discussed in **Section 9.3.1**. Individual surface water supply sources are discussed in further detail in **Section 7.7.6.**

Table 9-B: Imported Surface Water Supplies/Storage

Surface Water Supply Source	Maximum Volume Available (AFY)
State Water Project (Table A)	**80,619**
Lake Del Valle (AV Water Rights)	**8,000***
Kern Groundwater Basin (Storage Only)	**198,000**
Semitropic	78,000
Cawelo	120,000
Other	**3,000***
Yuba Accord	2,000*
Dry Year Transfer	1,000*
Other Transfers	varies

AV = Arroyo Valle
*Estimated maximum volume, may vary

As discussed in **Section 7.7.5**, six major streams flow into and/or through the Basin and merge in the southwest where Arroyo de la Laguna flows out of the Basin. Stream flows and surface water quality are monitored by the surface water monitoring program described in **Section 14**. Natural stream recharge and artificial stream recharge of surplus imported surface water are discussed in **Section 9.2.2.2**.

9.2.2. Groundwater Inflows

☑ 23 CCR § 354.18(b)(2)

9.2.2.1. Rainfall and Applied Water Recharge

Zone 7 has historically used the ARM (**Section 9.1.1.1**) to estimate rainfall recharge and applied water recharge for the Main Basin. Model parameters include rainfall, evapotranspiration, soil moisture capacity, and irrigation efficiency, and account for land use, growing season, source water type (municipal, groundwater, or recycled water). This model has been refined over the years to resolve the difference between the HI and the GWE methods for calculating storage. For this Alt GSP update, Zone 7 upgraded the ARM model to IDC (see **Section 9.1.1.2**) and compared the resulting IDC recharge volumes to those from the ARM for the last 10 years (**Appendix D**). Moving forward starting with the 2021 WY, Zone 7 intends to use the IDC model for recharge accounting.

9.2.2.2. Stream Recharge

Stream recharge is categorized into the following three components:

- **Natural stream recharge** – runoff from rainfall into the streams, including both urban and rural runoff from the watershed, which naturally recharges the Basin's aquifers through the streambeds.
- **Artificial stream recharge** – aquifer recharge resulting from Zone 7-purchased SWP water being released from the South Bay Aqueduct (SBA) or from Lake Del Valle (both operated by DWR) into the Arroyos for the purpose of augmenting the natural stream recharge, maintaining habitat along Arroyo Valle, or as an alternate method of delivering water to Alameda County Water District (ACWD).
- **Arroyo Valle Prior Rights recharge** – aquifer recharge resulting from SWP or local water released from the SBA or Lake Del Valle to the Arroyo Valle to fulfill Zone 7 and ACWD's Arroyo Valle water rights requirements. The amount released is based on the amount that would have occurred if Lake Del Valle had not been constructed and is only required when Zone 7 and ACWD have local water stored in the lake.

Zone 7 calculates stream recharge for each stream reach by subtracting all stream outflows (e.g., flow at the downstream end of the reach and any diversions from the stream) from all inflows (flow entering the upstream end of the reach, diversions into the stream, and rainfall runoff). The three primary recharge streams (Arroyo Valle, Arroyo Mocho, and Arroyo Las Positas) have gauges upstream and downstream of the reaches along which recharge occurs (see **Figure 14-4** for stream gauge locations). To estimate rainfall runoff into each stream reach, Zone 7 uses either the ARM (to be replaced by IDC going forward) or a regression formula based on rainfall totals and stream flow at various gauge stations.

9.2.2.3. Subsurface Groundwater Flows

The Basin is a closed basin with little subsurface inflow into the Basin from the surrounding bedrock. There may be some subsurface inflow across the northern boundary from the San Ramon Basin, however the volume is unknown. Within the Basin, some subsurface inflow occurs from the Fringe Management Area (Fringe Area) into the Main Basin, primarily from the North Fringe Area across the northwestern border of the Main Basin. This inflow is estimated based on gradients across the Main Basin boundaries, aquifer structure, and the hydraulic conductivities of the aquifer sediments. Prior to 2000 WY, water levels were used to create rough estimates of subsurface inflow across boundaries; however, the subsurface inflow volumes varied little each year. Therefore, since the 2000 WY, Zone 7 has simply reported it as 1,000 AF per year.

9.2.2.4. Pipe Leakage

In the 2012 WY, Zone 7 staff began estimating the volume of water leaking from all underground water pipes into the Main Basin. Zone 7 estimates pipe leakage from water supply and sewage pipes into the Main Basin by using the following formula where pipe age is between 10 and 70 years old:

Leakage [gallon per day, gpd] = Pipe length [mile] x 50 [gpd/mile/year] x (Pipe Age [year] – 10).

The formula assumes that pipe leakage does not start until the pipe is at least 10 years old, after which it leaks at a rate of 50 gallons per day per mile (gpd/mi) for each year above 10 years old, up to a maximum of 3,000 gpd/mi.

9.2.3. Groundwater Outflows

☑ **23 CCR § 354.18(b)(3)**

9.2.3.1. Zone 7 Groundwater Pumping

Zone 7 operates ten municipal supply wells in four wellfields (see **Figure 9-1**). Historically, Zone 7's annual groundwater pumping has varied with the availability of imported surface water and the capacity to treat that surface water. In general, Zone 7 operates its municipal supply wells for salt management, demand peaks, and compensation for a shortage or interruption in its surface water supply or treatment. Zone 7 pumps only water that has been recharged as part of its artificial recharge program using its surface water supplies. The decision of which well(s) to pump is based on pumping costs, pressure zone needs, delivered aesthetic water quality issues, salt management needs, local groundwater levels, and demineralization facility capacity.

9.2.3.2. Groundwater Pumping by Others

Zone 7 compiles pumping data for all large capacity wells within the Main Basin. This includes daily and monthly pumping totals from the retailers. Records of other pumping wells are obtained from well owners when available. Pumping volumes from significant wells without meters are estimated from utility records or from the associated land use (e.g., crop type and number of acres irrigated).

In addition to Zone 7's ten municipal wells, California Water Company (Cal Water) operates 12 wells in the Livermore area, and the City of Pleasanton operates 3 wells and San Francisco Public Utilities Commission (SFPUC) operates 2 wells in Pleasanton (see **Figure 9-1** for the relative locations of the municipal supply wells).

As discussed in **Section 9.3.1.2** below, there are no municipal supply wells in the Fringe and Upland Areas, and groundwater pumping is limited to domestic and agricultural uses.

9.2.3.3. Mining Area Losses

Mining area evaporation accounts for a large portion of the losses from the Basin and is second only to municipal pumping as an outflow component in the annual HI calculation. Zone 7 calculates the total monthly evaporative losses for the water bodies exposed to the atmosphere by mining operations (also referred to as mining ponds) using the net difference between total rainfall and estimated evaporation over the total pond area.

Mining activity losses also include groundwater lost due to export of moist gravels and groundwater that has been pumped from the quarry pits and discharged into a stream without subsequent recharge. The volume of this exported groundwater varies over time depending on the stage of mining in any given pit and the demand for aggregate resources. When the permitted gravel extraction operations are complete (currently envisioned for 2058), the associated operational groundwater losses (i.e., pit dewatering, gravel washing, and moisture export) will be eliminated.

9.2.3.4. Basin Outflow

Subsurface Basin outflow, which also occurs primarily in the Upper Aquifer, tends to discharge into the Arroyo de la Laguna and flows out of the Basin to the San Francisco Bay through Alameda Creek when water levels are above elevation 295 feet above mean sea level (ft msl) in this portion of the Bernal Subarea. Zone 7 used groundwater elevation data and synoptic streamflow measurements to develop a formula that estimates groundwater overflow rate based on the groundwater elevations in that part of the Basin.

When water levels are sufficiently high in the northeast Fringe Area, groundwater in the vicinity of the Springtown Alkali Sink (**Section 7.7.5**) discharges to Altamont Creek, exiting the Springtown Alkali Sink as surface water. Groundwater also constantly discharges from the northwest Fringe Area into the San Ramon Creek/Alamo Canal, which merges into the Arroyo de La Laguna and eventually flows out of the Basin. The volumes for both are estimated as part of the Fringe Area water budgets (see **Section 9.3.1.2**)

9.3. Current and Historical Water Budget

The current water budget for 2020 WY is shown on **Table 9-2**; the historical water budget for 1974 WY to 2020 WY is tabulated in **Table 9-3** and charted in **Figure 9-2** along with the water year type (e.g., wet, normal, dry, etc.) noted for each year.

9.3.1. Current Water Budget

§ 354.18. Water Budget
(c) Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:
(1) Current water budget information shall quantify current inflows and outflows for the basin using the most recent hydrology, water supply, water demand, and land use information.

☑ 23 CCR § 354.18(c)(1)

The availability of State Water Project (SWP) supplies is fundamental to Zone 7's maintenance of its Basin measurable objectives for sustainable groundwater levels and storage, avoidance of subsidence, and protection of groundwater dependent eco-systems (GDEs). DWR accounts for the SWP supplies on a calendar year (CY) basis so these are presented as such in the tables and figures in this section. The SWP allocation for the 2020 CY was 20% (16,124 AF) of Zone 7's maximum allocation (80,619 AF). **Table 9-C** below shows Zone 7's imported water supplies for the 2020 CY and the amounts being carried over to the 2021 CY. Imported surface water supplies in the 2020 CY made up 60% of regional water demands.

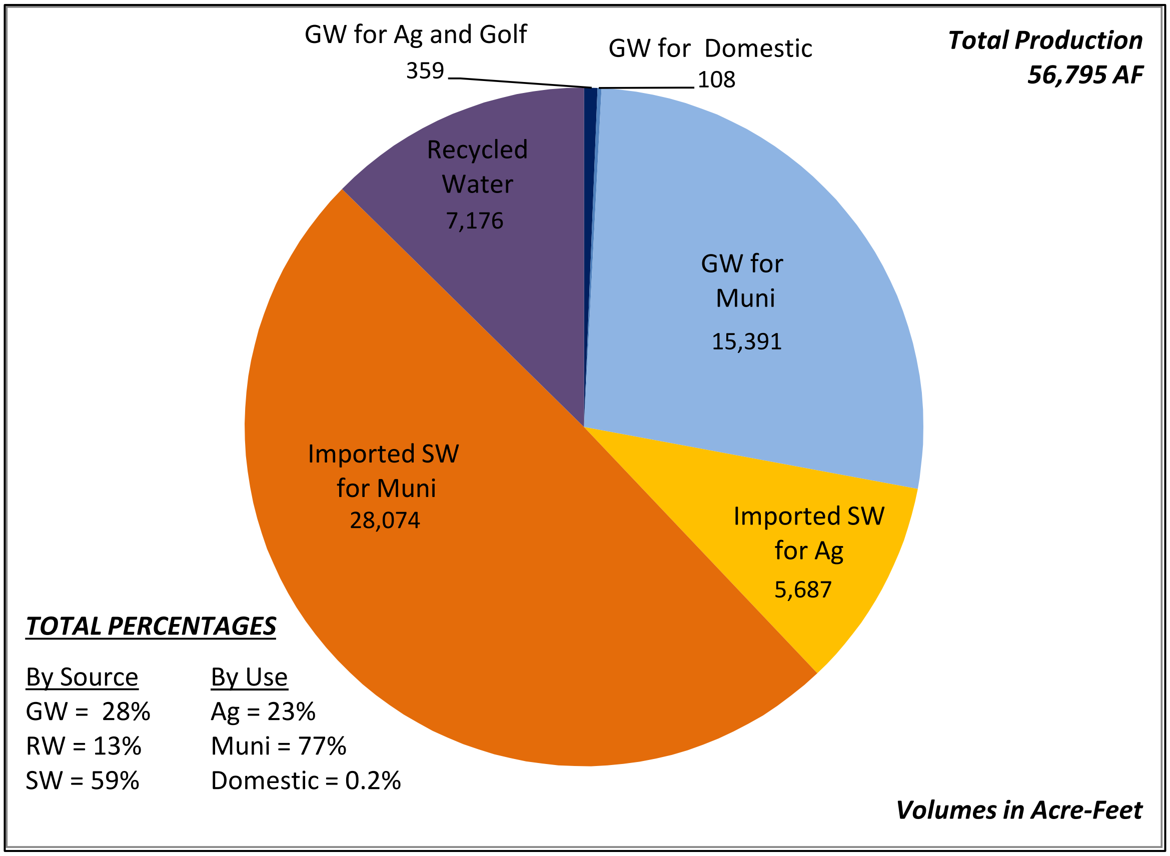
Table 9-C: Imported Water Sources for the 2020 Calendar Year (AF)

Source	Available at end of 2019	Added in 2020 *	Used in 2020	Carryover to 2021
State Water Project	**10,810**	**16,124**	**18,070**	**8,864**
Table A	0	16,124	7,260	8,864
Article 56	10,810	0	10,810	0
Lake Del Valle (AV Water Rights)	**8,100**	**600**	**8,700**	**0**
Kern Groundwater Basin	**117,075**	**0**	**1,000**	**116,075**
Semitropic	87,170	0	1,000	86,170
Cawelo	29,905	0	0	29,905
Other	**0**	**7,111**	**7,111**	**0**
Yuba	0	2,111	2,111	0
Dry Year Transfers	0	0	0	0
Other	0	5,000	5,000	0
Total	**135,985**	**23,835**	**34,881**	**124,939**

* 20% State Water Project Allocation for the 2020 WY
AV = Arroyo Valle

The volume of water produced and used in the Basin during the 2020 WY is shown in **Figure 9-A** below.

Figure 9-A: Basin-Wide Water Production for the 2020 Water Year (AF)



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

Figure 9-3 shows the volumes of both the surface water imported and Basin-wide water produced during the 2020 WY**.** The following activities occurred during the 2020 WY.

- Total groundwater production in the Basin (including by Zone 7, retailers, agriculture, domestic, etc.) supplied about 28% of the total Basin-wide water demand.
- Of the 11,746 AF of groundwater pumped by Zone 7 during the 2020 WY, about 11,346 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 28% of the total treated water production that Zone 7 delivered to its retailers during the 2020 WY (on average, groundwater makes up about 15% of Zone 7's annual treated water deliveries).

9.3.1.1. Main Basin Management Area Budget

The Main Basin water budget involves accounting for inflows and outflows described in **Section 9.2** for each water year and adds the net change in storage to the previous year's volume to obtain the total storage. All the HI components are listed in **Table 9-1** along with their method of measurement and their approximate accuracy. The results of the HI method for the 2020 WY are summarized below in **Table 9-D** below and shown in detail on **Table 9-2.**

Table 9-D: Groundwater Inflow and Outflow Volumes, 2020 WY (AF)

CATEGORY	Sustainable Yield*	2020	% of Average
SUPPLIES	**19,800**	**13,515**	**68%**
Stream Recharge Artificial	5,300	2,461	46%
Stream Recharge Natural	6,600	3,511	53%
Rainfall Recharge	4,300	2,869	67%
Applied Water Recharge	1,600	2,465	154%
Pipe Leakage	1,000	1,209	121%
Subsurface Inflow	1,000	1,000	100%
DEMANDS	**18,800**	**21,447**	**114%**
Zone 7 Pumping excluding DSRSD	5,300	11,101	209%
Other Pumping	8,400	5,248	62%
Agricultural Pumping	400	112	28%
Mining Losses	1,400	700	50%
Evapotranspiration (ETo)	3,200	4,140	129%
Subsurface Outflow	100	146	146%
NET CHANGE (SUPPLY - DEMAND)	**1,000**	**-7,932**	
TOTAL STORAGE (HI Method)		**247,232**	

* Sustainable Yield and Allocated Outflows - See Section 9.3.6 for more details

The total groundwater storage for the Main Basin from the HI Method is 247.2 thousand acre-feet (TAF). For accounting purposes Zone 7 computes Main Basin storage by averaging the storage estimates from the GWE (231.7 TAF) and HI methods (247.2 TAF, **Table 8-B, Section 8.4.2**). As a result, the total groundwater in storage at the end of 2020 WY was calculated to be 239.5 TAF, with 111.5 TAF of groundwater available as operational storage, which is about 88% of the total operational storage capacity (i.e., 126 TAF from 1983 WY).

9.3.1.2. Fringe and Upland Management Areas Budget

Groundwater elevations in the Fringe and Upland Areas vary little over time, indicating that storage also remains relatively constant over time. Since groundwater pumping is minimal in these Management Areas, this constant storage volume suggests that variations in groundwater inflow volumes (e.g., from rainfall) are balanced by a corresponding change in basin overflow into the gaining streams and/or subsurface outflow into the Main Basin (**Section 9.3.3.2**). The HI method was used to estimate a groundwater budget for the Fringe and Upland Areas in an average water year (i.e., using average annual precipitation data, see **Table 9-E** below).

There is no pumping by Zone 7 or the retailers from the Fringe or Upland Areas. In general, wells within the Upland Area are completed within semi-consolidated to consolidated bedrock units, have relatively low yields, and are for domestic use by de minimis extractors. Most of the precipitation that falls on the Upland Area leaves the area as runoff and contributes to streams in the Fringe Area and the Main Basin. Information such as crop type and irrigated acreage was used in conjunction with the ARM/IDC models to estimate pumping by agricultural users and golf courses. Domestic well pumping was calculated by multiplying the number of known wells in those areas by an estimated 0.5 acre-feet per year (AFY) per well (estimated average annual use by a family).

