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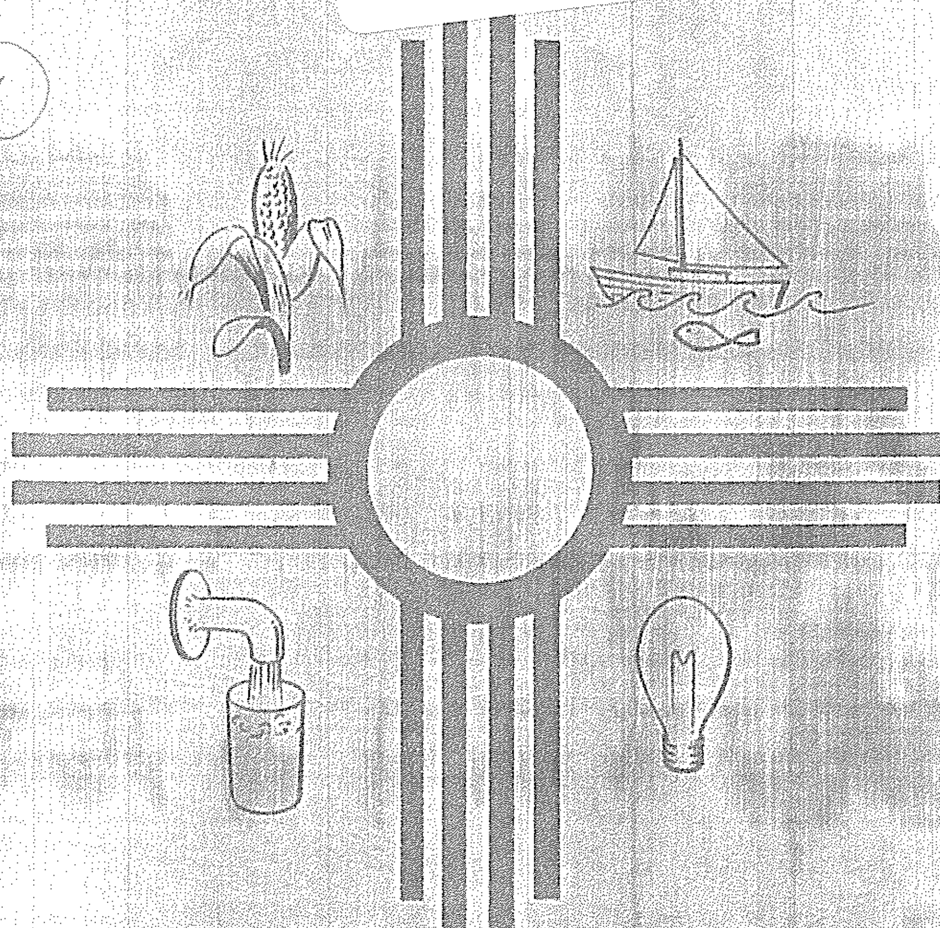

New Mexico Water Resources Research Institute

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

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ANNUAL REPORT--YEAR 1
February 17, 1975 to February 16, 1976
EPA Grant No. S803565-01-0

PROJECT OFFICER
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New Mexico Water Resources Research Institute
in cooperation with
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March 1976

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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.

PRINCIPAL INVESTIGATORS

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Peter J. Wierenga	NMSU	Soil Physics	Field Plot Demonstration
Lynn W. Gelhar	NMIMT	Hydrology	Hydrosalinity Model
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Special thanks go to John W. Clark, Director of the New Mexico Water Resources Research Institute for his support in the search for funding for the project; to the United States Environmental Protection Agency; to Dr. Arthur G. Hornsby 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; to Virginia Johansen for her able assistance in editing the manuscript; 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.

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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. 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, 1975 to February 16, 1976 on the project plan of work (Appendix A). This interdisciplinary research effort in the first year entailed primarily planning, construction of physical equipment, and monitoring farming practices on the 450-acre demonstration farm located near La Mesa in the Mesilla Valley (Figure 1). 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 Seldon 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 thick 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; Terry A. Howell, 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; Vijay P. Singh, Hydrologist, NMIMT; Charles E. Siepel, Agricultural Economist, NMSU.

DEMONSTRATION FARM

Cooperative Agreements

A cooperative agreement was reached with Mr. Orlando Cervantes, manager of the J. F. Apodaca Farms Co., Inc., for use of a part of their total operation as the demonstration site. Mr. Cervantes and Project Coordinator, Robert Lansford, are shown in Photo 1 next to the sign marking the demonstration site. Arrangements have been reached for the construction of a well (Photo 2) and two trickle irrigation installations (Photos 3 and 4). One of these will be used on a small pecan orchard, and the other, located on the east side of Field 3, will be used on vegetable crops (Figure 2).

Agreements were also finalized on the installation of meters on all of the irrigation wells (Photo 5), piezometers (Photos 6 and 7) to monitor groundwater fluctuations, water-stage recorders (Photo 8) to monitor open-drain quantity sites and to measure open-channel seepage (Photo 9). These areas have been selected to record water-delivery efficiencies of lines and open channels. In addition to the collection of the return flow data, the monitoring of farming operations will be continued.

The crops by field and approximate acreage of each for 1975 are presented in Figure 2 and Table 1. The primary crops on the demonstration farm in 1975 were long green chile (124.2 acres), cotton (102.5 acres), tomatoes (74 acres), and alfalfa (69.4 acres). These four crops accounted for 83 percent of the total cropland. The remaining crop acreage consisted of pecans, wheat, Floral Gem chile, corn for silage, and lettuce. Due to adverse weather conditions, stands on Field 5 (Floral Gem chile), Field 7 (Cayenne chile), and half of Field 6 (chile 6-4) were so poor that they were abandoned. Later in the year, part of Field 7 was planted to lettuce, and part of the abandoned portion of Field 6 was planted to corn.

Table 1. Crops and acreage, by field, demonstration farm, 1975

Number	Number of Acres	Crop	Generic Name
1	3.2	Pecans	Carya illinoensis; var 'Western Schley'
2	13.9	Wheat/Stubble	Triticum durum
3	74.0	Tomatoes	Lycopersicom esculentum; var 'VF 279'
4	69.1	Upland Cotton	Gossypium hirsutum
5	19.7	'Floral Gem' Chile	Capsicum annuum
6	19.0	Chile '6-4'	Capsicum annuum
7	40.7	Cayenne Chile	Capsicum annuum
8	33.4	Upland Cotton	Gossypium hirsutum
9	26.4	Chile '6-4'	Capsicum ammuum
10	69.4	Alfalfa	Medicago sativa; var 'Mesilla'
11	62.0	Chile '6-4'	Capsicum annuum
12	16.8	Chile '6-4'	Capsicum annuum
Total	447.6		

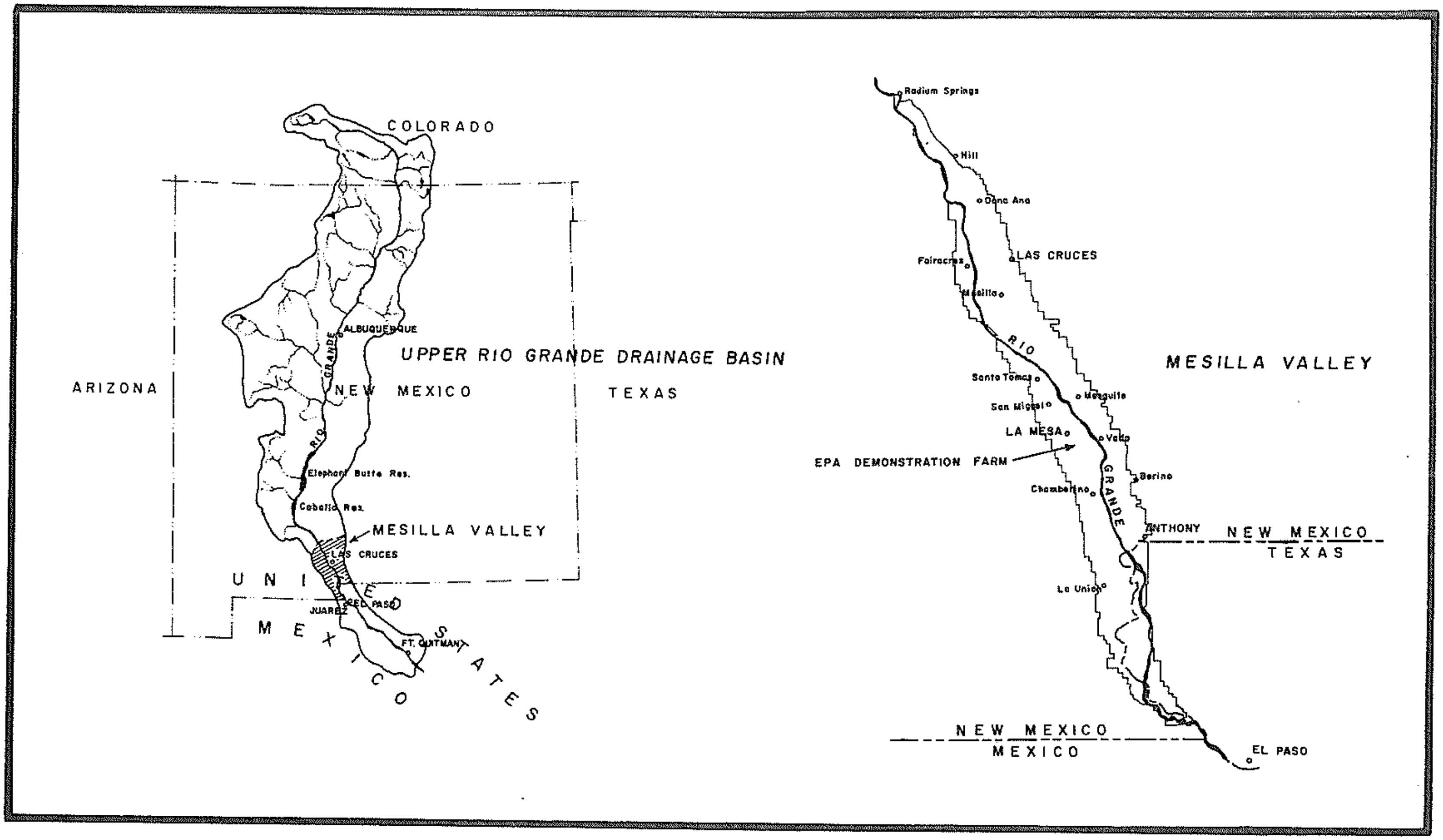


Figure 1. Location of irrigation return flow salinity control demonstration farm in the Mesilla Valley and Upper Rio Grande drainage basin, New Mexico.

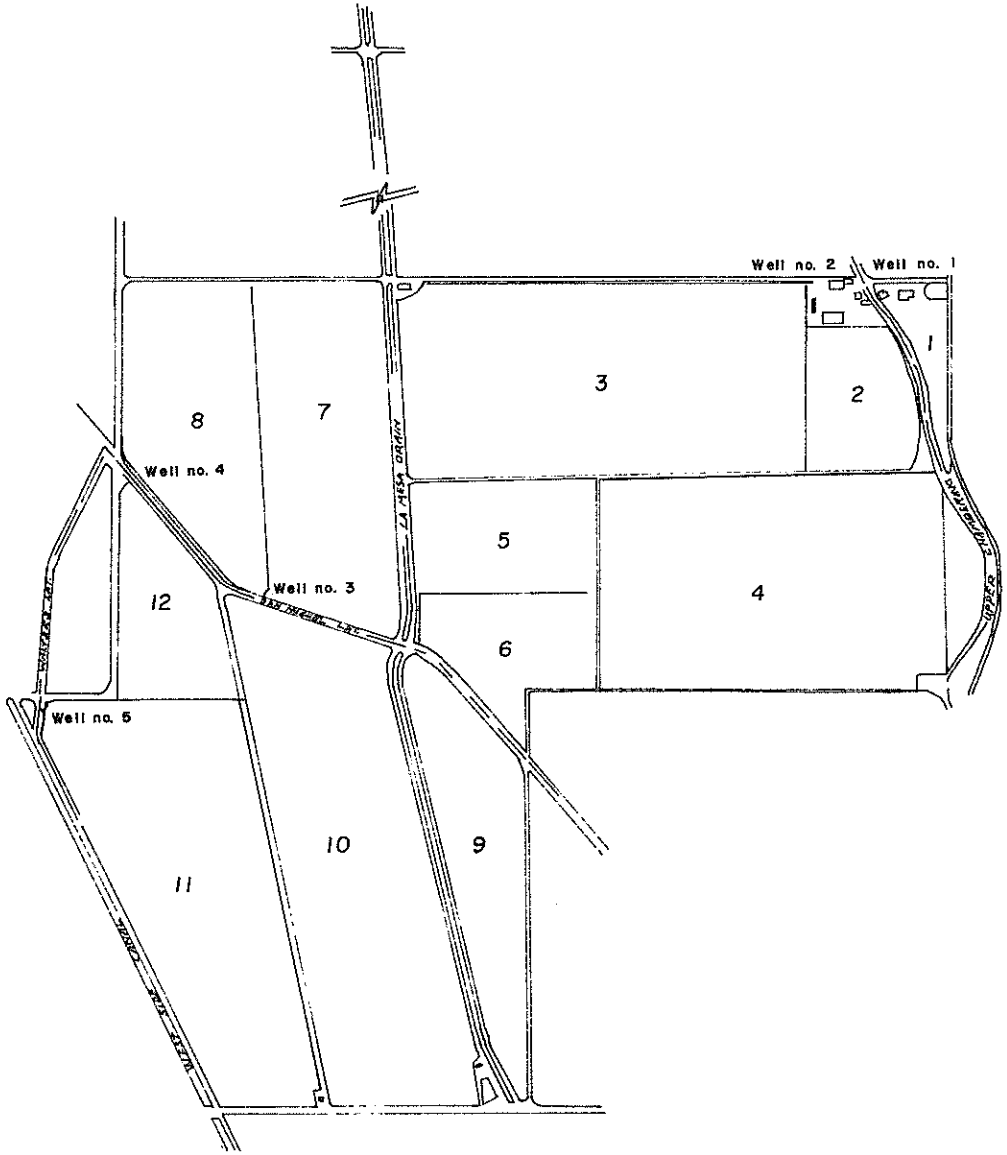


Figure 2. Crops and well locations on demonstration farm.

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

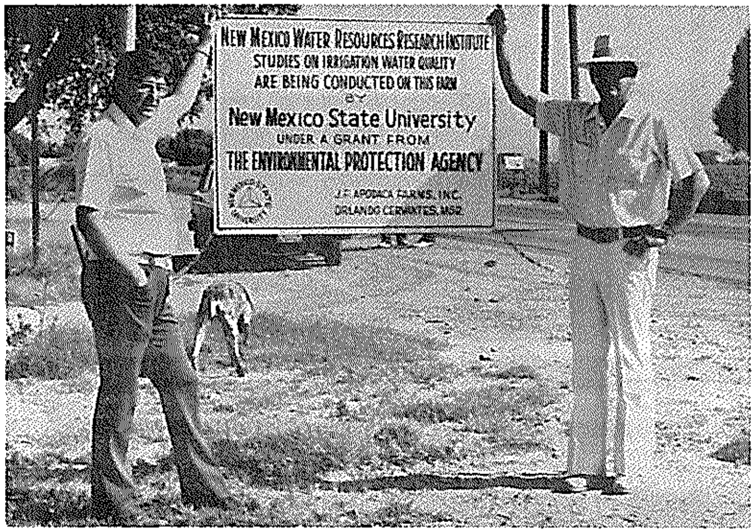


Photo 1. Orlando Cervantes (right), La Mesa farmer, and Robert R. Lansford, Professor of Agricultural Economics, NMSU at demonstration farm

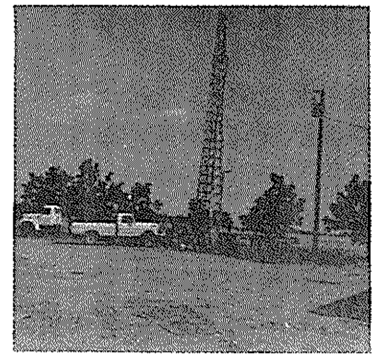


Photo 2. Trickle irrigation well being drilled on demonstration farm

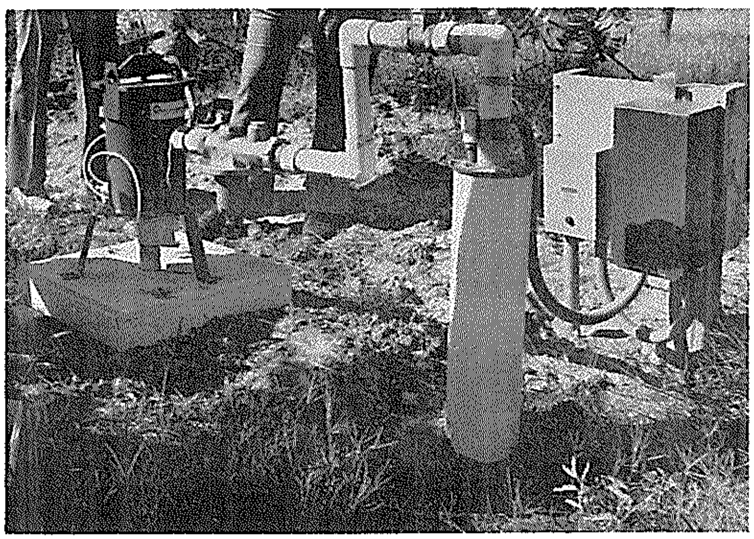


Photo 3. The irrigation well, trickle irrigation system filter, and pressure regulator

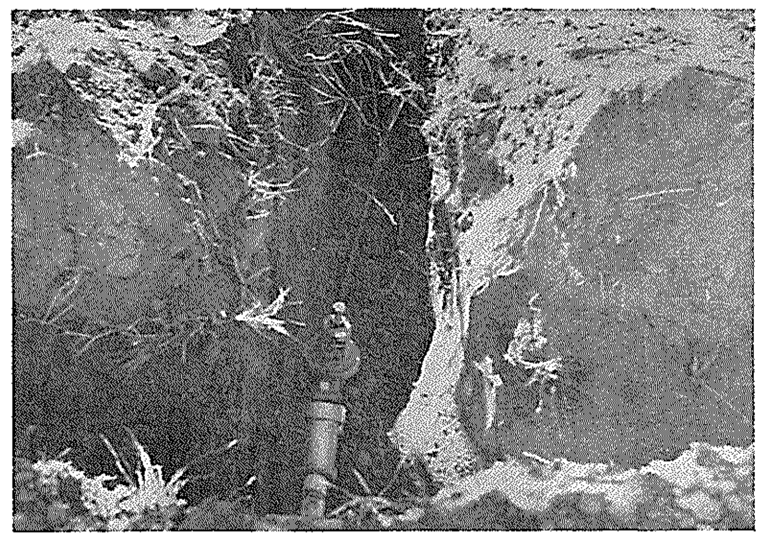


Photo 4. Trickle irrigation lateral header showing the filter, pressure regulator, and lateral

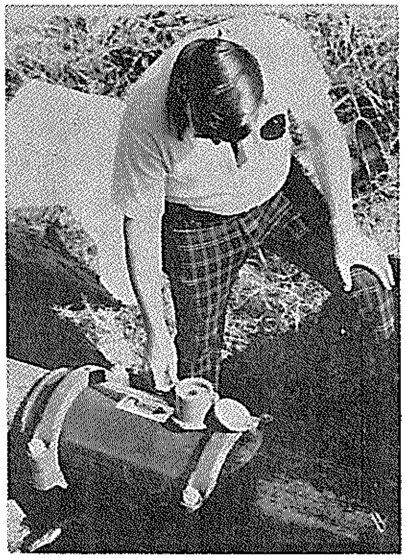


Photo 5. Terry A. Howell, Agricultural Engineering, inspecting one of irrigation well flow meters

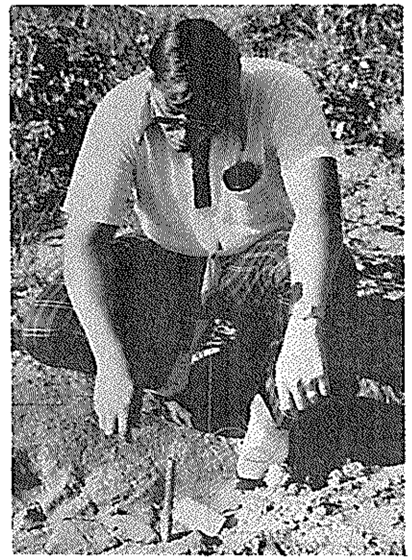


Photo 6. Terry A. Howell, Agricultural Engineering, indicating location of one of a series of piezometers strategically located across the demonstration farm

Photo 7. Close-up of piezometer used to record ground-water fluctuations on demonstration farm

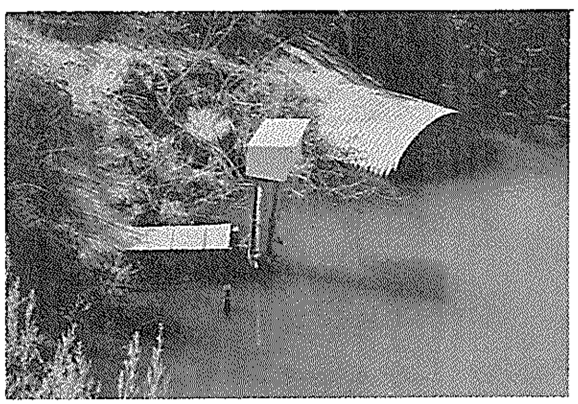


Photo 8. Water-stage recorder used to monitor open-drain quantity on demonstration farm

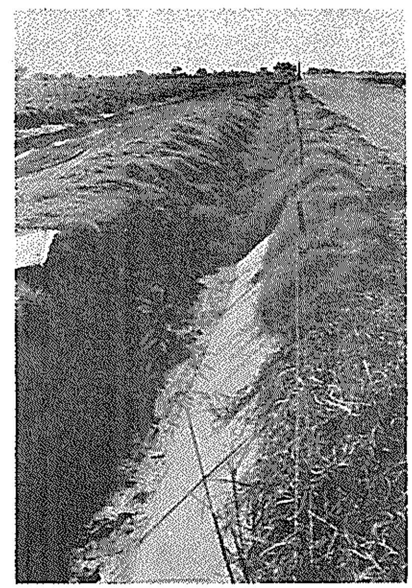


Photo 9. Lined and unlined sections of irrigation ditch on demonstration farm

Planning and Construction

Selection of Sites

Sampling sites were selected for monitoring the La Mesa Drain and for testing seepage from two irrigation canals and one irrigation lateral (Figure 3). Irrigation canal site 1 was an unlined ditch while approximately one-half of site 2 was concrete lined. Water meters were installed on Wells 2, 3, 4, and 5, as shown in Figure 3.

Also shown in Figure 3 are the well site for the trickle irrigation systems and the two trickle demonstration areas. Field 1 and six rows (3,618 feet in total length) in Field 2 will be used to study trickle irrigation of pecans and vegetables.

These two demonstration areas are within 700 feet of each other, so only one irrigation well was drilled and the water was piped to the areas. Permission was obtained from the Bureau of Reclamation to cross the upper Chamberino lateral.

Construction

Metering System. Metering irrigation water taken from the surface water system (Elephant Butte Irrigation District) has posed some problems. Several culverts with propeller meters to monitor the delivery of irrigation water were installed, but these meters became plugged with sediment and debris. Requirements were then re-evaluated, and it was decided to construct and install sheet metal flumes, of the Parshall type, for metering surface irrigation water. These flumes will be equipped with water-level recorders to measure the head of water on the flumes. A bid was let and has been accepted for construction on the flumes and construction is currently underway. Proposed location of each flume is shown in Figure 4. From these selected locations, all surface water entering the farm can be monitored. The installation and calibration of these flumes should be completed during the first quarter of the second year.

Trickle Irrigation System. An irrigation well was completed during July 1975 to provide water for the trickle irrigation system. Appendix B gives the geologic data and well log, respectively. The well screen was located at 248 feet below the soil surface. An analysis of a water sample taken from the well follows:

Electrical conductivity mmhos/cm	0.57
pH	7.89
Ca (meq/liter)	1.74
Mg (meq/liter)	0.79
Na (meq/liter)	3.13
K (meq/liter)	0.28
CL (meq/liter)	1.28
CO_3 (meq/liter)	0.0
HCO_3 (meq/liter)	3.36
SO_4 (meq/liter)	1.28
NO_3 (ppm)	2.22
SAR	2.78

The water was classified as C2-S1, which is very good quality for irrigation or domestic use. Installation of the fully automatic trickle irriation system was begun in October 1975 and completed after a delay because the mainline had to cross an irrigation canal (the canal was not dry until the end of October). Each lateral has a pressure regulator to maintain precise pressure control on the line. The system provides excellent demonstration potential since there are several lateral sizes ranging from one-half inch to one inch and lengths varying from 200 feet to 1,000 feet. This wide range in pipe sizes and lateral lengths will be useful in demonstrating the hydraulic principles applying to drip or trickle irrigation.

Piezometers. Figure 4 shows the location of the piezometers which were installed on August 10, 1975. The piezometers were installed to measure water-table changes. All piezometers are read weekly and records are presented in Appendix C.

Monitoring

Drains

The flow data for the La Mesa drain are presented in Appendix D. The drain flow at each gaging station was recorded each week and samples were analyzed in the NMSU soils and water laboratory.

Wells

Natural gas consumption and water volume pumped for each well on the demonstration farm are shown in Appendix E. 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.

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 F.

Irrigation Scheduling

Irrigation scheduling has been monitored since May 5, 1975. The data from each irrigation are recorded by field numbers. Irrigation quantity was estimated from current meter readings and flow duration. The dates and amounts of irrigation for each field are presented in Appendix G.

Inventory of Machinery, Equipment, and Irrigation Wells

The inventory of all machinery and equipment used in the farming operations of the J. F. Apodaca Farms, Inc. has been completed and is included in Appendix H. This inventory includes size of implement, 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 preliminary 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 variations in the cultural practices for various crops, no single schedule was developed.

Preliminary costs-and-return enterprise budgets have been completed for the past cropping season. However, the specific operations and time requirements are included as an integral part of each preliminary budget.

The machinery and equipment used in 1975 are represented in the preliminary crop budgets under pre-harvest and harvest operations in the form of "hours used" and "cost per acre." Preliminary cost-and-return enterprise budgets are presented in Appendix I for wheat, cotton, alfalfa, tomatoes, chile, lettuce, and corn for silage for 1975. These budgets are being finalized to provide a base from which to operate for the duration of the project. Once finalized, these budgets will consist of the purchased inputs, labor, fuel and repairs, and depreciation, insurance, and shelter for each field crop.

Figure 3. Proposed sampling and demonstration sites for demonstration farm.

Figure 4. Flume and piezometer locations on demonstration farm.

Information Dissemination

Since the start of the project, C. M. Hohn, Extension Agricultural Engineer, and Gene Ott, Extension Farm Management Specialist, have regularly obtained photographs of the farming operations at the demonstration farm site. These photos, showing the various stages of crop production, will be used at the end of the project to show the benefits to the local economy (Photo 10).

In addition, during the past season, Farm Management Specialist Ott consulted with Manager Cervantes on the economic impact of changing irrigation techniques on the net return to the farm (Photo 11).

Although the project was only in its first year of operation, numerous farm groups and individuals, including several foreign leaders (Photo 12), viewed the demonstration project.

Information dissemination continued through the press (see clippings in Appendix J) and radio. A radio tape prepared by Gene Ott and NMSU Associate Agricultural Editor Neil Stueven on the project's progress was distributed throughout the state. In February, a story directed at agricultural producers was sent to farm magazines in the Southwest. The continuation of these procedures should insure a wide distribution of the Environmental Protection Agency efforts to aid the farmers toward a more productive agriculture.

HYDROSALINITY MODEL SUPPORT

Soils

Obtaining Soils Maps

A soil survey of the Mesilla Valley was recently compiled by personnel of the Soil Conservation Service field office in Las Cruces. The survey is scheduled for publication in approximately 10 years, but detailed soils maps are completed and have been reproduced. Once the number of maps for the Mesilla Valley is known reproductions will be obtained.

Soil Chemical and Physical Data

Existing soil physical and chemical data for five soil series (obtained on soil samples taken from field plots at the New Mexico Plant and Soil Science Research Station) have been forwarded to Socorro for incorporation into the hydrosalinity model.

It was found that the Las Cruces SCS office did not have adequate chemical data for the soil series mapped, so the major soil-mapping units were sampled with the support of the SCS field office. The soils series sampled were the:

- Armijo clay
- Belen clay
- Harkey loam
- Glendale silty clay loam
- Harkey fine sandy loam
- Maricopa loam
- Anthony-Vinton loam
- Brazito very fine sandy loam

The results of the analysis will be available for incorporation into the hydrosalinity model in early 1976.

Photo 10. Photograph of Lettuce harvest on demonstration farm

Photo 11. Gene Ott (left), Farm Management Specialist, NMSU discusses farm management systems with Manager Cervantes (right)

Photo 12. Demonstration farm research group and Manager Cervantes discussing project with one of several foreigh leaders visiting area

Cropping Patterns for the Mesilla Valley

A preliminary historical cropping pattern (1947-1974) has been developed from Bureau of Reclamation and other records and forwarded to Socorro for incorporation into the hydrosalinity model. When more information is available, the cropping pattern will be sub-divided into an appropriate nodal configuration. The historic cropping pattern is presented in Appendix K.

Aerial photographs of the Mesilla Valley have been obtained from the Agricultural Stabilization and Conservation Service (ASCS). These photographs will be used to develop detailed cropping patterns for 1976-1977 for use in the hydrosalinity model, by nodes, for the Mesilla Valley.

HYDROSALINITY MODELING

The objective of this portion of the study is to implement and test a computer-based mathematical model of irrigation-related water quality in the Mesilla Valley. The model, which was developed by the U. S. Bureau of Reclamation (1975b) for the Environmental Protection Agency, can represent a general water and mass balance for a river basin or portion thereof. The model includes components which simulate surface and groundwater reservoirs, diversions to meet irrigation needs and other uses, irrigation return flows, and chemical transformations in the soil. Several nodes can be used to simulate the conditions in different segments of a basin. The model would be classified as a multi-cell lumped parameter model. Input data on water use, surface and groundwater quality, and streamflows and diversions are required to operate the model.

A review of the literature on irrigation return-flow modeling was an integral part of this effort. Much emphasis in irrigation return-flow modeling has been on the flow and chemical characteristics in the near-surface unsaturated zone above the water table. Hornsby (1973) reviews modeling techniques which have been applied to predict the quality of irrigation return flows. Examples of recent computer-based models of moisture and salt transport in soils include King and Hanks (1973) and Dutt, Shaffer, and Moore (1972). The latter represents chemical equilibrium of major ions and a kinetic approach to the nitrogen cycle in the soil. The soil chemistry portion of the USBR model which is being used in the current study is an outgrowth of that model.

When one considers the large volumes of water in groundwater storage, it is evident that aquifers underlying irrigated areas can play a central role in irrigation return-flow quality. At a recent workshop on irrigation return-flow modeling, Walker (1975) noted the need for improved information on groundwater behavior. Several recent modeling studies have emphasized the groundwater flow in salinity models, (Maddaus and Aaronson 1972; Lyons and Stewart, 1973; Konikow and Bredehoeft, 1974; and Hassan et. al., 1974); these models all represent two-dimensional horizontal flow with total dissolved solids taken as a conservative solute. In contrast, the Bureau of Reclamation (Shaffer, Ribbens and Huntley, 1975) consider two-dimensional groundwater flow in a vertical plane and chemical equilibrium for major ions. Gupta, Tanji and Luthin (1975) have developed a three-dimensional groundwater flow and quality model assuming conservative solute. Lumped parameter groundwater flow and quality models have been used by Gelhar and Wilson (1974) and Mercando (1976); these models are similar to the structure implicit in the groundwater portion of the USBR-EPA model being used in the current study.

Described in the following sections are the activities relating to the implementation and evaluation of the USBR-EPA model for the Mesilla Valley. Included are a summary of the model structure and documentation of the program revisions required to operate the program on an IBM system. The testing of the model for the Vernal case study is outlined and the model setup for the Mesilla Valley is then developed. Results of preliminary simulations for the Mesilla Valley are presented. The existing data base and the current sampling program are described. Features of the consumptive use estimates and some initial analysis of aquifer properties are discussed. Finally, the major results are summarized, especially as related to expected direction of the work during the next year.

Model Implementation

Model Structure

The USBR model represents an irrigated area by a series of small subunits, each of which is called a node. The number of nodes depends on the physical features of the study area, the availability of data, and the number of points at which the model response is desired within the area. The model structure is based on water balance for a given time interval which is computed and maintained for each node. The transfer of water between river and aquifer may be essential to maintain this balance. A soil column is included to simulate the chemical exchange between soil and water as water percolates down through the soil column. The model allows the mixing of one water with another, and computes the chemical quality of the mixed waters in proportion to the volumes mixed. Thus a chemical mass balance is simultaneously maintained. All these computations are performed for one node at a time and progress from the upstream to the downstream nodes.

A node includes simulation of several features as shown in Figure 5. These are: simulation of magnitude and quality of river flow, diversion to meet the irrigation demand, water transfer between river and aquifer, irrigation return flows directly to the aquifer, through the soil to the aquifer, and to the river. The river flow at the start of nodal operation is a known quantity, a portion of which is diverted to meet the irrigation demand. The irrigation return flow is then computed by subtracting the crop consumptive use from the irrigation demand. The chemical quality of mixed waters is computed at each point. At the end of nodal operation, the balance of inflow to and outflow from the river is determined. If the river flow is in excess of that observed, the additional water is transferred to the aquifer; if the river flow is in deficit, water is withdrawn from the aquifer to maintain the balance. In the model operation no consideration is given to spatial variability of hydrologic variables within a node. Hydraulic properties of soil and aquifer are not considered.

The input data needed to operate the model include irrigation demand, crop consumptive use, diversion, river water quality, initial aquifer water storage and chemical quality, soil moisture content and its chemical quality, and precipitation.

Model Revision

The revision of the model from its original version to the present Fortran version consisted of the following changes:

a. The subroutines PWROPR, RESOPR and DTABLE, describing the operation of surface reservoir and power plant, were deleted, for they are not needed in either the Vernal case study or Mesilla Valley study. Necessary changes, as a result of the deletion of these subroutines, were made in the subroutine PERUSE.

b. Originally, the computer program for the model was written for a Control Data Corporation computing system. To make the program compatible with an IBM 360-44 system, three types of changes were made:

(1) Definition of variables and arrays--Several variables and arrays were defined by

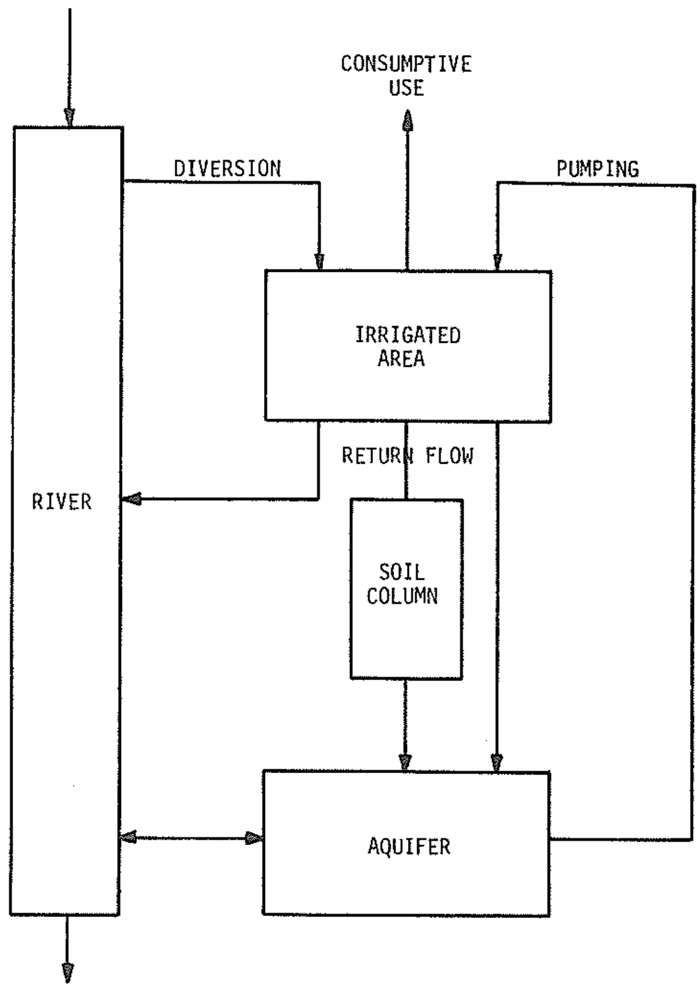


Figure 5. Schematic flow chart showing the features simulated in each node of the model.

Hollerith having more than four-character word length (e.g., A6, A8, etc). Because of smaller word length available on IBM 360-44, a provision was made to accommodate such variables and arrays.

Some data arrays were part alphanumeric (more than four character) and part real variable. These data arrays were changed so that they could be accommodated on an IBM 360-44.

(2) Format statements--The original program used R-FORMAT to define a number of variables. These variables were redefined by nonexecutable statements (e.g., integer or real statements). The Hollerith format statements involving A_i, $i > 4$ (e.g., A6, A8, etc.) were changed.

(3) Dimension statements--The dimension of the arrays containing 20 nodes was changed to five nodes, since we do not propose to use more than five nodes in our study. This reduced the computer storage space and made the program more efficient. Necessary changes, as a result of this change, were made within the body of the computer program.

The revised computer program is given in Appendix L with all the program changes identified.

Test of the Model for the Vernal Case Study

With the revisions made and changes incorporated, it was necessary to test the model and see whether it would reproduce the previous results. The model results for an irrigated area near Vernal, Utah (USBR, 1975, Vol. I) were used in this evaluation. An attempt was then made to test the model both with and without soil column for the period April 1971 through October 1972. It was found that the model, in the existing form, would not reproduce the results provided by the USBR. The reason for the discrepancy was that the model did not allow an internodal transfer of water from the upstream aquifer to the downstream aquifer. When this provision was made in the computer program, the model produced results practically identical to the USBR results. Much difficulty was experienced in testing the model because of the lack of sample input data set-up and a sample problem.

Preliminary Simulation for the Mesilla Valley

The objectives of these simulations are 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 was implemented with existing field data for the period June 1967 to June 1968. A complete set of groundwater data was available at the beginning of this period.

The Leasburg and Mesilla Dam, the two major water diversions in the Mesilla Valley, form natural nodes for the model. The quantity and chemical quality of flow in these diversions are observed. Therefore, two nodes were used to represent the Mesilla Valley as shown in Figure 6. Each node includes several operational features as shown in Figure 7. The nodal configuration and its subsequent operation are best described by a sequence of operations that actually occur. Each operation is assigned a sequence number in the order that it takes place (see Figure 7). In the assignment of sequence numbers, a positive number is assigned to inflow and a negative number to outflow or diversion. The configuration of operations in node 1 is about the same as in node 2 so only node 1 is explained here (see Figure 7).

At the upstream end of node 1 the flow in the Rio Grande is observed. The portion of this riverflow diverted at Leasburg is also observed. The river flow remaining after diversion is then computed; this quantity of flow is not available for irrigation use within node 1 and therefore is diverted from the node through sequence 1. The irrigation demand for crops in the area is computed independently, using the program EVPCOM and the overall irrigation efficiency. If the amount of surface water diversion is not sufficient to meet the demand, additional water is pumped from the aquifer. This feature was not available in the model input data set-up for the Vernal study. Originally, the model would satisfy the demand either entirely by surface water or groundwater. This feature, not included in the model through the input data, is more realistic because both groundwater and surface water are used to meet the demand. However, no changes were made in the program as a consequence of this added feature. Then the return flow, the difference between the demand and the consumptive use, takes place. A part of this return flow will go to the river and a part to the aquifer through the soil. Once the return flow mixes with river flow (after diversion) the chemical quality of river flow is updated; this river flow is identified as the predicted river flow. At the downstream end of the node, the river flow, a combination of the flows from El Paso carriage and waste, Del Rio drain, and the Rio Grande at Mesilla dam, is observed. A comparison is made between this observed flow and the predicted river flow to establish the required water transfer between river and aquifer. If the predicted flow is higher than the observed flow, the model forces a transfer of water from river to aquifer. If the predicted flow is lower than the observed flow, a transfer of water from aquifer to river is required. This exchange mechanism is essential to accomplish the hydrologic balance. When

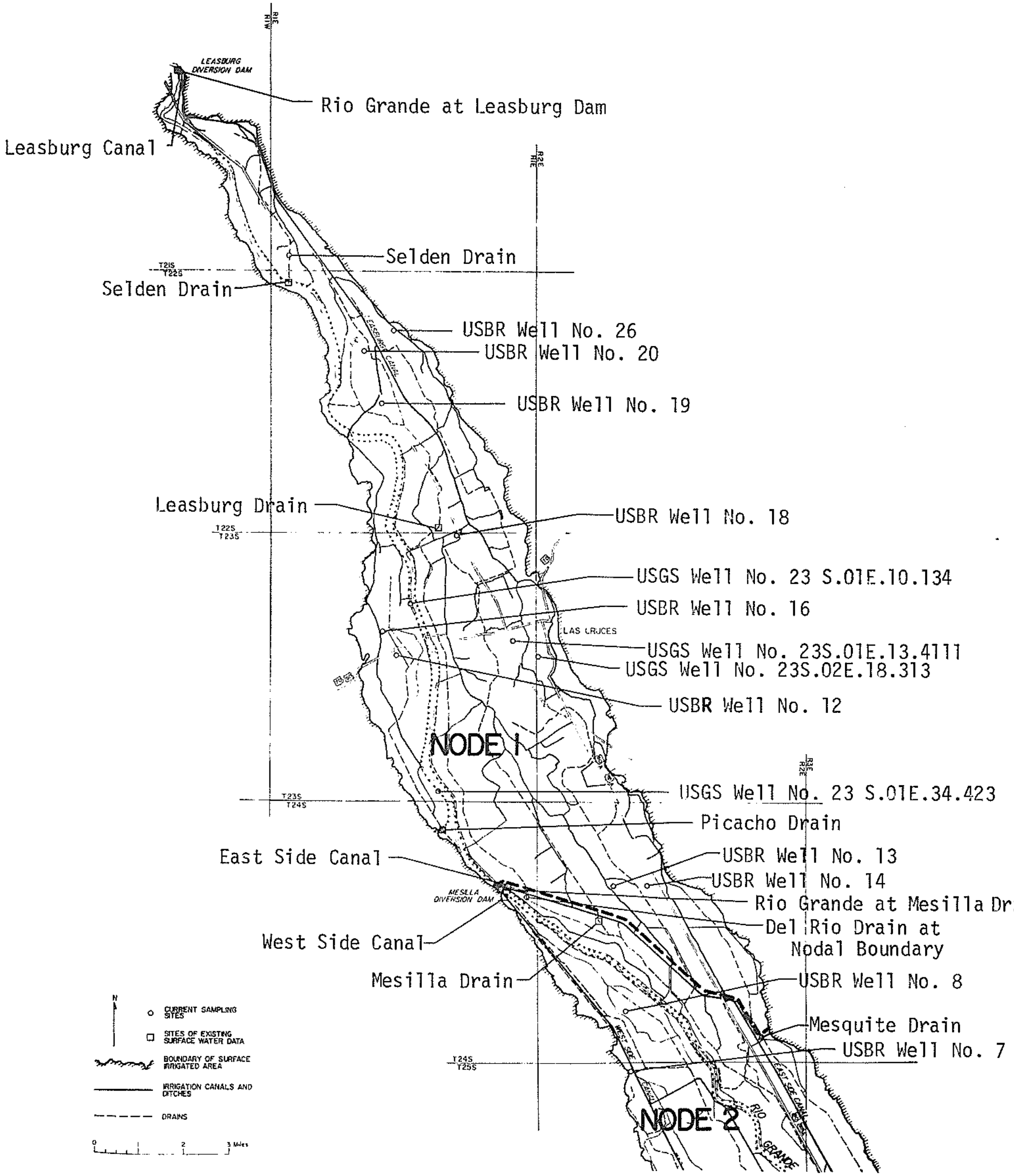


Figure 6a. Location of existing surface data and sampling points.

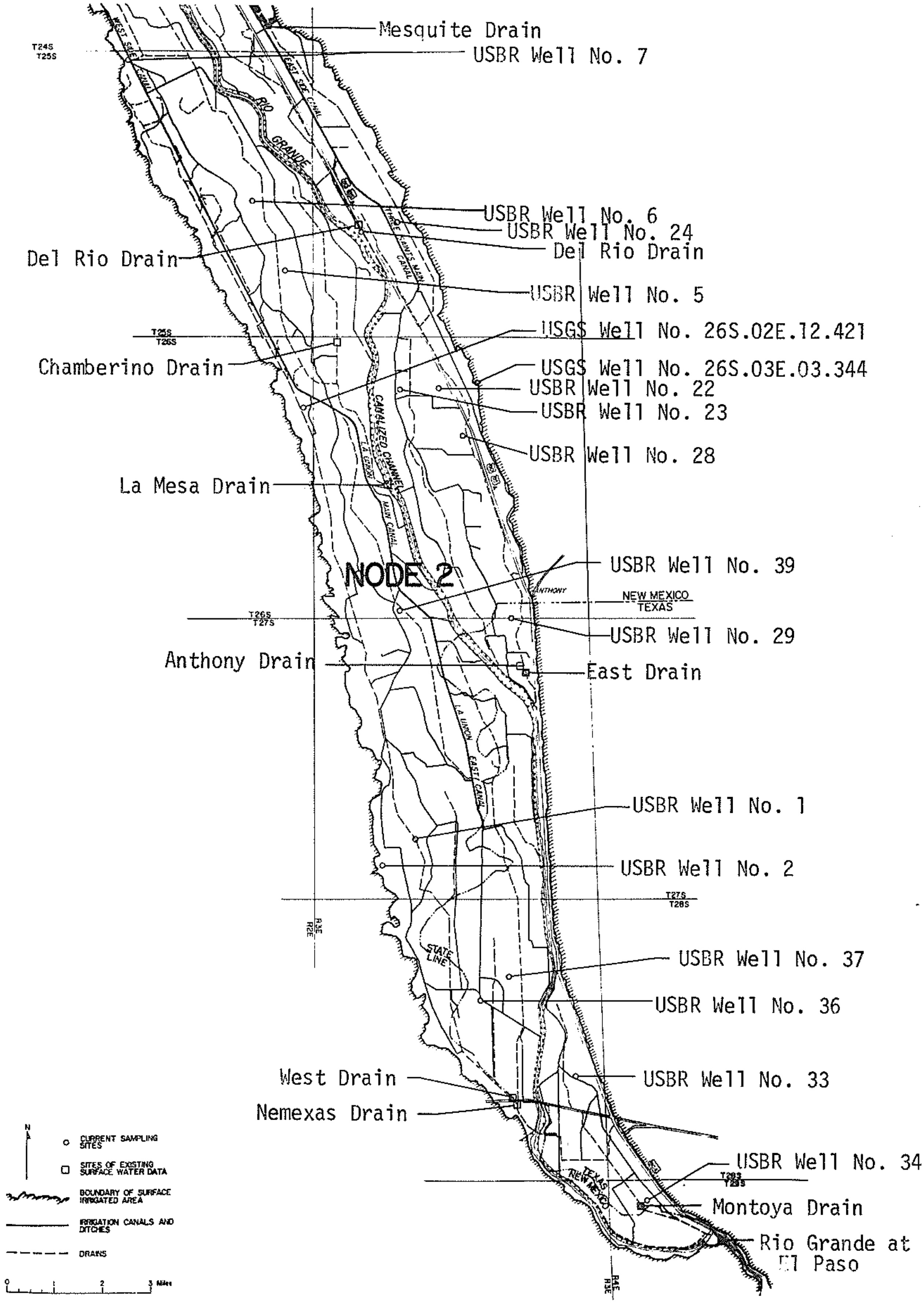


Figure 6b. Location of existing surface data and sampling points.

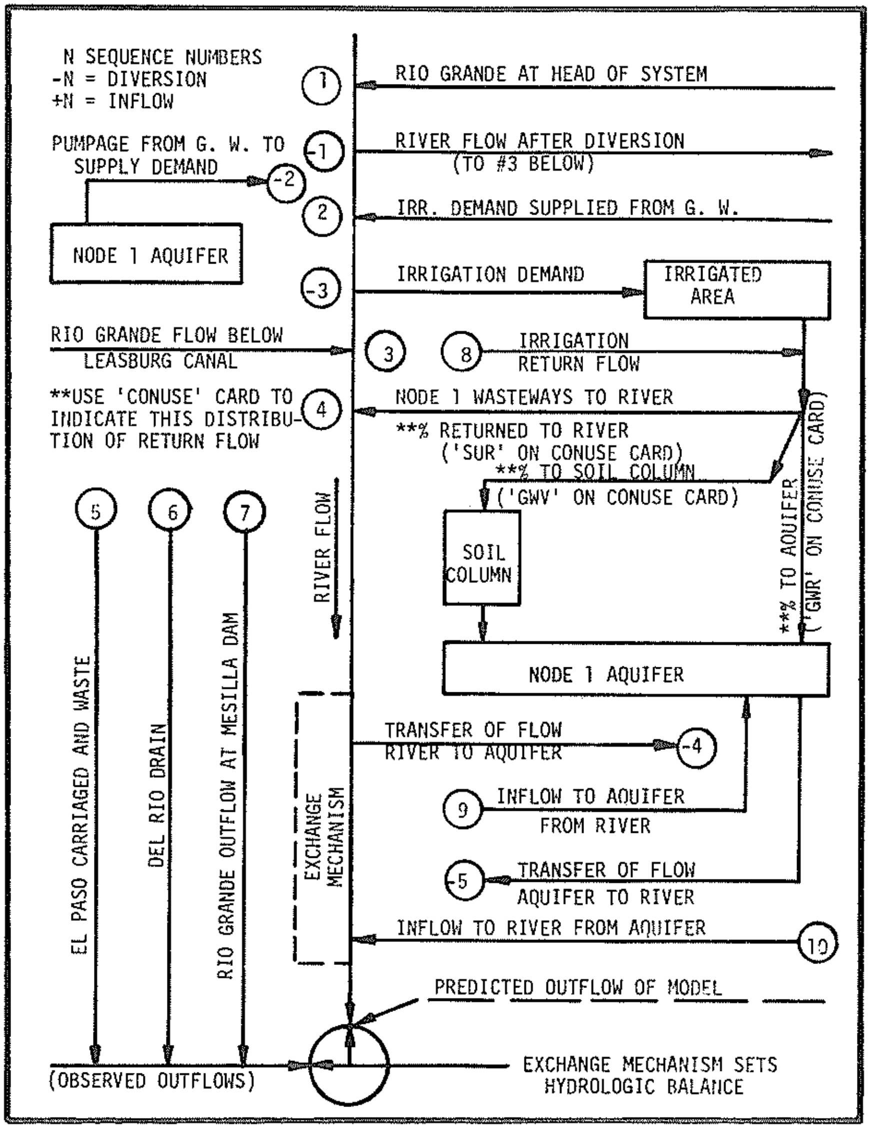


Figure 7a. Mesilla Valley system flow chart--node 1

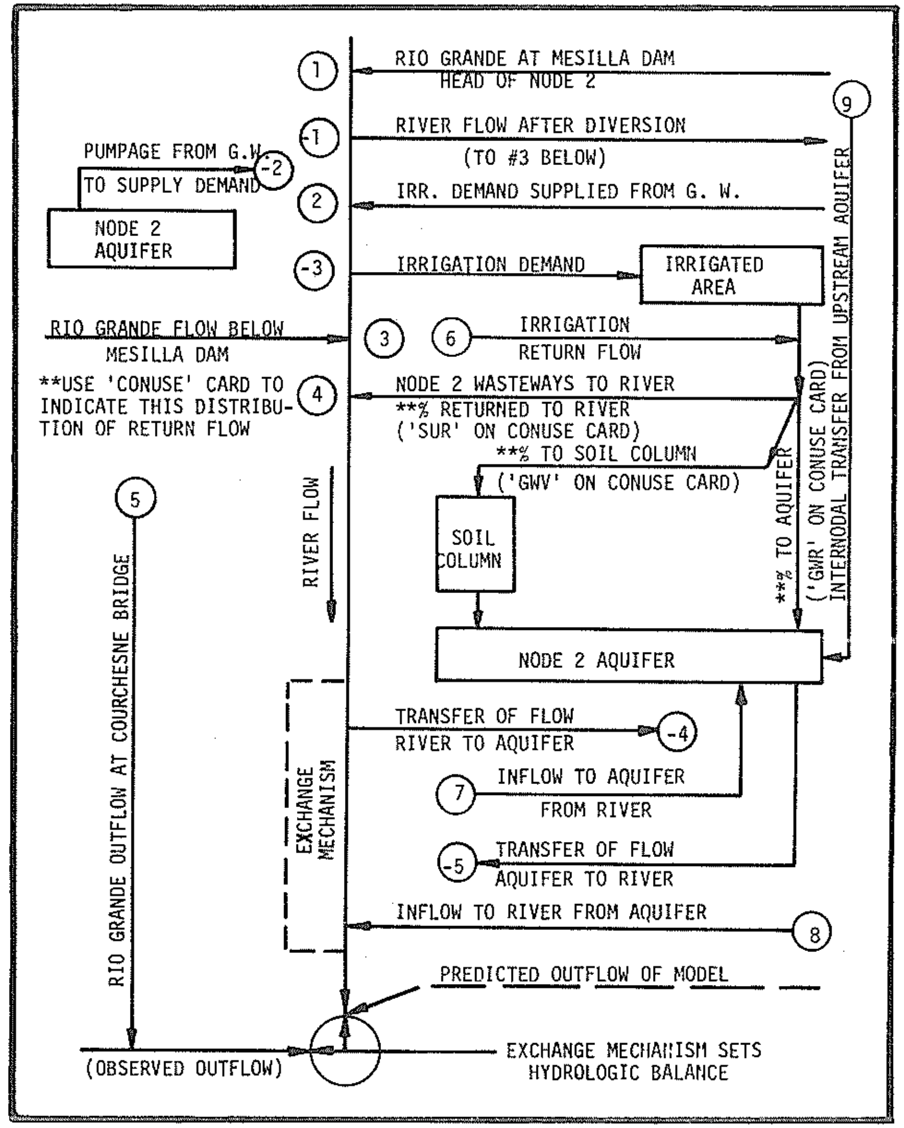


Figure 7b. Mesilla Valley system flow chart--node 2

the exchange is made, the chemical quality of flow is updated simultaneously. Finally, at the end of nodal operation, the model yields flow and its chemical quality.

The monthly input data used to operate the model include: observed river flow at the upstream end of the node and its chemistry, the amount of water diverted at Leasburg, crop consumptive use and irrigation efficiency, data on percentage of return flow going to river and to aquifer, initial aquifer water storage and chemical quality, and observed river flow at the downstream end of the node including flows to and from El Paso carriage and waste, Del Rio drain, and Rio Grande at Mesilla dam, and soil chemistry.

