

APPENDIX G
SUPPORTING DATA FOR ALTERNATIVES ANALYSIS

Daily Flow Calculations Methodology for Alternatives Evaluation

Big Sur River Zone 4 to Zone 2 Estimated Daily Flow

USGS Big Sur River gage daily flow rate records, from 1985 to 2004, were used to estimate flow entering Zone 4 within the study area. A linear relationship between USGS flow and measured unimpaired flow was determined to be (Figure 3-35 SGI 2008):

$$Q_{\text{unimpaired}} \text{ entering Zone 4} = 1.3352 * \text{USGS flow rate} - 7.771 \text{ (cfs)}$$

Estimated groundwater accretion between Zone 4 and Zone 2 is about 1.7 cfs

Therefore, unimpaired flow from Zone 4 through Zone 2 was estimated as:

$$Q_{\text{unimpaired}} \text{ through Zone 4 to Zone 2} = 1.3352 * \text{USGS flow rate} - 7.771 + 1.7 \text{ (cfs)}$$

Synthetic Daily Flow

For all diversion conditions:

- If unimpaired flow rate was 0, no diversion was applied
- A river flow loss of 0.24 cfs per 1.0 cfs diverted was assumed (Table 3-1 SGI 2008)
- If calculated flow rates were less than 0, a flow rate of 0 was assumed.
- If the diversion reduced river flow to less than 0, a river flow rate of 0 was assumed

Diversion Rate Estimation

Baseline Conditions

Historic monthly average diversion rate, for each year from 1985 through 2004, was used to determine Baseline flow rate Big Sur River Zone 4 through Zone 2 flow rate losses (see El Sur Ranch Monthly Pumping (cfs)). The average diversion rate for each month was applied to each day for the entire month for the applicable year.

Proposed Project

Maximum application diversion rates for May through October (Table 6-1 this DEIR), and annual monthly maximum diversion rate for May and June were used to estimate proposed project effects on Big Sur River Zone 4 through Zone 2 daily flow rates. The remainder of the application allotment was divided equally among the remaining winter months. The table below lists the monthly average diversion rate per day was applied to each day of the month for each year.

TABLE 1	
DIVERSION RATES USED FOR PROPOSED PROJECT DAILY FLOW SIMULATION	
Month	Diversion Rate cfs
January	0.5
February	0.5
March	0.5
April	0.5
May	5.34
June	5.34
July	3.01
August	3.01
September	3.01
October	3.01
November	0.5
December	0.5

No Project Alternative (NPA)

The NPA was assumed to use the same irrigation strategy as historic conditions. Therefore, the application of irrigation water was assumed to be 9 percent of historic uses (25 acres/267 acres). Historic monthly average diversion rate, for each year from 1985 through 2004, was reduced to 9 percent of historic values and these diversion rates (see El Sur Ranch Monthly Pumping (cfs)) were used to determine flow rate losses in Big Sur River Zone 4 through Zone 2 for the NPA. The average diversion rate for each month was applied to each day for the entire month for the applicable year.

Alternate Irrigation Efficiency (AIE)

The AIE assumed an average irrigation efficiency of 80 percent. Historic records of irrigation use were adjusted to reflect an 80 percent irrigation efficiency, compared to historic uses (see Historic Required Irrigation).

This historic required irrigation at 80 percent efficiency rate, for each year from 1985 through 2004, was used for the diversion rates were used to determine flow rate Zone 4 through Zone 2 Big Sur River flow losses. The average diversion rate for each month was applied to each day for the entire month for the applicable year.

Frequency Analysis

A frequency analysis was performed for flow rates in the 20-year synthetic daily flow record (adjusted for the various diversion scenarios as described above). The frequency analysis was used to determine Bankful and Flood flow rates, and critical (0 and 1 cfs) non-exceedence probabilities.

The Bankful flow was estimated as the 1.5-year, 2.0-year, or 2.5-year return period flow, which have a probability of 66.7, 50, and 40 percent, respectively, chance of occurrence in any given year. Flood flow was estimated as the 10-year return flow (10 percent chance of occurrence in any given year).

In addition to the annual critical non-exceedence probability, critical non-exceedence flow probability was also evaluated for the month of November for the 20-year synthetic daily flow record.

TABLE 2								
FLOW RATES FOR CHANNEL FORMING FACTORS AND FREQUENCY FOR NON-EXCEEDENCE OF CRITICAL FLOW RATES								
Flow Condition cfs	Baseline/ Historic cfs	Proposed Project/ Alternative Limits on Diversions cfs	No Project Alternative cfs	No Project Alternative Difference		Alternative Irrigation Efficiency Difference		
				Baseline cfs	Proposed Project cfs	Alternate Irrigation Efficiency cfs	Baseline cfs	Proposed Project cfs
Flood								
10-year	257.2	257.0	257.2	0.01	0.26	257.2	0.01	0.26
Bankful								
2.5-year	41.02	40.86	41.91	0.89	1.05	41.45	0.43	0.59
2.0-year	28.21	28.29	28.61	0.4	0.32	28.20	-0.01	-0.09
1.5-year	18.02	17.91	18.24	0.22	0.33	18.13	0.11	0.22
Critical Flow (Frequency of Non-Exceedence)								
1 cfs	1.94	2.3	1.48	-0.46	-0.82	1.97	0.03	-0.33
0 cfs	1.08	1.23	0.92	-0.16	-0.31	1.07	-0.01	-0.16

TABLE 3						
IRRIGATION SEASON DIVERSION EFFECT ON BIG SUR RIVER FLOW LOSS						
	Baseline cfs	Proposed Project cfs	No Project Alternative cfs	Historic Diversion cfs	Alternative Irrigation Efficiency cfs	Alternative Limits on Diversion cfs
Diversion^a						
Monthly Maximum	4.52	3.87	0.42	4.52	2.24	3.87
Seasonal Average	2.21	3.01	0.21	2.21	1.76	3.01
BSR Flow Loss^b						
Monthly Maximum	0.81	0.70	0.08	0.81	0.40	0.70
Seasonal Average	0.40	0.54	0.04	0.40	0.32	0.54
Difference from Baseline						
Monthly Maximum	--	-0.12	-0.74	0.00	-0.41	-0.12
Seasonal Average	--	0.14	-0.36	0.00	-0.08	0.14
Difference from Proposed Project						
Monthly Maximum	--	--	-0.62	0.12	-0.29	0.00
Seasonal Average	--	--	-0.50	-0.14	-0.23	0.00
Notes: aFrom Table 6-1 bWhere Big Sur River (BSR) Flow Loss is estimated as 0.16 cfs per 1.0 cfs diverted (See Section 4.2, Impact 4.2-2, gradient method) -- = not applicable						

