

3 Monitoring Programs

3.1 Climatological Monitoring Program

3.1.1 Program Description

The Zone 7 Climatological Monitoring Program network consists of seven rainfall stations and one pan evaporation station located within the approximate 400-square-mile watershed of the Valley. The Zone 7 network stations provide sufficient high quality data for long-term studies, basin recharge calculations, and water management decisions. The boundary of the watershed, the location of the climatological stations, and the lines of equal annual rainfall (isohyets) are shown in Figure 3.1-1. Table 3.1-1 lists the stations and provides basic station information including the station ID, name, location, and mean annual precipitation or evaporation.

All of the rainfall stations provide a daily data record. A daily record station consists of a rain gage at which, once-a-day, the observer measures and records the depth of rain that has fallen during the preceding 24 hours. A recorder station consists of a rain gage and a computerized tipping bucket recorder. These tipping buckets continuously record the amount of rain that has fallen at that station and generally provide 15-minute recorded totals.

Recorder stations provide intensity data for 15-minute periods through 24-hour periods. Daily stations provide one-day through six-day rainfall intensities.

Zone 7 funded the installation of a California Irrigation Management System (CIMIS) station at the Pleasanton Fairways Golf Course at the Alameda County Fairgrounds in Pleasanton. This station (CIMIS Station 191) records evapotranspiration, precipitation, solar radiation, air temperature, soil temperature, relative humidity, wind speed, and direction. The data for this station, which will be incorporated into the program for the 2011 Water Year, is available to the general public at <http://www.cimis.water.ca.gov/cimis/data.jsp>.

3.1.2 2010 Results

The 2010 Water Year rainfall in the Valley was above average at 110% of normal. Individual stations ranged from 90% at Station 24 (Patterson Pass Water Treatment Plant) to 122% at Station 170 (Hopyard 6 Well). Evaporation was 97% of normal as represented by the Lake Del Valle Station.

The monthly precipitation totals for each of Zone 7's precipitation stations for the 2010 Water Year are shown in Table 3.1-2. Table 3.1-3 shows historical monthly data from Station 15E, the network key station with the longest historical record. Figure 3.1-2, a graph of cumulative rainfall from Station 15E,

presents data for the 2010 Water Year, along with the driest water year (1977), the calculated average water year, the wettest year (1983), and the 2010 Water Year for comparison.

Table 3.1-4 provides the daily pan evaporation measured at Station CM_STA LDV-EV during the 2010 Water Year, and Table 3.1-5 shows monthly data going back to the 1969 Water Year.

3.2 Groundwater Elevation and Quality Monitoring Program

3.2.1 Program Description

The Groundwater Elevation and Quality Monitoring Program includes the measurement of groundwater levels in monitoring and production wells, and the collection and analyses of groundwater samples. These hydrologic data are needed to assess groundwater supplies (i.e., quantity, quality, and trends). The program focuses on the Main Basin, where groundwater is pumped for municipal uses. Other Zone 7 programs utilize the data collected in this program, and the results are used in water resources management planning and decision making.

There were a total of 236 wells in the Zone 7 groundwater monitoring program during the 2010 Water Year (shown on Figure 3.2-1). Each well in the program was monitored and/or sampled to fulfill one or more specific objective. Table 3.2-1 lists all of the wells in the program, the objective(s) of each monitoring well, and the frequency of monitoring or sampling for each objective. The objectives listed in the table are described fully in the GWMP and are described briefly below:

Water Level Monitoring – water level measurements are taken from various wells in the basin at varying frequencies.

- **Semi-Annual (SA)** - groundwater basin semi-annual water level measurements during seasonal extremes (spring highs and fall lows).
- **Quarterly (Q)** – created in the 2007 Water Year to reduce the number of wells measured monthly.
- **Monthly (M)** – monthly water level measurements used to identify when seasonal extremes occur and in turn used to trigger the semi-annual water level measurement events.

Del Valle Water Rights (WR) – monitoring of water levels and quality required for Arroyo Valle water rights.

Groundwater Basin Quality – annual sampling of groundwater for major minerals and metals. Additional sampling and testing may be performed by an outside contractor or property owner if not sampled by Zone 7 staff.

**TABLE 3.1-1
ZONE 7 WATER AGENCY
CLIMATOLOGICAL STATION INFORMATION**

PRECIPITATION NETWORK								
Alameda County STATION	Computer SITE ID	STATION NAME	LOCATION	OBSERVER	ELEVATION	STATION ESTABLISHED		MEAN ANNUAL PRECIPITATION INCHES
						STORAGE GAGE (DAILY)	RECORDER RECORD	
15E	CM_STA 15E	NOAA LIVERMORE	WELLINGHAM DRIVE, LIVERMORE CCN: 2077172 Lat: 37.6925 CCE: 6194524 Long: -121.7693	MR. RON HAFNER	480	1871	-	14.57
17	CM_STA 17	DEL VALLE PLANT	VALLECITOS ROAD, LIVERMORE CCN: 2054906 Lat: 37.6327 CCE: 6189667 Long: -121.7843	ZONE 7 STAFF	640	1974	1978	16.06
24	CM_STA 24	PATTERSON PLANT	PATTERSON PASS ROAD, LIVERMORE CCN: 2077605 Lat: 37.6948 CCE: 6219168 Long: -121.6837	ZONE 7 STAFF	680	1963	1969	12.91
34	CM_STA 34	MOCHO WELL FIELD	SANTA RITA ROAD, PLEASANTON CCN: 2075106 Lat: 37.6864 CCE: 6163467 Long: -121.8770	ZONE 7 STAFF	340	1968	1970	17.84
44	CM_STA 44	MT HAMILTON	LICK OBSERVATORY, MT HAMILTON CCN: 1947881 Lat: 37.3388 CCE: 6228576 Long: -121.6457	LICK OBSERVATORY STAFF	4209	1881	-	24.78
101	CM_STA 101	TASSAJARA	CAMINO TASSAJARA ROAD, DANVILLE CCN: 2116905 Lat: 37.8004 CCE: 6158368 Long: -121.8959	MRS. JOAN HANSEN	800	1912	-	18.42
170	CM_STA 170	ZONE 7 OFFICE	PARKSIDE DRIVE, PLEASANTON CCN: 2072426 Lat: 37.6852 CCE: 6156517 Long: -121.9000	ZONE 7 STAFF	330	1986	1986 to 2005	21.05
191	CM_STA 191	CIMIS STATION	ALAMEDA COUNTY FAIRGROUNDS, PLEASANTON CCN: 2067061 CCE: 6161028	DWR STAFF	335	-	2004	19.46

