University of Nevada

Reno

An Evaluation of a Variable Water Supply for Lovelock Valley, Nevada

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Hydrology

by

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August 1967

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August 1967

ABSTRACT

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This study determines the value of a variable surface-water supply in Lovelock Valley, Nevada from 1953 to 1963. The effects of uncertainty of water supply are considered in the analysis by using a decision model. Economic principles and statistical methods are used in application of the model. The major conclusion is that average value of water for irrigation at maximum production is $4.88 per acre-foot when 89,900 acre-feet of water is delivered at the farm headgate. Other facts and relationships derived were marginal value of water, effect of price on decisions, frequency of irrigation deliveries, and loss in net revenue that occurs when a water supply less than 89,900 acre-feet is delivered.

ACKNOWLEDGMENT

The author wishes to express appreciation to Dr. George B. Maxey for his support and confidence, Patrick A. Domenico for his guidance and criticisms, and George B. Moseley of the Pershing County Water Conservation District for his helpfulness in supplying data essential to the study.

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Purpose and Scope

The Desert Research Institute at the University of Nevada is currently engaged in a system analysis of Humboldt River basin in northern Nevada for the purpose of developing a feasible plan for management of both ground-water and surface-water resources. Currently primary use of the surface-water resource is for irrigation. Before a successful plan for management can be developed several relationships must be known. Three questions needing answers are:

(1) What has been the value of surface-water to users?

(2) What have been the losses in net benefits resulting from an insufficient supply of irrigation water?

(3) Is there a demand for additional water?

This study attempts to answer these and other related questions for Lovelock Valley located in the lower reach of Humboldt Basin.

Irrigators in Lovelock Valley do not receive a constant annual water supply. Runoff from upper Humboldt Basin is primarily a function of snowpack melt in the watershed. Even with the storage in Rye Patch Reservoir, completed in 1936 by the Bureau of Reclamation, uncertainty remained in the amount of irrigation water annually available to irrigators. This uncertainty complicates an analysis of these questions concerning water supply. In order to consider uncertainty in this analysis, a decision model presented by Hildreth (1957) was applied to the Lovelock area.

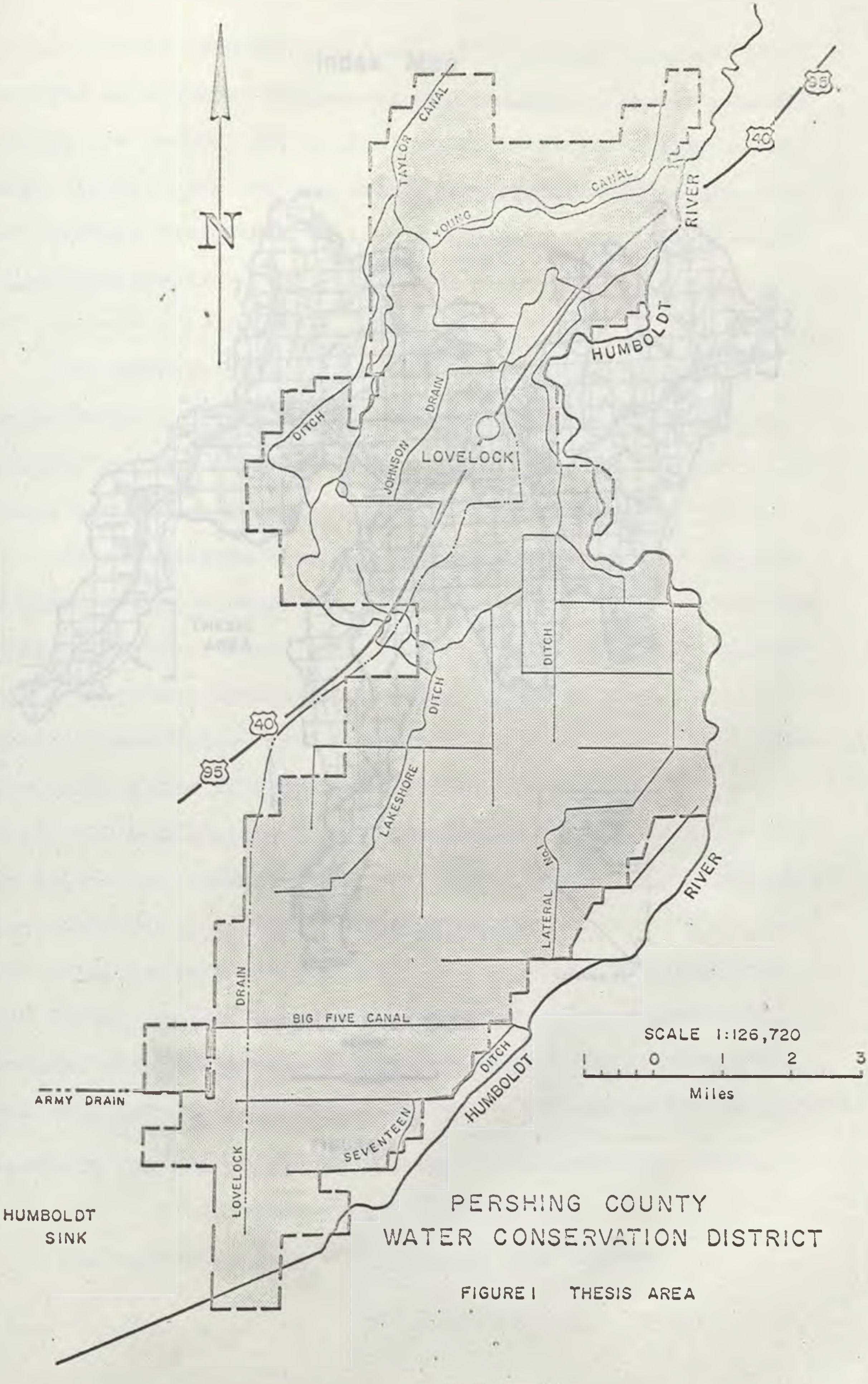
Statistical methods and economic principles will be used to determine relationships in this analysis. Linear correlation, curvilinear regression, and cumulative frequency analysis are statistical tools to be used. Production function theory will be used to determine the value of surface water to the users.

