8 Benefits and Cost Analysis

8.0 Proposal Benefits and Costs Summary

The Poso Creek IRWM Implementation Proposal includes a regional Intertie with a positive benefit/cost ratio combined with two critical DAC drinking water solutions for small communities with limited resources, and one sewer project for a small community DAC with five neighboring DACs that can share and utilize the planning and design information once developed through the County of Kern Engineering Services Group. The Poso Creek IRWM RWMG has included two regional programs: 1) support on-farm water use conservation and 2) water quality management by destroying unused wells near DAC drinking water supply wells. Regarding the smallest communities within Poso Creek IRWM Region, none of the small DACs in the Poso Creek IRWM Region can sustain a rate increase to fund these DAC projects or regional programs. Table 8.0-1 provides a summary of Proposal Benefits and Costs as well as the evaluation approach taken for each project.

Table 8.0-1 – Proposal Benefits and Costs Summary

Proposal: Poso Creek IRWM Implementation Grant, Proposition 84, Round 2
Agency: Semitropic Water Storage District

Project	Project Proponent	Total Present Value Project Costs [1]	Total Present Value Project Benefits			D1 – Cost-Effectiveness Analysis	D2 – Non-Monetized Benefits
			From Section D3 – Monetized [2]	From Section D4 – Flood Damage Reduction [3]	Total		
(a)	(b)	(c)	(d)	(e)	(f) = (d) + (e)	(g)	(h)
Madera Avenue Intertie	Semitropic Water Storage District	$ 25,125,254	$ 39,708,000	$ -	$ 39,708,000	N/A	N/A
Lost Hills New Well and Tank Replacement	Lost Hills Utility District	$ 2,046,702	$ 516,204	$ -	$ 516,204	See Table 8.2-1	See Table 8.2-2
Allensworth Tank Replacement and SCADA Upgrade	Allensworth Community Services District	$ 320,494	$ -	$ -	$ -	See Table 8.3-1	See Table 8.3-2
Groundwater Well Destruction Program	Semitropic Water Storage District	$ 64,974	$ -	$ -	$ -	See Table 8.4-1	See Table 8.4-2
On-Farm Mobile Lab for Water Use Efficiency in Support of Nutrient Management	North West Kern Resources Conservation District	$ 179,387	$ -	$ -	$ -	See Table 8.5-1	See Table 8.5-2
South Shafter Sewer - Planning and Design	Kern County Engineering & Survey Services	$ 305,733	$ -	$ -	$ -	See Table 8.6-1	See Table 8.6-2
	TOTAL	$ 28,042,544			$ 40,224,204		

From Table 20, November 2012 PSP

(1) From Tables 8.1-2, 8.2-4, 8.3-3, 8.4-3, 8.5-3, and 8.6-3

(2) From Tables 8.1-1 and 8.2-3

(3) Not Applicable

8.1 Project 1 – Madera Avenue Intertie

8.1.1 Introduction

The benefit-cost analysis for the Madera Avenue Intertie is based on monetized benefits and costs calculated on a net present value basis as specified in Section D3 - Monetized Benefits Analysis of the IRWM Proposition 84 PSP ("PSP"). This analysis provides a With-Project and Without-Project comparison of present values for a Project life cycle of 50 years, and is based on avoided water supply purchase costs. Recall from Section 7.1 (in *Attachment 7*) that the proposed Intertie would provide for the recovery and delivery of San Joaquin River Recirculation Water and for the regulation and delivery of CVP-Delta water, which collectively have been estimated to average at least 10,000 acre-feet per year over the long term. The Without-Project condition is based on purchasing replacement water supplies in a like amount.

The estimated total present value of Project benefits is $39,708,000 and the estimated total present value of Project costs is $25,125,254, which implies a net benefit of about $14.6 million (expressed in terms of present value). Tables 8.1-1 and 8.1-2 develop these total amounts (which are 2012 costs developed by applying the discount factors provided in the PSP).

8.1.2 Project Costs

Project costs have been estimated to total about $25.1 million (expressed in terms of the present value over a period of 50 years), with about 40 percent of that amount attributable to capital costs and the remaining 60 percent attributable to annual costs. These costs are addressed in the sections which follow.

8.1.2.1 Capital Costs

Capital costs for the Project are discussed and presented in tables contained in *Attachment 4* of this Proposal. In summary, capital costs total about $10.5 million, with expenditures estimated to take place over a period of three years (10% in Year 1, 60% in Year 2, and 30 percent in Year 3).

8.1.2.2 Annual Costs

Annual costs have been developed under three general categories: 1) administrative costs; 2) operating costs; and 3) maintenance and replacement costs. The individual items of cost relevant to the proposed Project are all those which would be incurred to convey water in the California Aqueduct (from the Delta to Semitropic Water Storage District's turnouts in Kern County); thence into and through Semitropic WSD's distribution system; thence into Shafter-Wasco ID's distribution system via the proposed Intertie; thence through Shafter-Wasco ID's system to and into the Friant-Kern Canal.

Table 8.1-1 – Annual Benefit (All benefits should be in 2012 dollars) Project: Project 1 - Madera Avenue Intertie									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Discount Factor (1)	Discounted Benefits (1) (h) x (i)
2012	Avoided Water Supply Purchases	acre- feet	0	0	0	0	$0	1.000	**$0**
2013	Avoided Water Supply Purchases	acre- feet	0	0	0	0	$0	0.943	**$0**
2014	Avoided Water Supply Purchases	acre- feet	0	0	0	0	$0	0.890	**$0**
2015	Avoided Water Supply Purchases	acre- feet	0	0	0	0	$0	0.840	**$0**
2016	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.792	**$2,376,000**
2017	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.747	**$2,241,000**
2018	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.705	**$2,115,000**
2019	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.665	**$1,995,000**
2020	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.627	**$1,881,000**
2021	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.592	**$1,776,000**
2022	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.558	**$1,674,000**
2023	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.527	**$1,581,000**
2024	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.497	**$1,491,000**
2025	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.469	**$1,407,000**
2026	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.442	**$1,326,000**
2027	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.417	**$1,251,000**
2028	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.394	**$1,182,000**
2029	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.371	**$1,113,000**
2030	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.350	**$1,050,000**
2031	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.331	**$993,000**
2032	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.312	**$936,000**
2033	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.294	**$882,000**
2034	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.278	**$834,000**
2035	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.262	**$786,000**
2036	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.247	**$741,000**
2037	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.233	**$699,000**
2038	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.220	**$660,000**
2039	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.207	**$621,000**
2040	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.196	**$588,000**
2041	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.185	**$555,000**
2042	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.174	**$522,000**
2043	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.164	**$492,000**
2044	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.155	**$465,000**
2045	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.146	**$438,000**
2046	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.138	**$414,000**
2047	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.130	**$390,000**
2048	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.123	**$369,000**
2049	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.116	**$348,000**
2050	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.109	**$327,000**
2051	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.103	**$309,000**
2052	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.097	**$291,000**
2053	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.092	**$276,000**
2054	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.087	**$261,000**
2055	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.082	**$246,000**
2056	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.077	**$231,000**
2057	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.073	**$219,000**
2058	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.069	**$207,000**
2059	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.065	**$195,000**
2060	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.061	**$183,000**
2061	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.058	**$174,000**
2062	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.054	**$162,000**
2063	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.051	**$153,000**
2064	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.048	**$144,000**
2065	Avoided Water Supply Purchases	acre- feet	0	10,000	10,000	300	$3,000,000	0.046	**$138,000**
Last Year of Project Life								...	
								Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)	**$39,708,000**

Comments: Delivery of Recirculation Water to CVP Contractors can start when the Project is completed in 2016. The last year of Project life is assumed to be 2065. However, the actual Project life will likely extend beyond this date.

(1) Complete these columns if dollar value is being claimed for the benefit.
Based on Table 15, November 2012 PSP

Table 8.1-2 – Annual Costs of Project (All costs should be in 2012 Dollars) Project: Project 1 - Madera Avenue Intertie										
	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost[1]	Annual Costs [2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	1.000	**$ -**
2013	$ 1,049,876	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,049,876	0.943	**$ 990,033**
2014	$ 6,299,253	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,299,253	0.890	**$ 5,606,335**
2015	$ 3,149,627	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,149,627	0.840	**$ 2,645,686**
2016	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.792	**$ 950,400**
2017	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.747	**$ 896,400**
2018	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.705	**$ 846,000**
2019	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.665	**$ 798,000**
2020	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.627	**$ 752,400**
2021	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.592	**$ 710,400**
2022	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.558	**$ 669,600**
2023	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.527	**$ 632,400**
2024	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.497	**$ 596,400**
2025	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.469	**$ 562,800**
2026	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.442	**$ 530,400**
2027	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.417	**$ 500,400**
2028	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.394	**$ 472,800**
2029	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.371	**$ 445,200**
2030	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.350	**$ 420,000**
2031	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.331	**$ 397,200**
2032	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.312	**$ 374,400**
2033	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.294	**$ 352,800**
2034	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.278	**$ 333,600**
2035	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.262	**$ 314,400**
2036	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.247	**$ 296,400**
2037	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.233	**$ 279,600**
2038	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.220	**$ 264,000**
2039	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.207	**$ 248,400**
2040	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.196	**$ 235,200**
2041	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.185	**$ 222,000**
2042	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.174	**$ 208,800**
2043	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.164	**$ 196,800**
2044	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.155	**$ 186,000**
2045	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.146	**$ 175,200**
2046	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.138	**$ 165,600**
2047	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.130	**$ 156,000**
2048	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.123	**$ 147,600**
2049	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.116	**$ 139,200**
2050	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.109	**$ 130,800**
2051	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.103	**$ 123,600**
2052	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.097	**$ 116,400**
2053	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.092	**$ 110,400**
2054	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.087	**$ 104,400**
2055	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.082	**$ 98,400**
2056	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.077	**$ 92,400**
2057	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.073	**$ 87,600**
2058	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.069	**$ 82,800**
2059	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.065	**$ 78,000**
2060	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.061	**$ 73,200**
2061	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.058	**$ 69,600**
2062	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.054	**$ 64,800**
2063	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.051	**$ 61,200**
2064	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.048	**$ 57,600**
2065	$ -	$ -	$ 50,000	$ 1,030,000	$ 120,000	$ -	$ -	$ 1,200,000	0.046	**$ 55,200**
								Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries		**$ 25,125,254**

Comments: It is estimated that 10-percent of the total project cost will be expended in 2013, 60-percent will be expended in 2014, and the remaining 30-percent will be expended in 2015.

(1) If any, based on opportunity costs, sunk costs and associated costs

(2) The incremental change in O&M costs attributable to the project

Based on Table 19, November 2012 PSP

The resulting estimate of total annual costs should be considered to err on the high side and thereby contribute to a conservative estimate of net benefits. In practice, not all water would be delivered into the Friant-Kern Canal; rather, some amount would be delivered directly to demands within Shafter-Wasco ID, in which case the cost of Friant-Kern Canal pumping would not be incurred.

In summary, the total unit cost has been estimated at $120 per acre-foot, which is comprised of the following: (1) $5 per acre-foot for administrative costs; (2) $103 per acre-foot for operating costs; and (3) $12 per acre-foot for maintenance and replacement costs. With the average annual conveyance of 10,000 acre-feet, this implies an estimated total average annual cost of $1.2 million ($120 per acre-foot X 10,000 acre-feet per year), which is exclusive of the Project's capital costs. The annual costs were based on consultation with Paul Oshel, District Engineer with Semitropic WSD; Steve Dalke, General Manager with Kern-Tulare WD; and Jerry Ezell, General Manager with Shafter-Wasco ID. Development of the above-listed unit costs is addressed below by cost category.

Administrative Costs:

The cost to wheel "non-Project water" (i.e., non-SWP water) in the California Aqueduct is the only cost assigned to this category. In this regard, Semitropic WSD has an agreement with the Kern County Water Agency for wheeling non-Project water in the aqueduct between Semitropic and its banking partners, which includes a wheeling fee of $5 per acre-foot.[1] The proposed Project would trigger this same fee since it is based on wheeling CVP water.

Operating Costs:

The most significant Project operating costs are those associated with pumping (i.e., the cost of energy), which would include the California Aqueduct, Semitropic WSD's system, the new pumping plant which is part of the Project improvements, and the Friant-Kern Canal. Two additional costs were included in this category: operation of a pH-adjustment facility and water quality sampling and testing. The total of all operating costs has been estimated at $103 per acre-foot, which is detailed in the discussion that follows.

Wheeling in the California Aqueduct would require pumping at the Dos Amigos Pumping Plant, and the pumping cost is currently estimated at $25.16 per acre-foot. This unit cost was derived from the Kern County Water Agency's 2013 preliminary estimate of the 2013 State Water Project Costs (which is available upon request). Once the water has been delivered to Semitropic's turnout from the California Aqueduct, three separate pumping lifts (all within Semitropic WSD's system) would be required to reach the new Madera Avenue Pumping Plant: 1) the South Pumping Plant (TDH = 45 feet); 2) the B-230 Pumping Plant (maximum TDH = 85 feet); and 3) the B230-B Booster Pumping Plant (maximum TDH = 45 feet).[2] The new Madera Avenue Pumping Plant (maximum TDH = 155 feet) would then be required to

[1] Invoices used to document this wheeling fee are available upon request.
[2] "TDH" = Total Dynamic Head

deliver the Project water to Shafter-Wasco ID demands and/or into the Friant-Kern Canal. Finally, in the worst case, water delivered into the Friant-Kern Canal would require pumping to lift it around one of the canal check structures in order to make direct deliveries to Kern-Tulare WD or Delano-Earlimart ID. The total of all these pumping costs has been estimated at $92 per acre-foot.

With the exception of the cost of pumping at the SWP's Dos Amigos Pumping Plant and pumping within the Friant-Kern Canal, the unit cost of pumping was calculated as follows:

E = L x Le x R

Where,

E = Cost of energy per acre-foot pumped (in $/af)

L = Pumping lift or TDH (in feet)

Le = Energy consumption per foot of pump lift (in kWh/af per foot of pumping lift; use 1.28 for an assumed overall plant efficiency of 80%)

R = Cost of energy (in $/kWh; $0.115/kWh if Semitropic WSD-supplied, and $0.152 if utility-supplied)

<u>South P.P. to the B-230 P.P. (L = 45 feet):</u>
Energy Costs = 45 feet of lift x 1.28 kWh/foot of lift per acre-foot x $0.115/kWh (District power) = $6.62 per acre-foot

<u>B-230 P.P. to the B230-B Booster P.P. (L = 85 feet):</u>
Energy Costs = 85 feet of lift x 1.28 kWh/foot of lift per acre-foot x $0.115/kWh (District power) = $12.51 per acre-foot

<u>B230-B Booster P.P to the Madera Ave P.P. (L = 45 feet)</u>
Energy Costs = 45 feet of lift x 1.28 kWh/foot of lift per acre-foot x $0.152/kWh (PG&E power) = $8.76 per acre-foot

<u>Madera Avenue P.P to Friant-Kern Canal (L = 155 feet)</u>
Energy Costs = 155 feet of lift x 1.28 kWh/foot of lift per acre-foot x $0.152/kWh (PG&E power) = $30.16 per acre-foot

The unit cost of pumping in the Friant-Kern Canal was based on actual experience in 2012. In particular, from March through December 2012, Kern-Tulare WD and Delano-Earlimart ID pumped a total of 29,603 acre-feet at a total cost of $265,557, which implies a unit cost of about $9 per acre-foot.

As previously noted, in addition to pumping costs, two other cost items were included in this category: operation of a pH-adjustment facility and water quality sampling and testing. The pH-adjustment facility is part of the Madera Avenue Pumping Plant and was included in the

project to address water quality concerns. Based on historical cost information for a similar facility currently being operated by Semitropic WSD, the estimated cost to operate the pH-adjustment facility is $10 per acre-foot, with most of that amount attributable to supplementing the sulfuric acid in the system.[3] To address water quality concerns, water samples will be collected and tested relatively frequently. In this regard, the following provided the basis for estimating this cost:

- Assume one water sample is collected during each week of operation and a cost of $300 per sample for water quality testing
- Water Volume (per week) = 50 cfs x 1.98 acre-feet/day per cfs x 7days/ 1week = 693 acre-feet/week
- Water Sampling cost (per acre-foot) = $300/ 693 acre-feet = $0.43 per acre-foot

For purposes of this evaluation of Project costs, the unit cost for water quality sampling and testing was rounded up to $1.00 per acre-foot, with the cost intended to include sampling, testing, and other incidental costs.

Any labor/equipment costs to operate the Project are included as part of the maintenance and replacement costs which are addressed immediately below.

Maintenance and Replacement Costs:

Currently, the Semitropic WSD and Shafter-Wasco ID are operating another intertie and where they have adopted (based on experience) a fee of $6 per acre-foot to fund maintenance and replacement costs. Owing to the larger scope and cost of the proposed Project, this fee has been doubled for purposes of this estimate of costs and would be adjusted as experience is gained during the actual operation of the Project.

Summary of Annual Costs:

Total Average Annual Cost per acre-foot = Administration Cost + Operating Cost + Maintenance/Replacement Cost = $5 per acre-foot + $103 per acre-foot + $12 per acre-foot = $120 per acre-foot.

8.1.3 Project Benefits

Recall from Section 7.1 (in *Attachment 7*) that the proposed Intertie would provide for the recovery and delivery of San Joaquin River Recirculation Water and for the regulation and delivery of CVP-Delta water, which collectively have been estimated to average at least 10,000 acre-feet per year over the long term. Also recall that these are supplies upon which the Region has historically relied, but which are no longer available without additional

[3] A spreadsheet showing the calculation of the operating costs for the pH-adjustment facility at Semitropic WSD's "Delta Plant" is available upon request.

conveyance facilities or without additional regulation. This is the result of environmental restrictions on pumping from the Delta and augmentation of flows in the San Joaquin River below Friant Dam under the San Joaquin River Settlement. In the absence of the proposed Project, scenarios include 1) the purchase of replacement water supplies, or 2) increased reliance on pumped groundwater, with its attendant consequences, which could include lowered groundwater levels, increased power and energy costs, impaired groundwater quality, deficit irrigation and reduced crop yields, crop losses, and permanent loss of agricultural production and the industries that support irrigated agriculture. For the purpose of this evaluation of Project benefits, the first scenario was selected as the without-Project (or no-Project) condition. In particular, benefits were quantified on the basis of avoided replacement water supply purchase costs. On this basis, the present value of Project benefits over a period of 50 years has been estimated to total about $39.7 million. This estimate of benefits is discussed and developed in the subsection which follows. In addition, though not relied upon in the quantification of Project benefits, some discussion related to the second scenario has also been included in subsections which follow.

8.1.3.1 Avoided Water Supply Purchase Costs

This measure of Project benefits is based on purchasing replacement water supplies in an amount equal to the physical Project benefit of 10,000 acre-feet per year on average. The cost to acquire 10,000 acre-feet of annual supply on the open market can be approximated by what other Central Valley water districts have paid for supplies. Recent sales have varied from $225/acre-foot to $655/acre-foot depending on SWP allocations, as provided in Appendix 8.1-1 Water Sales. The most recent water sales have been from Dudley Ridge Water District to Tejon Ranch for $11.7 million for 1,998 acre-feet of SWP Table A water. This equates to a unit annual present worth of about $293/acre-foot plus annual SWP charges of about $100/acre-foot assuming 100 percent SWP allocation, for a total of $393/acre-feet. At 60-percent reliability this cost becomes $655/acre-feet. In another recent sale, the purchasing district, West Kern Water District, paid $100/acre-foot plus the annual SWP costs. During 2010 with an SWP allocation of 50 percent, this amounted to just over $300/acre-foot. If the allocation would have remained at 35-percent of Table A, the cost would have been $385/acre-foot. A third recent sale moved water from Kern Delta Water District to West Kern Water District at $100/acre-foot over SWP fixed costs, which has ranged from $225/acre-foot to $250/acre-foot. Based on the range of water sales and the ability of local growers to pay for water, a water purchase cost of $300/acre-foot was used for purposes of this evaluation. Accordingly, Table 8.1-1 (Annual Benefit) has been completed on the basis of purchasing 10,000 acre-feet per year at a cost of $300 per acre-foot. As shown in this table, the present value of Project benefits over a period of 50 years has been estimated to total about $39.7 million.

8.1.3.2 Avoided Water Shortage Costs

As previously noted, the quantification of Project benefits did not rely on the no-Project scenario wherein increased reliance would be place on the underlying groundwater, the discussion in this section has been included to illustrate the gravity of the problems facing irrigated agriculture in the Poso Creek Region.

Increased reliance on pumped groundwater can be expected to result in groundwater level declines that, at some point, would make it not cost effective to pump groundwater or water quality degrades to the point it impacts crop production, in which case growers will have to fallow crops or not irrigate permanent crops. During 2009, an analysis was done by Kern County Water Agency for Kern County on the value of crop losses due to the drought and reduced pumping from the Delta. The analysis drew from a State-wide analysis by Howitt, MacEwan, and Medellin-Azuara, published in Agricultural and Resources Economics Update, V. 12 No. 3 Jan/Feb 2009, "Economic Impacts of Reductions in Delta Exports on Central Valley Agriculture", by the Giannini Foundation of Agricultural Economics, University of California. Based on the amount of damages occurring due to a predicted 35-percent water supply on the SWP, about $300 million in damages was expected to occur on 88,000 acres not irrigated or under-irrigated, which equates to about $3,400/acre. (Note the final allocation did go up to 40-percent, but late in the season after cropping plans were already in place).

Based on crop water use requirements within the CVP districts that would store water pursuant to this Project, for every 2.5 acre-feet lost, about one acre is at risk. Considering the expected new supply available as a result of the Project (10,000 acre-feet per year), 10,000/2.5 = 4,000 acres would be damaged or under-irrigated if alternative supplies are unavailable. This results in an economic impact of $3,400/acre times 4,000 acres = $13.6 million each dry year, which is equivalent to $4.5 million on an average annual basis. Note that the $3,400/acre value is based on a mix of permanent and row crops, for the most part the districts participating in the storage program are supplying water to predominately permanent crops. If those crops are destroyed as a result of the lack of supply the damage value is closer to $23,000/acre, as defined in Table 15 of Northwest Economics, "Economic Impacts of the 1992 Drought Year", Kern County Water Agency, 1994, Appendix 8.1-2 Economic Impacts of the 1992 Drought Year, resulting in a permanent loss of direct on-farm agricultural value of 4,000 acres times $23,000/acre, for a total of $92 million.