EVAPORATION NETWORK							
STATION ID	SITE ID	STATION NAME	LOCATION	OBSERVER	ELEVATION	STATION ESTABLISHED	MEAN ANNUAL EVAPORATION INCHES
LDV	CM_STA LDV-EV	LAKE DEL VALLE	ARROYO ROAD, LIVERMORE CCN: 2048605 Lat: 37.6145 CCE: 6200367 Long: -121.7474	DWR STAFF	760	1969	66.20
191	CM_STA 191	CIMIS STATION	ALAMEDA COUNTY FAIRGROUNDS, PLEASANTON CCN: 2067061 CCE: 6161028	DWR STAFF	335	2004	50.10

TABLE 3.1-2
ZONE 7 WATER AGENCY
MONTHLY PRECIPITATION
2010 WATER YEAR

MONTHLY PRECIPITATION IN INCHES

	STATION NUMBER							NETWORK AVERAGE	% AVG OF NETWORK
	15	17	24	34	44	101	170		
OCT	2.79	1.98	2.01	4.83	3.91	3.69	4.90	3.44	377%
NOV	0.21	0.07	0.01	0.27	0.39	0.19	0.30	0.21	10%
DEC	2.02	2.10	1.55	2.50	4.00	3.07	2.91	2.59	85%
JAN	3.53	4.03	3.09	5.67	6.64	5.81	6.50	5.04	142%
FEB	2.36	2.11	1.92	2.53	4.05	2.80	3.03	2.69	81%
MAR	1.57	2.03	1.15	2.06	2.72	2.25	2.97	2.11	78%
APR	2.10	2.34	1.59	3.05	4.39	2.83	4.34	2.95	218%
MAD	0.24	0.50	0.24	0.60	1.36	1.33	0.79	0.72	120%
JUN	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	4%
JUL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0%
AUG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0%
SEP	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	1%
TOTAL:	14.82	15.16	11.56	21.51	27.51	21.97	25.74	19.75	
PERCENT AVG:	102%	94%	90%	121%	111%	119%	122%	110%	

DISTRIBUTION OF DAILY PRECIPITATION
Number of days with precipitation greater than given depth.

DEPTH (in)	STATION NUMBER							NETWORK AVERAGE
	15	17	24	34	44	101	170	
TRACE	70	60	59	66	106	73	68	72
0.1	36	38	29	42	55	48	43	42
0.5	5	7	5	12	17	15	13	11
1	1	1	1	4	5	4	6	3
2	1	0	0	1	1	1	1	1

TABLE 3.1-3
ZONE 7 WATER AGENCY
MONTHLY PRECIPITATION (CM_STA 15E in inches), WELLINGHAM DRIVE, LIVERMORE
1871 to 2010 WATER YEARS

