STREAM FLOW STUDIES IN THE MESILLA VALLEY

By

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INTRODUCTION

All of the work described in this paper was done by members of the staff of the Civil Engineering Department of New Mexico College of Agriculture and Mechanic Arts. The work was financed by the Elephant Butte Irrigation District and under the terms of our contract with them, the results obtained are the exclusive property of the District.

A short description of the physical characteristics of the irrigation system of the valley is necessary in order to see the reasons for the projects undertaken and the relation they bear to each other.

DESCRIPTION OF VALLEY

The Mesilla Valley is approximately 50 miles in length from Leasburg Dam at the north to Courchesne Gap at the south. There are about 78,000 acres under irrigation, of which about 69,000 acres are in New Mexico and 9,000 are in Texas. There are three main canals which carry water from the river. These are:

Leasburg Canal which irrigates about 37% of the valley
Mesilla East Side Canal which irrigates about 21% of the valley
Mesilla West Side Canal which irrigates about 42% of the valley.

A small area, known as the Picacho Area, near the northern end of the valley and west of the river, is irrigated by Leasburg water which reaches the area through a metal flume over the river. This area of 4305 acres, or about 5½% of the valley, was used for a number of special studies because of its size and the ease with which the amount of water delivered to it could be measured.

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1952 STUDIES

The first study undertaken began in September of 1952. It consisted of a collection and study of data available from:

United States Bureau of Reclamation
United States Weather Bureau
International Boundary Commission

Such data as flows, diversions, rainfall, deliveries to the land, wastes and evaporation were collected, tabulated and graphed to make them available for easy reference. The period 1936 through 1951 was considered. This report was completed and submitted in January 1954. Present plans call for bringing it up to date through 1955 this year.

1953 STUDIES

The second study was undertaken during the irrigation season of 1953. This study was made on the Picacho Area and was conducted in order to find the distribution of the water over that section of the project.

A continuous water stage recorder was installed at the inlet of the Picacho Flume. Flow measurements were made at the same location from time to time during the summer. From the quantities measured and the water stage recorder values it was possible to develop a relationship between quantity of flow and stages. This relationship was then used to compute the total flows from the charts produced by the recorder. This technique proved to be satisfactory and has been used on all of the work done on this project.

Analysis of the results of the study including estimates of the probable losses by evaporation and transpiration indicated that a considerable portion of the water was not accounted for in our calculations. The conclusion reached was that either a large amount of water was being lost through seepage or that the ditch riders estimates of deliveries to the land were wrong.

1954 STUDIES

In 1954 the study of the Picacho Area was repeated to check the conclusions reached in 1953. Examination of this

information confirmed the previous conclusion.

In addition, three other studies were undertaken in 1954. The first was an analysis of that part of the Picacho Area served by Lateral A. A weir was built and a recorder installed near the entrance of the Lateral. This recorder showed a total flow for the season of 480 acre feet. Part of this flow came from the Lateral system, and part from a privately owned pump. From the shape of the lines on the recorder graph, it was possible to separate the pump flow from the river water. Our calculations indicated that 200 acre feet was pump flow and 280 acre feet was river water. The ditch riders' estimate for deliveries of water to Lateral A was 271 acre feet.

The second study of this season was a soil study of the Lateral A area. Holes were drilled or dug adjacent to the Lateral and measurements made to locate the water table. This work was carried on by students in the departments of Agricultural Engineering and Civil Engineering. The conclusions reached from this study were that silt in the ditch bottom provided a good seal and reduced seepage losses. Scour of this silt by high velocity flows would increase losses. It was decided to recommend to the Irrigation District that a study be made of the Picacho Area during 1955 in an attempt to locate areas where high losses occurred regularly.

A small amount of preliminary work was done during this season on ground-water observations. Mr. Fields, of the department of Mechanical Engineering made observations on his well in Mesilla Park and compared the results with the level of water in the park drain near by. No important numerical values were obtained, but as a result of the information gathered it was decided that an investigation of ground-water levels was needed.

1955 STUDIES

The field work during the 1955 irrigation season was divided into three main studies. These were:

Seepage study in Picacho Area.
River flow study
Ground-water investigation

As a result of the conclusions reached in the 1954 soil

study, an intensive investigation of the soils in the bottom of the canals in the Picacho Area was made. The entire canal system was examined visually and 32 samples of the canal bottom material were obtained on which permeability tests were run in the laboratory. In addition, a piece of equipment was developed from which measurements of seepage losses in place could be made.

A laboratory experiment was developed in which silt was allowed to deposit itself on a sample of sand and the change in the seepage losses was measured. It was found that as little as 0.2#/sq. ft. of silt settling on a sample cut the seepage by 97%, but the silt film dried, cracked, and was washed away by the next flow.

The conclusions reached in this study were that the first few inches of soil in ditch bottom offer most of the resistance to seepage and are saturated. Soil below this level is not saturated so that the distance to water table has no effect on seepage losses. Another conclusion was that the amount of loss from any section of canal varied greatly depending on conditions of flow and on previous history of flow.