Location

The thesis area is Pershing County Water Conservation District in Lovelock Valley (Figure 1). Nearly all irrigation in the Valley is within the District.

Lovelock Valley is in northeastern Nevada, almost entirely in the southern part of Pershing County, except for the extreme southern part which is in Churchill County (Figure 2). The Valley extends southwestward from Rye Patch Dam on Humboldt River to the Humboldt Sink. The area, approximately 45 miles long and 18 miles wide, encloses about 740 square miles (Everett and Rush, 1965). On the east side is Humboldt Range and West Humboldt Range, and on the west side is Trinity Range. Southern Pacific Railroad and U.S. Highway 40 pass through the Valley and Lovelock, the principal city with a population of 1,948 in 1960.

The climate in the Valley is arid, with warm summers and mild winters. Precipitation and humidity generally are low and summer evaporation rates are high. Much of the precipi-



PERSHING COUNTY
WATER CONSERVATION DISTRICT

FIGURE I THESIS AREA

Index Map

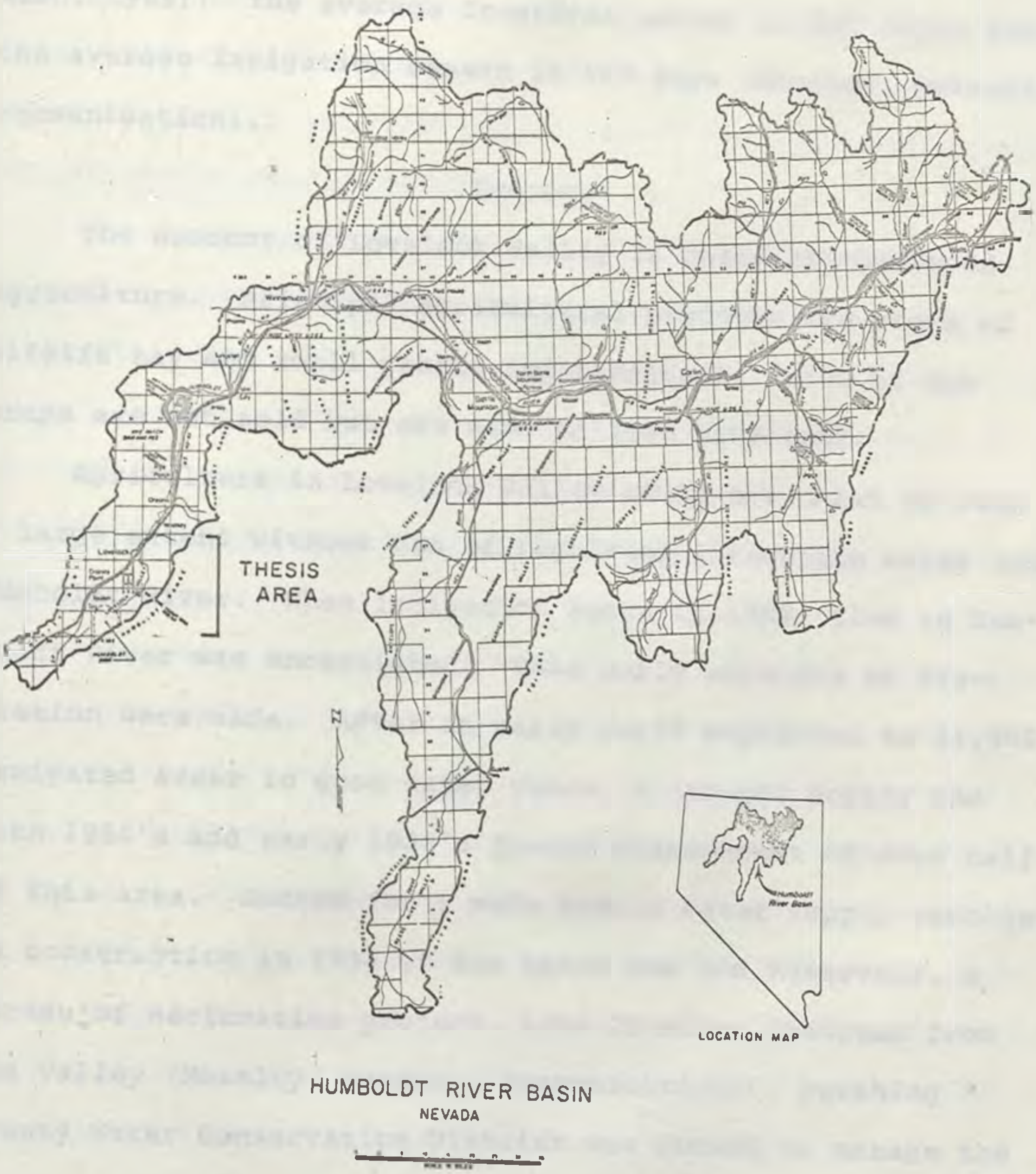


FIGURE 2

tation occurs as snow in winter and localized thundershowers in summer. Average annual precipitation at Lovelock during the period 1891 to 1963 was 5.78 inches (Everett and Rush, 1965). The average frostfree period is 133 days, and the average irrigation season is 180 days (Moseley, personal communication).

Economy

The economy of Lovelock Valley is based primarily on agriculture. Principal agricultural products are crops of alfalfa hay and small grains and livestock. Most of the crops are not sold but are used to feed livestock.

Agriculture in Lovelock Valley would not exist to such a large extent without use of regulated irrigation water from Humboldt River. When irrigation began in 1862, flow in Humboldt River was unregulated. Some early arrempts at regulation were made. After an early rapid expansion to 24,000 irrigated areas in good water years, a drought during the late 1920's and early 1930's forced abandonment of over half of this area. Demand for a more stable water supply resulted in construction in 1936 of Rye Patch Dam and Reservoir, a Bureau of Reclamation project, some 25 miles upstream from the Valley (Moseley, personal communication). Pershing County Water Conservation District was formed to manage the resource and is the contracting entity for repayment of project costs to the United States (Bureau of Reclamation, 1952).