El Sur Ranch Baseline (1985-2004) Irrigation

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Count	20	20	20	20	20	20	20	20	20	20	20	20
Monthly Average Pumping Volume												
	<i>AF</i>	<i>AF</i>	<i>AF</i>	<i>AF</i>	<i>AF</i>	<i>AF</i>	<i>AF</i>	<i>AF</i>	<i>AF</i>	<i>AF</i>	<i>AF</i>	<i>AF</i>
Minimum	0	0	0	0	0	20	60	71	32	0	0	0
25th percentile	0	0	0	0	37	114	105	103	120	34	0	0
Median	0	0	0	0	96	176	148	130	152	93	0	0
75th percentile	0	0	0	0.1	152	218	194	179	190	121	6	0
Maximum	17	0	0.6	239	267	339	264	218	269	215	76	57
Mean	0.8	0	0	25	104	172	152	143	155	90	12	3
Standard Deviation	4	0	0.1	60.4	84	83	57	46	54	62	24	13
Monthly Average Pumping Rate												
	<i>cfs</i>	<i>cfs</i>	<i>cfs</i>	<i>cfs</i>	<i>cfs</i>	<i>cfs</i>	<i>cfs</i>	<i>cfs</i>	<i>cfs</i>	<i>cfs</i>	<i>cfs</i>	<i>cfs</i>
Minimum	0	0	0	0	0	0.34	0.98	1.15	0.54	0	0	0
25th percentile	0	0	0	0	0.60	1.92	1.71	1.68	2.01	0.55	0	0
Median	0	0	0	0	1.56	2.96	2.41	2.12	2.56	1.52	0	0
75th percentile	0	0	0	0	2.47	3.67	3.15	2.91	3.20	1.97	0.10	0
Maximum	0.27	0	0.01	4.01	4.35	5.70	4.29	3.55	4.52	3.50	1.27	0.93
Mean	0.01	0	0	0.42	1.69	2.89	2.48	2.32	2.60	1.47	0.20	0.05
Standard Deviation	0.10	0	0	1.02	1.36	1.40	0.93	0.75	0.91	1.01	0.41	0.21

El Sur Ranch Monthly Pumping (inches)

	days	31	28	31	30	31	30	31	31	30	31	30	31	365			
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Irrigation (AF)	Total Irrigation (in)	July to October Irrigation (in)		
1975	-	-	-	-	1.63	8.66	9.26	9.23	5.96	2.82	0.03	0.14	840	37.7	27.3		
1976	0.14	1.55	2.13	2.62	9.53	8.34	8.51	9.04	8.50	1.80	2.30	-	1,212	54.5	27.8		
1977	-	-	6.19	9.12	8.87	10.24	8.10	8.54	8.24	4.86	5.38	2.87	1,611	72.4	29.7		
1978	-	-	-	-	7.38	6.87	5.61	5.61	9.92	6.88	-	-	941	42.3	28.0		
1979	-	-	-	-	2.65	10.27	9.29	9.37	7.54	7.30	-	-	1,033	46.4	33.5		
1980	-	-	-	-	1.02	10.14	8.79	8.46	8.37	3.37	4.84	1.66	1,038	46.6	29.0		
1981	-	-	-	-	6.41	9.17	9.67	10.34	7.19	4.17	-	-	1,045	47.0	31.4		
1982	-	-	-	-	5.42	8.99	9.09	8.26	9.15	6.11	0.05	-	1,047	47.1	32.6		
1983	-	-	-	-	0.64	0.64	9.37	5.97	2.73	2.04	-	-	476	21.4	20.1		
1984	1.33	-	-	10.86	11.74	11.77	11.39	13.51	7.94	9.56	-	-	1,738	78.1	42.4		
1985	-	-	-	-	10.81	12.22	10.36	9.42	1.44	-	-	-	985	44.3	21.2		
1986	-	-	-	-	4.73	15.24	8.51	8.95	5.70	-	2.35	-	1,012	45.5	23.2		
1987	-	-	-	-	-	12.33	11.86	9.23	8.83	0.44	-	-	950	42.7	30.4		
1988	-	-	-	10.72	0.94	11.93	3.04	3.18	4.47	9.67	3.40	-	1,053	47.3	20.4		
1989	-	-	-	-	1.60	3.18	4.15	3.54	7.25	6.02	-	-	573	25.7	21.0		
1990	-	-	-	2.25	6.44	2.78	2.71	7.79	12.09	8.95	2.86	-	1,021	45.9	31.5		
1991	0.75	-	-	-	2.32	8.83	8.57	6.08	5.21	7.65	-	2.57	934	42.0	27.5		
1992	-	-	-	-	12.02	11.55	5.22	4.45	10.83	5.33	-	-	1,099	49.4	25.8		
1993	-	-	-	0.03	7.16	8.00	9.09	9.81	6.61	3.92	-	-	993	44.6	29.4		
1994	-	-	-	-	5.00	6.26	4.59	4.59	8.16	1.46	-	-	669	30.1	18.8		
1995	-	-	-	-	3.90	3.72	10.11	6.99	9.04	5.00	-	-	862	38.8	31.1		
1996	-	-	-	-	5.78	7.35	7.65	8.26	8.53	5.78	0.38	-	973	43.7	30.2		
1997	-	-	-	5.27	6.72	5.51	4.20	4.37	5.43	4.42	-	-	799	35.9	18.4		
1998	-	-	-	-	-	0.91	6.30	5.55	4.92	3.18	0.21	-	469	21.1	20.0		
1999	-	-	0.03	-	3.84	3.98	4.75	7.96	5.70	4.06	-	-	675	30.3	22.5		
2000	-	-	-	-	1.66	9.23	5.78	5.22	8.61	1.55	-	-	713	32.0	21.2		
2001	-	-	-	-	1.77	8.45	7.82	5.22	7.09	0.94	-	-	696	31.3	21.1		
2002	-	-	-	-	7.24	7.81	6.05	4.67	4.73	3.95	-	-	767	34.5	19.4		
2003	-	-	-	-	0.28	6.47	9.20	5.61	6.36	4.59	1.66	-	760	34.2	25.8		
2004	-	-	-	4.20	11.39	8.96	7.02	7.27	7.94	4.31	-	-	1,137	51.1	26.5		
Average	0.07	0.05	0.28	1.50	4.96	7.99	7.54	7.22	7.15	4.34	0.78	0.24	937	42.1	26.2		
1985 - 2004	0.04	0.00	0.00	1.12	4.68	7.74	6.85	6.41	6.95	4.06	0.54	0.13	857	38.5	24.3		