With the input data and the described operational procedure, the model was operated to simulate the monthly response of the Mesilla Valley system. The model response for both nodes in terms of TDS (total dissolved salts) in ppm from July 1967 through June 1968 is shown in Figure 8. The transfer of water between the aquifer and the river is also shown. The observed and predicted TDS differed greatly, especially in node 2; however, the differences are comparable to those found in the Vernal verification study for node 3 (USBR, 1975, Vol. I). The model definitely does not reproduce the observed time history of TDS variation; this same type of discrepancy was found in previous applications of the model. From Figure 8, it is evident that large discrepancies occur when large transfers of water from the aquifer are being forced by the water-balance feature of the model. We suspect that the discrepancies are produced primarily by the transfer of high salinity water from the aquifer to the river. Considering the aquifer parameters, it is difficult to justify water transfers of up to 20,000 acre-feet/month. Model improvements which related the stream-aquifer interaction to the aquifer properties and aquifer water level will be considered in the next year. The input data and a typical output for one month for the Mesilla Valley simulation are given in Appendix M.

The effects of the chemical changes in the soil were also tested in the preliminary runs. Initially, the soil chemistry data for the Vernal study were used to test the functioning of the subroutine SOILCO. The chemical transformations in the soil introduce only very minor changes. We have also made some runs using the preliminary soils data for the Mesilla Valley. These data had very little effect, as is illustrated in Figure 8.

The consumptive use estimates which were used in these preliminary simulations are probably somewhat high, as is discussed in a later section. A relatively high irrigation efficiency of 75 percent was also assumed, so that the actual irrigation requirement is more reasonable. Our experience has shown that the model is quite sensitive to consumptive use and irrigation efficiency. These factors will require careful evaluation in the coming year.

Data Base and Analysis

Existing Date Base

Surface water data for the Mesilla Valley during the last 50 years are extensive, as can be seen from Table 2; data sites are shown on Figure 6. Long-term records of flow rate are available for most parts of the Mesilla Valley, except for the Rio Grande at the Mesilla dam. The latter information would be useful as a water balance check point for node 1, but the data are not required to operate the model. The data on chemical quality are fairly complete for the Rio Grande at the Leasburg dam and at El Paso. A fair portion of the water quality data is either in the form of electrical conductivity or total dissolved solids. The main drains (Selden, Picacho, Del Rio, La Mesa, East, and Montoya) have a long record of flow rates but a short record of water quality (this is usually either electrical conductivity or total dissolved solids). Irrigation diversions (Leasburg, East Side, and West Side canals) have excellent long-term flow-rate records but no

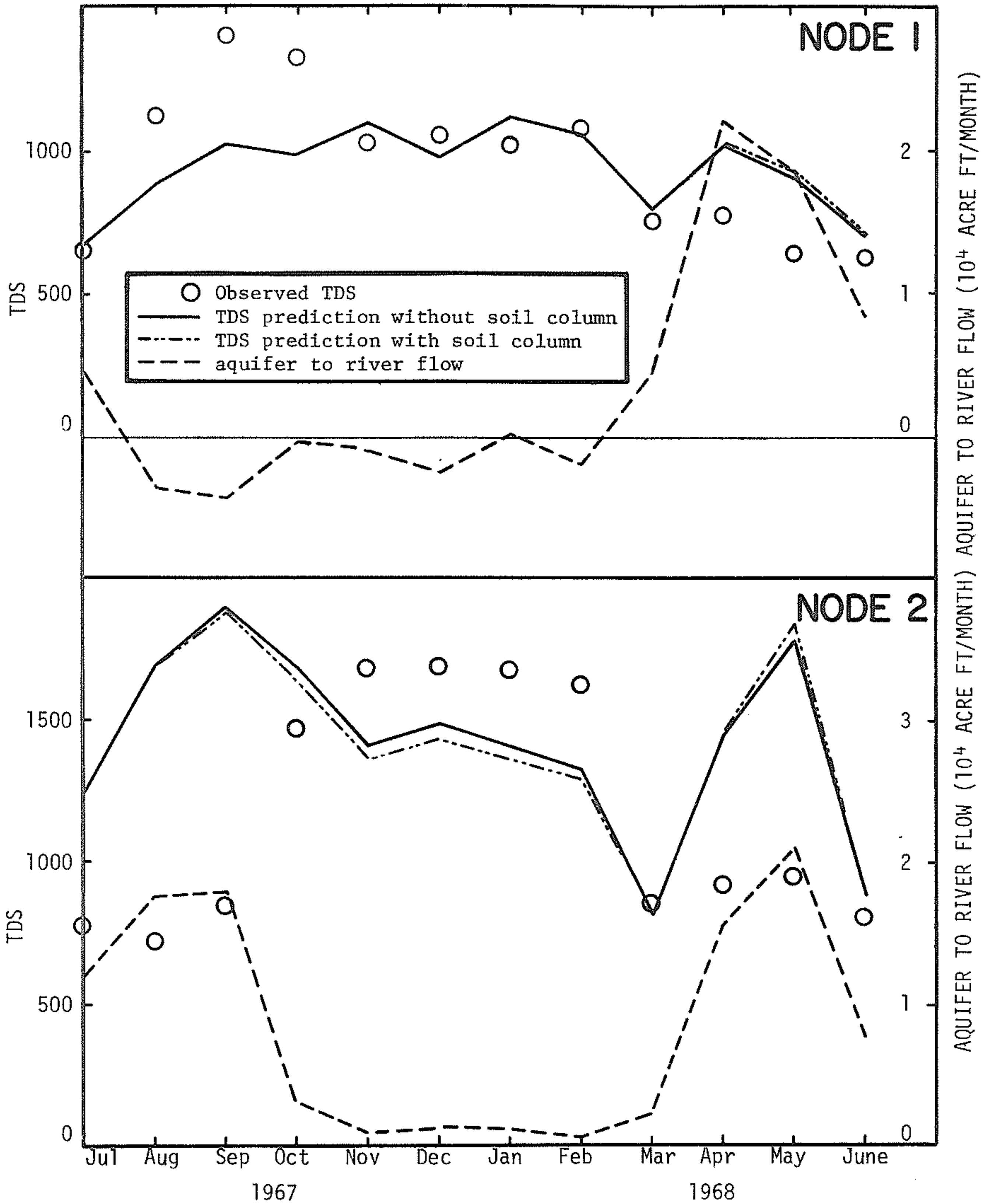
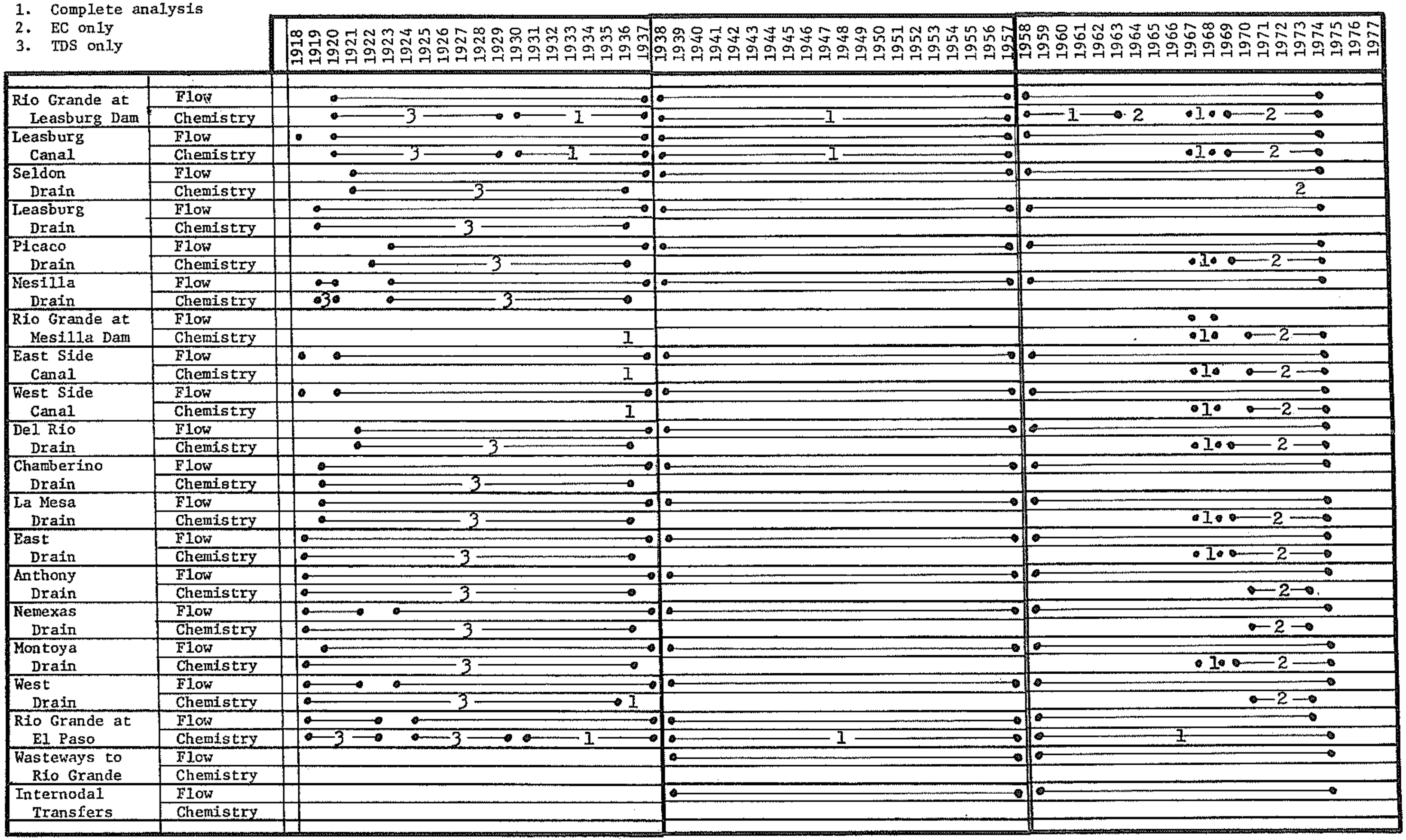


Figure 8. Model predictions for July 1967 to June 1968

Table 2. Existing surface water data

Legend
1. Complete analysis
2. EC only
3. TDS only



chemical records. It is assumed that the Leasburg canal chemical quality is the same as that of the Rio Grande at the Leasburg dam and the East Side and West Side. Canal chemistries are the same as that of the Rio Grande at the Mesilla dam. Agencies that have provided or helped to provide surface water data are the Bureau of Reclamation and the International Boundary and Water Commission, both at El Paso, Texas. Wilcox (1968) and Scofield (1938) were also sources of useful surface water data.

The groundwater data are less complete than the surface water data. The only long-term month-by-month measurements of water levels are done by the Bureau of Reclamation in Las Cruces, New Mexico. They measure water levels in 40 observation wells. The chemical quality of these well waters was measured only once, during late May and early June 1967 (Basler and Alary, 1968). Otherwise the records of groundwater levels and quality are sporadic. Either the well data are not well distributed throughout the valley for any given month or any given well does not have a long continuous month-by-month or year-by-year record. Water level and quality data were obtained from the U. S. Geological Survey branch offices in Las Cruces, New Mexico, and El Paso, Texas, the El Paso Water Utilities Public Service Board in El Paso, Texas, and from the following publications: Basler and Alary (1968), Conover (1954), Judson (1964-1973), Leggat, Lowery, and Hood (1962), King, Hawley, Taylor, and Wilson (1969, 1971), and Richardson (1971).

Estimation of Crop Consumptive Use

The consumptive use of crops in the Mesilla Valley is estimated by the modified Jensen-Haise method (Jensen, Roble and Franzoy, 1970) with the program EVPCOM prepared by the U. S. Bureau of Reclamation (1974). This method first evaluates potential evapotranspiration from air temperature and solar radiation data. By multiplying potential evapotranspiration by a crop coefficient, a specific estimate of evapotranspiration is obtained, and this is the estimated crop consumptive use. The crop coefficient not only varies from one crop to another but also varies for the same crop with the stage of its growth. One modification made in the program was that the crop coefficient was set to zero for the non-growing season; originally a value of 0.15 was used for that period. The temperature and solar radiation data used in computing the consumptive use are from a climatological station at El Paso. The crop consumptive use computed by the Jensen-Haise method for the Mesilla Valley is shown in Table 3. These results are much higher than the commonly accepted estimate of around two feet per year based on the Blaney-Criddle equation (Henderson and Sorensen, 1968; Lansford et. al., 1973). Since the Jensen-Haise method is based on temperature and solar radiation input data from El Paso, it might appear that use of these data to represent the entire valley might cause this difference. Preliminary comparisons with air temperature and solar radiation at Las Cruces from March to October 1973 show only minor differences from the data for El Paso. These differences definitely do not explain the high consumptive use obtained with the Jensen-Haise method. All calculations were carefully checked for error. Furthermore, a few sample calculations were made for June and November 1973 with data for the Elephant Butte Irrigation District (USBR, 1974). These Jansen-Haise estimates of evapotranspiration were also higher than those usually reported. The Jensen-Haise method was used by the USBR (1974) for these data, and they found lower values than we obtained. For those results, the implicit values of the parameters which were used in the Jensen-Haise equation are drastically different than those given by Jensen, Roble and Franzoy (1970) and used in the EVPCOM program. Obviously the method of estimating consumptive use will require thorough re-evaluation using lysimeter data and actual soil-moisture observations (USBR, 1974). Considering the highly empirical nature of the Jensen-Haise method, it may be appropriate

Table 3. Crop consumptive use (acre-feet/acre) Mesilla Valley based on the Jensen-Haise method for computing evapotranspiration, using daily mean temperature and solar radiation for El Paso, Texas

	1967	1968
JAN	.008	.008
FEB	.006	.007
MAR	.146	.036
APR	.218	.168
MAY	.326	.328
JUN	.374	.362
JUL	.709	.639
AUG	.770	.759
SEP	.664	.632
OCT	.452	.457
NOV	.001	.106
DEC	.001	.001
TOT EVAP	3.675	3.503
TOT CROPPED ACRES	74662.	82820.

to calibrate the simpler Blaney-Criddle method which requires only monthly temperature. This method could then by used to estimate consumptive use in the period prior to 1952 when solar radiation data are lacking.

Sampling Program

The current sampling program emphasizes groundwater quality. Water samples are taken from at least 25 shallow two-inch diameter observation wells which are maintained by the USBR or the USGS; locations of these wells are shown in Figure 6. The wells are sampled using a one-pint bailer and are bailed at least 20 times before a sample is taken to assure that aquifer water is being obtained. A small sampling pump which operates on a 12-volt auto electrical system has also been used in sampling some wells. This system has been unreliable because of leaks in the suction lines. Improvements in the check valve are planned. Water levels are measured in each well before it is bailed. Electrical conductivity and temperature are measured in the field.

Surface water samples are obtained at 10 locations as shown in Figure 6; electrical conductivity and temperature are measured on site. The water samples are analyzed by the soil and water testing lab at NMSU; laboratory analyses include conductivity, pH, Mg, Na, K, Ca, Cl, HCO_3, CO_3, and SO_4. A few check samples are also analyzed at the water chemical laboratory of the Bureau of Mines and Mineral Resources at New Mexico Tech. Some systematic differences (up to 20 percent) between some of the analyses of individual ions from the two laboratories have been found. Additional check analyses are planned, and on-site measurements of pH, HCO_3 and possibly dissolved CO_2 will be used to improve the chemical analyses.

There were two on-going studies which will compliment the data base for the current project. A USGS study, directed by C. A. Wilson at Las Cruces, is providing new field information on groundwater conditions, especially in the Santa Fe formation which underlies the shallow alluvial aquifer. The work involves drilling, geophysical logging, test pumping, and water-quality sampling for several wells a few thousand feet in depth. The results will be helpful in estimating the depth of the alluvial aquifer and the interchange of water between the shallow and deep aquifers. Another study sponsored by the U. S. Bureau of Reclamation and directed by Dr. John W. Hernandez at NMSU includes monitoring of surface water quality at 15 locations on drains and the river in the Mesilla Valley. This project involved sampling at five times during 1975; complete water analyses included trace metals, pesticides, oxygen demand, and coliform bacteria.

Data Analysis

The Theissen polygon method was used to estimate the initial values of aquifer volume and the average chemical quality for each node. This method was chosen because it yields fixed weighting factors for a given configuration of wells. A description of the method is found in Linsley, Kohler, and Paulhus (1975). The data for the aquifer initial chemical conditions came from the Basler and Alary (1968) report. They obtained this data during late May and early June 1967, from 40 U. S. Bureau of Reclamation observation wells located in the Mesilla Valley. Since this report contained the only comprehensive set of chemical analyses for the entire valley, it was chosen for the determination of aquifer initial conditions.

The initial storage in the alluvial aquifer was estimated, using the observed depth to water in the observation wells weighted according to the factors determined from the Theissen polygons. The base of the alluvial aquifer was taken to be 80 feet below the ground surface and a specific yield of 20 percent was used to calculate the storage in the aquifer. Figure 9 shows a water table contour map prepared from the observed water levels for May to June 1967; maps of this type are also being used to estimate the volume of water in the aquifer. Maps showing concentration contours will be used to obtain another estimate of the average concentration in the aquifer. Figure 10 shows iso-concentration of dissolved solid for the Basler and Alary (1968) data, and illustrates the high degree of spatial variability which is typical of groundwater quality data.

The transmissivity of the shallow alluvial aquifer is an important parameter which controls the stream-aquifer interaction. The transmissivity can be estimated from base flow recession curves for drains which collect groundwater. Figure 11 illustrates a typical recession curve which shows an exponential decrease in flow after the irrigation season. The annual pattern of water level fluctuations in a nearby observation well (Figure 11) parallels that of the drain flow, thus indicating that the flow recession is directly related to leakage of water from the aquifer. Using the slope of recession curve in a development by Gelhar and Wilson (1974) (Eq. 15), we have estimated the transmissivity to be 5,000 ft^2/day if the average drain spacing is 4,000 feet and the specific yields are 0.20. This compares with a transmissivity 15,000 ft^2/day found by Conover (1954) from pumping test; the difference is probably related to the local convergence of the flow near the drains. Our value is more appropriate for purposes of estimating flow from the aquifer to the surface water. Data collected by the USGS on the drawdown in irrigation wells will also be used to estimate transmissivity from the specific capacity of the wells. The information on transmissivity will be important when we modify the model to provide for a more realistic aquifer-river exchange mechanism.

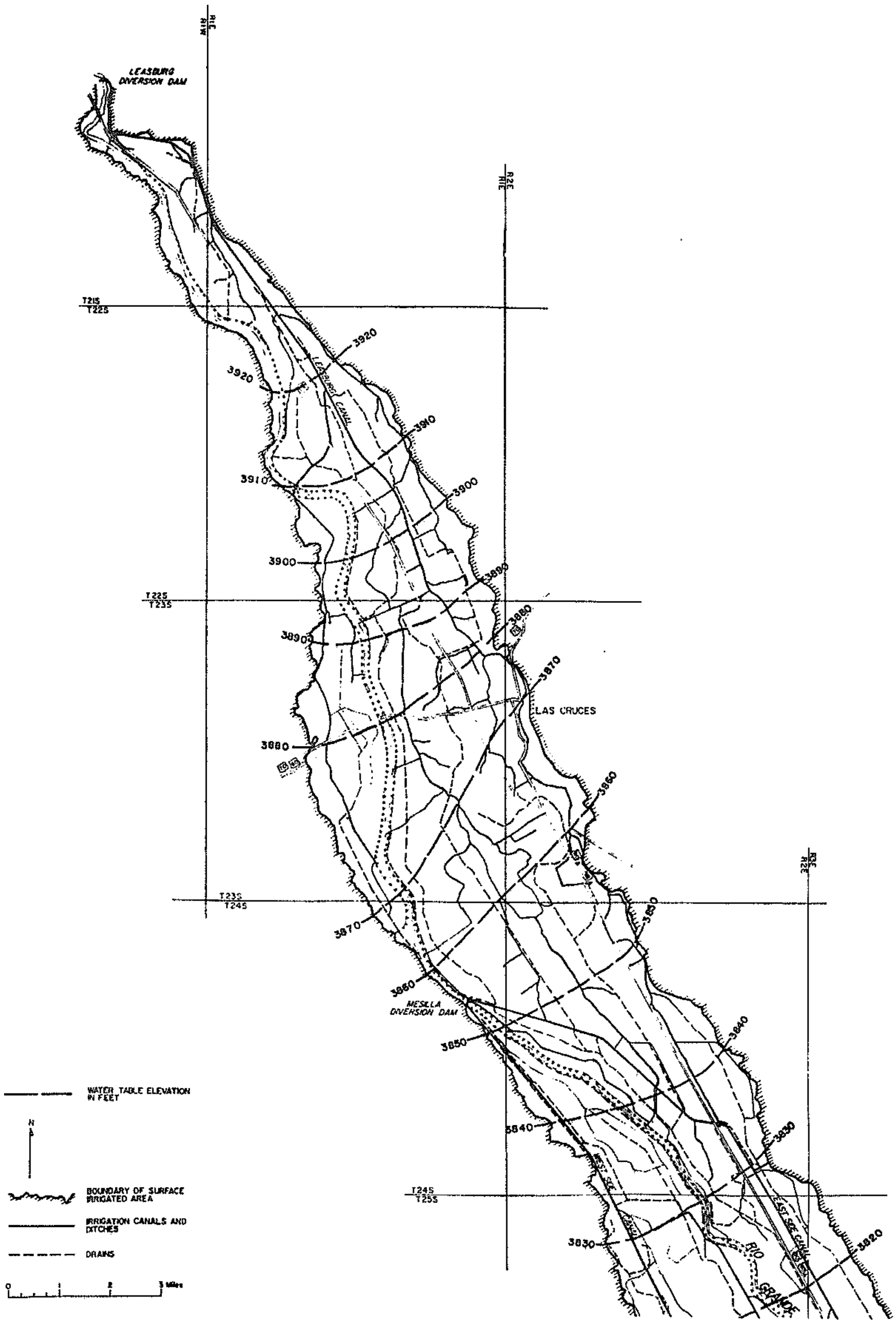


Figure 9a. Water table contour map for the May-June 1967 period, northern portion of Mesilla Valley

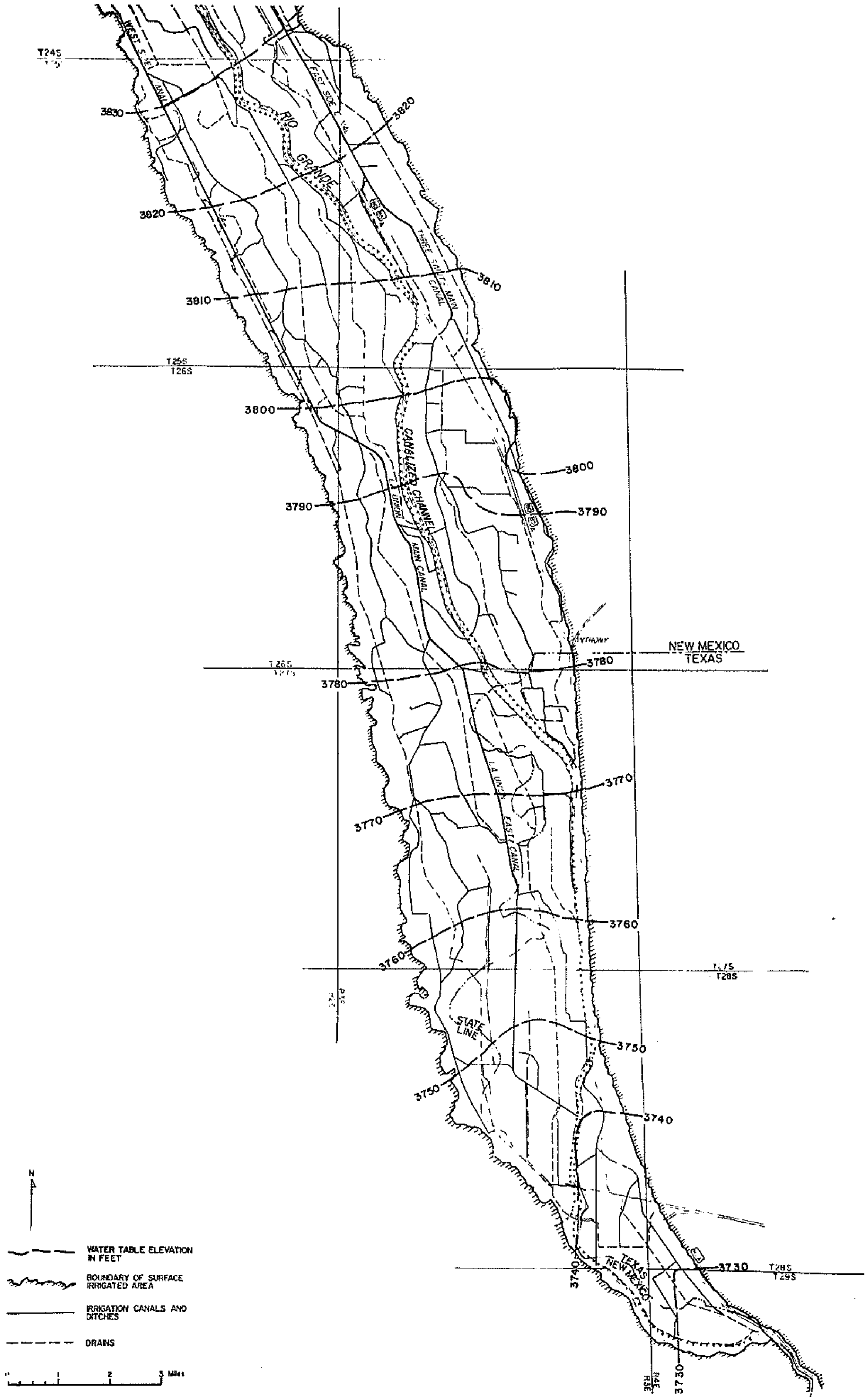


Figure 9b. Water table contour map for the May-June 1967 period, southern portion of Mesilla Valley

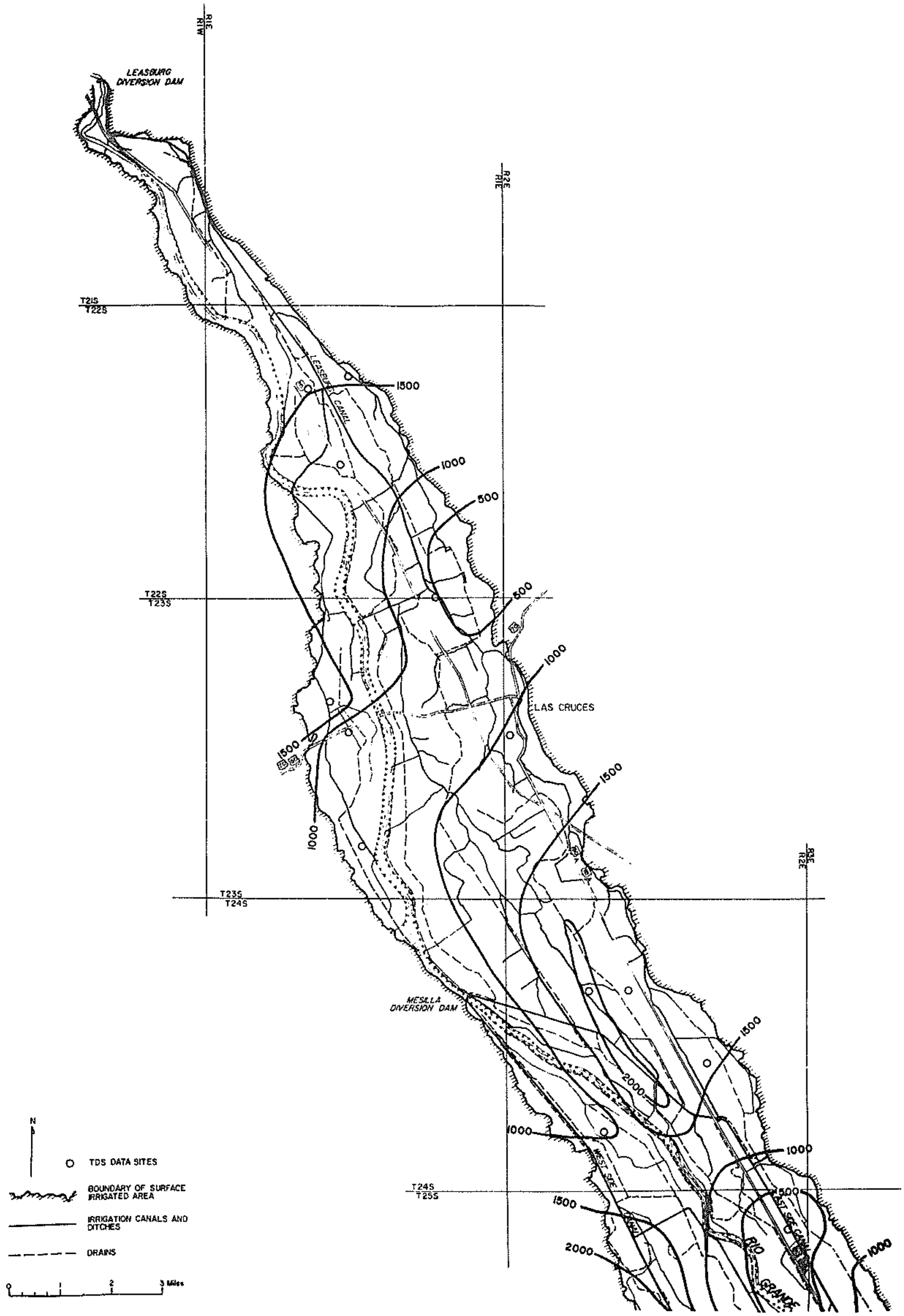


Figure 10a. TDS contour map in ppm for the May-June 1967 period, northern portion of the Mesilla Valley

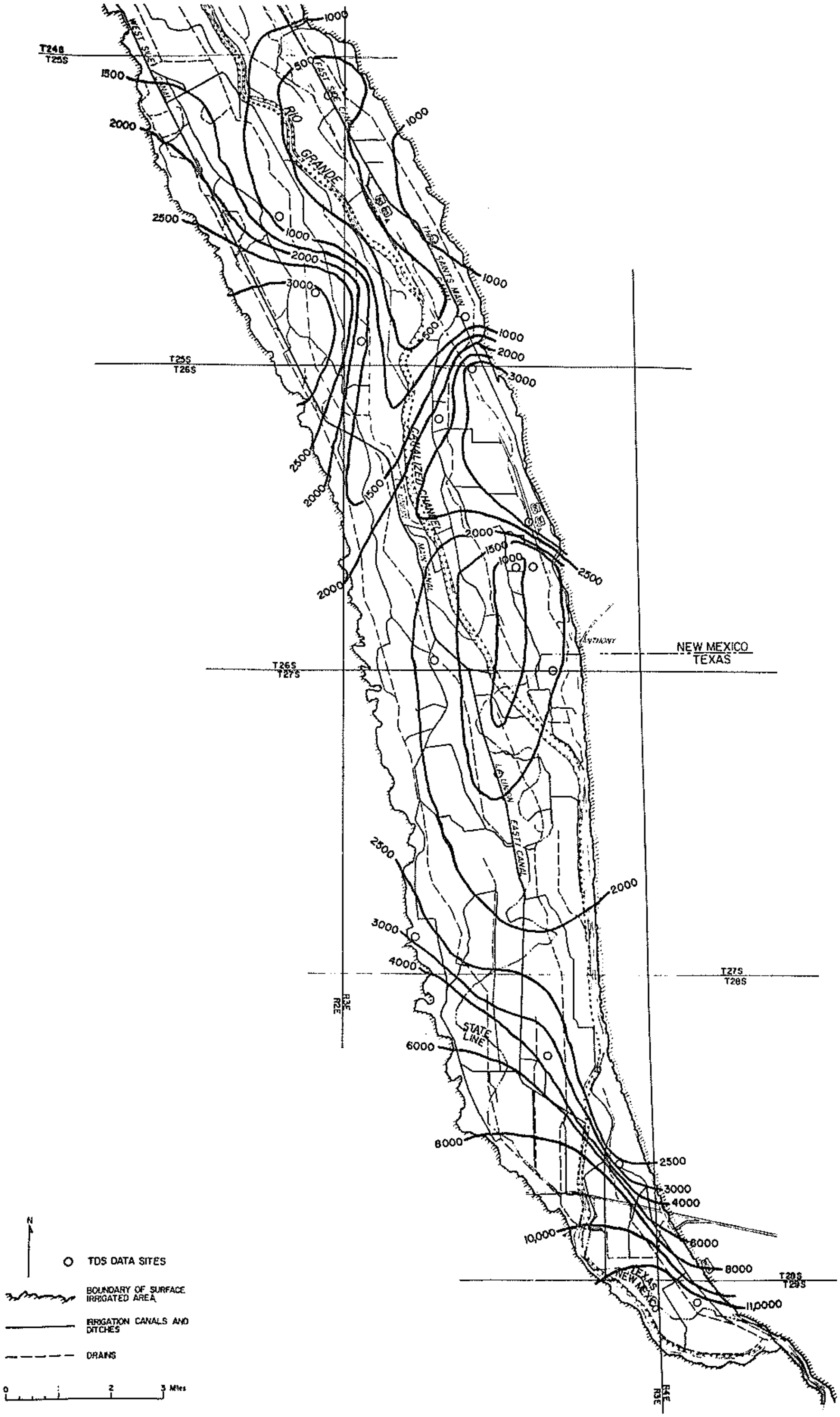


Figure 10b. TDS contour map in ppm for the May-June 1967 period, southern portion of the Mesilla Valley

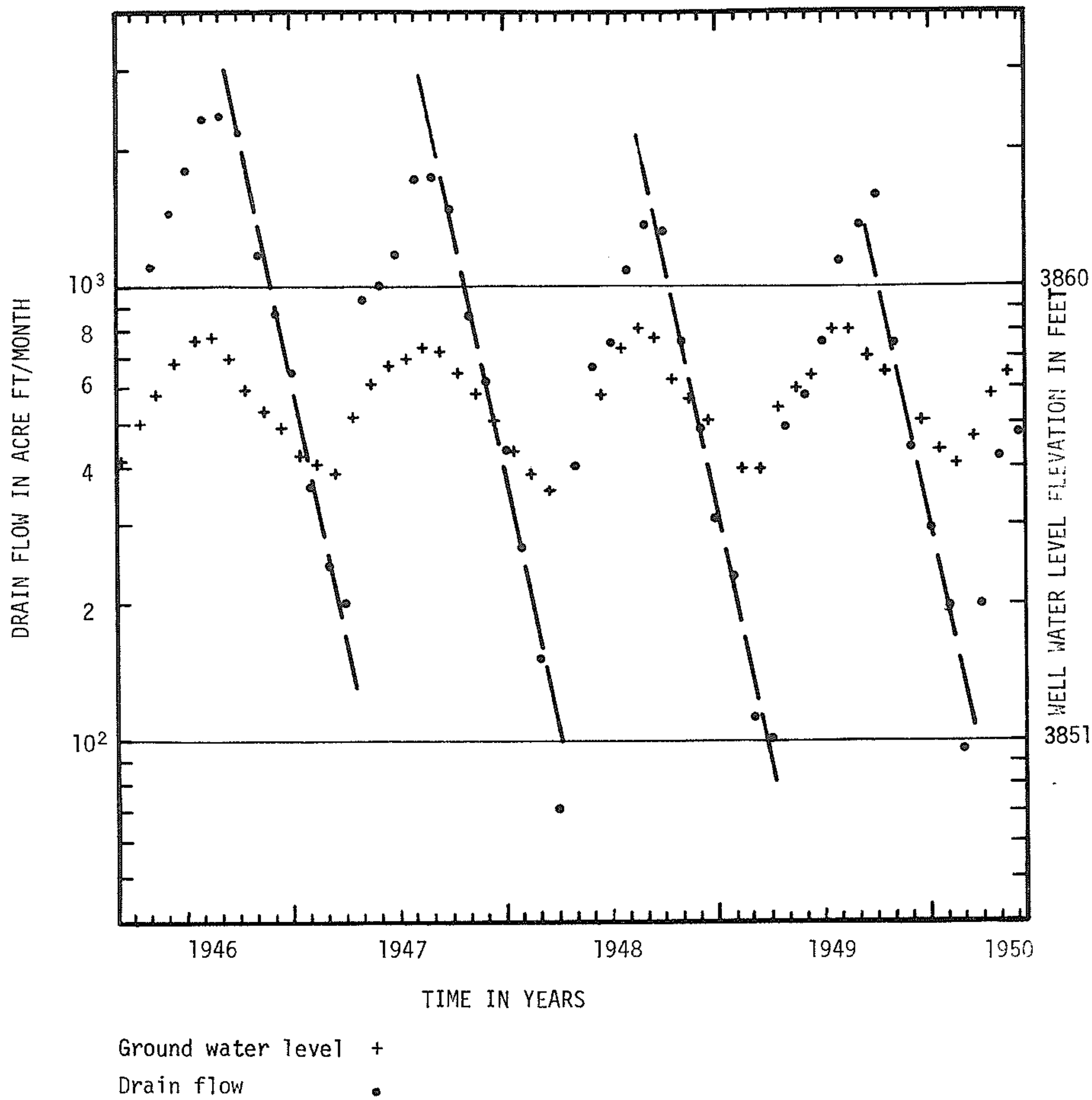


Figure 11. Groundwater level (BR observation Well 13) and drain flow recession curves (Mesilla drain) for February 1946 to June 1950.

Summary and Plans

The experience with the USBR-EPA simulation model demonstrates the difficulty of routine application of large and complex computer-programs even when the model is designed to be general and flexible. This model is actually computer- and site-specific; a new subroutine must be prepared for each application and this requires substantial knowledge of the logic of the entire program.

The preliminary simulation results for the Mesilla Valley indicate a need to improve the input data and model structure. Several sensitivity analyses will be conducted with the model in its current preliminary form; the effects of water use, soil chemistry, and groundwater-surface water transfers are of special interest. The scheme currently 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. Improvements which relate the stream-aquifer interaction to aquifer properties and water level (see Gelhar and Wilson, 1974) will be incorporated after the model has been tested in its current form. Baseflow recession and well drawdown data will be used to estimate the required aquifer parameters.

The consumptive use estimates from the USBR EVPCOM program will require careful re-evaluation. The current results, which are based on the well established Jensen-Haise equation, are substantially higher than commonly accepted values for the area. Lysimeter data and results from current water-use studies will be used in this evaluation.

Generally the existing data base will provide adequate input for some long-term simulations beginning as much as 50 years ago. Even though approximate, these simulations can provide important insight on the long-term changes of irrigation return-flow quality. Data on groundwater quality and pumpage are very limited; no continuous long-term groundwater-quality records have been located, and systematic pumpage information is lacking. The current USGS study on groundwater resources of the valley may provide some data on pumpage which should be useful in testing the groundwater transfer in the models. The emphasis of our current sampling program is on groundwater quality. We are planning to maintain the same sampling network and improve the analysis procedures by using field analyses for some of the ions.

FIELD PLOT DEMONSTRATION

Among the goals of this segment of the project are to provide estimates of parameters required to estimate evapotranspiration from climatological data (for input into an areal hydrosalinity model of the Mesilla Valley); collect, report, and interpret soil-salinity data from under several irrigation management schemes; monitor and report the salinity levels of a nest of test wells on the research area; monitor and report flow rates and water quality of the Del Rio drain at two locations; and provide soils data and interpretation for the hydrosalinity model.

The original plan for cropping sequence was to seed spring wheat February 1975; follow it with a short-season grain sorghum (June 1975-October 1975); then proceed with a spring barley (November-April); cotton (May-November) rotation for the remainder of the project. This intense rotation should allow for better plant disease and pest control and provide more irrigation cycles (faster soil-salinity profile development).

Spring Wheat, Water Use and Yield

The Mexican spring wheat cultivar, Cajame, was seeded with one-row planters by hand February 18, 1975, at a rate of 143 seeds/m^2 (13.3 seeds/ft. of row, at a row spacing of 12 in). The seedlings emerged March 8. The plots were fertilized April 15 by hand broadcasting 112 kg/ha of N, 224 ka/ha of P_2O_5. The wheat headed May 16 and was harvested June 24.

The following data were taken: (1) heads/ha; (2) seed index (wt of 1,000 seeds); (3) dry matter (air-dry); (4) seeds/head; (5) consumptive use from neutron readings; (6) irrigation water applied; and (7) rainfall (0.74 cm total for season) (see Appendix N).

Two methods were used to estimate the wheat's water use, the "neutron method" and the "budget method." The neutron method consisted of estimating a smooth curve through soil-water depletion data (obtained from neutron readings taken twice weekly). Using the smooth curve as an overlay, neutron data were extrapolated to the days of irrigation to estimate both the initial water in the profile and the total amount remaining in the profile after irrigation. An example of this interpolation-extrapolation technique is shown in Figure 12. Also shown in Figure 12 is the actual amount of irrigation water applied. The differences between the amount applied and the neutron accountable water are great. Under the budget method, crop water use was estimated as total water applied and the change in soil water storage (from neutron probe data). The estimates obtained with the "budget method" and the "neutron method" are presented in Table 4.

Water use estimates obtained with the two methods were statistically compared with simple linear regression. With the budget method as the dependent variable, this resulted in the following regression equation:

Budget method = 1.30 + 1.54 x (neutron method)

$r^2 = 0.72$,

$F_{(1,24)}$ value = 62.1, and a standard error of the estimate = 4.7.

These regression results hint at a systematic error of some type. It may be that having the neutron pipe at the same point for four consecutive seasons may have resulted in compaction and/or reduced infiltration in the immediate vicinity of the neutron pipe. Whatever the source of the discrepancy, it does not appear to be random.

A high degree of positive intercorrelation among the yield components was found, and whatever increased one tended to increase the others (see Appendix N). The positive correlation coefficients were believed to be partially attributable to (1) early spring winds that drove sand across the plots and damaged the wheat seedlings, and (2) water standing on the plots after irrigation for more than just a few hours that appeared to reduce tillering (heads formed/ha) appreciably. The less the plant stress, the higher were all the yield components.

Water-use estimates obtained by the budget method regressed against grain yield resulted in the following predictive equation:

Budget method = 26.5 + 0.011 (yield kg/ha)

$r^2 = 0.50$,

$F_{(1,24)} = 23.7$

These results indicate that increasing yield by 1,000 kg/ha would require 11 cm of irrigation water. Whereas when water use by the neutron method was regressed against grain yields resulted in:

Neutron method = 19.77 + 0.0047 (yield ka/ha)

$r^2 = 0.29$,

$F_{(1,24)} = 9.93$

for a water-use predictive equation.

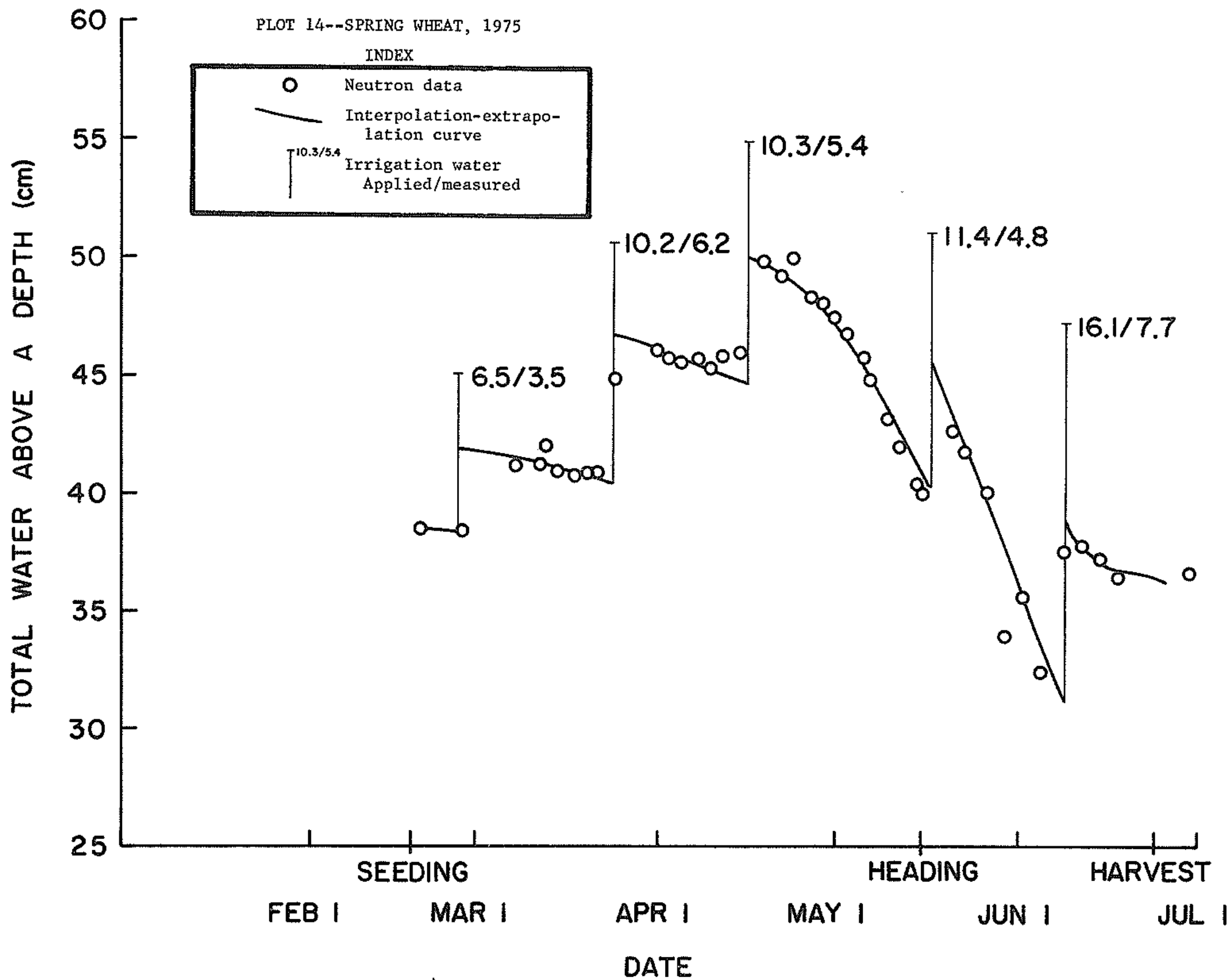


Figure 12. Example of interpolation and extrapolation of neutron data to estimate total water in the soil profile before and after irrigations, Plot 14, NMSU Plant Science Center, 1975

Table 4. 1975 Cajame spring wheat and soil-water data

Plot No.	Start[a]	End[b]	Applied[c]	Neutron[d]	Use[e]	Neutron Use[f]	Dry Matter	Grain Yield
	(cm)						(kg/ha)	(kg/ha)
1	32	23.73	21.86	11.2	30.13	19.47	3160	976
2	33.44	24.04	27.76	14.8	37.16	24.2	3300	836
3	37.14	28.75	35.85	18.8	44.24	27.19	4740	1480
5	38.16	34.25	52.83	25.4	56.74	29.31	5310	1750
6	39.55	28.51	37.3	15.9	48.34	26.94	5920	2310
7	35.05	14.77	24.6	13.9	44.88	34.18	2660	650
8	37.5	29.15	33.73	17.8	42.08	26.15	4200	1160
9	46.12	36.5	34.5	15	44.12	24.62	5460	1880
10	39.8	41.24	53.92	31.3	52.48	29.86	6100	1750
11	31.4	26.56	38.94	20.8	43.78	25.64	4380	1390
12	35.96	30	24.23	13.3	30.19	19.26	3020	790
13	38.32	31.97	35.69	19.6	42.04	25.95	4420	1360
14	38.75	36.5	56.88	27.6	59.13	29.85	6530	2170
15	34.26	35	57.05	31.3	56.31	30.56	6930	2470
16	33.5	28.57	34.99	20.3	39.92	25.23	4740	1630
17	35.28	29.05	38.96	22.1	45.19	28.33	4380	1360
18	37.76	28.5	24.38	13.6	33.64	22.86	3230	950
19	46.6	32.5	21.22	10.7	35.32	24.8	4520	1200
22	54.24	44	25.31	11.5	35.55	21.74	2870	1670
23	56.65	48.25	28.35	16.1	36.75	24.5	2800	761
24	52.5	42.38	20.92	10.2	31.04	20.32	2510	312
25	81	74.64	21.93	11.6	28.29	17.96	3270	976
26	69.16	56.93	22.57	12.7	34.8	24.93	2510	905
27	45.48	39.6	26.04	13.4	31.92	19.28	2440	689
29	56.45	46.7	24.95	14.2	34.7	23.95	3410	2050
30	42.71	32.73	24.52	11.2	34.5	21.18	3520	1220

[a]Total water above 150 cm on seeding date

[b]Total water above 150 cm on harvest date

[c]Total water applied to plot during growing season

[d]Amount of applied water accounted for by neutron probe measurements

[e]Water use estimated by budget method

[f]Water use estimated by neutron method (see text)

This discrepancy between the neutron method and the budget method will be discussed further in the lysimeter and neutron probe testing section of this report.

New Field Plot Layout

The plan was that following the Cajame wheat harvest a short-season sorghum would be sown, but it was found that the plastic and wood plot boarders had deteriorated beyond use, so the sorghum rotation was cancelled and the old boarders were removed. Rather than replace the boarders with the similar materials, a new plot layout was designed and constructed.

It can be seen in Figure 13 that each new plot lies over two old plots and that one plot number per replication has been deleted (numbers 10, 20, and 30). Table 5 presents a list of new plot numbers and treatments with the list of old plot numbers and treatments.

The new irrigation frequencies and amounts roughly parallel old ones. The amounts listed are tentative; they were selected as starting values and may be readjusted. The general purpose was to provide a range of treatments from definitely too dry and definitely too wet. With the

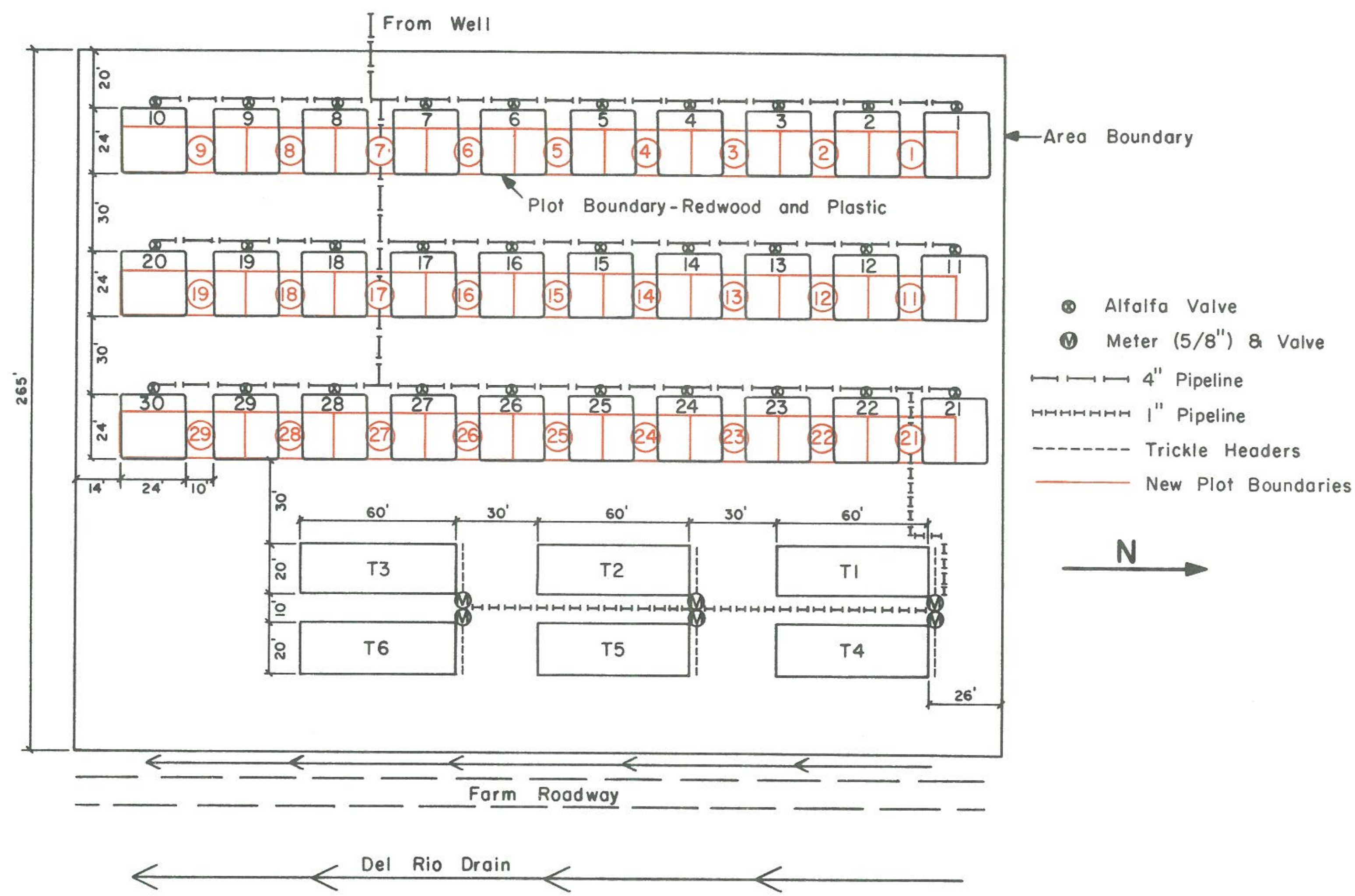


Figure 13. Layout of experimental site with the numbering system for new and old plots.

Table 5. Former treatments on the site with new proposed treatments for the site

Treatment Number	Former Plot Numbers	Former Treatments: Depletions	Former Treatments: Efficieny	New Plot Numbers	Proposed Treatments: Depletions	Proposed Treatments: Rate
		%	%		%	(in/day)
1	2, 14, 29	25	80	2, 14, 28	7	0.3
2	5, 20, 25	50	80	4, 19, 25	14	0.3
3	6, 16, 21	75	80	5, 16, 21	21	0.3
4	10, 18, 24	25	90	9, 18, 24	7	0.2
5	1, 15, 30	50	90	1, 15, 29	14	0.2
6	3, 11, 23	75	90	3, 11, 23	21	0.2
7	9, 12, 26	25	100	8, 12, 26	7	0.1
8	8, 17, 27	50	100	7, 17, 27	14	0.1
9	7, 13, 22	75	100	6, 13, 22	21	0.1

large variability in soils on the site, the choice lay between a large number of replications to detect differences among slightly different treatments and a wider range of treatments to fewer replications. The latter course was chosen, as is shown in Table 5.

Collection of Climatic and Crops Data

The following climatic data were collected on a daily basis at the NMSU Plant Science Farm: maximum and minimum temperatures, wind speed, income solar radiation, and open-pan evaporation (Class A). These data are in Appendix F.

Lysimeter, Flowmeter, and Neutron Probe Calibration

In the spring of 1975, eight vacuum lysimeters of the Duke and Haise type were installed. The lysimeters consist of a sheet-metal box, 15 cm wide, 20 cm high, and 150 cm long, open on the top, with filter candles lying on the bottom of the box. As water percolates through the soil profile, the water is intercepted by the box and extracted with suction through the filter candles. The intercepted solution is collected in containers and brought to the laboratory for analysis.