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL OCT-SEP	TOTAL JULY-JUNE	% NORMAL OCT-SEP
1871	1.42	1.93	0.36	1.25	0.02	0.00	0.00	0.00	0.00	0.00	1.13	11.69			
1872	2.15	2.69	0.65	0.43	0.00	0.32	0.00	0.00	0.00	0.00	1.22	3.87	19.06	19.06	131%
1873	1.04	3.73	0.68	0.15	0.00	0.00	0.00	0.00	0.00	0.42	0.70	4.48	10.69	10.69	73%
1874	2.96	1.03	1.34	0.95	0.32	0.06	0.00	0.00	0.30	1.67	2.03	0.20	12.56	12.26	86%
1875	5.40	1.20	0.35	0.00	0.00	0.52	0.00	0.00	0.00	0.00	7.23	1.62	11.37	11.67	78%
1876	2.68	3.01	4.39	0.73	0.33	0.00	0.00	0.00	0.00	1.26	0.10	0.00	19.99	19.99	137%
1877	2.47	0.56	1.10	0.13	0.39	0.00	0.00	0.00	0.00	1.27	1.29	0.73	6.01	6.01	41%
1878	4.61	6.73	2.01	0.96	0.06	0.00	0.00	0.00	0.00	0.24	0.31	0.17	17.66	17.66	121%
1879	2.83	1.78	2.49	0.75	1.34	0.20	0.00	0.00	0.00	0.83	1.06	1.94	10.11	10.11	69%
1880	1.48	1.80	1.45	6.51	0.91	0.00	0.00	0.00	0.00	0.00	0.65	7.75	15.98	15.98	110%
1881	2.40	2.62	1.06	1.93	0.00	0.04	0.00	0.00	0.00	0.08	0.78	1.97	16.45	16.45	113%
1882	1.07	1.72	4.85	1.03	0.20	0.00	0.00	0.00	0.34	1.52	1.48	0.38	12.04	11.70	83%
1883	2.38	0.63	3.45	1.50	2.18	0.00	0.00	0.00	0.35	1.52	0.57	0.44	13.87	13.86	95%
1884	4.03	5.29	5.92	2.70	0.20	1.73	0.00	0.10	0.30	1.14	0.02	6.22	22.80	22.75	156%
1885	1.72	0.36	0.78	1.29	0.08	0.00	0.00	0.00	0.05	0.00	6.20	1.94	11.66	12.01	80%
1886	4.20	0.24	1.18	2.36	0.00	0.00	0.40	0.00	0.00	0.30	0.70	0.81	16.52	16.17	113%
1887	0.90	6.23	0.23	1.60	0.00	0.00	0.00	0.00	0.80	0.00	0.61	3.51	11.57	11.17	79%
1888	3.20	0.94	2.51	0.60	0.66	0.30	0.00	0.00	0.76	0.00	3.80	2.21	13.09	13.13	90%
1889	0.46	0.67	5.15	0.51	2.25	0.00	0.00	0.00	0.00	3.94	2.95	8.63	15.05	15.81	103%
1890	5.24	3.71	2.85	0.86	0.48	0.00	0.00	0.00	1.20	0.00	0.00	3.31	29.86	28.66	205%
1891	0.54	4.18	2.50	1.88	0.40	0.15	0.00	0.00	1.32	0.05	0.38	4.42	14.28	14.16	98%
1892	0.84	1.08	3.96	0.90	1.30	0.00	0.00	0.00	0.45	1.65	4.97	7.27	13.38	14.25	92%
1893	3.02	3.12	3.68	1.40	0.73	0.00	0.00	0.00	0.00	0.00	1.59	2.14	25.84	26.29	177%
1894	4.97	5.36	0.81	0.58	1.19	0.52	0.00	0.00	1.45	1.15	0.50	8.56	18.61	17.16	128%
1895	6.83	1.56	1.81	1.26	1.25	0.00	0.00	0.00	0.22	0.83	1.69	1.28	23.14	24.37	159%
1896	7.16	0.17	1.50	3.11	0.39	0.00	0.00	0.73	0.55	1.48	3.02	1.71	17.41	16.35	119%
1897	1.89	3.54	4.04	0.24	0.00	0.08	0.00	0.00	0.06	1.43	0.52	1.31	16.06	17.28	110%
1898	1.47	1.78	0.78	0.45	0.96	0.35	0.00	0.00	0.95	0.74	0.25	1.61	10.00	9.11	69%
1899	2.60	0.08	4.81	0.35	0.15	0.22	0.00	0.00	0.00	2.52	2.49	2.07	10.81	11.76	74%
1900	2.44	0.34	1.11	0.86	1.10	0.00	0.00	0.00	0.18	1.93	4.48	1.06	13.11	12.93	90%
1901	2.69	5.15	0.95	1.80	1.58	0.00	0.00	0.00	0.68	0.70	1.99	0.74	20.32	19.82	139%
1902	0.99	3.62	2.69	0.75	0.32	0.00	0.00	0.13	0.00	0.47	2.07	0.87	11.93	12.48	82%
1903	3.19	0.94	5.65	0.81	0.12	0.00	0.00	0.00	0.00	0.00	2.16	0.59	14.12	14.25	97%
1904	0.89	4.18	3.71	1.56	0.24	0.00	0.00	0.32	1.62	1.00	0.78	1.42	15.27	13.33	105%
1905	2.43	2.30	3.12	0.93	1.89	0.00	0.00	0.00	0.00	0.00	1.01	1.18	13.87	15.81	95%
1906	5.56	2.67	5.18	0.95	1.61	0.56	0.00	0.00	0.20	0.03	1.34	6.45	18.92	18.72	130%
1907	3.22	1.86	8.85	0.47	0.16	0.56	0.00	0.00	0.00	0.81	0.04	3.90	22.94	23.14	157%
1908	2.27	1.35	0.73	0.28	0.53	0.00	0.00	0.00	0.03	0.27	0.60	1.55	9.94	9.91	68%
1909	10.18	3.96	1.94	0.00	0.00	0.05	0.00	0.00	0.62	0.75	1.68	5.77	19.17	18.58	132%
1910	2.50	1.14	1.90	0.10	0.00	0.04	0.00	0.00	0.10	0.29	0.10	1.32	13.98	14.50	96%
1911	12.60	1.42	4.45	0.69	0.24	0.07	0.00	0.00	0.00	0.43	0.29	1.71	21.18	21.28	145%
1912	2.66	0.20	1.99	0.73	0.94	0.65	0.00	0.00	0.48	0.71	0.44	0.81	10.08	9.60	69%
1913	2.63	0.38	1.65	0.54	0.58	0.01	0.27	0.02	0.00	0.00	2.47	3.17	8.04	8.23	55%
1914	7.10	2.11	0.66	0.76	0.45	0.19	0.00	0.00	0.00	0.45	0.33	3.96	16.91	17.20	116%
1915	4.16	5.79	1.50	0.66	2.66	0.00	0.00	0.00	0.00	0.00	0.76	4.41	19.51	19.51	134%
1916	11.35	2.17	1.47	0.21	0.05	0.00	0.00	0.00	0.44	0.50	0.68	3.28	20.86	20.42	143%
1917	1.06	3.37	1.08	0.15	0.02	0.00	0.00	0.00	0.04	0.00	0.43	0.66	10.18	10.58	70%
1918	0.59	3.08	3.32	0.61	0.00	0.00	0.00	0.00	5.72	0.39	2.38	1.51	14.41	8.73	99%
1919	1.03	4.58	2.33	0.05	0.00	0.00	0.00	0.00	0.48	0.15	0.33	2.21	12.75	17.99	88%
1920	0.22	0.71	3.52	1.07	0.00	0.13	0.00	0.00	0.00	2.03	1.43	3.81	8.34	8.82	57%
1921	3.38	0.59	0.83	0.16	1.05	0.00	0.00	0.00	0.05	0.15	1.17	3.38	13.33	13.28	91%
1922	1.51	5.46	1.83	0.23	0.27	0.00	0.00	0.00	0.00	0.54	2.86	5.43	14.00	14.05	96%
1923	1.80	0.65	0.15	2.15	0.00	0.02	0.00	0.00	0.82	0.25	0.76	0.87	14.42	13.60	99%
1924	1.40	0.93	0.65	0.28	0.07	0.00	0.00	0.00	0.00	1.30	1.53	2.63	5.21	6.03	36%
1925	1.02	3.74	1.14	1.75	1.41	0.04	0.00	0.00	0.00	0.00	0.97	1.14	14.56	14.56	100%
1926	2.44	3.58	0.16	3.11	0.11	0.00	0.00	0.00	0.00	0.93	2.83	0.78	11.51	11.51	79%
1927	1.74	3.49	1.54	1.73	0.10	0.18	0.00	0.00	0.03	1.71	1.43	2.00	13.35	13.32	92%
1928	1.46	0.89	3.43	1.43	0.45	0.00	0.00	0.00	0.00	0.00	2.57	2.76	12.80	12.83	88%
1929	1.26	0.87	1.07	0.70	0.03	0.83	0.00	0.00	0.00	0.01	0.00	1.81	10.09	10.09	69%
1930	3.64	1.91	1.88	1.14	0.43	0.00	0.00	0.00	0.20	0.58	1.15	0.26	11.02	10.82	76%
1931	3.45	1.67	0.57	0.36	0.93	0.11	0.00	0.00	0.00	0.27	1.89	5.63	9.08	9.28	62%
1932	1.29	3.15	0.19	0.41	0.37	0.00	0.00	0.00	0.00	0.00	0.51	2.03	13.20	13.20	91%
1933	4.51	0.44	2.09	0.13	0.70	0.03	0.00	0.00	0.01	0.75	0.00	3.69	10.45	10.44	72%
1934	1.29	2.86	0.00	0.13	0.60	0.53	0.00	0.00	0.27	0.62	2.71	2.32	10.12	9.86	69%
1935	3.53	0.52	3.16	3.28	0.00	0.00	0.00	0.04	0.00	0.79	0.21	1.53	16.18	16.41	111%
1936	3.28	6.76	0.71	0.63	0.46	0.10	0.00	0.00	0.00	0.40	0.02	3.26	14.47	14.51	99%
1937	3.38	4.13	5.07	0.68	0.17	0.20	0.00	0.00	0.00	0.55	2.46	4.57	17.31	17.31	119%
1938	2.40	6.14	4.09	0.90	0.02	0.00	0.00	0.00	0.00	1.00	1.08	0.52	21.13	21.13	145%
1939	2.40	1.57	2.18	0.53	0.18	0.00	0.00	0.00	0.16	1.23	0.15	0.78	9.62	9.46	66%
1940	8.13	5.14	2.60	0.35	0.14	0.00	0.00	0.00	0.25	0.50	0.43	4.63	18.77	18.68	129%