Sources and Type of Data

The following data were used in this thesis:

Total amounts of water released from Rye Patch Reservoir, amounts at the head of canals, and amounts delivered to the farms are reported by Pershing County Water Conservation District's annual summaries. Lateral losses between head of canals and farm headgates are also given. Amounts of water diverted monthly are reported in the summaries. These records are available only from 1949.

The Pershing County Water Conservation District annual summaries report crop data from the area serviced by the district. Crop yield, crop acreage, unit prices, crop values, as well as acres irrigated are given. This information is printed by the Bureau of Reclamation in the report, Federal Reclamation Projects, Statistical Appendix to Crop Report and Related Data.

Production costs for crops were derived from data prepared cooperatively by Soil Conservation Service and Big Meadow Soil Conservation District cooperators. There is no direct unit cost for irrigation water, but operation and maintenance costs of Pershing County Water Conservation District are assessed as a land tax to irrigators. This assessment was considered as an annual cost of water and was used in deriving net benefits from irrigation water. The average annual assessment was derived from data supplied by the District.

DECISION MODEL FOR UNCERTAINTY

Building of Rye Patch Reservoir has partially stabilized the supply of irrigation water in Lovelock Valley, but several consecutive years of low flow on Humboldt River (1954, 1955 and 1959 to 1961) have shown that use of the reservoir cannot guarantee enough irrigation water to meet the demand. Uncertainty exists as to the amount of irrigation water that will be available next year. When an insufficient supply of irrigation water is available, agricultural producers in Lovelock Valley must make immediate decisions as to its best use.

A theoretical framework of a decision model for uncertainty is given by Hildreth (1957). Hildreth states, "Parts of a decision problem are sets of possible events, actions, strategies, and consequences; a criterion for ordering the consequences; and function assigning a consequence to each pair consisting of an action and an event."

An event, as defined by Hildreth, "is a circumstance or combination of circumstances relavent to the decision-maker's welfare and behavior but outside his control." Events considered in this study are prices and surface-water deliveries. The price that occurred in any year is denoted by z_p of the set of possible prices denoted by Z_p. Similarly, irrigation water deliveries are denoted by the same letters z_w and Z_w. The set used in this study was the range of prices and surface-water deliveries during 1953 to 1963.

An action, x, is the decision-maker's response to an event. Actions considered in this study are the number of acres irrigated annually.

A strategy, σ, is defined by Hildreth as a function that designates an action corresponding to a given event and can be written

$$x = \sigma(z). \tag{1}$$

Hildreth states, "Thus a strategy is a way of reacting to events in one's environment. For theories of behavior under uncertainty it is important to note that, whereas the set of possible actions depends on which event obtains, the set of possible strategies is independent of events."

A consequence, Y, is a result of actions and events. Net revenue resulting from a selection of inputs was the consequence considered in this study. The functional relationship can be written

$$Y = \eta(x,z). \tag{2}$$

This equation states that the consequence is a function of actions and events.

A criterion is the monetary valued function of consequences. Hildreth expresses a criterion function with the notation

$$U = \Phi(Y) \tag{3}$$

and using (2)

$$U = \Phi[\eta(x,z)] = \Psi\ (x,z). \tag{4}$$

Equation (4) states that value is a function of actions and events.

This model was presented as a guide to economic principles involved in determining strategy irrigators use when faced with an uncertain water supply.

APPLICATION OF THE DECISION MODEL OF UNCERTAINTY TO LOVELOCK VALLEY

Strategy Function

Uncertain events that influence actions of agricultural producers in Lovelock Valley can be analyzed by the strategy function (Equation 1). Although decision criteria for each uncertain event may be different for each individual agricultural producer, the strategy function indicates an aggregate reaction of all agricultural producers to a selected uncertain event. Two events, price and an uncertain irrigation supply, and two actions, the total number of acres irrigated and number of acres of alfalfa and other crops irrigated, can be readily analyzed from available data. These are only two pair of many possible combinations of actions and events.

INFLUENCE OF PRICE ON DECISIONS

A basic assumption underlying an economic analysis is that agricultural producers desire to maximize their income for their efforts. This assumption may or may not be true. On the basis of this assumption, market price may be an important factor in the strategy and resulting actions of the agricultural producer.

The return that an agricultural producer will receive next year for his crop is an uncertain event, but previous years' prices may be an indication of what the price may be the following year. Action resulting from previous prices is the number of acres of a particular crop grown that year. A linear correlation analysis was used to attempt to determine the effect of previous price on number of acres irrigated of four crops. These four crops comprise, on the average, about seventy to eighty-five percent of total acreage irrigated annually. The results are given in table 1.

Table 1.

Correlation Coefficients of Previous Unit Prices and Acres Irrigated the Following Year

Crop	Previous Year's Price	Previous Two Year Average	Previous Three Year Average	Previous Trend
	Correlation Coefficients of			
Barley	.262	.174	.123	-.076
Wheat	.105	-.078	.030	.021
Alfalfa	.167	-.063	.226	.029
Irrigated Pasture	-.343	-.713*	-.294	-.241

* Significant at the five percent level

Previous year's unit price is not significantly correlated at the five percent level with number of acres of a crop irrigated in the following year. A significance level is the probability of rejecting a hypothesis that is correct or accepting a hypothesis that is incorrect.

Previous two- and three-year averages indicate general market conditions for those years. With the exception of irrigated pasture, there was no significant correlation at the five percent level of significance. There was significant correlation between the previous two year average and number of acres of pasture irrigated the following year probably because total number of acres of pasture irrigated and unit price exhibited a general decline during the period of analysis (Appendix B).

Previous trend indicates whether prices rose or declined during the two previous years. There was no significant correlation at the five percent level between previous trend and number of acres irrigated the following year.

The general conclusion is that price is not the primary determining factor in the strategy of the agricultural producer in Lovelock Valley. Variation in price can account for only a small percentage of variation in number of acres of pasture irrigated which comprises only 15 percent, on the average of total number of acres irrigated annually (Appendix B).