Project costs and benefits are presented in Tables 8.1-1 and 8.1-2"

- Table 8.1-1 Annual Benefit
- Table 8.1-2 Annual Costs of Project

8.1.4 Appendices

- Appendix 8.1-1 Water Sales
- Appendix 8.1-2 Economic Impacts of the 1992 Drought Study

AGREEMENT FOR PURCHASE AND SALE
OF STATE WATER PROJECT WATER

THIS AGREEMENT (Agreement) is executed in duplicate as of July 1, 2010 (Effective Date) by and between TEHACHAPI-CUMMINGS COUNTY WATER DISTRICT, a California county water district (Tehachapi), and WEST KERN WATER DISTRICT, a California county water district (West Kern);

W I T N E S S E T H:

WHEREAS, Tehachapi and West Kern are member units of the KERN COUNTY WATER AGENCY (Agency); and

WHEREAS, Tehachapi desires to sell to West Kern and West Kern desires to purchase from Tehachapi 2,000 acre feet of Tehachapi's State Water Project (SWP) Table 1 water available under its Contracts (Tehachapi Water Supply Contracts) allocated for 2010, 2011 and 2012 under the terms of this Agreement and the Board of Directors of Tehachapi has determined that such water is surplus for use within Tehachapi;

NOW, THEREFORE, IT IS HEREBY AGREED by and between Tehachapi and West Kern as follows:

1. Purpose of Agreement.

This Agreement is for the sale by Tehachapi and purchase by West Kern, through the Agency, of 2,000 acre feet of Tehachapi's SWP allocated Table 1 water available to Tehachapi in 2010 and 2,000 acre feet per year in 2011 and 2012 if the final allocation

made by the State each year (State Allocation) is greater than 35%.

2. Term.

This Agreement shall commence as of the Effective Date and remain in effect through December 31, 2012 and so long thereafter as necessary for each party to perform its obligations under this Agreement.

3. Relationship of Master Contract and Tehachapi Water Supply Contracts.

This Agreement is subject to the obligations and limitations imposed by the Master Contracts (KCWA/ M&I Water Supply Contracts), as amended, and the Tehachapi Water Supply Contracts (Tehachapi /KCWA SWP Contracts), as amended, and is intended to be in conformance and harmony with those contracts.

4. Water Available for Sale.

The water available for sale in 2010 is 2,000 acre feet of Tehachapi's allocated SWP Table 1 water. The water available for sale in 2011 and 2012 will be made available in years wherein the final State Allocation is greater than than 35%. If the water is available, West Kern will purchase 2,000 acre-feet in 2011 and 2012.

5. Point of Delivery.

Tehachapi, at its sole cost and expense, shall deliver all water available for sale to West Kern in Reach 13B of the Aqueduct (Point of Delivery). West Kern, at its sole cost and expense, shall make arrangements for the transportation of the water beyond the Point of Delivery and be responsible for all water losses associated therewith.

6. Scheduling.

The water to be delivered under this agreement to West Kern shall be delivered

prior to the end of the year in which the water is offered, but may be carried over by West Kern into the following year.

7. Payment for Water.

(a) Unit Rate.

West Kern shall pay Tehachapi for each acre foot of water sold under this Agreement a unit rate based on Tehachapi's actual melded (Ag and M&I) annual unit rate of allocated SWP Table 1 water, as determined by the Agency in the year of sale exclusive of (1) interest, penalties, late charges, or similar charges attributable to acts of Tehachapi, (2) Tehachapi's portion of the Ag Trust Fund Distribution and (3) any charges under Article 14 (b)(3) of the Tehachapi Ag Water Supply Contract or Article 13 (b)(3) of the Tehachapi M&I Water Supply Contract (shown on the Agency's statement of charges as "Incremental Variable OMP&R"), plus $100 per acre foot. As an example the Adjusted Unit Rate using the Agency's December 1, 2009 Statement of Charges for Calendar Year 2009 for Tehachapi Ag and M&I entitlement (Exhibit A) is as follows:

Adjusted Annual Obligation less Incremental Variable OMP&R

($1,462,892+$468,179) – ($283,141+81,167) = $1,566,763

Adjusted Table 1 Allocation	(1,720+6,000) = 7,720 AF
Adjusted Unit Rate	$1,566,763/7,720AF = $202.94/AF
Unit Rate:	$202.94AF + 100/AF = $302.94/AF
Example Amount Due:	$302.94/AF * 2,000 AF = $605,880

The same methodology shall be applied for 2010 and followed for 2011 and 2012 to determine the Unit Rate for those years.

(b) Time of Payment.

West Kern shall pay Tehachapi $605,880.00 within 30 days after the Effective Date for the 2,000 acre feet of water to be delivered in 2010, which amount shall be subject to adjustment under paragraph 7(c) hereof. In 2011 Tehachapi shall invoice West Kern for the water anticipated to be delivered in 2011 on the basis of the amount of water determined available by Tehachapi's latest available information from the Agency. Upon receiving the final State Allocation of 2011 Tehachapi shall determine the amount due by West Kern for the water to be delivered in 2011 on the basis of the SWP cost and allocation information available at that time and shall invoice West Kern for the balance due. West Kern shall pay the balance due within 30 days of receipt of such invoice. A like procedure shall be used for the payments due for water to be delivered in 2012.

(c) Adjustment of Price.

In January of 2011 Tehachapi shall recalculate the Adjusted Unit Rate for 2010 on the basis of the latest available information from the Agency and the actual State Allocation for 2010. If the final Adjusted Unit Rate is greater than the initial Adjusted Unit Rate, Tehachapi shall determine the actual payment due from West Kern to Tehachapi for water delivered to West Kern in 2010 and invoice West Kern for the additional amount due. West Kern

shall pay the additional amount due within 30 days after receipt of such invoice. If the final Adjusted Unit Rate is less than the initial Adjusted Unit Rate, Tehachapi shall determine the amount of West Kern's overpayment for water delivered to West Kern in 2010 and pay such amount to West Kern. Tehachapi shall follow a similar procedure to adjust any amounts payable from West Kern to Tehachapi or from Tehachapi to West Kern for water delivered in 2011 and 2012. There shall be no further adjustments irrespective of further adjustments by the State or the Agency, or both, with respect to SWP costs or State allocations.

8. Environmental Compliance.

Tehachapi has adopted a Negative Declaration regarding the sale of SWP water under the terms of this Agreement. West Kern shall act as the lead agency and perform any environmental review it deems appropriate under the California Environmental Quality Act with respect to matters not covered in the Negative Declaration adopted by Tehachapi.

9. Special Indemnity.

Tehachapi shall defend and indemnify West Kern against liability resulting from any action or proceeding instituted and maintained by any water user within the boundaries of Tehachapi seeking redress for any damage allegedly resulting from the sale of SWP water by Tehachapi to West Kern under the terms of this Agreement. West Kern shall defend and indemnify Tehachapi against liability resulting from any action or proceeding instituted and maintained by any water user within the boundaries of West Kern seeking redress for any damage allegedly resulting from the purchase of SWP water by West Kern from

Tehachapi under the terms of this Agreement.

10. General Indemnity.

Each party shall protect, defend, indemnify and hold harmless the other party, its officers, agents , servants, employees, and consultants, from and against any and all losses, claims, liens, demands and causes of action of every kind and character on account of personal injuries or death or damages to property and, without limitation by enumeration, all other claims or demands of every character occurring or in any manner incident to, connected with, or arising directly or indirectly out of the performance or non-performance by the indemnifying party, including actions or omissions related to environmental compliance.

11. Termination.

In the event either party is named as a defendant, respondent, real party in interest, or the like in any action or proceeding related to the transaction(s) contemplated by this Agreement (Named Party), and the Named Party is not held harmless, defended, or indemnified by the other party pursuant to other provisions of this Agreement, the Named Party shall have the option of (1) defending such action or proceeding, or (2) terminating the transaction(s) contemplated by this Agreement, in which event each of the parties will place the other in the same position such party would have been in absent such transaction, or as close thereto as reasonably possible under the circumstances.

12. Approvals.

Tehachapi and West Kern shall cooperate in securing any necessary or appropriate approval which is a condition precedent of either party to perform its obligations under

this Agreement.

13. Written Notice.

Any written notice required to be given by Tehachapi to West Kern shall be deemed given and delivered if (a) delivered personally to West Kern, (b) enclosed in an envelope addressed to West Kern and deposited in the United States mail, postage prepaid, (c) sent by Tehachapi to West Kern by facsimile, or (d) sent by Tehachapi to West Kern by e-mail. Any written notice to be given by West Kern to Tehachapi shall be deemed given and delivered if (a) delivered personally to Tehachapi, (b) enclosed in an envelope addressed to Tehachapi and deposited in the United States mail, postage prepaid, (c) sent to Tehachapi by facsimile, or (d) sent to Tehachapi by e-mail. A written notice by mail shall be deemed received by the addressee three days following the mailing thereof; all other written notices shall be deemed received when delivered or sent. The addresses of Tehachapi and West Kern for the giving of written notice are as follows:

To Tehachapi:	Mailing address: PO Box 326 Tehachapi, CA 93581 Facsimile address (661)-822-5122 E-mail address: jmartin@tccwd.com
To West Kern:	Mailing address: 800 Kern Street P. O. Box 1105 Taft, California 93268 Facsimile address: (661) 765-4271

E-mail address:
harry@wkwd.org

Tehachapi or West Kern, or both, may at any time and from time-to-time, by proper written notice to the other, change its address for the receipt of written notice.

14. Successors and Assigns.

The terms and provisions of this Agreement shall bind and shall inure to the benefit of the successors and assigns of Tehachapi and West Kern.

15. Force Majeure.

Except as otherwise provided in this Agreement, all obligations of Tehachapi and West Kern shall be suspended for so long as and to the extent that the performance thereof shall be prevented by earthquakes, fires, tornadoes, facility failures, floods, drownings, strikes, other casualties or acts of God, orders of court or governmental agencies having jurisdiction of the subject matter or other events or causes beyond the control of Tehachapi and West Kern.

16. Integration.

This Agreement contains the entire agreement between the parties hereto with the respect to the subject of this Agreement and supersedes any other agreement, whether written or oral, between the parties hereto relating to the same subject. Any prior representation, promise, or the like that is not contained in this Agreement shall be of no force or effect.

IN WITNESS WHEREOF, Tehachapi and West Kern have caused this Agreement to be executed as of the Effective Date.

Exhibit A

KERN COUNTY WATER AGENCY
P.O. BOX 58
BAKERSFIELD, CA 93302-0058
PHONE: 661/634-1400 FAX: 661/634-1428

INVOICE DATE	DUE DATE
01-Dec-09	04-Jan-10

INVOICE NO. 21969

DEC 0 9 2009

Tehachapi-Cummings County Water District (M&I)
Post Office Box 326
Tehachapi, CA 93561

DR: 0002-1310
CR: 190B-4209

Statement of Charges
for Calendar Year 2009

Contract Basis for Charges: Article 13 (a)(b) of M&I Basic Contract dated December 16, 1966, Amendment No. 1 thereto dated October 25, 1979, and Amendment No. 2 thereto dated November 14, 1995.

Table 1 Entitlement		15,000 AF		
Basic Obligation [1]			1,218,469	
KWB Delta Water Rate Increase [2]			6,547	
Urban Rate Management			0	
Monterey Amendment Litigation Charge			3,104	
Delta Habitat Conservation & Conveyance Program			98,285	
Unadjusted Annual Obligation				1,326,405
Municipal Water Quality Investigation			16,339	
Incremental Variable OMP&R [3]			283,141	
Incremental Var OMP&R Past Cost Adjustment			0	
Long Term M&I Pool			0	
Undelivered Entitlement:				
Firm Ent Credit	$18.110300	(9,000) AF	(162,993)	
Surplus Ent Credit	$14.005210	0 AF	0	
Adjustments to Annual Obligation				136,486
Adjusted Annual Obligation		6,000 AF		$1,462,892
Less Amount Paid				1,462,635
Amount Due				257

[1] Contract Percentage of	0.012807	times Multiplier of	$95,140,856 .	
[2] Contract Percentage of	0.012807	times KWB Delta Rate increase of		$511,235 .
[3] Reach 16 Delivery of	6,000	AF times Var Rate of	$47.190100 .	

Requested By	Prepared By	Approved By	Approved By
	le	HM	

☐ ORIGINAL ☐ REMITTANCE ☐ FILE ☐ ACCOUNTING ☐ NUMERICAL CONTROL

KERN COUNTY WATER AGENCY
P.O. BOX 58
BAKERSFIELD, CA 93302-0058
PHONE: 661/634-1400 FAX: 661/634-1428

INVOICE DATE	DUE DATE
01-Dec-09	04-Jan-10

INVOICE NO. 21968

Tehachapi-Cummings County Water District (Ag)
Post Office Box 326
Tehachapi, CA 93561

DEC 0 3 2009

DR: 0002-1310
CR: 190B-4209

Statement of Charges
for Calendar Year 2009

Contract Basis for Charges: Article 14 (a)(b) of Agricultural Basic Contract dated December 16, 1966, Amendment No. 1 thereto dated January 10, 1980, and Amendment No. 2 thereto dated November 14, 1995.

Table 1 Entitlement		5,000 AF		
Basic Obligation [1]			407,583	
KWB Delta Water Rate Increase [2]			2,190	
Urban Rate Management			0	
Monterey Amendment Litigation Charge			890	
Delta Habitat Conservation & Conveyance Program			32,877	
Unadjusted Annual Obligation				443,540
Other			0	
Incremental Variable OMP&R [3]			81,167	
Incremental Var OMP&R Past Cost Adjustment			0	
Undelivered Entitlement:				
Firm Ent Credit	$18.110300	(2,580) AF	(46,725)	
Surplus Ent Credit	$14.005210	(700) AF	(9,804)	
Adjustments to Annual Obligation				24,639
Adjusted Annual Obligation		1,720 AF		$468,179
Less Amount Paid				468,095
Amount Due				84

[1] Contract Percentage of	0.004284	times Multiplier of	$95,140,856 .	
[2] Contract Percentage of	0.004284	times KWB Delta Rate increase of		$511,235 .
[3] Reach 16 Delivery of	1,720	AF times Var Rate of	$47.190100 .	

Requested By	Prepared By	Approved By	Approved By
	lc	HM	

☐ ORIGINAL ☐ REMITTANCE ☐ FILE ☐ ACCOUNTING ☐ NUMERICAL CONTROL

TEHACHAPI-CUMMINGS
COUNTY WATER DISTRICT

Harry Cowan, President

John Martin, Secretary

WEST KERN WATER DISTRICT

President

Secretary

AGREEMENT FOR PURCHASE AND SALE
OF STATE WATER PROJECT WATER

THIS AGREEMENT (Agreement) is executed in duplicate as of July 17, 2009 (Effective Date) by and between KERN DELTA WATER DISTRICT, a California water district (Kern Delta), and WEST KERN WATER DISTRICT, a California county water district (West Kern);

W I T N E S S E T H:

WHEREAS, Kern Delta and West Kern are member units of the KERN COUNTY WATER AGENCY (Agency); and

WHEREAS, Kern Delta desires to sell to West Kern and West Kern desires to purchase from Kern Delta 2,000 acre feet of Kern Delta's State Water Project (SWP) Table 1 water allocated for 2009, 2010 and 2011 under the terms of this Agreement and the Board of Directors of Kern Delta has determined that such water is not necessary for use within Kern Delta;

NOW, THEREFORE, IT IS HEREBY AGREED by and between Kern Delta and West Kern as follows:

1. Purpose of Agreement.

This Agreement is for the sale by Kern Delta and purchase by West Kern, through the Agency, of 2,000 acre feet of Kern Delta's SWP allocated Table 1 water available to Kern Delta in 2009, 2010 and 2011 if (a) the allocation made by the State as of March 15 of each

year (State Allocation) is less than 50%, (b) all other conditions are in Kern Delta's Negative Declaration are met, (c) the Kern Delta Board of Directors declares this water surplus to the District's needs, and (d) there are no material impediments to such, as determined in Kern Delta's sole discretion.

2. Term.

This Agreement shall commence as of the Effective Date and remain in effect through December 31, 2011 and so long thereafter as necessary for each party to perform its obligations under this Agreement.

3. Relationship of Master Contract and Kern Delta Water Supply Contract.

This Agreement is subject to the obligations and limitations imposed by the Master Contract (KCWA/State SWP Contract), as amended, and the Kern Delta Water Supply Contract (Kern Delta/KCWA SWP Contract), as amended, and is intended to be in conformance and harmony with those contracts.

4. Water Available for Sale.

The water available for sale in 2009 is 2,000 acre feet of Kern Delta's allocated SWP Table 1 water. The water available for sale in 2010 and 2011 is the first 2,000 acre feet of Kern Delta's allocated SWP Table 1 water if (a) the applicable State Allocation is less than 50%, (b) all other conditions in Kern Delta's Negative Declaration are met, (c) the Kern Delta Board of Directors declares this water surplus to the District's needs, and (d) there are no material impediments to such, as determined in Kern Delta's sole discretion. If Kern Delta's allocated SWP Table 1 water is less than 2,000 acre feet, the amount of water available for sale will be the amount allocated to Kern Delta. Kern Delta's allocated SWP

Table 1 water may be replaced with other Kern Delta supplies if and when environmental review is completed by Kern Delta, and to the extent Kern Delta has such supplies available, provided, however, that such replacement supply shall not place West Kern in a position worse than it otherwise would be in, absent such replacement supply.

5. Point of Delivery.

Kern Delta, at its sole cost and expense, shall deliver all water available for sale to West Kern in the Kern River Canal at the juncture of the Kern River Canal and the Buena Vista Canal (Point of Delivery) without losses if delivered between March 15 and August 15 of the year of sale. West Kern, at its sole cost and expense, shall make arrangements for the transportation of the water beyond the Point of Delivery and be responsible for all water losses associated therewith.

6. Scheduling.

The water to be delivered to West Kern in 2009 shall be delivered prior to August 15, 2009 if possible. West Kern shall submit to Kern Delta an initial monthly delivery schedule for 2010 on or before December 15, 2009 and a like schedule for 2011 on or before December 15, 2010. The delivery schedules shall provide for deliveries between March 15 and August 15 of each year and are subject to Kern Delta's approval. The initial schedules may be adjusted by West Kern with Kern Delta's consent based on its actual delivery requirements for the year. If West Kern requests that the water be delivered outside of March 15 through August 15, West Kern shall be responsible for all costs, expenses, and losses associated with such delivery.

7. Payment for Water.

(a) Unit Rate.

West Kern shall pay Kern Delta for each acre foot of water sold under this Agreement a unit rate based on Kern Delta's actual annual unit rate of allocated SWP Table 1 water, as determined by the Agency in the year of sale exclusive of interest, penalties, late charges, or similar charges attributable to acts of Kern Delta and exclusive of Kern Delta's portion of the Ag Trust Fund Distribution (Adjusted Unit Rate), plus $100 per acre foot. The Adjusted Unit Rate and the amount due for 2009 using the Agency's June 1, 2009 Statement of Charges for Calendar Year 2009 for Kern Delta (Exhibit A) is as follows:

Adjusted Annual Obligation	$1,532,617
Adjusted Table 1 Allocation	10,200 AF
Adjusted Unit Rate	$1,532,617/10,200 AF = $150.26/AF
Unit Rate:	$150.26 AF + 100/AF = $250.26/AF
Amount Due:	$250.26/AF * 2,000 AF = $500,520

The same methodology shall be followed for 2010 and 2011 to determine the Unit Rate for those years.

(b) Time of Payment.

West Kern shall pay Kern Delta $500,520.00 within 30 days after the Effective Date for the 2,000 acre feet of water to be delivered in 2009, which amount shall be subject to adjustment under paragraph 7(c) hereof. In

January of 2010 Kern Delta shall invoice West Kern for the water anticipated to be delivered in 2010 on the basis of the latest available information from the Agency and assuming a State Allocation in 2010 of 50%. One-half of such billing shall be paid by West Kern within 30 days of receipt of such invoice. In June of 2010 Kern Delta shall determine the balance due by West Kern for the water to be delivered in 2010 on the basis of the SWP cost and allocation information available at that time and shall invoice West Kern for the balance due. West Kern shall pay the balance due within 30 days of receipt of such invoice. A like procedure shall be used for the payments due for water to be delivered in 2011.

(c) Adjustment of Price.

In January of 2010 Kern Delta shall recalculate the Adjusted Unit Rate for 2009 on the basis of the latest available information from the Agency and the actual State Allocation for 2009. If the final Adjusted Unit Rate is greater than the initial Adjusted Unit Rate, Kern Delta shall determine the actual payment due from West Kern to Kern Delta for water delivered to West Kern in 2009 and invoice West Kern for the additional amount due. West Kern shall pay the additional amount due within 30 days after receipt of such invoice. If the final Adjusted Unit Rate is less than the initial Adjusted Unit Rate, Kern Delta shall determine the amount of West Kern's overpayment for water delivered to West Kern in 2009 and pay such amount to West Kern. Kern Delta shall follow a similar procedure to adjust any amounts payable

from West Kern to Kern Delta or from Kern Delta to West Kern for water delivered in 2010 and 2011. There shall be no further adjustments irrespective of further adjustments by the State or the Agency, or both, with respect to SWP costs or State allocations.

8. Environmental Compliance.

Kern Delta has adopted a Negative Declaration regarding the sale of SWP water under the terms of this Agreement. West Kern shall act as the lead agency and perform any environmental review it deems appropriate under the California Environmental Quality Act with respect to matters not covered in the Negative Declaration adopted by Kern Delta.