Monthly Irrigation Pumping Table 6-10 Beneficial Use Study, 2005

 = Baseline Max

El Sur Ranch Monthly Pumping (cfs)

	days	31	28	31	30	31	30	31	31	30	31	30	31	365			
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average (cfs)	Annual (ac-ft)	July to October Irrigation (cfs)		
1975	-	-	-	-	0.59	3.24	3.35	3.34	2.23	1.02	0.01	0.05	1.16	837	2.49		
1976	0.05	0.62	0.77	0.98	3.45	3.12	3.08	3.27	3.18	0.65	0.86	-	1.67	1,208	2.54		
1977	-	-	2.24	3.41	3.21	3.83	2.93	3.09	3.08	1.76	2.01	1.04	2.23	1,607	2.71		
1978	-	-	-	-	2.67	2.57	2.03	2.03	3.71	2.49	-	-	1.30	938	2.56		
1979	-	-	-	-	0.96	3.84	3.36	3.39	2.82	2.64	-	-	1.43	1,030	3.05		
1980	-	-	-	-	0.37	3.79	3.18	3.06	3.13	1.22	1.81	0.60	1.43	1,035	2.64		
1981	-	-	-	-	2.32	3.43	3.50	3.74	2.69	1.51	-	-	1.44	1,042	2.86		
1982	-	-	-	-	1.96	3.36	3.29	2.99	3.42	2.21	0.02	-	1.45	1,044	2.97		
1983	-	-	-	-	0.23	0.24	3.39	2.16	1.02	0.74	-	-	0.66	475	1.83		
1984	0.48	-	-	4.06	4.25	4.40	4.12	4.89	2.97	3.46	-	-	2.40	1,733	3.87		
1985	-	-	-	-	3.91	4.57	3.75	3.41	0.54	-	-	-	1.36	982	1.94		
1986	-	-	-	-	1.71	5.70	3.08	3.24	2.13	-	0.88	-	1.40	1,009	2.11		
1987	-	-	-	-	-	4.61	4.29	3.34	3.30	0.16	-	-	1.31	947	2.77		
1988	-	-	-	4.01	0.34	4.46	1.10	1.15	1.67	3.50	1.27	-	1.46	1,051	1.86		
1989	-	-	-	-	0.58	1.19	1.50	1.28	2.71	2.18	-	-	0.79	571	1.91		
1990	-	-	-	0.84	2.33	1.04	0.98	2.82	4.52	3.24	1.07	-	1.41	1,018	2.88		
1991	0.27	-	-	-	0.84	3.30	3.10	2.20	1.95	2.77	-	0.93	1.29	931	2.51		
1992	-	-	-	-	4.35	4.32	1.89	1.61	4.05	1.93	-	-	1.52	1,096	2.36		
1993	-	-	-	0.01	2.59	2.99	3.29	3.55	2.47	1.42	-	-	1.37	990	2.68		
1994	-	-	-	-	1.81	2.34	1.66	1.66	3.05	0.53	-	-	0.92	667	1.71		
1995	-	-	-	-	1.41	1.39	3.66	2.53	3.38	1.81	-	-	1.19	860	2.84		
1996	-	-	-	-	2.09	2.75	2.77	2.99	3.19	2.09	0.14	-	1.34	970	2.76		
1997	-	-	-	1.97	2.43	2.06	1.52	1.58	2.03	1.60	-	-	1.10	797	1.68		
1998	-	-	-	-	-	0.34	2.28	2.01	1.84	1.15	0.08	-	0.65	468	1.82		
1999	-	-	0.01	-	1.39	1.49	1.72	2.88	2.13	1.47	-	-	0.93	673	2.05		
2000	-	-	-	-	0.60	3.45	2.09	1.89	3.22	0.56	-	-	0.98	711	1.93		
2001	-	-	-	-	0.64	3.16	2.83	1.89	2.65	0.34	-	-	0.96	694	1.92		
2002	-	-	-	-	2.62	2.92	2.19	1.69	1.77	1.43	-	-	1.06	765	1.77		
2003	-	-	-	-	0.10	2.42	3.33	2.03	2.38	1.66	0.62	-	1.05	758	2.35		
2004	-	-	-	1.57	4.12	3.35	2.54	2.63	2.97	1.56	-	-	1.57	1,134	2.42		
Average	0.03	0.02	0.10	0.56	1.80	2.99	2.73	2.61	2.67	1.57	0.29	0.09	1.29	935	2.39		
1985-2004	0.01	0.00	0.00	0.42	1.69	2.89	2.48	2.32	2.60	1.47	0.20	0.05	1.18	855	2.21		