Table 9-E: Estimated Average Groundwater Budget for Fringe and Upland Areas

COMPONENTS	Fringe Northwest	Fringe Northeast	Fringe East	Upland
INFLOW	**2,154**	**2,462**	**681**	**4,530**
Stream Recharge (natural)	150	659	100	0
Stream Recharge (artificial)	0	0	0	0
Rainfall Recharge	1,173	973	317	3,235
Leakage	301	385	21	404
Applied Water	530	444	243	892
Subsurface Inflow	0	0	0	0
OUTFLOW	**2,155**	**2,462**	**681**	**4,530**
Zone 7 Pumping				
Retailer Pumping				
Ag Pumping	32	16	29	92
Other Pumping	12	46	28	178
Mining Losses				
Basin Outflow	2,111	2,400	625	4,260
Outflow to Streams	1,111	2,400		4,260
Subsurface Outflow	1,000		625	
NET WATER BALANCE	**0**	**0**	**0**	**0**

9.3.2. Historical Water Budget

§ 354.18. Water Budget
(c) Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:
(2) Historical water budget information shall be used to evaluate availability or reliability of past surface water supply deliveries and aquifer response to water supply and demand trends relative to water year type. The historical water budget shall include the following:
(A) A quantitative evaluation of the availability or reliability of historical surface water supply deliveries as a function of the historical planned versus actual annual surface water deliveries, by surface water source and water year type, and based on the most recent ten years of surface water supply information.
(B) A quantitative assessment of the historical water budget, starting with the most recently available information and extending back a minimum of 10 years, or as is sufficient to calibrate and reduce the uncertainty of the tools and methods used to estimate and project future water budget information and future aquifer response to proposed sustainable groundwater management practices over the planning and implementation horizon.
(C) A description of how historical conditions concerning hydrology, water demand, and surface water supply availability or reliability have impacted the ability of the Agency to operate the basin within sustainable yield. Basin hydrology may be characterized and evaluated using water year type.

9.3.2.1. Historical Surface Water Availability and Reliability

☑ **23 CCR § 354.18(c)(2)(A)**

Figure 9-4 shows that about 82.3 TAF more surface water (natural and artificial) has inflowed into the valley than what has outflowed over the last 15 years. As a SWP contractor, Zone 7 imports supplies from the SWP through the SBA. As of 1998, Zone 7 has had an annual maximum SWP contract amount of 80,619 AFY referred to as the "Table A Contract Amount." However, actual SWP deliveries are usually allocated in any given year by DWR at a lower level based on numerous factors, including hydrologic conditions. Currently, the long-term reliable yield of the SWP is approximately 50% of the Table A amount (40,300 AFY). Over that same 1974 to 2020 time period, the average delivered volume of imported water (not including imported water that was previously banked at one of the Kern Basins) is about 25,500 AFY. Actual imported surface water volumes from 1975 to 2020 WY are shown on **Figure 9-5**.

9.3.2.2. Quantitative Assessment of Historical Water Budget

☑ **23 CCR § 354.18(c)(2)(B)**

The water budget has been evaluated using the methodologies described in **Section 9.1.1** for every year since 1974. The HI is updated and presented in the Annual Water Year Reports. **Table 9-3** shows the volume of groundwater inflows and outflow from the Basin from 1974 to 2020. **Figure 9-5** shows the historical percentage of groundwater production relative to total Valley-wide production end-of-year storage balances from the 1974 to 2020 WYs. **Figure 9-6** presents annual inflows (blue), outflows (red) and the cumulative change in groundwater storage from 1974 WY through 2020 WY. As shown on the figure, any given year may have an imbalanced inflow and outflow; but with adaptive management, long-term sustainability has been achieved for 45 years. Beginning in about 1974, the Basin had recovered from the historic lows in the early 1960s to more average water level conditions because of the Zone 7 conjunctive use program. Since that time, annual changes in groundwater storage have responded to wet and dry periods. However, only in the drought conditions of the 1990s did the cumulative change in Basin-wide groundwater storage persist below 1974 storage levels for more than two consecutive years. Even in the recent 2009-2015 drought conditions, changes in groundwater storage were managed above the 1974 volumes.

9.3.2.3. Operation Within Sustainable Yield

☑ **23 CCR § 354.18(c)(2)(C)**

Section 9.3.6 outlines how the sustainable yield of the Main Basin is budgeted in two categories:

- **Natural Recharge** (sustainable yield = 13,400 AFY) - water recharged naturally or by entities other than Zone 7. This is allocated to groundwater outflow not managed or pumped by Zone 7 (see **Section 9.3.6.2**).
- **Artificial Recharge** (sustainable average = 5,300 AFY) - imported surface water that Zone 7 recharges into the groundwater basin to manage and pump (i.e., "Conjunctive Use", see **Section 9.3.6.3**)

Figure 9-7 shows that the cumulative net natural recharge/outflow since 1974 is approximately -40 TAF (see **Section 9.3.6.2** for a more detailed description). Over that same time period, Zone 7 has recharged about 67 TAF more than it has pumped (**Figure 9-8, Section 9.3.6.3**). Without this recharge, natural demands would have outpaced the natural sustainable yield of the Basin. Since 1974, Zone 7 has imported and recharged about 220 TAF to keep the Basin sustainable.

9.3.3. Change in Groundwater Storage

☑ **23 CCR § 354.18(b)(4)**

9.3.3.1. Main Basin Management Area

Methodologies Zone 7 used to calculate groundwater storage in the Basin are described in **Section 8.4**. The GWE method yielded a total storage of 231.6 TAF at the end of the 2020 WY, which is 16.8 TAF less than the GWE value calculated for the 2019 WY. The HI method produced a total storage value of 247.2 TAF for the end of the 2020 WY, which is about 7.9 TAF less than the end of the 2019 WY HI value. The average of the both methods for the 2020 WY, summarized below in **Table 9-F,** indicates a storage loss of 12.3 TAF since the 2019 WY. **Table 9-G** shows the change in groundwater inflows and outflows for the 2020 Water Year.

Table 9-F: Change in Groundwater Storage 2020 WY (in TAF)

Storage Calculation Method	End of 2019 WY	End of 2020 WY	Change in Storage
Groundwater Elevations (GWE)	248.5	231.7	-16.8
Hydrologic Inventory (HI)	255.2	247.2	-8.0
Total Storage (average of GWE & HI)	251.8	239.5	-12.3
Operational Storage*	123.8	111.5	-12.3

* Operational Storage = Total Storage - Reserve Storage (i.e., 128 TAF)

Table 9-G: Change in Groundwater Inflows and Outflows 2020 WY (AF)

CATEGORY	Sustainable Yield*	2020 WY	Change from 2019 WY
SUPPLIES	**19,800**	**13,515**	**-10,110**
Artificial Stream Recharge	5,300	2,461	-482
Natural Stream Recharge	6,600	3,511	-4,151
Rainfall Recharge	4,300	2,869	-5,719
Applied Water Recharge	1,600	2,465	179
Pipe Leakage	1,000	1,209	64
Subsurface Inflow	1,000	1,000	0
DEMANDS	**18,800**	**21,447**	**2,305**
Zone 7 Pumping excluding DSRSD	5,300	11,101	3,081
Other Pumping	8,400	5,248	-1,366
Agricultural Pumping	400	112	-1
Mining Losses	1,400	700	0
Evapotranspiration (ETo)	3,200	4,140	1,255
Subsurface Outflow	100	146	-663
NET CHANGE (SUPPLY - DEMAND)	**1,000**	**-7,932**	**-12,415**
TOTAL STORAGE (HI Method)		**247,232**	**-7,932**

AF = acre-feet
DSRSD = Dublin San Ramon Services District
* Sustainable Yield and Allocated Outflows - See Section 9.3.6

Annual and cumulative changes in groundwater storage since 1974 WY are presented on **Figure 9-6** and in **Table 9-3.** Since 1974 WY, the Main Basin has experienced a cumulative gain in storage of +35 TAF.

9.3.3.2. Fringe and Upland Management Areas

Figure 8-8 shows that water levels in the Fringe Area vary little over time, indicating that storage remains relatively constant over time. Since groundwater pumping is minimal in these areas, this constant storage volume suggests that variations in groundwater inflow volumes (e.g., from rainfall) are balanced by a corresponding change in Basin overflow into the gaining streams and/or subsurface outflow into the Main Bain. **Section 9.3.1.2** shows the estimated average rainfall inflow and Basin outflow from the Fringe Area.

The same is believed to be the case for the Upland Area, however little groundwater and flow data is available to confirm this. For this Alt GSP update, Zone 7 added several wells in the Upland Area to monitor changes in water levels over time (see **Section 14.2.1**).

9.3.4. Overdraft Conditions

☑ **23 CCR § 354.18(b)(5)**

The Basin is a medium-priority basin and is not designated as being in a condition of critical overdraft by DWR in its latest version of Bulletin 118 – California's Groundwater (*DWR, 2016c*). As described in **Section 8.3.3**, the groundwater levels in the Basin dropped significantly during the 1940s and 1950s. Zone 7 was established in 1957 partially to address the water supply overdraft. The downward trend in groundwater elevation began to reverse in 1962 when Zone 7 began importing water from the SWP and later in the 1960s when Zone 7 began capturing and storing local runoff in Lake Del Valle. The first imports were diverted to an off-stream recharge facility called Las Positas Pit. This facility was operated from 1962 until the late 1970s and again, briefly, in the 1980s. Since that time, the Zone 7 program of capturing and storing water has been expanded throughout the Main Basin.

Thus, after experiencing historical groundwater lows in the 1960s, Main Basin water levels stabilized in the late 1960s and started to rise in the early 1970s with the advent of regional groundwater management programs. Following a 'very critical dry' year in 1977, groundwater levels continued to recover and peaked in 1983, which is the modern maximum ("basin full") limit.

Since 1983, water levels have been drawn down three separate times in response to times of limited water importation from the SWP but have not reached previous historic low levels (see **Figure 8-1** of the Fairgrounds Key Well). As shown on **Figure 8-1**, groundwater levels subsequently recovered following the dry cycles in the early 1990s and the early 2000s because of Zone 7's managed aquifer recharge operations and a corresponding reduction in groundwater production. The recent severe drought cycle of 2012-2015 resulted in a lowering of Basin-wide water levels, but levels remained above the drought cycle of the early 1990s and significantly above historic lows (**Section 8.3.3**). These water level data are consistent with sustainable groundwater management practices since at least the early 1970s.

A "condition of long-term overdraft" is defined in Section 10735 of the California Water Code (CWC) as "the condition of a groundwater basin where the average annual amount of water extracted for a long-term period, generally 10 years or more, exceeds the long-term average annual supply of water to the basin, plus any temporary surplus. Overdraft during a period of drought is not sufficient to establish a condition of long-term overdraft if extractions and 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". Therefore, based on the above discussion and the definition of overdraft provided in the CWC, the Basin as a whole is not in a condition of overdraft.

9.3.5. Water Year Types

☑ **23 CCR § 354.18(b)(6)**

Zone 7's Climatological Monitoring Program tracks rainfall and evaporation in the Basin, employing a network of climatological stations. The primary objective of this monitoring network is to provide high quality Basin-wide climate data for long-term studies, Basin recharge calculations, and water management decisions. Specifically, the calculations of Basin recharge are used in the annual water budget, change in groundwater storage, and the defined objectives of operational storage (see **Section 8.4**). Data are collected to provide short-term, seasonal, and long-term trends in local hydrologic conditions.

As part of the Climatological Program, Zone 7 collects and displays (e.g., **Table 9-3**, **Figure 9-4**, and **Figure 9-5**) the Water Year type obtained from DWR's Sacramento Valley Water Year Index (https://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST). This hydrology is more consistent with the availability of imported supplies, generally approximates local rainfall patterns in the Basin, and is used to show how supplies, demands, and groundwater storage changes vary in different water year types.

9.3.6. Sustainable Yield

☑ **23 CCR § 354.18(b)(7)**

9.3.6.1. Overview

As defined by Sustainable Groundwater Management Act (SGMA), Sustainable Yield is the amount of water that can be extracted from the Basin on an annual basis without causing Undesirable Results (defined in **Section 13**). Given that the Basin is a relatively closed basin with minor amounts of subsurface inflow and outflow, the volume of groundwater in storage can be managed within an operational storage range, using averages of each water budget component as a general method for avoiding historic lows. Because no Undesirable Results have been observed while operating within this storage range, average water budget targets are referred to as Sustainable Yield estimates for the purposes of groundwater management.

To maintain sustainable management of the Basin, Zone 7 developed target values for inflows and outflows in 1992 using the HI method. The Sustainable Yield of the Main Basin is budgeted in two categories, both of which are discussed in more detail in the next sections. As further described below, the total Sustainable Yield of the Basin is the sum of the following two categories:

- **Natural Recharge** (sustainable average = 13,400 AFY) - water recharged naturally or by entities other than Zone 7. This is allocated to groundwater outflow not managed or pumped by Zone 7 (see **Section 9.3.6.2**).
- **Artificial Recharge** (sustainable average = 5,300 AFY) - imported surface water that Zone 7 recharges into the groundwater basin to manage and pump (i.e., "Conjunctive Use", see **Section 9.3.6.3**)

Overall, Zone 7 maintains the sustainability of the Basin through the following actions to help avoid a repeat of historical overdraft of the Basin (**Section 9.3.4**):

- Monitoring the long-term natural groundwater budget
- Importing, artificially recharging, and banking surface water to meet future demands,
- Implementing a conjunctive use program that maximizes use of the storage capacity of the Basin
- Limiting long-term groundwater pumping to sustainably manage the Basin
- Maintaining sustainable long-term groundwater storage volumes, even when total outflows exceed the natural sustainable supply
- Promoting increased and sound recycled water use, and
- Identifying and planning for future supply needs and demand impacts. This is often performed using Zone 7's groundwater model of the Basin.

9.3.6.2. Natural Recharge and Non-Zone 7 Outflow

In 1992, Zone 7 estimated that the long-term average "natural" groundwater inflow into the Main Basin is about 13,400 AF annually (*Zone 7, 1992*). This long-term average (shown as the "sustainable yield" in the **Table 9-H** below) was primarily based on average local precipitation and natural recharge over a century of hydrologic records; however, the actual amount of natural recharge varies from year to year depending on the amount of local precipitation during the year. Recharge from irrigation (applied water) is also included in the "natural" inflow total, because of its steady, sustainable, contribution to groundwater recharge in the Basin.

Table 9-H: Natural Groundwater Inflow

Supply Component	Sustainable Yield Estimate (AFY)*	Actual Average (1974-2020 WY, AFY)
Natural Stream Recharge	5,700	5,715
Arroyo Valle Prior Rights	900	902
Rainfall Recharge	4,300	4,675
Applied (Irrigation) Water Recharge	1,600	2,061
Subsurface Groundwater Flow	900	597
Subsurface Inflow	1,000	986
Basin Overflow	-100	-389
TOTAL	13,400	13,950

* as calculated in *Zone 7, 1992*

In the early 1990s, Zone 7 collaborated with the Retailers to ensure that average natural recharge to the Basin was not less the non-Zone 7 groundwater outflow, which includes groundwater pumping (other than Zone 7's), evapotranspiration (ET), mining losses, and Basin overflow. As a result, each retailer was allocated an annual independent Groundwater Pumping Quota (GPQ), which is generally based on average historical uses and is pro-rated based on the agreed upon natural recharge. The retailers are permitted by contract to pump this 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). **Table 9-I** below includes each retailer's GPQ, along with their groundwater pumping volumes for the 2020 CY. None of the retailers pumped more than their respective GPQ in 2020 CY.

Table 9-I: Retailer Groundwater Pumping and Quotas in 2020 Calendar

Retailer	GPQ	Carryover from 2019 CY	Pumped in 2020 CY	Carryover to 2021**
City of Pleasanton	3,500	3	3,110	393
Cal Water	3,069	614	1,063	614
DSRSD (pumped by Zone 7)	645	0	645	0
City of Livermore (not used)*	31	-	0	-
Total	**7,214**	**617**	**4,818**	**1,007**

AF =Acre-feet
GPQ = Groundwater Pumping Quota
* = Livermore no longer pumps groundwater, GPQ not included in totals or carryover.
** = Maximum of 20% of GPQ can be carried over

The remaining balance of the average natural recharge is allocated to other domestic, agricultural, and gravel mining uses as shown in **Table 9-J** below:

Table 9-J: Average Natural Sustainable Yield Outflow

Demand Component	Sustainable Average (AFY)	Actual Average (1974-2020 WY, AFY)
Municipal pumping by retailers (GPQs)	7,214[a]	6,272
Pleasanton	3,500	3,264
Cal Water	3,069	2,761
DSRSD	645	247
Other groundwater pumping[b]	1,186	1,188
Agricultural pumping	400	996
Mining area losses[c]	4,600	6,369
TOTAL	**13,400**	**14,825**

a. Based on calendar year. Livermore has a GPQ of 31 AF but it has not been used for many years.
b. For drinking water supply
c. Includes mining area evaporation, discharges that are diverted to arroyos and flow out of the Main Basin, and losses incurred during gravel production and export.

Since 1974 the average non-Zone 7 outflow has exceeded the average natural recharge by 875 AFY. **Figure 9-7** shows that the cumulative net natural recharge/outflow since 1974 is approximately -41 TAF. The graph shows that the cumulative dropped significantly from 1974 to early 2000. This drop was primarily because of losses due to mining activity, where groundwater was extracted from the mined pits and then discharged into the arroyos where it flowed out of the Basin. Starting in the early 2000s, the cumulative curve flattens out when Zone 7 worked with the mining companies to recapture their pit-dewatered groundwater in other unused ponds. In 2013 all dewatering discharged into the streams ceased when Vulcan Materials started discharging their dewatering groundwater into Cope Lake, which drains into neighboring Lake I and eventually reenters the Basin. As a result, since 2000 the average total non-Zone 7 outflow (13,463 AF) has been slightly less than the average total natural recharge (14,466 AF).