9. Special Indemnity.

Kern Delta shall defend and indemnify West Kern against liability resulting from any action or proceeding instituted and maintained by any water user within the boundaries of Kern Delta seeking redress for any damage allegedly resulting from the sale of SWP water by Kern Delta to West Kern under the terms of this Agreement. West Kern shall defend and indemnify Kern Delta against liability resulting from any action or proceeding instituted and maintained by any water user within the boundaries of West Kern seeking redress for any damage allegedly resulting from the purchase of SWP water by West Kern from Kern Delta under the terms of this Agreement.

10. General Indemnity.

Each party shall protect, defend, indemnify and hold harmless the other party, its officers, agents , servants, employees, and consultants, from and against any and all losses, claims, liens, demands and causes of action of every kind and character on account of

personal injuries or death or damages to property and, without limitation by enumeration, all other claims or demands of every character occurring or in any manner incident to, connected with, or arising directly or indirectly out of the performance or non-performance by the indemnifying party, including actions or omissions related to environmental compliance.

11. Termination.

In the event either party is named as a defendant, respondent, real party in interest, or the like in any action or proceeding related to the transaction(s) contemplated by this Agreement (Named Party), and the Named Party is not held harmless, defended, or indemnified by the other party pursuant to other provisions of this Agreement, the Named Party shall have the option of (1) defending such action or proceeding, or (2) terminating the transaction(s) contemplated by this Agreement, in which event each of the parties will place the other in the same position such party would have been in absent such transaction, or as close thereto as reasonably possible under the circumstances.

12. Approvals.

Kern Delta and West Kern shall cooperate in securing any necessary or appropriate approval which is a condition precedent of either party to perform its obligations under this Agreement.

13. Written Notice.

Any written notice required to be given by Kern Delta to West Kern shall be deemed given and delivered if (a) delivered personally to West Kern, (b) enclosed in an envelope addressed to West Kern and deposited in the United States mail, postage prepaid, (c) sent

by Kern Delta to West Kern by facsimile, or (d) sent by Kern Delta to West Kern by e-mail. Any written notice to be given by West Kern to Kern Delta shall be deemed given and delivered if (a) delivered personally to Kern Delta,(b) enclosed in an envelope addressed to Kern Delta and deposited in the United States mail, postage prepaid, (c) sent to Kern Delta by facsimile, or (d) sent to Kern Delta by e-mail. A written notice by mail shall be deemed received by the addressee three days following the mailing thereof; all other written notices shall be deemed received when delivered or sent. The addresses of Kern Delta and West Kern for the giving of written notice are as follows:

To Kern Delta:	Mailing address: 501 Taft Highway Bakersfield, California 93307 Facsimile address: (661)-836-1705 E-mail address: mulkay@kerndelta.org
To West Kern:	Mailing address: 800 Kern Street P. O. Box 1105 Taft, California 93268 Facsimile address: (661) 765-4271 E-mail address: jerry@wkwd.org

Kern Delta or West Kern, or both, may at any time and from time-to-time, by proper written notice to the other, change its address for the receipt of written notice.

14. Successors and Assigns.

The terms and provisions of this Agreement shall bind and shall inure to the benefit of the successors and assigns of Kern Delta and West Kern.

15. Force Majeure.

Except as otherwise provided in this Agreement, all obligations of Kern Delta and West Kern shall be suspended for so long as and to the extent that the performance thereof shall be prevented by earthquakes, fires, tornadoes, facility failures, floods, drownings, strikes, other casualties or acts of God, orders of court or governmental agencies having jurisdiction of the subject matter or other events or causes beyond the control of Kern Delta and West Kern.

16. Integration.

This Agreement contains the entire agreement between the parties hereto with the respect to the subject of this Agreement and supersedes any other agreement, whether written or oral, between the parties hereto relating to the same subject. Any prior representation, promise, or the like that is not contained in this Agreement shall be of no force or effect.

IN WITNESS WHEREOF, Kern Delta and West Kern have caused this Agreement to be executed as of the Effective Date.

KERN DELTA WATER DISTRICT

By

WEST KERN WATER DISTRICT

By

RN COUNTY WATER AGEN Y
O. BOX 58
BAKERSFIELD, CA 93302-0058
PHONE: 661/634-1400 FAX: 661/634-1428

INVOICE DATE	DUE DATE
01-Jun-09	01-Jul-09

INVOICE NO. 21160

Exhibit A

Kern Delta Water District
Post Office Box 49216
Bakersfield, CA 93382

DR: 0002-1310
CR: 190B-4209

Statement of Charges
for Calendar Year 2009

Contract Basis for Charges: Article 14 (a)(b) of Basic Contract dated October 26, 1972, Amendment No. 1 thereto dated December 13, 1979, and Amendment No. 2 thereto dated November 14, 1995.

Table 1 Entitlement		30,000 AF		
Basic Obligation [1]			1,720,001	
KWB Delta Water Rate Increase [2]			9,219	
Urban Rate Management			0	
Monterey Amendment Litigation Charge			5,276	
Delta Habitat Conservation & Conveyance Program			138,391	
Unadjusted Annual Obligation				1,872,887
Other			0	
Incremental Variable OMP&R			0	
Incremental Var OMP&R Past Cost Adjustment			0	
Undelivered Entitlement:				
Firm Ent Credit	$18.110300	(15,300) AF	(277,088)	
Surplus Ent Credit	$14.040519	(4,500) AF	(63,182)	
Adjustments to Annual Obligation				(340,270)
Adjusted Annual Obligation		10,200 AF		$1,532,617
Less Amount Paid				923,562
Amount Due				609,056

[1] Contract Percentage of 0.018033 times Multiplier of $95,380,721 .
[2] Contract Percentage of 0.018033 times KWB Delta Rate increase of $511,235 .

Requested By | Prepared By | Approved By | Approved By

☐ ORIGINAL ☐ REMITTANCE ☐ FILE ☐ ACCOUNTING ☐ NUMERICAL CONTROL

Kings farmers set to sell $11.7M in water rights
Hanford Sentinel-11/9/10
By Seth Nidever

In the threatened world of Westside agriculture, two more farmers have decided to sell water rights to urban development interests in Southern California.

The deal would send 1,998 acre-feet of water from two Kings County growers to Tejon Ranch Co. for $5,850 per acre-foot, or $11.7 million. The water would likely be used for urban development Tejon Ranch Co. has planned along Interstate 5 south of Bakersfield.

An acre-foot of water is the amount of water that would cover an acre of land to a depth of one foot. The average family uses about an acre-foot of water per year.

Both growers are in the Dudley Ridge Water District, located in remote western Kings County. The district's board of directors will consider the proposed sale at their next meeting on Dec. 8 at the office of Provost & Pritchard Consulting Group in Fresno, said Rick Besecker, district treasurer.

The sellers are 3R Land and Development and Don Jackson, Besecker said. Jackson and an official from 3R did not return phone calls seeking comment.

Other district growers have the right of first refusal on the sale, meaning one or more of them could match Tejon's offer and keep the water in the district. More than 80 percent of the district's irrigated acreage is owned by Paramount Farms and Sandridge Partners. The sale is expected to go through without objection, Besecker said.

Sandridge, a Bay Area company, made news last year for selling $73 million in permanent water rights from the district to the Mojave Water Agency in Southern California.

That was followed later in the year by another grower, Steve Jackson, selling 884 acres of land and its $14.3 million in water rights to the Irvine Ranch Water District, also in Southern California.

Steve Jackson is Don Jackson's son.

The dynamics of Westside water haven't changed much, Jackson said. Environmental problems in the Sacramento-San Joaquin River Delta are limiting flows to Kings and Fresno counties, not to mention cities that also count on the deliveries. Some of the limitations are designed to protect the delta smelt, a small endangered fish biologists consider to be a key indicator of the overall health of the delta.

Environmentalists believe that siphoning too much water out of the delta is the main problem. Farmers and some cities who depend on those supplies suggest that other issues, such as contaminated runoff from delta-area cities, are more relevant.

Jackson isn't betting that flows will increase under new Gov. Jerry Brown, but he's reserving judgment until Brown takes over in January.

Even with last year's above-average snowpack, Jackson only got 50 percent of his historic water contract delivered.

"We don't see much hope of going back to [the levels] we had pre-delta smelt," Jackson said.#

http://www.hanfordsentinel.com/news/local/article_525bf8c8-ec31-11df-93ac-001cc4c002e0.html

Economic Impacts of the 1992 Drought Year

An Analysis of Economic Costs in Kern County

Prepared for

Kern County Water Agency
3200 Rio Mirada Drive
Bakersfield, CA 93302

Prepared by

Northwest Economic Associates
13101 N.E. Highway 99
Vancouver, WA 98686-2786

Draft: October 1993
Final: December 1994

Table of Contents

OVERVIEW AND HIGHLIGHTS 1

Background 1

Study Highlights 3

Organization of the Report 7

KERN COUNTY AGRICULTURE 8

Irrigated Crop Acreage 8

Value of Production 12

Water District Organization 13

IRRIGATION WATER SUPPLY AND UTILIZATION FOR 1992 15

Available Irrigation Surface Water Supplies 15
State Water Project Deliveries 15
Other Surface Water Supplies to KCWA Member Districts 17
Total Surface Water Supplies to KCWA Member Districts 17
Surface Water Deliveries to Non-Member Districts 18
Total Surface Water Supplies Available for Irrigation 20

Irrigation Water Demand 21
Applied Water Requirements 22

Estimated Groundwater Pumping 24

DROUGHT-RELATED ACREAGE IMPACTS 26

Farm-Level Adjustments to Water Shortage 26

Drought Related Acreage Reductions 27
Acreage with Drought-Related Yield Reductions 28

Table of Contents, continued

Farm-Level Economic Losses Related to Acreage Impacts 29
Economic Losses to Related Industries 30

Permanently Abandoned Crop Acreage 31

DROUGHT-RELATED INCREASES IN 1992 WATER COSTS 33

1992 Surface Water Costs 33
Water Costs for KCWA Member Districts 34
SWP Entitlement Deliveries 34
Westside Water Districts 36
Groundwater Districts 36
Other Imported Water Supplies 36
Kern River Deliveries 36
Water Costs for Non-Member Districts 37

1992 Groundwater Costs 37
Groundwater Substitution 38
Groundwater Drawdown 39
Additional Groundwater Costs 40

Summary of Increased Water Costs 40
The Economic Impacts of Increased Water Costs 40

A SUMMARY OF TOTAL ECONOMIC LOSSES RELATED TO THE 1992 DROUGHT 42

Measured Economic Losses 42
On-Farm Economic Losses 42
County-Wide Economic Losses 44

Long-Term Issues Raised by the Drought 44

APPENDIX A: 1992 KERN COUNTY CROP ACREAGE IMPACTED BY THE DROUGHT 46

Overview and Highlights

Background

California's six year hydrologic drought, extending from 1987 through 1992, formally ended in 1993 when heavy rains early in the year pushed measured snow-pack and subsequent run-off to pre-drought levels. Although 1993 was officially recorded as a wet year, low rainfall and snowpack levels in 1994 again saw the return of critical shortages in surface water supplies.

Agricultural producers in California's San Joaquin Valley are dependent on surface water for nearly 75% of their crop water requirements. Local surface water supplies account for 35% of water use while imported supplies account for an additional 40%;. groundwater makes up the remaining water requirements. Imported surface water supplies are delivered primarily to the valley's westside via the federal Central Valley Project and California's State Water Project. Normal deliveries from these projects to agricultural growers in the San Joaquin Valley average 5.9 million acre-feet annually. During the recent drought however, significant reductions occurred in delivered water supplies, resulting in considerable economic hardship for many farmers throughout the valley.[1]

Growers in Kern County take deliveries of both imported and local surface water supplies for irrigated production. During normal water years surface water accounts for approximately two-thirds of agricultural water requirements with imported water accounting for the largest share of this use. Drought-related restrictions in project water deliveries in 1990, 1991, and

[1] / The economic impacts of the 1991 and 1992 California droughts on San Joaquin Valley agriculture are presented in the following reports prepared by Northwest Economic Associates: *Economic Impacts of the 1991 California Drought on San Joaquin Valley Agriculture and Related Industries*; and *Economic Impacts of the 1992 California Drought and Regulatory Reductions on the San Joaquin Valley Agriculture Industry.*

1992 and reduced availability of local surface water have resulted in farm income losses for most growers in the county.

The most significant reductions in available water supplies have occurred on the state water system. The Kern County Water Agency is the largest agricultural water contractor to the State Water Project, with an annual firm water supply entitlement of 1,130,000 acre-feet (AF). The largest share of this, nearly 90%, is accounted for by agricultural water while the remaining represents municipal contracts. In 1992, water deliveries to agricultural contractors on the State Water Project were restricted for the third consecutive year. Deliveries of only 45% of entitlement in 1992 were preceded by a 100% shortage in 1991 and a 50% shortage in 1990. Agricultural member units of the Kern County Water Agency received a 1992 entitlement of only 334,200 AF compared to a contracted full firm entitlement of 1,015,000 acre-feet.

The accumulated results of limited water supplies and higher water costs have led to some restructuring of Kern County agriculture. Permanent crop acreage has declined somewhat since 1989, with most of the reduction occurring in the KCWA westside service area. Land values have also declined in many parts of the county, reflecting the increased uncertainty of imported surface water supplies.

Irrigation water districts in Kern County have likewise seen significant changes in response to the extended period of drought. Fiscal reserves built up over the past twenty-five years have been depleted in many districts, increasing the financial risk faced by growers in an era of uncertain water supplies and increasing water costs. In some cases, water districts have begun significant investments in a dual water system designed to increase groundwater pumping capacities to meet district water demands.

This report documents the economic impacts of the 1992 drought on agricultural producers in Kern County. The effects of limited water supplies on planted acreage are examined as are the cost impacts associated with the acquisition of alternative water supplies. Economic impacts are measured in terms of income and job losses incurred both on the farm and throughout the county.

Study Highlights

Kern County Crop Production

- Kern County irrigated crop acreage for 1992 was 762,500 acres, ranking the county third among the eight San Joaquin Valley counties for land in irrigated production. About two-thirds of the acreage was planted in annual crops, while the remaining one-third was utilized for permanent crops (grapes, tree nuts, and tree fruits).

- 1992 Kern County crop production was valued at $1.6 billion and accounted for 21% of total value of crop production for the eight county San Joaquin Valley region, and nearly 12% of California's $13.5 billion crop production industry

Shortages in Surface Water Supplies

- Surface water supplies available for Kern County agriculture in 1992 amounted to just over 890,000 acre-feet. This is considerably less than the 2.2 million acre-feet of surface water available under normal supply conditions.

- Limited surface water deliveries were received from all Kern County water sources: i) deliveries from the State Water Project were 45% of full entitlement, ii) deliveries on the federal Central Valley Project were 75% of Class I entitlements, and iii) local Kern River supplies were only 49% of normal.

Grower's Response to Water Shortage

- The economic impacts of the 1992 drought in Kern County agriculture have been primarily two-fold: 1) a decline in gross crop revenues and net farm income caused by acreage idled because of insufficient water supplies, and 2) an increase in water costs resulting from higher average unit rates on the state project, higher costs associated with water purchased to replace the state supplies unavailable for delivery, and increased groundwater pumping.

Drought-Related Reductions in Planted Crop Acreage

- According to Kern County growers and water district managers, 44,600 acres of irrigated cropland were not planted in 1992 as a results of the drought-related reductions in water supply. All but 700 acres of the reduction occurred in the westside service area of the KCWA. The acreage not planted was predominantly cotton but also included vegetables, grains, and alfalfa hay.

- An additional 18,200 acres of cotton and alfalfa hay placed into production suffered yield losses of 20% as a result of reduced water applications. All of this Acreage was located in the westside service area of the KCWA.

Some Crop Acreage Permanently Abandoned

- Since 1990, 14,500 acres of productive Kern County cropland has been permanently abandoned as a result of increasing uncertainty regarding available water supplies and the high costs associated with available supplies. The permanently idled land includes 10,500 acres of perennial orchards and vineyards and 4,000 acres of vegetables and alfalfa hay.

- The permanently idled acreage includes 1,200 acres of vegetables and 4,800 acres of perennial crops abandoned in 1992. This acreage is in addition to the 44,600 acres of cropland temporarily idled as a result of the drought.

Economic Losses Related to Acreage Reductions

- When productive acreage is fallowed or suffers yield declines, losses in crop revenues, farm income, and farm employment result. It is estimated that the 50,600 acres not planted or abandoned in 1992 along with the yield losses on an additional 18,200 acres led to a direct on-farm loss of $66.5 million in crop revenues including an income loss of $27.5 million and a reduction of 800 farm jobs.

- Additional losses occurred throughout the Kern County economy as a consequence of the economic linkages between agriculture and other manufacturing, trade, and service industries in the region. The total economic losses related to idled cropland were comprised of county-wide revenue losses of $133.4 million, including income losses of $57.2 million. Approximately 2,000 jobs were lost including the 800 on-farm jobs.

- The 10,500 acres of cropland permanently idled as a result of the drought will sustain economic losses into the future. It is estimated that the present value of crop revenues lost over the remaining life of the abandoned perennial orchards is $240 million while the present value of lost annual crop revenues is estimated to be $150 million. The abandoned revenue streams include future farm income losses of almost $102 million.

Growers Shifted to Groundwater Utilization Where Possible

- Growers with access to groundwater resources significantly increased their utilization of this water source in 1992 in order to compensate for critical reductions in surface water deliveries. It is estimated that groundwater pumping for irrigation purposes increased to over 1.5 million acre-feet, more than doubling normal pumping levels of about 740,000 acre-feet.

- The most significant increases in groundwater use was accounted for by growers within the service areas of the KCWA were usage increased from normal levels of about 200,000 acre-feet to estimated withdrawals of about 900,000 acre-feet, an increase of 450%.

Significant Increases in Water Costs

- Growers utilizing additional groundwater in 1992 were able to avoid acreage reductions but incurred significantly higher water costs. It is estimated that the increased costs related to additional groundwater pumping in 1992 were $47.3 million, based on increased withdrawals of 776,000 acre-feet. These increased water costs can be viewed as a direct decline in grower income.

- Additional groundwater costs were incurred by all pumpers as a result of the accelerated drawdown of the groundwater basin. Increased pumping during the drought caused the depth to water to increase more rapidly for all growers, resulting in increased pumping costs for each acre-foot withdrawn from the basin. It is estimated that the increased costs associated with accelerated drawdown amounted to $1.1 million in 1992.

- Costs for available surface water supplies also increased significantly as a result of the drought. In the KCWA westside service areas (without access to groundwater) many growers were able to replace water supplies normally received with more expensive water resources. Costs for these additional supplies averaged $86 per acre-foot but ranged to over $200 per acre-foot.

- The effective costs for actual deliveries of imported project water also increased in 1992. Although full entitlement deliveries were not made, KCWA districts receiving state project water were required to cover their full fixed cost obligation. This caused the average unit rates for water actually received to be substantially greater than average rates under full entitlement. Average district water costs increased from $40 per acre-foot to $76 per acre-foot.

- It is estimated that the costs for surface water actually delivered to Kern County growers increased by $25.3 million in 1992. Most of these costs were incurred by growers in the KCWA westside service areas.

Total Economic Costs Related to the 1992 Drought

- Kern County crop revenues declined by $66.5 million in 1992 as a result of drought-related reductions in planted acreage and crop yields. This included a $27.5 million in farm income and an associated loss of 800 farm jobs. The drought-related increases in surface and groundwater costs led to additional farm income losses of $73.7 million, resulting in total farm income losses of $101.2 million.

- Average county-wide income losses were nearly $130 per planted acre in 1992. However, in the KCWA service area average income losses in the westside water districts were nearly $300 per acre while losses in the groundwater districts were approximately $150 per acre.

- Kern County agricultural support industries also saw a decline in 1992 business revenues and earned income as a result of the drought. It is estimated that $254 million in county-wide revenues, including on-farm revenues, were lost. Approximately $133 million of this loss was related to idled crop acreage while the remaining $121 million decline in revenues can be linked to the reduction in farm income caused by increased water costs.

- The reduction in county-wide revenues also includes a $191 million income loss including wages and salaries and returns to business ownership and management for agriculture and its support industries. Most of the income losses were tied to the effects of the drought on farm-level water costs. Over $134 million of the income losses were related to water costs while the remaining $57 million was linked to idled crop acreage.

- It is estimated that the combined impacts of the drought on water costs and planted crop acreage led to a decline of 4,900 Kern County jobs, including 800 on-farm jobs.

Long-Term Effects of the Drought

- As environmental needs place increasing demands on limited water supplies, Kern County growers are likely to face a future of permanent water shortages. Farm-level adjustments made during the recent drought provide important insights into the potential impacts of these long-term shortages on irrigated agriculture.

- The extended period of drought focused attention on those regions within the KCWA service area which are most vulnerable to drought. Growers without access to groundwater and with only limited access to affordable alternative water supplies were most adversely impact by shortage. Implementation of permanent project water supply reductions which take into account the localized effects of shortage will help to minimize the overall costs of meeting the expanded water requirements for protecting environmental resources.

- During the drought growers overlying the groundwater basin indicated that they completely offset reduced surface water deliveries through increased groundwater pumping. As permanent water shortages are put into place, questions regarding long-term groundwater management may need to be evaluated . The extent to which the new pattern of drawdown and recharge will be sustainable over the long-run must be determined.

- Empirical evidence from the drought has also shown that the availability of affordable water transfers can mitigate the impacts of water shortages. In areas without alternative water supplies, water transfers provide the only opportunity to maintain production on lands that otherwise would be fallowed.

Organization of the Report

The economic impacts measured for both the surface water and groundwater areas of Kern County are presented in the sections that follow. First, a brief discussion of county-wide agricultural production in 1992 is presented. This is followed by a presentation of irrigation water supply and utilization for 3 major water district groupings (based on primary water source). The next two sections document the economic costs of the drought in Kern County including the effects on planted acreage and irrigation water costs. A discussion of the long-term impacts of the drought is also presented.

Kern County Agriculture

Irrigated Crop Acreage

Kern County's irrigated crop acreage for 1992 was estimated at 762,500 acres, about 15% of the total crop acreage for the San Joaquin Valley, and nearly 11% of California's total crop acreage. Among San Joaquin Valley counties, Kern was ranked third in total irrigated crop acreage; Fresno and Tulare counties were ranked first and second, respectively (see Table 1).