TABLE 3.1-3
ZONE 7 WATER AGENCY
MONTHLY PRECIPITATION (CM_STA 15E in inches), WELLINGHAM DRIVE, LIVERMORE
1871 to 2010 WATER YEARS

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL OCT-SEP	TOTAL JULY-JUNE	% NORMAL OCT-SEP
1941	3.24	4.19	2.07	2.76	0.23	0.00	0.00	0.03	0.00	0.72	0.89	5.34	18.08	18.30	124%
1942	3.89	1.68	1.42	3.10	1.00	0.00	0.00	0.00	0.09	1.08	3.05	1.73	18.13	18.07	124%
1943	4.48	1.68	2.39	1.14	0.00	0.06	0.00	0.00	0.00	0.30	0.53	1.23	15.61	15.70	107%
1944	2.36	4.89	1.01	0.94	0.73	0.00	0.00	0.00	0.00	0.77	3.41	2.03	11.99	11.99	82%
1945	0.87	3.68	3.19	0.20	0.17	0.00	0.00	0.02	0.00	1.07	2.07	2.98	14.34	14.32	98%
1946	0.76	1.23	1.69	0.02	0.61	0.00	0.24	0.00	0.02	0.02	2.93	2.07	10.69	10.45	73%
1947	0.69	1.45	2.34	0.53	0.17	0.36	0.00	0.00	0.00	1.84	0.85	0.51	10.56	10.82	72%
1948	0.20	1.11	2.79	2.50	1.03	0.16	0.03	0.00	0.00	0.46	0.34	2.71	11.02	10.99	76%
1949	1.39	2.47	3.38	0.02	0.34	0.00	0.03	0.16	0.05	0.08	1.20	1.21	11.35	11.14	78%
1950	4.65	1.54	1.44	0.85	0.59	0.01	0.00	0.00	0.08	1.84	5.95	4.95	11.65	11.81	80%
1951	2.23	1.87	1.82	0.55	0.35	0.06	0.00	0.00	0.00	1.04	3.15	6.07	19.62	19.70	135%
1952	7.60	1.40	2.53	2.20	0.16	0.04	0.00	0.00	0.10	0.01	2.11	6.33	24.29	24.19	167%
1953	2.07	0.05	1.12	1.92	0.61	0.59	0.00	0.15	0.00	0.21	1.38	0.64	14.96	14.91	103%
1954	2.19	2.27	3.30	0.73	0.16	0.30	0.00	0.00	0.04	0.00	1.68	3.33	11.22	11.33	77%
1955	3.28	1.69	0.40	1.37	0.65	0.00	0.00	0.01	0.01	0.01	1.31	10.15	12.42	12.44	85%
1956	5.49	1.15	0.14	1.92	0.63	0.00	0.00	0.00	0.63	0.79	0.03	0.48	21.43	20.82	147%
1957	2.65	2.23	1.30	1.14	2.74	0.04	0.00	0.00	0.05	1.06	0.37	2.26	11.45	12.03	79%
1958	3.16	5.37	4.44	3.74	0.66	0.41	0.00	0.00	0.02	0.09	0.14	0.86	21.49	21.52	147%
1959	2.45	3.59	0.29	0.35	0.00	0.00	0.00	0.07	1.89	0.00	0.00	0.75	9.73	7.79	67%
1960	2.98	4.12	0.60	0.48	0.42	0.00	0.02	0.00	0.01	0.05	2.92	1.25	9.38	11.31	64%
1961	2.08	1.04	1.92	1.03	0.69	0.19	0.00	0.13	0.16	0.15	2.24	0.82	11.46	11.20	79%
1962	0.73	5.61	1.82	0.22	0.00	0.00	0.00	0.00	0.00	3.64	0.28	1.55	11.59	11.88	80%
1963	1.40	4.50	2.60	3.47	0.70	0.00	0.00	0.00	0.33	0.93	3.18	0.19	18.47	18.14	127%
1964	2.37	0.08	1.57	0.21	0.48	0.32	0.00	0.12	0.04	0.85	2.44	4.91	9.49	9.66	65%
1965	2.11	0.59	1.73	1.53	0.00	0.00	0.00	0.21	0.00	0.03	4.22	3.23	14.37	14.32	99%
1966	1.05	1.17	0.17	0.33	0.10	0.12	0.17	0.00	0.11	0.00	3.43	2.35	10.70	10.63	73%
1967	6.14	0.29	4.15	4.65	0.19	0.48	0.00	0.00	0.02	0.24	0.88	1.62	21.70	21.96	149%
1968	3.93	0.90	2.40	0.43	0.15	0.00	0.00	0.00	0.00	0.43	2.48	3.04	10.55	10.57	72%
1969	6.28	4.76	0.55	1.24	0.08	0.00	0.00	0.00	0.00	1.10	0.49	2.34	18.86	18.86	129%
1970	5.38	1.18	1.42	0.40	0.07	0.32	0.00	0.00	0.00	0.41	5.42	5.27	12.70	12.70	87%
1971	1.19	0.33	1.75	1.37	0.54	0.00	0.00	0.00	0.13	0.04	0.46	3.27	16.41	16.28	113%
1972	0.90	0.79	0.14	0.64	0.00	0.04	0.00	0.00	0.58	2.98	4.91	2.22	6.86	6.41	47%
1973	5.50	3.38	2.63	0.29	0.03	0.00	0.00	0.00	0.08	2.08	3.71	3.80	22.02	22.52	151%
1974	1.50	0.71	2.69	1.62	0.00	0.00	0.00	0.00	0.00	0.50	0.66	1.98	16.11	16.19	111%
1975	0.84	3.65	5.24	1.42	0.00	0.00	0.10	0.35	0.00	1.27	0.08	0.21	14.74	14.29	101%
1976	0.30	1.46	0.48	0.39	0.00	0.10	0.00	0.91	0.95	0.50	0.50	0.73	6.15	4.74	42%
1977	1.15	0.82	0.82	0.16	1.01	0.00	0.10	0.00	0.22	0.13	1.34	3.07	6.01	7.55	41%
1978	5.44	2.95	3.07	2.49	0.01	0.00	0.00	0.00	0.04	0.00	2.16	0.58	18.54	18.82	127%
1979	4.52	3.19	1.86	0.88	0.34	0.00	0.06	0.00	0.00	1.51	1.13	2.66	13.59	13.57	93%
1980	4.16	4.24	1.36	1.32	0.48	0.00	0.71	0.00	0.00	0.04	0.28	1.18	17.57	16.92	121%
1981	3.97	1.11	2.94	0.61	0.11	0.00	0.00	0.00	0.06	2.07	3.44	2.57	10.30	10.95	71%
1982	5.29	2.16	5.58	1.50	0.00	0.28	0.00	0.01	1.48	2.24	3.72	2.80	24.38	22.95	167%
1983	6.28	5.56	6.14	3.51	0.21	0.00	0.00	0.50	1.02	0.27	5.44	3.44	31.98	31.95	219%
1984	0.33	1.87	1.00	0.53	0.01	0.03	0.00	0.00	0.04	1.25	4.71	1.51	12.96	14.44	89%
1985	0.48	1.25	2.62	0.32	0.07	0.22	0.00	0.03	0.13	0.89	2.69	1.97	12.59	12.47	86%
1986	2.04	7.11	4.09	0.40	0.14	0.00	0.01	0.00	0.45	0.04	0.08	0.92	19.79	19.49	136%
1987	1.83	3.47	2.30	0.16	0.09	0.00	0.00	0.00	0.00	0.87	1.40	2.30	8.89	9.35	61%
1988	1.78	0.38	0.26	1.15	0.45	0.10	0.00	0.00	0.00	0.11	1.92	2.03	8.69	8.69	60%
1989	0.81	0.95	2.94	0.88	0.08	0.10	0.00	0.00	1.33	1.13	1.02	0.10	11.15	9.82	77%
1990	1.54	2.46	0.87	0.37	1.78	0.00	0.00	0.00	0.05	0.08	0.00	0.00	9.32	10.60	64%
1991	0.31	2.20	5.87	0.34	0.35	0.08	0.00	0.21	0.04	0.00	0.00	0.00	9.48	9.28	65%
1992	1.39	4.61	1.97	0.43	0.00	0.09	0.00	0.00	0.00	0.90	0.15	4.99	8.49	8.74	58%
1993	6.41	4.53	2.91	0.63	0.51	0.30	0.00	0.00	0.00	0.57	2.00	1.81	21.33	21.33	146%
1994	0.94	3.33	0.15	1.20	1.78	0.04	0.00	0.00	0.00	0.58	3.08	1.36	11.82	11.82	81%
1995	6.64	0.33	6.66	1.02	0.92	0.70	0.00	0.00	0.00	0.00	0.01	5.37	21.29	21.29	146%
1996	5.17	4.10	2.34	1.91	1.05	0.00	0.00	0.00	0.00	1.08	2.55	4.43	19.95	19.95	137%
1997	5.81	0.15	0.06	0.15	0.29	0.17	0.00	0.42	0.00	0.28	4.23	1.95	15.11	14.69	104%
1998	5.47	7.30	2.37	1.37	2.00	0.13	0.00	0.00	0.18	0.54	2.48	0.73	25.28	25.52	174%
1999	3.23	3.33	1.67	0.99	0.08	0.01	0.00	0.03	0.04	0.15	1.26	0.25	13.13	13.24	90%
2000	4.61	4.87	1.25	0.59	0.69	0.18	0.00	0.01	0.24	1.97	0.49	0.45	14.10	13.92	97%
2001	1.92	2.89	1.22	1.80	0.00	0.12	0.00	0.00	0.09	0.37	1.92	5.09	10.95	11.11	75%
2002	0.72	0.62	1.65	0.16	0.68	0.00	0.00	0.00	0.00	0.00	2.65	7.01	11.21	11.30	77%
2003	0.66	1.31	1.07	3.09	0.95	0.00	0.00	0.29	0.00	0.02	2.02	3.57	17.03	16.74	117%
2004	2.19	4.01	0.39	0.18	0.11	0.00	0.00	0.00	0.58	2.77	0.89	3.01	13.07	12.78	90%
2005	2.81	3.55	3.41	1.53	1.03	0.05	0.00	0.00	0.25	0.17	0.65	5.40	19.30	19.63	132%
2006	2.22	1.32	4.79	2.60	0.34	0.00	0.00	0.00	0.00	0.20	1.68	2.25	17.49	17.74	120%
2007	0.52	3.92	0.33	0.44	0.11	0.00	0.00	0.00	0.21	1.12	0.71	2.05	9.66	9.45	66%
2008	4.79	1.89	0.10	0.02	0.00	0.00	0.00	0.00	0.00	0.33	1.4	1.56	10.68	10.89	73%
2009	1.34	3.31	2.29	0.23	0.51	0.11	0.00	0.00	0.31	2.79	0.21	2.02	11.39	11.08	78%
2010	3.53	2.36	1.57	2.1	0.24	0.00	0.00	0.00	0.00				14.82	15.13	102%
COUNT	140	140	140	140	140	140	140	140	140	139	139	139	139	139	139
MAXIMUM	12.60	7.30	8.85	6.51	2.74	1.73	0.71	0.91	5.72	3.94	7.23	11.69	31.98	31.95	219%
MINIMUM	0.20	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.21	4.74	36%
MEAN	2.96	2.50	2.18	1.08	0.48	0.11	0.02	0.04	0.24	0.70	1.63	2.63	14.57		