9.3.6.3. Zone 7 "Artificial" Supply and Demand (Conjunctive Use)

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. These features include local Arroyos (which are also used as flood protection facilities during wet seasons) and two former quarry pits (Lake I and Cope Lake). Zone 7's "artificial recharge" operation involves releasing imported water supplies into the local "losing stream" Arroyos to recharge the Basin. The volume of artificial recharge is dependent on Zone 7's annual SWP allocations, precipitation captured locally, and water supply operations plans. Typically, Zone 7 will commence artificial recharge operations during times of surplus imported water availability.

While groundwater pumping by the retailers is accounted for in the "natural" budget (see above), Zone 7's groundwater pumping and artificial recharge volumes are accounted for in the "conjunctive use" budget. 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. In the 2016 Alt GSP

(*Zone 7, 2016e*), Zone 7's historical artificial conjunctive use (i.e., artificial sustainable yield) for the Main Basin was estimated to be about 5,300 AFY (see **Table 9-K),** but the actual volumes have varied significantly depending on surface water supplies and hydrologic conditions. Since 1974, Zone 7 has artificially recharged about 67 TAF more than it has pumped (**Figure 9-8**). These totals do not include the water Zone 7 pumps for DSRSD (usually 645 AFY), which is considered part of the "natural" demand.

Table 9-K: Zone 7 Historical Conjunctive Use Balance

Component	Estimated Sustainable Average (AFY)	Actual Average (AFY)
Artificial Recharge	5,300	5,380
Zone 7 Pumping	5,300	3,955
Net Artificial Recharge	**0**	**1,425**

AFY = acre-feet per year

9.3.6.4. Total Sustainable Yield

The total Sustainable Yield of the basin, which is the sum of the natural (13,400 AF) and artificial (5,300 AF) recharge components, has been estimated to be **18,700 AF**. However, since 1974, the non-Zone 7 outflow has exceeded the natural recharge by about 41 TAF, primarily due to mining pit dewatering that was discharged into the arroyos prior to about 2000 (**Figure 9-7**). Over that same period Zone 7 has artificially recharged about 67 TAF more than it has pumped (**Figure 9-8**), which has more than covered the 41 TAF loss. **Figure 9-9** shows that the cumulative change in storage since 1974 is about +35 TAF.

Looking to the future, Zone 7 will continue to work with the mining companies to ensure that their dewatered groundwater does not leave the Basin so that future non-Zone 7 outflow will be equal to or less than the natural recharge (i.e., sustainable). Zone 7 also plans to increase its conjunctive use when it acquires the additional former quarries (Lakes A through H) that will become the area's future "Chain of Lakes" (COL). These additional lakes will provide additional capacity for artificial recharge and regional flood protection (see **Section 9.4** below).

9.4. Projected Water Budget

§ 354.18. Water Budget
(c) Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:
(3) Projected water budgets shall be used to estimate future baseline conditions of supply, demand, and aquifer response to Plan implementation, and to identify the uncertainties of these projected water budget components. The projected water budget shall utilize the following methodologies and assumptions to estimate future baseline conditions concerning hydrology, water demand and surface water supply availability or reliability over the planning and implementation horizon:
(A) Projected hydrology shall utilize 50 years of historical precipitation, evapotranspiration, and streamflow information as the baseline condition for estimating future hydrology. The projected hydrology information shall also be applied as the baseline condition used to evaluate future scenarios of hydrologic uncertainty associated with projections of climate change and sea level rise.
(B) Projected water demand shall utilize the most recent land use, evapotranspiration, and crop coefficient information as the baseline condition for estimating future water demand. The projected water demand information shall also be applied as the baseline condition used to evaluate future scenarios of water demand uncertainty associated with projected changes in local land use planning, population growth, and climate.
(C) Projected surface water supply shall utilize the most recent water supply information as the baseline condition for estimating future surface water supply. The projected surface water supply shall also be applied as the baseline condition used to evaluate future scenarios of surface water supply availability and reliability as a function of the historical surface water supply identified in Section 354.18(c)(2)(A), and the projected changes in local land use planning, population growth, and climate.
(d) The Agency shall utilize the following information provided, as available, by the Department pursuant to Section 353.2, or other data of comparable quality, to develop the water budget:
(1) Historical water budget information for mean annual temperature, mean annual precipitation, water year type, and land use.
(2) Current water budget information for temperature, water year type, evapotranspiration, and land use.
(3) Projected water budget information for population, population growth, climate change, and sea level rise.

9.4.1. Projected Water Budget Methods and Data Sources

☑ **23 CCR § 354.18(c)(3)(A)**
☑ **23 CCR § 354.18(c)(3)(B)**
☑ **23 CCR § 354.18(c)(3)(C)**

Zone 7's imported water supplies have decreased in reliability over the years as SWP reliability has declined while demand has increased due to continued population growth. Zone 7 regularly evaluates the Valley's water supplies and demands in their Water Supply Evaluation Updates (WSE; *Zone 7, 2016b*) and their Urban Water Management Plans (UWMP; *Zone 7, 2021*). About ten years ago, Zone 7 developed a Water Supply Risk Model as a powerful tool for water supply decision-making and planning. The dynamic model allows for a year-by-year analysis of water system operations in response to hydrologic conditions (e.g., drought). The Water Supply Risk Model simulates water system behavior and calculates reliability forecasts on an annual time scale using a Monte Carlo technique that generates a range of future water supply conditions, random Delta outage scenarios, and uncertain climate impacts. The projected water budget presented herein is consistent with the results of the Water Supply Risk Model applied as part of the 2020 UWMP.

9.4.2. Development of Projected Water Budget Scenarios

☑ **23 CCR § 354.18(c)(3)(A)**
☑ **23 CCR § 354.18(c)(3)(B)**
☑ **23 CCR § 354.18(c)(3)(C)**
☑ **23 CCR § 354.18(d)(3)**

In its 2020 UWMP (*Zone 7, 2021*), Zone 7's used the Water Supply Risk Model to evaluate future water supplies assuming long-term average hydrologic conditions, climate change impacts to local surface water supplies, and climate change impacts to SWP reliability based DWR's CalSim II water resources planning model (*DWR, 2020b*).

For the demand portion of the Water Supply Risk Model, Zone 7 worked closely with its retailers to develop demand projections and jointly completed a Regional Demand Study[30] (*Woodard & Curran, 2021)* concurrently with the 2020 UWMP. The primary goal of the Regional Demand Study was to develop a regional, land-use based water demand forecasting model that can be used for planning efforts. Historically, the retailers have conducted independent demand forecasting, with Zone 7 using those forecasts to develop a regional forecast (after some adjustment). The Regional Demand Study developed a consistent method for estimating demands across the Tri-Valley region, while still considering the unique characteristics of each of Zone 7's retailers, including demographic data, historical water use, demand hardening patterns, and future projections for land use and population. Zone 7 also developed projections for its direct retail customers, untreated water (agricultural) customers, and losses (i.e., unaccounted-for water) in its water supply system. As further described below, the Regional Demand Study also accounts for climate change impacts in developing projections of future outdoor water demands. See the 2020 UWMP (*Zone 7, 2021*) for more details of estimated future supplies and demands used in the Water Supply Risk Model.

For this Alt GSP update, the Water Supply Risk Model was run assuming average hydrologic conditions from 2020 to 2081 WYs using the estimated future supplies and demands discussed above.

9.4.2.1. Climate Change Considerations

Climate change is anticipated to impact Zone 7's future water supply availability, demand, and operational patterns. Warmer temperatures are expected to increase irrigation demand and lengthen the growing season. In addition, climate change may impact hydrologic cycles, watershed management, surface water

[30] https://www.zone7water.com/sites/main/files/file-attachments/2020_tri-valley_demand_study.pdf?1627595774

quality, stream flow and groundwater recharge. Increased water efficiency and conservation, along with expanded use of recycled water by Zone 7's retailers, could mitigate the effects of climate change on water demands. More importantly, Zone 7's adaptive management and integrated planning will be required to account for effects of climate change and respond appropriately.

As mentioned above, projections of future SWP supplies in the Water Supply Risk Model were derived from DWR's CalSim II water resources planning model included in DWR's 2019 State Water Project Delivery Capability Report (DCR; *DWR, 2020b*). The Water Supply Risk Model specifically accounts for climate change impacts to future SWP supply reliability by employing the DCR 2035 Central Tendency climate scenario with 45-centimeter (cm) sea level rise for SWP supply forecasting. (*DWR, 2020b*). The Water Supply Risk Model also considers climate change impacts to local water supplies (i.e., Arroyo Valle) using a more conservative risk-based analysis (see 2020 UWMP for further details).

The Water Supply Risk Model additionally included a 5-year drought assessment and evaluated the impacts of climate change on Zone 7's future water demand and use patterns based on results from the Regional Demand Study. Specifically, the Regional Demand Study applied a 5% increase in outdoor water demands by 2040 to account for warmer temperatures increasing irrigation demand and lengthening the growing season. This demand multiplier starts at 0% in 2020, increases linearly to 5% by 2040, and remains at 5% through the remainder of the projected simulation (*Zone 7, 2021*).

9.4.3. Projected Water Budget Results

Table 9-4 shows the projected water supplies output from the Water Supply Risk Model, which projected normal year water supplies from 76,700 AF in 2025 to 90,700 AF in 2030 and down to 83,200 AF at buildout around 2040. Since the SWP is the main source of Zone 7's water supplies, climate change impacts to the SWP will impact Zone 7. As shown in **Table 9-4**, supplies derived from the SWP, including Table A deliveries, groundwater (i.e., stored SWP water), and SWP carryover, represent about 90 percent of Zone 7's 2025 supplies. This percentage remains high throughout the projected simulation period, with SWP-derived supplies comprising approximately 75 percent of Zone 7's total supplies in 2045.

Figure 9-10 shows projected groundwater storage from the modeled scenario. Initially Zone 7 is expected to continue to rely on the Basin for municipal supply, which will both decrease Basin storage. In 2025, the COL Pipeline is expected to come online which will allow Zone 7 to recharge surface water into the COL; however, SWP supplies are still expected to be limited, so storage will continue to drop. In 2030 the Sites Reservoir and potable reuse projects are expected to come online, so Zone 7's can rely less on the Basin. As a result, Basin storage increases significantly through the 2030s and eventually levels off as the Basin fills up. In 2060 Zone 7 retains ownership of the remaining COL. The increased recharge capacity enables Zone 7 to install a second demineralization plant and increase pumping, resulting in a temporary decrease in Basin storage. The cumulative change in storage shown **Figure 9-10** shows that groundwater storage in the Basin will remain stable or slightly increase over the 61-year projected water budget timeline upon full implementation of the projects and management actions described above (see also **Section 15**).

9.4.3.1. Future Refinements

Future refinements to the projected water budget will further incorporate climate change scenarios included in Zone 7's ongoing update to the Water Supply Risk Model. Additionally, Zone 7 plans to update its aerial recharge model (ARM) and groundwater flow model to directly incorporate DWR's 2030 and 2070 Climate Change Factors dataset (*DWR, 2018*) in simulations of future hydrology and resulting impacts to recharge and runoff rates within the Basin. Current ongoing and future planned updates to the Water Supply Risk Model and groundwater flow model are further described in **Section 15.2.4**.

TABLE 9-1
DESCRIPTION OF HYDROLOGIC INVENTORY COMPONENTS
LIVERMORE VALLEY GROUNDWATER BASIN

COMPONENTS	*DESCRIPTION/REMARK*	*Direct/ Indirect*	*HOW CALCULATED/MEASURED*	*ESTIMATED ACCURACY*
SUPPLY INDICES				
Rainfall	Pleasanton rainfall (Parkside Office)	Direct	Measured by Zone 7	0.5 in
Evaporation	Evaporation at Lake Del Valle Station	Direct	Collected by DWR	0.5 in
Streamflow	Arroyo Valle Streamflow if Lake Del Valle Dam did not exist	Direct	USGS Stream Gage Station AV_BLC	10 AF
Water Year Type	Indicator of Water Year in Sacramento Valley	Direct	DWR California Data Exchange Center	-
SUPPLY COMPONENTS				
NATURAL STREAM RECHARGE				
ARROYO VALLE	AV natural recharge.	Indirect	Stream Inflows - Stream Outflows	100 AF
ARROYO MOCHO	AM natural recharge.	Indirect	Stream Inflows - Stream Outflows	100 AF
ARROYO LAS POSITAS	ALP natural recharge.	Indirect	Stream Inflows - Stream Outflows	100 AF
ARTIFICIAL RECHARGE				
ARROYO VALLE	Total artificial recharge on Arroyo Valle minus AV_RC_PR	Indirect	Stream Inflows - Stream Outflows	100 AF
ARROYO VALLE PRIOR RIGHTS	AVBLC flow that would have recharged if no dam. Subset of AV_RC.	Indirect	Formula based on AVBLC flow.	100 AF
ARROYO MOCHO	Total artificial recharge on Arroyo Mocho	Indirect	Stream Inflows - Stream Outflows	100 AF
ARROYO LAS POSITAS	Total artificial recharge on Arroyo Las Positas	Indirect	Stream Inflows - Stream Outflows	100 AF
INJECTION WELL RECHARGE	Injection at Hop 6 from 1998 to 2000	Direct	Metered by Zone 7	10 AF
RAINFALL RECHARGE	Recharge from rainfall	Indirect	Calculated by Areal Recharge Model	1000 AF
PIPE LEAKAGE	Pipe leakage that recharges the GW basin	Indirect	Estimated using length and age of pipes	500 AF
APPLIED WATER RECHARGE				
URBAN MUNICIPAL (GW & SBA)	Applied recharge in urban area - delivered water (gw & sba)	Indirect	Calculated by Areal Recharge Model/IDC	100 AF
URBAN RECYCLED WATER	Applied water recharge from urban area - recycled water	Indirect	Calculated using Wastewater Plant deliveries	10 AF
AGRICULTURAL (SBA)	Total applied recharge from 'untreated' ag sources (untreated SBA)	Indirect	Calculated by Areal Recharge Model/IDC	100 AF
AGRICULTURAL (GW)	Total applied water recharge from groundwater ag sources	Indirect	Calculated by Areal Recharge Model/IDC	100 AF
GOLF COURSES (GW)	Applied water from golf courses on groundwater	Indirect	Calculated by Areal Recharge Model/IDC	100 AF
GOLF COURSES (RW)	Applied water from golf courses from recycled water	Indirect	Calculated using Wastewater Plant deliveries	10 AF
SUBSURFACE BASIN INFLOW	Subsurface Inflow from Northern Fringe Basin	Indirect	Estimated historically groundwater contours	500 AF
DEMAND COMPONENTS				
MUNICIPAL PUMPING				
ZONE 7	Total pumping by Zone 7, including pumping to waste	Direct	Metered by Zone 7	10 AF
DSRSD	*Pumping by Zone 7 for DSRSD.*	*Direct*	*DSRSD Groundwater Pumping Quota*	*0 AF*
PLEASANTON	Pumping by Pleasanton.	Direct	Metered by Pleasatnon	10 AF
CALIFORNIA WATER SERVICE	Pumping by CWS.	Direct	Metered by CWS	10 AF
SFPUC	Pumping by SF Public Utilities Commission	Direct	Metered by SFPUC	10 AF
FAIRGROUNDS	Pumping by Alameda County Fairgrounds	Indirect	Metered by Fairgrounds	10 AF
DOMESTIC	Pumping from active domestic, supply, and potable wells	Indirect	Estimated: Number of Wells x 0.5 AF/yr	50 AF
GOLF COURSES				
CASTLEWOOD GOLF COURSE	*Pumping for Castlewood Golf Course*	*Indirect*	*Estimated using historical meter data*	*50 AF*
TRI VALLEY GOLF CENTER	*Pumping for TriValley Golf Driving Range*	*Indirect*	*Calculated by Areal Recharge Model/IDC*	*50 AF*
AGRICULTURAL PUMPING	Unmetered pumping for agriculture	Indirect	Calculated by Areal Recharge Model/IDC	100 AF
MINING				
EXPORT	Total mining area releases that leave the basin	Indirect	Calculated from metered data and stream recharge rate	50 AF
EVAPORATION	Pond evaporation & rainfall.	Indirect	Calculated using lake area, evaporation, and rainfall	100 AF
PROCESSING	Mining Area processing losses	Indirect	Estimated at 700 AF/Yr	100 AF
SUBSURFACE BASIN OUTFLOW	Basin overflow leaving basin	Indirect	Formula based on GW elevation and synoptic data	100 AF

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9/13/2021

TABLE 9-2
GROUNDWATER STORAGE
HYDROLOGIC INVENTORY (HI) METHOD
2020 WATER YEAR (in Acre-Feet, except where indicated)

