DEMONSTRATION OF IRRIGATION RETURN FLOW SALINITY CONTROL IN THE UPPER RIO GRANDE--ANNUAL REPORT, YEAR 2

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ANNUAL REPORT--YEAR 2
February 17, 1976 to February 16, 1977
EPA Grant No. S803565-02-0

PROJECT OFFICER
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in cooperation with
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and
Department of Geoscience, NMIMT

March 1977

The work upon which this report is based was supported in part by funds provided by the United States Environmental Protection Agency under Grant number S803565-02-0 through the New Mexico Water Resources Research Institute as authorized under the Water Resources Research Act of 1965, Public Law 88-379.

ACKNOWLEDGEMENTS

This study is being conducted under NMWRRI project number 3109-314, further described by EPA Grant number S803565-02-0, through the New Mexico Water Resources Research Institute in cooperation with the New Mexico Agricultural Experiment Station, New Mexico State University, and New Mexico Institute of Mining and Technology.

The work upon which this report is based was supported primarily by funds provided through the New Mexico Water Resources Research Institute by the United States Environmental Protection Agency.

Principal and other investigators include the following professionals with universities represented and area of expertise. This is an interdisciplinary team effort. The order of authors does not represent seniority of authorship. Robert R. Lansford served as coordinator for all phases of the project.

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Special thanks go to John W. Clark, former Director of the New Mexico Water Resources Research Institute for his support in the search for funding for the project; to Garrey E. Carruthers, Acting Director of the NMWRRI for his continuing support of the project; to the United States Environmental Protection Agency; to Drs. Arthur G. Hornsby and James P. Law of the Robert S. Kerr Environmental Research Laboratory at Ada, Oklahoma, for providing funding for the project; to the Bureau of Reclamation of the U. S. Department of Interior for providing data for the hydrosalinity model; and to Linda Burks for efficiently and expertly typing the report. Needless to say errors remaining, either in logic or numerical content are attributable to the authors.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOS

DEMONSTRATION OF IRRIGATION RETURN FLOW SALINITY CONTROL IN THE UPPER RIO GRANDE--ANNUAL REPORT, YEAR 2*

INTRODUCTION

The general objective of this demonstration project is to show the feasibility of alternative water management practices on the quality of drainage return flow and soil salinity in the Upper Rio Grande basin (Figure 1). The project consists of a 450-acre demonstration site, a four-acre test site, and a hydrosalinity model. On the 450-acre demonstration site, a combination of present-day irrigation techniques will be used to show how, through modern water management, the irrigation return-flow quality and quantity can be improved. The feasibility of irrigating at or near 100 percent efficiency with water of medium salinity (1,200 ppm), while maintaining optimum crop yields over a period of many years will be shown on a four-acre test site. The hydrosalinity model will be tested for the Mesilla Valley conditions.

This report summarizes progress achieved from February 17, 1976 to February 16, 1977 on the project plan of work (Appendix A). This interdisciplinary research effort in the second year entailed primarily reconstruction of physical equipment and monitoring farming and irrigation practices on the 450-acre demonstration farm located near La Mesa in the Mesilla Valley (Figure 2). A second major effort involved preliminary testing in the Mesilla Valley of a hydrosalinity model developed by the Bureau of Reclamation for the Environmental Protection Agency. This model permits prediction of the quality of irrigation return flow from a drainage basin. A third major area in this research effort is to study the effect of irrigating at or near 100 percent efficiency.

GENERAL DESCRIPTION

The Mesilla Valley, an alluvial valley adjacent to the Rio Grande in southern New Mexico, extends approximately 60 miles from Selden Canyon to El Paso Canyon and has a maximum width of about five miles. The valley encompasses about 100,000 acres. The major population center is Las Cruces, New Mexico with El Paso, Texas immediately south of the area. The valley has fairly level topography with a relatively smooth alluvial floodplain ranging in width from a few hundred feet to about five miles; it is bordered by steep bluffs 50 to 100 feet high, composed of loosely cemented sand, silt, clay, and gravel. Recent alluvium about 100 feet forms the primary aquifer; it is underlain by basin fill deposits (Santa Fe Group) which also yield substantial amounts of water.

The climate of the valley is predominantly semi-arid. It is characterized by clear and sunny days, large diurnal temperature ranges, low humidity, and scant rainfall. The mean annual precipitation averages less than 10 inches, with a maximum of about 18 inches and a minimum of about three inches. Most of the rain usually falls in summer when tropical air masses from the Gulf of Mexico move over the area and cause thunderstorms. These showers are occasionally accompanied by hail, which may severely damage crops. The high temperature and low humidity lead to rapid evaporation of rainfall.

**Principal contributors to this interdisciplinary annual report: Robert R. Lansford, Agricultural Economist, NMSU; Peter J. Wierenga, Soil Physicist, NMSU; Lynn Gelhar, Hydrologist, NMIMT; Ted W. Sammis, Agricultural Engineer, NMSU; Charles M. Hohn, Extension Agricultural Engineer, NMSU; Gene O. Ott, Extension Farm Management Specialist, NMSU. Other investigators contributing to the annual report: Bobby J. Creel, Agricultural Economist, NMSU; James B. Sisson, Soil Physicist, NMSU; D. Mark Stilson, Agricultural Engineer, NMSU; Adel A. Bakr, Hydrologist, NMIMT; and Charles E. Siepel, Agricultural Economist, NMSU.*

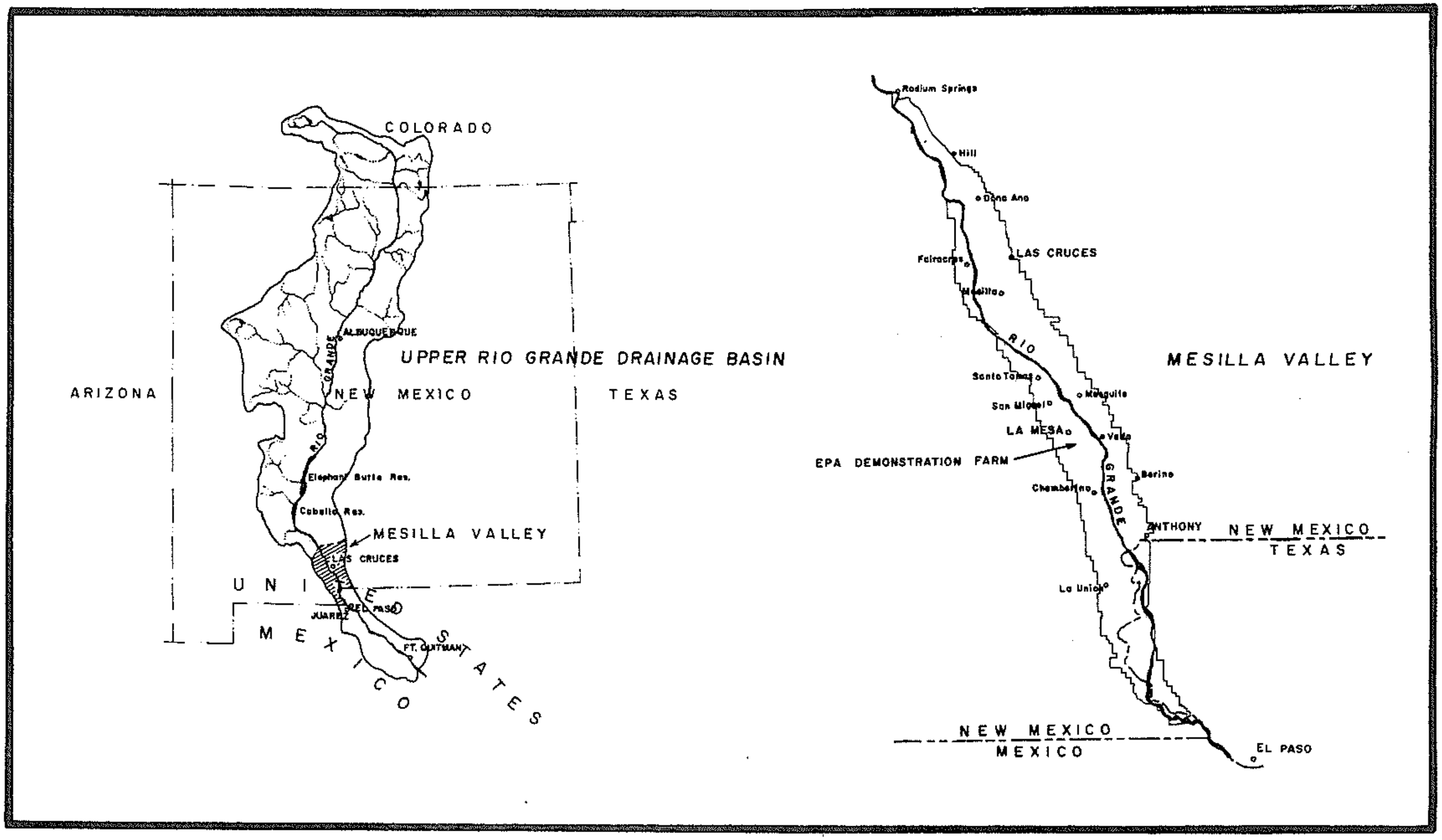
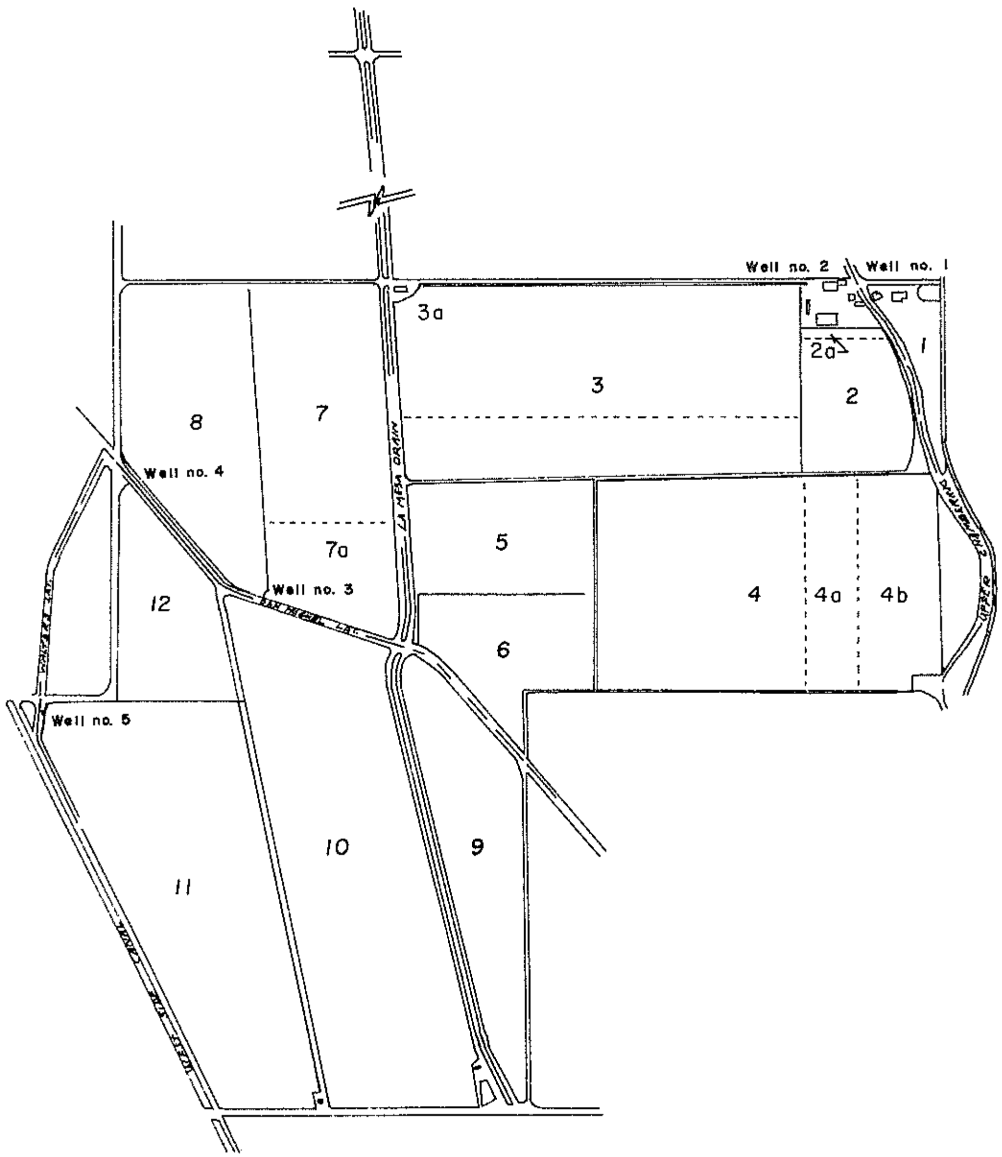


Figure 1. Location of irrigation return flow salinity control demonstration farm in the Mesilla Valley and Upper Rio Grande drainage basin, New Mexico.



1976 Crop Year

Field Number	Crop
1	Pecans
2	Cayenne Chile
2a	Trickle vegetables
3	Wheat
3a	Wheat/Lettuce
4	Cotton
4a	Chile 6-4
4b	Floral Gem Chile
5	Wheat
6	Wheat
7	Cayenne Chile
7a	Grain Sorghum
8	Tomatoes
9	Cotton
10	Alfalfa
11	Tomatoes
12	Cotton

1975 Crop Year

Field Number	Crop
1	Pecans
2	Wheat
3	Tomatoes
4	Cotton
5	Floral Gem Chile
6	Chile 6-4/Corn
7	Lettuce
8	Cotton
9	Chile 6-4
10	Alfalfa
11	Chile 6-4
12	Chile 6-4

Figure 2. Crops and well locations on demonstration farm, 1975 and 1976 crop years.

DEMONSTRATION FARM

The cooperative agreement with Mr. Orlando Cervantes, Manager of the J. F. Apodaca Farms, Inc. has continued on into the second year of the project. With Mr. Cervantes' cooperation, parshall flumes have been installed in all the irrigation distribution ditches on the farm. In the previous year, meters had been installed on all the pumps. Table 1 presents the cropping patterns for the 1975 and 1976 crop years by field number. The major changes in crops were a 19.2 acre decrease in the cotton acreage, 115 acre decrease in chile 6-4, tomatoes acreage increased 21.4, wheat acreage increased by 98.8 and 14 acres of sorghum for a green manure crop. The sorghum was planted in mid-June in field 7 where the stand of cayenne chile was not sufficient for production. Later in 1976, 50 acres of field 3 was planted to fall lettuce.

Table 1. Crop and acreages, demonstration farm 1975 and 1976 crop years

Crop	1975	1976
	(acres)	
Cotton	102.5	83.3
Chile 6-4	124.2	9.0
Tomatoes	74.0	95.4
Alfalfa	69.4	69.4
Wheat	13.9	112.7
Floral gem chile	19.7	20.0
Cayenne chile	40.7	40.3
Pecans	3.2	3.2
Lettuce		(50.0)**
Grain sorghum	0.0	14.0
Vegetable trickle demonstration	0.0	0.3
	447.6	447.6

*Second crop following cayenne chile field 7.
**Second crop following wheat on field 3.

Reconstruction of Physical Equipment

Trickle System

Two problems developed with the trickle system: (1) timing of irrigations on the pecan orchard and (2) inadequate filter systems on the trickle irrigation well. A timer was installed on the trickle system and operated the system on a six-hour per day schedule.

The screen filter originally installed on the drip-irrigation system was inadequate, passing sand particles through the filters. Subsequently, a new filter system was installed using two sand filters connected in such a manner to permit automatic back-flushing. A picture of the installation and a flow schematic is presented in Figure 3 and Photo 1.

After installation of the new filter system, the existing lines were cut open and over a quarter of an inch of sand was found deposited in the bottom of the distribution lines. Consequently, the system will have to be flushed in the spring to remove as much of the sand as possible and monitored carefully to prevent the existing sand in the system from plugging emitters. The drip demonstration vegetable site was abandoned in early summer after the drip distribution lines became plugged with sand. The site became a garden plot for the farm manager and workers on the farm.

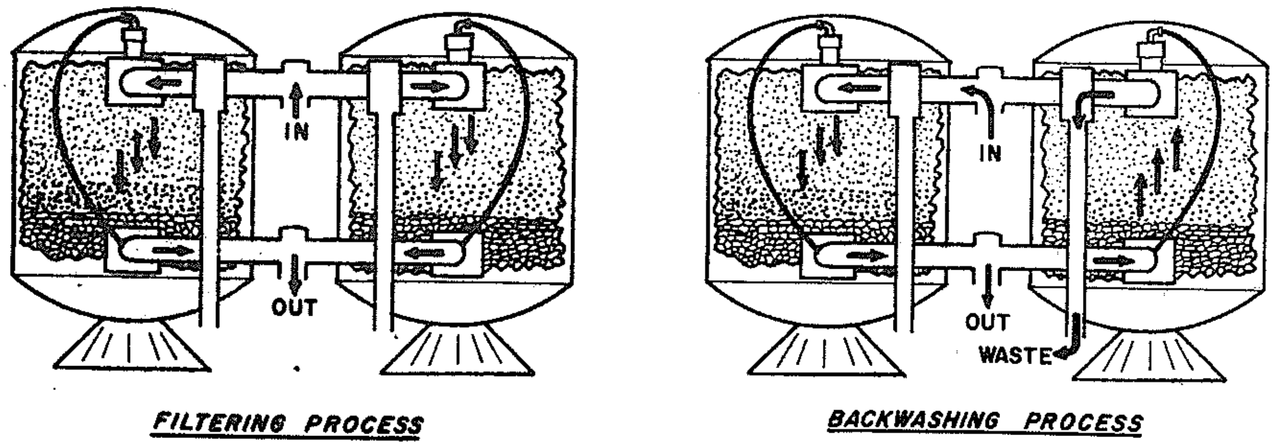


Figure 3. Flow schematic of automatic drip-irrigation filter system.

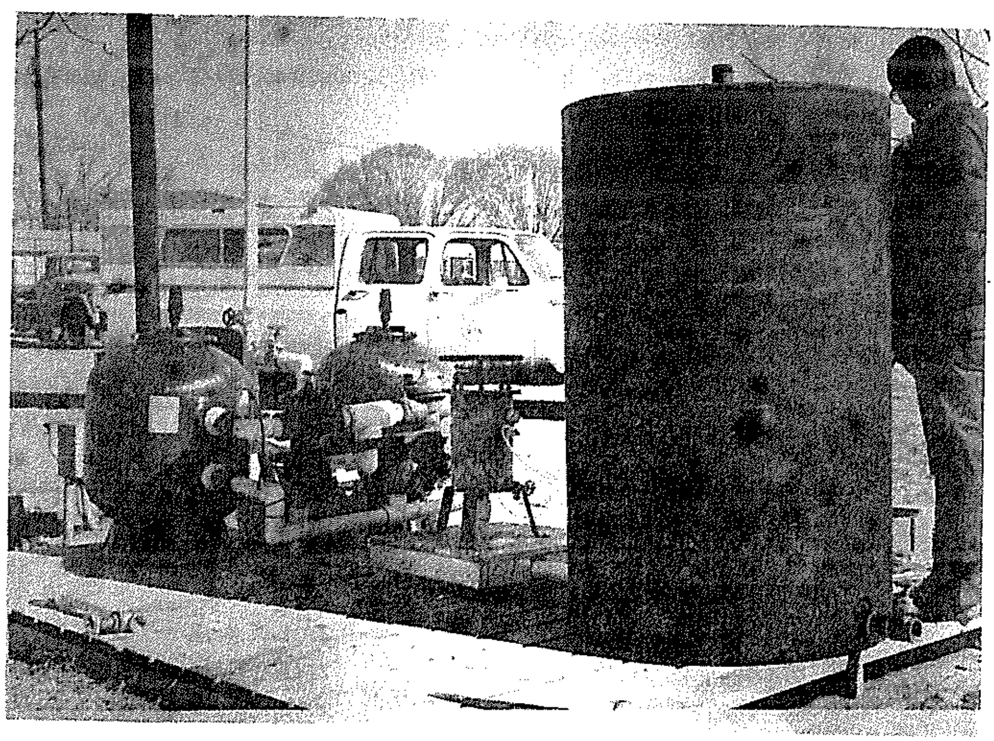


Photo 1. Photo of installation of automatic drip-irrigation filter system.

Partial Flumes

The partial flumes were cemented into position to keep irrigation water from bypassing them. Additional water stage recorders and stilling wells have been purchased. They are being installed on all flumes so that a continuous record of the water applications will be available.

Monitoring

Piezometers

The piezometers that were installed in August of 1975 have been continually monitored weekly for changes in the water table (Figure 4). The measurement records are presented in Appendix B.

Drains

The flow for the La Mesa drain is presented in Appendix C. The drain flow at each gaging station was recorded each week and samples were analyzed in the New Mexico State University Soils and Water Laboratory. The locations are shown in Figure 5.

Climatological Data

Climatological data (solar radiation, air temperature, dew point temperature, wind speed, and pan evaporation) were measured at the NMSU Plant Science Center and are presented in Appendix D.

Irrigation Wells

Natural gas consumption and water volume pumped for each well on the demonstration farm are presented in Table 2. Also shown in Appendix E are curves relating fuel consumption to gallons pumped for pumps on wells 3 and 5. Wells 1 and 2 are hooked to the same gas meter. The gas and water meters were read weekly. Each well and pumping plant has been tested for engine efficiency, pump efficiency, and overall efficiency. The fuel pumping cost per acre-foot of water based on the above tests is presented in Table 3. Chemical composition of wells 1, 2, 3, and trickle is presented in Appendix F.

Irrigation Schedule

Irrigation scheduling at the demonstration farm is provided through a contact with Agricultural Technology, Inc. The data on dates of recommending irrigation and the date that the fields were irrigated are presented in Table 4 along with the applied amount of water.

Table 3. 1976 pumping costs (fuel only)*, EPA demonstration farm, La Mesa, New Mexico

Pump No.	Volume Pumped (acre-feet)	Fuel Cost/Ac-Ft (dollars)	Total Fuel Cost (dollars)
2	115.10	6.07	698.66
3	106.48	2.01	214.03
4	123.60	2.11	260.80
5	141.54	2.40	339.70

*Pump tests were performed by George Abernathy, Professor, Agricultural Engineering, NMSU; Dan Cook, Assistant Professor, Agricultural Institute, NMSU; Tom Blain, Research Assistant, Agricultural Engineering, NMSU.

Figure 4. Flume and piezometer locations on demonstration farm.

Figure 5. Sampling and demonstration sites for demonstration farm.

Table 2. Irrigation pump natural gas consumption and water meter readings on selected wells, demonstration farm

Date	Demonstration Farm Wells: No. 1 & 2 Natural Gas Meter	No. 1 & 2 Water Meter[a]	No. 3 Natural Gas Meter	No. 3 Water Meter	No. 4 Natural Gas Meter	No. 4 Water Meter	No. 5 Natural Gas Meter	No. 5 Water Meter
1976	(00 ft^3)	(000 gal)	(00 ft^3)	(000 gal)	(00 ft^3)	(000 gal)	(00 ft^3)	(000 gal)
2-21	421	21,735	6,774	9,870	4,043	1,073	4,263	16,591
2-28	423	21,735	6,774	9,870	4,043	1,073	4,263	16,591
3-6	425	21,735	6,774	9,870	4,043	1,073	4,263	16,591
3-13	427	21,735	6,774	9,870	4,043	1,073	4,263	16,591
3-20	428	21,736	6,774	9,870	4,043	1,073	4,263	16,591
3-27	430	21,736	6,774	9,870	4,043	1,073	4,263	16,591
4-3	431	21,736	6,774	9,869	4,044	1,073	4,263	16,592
4-10	432	21,736	6,774	9,869	4,043	1,073	4,263	16,592
4-17	446	21,886	6,774	9,869	4,044	1,073	4,263	16,592
4-23	490[b]	22,343			4,180[b]	4,593		
4-24	0	22,343	6,870	12,343	4,630	4,593	4,480	20,166
4-26			2,320[c]	12,343			0[c]	20,166
5-1	0	22,343	2,320	12,343	4,630	4,593	0	20,166
5-8	435	25,956	2,320	12,343	4,630	4,593	0	20,166
5-15	1,061	31,054	2,402	12,402	4,630	4,593	0	20,166
5-20	1,061	31,054	2,560	19,221	4,881	11,204	405	25,912
5-28	1,075	31,080	2,665	22,192	5,015	14,453	718	30,624
6-21	1,350	33,262	2,772	22,192	5,347	22,878	1,455	41,326
6-29	1,355	33,293	2,721	27,210	5,504	29,518	1,822	46,534
7-8	1,355	33,293	2,721	27,210	5,504	29,518	1,956	47,422
7-19	1,358	33,293	2,856	27,223	5,504	29,518	1,958	48,453
7-26	1,360	33,293	2,856	27,223	5,648	30,644	2,377	54,123
8-3	1,361	33,293	2,857	27,223	5,703	32,300	2,377	54,123
8-11	2,328	40,254	2,882	27,714	5,703	32,300	2,377	54,123
8-18	2,721	43,551	3,182	36,101	5,712	32,530	2,377	54,123
8-25	2,721	43,551	3,200	36,581	5,723	32,539	2,413	54,641
8-31	3,360	48,956	3,259	38,184	5,861	36,442	2,554	56,713
9-7	3,360	48,956	3,276	38,669	5,952	38,901	2,835	60,785
9-14	3,362	48,956	3,276	38,669	5,952	38,901	2,835	60,785
9-23	3,362	48,956	3,276	38,669	5,952	38,901	2,835	60,785
9-29	3,671	51,652	3,276	38,669	5,952	38,901	2,835	60,785
10-5	3,671	51,652	3,402	42,161	5,952	38,901	2,835	60,785
10-12	4,105	54,801	3,586	47,441	6,174	44,685	3,200	66,533
10-19	4,522	58,655	3,586	47,441	6,174	44,685	3,200	66,533
10-26	4,530	58,654	3,586	47,441	6,174	44,685	3,200	66,533
11-2	4,532	58,654	3,586	47,441	6,174	44,684	3,200	66,533
11-9	4,932	62,348	3,586	47,441	6,174	44,684	3,200	66,533
11-16	4,932	62,348	3,586	47,441	6,175	44,684	3,200	66,532
11-23	4,932	62,348	3,586	47,441	6,175	44,684	3,200	66,532
11-30	4,932	62,348	3,586	47,441	6,175	44,684	3,200	66,532
12-7	4,932	62,348	3,586	47,441	6,175	44,684	3,200	66,532
12-14	4,932	62,348	3,586	47,441	6,175	44,684	3,200	66,532
12-21	4,932	62,348	3,586	47,441	6,175	44,684	3,200	66,532
12-29	4,932	62,348	3,586	47,441	6,175	44,684	3,200	66,532
1977								
1-4	4,940	62,348	3,586	47,441	6,175	44,685	3,200	66,533
1-12	4,942	62,348	3,586	47,441	6,176	44,685	3,200	66,533
1-18	4,944	62,348	3,586	47,441	6,176	44,685	3,200	66,533
1-26	4,945	62,348	3,586	47,441	6,176	44,684	3,200	66,533
2-2	4,945	62,348	3,586	47,441	6,176	44,684	3,200	66,533
2-9	4,945	62,348	3,586	47,441	6,176	44,684	3,200	66,533

[a]Well No. 1 does not have a water meter and is used occasionally.

[b]Natural gas meters were replaced and reset on April 23, 1976.

[c]Natural gas meters were replaced and reset on April 26, 1976.

Table 4. Irrigation water application, source of water, and evapotranspiration for crops on the EPA demonstration farm, 1976

Irrigation Date	Recommended Irrigation Date	Total Water Applied (acre-inches)	Application Per Acre (ac-in/acre)	Source of Water	Evapotranspiration (ET) for time period (ac-in/acre)
Alfalfa-Fd. 10 (69.4 acres)					
3-15-76	3-17-76	451.2	6.5	S[a]	4.1
5-18-76	5-13-76	243.6	3.5	G[b]	7.9
6-3-76	6-8-76	704.4	10.1	G	3.9
6-22-76	6-24-76	641.3	9.2	-	5.0
7-12-76	7-10-76	558.0	8.0	S	5.6
8-7-76	8-5-76	316.5	4.6	S	8.9
8-20-76	8-21-76	366.4	5.3	S	9.0
9-19-76	9-18-76	366.4	5.3	S	13.4
10-8-76	10-7-76	408.1	5.9	S	3.1
Season Total		4,055.9	58.4		60.9
Percentage Surface Water		60.7%			
Seasonal Field Irrigation Efficiency		95.6%			
Cotton-Fd. 4 West (40.1 acres)					
3-27-76	pre-irrigate	388.8	9.7	S	
5-12-76	NI[c]	150.0	3.7	G	0.6
6-28-76	6-30-76	175.2	4.4	S	3.0
8-5-76	7-31-76	158.4	4.0	S	8.1
8-17-76	8-22-76	128.4	3.2	S	2.6
8-28-76	9-2-76	126.0	3.1	S	2.4
10-27-76		--	--	-	7.0
Season Total		1,126.9	28.1		23.7
Percentage Surface Water		87%			
Seasonal Field Irrigation Efficiency		84%[d]			
Cotton-Fd. 9 (26.4 acres)					
3-29-76	pre-irrigate	240.0	9.1	S	
5-18-76	NI	96.0	3.6	S	0.7
6-22-76	7-1-76	152.0	5.8	S	2.1
8-7-76	8-5-76	120.4	4.5	S	9.1
8-27-76	finished	205.2	7.8	G	4.5
10-5-76	--	--	--	-	5.5
10-27-76		--	--	-	1.7
Season Total		813.6	30.8		23.6
Percentage Surface Water		75%			
Seasonal Field Irrigation Efficiency		77%			
Cotton-Fd. 12 (16.8 acres)					
3-19-76		48.9	2.9	S	
5-13-76	NI	50.4	3.0	S	0.7
6-29-76	7-1-76	66.5	4.0	G	3.0
7-25-76	7-22-76	66.5	4.0	S	5.3
8-21-76	8-26-76	60.4	3.6	S	6.1
8-26-76		62.5	3.7	G	1.2
9-29-76		--	--	-	5.1
10-27-76		--	--	-	2.3
Season Total		355.2	21.2		23.7
Percentage Surface Water		63%			
Seasonal Field Irrigation Efficiency		112%			
Wheat-Fd. 3 (74.0 acres)					
1-13-76	--	398.0	5.4	G	.0
3-14-76	3-17-76	408.0	5.5	S	1.9
4-7-76	4-8-76	414.0	5.6	S	3.4
4-29-76	4-27-76	417.6	5.6	S	3.0
5-13-76	5-12-76	255.6	3.5	S	2.3
7-12-76	harvested	--	--	-	4.6
Season Total		1,893.2	25.6		15.2
Percentage Surface Water		79%			
Seasonal Field Irrigation Efficiency		55%			
Wheat-Fd. 5 & 6[e] (38.7 acres)					
1-28-76		187.2	4.8	S	
3-26-76	3-26-76	150.0	3.9	S	3.4
4-22-76	4-23-76	340.8	8.8	S	3.7
5-18-76	5-16-76	215.9	5.6	S	4.5
6-16-76	harvested	--	--	-	3.2
Season Total		893.9	23.1		14.8
Percentage Surface Water		100%			
Seasonal Field Irrigation Efficiency		54%			
Lettuce-Fd. 3a (50 acres)					
7-23-76		162.0	3.2	S	
8-4-76		119.0	2.4	S	
8-8-76		399.6	8.0	S(52%)	
8-18-76		112.0	2.2	S	
8-21-76		318.0	6.4	S(37%)	
8-29-76		164.9	3.3	S	
9-16-76		119.9	2.4	S	
9-27-76		309.6	6.2	S(68%)	
10-13-76		142.8	2.9	G	
11-4-76		136.7	2.7	G	
Season Total		1,984.5	39.7		17.8[f]
Percentage Surface Water		41%			
Seasonal Field Irrigation Efficiency		45%			

Table 4 . Continued

Irrigation Date	Recommended Irrigation Date	Total Water Applied (acre-inches)	Application Per Acre (ac-in/acre)	Source of Water	Evapotranspiration (ET) for time period (ac-in/acre)
Tomatoes-Fd. 8 (33.4 acres)					
3-20-76		228.0	6.8	S	
3-23-76		270.0	8.1	S	
5-1-76	5-1-76	192.0	5.7	S	
5-7-76	5-7-76	63.6	1.9	S	
6-17-76	6-13-76	99.6	3.0	S	
7-13-76	7-10-76	116.4	3.5	S	
8-4-76	8-2-76	144.3	4.3	G	
8-20-76	finished	16.0	0.5	G	
Season Total		1,129.9	33.8		22.8[g]
Percentage Surface Water		85.8%			
Seasonal Field Irrigation Efficiency		67%			
Tomatoes-Fd. 11[h] (62.0 acres)					
5-18-76	5-18-76	409.0	6.6	S	
6-22-76	6-20-76	810.0	13.1	S&G	
7-22-76	7-15-76	312.0	5.0	G	
8-3-76	NI	60.0	1.0	G	
8-7-76	8-5-76	282.0	4.5	S	
8-27-76	8-22-76	215.0	3.5	G	
8-31-76	NI	149.0	2.4	G	
9-29-76	9-11-76		--		
Season Total(5/14-10/8)		2,237.0	36.1		22.8[g]
Percentage Surface Water		35.9%			
Seasonal Field Irrigation Efficiency		63%			
Chile 6-4 & Floral Gem-Fd 4a &4b (29.0 acres)					
3-13-76	pre-irrigate	271.2	9.4	S	
6-4-76	6-13-76	103.2	3.6	S	
6-22-76	6-31-76	168.0	5.8	S	
7-12-76	7-10-76	139.2	4.8	S	
8-5-76[i]	7-31-76	144.8	3.9	S	
8-18-76	8-17-76	127.2	4.4	S	
8-28-76	8-27-76	198.0	6.8	G	
10-5-76	9-20-76	114.0	3.9	G	
Season Total		1,235.6	42.6		30.8[j]
Percentage Surface Water		75%			
Seasonal Field Irrigation Efficiency		72%			
Cayenne Chile-Fd. 2 (13.6 acres)					
4-12-76	pre-irrigate	60.0	4.4	S	
4-22-76		31.2	2.3	S	
5-12-76		37.2	2.7	G	
5-15-76	5-15-76	46.8	3.4	S	
6-2-76	6-2-76	80.28	5.9	G	
6-20-76	6-30-76	80.40	5.9	G	
7-8-76	7-16-76	54.0	4.0	G	
8-8-76	8-5-76	54.6	4.0	G	
8-18-76	8-17-76	79.92	5.9	S	
9-2-76	9-1-76	69.6	5.1	S	
9-27-76[k]	9-21-76	70.2	5.2	S(55%)	
10-5-76			--		
Season Total		664.2	48.8		30.8[j]
Percentage Surface Water		54%			
Seasonal Field Irrigation Efficiency		63%			
Cayenne Chile & Sorghum- Fd. 7 & 7a (40.7 acres)					
5-14-76	5-14-76	89.7	2.2	S	
5-18-76		109.2	2.7	S	
5-20-76	6-3-76	107.4	2.6	G	
6-12-76	6-20-76	161.1	4.0	S	
6-26-76	7-2-76	184.8	4.5	G	
7-15-76	7-13-76	192.0	4.7	S	
8-2-76	8-3-76	122.1	3.0	S	
8-20-76	8-18-76	344.4	8.5	G	
9-3-76	9-2-76	180.0	4.4	S	
9-21-76	9-21-76	59.8	1.5	S	
10-1-76		128.4	3.2	S	
Season Total		1,678.9	41.3		30.8[j]
Percentage Surface Water		62%			
Seasonal Field Irrigation Efficiency		75%			

[a] S - Surface water

[b] G - Groundwater

[c] No irrigation recommended

[d] Received tail water from Field 3

[e] Field #6 irrigated at the same time as Field 5, with the same amount and ET

[f] Gregory, E. J. and Eldon G. Hanson, Predicting Consumptive Use with Climatological Data, New Mexico Water Resource Research Institute, Report No. 066, April 1976

[g] Seasonal estimate based on minimum value measured in San Joaquin Valley, California, Vegetative Water Use, Bulletin 113-3, Department of Water Resources, California

[h] Harvesting started 9-18 and continued through 10-8, with irrigation between first and second picking

[i] Irrigated Cotton Field 4-West at same time

[j] Blaney, Harry F. and Eldon G. Hanson, Consumptive Use and Water Requirements in New Mexico, New Mexico State Engineer, Santa Fe, New Mexico, Technical Report 32, 1965

[k] Other acreage irrigated

Irrigation Water Application

The amount of water applied on each field and the source (surface and groundwater) is presented in Table 4 for each of the fields. On the average, the farm received 59 percent of its water from the Elephant Butte Irrigation District and the rest from pumped groundwater. Estimates of evapotranspiration from measurements taken on the Plant Science Farm at New Mexico State University in cooperation with a consumptive-use project and estimates of evapotranspiration supplied by Agricultural Technology, Inc., using a micrometerological model for estimating consumptive use are also presented in Table 4. Season irrigation efficiencies (Table 4) ranged from 54 for wheat to 97 percent for alfalfa. The alfalfa plants were able to draw water from the groundwater table located at a depth of six to seven feet, accounting for the high irrigation efficiencies. Cotton in field 12 had a seasonal irrigation efficiency of about 112 percent indicating that the plants received water from the soil water reservoir or tail water from other fields.