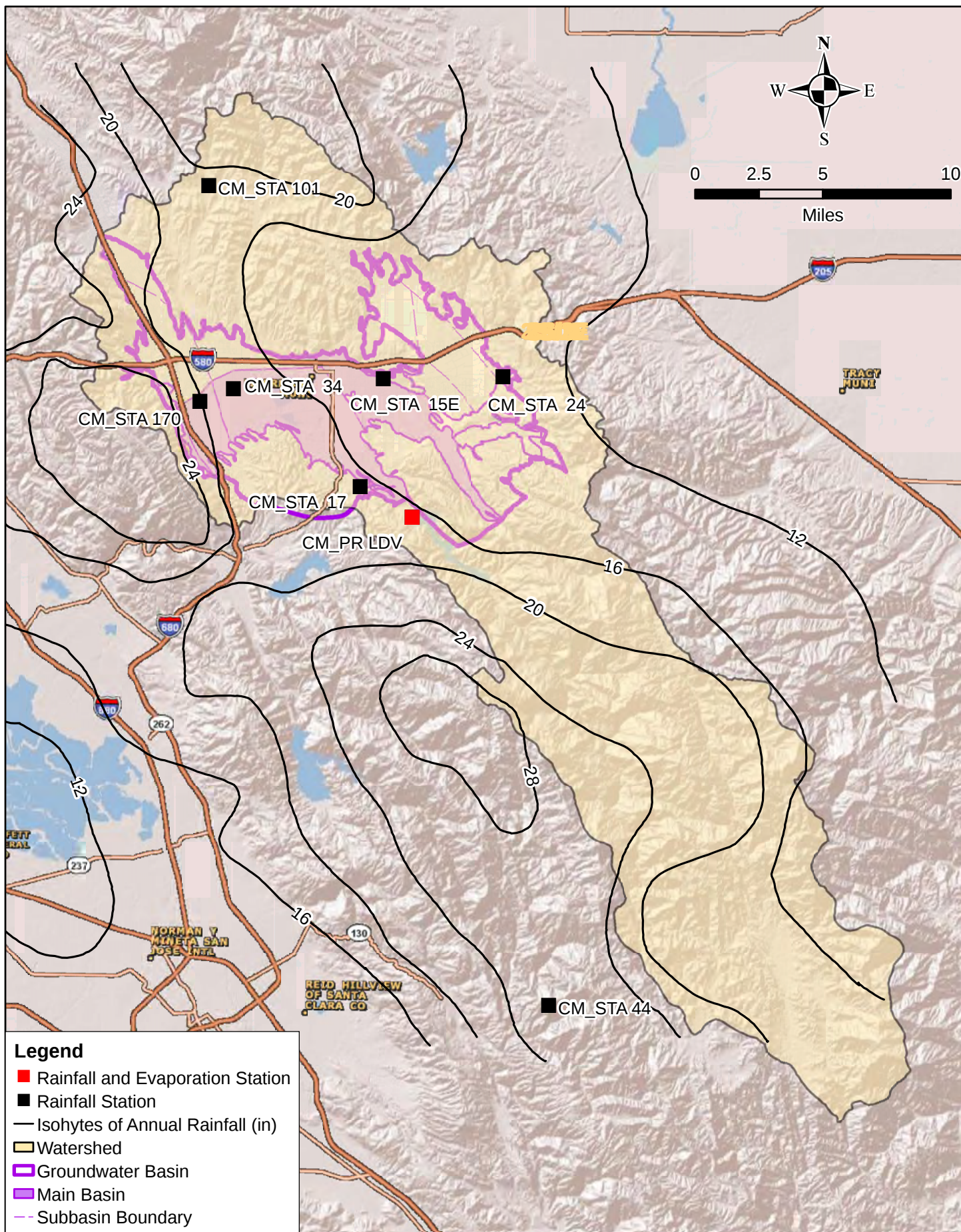
TABLE 3.1-4
ZONE 7 WATER AGENCY
DAILY PAN EVAPORATION, LAKE DEL VALLE, LIVERMORE
(CM_STA LDV-EV, in inches)
2010 WATER YEAR