INFLUENCE OF SURFACE-WATER DELIVERIES ON DECISIONS

Data on delivery at the farm headgate of surface water show that annual supply is not constant (Appendix D). Since supplemental water is an uncertain event, actions are related to the uncertain event by the strategy function. The general form of the equation is

$$x = \sigma(z_w)$$

where

z_w = amount of irrigation water delivered at the farm headgate in acre-feet

x = total number of acres irrigated.

Correlation and regression by the method of least squares were used to analyze the data. Several standard mathematical equations were used in attempting to correlate the data. The regression equation that resulted in the highest significant correlation coefficient (r = .87) was

$$\log x = 3.4067 + .2102 \log z_w$$

where

z_w = amount of irrigation water delivered at the farm headgate in acre-feet

x = estimated total number of acres irrigated.

A plot of the data and regression line is shown in Figure 3. The coefficient of determination, r^2, indicates that variation in supply of irrigation water accounts for 76 percent of variation in number of acres irrigated. The general conclusion is that variation in amount of irrigation water available is the most important factor in the strategy of the agricultural producer in Lovelock Valley.

The next step in the analysis was to determine overall strategy used with an uncertain water supply. Crops grown in Lovelock Valley were divided into two types, alfalfa and other crops. Annual variation in acreage of alfalfa and other crops as compared to annual variation in surface-water delivered can be seen in Figure 4.

There is little variation in acreage of alfalfa as compared to variation in surface water delivered. Acreage of other crops seem to vary as variation in surface-water deliveries. This result was to be expected as alfalfa is a perennial crop with an average stand life from seven to nine years. Overall acreage of alfalfa is probably based on

Regression between Irrigation Deliveries and Acres Irrigated

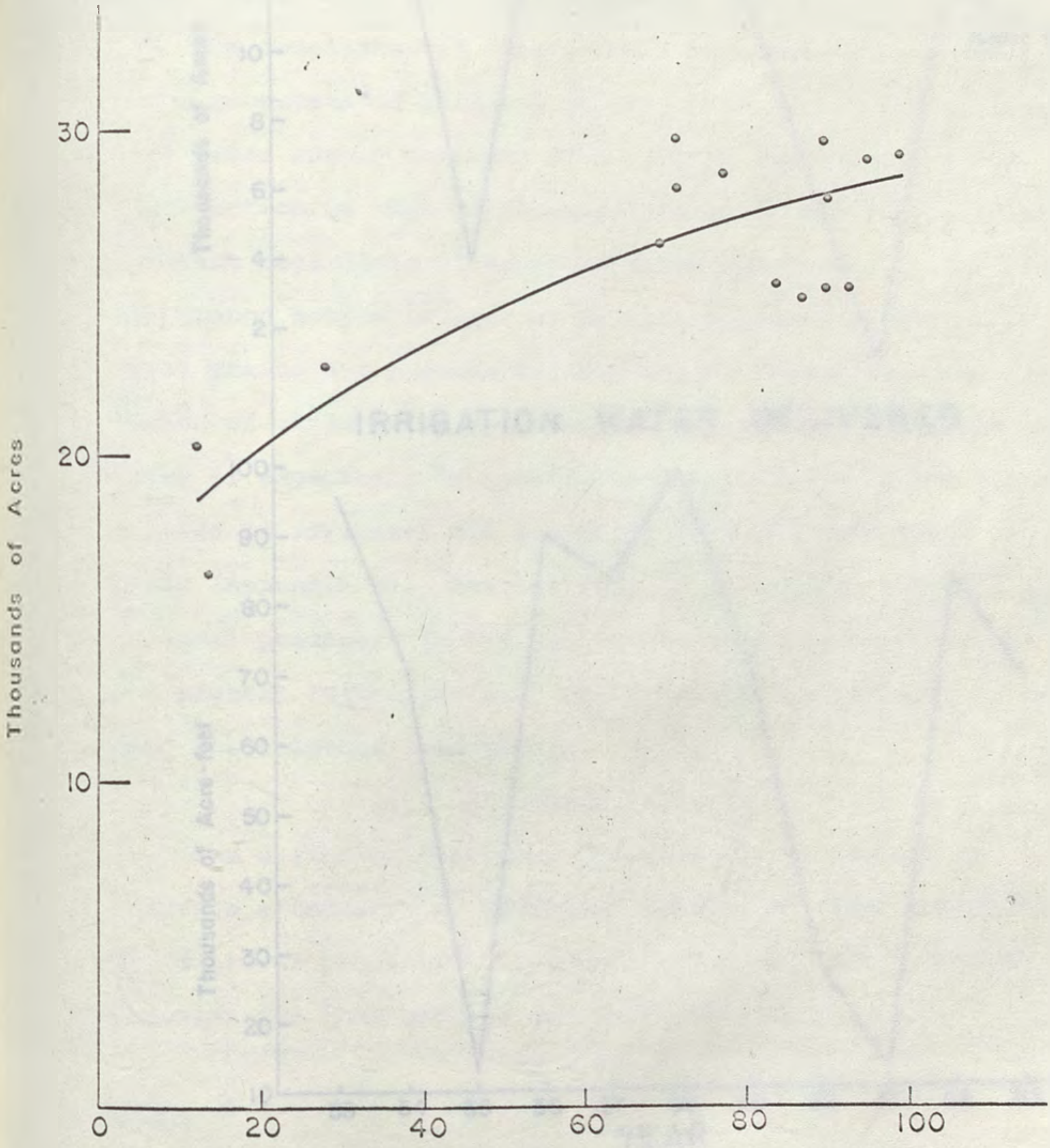
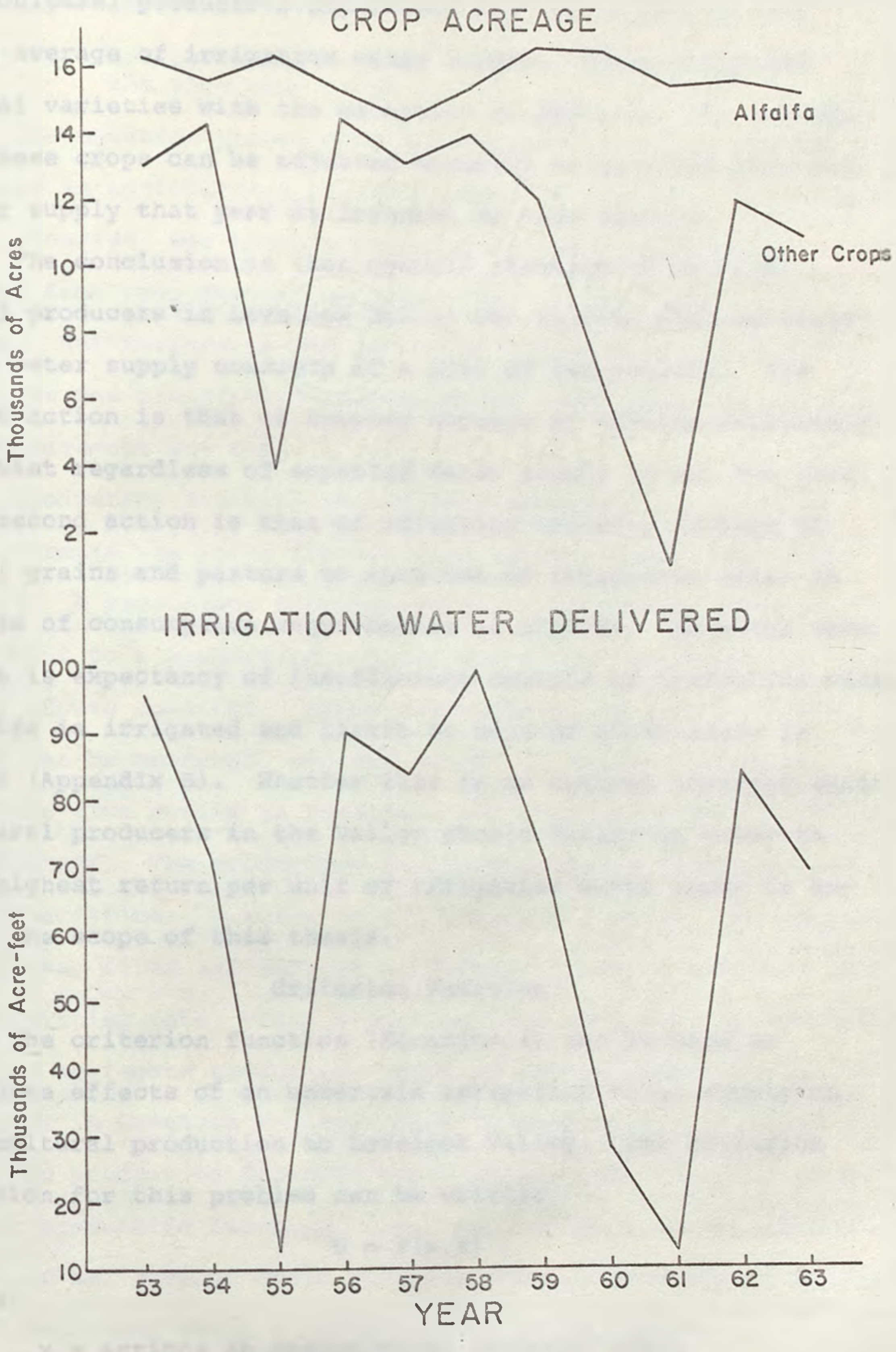