	Total for Water Year	Sustainable Average	Percent of Sust Avg
INDICES			
Rainfall at Livermore (inches)	10.48	14.46	72%
8 Station Rainfall Index (Northern CA)(inches)	31.74	50.16	63%
Evaporation at Lake Del Valle (inches)	76.37	67.14	114%
SUPPLY TOTAL (AF)	**13,515**	**19,800**	**68%**
Stream Recharge	**5,972**	**11,900**	**50%**
[1] Natural Stream Recharge	2,595	5,700	46%
Arroyo Valle	*793*	*1800*	*44%*
Arroyo Mocho	*1,072*	*2,600*	*41%*
Arroyo Las Positas	*730*	*1,300*	*56%*
[1] Arroyo Valle Prior Rights	916	900	102%
[3] Artificial Stream Recharge	2,461	5,300	46%
Arroyo Valle	*2,045*	*1,640*	*125%*
Arroyo Mocho	*416*	*3,530*	*12%*
Arroyo Las Positas	*0*	*130*	*0%*
Injection Well Recharge	**0**	**0**	**0%**
[1] **Rainfall Recharge**	**2,869**	**4,300**	**67%**
Lake Recharge	7,529	NA	NA
Pipe Leakage	**1,209**	**1,000**	**NA**
[1] **Applied Water Recharge**	**2,465**	**1,600**	**154%**
Urban - Municipal	2,109	1,280	165%
Urban - Recycled Water	129	26	496%
Agricultural - Municipal (SBA)	80	92	87%
Agricultural - Groundwater	14	12	117%
Golf Courses - Groundwater	66	146	45%
Golf Courses - Recycled Water	67	44	152%
[1] **Subsurface Inflow**	**1,000**	**1,000**	**100%**
DEMAND TOTAL (AF)	**21,447**	**18,800**	**114%**
Municipal Pumping	**16,349**	**13,700**	**119%**
[4] Zone 7	11,746	5,950	197%
[2] *Zone 7 pumping for DSRSD*	*645*	*645*	*100%*
GW through Demin Membranes	*1,458*	*-*	*-*
Demin Permeate to Z7 Distribution System	*1,131*	*-*	*-*
[2] City of Pleasanton	2,701	3,500	77%
[2] California Water Service	904	3,070	29%
[2] SFPUC	322	450	72%
[2] Fairgrounds	321	310	104%
[2] Domestic	108	200	54%
[2] Golf Courses	247	225	110%
GWP_Castle	*225*	*205*	*110%*
Tri Valley Golf	*22*	*20*	*110%*
[2] **Agricultural Pumping**	**112**	**400**	**28%**
SFWD	0	0	0%
Concannon	0	0	0%
Calculated	112	400	28%
[2] **Mining Use**	**4,840**	**4,600**	**105%**
Mining Discharges (Export) to Stream	0	700	0%
Mining Discharges to Cope Lake	*7,906*	*NA*	*NA*
Evaporation	4,140	3,200	129%
Processing	700	700	100%
[1] **Subsurface Overflow**	**146**	**100**	**146%**
SUBTOTALS (AF)			
Sustainable Yield - Natural Recharge [sum of [1]]	9,699	13,400	72%
Sustainable Yield - Demand Components [sum of [2]]	10,200	13,400	76%
Net Natural	-501		
Zone 7 - Artificial Recharge (Stream) [sum of [3]]	2,461	5,300	46%
Zone 7 - Municipal Pumping [sum of [4]]	11,101	5,300	209%
Net Artificial	-8,640		
NET RECHARGE (Supply - Demand)	**-7,932**	**1,000**	**-793%**
Check Net Natural/Artificial + pipe leakage	*-7,932*		
TOTAL STORAGE (AF)	**2020 WY**	**2019 WY**	**Δ Storage**
Hydrologic Inventory (HI)	247,232	255,164	-7,932
Nodal GW Elevations (NGE)	231,725	248,579	-16,854
Average Storage: (HI + NGE)/2	239,479	251,872	-12,393
Available Storage: Avg Storage - Reserve (128K AF)	111,479	123,872	-12,393

Sustainable average includes original estimates for Sustainable Yield components (shown with *)

Natural Component

Artificial Component

TABLE 9-3
HISTORICAL GROUNDWATER STORAGE
HYDROLOGIC INVENTORY (HI) METHOD
1974-2020 WATER YEARS (in Acre-Feet, except where indicated)

COMPONENTS	WATER YEAR (Oct - Sep) 1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
INDICES																	
Rainfall at Livermore (in)	16.1	14.8	6.2	6.0	18.5	13.6	17.6	10.3	24.4	32.0	13.0	12.6	19.8	8.9	8.7	11.2	9.4
8 Station Rain Index (N. CA)(in)	78.6	48.8	28.3	19.0	71.6	39.1	59.6	37.6	84.8	88.5	58.1	37.8	72.1	28.6	34.9	50.1	36.0
Evap at Lake Del Valle (in)	60.9	62.7	63.5	66.0	64.2	67.7	59.7	72.1	60.5	59.7	70.2	64.9	61.1	64.0	66.9	63.6	65.9
Arroyo Valle Stream flow (AF)	30538	28307	475	177	43749	9721	45800	5817	61427	125882	25653	7282	67903	3023	1506	1988	815
Water Year Type*	W	W	C	C	AN	BN	AN	D	W	W	W	D	W	D	C	D	C
SUPPLY	**18,140**	**21,437**	**11,121**	**8,683**	**24,813**	**22,213**	**23,830**	**18,821**	**29,942**	**35,412**	**15,547**	**8,784**	**20,866**	**6,670**	**8,071**	**11,170**	**10,353**
Injection Well Recharge	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Stream Recharge	**11,340**	**15,400**	**6,910**	**3,820**	**16,330**	**16,110**	**16,480**	**15,040**	**16,420**	**17,158**	**9,486**	**4,747**	**9,045**	**3,565**	**4,549**	**7,880**	**7,026**
Artificial Stream Recharge	3,509	6,750	5,695	3,190	6,442	12,266	10,211	11,918	5,952	901	0	0	0	0	1,172	4,320	4,488
Arroyo Valle	*1,439*	*4,320*	*1,875*	*1,300*	*3,002*	*5,886*	*4,541*	*6,328*	*2,442*	*0*	*0*	*0*	*0*	*0*	*0*	*139*	*304*
Arroyo Mocho	*1,670*	*1,830*	*3,220*	*1,290*	*2,840*	*5,780*	*5,270*	*5,130*	*3,290*	*901*	*0*	*0*	*0*	*0*	*1,172*	*4,181*	*4,184*
Arroyo las Positas	*400*	*600*	*600*	*600*	*600*	*600*	*400*	*460*	*220*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Natural Stream Recharge	6,060	7,110	1,100	630	8,850	2,860	4,850	2,200	8,620	14,387	8,326	3,541	8,168	2,696	2,653	2,589	2,250
Arroyo Valle	*2,400*	*2,950*	*360*	*290*	*2,450*	*1,290*	*1,750*	*840*	*2,970*	*4,893*	*2,580*	*751*	*2,831*	*527*	*679*	*458*	*418*
Arroyo Mocho	*3,160*	*3,760*	*540*	*140*	*5,900*	*1,170*	*2,500*	*880*	*4,810*	*8,514*	*4,616*	*1,716*	*4,176*	*843*	*902*	*809*	*428*
Arroyo las Positas	*500*	*400*	*200*	*200*	*500*	*400*	*600*	*480*	*840*	*980*	*1,130*	*1,074*	*1,161*	*1,326*	*1,072*	*1,322*	*1,404*
Arroyo Valle Prior Rights	1,771	1,540	115	0	1,038	984	1,419	922	1,848	1,870	1,160	1,206	877	869	724	971	288
Rainfall Recharge	**3,031**	**2,523**	**0**	**0**	**4,398**	**2,002**	**3,891**	**967**	**11,423**	**16,357**	**3,110**	**1,249**	**9,008**	**290**	**398**	**283**	**141**
Lake Recharge	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Pipe Leakage	**31**	**37**	**44**	**51**	**60**	**71**	**82**	**95**	**109**	**124**	**139**	**155**	**169**	**185**	**200**	**217**	**233**
Applied Water Recharge	**2,738**	**2,477**	**3,158**	**3,022**	**2,795**	**3,041**	**2,727**	**2,089**	**1,360**	**1,344**	**2,162**	**1,884**	**1,904**	**1,860**	**2,004**	**1,630**	**1,694**
Urban - Municipal	1,074	766	1,354	1,375	1,087	1,179	810	1,284	668	690	1,253	1,027	998	1,328	1,377	1,053	1,025
Urban - Recycled Water	0	0	27	16	26	13	21	7	12	8	16	6	12	8	5	14	5
Agricultural - Municipal (SBA)	74	109	157	124	95	118	147	182	140	165	208	182	232	245	289	240	265
Agricultural - Groundwater	384	280	513	525	352	388	281	241	174	139	198	210	190	137	152	140	153
Golf Courses - Groundwater	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Golf Courses - Recycled Water	0	0	64	68	75	73	73	60	54	63	62	55	61	47	63	60	64
Others	1,206	1,322	1,042	915	1,160	1,270	1,394	315	312	279	425	404	411	95	118	123	182
Subsurface Basin Inflow	**1,000**	**1,000**	**1,010**	**1,790**	**1,230**	**990**	**650**	**630**	**630**	**430**	**650**	**750**	**740**	**770**	**920**	**1,160**	**1,260**
DEMAND	**18,618**	**15,929**	**15,432**	**14,636**	**12,871**	**15,819**	**15,727**	**19,349**	**18,349**	**26,220**	**19,750**	**18,506**	**22,550**	**14,575**	**17,176**	**16,143**	**16,045**
Municipal Pumpage	**11,806**	**9,881**	**7,782**	**6,721**	**7,022**	**8,207**	**6,982**	**7,361**	**7,281**	**7,965**	**8,473**	**7,990**	**8,652**	**8,152**	**9,431**	**10,393**	**11,255**
Zone 7 (excluding DSRSD)	5,403	3,090	1,292	309	776	816	41	0	0	25	348	1,199	1,163	480	2,017	3,213	3,327
Zone 7 for DSRSD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
City of Pleasanton	2,264	2,497	1,707	3,271	2,640	3,273	2,961	3,089	3,565	3,886	3,486	3,056	3,705	3,310	3,548	3,316	3,856
Cal. Water Service	2,612	2,852	2,781	1,312	1,964	2,358	2,489	2,695	2,286	2,660	3,035	2,788	2,774	3,276	2,761	2,850	3,073
Camp Parks	769	808	980	925	796	881	819	808	713	630	647	40	0	0	0	0	0
SFWD	302	242	495	374	397	413	372	402	348	321	378	353	484	491	472	443	362
Fairgrounds	200	200	200	200	200	200	200	267	217	242	281	272	280	280	280	280	280
Domestic	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Golf Courses	156	92	227	230	149	166	0	0	52	101	198	182	146	215	253	191	257
3S/1E 1P3	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*46*
Castlewood	*156*	*92*	*227*	*230*	*149*	*166*	*0*	*0*	*52*	*101*	*198*	*182*	*146*	*215*	*253*	*191*	*211*
Tri-Valley Golf	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Agricultural Pumpage	**3,744**	**2,217**	**4,596**	**4,970**	**3,191**	**3,711**	**2,628**	**2,433**	**1,295**	**1,342**	**1,556**	**1,914**	**1,911**	**1,470**	**1,476**	**1,166**	**1,478**
SFWD	500	0	62	304	252	365	168	513	150	549	107	410	543	663	493	359	548
Concannon	6	15	20	20	20	70	250	112	0	0	68	0	60	26	59	0	0
Calculated	3,238	2,202	4,514	4,646	2,919	3,276	2,210	1,808	1,145	793	1,381	1,504	1,308	781	924	807	930
Mining Use	**3,068**	**3,831**	**3,054**	**2,945**	**2,658**	**3,751**	**5,586**	**9,005**	**7,613**	**13,953**	**7,481**	**7,402**	**11,387**	**4,353**	**5,869**	**4,484**	**3,312**
Stream Export	1,219	2,200	690	470	800	2,000	3,480	6,530	6,050	12,760	4,340	4,265	8,858	558	2,443	1,808	665
Discharges to Cope Lake	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Evaporation	1,149	931	1,664	1,775	1,158	1,051	1,406	1,775	863	493	2,441	2,437	1,829	3,095	2,726	1,976	1,947
Production	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700
Subsurface Basin Overflow	**0**	**0**	**0**	**0**	**0**	**150**	**530**	**550**	**2,160**	**2,960**	**2,240**	**1,200**	**600**	**600**	**400**	**100**	**0**
NET RECHARGE (AF)	**-478**	**5,508**	**-4,311**	**-5,953**	**11,942**	**6,394**	**8,103**	**-528**	**11,593**	**9,192**	**-4,203**	**-9,722**	**-1,684**	**-7,906**	**-9,106**	**-4,973**	**-5,692**
INVENTORY STORAGE (AF)	**211,522**	**217,030**	**212,719**	**206,766**	**218,708**	**225,102**	**233,205**	**232,677**	**244,270**	**253,462**	**249,259**	**239,537**	**237,853**	**229,947**	**220,841**	**215,868**	**210,176**

STORAGE CALCULATION	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**
INVENTORY (Rounded to TAF)	212	217	213	207	219	225	233	233	244	253	249	240	238	230	221	216	210
GW ELEVATIONS (Rounded to TAF)	213	215	226	216	210	228	239	246	241	254	258	250	240	231	217	214	210
AVERAGE STORAGE (TAF)	**212**	**216**	**219**	**211**	**214**	**227**	**236**	**239**	**243**	**254**	**253**	**245**	**239**	**230**	**219**	**215**	**210**
AVAILABLE STORAGE (TAF)	**84**	**88**	**91**	**83**	**86**	**99**	**108**	**111**	**115**	**126**	**125**	**117**	**111**	**102**	**91**	**87**	**82**

Artificial Components Natural Components

*Water Year Type (CDEC Sacramento Valley)
W = Wet; AN = Above Normal;
BN = Below Normal; D = Dry; C = Critical

TABLE 9-3
HISTORICAL GROUNDWATER STORAGE
HYDROLOGIC INVENTORY (HI) METHOD
1974-2020 WATER YEARS (in Acre-Feet, except where indicated)