AVERAGE MONTH	5.07	2.41	1.46	1.37	1.87	3.57	5.36	7.7	9.28	10.6	9.71	7.8
YEAR TO DATE	5.07	7.48	8.94	10.31	12.18	15.75	21.11	28.81	38.09	48.69	58.4	66.2
DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.25	0.10	0.14	0.05	0.06	0.09	0.13	0.19	0.20	0.32	0.35	0.31
2	0.27	0.16	0.06	0.03	0.04	0.11	0.14	0.20	0.28	0.33	0.35	0.38
3	0.27	0.15	0.03	0.05	0.04	0.07	0.04	0.30	0.27	0.30	0.27	0.45
4	0.19	0.12	0.10	0.02	0.04	0.07	0.09	0.30	0.28	0.41	0.33	0.30
5	0.18	0.11	0.04	0.04	0.03	0.06	0.09	0.28	0.21	0.40	0.31	0.30
6	0.22	0.07	0.07	0.03	0.06	0.07	0.10	0.23	0.34	0.39	0.30	0.37
7	0.20	0.10	0.02	0.04	0.05	0.09	0.19	0.28	0.34	0.21	0.22	0.40
8	0.20	0.11	0.02	0.02	0.06	0.13	0.19	0.26	0.27	0.31	0.26	0.25
9	0.15	0.10	0.05	0.01	0.05	0.09	0.23	0.21	0.26	0.32	0.30	0.14
10	0.10	0.09	0.01	0.01	0.06	0.10	0.18	0.13	0.22	0.25	0.30	0.20
11	0.15	0.07	0.04	0.03	0.05	0.10	0.14	0.09	0.25	0.32	0.28	0.26
12	0.16	0.15	0.06	0.02	0.07	0.13	0.07	0.20	0.42	0.37	0.25	0.30
13	0.07	0.00	0.01	0.04	0.06	0.00	0.06	0.30	0.45	0.30	0.28	0.28
14	0.12	0.08	0.00	0.05	0.06	0.13	0.17	0.17	0.50	0.30	0.25	0.15
15	0.11	0.09	0.02	0.07	0.07	0.13	0.17	0.23	0.32	0.41	0.24	0.22
16	0.08	0.17	0.03	0.02	0.08	0.13	0.18	0.25	0.27	0.45	0.26	0.23
17	0.17	0.10	0.05	0.03	0.10	0.13	0.19	0.21	0.35	0.39	0.33	0.19
18	0.15	0.08	0.02	0.05	0.09	0.18	0.20	0.07	0.33	0.37	0.22	0.16
19	0.09	0.09	0.04	0.07	0.05	0.23	0.23	0.18	0.30	0.41	0.26	0.17
20	0.08	0.11	0.02	0.09	0.05	0.23	0.20	0.12	0.29	0.36	0.35	0.15
21	0.10	0.02	0.03	0.08	0.07	0.14	0.11	0.15	0.30	0.31	0.22	0.23
22	0.09	0.08	0.01	0.01	0.01	0.12	0.05	0.17	0.32	0.26	0.25	0.22
23	0.12	0.08	0.08	0.03	0.11	0.24	0.15	0.23	0.35	0.30	0.37	0.19
24	0.13	0.12	0.08	0.04	0.00	0.15	0.18	0.25	0.40	0.34	0.45	0.25
25	0.15	0.15	0.05	0.03	0.08	0.12	0.22	0.18	0.25	0.36	0.45	0.30
26	0.20	0.05	0.06	0.04	0.08	0.14	0.28	0.09	0.27	0.32	0.42	0.34
27	0.17	0.11	0.03	0.02	0.04	0.15	0.26	0.14	0.24	0.30	0.30	0.36
28	0.21	0.01	0.03	0.04	0.05	0.17	0.10	0.16	0.45	0.24	0.29	0.38
29	0.24	0.20	0.02	0.03		0.21	0.16	0.12	0.39	0.26	0.18	0.42
30	0.11	0.13	0.03	0.05		0.10	0.15	0.33	0.40	0.31	0.22	0.36
31	0.11		0.03	0.06		0.10		0.38		0.28	0.22	
MONTHLY TOTAL	4.84	3.00	1.28	1.20	1.61	3.91	4.65	6.40	9.52	10.20	9.08	8.26
PERCENT AVERAGE	95%	124%	88%	88%	86%	110%	87%	83%	103%	96%	94%	106%
TOTAL TO DATE	4.84	7.84	9.12	10.32	11.93	15.84	20.49	26.89	36.41	46.61	55.69	63.95
PERCENT AVERAGE	95%	105%	102%	100%	98%	101%	97%	93%	96%	96%	95%	97%

