

April 25, 2018

Ryan Fowler, Senior Planner
Community Development Department
City of Menifee
29714 Haun Road
Menifee, CA 92586

**RE: Rockport Ranch Tentative Tract Map 37131 (TR 2016-285)
Lake/Wet-Pond Water Supply Technical Memo**

Dear Mr. Fowler,

In order to properly plan for a proposed Lake/Wetpond system on the Rockport Ranch residential subdivision, the effects of water loss from such a large area of open water must be analyzed. In an arid climate such as the Menifee Valley area, the effects of evapo-transpiration and seepage are of concern. Large surface area lakes can lose thousands of cubic feet of water a day to evaporation and transpiration during dry summer months with little-to-no-rainfall to replenish the volumes. Additionally, where the mean high groundwater elevation is significantly below proposed lake, the daily loss of lake water due to seepage, even in lined basins, can be in the thousands of cubic feet. A supply of clean water must be provided to keep the lake level at design elevations while not causing stress on the water supply to the surrounding communities.

Water Loss Sources:

Rates of seepage into the surrounding soil can be affected by groundwater elevation, soil type, compaction of soil, the permeability of any surface liner applied throughout, and the amount of head sitting over the bottom soil (depth of lake). An analysis of typical groundwater depths in the region shows that the highest elevation of 100' below ground level will still lie below the planned bottom of the lake and therefore will not serve to prevent seepage. That said, the soil type of the existing site soils do not infiltrate well at all, about 0.05 inches (in)/hour (hr) or 1.2 in/day. This rate would even be vastly reduced by heavily compacted, processed soils at the bottom of the lake with a 6"-12" layer of silty-clayey soil liner applied at completion of site grading. However, with the maximum depth expected to be 30'-40' deep, a large amount of pressure head will be created that will increase typical infiltration rates. It should be assumed that, at the completion of the lake, approximately 0.5 in/day will be lost to seepage – a peak rate of 254,452 cubic feet (cf)/month in a 31-day month for the proposed 196,995 square feet (sf) of the lake/wetpond at Rockport Ranch.

For evaporation-transpiration losses in the Menifee Valley area, data from the State of California Irrigation Management System for evaporation-transpiration rate was referenced and applied across the design surface area of the lake. Based on a review of this data, the annualized loss due to evaporation-transpiration is found to be 6,100,384 gallons. The combined annual loss from both evaporation-transpiration and seepage is calculated to be 13,635,579 gallons.

While an annualized loss of water from the lake is beneficial information to local jurisdictions and Water Districts, determining peak loss rates are also important to calculate daily replenishment requirements. The effects of evaporation-transpiration are largely seasonal, with much lower losses anticipated during winter months versus summer months. As expected, the month of July sees the greatest losses of surface water volumes to dry air and winds – and for this project, that peak loss rate is 106,870 cf for the month. With the peak seepage rate combined, the overall losses during the month of July are 361,322 cf which translates into an average loss rate of 60.54 gallons per minute (gpm).

The above calculated outflow from the lake is a minimum amount without any safety factors. Due to several uncertainties such as hotter-than-expected summers, higher winds, greater-than-thought seepage rates, or water supply downtimes due to maintenance and repairs, it is appropriate to apply a safety factor of at least two (2) when determining the amount of water to supply to the lake. This factor means that the lake should be connected to a supply of clean water with a peak inflow rate of 121.1 gpm. That said, additional compaction and lining of the Lake/Wetpond slopes with a thicker non-infiltrative soil layer can equally reduce the seepage rate by a factor of 2 – however, the conservative number will be used to verify sufficient supply sources.

Water Replenishment Sources:

To keep the Lake/Wetpond at a proper level in order to maintain functionality and aesthetic value, an analysis of the existing water sources to the system has been performed to determine availability of viable supply. The replenishment sources, in order of preference are as follows:

- Rain water, when available (amounts summarized in attached table)
- Well water from existing, to be relocated, ground water well
- Reclaimed water supplied by EMWD
- Domestic water supplied by EMWD

In Southern California, rainfall and storm water runoff from that rainfall is a good supply mechanism during the rainy season, but cannot be counted on during the peak-loss month of July. The attached table, using data from the U.S. Climate Data for the City of Menifee, provides rain fall amounts for each month in addition to the total for the year. This data has been utilized to determine the amount of water replenishment that will be needed to supplement this resource through the year. There are two months (January and February) that will not require some supplemental water supplied to the Lake/Wetpond. It is important to note that losses in the months of November, December, March, and April are less than half the peak inflows required during the summer months.