Figure 3



CROP ACREAGE
Alfalfa
Other Crops
Thousands of Acres
16
14
12
10
8
6
4
2
IRRIGATION WATER DELIVERED
Thousands of Acre-feet
100
90
80
70
60
50
40
30
20
10
53
54
55
56
57
58
59
60
61
62
63
YEAR

Figure 4

agricultural producer's experience and influenced by long term average of irrigation water supply. Other crops are annual varieties with the exception of pasture. The acreage of these crops can be adjusted annually to meet the expected water supply that year as forecast by snow surveys.

The conclusion is that overall strategy of agricultural producers in Lovelock Valley who operate with an uncertain water supply consists of a plan of two actions. The first action is that of keeping acreage of alfalfa relatively constant regardless of expected water supply in any one year. the second action is that of adjusting annually acreage of small grains and pasture to make use of irrigation water in excess of consumptive requirements of alfalfa. In years when there is expectancy of insufficient amounts of irrigation water, alfalfa is irrigated and little or none of other crops is grown (Appendix B). Whether this is an optimum strategy agricultural producers in the Valley should follow in order to get highest return per unit of irrigation water input is beyond the scope of this thesis.

Criterion Function

The criterion function (Equation 4) can be used to evaluate effects of an uncertain irrigation water supply on agricultural production to Lovelock Valley. The criterion function for this problem can be written

$$U = \Psi(x,z)$$

where

x = actions an agricultural producer makes

z = uncertain event

U = net revenue resulting from actions taken when the uncertain event occurs.

The equation states that net revenue is a function of actions an agricultural producer makes in response to events that occurred. Net revenue is equal to total revenue received from crop production minus cost of producing those crops. Net revenue is the return an agricultural producer receives for his capital investment in land and water and for his management and time.

Production function theory from economics can be used to determine the value derived from surface water for irrigation. A production function is the relationship between one input to a production process and output assuming all other inputs constant. Other assumptions are that variable input can be measured, without error, in continuous units, that one time period is involved, and that state of the art is constant. The production function displays the following characteristics: returns to the variable input as the variable increases, first increase at an increasing rate, increase at a diminishing rate, reach a maximum, and then decline absolutely.

An aggregate production function was derived for the District in Lovelock Valley. This researcher hypothesized that the production function would approximate the form of a normal production function, i.e., production as measured in terms of net revenue would increase with an increase in surface water delivered until a certain point, then decline.

The aggregate production function can be defined in terms of the criterion function. The criterion function can be written

$$U = \Psi(x, z_w)$$

where

x = actions the agricultural producers make

x_w = variable input, i.e., the amount of surface water delivered (an uncertain event)

U = net revenue resulting from actions and the variable input.