Monthly Irrigation Pumping Table 6-10 Beneficial Use Study, 2005

 = Baseline Max

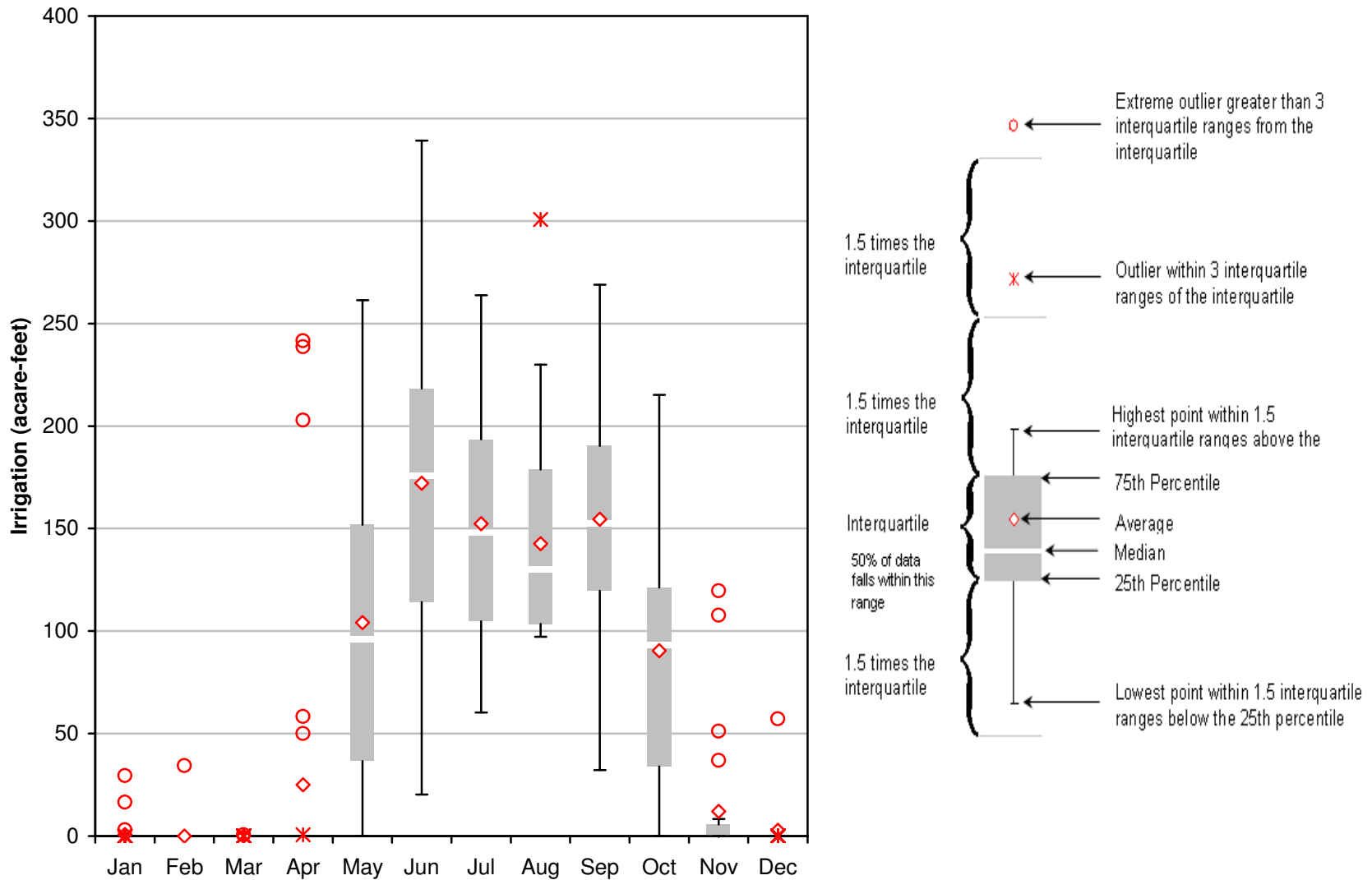
El Sur Ranch Monthly Pumping (acre-feet)

	days	31	28	31	30	31	30	31	31	30	31	30	31	365		
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Irrigation (AF)	July to October Irrigation (ac-ft)	Calculated Irrigation Requirement with leaching	
1975	-	-	-	-	36	193	206	205	133	63	1	3	840	607	576	
1976	3	34	47	58	212	186	189	201	189	40	51	-	1,212	620	938	
1977	-	-	138	203	197	228	180	190	183	108	120	64	1,611	662	999	
1978	-	-	-	-	164	153	125	125	221	153	-	-	941	624	589	
1979	-	-	-	-	59	228	207	208	168	162	-	-	1,033	745	604	
1980	-	-	-	-	23	226	196	188	186	75	108	37	1,038	645	689	
1981	-	-	-	-	143	204	215	230	160	93	-	-	1,045	698	551	
1982	-	-	-	-	121	200	202	184	204	136	1	-	1,047	726	433	
1983	-	-	-	-	14	14	208	133	61	46	-	-	476	447	472	
1984	30	-	-	242	261	262	253	301	177	213	-	-	1,738	943	989	
1985	-	-	-	-	240	272	231	210	32	-	-	-	985	472	587	
1986	-	-	-	-	105	339	189	199	127	-	52	-	1,012	515	670	
1987	-	-	-	-	-	274	264	205	196	10	-	-	950	675	602	
1988	-	-	-	239	21	265	68	71	99	215	76	-	1,053	453	844	
1989	-	-	-	-	36	71	92	79	161	134	-	-	573	466	506	
1990	-	-	-	50	143	62	60	173	269	199	64	-	1,021	702	817	
1991	17	-	-	-	52	196	191	135	116	170	-	57	934	612	601	
1992	-	-	-	-	267	257	116	99	241	119	-	-	1,099	575	713	
1993	-	-	-	1	159	178	202	218	147	87	-	-	993	655	646	
1994	-	-	-	-	111	139	102	102	181	33	-	-	669	418	612	
1995	-	-	-	-	87	83	225	156	201	111	-	-	862	693	578	
1996	-	-	-	-	129	164	170	184	190	129	8	-	973	672	591	
1997	-	-	-	117	149	123	93	97	121	98	-	-	799	410	800	
1998	-	-	-	-	-	20	140	124	109	71	5	-	469	444	460	
1999	-	-	1	-	85	89	106	177	127	90	-	-	675	500	538	
2000	-	-	-	-	37	205	129	116	192	34	-	-	713	471	537	
2001	-	-	-	-	39	188	174	116	158	21	-	-	696	469	529	
2002	-	-	-	-	161	174	135	104	105	88	-	-	767	432	612	
2003	-	-	-	-	6	144	205	125	142	102	37	-	760	573	599	
2004	-	-	-	93	253	199	156	162	177	96	-	-	1,137	591	660	
Average	2	1	6	33	110	178	168	161	159	97	17	5	937	584	614	
1985-2004	1	0	0	25	104	172	152	143	155	90	12	3	857	540	625	

Monthly Irrigation Pumping Table 6-10 Beneficial Use Study, 2005

 = Baseline Max

1985 - 2004 Monthly Average Irrigation Volumes on 267 Acres
n=20



HISTORIC REQUIRED IRRIGATION

Acres = 267

Similar to Table 7-8: Net Irrigation Requirement -- calculated with mean ETC (inches); Crop Requirements