	WATER YEAR (Oct - Sep)																			
COMPONENTS	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
INDICES																				
Rainfall at Livermore (in)	11.3	11.6	21.3	11.8	21.3	20.0	15.1	25.3	13.1	14.1	11.0	11.2	17.0	13.1	19.3	17.5	9.7	10.7	11.4	14.8
8 Station Rain Index (N. CA)(in)	32.2	36.0	65.3	31.8	85.4	61.3	68.8	82.4	54.8	56.7	33.0	46.3	59.7	47.3	57.4	80.1	37.3	34.9	46.8	53.6
Evap at Lake Del Valle (in)	64.7	68.2	64.2	65.5	58.3	71.6	69.5	57.2	61.0	68.3	68.5	73.2	69.9	72.1	63.6	68.6	68.9	72.7	71.6	64.0
Arroyo Valle Stream flow (AF)	9909	11692	52831	3424	67142	51058	54115	87819	15169	18949	8156	7848	19648	11410	26930	28325	2027	18059	11231	12914
Water Year Type*	C	C	AN	C	W	W	W	W	W	AN	D	D	AN	BN	AN	W	D	C	D	BN
SUPPLY	**12,715**	**10,610**	**28,529**	**16,095**	**29,095**	**22,556**	**24,184**	**27,853**	**20,780**	**23,211**	**15,691**	**24,052**	**29,840**	**19,778**	**31,021**	**23,960**	**14,998**	**16,258**	**18,659**	**25,382**
Injection Well Recharge	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**652**	**1,524**	**1,146**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Stream Recharge	**8,347**	**5,247**	**14,714**	**11,838**	**13,058**	**11,109**	**12,284**	**13,603**	**10,813**	**12,842**	**8,601**	**16,195**	**21,483**	**12,885**	**21,025**	**13,418**	**9,154**	**8,448**	**11,249**	**17,144**
Artificial Stream Recharge	3,261	914	5,621	7,883	4,672	2,968	5,314	2,343	5,174	8,019	3,428	10,588	11,409	8,084	11,143	4,583	4,811	2,229	3,984	6,773
Arroyo Valle	*82*	*412*	*1,182*	*798*	*179*	*144*	*1,827*	*413*	*1,181*	*890*	*1,476*	*1,831*	*1,547*	*1,670*	*2,277*	*1,216*	*2,879*	*2,229*	*2,104*	*2,459*
Arroyo Mocho	*3,178*	*502*	*4,439*	*7,085*	*4,493*	*2,824*	*3,487*	*1,930*	*3,993*	*7,129*	*1,930*	*8,755*	*9,862*	*6,414*	*8,698*	*3,205*	*1,932*	*0*	*1,880*	*4,314*
Arroyo las Positas	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*22*	*2*	*0*	*0*	*168*	*162*	*0*	*0*	*0*	*0*
Natural Stream Recharge	4,418	3,997	8,247	3,080	7,259	7,743	6,607	10,533	5,091	4,178	4,512	4,476	8,462	3,458	9,589	6,905	3,536	5,913	6,018	10,371
Arroyo Valle	*1,215*	*970*	*2,754*	*735*	*2,818*	*1,426*	*2,753*	*4,401*	*1,796*	*1,389*	*2,440*	*2,259*	*4,397*	*1,447*	*5,980*	*3,043*	*1,941*	*4,030*	*3,958*	*6,909*
Arroyo Mocho	*1,883*	*1,711*	*3,903*	*1,263*	*3,144*	*5,226*	*2,670*	*4,560*	*1,833*	*1,539*	*961*	*1,279*	*2,980*	*1,082*	*2,854*	*3,104*	*858*	*1,077*	*970*	*2,547*
Arroyo las Positas	*1,320*	*1,315*	*1,591*	*1,082*	*1,297*	*1,091*	*1,184*	*1,572*	*1,462*	*1,250*	*1,111*	*939*	*1,085*	*929*	*755*	*758*	*737*	*806*	*1,090*	*915*
Arroyo Valle Prior Rights	668	337	846	876	1,127	398	362	727	548	644	660	1,131	1,612	1,343	293	1,930	807	306	1,247	0
Rainfall Recharge	**1,838**	**1,760**	**10,761**	**1,242**	**13,243**	**8,176**	**8,634**	**10,692**	**5,540**	**5,924**	**3,644**	**4,239**	**4,899**	**3,192**	**6,378**	**6,969**	**1,987**	**3,782**	**3,375**	**4,315**
Lake Recharge	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Pipe Leakage	**249**	**267**	**285**	**304**	**324**	**344**	**365**	**387**	**410**	**434**	**461**	**490**	**518**	**548**	**579**	**610**	**642**	**675**	**708**	**742**
Applied Water Recharge	**602**	**1,766**	**1,440**	**1,621**	**1,480**	**2,007**	**2,221**	**1,709**	**1,743**	**1,960**	**1,985**	**2,129**	**1,940**	**2,153**	**2,039**	**1,962**	**2,214**	**2,353**	**2,327**	**2,181**
Urban - Municipal	222	1,288	1,108	1,252	1,060	1,467	1,632	1,472	1,549	1,743	1,770	1,888	1,749	1,926	1,834	1,747	1,983	2,124	2,064	1,894
Urban - Recycled Water	2	0	11	14	13	18	21	15	12	21	19	30	10	14	15	26	24	7	52	84
Agricultural - Municipal (SBA)	242	279	177	192	257	347	401	104	57	64	59	67	66	64	63	63	62	68	68	67
Agricultural - Groundwater	109	133	96	100	92	100	109	26	11	12	11	13	12	12	12	12	12	13	13	12
Golf Courses - Groundwater	0	0	0	0	0	0	0	42	49	55	56	60	56	61	58	56	63	68	65	60
Golf Courses - Recycled Water	26	66	48	63	58	75	58	50	65	66	69	72	47	75	58	59	71	74	66	64
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subsurface Basin Inflow	**1,680**	**1,570**	**1,330**	**1,090**	**990**	**920**	**680**	**810**	**750**	**906**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
DEMAND	**21,104**	**17,237**	**13,555**	**15,503**	**16,064**	**20,683**	**25,574**	**25,342**	**25,691**	**26,885**	**27,357**	**23,991**	**21,531**	**24,338**	**17,828**	**15,169**	**18,636**	**19,269**	**23,656**	**21,091**
Municipal Pumpage	**17,355**	**13,331**	**9,132**	**6,499**	**4,594**	**6,324**	**8,824**	**10,264**	**11,832**	**15,520**	**17,806**	**19,307**	**17,123**	**19,635**	**14,686**	**11,697**	**12,681**	**13,516**	**18,022**	**16,064**
Zone 7 (excluding DSRSD)	8,119	5,136	2,215	213	368	2,388	1,565	1,682	4,912	6,140	9,864	11,047	7,734	11,175	6,213	3,157	4,146	6,210	9,439	8,274
Zone 7 for DSRSD	0	0	0	0	0	0	0	0	0	0	0	0	645	645	645	645	645	645	645	645
City of Pleasanton	4,164	3,368	3,252	2,578	1,262	1,333	3,208	3,935	2,563	4,558	3,112	3,579	3,674	3,688	3,604	3,587	3,638	2,387	3,660	3,280
Cal. Water Service	3,966	3,744	2,570	2,626	2,053	1,551	2,947	3,595	3,271	3,567	3,707	3,458	3,979	2,911	3,166	3,106	2,971	3,143	3,123	2,844
Camp Parks	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SFWD	408	410	414	396	370	411	477	460	380	532	472	448	423	481	436	467	494	492	446	417
Fairgrounds	346	336	282	325	285	343	342	230	333	369	318	423	327	365	284	441	443	289	335	284
Domestic	100	113	113	116	116	117	117	113	116	109	109	134	134	167	131	93	96	109	123	112
Golf Courses	252	222	286	245	139	182	169	249	256	245	223	218	208	203	207	199	249	241	250	208
3S/1E 1P3	*101*	*36*	*138*	*36*	*41*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Castlewood	*151*	*186*	*131*	*186*	*82*	*159*	*146*	*236*	*235*	*223*	*193*	*193*	*193*	*173*	*191*	*177*	*222*	*213*	*222*	*188*
Tri-Valley Golf	*0*	*0*	*17*	*23*	*16*	*23*	*23*	*13*	*21*	*22*	*30*	*25*	*15*	*30*	*16*	*22*	*27*	*28*	*28*	*20*
Agricultural Pumpage	**382**	**355**	**213**	**218**	**150**	**212**	**266**	**73**	**81**	**231**	**227**	**119**	**93**	**92**	**88**	**88**	**87**	**96**	**95**	**94**
SFWD	20	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Concannon	11	0	0	0	0	0	0	0	0	140	143	25	0	2	0	0	0	0	0	0
Calculated	351	346	213	218	150	212	266	73	81	91	84	94	93	91	88	88	87	96	95	94
Mining Use	**3,367**	**3,551**	**4,210**	**8,786**	**11,120**	**13,381**	**15,724**	**14,255**	**13,416**	**11,010**	**9,324**	**4,564**	**4,314**	**4,610**	**3,055**	**3,385**	**4,947**	**4,452**	**5,346**	**4,934**
Stream Export	639	712	2,219	6,070	9,071	10,577	12,661	12,617	10,082	7,827	5,461	143	0	163	150	487	594	523	1,493	1,996
Discharges to Cope Lake	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Evaporation	2,028	2,139	1,291	2,016	1,349	2,104	2,363	938	2,634	2,483	3,163	3,951	3,764	3,762	2,205	2,198	3,653	3,230	3,153	2,238
Production	700	700	700	700	700	700	700	700	700	700	700	470	550	686	700	700	700	700	700	700
Subsurface Basin Overflow	**0**	**0**	**0**	**0**	**200**	**766**	**760**	**750**	**362**	**125**	**0**	**0**	**0**	**0**	**0**	**0**	**921**	**1,205**	**194**	**0**
NET RECHARGE (AF)	**-8,389**	**-6,628**	**14,974**	**592**	**13,031**	**1,873**	**-1,390**	**2,511**	**-4,911**	**-3,674**	**-11,666**	**62**	**8,309**	**-4,560**	**13,193**	**8,790**	**-3,639**	**-3,011**	**-4,997**	**4,290**
INVENTORY STORAGE (AF)	**201,787**	**195,159**	**210,133**	**210,725**	**223,756**	**225,629**	**224,239**	**226,750**	**221,839**	**218,165**	**206,499**	**206,561**	**214,870**	**210,310**	**223,503**	**232,293**	**228,654**	**225,643**	**220,646**	**224,936**

STORAGE CALCULATION	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
INVENTORY (Rounded to TAF)	202	195	210	211	224	226	224	227	222	218	206	207	215	210	224	232	229	226	221	225
GW ELEVATIONS (Rounded to TAF)	195	184	211	216	225	223	222	225	222	222	203	212	220	213	236	238	232	235	233	234
AVERAGE STORAGE (TAF)	**198**	**189**	**210**	**213**	**225**	**224**	**223**	**226**	**222**	**220**	**205**	**209**	**218**	**212**	**230**	**235**	**230**	**230**	**227**	**229**
AVAILABLE STORAGE (TAF)	**70**	**61**	**82**	**85**	**97**	**96**	**95**	**98**	**94**	**92**	**77**	**81**	**90**	**84**	**102**	**107**	**102**	**102**	**99**	**101**

Artificial Components | Natural Components

*Water Year Type (CDEC Sacramento Valley)
W = Wet; AN = Above Normal;
BN = Below Normal; D = Dry; C = Critical

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TABLE 9-3
HISTORICAL GROUNDWATER STORAGE
HYDROLOGIC INVENTORY (HI) METHOD
1974-2020 WATER YEARS (in Acre-Feet, except where indicated)

	WATER YEAR (Oct - Sep)										1974 - 2020		
COMPONENTS	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**AVG**	**Sust Avg**	**TOTAL**
INDICES													
Rainfall at Livermore (in)	16.2	8.8	10.7	6.8	13.1	15.4	25.6	12.4	17.1	10.5	14		
8 Station Rain Index (N. CA)(in)	72.8	41.5	46.3	31.3	37.2	57.8	94.6	40.9	70.7	31.7	53		
Evap at Lake Del Valle (in)	64.5	73.2	73.9	78.3	73.6	72.6	69.3	73.4	72.8	76.4	67		
Arroyo Valle Stream flow (AF)	28634	1557	7801	272	2217	19436	89173	2783	36944	2397	24892		**1169933**
Water Year Type*	W	BN	D	C	C	BN	W	BN	W	C			
SUPPLY	**27,315**	**18,442**	**20,158**	**10,452**	**18,753**	**28,293**	**38,895**	**17,164**	**23,625**	**13,515**	**20,165**	**19,800**	**947,750**
Injection Well Recharge	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**71**	**0**	**3,322**
Stream Recharge	**17,595**	**12,734**	**13,457**	**5,820**	**11,469**	**18,083**	**20,495**	**9,560**	**10,605**	**5,972**	**11,927**	**11,900**	**560,552**
Artificial Stream Recharge	4,555	8,778	7,887	3,826	3,766	8,910	9,615	6,773	2,943	2,461	5,309	5,300	249,528
Arroyo Valle	*768*	*3,613*	*1,916*	*924*	*3,718*	*3,983*	*3,271*	*3,778*	*2,168*	*2,045*	*1,799*	*1,640*	*84,555*
Arroyo Mocho	*3,671*	*5,059*	*5,961*	*2,844*	*0*	*4,927*	*6,344*	*2,995*	*775*	*416*	*3,400*	*3,530*	*159,802*
Arroyo las Positas	*116*	*106*	*10*	*58*	*48*	*0*	*0*	*0*	*0*	*0*	*110*	*130*	*5,172*
Natural Stream Recharge	11,272	3,355	4,200	1,987	6,822	8,289	10,433	1,938	6,439	2,595	5,715	5,700	268,614
Arroyo Valle	*8,540*	*1,676*	*2,790*	*891*	*4,567*	*4,749*	*6,053*	*740*	*3,419*	*793*	*2,539*	*1,800*	*119,315*
Arroyo Mocho	*2,293*	*1,225*	*838*	*587*	*1,748*	*2,794*	*3,775*	*590*	*2,393*	*1,072*	*2,290*	*2,600*	*107,624*
Arroyo las Positas	*439*	*454*	*572*	*509*	*507*	*746*	*605*	*608*	*627*	*730*	*887*	*1,300*	*41,675*
Arroyo Valle Prior Rights	1,768	601	1,370	7	881	884	447	849	1,223	916	902	900	42,409
Rainfall Recharge	**5,771**	**1,462**	**2,708**	**1,075**	**3,735**	**6,554**	**14,087**	**3,220**	**8,588**	**2,869**	**4,675**	**4,300**	**219,730**
Lake Recharge	*0*	*0*	*0*	*2,428*	*4,322*	*6,785*	*13,029*	*15,003*	*13,248*	*7,529*	*1,326*	*NA*	*62,343*
Pipe Leakage	**776**	**811**	**847**	**884**	**921**	**958**	**996**	**1,034**	**1,146**	**1,209**	**445**	**1,000**	**20,922**
Applied Water Recharge	**2,172**	**2,435**	**2,147**	**1,674**	**1,629**	**1,697**	**2,316**	**2,350**	**2,286**	**2,465**	**2,061**	**1,600**	**96,889**
Urban - Municipal	1,849	2,061	1,750	1,229	1,143	1,312	1,957	2,020	1,956	2,109	1,436	1,280	67,505
Urban - Recycled Water	133	159	189	220	275	160	147	106	119	129	48	26	2,242
Agricultural - Municipal (SBA)	61	68	64	66	61	88	77	80	80	80	137	92	6,461
Agricultural - Groundwater	11	13	7	20	18	15	14	14	14	14	117	12	5,504
Golf Courses - Groundwater	59	65	62	66	67	65	61	63	61	66	29	146	1,384
Golf Courses - Recycled Water	59	70	75	73	65	59	60	66	57	67	60	44	2,819
Others	0	0	0	0	0	0	0	0	0	0	233	0	10,973
Subsurface Basin Inflow	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**986**	**1,000**	**46,336**
DEMAND	**20,421**	**28,880**	**25,700**	**22,604**	**12,717**	**12,888**	**13,636**	**16,879**	**19,142**	**21,447**	**19,415**	**18,800**	**912,518**
Municipal Pumpage	**13,430**	**20,463**	**16,823**	**16,662**	**8,284**	**9,176**	**10,714**	**11,966**	**14,635**	**16,349**	**11,661**	**13,700**	**548,071**
Zone 7 (excluding DSRSD)	5,618	11,461	8,909	8,137	1,920	1,357	3,243	4,215	8,021	11,101	4,202	5,300	197,479
Zone 7 for DSRSD	646	644	646	645	645	645	645	645	645	645	247	645	11,611
City of Pleasanton	3,435	3,900	3,301	3,740	2,775	3,752	4,222	3,913	3,785	2,701	3,264	3,500	153,386
Cal. Water Service	2,673	3,333	2,770	3,085	2,012	2,575	1,878	2,389	1,296	904	2,761	3,070	129,780
Camp Parks	0	0	0	0	0	0	0	0	0	0	188	0	8,819
SFWD	442	482	482	398	309	286	214	253	286	322	403	450	18,956
Fairgrounds	301	318	350	286	268	231	208	196	270	321	288	310	13,527
Domestic	107	90	105	115	112	110	107	115	116	108	109	200	5,123
Golf Courses	208	236	260	257	243	220	198	240	216	247	200	225	9,390
3S/1E 1P3	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*8*	*0*	*397*
Castlewood	*187*	*214*	*233*	*227*	*213*	*195*	*176*	*218*	*194*	*225*	*178*	*205*	*8,351*
Tri-Valley Golf	*21*	*22*	*27*	*30*	*30*	*25*	*22*	*22*	*22*	*22*	*14*	*20*	*642*
Agricultural Pumpage	**85**	**95**	**486**	**640**	**590**	**115**	**109**	**113**	**113**	**112**	**996**	**400**	**46,818**
SFWD	0	0	0	0	0	0	0	0	0	0	128	0	6,015
Concannon	0	0	0	0	0	0	0	0	0	0	22	0	1,047
Calculated	85	95	486	640	590	115	109	113	113	112	846	400	39,756
Mining Use	**6,906**	**8,322**	**8,391**	**5,302**	**3,843**	**3,597**	**2,813**	**4,236**	**3,585**	**4,840**	**6,369**	**4,600**	**299,337**
Stream Export	4,277	4,676	4,796	850	0	0	0	0	0	0	3,345	700	157,219
Discharges to Cope Lake	*0*	*0*	*0*	*5,420*	*4,890*	*7,700*	*13,452*	*15,562*	*13,864*	*7,906*	*1,464*	*NA*	*68,793*
Evaporation	1,929	2,946	2,895	3,752	3,143	2,897	2,113	3,536	2,885	4,140	2,332	3,200	109,612
Production	700	700	700	700	700	700	700	700	700	700	692	700	32,506
Subsurface Basin Overflow	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**564**	**809**	**146**	**389**	**100**	**18,292**
NET RECHARGE (AF)	**6,893**	**-10,438**	**-5,542**	**-12,153**	**6,037**	**15,405**	**25,259**	**285**	**4,482**	**-7,932**	**750**	**1,000**	**35,232**
INVENTORY STORAGE (AF)	**231,829**	**221,391**	**215,849**	**203,696**	**209,733**	**225,138**	**250,397**	**250,682**	**255,164**	**247,232**	**223,876**	**13,400**	

STORAGE CALCULATION	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
INVENTORY (Rounded to TAF)	232	221	216	204	210	225	250	251	255	247
GW ELEVATIONS (Rounded to TAF)	235	228	221	210	215	227	246	246	249	232
AVERAGE STORAGE (TAF)	**233**	**225**	**218**	**207**	**212**	**226**	**248**	**248**	**252**	**239**
AVAILABLE STORAGE (TAF)	**105**	**97**	**90**	**79**	**84**	**98**	**120**	**120**	**124**	**111**

Artificial Components Natural Components

*Water Year Type (CDEC Sacramento Valley)
W = Wet; AN = Above Normal;
BN = Below Normal; D = Dry; C = Critical

TABLE 9-4
PROJECTED WHOLESALE WATER SUPPLIES
FOR MODEL SCENARIO
LIVERMORE VALLEY GROUNDWATER BASIN

Water Supply		Projected Water Supply				
		2025	2030	2035	2040	2045
Purchased or Imported Water	SWP Table A[a]	47,000	46,000	45,000	43,500	43,500
Purchased or Imported Water	Yuba Accord (available mainly in dry years)	0	0	0	0	0
Supply from Storage	SWP Carryover[b]	10,000	10,000	10,000	10,000	10,000
Surface water (not desalinated)	Arroyo Valle[c]	5,500	5,500	5,500	5,500	5,500
Groundwater (not desalinated)	Main Basin	9,200	9,200	9,200	9,200	9,200
Supply from Storage	Semitropic (used mainly in dry years)	0	0	0	0	0
Supply from Storage	Cawelo (used mainly in dry years)	0	0	0	0	0
Other	SWP/Other Transfer[d]	5,000	5,000			
Other	BARDP or Potable Reuse[e]		5,000	5,000	5,000	5,000
Purchased or Imported Water	Sites Reservoir[f]		10,000	10,000	10,000	10,000
	Total	76,700	90,700	84,700	83,200	83,200

NOTES: Volumes are in AF.
a. Based on the 2019 Delivery Capability Report. "Existing" assumed for 2020, the "Future" applied to 2040; years in between were interpolated. The effect of the Delta Conveyance Project on water supply yield is still being analyzed and has not been included here.
b. Zone 7 regularly carries over SWP water from year to year, targeting approximately 10,000 AFY.
c. Arroyo Valle: From 2019 Water Supply Evaluation, observed ten-year (2008 to 2017) average was 6,200 AFY, reduced to 5,500 AFY to reflect climate change impacts. This will be refined as more information on the role of the Chain of Lakes on capturing Arroyo Valle water is developed over the coming years.
d. Zone 7 is pursuing water transfer agreements for the period through 2030.
e. These projects are under consideration as potential components of Zone 7's future water supply portfolio.
f. Zone 7 is currently participating in the planning phase of Sites Reservoir at a level of 10,000 AFY of average yield.