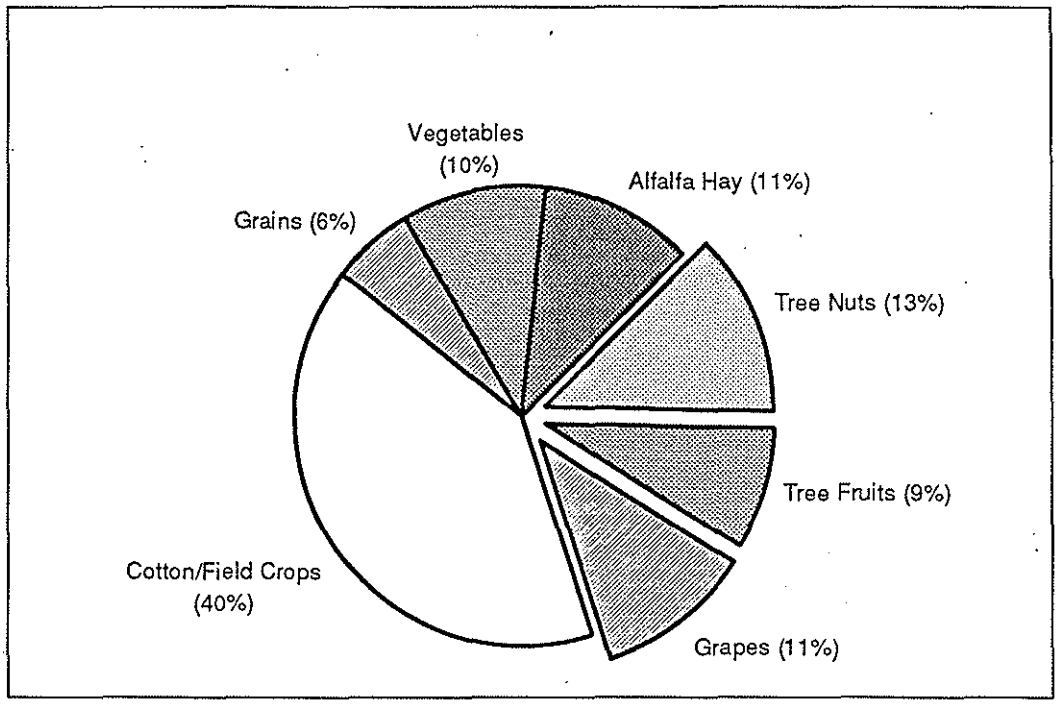
Table 1
1992 San Joaquin Valley Crop Acreage

San Joaquin Valley County	Crop Acreage
Fresno	1,151,670
Tulare	780,976
Kern	**762,506**
Merced	546,043
Kings	534,113
San Joaquin	486,430
Stanislaus	455,650
Madera	336,710

Source: *1992 County Agricultural Commissioners Reports and Kern County Water Agency*

The largest portion (40%) of Kern County crop acreage was devoted to cotton and field crops. The remainder was fairly evenly distributed among crop types, as shown in Figure 1. About two thirds of the acreage was planted in annual crops, while the remaining third was utilized for permanent crops (grapes, tree nuts, and tree fruits).

Figure 1
Distribution of 1992 Kern County Acreage



Source: *Kern County Water Agency*

Total permanent crop acreage in Kern County has remained fairly constant since 1986. However, the composition of the acreage has shifted over time. Grape and almond plantings declined by 18,000 acres between 1986 and 1990 while pistachio and citrus acreage increased by nearly 15,000 acres. Recent trends in permanent crop acreage are presented in Table 2 and Figure 2.

Annual crop acreage in Kern County has shown more variation than permanent crop acreage in recent years, due in large part to drought-related reductions in available water supplies (see Table 3 and Figure 3).

Table 2
Kern County Permanent Crop Acreage, 1986-1993

	Tree Nuts	Tree Fruits	Grapes/Vines	Permanent Crop Total
1986	104,600	50,900	92,400	247,900
1987	103,200	52,800	90,700	246,700
1988	104,800	55,000	90,300	250,100
1989	103,700	56,900	87,400	248,000
1990	104,600	60,000	89,300	253,900
1991	103,100	63,900	85,400	252,400
1992	98,700	65,300	85,700	249,700
1993	99,900	62,800	84,300	247,000

Source: *Kern County Water Agency*

Figure 2
Kern County Permanent Crop Acreage, 1986-1993

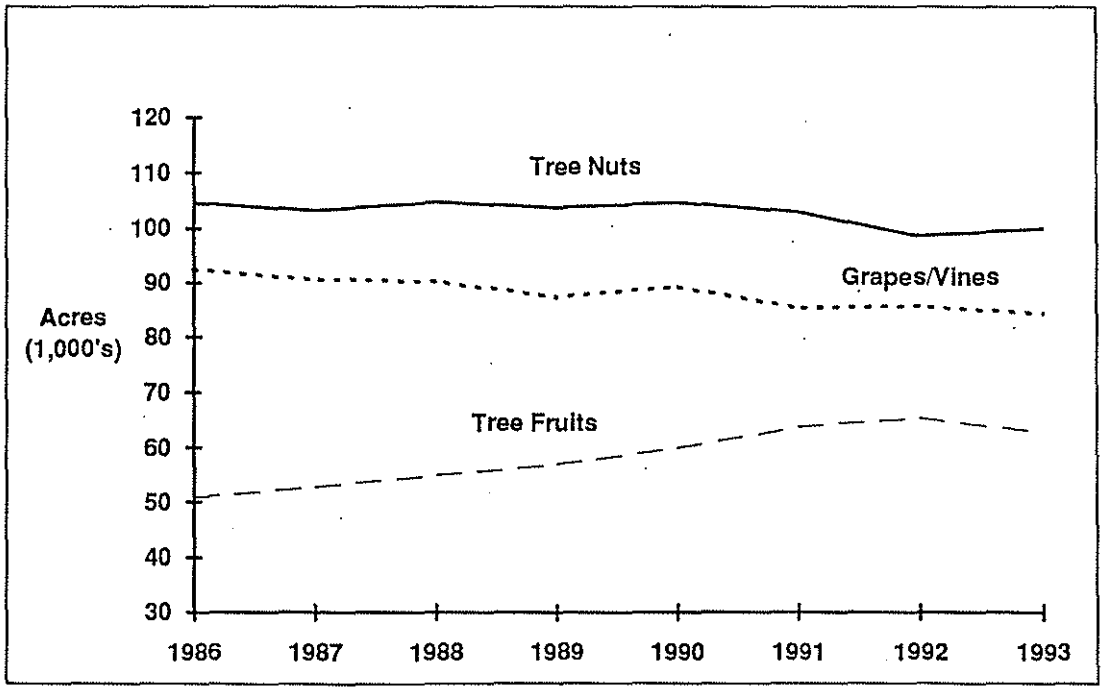
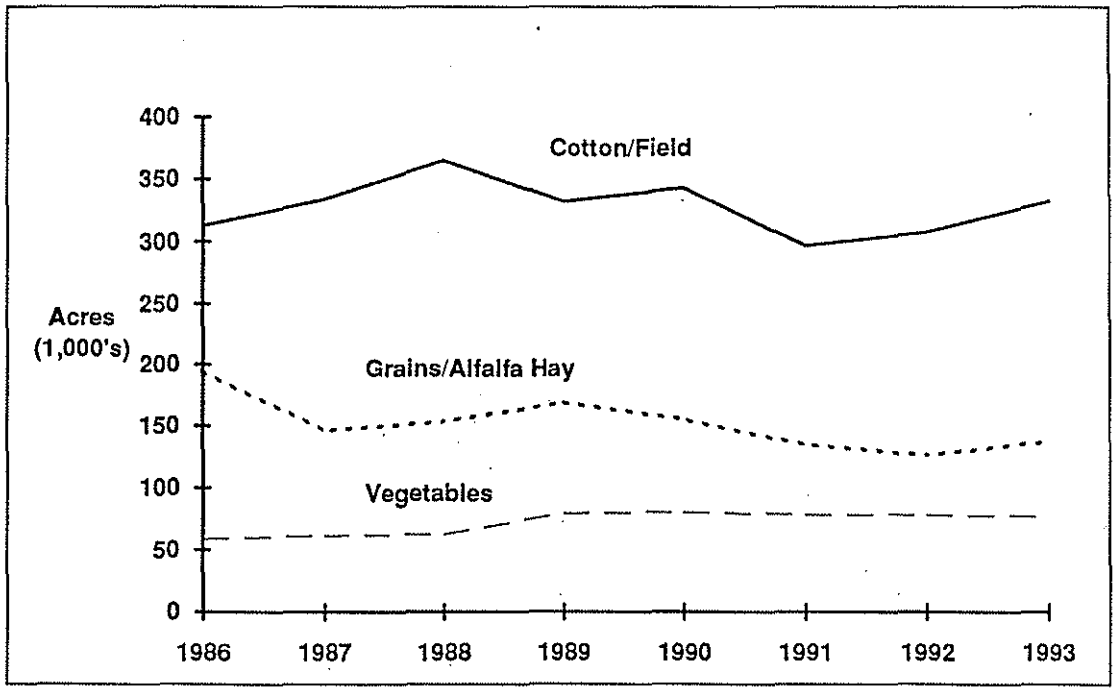


Table 3
Kern County Annual Crop Acreage, 1986-1993

	Cotton/ Field Crops	Grains/ Alfalfa Hay	Vegetables	Annual Crop Total
1986	313,200	194,100	58,800	566,100
1987	333,800	146,100	61,300	541,200
1988	364,900	154,500	62,500	581,900
1989	332,200	169,000	79,500	580,700
1990	343,300	155,600	80,800	579,700
1991	297,000	135,100	78,400	510,500
1992	308,000	123,400	78,300	509,700
1993	332,600	137,400	76,800	546,800

Source: *Kern County Water Agency*

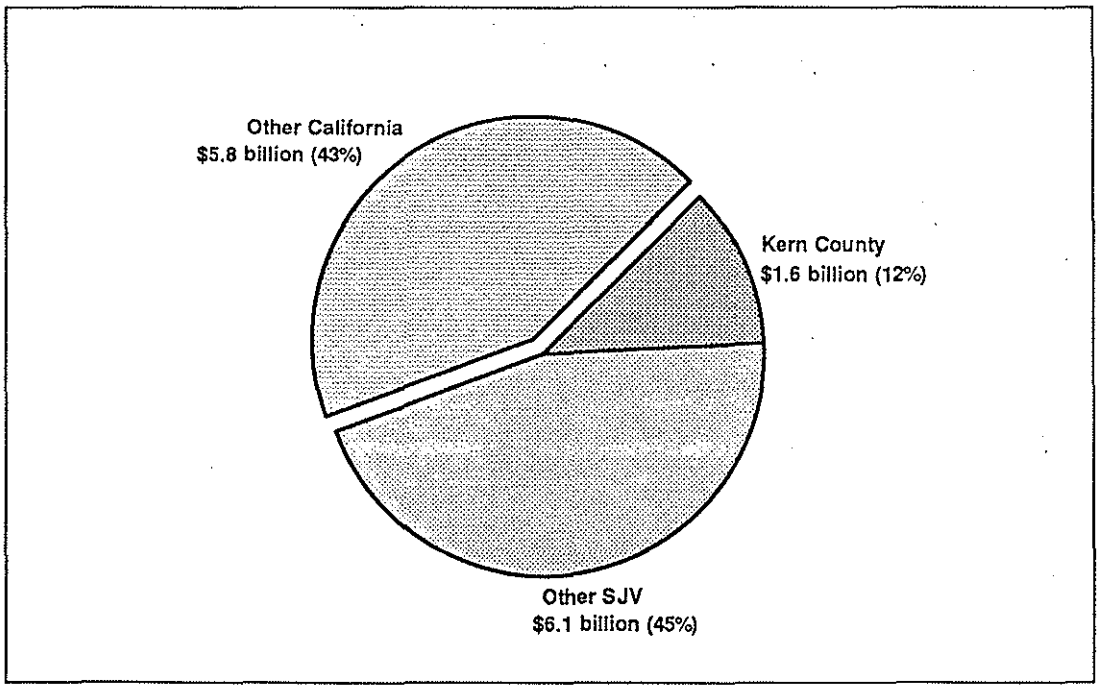
Figure 3
Kern County Annual Crop Acreage, 1986-1993



Value of Production

In 1992, agricultural commodities valued at nearly $1.7 billion were produced in Kern County. Nearly all of this, $1.6 billion, was attributable to irrigated crop production with cotton, grapes, almonds, carrots, and pistachios ranking as the county's five leading commodities. The value of Kern County crop production, measured by gross crop receipts, accounted for 21% of total value of crop production for the entire eight county San Joaquin Valley region, and nearly 12% of California's $13.5 billion crop production industry (see Figure 4). For 1992, Kern County was ranked fourth in the state based on the total value of agriculture production (both crops and livestock). The county was ranked third among San Joaquin Valley counties for total agriculture production, and second for crop production only.

Figure 4
1992 Value of Crop Production in Kern County, San Joaquin Valley, and California



Source: *1992 California Agriculture Statistical Review*

Water District Organization

The water-using areas of the San Joaquin Valley portion of Kern County, with the exception of about 27,000 acres of irrigated lands, are included within the organized areas of 23 public water districts. These districts are generally contiguous and overlapping, with just a few exceptions. The districts receive surface water deliveries from three major sources: I) the State Water Project, ii) the Central Valley Project, and iii) the Kern River.

The service area of the Kern County Water Agency encompasses the entire valley area of Kern County as well as less developed mountain and desert areas, including the Tehachapi-Cummings County Water District and Tejon-Castac Water District. The agency was formed primarily to provide a county-wide authority to contract with the State of California for water, then wholesale that water to retailing member districts within the county.

Fourteen of the county's irrigation water districts are member units of the Kern County Water Agency and receive direct deliveries of state project water. Ten of the member units overly the groundwater basin and are able to supplement surface water deliveries with groundwater pumping. For the remaining four districts however, state project water deliveries provide the only available water supplies. These districts are located primarily along the westside of the KCWA service area and generally do not overly the groundwater basin.

Local Kern River supplies are utilized by ten of the county's irrigation districts, including five districts that also take deliveries from the State Water Project. Deliveries from the federal Central Valley Project are supplied to six Kern County districts, two of which also receive Kern River deliveries.

The twenty-three Kern County agricultural water districts utilizing imported and local surface water supplies are presented in Table 4.

Table 4
Kern County Water District Organization

Water District	Surface Water Supplies
KCWA Member Water Districts	
Westside Water Districts	
Belridge Water Storage District	SWP
Berrenda Mesa Water District	SWP
Lost Hills Water District	SWP
Wheeler Ridge-Maricopa Water Storage District	SWP
Groundwater Area Water Districts	
Buena Vista Water Storage District	SWP, Kern River*
Buttonwillow Improvement District	SWP
Cawelo Water District	SWP*, Kern River
Henry Miller Water District	SWP*, Kern River
Improvement District No. 4	SWP
Kern Delta Water District	SWP, Kern River*
Pond-Poso Improvement District	SWP
Rosedale-Rio Bravo Water Storage District	SWP*, Kern River
Semitropic Water Storage District	SWP
West Kern County Water District	SWP
Non-Member Water Districts	
Arvin-Edison Water Storage District	CVP
Delano-Earlimart Irrigation District	CVP
Kern-Tulare Water District	CVP, Kern River*
North Kern Water Storage District	Kern River
Rosedale Ranch Improvement District	Kern River
Olcese Water District	Kern River
Rag Gulch Water District	CVP*, Kern River
Shafter-Wasco Irrigation District	CVP
Southern San Joaquin Municipal Utility District	CVP

* Denotes primary surface water supply.

Source: *Kern County Water Agency.*

Irrigation Water Supply and Utilization for 1992

Available Irrigation Surface Water Supplies

Limited water supply availability in 1992 marked the sixth consecutive year of drought in California and the San Joaquin Valley. Water deliveries on both the State Water Project and the federal Central Valley Project were cut for the third year in a row and available local water supplies were at levels significantly below normal. Once again, farmers found it necessary to increase their utilization of groundwater and to seek out alternative, and more costly, sources of surface water supply in order to maintain crop production. Where alternative water sources were unavailable, cropland was idled and production was lost.

State Water Project Deliveries

In 1992, agricultural contractors on the State Water Project were allocated only 45% of their firm entitlement. Deliveries of 1992 SWP firm entitlement to the KCWA irrigation member districts amounted to just under 334,200 AF. After taking into account carry-overs, transfers, and exchanges, state project deliveries totaled nearly 385,800 AF, significantly less than the full firm entitlement of 1,015,000 AF.[2] Actual 1992 SWP agricultural water deliveries to the KCWA member units are displayed in Table 5.

The KCWA westside surface water districts have firm entitlement contracts for annual delivery of 696,400 acre-feet of state project water. State project deliveries to the westside member units measured only 271,300 acre-feet in 1992. Miscellaneous transfers and exchanges

2/ Actual deliveries in 1992 exclude 57,171 acre-feet of entitlement returned to DWR under the 1990 Demonstration Programs and 40,156 acre-feet of 1992 entitlement delivered in 1993.

augmented delivery of state water to these districts to 286,600 acre-feet. The net result was a reduction of nearly 60% in available SWP surface water supplies.

Table 5
1992 SWP Irrigation Deliveries to KCWA Member Districts

Member Unit	Firm Entitlement	Actual Deliveries	Delivery Shortage[1]
	Acre-Feet	Acre-Feet	Percentage
Westside Districts	**696,424**	**286,600**	**59%**
Belridge WSD	148,000	53,830	64%
Berrenda Mesa WD	155,100	73,750	52%
Lost Hills WD	140,400	51,990	63%
Wheeler Ridge WSD	252,924	107,030	58%
Groundwater Districts	**318,676**	**99,200**	**69%**
Buena Vista WSD[2]	21,300	35,440	
Buttonwillow ID	83,000	14,610	82%
Cawelo WD	38,200	5,550	85%
Henry Miller WD	35,500	15,360	57%
ID No.4 - Agriculture	10,276	3,440	69%
Kern Delta WD[2]	25,500		
Pond Poso ID	67,000	12,070	82%
Rosedale-Rio Bravo WSD	29,900	10,030	66%
Semitropic WSD	8,000	2,030	75%
West Kern WD[2]	0	670	
Total Member Districts	**1,015,100**	**385,800**	**62%**

1/ Net delivery shortages to individual member districts vary significantly due to various exchange agreements and repayment obligations under past programs.

2/ Deliveries to Buena Vista WSD include Kern Delta and West Kern entitlement deliveries via a long term agreement.

Source: *1992 Water Supply Report*, Kern County Water Agency, December 1993.

State Water Project 1992 entitlement deliveries to the KCWA groundwater member units summed to nearly 63,000 acre-feet. Miscellaneous transfers and exchanges increased delivery

of state water to 99,200 acre-feet. With full firm entitlement contracts for 318,700 acre-feet annually, the state project-related surface water deliveries to the groundwater member units were reduced by nearly 70% in 1992.

Other Surface Water Supplies to KCWA Member Districts

In addition to deliveries of state water, miscellaneous other supplies of surface water were utilized by growers within the KCWA service area. At the outset of 1992, when only a 20% SWP allocation was expected, plans for a two-part Emergency Water Supply Program were developed by the agency. The program consisted of continuation of the 1991 Emergency Groundwater Supply Program and continued participation in the State's Emergency Water Bank. When the final allocation of 45% was announced for SWP supplies, the KCWA Emergency Program was scaled back to only include participation in the 1992 State Water Bank.

Purchases from the water bank by all KCWA member units amounted to 13,900 acre-feet, at an average cost of $147/AF. Over 90% of these purchases were made by growers in the westside districts.

Five of the fourteen KCWA member units receive annual deliveries of Kern River water through either direct entitlements or long-term contracts. These districts included Kern Delta WD, Buena Vista WSD, Cawelo WD, ID No. 4, and Rosedale-Rio Bravo WSD. Six consecutive low water years were recorded between 1987 and 1992, with annual deliveries ranging from 39% to 70% of median regulated flows of 564,600 acre-feet. Total deliveries of Kern River water to the KCWA districts amounted to 200,430 acre-feet in 1992.

In addition to local surface water supplies, several of the KCWA districts also facilitated the transfer of well water from one landowner to another. District conveyance facilities were used to transfer 32,100 acre-feet of groundwater in 1992. The transfers included both within district and between district exchanges.

The allocation of KCWA water district purchases of surface water from sources other than the State Water Project is presented in Table 6.

Total Surface Water Supplies to KCWA Member Districts

Total surface water deliveries to the KCWA member units from all sources amounted to 632,250 acre-feet. Of this amount, 309,720 acre-feet, or 49%, was delivered to the westside districts while the remainder was delivered to the districts overlying the groundwater basin. Total deliveries are presented in Table 6.

Table 6
Total 1992 Surface Water Supplies for the KCWA Member Districts

Member Unit	State Water Bank	Kern River Deliveries	District Provided Groundwater[1]	Total Water Supply[2]
	Acre-Feet	Acre-Feet	Acre-Feet	Acre-Feet
Westside Districts	**12,700**	**0**	**10,420**	**309,720**
Belridge WSD	430	0	2,320	56,580
Berrenda Mesa WD	4,380[a]	0	0	78,130
Lost Hills WD	7,890[a]	0	50	59,930
Wheeler Ridge WSD		0	8,050	115,080
Groundwater Districts	**1,200**	**200,430**	**21,700**	**322,530**
Buena Vista WSD	500	14,490	3,540	53,970
Buttonwillow ID	190		0	14,800
Cawelo WD		24,050	16,620	46,220
Henry Miller WD			1,540	16,900
ID No.4 - Ag		10,100	0	13,540
Kern Delta WD		150,670	0	150,670
Pond Poso ID	270		0	12,340
Rosedale-Rio Bravo WSD		1,120	0	11,150
Semitropic WSD	240		0	2,270
West Kern WD			0	670
Member District Total	**13,900**	**200,430**	**32,120**	**632,250**

1/ District facilitated transfers of groundwater from one landowner to another.

2/ Total includes 1992 actual SWP deliveries reported in Table 8.

a/ Includes carry-over of 1991 State Water Bank water.

