

Appendix B

Normal Year Monthly Evaporation and
Evapotranspiration for Several Crops in
Southern San Joaquin Valley

Monthly Observed Evaporation
and Calculated Evapotranspiration
for Several Crops
Southern San Joaquin Valley
1992 – 1996

TABLE B-1

NORMAL YEAR MONTHLY EVAPORATION AND EVAPOTRANSPIRATION
FOR SEVERAL CROPS
SOUTHERN SAN JOAQUIN VALLEY
(inches)

Month	Evapo- ration ⁱ	ETP ⁱⁱ	PET ⁱⁱⁱ	Alfalfa Hay	Cotton	Citrus	Deciduous Orchard		Grain Sorghum ⁴	Grain Sorghum ⁵	Small Grains	Vineyard
							Clean Culti- vation	With Cover Crop				
Jan	1.35	1.25	0.96	1.03		0.81		0.97			0.60	
Feb	2.23	2.06	1.69	1.70		1.30		1.68			1.75	
Mar	4.13	3.79	3.16	3.13		2.33	1.68	3.32			3.95	
Apr	5.94	5.46	4.62	4.51	0.32	3.32	3.25	5.05			5.59	0.35
May	8.32	7.66	6.48	6.32	1.74	4.61	5.38	7.64	0.92		5.48	2.47
Jun	9.29	8.54	7.25	7.06	5.60	4.88	6.62	8.72	2.83	0.45	0.37	5.02
Jul	10.03	9.23	7.81	7.62	9.73	5.23	7.52	9.47	8.70	2.73		6.49
Aug	8.58	7.89	6.70	6.51	8.43	4.46	6.42	7.97	7.16	7.55		5.66
Sep	6.43	5.92	4.99	4.89	4.75	3.34	4.60	5.71	3.51	5.29		3.99
Oct	4.35	4.02	3.31	3.31	1.02	2.42	2.65	3.57		1.68		1.73
Nov	2.19	2.01	1.61	1.67		1.24	0.92	1.65				0.40
Dec	<u>1.02</u>	<u>0.95</u>	<u>0.75</u>	<u>0.79</u>		<u>0.60</u>		<u>0.73</u>			<u>0.14</u>	
Total ⁶	63.86	58.78	49.33	48.54	31.59	34.54	39.04	56.48	23.12	17.70	17.88	26.11

¹Evaporation from U.S. Weather Bureau Class 'A' pans located in large, well-managed, irrigated pastures. Average of several locations and several years.

²Potential ET of alfalfa. ET of vigorously growing alfalfa at 100-percent ground cover with no moisture stress. Estimated as 0.92 x pan evaporation.

³Potential ET of grass. ET of low-growing grass at 100-percent ground cover and no moisture stress.

⁴Grain sorghum (milo) planted in early May.

⁵Grain sorghum (milo) planted in mid-June following winter-planted small grains.

⁶Growing season totals.

TABLE B-2
 MONTHLY OBSERVED EVAPORATION AND
 CALCULATED EVAPOTRANSPIRATION FOR SEVERAL CROPS
 SOUTHERN SAN JOAQUIN VALLEY
 1992
 (inches)

Month	Evapo- ration ⁱ	ETP ⁱⁱ	PET ⁱⁱⁱ	Alfalfa Hay	Cotton	Citrus	Deciduous Orchard		Dry Beans	Small Grains	Vineyard
							Clean Culti- vation	With Cover Crop			
Jan	0.96	0.89	0.69	0.74		0.56		0.69		0.39	
Feb	2.44	2.23	1.83	1.85		1.44		1.84		1.85	
Mar	3.35	3.09	2.57	2.55		1.89	1.29	2.68		3.20	0.14
Apr	6.39	5.88	4.97	4.85	0.49	3.57	3.49	5.54		6.03	1.71
May	8.91	8.20	6.95	6.77	1.89	4.96	5.73	8.18	1.67	5.50	4.71
Jun	9.80	9.02	7.63	7.45	5.77	5.14	6.96	9.18	8.17		6.29
Jul	8.77	8.05	6.85	6.70	8.60	4.58	6.61	8.32	7.54		5.81
Aug	8.77	8.08	6.84	6.67	8.49	4.55	6.59	8.16	2.53		5.53
Sep	6.74	6.19	5.23	5.19	4.55	3.54	4.86	6.03			2.80
Oct	4.23	3.89	3.20	3.21	0.57	2.32	2.57	3.47			0.87
Nov	2.25	2.08	1.66	1.71		1.27	0.87	1.69			0.09
Dec	<u>1.36</u>	<u>1.25</u>	<u>0.95</u>	<u>1.04</u>		<u>0.78</u>		<u>0.95</u>		<u>0.25</u>	
Total ^{iv}	63.97 ^v	58.85	49.37	48.73	30.36	34.60	38.97	56.73	19.91	17.22 ⁶	27.95
Percent of Normal	100.2	100.2	100.1	100.4	96.1	100.2	99.8	100.4	95.6	96.3	107.0

ⁱObserved evaporation from USWB Class 'A' pan. Average of Bakersfield 12S and Lamont 2NW agroclimatic stations (irrigated pasture).