Available data does not allow incorporation of actions (x) that agricultural producers make in the production process. Therefore, actions (x) are unaccountable variables that add to variation of data in the criterion function. In the normal production function actions (x) are held constant. In the definition of the criterion function above, assumptions of the normal production function were violated. The effect of violating the assumptions of the normal production function are discussed in an unpublished Master's thesis by McCoy (1963). McCoy derived an aggregate production function for Newlands Project in Nevada. His conclusion was that these violations were not material within the relavant range considered.

A period of time was chosen for study after the developmental stage of agriculture in the Valley was completed as evidenced by relatively continuous expansion of acreage being irrigated (Appendix B). Thirteen years of data, from 1953 to 1965, met this condition. The years 1964 and 1965 were omitted from the study because introduction of large acreages of sugar beets biased upward the net return to surface water.

Curvilinear regression analysis was used to quantify the criterion function. A plot of the data and the regression curve is shown in Figure 5. The resulting equation was

$$U = -322.7732 + 16.8337z_w - .0936z_w^2$$

where

z_w = thousands of acre-feet of surface water delivered at the farm headgate

U = estimated thousands of dollars of net revenue.

The regression coefficient (r = .89) indicates a highly significant relationship (1 percent level) between acre-feet of surface water delivered at the farm headgate and thousands of dollars of net revenue. The coefficient of determination indicates that variation in amount of irrigation water available accounts for 79 percent of variation in net revenue received from crop production. An F test indicates the level of significance of z^2 in this regression equation is 16.5 percent.

Maximum production occurs where the first derivative of the above equation equals zero. Average net revenue received as a function of irrigation water can be determined by dividing the estimated net revenue at maximum production by the amount of irrigation water delivered. The average net revenue at maximum production from irrigation water between 1953 and 1963 is estimated to be $4.88 per acre-foot when 89,900 acre-feet of irrigation water is delivered.

Level of input of irrigation water that gives the maximum

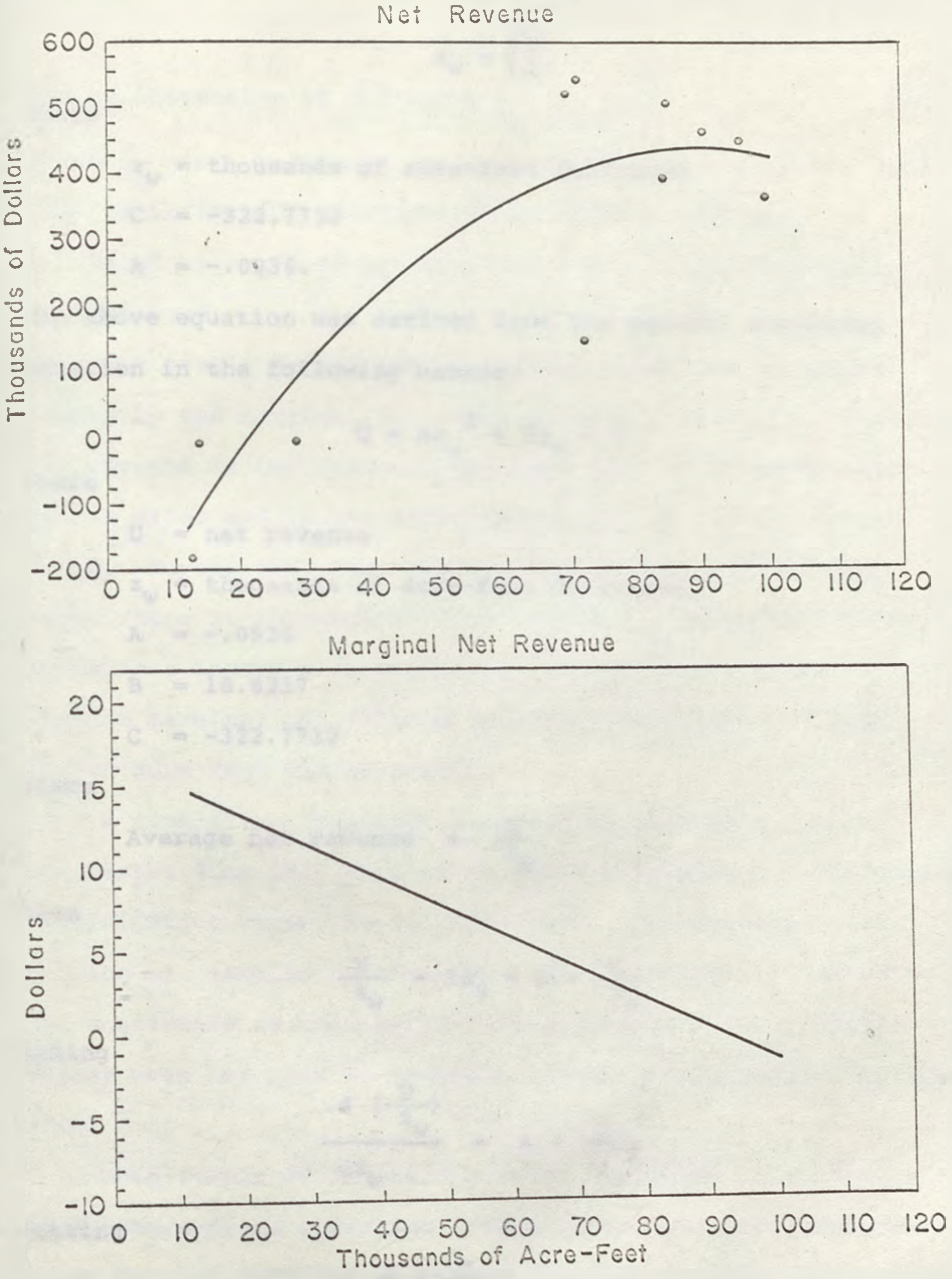

Net Revenue
Thousands of Dollars
600
500
400
300
200
100
0
-100
-200
0 10 20 30 40 50 60 70 80 90 100 110 120
Marginal Net Revenue
Dollars
20
15
10
5
0
-5
-10
0 10 20 30 40 50 60 70 80 90 100 110 120
Thousands of Acre-Feet

Figure 5

average net revenue per acre-foot is given by the equation

$$z_w = \sqrt{\frac{C}{A}}$$

where

z_w = thousands of acre-feet delivered

C = -322.7732

A = -.0936.