Source: *1992 Water Supply Report*, Kern County Water Agency, December 1993.

Surface Water Deliveries to Non-Member Districts

In addition to the fourteen member districts of the Kern County Water Agency, ten other water districts provide irrigation water to growers in the San Joaquin Valley portion of the county.

These districts have entitlements to federal project water or rights to Kern River supplies or, in some cases, access to both sources.

Six of the ten non-member districts received deliveries through the federal Central Valley Project. The primary source of CVP water in the Kern County service area is delivered through the Friant Unit which stores and deliveries water from the central Sierra watersheds via the Friant-Kern Canal.[3] Water supplies within the unit were about 75% of normal in 1992. Total deliveries to the KCWA non-member districts amounted to 56,900 acre-feet.

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Deliveries of federal project water and Kern River water supplies to the non-member districts in 1992 is presented in Table 7.

Table 7
1992 Surface Water Deliveries to KCWA Non-Member Districts

Non-Member District	CVP Deliveries	Kern River Deliveries	Total Surface Water Deliveries
	Acre-Feet	Acre-Feet	Acre-Feet
Arvin-Edison WSD	38,360	2,040	40,400
Delano Earlimart WD	12,660		12,660
Kern Tulare WD	16,920	10,070	26,990
North Kern WSD		42,080	42,080
Olcese WD		1,220	1,220
Rag Gulch WD	6,360	1,510	7,870
Shafter-Wasco WD	43,460		43,460
So. San Joaquin MUD	84,240		84,240
Non-Member District Total	**202,000**	**56,920**	**258,920**

Source: *1992 Water Supply Report*, Kern County Water Agency, December 1993.

3/ Two of the districts, Rag Gulch and Kern Tulare, hold water rights agreements with the Bureau of Reclamation for water stored in Shasta Reservoir. Through the Cross Valley Canal Exchange Agreement the Shasta water is delivered through the California Aqueduct to Arvin Edison WSD. In exchange, Arvin-Edison makes available a portion of its water supply delivered through the Friant Kern Canal.

Total Surface Water Supplies Available for Irrigation

Utilization of surface water for irrigation purposes in Kern County amounted to just over 890,000 acre-feet in 1992. This is considerably less than the amount of surface water available under full supply conditions where an estimated 2.2 million acre-feet would be available. Member districts of the Kern County Water Agency accounted for 70 percent of the 1992 deliveries while the non-member districts accounted for the remaining 30 percent of surface water deliveries. The distribution of total irrigation surface water supplies is presented in Table 8.

Table 8
Total 1992 Kern County Irrigation Surface Water Supplies

Water Source	KCWA Member Districts	KCWA Non-Member Districts	All Kern County Water Districts
	Acre-Feet	Acre-Feet	Acre-Feet
State Water Project	385,800		385,800
State Water Bank	13,900		13,900
Central Valley Project		202,000	202,000
Kern River	200,430	56,920	257,350
Other	32,120		32,120
Total Water Supply	**632,250**	**258,920**	**891,170**

Irrigation Water Demand

Crop acreage in Kern County was measured at 762,500 acres in 1992. This was about 15% of the total crop acreage for the San Joaquin Valley, and nearly 11% of California's total crop acreage. In the five year period prior to 1991's severe water shortage, Kern County crop production averaged 825,000 acres, reaching a high of 856,000 acres in 1989. Surface water shortages in 1992 caused a significant portion of Kern County's productive acreage to lay idle during the growing season. The distribution of 1992 crop acreage by crop and water district grouping is presented in Table 9.

Table 9
1992 Kern County Crop Acreage

Crop Group	KCWA Member Districts		Non-Member Districts	Kern County Total Acreage
	Westside	Groundwater		
Annual Crops	**82,432**	**280,175**	**150,142**	**512,749**
Cotton/Field Crops	53,058	188,145	66,809	308,012
Alfalfa/Hay	3,786	52,972	24,534	81,292
Grains	6,942	25,516	12,669	45,127
Vegetables	18,646	13,542	46,130	78,318
Permanent Crops	**69,734**	**51,375**	**128,648**	**249,757**
Tree Nuts	37,592	19,539	41,578	98,709
Tree Fruits	16,610	14,382	34,340	65,332
Grapes/Vines	15,532	17,454	52,730	85,716
Total Acreage	**152,166**	**331,550**	**278,790**	**762,506**

Source: *Kern County Water Agency*

Permanent crops accounted for approximately one-third of total county crop acreage in 1992, with annual crops accounting for the remaining two-thirds. This contrasts with normal water years where annual crops account for 70 to 75 percent of total acreage.

The KCWA service area accounts for two-thirds of total crop production in Kern County, nearly 484,000 acres in 1992. Of this, the westside districts account for approximately 35% of production in a normal water year. In 1992, the westside share of KCWA crop acreage fell to just 30% of acreage in production. Annual crops predominate the KCWA service area, with

nearly all of the acreage planted to cotton or vegetable rotations. Permanent crops, accounting for 25% of acreage in the KCWA service area, are predominated by almond, pistachio, and grape production.

Applied Water Requirements

Estimates of per acre applied water requirements were developed using crop specific consumptive water use data and average irrigation efficiencies. The applied water use data were obtained from the Kern County Water Agency. Because of the significant shortage of water in the westside service areas, many growers were forced to cut water applications below consumptive requirements. This in turn led to crop stress and lower yields for many annual and permanent crops. Estimates of the drought-related reductions in per acre water applications were obtained from district managers and growers in the westside service areas.

Water application rates for the groundwater and westside growing areas are presented in Table 10.[4] The actual applied water rates for the various crops differ significantly over the valley, and are dependent on soil characteristics, topography, microclimates, irrigation system types, and cultural practices. The application rates in Table 10 represent the typical range of water use. It was generally found that

Total estimated water demand for 1992 was calculated using the average applied water rates presented in Table 10 and the planted crop acreages presented in Table 9. Irrigation water demand for 1992 was estimated to be 2.4 million acre-feet. The westside districts utilized 384,000 acre-feet, or 16% of total demand. The groundwater areas utilized the remaining 84 % of water demand, just over 2.0 million acre-feet. Total 1992 applied water requirements for the westside and groundwater service areas of Kern County are presented in Table 11.

4 / It should be noted that the annual effective precipitation rate for Kern County, 0.2 acre-feet/acre, was netted out of the applied water rate estimate.

Table 10
Average 1992 Applied Water Requirements

Crop Group	Westside Districts	Groundwater Districts
	Acre-feet/Acre	Acre-feet/Acre
Cotton/Field Crops	2.2 - 3.0	3.5
Alfalfa/Hay	4.0[a]	4.5
Grains	0.0 - 1.6	2.5
Vegetables	1.5	1.7
Tree Nuts	2.2 - 3.3	3.8
Tree Fruits	2.2 - 3.3	3.6
Grapes/Vines	2.2 - 2.7	2.7

Source: *1992 Water Supply Report*, Kern County Water Agency, December 1993, and personal communications with growers and water district managers.

Table 11
1992 Kern County Crop Water Requirements

Crop Group	KCWA Member Districts		Non-Member Districts	Kern County Total[1]
	Westside	Groundwater		
	Acre-Feet	Acre-Feet	Acre-Feet	Acre-Feet
Cotton/Field Crops	138,200	657,300	233,400	1,028,900
Alfalfa/Hay	14,500	235,900	109,300	359,700
Grains	0	62,900	31,200	94,200
Vegetables	31,200	22,700	77,300	131,100
Tree Nuts	112,100	74,200	158,000	344,300
Tree Fruits	47,700	51,100	121,900	220,700
Grapes/Vines	40,700	46,700	141,100	228,500
Total Acreage	**384,400**	**1,150,800**	**872,200**	**2,407,400**

1/ Some totals may not add due to rounding.

Estimated Groundwater Pumping

Surface water deliveries to the KCWA westside districts totaled 310,000 acre-feet in 1992. In three of the four water districts these limited deliveries were fully utilized to meet applied water requirements on a reduced acreage base. In Wheeler Ridge surface water deliveries were enhanced by limited groundwater pumping, estimated as the difference between applied water use and surface water deliveries, or 74,000 acre-feet.[5]

In the groundwater areas, 1992 deliveries to the KCWA member districts were 323,000 acre-feet and applied water requirements were 1,151,000 acre-feet. Groundwater pumping for these districts, estimated as the difference between deliveries and utilization, was 828,000 acre-feet. Non-member districts are estimated to have pumped 613,000 acre-feet in order to meet applied water requirements in their service areas. Irrigation water supply and utilization, including estimates of groundwater pumping, are presented in Table 12.

Based on surface water deliveries of 891,000 acre-feet and applied water requirements of just over 2.4 million acre-feet, groundwater pumping for irrigation purposes in Kern County was estimated to be 1,516,000 acre-feet in 1992.

5 / A small section of the Wheeler Ridge service area has limited access to groundwater. In normal water years, groundwater pumping is generally in the range of 20,000 to 30,000 acre-feet.

Table 12
Irrigation Water Supply and Utilization
Including Estimated Groundwater Pumping

Water District	Surface Water Supplies	Applied Water Use	Groundwater Pumping[1,2]
	Acre-Feet	Acre-Feet	Acre-Feet
KCWA Member Districts	632,000	1,535,000	903,000
Westside Districts[3]	310,000	384,000	74,000
Groundwater Districts	323,000	1,151,000	828,000
Non-member Districts	259,000	872,000	613,000
Kern County Total	**891,000**	**2,407,000**	**1,516,000**

1/ Groundwater pumping is estimated as the difference between applied water use and surface water deliveries.

2/ Some totals may not add due to rounding.

3/ Groundwater pumping occurs in some portions of the Wheeler Ridge service area.

Drought-Related Acreage Impacts

Farm-Level Adjustments to Water Shortage

The economic costs of water shortages, measured by losses in jobs, income, and gross revenues in agriculture and its support industries, are directly related to the magnitude and duration of reductions in water supply. For agricultural producers without access to alternative water supplies, the short-run response to water shortages is to remove relatively lower-valued crops from production. Depending on the severity of shortage, higher-valued crops may also be affected. Economic impacts become increasingly more significant as the magnitude of water shortage increases. Water is a necessary input for crop production; when deliveries are not made crops cannot be grown.

For growers with access to supplementary water supplies, reductions in surface water entitlement deliveries can be offset by increased groundwater pumping (where available) or through purchases on non-entitlement surface water supplies. Although net water use by these growers may remain unchanged, water costs increase substantially because of significantly higher per unit costs. Generally, growers are unable to recover increased water costs through higher output prices. As a result, farm income is adversely affected.

Reductions in water supply can also affect growers without contracts for entitlement deliveries. As growers who normally receive surface water deliveries become increasingly dependent on groundwater, problems of overdraft become more severe and pumping depths increase throughout the basin. This affects all growers utilizing groundwater.

In order to measure the economic impacts of the 1992 drought on agricultural producers in Kern County, growers and water districts were contacted mail surveys and direct interviews to document grower responses to the shortage in surface water deliveries. Water districts and producers in areas with and without access to alternative water supplies were contacted. As

outlined above, the primary drought-related economic effects identified by the growers and water managers were caused by:

- Drought-related reductions in planted acreage;
- Reductions in yields on water stressed crops; and
- Increased water costs for growers able to acquire supplemental water supplies.

Estimates on the economic costs of the 1992 drought to growers in Kern County are presented below.

Drought Related Acreage Reductions

Kern County irrigated crop acreage totaled 762,500 acres in 1992, with 249,760 acres (33%) in permanent crops (tree nuts, tree fruits, and grapes) and 512,750 acres in annual crops. The estimated value of 1992 crop production was $1.6 billion. Approximately 152,200 of the productive acres were located in the KCWA westside service areas and the remainder were located in the groundwater areas. Nearly 48% of the acreage in the westside area was planted to permanent crops compared to 29% in the groundwater areas.

Based on discussions with Kern County growers and water district managers, it was determined that 44,600 acres were not planted as a result of drought-related reductions in available surface water supplies. All but 700 acres of this reduction occurred within the service areas of the westside water districts.

In some cases growers found it necessary to abandon acreage that had been previously planted. The abandoned acreage included 1,200 acres of vegetables and 4,840 acres of permanent crops. Abandoned vegetable lands were first planted and then idled when anticipated water deliveries were unavailable. Decisions to abandon permanent crop acreage took into account the cumulative effects of water shortages in previous years and the anticipated reliability of future deliveries.

Croplands lost to production in 1992 as a result of the drought amounted 50,640 acres, including acreages not planted, abandoned, or idled. The drought-impacted acreages are presented in Table 13. Acreage is identified by crop type and water district service areas. The reduction in cropped acreage in turn led to a loss in crop revenues, farm income, and regional jobs.

Table 13
Kern County Crop Acreage Impacted by the 1992 Drought

	Westside Water Districts	Groundwater Districts	Kern County Total
Acreage Idled or Not Planted	**43,900**	**700**	**44,600**
Cotton/Field Crops	35,800	700	36,500
Alfalfa Hay	400		400
Grains	4,600		4,600
Vegetables	3,100		3,100
Abandoned Acreage	**5,740**	**300**	**6,040**
Vegetables	1,200		1,200
Tree Nuts	3,000	300	3,300
Tree Fruits	400		400
Grapes	1,140		1,140
Total Not Planted/Abandoned	**49,460**	**1,000**	**50,640**
Cotton/Field Crops	35,800	700	36,500
Alfalfa Hay	400		400
Grains	4,600		4,600
Vegetables	4,300		4,300
Tree Nuts	3,000	300	3,300
Tree Fruits	400		400
Grapes	1,140		1,140

Acreage with Drought-Related Yield Reductions

Water supplies were sufficient in some areas of the westside to place land into production but were insufficient to provide a full water supply to meet applied water requirements Where this occurred, yields fell below normal levels. Growers identified 18,240 acres of cotton and alfalfa as having lower yields as a result of reduced water applications. All of this acreage was located in the westside areas. Cotton yields on the affected acreage were estimated to have declined by 15% while alfalfa yield were estimated to have fallen by 20%.

Farm-Level Economic Losses Related to Acreage Impacts

When productive acreage is fallowed or shows yield reductions, losses in crop revenues, farm income, and farm employment result. It is estimated that the 50,640 acres not planted or abandoned resulted in a direct loss of $63.6 million in gross crop revenues. An additional loss of $2.9 million in crop revenues resulted from drought-related yield reductions on 18,000 acres of cotton and alfalfa. Direct crop revenue losses related to the 1992 drought, including yield reductions and acreage not planted, amounted to $66.5 million. Permanent crops accounted for $10.4 million (15%) of the crop revenue loss with the remaining $53.2 million linked to annual crops, primarily cotton.

The direct farm revenue loss of $66.5 million includes nearly $27.5 million in lost farm income. Farm income losses include wage and salary payments to farm workers and returns to farm proprietors. While only 15% of direct revenue losses can be attributed to reductions in permanent crop acreage, over 21% of farm income losses are related to permanent crops. This is because of the relatively higher labor intensity associated with permanent crop production.

When crop acreage is idled as a result of limited water supplies, there is an associated reduction in farm labor requirements. It is estimated that approximately 800 farm-level jobs were lost as a result of the 50,600 acre reduction in 1992 crop acreage.

Direct crop revenue losses along with farm income and employment losses are presented in Table 14.

Table 14
Economic Losses Associated with Drought-Related Acreage Impacts

	Westside Water Districts	Groundwater Districts	Kern County Total
Acreage Impacts			
Not Planted or Abandoned	49,640	1,000	50,640
Permanent Crops	4,540	300	4,840
Annual Crops	45,100	700	45,800
Yield Reductions[1]	18,420	0	18,420
Revenue Losses ($1,000)	**$130,703**	**$2,700**	**$133,403**
On-Farm Losses	$65,281	$1,235	$66,516
Permanent Crops	$9,938	$476	$10,414
Annual Crops	$55,343	$759	$56,102
Support Industry Losses	$68,422	$1,465	$66,887
Income Losses ($1,000)	**$56,099**	**$1,082**	**$57,181**
On-Farm Losses	$27,057	$428	$27,485
Permanent Crops	$5,616	$186	$5,802
Annual Crops	$21,441	$242	$21,683
Support Industry Losses	$29,042	$654	$29,696
Employment Losses (jobs)			**2,000**
On-Farm Losses			800
Support Industry Losses			1,200

1/ Documented yield reductions occurred only on annual acreage.

Economic Losses to Related Industries

As growers face reductions in crop revenues and declines in net farm returns to ownership, labor, and management, other business and industries in the local economy are also affected. Firms providing production inputs and support services were also affected by the drought-related reductions in acreage and yields. Revenue losses incurred by other farm-related businesses in Kern County were estimated to be $66.9 million for a total economy-wide revenue loss of $133.4 million. Approximately 85% of these losses can be attributed to reductions in annual crop acreage.

The county-wide total revenue losses of $133.4 million include regional income losses of $57.2 million. In addition to the on-farm loss of $27.5 million, over $29.7 million in lost income was distributed throughout the Kern County regional economy. In addition to the 800 farm jobs that were lost, 1,200 jobs are estimated to have been lost county-wide as result of the indirect revenue losses to farm-related business. The total drought-related employment loss in Kern County reached 2,000 jobs in 1992. County-wide losses are also presented in Table 14.

Permanently Abandoned Crop Acreage

Permanent crop acreages in Kern County have declined significantly since 1990. This reduction has been due primarily to increased uncertainty regarding available water supplies, along with the resulting higher water costs. Some reductions in annual crop acreages have also occurred as a result of increasing water uncertainty. These acreage reductions have occurred in areas with limited or no access to supplemental groundwater resources. Based on discussions with growers it is estimated that permanent crop acreage has declined by 10,535 acres while annual cropland has declined by 4,000 acres.

When land is permanently idled, crop revenues are lost and an associated decline in farm jobs and farm income results. It is estimated that the present value of crop revenues lost over the remaining life of abandoned perennial orchards is $240 million. The present value of lost annual crop revenues is estimated to be $150 million. The associated losses in support industry revenues is $368 million, for a county-wide loss of over $750 million in future business revenues. These lost future revenues include an estimated future income loss of almost $220 million. The foregone income is comprised of $102 million in on-farm losses and $117 million in losses to agricultural support industries. A permanent loss of nearly 600 on-farm jobs is associated with the permanently idled acreage along with an additional loss of 500 jobs throughout the Kern County economy.

The economic losses resulting from permanently abandoning nearly 15,000 acres of productive crop acreage are presented in Table 15.

Table 15
Lost Value of Permanently Abandoned Crop Acreage

	Westside Water Districts	Groundwater Districts	Kern County Total
Abandoned Acreage	**13,335**	**1,200**	**14,535**
Permanent Crops	9,335	1,200	10,535
Almonds	*5,600*	*1,200*	*6,800*
Pistachios	*200*		*200*
Olives	*400*		*400*
Grapes	*3,135*		*3,135*
Annual Crops	4,000		4,000
Alfalfa Hay	*2,800*		*2,800*
Vegetables	*1,200*		*1,200*
Revenue Losses ($1,000)[1]	**$711,600**	**$47,500**	**$759,100**
On-Farm Losses	$370,100	$20,600	$390,700
Permanent Crops	$219,800	$20,600	$240,400
Annual Crops	$150,300	$0	$150,300
Support Industry Losses	$341,500	$26,900	$368,400
Income Losses ($1,000)[1]	**$204,200**	**$14,700**	**$218,900**
On-Farm Losses	$96,400	$5,700	$102,100
Permanent Crops	$61,600	$5,700	$67,300
Annual Crops	$34,800	$0	$34,800
Support Industry Losses	$107,800	$9,000	$116,800
Employment Losses (jobs)	**1,000**	**100**	**1,100**
On-Farm Losses	550	50	600
Permanent Crops	450	50	500
Annual Crops	100	0	100
Support Industry Losses	450	50	500

1/ Figures represent present value of losses over the remaining life of the orchards.

Drought-Related Increases in 1992 Water Costs

1992 Surface Water Costs

Limited surface water deliveries from the State Water Project, the Central Valley Project, and the Kern River led to significantly higher water costs for all growers in Kern County. Two major reasons accounted for the drought-related increases in 1992 water costs. First, to replace the water supplies normally received, many growers and districts found it necessary to utilize more expensive water resources. The KCWA west-side member districts, generally without access to groundwater, implemented a variety of water transfer programs in order to augment the limited deliveries from the State system. In the groundwater areas, growers were able to supplement restricted surface water deliveries with increased groundwater pumping.

In some cases, growers were unable to obtain the necessary replacement water for irrigation. This led to the reduction in 1992 planted acreage discussed in the previous sections.

The second reason for higher water costs in 1992 was the effective increase in the average unit rate paid by Kern County water districts for actual contract deliveries from the state and federal projects. Although less than full entitlement deliveries were made, KCWA member districts receiving state project water were required to make full payment on their fixed cost obligation. Therefore, the full SWP fixed payment was allocated over a smaller delivered water base, substantially increasing average unit rates for the water that was received. Similarly, growers in water districts with Central Valley Project and Kern River entitlements also paid higher average unit rates for surface water deliveries available in 1992.

Surface water deliveries to Kern County growers, from all sources, amounted to 891,100 acre-feet. Expected total cost for this water, estimated using normal year unit rates, would have been $34.4 million; actual costs reached $59.7 million. The drought-related net increase in surface water costs for growers in Kern County amounted to $25.3 million. Nearly all of these costs were borne by growers within the KCWA service area, particularly those producers in

the westside water districts. A majority of the cost increase was tied to increased unit rates for state project entitlement deliveries. Many growers outside the KCWA service area also paid higher costs for limited deliveries of CVP and Kern River deliveries. Average district water costs throughout Kern County increased from $39 per acre-foot to $54 per acre-foot, an increase of 75%.

Expected and actual unit rates for 1992 surface water deliveries to growers in Kern County are presented in Table 16. The estimated net increase in total water costs for actual deliveries is also presented. A more detailed discussion of water costs for various water district groupings is presented below.