Reclaimed water is available to supply the lake, but the Santa Ana Regional Water Control Board forbids the use of reclaimed waste water if the lake overflows during a rainstorm. Being that the lake is also to serve as a water quality Wetpond, this function is absolutely expected and therefore disqualified from using reclaimed water. Domestic

water could be supplied to the lake as a back-up, but that should be considered as a last resort so as to not create a strain on the water supply. Well water should be considered the preferred supply.

Well water from the ground water aquifer will be the main source of replenishment for the lake during the dry summer months or when the wet months do not produce the necessary amount of rainfall to supply the Lake/Wetpond. There is an existing well at the southwestern-most portion of the property that is to be abandoned and relocated to a more northern location – near to the Lake/Wetpond facilities. A recent well test performed in April of 2018, the well showed that it could generate up to 243 gpm for 6 hours with only 3 feet of drawdown. The well has been in operation for close to four decades and has shown that it can be a sufficient source of replenishment – especially when you factor in the recharge of the aquifer that is taking place with the seepage from from the lake.

Conclusion:

The historical records of well water use on this site and the size, depth, and production of the well are all strong indicators that there is and will continue to be sufficient quantities of ground water available to serve the needs of this Lake/Wetpond system. The amount of water necessary to keep the lake at appropriate levels is not, according to the attached data and calculation table, a significant impact on the ground water aquifer from which the well draws its water.

Thank you for your attention to this matter.



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Cc: Jim Simmons, Consultants Collaborative Inc.
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Climate Menifee - California °C | °F

	Jan	Feb	Mar	Apr	May	Jun
Average high in °F:	69	69	72	79	85	92
Average low in °F:	35	37	40	44	50	54
Av. precipitation in inch:	2.24	3.31	1.65	0.91	0.31	0.04
Days with precipitation:	-	-	-	-	-	-
Hours of sunshine:	-	-	-	-	-	-

	Jul	Aug	Sep	Oct	Nov	Dec
Average high in °F:	100	100	95	85	76	69
Average low in °F:	58	59	58	49	40	34
Av. precipitation in inch:	0.04	0.24	0.12	0.43	0.59	1.3
Days with precipitation:	-	-	-	-	-	-
Hours of sunshine:	-	-	-	-	-	-

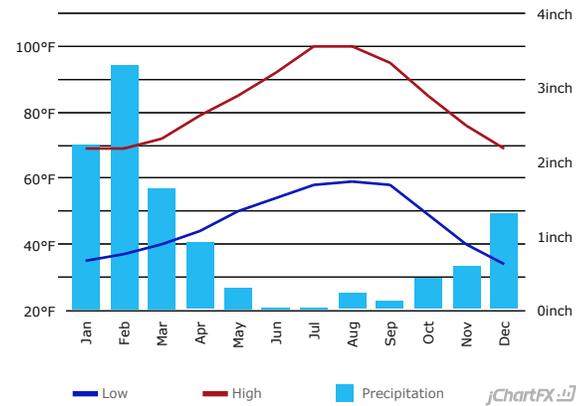
Menifee weather averages

Annual high temperature:	82.6°F
Annual low temperature:	46.5°F
Average temperature:	64.55°F
Average annual precipitation - rainfall:	11.18 inch
Days per year with precipitation - rainfall:	-
Annual hours of sunshine:	-
Av. annual snowfall:	-



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Menifee Climate Graph - California Climate Chart



[Climograph of Menifee on your website](#)

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Climate data for sun city, Longitude: -117.19, Latitude: 33.7156
Average weather Menifee, CA - 92584 - 1981-2010 normals

Jan: January, Feb: February, Mar: March, Apr: April, May: May, Jun: June, Jul: July, Aug: August, Sep: September, Oct: October, Nov: November, Dec: December

