project would be in-service by 2040.

- Zone 7 is also continuing to evaluate alternative water supply and storage options such as the Bay Area Regional Desalination Project, potable reuse, Los Vaqueros Expansion, Sites Reservoir, and water transfers. Ultimately, Zone 7 may choose to implement one or several of these options depending on the results of the studies and planning efforts, the amounts and timing of development and conservation, and the determination of costs and benefits to the Basin.

- Finally, Zone 7 continues to evaluate the feasibility of an intertie with another major water agency (e.g., East Bay Municipal Utilities District or SFPUC). An outage of the SBA, or major disruptions in the Delta, would prevent Zone 7 access to most of its water supplies, leaving only groundwater, water in the Chain of Lakes, and water in Lake Del Valle available to meet its demands. An intertie with another agency could provide an additional source of water during an emergency or drought and could also facilitate water transfers.

Conjunctive Use

Zone 7 continues to implement conjunctive use practices within the Basin to the greatest extent possible given current hydrologic conditions and imported water supply availability. During the 2021 WY, Zone 7 released 1,050 AF from the SBA into the Arroyo Valle for artificial recharge and water rights, of which 789 AF recharged.

Additionally, Zone 7 recently commissioned a technical study to assess the potential to increase conjunctive use in the Basin, including expansion of artificial recharge operations within the COL.

Well Master Plan (WMP)

During the 2021 WY, Zone 7 staff continued the process of reevaluating Zone 7's supply well needs. Site specific evaluation and future well construction will depend on the outcome of PFAS investigations and future regulatory requirements. Once the evaluation is complete, staff plans to begin WMP update in the upcoming fiscal year.

Chain of Lakes Recharge Projects

During the 2021 WY, Zone 7 continued to work with Hanson Aggregates (former quarry operator for Lakes H, I, and Cope) while they continue to finalize reclamation on Lake H.

The amendment to surface mining permit SMP-23 submitted by CEMEX (the quarry operator for Lakes A, B, and J) was approved in the 2021 WY. The amendment eliminates any additional mining in Pits P28 and P41 (Lake A), while increasing the amount mined in Pits P42 (Lake B) and P46 (Lake J). Zone 7 is still working with CEMEX to understand the potential impacts the proposed deeper mining in Lakes B and J will have on the Basin. The Environmental Impact Report (EIR) for the SMP-23 amendment was adopted by the Alameda County Planning Commission in June 2021. The Planning Commission also authorized new conditions of approval for SMP-23. One of the new conditions of approval is to install up to three new monitoring wells with guidance from Zone 7 on location and screened intervals. Zone 7 and CEMEX are working together on these wells which should be installed in the 2022 WY.

Water Demand Reduction Management Actions

Existing and Future Non-Potable Recycled Water Use

Both City of Livermore and DSRSD plan to expand the use of recycled water for turf and landscape irrigation projects over the next few years. Similarly, Pleasanton is planning to use recycled water from DSRSD and/or Livermore for irrigation of city parks and landscapes located over the Main Basin. In 2021, 8,215 AF were used, approximately 14% of the total water use for the Basin.

Zone 7 continues to collaborate with Livermore, DSRSD, and Pleasanton to mitigate for additional potential impact to groundwater quality from the future planned recycled water use.

Water Conservation

Throughout the 2021 WY, Zone 7 continued its regional coordination of conservation programs, including community workshops and other education/training events, school education programs, and rebates and water-saving giveaway programs, with adjustments made for pandemic conditions.

Groundwater Pumping Quota Program

The retailers are permitted by contract to pump a GPQ (accounted for on a CY basis) without having to pay a replenishment fee to Zone 7. They can carry forward any un-pumped GPQ (up to 20% of their GPQ). The retailer's GPQ, along with their groundwater pumping volumes for the

2021 CY, are shown in **Table 4**. None of the retailers pumped more than their respective GPQ in 2021 WY.

Projects to Improve Drinking Water Quality in Zone 7 Service Area

Well Ordinance Program

During the 2021 WY, Zone 7 issued 142 drilling permits, 26 more permits than in the 2020 WY. **Table 9** details the breakdown of the types of permits issued during the 2021 WY and their quantities.

Table 9: Well Ordinance Permits Issued in the 2021 WY

Permit Type	Quantity
Geotechnical Investigations	78
Well Destructions	24
Contamination Investigations/Remediation	9
Water Supply Wells	17
Groundwater Monitoring	12
Cathodic Protection Wells	2
Total	***142***

- Seventeen (17) water supply well permits were issued in the 2021 WY. The pre-drought average was 25 per year.

- About 78% of the permitted well work was physically inspected by Zone 7 permit compliance staff; the remaining 22% could proceed with self-monitoring and reporting efforts when a licensed professional was supervising the project.