Water Costs for KCWA Member Districts

Growers within the Kern County Water Agency service area utilize water supplies from three primary sources: imported surface water supplies from the State Water Project, local surface water supplies from the Kern River, and, where available, groundwater.[6] Total 1992 surface water deliveries to the member districts amounted to 632,200 acre-feet. Drought-related cost increases were associated with all of the water sources.[7] It is estimated that the net increase in water costs for districts within the KCWA service area amounted to $23.2 million, with average unit rates for all surface water sources increasing from $40 to $76 per acre-foot.

SWP Entitlement Deliveries

The effective average unit rates ($/AF) for actual deliveries of state project entitlement water doubled in 1992 for most KCWA member districts. If full entitlement had been available, the member units would have paid an average of $53 per acre-foot; actual unit rates averaged $106 per acre-foot. The 1992 SWP deliveries of 385,800 acre-feet are estimated to have cost the KCWA member districts an additional $20.5 million as a result of the higher effective unit rates. These increased water costs were passed along to district producers. For many growers, state project costs increased even further as additional payments for fixed in-district assessments were spread over less delivered water.[8]

6/ Effective precipitation for irrigation purposes generally averages less than 0.2 acre-feet per acre annually in Kern County.

7/ Cost increases associated with groundwater are discussed in a later section.

8/ These additional net cost increases were not quantified for this study. However, an earlier district water rate survey conducted by the Kern County Water Agency showed that many of the water districts pass along infrastructure costs through fixed assessments.

Table 16
1992 Increased Water Costs for Kern County Growers[a]

Water District	Water Deliveries	Expected Cost	Actual Cost	Increased Water Costs
	AF	Cost/AF	Cost/AF	($1,000s)
KCWA Member Districts	**632,200**	**$40**	**$76**	**$23,160**
State Project Supplies	431,800	$52	$104	$22,158
SWP Entitlement	*385,800*	*$53*	*$106*	*$20,492*
State Water Bank	*13,900*	*$55*	*$148*	*$1,290*
District Programs	*32,100*	*$47*	*$59*	*$377*
Kern River Deliveries	200,400	$13	$18	$1,002
Westside Districts	**309,700**	**$56**	**$115**	**$18,167**
State Project Supplies	309,700	$56	$115	$18,167
SWP Entitlement	*286,600*	*$56*	*$114*	*$16,6234*
State Water Bank	*12,700*	*$56*	*$153*	*$1,232*
District Programs	*10,400*	*$56*	*$86*	*$312*
Groundwater Districts	**322,500**	**$24**	**$40**	**$4,994**
State Project Supplies	121,900	$43	$76	$3,992
SWP Entitlement	*99,200*	*$43*	*$82*	*$3,869*
State Water Bank	*1,200*	*$43*	*$91*	*$58*
District Programs	*21,700*	*$43*	*$46*	*$65*
Kern River Deliveries	200,400	$13	$18	$1,002
Non-Member Districts	**258,900**	**$36**	**$44**	**$2,148**
CVP Deliveries	202,000	$40	$45	$1,010
Kern River Deliveries	56,900	$20	$40	$1,138
Total All Water Districts	**891,100**	**$39**	**$54**	**$25,308**

a/ Some totals may not add due to rounding.

Westside Water Districts

If full entitlement deliveries had been available in 1992, the average price paid for water by the westside water districts would have been $56 per acre-foot. Actual deliveries in 1992 were 45% of normal, resulting in higher unit rates for the state water that was received. State water costs averaged $114 per acre-foot, an increase of $58 per acre foot over expected costs with full entitlement. It is estimated that the net increase in 1992 SWP water costs paid by the four surface water districts for deliveries actually made was $16.6 million.

Groundwater Districts

With full entitlement, the average price paid for water by the groundwater districts in 1992 would have been $43 per acre-foot. Limited deliveries to these districts also resulted in higher unit rates for the state water that was received. State water costs averaged $82 per acre foot, an increase of $39 per unit over expected costs with full entitlement. It is estimated that the net increase in 1992 SWP water costs paid by the groundwater districts for deliveries actually made was $3.9 million.

Other Imported Water Supplies

Districts and landowners in the KCWA service area were able to develop an additional 46,000 acre-feet of surface water in 1992 through State Water Bank purchases and carry-overs, imported water transfers, and local district projects. Purchases by the westside districts included transfers from the State Bank and a local groundwater program developed by Wheeler Ridge WSD. Under the program, groundwater was developed by local growers and transferred via district facilities to other landowners within the district. Groundwater programs also comprised the majority of other surface water purchases in the groundwater districts.

Average unit rates for these surface water supplies and groundwater programs ranged from $30 per acre-foot to over $200 per acre-foot, with a weighted average cost of $86. Based on actual costs for the purchases of other imported surface water supplies, it is estimated that the total cost for the additional water was $3.9 million, an increase of $1.7 million over expected costs.

Kern River Deliveries

Four of the KCWA member districts in the groundwater area also have entitlements to the local Kern River surface water supply. Six consecutive low water years for the river were recorded between 1987 and 1992, with annual deliveries ranging from 39% to 70% of median regulated flows of 564,600 acre-feet. Deliveries of 275,000 acre-feet in 1992 averaged only

49% of median flows. Allocations of available supplies to the individual districts is based on a historical priority system, resulting in a wide variation in supply shortages among the districts. Total deliveries to water districts in the KCWA service area amounted to 200,400 acre-feet. Average unit rates for these deliveries increased from $13 to $18 per acre-foot, resulting in a net water cost increase of $1 million.

Water Costs for Non-Member Districts

Modest increases in 1992 surface water costs were also incurred by growers outside the KCWA service area. Average unit rates for CVP deliveries increased from an expected $40 per acre-foot to actual costs of $45 per acre-foot. Costs for Kern River deliveries increased from an expected average rate of $20 per acre-foot to actual costs of $40 per acre-foot.[9] The net result was an increased water cost of $2.1 million to growers in these areas.

1992 Groundwater Costs

In order to compensate for the shortage not only in SWP surface water deliveries but also in CVP and Kern River supplies, Kern County growers were forced to significantly increase their use of groundwater. For most growers, groundwater costs per acre-foot are higher than costs for delivered project water. Therefore, the result of the increased groundwater reliance was a net increase in on-farm water costs, which in turn led to a decline in net farm income. Significant capital outlays were also necessary for the production of new wells and the rehabilitation of existing wells.

The drought-related impacts affecting grower pumping costs derive from two sources. First, as higher cost groundwater is substituted for unavailable surface water supplies applied water costs increased. Secondly, acceleration in the drawdown of the county's underground aquifers occurred as a result of increased groundwater pumping by growers. This led to additional increased pumping depths for groundwater normally pumped by all growers utilizing the groundwater basin.

9/ Variations in water rate schedules for the Kern River districts resulted in different average unit rates for districts outside the KCWA service area than for those districts within the service area boundaries. The reader is referred to Tables 6 and 7 for a listing of the individual water districts in each of these regions.

Groundwater Substitution

Applied water demand by all Kern County growers amounted to 2,407,000 acre-feet in 1992. Under normal water conditions 70% of this demand, or 1,667,000 acre-feet would have been met by surface water supplies from the SWP, the CVP, and the Kern River. Groundwater pumping would have accounted for 740,000 acre-feet of applied water use. However, diminished surface water supplies in 1992 resulted in a much larger proportion of applied water requirements made up by groundwater. It is estimated that 1,516,000 acre-feet of groundwater was pumped, an increase of 776,000 acre-feet. Actual deliveries of surface water accounted for only 35% of total water use.

The most significant increase in groundwater use was accounted for by member districts of the Kern County Water Agency where usage increased from normal levels of 200,000 acre-feet to just over 900,000 acre-feet, an increase of 450%. Groundwater pumping by the non-member districts increased from expected normal levels of 537,000 acre-feet to actual withdrawals of 613,00 acre-feet in 1992.

Results from the water district and grower surveys indicated that average pumping depths in Kern County are approximately 400 feet, although some variation exists throughout the region.[10] Pumping costs at this depth are estimated at about $71 per acre-foot. Because the fixed charges for surface water must be paid regardless of what quantity of water is actually delivered, the net increase in water costs related to groundwater substitution are measured as the difference between pumping costs and the variable cost of delivered surface water. Discussions with water district managers indicate that variable costs for surface water average approximately $10/acre-foot throughout the county. Therefore, increased costs related to the additional drought-related pumping in 1992 were calculated to be $47.3 million, based on increased withdrawals of 776,000 acre-feet.

Expected and actual groundwater usage for 1992 are presented in Table 17, along with the net increase in water costs related to groundwater substitution.

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[10] / Average pumping depths of 400 feet is consistent with information collected by the Kern County Water Agency.

Table 17
Increased Costs Related to Groundwater Substitution

	KCWA Member Districts	Non-Member Districts	Total
	Acre-feet	Acre-feet	Acre-feet
Applied Water Use	**1,535,000**	**872,000**	**2,407,000**
Normal Year Water Supply	**1,535,000**	**872,000**	**2,407,000**
Surface Water Deliveries	1,332,000	335,000	1,667,000
Groundwater Pumping	203,000	537,000	740,000
1992 Drought Water Supply	**1,535,000**	**872,000**	**2,407,000**
Surface Water Deliveries	632,000	259,000	891,000
Groundwater Pumping	903,000	613,000	1,516,000
Net Increase in 1992 Groundwater Pumping	**700,000**	**76,000**	**776,000**
Increased Costs for Groundwater Substitution *($1,000s)*	**$42,700**	**$4,600**	**$47,300**

Groundwater Drawdown

Additional groundwater costs were also incurred by growers as a result of the acceleration in drawdown of the groundwater aquifer. With increased utilization of groundwater during the 1992 production season, pumping depths increased more rapidly for all growers which in turn led to increased pumping costs for each acre-foot of water withdrawn from the basin. The Kern County Water Agency has developed a rule of thumb which indicates that pumping lifts increase one foot for every 100,000 acre-feet of overdraft. Using this rule, it is estimated that average Kern County pumping depths have increased by eight feet between 1991 and 1992, at an average costs of about $1.50 for each acre-foot withdrawn. This translates to an increased cost of $1.1 million for the estimated 740,000 AF that is normally pumped for irrigation use; approximately $305,000 was lost by growers within the KCWA service area while the remaining $805,000 was lost by growers in the non-member districts. These regional estimates are based on normal levels of groundwater pumping in the two areas (see Table 17).

Additional Groundwater Costs

Groundwater pumping capacity throughout Kern County was developed with the expectation that full entitlement deliveries of surface water would generally be available. The significant reductions in surface water deliveries between 1990 and 1992 led many growers and water districts to increase pumping capacity through investments in new wells. It was estimated by the Kern County Water Agency that fifty-one new wells were reported in 1992, including 16 district wells and 35 on-farm wells. At an average cost of $110,000 per well, Kern County growers invested $5.6 million to make up for surface water shortages related to the drought.[11] In addition to the capital costs of developing the wells, growers also incurred (and will continue to incur) the annual operations and maintenance costs which are estimated at $3,000 per year.

Summary of Increased Water Costs

It is estimated that total water costs paid by Kern County growers in 1992 increased by $73.7 million as a result of the drought-related reductions in surface water supplies available for irrigation. This figure includes $48.4 million in increased groundwater pumping costs and $25.3 million for increased costs related to surface water deliveries. These costs reflect direct losses in net farm income and are additive to the farm income losses which were incurred as a result of reductions in planted acreage and crop yields.

A summary of these costs are presented in Table 18.

The Economic Impacts of Increased Water Costs

The drought-related increases in agricultural water costs generated significant economic impacts throughout Kern County. These are in addition to the impacts generated by drought-related reductions in planted acreage and crop yields. The increased water costs are reflected in the farm operation as incremental to all other production costs, including water costs expected under normal water supply conditions. There is no offset to these costs through increased crop revenues. Therefore, the increased water costs result in a direct reduction in net farm income.

[11] / Average well costs based on information collected from water district surveys.

Table 18
Summary of Drought-Related Increases in 1992 Water Costs[a]

	Increased Water Costs Related to		
	Surface Water	Groundwater	Total
	($1,000s)	($1,000s)	($1,000s)
KCWA Member Districts	**$23,160**	**$43,000**	**$66,160**
Westside Districts	$18,167		$18,167
Groundwater Districts	$4,994	$43,000	$47,994
Non-Member Districts	**$2,148**	**$5,400**	**$7,548**
All Water Districts	**$25,308**	**$48,400**	**$73,708**

a/ Some totals may not add due to rounding.

In order to estimate the economic impacts associated with the increased costs, it was assumed that the loss in net farm income had a two-fold effect on the farming operation: 1) with less business income available, farm investments were delayed or withheld; and 2) with lower returns to land, management, and capital, less money was available to the farm household. Therefore, one-half of the net farm income change was assumed to have generated economic impacts through the effects on household income and the consequent reduction in household expenditures. The remaining portion of the change in farm income was assumed to have generated economic impacts through reduced purchases of farm machinery and equipment.

The direct loss of $73.7 on on-farm income is estimated to have generated additional income losses of $59.8 million to support businesses and industries throughout the economy resulting in a total income loss of $133.5 million to Kern County growers and residents. These income losses, along with the associated reduction in the production of goods and services, led to a reduction in Kern County employment, estimated at 2,900 jobs.

A Summary of Total Economic Losses Related to the 1992 Drought

Measured Economic Losses

A summary of the economic losses in Kern County related to the 1992 drought is presented in Table 19. The loss summary includes impacts related to reductions in planted crop acreage, crop yield losses, abandoned crop acreage, increased surface water costs, and increased groundwater costs related to increased pumping and accelerated drawdown of the aquifer. Measures of economic loss include changes in the total value of on-farm and support industry production (revenue losses), changes in wage and salary earnings and returns to management and ownership (income losses), and changes to regional employment.[12] Where possible losses are identified by water district grouping and are allocated to on-farm and support industries.

On-Farm Economic Losses

Kern County crop revenues declined by $66.5 million in 1992 as a result of drought-related reductions in planted acreage and crop yields. This included a $27.5 million in farm income and an associated loss of 800 farm jobs. The drought-related increases in surface and groundwater costs led to additional farm income losses of $73.7 million, resulting in total farm income losses of $101.2 million.

[12] / It should be noted that the income losses are not additive to the revenue losses. A portion of any industries product revenue is used to cover wage and salary payments as well as returns to management and ownership.

Table 19
Summary of Economic Losses Related to the 1992 Drought[a,b]

	Economic Impacts Related to		
	Crop Acreage	Water Costs	Total
On-Farm Revenue Losses ($1,000s)	**$66,516**		**$66,516**
KCWA Member Districts	$66,516		$66,516
Westside Districts	$65,281		$65,281
Groundwater Districts	$1,235		$1,235
Non-Member Districts			
Total Revenue Losses ($1,000s)	**$133,403**	**$120,623**	**$254,026**
KCWA Member Districts	$133,403	$108,271	$241,674
Westside Districts	$130,703	$29,730	$160,433
Groundwater Districts	$2,700	$78,542	$81,242
Non-Member Districts		$12,352	$12,352
On-Farm Income Losses ($1,000s)	**$27,485**	**$73,708**	**$101,193**
KCWA Member Districts	$27,485	$66,160	$93,645
Westside Districts	$27,057	$18,167	$45,224
Groundwater Districts	$428	$47,994	$48,422
Non-Member Districts		$7,548	$7,548
Total Income Losses ($1,000s)	**$57,181**	**$133,485**	**$190,666**
KCWA Member Districts	$57,181	$119,816	$176,997
Westside Districts	$56,099	$32,900	$88,999
Groundwater Districts	$1,082	$86,917	$87,999
Non-Member Districts		$13,669	$13,669
Total Employment Losses (jobs)	**2,000**	**2,900**	**4,900**
On-Farm Job Losses	800		800

a/ Total losses include on-farm and support industry losses.

b/ Some totals may not add due to rounding.

The relative value of these losses becomes more apparent when measured on a per acre basis. Average county-wide income losses related to the 1992 drought were nearly $130 per planted acre in 1992. However, in the KCWA service area these losses were much more significant. Average income losses in the westside water districts were nearly $300 per acre while average losses in the groundwater districts were approximately $150 per acre. Losses in the non-member district service areas averaged $30 per acre.

The farm job losses result from the 50,64 0 acres of cropland idled as a result of the drought, primarily in the KCWA westside district service areas.

County-Wide Economic Losses

Kern County agricultural support industries also saw a decline in 1992 business revenues and earned income as a result of the drought. It is estimated that $254 million in county-wide revenues, including on-farm revenues, were lost. Approximately $133 million of this loss was related to idled crop acreage while the remaining $121 million decline in revenues can be linked to the reduction in farm income caused by increased water costs.

The reduction in county-wide revenues also includes a $191 million income loss including wages and salaries and returns to business ownership and management for agriculture and its support industries. Most of the income losses were tied to the effects of the drought on farm-level water costs. Over $134 million of the income losses were related to water costs while the remaining $57 million was linked to idled crop acreage.

It is estimated that the combined impacts of the drought on water costs and planted crop acreage led to a decline of 4,900 Kern County jobs, including 800 on-farm jobs.

Long-Term Issues Raised by the Drought

As environmental needs place increasing demands on limited water supplies, Kern County growers are likely to face a future of permanent water shortages. Farm-level adjustments made by growers during the recent drought should provide water managers and policymakers with important insights into the potential impacts of these long-term shortages on irrigated agriculture. Although the drought represented temporary rather than permanent water shortages, grower actions during that time are likely to be indicative of the initial adjustments that will be required in the face of limited water supplies. Production responses by growers during the recent drought generally included land fallowing, increased groundwater pumping, and increased water transfers. Opportunities for reduced water applications were not

widespread and did not result in significant water savings.[13] In the face of permanent water shortages additional adjustments may also be made by growers. These include shifts in cropping patterns and crop mixes or investments in new water application technology. However, these longer-term adjustments are not likely to provide significant mitigation for the adverse impact of water shortages on irrigated agriculture.

The extended period of drought also focused attention on those regions within the KCWA service area which are most vulnerable to water shortages. Growers in the westside service area, without access to groundwater and with only limited access to affordable alternative water supplies, were most adversely affected by shortages in State Water Project deliveries. The empirical evidence gained during the drought on the localized impacts of water shortages should provide valuable information as the implementation of long-term reductions in project water supplies become a reality. Implementation measures which are developed to minimize the adverse impacts in areas most vulnerable to water shortage will help to minimize the overall costs of meeting the expanded water requirements for protection of environmental resources.

Water shortage, whether temporary or permanent, leads to increased reliance by growers on groundwater resources. During the drought growers overlying the groundwater basin indicated that they completely offset reduced surface water deliveries through increased groundwater pumping. As permanent water shortages are put into place, questions regarding long-term groundwater management may need to be evaluated . The extent to which the new pattern of drawdown and recharge will be sustainable over the long-run must be determined. Increased reliance on groundwater may also to lead to continued water quality degradation and increased land subsidence.

Empirical evidence from the drought has also shown that the availability of affordable water transfers can mitigate the impacts of water shortages. In areas without alternative water supplies, water transfers provide the only opportunity to maintain production on lands that otherwise would be fallowed. Mechanisms to improve water trading opportunities while still protecting third-party impacts and avoiding adverse environmental effects will be an important factor in determining the overall impacts of permanent water shortages.

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[13] / Irrigation efficiencies in Kern County's waster short areas are generally among the highest in the San Joaquin Valley. Therefore, opportunities for significant improvements in water application efficiencies are not available to growers in these areas.