PAN EVAPORATION IN INCHES, RECORDED BETWEEN 900 AND 1300 HRS. STATION ESTABLISHED OCTOBER 1969.

TABLE 3.1-5
ZONE 7 WATER AGENCY
MONTHLY PAN EVAPORATION, LAKE DEL VALLE, LIVERMORE
(CM_STA LDV-EV, in inches)
1968 to 2010 WATER YEARS

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL OCT-SEP	TOTAL JULY-JUNE	% NORMAL OCT-SEP
1968										3.20	2.50	1.54			
1969	0.66	1.08	4.89	5.92	9.99	7.84	11.38	11.77	8.32	4.04	2.94	1.12	69.09	37.62	104%
1970	1.23	2.29	4.96	5.83	8.88	8.88	11.52	9.92	9.16	5.07	2.14	1.05	70.77	71.64	107%
1971	1.33	2.12	3.67	5.17	6.54	8.91	10.92	10.30	9.12	5.91	3.01	1.49	66.34	66.60	100%
1972	1.53	2.01	4.74	6.52	8.84	10.03	11.63	10.40	7.12	3.67	1.30	0.93	73.23	74.42	111%
1973	1.14	1.20	2.98	6.36	8.69	10.59	10.89	10.21	7.33	4.70	1.86	0.85	65.29	66.01	99%
1974	1.40	1.73	2.40	4.16	7.31	9.14	9.68	9.73	7.94	5.52	2.15	1.44	60.90	61.98	92%
1975	1.73	1.99	3.01	3.64	8.27	8.63	9.45	9.39	7.45	3.72	2.28	1.58	62.67	63.73	95%
1976	2.45	1.96	3.94	5.56	8.47	9.85	9.80	7.05	6.80	4.82	2.75	2.59	63.46	66.10	96%
1977	1.08	2.12	3.84	7.15	5.48	9.28	11.24	8.89	6.74	5.12	2.70	1.37	65.98	62.76	100%
1978	0.99	1.43	2.57	3.73	8.69	8.91	10.52	10.24	7.90	5.80	2.24	1.51	64.17	62.38	97%
1979	1.25	1.29	2.29	4.80	8.36	11.02	10.40	9.23	9.47	4.14	1.85	1.95	67.66	67.22	102%
1980	1.66	1.40	3.82	4.78	6.22	8.18	9.41	9.17	7.16	5.86	3.30	1.79	59.74	63.10	90%
1981	1.08	2.18	2.83	5.80	8.11	11.82	11.34	10.23	7.72	4.43	2.10	1.14	72.06	68.51	109%
1982	1.23	2.10	2.25	4.59	7.55	7.31	10.34	10.58	6.83	4.53	1.50	1.54	60.45	61.99	91%
1983	1.72	1.54	2.17	4.05	6.71	8.34	10.44	9.35	7.82	4.37	1.86	1.08	59.71	59.85	90%
1984	1.52	1.79	4.29	5.32	9.04	9.88	11.99	9.80	9.24	4.02	1.63	1.11	70.18	66.76	106%
1985	1.18	2.70	3.09	5.95	7.75	10.40	11.49	9.23	6.38	5.05	2.27	1.11	64.93	68.86	98%
1986	1.11	1.75	3.55	4.96	7.44	8.67	10.20	8.88	6.10	4.84	3.47	1.22	61.09	63.01	92%
1987	1.45	2.08	3.19	6.43	7.90	8.73	8.46	8.97	7.29	4.71	1.71	1.50	64.03	64.49	97%
1988	1.21	2.94	5.17	5.30	7.22	8.92	11.46	8.90	7.90	4.81	1.85	1.64	66.94	63.40	101%
1989	1.39	1.57	2.75	5.75	7.70	9.30	11.30	9.14	6.41	4.86	2.95	1.75	63.61	65.02	96%
1990	1.57	1.83	3.64	5.74	7.86	9.18	10.19	9.21	7.09	6.56	3.48	1.95	65.87	66.23	100%
1991	1.86	2.44	2.63	5.00	6.42	8.50	10.25	8.00	7.61	6.45	3.03	1.71	64.70	65.33	98%
1992	0.96	1.65	2.84	5.91	8.87	8.23	10.01	10.76	7.82	5.12	2.79	1.19	68.24	65.51	103%
1993	1.21	1.42	2.83	4.93	6.61	9.64	10.23	10.02	8.18	4.65	3.27	1.22	64.17	64.33	97%
1994	1.49	1.36	4.12	5.23	6.38	10.01	10.03	10.31	7.44	4.94	1.66	0.76	65.51	66.16	99%
1995	0.73	1.61	2.33	4.75	5.22	8.18	10.06	10.39	7.65	6.23	2.80	0.88	58.28	57.96	88%
1996	1.33	1.66	3.85	6.38	8.12	9.68	12.03	11.13	7.48	5.44	2.05	1.04	71.57	69.03	108%
1997	1.02	2.67	4.82	6.22	8.95	9.40	10.32	8.78	8.52	5.25	1.82	1.60	69.23	72.25	105%
1998	1.19	0.96	2.80	4.36	4.13	7.10	9.91	10.57	7.51	4.51	1.63	1.41	57.20	56.83	86%
1999	1.32	1.58	2.93	5.25	7.04	8.70	10.51	8.58	7.53	6.86	2.73	2.51	60.99	62.36	92%
2000	1.57	1.55	3.91	5.48	7.16	9.66	9.23	9.82	7.86	3.84	1.84	1.68	68.34	68.05	103%
2001	1.45	2.20	4.14	4.86	10.05	10.92	9.78	9.75	7.98	6.56	2.56	1.47	68.49	67.89	103%
2002	1.97	2.56	4.63	5.65	7.82	9.87	11.08	9.87	9.13	5.64	3.23	1.73	73.17	70.60	111%
2003	1.26	2.31	4.04	4.05	7.62	9.78	12.14	9.23	8.84	6.71	1.72	1.12	69.87	69.74	106%
2004	1.08	2.22	4.99	7.38	8.66	9.46	10.16	9.88	8.76	4.86	2.21	1.54	72.14	73.55	109%
2005	1.14	1.54	3.2	4.93	6.6	8.37	11.13	10.65	7.41	5.19	3.38	1.5	63.58	63.19	96%
2006	1.52	2.47	3.04	3.81	8.54	9.82	12.43	9.37	8.42	5.27	2.09	2.22	69.49	68.46	105%
2007	1.98	1.71	4.34	5.86	8.58	9.59	9.81	10.45	7.00	4.45	3.25	1.68	68.90	71.86	104%
2008	1.37	2.14	4.6	6.65	8.66	10.37	10.54	10.54	8.42	6.27	2.4	1.35	72.67	70.43	110%
2009	2.04	1.95	3.9	6.24	8.52	9.09	11.05	10.12	8.63	4.84	3	1.28	71.56	71.26	108%
2010	1.2	1.61	3.91	4.65	6.4	9.52	10.2	9.08	8.26				63.95	66.21	97%
COUNT	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42
MAXIMUM	2.45	2.94	5.17	7.38	10.05	11.82	12.43	11.77	9.47	6.86	3.48	2.59	73.23	74.42	111%
MINIMUM	0.66	0.96	2.17	3.64	4.13	7.10	8.46	7.05	6.10	3.20	1.30	0.76	57.20	37.62	86%
MEAN	1.37	1.87	3.57	5.36	7.70	9.28	10.60	9.71	7.80	5.07	2.41	1.46	66.20		