The lysimeters were installed as follows: (1) an excavation pit was dug with a back hoe to the desired depth; (2) a horizontal rectangular tunnel large enough to hold a lysimeter was driven into the face of the pit; (3) the lysimeter was packed with sand from the excavation and then was slid into the tunnel on a reinforced rubber pillow; (4) the supporting rubber pillow was inflated, forcing the device against the tunnel ceiling and maintaining hydraulic contact with the overlying non-disturbed soil.

The first problem encountered was keeping air in the supporting pillow. Replacing the air with water merely slowed the leakage rate. An attempt will be made to keep the device in hydraulic contact with the surroundings by packing soil under the lysimeter and abandoning the pillow concept.

In October 1975, a large filter candle (4" length x 2" O.D.) was bonded to 1 1/2" OD PVC pipe and placed in a bored hole under plot 1. Hydraulic contact between the candle and the surrounding subsoil was formed by packing soil from the hole around the candle assembly. Packing was accomplished by sliding a larger piece of PVC pipe over the candle-pipe assembly and stroking gently as back filling took place. Soil water samples were obtained almost immediately upon application of suction. This experiment was considered so successful that large suction candles will be installed under all the plots. The soil solution samples obtained from both lysimeters and suction candle were clear under suction but became cloudy within minutes after exposure to the atmosphere. The cloudiness was probably due to the precipitation of calcium carbonate salts as the carbon dioxide effervesces.

The precipitate does not affect use of the suction samples for estimating return-flow quality, since this precipitation would happen upon exposure of the solution to air at the drain. But the precipitation of the salts before chemical analysis does complicate estimating salt balance under the various irrigation treatments.

At the end of the first season, pH and EC sensors will be installed so that these variables can be estimated before the samples are exposed to the atmosphere. When pH and EC are known for the real solution, the concentrations of the various salts can be calculated from equilibrium chemistry.

Since the neutron probe is known to be sensitive to the soil in which it is being used, calibration standards were constructed from 15-gallon galvanized cans. The standards were made up from a large well-mixed sample of the soil surface layer. The soil was ground to pass a 2 mm sieve and divided into equal piles, each of which was brought to a different water content to provide a wide range of water contents.

While the soil was being packed, subsamples were taken to determine gravimetric water content (dried at 105° C). The galvanized containers were sealed to form a permanent set of soil-moisture standards. In addition to these four moisture standards, three permanent plastic standards from the Troxler Corp. were also used. To compute the actual calibration curve, a straight-line regression was fitted to the calibration data. The results of this regression were:

$$\% \text{ water by volume} = 41.10\ (CR) - 1.76$$

Where CR is the ratio of neutron counts in the sample to that in the standard shield.

Trickle Plots

The trickle plots (Figure 13) were seeded to Cajame spring wheat February 18 and watered up. Shortly after seeding, the drip system became clogged with an organic substance (believed to be algae) and became inoperative. The trickle system was replaced with the newly marketed, plastic-impregnated paper "porous hose" [trade name Via Flow from Dupont]. After the early-season sand storms, the porous trickle lines were found to be so badly perforated that the distribution of irrigation water was inadequate. New lines were ordered but did not arrive before the wheat was severely damaged by drought.

Del Rio Drain and Test Wells

The experimental details of the test wells and the Del Rio drain installations were described by Wierenga (1975). The monitoring he reported has been continued. The results are presented in Appendix N.

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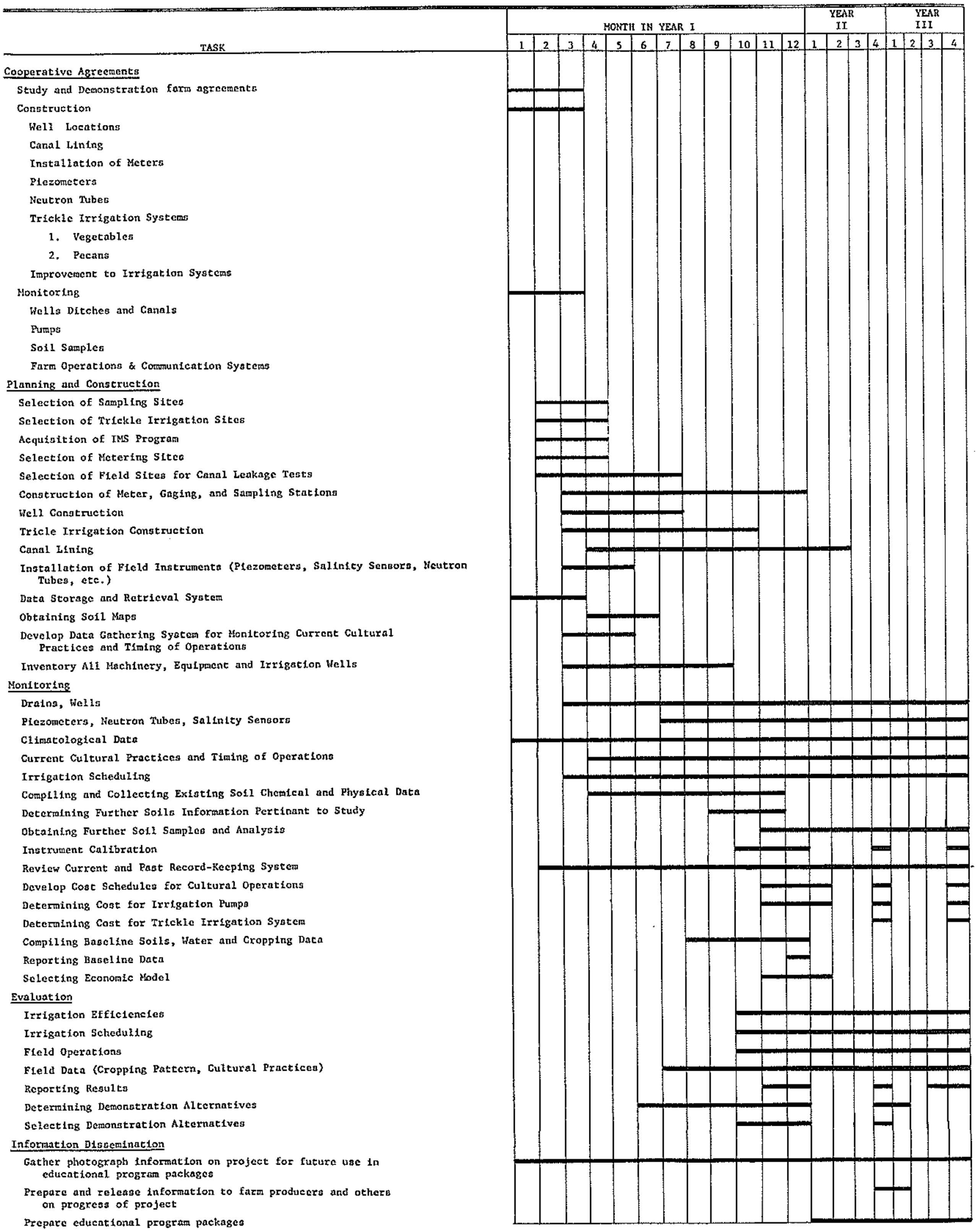
APPENDIX A

PLAN OF WORK

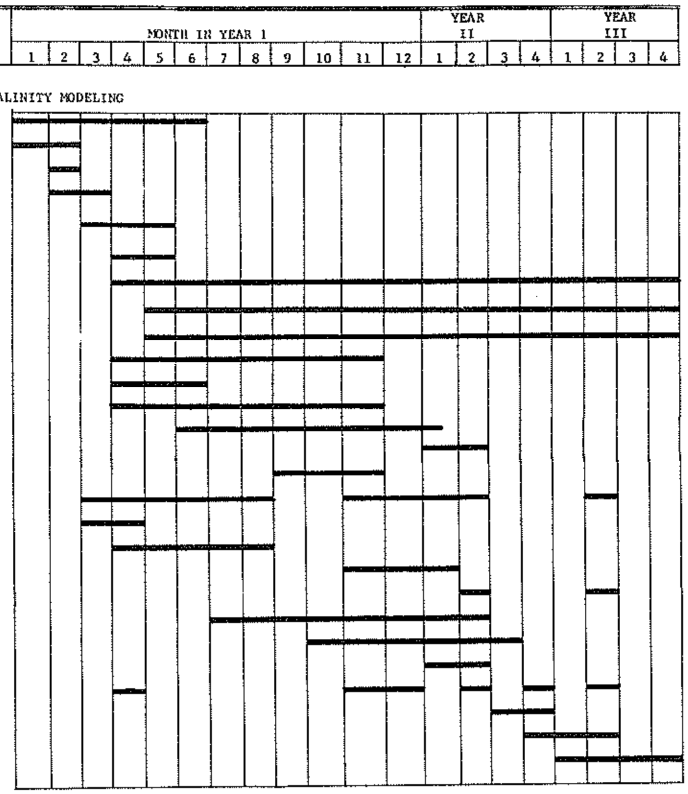
YEAR 1

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

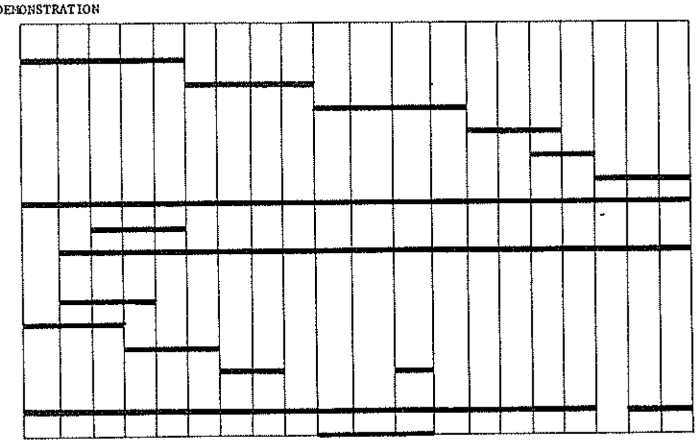
TASK



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

TRICKLE IRRIGATION WELL GEOLOGY AND WELL LOG

Table B-1. Geology of trickle irrigation well on demonstration farm

Depth feet	Description
0-5	Soil
5-40	Sand
40-65	Sand & gravel
65-68	Clay & some sand
68-75	Sand & gravel
75-103	Sand
103-116	Some sand & light brown clay
116-151	Sand & gravel
151-158	Clay (light brown)
158-183	Sand & gravel
183-192	Sand & large gravel
192-203	Gray to light brown clay & gravel
203-205	Sand
205-210	Clay & gravel
210-212	Sand & gravel
212-221	Sand & clay
221-248	Sand & gravel

Figure B-1. Trickle irrigation well log at J. F. Apodaca Farm, La Mesa, New Mexico.

APPENDIX C

PIEZOMETER READINGS

Table C-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)-																		
8-25-75	5.5	6.2	5.2	5.3	4.0	5.2	5.1	5.1	5.1	5.0	5.0	4.9	4.8	4.9	5.1	4.5	4.8	5.0	
9-2-75	4.3	6.2	4.8	5.0	4.0	4.8	4.6	4.3	4.4	4.1	4.2	4.4	4.6	4.9	4.8	4.2	4.5	5.0	
9-8-75	4.0	6.3	5.1	5.2	4.1	5.4	5.2	5.0	4.8	4.6	4.6	4.4	4.5	4.6	4.6	4.2	4.5	5.0	5.1
9-16-75		6.2	5.1	5.1	4.3	5.1	5.0	4.6	4.6	4.5	4.5	4.5	4.5	4.4	4.4	4.3	4.5	5.0	5.2
9-23-75	4.4	6.6	5.5	5.5	4.4	5.4	5.5	4.9	5.1	5.0	5.0	4.9	4.6	5.0	4.7	4.5	5.0	5.8	5.7
9-30-75	4.9	6.7	5.8	5.7	4.5	5.6	5.5	5.4	5.4	5.4	5.4	5.1	4.5	5.0	4.3	4.9	5.3	5.5	5.5
10-7-75	5.2	6.9	6.0	5.8	4.7	5.8	5.7	5.6	5.5	5.4	5.6	5.1	4.7	5.0	4.8	4.9	5.2	5.6	5.7
10-12-75	5.5	7.1	6.0	6.2	4.6	6.2	6.0	5.7	5.6	5.5	5.5	5.4	4.7	5.3	5.0	5.0	5.6	5.9	
10-22-75	5.7	7.1	6.4	6.2	4.8	6.3	6.0	6.9	5.8	5.7	5.8	5.5	4.8	5.5	4.9	5.4	5.6	5.9	6.2
10-28-75	6.0	7.3	6.6	6.6	4.8	6.5	6.3	6.0	6.0	5.9	6.0	5.8	4.9	5.8	5.2	5.5	5.7	6.1	6.2
11-4-75	6.1	7.4	6.7	6.6	5.0	6.5	6.4	6.2	6.1	6.0	6.0	5.9	5.0	5.9	5.3	5.7	6.0	6.3	6.2
11-11-75	6.4	7.3	6.8	6.8	5.0	6.8	6.6	6.3	6.4	6.1	6.3	6.0	5.2	6.3	5.4	5.7	6.1	6.4	6.5
11-18-75	6.3	7.4	6.8	6.8	5.1	6.7	6.7	6.4	6.5	6.3	6.3	6.0	5.6	6.0	5.3	5.7	6.2	6.5	6.5
12-18-75		7.9	7.0	7.1	5.1	6.9	6.8	6.6	6.6	6.4	6.5	6.3	6.2	6.3	5.2	6.0	6.4	6.4	
12-30-75	6.4	8.0	7.1	6.4	5.3	7.2	7.1	6.8	7.9	6.6	5.7	6.7	6.5	6.6	5.3	6.3	6.4	6.5	6.7
1 9 7 6																			
1-6-76	6.8	8.2	7.5	7.4	5.4	7.4	7.4	7.2	7.2	6.7	7.2	6.7	6.8	6.7	5.2	6.4	6.4	6.5	7.0
1-13-76	6.8	7.9	7.6	7.5	5.4	7.5	7.4	7.2	7.2	6.8	7.0	6.8	7.7	6.7	5.3	6.4	6.6	6.6	6.8
1-21-76	8.4	8.1	7.8	7.6	5.5	7.5	7.3	6.9	6.9	6.6	6.5	6.4	Flood	Flood	5.4	Flood	6.6	6.6	6.9

APPENDIX D

LA MESA DRAIN FLOW AND QUALITY DATA

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

	La Mesa Drain							La Mesa Drain					
Date 1975	Site A Stake feet	Site B Stake feet	Site B Flow cfs.	Site C Stake feet	Site D Stake feet	Site D Flow cfs.	Date 1975	Site A Stake feet	Site B Stake feet	Site B Flow cfs.	Site C Stake feet	Site D Stake feet	Site D Flow cfs.
2-4							8-18	3.68	3.02	34.71	2.77	2.78	34.49
2-10							8-25	3.64	3.45	38.71	3.12	2.96	38.21
2-17							8-31	3.46	3.31	39.48	3.01	2.94	36.31
2-24							9-8	3.53	3.32	37.30	3.01	2.95	34.23
3-3							9-16	2.92	2.30	32.77	2.58	2.83	30.74
3-10							9-23	2.84	2.65	31.14	3.40	2.60	29.76
3-17							9-30	2.96	2.84	32.99	3.53	2.76	28.28
3-24							10-7	3.02	2.36	22.68	2.20	2.70	22.68
3-31							10-14	3.07	1.90	18.92	2.60	2.00	15.07
4-7							10-22	3.28	1.90	20.27	2.60	2.00	19.35
4-14							10-28	2.90	1.64	13.45	2.30	1.80	14.96
4-21	2.45	1.81		2.85	1.89		11-4	2.00	1.57	13.23	2.20	1.72	12.69
4-28	2.56	1.86		2.88	1.90		11-11	2.10	1.56	12.37	2.05	1.74	13.07
5-5	2.69	2.04		2.95	2.09		11-18	2.00	1.56	12.18	2.20	1.72	12.77
5-12	2.74	2.05		2.93	2.08		11-25						
5-19	2.69	2.06		2.87	2.05		12-2	1.90	1.74	11.30	2.30	1.80	10.95
5-26	2.68	2.04		2.90	2.10		12-9	1.90	1.60	10.23	2.20	1.72	10.27
6-2	2.85	2.33	25.60	3.20	2.27	27.10	12-16	1.92	1.58	9.92	2.20	1.67	9.08
6-9	2.70	2.16	22.00	3.01	2.38	25.08	12-30	1.80	1.50	10.14	2.12	1.75	9.39
6-16	2.87	2.34	26.23	3.18	2.31	25.62	1976						
6-23	2.78	2.50	29.04	3.35	2.37	28.69	1-6	1.90	1.50	8.53	2.12	1.72	9.61
6-30	2.70	2.40	26.64	3.26	2.36	27.34	1-13	1.80	1.44	9.14	2.05	1.68	7.63
7-7	2.93	2.71	28.23	3.53	2.50	30.29	1-21	1.74	1.37	7.99	2.00	1.45	7.17
7-14	3.00	2.78	31.73	3.63	2.59	29.88	1-26	1.95	1.50	9.63	2.12	1.57	9.16
7-21	3.06	2.89	30.99	3.72	2.59	34.01	2-2	1.80	1.54		2.16	1.64	
7-28	3.04	2.83	33.25	3.66	2.58	35.32	2-7	2.07	1.63	13.92	2.33	1.75	13.28
8-4	3.16	3.70	45.78	3.35	3.01	40.60	2-14	1.97	1.57	12.27	2.20	1.74	11.25
8-11	3.08	2.88	36.15	2.66	2.69	34.69							

Table D-2. Composition of water samples taken at La Mesa drain site A during 1975 (sampling was begun in April)

Site	Date	ECx10^3	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				- - - - -	- - - -	- - - -(meq/l)-	- - -	- - - -	- - -	- - - -	- - -	- - - -	- - - -	(ppm)
A	4/21/75	1.37	7.97	15.19	14.00	5.83	2.04	7.09	0.23	3.77	0.0	3.26	6.96	0.66
A	5/ 5/75	1.46	7.99	16.28	15.30	6.78	2.07	7.19	0.24	3.60	0.0	4.52	7.16	1.31
A	5/19/75	1.42	8.24	16.64	15.45	6.78	2.24	7.40	0.22	3.62	0.0	4.62	7.20	0.47
A	6/ 2/75	1.42	8.11	14.95	15.39	5.85	2.04	6.85	0.21	3.43	0.0	4.80	7.16	0.19
A	6/16/75	1.40	8.00	12.22	12.54	4.11	1.51	6.36	0.24	3.35	0.0	2.50	6.68	0.38
A	6/30/75	1.29	8.29	12.78	12.96	3.59	1.69	7.24	0.26	3.50	0.0	2.18	7.28	0.0
A	7/14/75	1.35	8.32	14.85	13.80	5.73	2.01	6.87	0.24	3.39	0.36	3.08	6.96	0.47
A	7/28/75	1.43	7.85	15.61	15.24	6.50	1.89	7.00	0.22	3.35	0.0	4.64	7.24	0.47
A	8/11/75	1.43	8.27	15.21	14.93	6.68	1.92	6.39	0.22	3.45	0.0	4.78	6.68	1.48
A	8/25/75	1.38	7.64	14.58	13.57	6.14	1.86	6.35	0.23	3.29	0.0	4.12	6.13	1.76
A	9/ 8/75	1.39	7.90	15.29	14.46	6.63	1.89	6.53	0.24	3.39	0.0	4.60	6.47	0.0
A	9/23/75	1.51	8.36	16.58	16.14	7.24	2.11	6.99	0.24	3.90	0.0	4.98	7.24	1.29
A	10/ 7/75	1.73	7.89	19.53	18.62	8.16	2.57	8.56	0.24	4.34	0.0	5.56	8.70	1.45
A	10/21/75	2.01	7.95	20.58	21.03	10.00	2.78	7.51	0.29	6.44	0.0	5.64	8.95	0.0
A	11/ 4/75	1.72	7.86	22.02	20.88	11.44	2.99	7.30	0.29	5.43	0.0	5.36	10.06	1.85
A	11/18/75	1.74	8.27	19.92	20.61	9.61	2.81	7.23	0.27	5.25	0.0	6.00	9.32	2.47
A	12/ 2/75	2.00	8.06	19.93	20.85	9.74	2.74	7.39	0.06	5.21	0.0	5.82	9.78	2.34
A	12/16/75	1.61	7.87	18.77	20.89	8.59	2.76	7.14	0.28	5.27	0.0	5.68	9.92	1.43
A	12/30/75	1.89	7.86	21.02	20.93	10.72	2.81	7.24	0.25	5.33	0.0	5.64	9.96	0.0
MEAN =		1.56	8.04	16.94	16.72	7.37	2.25	7.09	0.24	4.17	0.02	4.62	7.89	0.95
STD. DEV. =		0.23	0.20	2.87	3.17	2.16	0.45	0.51	0.05	0.98	0.08	1.13	1.35	0.82

Table D-3. Composition of water samples taken at La Mesa drain site B during 1975 (sampling was begun in April)

Site	Date	$ECx10^3$	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meq/l)										(ppm)
B	4/21/75	1.39	7.94	15.28	14.48	5.78	2.11	7.18	0.21	3.74	0.0	3.36	7.36	1.37
B	5/ 5/75	1.41	7.92	15.49	14.64	5.88	2.11	7.25	0.25	3.70	0.0	3.48	7.44	1.53
B	5/19/75	1.43	8.34	17.48	15.99	7.46	2.23	7.56	0.23	3.67	0.0	4.82	7.48	1.39
B	6/ 2/75	1.42	8.18	15.59	15.31	6.38	2.11	6.88	0.22	3.42	0.0	4.76	7.12	0.57
B	6/16/75	1.43	8.10	14.22	14.94	6.05	1.71	6.21	0.25	3.51	0.0	4.66	6.76	0.38
B	6/30/75	1.28	8.28	16.13	12.86	6.96	2.05	6.87	0.25	3.42	0.0	2.20	7.24	0.0
B	7/14/75	1.36	8.38	14.89	13.89	5.73	1.99	6.93	0.24	3.43	0.0	3.54	6.92	0.28
B	7/28/75	1.42	8.23	15.91	14.91	6.68	2.02	6.98	0.23	3.46	0.0	3.64	7.80	0.63
B	8/11/75	1.45	8.08	16.15	15.85	6.92	2.00	7.00	0.23	3.54	0.0	4.82	7.47	1.35
B	8/25/75	1.40	7.84	14.45	13.22	6.18	1.87	6.15	0.25	3.33	0.0	4.14	5.73	1.44
B	9/ 8/75	1.41	7.98	14.77	14.55	6.37	1.87	6.28	0.25	3.41	0.0	4.64	6.50	0.0
B	9/23/75	1.56	8.33	16.59	16.76	7.88	2.24	6.22	0.25	3.98	0.0	5.00	7.77	0.67
B	10/ 7/75	1.74	7.99	17.27	18.70	5.49	2.67	8.86	0.25	4.40	0.0	5.54	8.73	1.73
B	10/21/75	1.88	7.81	18.46	19.84	5.98	2.78	9.43	0.27	5.51	0.0	5.44	8.89	0.30
B	11/ 4/75	1.79	7.82	22.23	22.01	11.35	3.18	7.42	0.28	5.53	0.0	5.98	10.50	0.0
B	11/18/75	1.78	8.27	20.06	21.77	9.80	2.82	7.19	0.25	5.26	0.0	5.90	10.56	2.95
B	12/ 2/75	1.98	8.10	20.67	21.12	10.21	2.96	7.44	0.06	5.25	0.0	5.64	10.18	2.86
B	12/16/75	1.70	7.89	19.95	21.03	9.84	2.81	7.02	0.28	5.36	0.0	5.64	10.00	1.91
B	12/30/75	1.83	7.85	20.19	20.03	9.84	2.76	7.32	0.27	5.43	0.0	4.57	10.03	0.0
MEAN=		1.56	8.07	17.15	16.94	7.41	2.33	7.17	0.24	4.18	0.0	4.62	8.13	1.02
STD. DEV.=		0.21	0.19	2.41	3.11	1.84	0.44	0.83	0.05	0.88	0.0	1.01	1.48	0.92

Table D-4. Composition of water samples taken at La Mesa drain site C during 1975 (sampling was begun in April)

Site	Date	$ECx10^3$	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meq/l)										(ppm)
C	4/21/75	1.39	8.04	15.03	14.23	5.38	2.06	7.35	0.24	4.09	0.0	2.64	7.48	1.02
C	5/ 5/75	1.43	7.94	15.33	14.58	5.78	2.15	7.17	0.23	3.77	0.0	3.40	7.40	0.69
C	5/19/75	1.41	8.28	16.69	15.46	7.10	2.21	7.17	0.21	3.57	0.0	4.72	7.16	0.81
C	6/ 2/75	1.43	8.14	15.53	15.48	6.19	2.11	7.02	0.21	3.44	0.0	4.76	7.28	0.12
C	6/16/75	1.46	7.70	14.31	15.35	6.05	1.78	6.24	0.24	3.52	0.0	4.70	7.12	0.53
C	6/30/75	1.44	8.35	14.67	12.13	5.08	2.04	7.30	0.25	2.69	0.0	2.04	7.40	0.0
C	7/14/75	1.31	8.38	14.04	13.67	5.36	1.98	6.46	0.24	3.38	0.0	3.32	6.96	0.80
C	7/28/75	1.46	7.60	15.46	15.91	6.57	1.91	6.75	0.23	3.48	0.0	4.82	7.60	0.63
C	8/11/75	1.46	8.01	15.55	16.06	6.74	2.00	6.58	0.23	3.60	0.0	4.84	7.60	1.35
C	8/25/75	1.36	8.12	14.02	13.78	5.77	1.75	6.27	0.23	3.10	0.0	4.08	6.58	1.51
C	9/ 8/75	1.47	7.76	15.96	14.62	6.67	1.92	7.08	0.29	3.68	0.0	4.60	6.32	1.00
C	9/23/75	1.51	8.33	17.76	16.53	7.32	2.13	8.06	0.25	4.04	0.0	5.04	7.43	1.29
C	10/ 7/75	1.76	7.93	19.46	19.14	7.73	2.68	8.80	0.25	4.53	0.0	5.56	9.01	2.28
C	10/21/75	1.87	8.10	19.00	19.59	5.99	2.74	9.99	0.28	5.09	0.0	5.46	9.04	0.0
C	11/ 4/75	1.78	8.01	21.15	21.59	10.65	2.95	7.29	0.26	5.34	0.0	5.82	10.40	2.15
C	11/18/75	1.80	8.50	19.28	21.17	9.30	2.69	7.03	0.26	4.90	0.0	5.96	10.25	3.95
C	12/ 2/75	1.96	8.24	20.43	20.73	10.13	2.86	7.38	0.06	5.25	0.0	5.62	9.81	3.11
C	12/16/75	1.64	8.12	20.48	20.84	10.22	2.81	7.19	0.26	5.35	0.0	5.50	9.96	1.91
C	12/30/75	1.91	8.06	21.19	21.34	10.76	2.89	7.29	0.25	5.41	0.0	5.71	10.22	0.0
MEAN=		1.57	8.09	17.12	16.96	7.30	2.30	7.29	0.24	4.12	0.0	4.66	8.16	1.22
STD. DEV.=		0.21	0.23	2.57	3.08	1.93	0.42	0.88	0.05	0.86	0.0	1.11	1.38	1.08

Table D-5. Composition of water samples taken at La Mesa drain site D during 1975 (sampling was begun in April)

Site	Date	ECx10^3	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meq/1)										(ppm)
D	4/21/75	1.33	8.04	14.43	13.79	4.89	2.06	7.26	0.22	3.77	0.0	2.56	7.44	1.16
D	5/ 5/75	1.45	8.22	16.33	15.04	6.37	2.17	7.52	0.27	3.74	0.0	3.96	7.28	3.62
D	5/19/75	1.36	8.20	15.46	14.95	5.95	2.13	7.17	0.21	3.57	0.0	3.88	7.48	1.05
D	6/ 2/75	1.46	8.22	15.98	15.57	6.46	2.13	7.17	0.22	3.50	0.0	4.82	7.24	0.80
D	6/16/75	1.48	8.00	14.13	15.49	5.76	1.77	6.36	0.24	3.58	0.0	4.74	7.16	0.61
D	6/30/75	1.33	8.31	16.88	15.60	7.20	2.14	7.28	0.26	3.74	0.0	4.30	7.56	0.0
D	7/14/75	1.38	8.41	13.39	13.41	4.55	1.89	6.70	0.25	2.55	0.0	4.10	6.76	0.28
D	7/28/75	1.46	8.33	16.41	15.84	6.88	2.03	7.27	0.23	3.55	0.0	4.20	8.08	0.88
D	8/11/75	1.48	7.94	15.93	16.20	6.78	2.00	6.92	0.23	3.58	0.0	4.80	7.80	1.48
D	8/25/75	1.35	8.47	14.32	12.96	5.93	1.79	6.35	0.25	3.22	0.20	3.92	5.60	1.26
D	9/ 8/75	1.44	8.04	16.32	15.23	6.67	1.98	7.41	0.26	3.33	0.0	4.90	7.00	0.0
D	9/23/75	1.57	8.20	15.84	16.48	7.20	2.10	6.28	0.26	4.04	0.0	5.04	7.37	1.58
D	10/ 7/75	1.76	7.88	18.44	19.19	7.10	2.48	8.56	0.30	4.52	0.0	5.66	8.98	1.86
D	10/21/75	1.88	8.03	21.66	19.71	9.44	2.66	9.27	0.29	5.11	0.0	5.50	9.10	0.0
D	11/ 4/75	1.75	7.99	21.00	21.14	10.43	3.07	7.25	0.25	5.43	0.0	5.02	10.68	0.54
D	11/18/75	1.80	8.31	20.11	21.99	9.76	2.81	7.27	0.27	5.27	0.0	6.10	10.56	3.95
D	12/ 2/75	1.99	7.96	20.79	21.24	10.38	2.96	7.39	0.06	5.33	0.0	5.72	10.15	2.24
D	12/16/75	1.66	7.91	18.95	21.06	8.48	2.75	7.43	0.29	5.44	0.0	5.52	10.07	2.07
D	12/30/75	1.88	7.98	21.91	21.24	11.33	2.93	7.38	0.27	5.41	0.0	5.57	10.26	0.0
MEAN=		1.57	8.13	17.28	17.17	7.45	2.31	7.28	0.24	4.14	0.01	4.75	8.24	1.23
STD. DEV.=		0.21	0.18	2.71	3.03	1.96	0.42	0.70	0.05	0.91	0.05	0.86	1.49	1.14

Table D-6. Electrical conductivity (mmhos/cm) and flow (m^3/sec) of water at La Mesa drain sampling site A, B, C, and D during 1975 (sampling was begun in April).

Site A		Site B			Site C		Site D		
Date	$ECx10^3$	Date	$ECx10^3$	Flow (m^3/sec)	Date	$ECx10^3$	Date	$ECx10^3$	Flow (m^3/sec)
4/21/75	1.37	4/21/75	1.39	—	4/21/75	1.39	4/21/75	1.33	—
4/28/75	1.49	4/28/75	1.50	—	4/28/75	1.49	4/28/75	1.52	—
5/ 5/75	1.46	5/ 5/75	1.41	—	5/ 5/75	1.43	5/ 5/75	1.45	—
5/12/75	1.49	5/12/75	1.49	—	5/12/75	1.52	5/12/75	1.52	—
5/19/75	1.42	5/19/75	1.43	—	5/19/75	1.41	5/19/75	1.36	—
5/26/75	1.50	5/26/75	1.52	—	5/26/75	1.53	5/26/75	1.54	—
6/ 2/75	1.42	6/ 2/75	1.42	0.725	6/ 2/75	1.43	6/ 2/75	1.46	0.767
6/ 9/75	1.46	6/ 9/75	1.49	0.623	6/ 9/75	1.51	6/ 9/75	1.52	0.710
6/16/75	1.40	6/16/75	1.43	0.743	6/16/75	1.46	6/16/75	1.48	0.725
6/23/75	1.36	6/23/75	1.36	0.822	6/23/75	1.41	6/23/75	1.38	0.812
6/30/75	1.29	6/30/75	1.28	0.754	6/30/75	1.44	6/30/75	1.33	0.774
7/ 7/75	1.29	7/ 7/75	1.32	0.799	7/ 7/75	1.28	7/ 7/75	1.40	0.858
7/14/75	1.35	7/14/75	1.36	0.698	7/14/75	1.31	7/14/75	1.38	0.846
7/21/75	1.43	7/21/75	1.50	0.878	7/21/75	1.47	7/21/75	1.47	0.963
7/28/75	1.43	7/28/75	1.42	0.942	7/28/75	1.46	7/28/75	1.46	1.000
8/ 4/75	1.07	8/ 4/75	1.11	1.296	8/ 4/75	1.11	8/ 4/75	1.11	1.150
8/11/75	1.43	8/11/75	1.45	1.024	8/11/75	1.46	8/11/75	1.48	0.982
8/18/75	1.40	8/18/75	1.45	0.983	8/18/75	1.46	8/18/75	1.48	0.977
8/25/75	1.38	8/25/75	1.40	1.096	8/25/75	1.36	8/25/75	1.35	1.062
9/ 1/75	1.41	9/ 1/75	1.43	1.118	9/ 1/75	1.44	9/ 1/75	1.45	1.028
9/ 8/75	1.39	9/ 8/75	1.41	1.056	9/ 8/75	1.47	9/ 8/75	1.44	0.969
9/16/75	1.64	9/16/75	1.64	0.928	9/16/75	1.57	9/16/75	1.61	0.870
9/23/75	1.51	9/23/75	1.56	0.882	9/23/75	1.51	9/23/75	1.57	0.843
9/30/75	1.46	9/30/75	1.49	0.934	9/30/75	1.46	9/30/75	1.47	0.801
10/ 7/75	1.73	10/ 7/75	1.74	0.642	10/ 7/75	1.76	10/ 7/75	1.76	0.642
10/14/75	1.71	10/14/75	1.82	0.537	10/14/75	1.81	10/14/75	1.83	0.427
10/21/75	2.01	10/21/75	1.88	0.574	10/21/75	1.87	10/21/75	1.88	0.546
10/28/75	1.91	10/28/75	1.93	0.381	10/28/75	1.91	10/28/75	1.92	0.424
11/ 4/75	1.72	11/ 4/75	1.79	0.375	11/ 4/75	1.78	11/ 4/75	1.75	0.359
11/11/75	1.63	11/11/75	1.71	0.350	11/11/75	1.72	11/11/75	1.64	0.370
11/18/75	1.74	11/18/75	1.78	0.345	11/18/75	1.80	11/18/75	1.80	0.362
11/26/75	1.84	11/26/75	1.88	—	11/26/75	1.86	11/26/75	1.86	—
12/ 2/75	2.00	12/ 2/75	1.98	0.320	12/ 2/75	1.96	12/ 2/75	1.99	0.310
12/ 9/75	1.94	12/ 9/75	1.94	0.290	12/ 9/75	1.93	12/ 9/75	1.93	0.291
12/16/75	1.61	12/16/75	1.70	0.281	12/16/75	1.64	12/16/75	1.66	0.257
12/30/75	1.89	12/30/75	1.83	0.287	12/30/75	1.91	12/23/75	1.51	—
							12/30/75	1.88	0.266
MEAN=	1.54	MEAN=	1.56	0.720	MEAN=	1.56	MEAN=	1.57	0.704
STD. DEV.=	0.22	STD. DEV.=	0.22	0.290	STD. DEV.=	0.21	STD. DEV.=	0.21	0.280

APPENDIX E

IRRIGATION PUMP NATURAL GAS CONSUMPTION AND WATER METER READINGS

Table E-1. Irrigation pump natural gas consumption and water meter readings on selected wells, demonstration farm

	Demonstration Farm Wells							
	No. 1 & 2		No. 3		No. 4		No. 5	
Date	Natural Gas Meter (000)	Water Meter (000)	Natural Gas Meter (000)	Water Meter (000)	Natural Gas Meter (000)	Water Meter (000)	Natural Gas Meter (000)	Water Meter (000)
4-18	6,594		4,382		2,724		324	
5-29	6,727		5,419		2,985		891	
6-2	7,162							
6-9	7,164		5,444		3,048		1,221	
6-16	7,165		5,457		3,048		1,226	
6-23	7,167		5,550		3,158		1,632	
6-30	7,170		5,607		3,264		1,958	
7-7	7,173		5,612		3,295		2,159	
7-14	7,174		5,661		3,321		2,168	
7-21	7,509		5,675		3,371		2,177	
7-28	7,685		5,688		3,536		2,513	
8-4	8,111		5,741		3,581		2,516	
8-11	8,112		6,084		3,704		2,817	
8-18	8,114		6,143		3,855		2,948	
8-25	8,115		6,154		3,948		2,954	
9-1	8,116		6,224		4,001		2,958	
9-8	8,117		6,237		4,001		2,963	
9-16	8,118	0	6,252	0	4,001	0	2,968	0
9-23	8,119	0	6,265	0	4,001	0	3,019	
9-30	8,121	5	6,509	5,917	4,042	1,073	3,312	5,351
10-7	8,122	5	6,512	5,917	4,042	1,073	3,813	13,466
10-14	8,123	5	6,572	7,386	4,042	1,073	3,908	14,679
10-21	8,125	5	6,627	8,600	4,043	1,073	4,039	16,591
10-28	8,125	5	6,636	8,600	4,043	1,073	4,055	16,591
11-4	8,128	5	6,694	9,870	4,043	1,073	4,069	16,591
11-11	8,129	5	6,700	9,870	4,043	1,073	4,084	16,591
11-18	8,131	5	6,706	9,870	4,043	1,073	4,108	16,591
11-26	8,131	5	6,714	9,870	4,043	1,073	4,115	16,591
12-2	8,131	5	6,714	9,870	4,043	1,073	4,115	16,591
12-9	8,131	5	6,714	9,870	4,043	1,073	4,115	16,591
12-16	8,131	5	6,714	9,870	4,043	1,073	4,115	16,591
12-30	8,131	5	6,714	9,870	4,043	1,073	4,115	16,591
1976								
1-6	8,131	5	6,714	9,870	4,043	1,073	4,115	16,591
1-13	8,279	(pumping)	6,756	9,870	4,043	1,073	4,124	16,591
1-21	9,827	(pumping)	6,756	9,870	4,043	1,073	4,124	16,591
1-28	10,416	21,736	6,767	9,870	4,043	1,073	4,246	16,591
2-7	10,418	21,736	6,774	9,870	4,043	1,073	4,263	16,591

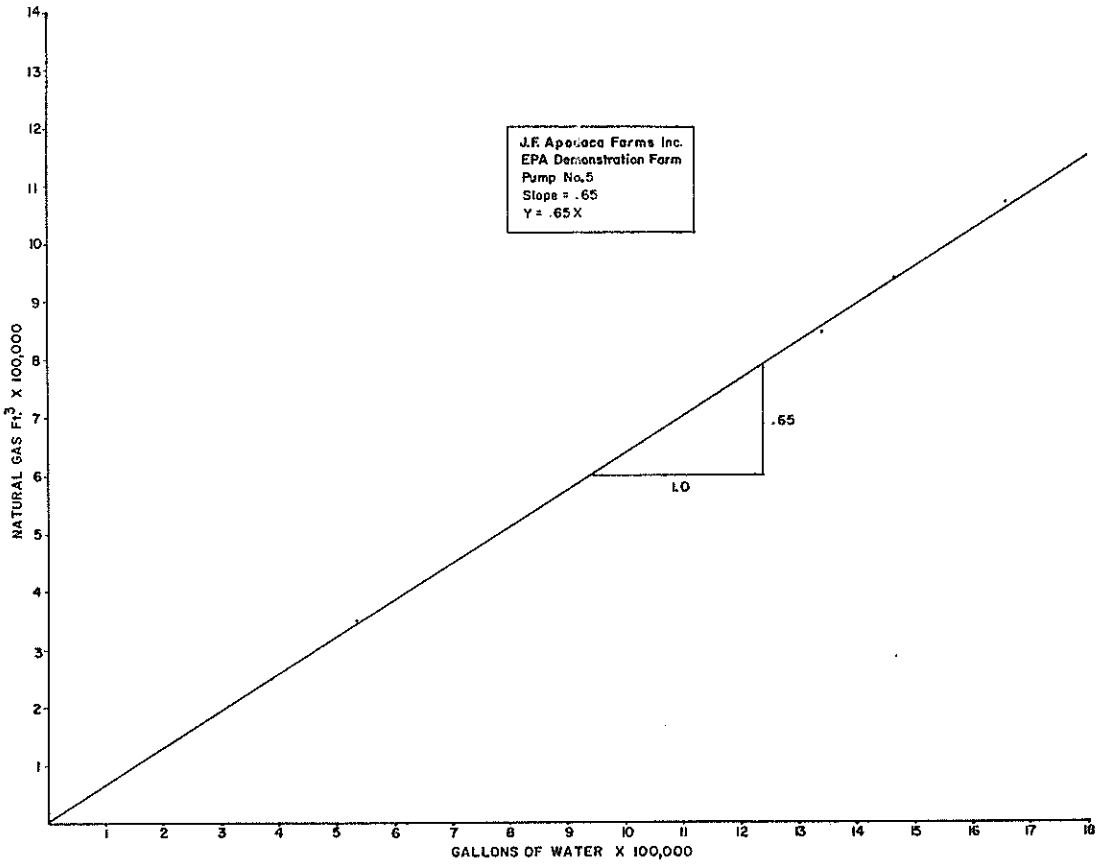


Figure E-1. Natural gas consumption versus water pumped for Pump No. 3, demonstration farm

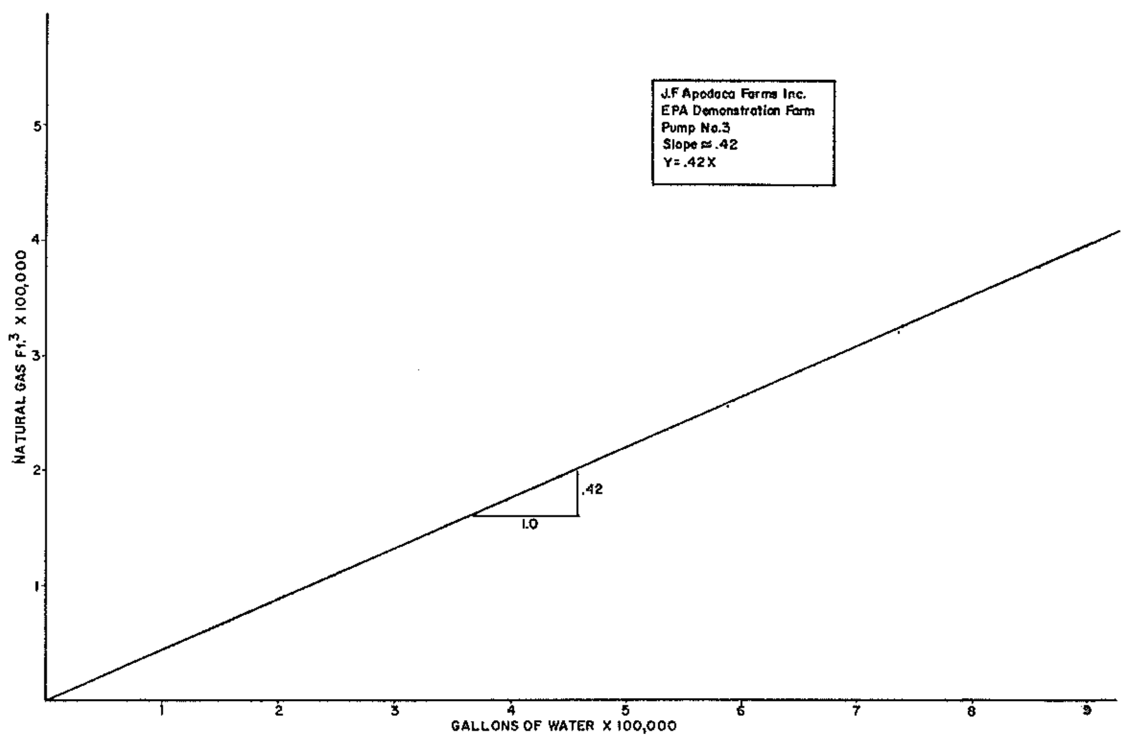


Figure E-2. Natural gas consumption versus water pumped for Pump No. 5, demonstration farm

APPENDIX F

CLIMATOLOGICAL DATA

Table F-1. Climatological data, Plant Science Farm, NMSU, February 1975

Day	Maximum Temp. F.	Minimum Temp. F.	Dew Point Temp. F.	Wind mi/day	Rain inches	Solar Rad. lang.	Evaporation Pan inches
1	53	45	42	53		145.4	.07
2	59	42	39	53	.29	257.5	.07
3	61	41	34	85		256.3	.15
4	59	33	25	153		377.7	.12
5	60	28	30	73		347.6	.14
6	55	25	20	170		377.0	.12
7	61	24	22	44		360.2	.09
8	66	39	29	140		380.0	.23
9	68	22	28	140		384.3	.24
10	67	30	29	136		356.9	.20
11	61	31	31	107		407.7	.15
12	65	27	27	36		407.1	.11
13	73	19	21	52		401.5	.14
14	63	31	32	100		186.5	.11
15	67	32	31	247		364.4	.48
16	60	31	31	144		401.5	.16
17	57	25	28	267		355.2	.26
18	55	22	25	65		425.1	.08
19	60	19	20	48		432.5	.09
20	69	18	22	128		426.4	.30
21	55	27	30	181	.07	143.8	.07
22	40	19	22	93		272.0	.05
23	51	16	16	87		469.7	.12
24	64	16	20	55		457.8	.11
25	70	22	23	69		423.7	.17
26	72	25	27	66		450.7	.16
27	72	27	32	116		457.4	.25
28	74	31	36	56		457.2	.18
Total	1,737	767	772	2,964	.36	10,183.1	4.42
Average	62	27	28	106		363.7	.16

Table F-2. Climatological data, Plant Science Farm, NMSU, March 1975

Day	Maximum Temp. F.	Minimum Temp. F.	Dew Point Temp. F.	Wind mi/day	Rain inches	Solar Rad. lang.	Evaporation Pan inches
1	78	29	35	50		461.5	.16
2	82	30	30	113		456.8	.30
3	78	28	24	113		433.0	.13
4	67	30		57		416.5	.18
5	62	27		116		450.1	.30
6	58	41		188		484.3	.37
7	77	28		69		458.7	.21
8	72	40		183		204.8	.22
9	64	42		234		462.3	.27
10	72	28		117		485.9	.25
11	60	35		262	.15	331.8	.26
12	53	36		111	.04	269.3	.13
13	61	28		90		524.4	.15
14	67	28		204		404.4	.25
15	60	30		250		497.3	.27
16	66	24		136		536.4	.24
17	63	27		240		540.5	.35
18	71	25		53		671.6	.18
19	79	28		57		412.5	.18
20	82	31		143		496.1	.35
21	74	46		190		428.1	.32
22	79	35		243		540.8	.48
23	64	39		270		511.1	.41
24	74	28		135		551.3	.28
25	82	33		203		506.6	.44
26	72	37	33	412		*	.43
27	56	37	34	262		464.5	.32
28	54	34	38	228	.02	186.3	.11
29	45	29	35	139		316.5	.08
30	53	26	25	137		566.1	.25
31	68	28	29	137		780.7	.26
Total	2,093	987	283	5,142	.21	13,850.2	8.13
Average	68	32	31	166		461.7	.26

*Instrument down for repairs.