In general, the dates of irrigation respond closely to the dates that were recommended by the irrigation scheduling.

Drip-Trickle Irrigation Demonstration

Data on the amount of applied water to the pecan orchard using the drip irrigation system are given in Table 5. The amount of applied water spread over the entire 3.2 acres for the season is .71 acre-feet per acre. This is considerably less than would be applied by a surface-irrigation method, estimated to be 2.4 to 3.2 feet, based upon six to eight irrigations using four acre-inch per acre per irrigation.

Table 5. Irrigation water applied on pecans by trickle irrigation system by weekly irrigation periods, EPA demonstration farm, 1976

Irrigation Period*	Applied Water (gal/tree)	Average Daily Applied Water (gal/tree/day)	Total Applied Water (ac-in/acre)	Total Average Daily Applied Water (ac-in/acre-day)
5-12/5-19	126.0	15.8	.47	.059
5-20/5-27	127.6	16.0	.48	.069
5-28/6-04	93.6	15.6	.35	.058
6-05/6-18	388.0	48.5	1.45	.180
6-19/7-01	75.2	6.8	.28	.026
7-02/7-10	112.0	12.4	.42	.047
7-11/7-17	113.0	16.2	.42	.061
7-18/7-29	64.7	8.1	.24	.030
7-30/8-05	219.0	31.3	.82	.120
8-06/8-27	549.0	24.9	2.06	.094
8-28/9-07	155.0	17.2	.58	.064
9-08/9-14	46.3	6.6	.17	.025
9-22/10-01	283.4	28.3	1.06	.110
Total			8.80	

*Divided into weekly irrigation periods; trickle irrigation system operated on continuous basis.

Note: 326 pecan trees on 3.2 acres (field number 1). Pan evaporation 5-12 to 10-1, 1976 equal to 47 inches, applied water/pan evaporation = 0.18.

One of the problems associated with increasing the irrigation efficiency through the use of drip irrigation is the possibility of salt accumulation within the root zone. Table 6 presents the results of soil analysis taken in alfalfa field number 10, lettuce field number 3, and the pecan orchard. Salts appear to be accumulating in the four and five-foot depths in the pecan orchard, compared to low salinity profiles in both the alfalfa and lettuce fields. The majority of the salts are sodium and sulfate ions. Experiments will be undertaken to flush the salts down to the six to eight-foot depths.

Seepage Test

Bulk heads were fabricated and installed for the irrigation ditch seepage test. The test sites are shown on Figure 5. Water was ponded in the ditch and the infiltration rate measured (Photos 2 and 3). An evaporation pan was also installed in the bottom of the ditch to measure the evaporation loss during the time period that the seepage test was conducted. The infiltration test was measured on two consecutive days and these data are presented in Figure 6.

Following the initiation of water into the ditch, the infiltration rate decreased with time until a steady state condition was reached after approximately 150 minutes. Water was left standing in the ditch at the end of the infiltration test and had completely infiltrated by ten o'clock on the following day (20-hour total infiltration time). Water was again initiated into the ditch and the infiltration rate measured. The steady state infiltration rate was slightly less for day 2 (Figure 6). The transmission losses per hundred meters of channel at the final infiltration rate of 1.8 cm/hr is approximately 2.7 m^3/hour.

During the infiltration tests, the turnouts were sealed by lining them with plastic. The influence of concrete lining on seepage losses from farm ditches reported by Hanson (1966) indicated a large variability in the transmission losses for unlined canals varying from less than one percent to as much as 16 percent of the flow with an average loss of about seven percent when the turnouts were sealed. The loss depends upon the type of soil and the sediment load in the water as it affects surface sealing. Another factor that affects the percentage loss of the stream is the velocity at which the water moves through the canal. The higher velocity results in a shorter opportunity time for water to be lost by deep seepage; therefore, loss on a percentage basis is lower.

The average length of irrigation ditches in the Mesilla Valley is similar to the ones on which the test was conducted (670 meters). Using Manning's equation to compute the flow in the ditch, the transmission loss represents 2.4 percent of the flow. The final infiltration rate on the first day of 2.25 cm/hour, represents a loss of 2.9 percent for the total length of the canal. However, the farmer does not always operate the ditch at maximum flow capacity, but often backs up water to irrigate a portion of the field leaving the entire ditch length filled with water. In the case of the ditch under investigation, the flow rate supplied by a pump was .08 meter/sec which represented a transmission loss between eight percent (day 1) to six percent (day 2). Additional measurements will be taken on this section of the canal and other sections of the unlined distribution ditches on the demonstration farm to get comparative answers of the transmission losses.

A similar infiltration test was conducted on the Upper Chamberino lateral (Photos 4 and 5). The infiltration rate in the lateral was considerably less than in the irrigation distribution ditch. The final infiltration rate was approximately .14 cm/hour which is equivalent to a loss of .4 cubic meters per hour/100 meters of canal.

nventory of Machinery, Equipment, and Irrigation Wells

The inventory of all machinery and equipment used in the farming operations of the J. F. Apodaca rms, Inc. has been completed and is included in Appendix G. This inventory includes sizes of imple-

Table 6. Soil analysis for salt content for selected samples, EPA demonstration farm, January 6, 1977

Plant Type	Sample	E.C.	pH	Saturation	Concentration* Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4
		(mmhos)		(%)	-(meq/L)-							
	0-3"	.92	7.73	32.5	4.24	1.48	3.84	.51	1.89	0	4.04	4.16
	3-6"	.89	7.77	29.8	4.13	1.42	3.95	.21	1.70	0	3.50	4.44
	1'-1'3"	.82	7.85	31.1	3.16	1.24	4.17	.21	1.86	0	3.02	4.36
	2'-2'3"	1.22	8.03	28.9	3.95	1.41	9.22	.26	2.96	0	3.26	8.00
Alfalfa	3'-3'3"	2.31	8.03	25.6	3.76	2.92	18.28	.39	6.76	0	3.18	15.40
	4'-4'3"	1.03	8.20	23.8	2.18	.99	8.02	.19	2.42	0	1.48	7.20
	5'-5'3"	.74	8.35	22.0	1.59	.59	6.24	.14	1.98	0	2.08	3.96
	5'9"-6'	.54	8.54	25.8	.68	.38	4.59	.14	1.62	0	1.68	2.52
	0-3"	1.58	8.08	61.3	4.28	2.31	7.87	.58	4.91	0	2.18	7.60
	3'6"	1.61	7.94	56.2	4.60	2.85	7.74	.65	4.91	0	3.08	7.70
	1'-1'3"	1.19	8.15	40.4	2.76	1.98	5.97	.45	3.29	0	2.40	5.10
Lettuce	2'-2'3"	.88	8.29	31.9	1.81	1.47	4.75	.32	2.13	0	1.54	3.60
	3'-3'3"	1.02	8.48	30.1	2.24	1.54	5.28	.31	2.48	0	1.54	5.00
	4'-4'3"	.61	8.35	33.8	.53	.75	4.75	.20	1.20	0	1.98	2.76
	5'-5'3"	.74	8.32	28.8	1.91	.72	5.84	.22	2.13	0	1.78	4.70
	5'9"-6'	.97	8.28	24.2	1.22	1.22	7.39	.20	2.15	0	2.46	5.08
	0-3"	1.21	7.88	50.0	1.95	1.68	8.30	1.07	3.12	0	5.50	5.00
	3-6"	1.11	7.85	50.1	2.01	1.64	7.94	.94	2.76	0	5.64	4.70
Pecan	1'-1'3"	1.25	8.01	66.2	1.31	1.26	10.05	.88	4.58	0	2.58	6.10
samples	2'-2'3"	1.81	8.01	50.4	4.13	1.46	14.91	.05	6.67	0	3.38	10.60
located	3'-3'3"	4.00	7.83	54.8	21.51	8.20	25.64	.60	5.08	0	.84	51.60
at tree	4'-4'3"	7.58	7.99	50.5	14.43	15.14	54.90	.79	5.62	0	1.46	73.60
trunk	5'-5'3"	5.55	8.26	34.5	7.69	7.39	53.62	.45	19.11	0	1.46	48.80
	5'9"-6'	5.33	8.26	31.3	5.43	5.87	55.54	.47	18.23	0	1.62	44.40
Pecan	0-3"	1.27	8.02	46.1	2.94	1.56	8.86	.91	4.29	0	4.54	5.40
samples	3-6"	1.09	8.08	50.8	3.20	1.13	7.58	.75	3.48	0	3.34	5.40
located	1'-1'3"	1.53	8.06	71.7	1.42	1.17	13.45	.36	4.16	0	2.16	9.90
1.5 ft.	2'-2'3"	4.25	7.88	85.0	22.14	9.12	28.83	.50	7.07	0	1.20	51.60
from	3'-3'3"	4.41	7.85	52.3	18.38	9.91	29.68	.45	11.34	0	1.32	48.80
trunk	4'-4'3"	6.40	7.95	46.4	15.38	12.52	54.26	.54	23.16	0	1.32	60.80
of tree	5'-5'3"	5.64	8.36	35.1	6.63	6.93	55.76	.43	20.54	0	1.48	47.60
	5'9"-6'	7.17	8.21	33.0	5.93	7.97	74.04	.50	28.61	0	1.50	60.00
Pecan	0-3"	1.11	8.08	49.0	3.88	1.27	7.70	.72	3.86	0	3.48	5.80
samples	3-6"	4.34	7.91	80.1	17.77	9.81	29.68	.43	12.87	0	1.26	46.00
located	1'-1'3"	1.40	8.12	53.7	1.57	1.19	11.15	.63	4.75	0	3.18	7.10
3 ft.	2'-2'3"	2.58	7.99	85.0	5.07	3.19	21.37	.51	8.35	0	1.72	20.20
from	3'-3'3"	1.76	8.24	30.5	4.92	1.77	13.78	.24	5.66	0	2.06	13.20
trunk	4'-4'3"	5.33	7.98	35.1	16.50	8.28	40.06	.69	21.52	0	13.6	44.00
of tree	5'-5'3"	6.72	8.21	31.9	11.89	10.40	60.37	.59	26.90	0	1.36	57.20
	5'9"-6'	1.48	8.58	23.1	.53	.86	13.68	.16	3.85	0	2.22	9.30
Pecan	0-3"	2.11	8.03	49.4	6.17	2.43	14.57	.87	7.32	0	2.86	14.20
Samples	3-6"	2.20	8.14	53.6	6.15	2.41	16.01	.86	7.69	0	2.26	15.60
located	1'-1'3"	3.71	8.00	54.5	12.73	5.10	30.06	.83	14.80	0	1.46	37.60
3 ft.	2'-2'3"	4.91	7.84	80.9	20.47	10.37	34.44	.72	15.31	0	1.28	48.00
from	3'-3'3"	4.44	7.97	29.8	20.33	9.75	29.12	.45	10.93	0	1.22	46.00
trunk	4'-4'3"	5.06	8.16	36.8	10.82	8.13	43.70	.47	21.38	0	1.18	38.00
of tree	5'-5'3"	3.63	8.32	28.0	4.70	4.32	34.25	.30	11.29	0	1.80	30.80
	5'9"-6'	1.41	8.45	25.5	1.16	1.08	12.68	.18	2.78	0	1.50	10.50

*Based on analysis of saturation extract samples at indicated saturation percent.

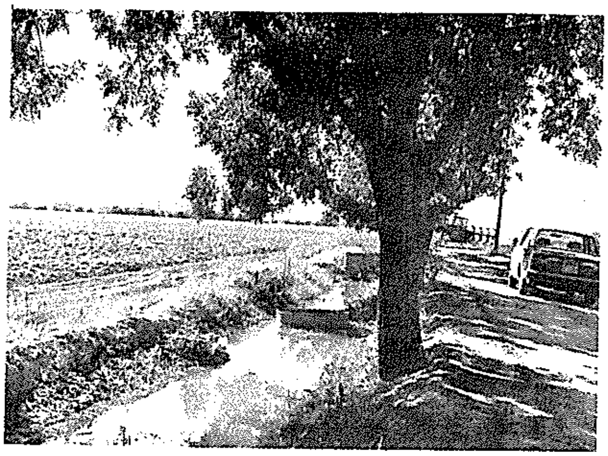
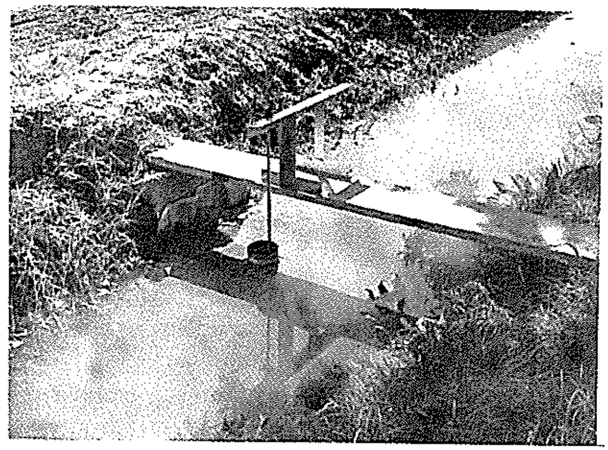
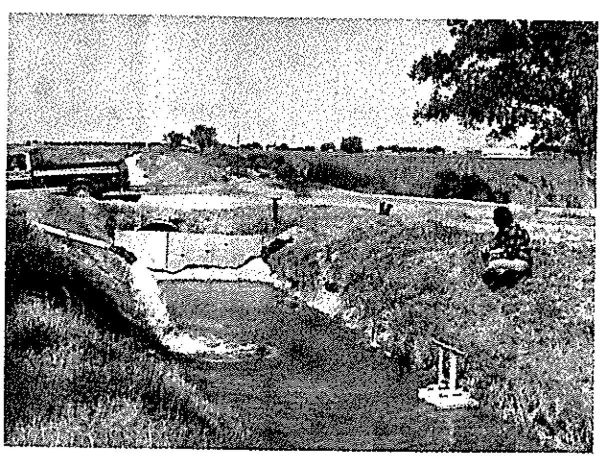


Photo 1. Water entering the farm irrigation supply ditch for infil[redacted] measurements on the J. F. Apodaca farm.



[redacted] 2. Measurement of changes in the water level by hook guage for the infiltration tests on the farm irrigation supply ditch on the J. F. Apodaca farm.



ioto 3. Water filling the infiltration test section of the Upper Chamberino lateral.

Photo 4. Evaporation loss measurements for infiltration test on the Upper Chamberino lateral.

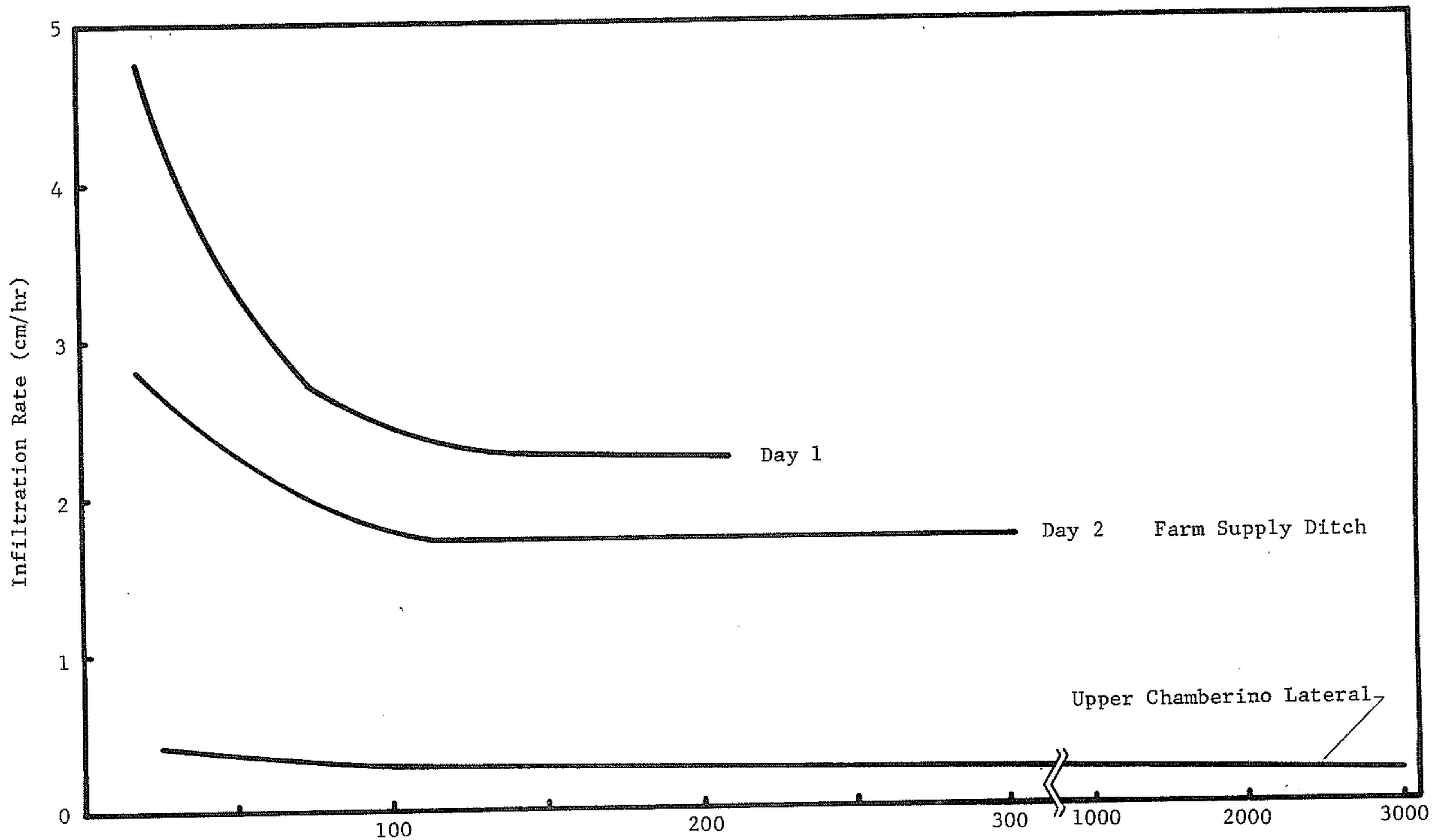


Figure 6. Seepage loss from farm irrigation supply ditch on the EPA Demonstration farm and seepage loss from the Upper Chamberino irrigation lateral.

ment, estimated cost new, estimated replacement cost, fuel and oil, operating and repair cost, hours used annually, expected life, depreciation, and taxes, housing, insurance, and interest (THII). The quantity of machinery would normally appear to be excessive due to the size of the actual demonstration area of 447.6 acres, but over three years, it is believed that all this equipment will be used on the area at one time or another.

Current Cultural Practices and Timing of Operations

A schedule of the cultural practices involved in each field crop has been derived along with the timing requirements of each of these practices. Due to the variation in the cultural practices for various crops, no single schedule was developed.

Preliminary cost-and-return enterprise budgets have been completed for the past cropping season and are presented in Appendix H. The specific operations and time requirements are included as an integral part of each preliminary budget.

The machinery and equipment used in 1976 are represented in the preliminary crop budgets under preharvest and harvest operations in the form of "hours used" and "cost per acre." These budgets consist of the purchased inputs, labor, fuel and repairs, and depreciation, insurance and shelter for each field crop. Crops presented in the cost and return enterprise budgets for 1976 are cotton, chile (6-4 and Floral Gem), tomatoes, alfalfa, wheat, cayenne peppers, pecans, and lettuce.

Cotton. The cotton enterprise had a yield of 480 pounds lint, utilizing 2.2 acre-feet of water at a cost of production of $318.98. The price was strong at $79.00/cwt resulting in a net return to capital of $124.22. The yield of the cotton was lower than the valley long-term average by four percent due to an early frost and a sandy stratification of soil that traversed field 4 resulting in a nutrient stress for excessive fertilizer leaching.

Chile. The chile enterprise had a yield of 7.8 tons of green and 2,154 pounds of red with prices of $150/ton and $33/cwt, respectively. This yield to price relationship represented a gross return of $1,880.82 with operation expenses of $842.37 resulting in a net return to capital of $1,038.45. There were no major problems in the chile enterprise. The red chile harvest was a little higher due to an early freeze.

Tomatoes. The tomatoes enterprise obtained a yield of 13.3 tons of canning tomatoes at $75 per ton with expenses totaling $641.42 per acre to yield a return to capital of $356.08 per acre. Tomatoes, unlike most of the other vegetable crops, were not affected by the early freeze due to an early planting date.

Alfalfa. The alfalfa enterprise had a lower yield of 7.0 tons per acre due to insect infestation at two different stages during the growing season. Expenses were $377.17 per acre while utilizing 4.9 acre-feet of water. The expenses were a little lower than would be expected with the insect infestations. However, this infestation occurred at points between cuttings where spraying of insecticides would have not been beneficial. Net return to capital was $21.83 per acre but is expected to increase in the next growing season due to the water shortage causing a decrease in supply and forcing the price upward.

Wheat. The wheat enterprise was stressed of nutrients due to leaching of applied fertilizers resulting in a lower yield. The yield was 4,200 pounds per acre with expenses of $211.02 per acre resuling in a net return to capital of $24.18 per acre.

Cayenne peppers (tabasco). Cayenne peppers received the worst frost damage resulting in a loss of approximately 80 percent of the crop. The enterprise budget presented indicates that typically the yield should be approximately 4,000 pounds per acre with expenses of $2,770.77 per acre resulting in a net return to capital of $429.23 per acre. However, with the early freeze much of what was harvested was picked green resulting in a lower gross return per pound picked and when accompanied with the severe crop damage a loss of approximately $1,862.95 per acre was incurred.

Lettuce. The early frost also reduced the lettuce yield by about 50 percent to 500 cartons per acre. The expenses were $1,561.09 per acre yielding a net return to capital of $2,188.91. With the strong market resulting from the loss of the lettuce crop in California, the normal yield would have been about 1,000 cartons per acre.

Information Dissemination

Charles Hohn, Extension Agricultural Engineer and Gene Ott, Extension Farm Management Specialist at NMSU, have continued photographing activities on the demonstration farm. This information will be used in a continuing program of information dissemination through newspapers, farm magazines, slide presentations, etc.

Results of the first year's activities at the demonstration farm, summarized in the Annual Project Report, were distributed to all county agricultural agents in the New Mexico Extension Service. This resulted in increased interest by Extension leaders in including more irrigation management information in their on-going educational programs. Practices demonstrated on the demonstration farm will be an integral part of these future programs.

The Extension Farm Management Specialist and the Extension Agricultural Engineer provided leadership in the development of two informational brochures (Appendix I) which were used for tours of the project during the second year. These brochures do not describe technical findings but they describe the objectives and the physical layout of the project. During tours where these brochures are passed out, project investigators presented recent data orally concerning the on-going work at each site.

Members of the International Soil Science Society toured the project on August 23, 1976, as a stop on an extensive tour during their annual meeting. Approximately 40 scientists representing eight countries attended (see clipping and Photo 6).

The New Mexico Cotton Advisory Committee toured the project in August (see clipping of advance publicity in Appendix I). This group was composed of 30 members of the New Mexico Cotton Advisory Committee. These participants represent the cotton industry in New Mexico as growers, ginners, cotton merchants, and county agents.

The Advisory Committee of the New Mexico Water Resources Research Institute has selected the demonstration farm as a conference topic for discussion and a subsequent tour at the forthcoming 22nd Annual Water Conference in April 1977.

Anticipating these tours, the Extension Agricultural Engineer and the Extension Farm Management Specialist made arrangements for advanced and follow-up publicity of the demonstration project. These were given wide-area dissemination (see clippings--Appendix I). In addition, area radio and press coverage are planned for the upcoming tours.

HYDROSALINITY MODELING

The objective of this section of the study is to implement, test and modify the USBR mathematical model for predicting changes in water quality due to irrigation activities in the Mesilla Valley. The emphasis of the work during the past year has been on the following aspects. Several sensitivity analyses were conducted with the USBR model in its present form in order to determine which input parameters are important. These sensitivity analyses indicated that the initial chemistry of aquifer waters and the consumptive use estimates play an important role in the predicted TDS output. The simulation results also demonstrated the importance of the manner in which water is transferred from the aquifer

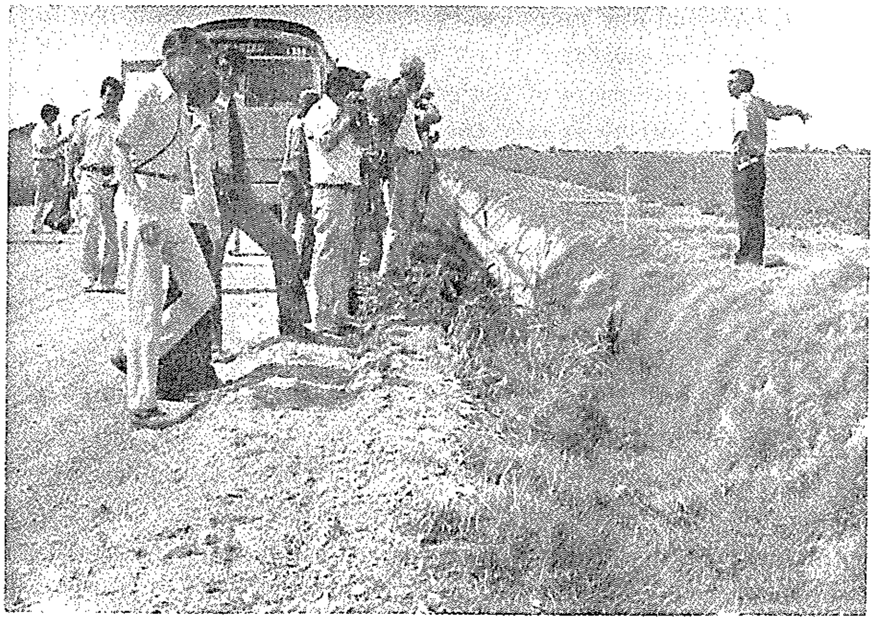


Photo 5. International Soil Science Society members touring the demonstration farm in mid-August.

International Science Group Tours Farm

LAS CRUCES, N.M. – Food production and water quality are worldwide concerns. That's why an international science group toured a water quality and crop yield demonstration farm near Las Cruces, recently.

While on a tour of the Southwest, about 40 members of the International Soil Science Society inspected the J.P. Apodaca Farms where New Mexico State University and the EPA are demonstrating new irrigation techniques.

All Out Effort

Charles Hohn, Extension agricultural engineer at NMSU, explains that the demonstration project is an all out effort to assist the farmer improve water quality while producing a wide range of crops.

Scientists on the tour represented Russia, Israel, the Netherlands, Germany, Japan, Spain, Mexico and the United States.

During the tour, they inspected trickle irrigation systems, well monitors, piezometers, lined ditches and return-flow monitors. They also saw the many crops grown on the farm, including tomatoes, tabasco peppers, chile, corn, cotton, vegetables, wheat and pecans.

Southwest Farm Press, September 9, 1976.

to the river or vice versa. The scheme currently used in the model to transfer water between the aquifer and the stream is independent of aquifer properties and water level. Therefore, an objective method calibrating the water balance aspect of the model was sought. A regression technique is developed to estimate the parameters of the shallow aquifer.

Data analysis has continued in each phase of the project. The computerized data file of the available hydrologic data for the Mesilla Valley is near completion. Detailed analysis of spatial patterns of aquifer water quality data was performed. Progress is being made in estimating the specific capacity of a large number of wells in the valley in order to determine transmissivities of existing aquifers. The current sampling program emphasizing groundwater quality is proceeding as originally scheduled.

Finally, plans for future work are discussed.

Modeling

Testing and Sensitivity Analysis

The USBR hydrosalinity model was used to simulate the monthly response of the Mesilla Valley system with the input data and operational procedure as previously described (Lansford, et al., 1976). The objectives of these simulations were to determine what model structure is suitable for the Mesilla Valley and to test the sensitivity of the model results to input data. The model response for both nodes in terms of TDS (total dissolved solids) in ppm from July 1967 through June 1968 and the transfer of water between the aquifer and the river are shown in Figure 7. The larger differences between observed and predicted TDS (especially in node 2) occur when larger transfers of high salinity water from the aquifer are being forced by the water-balance feature of the model. Figure 7 also shows that the chemical changes in the soils introduce only very minor changes. Our experience has also shown that the model is quite sensitive to consumptive use and irrigation efficiency. These and other factors are examined below.

In order to investigate the effects of several physical features on the predicted model output, a preliminary model sensitivity analysis was performed. The features examined included the effects of:

(1) a 25 percent reduction in the initial aquifer pore volume,

(2) a 50 percent reduction in the initial chemical concentration of aquifer waters,

(3) an average crop consumptive use of two feet/year with an irrigation efficiency of 50 percent, and

(4) a 50 percent increase in the initial chemical concentration in the soil.

The hydrosalinity model was run using the same data input as for Figure 7, but making the changes noted above. Necessary computer runs were made to simulate the effects of the model with and without the soil chemistry subroutine (McLin and Gelhar, 1976).

Results of the effect of the above changes on the predicted model output are summarized in Table 7 and are also shown graphically in Figures 8 and 9. These figures demonstrate that the initial chemistry of aquifer waters and the combined effects of crop consumptive use and irrigation efficiency play an important role in the predicted TDS output in contrast to the minor role of soil chemistry and aquifer pore volume.

Calibration of the Model

Results of the several sensitivity analyses conducted with the model in its current form indicate a need to improve the input data and model structure. The scheme presently used in the model to transfer water between the aquifer and the stream may be physically unrealistic in that it is independent of aquifer properties and water level. Consequently, we explored improvements which relate the stream aquifer interaction to aquifer properties and water level (see Gelhar and Wilson, 1974). Calibration

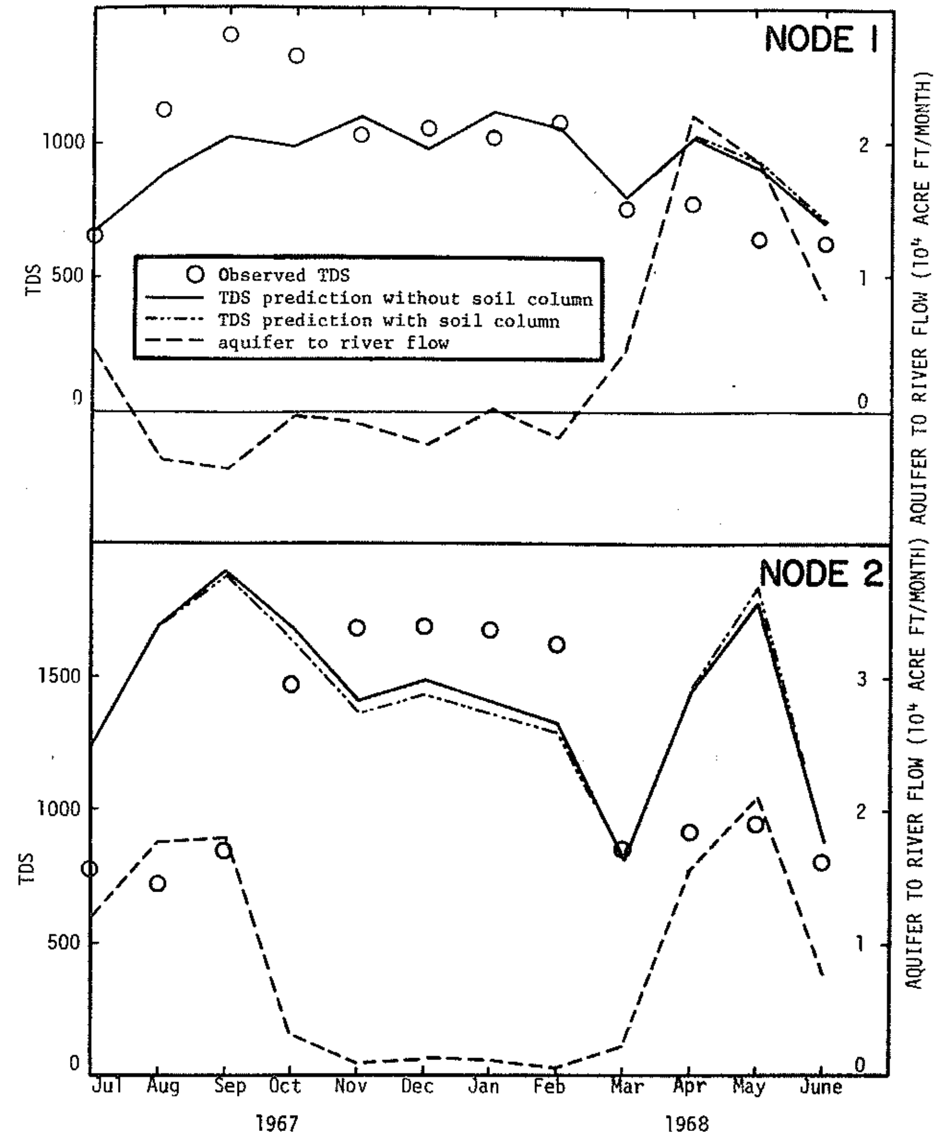


Figure 7. Model predictions for July 1967 to June 1968.

Table 7. Results of model sensitivity analysis

Physical Feature	(1) 25% reduction in initial aquifer pore volume	(2)* 50% reduction in chemical concentration of aquifer waters	(3)* Consumptive use; 2 ft/yr Irrigation effficiency, 50%	(4) 50% increase in initial chemical concentration in the soil
Effect	No appreciable difference from original predicted TDS output (i.e. identical to Fig. 7).	Large systematic differences of several ppm were noticed as compared to the original predicted TDS output (see Fig. 8).	Produced systematic differences in predicted TDS output (see Fig. 8). The transfer of water from the aquifer to the river remained practically unchanged (not shown in Fig. 8).	Produced only minor differences in TDS from that originally predicted for node 1. Node 2 differences are somewhat larger (see Fig. 9).

*Soil chemistry subroutine was omitted for clarity.

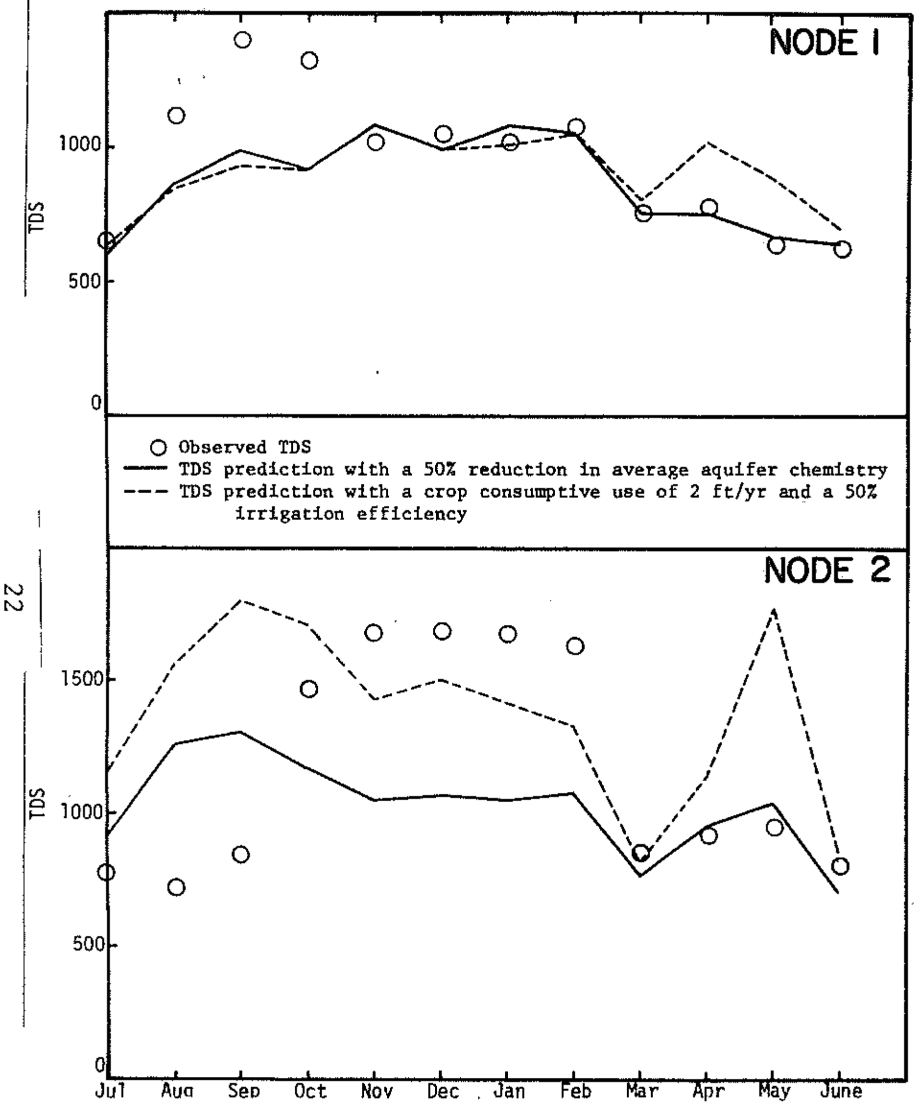


Figure 8. Sensitivity analysis showing the effects of a 50% reduction in initial aquifer chemistry; and the combined effects of an average consumptive use of 2 ft/yr and a 50% irrigation efficiency.