Appendix A: Kern County Crop Acreage Impacted by the 1992 Drought

1992 KERN COUNTY CROP ACREAGE IMPACTED BY THE DROUGHT

	Cotton/ Field Crops	Alfalfa	Grains	Vegetables	Almonds/ Tree Nuts	Pistachios	Tree Fruits	Grapes	Total
SURFACE WATER DISTRICTS									
Belridge Water Storage District									
Total Acres	26,910	2,420	2,390	3,850			5,420	300	41,290
Not Planted	14,000			1,200					15,200
Abandoned									
Reduced Yield/Maintained	4,300	2,420							6,720
Potential Tree/Vine Kill									
Actual Acreage	12,910	2,420	2,390	2,650			5,420	300	26,090
Berrenda Mesa Water District									
Total Acres				1,200	13,623	9,825	427	4,174	29,249
Not Planted									
Abandoned				1,200	3,000			850	5,050
Reduced Yield/Maintained									
Potential Tree/Vine Kill									
Actual Acreage					10,623	9,825	427	3,324	24,199
Lost Hills Water District									
Total Acres	21,379	160	4,552	1,100	2,659	7,585	2,110	2,315	41,860
Not Planted	8,100			1,100					9,200
Abandoned							400	40	440
Reduced Yield/Maintained	3,700								3,700
Potential Tree/Vine Kill									
Actual Acreage	13,279	160	4,552		2,659	7,585	1,710	2,275	32,220
Wheeler Ridge-Maricopa WSD									
Total Acres	40,569	1,606	4,600	16,796	5,865	1,035	9,053	9,883	89,407
Not Planted	13,700	400	4,600	800					19,500
Abandoned								250	250
Reduced Yield/Maintained	8,000								8,000
Potential Tree/Vine Kill									
Actual Acreage	26,869	1,206		15,996	5,865	1,035	9,053	9,633	69,657
All Surface Water Districts									
Total Acres	88,858	4,186	11,542	22,946	22,147	18,445	17,010	16,672	201,806
Not Planted	35,800	400	4,600	3,100					43,900
Abandoned				1,200	3,000		400	1,140	5,740
Reduced Yield/Maintained	16,000	2,420							18,420
Potential Tree/Vine Kill									
Actual Acreage	53,058	3,786	6,942	18,646	19,147	18,445	16,610	15,532	152,166

1992 KERN COUNTY CROP ACREAGE IMPACTED BY THE DROUGHT

	Cotton/ Field Crops	Alfalfa	Grains	Vegetables	Almonds/ Tree Nuts	Pistachios	Tree Fruits	Grapes	Total
GROUNDWATER DISTRICTS									
Buena Vista WSD									
Total Acres	33,630	3,185	1,590				89		38,494
Not Planted									
Abandoned									
Reduced Yield/Maintained									
Potential Tree/Vine Kill									
Actual Acreage	33,630	3,185	1,590				89		38,494
Buttonwillow ID									
Total Acres	32,404	11,780	2,739	1,667	5,967	67	48	227	54,899
Not Planted									
Abandoned									
Reduced Yield/Maintained									
Potential Tree/Vine Kill									
Actual Acreage	32,404	11,780	2,739	1,667	5,967	67	48	227	54,899
Cawelo Water District									
Total Acres	2,926	432	153	746	5,361	3,324	12,165	10,942	36,049
Not Planted	700								700
Abandoned					300				300
Reduced Yield/Maintained									
Potential Tree/Vine Kill									
Actual Acreage	2,226	432	153	746	5,061	3,324	12,165	10,942	35,049
Henry Miller Water District									
Total Acres	15,983		3,007						18,990
Not Planted									
Abandoned									
Reduced Yield/Maintained									
Potential Tree/Vine Kill									
Actual Acreage	15,983		3,007						18,990
I.D. #4									
Total Acres	2,796	1,170	650	410	550	7		8	5,591
Not Planted									
Abandoned									
Reduced Yield/Maintained									
Potential Tree/Vine Kill									
Actual Acreage	2,796	1,170	650	410	550	7		8	5,591

1992 KERN COUNTY CROP ACREAGE IMPACTED BY THE DROUGHT

	Cotton/ Field Crops	Alfalfa	Grains	Vegetables	Almonds/ Tree Nuts	Pistachios	Tree Fruits	Grapes	Total
Kern Delta Water District									
Total Acres	46,368	17,043	11,676	5,245			851	4,795	85,978
Not Planted									
Abandoned									
Reduced Yield/Maintained									
Potential Tree/Vine Kill									
Actual Acreage	46,368	17,043	11,676	5,245			851	4,795	85,978
Pond Poso ID									
Total Acres	32,558	12,437	4,185	2,057	4,526	18	272	1,482	57,535
Not Planted									
Abandoned									
Reduced Yield/Maintained									
Potential Tree/Vine Kill									
Actual Acreage	32,558	12,437	4,185	2,057	4,526	18	272	1,482	57,535
Rosedale Rio Bravo WSD									
Total Acres	17,313	6,012	1,236	3,417			957		28,935
Not Planted									
Abandoned									
Reduced Yield/Maintained									
Potential Tree/Vine Kill									
Actual Acreage	17,313	6,012	1,236	3,417			957		28,935
SemiTropic WSD									
Total Acres	4,695	606	280		19				5,600
Not Planted									
Abandoned									
Reduced Yield/Maintained									
Potential Tree/Vine Kill									
Actual Acreage	4,695	606	280		19				5,600
West Kern Water District									
Total Acres	172	307							479
Not Planted									
Abandoned									
Reduced Yield/Maintained									
Potential Tree/Vine Kill									
Actual Acreage	172	307							479

1992 KERN COUNTY CROP ACREAGE IMPACTED BY THE DROUGHT

	Cotton/ Field Crops	Alfalfa	Grains	Vegetables	Almonds/ Tree Nuts	Pistachios	Tree Fruits	Grapes	Total
All Groundwater Districts									
Total Acres	188,845	52,972	25,516	13,542	16,423	3,416	14,382	17,454	332,550
Not Planted	700								700
Abandoned					300				300
Reduced Yield/Maintained									
Potential Tree/Vine Kill									
Actual Acreage	188,145	52,972	25,516	13,542	16,123	3,416	14,382	17,454	331,550
TOTAL ALL DISTRICTS									
Total Acres	277,703	57,158	37,058	36,488	38,570	21,861	31,392	34,126	534,356
Not Planted	36,500	400	4,600	3,100					44,600
Abandoned				1,200	3,300		400	1,140	6,040
Reduced Yield/Maintained	16,000	2,420							18,420
Potential Tree/Vine Kill									
Actual Acreage	241,203	56,758	32,458	32,188	35,270	21,861	30,992	32,986	483,716

Source: Survey of Kern County Water Disitricts, 1993.

Not Planted:	Irrigated land that is typically planted but idled in 1992 because of lack of water.
Abandoned:	Acreage of perennial field crops and/or annual crops that were planted and established but abandoned due to lack of water.
Reduced Yield/Maintained:	Acreage receiving partial water but not enough to reach full yield potential.
Potential Tree/Vine Kill:	Acreage of fruits, nuts, and grapes that might die because of inadequate water.

8.2 Project 2 – Lost Hills New Well and Tank Replacement

8.2.1 Introduction

The Benefits and Cost Analysis for the Project are monetized benefits, and the costs are calculated on a net present value basis as specified in Section D3 - Monetized Benefits Analysis of the IRWM Proposition 84 Solicitation Package (Solicitation Package). This analysis does not reflect non-monetized benefits such as environmental improvements that may arise from the Project. This benefit analysis for the Lost Hills New Well and Tank Replacement provides a With-Project and Without-Project comparison for a Project life cycle of 50 years.

The Total Present Value Project Benefits is $516,204 and Total Present Value Costs is $2,046,702 as shown in Tables 8.01- and 8.2-4. All Project costs are 2012 costs calculated using the discount factors provided in the PSP.

With Project - A new well provides a source to help the Lost Hills Utility District (LHUD) to meet the Arsenic Standard for water delivered to residential customers. Replacing a deteriorating water tank with a new water storage tank assures the operability of the LHUD water delivery system. The existing storage tank is the only tank within LHUD's water system and it is critical for storage and for providing the required head pressure for operating LHUD's entire system.

Without Project – LHUD continues to operate the wells and treat for Arsenic. An alternative is to switch source water to SWP and construct a treatment plant. Although a detailed cost analysis was not conducted by the Consulting Engineer, the rough estimate of an alternative cost to construct a new treatment plant is to be at least $5M, which is over twice the proposed Project cost.

Arsenic is a prevalent naturally occurring element in the groundwater due to the local geology, predominantly found in the deeper parts of the groundwater aquifer. The LHUD's existing wells produce water that exceeds EPA and State standards for Arsenic. The two existing wells have arsenic levels of approximately 11 to 15 ppb. The acceptable MCL for potable water is an Arsenic level of less than 10 ppb. Both wells were constructed when the standard for drinking water was 50 ppb Arsenic. Currently to address the high Arsenic levels, the LHUD filters the water to remove the high concentrations of Arsenic. This filtration process is a significant added cost that is passed down to the DAC community's customers. A new well would minimize the water quality issues currently experienced by LHUD inasmuch as the new well would be constructed to minimize of avoid Arsenic issues.

The storage tank was built in 1952 and has been in operation since it was constructed. The water tank has sustained severe damage over its life time. Based on recent inspection, it was determined that the storage tank was severely corroded from the inside and that the storage tank could not be repaired. The storage tank has been in service beyond its rated lifetime.

The storage tank is burdening LHUD with excessive maintenance costs and inherent unplanned outages, which are becoming more frequent. In addition, repairs are becoming more frequent and some damages are beyond repair, threatening the operability of the system. Alternatives to Project 2 are summarized in Table 8.2-1, Cost Effectiveness.

Summary of Project Cost Benefits:

- Avoided Treatment Chemical Costs
- Power Cost savings

8.2.2 Project Costs

As shown in more detail on Table 7-2 – Project 2 (Attachment 7 of this Proposal), the Project costs are estimated to be $2,451,610. Project implementation will occur over 12 months, staggered over two calendar years, with 50-percent during the first year and 50-percent during the second year.

8.2.3 Project Benefits

8.2.3.1 Avoided Water Treatment Costs

Based on operations analyses looking at existing water treatment process by the LHUD for the DAC, it was determined that the annual cost of chemicals is $20,000 and the estimated annual electrical costs are $19,000, for a total of $39,000, as shown in Table 8.2-3.

8.2.3.2 Water Quality Benefits – Reduced Health Risks

These are non-monetized benefits shown in Table 8.2-2.

8.2.3.3 Power Cost Savings

See above

Project benefits, including water supply benefits, are shown in Tables 8.2-1 through 8.2-3:

- Table 8.2-1 Statement of Cost Effectiveness
- Table 8.2-2 Non-Monetized Benefits Checklist
- Table 8.2-3 Annual Costs of Avoided Project
- Table 8.2-4 Annual Costs of Project

Table 8.2-1 for Project 2 – Statement of Cost-Effectiveness Project name: Lost Hills New Well and Tank Replacement	
Question 1	**Types of benefits provided:** Water Quality, Water Supply
Question 2	**Have alternative methods of providing the same types and amounts of physical benefits as the proposed project been identified?**
	If no, why?
	If yes, list the methods (including the proposed project) and estimated costs: An alternative to pumping groundwater would be for Lost Hills Utility District (LHUD) to begin receiving State Water Project (SWP) water and construct a treatment facility. The District estimated that the construction of a water treatment facility would exceed $5 million. A new water storage tank would still need to be constructed with this alternative. The District came to the conclusion that the alternative was much more expensive, time consuming, and did not provide the same level of benefit as the New Well and Tank Replacement Project.
Question 3	**If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.**
Comments: The tank replacement is needed in all Project alternatives. The District has determined that the benefit/cost ratio of drilling a new groundwater well is greater than the benefit/cost ration of receiving SWP water and constructing a water treatment facility.	

Based on Table 11, November 2012 PSP

Table 8.2-2 for Project 2 – Non-monetized Benefits Checklist		
Project name: Lost Hills New Well and Tank Replacement		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	Community/Social Benefits **Will the proposal**	
1	**Provide education or technology benefits?**	**No**
2	**Provide social recreation or access benefits?**	**No**
3	**Help avoid, reduce or resolve various public water resources conflicts?**	**Yes**
	The Project directly helps a DAC meet an existing State Mandate on water quality.	
4	**Promote social health and safety?**	**Yes**
	The Tank Replacement element of the Project will promote social health and safety by providing LHUD with a new water storage tank that is in compliance with seismic standards, and is capable of providing potable water in the event of a natural disaster.	
5	**Have other social benefits?**	**Yes**
	The Project has a disproportionate beneficial effect on a disadvantaged community (DAC). LHUD will be able to replace and upgrade components of their potable water system without increasing water rates on its customers.	
	Environmental Stewardship Benefits: **Will the proposal**	
6	**Benefit wildlife or habitat in ways that were not quantified in Attachment 7?**	**No**
7	**Improve water quality in ways that were not quantified in Attachment 7?**	**No**
8	**Reduce net emissions in ways that were not quantified in Attachment 7?**	**No**
9	**Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?**	**No**
	Sustainability Benefits: **Will the proposal**	
10	**Improve the overall, long-term management of California groundwater resources?**	**No**
11	**Reduce demand for net diversions for the regions from the Delta?**	**No**
12	**Provide a long-term solution in place of a short-term one?**	**Yes**
	The Project will provide a long-term, reliable solution, rather than ongoing, piecemeal repairs of the tank.	
13	**Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?**	**No**
14	**Improve water supply reliability in ways not quantified in Attachment 7?**	**No**
15	**Other (If the above listed categories do not apply, provide non-monetized benefit description)?**	**No**

Based on Table 12, November 2012 PSP

Table 8.2-3 – Annual Costs of Avoided Projects (All avoided costs should be in 2012 dollars) Project: Project 2 - Lost Hills New Well and Tank Replacement						
	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Year	Alternative (Avoided Project Name): Do-Nothing Alternative Avoided Project Description: Avoided arsenic treatment and equipment power costs.				Discount Factor	Discounted Costs (e) x (f)
	Avoided Capital Costs	Avoided Replacement Costs	Avoided Operations and Maintenance Costs	Total Cost Avoided for Individual Alternatives		
2016	$ -	$ -	$ 39,000	$ 39,000	0.792	**$ 30,888**
2017	$ -	$ -	$ 39,000	$ 39,000	0.747	**$ 29,133**
2018	$ -	$ -	$ 39,000	$ 39,000	0.705	**$ 27,495**
2019	$ -	$ -	$ 39,000	$ 39,000	0.665	**$ 25,935**
2020	$ -	$ -	$ 39,000	$ 39,000	0.627	**$ 24,453**
2021	$ -	$ -	$ 39,000	$ 39,000	0.592	**$ 23,088**
2022	$ -	$ -	$ 39,000	$ 39,000	0.558	**$ 21,762**
2023	$ -	$ -	$ 39,000	$ 39,000	0.527	**$ 20,553**
2024	$ -	$ -	$ 39,000	$ 39,000	0.497	**$ 19,383**
2025	$ -	$ -	$ 39,000	$ 39,000	0.469	**$ 18,291**
2026	$ -	$ -	$ 39,000	$ 39,000	0.442	**$ 17,238**
2027	$ -	$ -	$ 39,000	$ 39,000	0.417	**$ 16,263**
2028	$ -	$ -	$ 39,000	$ 39,000	0.394	**$ 15,366**
2029	$ -	$ -	$ 39,000	$ 39,000	0.371	**$ 14,469**
2030	$ -	$ -	$ 39,000	$ 39,000	0.350	**$ 13,650**
2031	$ -	$ -	$ 39,000	$ 39,000	0.331	**$ 12,909**
2032	$ -	$ -	$ 39,000	$ 39,000	0.312	**$ 12,168**
2033	$ -	$ -	$ 39,000	$ 39,000	0.294	**$ 11,466**
2034	$ -	$ -	$ 39,000	$ 39,000	0.278	**$ 10,842**
2035	$ -	$ -	$ 39,000	$ 39,000	0.262	**$ 10,218**
2036	$ -	$ -	$ 39,000	$ 39,000	0.247	**$ 9,633**
2037	$ -	$ -	$ 39,000	$ 39,000	0.233	**$ 9,087**
2038	$ -	$ -	$ 39,000	$ 39,000	0.220	**$ 8,580**
2039	$ -	$ -	$ 39,000	$ 39,000	0.207	**$ 8,073**
2040	$ -	$ -	$ 39,000	$ 39,000	0.196	**$ 7,644**
2041	$ -	$ -	$ 39,000	$ 39,000	0.185	**$ 7,215**
2042	$ -	$ -	$ 39,000	$ 39,000	0.174	**$ 6,786**
2043	$ -	$ -	$ 39,000	$ 39,000	0.164	**$ 6,396**
2044	$ -	$ -	$ 39,000	$ 39,000	0.155	**$ 6,045**
2045	$ -	$ -	$ 39,000	$ 39,000	0.146	**$ 5,694**
2046	$ -	$ -	$ 39,000	$ 39,000	0.138	**$ 5,382**
2047	$ -	$ -	$ 39,000	$ 39,000	0.130	**$ 5,070**
2048	$ -	$ -	$ 39,000	$ 39,000	0.123	**$ 4,797**
2049	$ -	$ -	$ 39,000	$ 39,000	0.116	**$ 4,524**
2050	$ -	$ -	$ 39,000	$ 39,000	0.109	**$ 4,251**
2051	$ -	$ -	$ 39,000	$ 39,000	0.103	**$ 4,017**
2052	$ -	$ -	$ 39,000	$ 39,000	0.097	**$ 3,783**
2053	$ -	$ -	$ 39,000	$ 39,000	0.092	**$ 3,588**
2054	$ -	$ -	$ 39,000	$ 39,000	0.087	**$ 3,393**
2055	$ -	$ -	$ 39,000	$ 39,000	0.082	**$ 3,198**
2056	$ -	$ -	$ 39,000	$ 39,000	0.077	**$ 3,003**
2057	$ -	$ -	$ 39,000	$ 39,000	0.073	**$ 2,847**
2058	$ -	$ -	$ 39,000	$ 39,000	0.069	**$ 2,691**
2059	$ -	$ -	$ 39,000	$ 39,000	0.065	**$ 2,535**
2060	$ -	$ -	$ 39,000	$ 39,000	0.061	**$ 2,379**
2061	$ -	$ -	$ 39,000	$ 39,000	0.058	**$ 2,262**
2062	$ -	$ -	$ 39,000	$ 39,000	0.054	**$ 2,106**
2063	$ -	$ -	$ 39,000	$ 39,000	0.051	**$ 1,989**
2064	$ -	$ -	$ 39,000	$ 39,000	0.048	**$ 1,872**
2065	$ -	$ -	$ 39,000	$ 39,000	0.046	**$ 1,794**
					Total Present Value of Discounted Costs	**$ 516,204**
					(%) Avoided Cost Claimed by Project	**100%**
					Total Present Value of Discounted Avoided Project Costs Claimed by Alternative Project	**$ 516,204**

Comments:
The expenses associated with the "Do-Nothing" alternative relate to the arsenic removal system chemicals and arsenic removal equipment power use required to treat the low-quality groundwater to a level sufficient for domestic use. LHUD determined the a portion of the cost savings based on the arsenic removal chemicals currently required for treatment. As the new source would not require arsenic treatment, the savings is the total cost of arsenic treatment chemicals, which is $20,000. In addition, LHUD assessed the power requirements for the arsenic removal equipment. Based on energy use, LHUD estimated the arsenic removal equipment power cost savings at $19,000.

Based on Table 16, November 2012 PSP

Table 8.2-4 – Annual Costs of Project (All costs should be in 2012 Dollars) Project: Project 2 - Lost Hills New Well and Tank Replacement										
	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost[1]	Annual Costs [2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +…+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	1.000	**$ -**
2013	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0.943	**$ -**
2014	$ 367,742	$ -	$ -	$ -	$ -	$ -	$ -	$ 367,742	0.899	**$ 330,600**
2015	$ 1,397,418	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,397,418	0.839	**$ 1,172,433**
2016	$ 686,451	$ -	$ -	$ -	$ -	$ -	$ -	$ 686,451	0.792	**$ 543,669**
2017	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0.747	**$ -**
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										**$ 2,046,702**

Comments: It is estimated that 15-percent of the total Project cost will be expended in 2014, 57-percent will be expended in 2015, and the remaining 28-percent will be expended in 2016. No Initial Costs are expected after 2016. Once the Project is constructed, all Admin, Operation, Maintainence, and Replacement costs will be incorporated into the regular operating budget of LHUD. As such, no Annual Costs are expected for the life of the project.

(1) If any, based on opportunity costs, sunk costs and associated costs

(2) The incremental change in O&M costs attributable to the project

Based on Table 19, November 2012

8.3 Project 3 – Allensworth Tank Replacement and SCADA Upgrade

The Project consists of making improvements to ACSD's existing water system including (1) replacing an existing water tank and (2) upgrade of an automated control system (called Supervisory Control and Data Acquisition or SCADA) to increase operational reliability and water quality to a small DAC and state park. Because Project 3 directly benefits a DAC and would cost less than $1 Million, the Benefit Cost discussion for Project 3 uses the Cost Effectiveness Analysis (DWR Guidelines Exhibit D1).

8.3.1 Introduction and Summary of Benefits

Although both existing wells were constructed outside of the District's boundaries in an area with lesser Arsenic levels, one of the wells has Arsenic levels of approximately 6 to 12 ppb, at times above the acceptable MCL 10 ppb. The high Arsenic water from this problem well must be blended with water from the other well. The distances between each well and between the wells and the community cause serious operational problems (such as water hammer, well shutdown and uneven blending). This leads to water quality and water supply reliability problems which can be addressed cost effectively with replacing the antiquated water storage tank and installing a new SCADA system.

Project 3 would provide the following direct physical benefits:

- New storage tank (leading to improved reliability)
- Operational SCADA system (leading to more efficient operations and better water quality)

As a result the DAC community served by the ACSD would benefit from:

- Lower operational costs
- Increased emergency supply capacity
- Improved water quality due to lower Arsenic levels

8.3.2 Project Costs

As shown in more detail on Table 7-3 – Project 3 (Attachment 4 of this Proposal), the Project costs are estimated to be $356,500. All Project expenditures will occur in 2014.

8.3.3 Project Benefits

Project benefits, including water supply benefits, are shown in Tables 8.3-1 through 8.3-3:

- Table 8.3-1 Statement of Cost Effectiveness
- Table 8.3-2 Non-Monetized Benefits Checklist
- Table 8.3-3 Annual Costs of Project

Table 8.3-1 for Project 3 – Statement of Cost-Effectiveness Project name: Allensworth Tank Replacement and SCADA Upgrade	
Question 1	**Types of benefits provided:** Water Supply, Water Quality, and Operational Cost Savings
Question 2	**Have alternative methods of providing the same types and amounts of physical benefits as the proposed project been identified?**
	If no, why? The two elements of the Project that address the issues faced by the DAC are standard components of a water supply system. The system must have storage provided by the tank. Due to its condition, the antiquated tank cannot be brought into compliance with standards through repair. The only option is to replace the tank. Likewise, SCADA systems are standard for operation of a water supply system with dispersed elements that require integrated operation. Given the spacing of the wells, an upgrade of the existing SCADA system is the standard means to improve operation efficiency, and replaces the need for a person to access a remote site in the dark or during inclement weather.
	If yes, list the methods (including the proposed project) and estimated costs. N/A
Question 3	**If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.** N/A
Comments: The elements of the Allensworth Community Services District (ACSD) system that are proposed as Project 3 are standard components of a small water system. Evaluating engineering alternatives of a straightforward design and solution such as this is not considered fruitful or necessary for the small community. ACSD has worked with Self-Help Enterprises for years and relies on their advice to help determine options. The Project will provide other benefits, including: - A long-term, reliable solution, rather than ongoing, piecemeal repairs of the tank; - Assistance in meeting an existing State drinking water quality mandate; and - Bestow disproportional benefits on a DAC.	