Table F-3. Climatological data, Plant Science Farm, NMSU, April 1975

Day	Maximum Temp. F.	Minimum Temp. F.	Dew Point Temp. F.	Wind mi/day	Rain inches	Solar Rad. lang.	Evaporation Pan inches
1	71	38	24	288		578.7	.40
2	63	34	24	115		611.1	.23
3	72	26	23	66		576.5	.24
4	79	32	26	110		542.3	.31
5	76	31	24	82		544.2	.29
6	70	37	29	145		296.7	.18
7	55	36	30	239	T	511.3	.28
8	58	30	27	175		505.5	.26
9	67	26	26	79		433.8	.20
10	64	41	32	227		424.6	.31
11	67	37	40	444		542.6	.36
12	73	44	35	204		594.7	.33
13	66	32	34	153		602.5	.30
14	73	30	29	78		524.3	.24
15	82	34	24	82		634.5	.31
16	85	43	40	176		588.4	.43
17	80	48	34	387		597.0	.60
18	62	39	35	171		540.2	.31
19	72	35	32	171		636.7	.31
20	82	34	25	82		640.4	.30
21	86	37	31	92		610.3	.28
22	84	49	34	106		403.5	.22
23	81	37	32	122		644.2	.36
24	83	34	32	71		630.3	.30
25	84	43	34	112		607.7	.34
26	83	46	38	170		157.9	.25
27	68	46	31	210		666.2	.41
28	75	28	30	89		659.2	.30
29	76	34	30	157		653.4	.39
30	76	37	36	58		584.2	.24
Total	2,213	1,098	921	4,661		16,542.9	9.28
Average	74	37	31	155		551.4	.31

Table F-4. Climatological data, Plant Science Farm, NMSU, May 1975

Day	Maximum Temp. F.	Miniuum Temp. F.	Dew Point Temp. F.	Wind mi/day	Rain inches	Solar Rad. lang.	Evaporation Pan inches
1	80	35	31	106		653.0	.38
2	80	41	35	127		650.5	.40
3	82	43	34	56		*	.26
4	81	43	35	170		*	.46
5	77	44	32	248		651.2	.43
6	73	40	34	130		672.5	.28
7	75	33	33	72		673.2	.28
8	81	33	31	88		670.2	.31
9	85	36	32	62		659.7	.31
10	85	49	54	130	.09	294.8	.18
11	85	44	42	94		657.9	.28
12	90	43	32	135		664.7	.43
13	88	46	27	126		678.0	.37
14	89	45	32	127		673.4	.41
15	89	63	30	194		671.8	.52
16	87	64	29	254	.05	375.1	.33
17	85	52	45	140		583.9	.37
18	87	51	36	117		643.5	.39
19	77	46	40	122	.02	555.5	.33
20	80	49	24	182		687.2	.47
21	86	49	36	156		695.0	.46
22	73	47	41	151		628.5	.41
23	76	44	35	68		650.9	.28
24	82	38	36	63		690.8	.30
25	89	42	36	63		688.9	.30
26	91	45	37	100		*	.35
27	90	39	44	148		616.5	.48
28	84	48	46	198		567.1	.44
29	80	46	44	140		542.4	.29
30	76	47	48	70		535.0	.24
31	89	43	48	77		693.1	.33
Total	2,572	1,388	1,136	3,914			11.07
Average	83	45	37	126			.36

Table F-5. Climatological data, Plant Science Farm, NMSU, June 1975

Day	Maximum Temp. F.	Minimum Temp. F.	Dew Point Temp. F.	Wind mi/day	Rain inches	Solar Rad. lang.	Evaporation Pan inches
1	92	48	40	60		651.8	.33
2	96	50	38	92		676.5	.38
3	98	59	40	91		664.3	.46
4	95	53	42	102		642.6	.47
5	96	46	38	89		675.0	.50
6	98	52	36	134		665.0	.50
7	90	58	56	90		408.7	.29
8	91	55	51	99		641.2	.37
9	90	53	49	94		594.8	.39
10	91	52	49	137		*	.48
11	88	53	49	66		686.4	.31
12	95	57	57	77		657.5	.35
13	96	58	54	71		641.5	.37
14	100	57	41	188		630.4	.76
15	100	58	35	95		690.0	.53
16	96	59	46	133		693.7	.54
17	93	52	46	142		685.7	.53
18	92	62	47	186		650.4	.63
19	90	55	57	93		671.1	.41
20	90	57	61	104		671.9	.44
21	90	55	57	90		*	.44
22	93	51	48	65		*	.31
23	95	59	62	195		*	.47
24	97	71	64	109		*	.37
25	97	67	59	87		*	.45
26	99	56	42	53		*	.34
27	100	55	52	99		*	.43
28	100	63	66	110		*	.45
29	99	64	61	135		*	.44
30	94	72	69	160		668.3	.46
Total	2,841	1,707	1,512	3,246			13.10
Average	95	57	50	108			.44

Table F-6. Climatological data, Plant Science Farm, NMSU, July 1975

Day	Maximum Temp.	Minimum Temp.	Dew Point Temp.	Wind	Rain	Solar Rad.	Evaporation Pan
	F.	F.	F.	mi/day	inches	lang.	inches
1	91	66	68	142		683.5	.45
2	91	68	63	168		677.1	.50
3	89	69	68	162		483.8	.35
4	90	68	70	100		543.5	.31
5	92	63	62	71		612.0	.20
6	92	66	69	78		544.7	.37
7	96	64	65	105	.05	633.6	.40
8	91	67	64	80	.02	591.3	.34
9	95	62	57	75		649.5	.36
10	98	64	60	113	.05	601.3	.40
11	96	69	65	120	.11	488.3	.22
12	84	65	61	96	.12	354.9	.36
13	89	59	55	59		663.1	.31
14	92	55	59	88		630.5	.43
15	93	68	54	163		666.5	.44
16	90	69	61	157		672.5	.43
17	86	64	66	93		461.4	.27
18	93	60	60	81		*	.28
19	96	63	62	58		*	.26
20	94	63	62	123	.13	554.6	.41
21	89	64	67	83		543.2	.28
22	95	65	66	91		622.1	.33
23	95	66	64	99	.04	390.6	.28
24	90	65	64	98		598.4	.33
25	88	59	61	124		*	.34
26	88	64	62	98		554.9	.27
27	90	62	61	126		648.8	.39
28	96	62	63	76	1.05	*	.74
29	84	63	66	50	.03	365.8	.19
30	92	61	56	63		616.3	.32
31	98	59	53	39		649.9	.42
Total	2,843	1,982	1,934	3,081	1.60		10.98
Average	92	64	62	99			.35

Table F-7. Climatological data, Plant Science Farm, NMSU, August 1975

Day	Maximum Temp. F.	Minimum Temp. F.	Dew Point Temp. F.	Wind mi/day	Rain inches	Solar Rad. lang.	Evaporation Pan inches
1	97	59	47	61		570.5	.18
2	94	63	58	128		578.9	.44
3	93	66	63	100	1.09	517.0	.81
4	89	60	63	114		*	.34
5	92	57	56	81		643.3	.35
6	91	61	48	90		*	.37
7	90	54	53	56		641.0	.31
8	94	59	51	64		559.2	.32
9	92	61	561	108		521.4	.43
10	89	63	48	122		524.1	.38
11	88	58	51	76		613.5	.31
12	89	56	64	72	.17	437.8	.22
13	90	60	58	73	.03	*	.27
14	89	64	60	65		531.6	.26
15	92	60	56	109		605.7	.39
16	94	58	57	87		588.9	.34
17	92	60	55	84	.29	581.0	.41
18	97	64	59	53		607.6	.26
19	90	60	59	112	.23	503.3	.30
20	82	64	65	76	.04	403.0	.19
21	90	62	64	101	.73	497.0	.28
22	89	63	64	54	.01	447.5	.18
23	90	62	59	52		573.1	.26
24	94	63	60	53		545.5	.29
25	94	62	54	86		594.4	.33
26	94	64	55	129		575.6	.29
27	86	63	64	110		607.7	.35
28	90	65	60	49		562.6	.27
29	95	61	58	51		572.4	.30
30	97	56	51	68		571.3	.31
31	94	59	56	97		571.5	.35
Total	2,837	1,887	1,774	2,581	2.59		10.09
Average	92	61	57	83			.33

Table F-8. Climatological data, Plant Science Farm, NMSU, September 1975

Day	Maximum Temp.	Minimum Temp.	Dew Point Temp.	Wind	Rain	Solar Rad.	Evaporation Pan
	F.	F.	F.	mi/day	inches	lang.	inches
1	92	58	56	9[illegible]		517.3	.33
2	91	63	58	183	.04	554.5	.37
3	82	61	62	126	.08	411.9	.24
4	86	61	58	116	.06	498.6	.30
5	82	62	56	100	.02	239.2	.17
6	77	62	63	100		186.4	.09
7	86	60	56	149	.06	443.7	.34
8	85	60	58	80		355.3	.16
9	88	63	57	111	.01	474.3	.28
10	90	63	60	76		529.6	.23
11	90	62	59	153	1.25	332.1	.27
12	69	58	52	236	.40	339.3	.44
13	65	52	51	183	.04	290.0	.18
14	77	57	57	25		403.5	.10
15	85	53	44	44		526.0	.21
16	87	54	47	41		531.9	.23
17	90	51	53	49		469.9	.22
18	90	55	56	81	.02	504.3	.28
19	90	57	54	79	.12	504.7	.24
20	85	60	60	73		497.2	.26
21	77	53	53	168		390.2	.27
22	73	45	38	77		523.9	.20
23	78	40	37	55		517.2	.23
24	79	42	37	68		509.9	.19
25	82	40	33	40		500.6	.13
26	83	40	27	41		503.1	.27
27	86	40	30	30		469.7	.11
28	86	41	29	34		486.6	.20
29	87	43	29	43		460.1	.18
30	84	46	39	120		419.8	.29
Total	2,502	1,602	1,469	2,777	2.10		7.01
Average	83	53	49	93			.23

Table F-9. Climatological data, Plant Science Farm, NMSU, October 1975

Day	Maximum Temp.	Minimum Temp.	Dew Point Temp.	Wind	Rain	Solar Rad.	Evaporation Pan
	F.	F.	F.	mi/day	inches	lang.	inches
1	74	47	46	136		454.7	.27
2	76	43	42	127		460.7	.26
3	76	41	41	55		460.8	.18
4	82	39	34	38		465.4	.17
5	85	39	32	44		465.4	.13
6	85	39	23	46		461.4	.23
7	82	39	34	99		454.5	.23
8	80	45	38	71		453.9	.18
9	81	39	37	53		447.1	.16
10	86	40	31	49		441.1	.16
11	85	41	32	71		434.4	.20
12	86	44	31	71		430.4	.20
13	78	37	41	87		390.8	.18
14	74	36	21	80		442.0	.18
15	73	32	11	57		437.4	.14
16	76	34	7	54		433.3	.14
17	74	34	20	73		423.7	.13
18	78	39	21	73		420.3	.13
19	82	37	26	31		397.4	.11
20	82	43		67	.12	379.1	.15
21	66	47		109	.75	152.4	.37
22	72	40		89		397.0	.14
23	73	40		139		403.7	.19
24	69	37	28	75		400.4	.23
25	66	39	26	76		397.1	.14
26	74	34	25	46		396.5	.13
27	74	34	20	80		400.3	.19
28	79	34	21	49		389.2	.07
29	75	38	38	126		377.4	.23
30	76	42	40	116		375.9	.22
31	76	42	35	125		371.6	.25
Total	2,395	1,219	808	2,412	.87		5.65
Average	77	39	30	78			.18

Table F-10. Climatological data, Plant Science Farm, NMSU, November 1975

Day	Maximum Temp.	Minimum Temp.	Dew Point Temp.	Wind	Rain	Solar Rad.	Evaporation Pan
	F.	F.	F.	mi/day	inches	lang.	inches
1	69	36	37	110		329.0	.13
2	70	35	25	61		372.5	.15
3	74	31	31	43		368.5	.12
4	77	37	28	47		362.4	.12
5	77	36	31	27		355.3	.11
6	79	32	22	77		*	.19
7	79	32	27	40		355.0	.09
8	79	32	24	110		356.4	.24
9	74	33	33	92		356.5	.20
10	74	32	41	38		347.8	.04
11	73	28	33	71		352.3	.17
12	63	31	27	64		352.6	.16
13	68	20	30	45		354.7	.10
14	70	26	31	27		346.5	.10
15	72	25	35	37		295.5	.08
16	76	27	38	35		320.6	.11
17	75	25	35	57		330.2	.12
18	72	27	46	137	.15	217.0	.13
19	59	36	39	92		334.4	.15
20	57	22	32	34	.02	335.4	.13
21	62	21	25	100		326.0	.06
22	50	20	29	37		339.8	.09
23	56	18	26	44		210.3	.04
24	55	19	27	46		329.9	.07
25	67	18	22	175		310.4	.22
26	70	17	21	81		298.5	.10
27	70	17	22	73		307.6	.11
28	64	34	42	356		101.7	.08
29	49	28	40	143	.06	190.1	.19
30	47	19	18	82		325.4	.07
Total	2,027	814	917	2,381	.23		3.67
Average	68	27	31	79			.12

Table F-11. Climatological data, Plant Science Farm, NMSU, December 1975

Day	Maximum Temp.	Minimum Temp.	Dew Point Temp.	Wind	Rain	Solar Rad.	Evaporation Pan
	F.	F.	F.	mi/day	inches	lang.	inches
1	54	18	23	60		319.1	.05
2	65	21	32	60		307.8	.05
3	65	19	33	38		297.2	.07
4	67	23	26	72		*	.13
5	66	21	28	64		*	.12
6	63	25	32	68		294.0	.09
7	64	23	25	80		300.5	.11
8	69	22	28	63		287.3	.08
9	66	28	34	51		290.7	.11
10	68	22	31	26		294.1	.08
11	70	21	27	46		287.2	.11
12	69	20	24	102		296.4	.14
13	64	27	33	142		275.6	.16
14	58	19	37	143		296.4	.16
15	50	23	28	61		286.0	.06
16	55	19	29	69		44914	.08
17	52	21	28	75		436.0	.15
18	50	28	30	124		264.4	.07
19	54	21	30	39		276.6	.02
20	58	23	28	91	.09	234.4	.09
21	46	35	38	77	.11	73.2	.00
22	57	38	42	95	.08	229.5	.07
23	46	39	41	131	.10	80.9	.06
24	50	36	32	115	.03	214.4	.11
25	51	21	26	70		301.1	.05
26	56	26	27	61		306.8	.06
27	56	23	26	98		252.0	.09
28	51	30	24	123		307.5	.15
29	47	18	21	52		305.0	.06
30	53	16	18	44		308.8	.05
31	62	18	18	219		302.0	.15
Total	1,802	744		2,559	.41		2.78
Average	58	24		83			.09

Table F-12. Climatological data, Plant Science Farm, NMSU, January 1976

Day	Maximum Temp.	Minimum Temp.	Dew Point Temp.	Wind	Rain	Solar Rad.	Evaporation Pan
	F.	F.	F.	mi/day	inches	lang.	inches
1	39	26	30	113	.09	47.7	.07
2	40	25	22	42		299.0	.05
3	41	12	16	53		333.6	.05
4	46	15	20	53		291.6	.05
5	52	13	24	53		315.5	.06
6	56	17	19	184		*	.17
7	46	25	16	88		318.5	.10
8	54	14	16	44		313.6	.08
9	57	18	22	30		297.5	.04
10	66	23	27	92		290.2	.13
11	56	23	27	92		315.9	.12
12	65	18	29	65		316.7	.09
13	65	20	28	67		317.1	.11
14	61	23	32	83		314.5	.11
15	65	23	33	86		321.6	.12
16	67	24	36	86		317.3	.10
17	64	25	34	43		318.9	.11
18	65	23	35	43		313.9	.11
19	55	29	34	281		204.7	.21
20	50	32	36	62		248.5	.12
21	57	19	32	18		269.0	.04
22	61	24	36	38		316.1	.08
23	61	30	40	86	.19	149.4	.06
24	58	41	40	226	.02	270.0	.16
25	54	29	32	142		314.5	.13
26	46	23	16	93			.15
27	50	19	24	67			.08
28	59	19	26	57			.07
29	64	23	28	56			.12
30	69	23	32	88			.16
31	57	31	36	78			.05
Total	1,746	711		2,609	.30		3.10
Average	56	23		84			.10

APPENDIX G

IRRIGATION SCHEDULING FOR SURFACE WATER DELIVERIES

BY ELEPHANT BUTTE IRRIGATION DISTRICT

Table G-1. Preliminary estimates of surface irrigation water deliveries to demonstration farm by Elephant Butte Irrigation District

Date Ordered	Field	Acres	Crop	Canal	Date Received	Amount Charged by Bur. of Recl. (ac-ft)
3-14	3	72.2	Tomatoes	Upper Chamberino	3-16 - 3-18	
3-14	4	68.4	Cotton	Upper Chamberino	3-18 - 3-19	87.28
3-18	11	50.0	Chile	San Miguel	3-22 - 3-24	36.44
3-25	10	50.0	Alfalfa	San Miguel		
3-25	2	12.0	Wheat	Upper Chamberino	3-26	2.27
4-15	3	30.0	Tomatoes	Upper Chamberino	4-15	16.36
4-22	3	15	Tomatoes	Upper Chamberino		7.44
4-22	3	55	Tomatoes	Upper Chamberino		2.98
4-29	7	30	Pepper	Upper Chamberino		
5-2	4	60	Cotton	Upper Chamberino		42.15
5-2	7	30	Chile	San Miguel		
5-13	4	60	Alfalfa	San Miguel	5-13	
5-13		23	Pepper	San Miguel	5-13	7.93
5-20	10	50	Alfalfa	San Miguel	5-16	18.60
5-27	3	60	Tomatoes	Upper Chamberino	5-27	10.0
5-27	6	15	Pepper	San Miguel	5-27	6.61
5-30	10	60	Alfalfa	San Miguel	5-29	27.77
6-3	5	12	Chile	San Miguel	6-6	6.36
6-3	6	15	Chile	San Miguel	6-6	9.09
6-3	9	25	Chile	San Miguel	6-9	8.43
6-3	14	30	Chile	San Miguel	6-3	37.00
6-3	12					
6-6	1	3	Pecans	Upper Chamberino	6-10	1.49
6-6	8	25	Cotton	San Miguel	6-17	14.55
6-13	8	30	Cotton	San Miguel		
6-16	3	65	Tomatoes	Upper Chamberino	6-16 - 6-19	51.82
6-16	4	60	Cotton	Upper Chamberino		8.48
6-16	9	25	Chile	San Miguel		20.66
6-16	11	50	Chile	San Miguel		6.45
6-23	11	50	Chile	San Miguel		1.98
6-27	1	3	Pecans	Upper Chamberino	6-29	1.98
		75	Peppers		7-4	25.45
	3	50	Tomatoes	Upper Chamberino	7-7	15.21
7-13	1	3	Pecans	Upper Chamberino	7-13	1.49
7-18	8	30	Cotton	San Miguel	7-21	24.46
7-18	4	60	Cotton	Upper Chamberino		23.35
7-22	9	80	Chile	San Miguel		
7-22	10		Alfalfa	San Miguel		
8-1	11	60	Chile	San Miguel		
8-1	10	60	Alfalfa	San Miguel		41.66
8-1	3	30	Tomatoes	Upper Chamberino	8-11	12.7
8-7	4	60	Cotton	Upper Chamberino	8-11	25.29
8-11	8	30	Cotton	San Miguel	8-16	21.16
8-11	6	10	Corn	San Miguel		
8-11	3	60	Tomatoes	Upper Chamberino	8-15	14.88
9-5	8	30	Cotton	San Miguel	9-10	12.0
9-5	11	50	Alfalfa	San Miguel		33.06

APPENDIX H

MACHINERY AND EQUIPMENT INVENTORY

FOR DEMONSTRATION FARM

Table H-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	THII****
			- - - -	- - - -	-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 H-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 H-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 I

PRELIMINARY ENTERPRISE BUDGETS FOR DEMONSTRATION FARM

Table I-1. Preliminary per acre enterprise cost and return budget for cotton on the demonstration farm, La Mesa, New Mexico, 1975

Planting date(s): April 15
Harvesting date(s): Nov. 15
Yield: 395 lb/lint; 660 lb/seed
Price: .57/lbs.

Gross Return: 225.15 + 26.40 = 251.55
Expenses: 162.62
Net return to capital: 88.93

Item	Unit	Quantity	Purchased Inputs	Labor	Fuel and Repairs	Depreciation Insurance Shelter	Total
			dollars	dollars	dollars	dollars	dollars
Purchased Inputs							
Seed	lb.	30	.08				.08
Fertilizer 18-46	lb.	200	22.00				22.00
Canal Water	ac-ft	2.5	13.50				13.50
Pump Water	ac-ft	1.0			2.10	1.38	3.48
			35.58		2.10	1.38	39.06
Preharvest Operations							
Cut stalks & disc	hr.	.45		1.35	1.32	.85	3.52
Plow	hr.	.36		1.08	2.07	1.04	4.19
Disc	hr.	.28		.84	.87	.63	2.34
Plane	hr.	.34		1.02	1.33	1.00	3.35
Float	hr.	.17		.51	.46	.23	1.20
Furrow	hr.	.50		1.50	1.64	.78	3.92
Pre-irrigate	hr.	.61		1.22			1.22
Harrow	hr.	.17		.51	.45	.28	1.24
Plant	hr.	.20		.60	.92	.46	1.98
Seed bed firmer	hr.	.26		.78	.55	.18	1.51
Cultivate 1st	hr.	.59		1.77	1.46	.73	3.96
Cultivate 2nd	hr.	.50		1.50	1.25	.62	3.37
Cultivate 3rd	hr.	.32		.96	.80	.40	2.16
Cultivate 4th	hr.	.32		.96	.80	.40	2.16
Irrigate	hr.	4.60		9.20			9.20
Subtotal		9.67		23.80	13.92	7.60	45.32
Harvest Operations							
Downtime	hr.	.96		2.88			2.88
Pick (2x)	hr.	1.25		3.75	12.75	18.46	34.96
Haul	hr.	.40		1.20	.72	1.32	3.24
Management (10% of gross)			25.16				25.16
Land Charge (10% of 1,200)			12.00				12.00
Subtotal			37.16	7.83	13.47	19.78	78.24
Total		12.28	72.74	31.63	29.49	28.76	162.62

Table I-2. Preliminary per acre enterprise cost and return budget for wheat on the demonstration farm, La Mesa, New Mexico, 1975

Planting date(s): January 6
Harvesting date(s): July 25
Yield: 3,502
Price: 6.00/cwt

Gross Return: 210.12
Expenses: 122.07
Net return to capital: 88.05

Item	Unit	Quantity	Purchased Inputs	Labor	Fuel and Repairs	Depreciation Insurance Shelter	Total
			dollars	dollars	dollars	dollars	dollars
Purchased Inputs							
Seed	lb.	120	12.00				12.00
Anhydrous ammonia	lb.	100	10.50				10.50
18-46	lb.	100	20.00				20.00
Irrigation water	ac-ft	1.0	4.50				4.50
Pump	ac-ft	.5			1.05	.69	1.74
Subtotal			47.00		1.05	.69	48.74
Preharvest Operations							
Disc	hr.	.28		.84	.87	.63	2.34
Chisel	hr.	.33		.99	1.13	.57	2.69
Disc	hr.	.28		.84	.87	.63	2.34
Plane	hr.	.34		1.02	1.33	1.00	3.35
Float	hr.	.17		.51	.46	.23	1.20
Border	hr.	.17		.51	.46	.23	1.20
Harrow	hr.	.17		.51	.45	.22	1.18
Drill	hr.	.26		.78	1.17	.94	2.89
Irrigate	hr.	2.0		4.00			4.00
Subtotal	hr.	4.00		10.00	6.74	4.45	21.19
Harvest Operations							
Combine (custom)	lb.	100	12.25				12.25
Hauling (custom)	lb.	100	5.95				5.95
Management (10% of gross)		1.0	21.01				21.01
Land Charge (6 months)		1.0	12.00				12.00
Downtime	hr.	.4		.93			.93
Subtotal			51.21	.93			52.14
Total	hr.	4.0	98.21	10.93	7.79	5.14	122.07

Table I-3. Preliminary per acre enterprise cost and return budget for tomatoes on the demonstration farm, La Mesa, New Mexico, 1975

Planting date(s): May 1
Harvesting date(s): October 15
Yield: 13 tons/acre
Price: 75.00

Gross Return: 975.00
Expenses: 608.20
Net return to capital: 366.80

Item	Unit	Quantity	Purchased Inputs	Labor	Fuel and Repairs	Depreciation Insurance Shelter	Total
			dollars	dollars	dollars	dollars	dollars
Purchased Inputs							
Fertilizer	lb.	300	33.00				33.00
Urea	lb.	100	9.25				9.25
Seed	lb.	2/ac	30.00				30.00
Insecticide	pt.	1.0	2.00				2.00
Herbicide	qt.	1.0	15.86				15.86
Irrigation	ac-ft	3	13.50				13.50
Subtotal			103.61				103.61
Preharvest Operations							
Disc	hr.	.28		.84	.87	.63	2.34
Plow	hr.	.36		1.08	2.07	1.04	4.19
Disc	hr.	.28		.84	.87	.63	2.34
Plane	hr.	.34		1.02	1.33	1.00	3.35
List	hr.	.21		.63	.55	.27	1.45
Plant	hr.	.20		.60	.92	.46	1.98
Spray	hr.	.23		.69	.48	.35	1.52
Spray	hr.	.23		.69	.48	.35	1.52
Roll Cultivate	hr.	.59		1.77	1.46	.73	3.96
Spray	hr.	.23		.69	.48	.35	1.52
Cultivate 1st	hr.	.50		1.50	1.25	.62	3.37
Cultivate 2nd	hr.	.32		.96	.80	.40	2.16
Cultivate 3rd	hr.	.32		.96	.80	.40	2.16
Blocked	hr.	.25		.75	.95	.63	2.33
Fertilize	hr.	.20		.60	.92	.46	1.98
Spray (hellicopter)	acre	1.0	2.25				2.25
Hoe	hr.	5.6		15.40			15.40
Irrigate	hr.	4.8		9.60			9.60
Subtotal	hr.	14.94	2.25	38.62	14.23	8.32	63.42
Harvest Operations							
Pick	ton	13	162.50				162.50
Load	hr.	10.67		29.34			29.34
Haul	ton	13	52.00				52.00
Subtotal			214.50	29.34			243.84
Downtime	hr.	1.49		3.86			3.86
Management (10% of gross)		1.0	97.50				97.50
Land charge (8% of 1,200)		1.0	96.00				96.00
Subtotal			193.50	3.86			197.36
Total			513.86	71.82	14.23	8.32	608.20

Table I-4. Preliminary per acre enterprise cost and return budget for alfalfa on the demonstration farm, La Mesa, New Mexico, 1975

Planting date(s): November 1974
Harvesting date(s):
Yield: 6 ton/acre
Price $58.00

Gross Return: 348.00
Expenses: 296.22
Net return to capital: 51.78

Item	Unit	Quantity	Purchased Inputs	Labor	Fuel and Repairs	Depreciation Insurance Shelter	Total
			dollars	dollars	dollars	dollars	dollars
			ESTABLISHMENT				
Purchased Inputs							
Fertilizer							
0-46-0	lb.	300	27.75				27.75
Seed	lb.	30	49.50				49.50
Irrigation water	ac-ft	.75	3.38				3.38
Subtotal			80.63				80.63
Establishment Operations							
Plow	hr.	.36		1.08	2.07	1.04	4.19
Disc (2x)	hr.	.56		1.68	1.74	1.26	4.68
Plane	hr.	.34		1.02	1.33	1.00	3.35
Fertilize	hr.	.20		.60	.92	.46	1.98
Drill	hr.	.26		.78	1.17	.94	2.89
Irrigate (2x)	hr.	.40		.80			.80
Subtotal	hr.	2.12		5.96	7.23	4.70	17.89
Downtime	hr.	.21		.60			.60
Management (1/2)	acre	1.00	17.40				17.40
Land charge (8% of 1,200)		1.00	96.00				96.00
Subtotal	hr.	.21	113.40	.60			114.00
Total	hr.	2.33	194.03	6.56	7.23	4.70	212.52
			ANNUAL				
Purchased Inputs							
Fertilizer	lb.	300	27.75				27.75
Insecticide	qt.	1	2.81				2.81
Establishment Cost	lb.	1/5				42.50	42.50
Irrigation Water	ac-ft	4	13.50		2.11	1.39	17.00
Wire			16.74				16.74
Subtotal			60.80		2.11	43.89	106.80
Maintenance Operations							
Fertilize	hr.	.20		.60	.92	.46	1.98
Spray	hr.	.23		.69	.49	.35	1.53
Irrigate	hr.	4.8		9.60			9.60
Subtotal	hr.	5.23		10.89	1.41	.81	13.11
Harvest Operations							
Swath (5x)	hr.	.80		2.40	7.46	17.82	27.68
Bale (5x)	hr.	1.00		3.00	4.82	8.36	16.18
Subtotal	hr.	1.80		5.40	12.28	26.18	43.86
Downtime	hr.	.70		1.65			1.65
Management (10% of gross)		1.0	34.80				34.80
Land Charge (8% of 1,200)			96.00				96.00
Subtotal			130.80	1.65			132.45
Total			191.60	17.94	15.80	70.88	296.22

Table I-5. Preliminary per acre enterprise cost and return budget for corn (silage) on the demonstration farm, La Mesa, New Mexico, 1975

Planting date(s): May 15
Harvesting date(s): Sept. 15
Yield: 14 tons/acre
Price: 11.50/ton

Gross Return: 161.00
Expenses: 232.45
Net return to capital: -71.45

Item	Unit	Quantity	Purchased Inputs	Labor	Fuel and Repairs	Depreciation Insurance Shelter	Total
			dollars	dollars	dollars	dollars	
Purchased Inputs							
Fertilizer	lb.	200	22.00				22.00
Urea	lb.	100	9.25				9.25
Anhydrous ammonia	lb.	100	10.50				10.50
Seed	lb.	10	10.00				10.00
Irrigation water	ac-ft	3	13.50				13.50
Subtotal			65.25				65.25
Preharvest Operations							
Disc	hr.	.28		.84	.87	.63	2.34
Plow	hr.	.36		1.08	2.07	1.04	4.19
Disc	hr.	.28		.84	.87	.63	2.34
Float	hr.	.17		.51	.46	.23	1.20
Fertilize	hr.	.20		.60	.92	.46	1.98
List	hr.	.21		.63	.55	.27	1.45
Plant	hr.	.20		.60	.92	.46	1.98
Cultivate 1st	hr.	.59		1.77	1.46	.73	3.96
Cultivate 2nd	hr.	.50		1.50	1.25	.62	3.37
Cultivate 3rd	hr.	.32		.96	.80	.40	2.16
Fertilize	hr.	.20		.60	.92	.46	1.98
Irrigate	hr.	2.80		5.60			5.60
Subtotal		6.11		15.53	11.09	5.93	32.55
Harvest Operations							
Harvest	hr.	.28	21.00				21.00
Downtime	hr.	.61		1.55			1.55
Management	acre	1.0	16.10				16.10
Land Charge	acre	1.0	96.00				96.00
Subtotal			133.10	1.55			134.65
Total			198.35	17.08	11.09	5.93	232.45

Table I-6. Preliminary per acre enterprise cost and return budget for fall lettuce on the demonstration farm, La Mesa, New Mexico, 1975

Planting date(s): Sept. 1			Gross Return:		1,840.00		
Harvesting date(s): Nov. 15			Expenses:		1,231.05		
Yield: 460 ctn/acre			Net return to capital:		608.95		
Price: 4.00 ctn							

Item	Unit	Quantity	Purchased Inputs	Labor	Fuel and Repairs	Depreciation Insurance Shelter	Total
			dollars	dollars	dollars	dollars	dollars
Purchased Inputs							
Fertilizer	lb.	400	44.00				44.00
Urea	lb.	100	9.25				9.25
Seed	lb.	3/ac	64.50				64.50
Herbicide	pt.	5/ac	5.65				5.65
Insecticide	qt.	1	2.81				2.81
Irrigation water	ac-ft	.8	5.40				5.40
Subtotal			131.61				131.61
Preharvest Operations							
Plow	hr.	.36		1.08	2.07	1.04	4.19
Disc	hr.	.28		.84	.87	.63	2.34
Float	hr.	.17		.51	.46	.23	1.20
Apply herbicide	hr.	.23		.69	.48	.35	1.52
List	hr.	.21		.63	.55	.27	1.47
Pre-irrigate	hr.	.61		1.22			1.22
Harrow	hr.	.17		.51	.45	.28	1.24
Plant	hr.	.20		.60	.92	.46	1.98
Seed bed firmer	hr.	.26		.78	.55	.18	1.51
Cultivate 1st	hr.	.59		1.77	1.46	.73	3.96
Cultivate 2nd	hr.	.50		1.50	1.25	.62	3.37
Cultivate 3rd	hr.	.32		.96	.80	.40	2.16
Cultivate 4th	hr.	.32		.96	.80	.40	2.16
Apply insecticide	acre	1.0	4.00				4.00
Thin	hr.	8.00		22.00			22.00
Hoe	hr.	6.00		16.50			16.50
Irrigate	hr.	4.80		9.60			9.60
Subtotal	hr.	23.02	4.00	60.15	10.68	5.59	80.42
Harvest Operations							
Sales & Harvest (1.75)	ctn		805.00				805.00
Downtime	hr.	2.30		6.02			6.02
Management (10% of gross)		1.0	184.00				184.00
Land charge	acre	1.0	24.00				24.00
Subtotal			1013.00	6.02			1019.02
Total			1148.61	66.17	10.68	5.59	1231.05

Table I-7. Preliminary per acre enterprise cost and return budget for chile on the demonstration farm, La Mesa, New Mexico, 1975

Planting date(s): April 15
Harvesting date(s): October
Yield: 7.8 tons-green 300 lbs-red
Price: $150/ton-green $35/cwt

Gross Return: 1,275.00
Expenses: 670.58
Net return to capital: 604.42

Item	Unit	Quantity	Purchased Inputs dollars	Labor dollars	Fuel and Repairs dollars	Depreciation Insurance Shelter dollars	Total
Purchased Inputs							
Fertilizer							
18-46	lb.	300	33.00				33.00
Urea	lb.	100	9.25				9.25
Seed	lb.	2	17.00				17.00
Insecticide	pt.	1	3.75				3.75
Irrigation water	ac-ft	3.0	13.50				13.50
Pump	ac-ft	0.8			1.69	1.11	2.80
Subtotal			76.50		1.69	1.11	79.30
Preharvest Operations							
Cut stalks	hr.	.17		.51	.45	.22	1.18
Disc	hr.	.28		.84	.87	.63	2.34
Plow	hr.	.36		1.08	2.07	1.04	4.19
Disc	hr.	.28		.84	.87	.63	2.34
Plane	hr.	.34		1.02	1.33	1.00	3.35
List	hr.	.21		.63	.55	.27	1.45
Pre-irrigate	hr.	.61		1.22			1.22
Harrow	hr.	.17		.51	.45	.28	1.24
Plant	hr.	.20		.60	.92	.46	1.98
Thin	hr.	8.00		22.00			22.00
Spray	hr.	.23		.92	.48	.35	1.75
Cultivate 1st	hr.	.59		1.77	1.46	.73	3.96
Cultivate 2nd	hr.	.50		1.50	1.25	.62	3.37
Cultivate 3rd	hr.	.32		.96	.80	.40	2.16
Cultivate 4th	hr.	.32		.96	.80	.40	2.16
Irrigate	hr.	4.80		9.60			9.60
Hoe	hr.	5.60		15.40			15.40
Subtotal		22.98		60.36	12.30	7.03	79.69
Harvest Operations							
Pick	lb.	15,600	225.42				225.42
Load	hr.	9.25		25.43			25.43
Haul	lb.	15,600	31.20				31.20
Subtotal			256.62	25.43			282.05
Downtime	hr.	2.30		6.04			6.04
Management (10% of gross)		1.0	127.50				127.50
Land charge (8% of 1,200)		1.0	96.00				96.00
Subtotal			223.50	6.04	13.99	8.14	229.54
Total			556.62	91.83	13.99	8.14	670.58

APPENDIX J

DEMONSTRATION FARM NEWS ARTICLES

ALBUQUERQUE JOURNAL Sunday, December 14, 1975 p. A-11

River Water Quality, Crop Yield Being Studied on Las Cruces Farm

By JEANNE GLEASON

In an attempt to help the farmer, the Environmental Protection Agency is funding New Mexico State University in a three-year project in the upper Rio Grande area.

The study focuses on both water quality and crop yields. The project is an all-out effort to assist the farmer improve water quality and thus meet the new federal water quality standards for the Rio Grande.

The project centers on the J.F. Apodaca Farms Inc., managed by Orlando Cervantes. The farm produces a wide variety of crops, including tomatoes, peppers, chile, corn, cotton, wheat and pecans.

Although detailed laboratory research on the problem has been conducted, the principles learned in the lab are now being applied on the demonstration farm. Under actual farm conditions, the research encounters real-life economic, engineering and crop yield problems as well as water purity problems..

Cervantes has approved the installation of several units of test and measurement equipment. He is also cooperating with modifications of his irrigation management. The researchers are looking at the relationship between water salinity and different irrigation practices, such as drip irrigation, lined ditches and the traditional flood method.

Specialists on the project measure the quality and quantity of the water as it leaves the irrigation channels or deep wells. They again use the meters to record the amount and salinity of the water as it returns to the Rio Grange water system.

As the first crop year ends, the present quality of the water and ground water level have been recorded. Next year, the project will make additional changes in the irrigation process and hopefully improve the quality of the irrigation return flow.

In future years, computers will be used to schedule crop waterings to allow for the most benefit from irrigation while maintaining the best water quality.

Project results can be extremely important to New Mexico farmers. Each time water is used for irrigation, it is degraded. For example, as water moves down the Rio Grande, the salinity increases due to stream flow depletion by consumption and impurities from natural and man-made sources.

Irrigation accounts for 90 per cent of New Mexico's water consumption.

During irrigation, the pure water is utilized by the plants and the original salts are concentrated. Industrial and municipal water use also adds salts to the river. When the water accumulates a heavy salt and mineral load, it begins to salt-up the land, eventually rendering it worthless for farming.

Although there are some saline areas in the U.S., few areas in New Mexico have been irrigated long enough to cause heavy salting damage. However, poor irrigation practices could seriously damage cropland in the Southwest.

Project Studies Salinity In Irrigation Return Flow

By Jeanne Gleason
NMSU Associate Agricultural Editor

Salt build-up on New Mexico farm land can be disastrous.

However, every irrigator using water of less than distilled quality is aware of the salt build-up problem in his fields. In the past, the solution was simple enough. The farmer would simply apply more water than his crops needed or his soil profile could store. Thus the extra water leached away excessive salts.

Gleason

Definite Problems

Although the immediate solution seems simple enough, there are definite problems. Unfortunately for the downstream user, this leached water finds its way through the soil profile to open drains. Subsequently the water carrying the excessive salts returns to the river where it is reused on farms downstream. Thus, the water becomes saltier with each reuse.

While this irrigation return flow is a way of life and survival in arid region farming, it is also a big "no-no" under current Environmental Protection Agency regulations. Research reveals that this old method of irrigation is actually a point-source for water pollution and should be eliminated to protect water quality.

This creates a real dilemma for the farmer. If the present technique for leaching salt from a field is eliminated, the excess salt will build-up in the soil and virtually destroy the soil's capability to produce vital food and fiber crops.

3-Year Project

In an attempt to help the farmer, the EPA is funding New Mexico State University for a three year project in the upper Rio Grande area. The project is an all-out effort to find ways to deal with irrigation return flow salinity control and thus meet new federal water quality standards for the Rio Grande. In addition, the project is also concerned with the affect of the new techniques on the farmer's crop yields.

Basically the project demonstrates the feasibility of large scale use of alternative water management practices to control the quality of drainage return flow and soil salinity. Present day irrigation technology will be used on the test site to show how modern water management techniques can improve the return flow quality and quantity.

A four acre test site near the large demonstration farm will show the feasibility of irrigating at or near 100 percent efficiency using water of medium salinity (1200 parts per million) while maintaining optimum crop yields over many years.

The main project centers on the J. F. Apodaca Farms, Inc., which covers more than 650 acres. The commercial enterprise produces a wide variety of crops, including tomatoes, peppers, chile, corn, vegetables, cotton, wheat and pecans. Thus the NMSU researchers encounter real-life economic, engineering and crop yield problems in addition to the water purity problems.

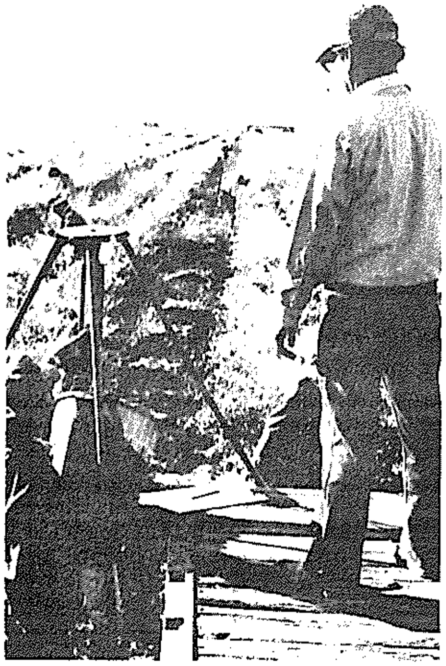
Monitor Farm

The primary objective here is to monitor an on-going successful commercial farming operation and to demonstrate the effects of salinity control techniques, such as canal lining, irrigation scheduling and trickle irrigation, on the quality and quantity of the return flow entering the Rio Grande.

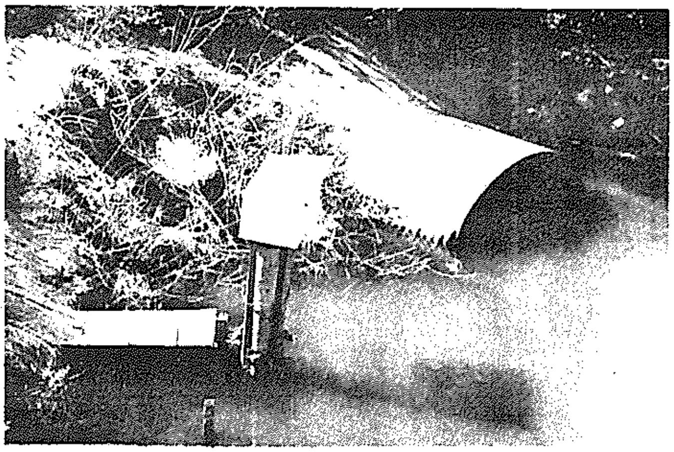
To accomplish this, the normal operation of the farm was monitored during the 1975 season, before salinity control measures were added. During this year, meters, piezo meters, a drip irrigation system, open drain monitoring systems and other hardware were installed.

Recordings of a "before" nature were taken. Specialists on the project measures the quality and quantity of the water as it left the irrigation channels or deep wells. They again used the meters to record the amount and salinity of the water as it returned to the Rio Grande water system. Researchers are also monitoring and collecting such obvious physical data as soil (See COMPUTERS, pg. 42)

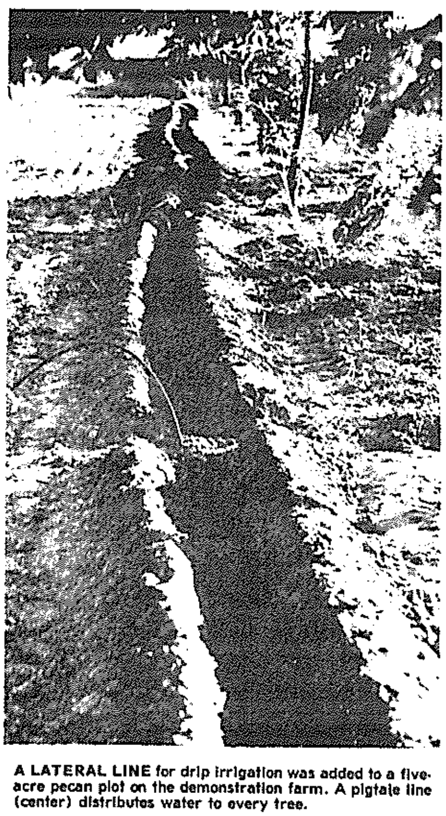
A RECORD of ground water fluctuation is gathered by a series of piezometers strategically located across the demonstration area.



COOPERATING FARMER Orlando Cervantes, left, manager of the J. F. Apodaca Farms, keeps careful record of field labor, production, equipment time and other economic inputs which might affect the farm's operation as a result of an imposed salinity control regime.



THE QUANTITY AND QUALITY of the open drain water flow is monitored as drain water enters and leaves the demonstration area.



A LATERAL LINE for drip irrigation was added to a five-acre pecan plot on the demonstration farm. A pigtale line (center) distributes water to every tree.

Computers May Schedule Crop Waterings

(Continued from Page 38)

salinity buildup.

Checks Inputs

In addition, Orlando Cervantes, manager of the J.F. Apodaca Farms, is keeping a careful record of field labor, equipment time and other economic inputs which might affect the farm's operation as a result of an imposed salinity control regime.

During the 1976 crop season, various water saving and salinity control practices are being instituted and their effects will be noted at various data bases.

In future years, computers will be used to schedule crop waterings to allow for the most benefit from irrigation while maintaining the best water quality.

Team Supervision

The EPA project is being conducted through the facilities of the New Mexico Water Resources Institute who has put together a multi-disciplinary team of agronomists, agricultural economists and agricultural engineers with both research and Extension expertise to guide and direct the project.

Robert R. Lansford, professor of Agricultural Economics - Water Resources Economics at the New Mexico State University Agricultural Experiment Station, is the project coordinator. Also representing the NMSU Experiment Station are Peter J. Wierenga, associate professor of Agronomy, Soil Physics.

Lynn W. Gelhar, associate professor of Hydrology, represents the New Mexico Institute of Mining and Technology and Buck Sision, research associate in Agronomy, is from NMSU.

Charles M. Hohn, Extension agricultural engineer and Gene Ott, Extension farm management specialist, serve with the NMSU Cooperative Extension Service.

In a nutshell, the three year study will evaluate the feasibility of controlling salinity by known technology and evaluating its impact on the successful large scale farming operation in the Upper Rio Grande basin near Las Cruces.

New Roses Take Time

A lot of time and money goes into the development of a new rose variety, points out a horticulturist for the Texas Agricultural Extension Service. It can take as long as 10 years to produce a single new rose and can cost up to $100,000.

Selecting plants for color, shape, firmness and scent is a long, enduring process, not to mention testing for strength, disease resistance and beauty. Tests are made in gardens throughout the United States.

WATER APPLIED FROM WELLS is monitored by propeller type meters in an effort to record all inputs to the irrigation operation. Cooperating farmer Cervantes reads the meter prior to the start of the 1976 watering season.

THE SEEPAGE LOSS occurring in lined and unlined ditches is compared in field laterals.

APPENDIX K

MESILLA VALLEY CROPPING PATTERN 1947-1974

Table K-1. Irrigated cropland acreage (ground-water irrigated) in the Mesilla Valley, New Mexico and Texas, 1947-74

CROPS	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
SMALL GRAINS	33	33	33	43	228	176	178	333	458	333	558	453	516	621
CORN	36	36	39	43	33	33	33	67	63	33	33	133	133	95
SORGHUM	0	0	0	0	0	0	0	0	0	0	25	50	50	75
ALFALFA	230	230	236	247	246	401	506	616	816	941	966	971	896	921
OTHER HAY-PASTURE	7	7	0	9	3	7	7	7	7	0	0	0	0	15
BEANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COTTON	263	269	270	253	260	256	256	246	246	294	398	553	603	694
LETTUCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ONIONS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PEPPERS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POTATOES	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOMATOES	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER VEGETABLES	30	30	32	35	35	35	35	35	36	80	78	68	88	91
PECANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ORCHARDS-VINEYARDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL CROPPED	599	605	610	630	805	910	1015	1304	1626	1681	2058	2228	2286	2512
MULTIPLE CROPPED	0	0	0	0	0	0	0	0	0	0	(25)	(50)	(50)	(75)
TOTAL CROPLAND	599	605	610	630	805	910	1015	1304	1626	1681	2033	2178	2236	2437

Table K-1. Continued

CROPS	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
SMALL GRAINS	803	703	411	583	438	363	313	293	93	128	333	250	291	185
CORN	63	48	120	120	100	85	78	65	66	67	67	90	76	69
SORGHUM	100	100	50	50	70	82	93	127	167	204	226	192	294	249
ALFALFA	994	1269	1209	1249	1526	1592	1554	1531	1332	1627	1642	1656	1682	1579
OTHER HAY-PASTURE	15	15	15	15	20	20	20	10	240	240	280	280	332	347
BEANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COTTON	846	1136	1242	1451	1493	1520	1598	1519	1696	1346	1204	1192	1162	1365
LETTUCE	0	0	0	0	0	4	7	61	14	14	15	19	26	18
ONIONS	0	0	0	0	0	3	8	13	15	15	15	15	19	27
PEPPERS	0	0	0	0	0	0	0	0	15	0	0	35	59	90
POTATOES	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOMATOES	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER VEGETABLES	86	86	108	112	118	106	108	119	92	84	90	90	90	94
PECANS	0	0	32	46	53	153	233	273	312	312	312	320	320	340
ORCHARDS-VINEYARDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL CROPPED	2907	3357	3187	3626	3818	3928	4012	4011	4042	4037	4184	4139	4351	4363
MULTIPLE CROPPED	(100)	(100)	(50)	(50)	(50)	(40)	(30)	(40)	(50)	(55)	(60)	(60)	(65)	(65)
TOTAL CROPLAND	2807	3257	3137	3576	3768	3888	3982	3971	3992	3982	4124	4079	4286	4298

Table K-2. Irrigated cropland acreage (surface-water irrigated) in the Mesilla Valley, New Mexico and Texas, 1947-1974

CROPS	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
SMALL GRAINS	489	420	157	322	4	464	237	2281	1825	1459	788	348	1407	1357
CORN	563	664	483	869	296	260	399	1766	3214	2397	1327	1747	2226	1664
SORGHUM	47	0	108	3	92	130	85	376	200	183	105	32	164	233
ALFALFA	12739	6563	6796	10297	5783	9192	10368	15938	19649	18727	12914	14368	12360	13013
OTHER HAY-PASTURE	2475	1665	1808	2496	749	2350	2201	2244	1483	980	658	2619	520	4088
BEANS	108	22	5	0	3	3	8	23	9	43	4	46	7	8
COTTON	62766	68604	69890	63444	72288	67225	66330	47243	47687	45092	52772	50054	51383	50481
LETTUCE	0	0	0	0	199	381	445	238	249	631	1079	1471	1052	1188
ONIONS	503	323	362	395	280	317	354	307	367	524	837	1230	1702	1852
PEPPERS	205	136	167	184	254	269	312	506	374	686	430	420	460	493
POTATOES	167	188	114	115	48	23	22	46	42	38	1	3	6	3
TOMATOES	0	0	0	53	48	75	43	138	179	323	97	131	240	109
OTHER VEGETABLES	1983	1510	1431	1981	568	496	386	710	600	395	363	462	581	495
PECANS	4120	4247	4140	4074	4134	4089	4065	4048	4091	3587	4117	4132	4194	4144
ORCHARDS-VINEYARDS	268	195	174	277	9	25	21	19	105	75	85	125	105	167
TOTAL CROPPED	86433	84537	85635	84510	84755	85299	85276	75883	80074	75140	75578	77688	76407	79295
MULTIPLE CROPPED	(6049)	(4494)	(4879)	(5142)	(5054)	(5437)	(5380)	(3658)	(3986)	(2181)	(2524)	(2247)	(2275)	(5116)
TOTAL CROPLAND	80384	80043	80756	79368	79701	79862	79896	72225	76088	72959	73054	75441	74132	74179

Table K-2. Continued.

CROPS	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
SMALL GRAINS	1675	931	397	715	921	687	888	1445	1758	3009	2137	2498	3700	2774
CORN	1321	898	673	1074	1424	831	1226	1415	1299	2155	1941	1397	1700	1000
SORGHUM	153	115	161	152	319	952	1481	1197	1941	1745	1664	758	1706	816
ALFALFA	14322	10217	6625	8646	11688	11479	10556	9797	10743	12512	12760	12292	13283	12345
OTHER HAY-PASTURE	730	546	409	586	682	908	1255	1031	1183	1225	1439	1459	2027	1893
BEANS	0	0	0	0	75	0	15	3	1	0	0	0	24	85
COTTON	50396	57991	63114	57961	50000	43642	39941	44949	42395	41719	41725	40099	38286	42484
LETTUCE	707	899	698	925	1340	3025	4753	7167	6154	4613	2919	3010	3342	2378
ONIONS	1549	1515	1191	1511	2006	2594	2838	3184	2996	3089	2566	2561	3161	2353
PEPPERS	569	396	374	495	523	500	736	908	1807	1847	2014	2493	2522	3255
POTATOES	0	0	1	0	50	138	263	35	7	5	4	5	3	9
TOMATOES	55	3	10	20	457	498	533	563	288	260	541	433	493	309
OTHER VEGETABLES	486	383	327	281	416	284	302	494	274	278	254	319	278	225
PECANS	4156	4145	4121	4094	4202	4305	4175	4799	5044	5451	5522	5813	6057	6197
ORCHARDS-VINEYARDS	115	188	43	79	65	85	225	224	59	122	141	111	264	295
TOTAL CROPPED	76234	78228	78144	76539	74168	69928	69187	77211	75949	78030	75627	73248	76846	76418
MULTIPLE CROPPED	(2192)	(1621)	(983)	(1118)	(1513)	(1975)	(2112)	(4181)	(4399)	(4011)	(2914)	(2367)	(3520)	(2501)
TOTAL CROPLAND	74042	76607	77161	75421	72655	67953	67075	73030	71550	74019	72713	70881	73326	73917

APPENDIX L

HYDROSALINITY MODEL PROGRAM

Appendix L. Listing of revised USBR computer program ACUMEN

Program Modifications:

A: cards changed

B: cards added

CN: cards deleted, N = no. of cards

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C     PROGRAM ACUMEN
C**** THIS COMPUTER APPLICATION HAS BEEN DESIGNED AS A SYSTEM ANALYSES  HYD00010
C**** AND CONJUNCTIVE USE MODEL EMULATING A NODAL CONCEPT IN DIVIDING   HYD00020
C**** A WATER BASIN INTO PERTINENT FUNCTIONAL OR RESPONSIVE CRITICAL    HYD00030
C**** AREAS ALLOWING AS MUCH FLEXIBILITY IN MODEL DESIGN AS WAS         HYD00040
C**** CONSIDERED PRACTICAL                                              HYD00050
        COMMON / GENRL / LTITLE(16),NCTRL( 5, 3), MOBEG, IYRBEG, MOEND, IHYD00060
     AYREND, NUMNOD, ISEQ( 5, 20), KPKI, NUMSEQ( 5), NDWTN( 5, 20)     HYD00070
        COMMON / RESER /                                               HYD00080
     A QINFLO(5,10,12),DEMAND(5,10,16),K                                        A
     BOLMNN( 5, 10,16), KQINNM( 5, 10,16) , KAQUNM (5,16)              HYD00100
        COMMON / PROPER / SOIL( 5, 10, 21), BTANK( 5, 10), TTANK( 5, 10),HYD00130
     1 GRTANK( 5, 10)   , NSEQ ( 5) , CONUSE ( 5, 10, 30)              HYD00140
      DIMENSION KUSE(5,10,30)
        COMMON / SALT / QTO ( 5, 20), WQAL( 5, 20)                     HYD00160
      COMMON / PARAM / OBSRES (  5, 11 ) , BEGWR (  5, 10 ) ,          HYD00170
     1           PREDIC (  5, 10 ), OBSVAL ( 5,10), CHEMOM (  5, 10, 10)  HYD00180
      DIMENSION QINRIV(10), OBSERV(10), KFA(20),                       HYD00190 A
     1           QFLOW (10 ) , TEMP (10)                               HYD00200
      EQUIVALENCE ( CONUSE, KUSE )                                     HYD00210
C**** THIS IS THE FIRST TIME PROGRAM HAS BEEN ENTERED FOR A PARTICULAR  HYD00240
C**** JOB - SET READ AND WRITE UNITS AND READ SYSTEM STRUCTURE AND      HYD00250
C**** PERTINENT INITIALIZATION PARAMETERS                               HYD00260
      IR=5                                                             HYD00270
      IW=6                                                             HYD00280
      LINE = 0                                                         HYD00290
      DO 5 K = 1, 4                                                    HYD00300
      JREAD = K                                                        HYD00310
      CALL PERUSL ( JREAD , IW , IR )                                  HYD00320
    5 CONTINUE                                                         HYD00330 C1
      MO = MOBEG                                                       HYD00350
      IYR = IYRBEG                                                     HYD00360
C**** INITIAILIZE PASS INDEX OF EACH NODE FOR USE IN ITERATIVE SCHEME   HYD00370 C3
C**** INITIALIZE STARTING INDICES FOR NODE (MIN) AND SEQUENCE ( MINA )  HYD00410 C2
C**** LOOPS                                                             HYD00420
   10 WRITE(IW,16)                                                     HYD00450 A
   16 FORMAT ( 1H1, 8X )                                               HYD00460
C**** BEGIN ITERATIVE SCHEME FOR EACH NODE WHERE NUMNOD = NUMBER OF NODEHYD00470
   20 DO 600 KN=1,NUMNOD                                               HYD00480
C**** CHECK TO DETERMINE IF THIS IS THE FIRST PASS THROUGH THIS NODE    HYD00490 C1
C**** THIS IS THE FIRST PASS THROUGH THIS NODE ** INITIALIZE RIVER      HYD00510
C**** FLOW AND CHEMISTRY ARRAY ( QINRIV ) AND UPDATE AQUIFER ASSUME ONE HYD00520
C**** MONTH LAG IN CHEMISTRY MIX ** LET ARRAY BEGWR = BEGINNING         HYD00530
C**** CONDITIONS OF AQUIFER AT START OF TIME FRAME                      HYD00540
      DO 25 K = 1, 10                                                  HYD00550
      QINRIV (K) = 0.0                                                 HYD00560
      BTANK ( KN, K ) = 0.0                                            HYD00570
      TTANK ( KN, K ) = 0.0                                            HYD00580
      BEGWR (KN, K ) = GRTANK ( KN, K )                                HYD00590
   25 CONTINUE                                                         HYD00600
C**** THIS PORTION OF THE SUBROUTINE IS USED FOR ALL PASSES ** LET NS=  HYD00610
C**** NUMBER OF SEQUENTIAL OPERATIONS IN THIS NODE                      HYD00620
   30 NS = NUMSEQ ( KN)                                                HYD00630
C**** LOOP THROUGH EACH SEQUENCE IN NODE                                HYD00640
      DO 500 KS=1,NS                                                   HYD00650
      IS = IABS ( ISEQ (KN, KS ) )                                     HYD00660