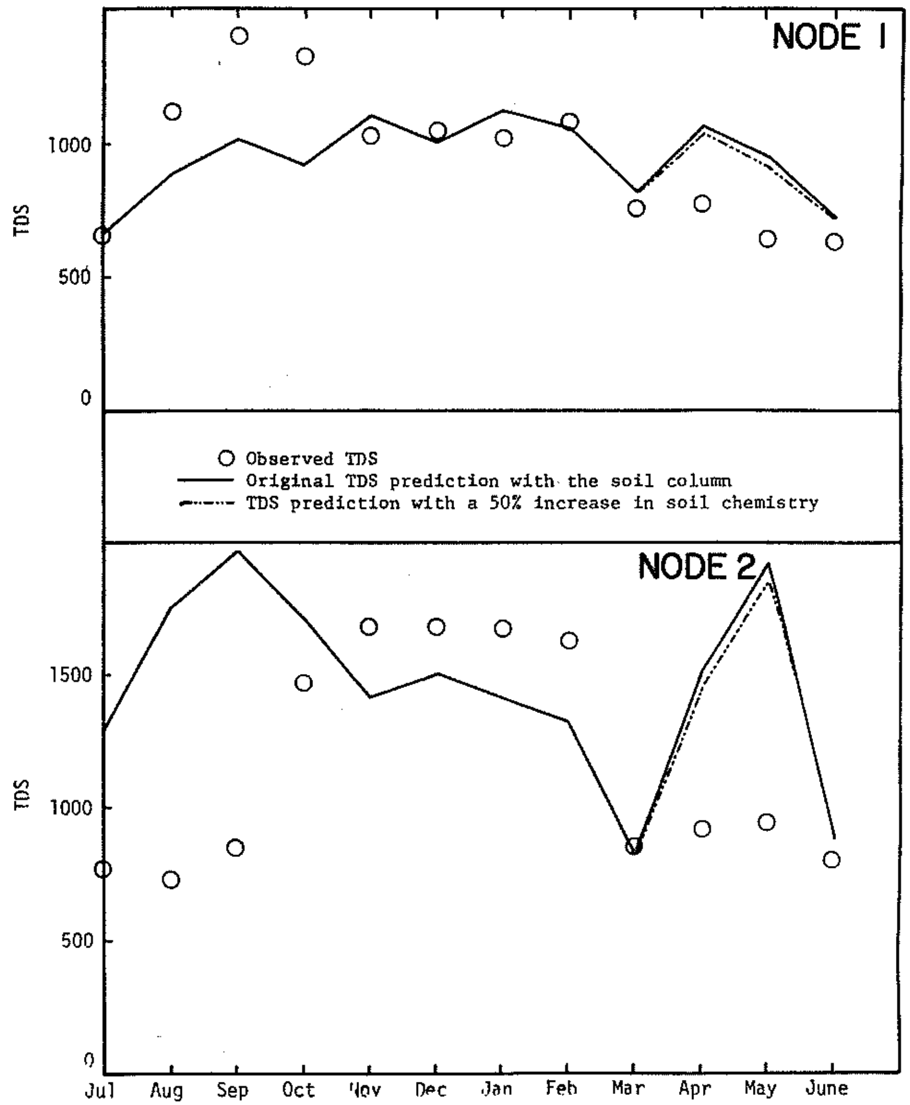


Figure 9. Sensitivity analysis showing the effects of the soil column using the original soil chemistry data; and for a soil chemistry of 1.5 times the original.

of the water balance aspect of the hydrosalinity model along the lines suggested in their work is discussed below.

Groundwater flow in a phreatic aquifer can approximately be stated in terms of a water balance in the form

$$n\frac{dh}{dt} = -q_d + q_r + \varepsilon \qquad [1]$$

where:

- h = average water level elevation in the aquifer, (ft)
- n = average effective porosity of the aquifer,
- q_r = rate of flow of water from river to aquifer per unit area (ft/mo)
- q_d = outflow or drain flow from the aquifer per unit area (ft/mo)
- ε = net recharge per unit area (ft/mo), and
- t = time

The outflow from the aquifer can be approximated by the linear term

$$q_d = a_d\ (h-h_d) \qquad [2]$$

in which a_d is an outflow constant (1/mo), and h_d is the elevation of water in drains (ft); it represents a reference level at which the outflow is zero as shown in Figure 10.

The model given by [1] with the outflow in [2] is a lumped parameter model in the form of a linear reservoir. A linear regression approach is used to estimate the shallow aquifer parameters and groundwater recharge from aquifer outflow (drain flow) and average water level in the aquifer. In the following, the procedure is briefly described (for details see Updegraff, 1977).

First, we use [2] to estimate both a_d and h_d given values of h. Then, solving [1] during the period of no irrigation (i.e. ε=0) and applying the regression method to the resulting solution, a physical parameter characterizing the response of the aquifer in the form n/a_d is obtained which leads to the estimation of n. Finally, the net recharge during the irrigation season is computed from numerically integrating [1] with all parameters known except ε.

Monthly values of drain flow, q_d, are plotted in Figure 11 versus values of average groundwater level in the Mesilla Valley for the period March 1946 through February 1951. A regression line fitted through the points is also shown. The slope of this best fit gives the outflow constant a_d and its intercept with the abscissa determines h_d. Figure 12 is a comparison between observed groundwater levels in the valley and those estimated from the regression method for the same period as in Figure 7. The agreement between predicted and observed values is very good; the rms error is 0.13 feet and the maximum difference of about 0.3 feet occurs during the summer months. Total monthly drain flows, q_d, are depicted in Figure 13 versus the predicted values for the same period. Again, the agreement between predicted and observed values is exceptionally good (rms error = 0.07 ft/mo) and it is also evident that model predicted values do not show consistent bias in relation to the observed values.

Estimated average effective porosity of the shallow aquifer in the valley is 0.21. This value compares with the study by Richardson (1971) which showed that a distributed groundwater model simulated records of historical water level data reasonably when the storativity of the aquifer was assumed to be 0.2.

The work on the water balance calibration as described briefly above represents a significant improvement in describing the stream-aquifer interchange. We plan to incorporate some of these features into the hydrosalinity model to account for the dependence of the stream-aquifer interaction on aquifer parameters and water levels, a feature which is not presently included in the USBR model.

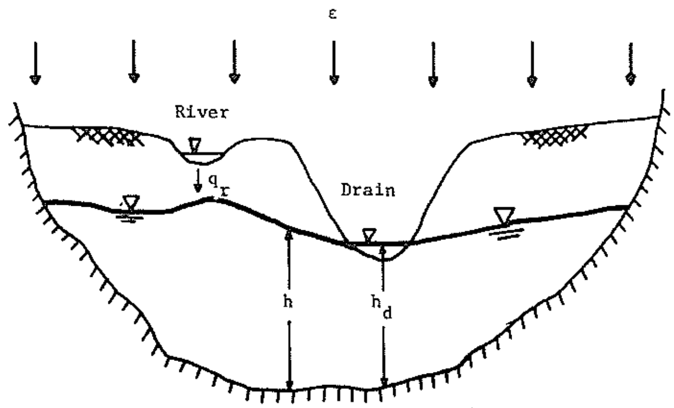


Figure 10. Schematic cross-section of the Mesilla Valley stream-aquifer system.

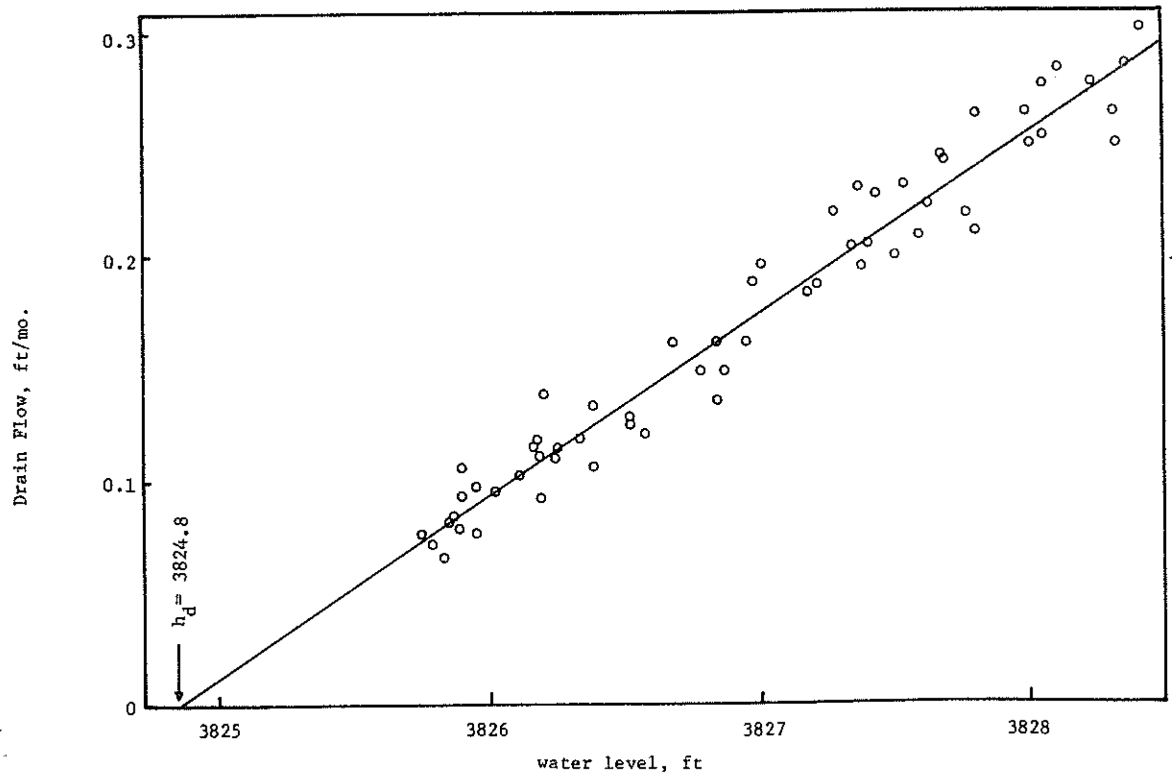


Figure 11. Average water level versus drainflow for the period March 1946 through February 1951.

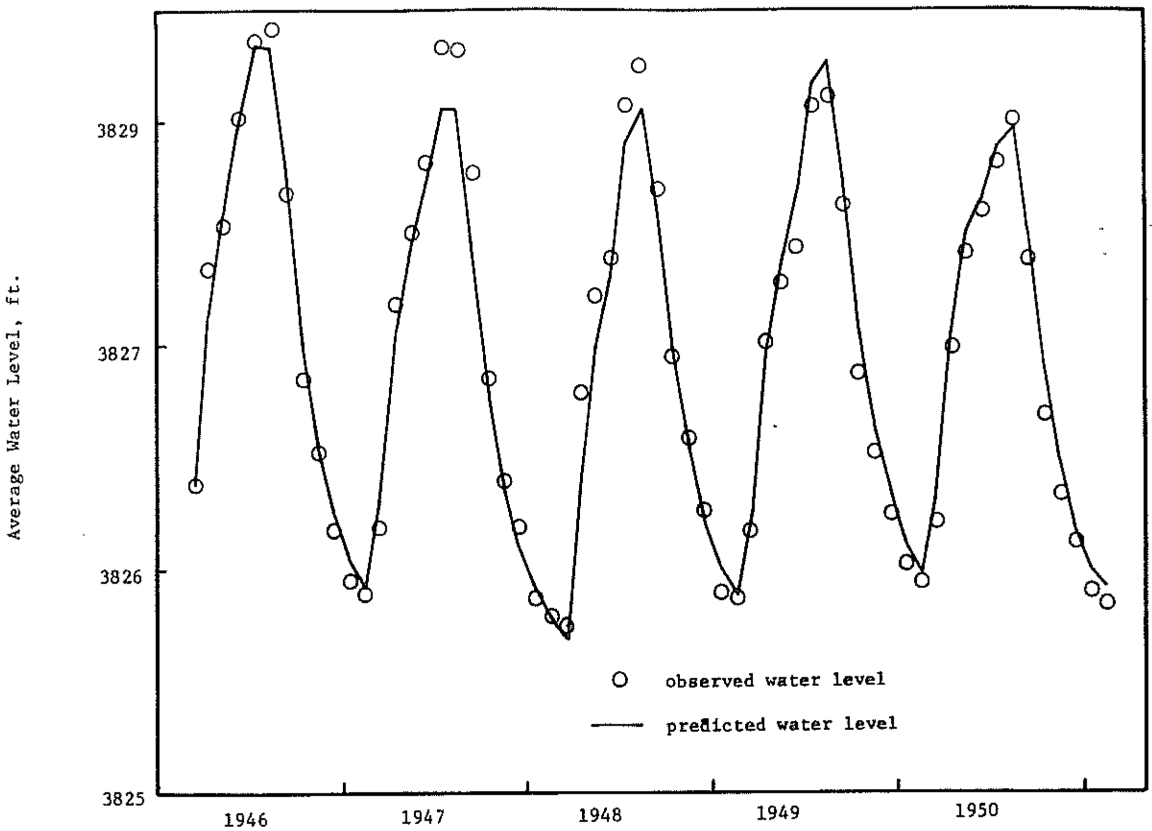


Figure 12. Variation in average water level for the Mesilla Valley (1946-1951).

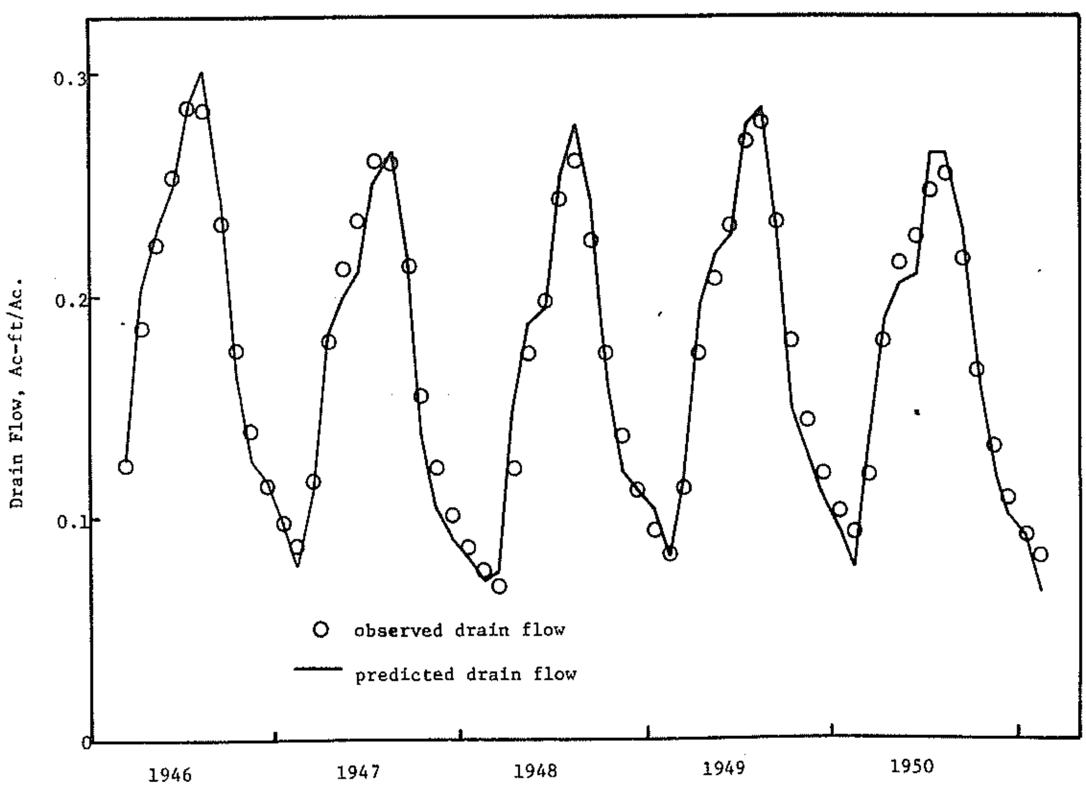


Figure 13. Total drain flow in the Mesilla Valley (1946-1951).

Data Acquisition and Analysis

Field Program

Monthly sampling of wells and surface water continued for the 35 sites which had been selected. Field measurements include water level, water temperature, pH, electrical conductivity, and alkalinity. All samples are forwarded to the soil and water testing laboratory at NMSU for detailed chemical analyses. A few check samples are also analyzed at the water chemistry laboratory of the Bureau of Mines and Mineral Resources at New Mexico Tech.

Computerized Data File

A data file is being set up for the extensive hydrologic data on water quantity and quality in canals, drains and wells acquired from the U. S. Geological Survey and the U. S. Bureau of Reclamation and other sources in addition to data collected specifically for this project. The purpose in preparing this file is to facilitate access to and enable analyses of these data easily. At this stage, a substantial portion of the surface water data has been punched on cards. Table 8 is a sample of the type of data available for the Rio Grande at El Paso (Courchesne Bridge). Work is now in progress to include available groundwater data in the file starting with the data collected specifically for this project.

Data Analysis

Chemical data from Basler and Alary (1968) were used to construct isocon maps for SO_4^{-2}, HCO_3^-, and TDS. These maps were utilized to estimate average concentrations for the valley by an areal integration method. Average TDS for the valley obtained from this method is about 16 percent higher than the corresponding value using Theissen polygon method. However, the difference between results from the two methods was one percent for HCO_3^-. Because of the large variability between estimates from the above two procedures, the statistical method of kriging (Matheron 1971) will be explored to analyze chemical data since it enables calculation of the variance of estimated parameters.

Consumptive-use estimates obtained from the Jensen-Haise method were considered to be high in comparison with those by the Blaney-Criddle approach which is commonly used in the area (Henderson and Sorensen 1968; Lansford, et al. 1973). However, a review of results reported by Gregory (1976) indicates that the Jensen-Haise consumptive use estimates may be reasonable. The final selection of the method of calculating consumptive use will be made after reviewing results of two current lysimeter studies in the valley.

Compilation of drawdown data of wells in the valley has been completed. Well records for the period 1972 through 1976, as obtained by the U. S. Geological Survey office in Las Cruces, were examined and approximately 130 wells out of the more than 800 have been selected for analysis. These are mostly irrigation wells with a few domestic ones and have discharge rates between 1,000 and 2,000 gallons per minute. Water level data for observation wells maintained by the U. S. Bureau of Reclamation are being used to estimate static water levels. The drawdown data in conjunction with static water level data will be used to estimate the specific capacity and the transmissivity of aquifers in the area. Our purpose is to characterize the transmissivity of aquifers in the valley on an areal basis which could also serve as an independent check on corresponding values obtained from calibration of the lumped parameter model.

In order to determine the parameters of the deep aquifer in the field, an elaborate pumping test involving several observation wells was conducted recently by the USGS in Las Cruces, with our assistance in planning and conducting the test. We will analyze the result of this test to determine the aquifer parameters and estimate the interaction between the shallow and deep aquifers.

Table 8. Flow rate and water quality data for the Rio Grande at El Paso (Courchesne Bridge)

DATE	RATE AC-FT/MO	NA MEQ	K MEQ	CA MEQ	MG MEQ	HCO3 MEQ	CO3 MEQ	CL MEQ	SO4 MEQ	NO3 MEQ	PH	TDS PPM	ELEC COND*	IRON TOTAL	SIO2 MEQ	HARD-NESS	B PPM	SAR
0 134	11200	13.05	-	6.46	2.59	5.40	-	8.51	8.29	-	-	1411.2	2060	-	-	-	0.21	9.1
0 234	33100	6.66	-	4.77	1.67	3.38	-	3.68	6.02	-	-	897.1	1250	-	-	-	0.18	3.7
0 334	43500	7.86	-	4.72	1.58	3.58	-	3.97	6.31	0.04	-	926.5	1290	-	-	-	0.20	4.4
0 434	56700	7.09	-	4.90	1.85	3.42	-	3.82	6.26	-	-	875.0	1310	-	-	-	0.18	3.9
0 534	60700	6.47	-	4.77	1.85	3.36	-	3.75	6.01	0.04	-	904.4	1300	-	-	-	0.19	3.6
0 634	62000	6.45	-	5.20	1.61	3.29	-	4.36	5.39	-	-	852.9	1380	-	-	-	0.48	3.5
0 734	73800	6.51	-	4.74	1.70	3.69	-	3.84	5.95	0.02	-	875.0	1280	-	-	-	0.35	3.6
0 834	80200	6.50	-	4.62	1.64	3.34	-	3.54	6.03	0.01	-	845.6	1260	-	-	-	0.23	3.7
0 934	48000	7.20	-	5.12	1.81	3.59	-	4.08	6.47	0.01	-	919.1	1370	-	-	-	0.18	3.9
01034	18300	10.52	-	6.11	2.23	4.38	-	6.92	7.86	0.01	-	1235.3	1870	-	-	-	0.30	5.2
01134	11400	13.35	-	6.49	2.72	5.02	-	8.79	8.87	0.01	-	1455.9	2190	-	-	-	0.29	6.2
01234	9590	13.57	-	6.58	2.73	4.87	-	9.31	8.87	0.01	-	1455.9	2210	-	-	-	0.31	6.3
0 135	8510	13.81	-	6.55	2.89	4.82	-	9.24	9.04	0.01	-	1458.3	2240	-	-	-	0.30	6.4
0 235	8800	12.17	-	6.37	2.96	4.52	-	8.00	8.57	0.07	-	1411.8	2030	-	-	-	0.31	5.6
0 335	18400	10.14	-	5.64	2.03	4.18	-	6.08	7.79	0.02	-	1176.5	1700	-	-	-	0.27	5.2
0 435	44900	7.22	-	4.64	1.90	3.54	-	3.96	6.89	0.04	-	911.8	1380	-	-	-	0.24	3.9
0 535	47600	7.01	-	4.96	1.92	3.69	-	3.97	6.23	-	-	926.5	1340	-	-	-	0.25	3.8
0 635	56700	7.00	-	4.89	1.98	3.69	-	3.78	6.68	0.01	-	919.1	1340	-	-	-	3.26	3.8
0 735	69900	6.71	-	4.73	1.79	3.57	-	3.73	6.31	0.02	-	975.0	1310	-	-	-	0.20	3.7
0 835	95900	4.77	-	3.98	1.38	2.92	-	2.53	4.82	0.04	-	661.8	994	-	-	-	0.20	2.9
0 935	65800	6.41	-	4.94	1.53	3.46	-	3.82	5.76	0.02	-	867.6	1270	-	-	-	0.20	3.6
01035	20200	10.33	-	5.31	2.44	3.74	-	6.63	7.85	0.01	-	1161.8	1770	-	-	-	0.21	5.2
01135	11500	12.21	-	6.34	2.33	4.73	-	7.82	8.36	0.01	-	1330.9	2020	-	-	-	0.22	5.9
01235	11700	11.16	-	6.10	2.53	4.73	-	7.42	7.45	0.00	-	1257.4	1910	-	-	-	0.25	5.4

*in micromhos per centimeter

Future Work

There are two unresolved aspects of this study which will be emphasized in the final year of the project. These include uncertainty of consumptive-use estimates from different methods and a procedure for the determination of groundwater quality on an areal basis. The sensitivity analyses performed demonstrated that the average initial chemistry of aquifer waters and the combined effects of crop consumptive use and irrigation efficiency plan an important role in the predicted TDS output of the model.

Comparison of consumptive-use estimates will be completed and a method for calculating consumptive use will be selected. Results of two on-going lysimeter investigations in the valley should be helpful in resolving this question.

In order to improve representation of special variations in groundwater quality data, we propose to use the method of kriging. Briefly, the problem is to find the best linear estimator of a given parameter, taking into account all available information. This method not only provides the best estimation possible but avoids any systematic errors by minimizing the variance of the estimated parameters (Matheron, 1971).

Finally, we plan to modify the water balance features of the hydrosalinity model by relating stream-aquifer water transfer to aquifer parameters and water levels in light of the lumped model calibration results. Further calibration of the model, with the above modification, will be carried out using available data for other years of record in order to examine the consistency of model output predictions.

ECONOMIC ANALYSIS

The objective of this portion of the project is to project the changes in the quantity of irrigation return flows as a result of alternative water management practices that could be adopted by farmers in the Mesilla Valley. They are (1) irrigation and management scheduling, (2) trickle irrigation on tree crops, and (3) sprinkle irrigation on vegetable crop emergence. The effects of these practices will be simulated for the approximately 100,000-acre Mesilla Valley.

The analytical system consists of two specific models sequentially linked to simulate the agricultural production and hydrological adjustments that would occur as a result of implementation of the alternative water management practices. The first is a linear programming model to estimate the economic impact and the irrigation water requirements. The solution is constrained by the usual physical, institutional, and market restrictions. The results of the LP model serve as inputs to the physical hydrosalinity model as tested by Gelhar.

Economic Model

The linear programming model derives a cropping pattern that maximizes returns to water in each of the nodes, subject to the amount of surface and groundwater available and the crop rotation and marketing requirements of the area. The locations of crops were specified in the base year, with the location of additional acreages of crops only being constrained by market characteristics. Water use in the base year approximated actual water use reported by the area irrigation districts. Average commodity prices for 1967-76 are justified by constraining the LP crop production.

Alternative crop production activities and coefficients will be developed by utilizing a submodel budget generator to derive engineering cost approach crop enterprise budgets. The base year budgets are being designed to simulate the cost and returns and input requirements for typical farming operations in the Mesilla Valley. Alternative crop production budgets incorporating irrigation water management practices are being developed by modification of the base year budgets, thus providing a series of levels of irrigation water management practices in the Mesilla Valley.

FIELD PLOT DEMONSTRATION

Experimental Information

The field plot design described in the first Annual Report was employed during the second year also, except that the previously bare area next to each plot was also planted. As a result, the total planted area was doubled in size. The irrigation treatments applied to previously planted plots were also used for the new plots. By merely extending the size of the plots, we were able to get yield and salinity data from "new" plots which had undergone no treatments, as opposed to the "old" plots which had been irrigated at various efficiencies and depletion rates for four years. The final plot layout and the numbering of the plots are presented in Figure 14.

Before planting, the area was deep plowed to approximately 20 cm, disked, releveled, listed, and shaped. Cotton (var. 1517-75) was planted May 7 in a single row of cotton per bed and irrigated May 11, 1976. In previous years, the cotton was planted following heavy pre-irrigations on the flat. These pre-irrigations could have leached soil salts unnecessarily. This year no pre-irrigations were applied. Because furrow irrigation of cotton planted in dry soil in the Mesilla Valley generally has a negative effect on soil temperature and germination, a temporary trickle irrigation system was laid on the beds. The cotton was watered with this system until stand establishment. The first trickle irrigation took place on May 11 (5.46 cm), the second irrigation May 16 (0.66 cm), and the last trickle was May 24 (2.24 cm). The first surface irrigation treatments started in the first week of June. An excellent stand establishment was obtained with the trickle irrigation system. The surface and trickle plots received 500 lbs/acre of 16-48-0, side banded on April 30, 1976.

Data on consumptive use of cotton at the experimental site indicated that about 60 cm of water would be required for a crop of cotton. On this basis, total irrigation depths of 50 cm, 60 cm, and 70 cm (20, 24, and 28 inches, respectively) were planned for 1976. These amounts were applied over the irrigation season, according to a previously developed curve relating consumptive use and days after emergence. Irrigations were scheduled at one-week, two-week, and three-week intervals, resulting in nine treatments (3 efficiencies and 3 depletions).

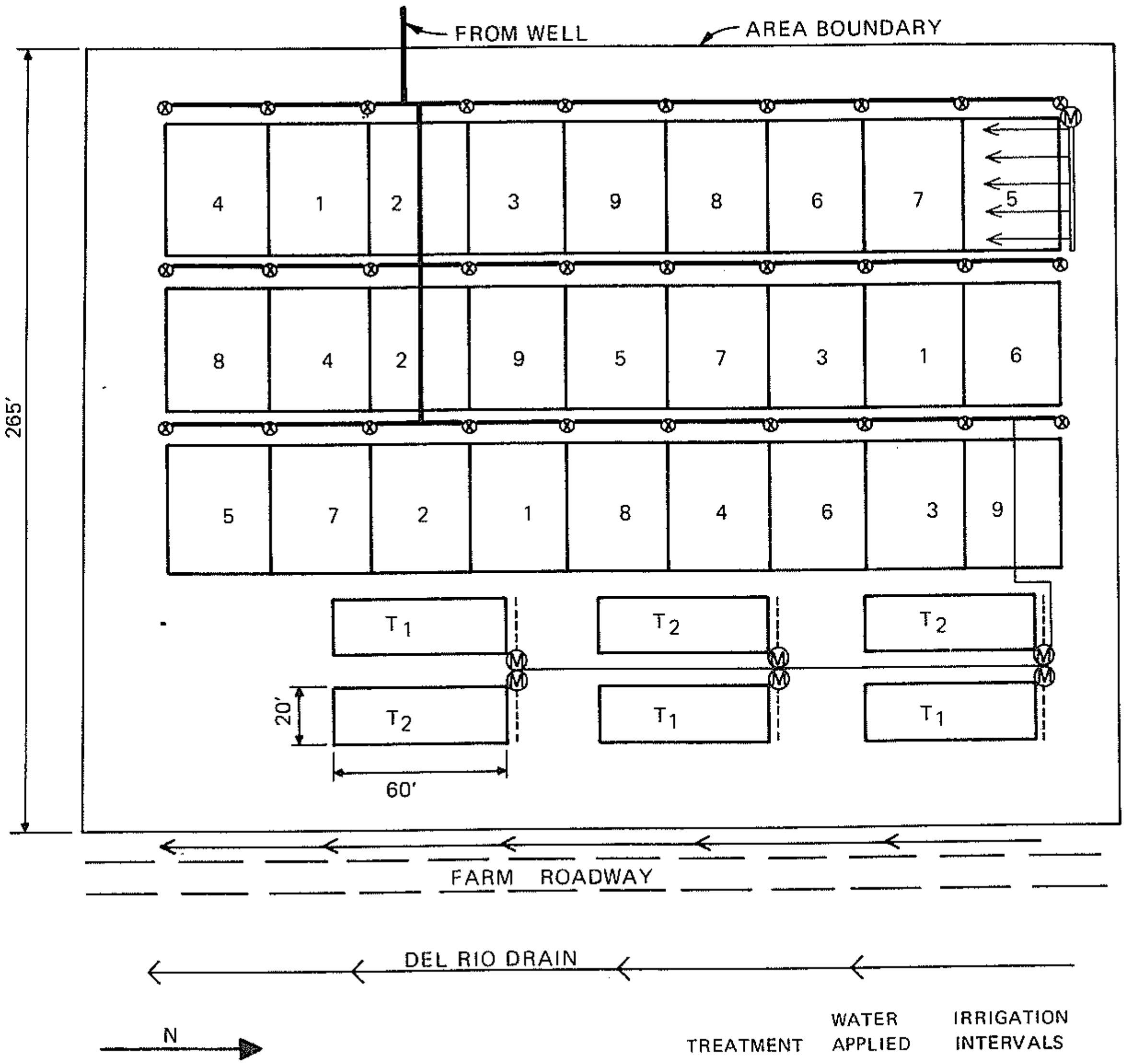
The "wet" trickle plots were irrigated when the soil water tension at eight inches below the trickle line reached a value of 0.2 bars. The "dry" treatment received 70 percent of the water applied to the "wet" treatment. Irrigation of the field plots was terminated on August 20, 1976.

Soil water solution samples were taken through 5 cm O.D. suction candles from under each plot and also from under the new area added to each plot. The soil water solution samples were drawn from the sandy subsoil at a depth selected to be 30 cm below the overlaying fine textured soil. The actual depth of the samples varied from 90 to 180 cm below the surface of the soil.

The cotton was machine harvested once on November 11. To determine the amount of cotton left in the field after the machine harvest, six-foot row sections were hand picked in each plot. The cotton so harvested was included in the total yield. Soil samples were taken after the harvest from 0 to 160 cm, in 20 cm depth intervals. Samples were taken on both the "old" plots and the "new" plots. Saturation extracts were prepared and the total salts and chloride concentrations in the extracts determined.

Figure 14.

LAYOUT OF EXPERIMENTAL SITE ON THE NMSU PLANT SCIENCE FARM WITH TREATMENTS



ALFALFA VALVE

WATER METER

4" PIPELINE

1" PIPELINE

TRICKLE HEADERS

GATED PIPE

TREATMENT	WATER APPLIED	IRRIGATION INTERVALS
1	20"	1 Week
2	20"	2 Weeks
3	20"	3 Weeks
4	24"	1 Week
5	24"	2 Weeks
6	24"	3 Weeks
7	28"	1 Week
8	28"	2 Weeks
9	28"	3 Weeks
T_1	Irrigated at 0.2 Bar	
T_2	Irrigated at 0.6 Bar	

Results and Discussion

The amounts of water applied during the 1976 growing season (May 6 to August 20) are listed in Table 9 for the surface irrigated plots, and in Table 10 for the trickle irrigated plots.

The plots were not pre-irrigated, but it is quite possible that residual water was present in the soil from irrigation of the barley during the preceding winter.

Note from the data that the average amount of water applied to the trickle plots (19.3 inches) is only one inch or 5.6 percent higher than the average amount of water applied to the 100 percent surface treatment. This indicates that the 100 percent treatment was indeed close to the planned irrigation efficiency of 100 percent. It also suggests that trickle irrigation management based on tensiometer readings is an efficient method of applying water.

The effects of irrigation efficiency and irrigation interval on cotton yield are presented in Table 11. The A plots are the "old" plots, which had undergone irrigation treatments for four years. The B plots were on the area adjacent to the "old" plots. This area was planted with cotton for the first time in five years.

Table 11 shows the considerably higher yields for the B plots than for the A plots, possibly because the B plots had been bare before planting for several years. Also, many of the A plots showed reduced growth and yellowing. The latter may have been due to nitrogen deficiency as a result of more leaching during the past years, and nitrogen loss caused by the less than favorable soil structure on many of the A plots.

This was the first year that irrigation treatments had a significant effect on yield. The 100 percent efficiency treatment on the A plots resulted in a significantly higher yield, possibly as a result of less leaching of nutrients from the plots in this treatment over the past four years. Irrigation of the B plots at three-week intervals resulted in reduced yields. This indicates that if the total water applied is nearly equal to the consumptive use, more frequent irrigation will produce an increased yield.

The effects of irrigation efficiency and irrigation interval on the quality of cotton from the surface irrigated A and B plots are presented in Tables 12 and 13, respectively. This year there were no significant effects on irrigation treatments on cotton quality.

The yield and quality of the cotton from the trickle irrigated plots are presented in Table 14. There were no significant effects due to irrigation treatment on either cotton yield or quality. Soil solution samples withdrawn at 30 cm below the clay-loam overlying the sand in each plot were collected throughout the growing season. These samples are being analyzed for chloride concentration only. The overall mean chloride concentration from all 50 locations in the plot area is 24.1 meq/l, with a standard deviation of 15.8 meq/l. The average chloride concentration of the irrigation well water is 2.90 meq/l (see Appendix Table J-1). Thus, there is an eight-fold increase in chloride concentration of the percolation water, as compared to the chloride concentration in the irrigation water. Results of the analysis of samples from the five test wells are presented in Appendix Tables J-2 through J-6. The composition of the water in the Del Rio Drain is presented in Appendix Tables K-1 through K-3 with the staff gage and flow data for the Del Rio Drain presented in Table K-4.