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7-YEAR WARRA

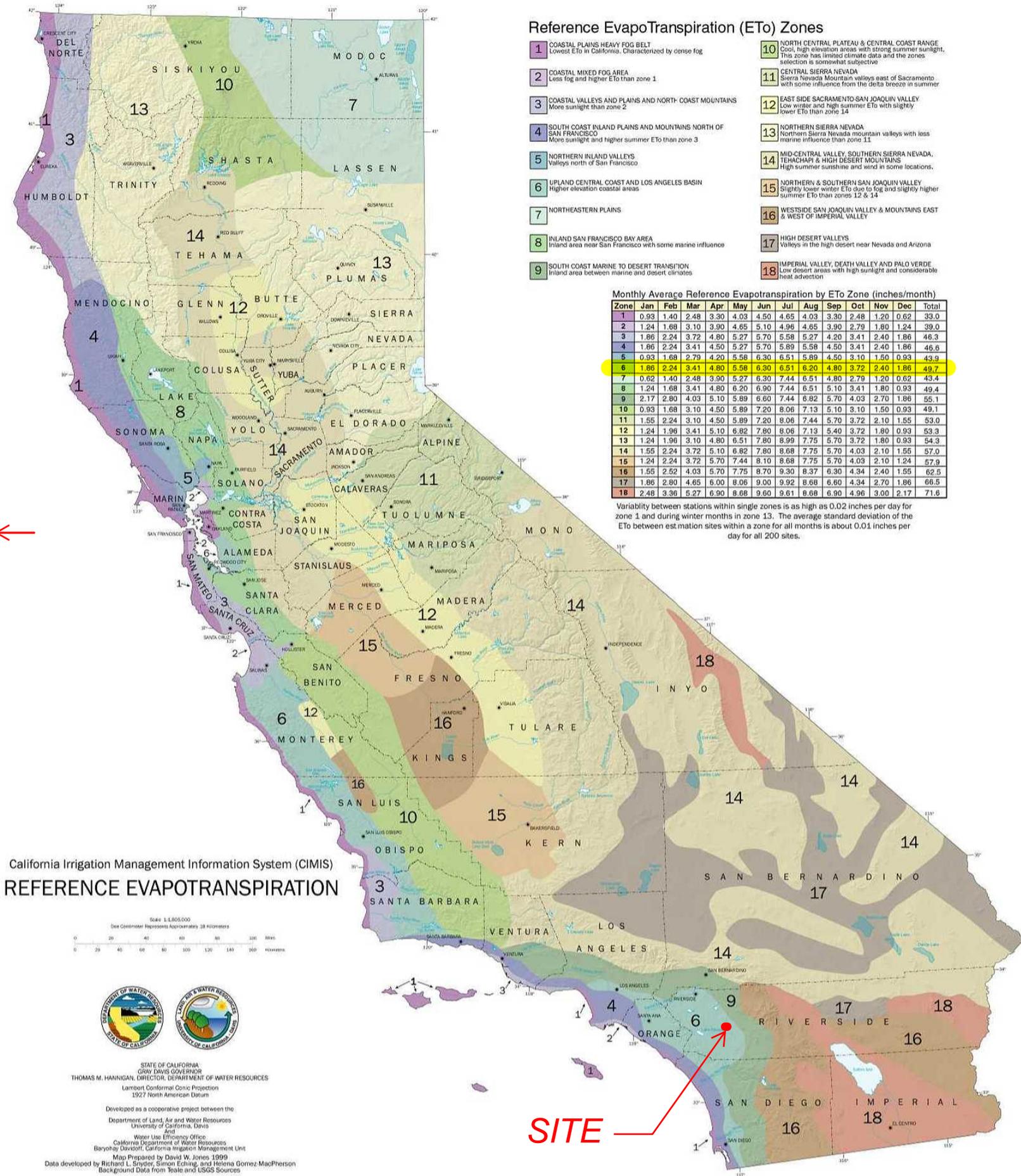
Reference EvapoTranspiration (ET₀) Zones