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Annual (ac-ft)	Jul through October Irrigation (inches)
1 1975	1.22	0.15	0.26	2.12	4.44	5.13	4.86	3.78	3.77	1.87	2.22	1.92	31.71	705	14.27
2 1976	2.26	0.27	1.84	2.11	4.44	5.12	4.98	3.23	3.37	2.79	2.01	0.50	32.89	732	14.36
3 1977	0.91	1.87	1.67	3.66	3.28	5.25	4.98	4.20	3.14	3.28	2.19	0.00	34.40	765	15.59
4 1978	0.00	0.00	0.00	0.00	4.44	5.25	4.98	4.20	3.51	3.36	0.92	0.91	27.55	613	16.04
5 1979	0.21	0.27	0.00	3.10	4.17	5.25	4.63	4.19	3.77	1.75	0.38	0.00	27.70	616	14.33
6 1980	0.00	0.00	1.14	2.03	3.88	5.25	4.21	4.19	3.76	3.36	2.63	0.75	31.17	694	15.51
7 1981	0.00	0.83	0.00	2.75	4.30	5.25	4.98	4.10	3.77	1.55	0.00	0.81	28.32	630	14.39
8 1982	0.32	0.66	0.26	0.98	4.44	4.71	4.95	4.20	2.43	1.36	0.17	0.05	24.50	545	12.93
9 1983	0.00	0.00	0.00	0.10	4.21	5.11	4.98	4.20	2.57	2.91	0.06	0.00	24.12	537	14.65
10 1984	2.34	0.66	2.03	2.95	4.23	5.11	4.98	4.20	3.77	1.57	0.17	0.58	32.56	724	14.51
11 1985	1.42	1.43	0.40	2.93	4.14	4.99	4.95	4.20	3.67	1.92	0.50	0.96	31.48	700	14.73
12 1986	0.58	0.00	0.00	3.27	4.00	5.25	4.98	4.20	2.89	3.30	2.46	0.82	31.72	706	15.36
13 1987	0.09	0.20	0.80	3.14	4.36	5.25	4.98	4.20	3.77	2.31	1.12	0.26	30.45	677	15.25
14 1988	0.58	1.96	3.12	1.89	3.81	4.98	4.98	4.20	3.77	3.25	0.47	0.16	33.14	737	16.19
15 1989	1.06	0.85	0.74	2.69	4.13	5.25	4.98	4.20	2.87	1.86	1.46	2.13	32.19	716	13.90
16 1990	0.00	0.39	1.78	2.80	2.71	5.25	4.98	4.20	3.77	3.28	2.21	0.87	32.21	717	16.22
17 1991	1.76	0.73	0.40	3.21	4.24	5.25	4.98	3.97	3.77	2.18	2.61	0.05	33.12	737	14.89
18 1992	0.56	0.00	0.00	3.66	4.44	5.09	4.98	4.17	3.77	2.73	2.56	0.05	31.98	712	15.64
19 1993	0.00	0.03	0.56	2.77	3.58	4.34	4.98	4.20	3.77	3.27	1.16	0.43	29.06	647	16.21
20 1994	0.00	0.15	2.74	2.38	3.61	5.25	4.98	4.20	3.77	3.07	0.50	0.29	30.91	688	16.01
21 1995	0.00	1.96	0.00	1.67	3.86	3.83	4.98	4.20	3.77	3.36	2.51	0.32	30.44	677	16.30
22 1996	0.00	0.00	0.72	2.75	3.11	5.25	4.98	4.20	3.77	2.37	0.54	0.00	27.66	616	15.31
23 1997	0.00	2.48	3.05	3.28	4.38	5.25	4.98	4.00	3.77	2.81	0.00	0.05	34.02	757	15.55
24 1998	0.00	0.03	0.00	0.83	2.02	4.91	4.76	4.20	3.58	2.80	0.33	0.83	24.27	540	15.33
25 1999	0.00	0.27	0.54	1.88	4.44	4.95	4.98	4.20	3.62	3.22	1.27	2.14	31.48	700	16.01
26 2000	0.00	0.00	1.29	2.76	3.63	5.25	4.98	4.20	3.38	0.24	2.20	1.98	29.88	665	12.79
27 2001	0.09	0.27	1.11	1.79	4.44	5.25	4.98	4.17	3.71	3.21	0.31	0.16	29.46	655	16.06
28 2002	1.13	1.26	1.91	3.27	3.39	5.22	4.98	4.20	3.77	3.36	0.70	0.05	33.21	739	16.30
29 2003	1.03	0.73	2.13	1.35	3.51	5.25	4.98	4.20	3.77	3.12	1.23	0.05	31.32	697	16.06
30 2004	0.80	0.23	2.55	3.63	4.44	5.22	4.86	4.20	3.71	0.46	1.71	0.21	31.99	712	13.22
31 2005	0.44	0.36	3.08	3.01	3.97	5.13	4.98	4.20	3.77	3.36	1.62	0.00	33.89	754	16.30
32 2006	2.38	2.28	0.69	0.54	3.67	5.25	4.98	4.20	3.77	3.36	1.59	0.01	32.69	727	16.30
1985-2004 Mean	0.45	0.65	1.19	2.59	3.81	5.06	4.96	4.18	3.63	2.60	1.29	0.59	31.00	690	15.36
1985-2004 Maximum	1.76	2.48	3.12	3.66	4.44	5.25	4.98	4.20	3.77	3.36	2.61	2.14	34.02	757	16.30
Irrigation Requirement (Crop Requirement/Irrigation Efficiency)															
1985-2004 Max AF	49	69	87	102	123	146	138	117	105	93	73	59	946		453
1985-2004 Days	31	28	31	30	31	30	31	31	30	31	30	31	365		123
1985-2004 Max cfs	0.79	1.24	1.41	1.71	2.01	2.45	2.25	1.90	1.76	1.52	1.22	0.97	1.31		1.86