Table 9. Water applied to surface irrigated plots from May 6 to August 20, 1976*

Irrigation Interval	Planned Irrigation Efficiency 100% Plot No	100% Water Applied (in)	90% Plot No	90% Water Applied (in)	80% Plot No	80% Water Applied (in)
1 week	8	18.2	9	22.1	2	25.9
	12	18.2	18	22.1	14	26.1
	26	18.2	24	22.1	28	26.2
2 weeks	7	18.4	1	22.1	4	26.1
	17	18.2	15	22.0	19	26.1
	27	18.2	29	21.6	25	26.1
3 weeks	6	18.3	3	21.3	5	24.2
	13	18.3	11	21.3	16	24.5
	22	18.2	23	21.2	21	24.1

*The amounts of water listed do not include rainfall of 3.5 inches over this period.

Table 10. Water applied to the trickle plots from May 6 to August 20, 1976*

Irrigation Treatment 0.2 BAR Plot No	0.2 BAR Inches	0.7 of Amount at 0.2 BAR Plot No	0.7 of Amount at 0.2 BAR Inches
3	19.15	1	16.87
4	19.72	2	16.89
5	19.04	6	16.60

*Not including rainfall of 3.5 inches over this period.

Table 11. Effects of irrigation efficiency and irrigation interval on the total fiber yields of cotton for the surface irrigated Plots A and B, 1976

Irrigation Interval (weeks)	Irrigation Efficiency 80	90 (Kg/ha)	100	Average (units)
		A Plots		
1	1,084	1,082	1,434	1,200
2	1,071	1,286	1,480	1,279
3	1,342	1,318	1,354	1,338
Average	1,166a	1,229a	1,423b	1,272
		B Plots		
1	1,557	1,459	1,528	1,515a
2	1,562	1,618	1,514	1,565a
3	1,424	1,326	1,318	1,356b
Average	1,514a	1,468a	1,453a	1,478

Yield means followed by the same letter are not significantly different at the five percent or less level of probability.

Table 12. Effects of irrigation efficiency on yield and quality of cotton for the surface irrigated plots A and B, 1976

Irrigation Efficiency (%)	Yield (kg/ha)	Lint (%)	2.5% Span	Uniformity Ratio	Mil	Strength	Elongation
				A Plots			
80	1,166a	39.57	1.153	47.58	3.53	22.48	6.99
90	1,229a	39.40	1.133	47.38	3.57	22.26	7.39
100	1,423b	38.01	1.18	47.17	3.63	23.32	7.31
				B Plots			
80	1,514	36.97	1.186	46.07	3.47	21.94	7.87
90	1,468	36.39	1.202	45.69	3.53	22.46	7.64
100	1,453	36.17	1.182	45.79	3.45	21.97	7.29

Yield means followed by same letter are not significantly different at the five percent or less level of probability.

Table 13. Effects of irrigation interval on yield and quality of cotton for the surface irrigated plots A and B, 1976

Irrigation Interval (weeks)	Yield (kg/ha)	Lint (%)	2.5% Span	Uniformity Ratio	Mil	Strength	Elongation
				A Plots			
1	1,200	39.24	1.137	46.64	3.45	22.79	6.94
2	1,279	38.38	1.169	47.34	3.60	22.36	7.19
3	1,338	39.40	1.161	48.13	3.68	22.91	7.56
				B Plots			
1	1,515a	37.47	1.179	45.09	3.40	21.90	7.48
2	1,565a	36.28	1.197	46.12	3.52	22.20	7.71
3	1,356b	35.78	1.194	46.33	3.53	22.27	7.61

Yield means followed by the same letter are not significantly different at the five percent or less level of probability.

Table 14. Yield and quality of cotton for the trickle irrigated plots 1-6, 1976

Treatment	Yield (kg/ha)	Lint (%)	2.5% Span	Uniformity Ratio	Mil	Strength	Elongation
.2 bar	1,280	38.61	1.167	46.60	3.93	23.17	6.93
70% of .2 bar treatment	1,308	38.66	1.197	44.57	3.53	22.77	6.53

No significant differences.

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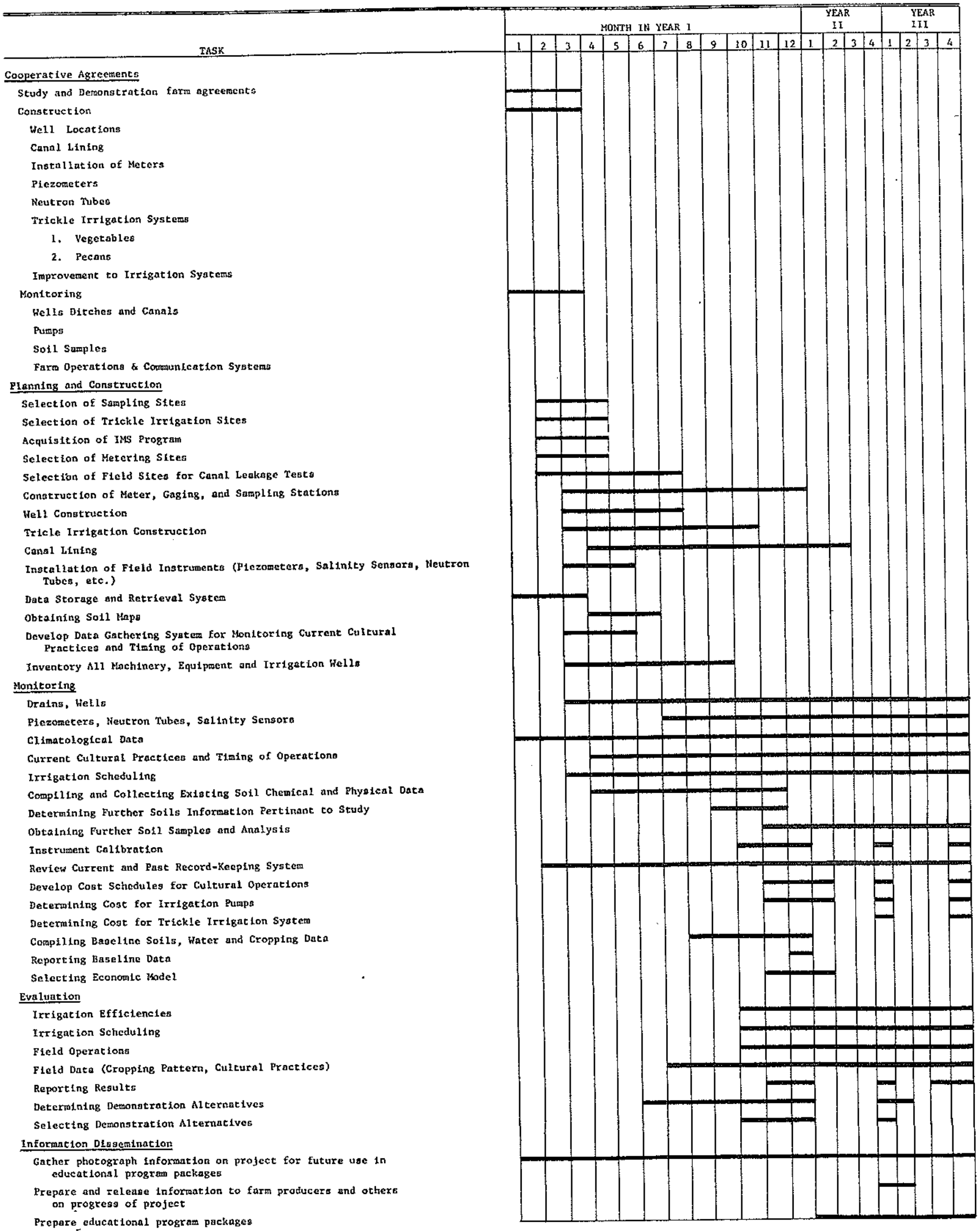
APPENDIX A

PLAN OF WORK

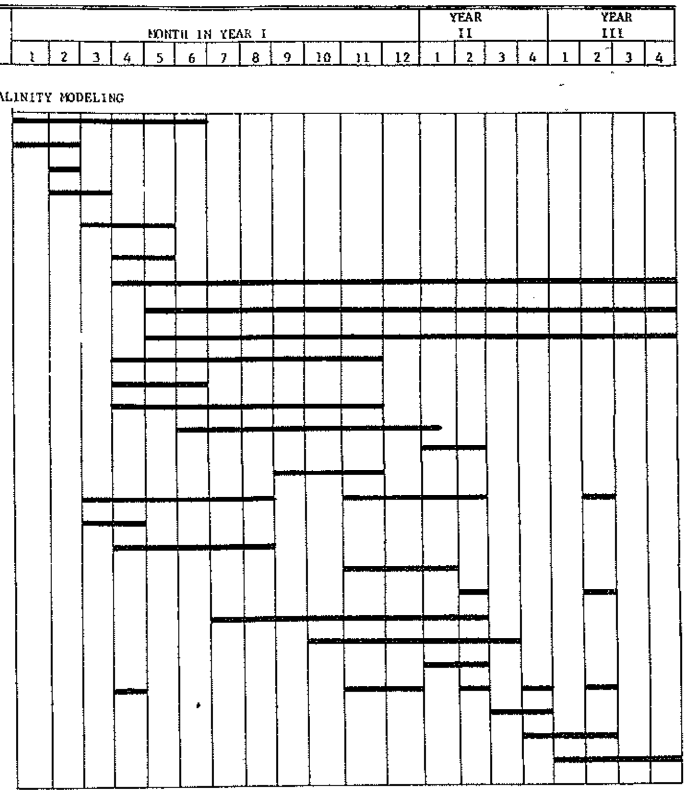
EPA PROJECT
Demonstration of Irrigation Return Flow Salinity
Control in the Upper Rio Grande
Work Plan For
Demonstration Farm



EPA PROJECT
Demonstration of Irrigation Return Flow Salinity
Control in the Upper Rio Grande
Work Plan

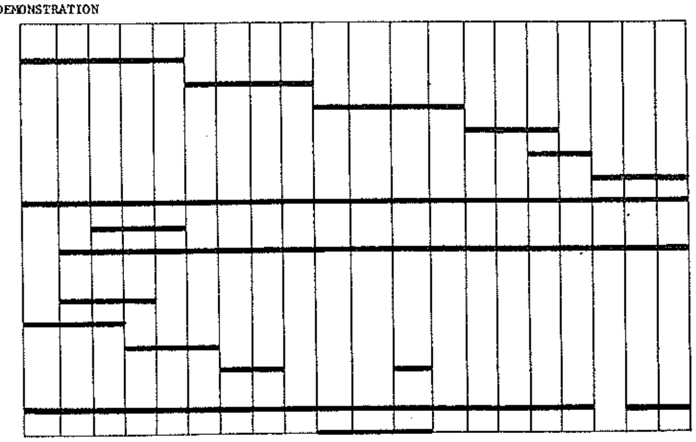
TASK

HYDROLOGIC AND SALINITY MODELING



Review existing data
Review model structure and input requirements
Select preliminary nodal layout
Develop preliminary model input data
Preliminary simulations for design of field network, sensitivity analysis, etc.
Selection of sampling stations-surface and ground water
Field observations, surface and ground water
Compilation, analysis and interpretation of field data
Hydrology
Soils
Obtaining soils maps
Collecting and compiling existing soil, chemical and physical data
Obtaining soil samples from major soil series in project area
Compiling soil chemical and physical data
Determining further soil information needed
Cropping patterns
Obtain maps
Collecting and compiling valley cropping patterns
Determining additional cropping pattern information
Obtain additional cropping pattern data
Detailed evaluation of water and mass balance for a single node
Model calibration for subsystem components
Model calibration for a single node
Preliminary results for economic, management and demonstration studies
Selection of final multi-nodal model configuration
Develop multi-nodal input data
Evaluation of multi-nodal mode, calibration
Predictions for economic, management and demonostration studies

FIELD PLOT DEMONSTRATION



Agronomics at NMSU Plant Science Farm (Water and solute movement studies)
Spring Wheat
Sorghum
Barley
Cotton
Barley
Cotton
Collection of climatic and crops data
Compile detailed soils map of research area
Compiling, correlating, and reporting climatic crops and soil water data
Instrumentation and Calibration
Neutron probe calibration
Lysimeter, flowmeter construction and installation
Lysimeter, flowmeter, neutron probe and salinity sensor testing
Evaluation and reporting of lysimeter, flowmeter, neutron probe and salinity sensor, tests and instrumentation recommendation
Modeling soil water and salt flux
Reevaluate 1973 and 1974 neutron and climate data

APPENDIX B

PIEZOMETER READINGS

Table B-1. Water stage below surface

Date	Piezometer No.																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	(feet)																		
1-29-76	7.3	8.3	7.7	7.5	5.5	7.5	7.3	7.1	7.1	6.8	6.7	6.4	6.2	6.2	6.3	6.4	-	6.5	6.7
2-7-76	7.3	8.3	7.6	7.6	5.8	7.5	7.4	7.2	7.1	6.8	6.9	6.8	6.6	6.6	5.4	6.2	6.5	6.7	6.8
2-21-76	7.2	8.6	7.8	7.6	6.1	7.7	7.6	7.3	7.1	6.6	7.1	6.9	6.9	6.8	5.3	6.4	6.6	6.6	6.9
2-28-76	7.2	8.5	7.6	7.5	6.2	7.6	7.6	7.1	7.2	7.2	7.1	6.9	6.9	6.8	5.5	7.3	6.6	6.3	7.2
3-6-76	7.2	8.8	7.7	7.5	6.4	7.7	7.4	7.3	7.2	7.0	7.1	6.8	7.0	6.8	5.5	6.5	6.5	6.6	6.8
3-13-76	7.2	8.4	7.4	7.2	6.6	7.6	7.4	7.2	7.2	7.0	7.1	6.8	6.8	6.8	5.6	6.4	6.6	6.6	6.8
3-20-76	6.7	7.9	6.7	7.2	6.7	7.1	6.8	6.7	6.8	6.2	6.5	6.5	6.4	6.3	5.7	6.3	6.5	6.8	7.0
3-27-76	6.3	7.5	6.5	6.7	6.5	6.5	6.4	6.0	6.4	5.9	6.1	5.9	6.2	6.3	5.7	6.0	6.3	6.6	6.9
4-3-76	6.1	7.6	6.6	6.6	6.1	6.6	6.4	6.4	6.2	6.1	5.9	5.9	5.9	5.9	5.8	5.6	6.0	6.1	7.0
4-10-76	6.0	7.5	6.1	6.4	6.1	6.4	6.2	5.7	5.7	5.8	5.9	5.7	5.9	6.0	5.7	5.5	5.8	6.1	6.8
4-17-76	6.0	7.1	6.3	6.4	6.1	6.5	6.3	6.0	6.2	6.0	6.1	5.8	5.8	5.9	5.7	5.5	5.9	5.1	6.7
4-24-76	5.7	7.3	6.4	6.5	6.1	6.5	6.4	6.2	6.2	6.2	6.2	6.1	-	6.1	-	5.6	-	6.0	6.8
5-1-76	5.7	7.2	6.3	6.2	6.0	6.2	6.2	5.7	5.9	5.9	5.8	5.6	-	5.7	5.6	5.3	-	5.9	6.0
5-8-76	5.5	6.9	5.9	6.0	6.1	6.3	6.1	6.0	6.1	5.9	5.9	5.8	-	5.8	5.7	5.3	-	5.8	5.9
5-15-76	5.4	6.8	5.6	5.6	5.7	5.4	5.0	4.6	4.8	4.9	5.1	5.6	-	5.6	5.7	5.2	-	5.8	5.7
5-20-76	5.5	6.7	6.0	6.0	6.2	6.0	5.9	5.9	5.8	5.7	5.6	5.7	-	5.2	5.9	5.2	-	5.9	6.8
5-28-76	6.9	7.0	5.8	6.2	6.2	6.4	6.0	5.9	5.9	5.6	6.0	5.7	-	5.9	5.9	5.6	-	6.0	6.0
6-7-76	5.5	6.7	5.5	5.7	6.0	6.0	6.0	5.9	5.9	5.8	5.8	5.6	-	5.8	5.9	5.5	-	5.8	6.1
6-21-76	-	6.9	6.1	6.0	5.8	5.9	5.8	5.8	6.2	5.7	5.7	5.4	-	5.3	5.6	6.2	-	5.8	5.9
6-29-76	-	6.5	4.9	5.3	6.1	4.9	4.4	4.2	4.5	4.4	4.5	5.0	-	-	5.7	5.8	-	5.8	5.6

Table B-1. Continued

Date	Piezometer No.																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	(feet)																		
7-8-76	-	6.4	5.7	5.5	6.1	5.7	5.1	5.5	5.6	5.4	4.6	5.2	-	-	5.7	5.8	-	5.8	5.6
8-11-76	-	6.7	5.4	5.3	4.8	5.2	5.6	5.5	4.9	4.7	4.7	5.7	-	-	5.0	-	-	-	5.3
8-25-76	-	6.3	5.2	5.3	5.1	5.3	5.3	5.0	5.0	4.7	4.8	4.7	-	-	4.9	4.6	-	-	4.9
8-31-76	-	6.5	5.4	5.3	5.4	5.2	5.2	5.1	5.2	4.9	4.9	5.7	-	-	5.0	4.6	-	-	5.5
9-7-76	-	5.8	4.9	4.8	5.1	4.9	4.9	4.8	-	4.7	4.8	4.7	-	-	4.8	4.4	-	-	5.8
9-14-76	-	6.4	4.4	4.5	4.4	5.4	4.5	4.3	4.4	4.0	4.3	4.2	-	-	4.2	3.8	-	-	5.4
9-23-76	-	6.7	5.7	5.7	5.4	5.9	5.8	5.6	5.6	5.1	5.6	5.4	-	-	5.3	4.9	-	-	5.4
9-29-76	-	6.6	5.6	5.6	5.4	5.8	5.6	5.4	5.7	5.0	5.5	-	-	-	5.1	5.0	-	-	5.5
10-5-76	-	7.2	6.2	6.1	5.5	6.2	6.1	5.9	5.8	5.2	5.8	5.6	-	-	5.4	4.9	-	-	6.7
10-12-76	-	7.4	6.3	6.3	5.4	6.4	6.3	6.1	6.0	5.3	6.2	5.8	-	-	5.7	5.0	-	-	7.0
10-19-76	-	7.7	6.6	6.6	5.4	6.7	6.5	6.3	6.2	5.4	6.2	5.0	-	-	5.8	5.3	-	-	7.0
10-26-76	-	7.3	6.2	6.2	5.3	6.3	6.2	6.0	5.9	5.3	6.1	5.9	-	-	5.6	4.9	-	-	6.9
11-2-76	-	7.7	6.6	6.5	5.0	6.7	6.4	6.2	6.1	5.3	6.2	5.9	-	-	5.7	5.2	-	-	6.8
11-9-76	-	7.6	6.5	6.6	5.1	6.6	6.3	6.1	6.1	5.3	6.2	6.0	-	-	5.6	5.2	-	-	6.9
11-16-76	-	7.7	6.9	6.8	5.1	6.8	6.7	6.5	6.4	5.4	6.4	6.2	-	-	6.0	5.5	-	-	7.0
11-23-76	-	7.7	6.9	6.8	5.1	6.8	6.7	6.5	6.4	5.4	6.4	6.2	-	-	5.9	5.5	-	-	7.0
11-30-76	-	7.7	6.9	6.7	5.1	6.7	6.5	6.4	6.1	5.4	6.4	6.2	-	-	5.9	5.4	-	-	7.0
12-7-76	-	7.6	6.8	6.7	5.0	6.7	6.6	6.5	6.2	5.4	6.2	6.0	-	-	5.9	5.4	-	-	6.9
12-14-76	-	7.6	6.9	6.7	5.1	6.7	6.5	6.5	6.2	5.4	6.2	6.0	-	-	5.9	5.3	-	-	6.9

APPENDIX C

LA MESA DRAIN FLOW AND QUALITY DATA

Table C-1. Staff gage and flow data for La Mesa drain measuring stations.

	La Mesa Drain							La Mesa Drain					
Date	Site A Stake	Site B Stake	Site B Flow	Site C Stake	Site D Stake	Site D Flow	Date	Site A Stake	Site B Stake	Site B Flow	Site C Stake	Site D Stake	Site D Flow
1976	feet	feet	cfs.	feet	feet	cfs.	1976	feet	feet	cfs.	feet	feet	cfs.
2-21	1.90	1.52	11.15	2.15	1.74	11.86	8-3			33.18			26.42
2-28	1.95	2.55	12.05	2.20	1.72	11.99	8-11		3.20	30.48			17.39
3-6		1.56	10.87	2.20	1.76	11.62	8-18		3.25	34.82	3.55	2.91	16.95
3-13	2.02	1.65	13.61	2.43	1.90	12.81	8-25		3.10	19.19		2.79	27.34
3-20	2.20	1.72	16.21	2.64	1.92	16.58	8-31		3.10	35.61			
3-27	2.40	2.00	17.76	2.83	2.20	17.54	9-7		1.90	35.37		2.40	
4-3	2.40	2.12	19.22		2.23	14.40	9-14		1.80	29.31		2.00	21.62
4-10	2.58	2.25	13.58	3.07	2.40	18.63	9-23		2.10	33.40		2.19	37.27
4-17	2.65	2.41	25.26	3.22	2.48	23.74	9-28		2.91	27.29		2.10	38.23
4-24		2.28	22.78	3.05	2.42	22.94	10-5		2.30	24.78		1.76	30.56
5-1	2.68	2.48	25.43	3.23	2.57	19.87	10-12		1.90	18.47		1.51	16.44
5-8	2.73	2.67	30.07	3.38	2.90	27.01	10-19		1.67	16.28		1.40	17.90
5-15	2.72	2.60	27.82	3.32	2.73	32.80	10-26		1.73	17.27		1.36	14.63
5-20	2.90	2.53	32.52	3.14	2.74	28.44	11-2		1.64	16.38		1.36	15.64
5-28	2.96	2.68	25.96	2.32	2.78	27.34	11-9		.96	14.70		1.40	18.01
6-7	3.30	2.90	32.67			28.60	11-16		.80	13.14		1.47	17.60
6-11	3.10	2.75	20.88			25.20	11-23		.75	12.53		1.56	16.51
6-21	3.16	3.20	19.19		3.16	27.95	11-30		.69	11.60		1.70	16.80
6-28	3.40	2.80	25.52		2.88	26.50	12-7		.76	12.42		1.20	11.76
7-8		2.95	21.72		2.96	37.24	12-14		.73	11.40		1.17	11.95
7-13		2.98	28.82		2.88	32.25	12-21		.74	12.72		1.14	10.63
7-19		3.02	27.21		2.93	-	12-28		.70	11.75		1.08	12.84
								1977					
7-26		3.05	32.48		2.88	36.02	1-4		.68	11.55		1.04	10.73

Table C-2. Composition of water samples taken at La Mesa drain site A during 1976

Site	Date	ECX10^3	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				- - - -	- - - -	- - -	- - -	- -(meq/1)- -	- - -	- - -	- - -	- - -	- - -	(ppm)
A	1-13-76	1.89	8.03	22.14	21.61	11.33	3.02	7.52	.27	5.43	0	6.07	10.11	0
A	1-28-76	1.71	-	19.07	19.31	9.86	2.43	6.55	.23	4.27	0	6.81	8.23	0
A	2-07-76	1.52	7.69	17.57	17.38	7.01	2.36	7.96	.24	4.20	0	5.57	7.61	0
A	2-21-76	1.49	8.22	16.93	16.58	6.14	2.55	7.96	.28	4.58	0	4.07	7.93	1.11
A	3-06-76	1.46	8.11	16.89	16.05	6.59	2.31	7.76	.23	4.13	0	4.86	7.06	.89
A	3-20-76	1.36	8.29	16.64	15.81	6.80	2.25	7.36	.23	4.14	0	5.04	6.73	.69
A	4-03-76	1.38	8.25	16.27	16.78	6.25	2.12	7.69	.21	3.69	0	5.00	7.09	1.35
A	4-10-76	1.34	8.30	16.06	15.25	5.57	2.08	7.17	.24	3.63	0	4.82	6.80	1.50
A	5-01-76	1.39	8.09	14.52	14.27	5.14	2.10	7.07	.21	3.44	0	4.62	6.21	1.22
A	5-15-76	1.44	8.48	16.35	15.83	6.52	2.21	7.41	.21	3.70	0	4.54	7.59	.5
A	5-28-76	1.39	8.43	14.94	15.06	6.36	1.96	6.39	.22	3.54	.65	3.65	7.22	1.10
A	6-11-76	1.48	7.64	15.57	16.89	7.23	2.09	7.01	.24	3.86	1.11	4.25	7.67	.06
A	6-28-76	1.35	8.54	15.40	15.31	6.37	2.05	6.75	.23	3.57	1.68	3.30	6.76	.28
A	7-12-76	1.30	8.42	14.97	14.36	6.19	1.99	6.56	.23	3.32	.64	3.84	6.56	.15
A	7-26-76	1.33	8.44	15.12	14.36	5.72	2.14	7.06	.20	3.62	.72	3.06	6.96	3.03
A	8-11-76	1.25	8.46	14.02	14.29	5.53	1.98	6.30	.21	3.25	.44	4.08	6.52	2.20
A	8-25-76	1.21	8.39	13.69	14.24	4.77	2.02	6.53	.37	3.62	.24	2.58	7.80	4.25
A	9-07-76	1.38	8.65	14.56	14.46	5.40	2.12	6.82	.22	3.66	.96	1.80	8.04	2.64
A	9-23-76	1.45	8.57	15.71	15.93	6.31	2.25	6.92	.23	3.83	.32	3.66	8.12	5.62
A	10-05-76	1.82	7.88	20.29	20.06	9.65	2.54	7.87	.23	5.78	0	5.44	8.84	.04
A	10-19-76	1.62	8.18	-	21.65	-	2.89	9.18	.23	4.73	.60	3.28	13.04	5.50
A	11-03-76	1.83	8.42	23.39	24.64	10.57	2.95	9.64	.23	5.14	.84	5.06	13.60	2.29
A	11-16-76	1.88	8.23	23.56	23.46	10.53	2.87	9.93	.23	5.36	0	5.74	12.36	2.45
A	11-30-76	1.85	7.69	23.48	22.72	10.53	2.82	9.91	.22	5.50	.64	5.38	11.20	2.05
A	12-14-76	1.88	7.93	24.80	24.50	10.97	2.98	10.60	.25	5.38	0	6.40	12.72	2.00
Mean		1.52	8.22	17.58	17.63	7.39	2.36	7.68	.24	4.21	.35	4.52	8.51	1.64
SD		.22	.29	3.44	3.50	2.13	.36	1.23	.03	.79	.46	1.21	2.26	1.62

Table C-3. Composition of water samples taken at La Mesa drain site B during 1976

Site	Date	$ECX10^3$	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meq/l)										(ppm)
B	1-13-76	1.90	8.00	22.47	21.61	11.60	3.08	7.53	.26	5.46	0	5.78	9.92	0
B	1-28-76	1.74	-	18.98	19.37	9.90	2.31	6.51	.26	4.36	0	6.78	8.23	1.26
B	2-07-76	1.50	7.66	17.34	17.02	6.70	2.39	8.01	.24	4.20	0	5.17	7.65	.06
B	2-21-76	1.50	8.19	16.98	16.52	6.14	2.58	7.99	.27	4.54	0	4.12	7.86	1.69
B	3-06-76	1.49	8.27	16.96	17.06	6.71	2.23	7.74	.23	4.23	0	4.94	7.89	1.11
B	3-20-76	1.32	8.35	15.74	15.42	6.00	2.21	7.30	.23	4.07	0	4.40	6.95	1.22
B	4-03-76	1.41	8.26	16.61	15.88	6.25	2.25	7.88	.23	3.86	0	5.26	6.76	1.70
B	4-10-76	1.40	8.41	16.13	15.51	6.62	2.08	7.19	.24	3.73	.16	4.74	6.88	2.50
B	5-01-76	1.39	8.23	14.77	14.55	4.95	2.12	7.48	.22	3.45	0	4.70	6.40	1.41
B	5-15-76	1.46	8.45	16.22	15.51	6.56	2.25	7.20	.21	3.75	.73	3.52	7.51	1.32
B	5-28-76	1.40	8.34	14.81	15.13	6.33	1.83	6.44	.21	3.49	.54	3.90	7.20	1.10
B	6-11-76	1.47	8.30	15.66	16.15	6.38	1.90	7.14	.24	3.88	0	4.64	7.63	1.39
B	6-28-76	1.40	8.55	13.85	14.09	5.00	2.03	6.59	.23	3.55	.88	2.74	6.92	.59
B	7-12-76	1.30	8.54	14.84	14.03	6.19	1.97	6.44	.24	3.35	0	4.08	6.60	1.38
B	7-26-76	1.37	8.59	15.85	15.10	6.41	2.16	7.08	.20	3.62	.48	3.88	7.12	2.87
B	8-11-76	1.29	8.27	14.50	14.16	5.55	1.98	6.75	.22	3.28	.48	4.08	6.32	3.59
B	8-25-76	1.28	8.66	14.61	15.27	5.75	1.96	6.69	.21	3.47	.80	3.32	7.68	2.20
B	9-07-76	1.30	8.24	14.18	14.73	4.38	2.12	7.44	.24	3.87	0	2.62	8.24	5.26
B	9-23-76	1.65	8.43	19.51	18.73	9.45	2.42	7.40	.24	6.57	.96	3.80	7.40	2.06
B	10-05-76	1.69	8.37	18.12	19.00	8.09	1.79	8.08	.22	4.38	.68	4.70	9.24	3.19
B	10-19-76	1.60	8.36	-	20.74	-	2.88	8.82	.23	4.76	.76	2.74	12.48	3.90
B	11-03-76	1.81	8.39	23.08	23.94	10.53	2.95	9.37	.23	5.08	.84	5.02	13.00	2.32
B	11-16-76	1.81	8.10	21.68	20.70	8.96	2.86	9.63	.23	5.42	0	4.40	10.88	2.35
B	11-30-76	1.68	8.13	21.99	21.59	9.27	2.81	9.68	.23	5.35	.52	4.20	11.52	2.85
B	12-14-76	1.86	8.07	24.79	23.54	11.08	3.05	10.41	.25	5.28	0	6.30	11.96	1.95
B	12-28-76	1.81	8.10	23.42	22.85	10.01	2.96	10.22	.23	5.45	0	5.40	12.00	2.30
Mean		1.53	8.29	17.72	17.62	7.39	2.35	7.81	.23	4.33	.30	4.43	8.55	1.98
SD		.20	.21	3.32	3.18	2.08	.41	1.18	.02	.86	.36	1.03	2.10	1.18

Table C-4. Composition of water samples taken from La Mesa drain site C during 1976

Site	Date	$ECX10^3$	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meq/l)										(ppm)
C	1-13-76	1.89	7.97	22.20	22.59	11.25	3.01	7.67	.27	5.48	0	5.85	10.26	.49
C	1-28-76	1.74	–	19.01	18.61	9.79	2.41	6.58	.23	4.43	0	6.76	8.42	.91
C	2-07-76	1.62	8.35	17.78	18.52	6.82	2.44	8.28	.24	4.36	0	6.29	7.87	0
C	2-21-76	1.46	8.06	16.22	15.98	6.03	2.54	7.38	.27	4.47	0	3.72	7.79	3.79
C	3-06-76	1.53	8.19	16.74	17.22	6.58	2.36	7.56	.24	4.32	0	4.90	8.00	1.63
C	3-20-76	1.40	8.26	17.15	16.33	7.33	2.25	7.34	.23	4.14	0	5.24	6.95	1.70
C	4-03-76	1.43	8.36	16.35	15.61	6.29	2.19	7.65	.22	3.79	0	4.98	6.84	1.91
C	4-10-76	1.40	8.30	16.23	15.94	6.59	2.13	7.27	.24	3.83	0	4.98	7.13	1.72
C	5-01-76	1.41	8.04	15.29	14.75	5.28	2.11	7.67	.23	3.53	0	4.68	6.54	.95
C	5-15-76	1.49	8.38	16.75	16.24	6.70	2.21	7.62	.22	3.78	1.08	4.07	7.31	1.25
C	5-28-76	1.43	7.97	15.11	14.72	6.90	1.99	6.01	.21	3.56	1.04	3.92	7.20	1.62
C	6-28-76	1.39	8.42	14.51	14.44	5.18	2.05	6.69	.23	3.57	.40	3.12	6.92	.28
C	7-12-76	1.34	8.53	15.39	15.16	6.70	1.98	6.46	.25	3.96	.96	3.68	6.56	1.05
C	8-11-76	1.28	8.66	14.98	14.84	6.54	1.90	6.33	.21	3.30	.76	4.26	6.52	.21
C	8-25-76	1.22	8.38	14.05	14.14	4.77	2.11	6.94	.23	3.62	.28	2.20	8.04	3.85
C	9-07-76	1.41	8.34	15.41	16.18	5.67	2.24	7.24	.23	3.78	.40	3.60	8.40	4.06
C	9-23-76	1.45	8.49	16.00	15.92	6.29	2.20	7.29	.22	3.88	.60	3.28	8.16	6.78
C	10-05-76	1.69	8.33	18.43	19.30	7.90	2.40	7.92	.21	4.38	.92	4.64	9.36	3.72
C	10-19-76	1.61	8.43	–	22.00	–	2.93	9.22	.23	4.90	.80	3.50	12.80	4.60
C	11-03-76	1.84	8.36	23.22	22.17	10.73	3.01	9.25	.23	5.15	.88	5.06	11.08	2.90
C	11-16-76	1.89	7.58	23.84	23.35	10.87	2.93	9.81	.23	5.41	0	5.90	12.04	2.15
C	11-30-76	1.90	7.64	23.55	23.07	10.66	2.90	9.76	.23	5.53	.72	5.58	11.24	2.55
C	12-14-76	1.85	7.99	24.38	23.21	10.71	2.97	10.46	.24	5.27	0	6.18	11.76	2.25
Mean		1.55	8.23	17.85	17.84	7.53	2.40	7.76	.23	4.28	.38	4.63	8.57	2.19
SD		.21	.27	3.34	3.25	2.10	.37	1.19	.02	.70	.42	1.16	1.97	1.66

Table C-5 . Composition of water samples taken from La Mesa drain site D during 1976

Site	Date	ECX10^3	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meq/l)										(ppm)
D	1-13-76	1.92	8.00	23.04	21.55	12.02	3.09	7.67	.26	5.44	0	6.00	10.11	.17
D	1-28-76	1.74	-	18.93	19.60	9.82	2.37	6.51	.23	4.45	0	6.73	8.42	0
D	2-07-76	1.57	7.76	18.65	17.97	7.73	2.47	8.21	.24	4.38	0	5.47	8.12	.06
D	2-21-76	1.46	8.23	15.89	15.39	5.73	2.54	7.34	.28	4.52	0	3.23	7.64	2.79
D	3-06-76	1.52	8.12	16.91	16.60	6.66	2.32	7.69	.24	4.25	0	5.00	7.35	1.53
D	3-20-76	1.33	8.30	16.41	15.75	6.57	2.30	7.32	.22	4.07	0	4.70	6.98	1.40
D	4-03-76	1.47	8.48	16.90	16.29	6.25	2.12	8.30	.23	3.92	0	4.23	7.09	1.05
D	4-10-76	1.43	8.17	16.33	15.83	6.59	2.18	7.32	.24	3.87	0	4.96	7.00	1.38
D	5-01-76	1.42	8.13	15.46	14.71	5.32	2.23	7.69	.22	3.53	0	4.71	6.47	1.30
D	5-15-76	1.45	8.52	17.35	16.66	6.79	2.35	7.99	.22	3.93	1.08	3.94	7.71	1.25
D	5-28-76	1.46	6.55	15.89	15.12	6.55	1.92	7.20	.22	3.55	1.31	3.90	7.36	.69
D	6-11-76	1.58	8.06	15.76	15.98	7.30	2.12	6.04	.30	4.06	1.04	4.29	7.59	1.60
D	6-28-76	1.38	8.48	13.92	14.03	4.88	2.04	6.76	.24	3.61	.60	2.94	6.88	.37
D	7-12-76	1.33	8.29	15.48	14.97	6.70	2.01	6.53	.24	3.41	.88	4.08	6.60	.50
D	7-26-76	1.43	8.63	16.26	15.51	6.92	2.14	6.99	.21	3.81	.68	4.08	6.96	3.58
D	8-11-76	1.23	8.59	13.69	13.49	5.68	1.99	6.15	.21	3.27	.56	3.34	6.32	2.35
D	8-25-76	1.23	8.44	13.88	14.12	4.69	2.03	6.94	.22	3.54	.44	2.26	7.88	2.92
D	9-07-76	1.35	8.23	15.40	15.81	5.52	2.21	7.44	.23	3.81	0	3.68	8.32	4.51
D	9-23-76	1.41	8.52	15.55	15.96	6.37	2.23	6.73	.22	3.86	.60	3.22	8.28	7.12
D	10-05-76	1.69	8.10	18.44	19.11	8.26	2.39	7.58	.21	4.17	.96	4.62	9.36	3.91
D	10-19-76	1.76	8.43	-	20.76	-	2.99	9.01	.23	4.78	.24	4.06	11.68	4.30
D	11-03-76	1.82	8.48	22.93	22.03	10.41	2.92	9.37	.23	5.07	.96	5.00	11.00	2.80
D	11-16-76	1.91	7.60	23.70	22.00	10.61	2.93	9.93	.23	5.46	0	5.82	10.72	2.80
D	11-30-76	1.76	8.16	22.17	21.31	9.44	2.82	9.68	.23	5.37	.88	4.10	10.96	2.45
D	12-14-76	1.88	8.11	24.75	24.04	11.03	3.12	10.35	.25	5.32	0	6.20	12.52	2.25
D	12-28-76	1.79	8.14	22.54	22.10	9.78	2.92	9.60	.24	5.44	.36	4.70	11.60	2.70
Mean		1.55	8.18	17.85	17.57	7.50	2.41	7.78	.23	4.27	.41	4.43	8.50	2.15
SD		.21	.42	3.35	3.08	2.08	.38	1.20	.02	.70	.44	1.05	1.85	1.65