- 1** COASTAL PLAINS HEAVY FOG BELT
Lowest ET₀ in California. Characterized by dense fog
- 2** COASTAL MIXED FOG AREA
Less fog and higher ET₀ than zone 1
- 3** COASTAL VALLEYS AND PLAINS AND NORTH COAST MOUNTAINS
- 4** SOUTH COAST INLAND PLAINS AND MOUNTAINS NORTH OF SAN FRANCISCO
More sunlight and higher summer ET₀ than zone 3
- 5** NORTHERN INLAND VALLEYS
Valleys north of San Francisco
- 6** UPLAND CENTRAL COAST AND LOS ANGELES BASIN
Higher elevation coastal areas
- 7** NORTHEASTERN PLAINS
- 8** INLAND SAN FRANCISCO BAY AREA
Inland area near San Francisco with some marine influence
- 9** SOUTH COAST MARINE TO DESERT TRANSITION
Inland area between marine and desert climates
- 10** NORTH CENTRAL PLATEAU & CENTRAL COAST RANGE
Cool, high elevation areas with strong summer sunlight. This zone has limited climate data and the zones selection is somewhat subjective
- 11** CENTRAL SIERRA NEVADA
Sierra Nevada Mountain valleys east of Sacramento with some influence from the delta breeze in summer
- 12** EAST SIDE SACRAMENTO SAN JOAQUIN VALLEY
Low winter and high summer ET₀ with slightly lower ET₀ than zone 2
- 13** NORTHERN SIERRA NEVADA
Northern Sierra Nevada mountain valleys with less marine influence than zone 11
- 14** MID-CENTRAL VALLEY, SOUTHERN SIERRA NEVADA, TEHACHAPI & HIGH DESERT MOUNTAINS
High summer sunshine and wind in some locations
- 15** NORTHERN & SOUTHERN SAN JOAQUIN VALLEY
Slightly lower winter ET₀ due to fog and slightly higher summer ET₀ than zones 12 & 14
- 16** WESTSIDE SAN JOAQUIN VALLEY & MOUNTAINS EAST & WEST OF IMPERIAL VALLEY
- 17** HIGH DESERT VALLEYS
Valleys in the high desert near Nevada and Arizona
- 18** IMPERIAL VALLEY, DEATH VALLEY AND PALO VERDE
High desert areas with high sunlight and considerable heat advection

Monthly Average Reference Evapotranspiration by ET₀ Zone (inches/month)

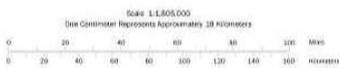
Zone	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1	0.93	1.40	2.48	3.30	4.03	4.50	4.65	4.03	3.30	2.48	1.20	0.62	33.0
2	1.24	1.68	3.10	3.90	4.65	5.10	4.96	4.65	3.90	2.79	1.80	1.24	39.0
3	1.86	2.24	3.72	4.80	5.27	5.70	5.58	5.27	4.20	3.41	2.40	1.86	46.3
4	1.86	2.24	3.41	4.50	5.27	5.70	5.89	5.58	4.50	3.41	2.40	1.86	46.6
5	0.93	1.68	2.79	4.20	5.58	6.30	6.51	5.89	4.50	3.10	1.50	0.93	43.9
6	1.86	2.24	3.41	4.80	5.58	6.30	6.51	6.20	4.80	3.72	2.40	1.86	49.7
7	0.62	1.40	2.48	3.90	5.27	6.30	7.44	6.51	4.80	2.79	1.20	0.62	43.4
8	1.24	1.68	3.41	4.80	6.20	6.90	7.44	6.51	5.10	3.41	1.80	0.93	49.4
9	2.17	2.80	4.03	5.10	5.89	6.60	7.44	6.82	5.70	4.03	2.70	1.86	55.1
10	0.93	1.68	3.10	4.50	5.89	7.20	8.06	7.13	5.10	3.10	1.50	0.93	49.1
11	1.55	2.24	3.10	4.50	5.89	7.20	8.06	7.44	5.70	3.72	2.10	1.55	53.0
12	1.24	1.96	3.41	5.10	6.82	7.80	8.96	7.13	5.40	3.72	1.80	0.93	53.3
13	1.24	1.96	3.10	4.80	6.51	7.80	8.96	7.75	5.70	3.72	1.80	0.93	54.3
14	1.55	2.24	3.72	5.10	6.82	7.80	8.68	7.75	5.70	4.03	2.10	1.55	57.0
15	1.24	2.24	3.72	5.70	7.44	8.10	8.68	7.75	5.70	4.03	2.10	1.24	57.9
16	1.55	2.52	4.03	5.70	7.75	8.70	9.30	8.37	6.30	4.34	2.40	1.55	62.5
17	1.86	2.80	4.65	6.00	8.06	9.00	9.92	8.68	6.60	4.34	2.70	1.86	66.5
18	2.48	3.30	5.27	6.90	8.68	9.60	9.61	8.68	6.90	4.96	3.00	2.17	71.8