= Max
 = within 70% of max

winter avg max AF 73
winter avg max cfs 1.22

HISTORIC IRRIGATION EFFICIENCY

* based on dS/m of 0.75, per 2007 report pg. 8-3

Clover Calc'd Leaching fraction

LF allowed loss: 10% loss 0.28

IE	Acres:
80%	267

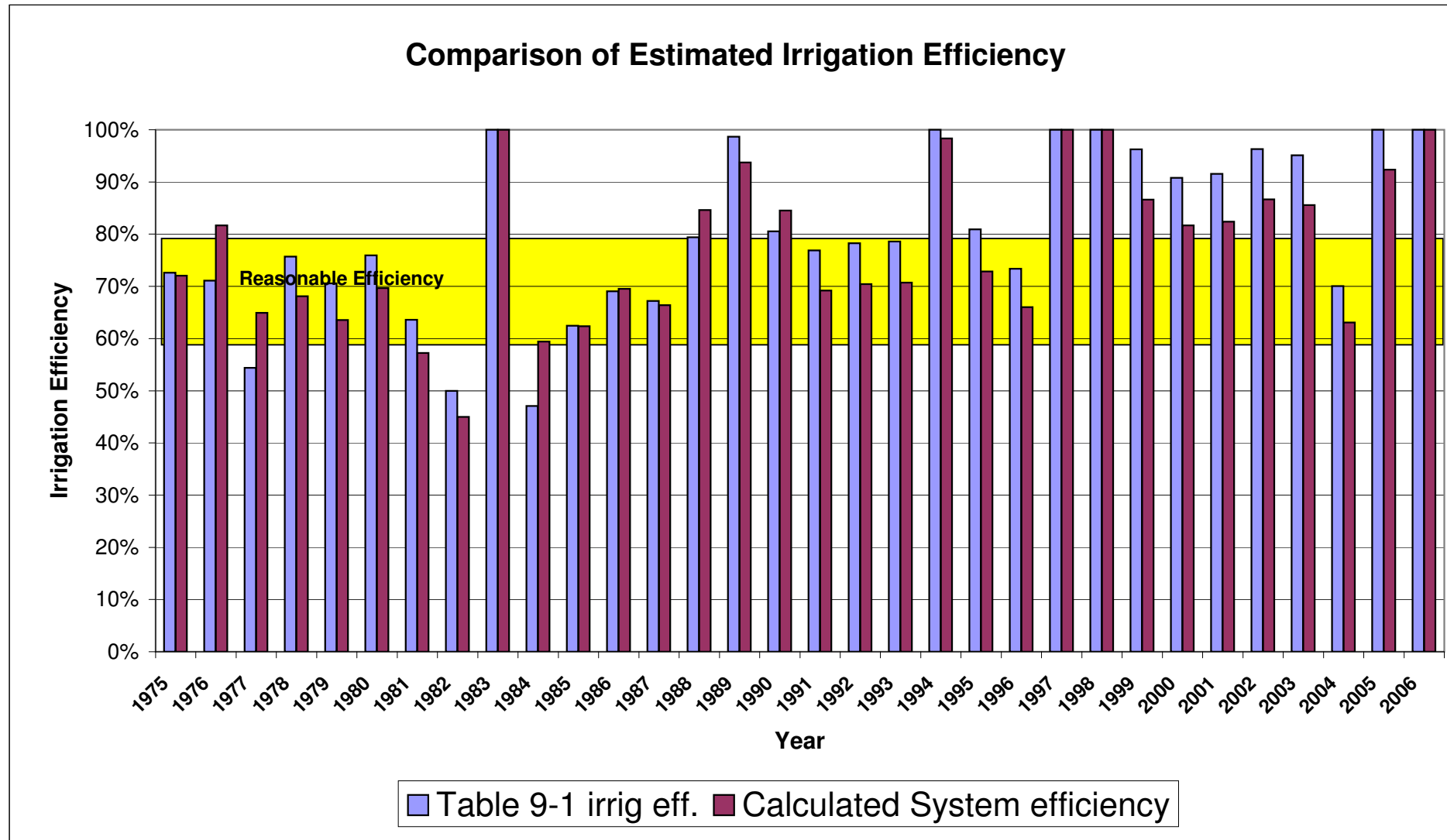
Year	(from Tb 9-1)		(from Tb 7-8)	(from Tb 7-11)	(from Tb 9-1)		(calc'd)	(calc'd)	(calc'd)						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Irrig. Water supply	Irrig. Water supply (AF)	Net Irrig. Req.	Irrig. For beneficial crop Etc	Total Benef. Use (in)	Irrigation Efficiency	Precip. Remainder	Leaching requirement	Additional irrig. needed for LR	NEW Total Benef. Use (in)	New total irrig. Req. (AF)	Calculated System efficiency	Table 9-1 irrig. eff.	Efficiency difference calc'd v. Tb 9-1	
1975	34.7	840	29.01	22.71	25.23	73%	7.41	9.73	2.32	25.03	696	72.0%	72.0%	67%	-5%
1976	50.1	1212	34.45	32.10	35.67	71%	5.18	14.04	8.86	40.96	1139	81.7%	81.7%	65%	-17%
1977	66.7	1611	34.26	32.64	36.27	54%	8.02	18.67	10.65	43.29	1204	64.9%	64.9%	50%	-15%
1978	38.9	940	27.99	26.49	29.43	76%	17.74	10.89	0.00	26.49	737	68.1%	68.1%	70%	2%
1979	42.7	1032	28.51	27.13	30.14	71%	14.27	11.96	0.00	27.13	755	63.5%	63.5%	65%	1%
1980	42.9	1038	32.05	29.34	32.60	76%	11.45	12.02	0.57	29.91	832	69.7%	69.7%	70%	0%
1981	43.3	1045	28.23	24.76	27.51	64%	15.30	12.11	0.00	24.76	689	57.2%	57.2%	59%	2%
1982	43.3	1046	23.00	19.48	21.64	50%	23.43	12.12	0.00	19.48	542	45.0%	45.0%	46%	1%
1983	19.7	476	26.37	21.22	19.70	100%	28.74	5.52	0.00	21.22	590	100.0%	N/A	100%	0
1984	71.9	1738	33.41	30.46	33.84	47%	7.86	20.13	12.27	42.73	1189	59.4%	59.4%	43%	-16%
1985	40.7	985	30.98	22.91	25.46	62%	8.90	11.41	2.51	25.42	707	62.4%	62.4%	58%	-4%
1986	41.9	1012	32.15	26.03	28.92	69%	8.64	11.73	3.09	29.12	810	69.5%	69.5%	64%	-6%
1987	39.3	950	31.89	23.77	26.41	67%	8.68	11.01	2.32	26.09	726	66.4%	66.4%	62%	-4%
1988	43.6	1054	33.71	31.16	34.62	79%	6.48	12.21	5.73	36.89	1026	84.6%	84.6%	73%	-12%
1989	23.7	572	32.29	21.02	23.36	99%	5.46	6.63	1.16	22.18	617	93.7%	93.7%	91%	-3%
1990	42.3	1021	32.99	30.62	34.02	81%	6.73	11.83	5.10	35.72	993	84.5%	84.5%	74%	-11%
1991	38.7	934	31.65	26.76	29.73	77%	11.52	10.82	0.00	26.76	744	69.2%	69.2%	71%	2%
1992	45.5	1099	36.38	32.04	35.60	78%	14.34	12.74	0.00	32.04	891	70.4%	70.4%	72%	2%
1993	41.1	992	32.61	29.04	32.27	79%	20.84	11.50	0.00	29.04	808	70.7%	70.7%	72%	1%
1994	27.7	669	30.36	27.23	27.69	100%	8.16	7.75	0.00	27.23	757	98.3%	98.3%	100%	2%
1995	35.7	862	33.00	25.99	28.88	81%	19.44	9.99	0.00	25.99	723	72.8%	72.8%	75%	2%
1996	40.3	973	29.13	26.58	29.53	73%	22.48	11.27	0.00	26.58	739	66.0%	66.0%	68%	2%
1997	33.1	800	37.67	35.94	33.09	100%	18.26	9.27	0.00	35.94	1000	100.0%	N/A	100%	0%
1998	19.4	468	23.46	20.67	19.38	100%	33.18	5.43	0.00	20.67	575	100.0%	N/A	100%	0%
1999	27.9	675	28.79	24.18	26.87	96%	10.39	7.82	0.00	24.18	673	86.6%	86.6%	89%	2%
2000	29.5	714	29.71	24.13	26.81	91%	18.02	8.27	0.00	24.13	671	81.7%	81.7%	84%	2%
2001	28.8	697	28.18	23.76	26.40	92%	16.72	8.07	0.00	23.76	661	82.4%	82.4%	84%	2%
2002	31.7	767	30.79	27.51	30.57	96%	10.74	8.89	0.00	27.51	765	86.7%	86.7%	89%	2%
2003	31.5	760	31.07	26.92	29.91	95%	9.67	8.81	0.00	26.92	749	85.6%	85.6%	88%	2%
2004	47.0	1136	32.94	29.65	32.94	70%	14.52	13.17	0.00	29.65	825	63.1%	63.1%	65%	2%
2005	29.9	722	36.16	27.58	29.87	100%	11.38	8.36	0.00	27.58	767	92.3%	92.3%	94%	2%
2006	17.6	426	29.28	19.15	17.63	100%	7.63	4.94	0.00	19.15	533	100.0%	N/A	100%	0%
1985 to 2004	35.46	857.03	31.49	26.80	29.12	84%				27.79	773	80%	77%	79%	-1%