Table C-6. Electrical conductivity (mmhos/cm) and flow (m^3/sec) of water at La Mesa drain sampling sites A, B, C, and D during 1976

Site A		Site B		Site C		Site D	
Date	ECX10^3	ECX10^3	Flow (m^3/sec)	Date	ECX10^3	ECX10^3	Flow (m^3/sec)
1-06-76	1.67	1.65	.242	1-06-76	1.62	1.70	.272
1-13-76	1.89	1.90	.259	1-13-76	1.89	1.92	.216
1-21-76	1.93	1.95	.226	1-21-76	1.91	1.93	.203
1-28-76	1.71	1.74	.273	1-28-76	1.74	1.74	.259
2-02-76	1.16	1.18	-	2-02-76	1.39	1.33	-
2-07-76	1.52	1.50	.394	2-07-76	1.62	1.57	.376
2-14-76	1.60	1.62	.347	2-14-76	1.62	1.63	.319
2-21-76	1.49	1.50	.316	2-21-76	1.46	1.46	.336
2-28-76	1.60	1.49	.341	2-28-76	1.54	1.57	.340
3-06-76	1.46	1.49	.308	3-06-76	1.53	1.52	.329
3-13-76	1.41	1.44	.385	3-13-76	1.47	1.44	.363
3-20-76	1.36	1.32	.459	3-20-76	1.40	1.33	.470
3-27-76	1.25	1.30	.503	3-27-76	1.29	1.30	.497
4-03-76	1.38	1.41	.544	4-03-76	1.43	1.47	.407
4-10-76	1.34	1.40	.384	4-10-76	1.40	1.43	.528
4-17-76	1.41	1.42	.715	4-17-76	1.44	1.46	.672
4-24-76	1.42	1.40	.645	4-21-76	1.44	1.46	.650
5-01-76	1.39	1.39	.720	5-01-76	1.41	1.42	.563
5-08-76	1.37	1.38	.852	5-08-76	1.40	1.40	.765
5-15-76	1.04	1.46	.788	5-15-76	1.49	1.45	.929
5-20-76	1.50	1.56	.921	5-20-76	1.54	1.56	.805
5-28-76	1.39	1.40	.735	5-28-76	1.43	1.46	.774
6-04-76	1.44	1.39	.925	6-04-76	1.38	1.39	.810
6-11-76	1.48	1.47	.591	6-11-76	-	1.58	.714
6-21-76	1.38	1.41	.543	6-21-76	1.41	1.42	.791
6-28-76	1.35	1.40	.723	6-28-76	1.39	1.38	.750
7-06-76	1.28	1.24	.615	7-06-76	1.29	1.30	1.055
7-12-76	1.30	1.30	.816	7-12-76	1.34	1.33	.913
7-19-76	1.39	1.35	.771	7-19-76	-	1.42	-
7-26-76	1.33	1.37	.920	7-26-76	-	1.43	1.020
8-03-76	1.31	1.28	.938	8-03-76	1.33	1.31	.748
8-11-76	1.25	1.29	.863	8-11-76	1.28	1.23	.492
8-18-76	1.30	1.29	.986	8-18-76	1.31	1.30	.480
8-25-76	1.21	1.28	.543	8-25-76	1.22	1.23	.774
8-31-76	1.29	1.28	1.008	8-31-76	1.33	1.39	-
9-07-76	1.38	1.30	1.002	9-07-76	1.41	1.35	-
9-14-76	1.61	1.60	.830	9-14-76	1.63	1.63	.612
9-23-76	1.45	1.65	.946	9-23-76	1.45	1.41	1.055
9-28-76	1.58	1.50	.773	9-28-76	1.54	1.50	1.083
10-05-76	1.82	1.69	.702	10-05-76	1.69	1.69	.865
10-12-76	1.84	1.84	.523	10-12-76	1.84	1.84	.466
10-19-76	1.62	1.60	.461	10-19-76	1.61	1.76	.507
10-26-76	1.78	1.79	.489	10-26-76	1.75	1.80	.414
11-03-76	1.83	1.81	.464	11-03-76	1.84	1.82	.443
11-09-76	1.88	1.85	.416	11-09-76	1.85	1.90	.510
11-16-76	1.88	1.81	.372	11-16-76	1.89	1.91	.498
11-24-76	1.89	1.89	.355	11-24-76	1.89	1.88	.468
11-30-76	1.85	1.68	.329	11-30-76	1.90	1.76	.476
12-07-76	1.89	1.88	.352	12-07-76	1.88	1.88	.333
12-14-76	1.88	1.86	.323	12-14-76	1.85	1.88	.338
12-22-76	1.95	1.90	.360	12-22-76	1.93	1.96	.301
12-28-76	-	1.81	.333	12-28-76	-	1.79	.364
Mean	1.52	1.53	.581		1.56	1.56	.570
SD	.24	.22	.241		.21	.22	.243

APPENDIX D

CLIMATOLOGICAL DATA

TABLE D-1. CLIMATOLOGICAL DATA, PLANT SCIENCE FARM, NMSU, JANUARY 1976

DAY	MAXIMUM TEMP.	MINIMUM TEMP.	DEW POINT TEMP.	WIND	RAIN	SOLAR RAD.	EVAPORATION PAN
	C.	C.	C.	KM/DAY	CM	LANG.	CM
1	3.89	-3.33	-1.11	181.9	.23	47.7	.18
2	4.44	-3.89	-5.56	67.6		299.0	.13
3	5.00	-11.11	-8.89	85.3		333.6	.13
4	7.78	-9.44	-6.67	85.3		291.6	.13
5	11.11	-10.56	-4.44	85.3		315.5	.15
6	13.33	-8.33	-7.22	296.1			.43
7	7.78	-3.89	-8.89	141.6		318.5	.25
8	12.22	-10.00	-8.89	70.8		313.6	.20
9	13.89	-7.78	-5.56	132.0		297.5	.10
10	18.89	-5.00	-2.78	62.8		290.2	.33
11	13.33	-5.00	-2.78	148.1		315.9	.30
12	18.33	-7.78	-1.67	104.6		316.7	.23
13	18.33	-6.67	-2.22	107.8		317.1	.28
14	16.11	-5.00		133.6		314.5	.28
15	18.33	-5.00	.56	138.4		321.6	.30
16	19.44	-4.44	2.22	138.4		317.3	.25
17	17.78	-3.89	1.11	69.2		318.9	.28
18	18.33	-5.00	1.67	69.2		313.9	.28
19	12.78	-1.67	1.11	452.2		204.7	.53
20	10.00	0.00	2.22	99.8		248.5	.30
21	13.89	-7.22		27.4		269.0	.10
22	16.11	-4.44	2.22	61.2		316.1	.20
23	16.11	-1.11	4.44	138.4	.48	149.4	.15
24	14.44	5.00	4.44	365.3	.05	270.0	.41
25	12.22	-1.67		226.9		341.5	.33
26	7.78	-5.00	-8.89	149.7			.38
27	10.00	-7.22	-4.44	107.8		291.6	.20
28	15.00	-7.22	-3.33	91.7		353.5	.18
29	17.78	-5.00	-2.22	90.1		356.4	.30
30	20.56	-5.00		141.6		347.7	.41
31	13.89	-0.56	2.22	125.5		352.1	.13
TOTAL				4,195.4	.76	8,543.60	7.85
AVERAGE	13.51	-5.07	-2.04	135.3		275.6	.25

TABLE D-2. CLIMATOLOGICAL DATA, PLANT SCIENCE FARM, NMSU, FEBRUARY 1976

DAY	MAXIMUM TEMP.	MINIMUM TEMP.	DEW POINT TEMP.	WIND	RAIN	SOLAR RAD.	EVAPORATION PAN
	C.	C.	C.	KM/DAY	CM	LANG.	CM
1	17.78	-3.89	-1.11	66.0		364.4	.38
2	20.00	-6.67	-1.11	64.4		311.8	.30
3	21.11	-6.11	-2.22	160.9		82.9	.48
4	12.78	2.78	7.22	122.3	.15	246.5	.05
5	17.78	-0.56	3.33	99.8	.05	268.9	.23
6	19.44	-1.11	2.22	127.1		361.4	.28
7	20.00	-1.11	1.11	83.7		351.9	.25
8	22.78	1.11	3.33	54.7		166.5	.41
9	22.22	6.11	3.89	252.7		96.5	.51
10	18.33	6.11	11.11	236.6		261.5	.33
11	18.89	5.00	6.67	98.2	.61	263.7	.25
12	18.89	6.11	8.89	94.9	.03	302.3	.20
13	23.33	7.78	7.22	207.6	.41	407.1	.63
14	16.67	2.78	-1.11	173.8	.03	411.9	.53
15	21.11	-2.22	-4.44	204.4		400.4	.53
16	16.11	-2.22	-3.89	183.5		410.4	.43
17	17.78	1.11	1.11	339.6		409.2	.63
18	21.11	-2.22	-1.67	175.4		421.9	.56
19	21.11	-2.22		263.9		433.4	.58
20	14.44	5.00	-6.67	478.0		439.7	.99
21	10.00	-5.00	-4.44	135.2		450.7	.38
22	13.89	-7.22	-5.56	54.7		452.3	.25
23	17.22	-8.33	-11.67	123.9		440.2	.43
24	23.89	-2.22	-4.44	210.8		440.2	.69
25	20.56	-0.56	-5.00	127.1		456.5	.53
26	22.22	-6.67	-3.33	104.6		455.1	.51
27	22.22	-2.22	1.11	112.7		382.4	.56
28	25.00	2.22	-1.11	111.0		353.0	.58
29	24.44	-1.11	-2.22	146.4		456.2	.66
TOTAL				4,613.9	1.28	10,298.90	13.14
AVERAGE	19.35	-.54	-.10	159.1		355.1	.45

TABLE D-3. CLIMATOLOGICAL DATA, PLANT SCIENCE FARM, NMSU, MARCH 1976

DAY	MAXIMUM TEMP.	MINIMUM TEMP.	DEW POINT TEMP.	WIND	RAIN	SOLAR RAD.	EVAPORATION PAN
	C.	C.	C.	KM/DAY	CM	LANG.	CM
1	23.33	2.22	3.89	247.8		442.6	.86
2	22.78	3.89	7.22	318.6		389.9	.56
3	22.78	5.56	5.00	637.3		327.4	1.17
4	10.00	0.00	-1.11	286.5		489.3	.53
5	16.11	-7.78	-3.33	197.9		456.4	.46
6	20.00	3.33	2.22	357.3		392.5	.66
7	17.78	1.11	3.33	357.3		419.0	.63
8	17.22	1.11	3.33	103.0		466.3	.46
9	21.11	-2.22	2.78	120.7		486.0	.56
10	22.22	2.22	4.44	267.1		316.0	.61
11	17.22	6.67	8.89	347.6		498.0	.86
12	18.89	-3.33	-1.11			504.9	.63
13	14.44	0.00	-2.22			491.3	.53
14	21.67	-5.56				512.3	.43
15	22.78	1.11					.71
16	18.33	-1.11		51.5		511.2	.46
17	23.89	-1.67		111.0		420.9	.56
18	26.67	1.67	4.44	141.6		504.4	.71
19	25.56	4.44	4.44	362.1		485.4	1.14
20	21.11	6.67	2.22	196.3		544.4	.86
21	22.22	-1.11	2.22	96.6			.43
22	25.00	1.11	2.22	270.4			.91
23	24.44	8.89	10.56	157.7		362.2	.66
24	25.00	2.78	5.56	91.7			
25	26.67	0.00	-1.11	294.5			
26	18.89	5.00	-5.00	231.7			
27	23.33	2.22	1.11	286.5			.74
28	19.44	5.00	5.00	481.2	.10		.76
29	16.11	2.22	4.44	392.7			.69
30	15.56	0.00	-2.22	162.5			.61
31	21.11	-5.00	-3.33	96.6			.56
TOTAL				6,665.7	.10	9,020.40	18.75
AVERAGE	20.70	1.27	2.06	215.0		291.0	.60

TABLE D-4. CLIMATOLOGICAL DATA, PLANT SCIENCE FARM, NMSU, APRIL 1976

DAY	MAXIMUM TEMP.	MINIMUM TEMP.	DEW POINT TEMP.	WIND	RAIN	SOLAR RAD.	EVAPORATION PAN
	C.	C.	C.	KM/DAY	CM	LANG.	CM
1	25.00	-2.22	-2.22	143.2			.66
2	23.89	2.78	1.11	94.9			.46
3	26.67	2.22	3.33	170.6			.79
4	24.44	4.44	10.00	350.8			.89
5	26.11	10.00	6.67	268.8			1.04
6	22.78	7.22	1.11	177.0		517.9	.74
7	25.00	2.22	.56	160.9		593.3	.76
8	27.22	3.89	3.89	341.2		488.3	.76
9	25.56	12.22	8.33	283.2		470.7	.79
10	27.78	7.78	7.78	94.9		542.8	.79
11	28.33	6.11	5.00	247.8		592.6	.76
12	28.33	6.11	11.11	59.5		564.9	1.04
13	26.11	7.78	5.00	338.0		260.0	.84
14	23.89	4.44	7.78	289.7	1.09	404.4	.69
15	12.22	5.56	7.78	349.2	.20	495.5	.43
16	14.44	2.22	4.44	402.3	.05	608.6	.51
17	12.22	0.00		292.9		591.9	.63
18	21.11	-1.67	-1.11	149.7		600.5	.58
19	22.22	2.78	2.22	247.8		642.1	.84
20	23.33	2.78	2.22	93.3		614.7	.56
21	27.78	2.78	3.33	103.0		547.4	.71
22	27.78	8.89	4.44	165.8		586.0	.94
23	27.78	7.78	6.67	196.3		586.0	.94
24	28.33	4.44	4.44	128.7		600.2	.86
25	30.00	5.00	4.44	152.9		595.1	.89
26	28.33	7.78	4.44	247.8		649.4	1.14
27	26.67	8.33	7.78	180.2		598.3	.81
28	31.67	6.11	10.00	212.4		590.7	.97
29	26.67	17.22	15.56	272.0		519.4	.91
30	27.78	14.44	5.56	202.8		607.4	.89
TOTAL				6,417.9	1.34	13,868.10	23.62
AVERAGE	24.98	5.65	5.06	213.9		462.3	.79

TABLE D-5. CLIMATOLOGICAL DATA, PLANT SCIENCE FARM, NMSU, MAY 1976

DAY	MAXIMUM TEMP.	MINIMUM TEMP.	DEW POINT TEMP.	WIND	RAIN	SOLAR RAD.	EVAPORATION PAN
	C.	C.	C.	KM/DAY	CM	LANG.	CM
1	22.22	6.11	7.78	94.9		655.7	.69
2	27.78	2.22	2.78	114.3		635.7	.79
3	27.78	7.78	10.00	275.2		352.0	.84
4	27.22	11.11	14.44	252.7	.36	414.6	.71
5	22.22	9.44	14.44	307.4	.13	428.0	.61
6	23.89	6.67	8.89	317.0	.13	514.2	.79
7	20.00	7.78	11.11	669.5		630.9	1.22
8	21.11	4.44	10.56	321.9		632.1	.76
9	26.11	6.11	4.44	93.3		637.5	.63
10	30.00	6.11	5.00	109.4		647.9	.79
11	32.22	10.00	10.56	160.9		575.5	.84
12	31.67	7.78	10.00	265.5		595.7	1.37
13	28.33	6.67	3.33	141.6		674.1	.94
14	32.22	3.89	5.56	99.8		661.5	.86
15	33.89	7.78	8.89	225.3		622.4	1.17
16	27.78	7.78	17.22	455.4		624.8	1.82
17	27.78	8.89	18.89	217.3		597.8	.98
18	26.67	8.89	13.33	222.1		610.2	.86
19	25.00	9.44	13.33	128.7		404.0	.33
20	25.56	9.44	13.33	123.9	.05	486.8	.74
21	30.00	12.22	11.11	177.0	.03	631.3	1.07
22	30.56	8.33	6.67	169.0		665.3	1.16
23	31.11	6.67	7.78	106.2		662.2	1.00
24	31.11	7.78	6.67	189.9		614.8	1.19
25	27.78	7.78	2.22	297.7		673.5	1.42
26	32.22	6.67	7.78	254.3		673.3	1.19
27	31.67	15.00	15.56	165.8		654.8	.91
28	32.78	8.89	6.67	178.6		660.3	.97
29	32.22	10.00	-1.11	238.2		677.3	1.27
30	28.89	9.44	3.33	218.9		693.3	1.35
31	31.67	6.11	3.33	77.2		672.0	.74
TOTAL				6,668.9	.70	18,679.50	30.01
AVERAGE	28.37	7.97	8.84	215.1		602.6	.97

TABLE D-6. CLIMATOLOGICAL DATA, PLANT SCIENCE FARM, NMSU, JUNE 1976

DAY	MAXIMUM TEMP.	MINIMUM TEMP.	DEW POINT TEMP.	WIND	RAIN	SOLAR RAD.	EVAPORATION PAN
	C.	C.	C.	KM/DAY	CM	LANG.	CM
1	32.78	6.11	8.89	132.0		679.7	.99
2	33.89	13.33	10.56	312.2		608.4	1.24
3	33.89	19.44	17.22	302.5		623.9	1.22
4	32.22	17.78	17.78	244.6		619.4	1.12
5	32.22	18.33	18.33	210.8		627.0	1.07
6	31.67	16.67	17.78	289.7	2.67	622.6	2.18
7	30.00	17.22	15.56	202.8		672.4	.89
8	31.67	17.78	15.56	112.7		650.1	.76
9	33.33	17.78	12.22	120.7		663.5	1.02
10	33.89	14.44	14.44	146.4		684.0	1.12
11	32.22	13.89	8.89	196.3		687.5	1.19
12	32.22	8.33	5.56	96.6		712.3	1.35
13	32.22	8.89	10.00	143.2		616.6	.89
14	32.78	10.56	2.22	226.9		686.9	1.45
15	32.22	12.22	2.22	164.1		703.9	.94
16	34.44	12.22	10.00	138.4		687.4	1.27
17	33.33	13.89	10.56	286.5		685.5	1.47
18	33.89	12.22	10.00	143.2		690.4	.97
19	33.89	11.11	12.78	289.7		670.0	1.32
20	37.22	21.67	20.56	122.3		629.0	1.02
21	37.78	15.56	16.67	103.0		586.4	1.02
22	37.22	20.56	16.67	233.3		548.7	1.22
23	32.78	17.22	15.56	267.1		717.1	1.75
24	32.78	11.11	13.33	125.5		715.5	.91
25	32.78	10.56	11.67	127.1		684.6	1.04
26	33.89	12.22	12.22	127.1		701.6	.76
27	34.44	13.89	15.00	194.7		692.8	1.19
28	32.78	14.44	16.67	114.3		648.7	1.60
29	35.00	15.00	16.67	144.8		659.8	1.07
30	32.78	17.78					
TOTAL				5,318.7	2.67	19,175.70	34.04
AVERAGE	33.41	14.41	12.52	177.3		639.2	1.13

TABLE D-7. CLIMATOLOGICAL DATA, PLANT SCIENCE FARM, NMSU, JULY 1976

DAY	MAXIMUM TEMP.	MINIMUM TEMP.	DEW POINT TEMP.	WIND	RAIN	SOLAR RAD.	EVAPORATION PAN
	C.	C.	C.	KM/DAY	CM	LANG.	CM
1	*	*					
2	*	*					
3	*	*			.38		
4	*	*					
5	*	*			.13		
6	*	*			1.14		
7	31.67	0.00				612.1	
8	32.78	17.78	13.33	194.7		643.0	1.27
9	34.44	20.00	17.78	196.3		641.3	1.04
10	36.11	22.22	20.56	220.5		611.2	1.75
11	32.22	20.56	21.11	173.8	.51	525.6	1.19
12	32.22	17.22	18.89	120.7	.13	505.2	.53
13	32.22	16.67	17.22	130.4	1.63	539.5	1.75
14	33.33	17.78	19.44	149.7	2.03	596.9	2.74
15	28.89	17.78	20.00	136.8		419.5	.61
16	37.22	18.89	18.89	265.5		526.2	1.12
17	32.22	19.44	18.89	162.5		573.3	.97
18	32.78	17.78	17.78	154.5		624.0	.99
19	32.22	18.89	21.11	111.0		423.6	.38
20	31.11	16.67	18.89	178.6	.58	339.1	.66
21	28.89	17.22	18.89	135.2	.05	478.3	.53
22	32.22	17.78	18.33	127.1	.13	602.5	.94
23	31.11	16.67	16.11	111.0	2.57	480.4	2.64
24	28.89	15.56		202.8	.03	539.6	.79
25	31.67	16.67		104.6	.28	546.6	.84
26	31.67	15.00	16.67	86.9		551.1	.61
27	32.22	17.22	17.22	91.7		563.4	.86
28	31.11	16.11	18.89	123.9		535.9	.84
29	32.78	17.78	20.00	133.6	.10	547.8	.66
30	32.22	18.33	17.78	98.2		430.9	.66
31	32.78	17.78	17.78	98.2		592.5	.81
TOTAL				3,508.3	9.69	13,449.90	25.18
AVERAGE	25.97	13.80	13.08	113.2		433.9	.81

* INSTRUMENT DOWN FOR REPAIRS

TABLE D-8. CLIMATOLOGICAL DATA, PLANT SCIENCE FARM, NMSU, AUGUST 1976

DAY	MAXIMUM TEMP.	MINIMUM TEMP.	DEW POINT TEMP.	WIND	RAIN	SOLAR RAD.	EVAPORATION PAN
	C.	C.	C.	KM/DAY	CM	LANG.	CM
1	30.00	15.00	16.67	94.9		323.3	.46
2	32.22	16.11	17.78	128.7		610.1	.81
3	33.33	15.56	16.67	169.0	.15	609.8	.99
4	34.44	17.78	19.44	66.0		593.1	.63
5	37.78	13.89	12.78	86.9		616.5	.91
6	37.22	13.33	8.89	98.2		612.2	.91
7	34.44	15.56	15.00	135.2		531.6	.81
8	34.44	16.11	14.44	135.2	.05	575.8	1.02
9	34.44	15.56	16.67	132.0		547.2	.76
10	33.89	15.56	16.67	123.9	.05	542.6	.79
11	32.78	17.22	17.78	61.2		577.9	.71
12	35.56	15.56	13.89	144.8		541.6	.97
13	34.44	17.22	17.22	90.1		576.2	.79
14	33.89	13.33	14.44	94.9		533.8	.81
15	34.44	15.00	17.22	114.3		538.4	.79
16	36.67	15.56	15.56	160.9		454.6	.91
17	31.67	16.11	18.89	165.8	.10	496.7	.74
18	30.56	16.11	18.33	165.8		500.8	.79
19	31.11	18.89	18.89	204.4		540.5	.84
20	31.67	15.56	16.11	140.0		521.4	.94
21	32.22	16.67	15.56	91.7		585.6	.69
22	33.33	16.11	16.67	199.6		551.5	1.60
23	40.56	20.00	13.89	127.1		526.5	.86
24	41.11	13.89	15.56	103.0		569.9	.84
25	33.89	15.00	16.11	99.8		552.4	.79
26	33.89	15.56		86.9		544.7	.71
27	32.78	15.00		162.5	.20	315.5	.61
28	31.67	15.56	17.22	202.8		420.3	.61
29	29.44	15.00	15.56	162.5		574.5	.74
30	30.56	13.89	14.44	111.0		542.6	.94
31	31.11	13.89	13.33	148.1	.08	460.7	1.65
TOTAL				4,007.2	.63	16,488.30	26.42
AVERAGE	33.73	15.66	14.89	129.3		531.9	.85

TABLE D-9. CLIMATOLOGICAL DATA, PLANT SCIENCE FARM, NMSU, SEPTEMBER 1976

DAY	MAXIMUM TEMP.	MINIMUM TEMP.	DEW POINT TEMP.	WIND	RAIN	SOLAR RAD.	EVAPORATION PAN
	C.	C.	C.	KM/DAY	CM	LANG.	CM
1	-1.67	-11.11	-11.03	135.2		454.1	2.03
2	-2.50	-8.89	-10.06	128.7		418.7	1.22
3	-0.56	-10.56	-12.75	53.1		529.7	.69
4	34.00	14.00	13.38	114.3		471.6	.79
5	23.00	17.50	20.25	94.9	2.11	156.4	.02
6	26.50	15.00	16.94	70.8		422.6	.40
7	30.00	13.50	15.31	59.5		524.3	.60
8	31.50	17.00	16.63	181.9		427.5	.56
9	23.50	16.50	18.07	354.0	.05	146.0	.39
10	25.50	13.50	16.33	162.5		482.1	.54
11	30.00	13.00	15.88	78.9		499.6	.55
12	30.50	13.00	8.64	80.5		544.3	.68
13	32.50	13.50	13.09	144.8		490.2	.64
14	28.50	18.00	19.89	235.0		429.8	.79
15	28.50	15.50	15.96	120.7		491.1	.95
16	30.00	14.50	16.47	148.1		434.1	.79
17	29.50	15.50	16.17	177.0	.81	462.5	.77
18	30.00	12.00	14.13	64.4		558.6	.35
19	31.00	11.50	12.55	123.9		491.8	.79
20	29.00	12.50	14.45	146.4		508.7	.62
21	27.00	12.00	13.85	111.0		502.9	.77
22	27.50	12.00	11.32	74.0		486.1	.41
23	30.00	11.50	12.32	112.7		416.2	.50
24	27.00	15.50	17.92	103.0		275.1	.14
25	26.50	14.00	14.62	160.9	.20	397.3	.79
26	26.50	10.00	14.05	101.4	.05	409.0	.32
27	25.50	11.00	10.96	159.3		490.3	.69
28	24.00	8.00	10.55	141.6		520.4	.49
29	27.00	6.50	6.98	170.6		512.9	.67
30	28.50	8.50	7.46	123.9		489.9	.62
TOTAL				3,933.1	3.22	13,443.80	19.57
AVERAGE	25.28	10.81	11.68	131.1		448.1	.65

TABLE D-10. CLIMATOLOGICAL DATA, PLANT SCIENCE FARM, NMSU, OCTOBER 1976

DAY	MAXIMUM TEMP.	MINIMUM TEMP.	DEW POINT TEMP.	WIND	RAIN	SOLAR RAD.	EVAPORATION PAN
	C.	C.	C.	KM/DAY	CM	LANG.	CM
1	25.00	9.50	7.95	177.0	.91	255.2	.25
2	25.50	12.00	12.61	125.5		488.5	.56
3	26.00	11.50	10.77	141.6		477.5	.54
4	25.00	8.50	7.53	98.2		510.3	.68
5	24.00	8.00	9.25	167.4		490.8	.55
6	27.00	6.50	6.76	128.7		504.1	.49
7	18.50	6.50	4.76	132.0		494.0	.60
8	18.50	-2.00	.32	49.9			.31
9	25.00	0.00	.84	51.5		436.2	.39
10	26.50	2.00	7.97	35.4		456.4	.35
11	27.00	0.50	2.31	57.9		462.6	.35
12	28.00	2.00	1.35	77.2		431.6	.40
13	20.00	6.50		101.4	.25	147.0	.30
14	20.00	9.50	11.24	86.9	.05	330.8	.35
15	22.00	4.50	10.05	112.7		372.7	.37
16	21.50	7.50	8.15	151.3		418.2	.38
17	24.00	4.50		103.0		385.9	.65
18	25.00	4.00	4.09	175.4		377.8	.49
19	18.00	3.00	-.65	112.7		426.5	.41
20	20.00	0.00	-2.88	156.1		371.6	.40
21	20.50	3.50	8.04	111.0		242.5	.02
22	23.50	3.50		66.0	.30	295.0	.32
23	22.00	6.00	6.71	125.5	.03	339.0	.57
24	21.50	4.00		56.3		368.3	.59
25	22.00	1.00	1.04	125.5		397.7	.27
26	20.50	1.00	.13	175.4		383.2	.39
27	9.00	5.50	.45	336.3		56.1	.24
28	6.00	1.00	.98	177.0	.69	61.5	.22
29	14.50	2.00	-1.12	106.2		336.8	.13
30	18.50	-3.00	-3.60	78.9		397.6	.33
31	20.00	0.00	.27			376.5	
TOTAL				3,600.0	2.23	11,091.90	11.90
AVERAGE	21.44	4.16	3.72	116.1		357.8	.38

TABLE D-11. CLIMATOLOGICAL DATA, PLANT SCIENCE FARM, NMSU, NOVEMBER 1976

DAY	MAXIMUM TEMP.	MINIMUM TEMP.	DEW POINT TEMP.	WIND	RAIN	SOLAR RAD.	EVAPORATION PAN
	C.	C.	C.	KM/DAY	CM	LANG.	CM
1	20.50	0.50	.73	152.9		413.7	.67
2	21.50	-1.00		56.3		310.5	.11
3	21.00	-0.50	-3.89	133.6		372.4	.39
4	19.50	2.00	-5.35	69.2		359.4	.42
5	21.00	-1.00	-.73	48.3		358.7	.31
6	22.50	-1.00	-2.84	53.1		349.6	.68
7	19.00	0.00	-3.35	222.1		355.6	.02
8	18.50	0.50	-1.53	51.5		354.7	.87
9	22.50	-2.50	-1.05	51.5		340.4	.21
10	24.00	-2.50	-6.84	107.8		346.4	.51
11	22.00	-2.00	-7.42	498.5		300.8	.69
12	5.50	3.50	2.74	510.1		57.4	
13	-1.00	-15.00	-8.71	111.0		173.7	
14	1.50	-10.00	-6.10	66.0		195.8	
15	5.50	-1.00		88.5	.23	134.8	
16	13.00	-2.00		143.2		268.2	.04
17	12.50	-2.00	-5.09	138.4	.03	159.6	
18	14.00	1.00	2.59	51.5		155.9	.06
19	15.50	2.00	3.05	86.9		217.8	.10
20	19.50	-0.50	-.56	75.6		283.6	.43
21	15.50	-2.00	-3.02	199.6		342.6	.45
22	16.00	-4.00	-1.85	93.3		316.6	.03
23	18.00	-3.50	-2.20	90.1		274.1	.33
24	17.50	-3.00	-2.16	64.4		262.0	.18
25	20.50	-1.00	-2.44	233.3		285.9	.36
26	19.50	3.00	-2.18	302.5		302.9	.60
27	10.00	2.00	.16	310.6	.97	169.2	.02
28	-2.00	-14.00	-11.35	48.3		312.1	
29	-1.00	-24.00	-17.98	83.7		322.9	
30	3.50	-17.00	-12.29	64.4		307.9	
TOTAL				4,206.7	1.23	8,405.20	7.48
AVERAGE	14.52	-3.17	-3.32	140.2		280.2	.25

TABLE D-12. CLIMATOLOGICAL DATA, PLANT SCIENCE FARM, NMSU, DECEMBER 1976

DAY	MAXIMUM TEMP.	MINIMUM TEMP.	DEW POINT TEMP.	WIND	RAIN	SOLAR RAD.	EVAPORATION PAN
	C.	C.	C.	KM/DAY	CM	LANG.	CM
1	8.00	-11.00	-8.69	82.1		301.4	
2	8.00	-7.00	-6.88	46.7		295.8	.23
3	12.00	-7.50	-8.39	78.9		342.4	.08
4	13.00	-6.00	-7.16	62.8		294.1	.04
5	15.50	-5.00	-4.33	59.5		270.4	.28
6	12.00	-4.00	-9.45	125.5		297.7	.09
7	12.00	-8.50	-12.56	83.7		294.7	.20
8	15.00	-7.00	-9.26	48.3		284.8	.16
9	15.00	-6.50	-8.16	57.9		252.9	.14
10	16.50	-6.50	-11.47	154.5	.05	252.6	.31
11	9.00	0.00	-1.29	83.7		221.5	.01
12	14.50	-4.00	-5.77	80.5		236.9	.29
13	13.50	-3.00	-6.06	83.7		274.9	.17
14	13.50	-7.50	-6.30	53.1		288.8	.22
15	13.00	-8.00	-9.09	91.7		303.8	.24
16	15.00	-6.50	-7.59	127.1		292.3	.17
17	5.50	-5.50	-6.09	59.5	.25	91.4	.03
18	11.50	-2.00	2.11	104.6		177.2	.14
19	13.00	-2.50	-.57	212.4		165.3	.06
20	10.00	0.00	-7.62	247.8		265.5	.42
21	10.00	-0.50	-7.77	141.6		247.8	.44
22	12.50	-8.00	-9.93	90.1		303.4	.03
23	12.50	-9.00		78.9		280.2	.14
24	15.50	-7.00	-5.58	149.7		277.0	.32
25	11.00	-7.00	-15.56	207.6		300.3	.08
26	10.50	-8.00	-11.07	96.6		21.2	.32
27	15.00	-11.00	-15.81	103.0		293.5	.25
28	15.50	-6.50	-14.87	115.9		243.9	.20
29	12.50	-5.00	-11.76	90.1		158.8	.08
30	15.50	-2.50	-2.53	220.5		260.0	.44
31	16.00	-6.50	-4.55				
TOTAL				3,237.9	.30	7,590.50	5.58
AVERAGE	12.65	-5.77	-7.55	104.4		244.9	.18

TABLE D-13. CLIMATOLOGICAL DATA, PLANT SCIENCE FARM, NMSU, JANUARY 1977

DAY	MAXIMUM TEMP.	MINIMUM TEMP.	DEW POINT TEMP.	WIND	RAIN	SOLAR RAD.	EVAPORATION PAN
	C.	C.	C.	KM/DAY	CM	LANG.	CM
1	12.00	2.00	2.43	102.7	.15	170.5	.03
2	12.00	-5.50	-6.51	144.7		252.2	.09
3	16.50	-4.50	-5.57	168.3		324.6	.48
4	14.00	-0.50	-4.61	156.1		258.4	.26
5	10.00	0.50	-2.38	129.5		70.3	.23
6	10.50	-7.00	-9.24	143.5		290.7	
7	12.50	-6.00	-6.55	103.5		302.3	.08
8	11.00	-2.50	-6.48	410.7		206.8	.35
9	7.00	-1.00	-16.80	254.9		305.4	.40
10	9.00	-11.00	-16.63	130.5		328.8	.51
11	13.00	-9.00	-14.93	161.4		317.1	.06
12	8.50	-2.00	-1.13	116.4	.10	203.4	.14
13	13.50	-7.00	-9.40	113.5		313.5	.04
14	13.00	-6.50	-10.17	168.8		329.3	.35
15	11.00	-6.00		144.0		329.8	.40
16	12.00	-8.00	-9.18	128.1		340.0	.09
17	14.00	-6.00	-11.81	134.2		324.8	.37
18	13.00	-5.00	-5.86	131.5		303.4	.74
19	17.50	-6.00	-8.66	218.5		299.4	.38
20	15.50	-1.00	-1.98	92.7		240.9	.23
21	12.00	1.00	1.03	126.0	.79	101.3	.01
22	10.00	4.00	4.91	60.5	.05	127.9	.03
23	15.00	2.50	37.78	142.4		272.5	.27
24	14.00	-1.00	-5.59	87.4		361.6	.24
25	14.50	-4.00	-6.21	120.9		344.3	.21
26	17.00	1.00	-1.70	239.1		346.0	.54
27	16.50	0.00	-2.41	355.5		295.7	.54
28	16.00	-3.00	-7.08	105.4		359.5	.28
29	13.00	-1.00	-3.51	169.1	.48	177.4	.11
30	5.50	2.00	1.81	120.1		121.7	.10
31	9.00	-3.00	-1.93	73.5		351.4	.13
TOTAL				4,753.6	1.57	8,370.45	7.69
AVERAGE	12.52	-3.02	-4.16	153.3		270.0	.25