      IF ( ISEQ (KN, KS)) 50, 500, 400                                 HYD00670
   50 CONST = DEMAND ( KN, IS, MO )                                    HYD00680
      TEST = DEMAND ( KN, IS, 14)                                      HYD00690
      IF ( TEST .GT. 2.0. AND. TEST . LT. 6.0 ) GO TO 250              HYD00700
C**** THIS OPERATIONAL SEQUENCE REPRESENTS A DEMAND IN THE NODE         HYD00710
C**** WHOSE SOURCE MAY BE FROM THE RIVER ( SURFACE FLOW ) OR FROM THE   HYD00720
C**** AQUIFER ( SUBSURFACE FLOW ) TO SUPPLY EITHER AN IRRIGATION        HYD00730
C**** OR A MUNICIPAL AND INDUSTRIAL REQUIREMENT                         HYD00740
      IF ( DEMAND (KN, IS, 13 ) .GT. 1.0 )  GO TO 170                  HYD00750
C**** DEMAND IS TO BE SUPPLIED FROM RIVER ( SURFACE FLOW)               HYD00760
      IF ( TEST . EQ. 6.0 ) GO TO 230                                  HYD00770
      TEMPR = QINRIV (1) - CONST                                       HYD00780
      IF ( ABS (TEMPR).LT. 1.0 )  TEMPR = 0.0                          HYD00790
      IF ( TEMPR . LT. 0.0 ) GO TO 100                                 HYD00800
C**** DEMAND CAN BE FULLY MET BY FLOW IN THE RIVER SET INDEX (INDY) = 1 HYD00810
      INDY = 1                                                         HYD00820
C**** CALL RETURN FLOW AND SHORTAGE SUBROUTINE ( RFCOMP ) TO COMPUTE    HYD00830
C**** AND ALLOCATE RETURN FLOW MAGNITUDE AND CHEMISTRY AND COMPARE      HYD00840
C**** SHORTAGE ( IF ANY ) WITH SHORTAGE INDEX ** IF THE TEST FAILS THE  HYD00850
C**** SHORTAGE CRITERIA RFCOMP WILL TERMINATE COMPUTATION               HYD00860
   60 CALL RFCOMP ( QINRIV, KN, IS, INDY, MO, CONST, IW )              HYD00870
C**** SET ACTUAL DIVERSION AND CHEMISTRY OF WATERS DIVERTED             HYD00880
   70 DEMAND ( KN, IS, 16 ) = CONST                                    HYD00890
      QINRIV (1) = TEMPR                                               HYD00900
      DO 80 K = 2, 10                                                  HYD00910
      CHEMOM ( KN, IS , K ) = QINRIV (K)                               HYD00920
   80 CONTINUE                                                         HYD00930
      GO TO 500                                                        HYD00940
C**** THERE ARE NO UPSTREAM RESERVOIRS AVAILABLE FOR ADDITIONAL RELEASESHYD01010
C**** SET DIVERSION EQUAL TO FLOW IN RIVER AND CALL ROUTINE RFCOMP      HYD01020
C**** TO DETERMINE IF SHORTAGE IS TOLERABLE AND COMPUTE RETURN FLOW     HYD01030
C**** AND ALLOCATION. IF SHORTAGE IS NOT TOLERABLE ROUTINE RFCOMP WILL  HYD01040
C**** TERMINATE COMPUTATION                                             HYD01050
  100 INDY = 2                                                         HYD01060
      CONST = QINRIV (1)                                               HYD01070
      TEMPR = 0.0                                                      HYD01080
      GO TO 60                                                         HYD01090
C**** SEARCH FOR AVAILABLE UPSTREAM RESERVOIRS FOR POSSIBLE ADDITIONAL  HYD01100
C**** RELEASES TO MEET THIS DEFICIT                                     HYD01110
  110 CONTINUE
      GO TO 100                                                        HYD01540
C**** DEMAND IS TO BE SUPPLIED FROM AQUIFER ( SUBSURFACE FLOW )         HYD01550
  170 TEMPR = GRTANK ( KN, 1 ) - CONST                                 HYD01560
      IF ( TEST .EQ. 6.0 )  GO TO 340                                  HYD01570
      IF ( ABS ( TEMPR ) .LT. 1.0 ) TEMPR = 0.0                        HYD01580
      IF ( TEMPR . LT. 0.0 ) GO TO 220                                 HYD01590
C**** DEMAND CAN BE FULLY SUPPLIED FROM AQUIFER ( SUBSURFACE FLOW )     HYD01600
C**** SET INDEX (INDY) = 1                                              HYD01610
      INDY = 1                                                         HYD01620
C**** CALL RETURN FLOW AND SHORTAGE SUBROUTINE ( RFCOMP ) TO COMPUTE    HYD01630
C**** AND ALLOCATE RETURN FLOW MAGNITUDE AND CHEMISTRY AND COMPARE      HYD01640
C**** SHORTAGE ( IF ANY ) WITH SHORTAGE INDEX ** IF THE TEST FAILS THE  HYD01650
C**** SHORTAGE CRITERIA RFCOMP WILL TERMINATE COMPUTATION               HYD01660
  180 DO 185 K = 2, 10                                                 HYD01670
      TEMP (K) = BEGWR ( KN, K )                                       HYD01680
  185 CONTINUE                                                         HYD01690
      CALL RFCOMP ( TEMP  , KN, IS, INDY, MO, CONST, IW )              HYD01700
      GRTANK ( KN, 1 ) = TEMPR                                         HYD01710
C**** SET ACTUAL DIVERSION AND CHEMISTRY OF WATERS DIVERTED             HYD01720
  190 DEMAND ( KN , IS, 16 ) = CONST                                   HYD01730
      DO 200 K = 2, 10                                                 HYD01740
      CHEMOM ( KN, IS, K ) = BEGWR ( KN, K )                           HYD01750
  200 CONTINUE                                                         HYD01760
      GO TO 500                                                        HYD01770
C**** DEMAND CAN NOT BE FULLY SUPPLIED BY AQUIFER- COMPUTE SHORTAGE     HYD01780
C**** RETURN FLOW AND ALLOCATION ( IF SHORTAGE NOT TOLERABLE RFCOMP     HYD01790
C**** WILL TERMINATE COMPUTATION )                                      HYD01800
  220 CONST = GRTANK ( KN, 1 )                                         HYD01810
      INDY = 2                                                         HYD01820
      TEMPR = 0.0                                                      HYD01830
      GO TO 190                                                        HYD01840
C**** THIS DEMAND REPRESENTS A SURFACE FLOW THAT IS TRANSFERRED OUT     HYD01850
C**** OF SYSTEM                                                         HYD01860
  230 TEMPR = QINRIV (1) - CONST                                       HYD01870
      IF ( TEMPR . LT. 0.0 )   GO TO 1010                              HYD01880
      GO TO 70                                                         HYD01890
C**** WHEN DEMAND ( KN, IS, 14) THE DESTINATION OR USE INDEX IS GREATER HYD01900
C**** THAN 2.0 SIMPLE TRANSFERS OF FLOW ARE TREATED AS DEMANDS SO THAT  HYD01910
C**** ROUTINE RFCOMP WILL SET UP THE PROPER QINFLO ARRAY. THESE TRANSFERHYD01920
C**** CAN HAVE PERCOMPUTED VOLUMES (INPUT DATA ) OR WILL BE COMPUTED IN HYD01930
C**** SIMULATION                                                        HYD01940
  250 IF ( DEMAND ( KN, IS, 13 ) .GT. 1.0 ) GO TO 290                  HYD01950
C**** TRANSFERS WILL BE MADE FROM THE RIVER (SURFACE FLOW) TO AQUIFER   HYD01960
C**** OR SOIL COLUMN                                                    HYD01970
      IF ( TEST.EQ. 3 )    INDY = 3                                    HYD01980
      IF ( TEST.EQ. 4 )    INDY = 4                                    HYD01990
      TEMPR = QINRIV (1) - CONST                                       HYD02000
      IF ( ABS (TEMPR) .LT. 1.0 )  TEMPR = 0.0                         HYD02010
      IF ( TEMPR . LT. 0.0 )  GO TO 1060                               HYD02020
      GO TO 60                                                         HYD02030
C**** TRANSFERS WILL BE MADE FROM THE AQUIFER (SUBSURFACE FLOW ) TO THE HYD02040
C**** RIVER ** CONDITIONALLY IF THE AQUIFER IN ANY NODE CANNOT MELT THE HYD02050
C**** TRANSFER REQUIREMENT.  AN INTERNODAL TRANSFER TO THE RIVER WILL   HYD02060
C**** BE ALLOWED ONLY FROM THE NODE IMMEDIATELY UPSTREAM OF THE NODE    HYD02070
C**** IN DEFICIT                                                        HYD02080
  290 TEMPR =  GRTANK ( KN, 1 ) - CONST                                HYD02090
      IF ( ABS ( TEMPR ) . LT. 1.0 )  TEMPR = 0.0                      HYD02100
      IF ( KN. GT. 1 )  GO TO 295                                      HYD02110
      IF ( TEMPR . LT. 0.0 )  GO TO 1070                               HYD02120
      GO TO 180                                                        HYD02130
C**** SET QINFLO ARRAY ** LET NODE = KUSE ( KN, IS, 24) AND SEQUENCE =  HYD02140
C**** KUSE ( KN, IS , 25 ) .  ALSO SET UPSTREAM AQUIFER NODE = KUSE     HYD02150
C**** ( KN, IS, 28 ) FOR INTERNODAL TRANSFER ( IF REQUIRED )            HYD02160
  295 LN = KUSE ( KN, IS, 28 )                                         HYD02170
      IF ( LN . EQ. 0 )  GO TO 1070                                    HYD02180
      KG = NFIND ( LN )                                                HYD02190
      LN = KUSE ( KN, IS, 24 )                                         HYD02200
      IF ( LN . EQ. 0 )  GO TO 1070                                    HYD02210
      KP = NFIND ( LN )                                                HYD02220
      KZ = KUSE ( KN, IS , 25 )                                        HYD02230
      IF ( TEMPR . LT. 0.0 )  GO TO 310                                HYD02240
C**** NO INTERNODAL TRANSFER REQUIRED                                   HYD02250

      DO 300 K = 1, 10                                                 HYD02260
      QINFLO ( KP, KZ, K ) = 0.0                                       HYD02270
  300 CONTINUE                                                         HYD02280
      GO TO 180                                                        HYD02290
C**** AN INTERNODAL TRANSFER IS REQUIRED CHECK CONDITIONS OF AQUIFER IN HYD02300
C**** UPSTREAM NODE                                                     HYD02310
  310 COMP = ABS ( TEMPR )                                             HYD02320
      COMPA = GRTANK ( KG, 1 ) - COMP                                  HYD02330
      IF ( COMPA . LT. 0.0 )  GO TO 500                                HYD02340 A
C**** UPSTREAM AQUIFER CAN MEET DEFICIT SET QINFLO AND GRTANK ARRAYS    HYD02350
      GRTANK ( KG, 1 ) = COMPA                                         HYD02360
      DO 320 K = 2, 10                                                 HYD02370
      QINFLO ( KP, KZ, K ) = GRTANK ( KG , K )                         HYD02380
  320 CONTINUE                                                         HYD02390
      QINFLO ( KP, KZ, 1 ) = COMP                                      HYD02400
      TEMPR = 0.0                                                      HYD02410
      DEMAND(KN,IS,MO) = DEMAND(KN,IS,MO) - QINFLO(KP,KZ,1)            00002415 B
      CONST = DEMAND(KN,IS,MO)                                         00002416 B
      GO TO 180                                                        HYD02420
C**** THIS DEMAND REPRESENTS A SUBSURFACE FLOW THAT IS TRANSFERRED      HYD02430
C**** OUT OF SYSTEM                                                     HYD02440
  340 IF ( TEMPR . LT. 0.0 )  GO TO 1020                               HYD02450
      GO TO 190                                                        HYD02460
C**** THIS IS A RESERVOIR UPDATE                                        HYD02470
C**** THIS PORTION OF THE PROGRAM INCLUDES THE VOLUME AND CHEMISTRY     HYD02510
C**** UPDATES FOR ALL INFLOWS TO THE NODE                               HYD02520
  400 DO 410 K = 1, 10                                                 HYD02530
      TEMP (K) = QINFLO ( KN, IS, K )                                  HYD02540
  410 CONTINUE                                                         HYD02550
      TEST = QINFLO (KN, IS, 11 )                                      HYD02560
      CONST = QINFLO (KN, IS, 1 )                                      HYD02570
      IF ( TEST . NE. 1.0 )  GO TO 430                                 HYD02580
C**** THIS IS AN INFLOW TO THE RIVER                                    HYD02590
      IF(QINRIV(1) .EQ. 0.0 .AND. CONST .EQ. 0.0)GO TO 500                      B
      CALL CHEMRV ( QINRIV, CONST, KN, IS )                            HYD02600
      QINRIV(1) = QINRIV (1) + CONST                                   HYD02610
      GO TO 500                                                        HYD02620
  430 IF ( TEST . NE. 2.0 )  GO TO 440                                 HYD02630
C**** THIS IS AN INFLOW TO THE AQUIFER                                  HYD02640
      IF(TEMP(1) .EQ. 0.0 .AND. CONST .EQ. 0.0)GO TO 500                        B
      CALL CHEMGR ( TEMP, CONST, KN, IS )                              HYD02650
      GRTANK ( KN, 1) = GRTANK (KN, 1 ) + CONST                        HYD02660
      GO TO 500                                                        HYD02670
  440 IF ( TEST . NE. 3.0 )  GO TO 450                                 HYD02680
C**** THIS IS AN INFLOW TO THE PONDING POOL                             HYD02690
      IF(TEMP(1) .EQ. 0.0 .AND. CONST .EQ. 0.0)GO TO 500                        B
      CALL CHEMTT ( TEMP, CONST, KN, IS )                              HYD02700
      TTANK ( KN, 1 ) = TTANK ( KN, 1 ) + CONST                        HYD02710
      GO TO 500                                                        HYD02720
  450 IF ( TEST .NE. 4.0 )  GO TO 1000                                 HYD02730
C**** AT THIS POINT IN THE MODEL CRITERIA FOR THE OPERATION OF THE      HYD02740
C**** SYSTEM IS REQUIRED.  THE OPERATIONAL CRITERIA SHOULD BE FORMULATEDHYD02750
C**** AND INSERTED AS A SUBROUTINE OR A SERIES OF SUBROUTINES AND/OR    HYD02760
C**** FUNCTIONS WHICH ARE MONITORED BY THE SUBROUTINE CALLED AT THIS    HYD02770
C**** POINT.  THE TECHNIQUE AS OUTLINED DOES NOT DESTROY THE            HYD02780
C**** GENERALIZED CONCEPT OF THE MODEL.                                 HYD02790
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C**** THIS AN OBSERVED CHECK POINT                                     HYD02800
C**** CALL VERNAL SUBROUTINE TO SIMULATE TRANSFERS OF FLOW             HYD02810
C**** BETWEEN SURFACE AND SUBSURFACE FACILITIES TO OBTAIN HYDRAULIC    HYD02820
C**** BALANCE IN NODE                                                  HYD02830
      CALL VERNAL (KN,IS,MO,OBSERV,QINRIV)                             HYD02840
  500 CONTINUE                                                         HYD02850
C**** CHECK TO DETERMINE IF A SOIL COLUMN EXISTS IN THIS NODE          HYD02860
      IF ( TTANK ( KN, 1 ) . LE. 0.0 ) GO TO 540                       HYD02870
C**** CHECK TO DETERMINE IF SOIL COLUMN DATA EXISTS FOR THIS NODE      HYD02880
      NSOIL = NSEG (KN )                                               HYD02890
      IF ( NSOIL . EQ. 0 ) GO TO 1030                                  HYD02900
C**** SOIL COLUMN DATA EXISTS PERCOLATE WATERS IN TTANK THROUGH        HYD02910
C**** SOIL COLUMN INTO BTANK                                           HYD02920
      CALL SOILCO ( KN, IW, IR, NSOIL )                                HYD02930
C**** UPDATE AQUIFER WITH LINEAR MIX WITH WATER IN BTANK               HYD02940
      BTANK (KN, 1) = TTANK ( KN, 1 )                                  HYD02950
      DO 520 K = 1, 10                                                 HYD02960
      TEMP (K) = BTANK ( KN, K )                                       HYD02970
  520 CONTINUE                                                         HYD02980
      CALL CONVER ( TEMP , 2 ,IW)                                      HYD02990
      CALL CHEMBT ( TEMP , 0., KN, 1 )                                 HYD03000
C**** SET UP TRANSFERS OF OUTFLOW FROM THIS NODE TO NEXT LOWER         HYD03010
C**** NODE - WHERE ND= NODE NUMBER OF NEXT LOWER NODE AND NS =         HYD03020
C**** ENTERING SEQUENCE OF NEXT LOWER NODE                             HYD03030
  540 ND = NCTRL ( KN, 2 )                                             HYD03040
      IF ( KN . EQ. NUMNOD )  GO TO 560                                HYD03050
      ND = NFIND (ND)                                                  HYD03060
      NS = NCTRL ( KN, 3 )                                             HYD03070
      DO 550 K = 1, 10                                                 HYD03080
      QINFLO (ND, NS, K) = OBSERV (K)                                  HYD03090
  550 CONTINUE                                                         HYD03100
  560 DO 570 K = 1, 10                                                 HYD03110
      PREDIC ( KN, K ) = QINRIV (K)                                    HYD03120
      OBSVAL ( KN, K ) = OBSERV (K)                                    HYD03130
  570 CONTINUE                                                         HYD03140
  600 CONTINUE                                                         HYD03150
      CALL WRIT ( MO, IYR, IW )                                        HYD03160
      MO = MO + 1                                                      HYD03170
      IF ( MO . LE. 12 ) GO TO 750                                     HYD03180
      MO = 1                                                           HYD03190
      IYR = IYR + 1                                                    HYD03200
  750 IF ( IYR . LT. IYREND )  GO TO 770                               HYD03210
      IF ( MO . GT. MOEND )  CALL EXIT                                 HYD03220
  770 JREAD = 5                                                        HYD03230
      CALL PERUSE ( JREAD , IW, IR )                                   HYD03240
      GO TO 10                                                         HYD03250
C**** PROGRAM CONTROLLED ERROR MESSAGES ARE GENERATED HERE             HYD03260
 1000 WRITE ( IW, 1005 ) TEST                                          HYD03270
 1005 FORMAT ( 1H1, 7X, 20HDESTINATION INDEX = ,F3.0,12H IS IN ERROR )  HYD03280
      GO TO 1500                                                       HYD03290
 1010 WRITE ( IW, 1015)                                                HYD03300
 1015 FORMAT(1H1,7X,45HDEMAND LEAVING SYSTEM FROM SURFACE IN DEFICIT)   HYD03310
      GO TO 1500                                                       HYD03320
 1020 WRITE ( IW, 1025 )                                               HYD03330
 1025 FORMAT(1H1,7X,48HDEMAND LEAVING SYSTEM FROM SUBSURFACE IN DEFICIT)HYD03340
      GO TO 1500                                                       HYD03350

 1030 WRITE ( IW , 1035 )                                              HYD03360
 1035 FORMAT ( 1H1, 7X, 25HNO SOIL COLUMN DATA FOUND    )               HYD03370
      GO TO 1500                                                       HYD03380  C6
 1060 WRITE ( IW , 1065 )                                              HYD03450
 1065 FORMAT ( 1H1, 7X, 42HSURFACE TRANSFER AS A DEMAND IS IN DEFICIT ) HYD03460
      GO TO 1500                                                       HYD03470
 1070 WRITE ( IW , 1075 )                                              HYD03480
 1075 FORMAT ( 1H1, 7X,45HSUBSURFACE TRANSFER AS A DEMAND IS IN DEFICIT)HYD03490
      GO TO 1500                                                       HYD03500
 1500 WRITE ( IW, 1510 ) KN , IS                                       HYD03510
 1510 FORMAT ( 8X, 12HFOR NODE =    , I3, 8X, 10HSEQ.NO. =  , I3 )      HYD03520
      CALL EXIT                                                        HYD03530
      END                                                              HYD03540

ORY REQUIREMENTS 0013AC BYTES

HEST SEVERITY CODE WAS  0

      SUBROUTINE PERUSE (JREAD , IW, IR )
       COMMON / GENRL / LTITLE(16),NCTRL( 5, 3), MOBEG, IYRBEG, MOEND, IHYD03560
     AYREND, NUMNOD, ISEQ( 5, 20), KPRI, NUMSEQ( 5), NOWTR( 5, 20)      HYD03570
        COMMON / RESER /                                               HYD00080
     A QINFLO(5,10,12),DEMAND(5,10,16),K                               HYD00090  A
     BDEMNM( 5, 10,16), KQINNM( 5, 10,16) , KAQUNM (5,16)              HYD00100
       COMMON / PROPER / SOIL( 5, 10, 21), BTANK( 5, 10), TTANK( 5, 10),HYD03630
     1 GRTANK( 5, 10)  , NSEG ( 5) , CONUSE ( 5, 10, 30)               HYD03640
      DIMENSION KUSE(5,10,30)
      EQUIVALENCE ( CONUSE, KUSE )                                     HYD03660
       DIMENSION LTEMP(22), CTEMP(15),NTEMP(16)                        HYD03670
      REAL * 8 ICHK,$SC1/'CONUSE  '/
      INTEGER  $CON/'CON '/,$NOD/'NOD '/,$SEQ/'SEQ '/,$WAT/'WAT '/,$END
     1/'END'/,$AQU/'AQU '/,$SUR/'SUR '/,$RES/'RES '/,$CHM/'CHM '/,$GRT
     2/'GRT '/,$COL/'COL '/,$BEG/'BEG '/,$SEG/'SEG '/,$EQU/'EQU '/,$SED
     3/'SED '/,$TWR/'TWP '/,$EFF/'EFF '/,$CAP/'CAP '/,$POW/'POW '/,$RUL
     4/'RUL '/,$EVP/'EVP '/,$BNK/'BNK '/,$DEM/'DEM '/,$GWR/'GWR '/,$IRR
     5/'IRR '/,$MAI/'MAI '/,$GWV/'GWV '/,$OUT/'OUT '/,$QIN/'QIN '/,$CHK/
     6'CHK '/,$TRN/'TRN '/,$TDA/'TDA '/,$PDA/'PDA '/,$ENE/'ENE '/
C**** SET READ AND WRITE LOGICAL UNITS                                 HYD03680
C**** WRITE INPUT LISTING HEADING AND VALUES OF JREAD                   HYD03690
      WRITE ( IW, 10 )                                                 HYD03700
   10 FORMAT  (1H1, 24X, 33H ***  LISTING OF INPUT DATA  ***  / / )     HYD03710
      WRITE ( IW , 30 ) JREAD                                          HYD03720
   30 FORMAT  (1H , 8HJREAD = , I3 )                                   HYD03730
C                                                                      HYD03740
C***** WHEN JREAD = 1 READ AND STORE SYSTEM STRUCTURE - CONCLUDE THIS   HYD03750
C*****READ WITH CARD CONTAINING THE WORD CONEND IN THE FIRST SIX COLUMNSHYD03760
C                                                                      HYD03770
C*****WHEN JREAD = 2 READ AND STORE TITLES AND INITIAL CONDITIONS OF    HYD03780
C*****SURFACE RESERVOIRS AND AQUIFERS ( SUBSURFACE RESERVOIRS).         HYD03790
C*****ALSO  WHEN JREAD = 2 READ AND STORE INITIAL SOIL CONTITIONS AS    HYD03800
C*****WELL AS SOIL COLUMN PHYSICAL FEATURES. CONCLUDE THIS READ WITH    HYD03810
C*****CARD CONTAINING THE WORD COLEND IN THE FIRST SIX COLUMNS        , HYD03820
C                                                                      HYD03830
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C*****WHEN JREAD = 3 READ AND STORE MATHEMATICAL REPRESENTATIONS OF     HYD03840
C*****PERTINENT SURFACE FACILITIES PHYSICAL FEATURES . CONCLUDE THIS    HYD03850
C*****READ WITH CARD CONTAINING EQUEND IN THE FIRST SIX COLUMNS         HYD03860
C                                                                      HYD03870
C*****WHEN JREAD = 4 READ INFLOWS AND DEMANDS WITH TITLES FOR THE FIRST HYD03880
C*****FRAME ONLY NOTE ** TITLE MUST PRECEDE EACH INFLOW AND DEMAND DATA HYD03890
C*****CONCLUDE THIS READ WITH CARD CONTAINING THE WORD ENDATA IN THE    HYD03900
C*****FIRST SIX COLUMNS                                                HYD03910
C                                                                      HYD03920
C*****WHEN JREAD = 5 READ INFLOW AND DEMAND DATA CARDS SUSEQUENT TO THE HYD03930
C*****FIRST TIME FRAME AS WELL AS ANY TRANSACTION CARDS-- CONCLUDE THIS HYD03940
C*****READ WITH CARD CONTAINING THE WORD ENDATA IN THE FIRST SIX COLUMNSHYD03950
      GO TO ( 40, 220, 2000, 600, 650 ) , JREAD                        0HYD0396
C**** READ SYSTEM CONTROL CARDS                                        HYD03970
   40 READ ( IR, 60 ) LTITLE, KPRI                                     HYD03980
   60 FORMAT ((16A4, I16)                                              HYD03990
      WRITE ( IW, 80 ) LTITLE , KPRI                                   HYD04000
   80 FORMAT  (1H ,16A4, I16)                                          HYD04010
      JK= 0                                                            HYD04020
      JJ = 0                                                           HYD04030
  100 READ (IR,120)IONE,ITWO,(LTEMP(I),I=1,22)                                    A
  120 FORMAT   (2A3,22I3)                                              HYD04050
      WRITE(IW,140)IONE,ITWO,(LTEMP(I),I=1,22)                                    A
  140 FORMAT   (1H , 2A3,22I3)                                         HYD04070
C**** STORE SYSTEM CONTROL DATA                                        HYD04080
      IF ( IONE . NE.  $CON )   GO TO 1000                             HYD04090
      IF ( ITWO . NE.  $NOD )  GO TO 160                               HYD04100
      JK = JK + 1                                                      HYD04110
      NUMNOD = JK                                                      HYD04120
      DO 150 K = 1, 3                                                  HYD04130
      NCTRL (JK, K ) = LTEMP (K)                                       HYD04140
  150 CONTINUE                                                         HYD04150
      GO TO 100                                                        HYD04160
  160 IF ( ITWO . NE.  $SEQ ) GO TO 190                                 HYD04170
      JK = NFIND ( LTEMP (1) )                                         HYD04180
C**** STORE NUMBER OF SEQUENCE POINTS IN A NODE                        HYD04190
      NUMSEQ (JK) = LTEMP (2)                                          HYD04200
      NS = LTEMP (2)                                                   HYD04210
C**** CHECK TO DETERMINE IF NUMBER OF SEQUENCE POINTS EXCEED 20        HYD04220
      IF ( NS . GT. 20 )  GO TO 1020                                   HYD04230
      DO 170 K = 1, NS                                                 HYD04240
      KX = K + 2                                                       HYD04250
      ISEQ (JK, K ) = LTEMP (KX)                                       HYD04260
  170 CONTINUE                                                         HYD04270
      GO TO 100                                                        HYD04280
  190 IF ( ITWO . NE.  $WAT )  GO TO 210                               HYD04290
      JK = NFIND ( LTEMP (1) )                                         HYD04300
C**** STORE SYSTEM FLOW ARRAY                                          HYD04310
      DO 200 K = 1, 20                                                 HYD04320
      KX = K + 2                                                       HYD04330
      NOWTR ( JK, K ) = LTEMP (KX)                                     HYD04340
  200 CONTINUE                                                         HYD04350
      GO TO 100                                                        HYD04360
  210 IF ( ITWO . NE.  $END )  GO TO 1040                              HYD04370
C**** STORE DATES FOR BEGINNING AND END OF STUDY PERIOD                HYD04380
      MOBEG = LTEMP (1)                                                HYD04390

      IYRBEG = LTEMP (2)                                               HYD04400
      MOEND = LTEMP (3)                                                HYD04410
      IYREND = LTEMP (4)                                               HYD04420
      GO TO 2000                                                       HYD04430
C**** READ AND STORE INITIAL VALUES AND MATHEMATICAL REPRESENTATIONS   HYD04440
C**** OF SYSTEM PHYSICAL FEATURES AS WELL AS TITLES OF SAME IF          HYD04450
C**** APPLICABLE - SOIL COLUMN INITIAL AND PHYSICAL DATA ARE INCLUDED   HYD04460
C**** IN THIS PORTION OF THE SUBROUTINE                                HYD04470
  220 READ  (IR, 230) IONE, ITWO, (LTEMP(I), I = 1, 3),(NTEMP(J),J=1,16)0YD04480
  230 FORMAT  (2A3,I2, 1X, I3, A3, 16A4)                               HYD04490
      WRITE  (IW, 240) IONE, ITWO, (LTEMP(I), I = 1,3),(NTEMP(J),J=1,16)HYD04500
  240 FORMAT  (1H , 2A3,I2, 1X, I3, A3, 16A4)                          HYD04510
      IF ( IONE . NE.  $AQU ) GO TO 370                                HYD04520
C**** STORE TITLE OF AQUIFER ( SUBSURFACE RESERVOIR )                  HYD04530
      JK = NFIND ( LTEMP (2) )                                         HYD04540
      DO 250 K = 1, 16                                                 HYD04550  C2
      KAQUNM(JK,K)=NTEMP(K)                                                      A
  250 CONTINUE                                                         HYD04580  C7
      READ  (IR, 290) IONE, ITWO, (LTEMP(I), I = 1, 4), (CTEMP(J), J = 1HYD04660
     A, 10), (LTEMP(K), K = 5, 7)                                      HYD04670
  290 FORMAT  (2A3,I2, I1, I3, A3, 10F6.0, I2, I1, I2)                 HYD04680
      WRITE  (IW, 300) IONE, ITWO, (LTEMP(I), I = 1, 4), (CTEMP(J), J = HYD04690
     A1, 10), (LTEMP(K), K = 5, 7)                                     HYD04700
  300 FORMAT(1H ,2A3,I2,I1,I3,A3,F7.0,9F6.1,I2,I1,I2)                  HYD04710
  340 IF ( IONE . NE.  $GRT )  GO TO 1220                              HYD05050
C**** STORE INITIAL CAPACITY AND CHEMISTRY FOR AQUIFER                 HYD05060
      JK = NFIND ( LTEMP(3))                                           HYD05070
C**** CHECK TO DETERMINE IF ONLY TOTAL SALTS IN PPM ARE REPORTED        HYD05080
      IF(CTEMP (10) . GT. 0.0 )  GO TO 350                             HYD05090
C**** CONCENTRATIONS OF CONSTITUENTS ARE REPORTED CONVERT TO PPM        HYD05100
C**** AND COMPUTE TOTAL SALTS ON BASIS OF CONCENTRATIONS               HYD05110
      CALL CONVER ( CTEMP, LTEMP (2),IW)                               HYD05120
  350 DO 360 K = 2, 10                                                 HYD05130
      GRTANK ( JK, K ) = CTEMP (K)                                     HYD05140
  360 CONTINUE                                                         HYD05150
      NEXP = LTEMP (6)                                                 HYD05160
      FAC = 10.0 ** NEXP                                               HYD05170
      GRTANK ( JK, 1 ) = CTEMP (1) * FAC                               HYD05180
      GO TO 220                                                        HYD05190
C**** READ SOIL DATA FOR SOIL COLUMN - EACH SEGMENT IN SOIL COLUMN MUST HYD05200
C**** BE IN PROPER SEQUENCE.  SEGMENT NUMBER ONE IS SEGMENT NEAREST     HYD05210
C**** GROUND SURFACE.                                                  HYD05220
  370 IF ( IONE . NE.  $COL  ) GO TO 1080                              HYD05230
      IF ( ITWO .EQ.  $END )    GO TO 2000                             HYD05240
      IF ( ITWO . NE.  $BEG   ) GO TO 1100                             HYD05250
      LSEG = 0                                                         HYD05260
      KNODE = LTEMP(2)                                                 HYD05270
      JK = NFIND (KNODE )                                              HYD05280
      NSEG ( JK) = LTEMP (1)                                           HYD05290
      LNODE = KNODE                                                    HYD05300
      MAX = NSEG (JK)                                                  HYD05310
      DO 400 J = 1, MAX                                                HYD05320
      READ(IR,380) IONE,ITWO, (LTEMP (KA), KA=1,2), (CTEMP(KB),KB=1,15) HYD05330
  380 FORMAT(2A3,2I3,8F5.0,F3.0,3F5.0, F1.0, F4.0,F5.0)                HYD05340
      WRITE(IW,390)IONE,ITWO, (LTEMP (KA), KA=1,2), (CTEMP(KB),KB=1,15) HYD05350
  390 FORMAT(1H ,2A3,2I3,1X,8(F6.1,1X),F3.2,1X,3(F5.2,1X),F1.0,1X,F4.2, HYD05360
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      <1X,F5.1)                                                         HYD05361
      IF ( IONE .NE.  $COL )   GO TO 1100                               HYD05370
      IF ( ITWO .NE.  $SEG  )   GO TO 1100                              HYD05380
      KNODE = LTEMP (1)                                                 HYD05390
      IF ( KNODE . NE. LNODE  ) GO TO 1100                              HYD05400
      LSEG = LSEG + 1                                                   HYD05410
      IF ( LSEG .NE. LTEMP (2)) GO TO 1100                              HYD05420
      KS = LSEG                                                         HYD05430
      DO 400 K = 1, 15                                                  HYD05440
      SOIL ( JK, KS, K ) = CTEMP (K)                                    HYD05450
  400 CONTINUE                                                          HYD05460
      GO TO 220                                                         HYD05470
C**** READ AND STORE INFLOW, DEMAND, AND CONSUMPTIVE USE CARDS FOR FIRSTHYD06070
C**** TIME FRAME ONLY WHERE TITLE CARDS MUST PRECEDE DATA CARDS         HYD06080
  600 IF ( JREAD . GT. 4 )  GO TO 650                                   HYD06090
      READ ( IR , 230 ) IONE , ITWO,(LTEMP(K),K=1,3),(NTEMP(J),J=1,16) 0HYD00610
      WRITE ( IW, 240 ) IONE , ITWO, (LTEMP(K),K=1,3),(NTEMP(J),J=1,16) HYD06110
      IF ( IONE . EQ.  $END )  GO TO 2000                               HYD06120
      IF ( IONE . NE.  $SUR )  GO TO 1160                               HYD06130
      JK = NFIND ( LTEMP (2) )                                          HYD06140
      IS = LTEMP (1)                                                    HYD06150
      IF ( ITWO . NE.  $DEM ) GO TO 620                                 HYD06160
C**** STORE TITLE OF DEMAND OR DIVERSION REQUIREMENT                    HYD06170
      DO 610 K = 1, 16                                                  HYD06180
      KDEMNM ( JK, IS, K) = NTEMP(K)                                    HYD06200
  610 CONTINUE                                                          HYD06210
      GO TO 650                                                         HYD06220
C**** STORE TITLE OF INFLOW SOURCE                                      HYD06230
  620 DO 630 K= 1, 16                                                   HYD06240
      KQINNM ( JK, IS, K ) = NTEMP(K)                                   HYD06260
  630 CONTINUE                                                          HYD06270
C**** READ AND STORE INFLOW , DEMAND AND CONSUMPTIVE USE DATA AS WELL ASHYD06280
C**** TRANSACTION CARDS ( USED FOR BOTH JREAD = 4 AND 5 )               HYD06290
  650 READ  (IR, 290) IONE, ITWO, (LTEMP(I), I = 1, 4), (CTEMP(J), J = 1HYD06300
     A, 10), (LTEMP(K), K = 5, 7)                                       HYD06310
      WRITE  (IW, 300) IONE, ITWO, (LTEMP(I), I = 1, 4), (CTEMP(J), J = HYD06320
     A1, 10), (LTEMP(K), K = 5, 7)                                      HYD06330
      IF ( IONE . EQ.  $END ) GO TO 2000                                HYD06340
      JK = NFIND ( LTEMP (3) )                                          HYD06350
      IS = LTEMP (1)                                                    HYD06360
      MO = LTEMP (5)                                                    HYD06370
C**** RAISE MAGNITUDE OF DEMAND BY POWER OF 10 ( LTEMP (6) )            HYD06380
      NEXP = LTEMP (6)                                                  HYD06390
      FAC = 10.0 ** NEXP                                                HYD06400
      CTEMP (1) = CTEMP (1) * FAC                                       HYD06410
      IF ( IONE . NE.  $DEM )  GO TO 700                                HYD06420
C**** STORE DEMAND DATA WITH OR WITHOUT REQUIRED CONSUMPTIVE USE DATA   HYD06430
      DEMAND ( JK, IS, MO ) = CTEMP (1)                                 HYD06440
C**** STORE SOURCE INDICATOR IN LOCATION 13 OF DEMAND ARRAY             HYD06450
C**** SYMBOLICALLY THERE ARE ONLY TWO SOURCES SUPPLYING DEMANDS         HYD06460
C**** NAMELY , SURFACE AND SUBSURFACE SOURCES                           HYD06470
      IF ( ITWO . EQ.  $SUR ) DEMAND ( JK, IS, 13 ) = 1.0               HYD06480
      IF ( ITWO . EQ.  $GWR ) DEMAND ( JK, IS, 13 ) = 2.0               HYD06490
C**** IN LOCATION 14 OF THE DEMAND ARRAY IS STORED THE USE IE IRRIGATIONHYD06500
C**** OR MUNICIPAL AND INDUSTRIAL OR THE DESTINATION IN A TRANSFER OF   HYD06510
C**** FLOWS FROM FACILITY TO FACILITY                                   HYD06520

      IF ( LTEMP (4) . EQ.  $IRR ) DEMAND ( JK, IS, 14 ) = 1.0          HYD06530
      IF ( LTEMP (4) . EQ.  $MAI ) DEMAND ( JK, IS, 14 ) = 2.0          HYD06540
      IF ( LTEMP (4) . EQ.  $GWR ) DEMAND ( JK, IS, 14 ) = 3.0          HYD06550
      IF ( LTEMP (4) . EQ.  $GWV ) DEMAND ( JK, IS, 14 ) = 4.0          HYD06560
      IF ( LTEMP (4) . EQ.  $SUR ) DEMAND ( JK, IS, 14 ) = 5.0          HYD06570
      IF ( LTEMP (4) . EQ.  $OUT ) DEMAND ( JK, IS, 14 ) = 6.0          HYD06580
C**** LTEMP (2) CONTAINS INDICATOR DESIGNATING CONSUMPTIVE USE DATA     HYD06590
C**** OR TRANSFER DATA WILL OR WILL NOT FOLLOW DEMAND CARD              HYD06600
      IF ( LTEMP (2) .NE. 1 )  GO TO 600                                HYD06610
      READ ( IR, 660 ) ICHK,(LTEMP(K),K=1,2),(CTEMP(KA),KA=1,3),        HYD06620
     1             (LTEMP (KB) , KB = 3, 16 )                           HYD06630
  660 FORMAT ( A6, I3, I2, F9.0, 2F3.0, 3 ( A3, I3, I2, I3) , 16X, I2 , HYD06640
     1           1X, I2 )                                               HYD06650
      WRITE ( IW, 670 ) ICHK,(LTEMP(K),K=1,2),(CTEMP(KA),KA=1,3),       HYD06660
     1             (LTEMP (KB) , KB = 3, 16 )                           HYD06670
  670 FORMAT(1H ,A6,I3,I2, F9.0, 2F3.0, 3 ( A3, I3, I2, I3) , 16X, I2 , HYD06680
     1           1X, I2 )                                               HYD06690
C**** CONSUMPTIVE USE OR TRANSFER DATA WILL BE READ AND STORED          HYD06700
      IF ( ICHK . NE. $SCL       )  GO TO 1160                          HYD06710
      JK = NFIND ( LTEMP (1) )                                          HYD06720
      IS = LTEMP (2)                                                    HYD06730
      MO = LTEMP ( 15)                                                  HYD06740
      CONUSE ( JK, IS, MO ) = CTEMP (1)                                 HYD06750
      CONUSE ( JK, IS, 13 ) = CTEMP (2)                                 HYD06760
      CONUSE ( JK, IS, 14 ) = CTEMP (3)                                 HYD06770
      DO 680 K = 3, 14                                                  HYD06780
      KA = K + 16                                                       HYD06790
      KUSE ( JK, IS, KA ) = LTEMP (K)                                   HYD06800
  680 CONTINUE                                                          HYD06810
      GO TO 600                                                         HYD06820
  700 IF ( IONE . NE.  $WIN )  GO TO 740                                HYD06830
C**** STORE INFLOW DATA WITH OR WITHOUT BREAKDOWN OF CHEMICAL           HYD06840
C**** CONSTITUENTS - LTEMP (2) DESIGNATES UNITS OF INPUT I.E. 1 = MEQ/  HYD06850
C**** LITER AND 2 = PPM                                                 HYD06860
C**** LOCATION 11 IN THE QINFLO ARRAY DESIGNATES THE DESTINATION OF     HYD06870
C**** THE PARTICULAR SOURCE                                             HYD06880
      IF ( LTEMP (4) .EQ.  $SUR )  QINFLO (JK, IS, 11 ) = 1.0           HYD06890
      IF ( LTEMP (4) .EQ.  $GWR )  QINFLO (JK, IS, 11 ) = 2.0           HYD06900
      IF ( LTEMP (4) .EQ.  $GWV )  QINFLO (JK, IS, 11 ) = 3.0           HYD06910
      IF ( LTEMP (4) .EQ.  $CHK )  QINFLO (JK, IS, 11 ) = 4.0           HYD06920
      DO 710 K = 1, 10                                                  HYD06930
      QINFLO (JK, IS, K ) = 0.0                                         HYD06940
  710 CONTINUE                                                          HYD06950
      IF ( CTEMP (1) . LE. 0.0 )  GO TO 600                             HYD06960
      QINFLO (JK, IS, 1 ) = CTEMP (1)                                   HYD06970
C**** CHECK TO DETERMINE IF DATA CONCERNING CHEMICAL CONSTITUENTS       HYD06980
C**** ARE PART OF THIS DATA                                             HYD06990
      IF ( CTEMP (2) . GT. 0.0 ) GO TO 720                              HYD07000
C**** CARD DOES NOT CONTAIN DATA FOR CHEMICAL CONSTITUENTS              HYD07010
      QINFLO ( JK, IS, 10) = CTEMP (10)                                 HYD07020
      GO TO 600                                                         HYD07030
C**** CARD CONTAINS DATA FOR CHEMICAL CONSTITUENTS                      HYD07040
  720 CALL CONVER ( CTEMP , LTEMP (2),IW)                               HYD07050
      DO 730 K = 2, 10                                                  HYD07060
      QINFLO (JK, IS, K ) = CTEMP (K)                                   HYD07070
  730 CONTINUE                                                          HYD07080
      QINFLO ( JK, IS, 12 ) = LTEMP (2)                                 HYD07090
      GO TO 600                                                         HYD07100
  740 IF ( IONE . NE.  $TRN )  GO TO 1200                               HYD07110
      GO TO 600                                                         HYD07380
C**** ALL PROGRAM CONTROLLED ERROR MESSAGES ARE GENERATED HERE          HYD07390
 1000 WRITE ( IW, 1010 )                                                HYD07400
 1010 FORMAT ( 1H1, 7X, 26HTHIS IS NOT A CONTROL CARD  )                HYD07410
      CALL EXIT                                                         HYD07420
 1020 WRITE ( IW , 1030 )                                               HYD07430
 1030 FORMAT ( 1H1, 7X, 36HNUMBER OF SEQUENCE POINTS EXCEEDS 20 )       HYD07440
      CALL EXIT                                                         HYD07450
 1040 WRITE ( IW , 1050 )                                               HYD07460
 1050 FORMAT ( 1H1, 7X, 36HNO END SIGNAL FOUND FOR CONTROL DATA  )      HYD07470
      CALL EXIT                                                         HYD07480
 1060 WRITE ( IW , 1070 )                                               HYD07490
 1070 FORMAT ( 1H1, 8X, 33HRESERVUIR CHEMISTRY CARD MISSING   )         HYD07500
      CALL EXIT                                                         HYD07510
 1080 WRITE ( IW , 1090 )                                               HYD07520
 1090 FORMAT ( 1H1, 7X, 34HDATA FOR JREAD = 3 IS OUT OF ORDER )         HYD07530
      CALL EXIT                                                         HYD07540
 1100 WRITE ( IW , 1110 )                                               HYD07550
 1110 FORMAT ( 1H1, 7X, 29HSOIL COLUMN DATA OUT OF ORDER  )             HYD07560
      CALL EXIT                                                         HYD07570
 1160 WRITE ( IW , 1170)                                                HYD07640
 1170 FORMAT ( 1H1, 8X, 30HNO CONSUMPTIVE USE CARD FOUND  )             HYD07650
      CALL EXIT                                                         HYD07660
 1180 WRITE ( IW , 1190 )                                               HYD07670
 1190 FORMAT ( 1H1, 7X, 39HINFLOW OR DEMAND CARDS ARE OUT OF ORDER  )   HYD07680
      CALL EXIT                                                         HYD07690
 1200 WRITE ( IW, 1210 )                                                HYD07700
 1210 FORMAT ( 1H1, 7X, 34HTRANSACTION CARDS ARE OUT OF ORDER  )        HYD07710
      CALL EXIT                                                         HYD07720
 1220 WRITE (IW , 1230 )                                                HYD07730
 1230 FORMAT ( 1H1, 7X, 34HDATA FOR JREAD = 2 IS OUT OF ORDER )         HYD07740
      CALL EXIT                                                         HYD07750
 2000 RETURN                                                            HYD07760
      END                                                               HYD07770

ORY REQUIREMENTS 001E84 BYTES
EST SEVERITY CODE WAS  0

      SUBROUTINE WRIT ( MO, IYR, IW )
      COMMON / GENAL / LTITLE(16),NCTRL( 5, 3), MOBEG, IYRBEG, MOEND, IHYD07790
     AYREND, NUMNOD, ISEQ( 5, 20), KPRI, NUMSEQ( 5), NOWTR( 5, 20)      HYD07800
      COMMON / RESER /                                                  HYD08080
     A QINFLO(5,10,12),DEMAND(5,10,16),K
     BDEMNM( 5, 10,16), KQINNM( 5, 10,16) , KAQUNM (5,16)               HYD00100  A
      COMMON / PROPEP / SOIL( 5, 10, 21), BTANK( 5, 10), TTANK( 5, 10),HYD07860
     1 GRTANK( 5, 10) , NSEG ( 5) , CONUSE ( 5, 10, 30)                 HYD07870
      DIMENSION KUSE(5,10,30)
      COMMON / PARAM / BEGRES ( 5, 11 ) , BEGWR ( 5, 10 ) ,             HYD07890
     1        PREDIC ( 5, 10 ) , OBSVAL ( 5,10), CHEMDM ( 5, 10, 10)    HYD07900

      DIMENSION MON (12) , LTEMP (20 ) , TEMP (10),NTEMP(10)            HYD07910
      INTEGER $JAN/'JAN '/,$FEB/'FEB '/,$MAR/'MAR '/,$MAY/'MAY '/,$JUN
     1/'JUN '/,$JUL/'JUL '/,$AUG/'AUG '/,$SEP/'SEP '/,$OCT/'OCT '/,$NOV
     2/'NOV '/,$DEC/'DEC '/
      EQUIVALENCE ( CONUSE, KUSE )                                      HYD07920
      DATA MON/'JAN ','FEB ','MAR ','APR ','MAY ','JUN ','JUL ','AUG ',
     1'SEP ','OCT ','NOV ','DEC '/
      DATA  IPAGE / 0 /
      MONTH = MON (MO)                                                  HYD07960
      KYR = IYR + 1900                                                  HYD07970
      DO 700 KN = 1, NUMNOD                                             HYD07980
      IPAGE = IPAGE + 1                                                 HYD07990
      WRITE ( IW, 50)  (LTITLE (K) , K = 1,16 ) , IPAGE                 HYD08000
   50 FORMAT( 1H1, 7X,16A4, 3X, 19HNUMBER OF NODES = 2  , 6X,           HYD08010
     1       8HPAGE NO. , I3 / )                                        HYD08020
      KNODE = NCTRL (KN,1)                                              HYD08030
      WRITE ( IW, 60 ) KNODE, MONTH, KYR                                HYD08040
   60 FORMAT ( 8X, 14HNODE NUMBER = , I3, 5X, 9HMONTH OF  , A3, 10X,    HYD08050
     1      5HYEAR , I4 // 58X, 6HVOLUME, 4X, 2HCA , 4X, 2HMG, 4X,      HYD08060
     2      2HNA, 4X, 2HCL, 4X, 3HSO4 , 2X, 4HHCO3 , 3X, 3HCO3 , 3X,    HYD08070
     3      3HNO3 , 3X, 11HTOTAL SALTS / 56X, 9HACRE FEET,              HYD08080
     4      9 (3X, 3HPPM ) , 3X, 7HTONS/AF / )                          HYD08090
      WRITE ( IW, 70)                                                   HYD08100
   70 FORMAT ( 8X, 42HOPERATIONAL SEQUENCE OF SURFACE FACILITIES   / )  HYD08110
   95 GO TO (100,110),KN                                                HYD08120  A
C
C     MA REFERS TO THE "IRRIGATION DEMAND" CARD OPERATION
C     NUMBER. FOR NODE 1 THIS SEQUENCE NUMBER IS -3, BUT IT IS THE 5TH
C     OPERATION IN THE NODE 1 SEQUENCE OF OPERATIONS.
C
C     MB REFERS TO THE 1ST OBSERVED OUTFLOW OPERATION NUMBER. FOR NODE 1
C     THIS SEQUENCE NUMBER IS 5, BUT IT IS THE 8TH OPERATION IN THE NODE
C     1 SEQUENCE OF OPERATIONS.
C
C     MC REFERS TO THE LAST OBSERVED OUTFLOW OPERATION NUMBER. FOR NODE
C     1 THIS SEQUENCE NUMBER IS 7, BUT IT IS THE 10TH OPERATION IN THE
C     NODE 1 SEQUENCE OF OPERATIONS.
C
C     MD REFERS TO THE "IRRIGATION RETURN FLOW" CARD NUMBER. FOR NODE 1
C     THIS SEQUENCE NUMBER IS 8, BUT IT IS THE 11TH OPERATION IN THE
C     NODE 1 SEQUENCE OF OPERATIONS.
  100 MA=5
      MB=8
      MC=10
      MD=11
      GO TO 150                                                         HYD08170
  110 MA=5
      MB=8
      MC=8
      MD=9
C
  150 NS = NUMSEQ ( KN )                                                HYD08270  C5
      MARK = 0                                                          HYD08280
      DO 490 KS = 1, NS                                                 HYD08290
      IS = IABS ( ISEQ ( KN, KS ) )                                     HYD08300
C**** WRITE OUTPUT OF LINES CONTROLLED BY INDEX(MA) (INFLOWS- DEMANDS)  HYD08310
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      IF ( KS . GT. MA )  GO TO 190                                    HYD08320
  160 IF ( ISEQ ( KN, KS ).GT. 0 )  GO TO 450                          HYD08330
      IF ( ISEQ ( KN, KS ).LT. 0 )   GO TO 300                         HYD08340
      GO TO 490                                                        HYD08350
  190 IF ( KS . NE. MB )   GO TO 220                                   HYD08360
      WRITE ( IW , 210 )                                               HYD08370
  210 FORMAT (/8X, 28HOBSERVED OUTFLOWS FROM NODE  / )                 HYD08380
  220 IF ( KS. LE. MC )  GO TO 450                                     HYD08390
      IF ( KS . NE. MD )    GO TO 250                                  HYD08400
      WRITE ( IW , 230 )                                               HYD08410
  230 FORMAT (/8X, 40HSUBSURFACE OPERATIONS AND FLOW TRANSFERS  / )    HYD08420  C5
      DO 240 K = 1, 10                                                 HYD08480
      KA = K + 5                                                       HYD08490
      LTEMP (KA) = BEGMR ( KN, K )                                     HYD08500
  240 CONTINUE                                                         HYD08510
      TONS = BEGMR ( KN, 10 ) * 1.36E-3                                HYD08520
      WRITE(IW,245)(LTEMP(K),K=6,15),TONS                              00000059  A
  245 FORMAT(11X,30HAQUIFER CONDITIONS OF LAST TIME FRAME   ,5X,I9,              B
     <8(2X,I4),2X,I5,3X,F6.3)                                                    B
  250 IF ( KS . LE. MS )  GO TO 160                                    HYD08540
C**** THIS PORTION OF THE SUBROUTINE SETS UP ALL DEMANDS FROM SYSTEM   HYD08550
C**** IN CORRECT OUTPUT MODE                                           HYD08560
  300 DO 320 K = 1, 10                                                 HYD08570
      NTEMP(K)=KDEMNM(KN,IS,K)                                         HYD08580
      LTEMP (K) = KDEMNM ( KN, IS, K )                                 HYD08590
  320 CONTINUE                                                         HYD08600
      LTEMP (6) = DEMAND ( KN , IS, 16 )                               HYD08610
  330 DO 340 K = 2, 10                                                 HYD08620
      KA = K + 5                                                       HYD08630
      LTEMP (KA) = CHEMDM ( KN, IS, K )                                HYD08640
  340 CONTINUE                                                         HYD08650
      TONS = CHEMDM (KN, IS, 10 ) * 1.36 E-3                           HYD08660
C**** THIS IS THE GENERAL OUTPUT STATEMENT FOR MOST OF THE OUTPUT      HYD08670
  400 IF ( MARK .GT. M )   GO TO 408                                   HYD08680
      IF ( LTEMP (6) .GT. 0 )   GO TO 408                              HYD08690
      TONS= 0.0                                                        HYD08700
      DO 405 K = 6, 15                                                 HYD08710
      LTEMP (K) = 0                                                    HYD08720
  405 CONTINUE                                                                   A
  408 WRITE(IW,409) (NTEMP(K),K=1,10),(LTEMP(J),J=6,15),TONS           HYD08740
  409 FORMAT(11X,10A4,5X,I9,8(1X,I5),2X,I5,3X,F6.3)                    HYD08750
      IF ( ISEQ ( KN, KS ) . GT. 0 ) GO TO 490                         HYD08760
      IF ( DEMAND ( KN, IS, 14 ) . GT. 2.0 ) GO TO 490                 HYD08770
C**** THIS PORTION OF THE SUBROUTINE COMPUTES AND OUTPUTS THE SHORTAGES HYD08780
C**** FROM THE IDEAL DEMANDS                                           HYD08790
      KTEM = DEMAND ( KN , IS, MO )                                    HYD08800
      LTEMP (17) = KTEM - LTEMP (6)                                    HYD08810
      WRITE ( IW, 420 ) LTEMP (17 )                                    HYD08820
  420 FORMAT ( 11X, 31HSHORTAGE FROM THE IDEAL DEMAND   , 14X, I9  )   HYD08830
      GO TO 490                                                        HYD08840
C**** THIS PORTION OF THE ROUTINE SETS UP ALL INFLOWS TO THE           HYD08850
C**** SYSTEM IN THE CORRECT OUTPUT MODE                                HYD08860
  450 DO 460 K = 1, 10                                                 HYD08870
      NTEMP (K) = KQINNM ( KN, IS , K )                                HYD08870
      LTEMP (K) = KQINNM ( KN, IS , K )                                HYD08880
  460 CONTINUE
      LTEMP (6) = QINFLO ( KN, IS , 1 )                                HYD08890
      DO 470 K = 2, 10                                                 HYD08900
      KA = K + 5                                                       HYD08910
      LTEMP (KA) = QINFLO ( KN, IS, K )                                HYD08920
  470 CONTINUE                                                         HYD08930
      TONS = QINFLO ( KN, IS, 10) * 1.36E-3                            HYD08940
      GO TO 400                                                        HYD08950
  490 CONTINUE                                                         HYD08960
C**** BEGIN THE COMPARISON OF OBSERVED AND PREDICTED END OF NODE       HYD08970
C**** FLOWS AND CHEMISTRY                                              HYD08980
  500 WRITE ( IW , 520 )                                               HYD08990
  520 FORMAT ( // 8X, 16HCOMPARISON INDEX    / )                       HYD09000  C5
      DO 530 K = 1, 10                                                 HYD09060
      KA = K + 5                                                       HYD09070
      LTEMP (KA ) = OBSVAL ( KN , K )                                  HYD09080
  530 CONTINUE                                                         HYD09090
      TONS = OBSVAL ( KN, 10 ) * 1.36E-3                               HYD09100
      WRITE(IW,535)(LTEMP(K),K=6,15),TONS                              00000106  A
  535 FORMAT(11X,33HTOTAL OBSERVED OUTFLOWS FROM NODE,12X,I9,8(1X,I5), HYD09120  B
     <2X,I5,3X,F6.3)                                                             B
      DO 540 K = 1, 10                                                 HYD09170
      KA = K + 5                                                       HYD09180
      LTEMP (KA ) = PREDIC ( KN, K )                                   HYD09190
  540 CONTINUE                                                         HYD09200
      TONS = PREDIC ( KN , 10 ) * 1.36E-3                              HYD09210
      WRITE(IW,545)(LTEMP(K),K=6,15),TONS                              00000112  A
  545 FORMAT(11X,34HTOTAL PREDICTED OUTFLOWS FROM NODE,11X,I9,8(1X,I5), HYD09230 B
     <2X,I5,3X,F6.3)                                                             B
      DO 550 K = 1, 10                                                 HYD09280  C6
      TEMP (K) = OBSVAL (KN, K ) - PREDIC ( KN, K )                    HYD09290
      KA = K+ 5                                                        HYD09300
      LTEMP (KA ) = TEMP (K)                                           HYD09310
  550 CONTINUE                                                         HYD09320
      TONS = TEMP (10) * 1.36E-3                                       HYD09330
      WRITE(IW,555)(LTEMP(K),K=6,15),TONS                              00000119  A
  555 FORMAT(11X,38HSIMPLE DIFFERENCE (OBSERVED-PREDICTED),7X,I9,8(1X,I5HYD09345 B
     <),2X,I5,3X,F6.3)
      WRITE ( IW, 560)                                                 HYD09350
  560 FORMAT ( / 8X, 25HCHEMICAL CHANGES IN NODE  / )                  HYD09360  C2
      DO 570 K = 3, 5                                                  HYD09390
      LTEMP (K) =$CONZ3                                                HYD09400
  570 CONTINUE                                                         HYD09410
      DO 580 K = 1, 10                                                 HYD09420
      TEMP (K) = OBSVAL ( KN, K ) - QINFLO (KN, 1, K )                 HYD09430
      KA = K + 5                                                       HYD09440
      LTEMP (KA) = TEMP (K)                                            HYD09450
  580 CONTINUE                                                         HYD09460
      TONS = TEMP (10) * 1.36E-3                                       HYD09470
      LTEMP (6) = 0                                                    HYD09480
      WRITE(IW,585)(LTEMP(K),K=6,15),TONS                              00000151  A
  585 FORMAT(11X,15HOBSERVED CHANGE,30X,I9,8(1X,I5),2X,I5,3X,F6.3)     HYD09510
      DO 590 K = 1, 10                                                 HYD09520
      TEMP (K) = PREDIC (KN, K ) - QINFLO (KN, 1, K )                  HYD09530
      KA = K + 5                                                       HYD09540
      LTEMP (KA) = TEMP (K)                                            HYD09550
  590 CONTINUE                                                         HYD09560
      LTEMP (6) = 0                                                    HYD09570
      TONS = TEMP (10) * 1.36E-3                                       HYD09580
      WRITE(IW,595)(LTEMP(K),K=6,15),TONS                              00000159
  595 FORMAT(11X,16HPREDICTED CHANGE,29X,I9,8(1X,I5),2X,I5,3X,F6.3)    HYD09595
      IF ( KN . NE. NUMNOD )    GO TO 700                              HYD09600
      WRITE ( IW, 600 )                                                HYD09610
  600 FORMAT ( / 8X, 26HCHEMICAL CHANGES IN SYSTEM  / )                HYD09620
      DO 610 K = 1, 10                                                 HYD09650
      TEMP (K) = OBSVAL ( KN, K ) - QINFLO (1, 1, K)                   HYD09660
      KA = K + 5                                                       HYD09670
      LTEMP (KA ) = TEMP (K)                                           HYD09680
  610 CONTINUE                                                         HYD09690
      LTEMP (6) = 0                                                    HYD09700
      TONS = TEMP (10 ) * 1.36E-3                                      HYD09710
      WRITE(IW,585)(LTEMP(K),K=6,15),TONS                                        A
      DO 620 K = 1, 10                                                 HYD09750  C2
      TEMP (K) = PREDIC (KN, K ) - QINFLO (1, 1, K )                   HYD09760
      KA = K + 5                                                       HYD09770
      LTEMP (KA) = TEMP (K)                                            HYD09780
  620 CONTINUE                                                         HYD09790
      LTEMP (6) = 0                                                    HYD09800
      TONS = TEMP (10 ) * 1.36E-3                                      HYD09810
      WRITE(IW,595)(LTEMP(K),K=6,15),TONS
  700 CONTINUE                                                         HYD09830
 2000 RETURN                                                           HYD09840
      END                                                              HYD09850
```

ORY REQUIREMENTS 00166C BYTES

HEST SEVERITY CODE WAS 0