The above equation was derived from the general quadratic equation in the following manner

$$U = Az_w^2 + Bz_w + C$$

where

U = net revenue

z_w = thousands of acre-feet delivered

A = -.0936

B = 16.8337

C = -322.7732

since

$$\text{Average net revenue} = \frac{U}{z_w}$$

then

$$\frac{U}{z_w} = Az_w + B + \frac{C}{z_w}$$

taking

$$\frac{d\left(\frac{U}{z_w}\right)}{dz_w} = A - \frac{C}{z_w^2}$$

setting

$$\frac{d\left(\frac{U}{z_w}\right)}{dz_w} = 0$$

therefore

$$z_w = \sqrt{\frac{C}{A}}$$

and by inspection of the curve $\frac{U}{z_w}$, $z_w = \sqrt{\frac{C}{A}}$ is the point at which $\frac{U}{z_w}$ is a maximum. Maximum average net return per acre-foot of irrigation water delivered between 1953 and 1963 is estimated to be $5.84 per acre-foot when 58,700 acre-feet is delivered.

The area's demand for irrigation water can be approximated by the marginal net revenue curve (Figure 5). Marginal net revenue is the value of the next unit of input of irrigation water and is the first derivative of the net revenue curve. Beyond the point where marginal net revenue equals zero, there is theoretically no demand for irrigation water, as further inputs will result in less total net revenue. Highest marginal net revenue is $15.71 per acre-foot when 12,500 acre-feet was delivered.

A cumulative frequency analysis of irrigation water deliveries from 1949 to 1965 is shown in Figure 6. The quantity of irrigation water, 89,900 acre-feet, that maximizes production was equaled or exceeded only 35 percent of the time. The conclusion is that agricultural producers in Lovelock Valley were not able to maximize production 65 percent of the time.

When amount of irrigation water delivered is less than 89,900 acre-feet, a decline in net revenue occurs. This decline derived from the criterion function is shown discreetly

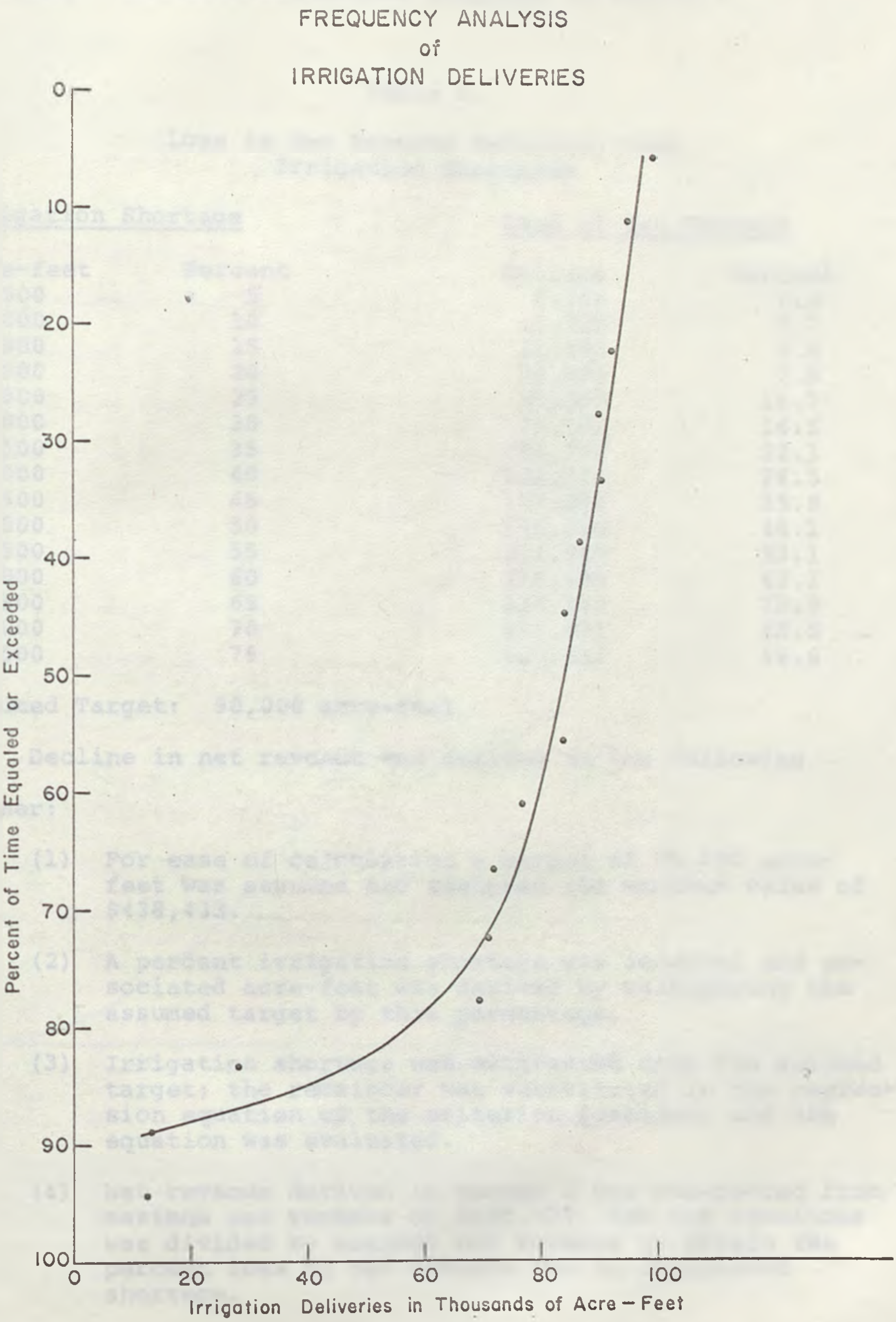

FREQUENCY ANALYSIS
of
IRRIGATION DELIVERIES
Percent of Time Equaled or Exceeded
0
10
20
30
40
50
60
70
80
90
100
0
20
40
60
80
100
Irrigation Deliveries in Thousands of Acre – Feet

Figure 6

in Table 2 and as a continuous function in Figure 7.