Caveats:
 Unknown number of irrigated acres
 Under-irrigation is treated as 100% efficiency
 Tailwater waste is not known
 Irrigation uniformity is not known

w/o 100%	
1979 to 2006	76%
1994 to 2006	87%
1985 to 2004	81%

w/o 100%	
1979 to 2006	72%
1985 to 2004	76%

HISTORIC IRRIGATION EFFICIENCY



1 from Table 9-1 and 7-9. Based on PG&E electric records and pump test 1967, 1992, 2004. Daily records 1989-2000 and 2004-2006

2 same as 1.

3 from Table 7-8, Based ETo, Kc = 1.06

4 from Table 7-11. Historic irrigation used for ET. Month to month annual moisture balance and Crop Uptake. Assumes field capacity = 5 inches. (Rootzone of 2ft and FC of .125 in/in = 3 in usable)

5 from Table 9-1. Beneficial Use (ET and LF), assumes LF is a constant 10% of Irrigated Water (1)

9 [8] - [7] = the amount of additional irrigation to achieve the calculated leaching fraction

10 [4]+[9] = Crop ETc plus newly calculated additional irrigation needed for leaching

11 same as 10 converted to acre-ft.

12 [10]/[1] = new efficiency with revised irrigation rate

13 remove 100%

14 difference between 6 and 13

No Project Alternative (Alt 1) El Sur Ranch Monthly Pumping Reduction on BSR Flow Rates (cfs)

	days	31	28	31	30	31	30	31	31	30	31	30	31	365	
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average (cfs)	Annual (ac-ft)	July to October Irrigation (cfs)
1985	-	-	-	-	0.08	0.10	0.08	0.07	0.01	-	-	-	0.03	21	0.04
1986	-	-	-	-	0.04	0.12	0.07	0.07	0.05	-	0.02	-	0.03	22	0.05
1987	-	-	-	-	-	0.10	0.09	0.07	0.07	0.00	-	-	0.03	20	0.06
1988	-	-	-	0.09	0.01	0.10	0.02	0.02	0.04	0.08	0.03	-	0.03	23	0.04
1989	-	-	-	-	0.01	0.03	0.03	0.03	0.06	0.05	-	-	0.02	12	0.04
1990	-	-	-	0.02	0.05	0.02	0.02	0.06	0.10	0.07	0.02	-	0.03	22	0.06
1991	0.01	-	-	-	0.02	0.07	0.07	0.05	0.04	0.06	-	0.02	0.03	20	0.05
1992	-	-	-	-	0.09	0.09	0.04	0.03	0.09	0.04	-	-	0.03	24	0.05
1993	-	-	-	0.00	0.06	0.06	0.07	0.08	0.05	0.03	-	-	0.03	21	0.06
1994	-	-	-	-	0.04	0.05	0.04	0.04	0.07	0.01	-	-	0.02	14	0.04
1995	-	-	-	-	0.03	0.03	0.08	0.05	0.07	0.04	-	-	0.03	19	0.06
1996	-	-	-	-	0.05	0.06	0.06	0.06	0.07	0.05	0.00	-	0.03	21	0.06
1997	-	-	-	0.04	0.05	0.04	0.03	0.03	0.04	0.03	-	-	0.02	17	0.04
1998	-	-	-	-	-	0.01	0.05	0.04	0.04	0.02	0.00	-	0.01	10	0.04
1999	-	-	0.00	-	0.03	0.03	0.04	0.06	0.05	0.03	-	-	0.02	15	0.04
2000	-	-	-	-	0.01	0.07	0.05	0.04	0.07	0.01	-	-	0.02	15	0.04
2001	-	-	-	-	0.01	0.07	0.06	0.04	0.06	0.01	-	-	0.02	15	0.04
2002	-	-	-	-	0.06	0.06	0.05	0.04	0.04	0.03	-	-	0.02	17	0.04
2003	-	-	-	-	0.00	0.05	0.07	0.04	0.05	0.04	0.01	-	0.02	16	0.05
2004	-	-	-	0.03	0.09	0.07	0.05	0.06	0.06	0.03	-	-	0.03	24	0.05
1985-2004	0.00	0.00	0.00	0.01	0.04	0.06	0.05	0.05	0.06	0.03	0.00	0.00	0.03	18	0.05