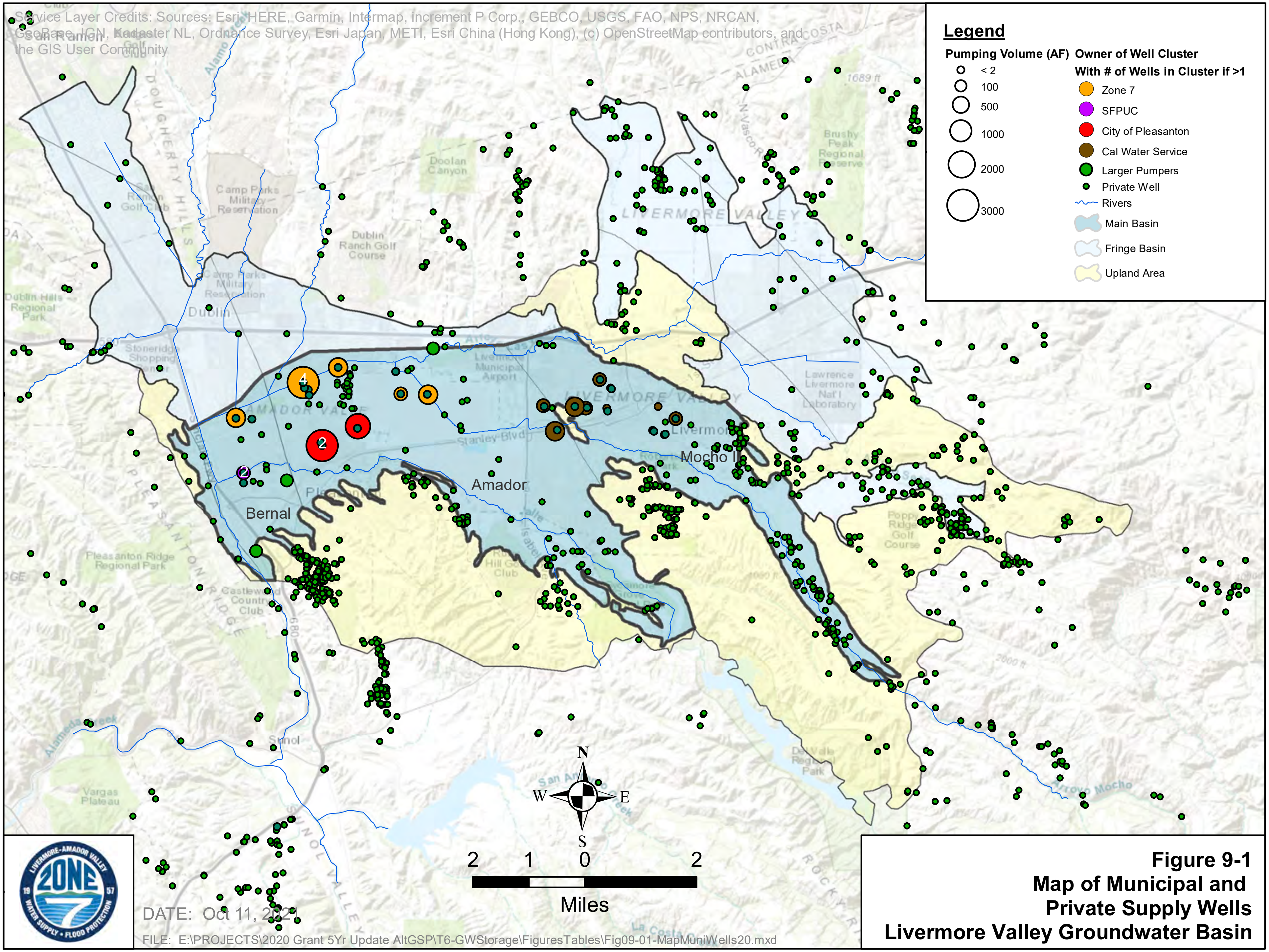
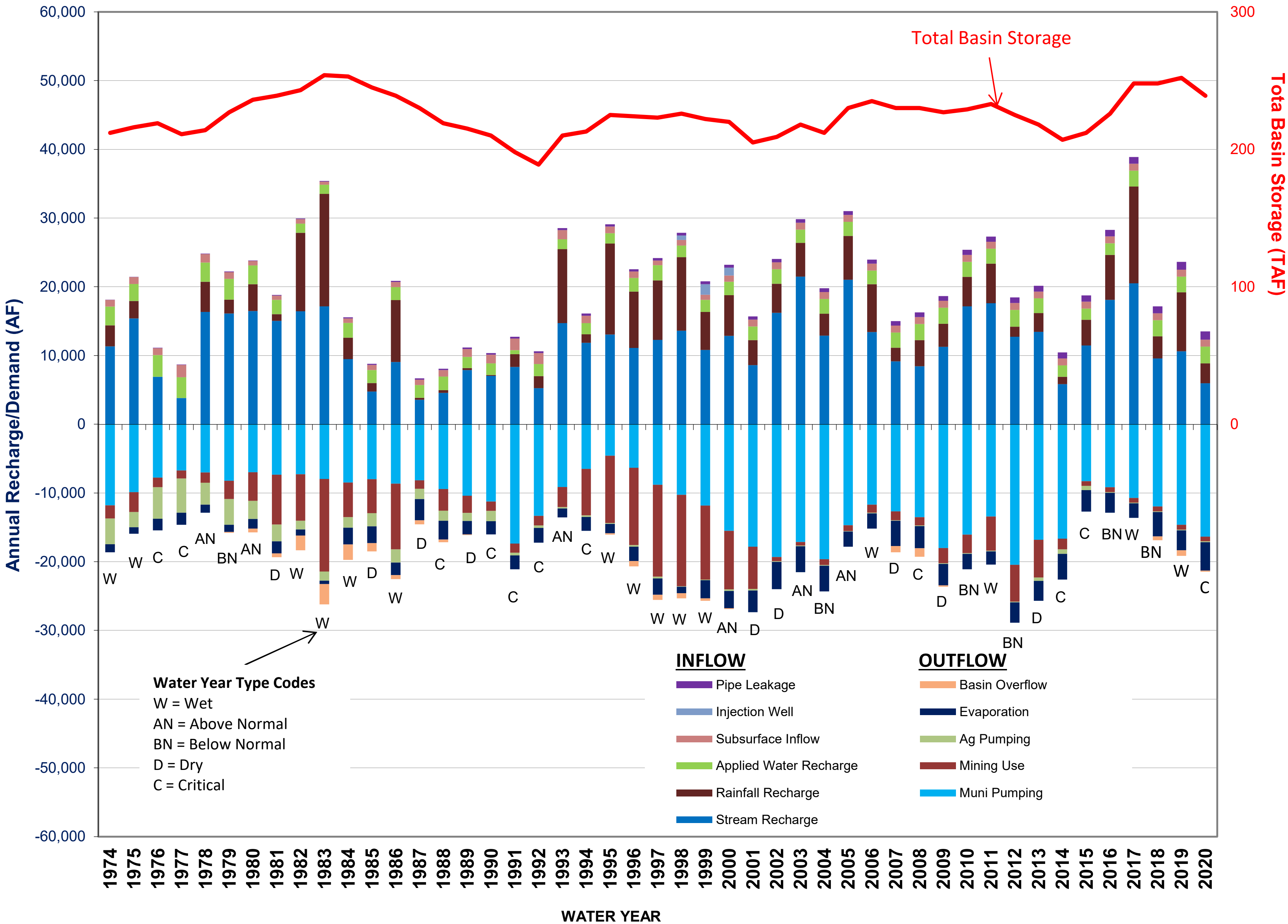


Figure 9-1
Map of Municipal and Private Supply Wells
Livermore Valley Groundwater Basin

FIGURE 9-2
GRAPH OF HYDROLOGIC INVENTORY 1974 - 2020 WATER YEARS
LIVERMORE VALLEY GROUNDWATER BASIN



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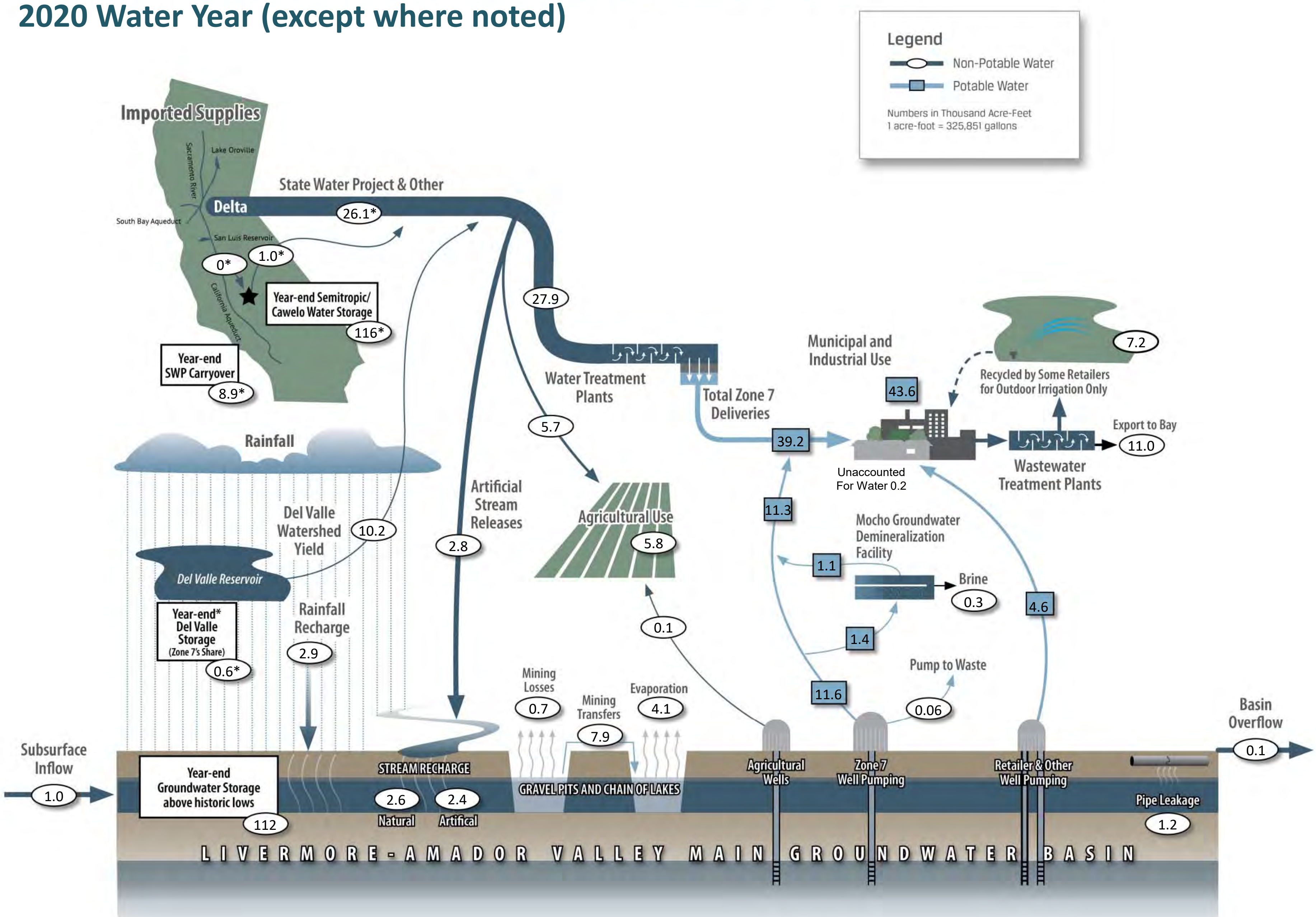
Livermore-Amador Valley Water Supply & Use (in Thousands of Acre-Feet)

Figure 9-3

2020 Water Year (except where noted)



* 2020 Calendar Year

FIGURE 9-4
GRAPH OF SURFACE WATER INFLOWS/OUTFLOWS
2005 - 2020 WATER YEARS
LIVERMORE VALLEY GROUNDWATER BASIN

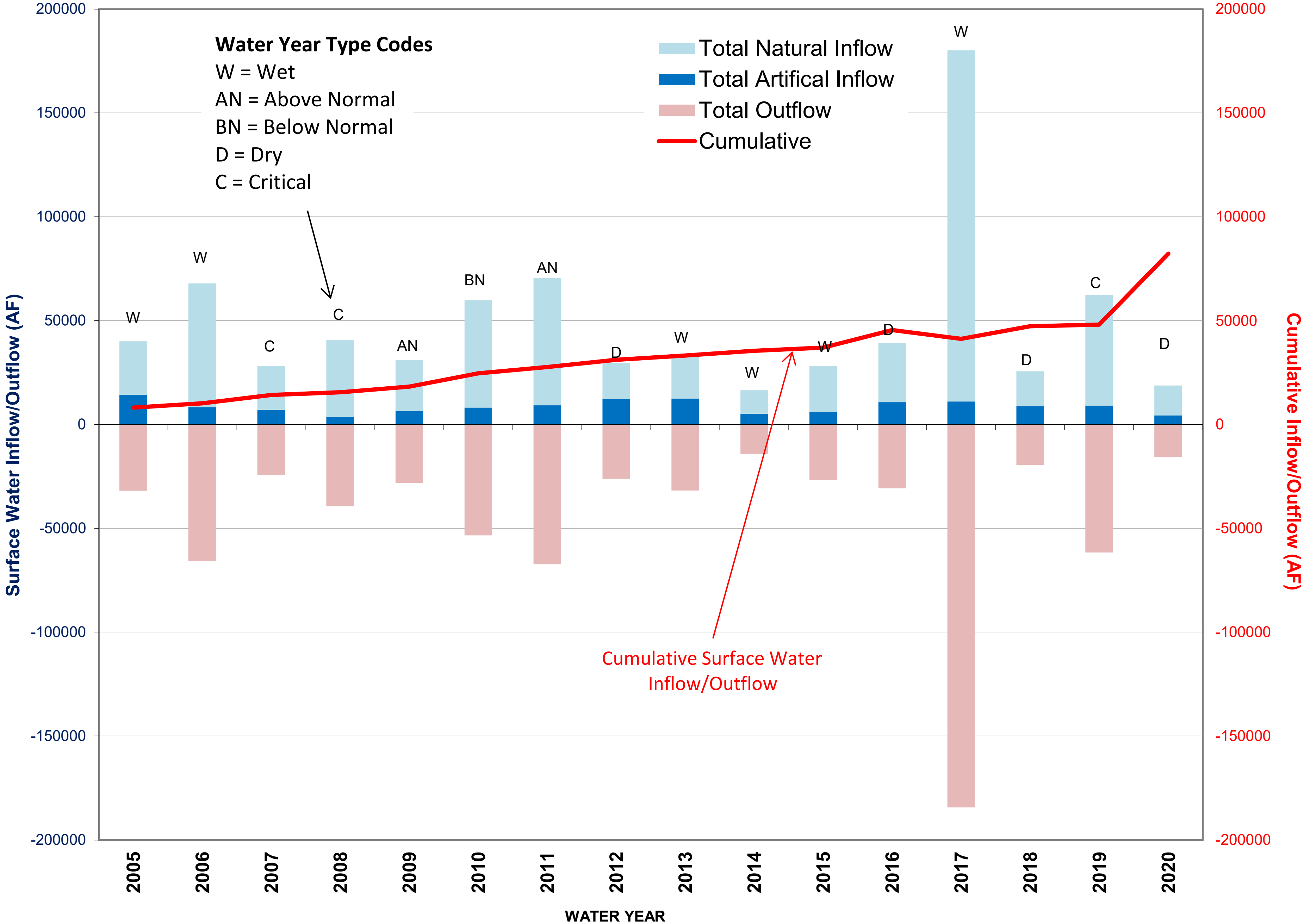


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FIGURE 9-5
IMPORTED SURFACE WATER SUPPLIES
1974 TO 2020 WATER YEARS
LIVERMORE VALLEY GROUNDWATER BASIN

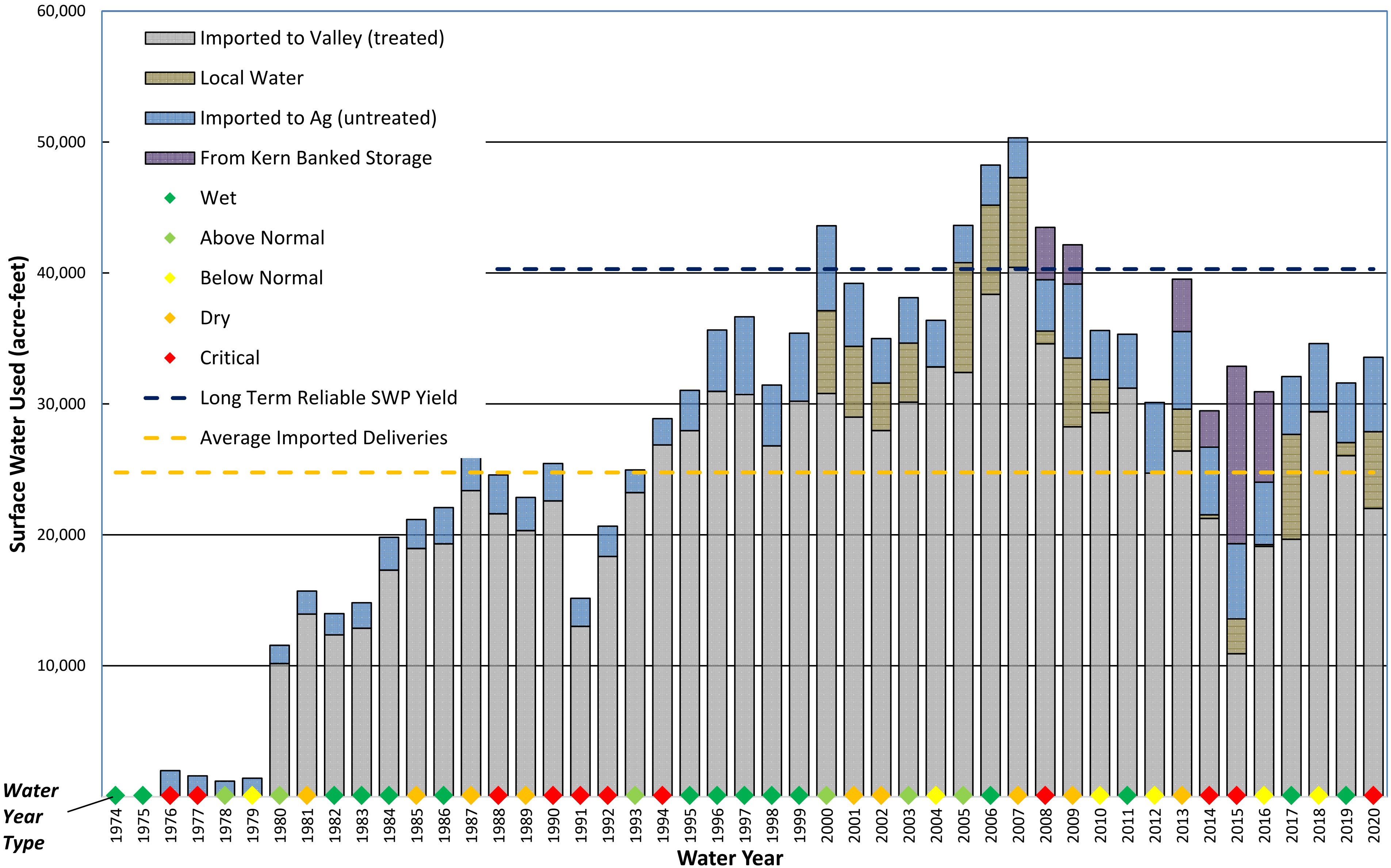

FIGURE 9-6
GRAPH OF ANNUAL AND CUMULATIVE GROUNDWATER INFLOWS AND OUTFLOWS
1974 - 2020 WATER YEARS
LIVERMORE VALLEY GROUNDWATER BASIN