```
                                                                                C711
      FUNCTION NFIND (NODE)
      COMMON / GENRL / ITITLE(16),NCTRL( 5, 3), MOBEG, IYRBEG, MOEND, IHYD15970
     AYREND, NUMNOD, ISEQ( 5, 20), KPRI, NUMSEQ( 5), NOWTR( 5, 20)     HYD15980
C**** SUBROUTINE FINDS SUBSCRIPT NUMBER FOR NODE PASSED THROUGH ARGUMENTHYD15990
C**** LIST                                                             HYD16000
      IW=6                                                                       A
      DO 5 J = 1, NUMNOD                                               HYD16020
      JK = J                                                           HYD16030
      IF (NODE.EQ.NCTRL(J, 1)) GO TO 10                                HYD16040
    5 CONTINUE                                                         HYD16050
      GO TO 15                                                         HYD16060
   10 NFIND = JK                                                       HYD16070
      RETURN                                                           HYD16080
C**** ERROR MESSAGES FOR PROGRAM CONTROLLED ERRORS ARE GENERATED HERE  HYD16090
   15 WRITE (IW, 20) NODE                                              HYD16100  C1
      CALL EXIT                                                        HYD16120
   20 FORMAT (1H1, 44HNO MATCH WAS FOUND IN CONNOD FOR NODE NUMBER, I5)HYD16130
      END                                                              HYD16140
```

ORY REQUIREMENTS 000270 BYTES

HEST SEVERITY CODE WAS 0

```
      SUBROUTINE RECOMP ( QFLOW, NK, IP, INDY, MO, CONST, IW )
      COMMON / RESER /                                                 HYD00080
     A QINFLO(5,10,12),DEMAND(5,10,16),K                                         A
     BDEMNM( 5, 10,16), KQINNM( 5, 10,16) , KAQUNM (5,16)              HYD00100
      COMMON / PROPER / SOIL( 5, 10, 21), BTANK( 5, 10), TTANK( 5, 10),HYD16190
     1 GRTANK (5, 10) , NSEG ( 5) , CONUSE ( 5, 10, 30)                HYD16200
      DIMENSION KUSE(5,10,30)
      INTEGER $SUR/'SUR '/,$GWR/'GWR '/,$IRR/'IRR '/,$MAI/'MAI '/                A
      INTEGER $GWV/'GWV'/                                              HYD16210  B
      EQUIVALENCE ( CONUSE, KUSE )                                     HYD16220
      DIMENSION QFLOW (10), RFLOW (10)                                 HYD16230
C**** THIS SUBROUTINE COMPUTES MAGNITUDE, CHEMISTRY AND THE ALLOCATION HYD16240
C**** OF RETURN FLOWS. ALSO THE SUBROUTINE COMPUTES SHORTAGES AND      HYD16250
C**** COMPARES THESE WITH THE SHORTAGE INDICES. EXCHANGES BETWEEN      HYD16260
C**** SURFACE FLOWS , SUBSURFACE FLOWS, AND THE SOIL COLUMNS ARE       HYD16270
C**** SIMULATED AS DEMANDS WITHOUT RETURN FLOW ALLOCATIONS.  THERE ARE HYD16280
C**** ONLY TWO DEMANDS WITH RETURN FLOW ALLOCATIONS AND THOSE ARE FOR  HYD16290
C**** IRRIGATION AND MUNICIPAL AND INDUSTRIAL REQUIREMENTS. DEMANDS    HYD16300
C**** ARE THOSE CONSIDERED IDEAL OR FULL SUPPLY COMPUTED AT THE        HYD16310
C**** POINT OF DIVERSION AND INCLUDE CONVEYANCE LOSSES AND FARM LOSSES HYD16320
C**** CONSUMPTIVE USE VALUES REPRESENT A LUMPED BENEFICIAL AND NON     HYD16330
C**** BENEFICIAL REQUIREMENT.      QFLOW = VOLUME AND CHEMISTRY OF     HYD16340
C**** SOURCE, NK AND IP ARE THE NODE AND SEQUENCE INDICES RESPECTIVELY HYD16350
C**** INDY = USE INDEX , MO = MONTH AND IW = WRITE UNIT.               HYD16360
      DO 70 K=1,10                                                               B
   70 RFLOW(K)=0.0                                                               B
      IF ( INDY .GT. 5 )  GO TO 1010                                   HYD16370
      GO TO ( 80, 200, 300, 300, 300) , INDY                           HYD16380
C**** DEMAND HAS BEEN MET SET SHORTAGE ( PERCENT ) EQUAL TO ZERO       HYD16390
   80 CONUSE ( NK, IP, 15 ) = 0.0                                      HYD16400
C**** BEGIN TO COMPUTE RETURN FLOW ITS ALLOCATION AND CHEMISTRY        HYD16410
      RFLOW (1) = CONST - CONUSE (NK, IP, MO )                         HYD16420
      IF(RFLOW(1) .LE. 0.0)RFLOW(1)=0.0                                HYD16424
      DO 129 K=2,10
  129 RFLOW(K)=0.0
      IF(RFLOW(1) .LE. 0.0)GO TO 110                                   HYD16425  B
   90 VOLA = CONST                                                     HYD16430
      VOLB = RFLOW (1)                                                 HYD16440
      DO 100 K = 2, 10                                                 HYD16450
      RFLOW (K) = QFLOW (K) * ( VOLA / VOLB )                          HYD16460
  100 CONTINUE                                                         HYD16470
  110 K=15                                                             HYD16480  A
  120 K = K + 4                                                        HYD16490
      IF ( K . GT. 27 )  GO TO 2000                                    HYD16500
      KDES = KUSE ( NK, IP, K)                                         HYD16510
      KNODE = KUSE (NK, IP, K + 1 )                                    HYD16520
      IF ( KNODE . LE. 0 )  GO TO 120                                  HYD16530
      KSEQ = KUSE ( NK, IP, K + 2 )                                    HYD16540
      KPER = KUSE ( NK, IP, K + 3 )                                    HYD16550
      JK = NFIND (KNODE )                                              HYD16560
      PER = KPER                                                       HYD16570
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      QINFLO ( JK, KSEQ, 1 ) = RFLOW (1) * PER * 1.0E-2                HYD16580
      DO 130 KA = 2, 10                                                 HYD16590
      QINFLO ( JK, KSEQ, KA ) = RFLOW (KA)                              HYD16600
  130 CONTINUE                                                          HYD16610
      IF ( KDES . EQ.  $SUR ) QINFLO( JK, KSEQ, 11 ) = 1.0              HYD16620
      IF ( KDES . EQ.  $GWR ) QINFLO( JK, KSEQ, 11 ) = 2.0              HYD16630
      IF ( KDES . EQ.  $GWV ) QINFLO( JK, KSEQ, 11 ) = 3.0              HYD16640
C**** SET ALPHA INDICATOR TO SHOW RETURN FLOW IS EITHER FROM            HYD16650
C**** IRRIGATION OR A MUNICIPAL AND INDUSTRIAL USE                      HYD16660
      IF ( DEMAND ( NK, IP, 14) . EQ. 1.0 )  KUSE ( NK, IP, 17 ) =  $IRRHYD16670
      IF ( DEMAND ( NK, IP, 14) . EQ. 2.0 )  KUSE ( NK, IP, 17 ) =  $MAIHYD16680
      GO TO 120                                                         HYD16690
C**** DEMAND HAS NOT BEEN MET COMPUTE SHORTAGE IN PERCENT               HYD16700
  200 RATIO = CONUSE ( NK, IP, 13 ) * 1.0E-2                            HYD16710
      TEMCU = CONST * ( 1.0 - RATIO )                                   HYD16720
      SHORT = ( 1.0 - ( TEMCU / CONUSE (NK, IP, MO))) * 1.0E2           HYD16730
C**** COMPARE SHORTAGE WITH SHORTAGE INDEX                              HYD16740
      IF ( SHORT . GT. CONUSE ( NK, IP, 14 )) GO TO 1000                HYD16750
C**** SHORTAGE IS LESS THAN SHORTAGE INDEX COMPUTE RETURN FLOW          HYD16760
      RFLOW (1) = CONST - TEMCU                                         HYD16770
      CONUSE ( NK, IP, 15) = SHORT                                      HYD16780
      GO TO 90                                                          HYD16790
C**** WHEN THE INDEX ( INDY ) IS GREATER THAN 2 THE ROUTINE TREATS      HYD16800
C**** THE DEMANDS AS TRANSFERS OF FLOW WITHOUT RETURN FLOW OR           HYD16810
C**** CONSUMPTIVE USE                                                   HYD16820
  300 KDES = KUSE (NK, IP, 19)                                          HYD16830
      KNODE = KUSE (NK, IP, 20)                                         HYD16840
      KSEQ = KUSE ( NK, IP, 21 )                                        HYD16850
      JP = RFINO ( KNODE)                                               HYD16860
      IF ( CONST . GT. 0.0 )  GO TO 315                                 HYD16870
      DO 310  K = 1, 10                                                 HYD16880
      QINFLO( JP, KSEQ, K ) = 0.0                                       HYD16890
  310 CONTINUE                                                          HYD16900
      GO TO 330                                                         HYD16910
  315 QINFLO( JP, KSEQ, 1 ) = CONST                                     HYD16920
      DO 320 K = 2, 10                                                  HYD16930
      QINFLO ( JP, KSEQ, K ) = QFLOW (K)                                HYD16940
  320 CONTINUE                                                          HYD16950
  330 IF ( KDES . EQ.  $SUR ) QINFLO( JK, KSEQ, 11 ) = 1.0              HYD16960
      IF ( KDES . EQ.  $GWR ) QINFLO( JK, KSEQ, 11 ) = 2.0              HYD16970
      IF ( KDES . EQ.  $GWV ) QINFLO( JK, KSEQ, 11 ) = 3.0              HYD16980
      GO TO 2000                                                        HYD16990
 1000 WRITE ( IW, 1005)  (KDEMNM ( NK, IP, K) , K= 1, 8), NK, IP        HYD17000
 1005 FORMAT ( 1H1, 7X, 32HSHORTAGE INDEX IS VIOLATED FOR     , 8A8 /   HYD17010
     1       13HFOR NODE NO.    , I3, 5X, 12HSEGMENT NO.     , I3 )     HYD17020
      CALL EXIT                                                         HYD17030
 1010 WRITE ( IW, 1015 ) INDY , NK, IP                                  HYD17040
 1015 FORMAT ( 1H1, 7HINDY =    , I3, 5X, 24HWHICH IS GREATER THAN 5  , HYD17050
     1       13HFOR NODE NO.    , I3, 5X, 12HSEGMENT NO.    , I3 )      HYD17060
      CALL EXIT                                                         HYD17070
 2000 RETURN                                                            HYD17080
      END                                                               HYD17090

IRY REQUIREMENTS 000824 BYTES

IEST SEVERITY CODE WAS  0

      SUBROUTINE  CHEMGR ( QFLOW , CONST , KN, KS )
        COMMON / RESER /                                                HYD00080
     A QINFLO(5,10,12),DEMAND(5,10,16),K                                             A
     8DEMNM( 5, 10,16), KQINNM( 5, 10,16) , KAQUNN (5,16)               HYD00100
       COMMON / PROPER / SOIL( 5, 10, 21), BTANK( 5, 10), TTANK( 5, 10),HYD17140
     1 GRTANK( 5, 10)  , NSEG ( 5) , CONUSE ( 5, 10, 30)                HYD17150
      DIMENSION KUSE(5,10,30)
      EQUIVALENCE ( CONUSE, KUSE )                                      HYD17170
      DIMENSION QFLOW(10),QINRIV(10),TEMP(10)                           HYD17180     A
C**** THIS SUBROUTINE IS USED TO COMPUTE A LINEAR MIX OF CHEMISTRY      HYD17190
C**** FOR FLOW ADDED TO THE RIVER ( SURFACE) , TO THE AQUIFER (SUBSURFACHYD17200
C**** , TO THE PONDING POOL ABOVE SOIL COLUMN, AND FLOW ADDED TO THE    HYD17210
C**** RESERVOIR.                                                        HYD17220
C**** QFLOW = FLOW IN RIVER ARRAY , KN AND KS ARE INDICES FOR NODE AND  HYD17230
C**** SEQUENCE RESPECTIVELY, CONST = DEMAND OR DIVERSION                HYD17240
C**** THIS ENTRY MIXES RIVER FLOW WITH AQUIFER                          HYD17250
      KAT=1                                                                          B
      VOLA = CONST                                                      HYD17260
      VOLB = GRTANK (KN, 1 )                                            HYD17270
      VOLUME = VOLA + VOLB                                              HYD17280
      IF (VOLUME.LE.0.0) GO TO 2001                                                  B
      DO 50 K = 2, 10                                                   HYD17290
      GRTANK (KN, K ) = ( QFLOW (K) * VOLA + GRTANK (KN, K ) * VOLB )   HYD17300
     1                / VOLUME                                          HYD17310
   50 CONTINUE                                                          HYD17320
      GO TO 2000                                                        HYD17330
C**** THIS ENTRY MIXES RIVER FLOW WITH PONDING POOL                     HYD17340
      ENTRY CHEMTT(QFLOW,CONST,KN,KS)                                   HYD17350
      KAT=2                                                                          B
      VOLA = CONST                                                      HYD17360
      VOLB = TTANK (KN, 1 )                                             HYD17370
      VOLUME = VOLA + VOLB                                              HYD17380
      IF (VOLUME.LE.0.0) GO TO 2001                                                  B
      DO 60 K = 2, 10                                                   HYD17390
      TTANK (KN, K ) = ( QFLOW (K) * VOLA + TTANK (KN, K ) * VOLB )     HYD17400
     1                / VOLUME                                          HYD17410
   60 CONTINUE                                                          HYD17420
      GO TO 2000                                                        HYD17430
C**** THIS ENTRY MIXES FLOW TO RIVER WITH RIVER                         HYD17440
      ENTRY CHEMRV(QINRIV,CONST,KN,KS)                                  HYD17450
      KAT=3                                                                          B
      VOLA = QINFLO( KN, KS, 1 )                                        HYD17460
      VOLB=QINRIV(1)                                                    HYD17470     A
      VOLUME = VOLA + VOLB                                              HYD17480
      IF (VOLUME.LE.0.0) GO TO 2001                                                  B
      DO 70 K = 2, 10                                                   HYD17490
      QINRIV(K)=(QINFLO(KN,KS,K)*VOLA+QINRIV(K)*VOLB)/VOLUME            HYD17500     A
   70 CONTINUE                                                          HYD17510
      GO TO 2000                                                        HYD17520
C**** THIS ENTRY MIXES AQUIFER FLOW WITH RIVER FLOW                     HYD17760
      ENTRY CHEMAQ(QFLOW,CONST,KN,KS)                                   HYD17770
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      KAT=4                                                                          B
      VOLA = QFLOW (1)                                                  HYD17780
      VOLB = GRTANK (KN, 1 )                                            HYD17790
      VOLUME = VOLA + VOLB                                              HYD17800
      IF (VOLUME.LE.0.0) GO TO 2001                                                  B
      DO 130 K = 2, 9                                                   HYD17810
      QFLOW (K) = ( QFLOW (K) * VOLA + GRTANK ( KN, K ) * VOLB)/ VOLUME HYD17820
  130 CONTINUE                                                          HYD17830
      GO TO 2000                                                        HYD17840
C**** THIS ENTRY MIXES BTANK WATER WITH AQUIFER                         HYD17850
      ENTRY CHEMBT(QFLOW,CONST,KN,KS)                                   HYD17860
      KAT=5                                                                          B
      VOLA = QFLOW (1)                                                  HYD17870
      VOLB = GRTANK (KN, 1)                                             HYD17880
      VOLUME = VOLA + VOLB                                              HYD17890
      IF (VOLUME.LE.0.0) GO TO 2001                                                  B
      DO 140 K = 2, 10                                                  HYD17900
      GRTANK (KN, K) = ( QFLOW (K) * VOLA + GRTANK (KN,K) * VOLB ) /    HYD17910
     1          VOLUME                                                  HYD17920
  140 CONTINUE                                                          HYD17930
      GRTANK (KN, 1 ) = VOLUME                                          HYD17940
      GO TO 2000                                                                     B
 2001 WRITE( 6,2002)KN,KS,KAT                                                        B
 2002 FORMAT(5X,'VOLUME LESS THAN OR EQUAL TO ZERO FOR NODE ',I5,2X,                 B
     1'SEQUENCE EQUAL TO ',I5,2X,'KAT = ',I2/)                                       B
 2000 RETURN                                                            HYD17950
      END                                                               HYD17960

EMORY REQUIREMENTS 000A00 BYTES

 GHEST SEVERITY CODE WAS  0

      SUBROUTINE CONVER ( TEMP , KR ,IW)                                             A
C**** THIS SUBROUTINE IS USED TO CONVERT INPUT UNITS TO PPM AND         HYD17980
C**** ALSO TO CHECK BALANCE BETWEEN CATIONS AND ANIONS                  HYD17990
      DIMENSION TEMP (15) , EQVWT (8)                                   HYD18000
      DATA   EQVWT              / 20.04,12.16,23.,35.46,48.03,30.,61.01, HYD18010
     1                            62.008 /                              HYD18020
      IF ( KR . NE. 1 )  GO TO 80                                       HYD18030
C**** UNITS ARE IN MILLIEQUIVALENTS PER LITER  CHECK SUM OF CATIONS     HYD18040
C**** AND ANIONS                                                        HYD18050
C**** SUM CATIONS                                                       HYD18060
   10 SUMC = 0.0                                                        HYD18070
      DO 20 K = 2, 4                                                    HYD18080
      SUMC = SUMC + TEMP (K)                                            HYD18090
   20 CONTINUE                                                          HYD18100
C**** SUM ANIONS                                                        HYD18110
      SUMA = 0.0                                                        HYD18120
      DO 30 K = 5,9                                                     HYD18130
      SUMA = SUMA + TEMP (K)                                            HYD18140
   30 CONTINUE                                                          HYD18150
      DIFF = SUMC - SUMA                                                HYD18160
      IF ( DIFF . GT. 0.0 )   GO TO 40                                  HYD18170

      TEMP (2) = TEMP (2) + ABS ( DIFF )                                HYD18180
      GO TO 45                                                          HYD18190
   40 TEMP (6) = TEMP(6) + DIFF                                         HYD18200
C**** CONVERT FROM MILLIEQUIVALENTS PER LITER TO PARTS PER MILLION      HYD18210
   45 DO 50 K = 2, 9                                                    HYD18220
      KA = K - 1                                                        HYD18230
      TEMP (K) = TEMP (K) * EQVWT ( KA )                                HYD18240
   50 CONTINUE                                                          HYD18250
C**** COMPUTE TOTAL DISSOLVED SOLIDS FROM ANALYSIS                      HYD18260
      TDS = 0.0                                                         HYD18270
      DO 70 K = 2, 9                                                    HYD18280
      IF ( K . EQ. 7 )  GO TO 60                                        HYD18290
      TDS = TDS + TEMP (K)                                              HYD18300
      GO TO 70                                                          HYD18310
   60 TDS = TDS + ( TEMP (K) * 5.0E-1 )                                 HYD18320
   70 CONTINUE                                                          HYD18330
      TEMP (10 ) = TDS                                                  HYD18340
      WRITE ( IW, 75) ( TEMP (K) , K = 1, 10 )                          HYD18350  A
   75 FORMAT ( 8X, 10 ( 2X, F10.2 ))                                    HYD18360
      GO TO 2000                                                        HYD18370
C**** CONVERT PARTS PER MILLION TO MILLIEQUIVALENTS PER LITER           HYD18380
   80 DO 85 K = 2, 9                                                    HYD18390
      KA = K- 1                                                         HYD18400
      TEMP (K) = TEMP (K) / EQVWT (KA)                                  HYD18410
   85 CONTINUE                                                          HYD18420
      GO TO 10                                                          HYD18430
 2000 RETURN                                                            HYD18440
      END                                                               HYD18450

EMORY REQUIREMENTS 000484 BYTES

 GHEST SEVERITY CODE WAS  0

      SUBROUTINE VERNAL (KN,IS,MO,OBSERV,QFLOW)
C**** THIS SUBROUTINE SIMULATES THE ASSUMED CRITERIA FOR EACH NODE      HYD18470
C**** IN OBTAINING A HYDROLOGIC BALANCE WITH SIMPLE TRANSFERS FROM      HYD18480
C**** SURFACE TO SUBSURFACE OR THE CONVERSE. THE ARGUMENT LIST IS       HYD18490
C**** AS FOLLOWS - KN AND IS ARE THE NODE AND SEQUENCE INDICES          HYD18500
C**** RESPECTIVELY. OBSERV IS THE ARRAY CONTAINING THE OBSERVED OUTFLOWSHYD18510
C**** QFLOW IS THE ARRAY CONTAINING THE RIVER VOLUME AND CHEMISTRY      HYD18520
        COMMON / RESER /                                                HYD00080
     A QINFLO(5,10,12),DEMAND(5,10,16),K                                             A
     BDEMNM( 5, 10,16), KQINNM( 5, 10,16) , KAQUNM (5,16)               HYD00100
      DIMENSION OBSERV (10) , QFLOW (10)                                HYD18560
      GO TO (50,70),KN                                                  HYD18570
C**** THESE ARE THE TRANSFER PARAMETERS FOR NODE 101                    HYD18580
C
C      MIN IS THE SEQUENCE NUMBER OF THE 1ST OBSERVED OUTFLOW
C      MAX IS THE SEQUENCE NUMBER OF THE LAST OBSERVED OUTFLOW
C      KA IS THE SEQUENCE NUMBER OF THE "TRANSFER OF FLOW FROM AQUIFER
C      TO RIVER" CARD
C
C      CARD #HYD18751 IS INCLUDED FOR NODE 2 BECAUSE MIN=MAX FOR THIS
```

```
C       CASE(1E, THERE WAS ONLY ONE OBSERVED OUTFLOW IN NODE 2)
C
     50 MIN=5                                                           HYD18590 A
        MAX=7                                                           HYD18600 A
        KA=5                                                            HYD18610 A
        GO TO 110                                                       HYD18620
C**** THESE ARE THE TRANSFER PARAMETERS FOR NODE 102                    HYD18630
     70 MIN=5                                                           HYD18640 A
        MAX=5                                                           HYD18650 A
        KA=5                                                            HYD18660 A
    110 IF ( IS .GT. MIN )    GO TO 150                                 HYD18720 C4
        DO 130 K = 1, 10                                                HYD18730
        OBSERV (K) = QINFLO ( KN, IS, K)                                HYD18740
    130 CONTINUE                                                        HYD18750
        IF(KN .EQ. 2)GO TO 181                                          00018751 B
        GO TO 2000                                                      HYD18760
    150 VOLA = OBSERV (1)                                               HYD18770
        VOLB = QINFLO (KN, IS, 1)                                       HYD18780
        VOLUME = VOLA + VOLB                                            HYD18790
        IF(VOLUME.LE.0.0) GO TO 180                                             B
        DO 170 K = 2, 10                                                HYD18800
        OBSERV (K) = ( OBSERV (K) * VOLA + QINFLO (KN, IS, K ) * VOLB ) / HYD18810
     1            VOLUME                                                HYD18820
    170 CONTINUE                                                        HYD18830
    180 OBSERV(1)=VOLUME                                                        A
        IF ( IS.LT. MAX )    GO TO 2000                                 HYD18850
    181 KB = KA-1                                                       HYD18860 A
        DIFF = OBSERV (1) - QFLOW (1)                                   HYD18870
        IF ( DIFF . LT. 0.0 ) GO TO 190                                 HYD18880
C**** VOLUME OF OBSERVED OUTFLOW IS GREATER THAN THE PREDICTED OUTFLOW  HYD18890
C**** SET UP TRANSFER OF RIVER FLOW TO THE AQUIFER                      HYD18900
        DEMAND ( KN, KA, MO ) = DIFF                                    HYD18910
        DEMAND ( KN, KB, MO ) = 0.0                                     HYD18920
        GO TO 2000                                                      HYD18930
C**** VOLUME OF OBSERVED OUTFLOW IS LESS THAN THE PREDICTED OUTFLOW     HYD18940
C**** SET UP TRANSFER FROM THE AQUIFER TO THE RIVER                     HYD18950
    190 DEMAND ( KN, KA, MO ) = 0.0                                     HYD18960
        DEMAND (KN, KB, MO ) = ABS (DIFF)                               HYD18970
   2000 RETURN                                                          HYD18980
        END                                                             HYD18990

MORY REQUIREMENTS 0004F0 BYTES

GHEST SEVERITY CODE WAS  0

        FUNCTION ROOTWO ( KNODE , KSEG , CA , MOLE , IW )
CALCULATE ROOT OF (X) USING QUADRATIC WHERE                             HYD19010
C**** X = ( - B + SQRT ( B*B - 4 * A * C ) / 2 A     KNODE = NODE       HYD19020
C**** INDEX AND KSEG = SEGMENT INDEX  CA = ARRAY OF COEFFICIENTS         HYD19030
C**** IN DECREASING POWERS OF (X)   MOLE = ALPHA DEFINITION OF (X)      HYD19040
        DIMENSION CA (10)                                               HYD19050
        RAD = CA (2) * CA (2) - ( 4.0 * CA (1) * CA (3) )               HYD19060
        IF ( RAD . LE. 0.0 ) GO TO 1000                                 HYD19070

        ROOTWO = ( - CA (2) + SQRT ( RAD )) /(2.0 * CA (1))             HYD19080
C    40 WRITE ( IW , 50 ) MOLE , CA(1) , CA(2) , CA(3) , RAD , ROOTWO   HYD19090
C    50 FORMAT ( 1H1, 8X, R6, 2X,                                       HYD19100
C      1              9HCA (1) = , F15.8, 2X,                           HYD19110
C      1              9HCA (2) = , F15.8, 2X,                           HYD19120
C      1              9HCA (3) = , F15.8, 2X,                           HYD19130
C      1              9HRADCAL = , F15.8 / 9X,                          HYD19140
C      1              9HROOTWO = , F15.8 )                              HYD19150
        GO TO 2000                                                      HYD19160
   1000 WRITE ( IW , 1005 ) KNODE , KSEG , MOLE                         HYD19170
   1005 FORMAT(1H1, 8X, 25HPROBABLY NOT A REAL ROOT   , 5X, 11HSET ROOT TO HYD19180
     1          5H ZERO  , 5X, 7HNODE =   , I3 , 5X, 6HSEG =   , I3, 5X, HYD19190
     2          4HFOR    , A6, 2X, 11HCOMPUTATION  )                    HYD19200
   2000 RETURN                                                          HYD19210
        END                                                             HYD19220

MORY REQUIREMENTS 000330 BYTES

GHEST SEVERITY CODE WAS  0

        FUNCTION ROOT (CONST, XMAX, XMIN , MOLE , CA, TESTA )
C**** THIS FUNCTION WILL COMPUTE THE REAL ROOT IF ONE EXISTS            HYD19240
C**** IN THE RANGE XMIN - XMAX INCLUSIVE. IF A ROOT EXISTS IN THIS RANGEHYD19250
C**** MOLE WILL BE SET = TRUE, IF NO ROOT EXISTS , MOLE WILL BE SET =   HYD19260
C**** FALSE. F (X) = CONST AND COEFFICIENTS CA (1) )) CA (N+1 ) ARE     HYD19270
C**** TRANSFERRED THROUGH ARGUMENT LIST IN INCREASING POWERS OF THE     HYD19280
C**** INDEPENDENT VARIABLE.  IN THE FUNCTION FOFX NK = 5 , SO IF  A     HYD19290
C**** A HIGHER THAN FOURTH DEGREE POLYNOMIAL IS TO SOLVED RESET NK .    HYD19300
C**** IF NO ROOT IS FOUND AFTER TWENTY ITERATIONS NO ROOT WILL BE       HYD19310
C**** CONSIDERED AND MOLE WILL BE SET = NONE.                           HYD19320
        DIMENSION  CA(10)                                               HYD19330
        INTEGER  $SC4/'FALS'/,$SC6/'NONE'/,$SC7/'TRUE'/                         B
        XA = 1.E-1 * XMAX                                               HYD19340
        IF ( XMIN . LT. 0.0 ) XA = 1.E-1 * XMIN                         HYD19350
        XB = XA + XA                                                    HYD19360
        IW=6                                                                    A
C       WRITE ( IW , 5 ) XMAX , XMIN , MOLE                             HYD19380
C     5 FORMAT ( 1H1, 8X, 7HXMAX =   , F15.8, 5X, 7HXMIN = , F15.8 , 5X, HYD19390
C      1           4HFOR    , R6 // )                                   HYD19400
        DO 15 K= 1, 5                                                   HYD19410
C       WRITE ( IW , 10 )  K , CA (K)                                   HYD19420
C    10 FORMAT ( 8X, 4HCA(    , I2 , 5H ) = , F20.8 // )                HYD19430
     15 CONTINUE                                                        HYD19440
C       WRITE ( IW , 18 )                                               HYD19450
C    18 FORMAT ( 10X, 2HXA , 18X, 3HFXA , 18X, 2HXB , 18X, 3HFXB , 18X, HYD19460
C      1           2HXC , 18X, 5HCONST  / )                             HYD19470
        MOLE = $SC7                                                     HYD19480
        NK = 0                                                          HYD19490
        CA(1) = CA(1) - CONST                                           HYD19500
        FXA = FOFX ( CA , XA, 1 )                                       HYD19510
        GO TO 30                                                        HYD19520
     20 FXA = FXB                                                       HYD19530
     30 NK = NK + 1                                                     HYD19540
        IF(NK.GT.20)  GO TO 100                                         HYD19550
        FXB = FOFX ( CA, XB, 1 )                                        HYD19560
        DX = XB - XA                                                    HYD19570
        DXOP = FXB - FXA                                                HYD19580
        IF(DXOP.EQ.0.0)  GO TO 50                                       HYD19590
        XC = XB - DX * FXB / DXOP                                       HYD19600
C       WRITE(61,  40) XA, FXA, XB, FXB, XC, CONST                      HYD19610
C    40 FORMAT (  6E20.10  )                                            HYD19620
        EPSLON =  ABS (XC - XB)                                         HYD19630
        IF ( ABS (EPSLON) . LT.TESTA  )  GO TO 50                       HYD19640
        XA = XB                                                         HYD19650
        XB = XC                                                         HYD19660
        GO TO 20                                                        HYD19670
     50 ROOT = XB                                                       HYD19680
        IF(XB.GT.XMAX.OR.XB.LT.XMIN) MOLE = $SC4                        HYD19690
        GO TO 2000                                                      HYD19700
    100 ROOT = 0.0                                                      HYD19710
        MOLE = $SC6                                                     HYD19720
   2000 RETURN                                                          HYD19730
        END                                                             HYD19740

MORY REQUIREMENTS 00043C BYTES

GHEST SEVERITY CODE WAS  0

        FUNCTION FOFX(CF,X, KAM )
C**** THIS FUNCTION EVALUATES ANY POLYNOMIAL  FROM 1ST DEGREE TO        HYD19760
C**** FOURTH DEGREE INCLUSIVE ( SEE SETTING OF NK ) IF A HIGHER DEGREE  HYD19770
C**** POLYNOMIAL IS TO BE EVALUATED RESET NK  WHERE NK - 1 = DEGREE     HYD19780
        DIMENSION  CF(10)                                               HYD19790
        FOFX = 0.0                                                      HYD19800
        NK = 5                                                          HYD19810
     30 FOFX = FOFX + CF(NK)                                            HYD19820
        FOFX = FOFX * X                                                 HYD19830
        NK = NK - 1                                                     HYD19840
        IF(NK.GT.1)  GO TO 30                                           HYD19850
        FOFX = FOFX + CF(1)                                             HYD19860
        IF ( KAM . NE. 0 ) GO TO 2000                                   HYD19870
        DO 40 K = 1, 10                                                 HYD19880
        CF (K) = 0.0                                                    HYD19890
     40 CONTINUE                                                        HYD19900
   2000 RETURN                                                          HYD19910
        END                                                             HYD19920

MORY REQUIREMENTS 000278 BYTES

GHEST SEVERITY CODE WAS  0

        SUBROUTINE SOILCO ( KNODE , IW , IR , NSEGS)
C****                                                                   HYD19940
C**** THIS SUBROUTINE IS USED AS A MONITOR SUBROUTINE FOR ALL SUB-      HYD19950
C**** ROUTINES USED IN THE SIMULATION OF PERCOLATING APPLIED WATERS     HYD19960

C**** VERTICALLY THROUGH A SOIL COLUMN USING PISTON DISPLACEMENT OF     HYD19970
C**** SOLUTION FROM SEGMENT TO SEGMENT. THE FIRST STEP IS TO CHECK      HYD19980
C**** FOR FIRST CALL TO THIS SUBROUTINE -- IF FIRST CALL CLEAR ARRAY    HYD19990
C**** ITER WHERE TALLY IS KEPT FOR NUMBER OF TIMES SEGMENT HAS BEEN     HYD20000
C**** EQUILIBRATED FOR EACH APPLICATION OF WATERS TO BE PERCOLATED      HYD20010
C**** AND ALSO ARRAY KWATER WHERE TALLY IS KEPT OF EACH APPLICATION     HYD20020
C**** OF NEW WATER.                                                     HYD20030
        COMMON /SOLUTE / SLCA, SLMG, SLNA, SLCL , SLSO4, SLHCO3, SLCO3, HYD20040
     1                   SLNO3 ,UCASO4 , UMGSO4                         HYD20050
        COMMON /SOLID/ CATEX, GYPSUM, SLIME ,BDENS, EXCA ,EXNA, EXMG ,  HYD20060
     1                 EXTRAC , DEPTH, SEGVOL , INTER                   HYD20070
        DIMENSION ITER (20, 10 ) , KWATER (20) , CA (10)                HYD20080
        DATA    IFIR / 0 /                                              HYD20090
        IF ( IFIR .NE. 0 ) GO TO 25                                     HYD20100
        DO 20 K = 1, 20                                                 HYD20110
        KWATER (K) = 0                                                  HYD20120
     20 CONTINUE                                                        HYD20130
        IFIR = 1                                                        HYD20140
     25 DO 30 I = 1, 20                                                 HYD20150
        DO 30 J = 1, 10                                                 HYD20160
        ITER ( I, J) = 0                                                HYD20170
     30 CONTINUE                                                        HYD20180
        IF ( KWATER (KNODE ) . GT. 0 )  GO TO 300                       HYD20190
        ISW = 0                                                         HYD20200
        MAX = NSEGS                                                     HYD20210
        MIN = 1                                                         HYD20220
C**** BEGIN EQUILIBRATION OF ALL SEGMENTS IN SOIL COLUMN FOR A          HYD20230
C**** A PARTICULAR ITERATION INDEX                                      HYD20240
     35 DO 200 K = MIN , MAX                                            HYD20250
        NCT = 0                                                         HYD20260
C**** UPDATE COUNTER (ITER) WHICH INDICATES NUMBER OF TIMES THE         HYD20270
C**** KTH SEGMENT HAS BEEN EQUILIBRATED                                 HYD20280
        ITER (KNODE , K ) = ITER ( KNODE , K ) + 1                      HYD20290
C**** PLACE DATA FROM SOIL ARRAY INTO COMPUTATIONAL VARIABLE            HYD20300
C**** NAME SEQUENCE FOR THE KTH SEGMENT                                 HYD20310
        CALL SETUP ( KNODE , K , NSEGS, ISW )                           HYD20320
C       WRITE ( IW , 40) ITER ( KNODE , K ) , KNODE , K                 HYD20330
C    40 FORMAT ( 1H1, 7X,41HBEGINNING CONDITIONS-EQUILIBRATION NO. = ,I2/ HYD20340
C      1                8X, 11HFOR NODE = , I3, 5X,10HSEGMENT =  , I2/ ) HYD20350
C       CALL SCRIBE (IW)                                                HYD20360
CALCULATE MOISTURE CONTENT (WRATIO) = GRAMS OF WATER / GRAMS OF SOIL    HYD20370
C**** FOR THE INITIAL SOIL ANALYSIS WRATIO = EXTRACT (EXTRAC) . MOISTUREHYD20380
C**** CONTENT FOR APPLIED WATERS IS A FUNCTION OF VOLUME OF WATER,      HYD20390
C**** BULK DENSITY AND DEPTH OF KTH SEGMENT                             HYD20400
C**** MOISTURE CONTENT IN PERCENT (PRATIO) = WRATIO * 1.E2              HYD20410
        WRATIO = EXTRAC                                                 HYD20420
        IF ( KWATER (KNODE) . GT. 0 ) WRATIO = SEGVOL / ( BDENS * DEPTH ) HYD20430
        PRATIO = WRATIO * 1.E2                                          HYD20440
        IF ( KWATER (KNODE ) . GT. 0 )  GO TO 50                        HYD20450
C**** IF APPLIED WATERS HAVE NOT BEEN PERCULATED THROUGH SOIL           HYD20460
C**** COLUMN - EQUILIBRATE ON BASIS OF ORIGINAL SOIL ANALYSIS           HYD20470
CALL SUBROUTINE TO EQUILIBRATE INITIAL SOIL ANALYSIS FOR EACH SEGMENT   HYD20480
        CALL FRSTIM ( KNODE , K, IW )                                   HYD20490
C       CALL SCRIBE (IW)                                                HYD20500
CALL SUBROUTINE TO CALCULATE SOLUTION - PRECIPITATION OF GYPSUM **      HYD20510
CASO4 . 2H2O                                                            HYD20520
```

```
   50 CALL GYPEX   ( KNODE , K, IW , PRATIO )
C     CALL SCRIBE (IW)
C     CALL SCRIBE (IW)
      CA (1) = SLCA
CALL SUBROUTINE TO CALCULATE EXCHANGE OF CALCIUM AND SODIUM
      CALL EXCANA  ( KNODE , K, IW , PRATIO )
C     CALL SCRIBE (IW)
      CA (2) = SLCA
CALL SUBROUTINE TO CALCULATE EXCHANGE OF CALCIUM AND MAGNESIUM
      CALL EXCAMG  ( KNODE , K, IW , PRATIO )
C     CALL SCRIBE (IW)
      CA (3) = SLCA
CALL SUBROUTINE TO CALCULATE REACTION OF CALCIUM WITH CARBONATE -
C**** BICARBONATE SYSTEM
      CALL CALCAR  ( KNODE , K, IW , PRATIO )
C     CALL SCRIBE (IW)
      CA (4) = SLCA
CHECK TO DETERMINE IF EQUILIBRIUM HAS BEEN ATTAINED IN THE SOIL - WATER
C**** SYSTEM USING CONCENTRATION OF CALCIUM IN SOLUTION AS THE
CONVERGENT VARIABLE
C     WRITE ( IW, 60 ) NCT , ( CA (M) , M = 1, 4 )
C  60 FORMAT ( 1H1, 8X, 10HCOUNTER = , I2 , / 4 ( 8X, F15.8 ))
      NCT = NCT + 1
      IF ( NCT . GT. 10 )  GO TO 200
      DO 70 L = 1, 4
      EPSLON = CA (L) - SLCA
      IF ( ABS (EPSLON) . GT. 5.E-4 )  GO TO 50
   70 CONTINUE
C**** COMPUTATIONAL SEQUENCE BACK INTO SOIL ARRAY
      CALL RELOAD ( KNODE , K , NSEGS , ISW )
C**** KTH SEGMENT HAS BEEN EQUILIBRATED CALL SUBROUTINE ENTRY TO LOAD
C     WRITE ( IW , 80 ) NCT, (CA (M) , M = 1, 4 )
C  80 FORMAT ( // 8X, 10HCOUNTER = , I2   / 4 ( 8X, F15.8) /
C    1               17HENDING CONDITIONS / )
C     CALL SCRIBE (IW)
  200 CONTINUE
C**** THE SOIL COLUMN HAS BEEN EQUILIBRATED FOR THIS PARTICULAR
C**** ITERATION ** TEST FIRST TO DETERMINE IF THIS ITERATION WAS FOR
C**** THE EQUILIBRATION OF THE ORIGINAL SOIL ANALYSIS
      IF ( KWATER ( KNODE ) . EQ. 0 )   GO TO 300
C**** EQUILIBRATION HAS BEEN FOR THE SOIL COLUMN AFTER APPLICATION
C**** OF SURFACE WATERS
      GO TO 310
C**** MOVE APPLIED WATER INTO FIRST SEGMENT AND  EQUILIBRATE
  300 MIN = 0
      MAX = NSEGS
C**** UPDATE COUNTER OF NUMBER OF APPLICATIONS OF SURFACE WATERS
      KWATER ( KNODE ) = KWATER (KNODE ) + 1
      ISW = 3
  310 MIN = MIN + 1
      IF ( MIN . GT. NSEGS )  GO TO 350
      KV = MIN
      CALL SMOVER ( KNODE , KV , NSEGS , ISW )
      GO TO 35
C**** THIS IS THE LAST EQUILIBRATION FOR THIS SOIL COLUMN FOR THIS TIME
C**** FRAME ** MIX SOLUTION IN LOWERMOST SEGMENT WITH BTANK **** SET

C**** VOLUME OF BTANK
  350 ISW = 4
      CALL SMOVER ( KNODE , KV , NSEGS , ISW )
 2000 RETURN
      END
```

MORY REQUIREMENTS 00098C BYTES

GHEST SEVERITY CODE WAS 0

```
      SUBROUTINE SETUP ( KN , KV, NSEGS, ISW )
C**** THIS SUBROUTINE HAS MULTIPLE ENTRIES AND CONTROLS THE TRANSFER
C**** OF DATA TO AND FROM THE COMPUTATIONAL VARIABLE NAME SEQUENCE AS
C**** THIS DATA RELATES TO THAT STORED IN THE ARRAY TITLED SOIL. THE
C**** SUBROUTINE ALSO SIMULATES THE VERTICAL DISPLACEMENT OF SOLUTION
C**** FROM ONE SEGMENT TO THE NEXT LOWER SEGMENT (PISTON EFFECT). KN AND
C**** KV IN THE ARGUMENT LIST REPRESENT THE NODE INDEX AND SEGMENT INDEX
C**** RESPECTIVELY.
       COMMON / PROPER / SOIL( 5, 10, 21), BTANK( 5, 10), TTANK( 5, 10),
     1 GRTANK (5, 10)  , NSEG ( 5)  , CONUSE ( 5, 10, 30)
      COMMON /SOLUTE / SLCA, SLMG, SLNA, SLCL , SLSO4, SLHCO3, SLCO3,
     1                SLNO3 ,UCASO4 , UMGSO4
      COMMON /SOLID/ CATEX, GYPSUM, SLIME ,BDENS, EXCA ,EXNA, EXMG ,
     1                EXTRAC , DEPTH, SEGVOL , INTER
      DIMENSION  EQVWT (8) , VALNCE (8)
      REAL INTER
      DATA   EQVWT               / 20.4 ,12.16,23.,35.46,48.03,30.,61.01,
     1                           62.008 /
C     DATA ((EQVWT(K), K=1,8) = 20.4 ,12.16,23.,35.46,48.03,30.,61.01,
C    1                           62.008 )
      DATA  VALNCE               / 2., 2., 1.,1.,2.,1.,2.,1./
C**** THE MAIN ENTRY TO THIS SUBROUTINE CONVERTS UNITS OF INITIAL SOIL
C**** ANALYIS INTO COMPUTATIONAL UNITS
CONVERSION OF MILLIEQUIVALENTS PER LITER (MEQ/L) TO COMPUTATIONAL UNITS
C**** OF MOLS PER LITER (SOLUTION)- MOLS/LITER =(MEQ/L) /(VALENCE * 1.E3
      IF ( ISW . NE. 0 ) GO TO 70
   50 DO 60 K = 1,8
      SOIL (KN,KV,K) = SOIL (KN,KV,K) / (VALNCE (K) * 1.E3)
   60 CONTINUE
CONVERT MILLIEQUIVALENTS PER 100 GRAMS TO COMPUTATION UNITS OF MOLS/GRAM
C**** WHEN ISW = 0 CONVERSION IS NECESSARY FOR INITIAL SOIL ANALYSIS
C**** PER GRAM (SOLID)- MOLS/GRAM = (MEQ/100GRAMS) /(VALENCE * 1.E5)
      SOIL (KN,KV,11) = SOIL (KN,KV,11)/ (VALNCE(4)* 1.E5)
      SOIL (KN,KV,12) = SOIL (KN,KV,12)/ (VALNCE(5)* 1.E5)
C**** WHEN ISW NOT EQUAL ZERO COMPUTATIONAL UNITS RETAINED NO
C**** CONVERSION REQUIRED
C**** PLACE DATA OF SOIL ARRAY IN COMPUTATIONAL VARIABLE NAME SEQUENCE
   70 SLCA    = SOIL (KN,KV, 1)
      SLMG    = SOIL (KN,KV, 2)
      SLNA    = SOIL (KN,KV, 3)
      SLCL    = SOIL (KN,KV, 4)
      SLSO4   = SOIL (KN,KV, 5)
      SLHCO3  = SOIL (KN,KV, 6)
      SLCO3   = SOIL (KN,KV, 7)
      SLNO3   = SOIL (KN,KV, 8)
      EXTRAC  = SOIL (KN,KV, 9)
      SEGVOL  = SOIL (KN,KV,10)
      CATEX   = SOIL (KN,KV,11)
      GYPSUM  = SOIL (KN,KV,12)
      SLIME   = SOIL (KN,KV,13)
      BDENS   = SOIL (KN,KV,14)
      DEPTH   = SOIL (KN,KV,15)
      EXCA    = SOIL (KN,KV,16)
      EXMG    = SOIL (KN,KV,17)
      EXNA    = SOIL (KN,KV,18)
      UCASO4  = SOIL (KN,KV,19)
      UMGSO4  = SOIL (KN,KV,20)
      INTER =   SOIL(KN,KV,21)
      GO TO 2000
C**** THIS ENTRY MOVES OF SOLUTION OF BOTTOMMOST SEGMENT INTO BTANK ARRA
C**** USING A LINEAR MIX AFTER CONVERTING UNITS OF COMPUTATIONAL MODE TO
C**** PARTS PER MILLION(PPM)  WHERE PPM = MOLES PER LITER * EQUIVALENT
C**** WEIGHT OF SPECIES * VALENCE OF SPECIES * 1.E3 . ALSO MOVES SOLUTIO
C**** OF ONE SEGMENT TO NEXT LOWER SEGMENT KEEPING COMPUTATIONAL UNITS O
C**** MOLES PER LITER  AS WELL AS PLACING APPLIED WATERS IN SOLUTION OF
C**** UPPERMOST SEGMENT CONVERTING UNITS OF PPM  TO MOLS/LITER  WHERE
C**** MOLS PER LITER = PPM /(EQUIVALENT WEIGHT * VALENCE * 1.E3)
      ENTRY SMOVER
      KG = KV
      IF ( KV . GT. 1 ) KG = KV - 1
      KR = NSEGS
      DO 90 K =1,8
      L = K + 1
      BTANK (KN,L) =(BTANK (KN,L) +(SOIL (KN,KR,K)* EQVWT(K) * VALNCE(K)
     1                 * 1.E3 )) * 5.E-1
   90 CONTINUE
      IF ( ISW . EQ. 4 ) GO TO 2000
C**** MOVE SOLUTION OF ONE SEGMENT TO NEXT LOWER SEGMENT
   95 KR = KR - 1
      IF ( KR . LT. KG )  GO TO 120
   97 KP = KR + 1
      DO 100 K = 1, 8
      SOIL(KN,KP,K) = SOIL(KN,KR,K)
  100 CONTINUE
      SOIL (KN,KP,19) = SOIL(KN,KR,19)
      SOIL (KN,KP,20) = SOIL(KN,KR,20)
      GO TO 95
  120 IF ( KV. GT. 1 )  GO TO 2000
C**** PLACE APPLIED WATERS INTO UPPERMOIST SEGMENT
      DO 130 K = 1, 8
      L = K + 1
      SOIL(KN, 1,K) = TTANK(KN,L) / (EQVWT(K) * VALNCE(K) * 1.E3)
  130 CONTINUE
      GO TO 2000
C**** AT THE COMPLETION OF EQILLBRATION OF EACH SEGMENT THIS ENTRY RELOA
C**** ARRAY SOIL BY TRANSFER OF DATA FROM COMPUTATIONAL VARIABLE NAME
C**** SEQUENCE.  ALL UNITS ARE IN COMPUTATIONAL UNITS.
      ENTRY RELOAD
      SOIL (KN,KV, 1) = SLCA

      SOIL (KN,KV, 2) = SLMG
      SOIL (KN,KV, 3) = SLNA
      SOIL (KN,KV, 4) = SLCL
      SOIL (KN,KV, 5) = SLSO4
      SOIL (KN,KV, 6) = SLHCO3
      SOIL (KN,KV, 7) = SLCO3
      SOIL (KN,KV, 8) = SLNO3
      SOIL (KN,KV,12) = GYPSUM
      SOIL (KN,KV,13) = SLIME
      SOIL (KN,KV,16) = EXCA
      SOIL (KN,KV,17) = EXMG
      SOIL (KN,KV,18) = EXNA
      SOIL (KN,KV,19) = UCASO4
      SOIL (KN,KV,20) = UMGSO4
      SOIL (KN,KV,21) = INTER
 2000 RETURN
      END
```

MORY REQUIREMENTS 000AAC BYTES

GHEST SEVERITY CODE WAS 0

```
      SUBROUTINE ERSTIM ( KNODE , NSEG , IW )
C**** THIS SUBROUTINE IS USED TO CALCULATE IONIC CONCENTRATIONS
C**** OF CALCIUM, MAGNESIUM ,SULFATE AND THE UNDISSOCIATED CALCIUM
C**** SULFATE AND MAGNESIUM SULFATE . THE SUBROUTINE ALSO CALCULATES
C**** THE EXCHANGEABLE CALCIUM ,MAGNESIUM AND SODIUM . THIS SUBROUTINE
C**** IS USED ONLY ONCE FOR EACH SOIL SEGMENT AND USES DATA FROM INITIAL
C**** SOIL ANALSIS.
      COMMON /SOLUTE / SLCA, SLMG, SLNA, SLCL , SLSO4, SLHCO3, SLCO3,
     1                 SLNO3 ,UCASO4 , UMGSO4
      COMMON /SOLID/ CATEX,GYPSUM, SLIME, BDENS, EXCA, EXNA, EXMG,
     1               EXTRAC, DEPTH, SEGVOL, INTER
      DIMENSION CA (10)
      INTEGER  $SC1/'FRST'/,$SC2/'TRUE'/
      DATA  TECA/ 4.9E-3/, TECMG/ 5.9E-3/
CALCULATE ACTIVITY COEFFICIENT FOR DIVALENT ION (GAMMA2)
      GAMMA2 = G(2)
CALCULATE CONCENTRATION OF UNCOMBINED SULFATE ION AS A POSITIVE REAL
C**** ROOT OF A THIRD DEGREE POLNOMIAL . LET THERMODYNAMIC EQUILIBRIUM
C**** CONSTANTS FOR UNDISSOCIATED CALCIUM SULFATE AND MAGNESIUM SULFATE
C**** = 4.9E-3 AND 5.9E-3 RESPECTIVELY
CHECK FIRST TO DETERMINE IF SULFATE IS IN SOLUTION - IF NO SULFATE IS
C**** SOLUTION BYPASS COMPUTATIONS WHERE SULFATE IS A VARIABLE
      IF(SLSO4.LE.0.0)  GO TO 60
CALCULATE COEFFICIENTS FOR THIRD DEGREE POLYNOMIAL
      DO 50 K = 1,10
      CA(K) = 0.0
   50 CONTINUE
      GSOR = GAMMA2 * GAMMA2
      CA(4) = GSOR * GSOR
      CA(3) = GSOR *(TECA + TECMG) + GSOR * GSOR * (SLCA + SLMG -SLSO4)
      CA(2) =  TECA* TECMG + GSOR *(TECMG* SLCA + TECA* SLMG - SLSO4 *
```

```
 1          (TECA + TECMG))
      CA(1) = - SLSO4 * TECA * TECMG
C**** CALCULATE UNCOMBINED SO4 AS ROOT GREATER THAN ZERO AND LESS THAN
C**** SLSO4
      CONST = 0.0
CALCULATE A POSITIVE ROOT (REAL) IN RANGE XMIN - XMAX
      XMIN = 0.0
      XMAX = SLSO4
C**** SET CONVERGENCE CRITERION (TESTA) SO THAT F(X) IS LESS THAN 1.E-6
      TESTA = 1.E-6
      MOLE = $SC1
      FSO4 = ROOT (CONST,XMAX, XMIN, MOLE , CA , TESTA )
      IF(MOLE.NE.$SC2   ) GO TO 900
CALCULATE CONCENTRATION OF UNDISSOCIATED CASO4 (MOLS/LITER)
      UCASO4 = SLCA * FSO4 * GSQR / (TECA + GSQR * FSO4)
CALCULATE UNCOMBINED CA (MOLES/ LITER)
      SLCA = SLCA - UCASO4
CALCULATE CONCENTRATION OF UNDISSOCIATED MGSO4 (MOLS/ LITER)
      UMGSO4 =  SLMG * FSO4 * GSQR / (TECMG + GSQR * FSO4)
CALCULATE UNCOMBINED MG (MOLS / LITER)
      SLMG = SLMG - UMGSO4
C**** CHANGE CONCENTRATIONS OF DIVALENT IONS FROM MOLS PER LITER TO
C**** EQUIVALENTS PER LITER
      SLMG = SLMG * 2.
      SLCA = SLCA * 2.
      GO TO 70
   60 FSO4 = 0.0
CALCULATE EXCHANGEABLE CALCIUM (EXCA) IN EQUIVALENTS PER GRAM
C**** LET EXCHANGE CONSTANT CA-MG = 0.67 AND FOR CA-NA = 2.0
CALCULATE ACTIVITY COEFFICIENT FOR MONOVALENT ION (GAMMA1)
   70 GAMMA1 = G(1)
      EXCA =  SLNA * GAMMA1/(2.0 * SQRT(SLCA * GAMMA2))  + 1.0  + 6.7E-1
 1              * SLMG /SLCA
      EXCA = CATEX / EXCA
CALCULATE EXCHANGEABLE SODIUM  (EXNA) IN EQUIVALENTS PER GRAM
      EXNA = EXCA * SLNA * GAMMA1 / (2.0 * SQRT (SLCA * GAMMA2))
CALCULATE EXCHANGEABLE MAGNESIUM (EXMG) IN EQUIVALENTS PER GRAM
      EXMG = CATEX - EXCA - EXNA
C**** CHANGE UNITS FROM EQUIVALENTS PER GRAM AND EQUIVALENTS PER
C**** LITER TO MOLS PER GRAM AND MOLS PER LITER
      EXCA = EXCA * 5.E-1
      EXMG = EXMG * 5.E-1
      SLMG = SLMG * 5.E-1
      SLCA = SLCA * 5.E-1
      SLSO4 = FSO4
      GO TO 2000
C**** ERROR MESSAGES ARE PRINTED HERE
  900 WRITE (IW,910) KNODE , KSEG
  910 FORMAT (1H1,14HERROR IN NODE  ,I3 ,2X ,12HSEGMENT NO. , I3,
 1            15HBECAUSE OF ****     )
  960 WRITE (IW,965) FSO4 , SLSO4
  965 FORMAT (8X , 20HROOT IS OUT OF RANGE , 7HROOT =    ,F10.5 ,
 1            8X,15HRANGE = 0.0 TO  , F10.5  )
      CALL EXIT
 2000 RETURN
      END
```

MORY REQUIREMENTS 000600 BYTES

GHEST SEVERITY CODE WAS 0