APPENDIX E

IRRIGATION PUMP NATURAL GAS CONSUMPTION

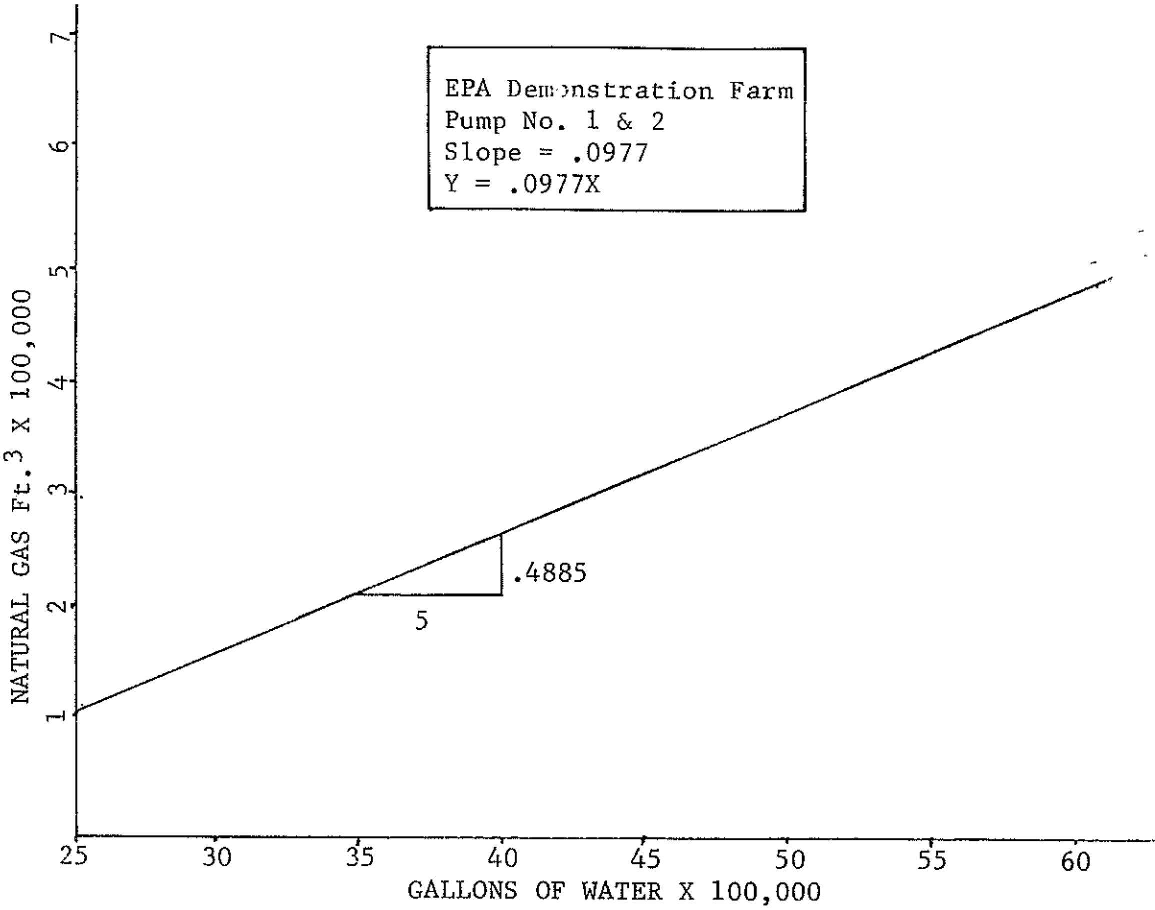


Figure E-1. Natural gas consumption versus water pumped for Pump No. 1 & 2, demonstration farm

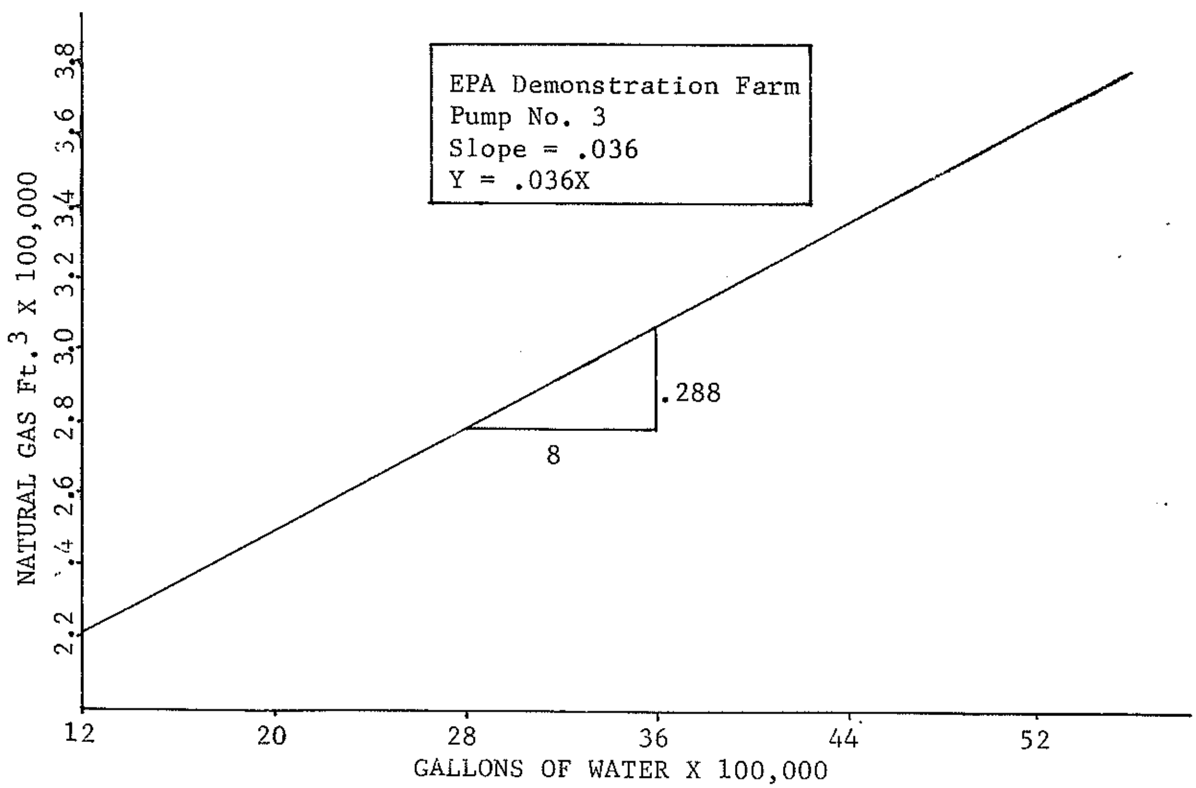


Figure E-2. Natural gas consumption versus water pumped for Pump No. 3, demonstration farm

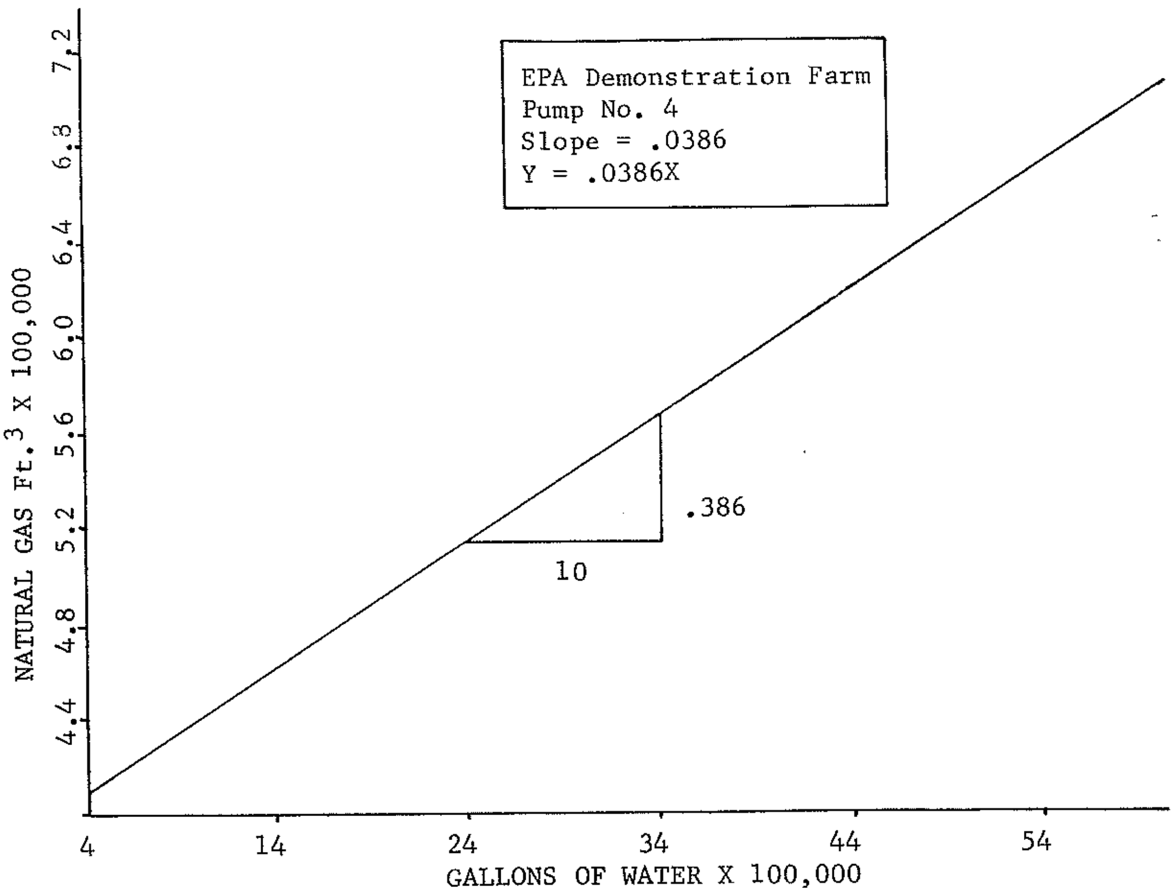


Figure E-3. Natural gas consumption versus water pumped for Pump No. 4, demonstration farm

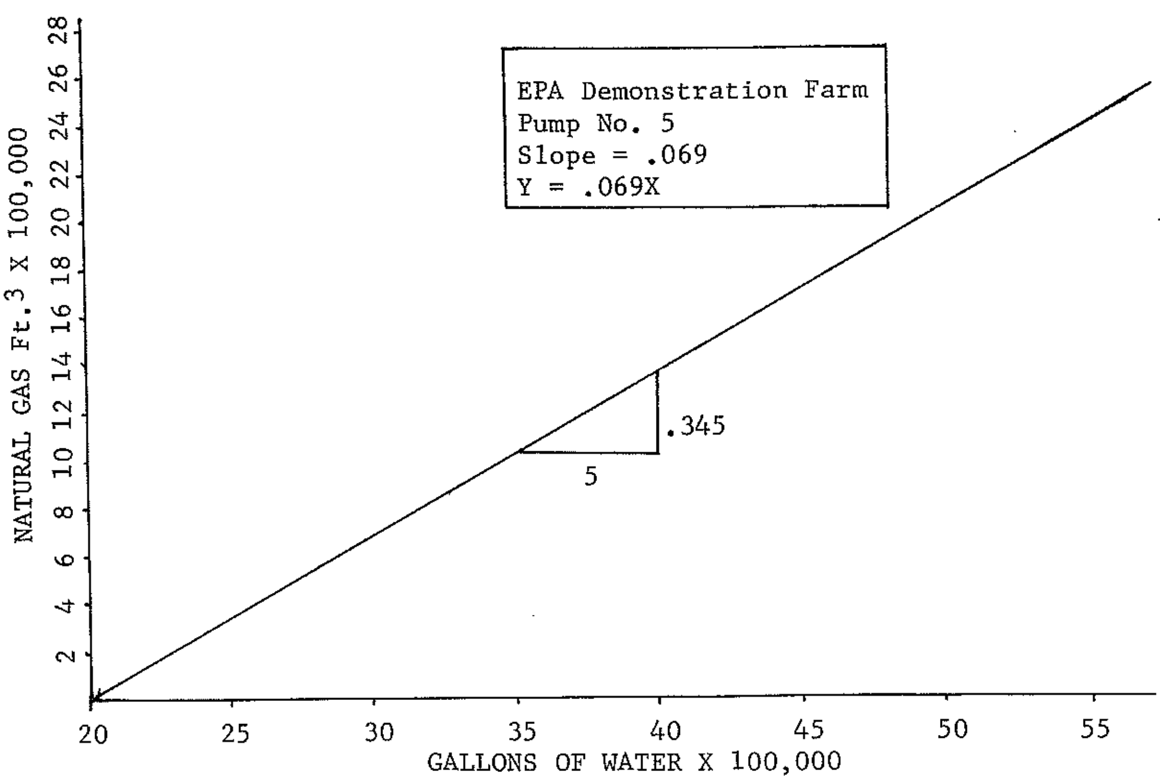


Figure E-4. Natural gas consumption versus water pumped for Pump No. 5, demonstration farm

APPENDIX F

DEMONSTRATION FARM IRRIGATION WELLS WATER QUALITY DATA

Table F-1. Composition of water samples from well 1 at 50 feet, demonstration farm, 1976

Site	Date	$ECX10^3$	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				- - - - -	- - - - -	- - - -	- - - -	-(meq/1)-	- - - -	- - - -	- - - -	- - - -	- - - -	(ppm)
1	3-20-76	2.06	8.23	25.21	24.00	8.27	4.28	12.36	.30	6.04	0	6.46	11.50	43.08
1	4-03-76	2.15	8.43	25.92	24.43	8.38	4.26	12.97	.31	6.31	0	6.50	11.62	71.28
1	4-10-76	2.08	8.18	25.02	24.74	7.91	4.08	13.00	.30	6.24	0	5.30	13.20	48.96
1	5-01-76	2.20	8.11	25.34	24.28	6.58	4.54	13.96	.26	6.48	0	4.70	13.20	61.60
1	5-15-76	2.16	8.44	25.76	24.45	8.86	4.56	12.05	.29	6.42	0	4.88	13.15	48.00
1	5-28-76	2.22	7.65	24.20	24.00	7.83	4.01	12.02	.34	6.46	0	4.42	13.12	46.50
1	6-28-76	2.15	8.19	22.66	22.05	5.94	4.34	12.03	.35	6.41	0	3.80	11.84	24.60
1	7-12-76	2.03	8.25	22.88	22.15	6.45	4.49	11.91	.30	6.23	0	4.28	11.64	21.78
1	7-26-76	1.93	8.18	24.38	23.19	7.09	4.72	12.25	.32	6.01	0	3.88	13.30	34.00
1	8-11-76	1.86	8.14	22.94	21.20	6.04	4.45	12.13	.32	6.02	0	3.58	11.60	33.10
1	8-25-76	1.85	6.11	22.52	21.29	6.11	4.55	11.53	.33	5.76	.53	2.56	12.44	28.70
1	9-07-76	1.84	8.29	20.49	21.19	5.20	4.15	10.82	.32	5.61	0	3.02	12.56	28.70
1	9-23-76	1.98	8.47	22.21	21.81	7.17	4.19	10.55	.30	5.27	.40	4.70	11.44	10.78
1	10-05-76	2.00	7.81	21.55	22.53	7.45	4.01	9.80	.29	5.11	0	6.02	11.40	46.90
1	10-21-76	1.81	8.41	21.68	22.10	6.06	4.61	10.68	.33	5.08	.48	3.38	13.16	28.00
1	12-14-76	1.84	7.90	24.14	22.58	8.57	4.08	11.20	.29	4.94	0	6.28	11.36	36.00
1	12-28-76	1.85	7.96	24.07	22.54	8.93	4.44	10.38	.32	5.24	.24	5.34	11.72	39.00
Mean		2.00	8.04	23.59	22.85	7.23	4.34	11.74	.31	5.86	.10	4.65	12.25	38.29
SD		.14	.55	1.61	1.23	1.16	.23	1.07	.02	.54	.19	1.21	.78	14.92

Table F-2. Composition of water samples from well 2 at 35 feet, demonstration farm, 1976

Site	Date	$ECX10^3$	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				- - - - -	- - - - -	- - - -	- - - -	- - (meq/1) - -	- -	- - - -	- - - -	- - - -	- - - -	(ppm)
2	3-20-76	2.50	8.09	31.82	30.31	10.72	5.48	15.30	.32	9.59	0	6.02	14.70	.05
2	4-03-76	2.67	8.17	33.88	32.30	12.34	5.37	15.86	.31	10.14	0	6.26	15.90	.50
2	4-10-76	2.66	8.04	33.01	31.56	11.30	5.21	16.52	.30	10.66	0	5.50	16.00	.52
2	5-01-76	2.73	8.15	31.58	30.30	9.17	5.37	16.72	.32	9.80	0	5.50	15.00	.52
2	5-15-76	2.75	8.41	32.48	31.27	12.20	5.25	14.72	.31	10.04	0	5.42	15.81	.39
2	5-28-76	2.65	7.71	28.50	28.98	10.33	4.58	13.24	.35	9.30	0	3.84	15.84	-
2	6-28-76	2.62	8.32	28.76	27.79	8.90	4.97	14.53	.36	9.55	0	4.14	14.10	0
2	7-12-76	2.56	8.17	29.14	28.22	10.14	4.93	14.04	.30	9.36	0	4.42	14.44	.30
2	7-26-76	2.40	8.08	30.13	28.97	10.44	5.13	14.28	.32	9.11	0	3.95	15.90	2.79
2	8-11-76	2.41	8.16	27.80	26.26	8.82	4.95	13.80	.32	9.17	0	3.14	13.96	3.19
2	8-25-76	2.31	8.19	28.05	27.71	9.20	4.97	13.53	.35	9.03	.36	2.08	16.24	1.05
2	9-07-76	2.33	8.06	27.85	28.07	8.92	4.99	13.61	.33	9.05	0	2.74	16.28	1.71
2	9-23-76	2.49	8.19	27.31	27.72	10.27	4.82	11.92	.30	8.68	.52	3.68	14.84	2.10
2	10-05-76	2.52	8.06	28.45	28.66	11.35	4.87	11.94	.29	8.48	0	5.42	14.76	.01
2	10-21-76	2.15	8.38	27.32	27.33	9.04	5.05	12.91	.32	7.69	.44	2.96	16.24	5.45
2	12-14-76	2.36	7.77	30.89	29.74	12.38	5.00	13.22	.29	8.24	0	5.58	15.92	3.65
2	12-28-76	2.31	7.62	30.05	28.75	12.03	4.81	12.91	.30	8.11	0	5.56	15.08	.15
Mean		2.50	8.09	29.82	29.06	10.44	5.04	14.06	.32	9.18	.08	4.48	15.35	1.32
SD		.17	.22	2.11	1.64	1.30	.23	1.42	.02	.78	.18	1.28	.78	1.60

Table F-3. Composition of water samples from well 3 at 20 feet, demonstration farm, 1976

Site	Date	$ECX10^3$	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meq/1)										(ppm)
3	3-20-76	2.59	8.16	32.59	31.15	9.01	3.91	19.33	.34	9.47	0	6.78	14.90	0
3	4-03-76	2.62	8.20	33.01	32.29	10.48	3.57	18.66	.30	9.23	0	6.56	16.50	.55
3	5-01-76	2.61	8.07	26.71	27.53	6.99	3.49	15.91	.32	8.62	0	5.71	13.20	.21
3	5-15-76	2.72	8.37	30.01	30.83	10.45	3.85	15.37	.34	9.36	0	5.42	16.05	.69
3	5-28-76	2.71	7.48	31.04	31.21	10.07	3.73	16.87	.37	9.06	1.69	4.46	16.00	.10
3	6-28-76	2.56	8.51	28.88	27.11	6.10	3.33	17.06	.39	8.87	.44	3.56	14.24	.10
3	7-12-76	2.61	8.32	29.12	27.77	7.51	3.72	17.85	.40	9.25	0	4.28	14.24	.05
3	7-26-76	2.41	8.10	31.71	30.30	9.21	3.57	18.58	.35	8.86	0	4.04	17.40	2.11
3	8-11-76	2.69	8.08	30.04	28.29	7.27	3.70	18.70	.37	9.35	0	4.32	14.44	.85
3	8-25-76	2.59	8.21	30.65	30.32	7.62	3.85	18.79	.39	9.90	0	2.98	17.44	1.99
3	9-07-76	2.65	8.16	28.56	29.97	7.26	3.80	17.04	.46	10.25	0	3.02	16.70	0
3	9-23-76	2.96	8.15	31.47	32.18	9.40	3.85	17.86	.36	10.08	.36	4.50	17.24	1.92
3	10-05-76	2.97	7.74	33.85	34.06	10.77	3.96	18.74	.35	9.98	0	6.96	17.12	.02
3	10-21-76	2.72	8.39	33.83	32.43	9.74	4.58	19.13	.38	9.45	.52	3.94	18.52	.20
3	12-14-76	2.75	7.72	36.48	34.56	12.85	4.34	18.95	.34	9.64	0	6.76	18.16	.30
3	12-28-76	2.76	7.43	36.69	34.81	12.54	4.10	19.67	.38	9.93	0	6.84	18.04	.05
Mean		2.68	8.07	31.54	30.93	9.21	3.83	18.03	.37	9.46	.19	5.01	16.26	.57
SD		.14	.32	2.78	2.43	1.98	.31	1.25	.04	.48	.44	1.42	1.62	.76

Table F-4. Composition of water samples from trickle system irrigation pump, demonstration farm, 1976

Site	Date	$ECX10^3$	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meq/l)										(ppm)
Irr. pump	3-20-76	.52	8.42	6.68	6.39	1.47	.70	4.41	.10	1.27	.16	3.44	1.52	0
	4-03-76	.54	8.50	6.65	6.34	1.47	.69	4.38	.11	1.34	0	3.44	1.56	.48
	4-10-76	.55	8.18	6.59	6.30	1.79	.66	4.02	.12	1.35	0	3.62	1.43	.40
	5-01-76	.55	8.90	6.63	6.41	1.75	.75	4.02	.11	1.27	0	3.78	1.36	.27
	5-15-76	.55	8.41	6.71	6.39	1.61	.75	4.24	.11	1.28	0	3.44	1.67	.20
	5-28-76	.62	7.94	7.08	6.82	1.33	.70	4.93	.12	1.32	0	4.04	1.46	.10
Mean		.56	8.26	6.72	6.44	1.57	.71	4.33	.11	1.31	.03	3.63	1.50	.24
SD		.03	.22	.18	.19	.18	.04	.34	.01	.04	.065	.24	.11	.18

APPENDIX G

MACHINERY AND EQUIPMENT INVENTORY

FOR DEMONSTRATION FARM

Table C-1. Equipment inventory for the demonstration farm

Implements	Numbers	Size	Estimated Cost New 1/17/1975	Estimated Current Value	Fuel & Oil Cost/Hour*	Operating Cost/Hour**	Repair Cost/Hr.	Hours*** Used/Yr.	Expected Life	Expected Life	Estimated Depreciation /Hour	THI****
			- - - - - - - -	- - - - - - -dollars-	- - - - - - - -	- - - - - - - -	- - - - - - - -	(hours)	(years)	(hours)	- - - - -dollars-	- - - -
Tractors and Self-Propelled:												
4230 John Deere	1	100hp	16,047	12,000	2.85	8.37	1.13	600	10	12,000	1.89	2.50
4010 John Deere	5	80hp	13,595	6,000	2.33	6.99	.96	600	10	12,000	1.59	2.11
3020 John Deere	2	70hp	11,475	6,500	2.05	5.99	.81	600	10	12,000	1.35	1.78
1010 John Deere	1	40hp	7,521	4,500	1.30	3.87	.53	600	10	12,000	.88	1.16
930 Case (row crop)	1	80hp	13,595	6,800	2.33	6.99	.96	600	10	12,000	1.59	2.11
930 Case (industrial)	1	80hp	13,595	6,000	2.33	6.99	.96	600	10	12,000	1.59	2.11
530 Case	1	40hp	7,521	400	1.30	3.87	.53	600	10	12,000	.88	1.16
530 Case (backhoe)	1	40hp	10,021	800	1.30	3.87	.53	600	10	12,000	.88	1.16
Super 'M' International	1	45hp	3,551	1,200	1.30	3.87	.53	600		(Fully Depreciated)		
'M' International	1	40hp	3,333	1,150	1.30	3.87	.53	600		"		
350 International	1	40hp	4,087	850	1.30	3.87	.53	600		"		
340 International	1	30hp	4,176	650	.99	1.44	.45	600		"		
230 International	1	25hp	2,139	600	.85	1.25	.40	600		"		
'H' International	1	25hp	1,955	300	.85	1.25	.40	600		"		
'H' International	1	25hp	1,955	300	.85	1.25	.40	600		"		
'B' International	1	15hp	1,400	200	.59	.99	.40	600		"		
'C' International	1	20hp	1,508	300	.72	1.12	.40	600		"		
'C' International	1	20hp	1,508	300	.72	1.12	.40	600		"		
110 International	1	20hp		250	.72	1.12	.40	600		"		
AC Harvesting Belt	1	32ft		2,500								
D7 Catepillar w/Doser	1		99,507	10,000								
420 Int. Cotton Picker	1	420	37,648	4,000	2.12	82.18	7.90	100	8	2,000	35.73	36.44
420 Int. Cotton Picker	1	420	37,648	4,000	2.12	82.18	7.90	100	8	2,000	35.73	36.44
220 Int. Cotton Picker	1	220	37,648	4,000	2.12	82.18	7.90	100	8	2,000	35.73	36.44
Clark Forklift	1		6,000	6,000	.45	21.64	.95	50	10	3,000	11.40	8.84
Clark Forklift	1		6,000	300	.45	1.40	.95	50		(Fully Depreciated)		
Tomato Harvester	3		30,000	4,000	1.13	60.49	6.90	85	10	2,000	28.24	24.22

Table G-1. Continued

Implements	Numbers	Size	Estimated Cost New 1/17/75	Estimated Current Value	Fuel & Oil Cost/Hour*	Operating Cost/Hour**	Repair Cost/Hr.	Hours*** Used/Yr.	Expected Life	Expected Life	Estimated Depreciation /Hour	THII****
			- - - - - -	- - - - - -	dollars - - -	- - - - - -	- - - - - -	(hours)	(years)	(hours)	- - - - -dollars-	- - - - -
Equipment & Implements:												
Land Plane	1	12x40	5,044	2,000		7.94	1.00	100	15	2,500	3.04	3.90
Carryall w/elevator	1	5 yard		4,000								
Carryall	1	3 yard		3,500								
Chisel Catepillar	1	3 chisels	960	1,500		1.76	.55	50	15	2,500	.57	.64
Chisel AC	1	7 chisels	1,376	2,200		2.46	.57	100	15	2,500	.83	1.06
Chisel AC	1	3 chisels	960	2,000		1.76	.55	50	15	2,500	.57	.64
Disk AC Offset	1	12ft	4,100	1,200		7.32	1.69	100	15	2,500	2.47	3.17
Disk JD	1	12ft	2,668	1,000		4.77	1.10	100	15	2,500	1.61	2.06
Disk International	1	6ft		500		.30	.30			(Fully Depreciated)		
Disk International	1	4ft		400		.10	.10			"		
Plow JD	1	3 bottom	2,843	600		2.82	1.36	400	6.3	2,500	.82	.64
Lister	1	5 bottom	1,587	800		2.84	.65	100	10	2,500	.96	1.23
Lister	2	3 bottom	795	800		2.10	.35	50	10	2,500	.77	.98
Lister (Tomatoes)	1	5 bottom	1,587	600		2.84	.65	100	10	2,500	.96	1.23
Planters International	2	4 row	2,964	800		10.21	2.06	50	15	1,200	179.00	
Planter Junior	1	2 bed		250								
Planter Junior	1	4 units		250								
Planter Junior (Tomato)	1	3 row		1,500								
Planter (Precision)	1	4 row		600								
Bed Form	1	2 bed		100								
Bed Form (Tomatoes)	1	2 row	1,248	400		2.23	.51	100	15	2,500	.75	.96
Grain Drill	1	12 ft	2,910	250		10.02	2.02	50	15	1,200	3.50	4.50
Cultivator JD	2	4 row	1,646	1,000		2.94	.68	100	15	2,500	.99	1.27
Cultivator Custom	2	4 row	1,646	600		2.94	.68	100	15	2,500	.99	1.27
Cultivator Tomato	1	4 row	1,646	800		2.94	.68	100	15	2,500	.99	1.27
Cultivator Rolling Int.	1	4 row	1,985	2,600		3.55	.82	100	15	2,500	1.20	1.53
Cultivator Rolling Int.	1	4 row	1,985	1,200		3.55	.82	100	15	2,500	1.20	1.53
Cultivator Rolling Int.	1	4 row	1,985	600		3.55	.82	100	15	2,500	1.20	1.53
Cultivator Rolling Boarder	1	4 row	1,985	200		3.55	.82	100	15	2,500	1.20	1.53

Table G-1. Continued

Implements	Numbers	Size	Estimated Cost New 1/17/1975	Estimated Current Value	Fuel & Oil Cost/Hour*	Operating Cost/Hour**	Repair Cost/Hr.	Hours*** Used/Yr.	Expected Life	Expected Life	Estimated Depreciation /Hour	THII****
			- - - - -	- - - - -	-dollars-	- - - - -	- - - - -	(hours)	(years)	(hours)	- - - -dollars-	- - - - -
Miscellaneous Equipment												
Fertilizer Custom	1			500								
Fertilizer JD	1			200								
Border Disc. Tandem	2	6 disc	616	300		1.10	.25				.37	.48
Border Single	2	3 disc	450	200		.71	.20	25			.22	.29
Scraper Large	2	10ft	1,479	900		4.28	.22	50	15	2,500	1.78	2.28
Scraper Small	1	5ft	350	300		.12	.12	50	15	2,500		
Duster	1	4 row	600	300		.15	.15	25	5	2,000		
Spraying Rig	1	large	2,311	600		9.00	1.36	50	10	1,200	3.80	3.84
Spraying Rig	1	small	1,161	250		4.52	.68	50	10	1,200	1.92	1.92
Spraying Rig	2	2 tanks	1,404	400		5.46	.82	50	10	1,200	2.32	2.32
Weed Cutter	1	2 row	3,016	200		10.49	.52	50	10	2,000	4.96	5.00
Weed Burner Wheel Mounted	1			800								
Weed Burner Hand Type	1			750								
Drag Float	2	12x36	1,664	400		2.62	.33	100	15	2,500	100.00	1.29
Harrow	4	12ft	336	1,300		.60	.14	100	20	2,500	.20	.26
Stalk Cutter Int.	1	2 row	3,016	300		10.49	.52	50	10	2,000	4.96	5.00
Hay Loader	1			400								
Hay Baler Motor JD	1	2 wire	5,880	4,500	1.68	23.10	1.44	50	10	2,500	10.76	9.22
Hay Rake	1	9.5ft	4,212	200		8.13	1.17	25	10	2,500	3.47	3.49
Roller	1	6ft	864	200		.10	.10		20	2,500		

*Diesel at $.40 per gallon

**Estimates for demonstration farm only

***Estimated hours used on farm per year

****Taxes, housing, insurance, interest per hour

APPENDIX H

ENTERPRISE COST AND RETURN BUDGETS FOR DEMONSTRATION FARM

Table H-1. Preliminary per acre enterprise cost and return budget for alfalfa on the Demonstration Farm, La Mesa, New Mexico, 1976

Planting date(s):				Gross return: $399.00			
Harvesting date(s):				Expenses: 377.17			
Yield: 7.0 tons				Net return to capital: $21.83			
Price: $57							

Item	Unit	Quantity	Purchased Inputs	Labor	Fuel and Repairs	Depreciation Insurance Shelter	Total
			dollars	dollars	dollars	dollars	dollars
Purchased Inputs							
Fertilizer							
0-46-0	lb	200	18.50				18 0
Establishment cost						42.50	4
Irrigation water							
Canal	ac-ft	3.0	16.20				
Pumps	ac-ft	1.9			6.84	2.85	
Wire			16.74				
Subtotal			51.44		6.84	45.35	10
Maintenance Operations							
Fertilize	hr	.20		.50	.92	.46	1
Irrigate (10x)	hr	4.8		9.60			9
Subtotal		5.0		10.10	.92	.46	11
Harvest Operations							
Swath (5x)	hr	3.8		9.50	19.00	19.60	48
Bale (5x)	hr	5.3		13.25	18.09	9.19	40.
Subtotal	hr	9.1		22.75	37.09	28.79	88.63
Downtime	hr	1.41		3.53			
Management (10% of gross)		1.0	39.90				3
Land Charge (10% of 1,300)		1.0	130.00				130
Subtotal	hr	15.51	169.90	3.53			17
Total			221.34	36.38	44.85	74.60	377.17

Table H-2. Preliminary per acre enterprise cost and return budget for cotton on the Demonstration Farm, La Mesa, New Mexico, 1976

Planting date(s): April 20, 1976
Harvesting date(s): November 15
Yield: 480 lb/lint;
Price: .79/lbs lint

Gross return: $379.20 +
Expenses:
Net return to capital:

Item	Unit	Quantity	Purchased Inputs	Labor	Fuel and Repairs	Depreciation Insurance Shelter	Total
			dollars	dollars	dollars	dollars	dollars
Purchased Inputs							
Seed	lb	30	11.40				11.40
Fertilizer (11-46)	lb	200	19.00				19.00
Herbicide	qt	1	8.30				8.30
Canal water	ac-ft	1.7	9.18				9.18
Pump water	ac-ft	.5			1.80	.75	2.55
Subtotal			47.88		1.80	.75	50.43
Preharvest Operations							
Cut stalks	hr	.26		.65	.53	.34	1.52
Chisel	hr	.43		1.08	1.47	.74	3.29
Disc (2x)	hr	.76		1.90	2.36	2.18	6.44
Plow	hr	.36		.90	2.17	1.09	4.16
Plane	hr	.34		.85	1.46	1.10	3.41
Float	hr	.17		.43	.51	.25	1.19
List	hr	.53		1.33	1.80	.86	3.99
Pre-irrigate	hr	.61		1.53			1.53
Plant	hr	.30		.75	1.01	.50	2.26
Seed bed firmer	hr	.26		.65	.60	.20	1.45
Cultivate 1st	hr	.59		1.48	1.60	.80	3.88
Cultivate 2nd	hr	.50		1.25	1.37	.68	3.30
Cultivate 3rd	hr	.32		.80	.88	.44	2.12
Cultivate 4th	hr	.32		.80	.88	.44	2.12
Irrigate (7x)	hr	4.60		9.20			9.20
Fertilize	hr	.15		.38	.73	1.15	2.26
Subtotal	hr	10.40		23.98	17.37	10.77	52.12
Harvest Operations							
Downtime	hr	1.04		2.60			2.60
Pick (2x)	hr	1.52		3.80	14.02	20.31	38.13
Haul	hr	.20		.50	.40	.73	1.63
Management (10% of gross)		1	41.76				41.76
Land (10% of 1,300)		1	130.00				130.00
Ginning			32.00				32.00
Subtotal		2.76	203.76	6.90	14.42	21.04	246.12
Total	hr	13.16	251.64	30.88	33.59	32.56	348.67

Table H-3. Preliminary per acre enterprise cost and return budget for wheat on the Demonstration Farm, La Mesa, New Mexico, 1976

Planting date(s): January 15	Gross return: $235.20
Harvesting date(s): July 15	Expenses: 211.02
Yield: 4,200	Net return to capital: $24.18
Price: $5.60	