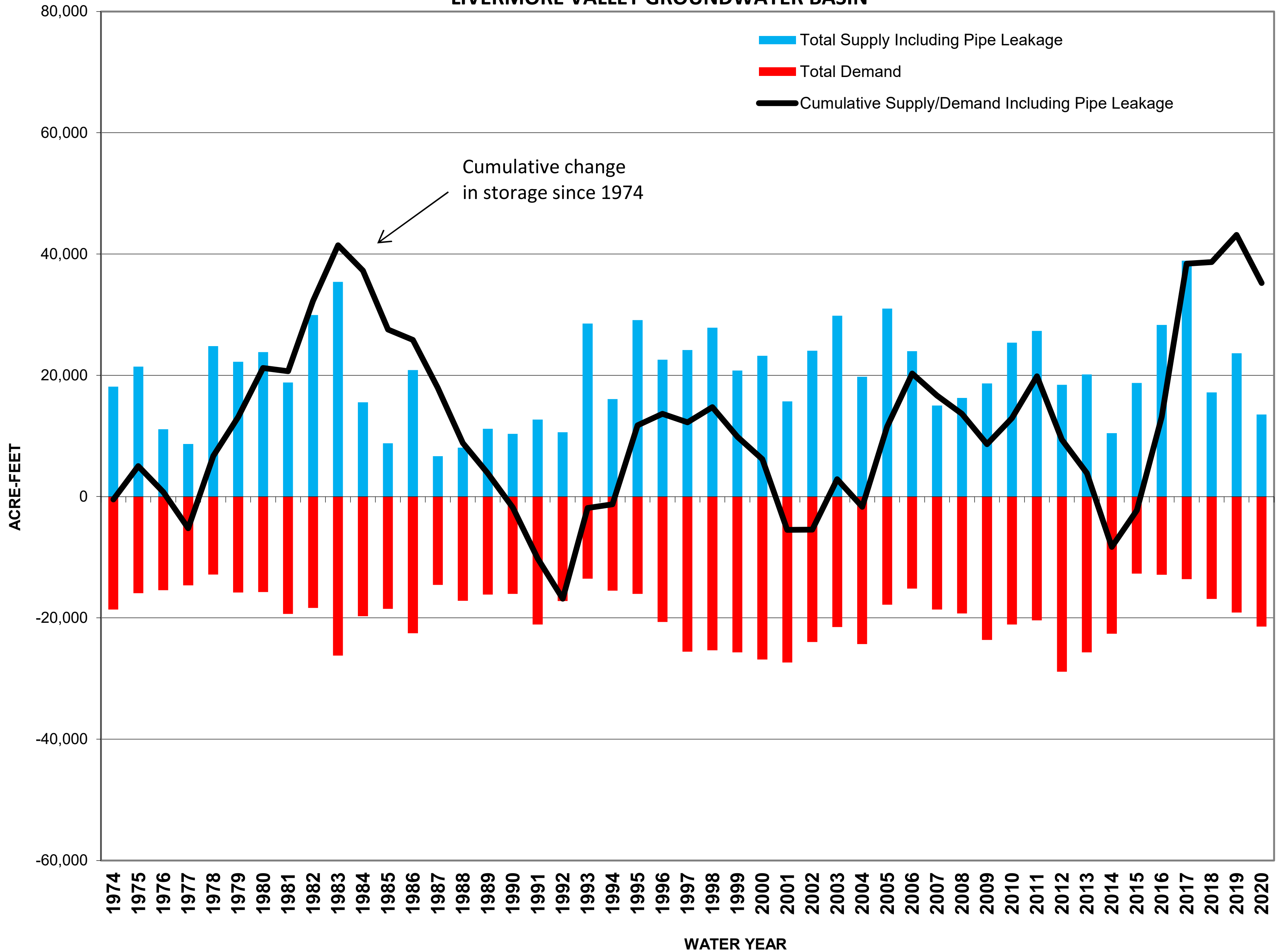

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FIGURE 9-7
GRAPH OF ANNUAL AND CUMULATIVE NATURAL INFLOWS AND OUTFLOWS
1974 - 2020 WATER YEARS
LIVERMORE VALLEY GROUNDWATER BASIN

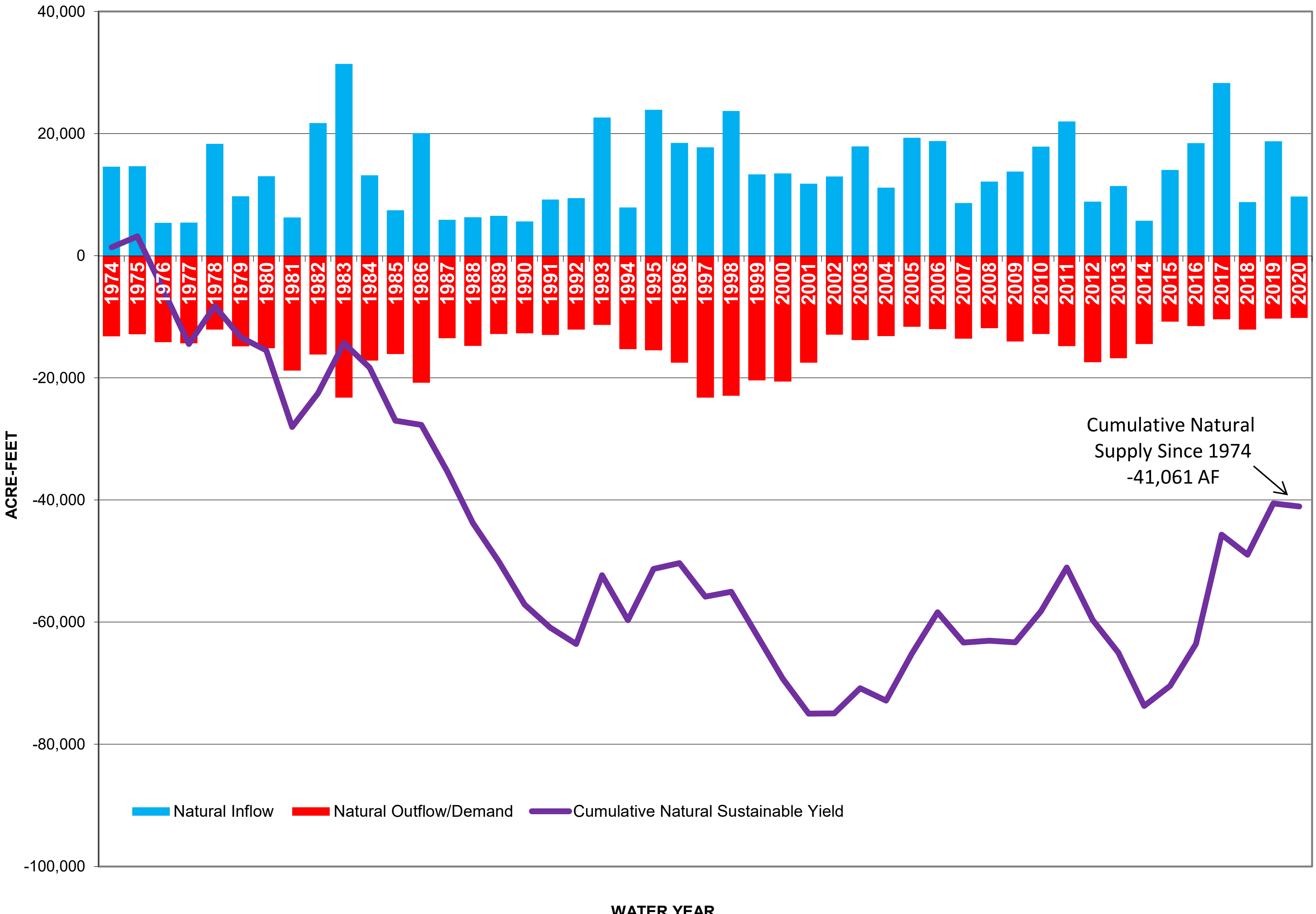

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FIGURE 9-7
GRAPH OF CUMULATIVE CONJUNCTIVE USE SUPPLY AND DEMAND SINCE 1974 WY
LIVERMORE VALLEY GROUNDWATER BASIN

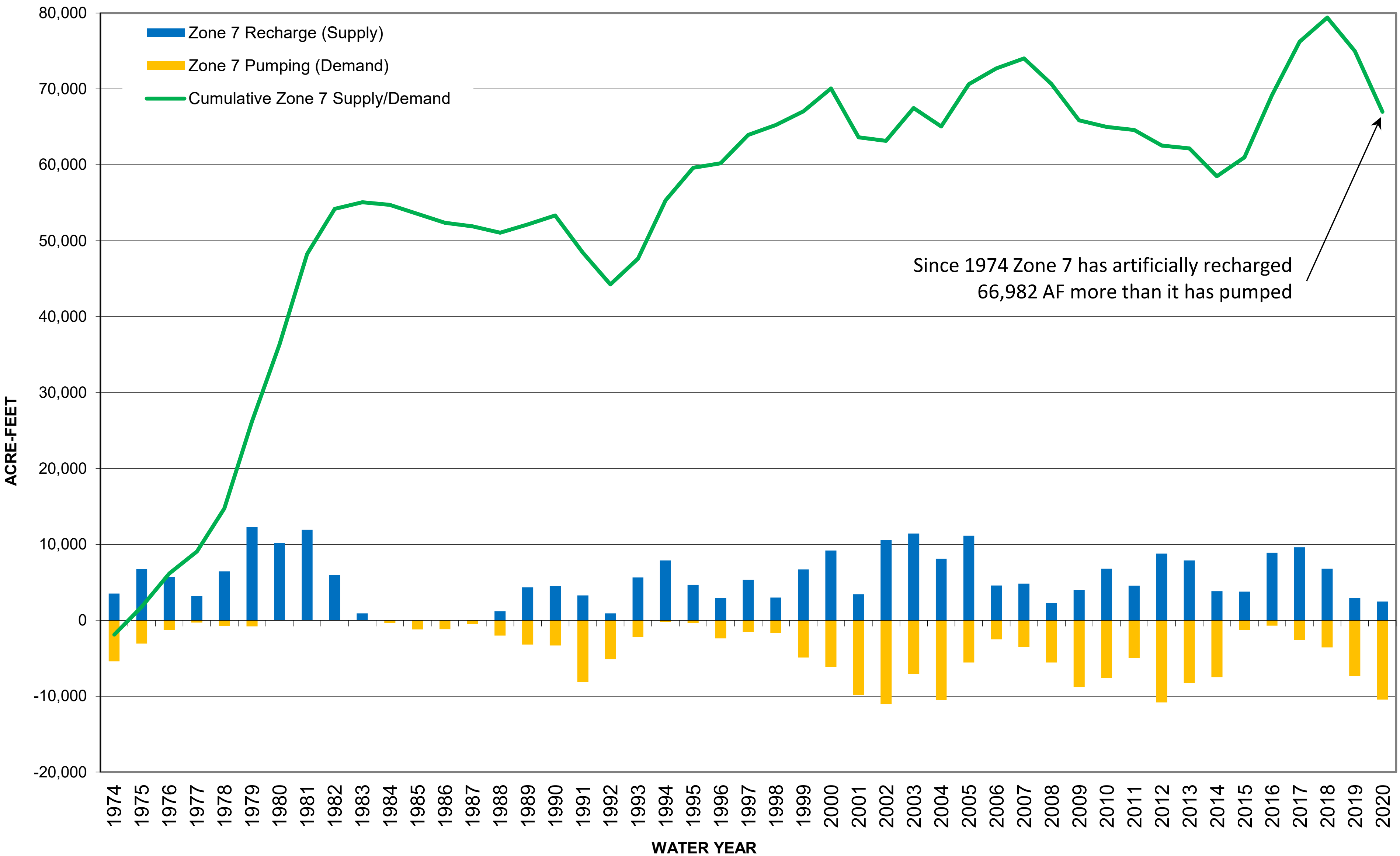

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FIGURE 9-9
CUMULATIVE CHANGE IN NATURAL AND ARTIFICIAL RECHARGE AND DEMAND 1974 - 2020 WATER YEARS
LIVERMORE VALLEY GROUNDWATER BASIN