Toxic Site Surveillance Program

In the 2021 WY, Zone 7 tracked the progress of 58 active sites where contamination has been detected in groundwater or is threatening groundwater. Five of these active sites have a contaminant plume that is within 2,000 ft of a water supply well or a surface water source and are therefore classified as "High Priority" cases due to their impact or threat of impact on potable groundwater supplies. Zone 7's database also contains 274 other contamination cases that have been either "Closed" or classified as "No Action Required" because they have been sufficiently cleaned up and/or pose minimal threat to drinking water supplies.

Salt Management

Table 10 below shows the salt loading summary for the 2021 WY.

Table 10: Salt Loading Summary for 2021 WY

Category	Volume (AF)	Salt Mass (Tons)	TDS Concentration (mg/L)	Change in Concentration from 2020 WY (mg/L)
Inflow	7,656	11,365	1,093	94
Outflow	27,999	18,362	483	38
Net (In – Out)	-20,343	-6,997	253	
Basin Total	226,900	220,437	715	38

- In the WY, the total salt mass added to the Main Basin by all the inflow (Supply) components was approximately 11,365 tons, whereas the total mass of salts removed from the Basin by all the outflow (Demand) components is estimated at 18,362 tons; a net decrease of 6,997 tons.

- While the salt load decreased during the 2021 WY, the end-of-water-year theoretical average TDS concentration for the Main Basin increased by 38 mg/L from the previous water year average. This is because the Basin storage dropped by 20,343 AF, which essentially concentrates the remaining salt in storage.

Groundwater Demineralization Program

The Mocho Groundwater Demineralization Plant (MGDP) was operated sparingly throughout the 2021 WY to conserve water during the drought:

- During the 2021 WY, the MGDP produced 143 AF of brine (compared to 344 AF in the 2020 WY) that resulted in the export of about 448 tons of salt from the Main Basin through the LAVWMA pipeline (compared to 1,230 tons in the 2020 WY).

- Since its inception, the MGDP has exported over 19,000 tons of salt from the Valley.

Nutrient Management

During the 2021 WY, Zone 7 continued working with Alameda County Environmental Health (ACEH) to implement the NMP measures. Zone 7 did receive one application for nonresidential onsite wastewater treatment systems (Onsite wastewater treatment system [OWTS], e.g., septic systems) in the 2021 WY and is working with ACEH to process the application.

Data Gap-Filling and Other Alternative GSP Implementation Projects

In 2021 Zone 7 conducted the following data gap filling activities and/or projects and will be seeking grant funding to fill additional data gaps:

- **Refinement and update of numerical groundwater flow model:** As part of the 2021 Alternative GSP, Zone 7 purchased a license for RockWorks (a three dimensional (3D) geologic modeling software platform), transferred the existing e-log and geology database, extended the hydrogeologic conceptual model (HCM) to include the Fringe and Upland Areas, and prepared three new cross sections that trace through the major groundwater production areas of the Basin. Zone 7's also migrated its existing Areal Recharge Spreadsheet Model (ARM) to DWR's Integrated Water Flow Model Demand Calculator (IDC) platform and extended the model to include the entire Basin.
- **Groundwater Contaminant Mobilization Study:** In 2021 and continuing into 2022, Zone 7 used its existing groundwater model to develop water quality fate and transport simulations to evaluate existing and future groundwater operations and the impact of constituents (including PFAS) that pose existing and/or anticipated challenges. The results of this study are expected to be presented later in 2022.
- **Well Metering and Pumping Record**: Zone 7 continues to assess the need for well metering and groundwater pumping data collection. Based on this assessment, a pumping data collection program may be implemented (e.g., well metering for all wells expected to pump more than 2 AFY).
- **Address and Resolve the Groundwater Storage Differences:** Zone 7 continues to refine the HI, Nodal/RockWorks GWE, and cross section methods for calculating groundwater storage. Although these conventional methodologies yield reasonable groundwater storage estimates, Zone 7 plans to use the updated groundwater model to estimate groundwater storage volumes more accurately once it becomes available.
- **Water Supply Risk Model:** Zone 7 continues to develop its new robust risk model using RiverWare software. This model will run on a monthly time step, and it will be able to represent the seasonal availability of supplies including local runoff, imported surface water, recovered water from groundwater banks and local groundwater in an integrated manner. Additionally, the risk model can be used in conjunction with the groundwater model to analyze sustainable management of the Basin.

9. References and Technical Studies

DWR, 2019, Sustainable Groundwater Management Act 2019, Basin Prioritization Process and Results. April 2019, 64 pp.

DWR, 2021. Sustainable Groundwater Management Act Water Year Type Data Set Development Report, January 2021, 17pp. https://data.cnra.ca.gov/dataset/sgma-water-year-type-dataset/resource/79c7b9c1-1203-4203-b956-844554fcec79

Zone 7 GSA, 2021, Alternative Groundwater Sustainability Plan 2021 Update for the Livermore Valley Groundwater Basin. Zone 7 Water Agency. December 2021. https://www.zone7water.com/alternative-groundwater-sustainability-plan-and-updates

APPENDICES

Appendix A. Annual Report Submittal Checklist
Appendix B. Supplemental Information