Based on Table 11, November 2012 PSP

Table 8.3-2 for Project 3 – Non-monetized Benefits Checklist		
Project name: Allensworth Tank Replacement and SCADA Upgrade		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	Community/Social Benefits **Will the proposal**	
1	**Provide education or technology benefits?**	**No**
2	**Provide social recreation or access benefits?**	**No**
3	**Help avoid, reduce or resolve various public water resources conflicts?**	**Yes**
	The SCADA element of the Project will help ACSD in meeting an existing State drinking water quality mandate by allowing ACSD to more efficiently operate their blending program.	
4	**Promote social health and safety?**	**Yes**
	The Tank Replacement element of the Project will promote social health and safety by providing ACSD with a new water storage tank that is in compliance with seismic standards, and is capable of providing potable water in the event of a natural disaster.	
5	**Have other social benefits?**	**Yes**
	The Project has a disproportionate beneficial effect on a disadvantaged community (DAC). ACSD will be able to replace and upgrade components of their water distribution system without increasing water rates on its customers.	
	Environmental Stewardship Benefits: **Will the proposal**	
6	**Benefit wildlife or habitat in ways that were not quantified in Attachment 7?**	**No**
7	**Improve water quality in ways that were not quantified in Attachment 7?**	**No**
8	**Reduce net emissions in ways that were not quantified in Attachment 7?**	**No**
9	**Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?**	**No**
	Sustainability Benefits: **Will the proposal**	
10	**Improve the overall, long-term management of California groundwater resources?**	**No**
11	**Reduce demand for net diversions for the regions from the Delta?**	**Yes**
	The Project allows ACSD to continue utilizing local groundwater instead of seeking water	
12	**Provide a long-term solution in place of a short-term one?**	**Yes**
	The Project will provide a long-term, reliable solution, rather than ongoing, piecemeal	
13	**Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?**	**No**
14	**Improve water supply reliability in ways not quantified in Attachment 7?**	**Yes**
	The SCADA componenet of the Project will provide a more flexible mix of water sources by improving operational efficiency in ACSD's blending program. The new tank included in the Project will be more seismically stable than the existing tank and will reduce the	
15	**Other (If the above listed categories do not apply, provide non-monetized benefit**	**No**

Based on Table 12, November 2012 PSP

Table 8.3-3 – Annual Costs of Project (All costs should be in 2012 Dollars) Project: Project 3 - Allensworth Tank Replacement and SCADA Upgrade										
	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost[1]	Annual Costs [2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +…+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	1.000	**$ -**
2013	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0.943	**$ -**
2014	$ 356,500	$ -	$ -	$ -	$ -	$ -	$ -	$ 356,500	0.899	**$ 320,494**
2015	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0.839	**$ -**
2016	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0.792	**$ -**
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										**$ 320,494**

Comments: All of the Project cost will be expended in 2014. No Initial Costs are expected after 2014. Once the Project is constructed, all Admin, Operation, Maintainence, and Replacement costs will be incorporated into the regular operating budget of ACSD. As such, no Annual Costs are expected for the life of the project.

(1) If any, based on opportunity costs, sunk costs and associated costs
(2) The incremental change in O&M costs attributable to the project
Based on Table 19, November 2012 PSP

8.4 Project 4 – Groundwater Well Destruction Program

This Project will provide a mechanism by which funding can be provided for identifying and properly destroying up to 15 groundwater wells that have no remaining useful purpose and that have a potential to contribute to DAC water quality problems if not properly destroyed. Because Project 4 would cost less than $100,000 and provide benefits that cannot be easily monetized, the Benefit Cost discussion for Project 4 uses the Non-monetized Analysis (DWR Guidelines Exhibit D2). The cost effectiveness of this Project is summarized in Table 8.4-1.

8.4.1 Introduction and Summary of Physical Benefits

Project 4 would safeguard the groundwater supply relied on by the DAC's and the region by expediting the proper destruction of unused/abandoned wells. This Project will target wells constructed without regard to isolating poor quality zones and/or have deteriorated with time, in either case potentially allowing poor quality water to enter higher quality production zones (Center for Watershed Studies (2012) UCD Technical Report 5).

Improperly abandoned and destroyed wells may contribute to water quality problems in aquifer zones in the groundwater aquifer relied on by several DAC's for their water supply in the region including:

- Lost Hills Utility District
- Allensworth Community Services District
- Ducor Community Services District
- City of Wasco
- City of Delano
- City of McFarland
- City of Shafter
- Unincorporated areas South of Shafter

Project 4 would provide the following direct physical benefit:

- Destruction of wells causing cross contamination (leading to improved water quality)

As a result the DAC communities near destroyed wells would benefit from:

- Improved water quality

Benefits of the Project will be realized over the course of several years as less flow between aquifer zones occurs and less contamination is transported to zones developed as drinking water sources. (No direct measurement of this benefit is feasible).

8.4.2 Project Costs

As shown in more detail on Table 7-4 – Project 4 (Attachment 4 of this Proposal), the Project costs are estimated to be $73,500. Project expenditures are expected to occur between 2014 and 2015, with the majority of the expenses occurring in 2014.

8.4.3 Project Benefits

Project benefits, including water supply benefits, are shown in Table 8.4-1 through 8.4-3:

- Table 8.4-1 Statement of Cost Effectiveness
- Table 8.4-2 Non-Monetized Benefits Checklist
- Table 8.4-3 Annual Costs of Project

Table 8.4-1 for Project 4 – Statement of Cost-Effectiveness Project name: Groundwater Well Destruction Program	
Question 1	**Types of benefits provided:** Water Quality
Question 2	**Have alternative methods of providing the same types and amounts of physical benefits as the proposed project been identified?**
	If no, why? Wells constructed currently, and in recent history, have been constructed with particular attention paid to isolating zones of poor water quality from zones of good water quality. The same cannot be said of older wells. Even wells that were properly constructed deteriorate over time. In either case, these unused wells have the potential to allow poor quality water to enter into higher quality production zones. This can contribute significantly to water quality problems in near-by urban supply wells. There is not an alternative to destroying these unused wells that would provide the same benefit.
	If yes, list the methods (including the proposed project) and estimated costs. N/A
Question 3	**If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.** N/A
Comments: Based on a Technical Report 2: Nitrogen Sources and Loading to Groundwater by the Center for Watershed Sciences at UC Davis: *The annual surface discharge into an improperly sealed or leaking large well can amount to as much as the total amount of percolating recharge of an 8 ha (20 ac) irrigated parcel at a recharge rate of 300 mm/yr (1AF/ac/yr).* Groundwater containing high levels of NO3 and/or As will be prevented from migrating through improperly abandoned wells into higher quality zones produced for domestic supply in DACs. Benefits of the Project will be realized over the course of several years as less flow between aquifer zones occurs and less contamination is transported to zones developed as drinking water sources.	

Based on Table 11, November 2012 PSP

Table 8.4-2 for Project 4 – Non-monetized Benefits Checklist		
Project name: Groundwater Well Destruction Program		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	Community/Social Benefits **Will the proposal**	
1	**Provide education or technology benefits?**	**No**
2	**Provide social recreation or access benefits?**	**No**
3	**Help avoid, reduce or resolve various public water resources conflicts?**	**Yes**
	The Project directly addresses control of nitrate from agricultural sources. In turn, this helps DACs meet an existing State Mandate on water quality and agricultural interests meet an	
4	**Promote social health and safety?**	**Yes**
	By addressing agricultural nitrate issues, and helping DACs meet State water quality standards, the health and safety issues associated with nitrate and arsenic contamination	
5	**Have other social benefits?**	**Yes**
	This Project has a disproportionate beneficial effect on DACs in Kern County and Tulare County. The potential for unused groundwater wells to contaminate the domestic water supply of DACs in the area will be significantly reduced.	
	Environmental Stewardship Benefits: **Will the proposal**	
6	**Benefit wildlife or habitat in ways that were not quantified in Attachment 7?**	**No**
7	**Improve water quality in ways that were not quantified in Attachment 7?**	**No**
8	**Reduce net emissions in ways that were not quantified in Attachment 7?**	**No**
9	**Provide other environmental stewardship benefits, other than those claimed in**	**No**
	Sustainability Benefits: **Will the proposal**	
10	**Improve the overall, long-term management of California groundwater resources?**	**Yes**
	The Project aims to reduce contamination of groundwater resources by permanently eliminating sources of contamination.	
11	**Reduce demand for net diversions for the regions from the Delta?**	**Yes**
	By reducing sources of contamination of groundwater resouces, the Project allows for the evtual utilization of higher quality groundwater. This, in turn, reduces the demand on	
12	**Provide a long-term solution in place of a short-term one?**	**Yes**
	The Project will permanently eliminate sources of contamination in the region.	
13	**Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?**	**No**
14	**Improve water supply reliability in ways not quantified in Attachment 7?**	**No**
15	**Other (If the above listed categories do not apply, provide non-monetized benefit**	**No**

Based on Table 12, November 2012 PSP

Table 8.4-3 – Annual Costs of Project (All costs should be in 2012 Dollars) Project: Project 4 - Groundwater Well Destruction Program										
	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost[1]	Annual Costs [2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	1.000	**$ -**
2013	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0.943	**$ -**
2014	$ 55,125	$ -	$ -	$ -	$ -	$ -	$ -	$ 55,125	0.899	**$ 49,557**
2015	$ 18,375	$ -	$ -	$ -	$ -	$ -	$ -	$ 18,375	0.839	**$ 15,417**
2016	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0.792	**$ -**
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										**$ 64,974**

Comments: It is estimated that 75-percent of the total project cost will be expended in 2014, and the remaining 25-percent will be expended in 2015. No Initial Costs are expected after 2015. There are no Admin, Operation, Maintainence, or Replacement costs associated with the Project. As such, no Annual Costs are expected for the life of the project.

(1) If any, based on opportunity costs, sunk costs and associated costs
(2) The incremental change in O&M costs attributable to the project
Based on Table 19, November 2012 PSP

8.5 Project 5 – On-Farm Mobile Lab for Water Use Efficiency In Support Of Nutrient Management

The On-Farm Mobile Lab for Nutrient Management in support of Nutrient Management (Project 5) will provide Mobile Lab services to an estimated 12,000 acres of irrigated farmland primarily within the North West Kern Resource Conservation District service area. Contribution to the On-Farm Mobile Lab for Water Use Efficiency in support of Nutrient Management will demonstrate to landowners methods that will enable them to better manage the water they have available to them by improving their irrigation scheduling, management and delivery methods, which supports fertilizer (nutrient) management. Because Project 5 would cost less than $100,000 and provide benefits that cannot be easily monetized, the Benefit Cost discussion for Project 5 uses the Non-monetized Analysis (DWR Guidelines Exhibit D2).

8.5.1 Introduction and Summary of Physical Benefits

The Mobile Lab provides specific onsite information about irrigation system performance that supports the grower to be more proficient in maintaining water application efficiency, which also supports nutrient management. In addition to the on-farm irrigation evaluations, irrigation workshops are presented annually to provide information to landowners who might not otherwise receive an on-farm irrigation evaluation.

The Project will assist in addressing a critical water supply need for several disadvantaged communities (DACs) in the region by reducing NO_3 loading that contributes to DAC water quality problems. Less than optimum water use may contribute to water quality problems in aquifer zones used by the 16 DACs in the region.

Project 5 would provide the following direct physical benefit:

- Reduced water use (direct measurement, District tracking/measurement)
- Reduced on-farm energy use (direct measurement, proprietary information)

Project 5 would provide the following indirect benefit:

- Reduced NO3 movement below the root zone and transported to the aquifer (no measurement)

As a result the agricultural growers increase water use efficiency at a lower cost and the DAC communities benefit from improved water quality.

8.5.2 Project Costs

As shown in more detail on Table 7-5 – Project 5 (Attachment 4 of this Proposal), the Project costs are estimated to be $206,500. Project expenditures are expected to occur between 2013 and 2016, with the majority of the expenses occurring in 2014 and 2015.

8.5.3 Project Benefits

Project benefits, including water supply benefits, are shown in Tables 8.5-1 through 8.5-3:

- Table 8.5-1 Statement of Cost Effectiveness
- Table 8.5-2 Non-Monetized Benefits Checklist
- Table 8.5-3 Annual Costs of Project

Table 8.5-1 for Project 5 – Statement of Cost-Effectiveness Project name: On-Farm Mobile Lab for Water Use Efficiency in Support of Nutrient Management	
Question 1	**Types of benefits provided:** Water Supply and Water Quality
Question 2	**Have alternative methods of providing the same types and amounts of physical benefits as the proposed project been identified?**
	If no, why? The Mobile Irrigation Lab services performed by the North West Kern Resource Conservation District (NWKRCD) and provide specific on-site evaluations of irrigation system performance. This evaluation includes observations and recommendations regarding system management, maintenance, and water application efficiency, which also supports optimum nutrient application. This service has been provided by NWKRCD, free of charge to landowners, for a number of years and has proven to be a valuable tool to land owners in Kern County and Tulare County. There are no other programs directly available to landowners of the size, scope, cost, and reputation of the NWKRCD Mobile Irrigation Lab.
	If yes, list the methods (including the proposed project) and estimated costs. N/A
Question 3	**If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.** N/A
Comments: The Project will support efficient water management practices that help address a critical water supply need for several disadvantaged communities (DACs) in Tulare and Kern Counties by assisting to reduce nutrient loading associated with DAC water quality problems.	

Based on Table 11, November 2012 PSP

Table 8.5-2 for Project 5 – Non-monetized Benefits Checklist		
Project name: On-Farm Mobile Lab for Water Use Efficiency in Support of Nutrient Management		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	Community/Social Benefits **Will the proposal**	
1	**Provide education or technology benefits?**	**No**
2	**Provide social recreation or access benefits?**	**No**
3	**Help avoid, reduce or resolve various public water resources conflicts?**	**Yes**
	The Project directly addresses control of nitrate from agricultural sources. In turn, this helps DACs meet an existing State Mandate on water quality and agricultural interests meet an existing state mandate for NO_3 control.	
4	**Promote social health and safety?**	**Yes**
	By addressing agricultural nitrate issues, and helping DACs meet State water quality standards, the health and safety issues associated with nitrate contamination will be reduced.	
5	**Have other social benefits?**	**Yes**
	This Project has a disproportionate beneficial effect on DACs in Kern County and Tulare County. The potential for unused groundwater wells to contaminate the domestic water supply of DACs in the area will be significantly reduced.	
	Environmental Stewardship Benefits: **Will the proposal**	
6	**Benefit wildlife or habitat in ways that were not quantified in Attachment 7?**	**No**
7	**Improve water quality in ways that were not quantified in Attachment 7?**	**No**
8	**Reduce net emissions in ways that were not quantified in Attachment 7?**	**No**
9	**Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?**	**No**
	Sustainability Benefits: **Will the proposal**	
10	**Improve the overall, long-term management of California groundwater resources?**	**Yes**
	The Project aims to reduce the use of groundwater resources by increasing efficiency of agricultural irrigation systems, and to reducing nitrate contamination by helping landowners optimize fertilizer application.	
11	**Reduce demand for net diversions for the regions from the Delta?**	**Yes**
	By increasing efficiency of agricultural irrigation systems, ag users will be able to use less water while maintaining agricultural yield. This equates to a reduced demand on groundwater and surface water.	
12	**Provide a long-term solution in place of a short-term one?**	**Yes**
	The on-farm system evaluations are intended to optimize agricultural irrigation and provide landowners with suggestions on how to operate more efficiently in the future.	
13	**Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?**	**Yes**
	By increasing efficiency of agricultural irrigation systems, ag users will be able to reduce the amount of energy used for pumping and operation of the irrigation systems.	
14	**Improve water supply reliability in ways not quantified in Attachment 7?**	**No**
15	**Other?**	**No**

Based on Table 12, November 2012 PSP

Table 8.5-3 – Annual Costs of Project (All costs should be in 2012 Dollars) Project: Project 5 - On-Farm Mobile Lab for Water Use Efficiency in Support of Nutrient Management										
	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost[1]	Annual Costs [2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +…+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012	$ -	0	0	0	0	0	0	$ -	1.000	**$ -**
2013	$ 20,650	0	0	0	0	0	0	$ 20,650	0.943	**$ 19,473**
2014	$ 82,600	0	0	0	0	0	0	$ 82,600	0.899	**$ 74,257**
2015	$ 82,600	0	0	0	0	0	0	$ 82,600	0.839	**$ 69,301**
2016	$ 20,650	0	0	0	0	0	0	$ 20,650	0.792	**$ 16,355**
2017	$ -	0	0	0	0	0	0	$ -	0.747	**$ -**
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										**$ 179,387**

Comments: It is estimated that 10-percent of the total project cost will be expended in 2013, 40-percent will be expended in 2014, 40-percent will be expended in 2015, and the remaining 10-percent will be expended in 2016. No Initial Costs are expected after 2016. There are no Admin, Operation, Maintainence, or Replacement costs associated with the project. As such, no Annual Costs are expected for the life of the Project.

(1) If any, based on opportunity costs, sunk costs and associated costs

(2) The incremental change in O&M costs attributable to the project

Based on Table 19, November 2012 PSP

8.6 Project 6 – South Shafter Sewer – Planning and Design

This project would fund planning and design of a wastewater collection system and trunk line that will connect the DAC community of Smith Corner to the City of Shafter/North of the River regional wastewater system. The technical justification is the need to replace failing septic systems to eliminate a source of groundwater contamination and health risk. Because this project directly benefits a DAC and would cost less than $1 Million, the Benefit Cost discussion for Project 6 uses the Cost Effectiveness Analysis (DWR Guidelines Exhibit D1).

8.6.1 Introduction and Summary of Benefits

The residents of Smith Corner south of the City of Shafter currently rely on septic systems, most of which are quite old, with failing leach fields that have been identified as a source of public health risk and groundwater contamination. The community is in the unincorporated area of Kern County and has no special district serving their wastewater treatment needs. Completion of planning and design will provide Smith Corner with the basis for seeking funds to implement a sewer collection system within the community's financial resources. The preliminary design demonstrated that a system serving Smith Corner could be readily extended to serve an additional 5 DAC communities.

This Project would result in plans and engineering design drawings. No physical benefit would occur until the sewer facilities are built and placed into operation. When constructed, the sewer collection system will end use of failing septic systems and eliminate a source of groundwater contamination and health risk. Sewage effluent would be transported to the City of Shafter/North of the River regional wastewater treatment plant. Sufficient capacity exists at the facility to accept the additional load.

Project 6 provides the following benefit:

- Readiness for future construction of the sewer collection system that will end use of failing septic systems (eliminating a source of groundwater contamination and health risk)

Once the sewer facilities are constructed, the DAC communities would benefit from:

- Improved water quality
- Reduced public health risk

8.6.2 Project Costs

As shown in more detail on Table 7-6 – Project 6 (Attachment 4 of this Proposal), the Project costs are estimated to be $356,000. Project expenditures are expected to occur between 2014 and 201, with the majority of the expenses occurring in 2015.

8.6.3 Project Benefits

Project benefits, including water supply benefits, are provided in Tables 8.6-1 through 8.6-3:

- Table 8.6-1 Statement of Cost Effectiveness
- Table 8.6-2 Non-Monetized Benefits Checklist
- Table 8.6-3 Annual Costs of Project

Table 8.6-1 for Project 6 – Statement of Cost-Effectiveness Project name: South Shafter Sewer - Planning and Design	
Question 1	**Types of benefits provided:** Water Quality
Question 2	**Have alternative methods of providing the same types and amounts of physical benefits as the proposed project been identified?**
	If no, why? The Project is in the planning and design stage. Feaseible alternatives will be considered during ongoing engineering. In addition, sewer collection systems have a standard design and practice of installation. Analysis of different alternatives to eliminate septic systems was not warranted.
	If yes, list the methods (including the proposed project) and estimated costs. N/A
Question 3	**If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.** N/A
Comments: The elements of a sewer collection system involve straightforward planning and standard design. Additional consideration of alternatives may occur during the ongoing design process, as warrented. The project will provide other benefits, including: - A long-term solution, rather than ongoing, piecemeal cleaning of septic systems; - Help meet an existing State drinking water quality mandate; and - Bestow disproportional benefits on a DAC	

Based on Table 11, November 2012 PSP

Table 8.6-2 for Project 6 – Non-monetized Benefits Checklist		
Project name: South Shafter Sewer - Planning and Design		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	Community/Social Benefits **Will the proposal**	
1	**Provide education or technology benefits?**	**No**
2	**Provide social recreation or access benefits?**	**No**
3	**Help avoid, reduce or resolve various public water resources conflicts?**	**Yes**
	The Project addresses the source of groundwater contamination from improper operation of septic tanks.	
4	**Promote social health and safety?**	**Yes**
	The aim of the project is to design a wastewater collection system that will get the residents off of septic systems. This promotes social health through the elimination of a source of groundwater contamination, as well as the elimination of unsanitary conditions caused by backed-up septic tanks.	
5	**Have other social benefits?**	**Yes**
	This Project has a disproportionate beneficial effect on DACs in Kern County and Tulare County. The potential for septic tanks to contaminate the domestic water supply of DACs in the area will be significantly reduced.	
	Environmental Stewardship Benefits: **Will the proposal**	
6	**Benefit wildlife or habitat in ways that were not quantified in Attachment 7?**	**No**
7	**Improve water quality in ways that were not quantified in Attachment 7?**	**No**
8	**Reduce net emissions in ways that were not quantified in Attachment 7?**	**No**
9	**Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?**	**No**
	Sustainability Benefits: **Will the proposal**	
10	**Improve the overall, long-term management of California groundwater resources?**	**Yes**
	The Project will permanently abandon a source of groundwater contamination.	
11	**Reduce demand for net diversions for the regions from the Delta?**	**No**
12	**Provide a long-term solution in place of a short-term one?**	**Yes**
	The aim of the project is to get the residents off of septic systems which require frequent and costly maintenance, and onto a well-designed wastewater collection system that will serve the community far into the future.	
13	**Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?**	**No**
14	**Improve water supply reliability in ways not quantified in Attachment 7?**	**No**
15	**Other (If the above listed categories do not apply, provide non-monetized benefit description)?**	**No**

Based on Table 12, November 2012 PSP

Table 8.6-3 – Annual Costs of Project (All costs should be in 2012 Dollars) Project: Project 6 - South Shafter Sewer - Planning and Design										
	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost[1]	Annual Costs [2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	1.000	**$ -**
2013	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0.943	**$ -**
2014	$ 117,480	$ -	$ -	$ -	$ -	$ -	$ -	$ 117,480	0.899	**$ 105,615**
2015	$ 238,520	$ -	$ -	$ -	$ -	$ -	$ -	$ 238,520	0.839	**$ 200,118**
2016	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0.792	**$ -**
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										**$ 305,733**

Comments: It is estimated that 33-percent of the total Project cost will be expended in 2014 and 67-percent will be expended in 2015. No Initial Costs are expected after 2015. There are no other Admin, Operation, Maintainence, or Replacement costs associated with this Project.

(1) If any, based on opportunity costs, sunk costs and associated costs
(2) The incremental change in O&M costs attributable to the project
Based on Table 19, November 2012 PSP