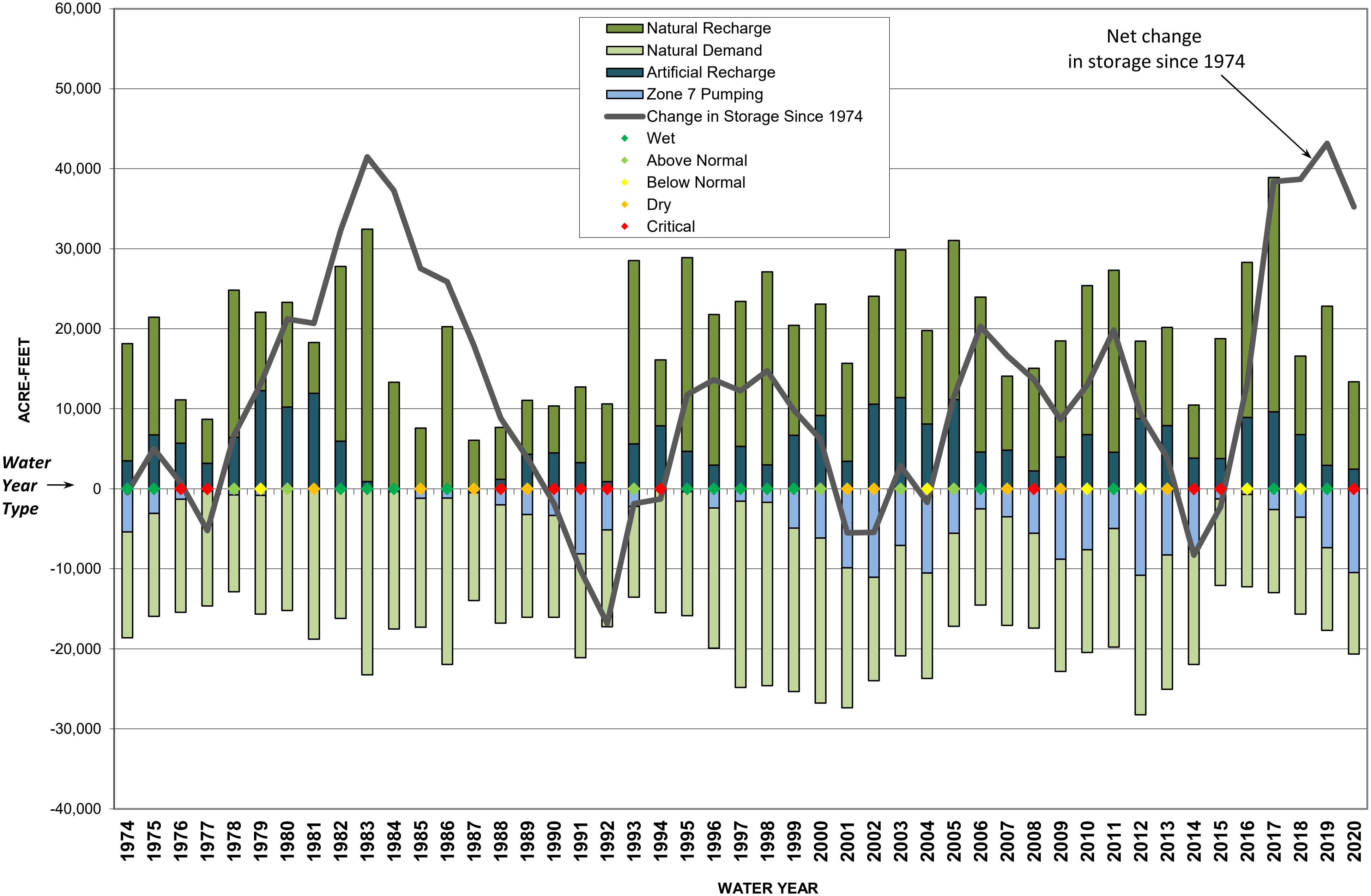

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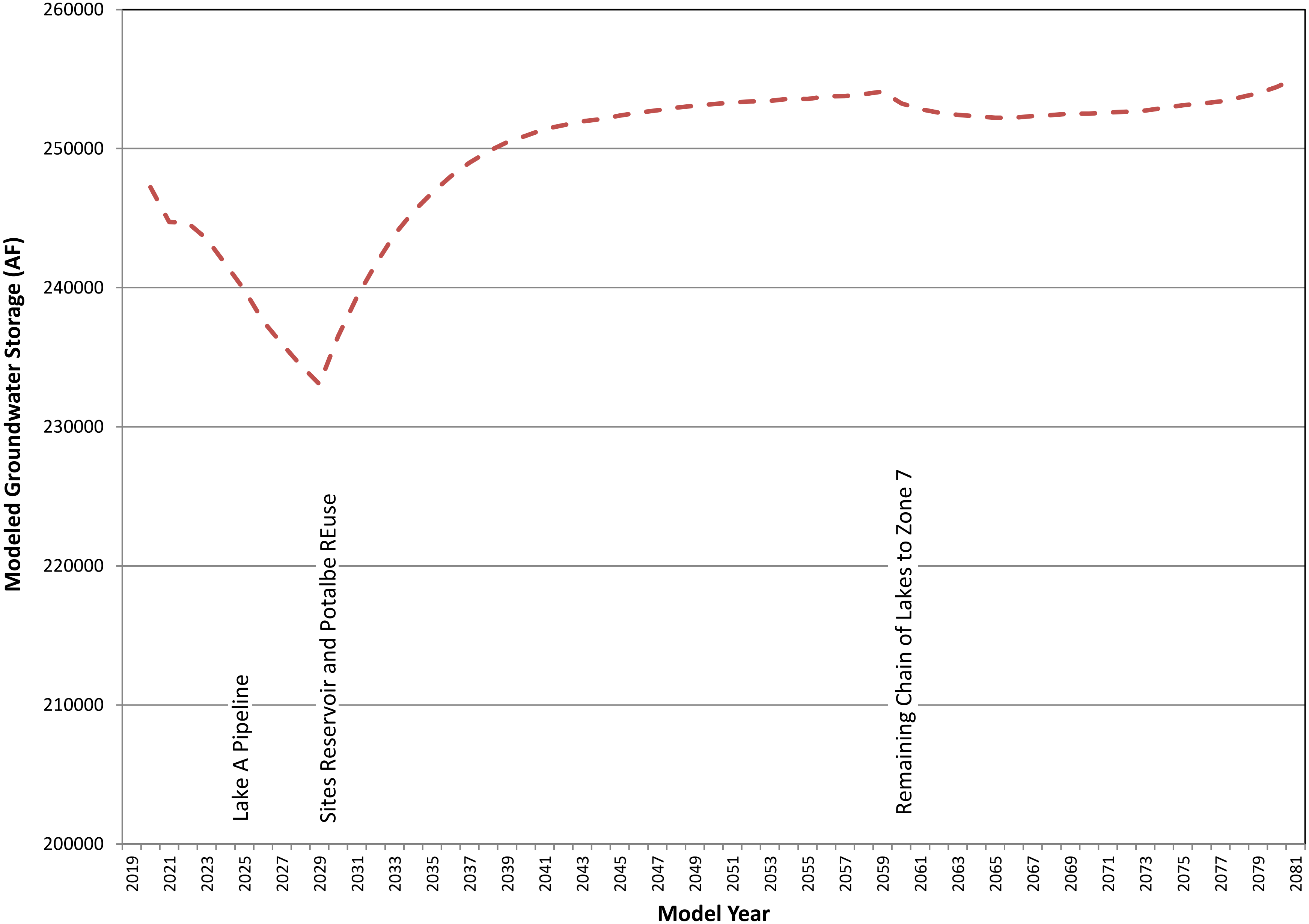
FIGURE 9-10
MODELED MAIN BASIN STORAGE
2020 to 2081 WATER YEARS



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10. MANAGEMENT AREAS

§ 354.20. Management Areas
(a) Each Agency may define one or more management areas within a basin if the Agency has determined that creation of management areas will facilitate implementation of the Plan. Management areas may define different minimum thresholds and be operated to different measurable objectives than the basin at large, provided that undesirable results are defined consistently throughout the basin.

☑ 23 CCR § 354.20(a)

For purposes of groundwater management, the Livermore Valley Groundwater Basin (Basin) has been divided by The Alameda County Flood Control and Water Conservation District, Zone 7 (Zone 7 Water Agency or Zone 7) into three Management Areas (and additional subareas). The Main Basin, Fringe, and Upland Management Areas are shown on **Figure 10-1** and listed in **Table 10-A**. The Management Areas are defined based on the following factors:

- Significant differences in geologic and aquifer characteristics (e.g., thickness, yield, quality) and groundwater use (i.e., volume of groundwater pumping) (see **Sections 7** through **9**);
- Land use characteristics (see **Section 5**); and,
- Degree of active groundwater management conducted by Zone 7 (see **Sections 5** and **15**).

Table 10-A: Basin Management Areas

Management Area	Area (acres)	General Description
Main Basin	19,809	Central portion of the Basin (i.e., the Livermore Valley); Includes the Castle, Bernal, Amador, and Mocho II Subareas; Highly urbanized land use; Upper and Lower Aquifers are actively managed for water supply benefits by Zone 7.
Fringe	21,956	Edges of the Basin and Livermore Valley; Includes the North Fringe (Bishop, Dublin, Camp subareas), Northeast Fringe (Mocho I, Spring, Altamont, May, Vasco, and Cayetano subareas) and East Fringe (Mocho I subareas) Areas; Urban, agricultural and open space land uses; limited groundwater use and management by Zone 7.
Upland	27,778	Edges of the Basin (i.e., gently sloping Livermore Valley wall); Low density residential, agricultural, and open space land uses; very limited groundwater use and management by Zone 7.
Total	**69,557**	

10.1. Description and Justification

§ 354.20. Management Areas
(a) A basin that includes one or more management areas shall describe the following in the Plan:
(1) The reason for the creation of each management area.
(b) If a Plan includes one or more management areas, the Plan shall include descriptions, maps, and other information required by this Subarticle sufficient to describe conditions in those areas.

☑ **23 CCR § 354.20(b)(1)**
☑ **23 CCR § 354.20(c)**

The unique characteristics of each Management Area are described below.

10.1.1. Main Basin Management Area

10.1.1.1. Hydrogeologic Description

The Main Basin Management Area (Main Basin) covers 19,809 acres within the center of the Basin (i.e., the Livermore Valley or Valley) and contains the thickest alluvial deposits, the highest-yielding aquifers, and the best quality groundwater within the Basin. As described in **Section 7,** the Main Basin contains up to over 800 feet of highly transmissive alluvial deposits spanning multiple geologic formations, including Holocene and Quaternary alluvial deposits as well as productive deposits of the upper Livermore Formation. The Principal Aquifer units of the Main Basin (i.e., the Upper Aquifer and Lower Aquifer) are considered to have very limited hydraulic connectivity to those of the Fringe and Upland Management Areas (Fringe and Upland Areas). As described in **Section 8,** the Main Basin contains the highest quality groundwater within the Basin and includes the majority of usable groundwater storage. As described in **Section 9**, the Main Basin supports most of the groundwater production within the Basin, with all municipal supply wells screened through the Lower Aquifer.

10.1.1.2. Land Use

As described in **Section 5** and shown on **Figure 5-1**, the Main Basin includes the highly urbanized Valley floor and the City of Pleasanton, the western portion of the City of Livermore, and the southern portion of the City of Dublin. The Main Basin also includes the Arroyo Valle and Arroyo Mocho stream corridors, through which Zone 7's artificial recharge operations occur (see **Sections 5** and **15**). The active mining operations related to the Chain-of-Lakes (COL) also exist within the Main Basin. As of 2020, approximately 56% (11,070 acres) of Main Basin lands were classified as urban, 27% (5,290 acres) as open space (including mining area pits), 11% (2,160 acres) as agricultural, and 7% (1,290 acres) as surface water bodies (including the COL).

10.1.1.3. Zone 7 Management

As described in **Section 9**, the majority of groundwater production within the Basin occurs through the Lower Aquifer unit of the Main Basin. Accordingly, many of Zone 7's management actions have focused on enhancement and protection of Main Basin aquifers. As described in **Sections 5**, **9**and **15**, Zone 7 has implemented a variety of groundwater management programs and policies within the Main Basin including: (1) providing imported surface water supplies to the four water agencies (Retailers) who supply potable water to urban areas within the Main Basin; (2) conducting artificial recharge operations through the Arroyo Valle and Arroyo Mocho stream corridors (and planning for future expanded recharge operations through the COL); (3) implementing a Groundwater Pumping Quota (GPQ) program to limit non-Zone 7 pumping to the "natural" Sustainable Yield calculated for the Main Basin; and (4) implementing various groundwater quality management practices (such as the Salt and Nutrient Management Plans described in **Sections 5** and **15**); and, (5) administering the well permitting program[31] to enforce Alameda County's "Water Wells Ordinance" (General Ordinance Number 0-2015-20) in Eastern Alameda County, and the Onsite Wastewater Treatment Systems (OWTS) permitting program. These groundwater management programs and policies are specifically designed to protect the long-term sustainable use of the Main Basin aquifers and are accounted for directly in the Hydrologic Inventory (HI) that Zone 7 has prepared for the Main Basin since the 1974 Water Year (WY; see **Section 9**).

10.1.2. Fringe Management Area

10.1.2.1. Hydrogeologic Description

The Fringe Area covers 21,956 acres on the edges of the Valley and contains thinner deposits of recent (Holocene) alluvium directly underlain by relatively impermeable deposits of the Livermore and Tassajara Formations. As described in **Section 7,** only a single Principal Aquifer unit is defined within the Fringe Area (i.e., the Fringe Aquifer) representing the combined Holocene alluvium and underlying Livermore/Tassajara deposits, and aquifer depths generally do not exceed 350 feet (based on the deepest wells in the area). As described in **Section 8**, the Fringe Aquifer is characterized by poorer groundwater quality and lower well yields than the Principal Aquifers of the Main Basin. As described in **Section 9,** there are no municipal supply wells within the Fringe Area and groundwater pumping is limited to domestic and agricultural uses. Groundwater conditions have historically remained stable in the Fringe Area, with very little observed changes in groundwater elevations or groundwater storage throughout the 46-year (i.e., 1974 WY to 2020 WY) historical HI period.

10.1.2.2. Land Use

As described in **Section 5** and shown on **Figure 5-1**, the Fringe Area includes the northern portion of the City of Dublin, the eastern portion of the City of Livermore, as well as undeveloped (open space) and agricultural lands. As of 2020, approximately 62% (13,650 acres) of Fringe Area lands were classified as urban, 33% (7,250 acres) as open space, and 5% (1,160 acres) as agricultural.

10.1.2.3. Zone 7 Management

Given the limited groundwater production, low aquifer transmissivity, generally poor groundwater quality, and historically stable groundwater conditions observed in the Fringe Area, Zone 7 has historically

[31] This program covers permitting of new wells, soil, soil vapor, or groundwater sampling wells, boreholes greater than ten feet deep, well destruction, or well casing reconstruction (to extend, replace, or reperforate), and cathodic protection wells.

conducted limited groundwater management actions within this portion of the Basin. While the Fringe Area receives the benefits of Zone 7's imported surface water and groundwater quality management programs, Zone 7's active operations within the Fringe Area are currently limited to ongoing monitoring of groundwater conditions and administering permitting programs for wells and OWTS. As part of this Five-Year Update to the Alternative Groundwater Sustainability Plan (Alt GSP), Zone 7 conducted several data-gap filling activities to better delineate the nature and extent of the Fringe Aquifer (see **Sections 7 and 8.4**), quantify salt and nutrient loading (see **Section 8.6**), identify groundwater dependent ecosystems and interconnected surface water bodies (see **Sections 8.8** and **8.9**), and expand the Monitoring Network (see **Section 14**) within the Fringe Area.

10.1.3. Upland Management Area

10.1.3.1. Hydrogeologic Description

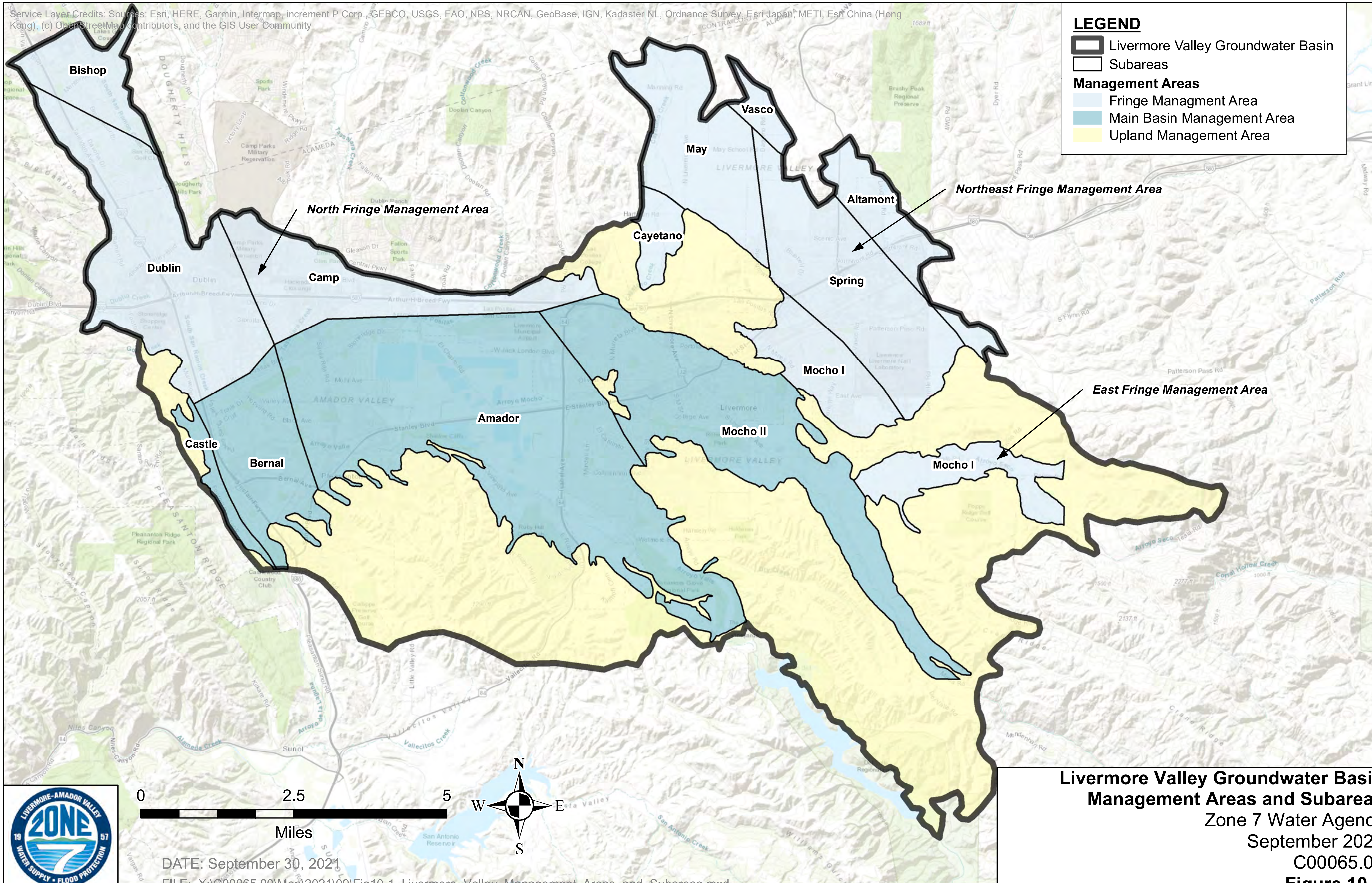
The Upland Area covers 27,778 acres on the edges of the Basin (i.e., outside the Valley) and is defined by relatively impermeable outcrops of the lower Livermore Formation and older bedrock units. As described in **Section 7,** the Upland Area does not yield significant quantities of groundwater and only a small number of domestic and agricultural wells exist within this portion of the Basin. All water-bearing sediments encountered within the Upland Area are considered a single Principal Aquifer unit and are collectively referred to as the Upland Aquifer. As described in **Section 8**, the Upland Aquifer is of generally poorer groundwater quality than in the Main Basin, and only provides a limited amount of groundwater supply for domestic and agricultural uses. There is insufficient information to characterize the thickness and total storage volume of the Upland Aquifer or to quantify storage changes over time, though all monitoring data collected suggests groundwater conditions have remained stable through the 46-year historical HI period.

10.1.3.2. Land Use

As described in **Section 5** and shown on **Figure 5-1**, the Upland Area mainly includes undeveloped (open space) and low-density residential areas as well as some agricultural lands. As of 2020, approximately 73% (20,390 acres) of Upland Area lands were classified as open space, 17% (4,670 acres) as urban, and 10% (2,720 acres) as agricultural.

10.1.3.3. Zone 7 Management

Given the insignificant groundwater production and low aquifer transmissivity coupled with the general lack of wells in the Upland Aquifer, Zone 7's active management of the Upland Area is currently limited to ongoing monitoring of groundwater conditions and administering permitting programs for wells and OWTS. As part of this Five-Year Update to the Alt GSP, Zone 7 conducted several data-gap filling activities to better delineate the nature and extent of the Upland Aquifer (see **Sections 7 and 8.4**), quantify salt and nutrient loading (see **Section 8.6**), identify groundwater dependent ecosystems and interconnected surface water bodies (see **Sections 8.8** and **8.9**), and expand the Monitoring Network (see **Section 14**) within the Upland Area.



Livermore Valley Groundwater Basin Management Areas and Subareas
Zone 7 Water Agency
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Figure 10-1