```
      SUBROUTINE GYPEX (KNODE, KSEG, IW, PRATIO )
C**** THIS SUBROUTINE IS USED TO CALCULATE THE SOLUTION OR PRECIPITATION
C**** OF GYPSUM ( CASO4*2H2O ) AND THE REQUIREMENTS OF CALCIUM
C**** AND MAGNESIUM FOR THE UNDISSOCIATED ION PAIRS CASO4 AND MGSO4.
      INTEGER  $SC1/'GYPS'/,$SC2/'CASO'/,$SC3/'MGSO'/
      DIMENSION CA (10)
      COMMON /SOLUTE / SLCA, SLMG, SLNA, SLCL , SLSO4, SLHCO3, SLCO3,
 1                     SLNO3 ,UCASO4 , UMGSO4
      COMMON /SOLID/ CATEX, GYPSUM, SLIME ,BDENS, EXCA ,EXNA, EXMG ,
 1                   EXTRAC , DEPTH, SEGVOL , INTER
CALCULATE ACTIVITY COEFFICIENCT OF DIVALENT ION (GAMMA2)
      GAMMA2 = G(2)
      GSQR = GAMMA2 * GAMMA2
CALCULATE CHANGES IN CONCENTRATIONS OF CALCIUM AND SULFATE (X). GIVEN TH
C**** SOLUBILITY PRODUCT (KSP) OF GYPSUM = 2.4E-5. SOLVE FOR (X) USING
C**** QUADRATIC  FORM OF KSP = ((SLCA + X)(SLSO4 +X))* GAMMA2 **2 . WHEN
C**** (X) IS POSITIVE SOLUTION IS UNDERSATURATED. WHEN (X) IS ZERO OR
C**** NEGATIVE SOLUTION IS SATURATED OR SUPERSATURATED. COMPUTE COEFFIC
C**** FOR QUADRATIC EQUATION
   40 CA(1) = 1.0
      CA(2) = SLCA + SLSO4
      CA(3) = (SLCA * SLSO4) - (2.4E-5 / GSQR)
      MOLE = $SC1
CONVERT GYPSUM (SOLID) FROM MOLS/GRAM TO MOLES PER LITER - PRATIO IS
C**** MOISTURE CONTENT IN PERCENT - MOLS/LITER = (1.0 /PRATIO)* 1.E5
      GYPSOL = GYPSUM * (1.0 /PRATIO) * 1.E5
      X = ROOTWO (KNODE,KSEG,CA, MOLE, IW)
      IF(X.LT.0.0)  GO TO 60
CONDITION-SOLUTION IS UNDERSATURED
      Y = GYPSOL - X
      IF(Y.LE.0.0)  GO TO 50
CONDITION - ENOUGH GYPSUM IN SOLID STATE TO SATURATE SOLUTION - UPDATE
C**** CALCIUM AND SULFATE   CONCENTRATIONS.
      SLCA = SLCA + X
      SLSO4 = SLSO4 + X
      GYPSOL = Y
      GO TO 70
CONDITION-NOT ENOUGH GYPSUM IN SOLID STATE TO SATURATE SOLUTION DISSOLVE
C**** ALL GYPSUM - UPDATE CALCIUM AND SULFATE CONCENTRATIONS
   50 GYPSOL = 0.0
      SLCA = SLCA + X
      SLSO4 = SLSO4 + X
      GO TO 100
CONDITION-SOLUTION IS SUPERSATURATED ADD EXCESS TO GYPSUM IN SOLID STATE
C**** UPDATE CALCIUM AND SULFATE CONCENTRATIONS
   60 X = ABS(X)
      GYPSOL = GYPSOL + X
      SLCA = SLCA - X
      SLSO4 = SLSO4 - X
CONDITION - TEST IF UNDISSOCIATED CASO4 (UCASO4) IS AT MAXIMUM CONCENTRA
C**** OF 4.987E-3 MOLS /LITER
   70 IF (UCASO4.GE.4.987E-3) GO TO 90
CONDITION - UCASO4 NOT AT MAXIMUM CONCENTRATION
      W = 4.987E-3 - UCASO4
      IF (W.LT.GYPSOL) GO TO 80
CONDITION-NOT ENOUGH RESIDUAL GYPSUM TO BRING UCASO4 TO MAXIMUM CONCENTR
      UCASO4 = UCASO4 + GYPSOL
      GYPSOL = 0.0
      GO TO 100
CONDITION - ENOUGH RESIDUAL GYPSUM TO MEET MAXIMUM CONCENTRATION OF UCAS
   80 GYPSOL = GYPSOL - W
      UCASO4 = 4.987E-3
CONVERT-RESIDUAL GYPSUM FOR MOLS/LITER BACK TO MOLS/GRAM
   90 GYPSUM = GYPSOL * PRATIO / 1.E5
      GO TO 200
CALCULATE CHANGES IN CALCIUM AND SULFATE CONCENTRATIONS (X) TO SATISFY
C**** UNDISSOCIATED CASO4 (UCASO4) - WHERE EQUATION OF EQUILIBRIUM IS
C**** EQUILIBRIUM CONSTANT = 4.9E-3 - COEFFICIENTS FOR SECOND DEGREE
C**** EQUATION ARE AFTER RECOMPUTING IONIC STRENGTH
  100 GAMMA2 = G(2)
      GSQR = GAMMA2 * GAMMA2
  110 CA(1) = GSQR
      CA(2) = GSQR * (SLCA + SLSO4) + 4.9E-3
      CA(3) =(GSQR * SLCA* SLSO4) -(4.9E-3 * UCASO4)
      MOLE = $SC2
      X = ROOTWO (KNODE, KSEG, CA, MOLE ,IW)
C**** UPDATE CONCENTRATIONS OF CASO4, CA AND SO4
      UCASO4 = UCASO4 - X
      SLCA = SLCA + X
      SLSO4 = SLSO4 + X
CALCULATE CHANGES IN MAGNESIUM AND SULFATE CONCENTRATIONS (X) TO SATISFY
C**** UNDISSOCIATED MGSO4 (UMGSO4)- WHERE EQUATION OF EQUILIBRIUM IS
C**** (UMGSO4 -X ) K = GAMMA2**2((SLMG +X )(SLSO4 +X)) AND K = THERMODYN
C**** EQUILIBRIUM CONSTANT = 5.9E-3 - COEFFICIENTS FOR SECOND DEGREE
C**** EQUATION ARE -
  200 CA(1) = GSQR
      CA(2) = GSQR * (SLMG + SLSO4) + 5.9E-3
      CA(3) = (GSQR * SLMG * SLSO4) -(5.9E-3 * UMGSO4)
      MOLE = $SC3
      X = ROOTWO (KNODE, KSEG, CA, MOLE, IW)
C**** UPDATE CONCENTRATIONS OF MGSO4, MG AND SO4
      UMGSO4 = UMGSO4 - X
      SLMG = SLMG + X
      SLSO4 = SLSO4 + X
 2000 RETURN
      END
```

MORY REQUIREMENTS 000574 BYTES

GHEST SEVERITY CODE WAS 0

```
      SUBROUTINE EXCANA ( KNODE , KSEG , IW, PRATIO )
C**** THIS SUBROUTINE CALCULATES THE SODIUM (MONOVALENT) EXCHANGE WITH
C**** CALCIUM(DIVALENT).           THE GAPON EQUATION EXPRESSING THE
C**** RELATIONSHIP OF CALCIUM AND SODIUM IN TERMS OF CONCENTRATIONS
C**** WAS USED. LET (X) REPRESENT THE CHANGE IN CONCENTRATION OF THE
C**** DIVALENT ION IN THE SOLID PHASE IN UNITS OF MOLS PER GRAM.
C**** CALCULATE COEFFICIENTS FOR THE FOURTH DEGREE POLYNOMIAL-- BETA
C**** IS THE CONVERSION FACTOR TO CONVERT MOLS PER GRAM TO MOLS
C**** PER LITER AND HAS UNITS OF GRAMS OF SOLID PER LITER OF SOLUTION
C**** EXCHANGE COEFFICIENT K (DEX) = 7.07E-1
      INTEGER  $SC1/'EXCA'/,$SC2/'TRUE'/
      COMMON /SOLUTE / SLCA, SLMG, SLNA, SLCL , SLSO4, SLHCO3, SLCO3,
 1                     SLNO3 ,UCASO4 , UMGSO4
      COMMON /SOLID/ CATEX, GYPSUM, SLIME ,BDENS, EXCA ,EXNA, EXMG ,
 1                   EXTRAC , DEPTH, SEGVOL , INTER
      DIMENSION CA (10)
      DIMENSION T(4)
      DEX = 7.07E-1
C**** IF THERE IS NO SODIUM IN SOLUTION OR SOLID  PHASE EXIT ROUTINE
      IF ( SLNA .EQ. 0.0. AND.EXNA . EQ. 0.0 )  GO TO 2000
CALCULATE MONOVALENT ACTIVITY COEFFICIENT GAMMA1
      GAMMA1 = G(1)
      DO 50 K = 1, 10
      CA (K) = 0.0
   50 CONTINUE
      BETA = ( 1.0 / PRATIO) * 1.E5
C**** ARRANGE ORDER OF COEFFICIENTS IN INCREASING POWERS OF (X)
      GSQR = GAMMA1 * GAMMA1
      BETA2 = BETA * BETA
      DEX2 = DEX * DEX
      CA(1) = ( GSQR * EXNA * EXNA * SLCA ) - ( DEX2 * EXCA * EXCA
 1            * SLNA * SLNA )
      CA(2) = GSQR * EXNA * ( 4.0 * SLCA + BETA * EXNA ) + 2.0 * DEX2*
 1            EXCA * SLNA * ( SLNA + 2.0 * BETA * EXCA )
      CA(3) = 4.0 * GSQR * ( SLCA + BETA * EXNA ) - 4.0 * DEX2* BETA *
 1          EXCA * ( BETA * EXCA + 2.0 * SLNA ) - DEX2 * SLNA* SLNA
      CA(4) = 4.0 * BETA * ( 2.0 * DEX2 * EXCA * BETA + GSQR + DEX2 *
 1            SLNA )
      CA(5) = - 4.0*BETA2 * DEX2
      ISW = 1
CALCULATE A POSITIVE ROOT (REAL) IN RANGE XMIN - XMAX
      XMIN = 0.0
      XMAX = EXCA
      IF ( EXCA .GT. EXNA ) XMAX = EXNA
   60 MOLE = $SC1
C**** SET CONVERGENCE CRITERION (TESTA) SO THAT F(X) IS LESS THAN 1.E-8
      TESTA = 1.E-8
      X = ROOT ( CONST, XMAX , XMIN , MOLE , CA , TESTA )
      IF ( MOLE . EQ . $SC2     )  GO TO 68
      GO TO ( 75, 68 ) , ISW
C**** TEST ROOT TO INSURE NO UPDATED CONCENTRATIONS ARE LESS THAN ZERO
   68 T(1) = EXNA + ( 2.0 * X )
      T(2) = EXCA - X
      T(3) = SLNA - ( 2.0 * BETA * X )
      T(4) = SLCA + ( BETA * X )
      DO 70 K = 1,4
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      IF ( T (K) . LT.0.0 ) GO TO 75                                        HYD24670
   70 CONTINUE                                                              HYD24680
      GO TO 80                                                              HYD24690
   75 IF ( ISW . EQ. 2 )  GO TO 1000                                        HYD24700
CALCULATE A NEGATIVE ROOT (REAL) IN RANGE XMIN - XMAX                       HYD24710
      XMIN = - XMAX                                                         HYD24720
      XMAX= 0.0                                                             HYD24730
      ISW = 2                                                               HYD24740
      GO TO 60                                                              HYD24750
C**** UPDATE CALCIUM AND SODIUM CONCENTRATIONS IN SOLUTION AND SOLID        HYD24760
C**** PHASES                                                                HYD24770
   80 EXNA = T(1)                                                           HYD24780
      EXCA = T(2)                                                           HYD24790
      SLNA = T(3)                                                           HYD24800
      SLCA = T(4)                                                           HYD24810
      GO TO 2000                                                            HYD24820
 1000 WRITE ( IW , 1005 ) KNODE , KSEG                                      HYD24830
 1005 FORMAT ( 1H1, 42HNO REAL ROOT EXISTS IN RANGE FOR CA-NA FOR   /       HYD24840
     1           7HNODE =    , I3 , 5X, 10HSEGMENT =    , I3 )              HYD24850
       WRITE ( IW, 1010 ) X, XMIN, XMAX, MOLE                               HYD24860
 1010 FORMAT ( // 8X, 4HX = , F20.8 , 3X, 7HXMIN = , F20.8 , 3X,            HYD24870
     1                   7HXMAX = , F20.8, 3X, 7HMOLE =   , A5 )            HYD24880
      CALL EXIT                                                             HYD24890
 2000 RETURN                                                                HYD24900
      END                                                                   HYD24910

MORY REQUIREMENTS 0006F8 BYTES

GHEST SEVERITY CODE WAS  0

      SUBROUTINE EXCAMG ( KNODE, KSEG, IW, PRATIO )                                B
      INTEGER  $SC1/'CALM'/
      COMMON /SOLUTE / SLCA, SLMG, SLNA, SLCL , SLSO4, SLHCO3, SLCO3,       HYD24930
     1                 SLNO3 ,UCASO4 , UMGSO4                               HYD24940
      COMMON /SOLID/ CATEX, GYPSUM, SLIME ,BDENS, EXCA ,EXNA, EXMG ,        HYD24950
     1               EXTRAC , DEPTH, SEGVOL , INTER                         HYD24960
C**** THIS SUBROUTINE CALCULATES THE MAGNESIUM (DIVALENT) EXCHANGE WITH HYD24970
C**** CALCIUM (DIVALENT) . THE COMMON EQUATION EXPRESSING THE RELATIONSHHYD24980
C**** OF CALCIUM AND MAGNESIUM IN TERMS OF CONCENTRATIONS WAS USED.      HYD24990
C**** LET (X) REPRESENT THE CHANGE IN CONCENTRATION OF THE DIVALENT ION HYD25000
C**** IN THE SOLID PHASE IN UNITS OF MOLS PER GRAM. CALCULATE THE        HYD25010
C**** COEFFICIENTS OF SECOND DEGREE POLYNOMIAL - BETA = CONVERSION       HYD25020
C**** FACTOR TO CONVERT MOLS PER GRAM TO MOLS PER LITER AND HAS UNITS OFHYD25030
C**** GRAMS OF SOLID PER LITER OF SOLUTION. EXCHANGE COEFFICIENT         HYD25040
C**** K (DEX) = 6.7E-1                                                   HYD25050
      DIMENSION CA (10)                                                     HYD25060
      DEX = 6.7E-1                                                          HYD25070
      BETA = ( 1.0 / PRATIO ) * 1.E5                                        HYD25080
      CA(1) = BETA * ( 1.0 - DEX)                                           HYD25090
      CA(2)=BETA * ( DEX * EXCA + EXMG ) + DEX * SLMG + SLCA                HYD25100
      CA(3) = SLCA * EXMG - ( DEX * SLMG * EXCA )                           HYD25110
      MOLE = $SC1                                                           HYD25120
      X = ROOTWO ( KNODE , KSEG , CA , MOLE , IW )                          HYD25130

C**** UPDATE CONCENTRATIONS OF CALCIUM AND MAGNESIUM IN SOLUTION AND        HYD25140
C**** SOLID PHASES                                                          HYD25150
      SLCA = SLCA + ( BETA * X )                                            HYD25160
      SLMG = SLMG - ( BETA * X )                                            HYD25170
      EXCA = EXCA - X                                                       HYD25180
      EXMG = EXMG + X                                                       HYD25190
 2000 RETURN                                                                HYD25200
      END                                                                   HYD25210

MORY REQUIREMENTS 0002EC BYTES

GHEST SEVERITY CODE WAS  0

      SUBROUTINE CALCAR ( KNODE, KSEG, IW, PRATIO )
C**** THIS SUBROUTINE IS USED TO CALCULATE THE REACTION OF CALCIUM          HYD25230
C**** WITH THE CARBONATES. IF   CACO3 ( LIME ) IS PRESENT IN THE SOLID      HYD25240
C**** PHASE THE INDICATOR SLIME WILL BE SET TO ONE , IF LIME IS NOT         HYD25250
C**** PRESENT SLIME WILL BE SET TO ZERO . LOG10 (KPRIME )= -1.68 *          HYD25260
C**** LOG10 (PRATIO) - LOG10 (INTER) , WHERE PRATIO = MOISTURE CONTENT      HYD25270
C**** IN PERCENT, KPRIME = SLCA * SLHCO3 * SLHCO3 * GAMMA1 * GAMMA1         HYD25280
C**** * GAMMA2 AND INTER = INTERCEPT. THE EXPRESSION FOR KPRIME WAS         HYD25290
C**** DERIVED USING A SIMPLE LINEAR REGRESSION ( BY DUTT ET AL )            HYD25300
C**** WITH A LOGARITHMIC TRANSFORM.                                         HYD25310
      COMMON /SOLUTE / SLCA, SLMG, SLNA, SLCL , SLSO4, SLHCO3, SLCO3,       HYD25320
     1                 SLNO3 ,UCASO4 , UMGSO4                               HYD25330
      COMMON /SOLID/ CATEX, GYPSUM, SLIME ,BDENS, EXCA ,EXNA, EXMG ,        HYD25340
     1               EXTRAC , DEPTH, SEGVOL , INTER                         HYD25350
      DIMENSION CA (10)                                                     HYD25360
      REAL KPRIME , INTER                                                   HYD25370
      INTEGER  $SC1/'CALC'/,$SC2/'TRUE'/                                           B
CHECK IF LIME IS PRESENT IN SOLID PHASE                                     HYD25380
      IF ( SLIME .EQ. 0.0 )  GO TO 50                                       HYD25390
C**** LIME IS PRESENT CALCULATE KPRIME                                      HYD25400
      IF (INTER . NE . 0.0 )  GO TO 43                                      HYD25410
   40 GAMMA1 = G(1)                                                         HYD25420
      GAMMA2 = G(2)                                                         HYD25430
      KPRIME = SLCA * SLHCO3 *SLHCO3 * GAMMA1 * GAMMA1 * GAMMA 2            HYD25440
COMPUTE INTERCEPT ONCE ONLY FOR EACH SOIL SEGMENT                           HYD25450
      INTER = KPRIME * (PRATIO * * 1.68)                                    HYD25460
   43 KPRIME = INTER / (PRATIO ** 1.68 )                                    HYD25470
      DO 45 K = 1,10                                                        HYD25480
      CA (K) = 0.0                                                          HYD25490
   45 CONTINUE                                                              HYD25500
      GO TO 55                                                              HYD25510
C**** LIME IS NOT PRESENT IN SOLID PHASE ASSUME INTER = 4.52E2              HYD25520
   50 INTER = 4.52E2                                                        HYD25530
      KPRIME = INTER / ( PRATIO ** 1.68)                                    HYD25540
      GO TO 100                                                             HYD25550
CALCULATE SOLUBILITY OF  LIME ( CACO3) , USE EXPRESSION K = SLCA            HYD25560
C**** *SLHCO3*   SLHCO3 ** 2 * GAMMA1 **2 / SLH2CO3 ( THEN LET KPRIME       HYD25570
C**** = K * SLH2CO3.  LET (X) = CHANGE IN CONCENTRATION OF CALCIUM          HYD25580
C**** (DIVALENT)ION IN SOLUTION PHASE IN MOLS PER LITER. CALCULATE          HYD25590
C**** COEFFICIENTS FOR THIRD DEGREE POLYNOMIAL IN INCREASING POWERS  OF HYD25600
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CALCULATE A POSITIVE ROOT (REAL) IN RANGE XMIN - XMAX                       HYD25610
   55 XMIN = 0.0                                                            HYD25620
      XMAX = SLHCO3                                                         HYD25630
      IF ( SLHCO3 . GT. SLCA ) XMAX = SLCA                                  HYD25640
      ISW = 1                                                               HYD25650
   60 CA (1) = - KPRIME / ( GAMMA1 * GAMMA1 * GAMMA2 )                      HYD25660
      CA (2) = 4.0 * SLCA * SLHCO3 + ( SLHCO3 * SLHCO3 )                    HYD25670
      CA (3) = 4.0 * ( SLHCO3 + SLCA )                                      HYD25680
      CA (4) = 4.0                                                          HYD25690
   65 MOLE = $SC1                                                           HYD25700
      CONST = 0.0                                                           HYD25710
C**** SET CONVERGENCE CRITERION (TESTA) SO THAT F(X) IS LESS THAN 1.E-6 HYD25720
      TESTA = 1.E-6                                                         HYD25730
      X = ROOT ( CONST , XMAX , XMIN , MOLE , CA , TESTA )                  HYD25740
      GO TO ( 67, 68 ) , ISW                                                HYD25750
   67 IF ( MOLE .EQ. $SC2     ) GO TO 69                                    HYD25760
CALCULATE A NEGATIVE ROOT (REAL) IN RANGE XMIN - XMAX                       HYD25770
      XMAX = 0.0                                                            HYD25780
      XMIN = - XMAX                                                         HYD25790
      ISW = 2                                                               HYD25800
      GO TO 60                                                              HYD25810
   68 IF ( MOLE .NE. $SC2     ) GO TO 1000                                  HYD25820
C**** UPDATE CONCENTRATIONS OF CALCIUM (SLCA) AND BICARBONATE (SLHCO3)      HYD25830
C**** IN SOLUTION                                                           HYD25840
   69 SLCA = SLCA + X                                                       HYD25850
      SLHCO3 = SLHCO3 + X                                                   HYD25860
   70 IF (SLIME . GT. 0.0 ) GO TO 2000                                      HYD25870
  100 TEMP = SLCA * SLHCO3 * SLHCO3 * GAMMA1 * GAMMA1 * GAMMA2              HYD25880
      IF ( TEMP .GE. KPRIME )  GO TO 43                                     HYD25890
      GO TO 2000                                                            HYD25900
 1000 WRITE ( IW, 1005 ) KNODE , KSEG                                       HYD25910
 1005 FORMAT(1H1, 8X, 28HNO REAL ROOT FOUND IN CALCAR  / 8X,                HYD25920
     1             7HNODE =    , I3 , 5X, 10HSEGMENT =  , I3 )              HYD25930
      CALL EXIT                                                             HYD25940
 2000 RETURN                                                                HYD25950
      END                                                                   HYD25960

EMORY REQUIREMENTS 0005C4 BYTES

GHEST SEVERITY CODE WAS  0

      SUBROUTINE SCRIBE (IW)
      COMMON /SOLUTE / SLCA, SLMG, SLNA, SLCL , SLSO4, SLHCO3, SLCO3,       HYD25980
     1                 SLNO3 ,UCASO4 , UMGSO4                               HYD25990
      COMMON /SOLID/ CATEX, GYPSUM, SLIME ,BDENS, EXCA ,EXNA, EXMG ,        HYD26000
     1               EXTRAC , DEPTH, SEGVOL  , INTER                        HYD26010
      REAL INTER                                                            HYD26020
      WRITE ( IW , 10 ) SLCA, SLMG, SLNA, SLCL , SLSO4 , SLHCO3 , SLNO3,HYD26030
     1      SLCO3,     EXTRAC, SEGVOL, CATEX, GYPSUM, SLIME , BDENS,        HYD26040
     2                 DEPTH , EXCA, EXNA, EXMG, UCASO4 , UMGSO4   ,        HYD26050
     3                 INTER                                                HYD26060
   10 FORMAT (      8X, 9HSLCA     =  , F20.8/ 8X, 9HSLMG     =  , F20.8 /  HYD26070
     A              8X, 9HSLNA     =  , F20.8/ 8X, 9HSLCL     =  , F20.8 /  HYD26080

     B              8X, 9HSLSO4    =  , F20.8/ 8X, 9HSLHCO3   =  , F20.8 /  HYD26090
     C              8X, 9HSLNO3    =  , F20.8/ 8X, 9HSLCO3    =  , F20.8 /  HYD26100
     D              8X, 9HEXTRAC   =  , F20.8/ 8X, 9HSEGVOL   =  , F20.8 /  HYD26110
     E              8X, 9HCATEX    =  , F20.8/ 8X, 9HGYPSUM   =  , F20.8 /  HYD26120
     F              8X, 9HSLIME    =  , F20.8/ 8X, 9HBDENS    =  , F20.8 /  HYD26130
     G              8X, 9HDEPTH    =  , F20.8/ 8X, 9HEXCA     =  , F20.8 /  HYD26140
     H              8X, 9HEXNA     =  , F20.8/ 8X, 9HEXMG     =  , F20.8 /  HYD26150
     I              8X, 9HUCASO4   =  , F20.8/ 8X, 9HUMGSO4   =  , F20.8 /  HYD26160
     J              8X, 9HINTER    =  , F20.8/  )                           HYD26170
      RETURN                                                                HYD26180
      END                                                                   HYD26190

EMORY REQUIREMENTS 000388 BYTES

IGHEST SEVERITY CODE WAS  0

      FUNCTION G(KVAL)
C*****                                                                      HYD26210
C**** THIS FUNCTION CALCULATES THE ACTIVITY COEFFICIENT (GAMMA)             HYD26220
C**** FOR MONOVALENT ION ( KVAL = 1) AND DIVALENT ION ( KVAL = 2 )          HYD26230
C*****                                                                      HYD26240
      COMMON /SOLUTE / SLCA, SLMG, SLNA, SLCL , SLSO4, SLHCO3, SLCO3,       HYD26250
     1                 SLNO3 ,UCASO4 , UMGSO4                               HYD26260
CALCULATE THE IONIC STRENGTH OF ALL SPECIES IN SOLUTION (U) WHERE           HYD26270
C**** U= 1/2 (SUMMATION OF CONCENTRATION OF ION ( MOLS/LITER) TIMES         HYD26280
C**** VALENCE OF ION SQUARED - FOR ALL SPECIES)                             HYD26290
      U = 2.0 * (SLCA + SLMG + SLSO4 + SLCO3) + 5.E-1 * (SLNA + SLCL +      HYD26300
     1    SLNO3 + SLHCO3 )                                                  HYD26310
CALCULATE ACTIVITY COEFFICIENT ******************** ION USING DEBYE-        HYD26320
C**** HUCKEL FORMULA AS A FUNCTION OF IONIC STRENGTH AND VALENCE            HYD26330
      COMP = 0.0                                                            HYD26340
      COMP = SQRT(U)                                                        HYD26350
      IF(U .GT. 0.1)GO TO 55                                                HYD26355
      GO TO ( 50, 100) , KVAL                                               HYD26360
   50 G      = EXP ( -1.17201 * COMP / ( 1.0 + COMP ))                      HYD26370
      GO TO 200                                                             HYD26380
  100 G      = EXP ( -4.68804 * COMP / ( 1.0 + COMP ))                      HYD26390
      GO TO 200                                                             HYD26391
   55 IF(U .GT. 0.5) GO TO 105                                              HYD26391
      GO TO(56, 101),KVAL                                                   HYD26392
   56 G=EXP(-1.17201*(COMP/(1.0+COMP)-0.3*U))                               HYD26393
      GO TO 200                                                             HYD26394
  101 G=EXP(-4.68804*(COMP/(1.0+COMP)-0.3*U))                               HYD26395
      GO TO 200                                                             HYD26396
  105 WRITE(6,106)                                                          HYD26397
  106 FORMAT(2X,'THE IONIC STRENGTH IS GREATER THAN 0.5')                   HYD26398
      CALL EXIT                                                             HYD26399
  200 RETURN                                                                HYD26400
      END                                                                   HYD26410

MORY REQUIREMENTS 000308 BYTES
```

APPENDIX M

INPUT DATA AND A TYPICAL OUTPUT
FOR ONE MONTH FOR THE MESILLA VALLEY SIMULATION

Appendix M. Input data and a typical output for one month for the Mesilla Valley simulation

```
*** LISTING OF INPUT DATA ***

JREAD =   1
RESEARCH IN CONJUNCTIVE USE STUDY FOR THE MESILLA PROJECT                          1
CONNOD101102  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
CONNOD102  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
CONSEQ101 15  1 -1 -2  2 -3  3  4  5  6  7  8 -4  9 -5 10  0  0  0  0  0
CONSEQ102 14  1 -1 -2  2 -3  3  4  5  6 -4  7 -5  8 -9  0  0  0  0  0  0
CONWAT101  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
CONWAT102  0101  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
CONEND  7 67  6 68  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0

JREAD =   2
AQUFER 0 101    FLOOD PLAIN ALLUVIAL AQUFER FOR NODE 1
GRTANK 02101    538490. 170.0  31.0 101.0 158.0 525.0 283.0    2.0    0.71250.0 7067
AQUFER 0 102    FLOOD PLAIN ALLUVIAL AQUFER FOR NODE 2
GRTANK 02102    965465. 135.0  33.0 358.0 282.0 705.0 423.0    4.0    0.91839.0 7067
COLBEG 8 101
COLSEG101  1    10.0   2.7   11.4   3.0   9.8  11.0   0.0    0.6 .71 10.05 20.00   0.40 * 1.42   20.0
COLSEG101  2    10.4   3.0   13.1   2.8  12.7  10.4   0.0    0.8 .73 10.09 20.00   0.40 * 1.38   20.0
COLSEG101  3    20.7   6.3   23.2   3.7  33.6   9.0   0.0    0.6 .78 10.06 20.00   0.40 * 1.29   20.0
COLSEG101  4    32.0  10.3   30.2   6.2  56.8   8.1   0.0    1.2 .70 10.72 20.00   0.40 * 1.54   20.0
COLSEG101  5    32.6  11.4   38.4  10.9  59.9   8.0   0.0    3.0 .38  5.78  5.00   0.20 * 1.52   20.0
COLSEG101  6    22.9   7.1   27.6   9.0  38.9   7.4   0.0    1.8 .35  5.20  5.00   0.20 * 1.49   20.0
COLSEG101  7    17.6   5.5   22.3   7.5  29.4   6.9   0.0    1.1 .34  5.41  5.00   0.20 * 1.61   20.0
COLSEG101  8    15.9   4.0   20.3   6.4  26.1   6.7   0.0    0.9 .31  4.93  5.00   0.20 * 1.61   20.0
COLBEG 0 102
COLSEG102  1    10.0   2.7   11.4   3.0   9.8  11.0   0.0    0.6 .71 10.05 20.00   0.40 * 1.42   20.0
COLSEG102  2    10.4   3.0   13.1   2.8  12.7  10.4   0.0    0.8 .73 10.09 20.00   0.40 * 1.38   20.0
COLSEG102  3    20.7   6.3   23.2   3.7  33.6   9.0   0.0    0.6 .76 10.06 20.00   0.40 * 1.29   20.0
COLSEG102  4    32.0  10.3   30.2   6.2  56.8   8.1   0.0    1.2 .70 10.72 20.00   0.40 * 1.54   20.0
COLSEG102  5    32.6  11.4   38.4  10.9  59.9   8.0   0.0    3.0 .36  5.78  5.00   0.20 * 1.52   20.0
COLSEG102  6    22.9   7.1   27.6   9.0  38.9   7.4   0.0    1.8 .35  5.20  5.00   0.20 * 1.49   20.0
COLSEG102  7    17.6   5.5   22.3   7.5  29.4   6.9   0.0    1.1 .34  5.41  5.00   0.20 * 1.61   20.0
COLSEG102  8    15.9   4.0   20.3   6.4  26.1   6.7   0.0    0.9 .31  4.93  5.00   0.20 * 1.61   20.0
COLEND 0   0