Variability between stations within single zones is as high as 0.02 inches per day for zone 1 and during winter months in zone 13. The average standard deviation of the ET₀ between estimation sites within a zone for all months is about 0.01 inches per day for all 200 sites.



SITE

California Irrigation Management Information System (CIMIS) REFERENCE EVAPOTRANSPIRATION



STATE OF CALIFORNIA
GRAY DAVIS GOVERNOR
THOMAS M. HANNIGAN, DIRECTOR, DEPARTMENT OF WATER RESOURCES

Lambert Conformal Conic Projection
1927 North American Datum

Developed as a cooperative project between the
Department of Land, Air and Water Resources
University of California, Davis
and
Water Use Efficiency Office
California Department of Water Resources
Baryshay Davostoff, California Irrigation Management Unit

Map Prepared by David W. Jones 1999
Data developed by Richard L. Snyder, Simon Eching, and Helena Gomez-MacPherson
Background Data from Teale and USGS Sources

Rockport Ranch Lake/Wetpond System

EvapoTranspiration Losses

By: AJV Date: 4/25/2018

Month	Rainfall (In)	Area of Dev (Ac)	C Factor	Total Inflow (CF/Mo)	Seepage Loss (In/Day)	Area of Pond (SF)	Total Outflow (CF/Mo)	Evap-Trans (In/Mo)	Area of Pond (SF)	Total Outflow (CF/Mo)	Total Water Loss (CF/Mo)	Total Water Loss (GPM)
Jan	2.24	70	0.7	398,429	0.5	196,995	254,452	1.86	196,995	30,534	(113,443)	(19.01)
Feb	3.31	70	0.7	588,750	0.5	196,995	229,828	2.24	196,995	36,772	(322,150)	(59.76)
Mar	1.65	70	0.7	293,486	0.5	196,995	254,452	3.41	196,995	55,979	16,946	2.84
Apr	0.91	70	0.7	161,862	0.5	196,995	246,244	4.8	196,995	78,798	163,180	28.25
May	0.31	70	0.7	55,140	0.5	196,995	254,452	5.58	196,995	91,603	290,915	48.75
Jun	0.04	70	0.7	7,115	0.5	196,995	246,244	6.3	196,995	103,422	342,551	59.31
Jul	0.04	70	0.7	7,115	0.5	196,995	254,452	6.51	196,995	106,870	354,207	59.35
Aug	0.24	70	0.7	42,689	0.5	196,995	254,452	6.2	196,995	101,781	313,544	52.54
Sep	0.12	70	0.7	21,344	0.5	196,995	246,244	4.8	196,995	78,798	303,697	52.58
Oct	0.43	70	0.7	76,484	0.5	196,995	254,452	3.72	196,995	61,068	239,036	40.05
Nov	0.59	70	0.7	104,943	0.5	196,995	246,244	2.4	196,995	39,399	180,699	31.29
Dec	1.3	70	0.7	231,231	0.5	196,995	254,452	1.86	196,995	30,534	53,755	9.01
							Annual Seepage Losses (CF) =	2,995,966			Annual Evap-Trans Losses (CF) =	815,559
							Annual Seepage Losses (Gal) =	22,409,823			Annual Evap-Trans Losses (Gal) =	6,100,384
											Annualized Total Water Loss (CF) =	1,822,938
											Annualized Total Water Loss (Gal) =	13,635,579
Rainfall amounts per U.S. Climate Data for City of Menifee											Note: If Monthly inflow is greater than losses, entry shows as (negative)	
Evapotranspiration amounts per CA Irrigation Management Information System												