Item	Unit	Quantity	Purchased Inputs	Labor	Fuel and Repairs	Depreciation Insurance Shelter	Total
			dollars	dollars	dollars	dollars	dollars
Purchased Inputs							
Seed	lb	110	22.00				22.00
Fertilizer (18-46)	lb	200	19.00				19.00
Anhydrous ammonia	lb	200	18.75				18.75
Canal water	ac-ft	1.53	8.10				8.10
Pump water	ac-ft	.5			1.80	.75	2.55
Subtotal			67.85		1.80	.75	70.40
Preharvest Operations							
Disc (2x)	hr	.76		1.90	2.36	2.18	6.44
Chisel	hr	.43		1.08	1.47	.74	3.29
Plane	hr	.34		.85	1.46	1.10	3.41
Float	hr	.17		.43	.51	.25	1.19
Border	hr	.12		.30	.38	.64	1.32
Harrow	hr	.17		.43	.64	.51	1.58
Drill (plant)	hr	.27		.68	1.17	1.33	3.18
Irrigate	hr	3.00		6.00			6.00
Subtotal		5.26		11.67	7.99	6.75	26.41
Harvest Operations							
Combine (custom)	cwt	1.0	16.80				16.80
Hauling (custom)	cwt	1.0	7.56				7.56
Management (10% of gross)			23.52				23.52
Land Charge (5% of 1,300)			65.00				65.00
Downtime	hr	.53			1.33		1.33
Subtotal	hr	.53	112.88		1.33		114.21
Total	hr	5.79	180.73	11.67	11.12	7.50	

Table H-4. Preliminary per acre enterprise cost and return budget for chile on the Demonstration Farm, La Mesa, New Mexico, 1976

Planting date(s): April 20, 1976
Harvesting date(s): October
Yield: 7.8 tons green; 2,154 lbs. red
Price: $150/ton green; $33/cwt red

Gross return: $1,880.82
Expenses: 842.62
Net return to capital: $1,038.70

Item	Unit	Quantity	Purchased Inputs	Labor	Fuel and Repairs	Depreciation Insurance Shelter	Total
			dollars	dollars	dollars	dollars	dollars
Purchased Inputs							
Seed	lb	7	63.00				63.00
Fertilizer (18-46)	lb	300	28.50				28.50
Irrigation canal	ac-ft	2.7	14.58				14.58
Pump	ac-ft	.9			3.24	1.35	4.59
Subtotal			106.08		3.24	1.35	110.67
Preharvest Operations							
Shred	hr	.26		.65	.53	.34	1.52
Chisel	hr	.43		1.08	1.47	.74	3.29
Disc (2x)	hr	.76		1.90	2.36	2.18	6.44
Plow	hr	.36		.90	2.17	1.09	4.16
Plane	hr	.34		.85	1.46	1.10	3.41
List	hr	.53		1.33	1.80	.86	3.99
Pre-irrigate	hr	.61		1.53			1.53
Plant	hr	.30		.75	1.01	.50	2.26
Rolling cultivate	hr	.59		1.48	1.60	.80	3.88
Cultivate 1st	hr	.50		1.25	1.37	.68	3.30
Cultivate 2nd	hr	.32		.80	.88	.44	2.12
Cultivate 3rd	hr	.32		.80	.88	.44	2.12
Fertilize	hr	.15		.38	.73	1.15	2.26
Hoe (custom)			15.40				15.40
Irrigate (12x)	hr	5.76		11.52			11.52
Subtotal	hr	11.13	15.40	25.22	16.26	10.32	67.20
Harvest Operations							
Pick	lb	17,754	279.27				279.27
Load	hr	10.62		26.55			26.55
Haul	lb	17,754	35.40				35.40
Subtotal	hr	10.62	314.67	26.55			341.22
Downtime	hr	2.18		5.45			5.45
Management (10% of gross)		1.0	188.08				188.08
Land Charge (10% of 1,300)		1.0	130.00				130.00
Subtotal			318.08	5.45			323.53
Total	hr	23.93	754.23	57.22	19.50	11.67	842.62

Table H-5. Preliminary per acre enterprise cost and return budget for fall lettuce on the Demonstration Farm, La Mesa, New Mexico, 1976

Planting date(s): August 3, 1976
Harvesting date(s): October 15, 1976
Yield: 500 ctn/acre
Price: $7.50/ctn

Gross return: $3,750.00
Expenses: 1,564.29
Net return to capital: $2,185.71

Item	Unit	Quantity	Purchased Inputs	Labor	Fuel and Repairs	Depreciation Insurance Shelter	Total
			dollars	dollars	dollars	dollars	dollars
Purchased Inputs							
Seed	lb	3	69.00				69.00
Fertilizer	lb	400	38.00				38.00
Insecticide	lb	25	11.00				11.00
Herbicide	lb	2	15.80				15.80
Irrigation water							
Canal	ac-ft	2.8	15.12				15.12
Pump	ac-ft	.5			1.80	.75	2.55
Subtotal			148.92		1.80	.75	151.47
Preharvest Operations							
Disc (2x)	hr	.76		1.90	2.36	2.18	6.44
Chisel	hr	.43		1.08	1.47	.74	3.29
Plow	hr	.36		.90	2.17	1.09	4.16
Plane	hr	.34		.85	1.46	1.10	3.41
List	hr	.53		1.33	1.80	.86	3.99
Block	hr	.25		.63	1.01	.69	2.33
Plant	hr	.40		1.00	1.21	.99	3.20
Fertilize	hr	.15		.38	.73	1.15	2.26
Cultivate 1st	hr	.50		1.25	1.37	.68	3.30
Cultivate 2nd	hr	.32		.80	.88	.44	2.12
Cultivate 3rd	hr	.32		.80	.88	.44	2.12
Hoe (custom)	acre		15.40				15.40
Herbicide	acre	1.0	4.00				4.00
Insecticide	acre	1.0	4.00				4.00
Thin	hr	8.00		24.00			24.00
Irrigate	hr	4.8		9.60			9.60
Subtotal		17.16	23.40	44.52	15.34	10.36	93.62
Harvest Operations							
Sales & Harvest	ctn		875.00				875.00
Downtime	hr	1.68		4.20			4.20
Management (10% of gross)			375.00				375.00
Land Charge (5% of 3,000)			65.00				65.00
Subtotal			1,315.00	4.20			1,319.20
Total	hr	18.84	1,487.32	48.72	17.14	11.11	1,564.29

Table H-6. Preliminary per acre enterprise cost and return budget for tomatoes on the Demonstration Farm, La Mesa, New Mexico, 1976

Planting date(s): March 23, 1976
Harvesting date(s): October
Yield: 13.3 tons/acre
Price: $75

Gross return: $997.50
Expenses: 642.73
Net return to capital: $354.77

Item	Unit	Quantity	Purchased Inputs	Labor	Fuel and Repairs	Depreciation Insurance Shelter	Total
			dollars	dollars	dollars	dollars	dollars
Purchased Inputs							
Seed	lb	2	30.00				30.00
Fertilizer (18-46)	lb	350	33.25				33.25
Insecticide	qt	1	2.50				2.50
Herbicide	qt	1	15.86				15.86
Irrigation							
Canal	ac-ft	1.9	10.26				10.26
Pump	ac-ft	1.0			3.60	1.50	5.10
Subtotal			91.87		3.60	1.50	96.97
Preharvest Operations							
Disc (2x)	hr	.76		1.90	2.36	2.18	6.44
Chisel	hr	.43		1.08	1.47	.74	3.29
Plow	hr	.36		.90	2.17	1.09	4.16
Plane	hr	.34		.85	1.46	1.10	3.41
List	hr	.53		1.33	1.80	.86	3.99
Blocked	hr	.25		.63	1.04	.69	2.36
Pre-irrigate	hr	.61		1.53			1.53
Plant	hr	.40		1.00	1.21	.99	3.20
Spray	hr	.15		.38	.73	1.15	2.26
Rolling cultivator	hr	.59		1.48	1.60	.80	3.88
Cultivate 1st	hr	.50		1.25	1.37	.68	3.30
Cultivate 2nd	hr	.32		.80	.88	.44	2.12
Cultivate 3rd	hr	.32		.80	.88	.44	2.12
Fertilize	hr	.15		.38	.73	1.15	2.26
Hoe (custom)			15.40				15.40
Irrigate	hr	4.8		9.60			9.60
Subtotal	hr	10.71	15.40	23.91	17.70	12.31	69.32
Harvest Operations							
Pick	ton	13.3	166.25				166.25
Load	hr	10.92		21.84			21.84
Haul	ton	13.3	53.20				53.20
Subtotal	hr	10.92	219.45	21.84			241.29
Downtime	hr	2.16		5.40			5.40
Management (10% of gross)			99.75				99.75
Land Charge (10% of 1,300)			130.00				130.00
Subtotal		2.16	229.75	5.40			235.15
Total	hr	23.80	556.47	51.15	21.30	13.81	642.73

Table H-7. Preliminary per acre enterprise cost and return budget for cayenne peppers on the Demonstration Farm, La Mesa, New Mexico, 1976

Planting date(s): Apr 20
Harvesting date(s): October
Yield: 4,000
Price: $.80/cwt

Gross return: $3,200.00
Expenses: 2,770.77
Net return to capital: $1,429.23

Item	Unit	Quantity	Purchased Inputs dollars	Labor dollars	Fuel and Repairs dollars	Depreciation Insurance Shelter dollars	Total dollars
Purchased Inputs							
Seed	lb	2	60.00				60.00
Fertilizer (18-46-0)	lb	300	28.50				28.50
Irrigation water							
Canal	ac-ft	2.2	11.88				11.88
Pump	ac-ft	1.6			5.76	2.40	8.16
Subtotal			100.38		5.76	2.40	108.54
Preharvest Operations							
Shred & disc (2x)	hr	1.02		2.55	2.89	2.52	7.96
Chisel & plow	hr	.79		1.98	3.64	1.83	7.45
Plane	hr	.34		.85	1.46	1.10	3.41
List	hr	.53		1.33	1.80	.86	3.99
Pre-irrigate	hr	.61		1.53			1.53
Plant	hr	500		875.00			875.00
Cultivate 1	hr	.50		1.25	1.37	.68	3.30
Cultivate 2	hr	.32		.80	.88	.44	2.12
Cultivate 3	hr	.32		.80	.88	.44	2.12
Fertilize	hr	.15		.38	.76	1.15	2.26
Hoe (custom)	hr		15.40				15.40
Irrigate (12x)	hr	5.76		11.52			11.52
Germination & Hothouses	hr	150.00	300.00	300.00	5.00	58.00	663.00
Subtotal	hr	660.34	315.40	1,197.99	18.65	67.02	1,599.06
Harvest Operations							
Pick	lb	4,000	800.00				800.00
Load	hr	2.40		4.80			4.80
Haul	hr	.80		2.00	1.60	2.92	6.52
Downtime	hr	19.80		39.60			39.60
Management (10% of gross)			32.00				32.00
Land charge (10% of 1,300)			130.00				130.00
Grind & Pack	hr	8	26.00	20.00	4.00	.25	50.25
Subtotal		31.00	988.00	66.40	5.60	3.17	1,063.17
Total			1,403.78	1,264.39	30.01	72.59	2,770.77

Table H-8. Preliminary per acre enterprise cost and return budget for pecans (7 year-old trees) on the Demonstration Farm, La Mesa, New Mexico, 1976

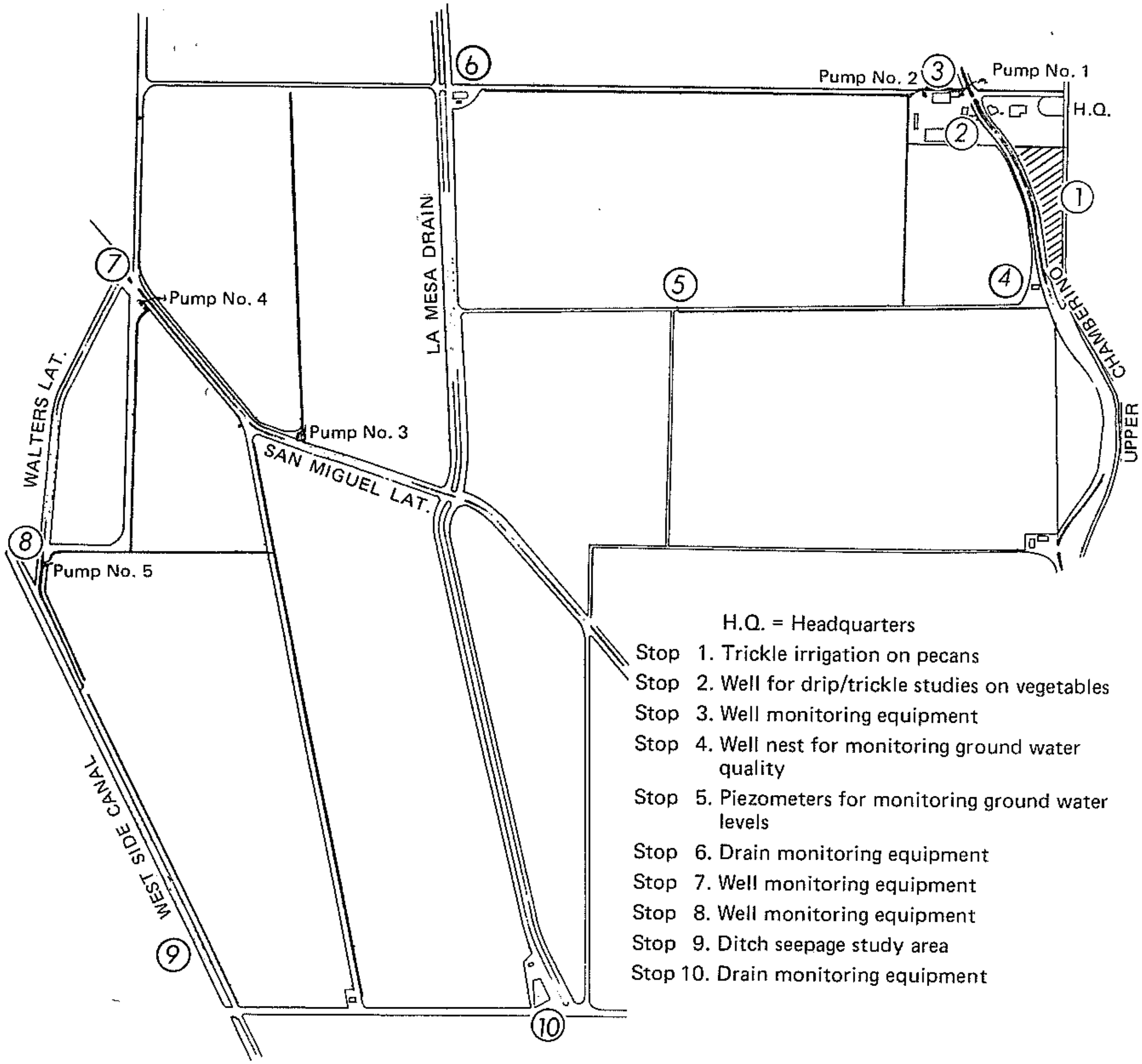
Harvesting date(s): Nov 15 - Jan 1	Gross return: $260.00
Yield: 400 lbs	Expenses: 337.30
Price: $.65/lb	Net return to capital: -$117.30

Item	Units	Quantity	Purchased Inputs	Labor	Fuel and Repairs	Depreciation Insurance Shelter	Total
			dollars	dollars	dollars	dollars	dollars
Purchased Inputs							
Nitrogen	lb	100	27.00				27.00
Zinc sulfate	lb	12	3.36				3.36
Manganese sulfate	lb	24	4.80				4.80
Herbicide	pt	2	2.30				2.30
Dysiston	lb	24	12.96				12.96
Pump water	ac-ft	.7					
Subtotal			50.42				50.42
Preharvest Operations							
Disc (2x)	hr	2.28		5.70	7.08	6.54	19.32
Prune	hr	1.00		2.50	3.44	3.46	9.40
Haul brush	hr	1.00		2.50	2.43	1.29	6.22
Disc (border)	hr	.05		.13	.12	.10	.35
Drill dysiston	hr	.24		.60	1.51	1.70	3.81
Irrigate	hr	4.54		9.08	1.18	60.31	70.57
Hoe (2x)	hr	4.00		8.00			8.00
Subtotal		13.11		28.51	15.76	73.40	117.67
Harvest Operations							
Shake	hr	2.00		5.00	9.86	6.32	21.18
Sweep	hr	2.00		5.00	5.68	3.56	14.24
Pick up nuts	hr	.50		1.00	4.28	4.44	9.72
Clean	hr	.64		1.28	.97	.74	2.99
Haul nuts	hr	.24		.48	.06	.04	.58
Management (10% of gross)			26.00				26.00
Land charge (10% of 1,300)			130.00				130.00
Downtime	hr	1.85		4.50			4.50
Subtotal			156.00	12.26	20.85	15.10	209.21
Total		20.34	206.42	45.77	36.61	88.50	377.30

APPENDIX I

INFORMATION DISSEMINATION

J. F. Apodaca Farms, Inc.
La Mesa, New Mexico



H.Q. = Headquarters

Stop 1. Trickle irrigation on pecans
Stop 2. Well for drip/trickle studies on vegetables
Stop 3. Well monitoring equipment
Stop 4. Well nest for monitoring ground water quality
Stop 5. Piezometers for monitoring ground water levels
Stop 6. Drain monitoring equipment
Stop 7. Well monitoring equipment
Stop 8. Well monitoring equipment
Stop 9. Ditch seepage study area
Stop 10. Drain monitoring equipment

IRRIGATION MANAGEMENT DEMONSTRATION

J. F. APODACA FARM'S INC.
LA MESA, NEW MEXICO

Conducted by
New Mexico Agricultural Experimental Station
and
New Mexico Cooperative Extension Service
through
New Mexico Water Resources Research Institute

Supported in part by funds provided by the United States Environment Protection Agency

Can modern science help farmers improve their irrigation water management and thereby help reduce salinity in the return flow from irrigated fields? The Environmental Protection Agency (EPA) is funding a three-year demonstration project being conducted by New Mexico State University (NMSU) to help answer these questions.

The project centers on property of the J. F. Apodaca Farm's Inc., located south of La Mesa in the Mesilla Valley of New Mexico. The 450-acre farm, managed by Orlando Cervantes, produces a wide variety of crops including tomatoes, peppers, chile, corn, cotton, wheat, and pecans.

The demonstration focuses on the quality of water management and crop yields. An all-out effort has been made to apply the very best of water-management technology to a commercial farm operation, where profits must be maximized.

Detailed laboratory research on the problem has been conducted. An example is the EPA-funded research at NMSU, where the feasability of irrigating at near 100 percent efficiency with water of medium salinity (1,200 parts per million) has been tested on small plots totaling four acres. The principles learned through these experiments are now being applied to the demonstration farm. Under actual farm conditions, research encounters real-life economic, engineering and crop-yield, as well as water purity, problems.

Equipment has been installed for testing and measuring what happens with irrigation water after it enters the farm at the well head or main canal until it leaves the farm through the drainage system.

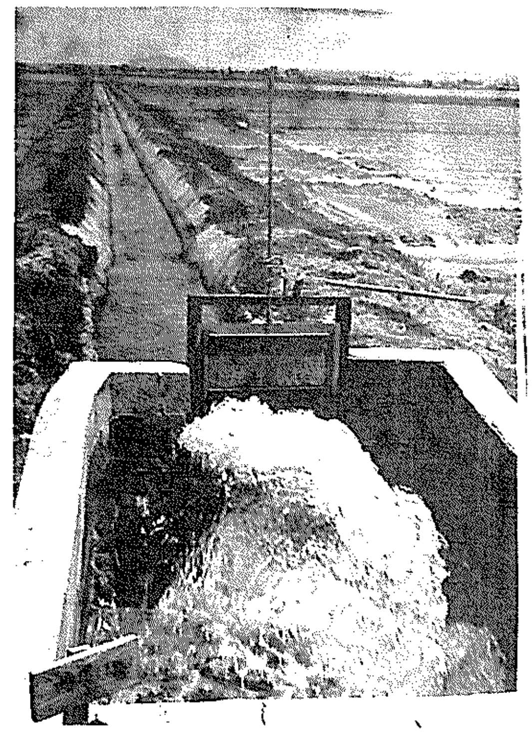
Orlando Cervantes (right), La Mesa farmer, and Robert R. Lansford, professor of agricultural economics, NMSU, at demonstration farm

During 1975, the first year of the project, records were made of ground water levels and water quality readings with the existing water management practices typical for the area. Starting with the 1976 crop year, Cervantes made modifications in his irrigation program upon recommendations of the NMSU research team.

The relationship between water salinity and different irrigation practices, such as drip irrigation, lined ditches and the traditional flood method, is being tested.

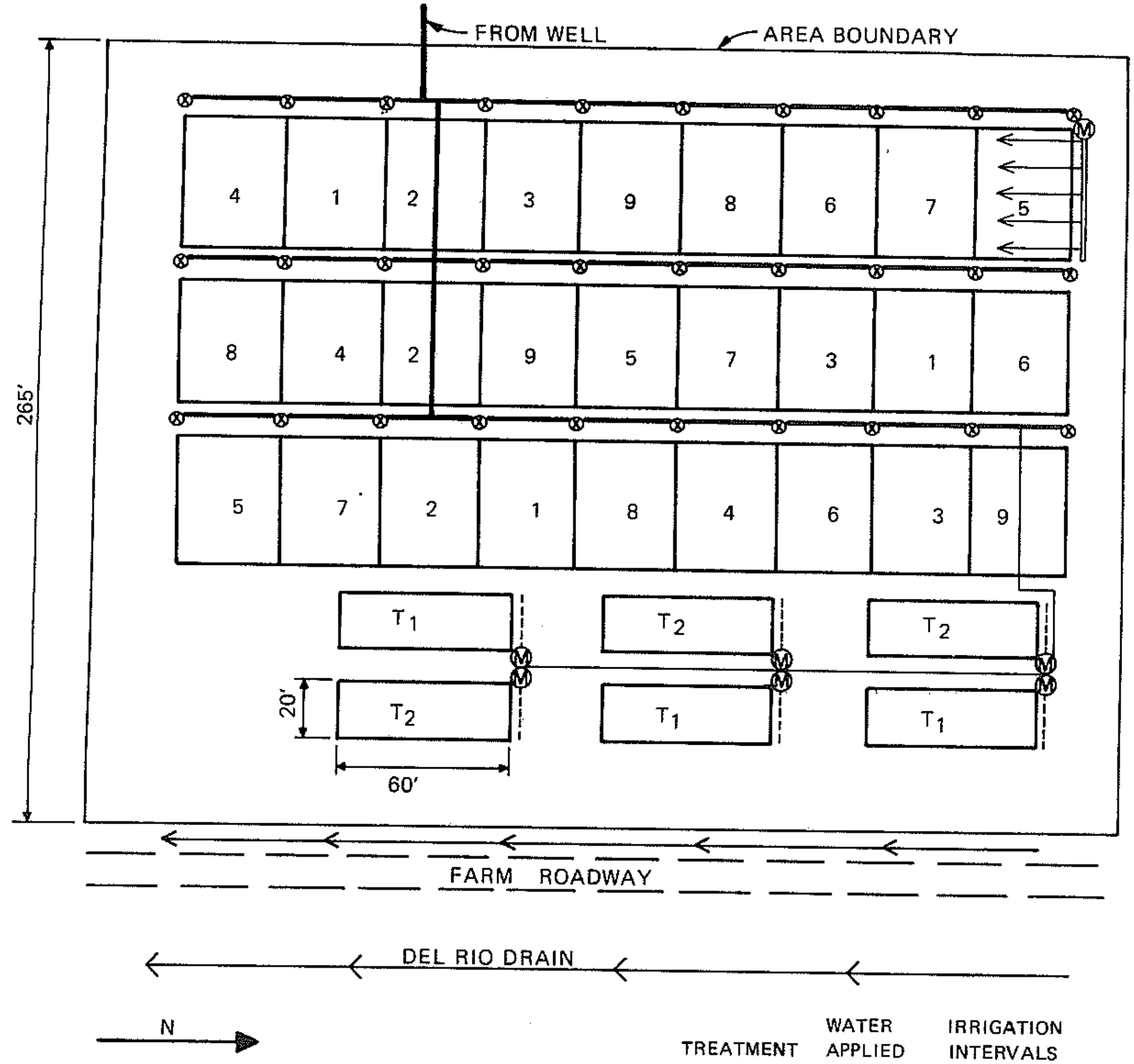
Specialists measure the quality and quantity of the water as it leaves the irrigation channels or deep wells. Meters are used to record the amount and salinity of the water as it returns to the Rio Grande water system.

Hopefully, modern technology can help farmers improve on-farm water management and the quality of water flowing down stream to other users, and at the same time maintain or increase financial returns.



Irrigation well water is of utmost importance to agriculture in New Mexico and the entire arid Southwest.

LAYOUT OF EXPERIMENTAL SITE ON THE NMSU PLANT SCIENCE FARM WITH TREATMENTS



TREATMENT	WATER APPLIED	IRRIGATION INTERVALS
1	20"	1 Week
2	20"	2 Weeks
3	20"	3 Weeks
4	24"	1 Week
5	24"	2 Weeks
6	24"	3 Weeks
7	28"	1 Week
8	28"	2 Weeks
9	28"	3 Weeks
T_1	Irrigated at 0.2 Bar	
T_2	Irrigated at 0.6 Bar	

⊗ ALFALFA VALVE

Ⓜ WATER METER

━━ 4" PIPELINE

── 1" PIPELINE

------- TRICKLE HEADERS

═══ GATED PIPE

EFFECTS OF SURFACE AND TRICKLE IRRIGATION ON RETURN-FLOW QUALITY

PLANT SCIENCE FARM
LAS CRUCES, NEW MEXICO

Conducted by
New Mexico Agricultural Experiment Station
and
New Mexico Cooperative Extension Service
through
New Mexico Water Resources Research Institute

Supported in part by funds provided by the
United States Environmental Protection Agency

Drainage water from irrigated areas along the Rio Grande is usually discharged into the river at points downstream from these areas. Because plants use water but take up very little salt, the salt content of the drainage water is generally 3 to 10 times higher in the drainage water than in the irrigation water.

Return of this drainage water to the river increases the salt content of the river water. Although there also are several natural causes which increase the salt content in the Rio Grande as it flows through New Mexico, irrigated agriculture contributes significantly to this process.

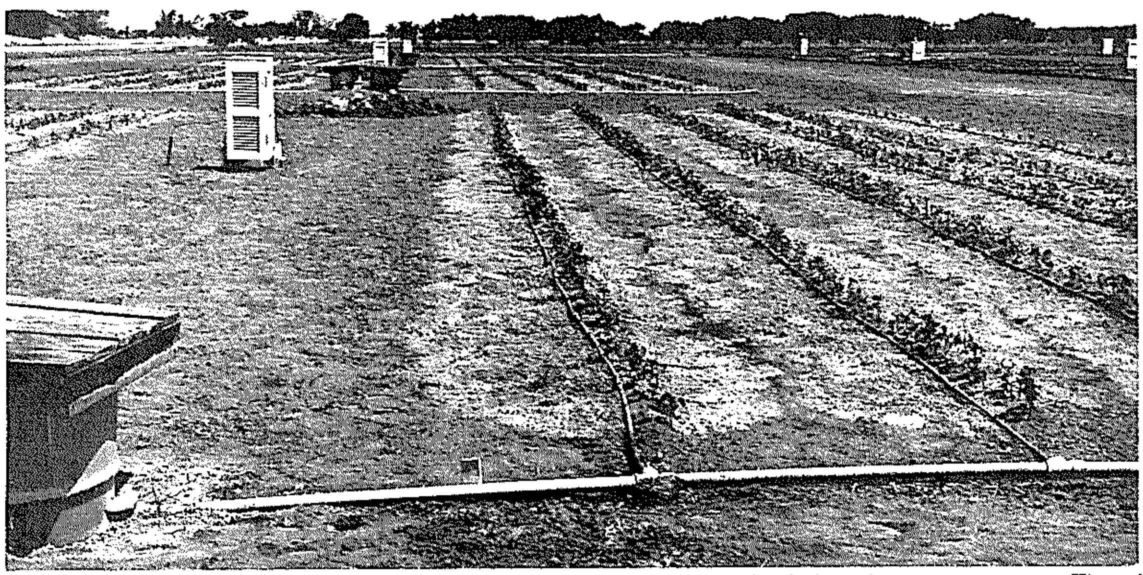
The best way to reduce the salt input from irrigated areas into the Rio Grande is to reduce the volume of drainage water. This can be accomplished by using less irrigation water, which reduces the chance of losing much irrigation water to the subsoil and into the drains. A certain amount of overirrigation is necessary, however, to prevent the buildup of salts in the profile, added by the irrigation water (±700 mg/l in the Rio Grande near Las Cruces during the irrigation season).

This puts the farmer in a quandary. Too much water is no good: it wastes water, which is scarce; it is detrimental to crop growth; and it contributes to groundwater pollution. Too little water reduces crop yields and builds up the salts in the soil profile.

One study, described here, is designed to help answer some of the questions on how to manage such a problem.

Nine different irrigation regimes are maintained on a four-acre field, subdivided into 27 field plots. Each field plot has its own underground irrigation outlet, and the water is measured on each plot according to a predetermined schedule. The irrigation treatments are based on the amount of water added (20, 24, or 28 inches per season) and the frequency (one-, two-, or three-week intervals). The added water includes preirrigation but not rainfall. Each treatment is repeated three times. The salt buildup under each irrigation system is measured, and the volume of drainage water is estimated. The quality of the drainage water below each plot area is also measured.

Water that drains below the cotton roots is collected for analysis of salt content.



Water is measured as it goes on these plots, and it is collected as it drains below the crop root zone. The trickle irrigation plots are in the foreground.

The project was started in 1971 with funds from the Environmental Protection Agency (EPA). It is hoped that the study will provide some answers as to how to increase or maintain yields through better water management without detrimental effects on water quality downstream.

In a separate study, the effects of trickle irrigation on drainage return flow and soil salinity are studied.

Cotton Committee To Meet

The New Mexico Cotton Advisory Committee will convene at New Mexico State University's Plant Science Research Center Aug. 24 to take a look at cotton research projects. Committee members will look at regional and ad vanced cotton strains, high population cotton, and a micro-climate sensing station.

The New Mexico Cotton Advisory Committee is made up of members from the New Mexico Farm and Livestock Bureau, the New Mexico Crop Improvement Association, the 1517 Cotton Association, the New Mexico Ginners Association and independent cotton merchants. The committee serves as an advisory board to the dean of the NMSU College of Agriculture and Home Economics.

James Yates, Deming, is currently serving as committee chairman. H. C. Bindle, Carlsbad is vice chairman.

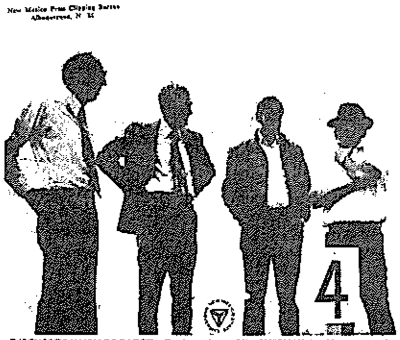
Included as a part of the Aug. 24 meeting will be a tour of an irrigation management demonstration on the 450-acre J. F. Apodaca Farms, Inc., La Mesa. The farm is managed by Orlando Cervantes. The demonstration focuses on the quality of water management and crop yields, and is being conducted by the Agricultural Experiment Station and the Cooperative Extension Service of NMSU, and the New Mexico Water Resources Research Institute. The demonstration is supported in part by funds from the Environmental Protection Agency.

An afternoon business meeting will hear observations and current problems discussed by committee members.

New Jersey ranks third in the country in the manufacture of apparel.

QUAY COUNTY SUN
TUCUMCARI, N. M.
DEC 19 1976
New Mexico Press Clipping Bureau
Albuquerque, N. M.

Water Management Solutions Demonstrated



DISCUSSES NMSU PROJECT -- During a tour of the NMSU Water Management demonstration site, Dr. L. S. Pope (second from left), dean and director of the New Mexico State University College of Agriculture and Home Economics, heard the encouraging results from (l to r) project specialists Peter Wierenga and Robert Lansford, and participating farmer Orlando Cervantes. The project, funded by EPA, demonstrates the effectiveness of several water management techniques.

By Jeanne Gleason 257
Associate Agricultural Editor
New Mexico State University

LAS CRUCES—Predictions say that water will soon be scarce across New Mexico. Some areas of the state are already experiencing shortages and irrigation costs are skyrocketing. In addition, the Environmental Protection Agency is calling for an elimination of excessive salinity levels in irrigation runoff.

Although there are several possible solutions to these problems, prior to 1975 little had been done to apply small plot research to full-scale commercial operation. Now New Mexico State University's Cooperative Extension Service is demonstrating the feasibility of these new water management practices on a large farm just south of Las Cruces.

Although results from this demonstration will be shared across the state, Extension's project now centers on the J. F. Apodaca Farms, Inc. Managed by Orlando Cervantes, the farm covers more than 650 acres and produces tomatoes, peppers, chile, corn, vegetables, cotton, wheat and pecans.

Extension often uses the practical demonstration procedure to encourage the acceptance of new practices. Gene Ott, Extension farm management specialist, says since the demonstration is on a full-time operating farm, it should help farmers see how these same techniques could be used on their farms.

Farmers often want to know, "Is this new idea economically practical?" "Will it work on my farm?" "Are the benefits worth the effort?"

On this demonstration farm, producers can see the effectiveness of several water management techniques, such as canal lining, irrigation scheduling and trickle irrigation. The effect of various plant positions in the row are also being demonstrated.

Although good water management practices are important across New Mexico, the Las Cruces site also offers an opportunity to demonstrate solutions to the high salinity of irrigation return-flow.

For years, farmers have prevented salt build-ups on their land by simply applying more water than the soil could hold. The extra water leached away excess salts. Unfortunately for the downstream users, this leached water finds its way through the soil profile to open drains and subsequently returns to the river. The more the water is reused, the saltier it gets.

Thus, although this salt leaching is a way of survival in arid regions such as New Mexico, it is also a big "no-no" under current EPA regulations. Faced with the problem of enforcing anti-pollution regulations which could cause disasterous salt build-ups, the EPA has funded a project through NMSU's Water Resources Research Institute. One phase of this project is to demonstrate practical alternative water management practices. Adoption of these practices could eventually improve the quality of the return flow water.

To accomplish these objectives, the normal operation of the Apodaca Farm was monitored during a growing season, before additional water management and salinity control measures were started. During the year, project workers installed meters, piezometers, a drip irrigation system, open drain monitoring systems and well meters.

During the 1976 crop season, various water saving and salinity control practices were used. In addition to recording scientific data, such as water inflow-outflow rates and soil salinity buildup, professionals also noted field labor, equipment time, and other economic inputs which are affected by these new water management practices.

After only one year, Cervantes is especially pleased with the results of computer scheduled irrigation. This system uses the soil's moisture content, and temperatures and state of plant development to determine irrigation timing and amount. Since the service is available commercially, Cervantes feels that he will continue to use computer scheduled irrigation long after the project is completed on his farm.

Although the economic benefits of this type of scheduling are quickly apparent, it will be years before anyone can see the results of other water management techniques. "When you're talking about water quality, things change slowly," says Charles Hohn, Extension engineer on the project. "It's not like switching off a light. Therefore, we need to start now to encourage the acceptance of these new techniques," Hohn says.

Ott and Hohn are conducting Extension demonstration work on this EPA project. Robert Lansford, associate professor of NMSU's Agricultural Economics, is the project coordinator. Other NMSU team members are Peter Wierenga, associate professor of Agronomy, Ted Samis, assistant professor of Agricultural Engineering and Buck Sission, research associate in Agronomy. Lynn W. Gelhar, associate professor of Hydrology, represents the New Mexico Institute of Mining and Technology.

B14 THE TAOS NEWS Thurs., Dec. 23, 1976

NMSU studying irrigation needs

259

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Extension Demonstrates Solutions To Water Management Problems

257

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Farm Testing Water Management Solutions

12-26 El Paso Times

agri-business

By JEANNE GLEASON
NMSU Associate Agricultural Editor

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Roswell (N.M.) Daily Record Sunday, December 19, 1976

Extension working on salinity project

259

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Gene Ott, Extension farm management specialist, says since the demonstration is on a full-time operating farm, it should help farmers see how these same techniques could be used on their farms.

Farmers often want to know, "Is this new idea economically practical?" "Will it work on my farm?" "Are the benefits worth the effort?"

On this demonstration farm, producers can see the effectiveness of several water management techniques, such as canal lining, irrigation scheduling and trickle irrigation. The effect of various plant positions in the row are also being demonstrated.

Although good water management practices are important across New Mexico, the Las Cruces site also offers an opportunity to demonstrate solutions to the high salinity of irrigation return-flow.

For years, farmers have prevented salt build-ups on their land by simply applying more water than the soil could hold. The extra water leached away excess salts.