JREAD =   4
SURQIN 1 101    RIO GRANDE AT HEAD OF SYSTEM
QINFLO 12101SUR 70069.  40.0   0.7  93.0  60.0 188.0 179.0    0.0   1.21721.0 7067
          70069.00      150.07        0.75        93.00       60.00       188.00     179.00     0.0     1.20     582.50
SURDEM 1 101    RIVER FLOW AFTER DIVERSION
DEMSUR 11101MAI 51563.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
CONUSE101 1       0. 0.50.SUR101 3100      0 0  0     0 0  0                 7 67
SURDEM 2 101    PUMPAGE FROM G.W. TO SUPPLY DEMAND
DEMGWR 21101SUR  4718.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
CONUSE101 2       0. 0.50.SUR101 2100      0 0  0     0 0  0                 7 67
SURQIN 2 101    IRR. DEMAND SUPPLIED FROM G.W.
QINFLO 22101SUR     0.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
SURDEM 3 101    IRRIGATION DEMAND
DEMSUR 31101IRR 23227.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
CONUSE101 3     19840.37.50.SUR101 4  7GWR101 8 93     0 0  0                 7 67
SURQIN 3 101    RIO GRANDE FLOW BELOW LEASBURG CANAL
QINFLO 30101SUR     0.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
SURQIN 4 101    NODE 1 WASTEWAYS TO RIVER
QINFLO 42101SUR     0.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
SURQIN 5 101    EL PASO CARRIAGE AND WASTE-OBS. OUTFLOW
QINFLO 52101CHK  4763.  48.0   0.7  93.0  60.0 188.0 179.0    0.0   1.21721.0 7067
           4763.00      150.07        0.73        93.00       60.00       188.00     179.00     0.0     1.20     582.50
SURQIN 6 101    DEL RIO DRAIN - OBSERVED OUTFLOW
QINFLO 62101CHK  1709.  95.0  13.0 205.0 128.0 353.0 253.0    0.0   1.9    0.0 7067
           1709.30      199.20       13.30       205.00      128.00       353.00     253.00     0.0     1.90    1016.60
SURQIN 7 101    RIO GRANDE OUTFLOW AT MESILLA DAM
QINFLO 72101CHK 49641.  61.0   0.7 103.0  64.0 179.0 232.0    0.0   0.91360.0 7067
          49641.00      175.21        0.70       103.00       64.00       179.00     232.00     0.0     0.85     638.76
SURQIN 8 101    IRRIGATION RETURN FLOW
QINFLO 80101GWR     0.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
SURDEM 4 101    TRANSFER OF FLOW FROM RIVER TO AQUIFER
DEMSUR 41101GWR     0.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
CONUSE101 4       0. 0.50.GWR101 9100      0 0  0     0 0  0                 7 67
SURQIN 9 101    INFLOW TO AQUIFER FROM RIVER
QINFLO 90101GWR     0.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
SURDEM 5 101    TRANSFER OF FLOW FROM AQUIFER TO RIVER
DEMGWR 51101SUR     0.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
CONUSE101 5       0. 0.50.SUR1011 0100     0 0  0     0 0  0                 7 67
SURQIN10 101    INFLOW TO RIVER FROM AQUIFER
QINFLO100101SUR     0.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
SURQIN 1 102    RIO GRANDE AT MESILLA DAM-HEAD OF NODE 2
QINFLO 10102SUR     0.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
SURDEM 1 102    RIVER FLOW AFTER DIVERSION
DEMSUR 11102MAI 18733.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
CONUSE102 1       0. 0.50.SUR102 3100      0 0  0     0 0  0                 7 67
SURDEM 2 102    PUMPAGE FROM G.W. TO SUPPLY DEMAND
DEMGWR 21102SUR  1333.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
CONUSE102 2       0. 0.50.SUR102 2100SUR102 2100SUR102 2100                  7 67
SURQIN 2 102    IRR. DEMAND SUPPLIED FROM G.W.
QINFLO 22102SUR     0.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
SURDEM 3 102    IRRIGATION DEMAND
DEMSUR 31102IRR 33715.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
CONUSE102 3     33366.36.50.SUR102 4 21GWR102 8 79     0 0  0                 7 67
SURQIN 3 102    RIO GRANDE FLOW BELOW MESILLA DAM
QINFLO 30102SUR     0.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
SURQIN 4 102    NODE 2 WASTEWAYS TO RIVER
QINFLO 40102SUR     0.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
SURQIN 5 102    RIO GRANDE OUTFLOW AT COURCHESNE BRIDGE
QINFLO 52102CHK 31663.  85.0  17.0 135.0 105.0 240.0 223.0    0.0   1.2 756.0 7067
          31663.00      163.19       17.00       135.00      105.00       240.00     223.00     0.0     1.20     772.89
SURQIN 6 102    IRRIGATION RETURN FLOW
QINFLO 62102GWR     0.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
SURDEM 4 102    TRANSFER OF FLOW FROM RIVER TO AQUIFER
DEMSUR 41102GWR     0.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
CONUSE102 4       0. 0.50.GWR102 7100      0 0  0     0 0  0                 7 67
SURQIN 7 102   *INFLOW TO AQUIFER FROM RIVER
QINFLO 70102GWR     0.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
SURDEM 5 102    TRANSFER OF FLOW FROM AQUIFER TO RIVER
DEMGWR 51102SUR     0.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
CONUSE102 5       0. 0.50.SUR102 8100SUR102 9100SUR101 1100                  7 67
SURQIN 8 102    INFLOW TO RIVER FROM AQUIFER
QINFLO 80102SUR     0.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
SURQIN 9 102    INTERNODAL TRANS FROM UPSTREAM AQUIFER
QINFLO 90102SUR     0.   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0 7067
ENDATA 0   0
```

RESEARCH IN CONJUNCTIVE USE STUDY FOR THE MESILLA PROJECT   NUMBER OF NODES = 2   PAGE NO. 1

NODE NUMBER = 101   MONTH OF JUL   YEAR 1967

	VOLUME ACRE FEET	CA PPM	MG PPM	NA PPM	CL PPM	SO4 PPM	HCO3 PPM	CO3 PPM	NO3 PPM	TOTAL PPM	SALTS TONS/AF
OPERATIONAL SEQUENCE OF SURFACE FACILITIES											
RIO GRANDE AT HEAD OF SYSTEM	70069	150	0	92	59	187	178	0	1	582	0.792
RIVER FLOW AFTER DIVERSION	51560	150	0	92	59	187	178	0	1	582	0.792
SHORTAGE FROM THE IDEAL DEMAND	0										
PUMPAGE FROM G.W. TO SUPPLY DEMAND	4719	170	31	101	158	525	283	2	0	1250	1.700
IRR. DEMAND SUPPLIED FROM G.W.	4717	170	31	101	158	525	283	2	0	1250	1.700
IRRIGATION DEMAND	23227	154	6	94	79	256	200	0	1	718	0.977
SHORTAGE FROM THE IDEAL DEMAND	0										
RIO GRANDE FLOW BELOW LEASBURG CANAL	51559	150	0	92	59	187	178	0	1	582	0.792
NODE 1 WASTEWAYS TO RIVER	237	1056	47	648	547	1758	1372	2	7	4924	6.697
OBSERVED OUTFLOWS FROM NODE											
EL PASO CARRIAGE AND WASTE-OBS. OUTFLOW	4763	150	0	92	59	187	178	0	1	582	0.792
DEL RIO DRAIN - OBSERVED OUTFLOW	1709	189	12	204	127	352	252	0	1	1016	1.383
RIO GRANDE OUTFLOW AT MESILLA DAM	49641	175	0	102	63	178	231	0	0	638	0.869
SUBSURFACE OPERATIONS AND FLOW TRANSFERS											
AQUIFER CONDITIONS OF LAST TIME FRAME	538490	170	31	101	158	525	283	2	0	1250	1.700
IRRIGATION RETURN FLOW	3149	1056	47	648	547	1756	1372	2	7	4924	6.697
TRANSFER OF FLOW FROM RIVER TO AQUIFER	0	0	0	0	0	0	0	0	0	0	0.0
INFLOW TO AQUIFER FROM RIVER	0	0	0	0	0	0	0	0	0	0	0.0
TRANSFER OF FLOW FROM AQUIFER TO RIVER	4315	170	31	101	158	525	283	2	0	1250	1.700
INFLOW TO RIVER FROM AQUIFER	4315	170	31	101	158	525	283	2	0	1250	1.700
COMPARISON INDEX											
TOTAL OBSERVED OUTFLOWS FROM NODE	56113	173	1	105	65	185	228	0	0	645	0.878
TOTAL PREDICTED OUTFLOWS FROM NODE	56113	155	3	95	69	220	192	0	1	652	0.887
SIMPLE DIFFERENCE (OBSERVED-PREDICTED)	0	18	-2	9	-3	-35	36	0	0	-6	-0.009
CHEMICAL CHANGES IN NODE											
OBSERVED CHANGE	0	23	0	12	5	-2	49	0	0	62	0.086
PREDICTED CHANGE	0	5	2	2	9	32	13	0	0	69	0.095

RESEARCH IN CONJUNCTIVE USE STUDY FOR THE MESILLA PROJECT   NUMBER OF NODES = 2   PAGE NO. 2

NODE NUMBER = 102   MONTH OF JUL   YEAR 1967

	VOLUME ACRE FEET	CA PPM	MG PPM	NA PPM	CL PPM	SO4 PPM	HCO3 PPM	CO3 PPM	NO3 PPM	TOTAL PPM	SALTS TONS/AF
OPERATIONAL SEQUENCE OF SURFACE FACILITIES											
RIO GRANDE AT MESILLA DAM-HEAD OF NODE 2	56113	173	1	105	65	185	228	0	0	645	0.878
RIVER FLOW AFTER DIVERSION	18703	173	1	105	65	185	228	0	0	645	0.878
SHORTAGE FROM THE IDEAL DEMAND	0										
PUMPAGE FROM G.W. TO SUPPLY DEMAND	1303	135	33	358	282	705	423	4	0	1839	2.501
IRR. DEMAND SUPPLIED FROM G.W.	1302	135	33	358	282	705	423	4	0	1839	2.501
IRRIGATION DEMAND	38713	172	2	113	72	202	234	0	0	685	0.932
SHORTAGE FROM THE IDEAL DEMAND	0										
RIO GRANDE FLOW BELOW MESILLA DAM	18702	173	1	105	65	185	228	0	0	645	0.878
NODE 2 WASTEWAYS TO RIVER	1185	1183	14	779	499	1388	1608	0	6	4700	6.393
OBSERVED OUTFLOWS FROM NODE											
RIO GRANDE OUTFLOW AT COURCHESNE BRIDGE	31663	163	16	134	104	239	222	0	1	772	1.051
SUBSURFACE OPERATIONS AND FLOW TRANSFERS											
AQUIFER CONDITIONS OF LAST TIME FRAME	965465	135	33	358	282	705	423	4	0	1839	2.501
IRRIGATION RETURN FLOW	4461	1183	14	779	499	1388	1608	0	6	4700	6.393
TRANSFER OF FLOW FROM RIVER TO AQUIFER	0	0	0	0	0	0	0	0	0	0	0.0
INFLOW TO AQUIFER FROM RIVER	0	0	0	0	0	0	0	0	0	0	0.0
TRANSFER OF FLOW FROM AQUIFER TO RIVER	11774	135	33	358	282	705	423	4	0	1839	2.501
INFLOW TO RIVER FROM AQUIFER	11774	135	33	358	282	705	423	4	0	1839	2.501
INTERNODAL TRANS FROM UPSTREAM AQUIFER	0	0	0	0	0	0	0	0	0	0	0.0
COMPARISON INDEX											
TOTAL OBSERVED OUTFLOWS FROM NODE	31663	163	16	134	104	239	222	0	1	772	1.051
TOTAL PREDICTED OUTFLOWS FROM NODE	31663	196	13	224	162	423	352	1	1	1241	1.688
SIMPLE DIFFERENCE (OBSERVED-PREDICTED)	0	-33	3	-89	-57	-183	-129	-1	0	-468	-0.637
CHEMICAL CHANGES IN NODE											
OBSERVED CHANGE	0	-13	15	29	39	54	-5	0	0	127	0.173
PREDICTED CHANGE	0	23	12	119	96	238	124	1	0	595	0.810
CHEMICAL CHANGES IN SYSTEM											
OBSERVED CHANGE	0	13	16	42	45	52	43	0	0	190	0.259
PREDICTED CHANGE	0	46	12	131	102	235	173	1	0	658	0.896

APPENDIX N

PLANT SCIENCE FARM DEMONSTRATION PLOT DATA

Table N-1. Cajame spring wheat yields and components of yields

Plot Number	Total Harvestable Dry Matter (kg/ha)	Weight of 1000 seeds (g)	Plant Height at Harvest (cm)	Heads per Square Meter (no.)	Seeds per Head (no.)	Grain Yield (kg/ha)
1	3160	20.91	37	30.45	20.21	976
2	3300	16:95	40	26.47	24.94	836
3	4740	34.42	40	42.18	27.93	1480
5	5310	27.60	48	34.75	30.05	1750
6	5920	32.49	48	34.32	27.68	2310
7	2660	21.13	40	19.37	34.92	650
8	4200	27.78	47	36.37	26.89	1160
9	5460	31.35	46	31.85	25.36	1880
10	6100	27.16	47	34.86	30.60	1750
11	4380	26.44	40	32.60	26.38	1390
12	3020	18.84	36	30.34	20.00	790
13	4420	23.39	46	36.91	26.69	1360
14	6530	34.21	52	28.41	30.59	2170
15	6930	36.20	46	34.32	40.30	2470
16	4740	32.92	45	31.53	25.97	1630
17	4380	25.96	44	29.37	29.07	1360
18	3230	22.29	35	28.84	23.60	950
19	4520	24.73	44	27.55	25.54	1200
22	2870	23.66	32	28.19	22.48	1670
23	2800	17.49	33	31.31	25.24	761
24	2510	25.64	34	30.67	21.06	312
25	3270	21.85	33	30.56	18.70	976
26	2510	22.93	32	30.77	25.67	905
27	2440	20.63	34	20.55	20.02	689
29	3410	28.95	36	29.59	24.69	2050
30	3520	25.17	33	31.85	21.92	1220

Table N-2. Staff gage and flow data for the Del Rio drain measuring station

Date 1975	Del Rio Drain Site A Stake feet	Site A Flow cfs.	Site B Stake feet	Site B Flow cfs.	Date 1975	Del Rio Drain Site A Stake feet	Site A Flow cfs.	Site B Stake feet	Site B Flow cfs.
2-4	3.30	20.88	4.20	24.22	8-18	4.64	50.89	4.66	52.11
2-10	3.20	17.39	4.10	22.95	8-25	4.57	51.58	4.70	55.05
2-17	3.10	16.41	3.90	20.41	8-31	4.42	42.04	4.63	51.41
2-24	3.10	16.16	4.00	21.17	9-8	4.56	55.89	4.84	59.62
3-3	3.15	17.25	4.00	22.47	9-16	4.16	41.88	4.58	48.25
3-10	3.30	21.86	4.15	27.38	9-23	4.10	38.62	4.50	45.29
3-17	3.40	24.03	4.20	30.94	9-30	4.14	42.90	4.52	49.54
3-24	3.60	32.29	4.40	36.99	10-7	3.85	30.89	4.30	38.13
3-31	3.60	31.67	4.40	38.10	10-14	3.70	23.93	4.20	32.39
4-7	3.55	28.87	4.35	33.73	10-22	3.68	26.53	4.15	32.24
4-14	3.55	30.51	4.35	34.44	10-28	3.60	23.82	4.09	31.17
4-21	3.50	28.00	4.35	35.02	11-4	3.55	20.96	4.03	28.67
4-28	3.50	29.72	4.40	33.64	11-11	3.49	19.24	4.00	26.33
5-5	3.60	28.76	4.40	34.40	11-18	3.46	19.44	3.98	25.36
5-12	3.60	29.33	4.50	36.17	11-25	3.50	17.70	4.10	24.82
5-19	3.60	27.42	4.60	35.80	12-2	3.46	24.07	4.00	22.76
5-26	3.70	28.72	4.60	26.27	12-9	3.35	16.32	3.95	24.29
6-2	3.80	29.84	4.80	43.12	12-16	3.32	16.01	3.96	22.16
6-9	3.90	32.74	4.80	40.86	12-30	3.45	14.66	3.95	21.44
6-16	4.00	34.79	4.90	43.03	1976				
6-23	4.15	37.12	5.00	41.04	1-6	3.45	12.93	3.95	20.52
6-30	4.20	33.43	5.00	40.67	1-13	3.43	13.37	4.95	18.47
7-7	4.30	37.56	5.00	42.77	1-21	3.60	16.29	4.03	22.87
7-14	4.50	39.51	4.90	43.33	1-26	3.68	19.72	4.15	25.30
7-21	4.50	36.94	4.70	39.88	2-2	3.72		4.18	
7-28	4.60	43.62	4.70	46.68	2-7	3.65	20.55	4.15	25.52
8-4	4.85	67.26	4.82	56.15	2-14	3.60	18.88	4.05	24.05
8-11	4.60	46.63	4.58	49.57					

Table N-3. Composition of water samples taken at Del Rio drain site A, 1975

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/ 1/75	1.19	8.28	14.10	13.62	5.85	1.67	6.36	0.22	3.48	0.0	3.94	6.18	1.09
A	1/14/75	1.28	7.92	13.99	14.18	6.02	1.66	6.11	0.20	3.50	0.0	4.72	5.94	1.00
A	1/28/75	1.21	8.11	14.50	13.62	6.06	1.80	6.43	0.21	3.56	0.0	4.34	5.72	0.10
A	2/10/75	1.35	8.28	14.61	13.76	6.13	1.82	6.45	0.21	3.60	0.0	4.22	5.92	1.51
A	2/24/75	1.30	8.49	15.46	14.22	6.63	1.86	6.77	0.20	3.62	0.36	4.10	6.12	1.00
A	3/10/75	1.24	8.07	14.30	13.62	6.09	1.65	6.34	0.22	3.64	0.0	4.24	5.72	1.34
A	3/24/75	1.22	8.36	13.07	13.11	5.01	1.72	6.13	0.21	3.42	0.0	4.04	5.64	0.39
A	4/ 7/75	1.22	8.04	13.40	13.20	5.82	1.61	5.77	0.20	3.52	0.0	3.72	5.96	0.0
A	4/21/75	1.25	8.19	13.57	13.35	5.70	1.61	6.06	0.20	3.55	0.0	3.96	5.84	0.30
A	5/ 5/75	1.22	8.18	13.43	12.46	5.08	1.60	6.54	0.21	3.36	0.0	3.52	5.56	1.45
A	5/19/75	1.21	8.26	13.59	12.99	5.60	1.66	6.14	0.19	3.28	0.0	4.18	5.52	0.74
A	6/ 2/75	1.19	8.11	13.12	12.42	5.47	1.62	5.84	0.19	3.15	0.0	4.02	5.24	0.51
A	6/16/75	1.17	7.50	11.61	12.19	5.00	1.48	4.90	0.23	3.10	0.0	4.08	5.00	0.61
A	6/30/75	1.20	8.53	13.28	12.30	5.39	1.58	6.08	0.23	3.04	0.44	3.58	5.24	0.0
A	7/14/75	1.17	8.69	12.12	12.44	4.99	1.49	5.41	0.23	3.04	0.0	4.14	5.24	1.32
A	7/28/75	1.14	7.97	12.70	12.68	5.00	1.49	5.96	0.25	2.85	0.0	4.22	5.60	0.39
A	8/11/75	1.22	7.88	13.39	13.24	5.30	1.61	6.27	0.21	3.15	0.0	4.08	6.00	0.70
A	8/25/75	1.22	8.11	12.11	12.84	5.20	1.56	5.13	0.22	2.99	0.0	3.64	6.19	1.26
A	9/ 8/75	1.14	8.09	11.33	11.44	4.31	1.23	5.56	0.23	2.85	0.0	4.10	4.49	0.0
A	9/23/75	1.26	7.85	12.95	13.54	5.48	1.52	5.71	0.24	3.33	0.0	4.40	5.79	1.00
A	10/ 7/75	1.23	7.59	13.08	13.11	5.13	1.82	5.89	0.24	3.07	0.0	4.48	5.54	1.08
A	10/21/75	1.32	7.52	14.74	13.45	5.76	1.60	7.11	0.27	3.41	0.0	4.10	5.94	0.0
A	11/ 4/75	1.22	7.53	13.56	13.80	6.15	1.74	5.45	0.22	3.39	0.0	4.40	6.01	0.12
A	11/18/75	1.14	6.38	13.23	13.85	5.70	1.67	5.64	0.22	3.35	0.0	4.50	5.98	1.39
A	12/ 2/75	1.36	7.94	13.85	13.96	5.99	1.73	5.87	0.26	3.58	0.0	4.42	5.92	2.24
A	12/16/75	1.06	8.06	12.17	13.44	4.60	1.71	5.63	0.23	3.55	0.0	4.50	5.37	1.00
A	12/30/75	1.23	7.53	13.91	13.36	6.55	1.62	5.52	0.22	3.55	0.0	4.00	5.81	0.0
MEAN =		1.22	8.05	13.38	13.19	5.56	1.63	5.97	0.22	3.33	0.03	4.13	5.68	0.76
STD. DEV.=		0.07	0.32	0.97	0.67	0.57	0.13	0.49	0.02	0.24	0.11	0.29	0.39	0.60

Table N-4. Composition of water samples taken at Del Rio drain site B, 1975

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/ 1/75	1.41	4.03	14.87	10.23	6.08	1.65	6.92	0.22	3.43	0.0	0.0	6.75	0.07
B	1/14/75	1.33	8.00	15.18	15.65	6.54	1.71	6.72	0.21	3.67	0.0	5.28	6.67	1.85
B	1/28/75	1.26	8.09	14.98	14.38	6.34	1.82	6.61	0.21	3.62	0.0	4.56	6.20	0.0
B	2/10/75	1.34	8.36	15.52	14.78	6.58	1.84	6.88	0.22	3.59	0.0	4.60	6.56	1.80
B	2/24/75	1.36	8.29	16.25	15.17	7.08	1.91	7.05	0.21	3.77	0.0	4.58	6.80	1.51
B	3/10/75	1.27	8.17	14.81	14.10	6.42	1.69	6.49	0.21	3.56	0.32	4.16	6.04	1.47
B	3/24/75	1.24	8.39	13.36	13.38	5.19	1.75	6.22	0.20	3.45	0.0	4.36	5.56	0.75
B	4/ 7/75	1.17	8.04	13.94	12.44	5.98	1.65	6.11	0.20	3.58	0.0	2.86	6.00	0.0
B	4/21/75	1.28	7.84	14.23	13.68	6.02	1.65	6.37	0.19	3.63	0.0	4.22	5.80	1.71
B	5/ 5/75	1.27	8.28	13.64	14.47	5.69	1.67	6.27	0.21	3.40	0.0	4.22	6.84	0.56
B	5/19/75	1.27	8.24	14.39	13.44	5.81	1.73	6.65	0.20	3.31	0.0	4.28	5.84	0.40
B	6/ 2/75	1.22	8.10	13.98	12.83	5.81	1.69	6.28	0.20	3.16	0.0	4.22	5.44	0.75
B	6/16/75	1.23	7.70	11.64	12.80	5.06	1.48	4.85	0.25	3.15	0.0	4.24	5.40	0.87
B	6/30/75	1.25	8.65	14.07	13.43	5.81	1.68	6.36	0.22	3.10	0.48	3.70	6.20	0.0
B	7/14/75	1.24	8.57	13.64	12.50	5.49	1.61	6.32	0.22	3.15	0.16	3.74	5.44	0.63
B	7/28/75	1.22	7.65	13.09	13.23	5.17	1.51	6.21	0.20	2.90	0.0	4.24	6.08	0.55
B	8/11/75	1.27	7.90	13.77	13.36	5.68	1.62	6.27	0.20	3.18	0.0	4.08	6.08	1.17
B	8/25/75	1.30	7.40	13.19	13.95	5.52	1.61	5.77	0.29	3.14	0.0	3.72	7.09	0.28
B	9/ 8/75	1.18	8.17	13.60	12.49	5.11	1.45	6.82	0.22	2.94	0.0	4.22	5.33	0.0
B	9/23/75	1.30	7.98	14.21	13.74	6.00	1.61	6.37	0.23	3.16	0.0	4.54	6.01	1.58
B	10/ 7/75	1.30	7.60	13.87	13.56	5.90	1.83	5.91	0.23	3.15	0.0	4.62	5.76	1.86
B	10/21/75	1.33	7.94	14.61	13.69	6.70	1.77	5.89	0.25	3.39	0.0	4.14	6.16	0.0
B	11/ 4/75	1.20	8.15	14.50	14.18	6.66	1.80	5.83	0.21	3.42	0.0	4.60	6.16	0.12
B	11/18/75	1.25	8.30	14.15	14.64	6.23	1.74	5.97	0.21	3.46	0.0	4.60	6.53	2.95
B	12/ 2/75	1.31	8.03	14.02	13.65	6.22	1.76	5.79	0.25	3.36	0.0	4.52	5.73	2.42
B	12/16/75	1.13	8.11	12.96	14.01	5.24	1.66	5.84	0.22	3.46	0.0	4.56	5.96	1.91
B	12/30/75	1.27	7.85	14.23	14.08	6.36	1.65	5.99	0.23	3.60	0.0	4.64	5.84	0.0
MEAN=		1.27	7.92	14.11	13.63	5.95	1.69	6.25	0.22	3.36	0.04	4.13	6.08	0.93
STD. DEV.=		0.06	0.83	0.89	1.04	0.54	0.11	0.46	0.02	0.23	0.11	0.93	0.48	0.86

Table N-5. Electrical conductivity (mmhos/cm) and flow (m^3/sec) of water at Del Rio drain sampling sites A and B during 1975

Site A			Site B		
Date	ECx10^3	Flow (m^3/sec)	Date	ECx10^3	Flow (m^3/sec)
1/ 1/75	1.19	—	1/ 1/75	1.41	—
1/ 7/75	1.17	0.392	1/ 7/75	1.25	0.501
1/14/75	1.28	0.480	1/14/75	1.33	0.647
1/21/75	1.23	0.501	1/21/75	1.21	0.693
1/28/75	1.21	0.585	1/28/75	1.26	0.707
2/ 4/75	1.17	0.591	2/ 4/75	1.22	0.686
2/10/75	1.35	0.492	2/10/75	1.34	0.650
2/17/75	1.25	0.465	2/17/75	1.31	0.578
2/24/75	1.30	0.458	2/24/75	1.36	0.599
3/ 3/75	1.33	0.488	3/ 3/75	1.41	0.636
3/10/75	1.24	0.619	3/10/75	1.27	0.775
3/17/75	1.25	0.680	3/17/75	1.30	0.876
3/24/75	1.22	0.914	3/24/75	1.24	1.047
3/31/75	1.26	0.897	3/31/75	1.30	1.079
4/ 7/75	1.22	0.816	4/ 7/75	1.17	0.955
4/14/75	1.22	0.864	4/14/75	1.27	0.975
4/21/75	1.25	0.793	4/21/75	1.28	0.992
4/28/75	1.19	0.842	4/28/75	1.24	0.953
5/ 5/75	1.22	0.814	5/ 5/75	1.27	0.974
5/12/75	1.23	0.831	5/12/75	1.30	1.024
5/19/75	1.21	0.776	5/19/75	1.27	1.014
5/26/75	1.17	0.813	5/26/75	1.23	0.744
6/ 2/75	1.19	0.845	6/ 2/75	1.22	1.221
6/ 9/75	1.23	0.927	6/ 9/75	1.28	1.157
6/16/75	1.17	0.985	6/16/75	1.23	1.218
6/23/75	1.13	1.051	6/23/75	1.24	1.162
6/30/75	1.20	0.947	6/30/75	1.25	1.152
7/ 7/75	1.13	1.064	7/ 7/75	1.21	1.211
7/14/75	1.17	1.122	7/14/75	1.24	1.227
7/21/75	1.14	1.046	7/21/75	1.22	1.129
7/28/75	1.14	1.235	7/28/75	1.22	1.322
8/ 4/75	1.13	1.905	8/ 4/75	1.15	1.590
8/11/75	1.22	1.320	8/11/75	1.27	1.404
8/18/75	1.18	1.441	8/18/75	1.23	1.476
8/25/75	1.22	1.461	8/25/75	1.30	1.559
9/ 1/75	1.18	1.190	9/ 1/75	1.24	1.456
9/ 8/75	1.14	1.583	9/ 8/75	1.18	1.688
9/15/75	1.25	1.186	9/15/75	1.30	1.566
9/23/75	1.26	1.094	9/23/75	1.30	1.262
9/30/75	1.20	1.215	9/30/75	1.26	1.403
10/ 7/75	1.23	0.875	10/ 7/75	1.30	1.080
10/14/75	1.26	0.678	10/14/75	1.31	0.917
10/21/75	1.32	0.751	10/21/75	1.33	0.913
10/28/75	1.20	0.675	10/28/75	1.29	0.883
11/ 4/75	1.22	0.594	11/ 4/75	1.20	0.812
11/11/75	1.10	0.545	11/11/75	1.18	0.746
11/18/75	1.14	0.550	11/18/75	1.25	0.718
11/26/75	1.19	0.501	11/26/75	1.25	0.705
12/ 2/75	1.36	0.682	12/ 2/75	1.31	0.644
12/ 9/75	1.25	0.462	12/ 9/75	1.30	0.688
12/16/75	1.06	0.453	12/16/75	1.13	0.628
12/23/75	1.06	—	12/23/75	1.11	—
12/30/75	1.23	0.415	12/30/75	1.27	0.607
MEAN=	1.21	0.841	MEAN=	1.26	0.990
STD. DEV.=	0.06	0.335	STD. DEV.=	0.06	0.307

Table N-6. Estimated electrical conductivity (mmhos/cm) of return flow between Del Rio drain sampling sites A and B for 1975*

Date	Flow at Site A	Flow at Site B	Increase in flow	EC at Site A	EC at Site B	Increase in EC	EC of return flow
	- - - - - -	-(m^3/sec)-	- - - - - -	- - - - -	- - - - - -	-(meq/1)-	- - - - - -
1/ 7	0.392	0.501	0.109	1.17	1.25	0.08	1.54
1/14	0.480	0.647	0.167	1.28	1.33	0.05	1.47
1/21	0.501	0.693	0.192	1.23	1.21	-0.02	1.16
1/28	0.585	0.707	0.122	1.21	1.26	0.05	1.50
2/ 4	0.591	0.686	0.095	1.17	1.22	0.05	1.53
2/10	0.492	0.650	0.157	1.35	1.34	-0.01	1.31
2/17	0.465	0.578	0.113	1.25	1.31	0.06	1.56
2/24	0.458	0.599	0.142	1.30	1.36	0.06	1.55
3/ 3	0.488	0.636	0.148	1.33	1.41	0.08	1.67
3/10	0.619	0.775	0.156	1.24	1.27	0.03	1.39
3/17	0.680	0.876	0.196	1.25	1.30	0.05	1.47
3/24	0.914	1.047	0.133	1.22	1.24	0.02	1.38
3/31	0.897	1.079	0.182	1.26	1.30	0.04	1.50
4/ 7	0.816	0.955	0.139	1.22	1.17	-0.05	0.88
4/14	0.864	0.975	0.111	1.22	1.27	0.05	1.66
4/21	0.793	0.992	0.199	1.25	1.28	0.03	1.40
4/28	0.842	0.953	0.111	1.19	1.24	0.05	1.62
5/ 5	0.814	0.974	0.160	1.22	1.27	0.05	1.52
5/12	0.831	1.024	0.194	1.23	1.30	0.07	1.60
5/19	0.776	1.014	0.237	1.21	1.27	0.06	1.47
5/26	0.813	0.744	-0.069	1.17	1.23	0.06	0.53
6/ 2	0.845	1.221	0.376	1.19	1.22	0.03	1.29
6/ 9	0.927	1.157	0.230	1.23	1.28	0.05	1.48
6/16	0.985	1.218	0.233	1.17	1.23	0.06	1.48
6/23	1.051	1.162	0.111	1.13	1.24	0.11	2.28
6/30	0.947	1.152	0.205	1.20	1.25	0.05	1.48
7/ 7	1.064	1.211	0.148	1.13	1.21	0.08	1.79
7/14	1.122	1.227	0.105	1.17	1.24	0.07	1.99
7/21	1.046	1.129	0.083	1.14	1.22	0.08	2.23
7/28	1.235	1.322	0.087	1.14	1.22	0.08	2.36
8/ 4	1.905	1.590	-0.315	1.13	1.15	0.02	1.03
8/11	1.320	1.404	0.083	1.22	1.27	0.05	2.06
8/18	1.441	1.476	0.035	1.18	1.23	0.05	3.32
8/25	1.461	1.559	0.098	1.22	1.30	0.08	2.49
9/ 1	1.190	1.456	0.265	1.18	1.24	0.06	1.51
9/ 8	1.583	1.688	0.106	1.14	1.18	0.04	1.78
9/15	1.186	1.366	0.180	1.25	1.30	0.05	1.63
9/23	1.094	1.282	0.189	1.26	1.30	0.04	1.53
9/30	1.215	1.403	0.188	1.20	1.26	0.06	1.65
10/ 7	0.875	1.080	0.205	1.23	1.30	0.07	1.60
10/14	0.678	0.917	0.240	1.26	1.31	0.05	1.45
10/21	0.751	0.913	0.162	1.32	1.33	0.01	1.38
10/28	0.675	0.883	0.208	1.20	1.29	0.09	1.58
11/ 4	0.594	0.812	0.218	1.22	1.20	-0.02	1.15
11/11	0.545	0.746	0.201	1.10	1.18	0.08	1.40
11/18	0.550	0.718	0.168	1.14	1.25	0.11	1.61
11/25	0.501	0.703	0.202	1.19	1.25	0.06	1.40
12/ 2	0.682	0.644	-0.037	1.36	1.31	-0.05	2.23
12/ 9	0.462	0.688	0.226	1.25	1.30	0.05	1.40
12/16	0.453	0.628	0.174	1.06	1.13	0.07	1.31
12/30	0.415	0.607	0.192	1.23	1.27	0.04	1.36

MEAN= 1.59

*Electrical conductivity as caluclated by the equation: $\frac{EC_B \times flow_B - EC_A \times flow_A}{flow_B - flow_A}$

Table N-7. Estimated electrical conductivity (mmhos/cm) of return flow between Del Rio drain sampling sites A and B for 1975*

Date	Flow at Site A	Flow at Site B	Increase in flow	EC at Site A	EC at Site B	Increase in EC	EC of return flow
	- - - - - (m^3/sec)	- - - - -		- - - - - - - - -	- (meq/1) -	- - - - -	
1/14	0.480	0.647	0.167	1.28	1.33	0.05	1.47
1/28	0.585	0.707	0.122	1.21	1.26	0.05	1.50
2/10	0.492	0.650	0.157	1.35	1.34	-0.01	1.31
2/24	0.458	0.599	0.142	1.30	1.36	0.06	1.55
3/10	0.619	0.775	0.156	1.24	1.27	0.03	1.39
3/24	0.914	1.047	0.133	1.22	1.24	0.02	1.38
4/ 7	0.816	0.955	0.139	1.22	1.17	-0.05	0.88
4/21	0.793	0.992	0.199	1.25	1.28	0.03	1.40
5/ 5	0.814	0.974	0.160	1.22	1.27	0.05	1.52
5/19	0.776	1.014	0.237	1.21	1.27	0.06	1.47
6/ 2	0.845	1.221	0.376	1.19	1.22	0.03	1.29
6/16	0.985	1.218	0.233	1.17	1.23	0.06	1.48
6/30	0.947	1.152	0.205	1.20	1.25	0.05	1.48
7/14	1.122	1.227	0.105	1.17	1.24	0.07	1.99
7/28	1.235	1.322	0.087	1.14	1.22	0.08	2.36
8/11	1.320	1.404	0.083	1.22	1.27	0.05	2.06
8/25	1.461	1.559	0.098	1.22	1.30	0.08	2.49
9/ 8	1.583	1.688	0.106	1.14	1.18	0.04	1.78
9/23	1.094	1.282	0.189	1.26	1.30	0.04	1.53
10/ 7	0.875	1.080	0.205	1.23	1.30	0.07	1.60
10/21	0.751	0.913	0.162	1.32	1.33	0.01	1.38
11/ 4	0.594	0.812	0.218	1.22	1.20	-0.02	1.15
11/18	0.550	0.718	0.168	1.14	1.25	0.11	1.61
12/ 2	0.682	0.644	-0.037	1.36	1.31	-0.05	2.23
12/16	0.453	0.628	0.174	1.06	1.13	0.07	1.31
12/30	0.415	0.607	0.192	1.23	1.27	0.04	1.36

MEAN= 1.58

*Electrical conductivity as calculated by the equation: $\frac{EC_B \times flow_B - EC_A \times flow_A}{flow_B - flow_A}$

Table N-8. Estimated Ca concentrations of return flow between Del Rio drain sampling sites A and B for 1975*

Date	Flow at Site A	Flow at Site B	Increase in flow	Ca at Site A	Ca at Site B	Increase in Ca	Ca conc. of return flow
	- - - - - (m^3/sec)	- - - - -		- - - - - - - - -	- (meq/1) -	- - - - - - -	
1/14	0.480	0.647	0.167	6.02	6.54	0.52	8.04
1/28	0.585	0.707	0.122	6.06	6.34	0.28	7.68
2/10	0.492	0.650	0.157	6.13	6.58	0.45	7.99
2/24	0.458	0.599	0.142	6.63	7.08	0.45	8.53
3/10	0.619	0.775	0.156	6.09	6.42	0.33	7.73
3/24	0.914	1.047	0.133	5.01	5.19	0.18	6.43
4/ 7	0.816	0.955	0.139	5.82	5.98	0.16	6.92
4/21	0.793	0.992	0.199	5.70	6.02	0.32	7.30
5/ 5	0.814	0.974	0.160	5.08	5.69	0.61	8.80
5/19	0.776	1.014	0.237	5.60	5.81	0.21	6.50
6/ 2	0.845	1.221	0.376	5.47	5.81	0.34	6.57
6/16	0.985	1.218	0.233	5.00	5.06	0.06	5.31
6/30	0.947	1.152	0.205	5.39	5.81	0.42	7.75
7/14	1.122	1.227	0.105	4.99	5.49	0.50	10.81
7/28	1.235	1.322	0.087	5.00	5.17	0.17	7.59
8/11	1.320	1.404	0.083	5.30	5.68	0.38	11.71
8/25	1.461	1.559	0.098	5.20	5.52	0.32	10.28
9/ 8	1.583	1.688	0.106	4.31	5.11	0.80	17.10
9/23	1.094	1.282	0.189	5.48	6.00	0.52	9.01
10/ 7	0.875	1.080	0.205	5.13	5.90	0.77	9.19
10/21	0.751	0.913	0.162	5.76	6.70	0.94	11.07
11/ 4	0.594	0.812	0.218	6.15	6.66	0.51	8.05
11/18	0.550	0.718	0.168	5.70	6.23	0.53	7.97
12/ 2	0.682	0.644	-0.037	5.99	6.22	0.23	1.99
12/16	0.453	0.628	0.174	4.60	5.24	0.64	6.90
12/30	0.415	0.607	0.192	6.55	6.36	-0.19	5.95

MEAN= 8.20

*Ca concentrations as calculated by the equation: $\frac{Ca_B \times flow_B - Ca_A \times flow_A}{flow_B - flow_A}$

Table N-9. Estimated Na concentrations of return flow between Del Rio drain sampling sites A and B for 1975*

Date	Flow at Site A	Flow at Site B	Increase in flow	Na at Site A	Na at Site B	Increase in Na	Na conc. of return flow
	------ (m^3/sec)	------		--------	(meq/l)	--------	
1/14	0.480	0.647	0.167	6.11	6.72	0.61	8.46
1/28	0.585	0.707	0.122	6.43	6.61	0.18	7.47
2/10	0.492	0.650	0.157	6.45	6.88	0.43	8.22
2/24	0.458	0.599	0.142	6.77	7.05	0.28	7.95
3/10	0.619	0.775	0.156	6.34	6.49	0.15	7.08
3/24	0.914	1.047	0.133	6.13	6.22	0.09	6.84
4/ 7	0.816	0.955	0.139	5.77	6.11	0.34	8.10
4/21	0.793	0.992	0.199	6.06	6.37	0.31	7.61
5/ 5	0.814	0.974	0.160	6.54	6.27	-0.27	4.89
5/19	0.776	1.014	0.237	6.14	6.65	0.51	8.32
6/ 2	0.845	1.221	0.376	5.84	6.28	0.44	7.27
6/16	0.985	1.218	0.233	4.90	4.85	-0.05	4.64
6/30	0.947	1.152	0.205	6.08	6.36	0.28	7.65
7/14	1.122	1.227	0.105	5.41	6.32	0.91	16.01
7/28	1.235	1.322	0.087	5.96	6.21	0.25	9.77
8/11	1.320	1.404	0.083	6.27	6.27	0.0	6.27
8/25	1.461	1.559	0.098	5.13	5.77	0.64	15.28
9/ 8	1.583	1.688	0.106	5.56	6.82	1.26	25.70
9/22	1.094	1.282	0.189	5.71	6.37	0.66	10.19
10/ 7	0.875	1.080	0.205	5.89	5.91	0.02	6.00
10/21	0.751	0.913	0.162	7.11	5.89	-1.22	0.22
11/ 4	0.594	0.812	0.218	5.45	5.63	0.38	6.86
11/18	0.550	0.718	0.168	5.64	5.97	0.33	7.05
12/ 2	0.682	0.644	-0.037	5.87	5.79	-0.08	7.26
12/16	0.453	0.628	0.174	5.63	5.84	0.21	6.39
12/30	0.415	0.607	0.192	5.52	5.99	0.47	7.01

MEAN= 8.41

*Na concentrations as calculated by the equation: $\frac{Na_B \times flow_B - Na_A \times flow_A}{flow_B - flow_A}$

Table N-10. Estimated Mg concentrations of return flow between Del Rio drain sampling sites A and B for 1975*

Date	Flow at Site A	Flow at Site B	Increase in flow	Mg at Site A	Mg at Site B	Increase in Mg	Mg Conc. of return flow
	----- (m^3/sec)	-----		--------	(meq/l)	--------	
1/14	0.480	0.647	0.167	1.66	1.71	0.05	1.85
1/28	0.585	0.707	0.122	1.80	1.82	0.02	1.92
2/10	0.492	0.650	0.157	1.82	1.64	0.02	1.90
2/24	0.458	0.599	0.142	1.86	1.91	0.05	2.07
3/10	0.619	0.775	0.156	1.65	1.69	0.04	1.85
3/24	0.914	1.047	0.133	1.72	1.75	0.03	1.96
4/ 7	0.816	0.955	0.139	1.61	1.65	0.04	1.88
4/21	0.793	0.992	0.199	1.61	1.65	0.04	1.81
5/ 5	0.814	0.974	0.160	1.60	1.67	0.07	2.03
5/19	0.776	1.014	0.237	1.66	1.73	0.07	1.96
6/ 2	0.845	1.221	0.376	1.62	1.69	0.07	1.85
6/16	0.985	1.218	0.233	1.48	1.48	0.0	1.48
6/30	0.947	1.152	0.205	1.58	1.68	0.10	2.14
7/14	1.122	1.227	0.105	1.49	1.61	0.12	2.89
7/28	1.235	1.322	0.087	1.49	1.51	0.02	1.80
8/11	1.320	1.404	0.083	1.61	1.62	0.01	1.78
8/25	1.461	1.559	0.098	1.56	1.61	0.05	2.35
9/ 8	1.583	1.688	0.106	1.23	1.45	0.22	4.75
9/22	1.094	1.282	0.189	1.52	1.61	0.09	2.13
10/ 7	0.875	1.080	0.205	1.82	1.83	0.01	1.87
10/21	0.751	0.913	0.162	1.60	1.77	0.17	2.56
11/ 4	0.594	0.812	0.218	1.74	1.80	0.06	1.96
11/18	0.550	0.718	0.168	1.67	1.74	0.07	1.97
12/ 2	0.682	0.644	-0.037	1.73	1.76	0.03	1.21
12/16	0.453	0.628	0.174	1.71	1.66	-0.05	1.53
12/30	0.415	0.607	0.192	1.62	1.65	0.03	1.71

MEAN= 2.05

*Mg concentrations as calculated by the equation: $\frac{Mg_B \times flow_B - Mg_A \times flow_A}{flow_B - flow_A}$

Table N-11. Composition of water samples taken from the irrigation well on the Plant Science Farm, NMSU during 1975

Well	Date	ECx10^3	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meg/1)										(ppm)
I	1/ 1/75	1.03	8.01	12.24	13.13	5.49	1.41	5.16	0.18	2.38	0.0	4.90	5.85	0.23
I	1/14/75	1.14	8.00	12.91	13.34	6.10	1.45	5.20	0.16	2.39	0.0	5.62	5.33	0.13
I	1/28/75	1.08	8.10	13.14	12.58	6.06	1.59	5.33	0.16	2.40	0.0	5.50	4.68	0.0
I	2/10/75	1.35	8.30	13.04	12.51	6.01	1.53	5.33	0.17	2.38	0.0	5.24	4.88	0.33
I	2/24/75	1.12	8.09	13.70	12.78	6.48	1.62	5.44	0.16	2.40	0.0	5.50	4.88	0.10
I	3/10/75	1.14	8.16	13.29	13.00	6.05	1.59	5.48	0.17	2.43	0.28	5.40	4.88	0.51
I	3/24/75	1.14	7.90	12.21	11.73	5.06	1.62	5.37	0.16	2.46	0.0	4.30	4.96	0.33
I	4/ 7/75	0.95	8.11	11.39	11.15	4.14	1.55	5.53	0.17	2.47	0.0	3.40	5.28	0.0
I	5/ 5/75	1.01	8.22	10.80	10.27	3.35	1.55	5.73	0.17	2.46	0.0	2.56	5.24	0.56
I	5/19/75	1.17	8.01	12.74	12.79	5.19	1.70	5.68	0.17	2.46	0.0	4.68	5.64	0.50
I	6/ 2/75	1.22	7.99	12.92	13.15	5.37	1.68	5.70	0.17	2.42	0.0	5.52	5.20	0.33
I	6/16/75	1.25	7.20	12.22	11.65	4.87	1.60	5.55	0.20	2.67	0.0	3.54	5.44	0.25
I	6/30/75	1.06	8.40	11.30	11.05	3.55	1.54	6.01	0.20	2.69	0.0	2.16	6.20	0.0
I	7/14/75	1.11	8.36	11.69	11.25	4.50	1.73	5.26	0.20	2.65	0.28	2.94	5.36	1.15
I	7/28/75	1.21	8.22	13.27	12.04	5.68	1.66	5.75	0.18	2.64	0.0	3.64	5.76	0.22
I	8/11/75	1.29	7.82	14.25	14.30	6.64	1.68	5.76	0.17	2.56	0.0	5.86	5.88	0.0
I	8/25/75	1.28	8.14	13.51	13.26	6.18	1.64	5.51	0.18	2.71	0.0	5.78	4.77	0.14
I	9/ 8/75	1.19	7.99	12.94	12.74	5.22	1.49	6.04	0.19	2.72	0.0	4.66	5.36	0.0
I	9/23/75	1.26	7.98	13.24	13.73	6.22	1.54	5.29	0.19	2.82	0.0	5.62	5.29	0.0
I	10/ 7/75	1.24	7.63	17.21	13.63	9.11	1.89	6.03	0.18	3.01	0.0	5.60	5.02	0.05
I	10/21/75	1.27	8.16	13.51	13.47	5.48	1.80	6.02	0.21	2.81	0.0	5.10	5.54	1.24
I	11/ 4/75	1.12	8.05	14.61	14.06	7.14	1.82	5.45	0.20	2.90	0.0	5.42	5.73	0.40
I	11/18/75	1.23	8.50	13.98	13.96	6.61	1.74	5.43	0.20	2.85	0.0	4.94	6.16	0.40
I	12/ 2/75	1.27	8.00	14.19	13.67	6.97	1.75	5.25	0.22	2.77	0.0	5.42	5.48	0.27
I	12/16/75	1.07	7.67	11.44	13.67	4.38	1.66	5.21	0.19	2.79	0.0	5.62	5.26	0.0
I	12/30/75	1.01	7.89	12.03	11.62	5.05	1.68	5.11	0.19	2.83	0.0	3.50	5.29	0.0
MEAN=		1.16	8.03	12.99	12.71	5.65	1.63	5.52	0.18	2.62	0.02	4.71	5.36	0.27
STD. DEV.=		0.10	0.26	1.31	1.07	1.21	0.11	0.29	0.02	0.19	0.08	1.09	0.41	0.33

Table N-12. Composition of water samples taken from test well #1 on the Plant Science Farm, NMSU, during 1975

Well	Date	$ECx10^3$	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				-(meq/l)-										(ppm)
1	1/14/75	0.99	7.87	10.74	10.75	5.97	1.56	3.07	0.14	2.79	0.0	3.56	4.40	0.0
1	1/28/75	0.95	8.11	10.57	10.96	5.79	1.58	3.05	0.15	2.82	0.0	3.50	4.64	0.0
1	2/10/75	1.05	8.43	11.73	11.51	6.22	1.71	3.65	0.15	2.86	0.0	3.92	4.72	0.43
1	2/24/75	0.96	8.45	11.37	10.79	6.22	1.65	3.35	0.15	2.64	0.44	3.18	4.52	0.61
1	3/10/75	1.08	8.12	12.28	11.95	6.49	1.75	3.88	0.16	2.84	0.0	4.18	4.92	0.38
1	3/24/75	1.02	8.00	11.06	11.13	5.74	1.59	3.58	0.15	2.78	0.20	3.62	4.52	0.45
1	4/ 7/75	0.95	8.24	10.64	10.70	5.16	1.68	3.65	0.15	2.82	0.0	2.96	4.92	0.10
1	4/21/75	0.95	8.20	12.13	11.19	4.75	1.71	5.49	0.18	2.41	0.0	3.42	5.36	0.0
1	5/ 5/75	1.02	8.11	10.83	9.97	3.26	1.69	5.68	0.20	2.52	0.0	2.32	5.12	0.81
1	5/19/75	1.07	8.16	11.63	10.86	4.17	1.72	5.57	0.17	2.47	0.0	3.02	5.36	0.47
1	6/ 2/75	1.26	8.10	14.87	13.63	7.19	1.77	5.73	0.18	2.64	0.0	5.62	5.36	0.51
1	6/16/75	1.18	7.80	11.87	12.47	6.12	1.34	4.19	0.22	2.61	0.0	4.94	4.92	0.14
1	6/30/75	1.14	8.31	10.72	9.79	3.63	1.69	5.20	0.20	2.64	0.0	2.07	5.08	0.0
1	7/14/75	1.19	8.05	12.79	14.01	6.17	1.69	4.72	0.21	3.71	0.0	5.00	5.28	1.15
1	7/28/75	1.12	7.99	12.48	11.82	6.16	1.72	4.43	0.17	2.52	0.0	4.18	5.12	0.11
1	8/11/75	1.13	7.85	11.74	10.87	5.70	1.57	4.31	0.16	2.58	0.0	4.66	3.60	2.00
1	8/25/75	1.03	7.90	10.82	10.22	5.77	1.60	3.29	0.16	2.64	0.0	3.54	4.02	1.09
1	9/ 8/75	1.05	8.05	11.45	10.88	5.85	1.44	3.99	0.17	2.56	0.0	3.80	4.52	0.0
1	9/23/75	1.01	8.11	10.95	12.31	5.15	1.38	4.26	0.16	2.69	0.0	5.50	4.12	0.13
1	10/ 7/75	1.05	7.98	12.31	14.32	6.04	1.78	4.31	0.18	2.46	0.0	7.40	4.46	0.09
1	11/ 4/75	0.86	8.03	9.65	10.44	3.86	1.74	3.89	0.16	2.67	0.0	3.26	4.49	0.97
1	11/18/75	0.95	8.46	11.32	10.87	5.93	1.61	3.61	0.17	2.69	0.0	3.80	4.37	0.81
1	12/ 2/75	1.02	8.11	11.51	10.58	6.11	1.63	3.59	0.18	2.60	0.0	3.64	4.34	0.11
1	12/16/75	0.86	7.53	10.24	10.60	4.83	1.59	3.66	0.16	2.66	0.0	3.52	4.41	0.40
1	12/30/75	0.87	8.02	11.37	9.52	6.14	1.49	3.58	0.16	2.69	0.0	2.93	3.90	0.17
MEAN=		1.03	8.08	11.48	11.29	5.54	1.63	4.15	0.17	2.69	0.03	3.90	4.66	0.44
STD. DEV.=		0.10	0.21	1.02	1.24	0.96	0.12	0.82	0.02	0.24	0.10	1.14	0.48	0.48

Table N-13. Composition of water samples taken from test well #2 on the Plant Science Farm, NMSU, during 1975

Well	Date	$ECx10^3$	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meq/l)										(ppm)
2	1/14/75	1.29	7.95	15.31	15.34	7.56	1.74	5.82	0.19	2.58	0.0	7.10	5.66	0.30
2	1/28/75	1.25	7.97	14.42	14.87	7.01	1.74	5.49	0.18	2.33	0.0	7.02	5.52	0.0
2	2/10/75	1.27	8.23	14.33	14.C7	7.15	1.74	5.27	0.17	2.24	0.0	6.70	5.12	0.33
2	2/24/75	1.20	8.32	15.08	14.77	7.34	1.77	5.80	0.17	2.61	0.60	5.88	5.68	0.10
2	3/10/75	1.22	8.35	12.91	14.07	5.36	1.75	5.62	0.18	2.31	0.96	5.48	5.32	0.14
2	3/24/75	1.20	8.06	14.03	13.64	6.56	1.81	5.48	0.18	2.27	0.20	6.00	5.16	0.33
2	4/ 7/75	1.00	8.19	10.90	10.48	3.81	1.69	5.23	0.17	2.40	0.0	2.28	5.80	0.0
2	4/21/75	1.16	8.02	13.84	13.20	4.87	2.15	6.63	0.19	3.14	0.0	3.62	6.44	0.06
2	5/ 5/75	1.01	8.14	10.92	10.23	3.36	1.68	5.70	0.18	2.28	0.0	2.42	5.52	0.50
2	5/19/75	1.10	8.14	11.80	11.32	4.37	1.74	5.51	0.18	2.23	0.0	3.56	5.52	0.62
2	6/ 2/75	1.26	7.90	12.65	13.76	4.98	1.84	5.65	0.18	2.38	0.0	6.26	5.12	0.25
2	6/16/75	1.28	7.80	13.62	13.49	6.50	1.78	5.14	0.20	2.45	0.0	5.92	5.12	0.14
2	6/30/75	1.12	8.07	11.27	11.42	3.30	1.86	5.91	0.20	2.48	0.0	3.38	5.56	0.0
2	7/14/75	1.29	7.87	14.2C	14.00	6.99	1.75	5.26	0.20	2.64	0.0	5.32	6.04	0.11
2	7/28/75	1.19	8.06	14.57	14.31	7.02	1.87	5.49	0.19	2.25	0.0	6.04	6.00	1.32
2	8/11/75	1.29	7.82	14.16	14.21	6.85	1.74	5.40	0.17	2.33	0.0	6.44	5.44	0.0
2	8/25/75	1.28	7.89	14.27	13.01	6.88	1.80	5.41	0.18	2.29	0.0	6.16	4.55	0.92
2	9/ 8/75	1.16	8.04	14.44	12.53	7.23	1.64	5.38	0.19	2.26	0.0	5.04	5.23	0.0
2	9/23/75	1.21	8.08	12.76	13.43	6.45	1.58	4.54	0.19	2.34	0.0	6.14	4.95	0.0
2	10/ 7/75	1.20	7.67	14.02	13.09	6.56	1.86	5.42	0.18	2.20	0.0	5.94	4.95	0.0
2	11/ 4/75	0.96	8.04	10.30	12.30	3.32	1.76	5.04	0.18	2.31	0.0	4.82	5.17	0.12
2	11/18/75	1.03	8.22	13.59	13.65	6.73	1.72	4.94	0.20	2.27	0.0	6.08	5.29	0.67
2	12/ 2/75	1.20	8.07	13.80	13.08	6.89	1.73	4.96	0.22	2.13	0.0	6.10	4.85	0.05
2	12/16/75	1.01	7.98	10.57	13.09	3.75	1.55	5.09	0.18	2.10	0.0	6.14	4.85	0.0
2	12/30/75	0.97	7.90	12.55	11.10	5.87	1.55	4.94	0.19	2.15	0.0	4.50	4.45	0.0
MEAN=		1.17	8.03	13.21	13.14	5.87	1.75	5.40	0.19	2.36	0.07	5.37	5.33	0.24
STD. DEV.=		0.11	0.16	1.47	1.35	1.45	0.12	0.41	0.01	0.21	0.22	1.35	0.46	0.34

Table N-14. Composition of water samples taken from test well #3 on the Plant Science Farm, NMSU, during 1975

Well	Date	$ECx10^3$	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meq/l)										(ppm)
3	1/14/75	1.51	7.99	17.88	17.90	9.02	2.23	6.43	0.20	3.51	0.0	7.00	7.39	0.13
3	1/28/75	1.48	7.97	18.09	17.46	8.97	2.37	6.56	0.19	3.20	0.0	7.22	7.04	0.0
3	2/10/75	1.50	8.09	18.02	16.80	8.94	2.28	6.59	0.21	3.06	0.0	7.34	6.40	0.28
3	2/24/75	1.45	8.25	18.24	17.00	9.10	2.32	6.62	0.20	2.90	0.0	7.10	7.00	0.18
3	3/10/75	1.58	8.29	17.10	17.45	7.50	2.58	6.85	0.17	3.39	0.36	6.22	7.48	0.14
3	3/24/75	1.59	7.83	17.42	17.44	7.67	2.66	6.88	0.21	3.53	0.0	6.34	7.56	0.45
3	4/ 7/75	1.31	8.10	15.01	15.37	5.78	2.50	6.54	0.19	3.53	0.0	3.96	7.88	0.0
3	4/21/75	1.27	8.21	16.27	14.86	6.78	2.52	6.77	0.20	3.40	0.0	4.02	7.44	0.0
3	5/ 5/75	1.34	8.07	14.80	13.58	5.51	2.34	6.74	0.21	3.17	0.0	3.16	7.24	0.69
3	5/19/75	1.29	8.10	13.76	13.30	4.78	2.17	6.61	0.20	2.77	0.0	3.96	6.56	0.47
3	6/ 2/75	1.45	7.86	16.87	16.25	8.21	2.12	6.35	0.19	2.77	0.0	7.04	6.44	0.19
3	6/16/75	1.50	7.70	15.97	16.21	7.19	2.02	6.54	C.22	2.89	0.0	7.00	6.32	0.0
3	6/30/75	1.14	8.29	17.05	14.52	7.93	2.12	6.77	0.23	2.78	0.0	5.30	6.44	0.0
3	7/14/75	1.42	7.77	15.37	15.89	7.12	1.91	6.12	0.22	2.67	0.0	6.34	6.88	0.28
3	7/28/75	1.32	8.01	13.69	14.74	8.01	2.13	3.35	0.20	2.64	0.0	5.82	6.28	0.0
3	8/11/75	1.47	7.81	16.65	16.98	7.87	2.05	6.54	0.19	2.88	0.0	7.10	7.00	0.0
3	8/25/75	1.43	7.85	13.95	13.89	5.76	1.52	6.47	0.20	2.69	0.0	6.80	4.40	0.0
3	9/ 8/75	1.23	8.04	13.80	13.45	5.83	1.33	6.43	0.21	2.52	0.0	5.02	5.91	0.0
3	9/23/75	1.36	8.16	15.59	14.96	7.08	1.85	6.45	0.21	2.82	0.0	7.00	5.14	0.0
3	10/ 7/75	1.34	7.57	16.27	14.11	7.29	2.12	6.65	0.21	2.39	0.0	6.74	4.98	0.05
3	11/ 4/75	1.03	8.09	14.53	13.32	6.58	1.95	5.81	0.19	2.49	0.0	4.94	5.88	0.40
3	11/18/75	1.24	8.29	14.27	14.41	6.65	1.76	5.67	0.19	2.37	0.0	6.12	5.91	0.54
3	12/ 2/75	1.28	8.08	14.42	13.75	6.77	1.80	5.62	0.23	2.19	0.0	6.34	5.22	0.05
3	12/16/75	1.05	7.64	10.04	13.74	3.08	1.57	5.19	0.20	2.15	0.0	6.30	5.29	0.12
3	12/30/75	1.07	7.96	13.05	11.96	6.02	1.5C	5.35	0.18	2.11	0.0	4.93	4.92	0.0
MEAN=		1.35	8.00	15.52	15.17	7.02	2.07	6.24	0.20	2.83	0.01	5.96	6.36	0.16
STD. DEV.=		0.16	0.20	1.95	1.66	1.43	C.35	0.76	0.01	0.43	0.07	1.22	0.96	0.20

Table N-15. Composition of water samples taken from test well #4 on the Plant Science Farm, NMSU, during 1975

Well	Date	$ECx10^3$	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				- - - - -	- - - - -	- - - - -	- - - - -	(meq/1)	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	(ppm)
4	1/14/75	1.50	7.88	17.39	17.20	6.41	1.84	8.92	0.22	3.23	0.0	7.22	6.75	0.13
4	1/28/75	1.45	7.81	17.01	17.18	6.14	1.89	8.77	0.21	3.14	0.0	7.32	6.72	0.0
4	2/10/75	1.51	8.28	17.43	16.66	6.30	2.00	8.91	0.22	3.02	0.0	7.20	6.44	0.21
4	2/24/75	1.40	8.24	17.26	15.90	6.29	1.85	8.91	0.21	2.88	0.0	7.02	6.00	0.23
4	3/10/75	1.44	8.38	16.52	16.05	5.72	1.81	8.77	0.22	3.01	0.60	6.16	6.28	0.14
4	3/24/75	1.38	8.14	16.58	14.87	5.82	1.81	8.74	0.21	2.80	0.16	6.26	5.64	0.57
4	4/ 7/75	1.19	8.46	12.57	12.02	2.15	1.61	8.61	0.20	2.82	0.0	2.92	6.28	0.0
4	4/21/75	1.20	8.44	13.25	12.74	2.59	1.68	8.78	0.20	2.84	0.0	3.66	6.24	0.0
4	5/ 5/75	1.22	8.34	13.07	12.47	1.96	1.60	9.29	0.22	2.74	0.0	3.56	6.16	0.50
4	5/19/75	1.30	8.18	13.94	13.25	3.23	1.66	8.84	0.21	2.68	0.0	4.68	5.88	0.47
4	6/ 2/75	1.41	7.91	16.06	15.38	5.40	1.68	8.78	0.20	2.62	0.0	7.12	5.64	0.19
4	6/16/75	1.44	7.80	15.51	15.49	5.37	1.79	8.12	0.23	2.63	0.0	7.18	5.68	0.0
4	6/30/75	1.18	8.43	15.95	13.02	4.93	1.58	9.21	0.23	3.52	0.0	3.34	6.16	0.0
4	7/14/75	1.41	7.70	15.05	15.43	5.13	1.57	8.12	0.23	2.54	0.48	5.94	6.44	2.12
4	7/28/75	1.30	8.18	15.46	15.11	5.14	1.56	8.56	0.20	2.39	0.0	6.92	5.80	0.0
4	8/11/75	1.35	7.74	14.67	15.41	4.88	1.48	8.12	0.19	2.43	0.0	7.18	5.80	0.0
4	8/25/75	1.35	7.78	14.71	13.83	4.67	1.44	8.40	0.20	2.46	0.0	7.00	4.37	0.0
4	9/ 8/75	1.20	8.18	12.98	12.80	6.48	1.43	4.86	0.21	2.41	0.0	5.50	4.89	0.0
4	9/23/75	1.33	8.24	15.44	14.78	4.88	1.44	8.91	0.21	2.94	0.0	7.10	4.74	0.0
4	10/ 7/75	1.27	7.46	15.47	14.05	5.84	1.76	7.66	0.21	2.29	0.0	7.02	4.74	0.0
4	11/ 4/75	0.99	8.24	12.07	12.28	3.82	1.72	6.32	0.21	2.52	0.0	4.84	4.92	0.0
4	11/18/75	1.09	8.35	13.73	14.93	5.59	1.68	6.25	0.21	2.57	0.0	7.24	5.11	0.67
4	12/ 2/75	1.35	8.22	14.41	14.75	6.15	1.78	6.22	0.26	2.54	0.0	7.10	5.11	0.19
4	12/16/75	1.14	7.56	10.24	14.85	2.23	1.70	6.09	0.22	2.60	0.0	6.92	5.33	0.0
4	12/30/75	1.18	7.82	13.88	13.42	5.99	1.58	6.08	0.23	2.74	0.0	5.35	5.33	0.17
MEAN=		1.30	8.07	14.83	14.56	4.92	1.68	8.01	0.21	2.73	0.05	6.07	5.70	0.22
STD. DEV.=		0.13	0.29	1.83	1.51	1.43	0.15	1.25	0.01	0.29	0.15	1.43	0.67	0.44

Table N-16. Composition of water samples taken from test well #5 on the Plant Science Farm, NMSU, during 1975

Well	Date	$ECx10^3$	pH	Cations	Anions	Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	NO_3
				(meq/l)										(ppm)
5	1/14/75	1.73	7.92	19.78	19.80	9.20	2.87	7.42	0.29	4.08	0.0	7.28	8.44	0.07
5	1/28/75	1.74	7.91	21.74	20.56	9.74	3.19	8.50	0.31	4.18	0.0	7.50	8.88	0.10
5	2/10/75	1.84	8.09	21.83	21.55	10.00	3.21	8.31	0.31	4.10	0.0	7.36	10.08	0.33
5	2/24/75	1.80	8.11	22.93	21.89	10.30	3.34	9.00	0.29	4.16	0.0	7.40	10.32	0.35
5	3/10/75	1.90	8.24	20.31	20.75	7.33	3.55	9.12	0.31	4.39	0.44	6.04	9.88	0.14
5	3/24/75	1.90	7.80	20.33	20.28	7.02	3.59	9.42	0.30	4.41	0.0	6.02	9.84	0.33
5	4/ 7/75	1.55	8.26	17.65	17.51	5.55	3.09	8.71	0.30	4.03	0.0	4.08	9.40	0.0
5	4/21/75	1.48	8.26	16.49	16.17	4.56	3.03	8.61	0.29	3.83	0.0	3.62	8.72	0.0
5	5/ 5/75	1.40	8.26	15.27	14.06	4.17	2.45	8.40	0.25	3.45	0.0	2.44	8.16	0.62
5	5/19/75	1.41	8.11	16.03	14.95	4.44	2.53	8.78	0.28	3.20	0.0	4.42	7.32	0.47
5	6/ 2/75	1.40	7.71	18.11	16.94	7.26	2.40	8.18	0.27	2.98	0.0	7.36	6.60	0.25
5	6/16/75	1.54	7.70	15.86	16.69	7.09	2.47	6.00	0.30	2.83	0.0	7.50	6.36	0.0
5	6/30/75	1.20	8.35	12.73	11.77	1.96	1.86	8.62	0.29	2.69	0.0	3.12	5.96	0.0
5	7/14/75	1.43	7.72	15.81	15.92	5.73	1.97	7.82	0.29	2.65	0.52	6.42	6.32	0.47
5	7/28/75	1.25	8.21	15.77	15.31	6.05	1.88	7.59	0.25	2.43	0.0	6.88	6.00	0.0
5	8/11/75	1.49	7.73	16.38	16.56	7.44	1.78	6.90	0.26	2.54	0.0	7.34	6.68	0.0
5	8/25/75	1.43	7.70	15.06	14.78	5.20	1.76	7.83	0.27	2.64	0.0	7.22	4.92	0.0
5	9/ 8/75	1.25	8.16	14.26	13.37	4.67	1.10	8.22	0.27	2.53	0.0	5.30	5.54	0.0
5	9/23/75	1.34	8.23	14.29	14.70	5.07	0.94	8.01	0.27	2.52	0.0	7.32	4.86	0.0
5	10/ 7/75	1.30	7.50	9.94	11.06	3.98	1.83	3.85	0.28	2.34	0.0	4.28	4.43	0.46
5	11/ 4/75	1.02	8.24	12.19	12.72	3.61	1.69	6.63	0.26	2.53	0.0	5.22	4.95	1.48
5	11/18/75	1.07	8.39	13.22	14.50	4.84	1.56	6.56	0.26	2.36	0.0	7.32	4.80	1.11
5	12/ 2/75	1.29	8.16	13.48	14.07	5.00	1.58	6.60	0.30	2.37	0.0	7.22	4.48	0.05
5	12/16/75	1.09	7.63	10.79	14.24	2.37	1.50	6.65	0.27	2.45	0.0	7.16	4.63	0.0
5	12/30/75	1.12	8.06	13.17	13.22	4.57	1.76	6.57	0.27	2.55	0.0	5.85	4.82	0.0
MEAN =		1.44	8.02	16.14	16.13	5.89	2.28	7.69	0.28	3.13	0.04	6.07	6.90	0.25
STD. DEV. =		0.26	0.26	3.49	3.10	2.25	0.78	1.24	0.02	0.76	0.13	1.57	2.03	0.37

Table N-17. Electrical conductivity (mmhos/cm) of water samples taken from the irrigation well and test wells 1-5 during 1975

Irrigation well		Test well 1		Test well 2		Test well 3		Test well 4		Test well 5	
Date	$ECx10^3$	Date	$ECx10^3$	Date	$ECx10^3$	Date	$ECx10^3$	Date	$ECx10^3$	Date	$ECx10^3$
1/ 1/75	1.03	1/ 8/75	0.99	1/ 8/75	1.27	1/ 8/75	1.50	1/ 8/75	1.47	1/ 8/75	1.67
1/ 7/75	1.07	1/14/75	0.99	1/14/75	1.29	1/14/75	1.51	1/14/75	1.50	1/14/75	1.73
1/14/75	1.14	1/21/75	0.90	1/21/75	1.19	1/21/75	1.41	1/21/75	1.40	1/21/75	1.66
1/21/75	1.12	1/28/75	0.95	1/28/75	1.25	1/28/75	1.48	1/28/75	1.45	1/28/75	1.74
1/28/75	1.08	2/ 4/75	0.98	2/ 4/75	1.18	2/ 4/75	1.42	2/ 4/75	1.40	2/ 4/75	1.70
2/ 4/75	1.06	2/10/75	1.05	2/10/75	1.27	2/10/75	1.50	2/10/75	1.51	2/10/75	1.84
2/10/75	1.35	2/17/75	0.98	2/17/75	1.22	2/17/75	1.45	2/17/75	1.44	2/17/75	1.76
2/17/75	1.10	2/24/75	0.96	2/24/75	1.20	2/24/75	1.45	2/24/75	1.40	2/24/75	1.80
2/24/75	1.12	3/ 3/75	1.18	3/ 3/75	1.30	3/ 3/75	1.60	3/ 3/75	1.50	3/ 3/75	1.94
3/ 3/75	1.21	3/10/75	1.08	3/10/75	1.22	3/10/75	1.58	3/10/75	1.44	3/10/75	1.90
3/10/75	1.14	3/17/75	1.08	3/17/75	1.26	3/17/75	1.65	3/17/75	1.49	3/17/75	2.01
3/17/75	1.15	3/24/75	1.02	3/24/75	1.20	3/24/75	1.59	3/24/75	1.38	3/24/75	1.90
3/24/75	1.14	3/31/75	1.03	3/31/75	1.23	3/31/75	1.66	3/31/75	1.41	3/31/75	1.90
3/31/75	1.20	4/ 7/75	0.95	4/ 7/75	1.00	4/ 7/75	1.31	4/ 7/75	1.19	4/ 7/75	1.55
4/ 7/75	0.95	4/14/75	1.24	4/14/75	1.26	4/14/75	1.65	4/14/75	1.46	4/14/75	1.84
4/14/75	1.19	4/21/75	0.95	4/21/75	1.16	4/21/75	1.27	4/21/75	1.20	4/21/75	1.48
4/28/75	1.17	4/28/75	1.05	4/28/75	1.23	4/28/75	1.55	4/28/75	1.43	4/28/75	1.72
5/ 5/75	1.01	5/ 5/75	1.02	5/ 5/75	1.01	5/ 5/75	1.34	5/ 5/75	1.22	5/ 5/75	1.40
5/12/75	1.21	5/12/75	1.34	5/12/75	1.30	5/12/75	1.53	5/12/75	1.46	5/12/75	1.71
5/19/75	1.17	5/19/75	1.07	5/19/75	1.10	5/19/75	1.29	5/19/75	1.30	5/19/75	1.41
5/26/75	1.25	5/26/75	1.18	5/26/75	1.29	5/26/75	1.49	5/26/75	1.44	5/26/75	1.62
6/ 2/75	1.22	6/ 2/75	1.26	6/ 2/75	1.26	6/ 2/75	1.45	6/ 2/75	1.41	6/ 2/75	1.40
6/ 9/75	1.27	6/ 9/75	1.20	6/ 9/75	1.31	6/ 9/75	1.52	6/ 9/75	1.47	6/ 9/75	1.61
6/16/75	1.25	6/16/75	1.18	6/16/75	1.28	6/16/75	1.50	6/16/75	1.44	6/16/75	1.54
6/23/75	1.28	6/23/75	1.06	6/23/75	1.28	6/23/75	1.47	6/23/75	1.44	6/23/75	1.46
6/30/75	1.06	6/30/75	1.14	6/30/75	1.12	6/30/75	1.14	6/30/75	1.18	6/30/75	1.20
7/ 7/75	1.09	7/ 7/75	1.15	7/ 7/75	1.27	7/ 7/75	1.41	7/ 7/75	1.42	7/ 7/75	1.40
7/14/75	1.11	7/14/75	1.19	7/14/75	1.29	7/14/75	1.42	7/14/75	1.41	7/14/75	1.43
7/28/75	1.21	7/21/75	1.10	7/21/75	1.26	7/21/75	1.42	7/21/75	1.37	7/21/75	1.37
8/11/75	1.29	7/28/75	1.12	7/28/75	1.19	7/28/75	1.32	7/28/75	1.30	7/28/75	1.25
8/25/75	1.28	8/ 4/75	1.12	8/ 4/75	1.29	8/ 4/75	1.47	8/ 4/75	1.37	8/ 4/75	1.40
9/ 1/75	1.30	8/11/75	1.13	8/11/75	1.29	8/11/75	1.47	8/11/75	1.35	8/11/75	1.49
9/ 8/75	1.19	8/18/75	1.10	8/18/75	1.27	8/18/75	1.43	8/18/75	1.34	8/18/75	1.41
9/15/75	1.24	8/25/75	1.03	8/25/75	1.28	8/25/75	1.43	8/25/75	1.35	8/25/75	1.43
9/23/75	1.26	9/ 1/75	1.05	9/ 1/75	1.28	9/ 1/75	1.41	9/ 1/75	1.33	9/ 1/75	1.46
9/30/75	1.27	9/ 8/75	1.05	9/ 8/75	1.16	9/ 8/75	1.23	9/ 8/75	1.20	9/ 8/75	1.25
10/ 7/75	1.24	9/16/75	1.14	9/16/75	1.16	9/16/75	1.33	9/16/75	1.23	9/16/75	1.31
10/14/75	1.26	9/23/75	1.01	9/23/75	1.21	9/23/75	1.36	9/23/75	1.33	9/23/75	1.34
10/21/75	1.27	9/30/75	1.08	9/30/75	1.22	9/30/75	1.37	9/30/75	1.31	9/30/75	1.32
10/28/75	1.26	10/ 7/75	1.05	10/ 7/75	1.20	10/ 7/75	1.34	10/ 7/75	1.27	10/ 7/75	1.30
11/ 4/75	1.12	10/14/75	1.06	10/14/75	1.22	10/14/75	1.35	10/14/75	1.29	10/14/75	1.31
11/11/75	1.00	10/28/75	1.02	10/28/75	1.19	10/28/75	1.35	10/28/75	1.30	10/28/75	1.31
11/18/75	1.23	11/ 4/75	0.86	11/ 4/75	0.96	11/ 4/75	1.03	11/ 4/75	0.99	11/ 4/75	1.02
11/26/75	1.18	11/11/75	0.89	11/11/75	1.07	11/11/75	1.19	11/11/75	1.16	11/11/75	1.15
12/ 2/75	1.27	11/18/75	0.95	11/18/75	1.03	11/18/75	1.24	11/18/75	1.09	11/18/75	1.07
12/ 9/75	1.22	11/26/75	1.03	11/26/75	1.18	11/26/75	1.25	11/26/75	1.31	11/26/75	1.25
12/16/75	1.07	12/ 2/75	1.02	12/ 2/75	1.20	12/ 2/75	1.28	12/ 2/75	1.35	12/ 2/75	1.29
12/23/75	0.99	12/ 9/75	1.00	12/ 9/75	1.18	12/ 9/75	1.24	12/ 9/75	1.33	12/ 9/75	1.28
12/30/75	1.01	12/16/75	0.86	12/16/75	1.01	12/16/75	1.05	12/16/75	1.14	12/16/75	1.09
		12/23/75	0.88	12/23/75	0.96	12/23/75	1.06	12/23/75	1.06	12/23/75	1.01
		12/30/75	0.87	12/30/75	0.97	12/30/75	1.07	12/30/75	1.18	12/30/75	1.12
MEAN=	1.17		1.05		1.20		1.39		1.34		1.48
STD. DEV.=	0.10		0.11		0.10		0.16		0.12		0.26