ⁱⁱPotential ET of alfalfa. ET of vigorously growing alfalfa at 100-percent ground cover with no moisture stress (Jensen-Haise alfalfa reference crop). Estimated as 0.92 x pan evaporation.

ⁱⁱⁱPotential ET of grass. ET of a large expanse of low-growing grass at 100-percent ground cover with no moisture stress (Penman grass reference crop). Estimates based upon 1991 observed evaporation and crop coefficients from Table 2, Department of Water Resources, San Joaquin District Report, *Crop Water Use*, September 1980.

^{iv}Growing season totals.

^vEvaporation adjusted for various weeks to compensate for nonstandard pasture conditions in the months of February, September, November, and December.

⁶Growing season ET includes 0.25 inch from December 1991 and excludes 0.25 inch from December 1992.

TABLE B-3

MONTHLY OBSERVED EVAPORATION AND
CALCULATED EVAPOTRANSPIRATION FOR SEVERAL CROPS
SOUTHERN SAN JOAQUIN VALLEY
1993
(inches)

Month	Evapo- ration ⁱ	ETP ⁱⁱ	PET ⁱⁱⁱ	Alfalfa Hay	Cotton	Citrus	Deciduous Orchard		Dry Beans	Small Grains	Vineyard
							Clean Culti- vation	With Cover Crop			
Jan	1.31	1.19	0.93	0.99		0.79		0.93		0.57	
Feb	2.47	2.27	1.85	1.87		1.46		1.85		1.87	
Mar	3.58	3.29	2.74	2.74		2.01	1.38	2.88		3.44	0.17
Apr	5.60	5.15	4.36	4.26	0.33	3.14	3.09	4.87		5.26	1.59
May	8.40	7.73	6.55	6.38	1.70	4.67	5.41	7.72	0.76	5.68	4.45
Jun	8.66	7.97	6.76	6.59	5.45	4.54	6.21	8.14	6.66	0.32	5.60
Jul	9.48	8.72	7.39	7.20	9.18	4.93	7.10	8.95	8.47		6.26
Aug	8.29	7.63	6.47	6.30	8.12	4.31	6.21	7.70	3.71		5.18
Sep	6.52	6.00	5.06	4.95	4.75	3.41	4.66	5.77			2.66
Oct	4.19	3.85	3.17	3.19	0.47	2.34	2.51	3.42			0.84
Nov	2.33	2.14	1.71	1.77		1.30	0.88	1.74			0.32
Dec	1.16	1.07	0.83	0.88		0.65		0.82		0.25	
Total ^{iv}	61.99	57.03	47.82	47.12	30.00	33.55	37.45	54.79	19.60	17.39 ⁵	27.07
Percent of Normal	97.1	97.0	96.9	97.1	95.0	97.1	95.9	97.0	94.1	97.3	103.7

ⁱObserved evaporation from USWB Class 'A' pan. Average of Bakersfield 12S and Lamont 2NW agroclimatic stations (irrigated pasture).

ⁱⁱPotential ET of alfalfa. ET of vigorously growing alfalfa at 100-percent ground cover with no moisture stress (Jensen-Haise Alfalfa reference crop). Estimated as 0.92 x pan evaporation.

ⁱⁱⁱPotential ET of grass. ET of a large expanse of low-growing grass at 100-percent ground cover with no moisture stress (Penman grass reference crop). Estimates based upon 1991 observed evaporation and crop coefficients from Table 2, Department of Water Resources, San Joaquin District Report, *Crop Water Use*, September 1980.

^{iv}Growing season totals.

^vGrowing season ET includes 0.25 inch from December 1992 and excludes 0.25 inch from December 1993.