Unfortunately for the downstream users, this leached water finds its way through the soil profile to open drains and subsequently returns to the river. The more the water is reused, the saltier it gets.

Thus, although this salt leaching is a way of survival in arid regions such as New Mexico, it is also a big "no-no" under current EPA regulations.

Faced with the problem of enforcing anti-pollution regulations which could cause disasterous salt build-ups, the EPA has funded a project through NMSU's Water Resource Research Institute. One phase of this project is to demonstrate practical alternative water management practices.

Adoption of these practices could eventually improve the quality of the return flow water.

To accomplish these objectives, the normal operation of the Apodaca Farm was monitored during a growing season, before additional water management and salinity control measures were started.

During the year, project workers installed meters, piezometers, a drip irrigation system, open drain monitoring systems and well meters.

During the 1976 crop season, various water-saving and salinity-control practices were used. In addition to recording scientific data, such as water inflow-outflow rates and soil salinity [illegible] inputs which are affected by these new water management practices.

After only one year, Cervantes is especially pleased with the results of computer scheduled irrigation. This system uses the soil's moisture content, and temperatures and state of plant development to determine irrigation timing and amount.

Since the service is available commercially, Cervantes feels that he will continue to use computer scheduled irrigation long after the project is completed on his farm.

Although the economic benefits of this type of scheduling are quickly apparent, it will be years before anyone can see the results of other water management practices.

APPENDIX J

PLANT SCIENCE FARM IRRIGATION AND TEST WELLS WATER QUALITY DATA

Table J-1. Composition of water samples taken from the irrigation well on the Plant Science Farm, NMSU, during 1976

Well	Date	ECX10^3	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meq/l)										(ppm)
Irr. well	1-13-76	1.17	7.95	12.73	13.72	5.31	1.77	5.46	.19	2.78	0	5.57	5.37	.17
	1-28-76	1.08	8.00	12.91	13.10	6.10	1.57	5.07	.17	2.64	0	5.61	4.85	0
	2-07-76	1.20	7.99	12.69	13.20	5.28	1.73	5.51	.17	2.76	0	5.55	4.89	.06
	2-21-76	1.06	8.16	12.33	12.65	4.23	1.81	6.11	.18	2.95	0	4.61	5.09	2.14
	3-06-76	1.20	8.17	12.60	12.96	4.30	1.82	6.30	.18	2.83	0	5.04	5.09	.18
	4-03-76	1.15	8.10	12.65	12.43	5.35	1.82	5.30	.18	2.90	0	4.24	5.29	.21
	4-10-76	1.17	8.23	12.96	12.69	5.43	1.71	5.63	.19	2.80	0	4.82	5.07	.50
	5-01-76	1.24	8.11	13.45	13.23	5.25	1.79	6.23	.18	2.81	0	5.35	5.07	.21
	5-15-76	1.32	8.44	14.22	13.64	5.51	1.99	5.58	.18	3.06	.16	4.14	6.28	.14
	5-28-76	1.32	8.24	13.47	13.10	5.95	1.81	5.52	.19	3.04	0	3.56	6.50	.20
	6-11-76	1.29	7.89	12.50	12.28	5.82	1.96	4.54	.18	3.35	0	3.17	5.76	.10
	7-12-76	1.30	8.27	13.27	13.29	5.18	2.02	5.87	.20	3.07	0	4.38	5.84	.31
	7-26-76	1.14	8.51	13.52	12.88	5.26	2.04	6.06	.16	3.00	.56	3.44	5.88	1.65
	8-11-76	1.19	8.16	11.95	12.35	3.82	1.97	5.98	.18	3.11	0	3.72	5.52	1.10
	8-25-76	1.07	8.46	12.12	12.60	3.91	1.94	6.09	.18	3.08	.28	2.28	6.96	0
	9-07-76	1.05	8.25	11.77	11.91	3.76	1.74	6.10	.17	2.91	0	2.88	6.12	0
	9-23-76	1.19	8.49	13.10	13.12	6.08	1.74	5.13	.17	2.86	.72	3.64	5.88	2.31
	10-05-76	1.25	8.19	14.18	14.52	6.73	1.75	5.54	.16	2.96	.96	4.76	5.92	.02
	10-21-76	1.12	8.02	-	14.25	-	1.83	5.51	.17	2.79	.56	4.26	6.64	.35
	11-03-76	1.15	8.41	14.27	14.63	7.02	1.81	5.28	.16	2.69	.80	4.82	6.32	.17
	12-14-76	1.17	7.81	14.45	14.46	6.89	1.79	5.60	.17	2.70	0	5.60	6.16	.35
	12-28-76	1.18	7.72	14.32	14.86	6.57	1.77	5.82	.16	2.80	0	5.78	6.28	.95
Mean		1.18	8.16	13.12	13.27	5.42	1.83	5.65	.18	2.90	.18	4.42	5.76	.51
SD		.08	.22	.82	.83	.99	.12	.43	.01	.17	.31	.99	.61	.69

Table J-2. Composition of water samples taken from test Well 1 at 75 feet on Plant Science Farm, NMSU, during 1976

Well	Date	ECX10^3	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meq/l)										(ppm)
1	1-13-76	.95	7.98	11.02	10.53	5.44	1.68	3.76	.14	2.65	0	3.83	4.15	.17
1	1-28-76	.95	8.09	10.45	10.81	5.47	1.47	3.38	.13	2.53	0	4.27	4.01	.60
1	2-07-76	.97	8.07	10.34	10.87	4.46	1.72	4.02	.14	2.78	0	3.97	4.12	.12
1	2-21-76	.90	7.90	11.23	10.87	5.43	1.65	4.01	.14	2.63	0	4.24	4.00	1.39
1	3-06-76	.92	8.06	10.90	10.76	5.52	1.59	3.66	.13	2.64	0	4.12	4.00	1.32
1	3-20-76	.91	8.29	11.47	10.70	6.15	1.65	3.53	.14	2.52	0	4.28	3.90	1.10
1	4-03-76	.95	8.35	10.78	10.54	5.50	1.65	3.49	.14	2.63	0	3.94	3.97	1.40
1	4-10-76	.85	7.36	10.40	9.96	5.46	1.57	3.23	.14	2.59	0	3.40	3.97	.73
1	5-01-76	.94	8.10	10.66	10.47	5.36	1.64	3.53	.13	2.61	0	3.38	4.48	.80
1	5-15-76	.97	8.33	10.63	10.21	5.40	1.64	3.45	.14	2.66	0	3.02	4.53	.08
1	6-11-76	.97	7.71	10.15	9.59	5.50	1.62	2.89	.14	2.69	0	2.65	4.25	0
1	6-28-76	.98	8.37	10.41	9.67	5.26	1.66	3.34	.15	2.73	0	2.78	4.16	.19
1	7-12-76	1.01	8.39	11.94	11.51	5.98	1.66	4.15	.15	2.73	.96	3.66	4.16	.31
1	7-26-76	.93	8.42	10.88	10.50	5.76	1.66	3.34	.12	2.56	.56	3.32	4.16	1.25
1	8-11-76	.91	8.44	9.47	9.71	4.49	1.64	3.21	.13	2.65	.44	3.06	3.56	1.35
1	8-25-76	.91	8.67	10.75	10.97	5.71	1.60	3.31	.13	2.61	.72	2.80	4.84	2.05
1	9-07-76	.94	8.63	10.76	11.33	5.59	1.57	3.47	.13	2.63	1.04	2.86	4.80	0
1	9-23-76	.95	8.46	10.71	11.15	5.71	1.61	3.26	.13	2.59	.68	3.24	4.64	1.92
1	10-05-76	.95	8.39	10.44	10.81	5.53	1.57	3.22	.12	2.55	.74	3.04	4.48	.02
1	10-21-76	.97	8.20	11.68	10.27	6.21	1.77	3.57	.14	2.49	.64	3.40	3.74	.25
1	11-03-76	.93	8.33	9.03	9.00	3.80	1.78	3.32	.13	2.54	.56	3.48	2.42	.10
1	12-14-76	.97	8.09	12.13	11.85	6.47	1.79	3.73	.14	2.57	0	4.00	5.28	.10
1	12-28-76	.97	7.88	12.14	11.87	6.35	1.83	3.82	.14	2.69	0	4.06	5.12	.10
Mean		.94	8.20	10.80	10.61	5.50	1.65	3.51	.14	2.62	.28	3.51	4.21	.67
SD		.03	.30	.75	.71	.61	.08	.30	.01	.07	.37	.53	.58	.66

Table J-3. Composition of water samples taken from test Well 2 at 50 feet on Plant Science Farm, NMSU, during 1976

Well	Date	$ECX10^3$	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meq/l)										(ppm)
2	1-13-76	1.07	7.89	12.69	12.60	5.56	1.73	5.21	.19	2.12	0	5.78	4.70	0
2	1-28-76	1.00	8.03	12.71	13.08	6.14	1.54	4.86	.17	2.02	0	6.80	4.26	0
2	2-07-76	1.14	8.11	13.22	13.97	4.11	1.76	7.17	.18	2.19	0	6.85	4.93	.06
2	2-21-76	1.12	7.89	11.57	12.15	4.11	1.68	5.61	.17	2.18	0	5.50	4.47	1.63
2	3-06-76	1.16	8.22	13.20	13.71	5.47	1.78	5.78	.17	2.27	0	6.78	4.66	0
2	3-20-76	1.08	8.21	13.59	13.58	5.54	1.87	6.00	.18	2.26	0	6.28	5.04	1.79
2	4-03-76	1.20	8.22	13.51	12.58	5.24	1.84	5.90	.17	2.26	0	4.36	5.96	.40
2	4-10-76	1.21	7.62	12.50	12.90	5.28	1.76	5.27	.19	2.26	0	5.79	4.85	1.09
2	5-01-76	1.21	8.20	12.95	13.17	5.33	1.85	5.10	.17	2.33	0	5.99	4.85	.15
2	5-15-76	1.21	8.39	13.15	12.58	5.33	1.87	5.78	.17	2.36	.16	4.08	5.98	.08
2	6-11-76	1.11	7.91	11.55	11.13	4.32	1.81	5.24	.16	2.53	0	3.00	5.60	.30
2	6-28-76	1.20	8.42	10.42	10.21	3.15	1.83	5.25	.19	2.47	0	2.22	5.52	.50
2	7-12-76	1.18	8.14	12.80	12.62	5.56	1.84	5.21	.19	2.44	0	5.16	5.08	.10
2	7-26-76	1.15	8.23	13.20	12.54	5.83	1.88	5.34	.15	2.40	0	5.14	5.00	.47
2	8-11-76	1.14	8.12	11.29	10.83	4.15	1.75	5.22	.17	2.39	0	4.24	4.20	2.92
2	8-25-76	.95	8.28	10.86	10.92	3.90	1.78	5.01	.17	2.36	0	2.88	5.63	0
2	9-07-76	.94	8.26	10.78	11.00	3.90	1.73	4.99	.16	2.36	0	2.80	5.84	0
2	9-23-76	1.19	8.42	11.99	12.39	5.04	1.78	5.01	.16	2.31	.32	4.20	5.56	2.11
2	10-05-76	1.12	8.32	13.10	13.43	6.17	1.85	4.97	.11	2.31	.96	4.64	5.52	.01
2	10-21-76	1.18	8.20	-	12.49	-	1.96	5.13	.16	2.31	.24	3.78	6.16	.20
2	11-03-76	1.17	8.48	14.68	14.34	7.44	2.02	5.06	.16	2.42	.84	5.32	5.76	.13
2	12-14-76	1.25	7.84	15.60	15.88	7.99	2.04	5.39	.18	2.56	0	6.76	6.56	.05
2	12-28-76	1.24	7.70	15.64	16.05	7.94	2.02	5.51	.17	2.73	0	6.60	6.72	.05
Mean		1.14	8.13	12.77	12.79	5.34	1.82	5.39	.17	2.34	.11	5.00	5.34	.52
SD		.08	.23	1.40	1.46	1.28	.11	.50	.02	.15	.26	1.43	.69	.81

Table J-4. Composition of water samples taken from test Well 3 at 35 feet on Plant Science Farm, NMSU, during 1976

Well	Date	$ECX10^3$	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meq/1)										(ppm)
3	1-13-76	1.10	7.93	14.21	13.67	6.63	1.67	5.72	.19	2.02	0	6.50	5.15	0
3	1-28-76	1.05	8.06	12.48	13.51	5.58	1.44	5.29	.17	1.90	0	6.51	4.74	0
3	2-07-76	1.17	7.95	15.36	14.45	5.54	1.63	8.02	.17	1.97	0	7.77	4.71	0
3	2-21-76	1.09	7.95	10.94	11.52	3.60	1.59	5.57	.18	1.98	0	5.14	4.40	4.25
3	3-06-76	1.09	8.19	13.21	13.14	5.09	1.54	6.41	.17	1.95	0	6.82	4.37	0
3	3-20-76	1.08	8.72	13.61	12.94	5.28	1.60	6.56	.17	1.97	1.56	4.74	4.67	2.25
3	4-03-76	1.13	8.30	13.52	13.12	5.17	1.57	6.61	.17	1.98	0	5.58	5.56	.29
3	4-10-76	1.33	7.28	14.06	13.88	5.13	1.95	6.76	.22	2.77	0	4.99	6.12	2.21
3	5-01-76	1.13	8.16	10.86	10.35	2.83	1.55	6.31	.17	1.99	0	2.89	4.56	.21
3	5-15-76	1.16	8.47	13.27	12.61	5.18	1.63	6.29	.17	2.15	.16	5.10	5.20	.14
3	6-11-76	1.10	8.52	10.69	10.81	3.70	1.59	5.23	.17	2.38	0	3.15	5.28	.06
3	6-28-76	1.20	8.58	10.52	10.26	2.44	1.68	6.21	.19	2.56	0	2.48	5.22	.24
3	7-12-76	1.22	8.27	13.39	12.99	5.26	1.67	6.27	.19	2.61	0	5.26	5.12	.15
3	7-26-76	1.18	8.13	13.45	13.20	5.22	1.78	6.29	.16	2.54	0	5.46	5.20	.4
3	8-11-76	1.21	8.20	11.59	11.06	3.58	1.76	6.08	.17	2.60	0	4.42	4.04	3.17
3	8-25-76	1.19	8.79	13.81	14.51	5.79	1.76	6.08	.18	2.63	.92	5.00	5.96	3.49
3	9-07-76	1.03	8.20	11.69	12.37	3.62	1.67	6.23	.17	2.61	0	3.84	5.92	0
3	9-23-76	1.24	8.56	13.44	13.57	5.40	1.74	6.13	.17	2.61	.40	5.12	5.44	2.58
3	10-05-76	1.15	8.33	13.27	13.95	5.46	1.68	5.97	.16	2.63	.84	4.68	5.80	.02
3	10-21-76	1.20	8.39	-	14.20	-	1.86	5.97	.17	2.52	.44	3.92	7.32	.20
3	11-03-76	1.20	8.65	14.95	15.07	7.06	1.90	5.82	.17	2.65	1.40	5.02	6.00	.10
3	12-14-76	1.21	8.16	15.08	15.36	6.99	1.82	6.09	.18	2.62	.16	6.26	6.32	.05
3	12-28-76	1.17	8.14	14.61	15.37	6.61	1.78	6.05	.17	2.67	0	6.42	6.28	.10
Mean		1.16	8.26	13.09	13.13	5.05	1.69	6.17	.18	2.36	.26	5.09	5.36	.87
SD		.07	.33	1.46	1.50	1.27	.12	.55	.01	.31	.47	1.29	.78	1.35

Table J-5. Composition of water samples taken from test Well 4 at 27 feet on Plant Science Farm, NMSU, during 1976

Well	Date	$ECX10^3$	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meq/l)										(ppm)
4	1-13-76	1.27	7.88	16.09	15.33	7.48	2.05	6.33	.23	2.75	0	7.14	5.44	.61
4	1-28-76	1.19	8.04	14.40	14.89	6.51	1.86	5.83	.20	2.62	0	7.05	5.22	0
4	2-07-76	1.39	8.13	16.21	16.17	5.54	1.98	8.48	.21	2.87	0	6.15	5.15	1.17
4	2-21-76	1.28	7.94	14.09	14.82	3.49	2.19	8.21	.20	2.84	0	6.88	5.20	2.30
4	3-06-76	1.32	8.07	15.46	15.88	5.95	2.04	7.26	.21	2.82	0	7.78	5.28	.06
4	3-20-76	1.19	8.31	14.03	13.57	5.13	2.12	6.57	.21	2.77	0	5.40	5.40	2.00
4	4-03-76	1.32	8.21	14.85	14.48	5.09	2.04	7.52	.20	2.76	0	5.62	6.80	.9
4	4-10-76	1.33	7.28	14.06	13.88	5.13	1.95	6.76	.22	2.77	0	4.99	6.12	2.21
4	5-01-76	1.30	8.10	14.67	14.12	5.25	1.99	7.23	.20	2.79	0	6.26	5.07	.08
4	5-15-76	1.32	8.34	14.64	13.97	5.18	2.05	7.21	.20	2.87	0	5.22	5.88	.14
4	6-11-76	1.12	8.24	10.90	11.36	3.92	1.64	5.15	.19	2.89	0	3.19	5.28	.10
4	6-28-76	1.31	8.32	11.07	10.49	2.56	1.93	6.36	.22	2.85	0	2.52	5.12	.28
4	7-12-76	1.27	8.20	13.92	13.58	5.26	1.99	6.46	.21	2.86	0	5.36	5.36	.05
4	7-26-76	1.18	8.10	13.43	13.26	4.76	1.97	6.53	.17	2.74	0	5.48	5.04	1.92
4	8-11-76	1.22	8.11	11.78	11.27	3.41	1.93	6.25	.19	2.81	0	4.26	4.20	0
4	8-25-76	1.03	8.32	12.46	11.98	3.97	2.02	6.28	.19	2.92	0	2.82	6.24	1.31
4	9-07-76	1.03	8.27	12.09	12.67	3.97	1.97	5.96	.19	2.83	0	3.60	6.24	0
4	9-23-76	1.25	8.35	12.57	12.81	4.23	1.93	6.23	.18	2.79	.20	3.70	6.12	1.92
4	10-05-76	1.25	8.16	14.14	14.47	5.73	2.04	6.19	.18	2.81	.80	5.10	5.76	.01
4	10-21-76	1.18	8.23	-	14.30	-	2.21	6.19	.18	2.72	.36	4.18	7.04	.20
4	11-03-76	1.24	8.34	15.18	15.14	6.79	2.23	5.98	.18	2.78	.84	5.44	6.08	.11
4	12-14-76	1.24	7.82	15.56	15.92	7.10	2.08	6.18	.20	2.54	0	7.26	6.12	.10
4	12-28-76	1.22	7.70	15.08	15.73	6.70	2.03	6.17	.18	2.61	0	7.20	5.92	0
Mean		1.24	8.11	13.94	13.92	5.14	2.01	6.58	.20	2.78	.10	5.33	5.66	.67
SD		.09	.25	1.54	1.58	1.29	.12	.77	.015	.09	.24	1.52	.64	.84

Table J-6. Composition of water samples taken from test Well 5 at 19 feet on Plant Science Farm, NMSU, during 1976

Well	Date	ECX10^3	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meq/l)										(ppm)
5	1-13-76	1.20	7.89	14.71	14.99	5.84	1.76	6.83	.28	2.56	0	7.43	5.00	0
5	1-28-76	1.12	8.28	13.20	13.71	4.99	1.60	6.36	.25	2.35	0	6.91	4.45	0
5	2-07-76	1.33	8.15	15.14	14.78	4.93	1.73	8.23	.25	2.51	0	7.23	5.04	1.03
5	2-21-76	1.24	8.00	13.72	14.41	3.34	1.76	8.36	.26	2.54	0	7.40	4.47	3.19
5	3-06-76	1.24	8.21	14.36	14.34	4.01	1.71	8.36	.26	2.51	0	7.05	4.80	.12
5	3-20-76	1.13	8.44	12.95	12.28	4.16	1.77	6.77	.25	2.53	.32	4.68	4.85	.75
5	4-03-76	1.28	8.39	15.79	15.12	5.13	1.78	8.64	.24	2.44	0	6.04	6.64	.20
5	4-10-76	1.29	7.24	14.96	14.37	5.05	1.73	7.90	.28	2.44	1.16	6.17	4.60	.39
5	5-01-76	1.33	8.12	15.01	14.66	4.47	1.81	8.47	.26	2.45	0	7.39	4.82	.27
5	5-15-76	1.33	8.42	15.10	14.36	4.51	1.89	8.45	.25	2.62	.16	6.10	5.48	.20
5	6-11-76	1.15	7.93	11.78	12.08	2.91	2.00	6.62	.25	2.77	0	3.59	5.72	.06
5	6-28-76	1.39	8.43	11.92	11.42	1.74	2.03	7.85	.30	2.94	0	2.92	5.56	.24
5	7-12-76	1.34	8.16	15.14	14.82	5.15	2.02	7.67	.30	2.74	0	5.78	6.32	.05
5	7-26-76	1.28	8.15	14.07	13.51	4.07	2.03	7.74	.23	2.73	0	5.26	5.16	.29
5	8-11-76	1.29	8.02	12.16	12.02	2.56	1.97	7.38	.25	2.74	0	4.96	4.32	.27
5	8-25-76	1.09	8.24	12.51	12.51	2.95	1.86	7.44	.25	2.71	0	3.64	6.16	2.05
5	9-07-76	1.08	8.40	12.66	12.96	3.48	1.97	6.96	.25	2.76	.48	3.52	6.20	0
5	9-23-76	1.33	8.42	13.49	13.95	3.97	1.87	7.40	.25	2.67	.40	5.12	5.76	1.75
5	10-05-76	1.33	8.06	13.70	14.30	5.18	2.05	6.24	.23	2.60	.16	6.10	5.44	.01
5	10-21-76	1.29	8.17	-	13.99	-	2.22	6.85	.26	2.55	.24	4.60	6.60	.25
5	11-03-76	1.27	8.35	15.40	15.45	6.33	2.26	6.57	.24	2.57	.88	6.12	5.88	.02
5	12-14-76	1.59	7.65	20.04	20.32	8.99	2.97	7.70	.38	3.36	0	8.44	8.52	.10
5	12-28-76	1.62	7.63	21.19	21.28	9.15	3.11	8.63	.30	3.78	0	8.46	9.04	.05
Mean		1.28	8.12	14.50	14.42	4.68	2.00	7.54	.26	2.69	.17	5.87	5.69	.49
SD		.13	.30	2.32	2.30	1.80	.37	.77	.03	.32	.31	1.57	1.20	.80

APPENDIX K

DEL RIO DRAIN FLOW AND QUALITY DATA

Table K-1. Composition of water samples taken at Del Rio drain site A, 1976

Site	Date	ECX10^3	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meq/l)										(ppm)
A	1-13-76	1.21	8.02	14.81	13.79	6.62	1.81	6.17	.21	3.56	0	4.50	5.73	0
A	1-28-76	1.21	8.19	13.12	14.08	5.80	1.73	5.39	.20	3.26	0	5.38	5.44	0
A	2-07-76	1.25	8.16	14.08	14.09	6.29	1.74	5.82	.23	3.48	0	5.10	5.51	.18
A	2-21-76	1.16	8.12	14.45	14.57	5.75	1.88	6.60	.22	3.69	.74	4.39	5.75	1.11
A	3-06-76	1.21	8.12	14.73	14.07	6.02	1.75	5.76	.21	3.50	0	5.10	5.38	1.76
A	3-20-76	1.14	8.51	14.78	14.22	6.22	1.82	6.53	.21	3.63	.44	5.00	5.15	1.65
A	4-03-76	1.18	8.50	14.38	13.33	5.81	1.67	6.70	.20	3.33	.28	4.72	5.00	.99
A	4-10-76	1.13	8.20	13.93	13.23	6.03	1.60	6.09	.21	3.33	0	4.94	4.96	1.05
A	5-01-76	1.18	7.91	13.34	13.15	5.07	1.61	6.45	.21	3.16	0	4.11	5.88	.89
A	5-15-76	1.18	8.17	13.63	13.51	5.36	1.70	6.37	.20	3.94	.65	3.48	5.44	.20
A	5-28-76	1.09	8.03	12.12	12.25	5.01	1.53	5.35	.23	3.02	.65	3.56	5.02	1.00
A	6-11-76	1.20	8.01	12.75	13.07	5.57	1.60	5.39	.19	3.14	.92	3.61	5.40	.60
A	6-28-76	1.10	8.30	12.84	12.60	5.37	1.54	5.65	.28	3.08	.76	3.60	5.16	.68
A	7-12-76	1.13	8.14	13.08	12.49	5.52	1.64	5.70	.22	3.09	.68	3.64	5.08	5.09
A	7-26-76	1.15	8.50	13.47	12.75	5.49	1.66	6.14	.18	3.03	.92	3.44	5.36	2.11
A	8-11-76	1.09	8.43	13.01	12.67	4.85	1.61	5.36	.19	2.95	.84	3.52	5.36	1.35
A	8-25-76	1.10	8.69	13.32	13.33	5.56	1.61	5.94	.21	3.25	.92	3.40	5.76	2.64
A	9-07-76	1.10	8.61	13.03	13.39	5.28	1.61	5.81	.33	3.07	0	4.44	5.88	1.31
A	9-23-76	1.10	8.49	12.70	13.29	5.98	1.18	5.35	.19	2.79	1.00	3.22	6.28	1.75
A	10-05-76	1.21	8.15	13.04	13.79	5.26	1.53	6.07	.18	3.05	.48	4.14	6.12	1.38
A	10-19-76	1.17	8.42	14.60	14.78	6.44	1.85	6.12	.19	3.06	1.00	3.56	7.16	1.20
A	11-03-76	1.17	8.44	13.88	14.21	6.03	1.76	5.90	.19	3.13	.68	3.92	6.48	1.10
A	11-16-76	1.34	7.84	15.71	15.52	5.55	1.68	8.28	.20	3.40	0	5.80	6.32	0
A	12-14-76	1.21	7.89	14.55	14.42	6.31	1.76	6.29	.19	3.34	0	4.72	6.36	.90
A	12-28-76	1.17	7.76	14.48	14.62	6.18	1.83	6.28	.19	3.48	0	4.42	6.72	.85
Mean		1.17	8.22	13.75	13.65	5.73	1.67	6.06	.21	3.27	.44	4.23	5.71	1.19
SD		.06	.25	.88	.81	.47	.14	.62	.03	.27	.40	.72	.59	1.05

Table K-2. Composition of water samples taken at Del Rio drain site B, 1976

Site	Date	ECX10^3	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				-(meq/1)-										(ppm)
B	1-13-76	1.30	8.02	15.00	14.41	6.77	1.86	6.15	.22	3.57	0	4.78	6.06	0
B	1-28-76	1.29	8.21	13.56	13.90	6.06	1.76	5.54	.20	3.35	0	4.93	5.62	1.09
B	2-07-76	1.28	7.69	14.26	14.16	6.34	1.82	5.88	.22	3.48	0	5.13	5.55	.12
B	2-21-76	1.22	8.28	14.99	15.08	5.91	1.91	6.95	.22	3.67	.79	4.76	5.86	2.06
B	3-06-76	1.22	8.25	14.98	14.40	6.18	1.78	6.81	.21	3.46	0	5.45	5.49	1.25
B	3-20-76	1.13	8.38	13.95	13.53	5.62	1.70	6.43	.20	3.28	.24	4.64	5.37	1.45
B	4-03-76	1.19	8.31	14.93	14.41	6.11	1.72	6.88	.22	3.38	0	5.44	5.59	1.60
B	4-10-76	1.16	8.38	13.94	13.34	6.03	1.61	6.09	.21	3.26	.16	4.80	5.28	2.30
B	5-01-76	1.17	7.98	13.57	13.36	5.03	1.69	6.64	.21	3.18	0	4.20	5.98	1.04
B	5-15-76	1.22	8.40	14.22	13.96	5.55	1.70	6.76	.21	3.34	.77	3.81	6.04	1.19
B	5-28-76	1.16	7.80	12.03	12.76	5.15	1.54	5.14	.20	3.08	.73	3.75	5.20	1.00
B	6-11-76	1.25	8.30	12.80	12.58	5.43	1.64	5.64	.19	3.22	0	3.52	5.84	1.11
B	6-28-76	1.22	8.54	12.75	11.99	4.81	1.64	6.09	.21	3.19	.64	2.72	5.44	1.09
B	7-12-76	1.14	8.17	13.32	12.85	5.68	1.64	5.79	.21	3.07	.64	3.86	5.28	1.30
B	7-26-76	1.19	8.58	13.73	13.25	5.51	1.73	6.31	.18	3.11	.76	3.90	5.48	3.19
B	8-11-76	1.04	8.48	11.62	12.09	4.88	1.48	5.06	.20	2.91	.76	3.02	5.40	1.78
B	8-25-76	1.04	8.59	12.20	12.43	4.42	1.67	5.91	.20	2.97	.60	2.58	6.28	.66
B	9-07-76	1.14	8.64	13.49	13.72	5.71	1.65	5.94	.19	2.98	1.12	3.46	6.16	1.78
B	9-23-76	1.18	8.53	12.95	13.40	5.36	1.54	5.85	.20	2.94	.88	3.54	6.64	3.38
B	10-05-76	1.25	8.25	13.42	14.00	5.57	1.58	6.08	.19	3.06	.72	3.98	6.24	2.20
B	10-19-76	1.19	8.32	-	14.83	-	1.82	6.15	.19	3.11	.84	3.68	7.20	1.30
B	11-03-76	1.21	8.51	14.68	14.78	6.56	1.85	6.08	.19	3.18	.84	4.00	6.76	1.79
B	11-16-76	1.28	7.94	14.78	14.82	6.49	1.78	6.32	.19	3.38	0	5.00	6.44	1.50
B	11-30-76	1.22	8.04	14.52	14.94	6.25	1.78	6.31	.18	3.38	.60	4.20	6.76	1.40
B	12-14-76	1.25	7.94	15.31	15.32	6.73	1.75	6.64	.19	3.34	0	4.98	7.00	1.35
B	12-28-76	1.24	7.60	15.19	15.39	6.39	1.84	6.76	.20	3.61	0	4.66	7.12	1.40
Mean		1.20	8.24	13.85	13.83	5.78	1.71	6.16	.20	3.25	.43	4.18	6.00	1.47
SD		.07	.29	1.05	.99	.63	.11	.50	.01	.21	.39	.79	.62	.75

Table K-3. Electrical conductivity (mmhos/cm) and flow (m^3/sec) of water at Del Rio drain sampling sites A and B during 1976

Site A			Site B		
Date	$ECX10^3$	Flow (m^3/sec)	Date	$ECX10^3$	Flow (m^3/sec)
1-06-76	1.11	.366	1-06-76	1.15	.581
1-13-76	1.21	.379	1-13-76	1.30	.523
1-21-76	1.25	.461	1-21-76	1.30	.648
1-28-76	1.21	.558	1-28-76	1.29	.716
2-02-76	1.20	-	2-02-76	1.28	-
2-07-76	1.25	.582	2-07-76	1.28	.723
2-14-76	1.24	.535	2-14-76	1.29	.681
2-21-76	1.16	.489	2-21-76	1.22	.706
2-28-76	1.28	.513	2-28-76	1.23	.764
3-06-76	1.21	.528	3-06-76	1.22	.658
3-13-76	1.16	.616	3-13-76	1.20	.806
3-20-76	1.14	.747	3-20-76	1.13	.883
3-27-76	1.08	.769	3-27-76	1.12	.926
4-03-76	1.18	.733	4-03-76	1.19	.946
4-10-76	1.13	.778	4-10-76	1.16	.927
4-17-76	1.18	.778	4-17-76	1.19	1.055
4-24-76	1.16	.778	4-24-76	1.19	.989
5-01-76	1.18	.776	5-01-76	1.17	.982
5-08-76	1.17	.960	5-08-76	1.21	1.038
5-15-76	1.18	.977	5-15-76	1.22	1.055
5-20-76	1.12	1.151	5-20-76	1.11	.997
5-28-76	1.09	1.140	5-28-76	1.16	1.073
6-04-76	1.16	1.109	6-04-76	1.17	1.195
6-11-76	1.20	1.102	6-11-76	1.25	1.167
6-19-76	1.21	.610	6-19-76	1.23	.982
6-28-76	1.10	1.121	6-28-76	1.22	1.195
7-06-76	1.10	1.352	7-06-76	1.15	1.085
7-12-76	1.13	1.206	7-12-76	1.14	1.427
7-19-76	1.19	1.282	7-19-76	1.18	1.118
7-26-76	1.15	1.065	7-26-76	1.19	.841
8-03-76	1.20	1.030	8-03-76	1.22	1.234
8-11-76	1.09	1.263	8-11-76	1.04	1.337
8-18-76	1.10	1.611	8-18-76	1.19	1.541
8-25-76	1.10	1.263	8-25-76	1.04	1.337
8-31-76	1.13	1.408	8-31-76	1.13	1.447
9-07-76	1.10	1.306	9-07-76	1.14	1.434
9-14-76	1.22	.938	9-14-76	1.28	1.370
9-23-76	1.10	1.001	9-23-76	1.18	1.242
9-28-76	1.13	.942	9-28-76	1.18	1.299
10-05-76	1.21	.856	10-05-76	1.25	.985
10-12-76	1.23	.764	10-12-76	1.29	1.036
10-19-76	1.17	.772	10-19-76	1.19	1.030
10-26-76	1.20	.505	10-26-76	1.24	.946
11-03-76	1.17	.479	11-03-76	1.21	.922
11-09-76	1.20	.462	11-09-76	1.35	.823
11-16-76	1.34	.436	11-16-76	1.28	.810
11-24-76	1.22	.436	11-24-76	1.25	.740
11-30-76	-	.437	11-30-76	1.22	.572
12-07-76	1.22	.440	12-07-76	1.25	.495
12-14-76	1.21	.563	12-14-76	1.25	.579
12-22-76	1.28	.388	12-22-76	1.30	.659
12-28-76	1.17	.387	12-28-76	1.24	.578
Mean	1.17	.807		1.21	.963
SD	.06	.329		.06	.272

Table K-4. Staff gage and flow data for the Del Rio drain measuring station

Date	Del Rio Drain				Date	Del Rio Drain			
	Site A Stake	Site A Flow	Site B Stake	Site B Flow		Site A Stake	Site A Flow	Site B Stake	Site B Flow
1976	feet	cfs.	feet	cfs.	1976	feet	cfs.	feet	cfs.
2-21	4.60	17.28	4.12	24.93	8-3	4.50	36.37	4.76	43.57
2-28	3.60	18.13	4.08	26.98	8-11	4.60	44.59	4.80	47.21
3-6	3.65	18.66	4.10	23.22	8-18	4.75	56.90	4.90	54.43
3-13	3.73	21.76	4.20	28.45	8-25	4.60	44.59	4.70	47.21
3-20	3.83	26.36	4.32	31.18	8-31	4.50	49.72	4.75	51.08
3-27	3.92	27.17	4.40	32.71	9-7	4.50	46.11	4.70	50.65
4-3	3.90	25.88	4.35	33.42	9-14	4.20	33.13	4.50	48.38
4-10	3.90	27.48	4.37	32.75	9-23	4.20	35.33	4.48	43.85
4-17	3.94	27.48	4.40	37.26	9-28	4.20	33.26	4.42	45.88
4-24	3.92	27.46	4.40	34.92	10-5	4.21	30.21	4.28	34.79
5-1	3.92	27.41	4.51	34.68	10-12	4.09	26.99	4.11	36.59
5-8	3.98	33.89	4.47	36.66	10-19	4.00	27.25	4.01	36.37
5-15	3.96	34.49	4.50	37.27	10-26	3.98	17.84	3.96	33.42
5-20	4.06	40.64	4.63	35.20	11-2	3.96	16.91	3.92	32.56
5-28	4.10	40.27	4.70	37.88	11-9	3.84	16.32	3.87	29.07
6-7	4.18	39.15	4.80	42.20	11-16	3.85	15.40	3.86	28.61
6-11	4.25	38.92	4.05	41.19	11-23	3.83	15.38	3.82	26.14
6-21	4.20	21.53	4.90	34.69	11-30	3.84	15.42	3.84	20.19
6-28	4.30	39.57	4.90	42.19	12-7	3.83	15.53	3.81	17.49
7-8		47.75	4.97	38.30	12-14	3.80	19.89	3.80	20.43
7-13	4.53	42.60	5.12	50.40	12-21	3.84	13.71	3.76	23.26
7-19	4.50	45.26	4.80	39.46	12-28	3.82	13.65	3.74	20.42
					1977				
7-26	4.50	37.62	4.65	29.69	1-4	3.78	14.26	3.74	21.88