Monthly Irrigation Pumping Table 6-10 Beneficial Use Study, 2005

0.03 = Alt 1 Max

Baseline and Historic Diversions (Alt 2) El Sur Ranch Monthly Pumping Effect on BSR Flow Rate Losses (cfs)

days	31	28	31	30	31	30	31	31	30	31	30	31	365		
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average (cfs)	Annual (ac-ft)	July to October Irrigation (cfs)
1985	-	-	-	-	0.94	1.10	0.90	0.82	0.13	-	-	-	0.33	236	0.46
1986	-	-	-	-	0.41	1.37	0.74	0.78	0.51	-	0.21	-	0.34	242	0.51
1987	-	-	-	-	-	1.11	1.03	0.80	0.79	0.04	-	-	0.31	227	0.66
1988	-	-	-	0.96	0.08	1.07	0.26	0.28	0.40	0.84	0.30	-	0.35	252	0.45
1989	-	-	-	-	0.14	0.29	0.36	0.31	0.65	0.52	-	-	0.19	137	0.46
1990	-	-	-	0.20	0.56	0.25	0.24	0.68	1.08	0.78	0.26	-	0.34	244	0.69
1991	0.06	-	-	-	0.20	0.79	0.74	0.53	0.47	0.66	-	0.22	0.31	224	0.60
1992	-	-	-	-	1.04	1.04	0.45	0.39	0.97	0.46	-	-	0.36	263	0.57
1993	-	-	-	0.00	0.62	0.72	0.79	0.85	0.59	0.34	-	-	0.33	238	0.64
1994	-	-	-	-	0.43	0.56	0.40	0.40	0.73	0.13	-	-	0.22	160	0.41
1995	-	-	-	-	0.34	0.33	0.88	0.61	0.81	0.43	-	-	0.29	206	0.68
1996	-	-	-	-	0.50	0.66	0.66	0.72	0.77	0.50	0.03	-	0.32	233	0.66
1997	-	-	-	0.47	0.58	0.49	0.36	0.38	0.49	0.38	-	-	0.26	191	0.40
1998	-	-	-	-	-	0.08	0.55	0.48	0.44	0.28	0.02	-	0.16	112	0.44
1999	-	-	0.00	-	0.33	0.36	0.41	0.69	0.51	0.35	-	-	0.22	161	0.49
2000	-	-	-	-	0.14	0.83	0.50	0.45	0.77	0.13	-	-	0.24	171	0.46
2001	-	-	-	-	0.15	0.76	0.68	0.45	0.64	0.08	-	-	0.23	167	0.46
2002	-	-	-	-	0.63	0.70	0.53	0.41	0.42	0.34	-	-	0.25	183	0.42
2003	-	-	-	-	0.02	0.58	0.80	0.49	0.57	0.40	0.15	-	0.25	182	0.56
2004	-	-	-	0.38	0.99	0.80	0.61	0.63	0.71	0.37	-	-	0.38	272	0.58
Average	0.01	0.00	0.02	0.13	0.43	0.72	0.65	0.63	0.64	0.38	0.07	0.02	0.31	224	0.57
1985-2004	0.00	0.00	0.00	0.10	0.41	0.69	0.59	0.56	0.62	0.35	0.05	0.01	0.28	205	0.53

Based on Monthly Irrigation Pumping Table 6-10 Beneficial Use Study, 2005 = Baseline and Alt 2

Alternative Irrigation Efficiency (Alt 3) El Sur Ranch Monthly Pumping Effect on BSR Flow Rate Losses (cfs)

	days	31	28	31	30	31	30	31	31	30	31	30	31	365		
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average (cfs)	Annual (ac-ft)	July to October Irrigation (cfs)	
1985	0.15	0.17	0.04	0.33	0.45	0.56	0.54	0.46	0.41	0.21	0.06	0.10	0.29	209	0.40	
1986	0.06	-	-	0.37	0.43	0.59	0.54	0.46	0.32	0.36	0.28	0.09	0.29	211	0.42	
1987	0.01	0.02	0.09	0.35	0.47	0.59	0.54	0.46	0.42	0.25	0.13	0.03	0.28	203	0.42	
1988	0.06	0.24	0.34	0.21	0.41	0.56	0.54	0.46	0.42	0.35	0.05	0.02	0.31	220	0.44	
1989	0.11	0.10	0.08	0.30	0.45	0.59	0.54	0.46	0.32	0.20	0.16	0.23	0.30	214	0.38	
1990	-	0.05	0.19	0.31	0.29	0.59	0.54	0.46	0.42	0.36	0.25	0.09	0.30	214	0.44	
1991	0.19	0.09	0.04	0.36	0.46	0.59	0.54	0.43	0.42	0.24	0.29	0.01	0.31	220	0.41	
1992	0.06	-	-	0.41	0.48	0.57	0.54	0.45	0.42	0.30	0.29	0.01	0.29	213	0.43	
1993	-	0.00	0.06	0.31	0.39	0.49	0.54	0.46	0.42	0.35	0.13	0.05	0.27	193	0.44	
1994	-	0.02	0.30	0.27	0.39	0.59	0.54	0.46	0.42	0.33	0.06	0.03	0.28	206	0.44	
1995	-	0.24	-	0.19	0.42	0.43	0.54	0.46	0.42	0.36	0.28	0.03	0.28	202	0.45	
1996	-	-	0.08	0.31	0.34	0.59	0.54	0.46	0.42	0.26	0.06	-	0.25	184	0.42	
1997	-	0.30	0.33	0.37	0.48	0.59	0.54	0.43	0.42	0.30	-	0.01	0.31	226	0.43	
1998	-	0.00	-	0.09	0.22	0.55	0.52	0.46	0.40	0.30	0.04	0.09	0.22	161	0.42	
1999	-	0.03	0.06	0.21	0.48	0.55	0.54	0.46	0.41	0.35	0.14	0.23	0.29	209	0.44	
2000	-	-	0.14	0.31	0.39	0.59	0.54	0.46	0.38	0.03	0.25	0.21	0.28	199	0.35	
2001	0.01	0.03	0.12	0.20	0.48	0.59	0.54	0.45	0.42	0.35	0.03	0.02	0.27	196	0.44	
2002	0.12	0.15	0.21	0.37	0.37	0.58	0.54	0.46	0.42	0.36	0.08	0.01	0.31	221	0.45	
2003	0.11	0.09	0.23	0.15	0.38	0.59	0.54	0.46	0.42	0.34	0.14	0.01	0.29	208	0.44	
2004	0.09	0.03	0.28	0.41	0.48	0.58	0.53	0.46	0.42	0.05	0.19	0.02	0.29	213	0.36	
1985-2004	0.05	0.08	0.13	0.29	0.41	0.57	0.54	0.45	0.41	0.28	0.14	0.06	0.29	206	0.42	

Based on Calculated Net Irrigation Requirement: this Appendix

0.31 = Alt 3 Max