TABLE B-4

MONTHLY OBSERVED EVAPORATION AND
CALCULATED EVAPOTRANSPIRATION FOR SEVERAL CROPS
SOUTHERN SAN JOAQUIN VALLEY
1994
(inches)

Month	Evapo- ration ⁱ	ETP ⁱⁱ	PET ⁱⁱⁱ	Alfalfa Hay	Cotton	Citrus	Deciduous Orchard		Dry Beans	Small Grains	Vineyard
							Clean Culti- vation	With Cover Crop			
Jan	1.49	1.37	1.08	1.12		0.90		1.08		0.71	
Feb	2.38	2.17	1.79	1.81		1.39		1.80		1.86	
Mar	4.43	4.08	3.39	3.36		2.49	1.40	3.56		4.26	0.28
Apr	6.48	5.96	5.06	4.92	0.53	3.62	3.41	5.62		6.09	1.74
May	7.95	7.31	6.20	6.05	2.27	4.40	5.00	7.31	0.85	5.08	4.30
Jun	9.86	9.08	7.68	7.50	7.36	5.17	6.91	9.26	7.56	0.27	6.38
Jul	10.04	9.23	7.83	7.62	10.00	5.23	7.50	9.48	9.04		6.63
Aug	8.74	8.04	6.83	6.65	8.28	4.55	6.56	8.12	3.57		5.44
Sep	6.53	5.99	5.05	4.96	4.04	3.41	4.74	5.77			2.61
Oct	4.75	4.36	3.59	3.60	0.42	2.66	2.94	3.92			0.96
Nov	2.23	2.07	1.61	1.69		1.23	1.06	1.65			0.36
Dec	<u>1.16</u>	<u>1.08</u>	<u>0.84</u>	<u>0.90</u>		<u>0.67</u>	<u>0.03</u>	<u>0.90</u>		<u>0.23</u>	
Total ^{iv}	66.04 ^v	60.74	50.95	50.18	32.90	35.72	39.55	58.47	21.02	18.50	28.70
Percent of Normal	103.4	103.3	103.3	103.4	104.1	103.4	101.3	103.5	101.8	103.5	109.9

ⁱObserved evaporation from USWB Class 'A' pan. Average of Bakersfield 12S and Bakersfield 14W agroclimatic stations (irrigated pasture).

ⁱⁱPotential ET of alfalfa. ET of vigorously growing alfalfa at 100-percent ground cover with no moisture stress (Jensen-Haise alfalfa reference crop). Estimated as 0.92 x pan evaporation.

ⁱⁱⁱPotential ET of grass. ET of a large expanse of low-growing grass at 100-percent ground cover with no moisture stress (Penman grass reference crop). Estimates based upon 1991 observed evaporation and crop coefficients from Table 2, Department of Water Resources, San Joaquin District Report, *Crop Water Use*, September 1980.

^{iv}Growing season totals.

^vGrowing season ET includes 0.25 inch from December 1993 and excludes 0.23 inch from December 1994.

Notes: Evaporation adjusted for various weeks to compensate for nonstandard pasture conditions in the months of February, September, November, and December. Totals utilized for the purpose of determining percent of normal were derived from Table A-1, Department of Water Resources, San Joaquin District Report, *Crop Water Use*, March 1973.

TABLE B-5

MONTHLY OBSERVED EVAPORATION AND CALCULATED
EVAPOTRANSPIRATION FOR SEVERAL CROPS
SOUTHERN SAN JOAQUIN VALLEY
1995
(inches)

Month	Evapo- ration ¹	ETP ²	PET ³	Alfalfa Hay	Cotton	Citrus	Deciduous Orchard		Dry Beans	Small Grains	Vineyard
							Clean Culti- vation	With Cover Crop			
Jan	1.76	1.61	1.18	1.34		1.08		1.28		0.64	
Feb	1.63	1.52	1.22	1.25		0.98	0.13	1.24		1.16	
Mar	3.59	3.29	2.74	2.72		2.01	1.71	2.87		3.39	0.22
Apr	5.79	5.35	4.50	4.41	0.21	3.24	3.34	4.94		5.54	1.64
May	7.40	6.80	5.54	5.61	1.25	3.96	4.75	6.52		5.17	3.87
Jun	9.62	8.85	7.49	7.32	5.14	5.02	7.05	9.02	6.42	1.03	6.24
Jul	9.35	8.34	7.30	7.11	8.83	4.85	7.00	8.83	8.41		6.17
Aug	8.83	8.38	6.89	6.70	8.75	4.60	6.62	8.20	5.11		5.50
Sep	6.58	6.06	5.08	5.00	5.21	3.44	4.50	5.80			2.57
Oct	4.68	4.31	3.52	3.56	1.45	2.60	2.64	3.81			0.94
Nov	2.42	2.23	1.73	1.84		1.34	0.82	1.76			0.47
Dec	<u>1.27</u>	<u>1.17</u>	<u>0.90</u>	<u>0.96</u>		<u>0.72</u>		<u>0.90</u>		<u>0.20</u>	
Total ⁴	62.92	57.91	48.09	47.81	30.84	33.84	38.56	55.17	19.94	17.16 ⁵	27.62
Percent of Normal	98.5	98.5	97.5	98.5	97.6	98.0	98.8	97.7	95.8	96.1	105.8

¹Observed evaporation from USWB class 'A' pan from Bakersfield 14W agroclimatic station (irrigated pasture).