Legend

- Rainfall and Evaporation Station
- Rainfall Station
- Isohytes of Annual Rainfall (in)
- Watershed
- Groundwater Basin
- Main Basin
- - Subbasin Boundary



ZONE 7 WATER AGENCY
100 North Canyons Parkway
Livermore, CA 94551

DRAWN: TR

REVIEWED: MK/MG

File: E:\MONITOR\PR\2010WY\GWMP\Submittal\Fig3.1-1-CMSiteMap.mxd

Scale: 1" = 5 miles

Date: Apr 6, 2011

FIGURE 3.1-1

**Climatological Monitoring
Stations with
Average Rainfall (in)**

FIGURE 3.1-2
ZONE 7 WATER AGENCY
Graph of Livermore Rainfall (Station 15E NOAA)

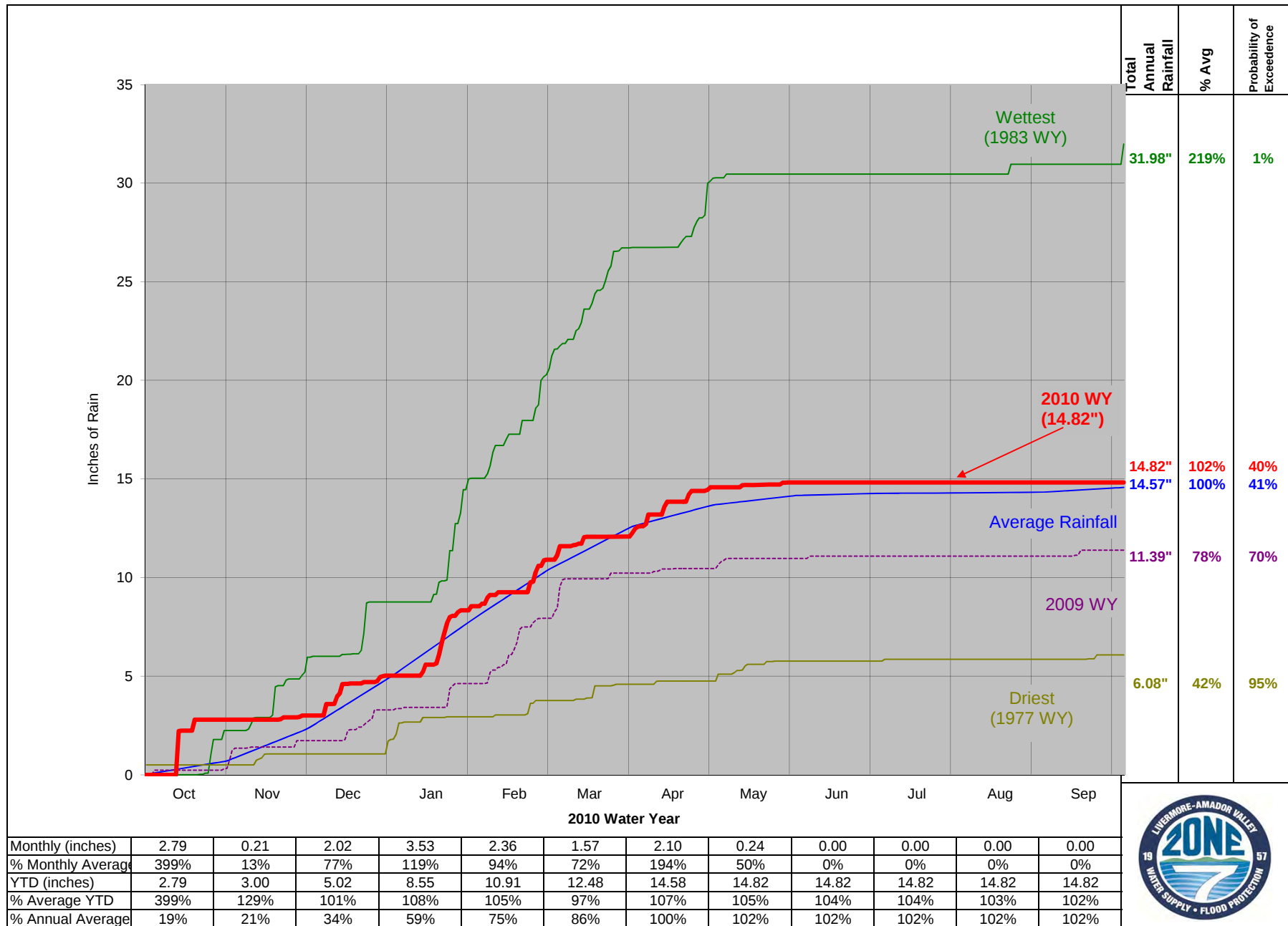


Figure 3.1-2
 By: M. Garguilo
 05/30/2011