The study of flow in the river was accomplished by means of gauging stations installed as follows:

Leasburg Cable
Mesilla Bridge (Mar 21 - Apr 5)
Highway 28 Bridge
Anthony Bridge
Vinton Bridge (June 10 on.)
Courchesne

Flows obtained in these stations were combined with data available on drain returns, wasteway flows, and arroyo flows to produce calculated values for losses from various reaches of the river. The results obtained in this study were:

1. The river is a perched water table

2. Rainfall during the irrigation season on the Mesilla Valley has a considerable effect on apparent losses from the river

Staten, Glen	Experiment Station
Stephens, W. P.	Agricultural Economics
Stucky, H. R.	Agricultural Economics
Sullivan, Darrell	Horticulture
Tejada, Jacob	Extension Service
Thomas, John W.	Agricultural Economics
Triviz, A. E.	Extension Service
Valentine, K. A.	Animal Husbandry
Vandecaveye, S. C.	Agronomy
Watts, J. G.	Biology
Williams, B. C.	Agronomy
Yager, Thomas U.	Soil Conservation Service

Students

Ales, Don	Agricultural Education
Arizo, Ted	Animal Husbandry
Biad, Victor	Civil Engineering
Binns, Eddie	Civil Engineering
Chavez, A. E.	Animal Husbandry
Davis, William R.	Civil Engineering
DeOliviera, Ralph	Animal Husbandry
Flowers, R. N.	Civil Engineering
Geer, Hunter L.	Agricultural Economics
Gonzales, M. E.	Agricultural Economics
Gross, Louis	Civil Engineering
Hix, Marvin	Agricultural Engineering
Hodge, John	Geology
Hogsett, Ted C.	Civil Engineering
Jenkins, Lloyd	Civil Engineering
Jones, David	Civil Engineering
Livingston, Leon	Civil Engineering
Lujan, Lawrence	Geology
Mayfield, Bob	Agricultural Economics
Miller, Wallace T.	Engineer
Moreno, Louis	Electrical Engineering
Naul, B. D.	Agricultural Economics
O'Brien, Walt	Geology
Parra, James	Civil Engineering
Pilley, Claude	Civil Engineering
Rivera, Luther	Agricultural Engineering
Robinson, Phil	Geology
Sanders, B. K.	Civil Engineering
Saunders, Gary	Geology
Shelley, Thomas R.	Agricultural Engineer
Stallings, Jack	Agricultural Engineer
Vance, Howard	Agricultural Engineer
Vigil, Lawrence D.	Civil Engineering
Wheeler, Wayne	Agronomy
Wicker, Clabe	Civil Engineering
Wilkes, Lambert H.	Agricultural Engineer

Others

Alberson, Ken	Soil Conservation Service, USDA
Duesberg, Peter	El Paso, Texas
Elmendorf, Harold B.	Soil Conservation Service
Fletcher, Joel E.	Soil Scientist, Tucson
Freudenthal, L. E.	Farmer
Gilman, Virgil	Extension Service, USDA
Gregg, John L.	Elephant Butte Irrigation District, Las Cruces
Hall, Dale	State Engineer's Office
Hardaway, George	U. S. Forest Service, Albuquerque, N.M.
Hedges, Frank R.	Soil Conservation Service
Hill, Leon	Bureau of Reclamation
Jordan, D.	State Engineer's Office
Moser, Theodore H.	Bureau of Reclamation
Putman, Lewis T.	State Engineer's Office
Redmond, J. L.	Corps of Engineer's Office, Albuquerque, N.M.
Reynolds, S. E.	State Engineer's Office
Thomas, Merton G.	Agricultural Engineer, Iowa
Worthen, C. H.	Bureau of Reclamation
Young, R. A.	Soil Conservation Service

3. Low flows in the river should be avoided since the per cent of water losses under these conditions is a maximum.

The ground-water study consisted entirely of a review of data available. This data was plotted to give a picture of ground-water conditions in the valley. The general pattern for the ground-water is as follows:

1. The slope of the water table down the valley is 4½ ft. per mile

2. The slope of the water table from the west into the valley is 3½ ft. per mile

3. The slope of the water table from the east into the valley adjacent to the Organ Mountains is 15 ft. per mile

4. There is no data available on the water table on the east side of the valley from Berino south to Courchesne.

A typical example of the weakness of the information presently available on ground-water conditions in the Mesilla Valley is shown by the available data on the underground flow through the Pass at Courchesne. Borings were made by a Mexican commission in 1897 which indicated that the depth to rock was 86 ft. Underground flow measurements were made by Slichter in 1907 which indicate that there is no flow at a depth of 42 ft. below the surface. However, the method used by Slichter is one that is now not acceptable.

CONCLUSION

The study for the current season has had to be reduced to a continuation of the river study. The well-publicized shortage of engineers made it impossible to obtain the manpower for any other work. We hope to be able to conduct a more extensive study of one reach of the river and the relation it bears to the water table next year if we can find the manpower and if funds are then available.