²Potential ET of alfalfa. ET of vigorously growing alfalfa at 100 percent ground cover with no moisture stress (Jensen-Haise alfalfa reference crop). Estimated as 0.92 x pan evaporation. Potential ET of grass. ET of a large expanse of low growing grass at 100 percent ground cover with no moisture stress (Penman grass reference crop). Estimates based upon 1991 observed evaporation and crop coefficients from Table 2, Department of Water Resources, San Joaquin District Report, *Crop Water Use*, September 1980.

³Potential ET of grass. ET of a large expanse of low growing grass at 100 percent ground cover with no moisture stress (Penman grass reference crop). Estimates based upon 1991 observed evaporation and crop coefficients from Table 2, Department of Water Resources, San Joaquin District Report, *Crop Water Use*, September 1980.

⁴Growing season totals.

⁵Growing season ET includes 0.23 inch from December 1994 and excludes 0.20 inch from December 1995.

Notes: January EP was partially estimated by correlation to the Fresno and Cotton Station Pans. Evaporation adjusted for various weeks to compensate for nonstandard pasture conditions in the months of February, September, November, and December.

TABLE B-6

MONTHLY OBSERVED EVAPORATION AND CALCULATED
EVAPOTRANSPIRATION FOR SEVERAL CROPS
SOUTHERN SAN JOAQUIN VALLEY
1996
(inches)

Month	Evapo- ration ¹	ETP ²	PET ³	Alfalfa Hay	Cotton	Citrus	Deciduous Orchard		Dry Beans	Small Grains	Vineyard
							Clean Culti- vation	With Cover Crop			
Jan	1.02	0.94	0.74	0.63		0.62		0.76		0.40	
Feb	1.79	1.65	1.34	1.50		1.03		1.35		1.32	
Mar	3.96	3.65	3.03	3.01		2.23	1.81	3.23		3.79	0.19
Apr	7.25	6.66	5.75	5.50	0.57	4.13	4.16	6.46	0.86	7.00	1.83
May	9.08	8.35	7.13	6.90	2.12	5.05	5.98	8.43	6.94	6.60	4.67
Jun	9.38	8.62	7.40	7.14	6.37	4.94	6.82	8.90	8.42	0.79	6.03
Jul	10.40	9.57	8.11	7.89	10.28	5.41	7.80	9.83	4.26		6.87
Aug	9.65	8.89	7.53	7.33	9.30	5.01	7.23	8.92			6.16
Sep	7.09	6.51	5.48	5.39	4.77	3.74	4.97	6.21			3.06
Oct	4.94	4.55	3.74	3.76	0.77	2.76	2.91	4.02			1.05
Nov	1.99	1.83	1.46	1.52		1.12	0.70	1.47			0.32
Dec	<u>1.34</u>	<u>1.22</u>	<u>0.94</u>	<u>1.01</u>		<u>0.75</u>		<u>0.94</u>		<u>0.20</u>	
Total ⁴	67.89	62.44	52.65	51.58	34.18	36.79	42.38	60.52	20.48	20.09 ⁵	30.18
Percent of Normal	106.3	106.2	106.7	106.3	108.2	106.5	108.5	107.2	98.3	112.3	115.6

¹Observed evaporation from USWB class 'A' pan from Bakersfield 14W agroclimatic station (irrigated pasture).

²Potential ET of alfalfa. ET of vigorously growing alfalfa at 100 percent ground cover with no moisture stress (Jensen-Haise alfalfa reference crop). Estimated as 0.92 x pan evaporation. Potential ET of grass. ET of a large expanse of low growing grass at 100 percent ground cover with no moisture stress (Penman grass reference crop). Estimates based upon 1991 observed evaporation and crop coefficients from Table 2, Department of Water Resources District Report, *Crop Water Use*, September 1980.

³Potential ET of grass. ET of a large expanse of low growing grass at 100 percent ground cover with no moisture stress (Penman grass reference crop). Estimates based upon 1991 observed evaporation and crop coefficients from Table 2, Department of Water Resources District Report, *Crop Water Use*, September 1980.

⁴Growing season totals.

⁵Growing season ET includes 0.19 inch from December 1995 and excludes 0.20 inch from December 1996.