Table 2.

Loss in Net Revenue Resulting From Irrigation Shortages

Irrigation Shortage		Loss of Net Revenue	
Acre-feet	Percent	Dollars	Percent
4,500	5	6,164	1.4
9,000	10	11,786	2.7
13,500	15	21,198	4.8
18,000	20	34,026	7.8
22,500	25	51,397	11.7
27,000	30	72,182	16.5
31,500	35	96,757	22.1
36,000	40	125,124	28.5
40,500	45	157,282	35.9
45,000	50	193,230	44.1
49,500	55	232,969	53.1
54,000	60	276,499	63.1
58,500	65	323,819	73.9
63,000	70	374,931	85.5
67,500	75	429,833	98.0

Assumed Target: 90,000 acre-feet

Decline in net revenue was derived in the following manner:

(1) For ease of calculation a target of 90,000 acre-feet was assumed and assigned the maximum value of $438,433.

(2) A percent irrigation shortage was selected and associated acre-feet was derived by multiplying the assumed target by this percentage.

(3) Irrigation shortage was subtracted from the assumed target; the remainder was substituted in the regression equation of the criterion function; and the equation was evaluated.

(4) Net revenue derived in Number 3 was subtracted from maximum net revenue of $438,433, and the remainder was divided by maximum net revenue to obtain the percent loss of net revenue due to irrigation shortage.

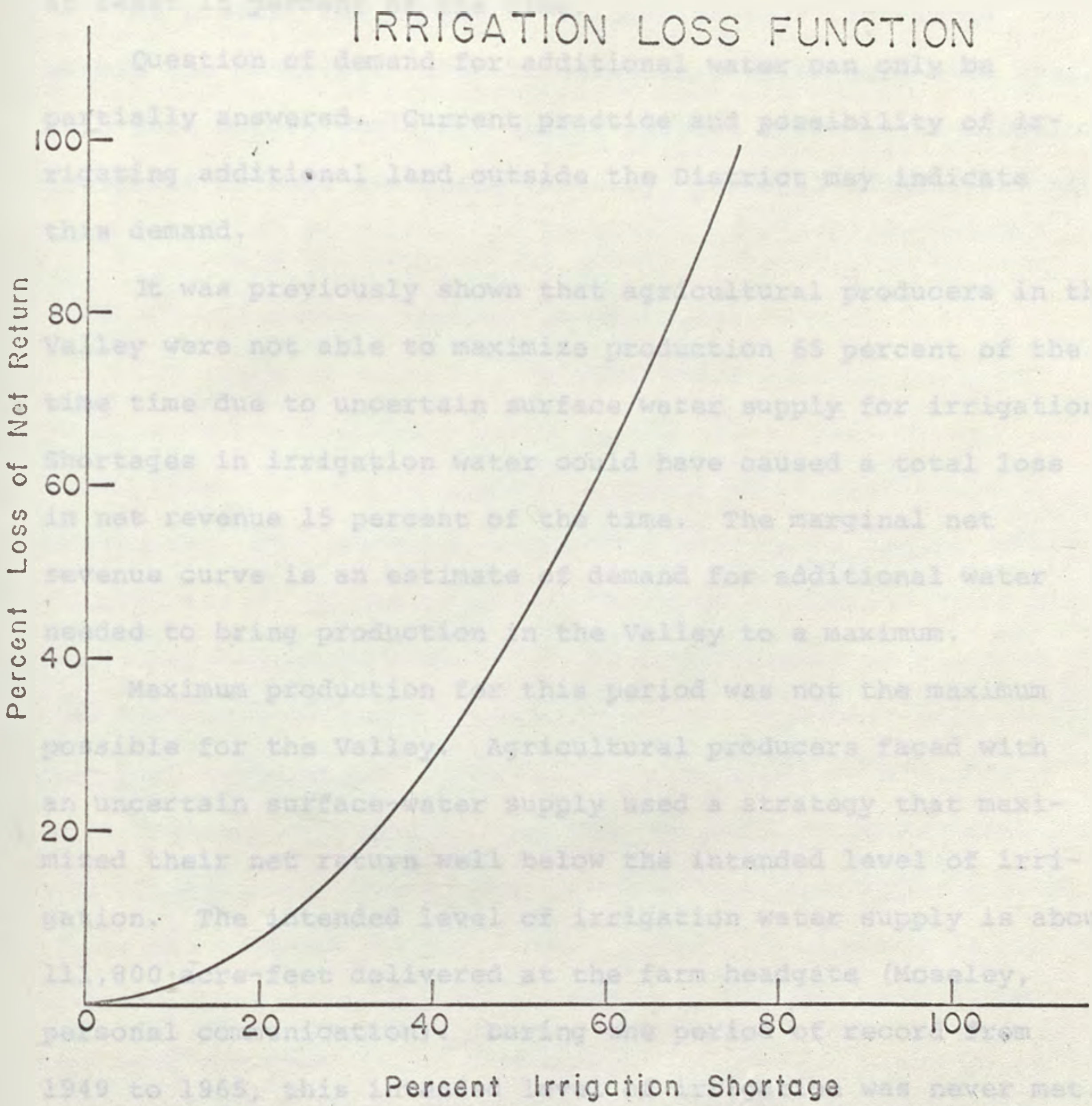

IRRIGATION LOSS FUNCTION
Percent Loss of Net Return
100
80
60
40
20
0
20
40
60
80
100
Percent Irrigation Shortage

Figure 7

When an irrigation shortage of 76 percent occurs a total loss in net revenue occurs. The cumulative frequency curve indicates that a total loss in net revenue could have occurred at least 15 percent of the time.

Question of demand for additional water can only be partially answered. Current practice and possibility of irrigating additional land outside the District may indicate this demand.

It was previously shown that agricultural producers in the Valley were not able to maximize production 65 percent of the time time due to uncertain surface water supply for irrigation. Shortages in irrigation water could have caused a total loss in net revenue 15 percent of the time. The marginal net revenue curve is an estimate of demand for additional water needed to bring production in the Valley to a maximum.

Maximum production for this period was not the maximum possible for the Valley. Agricultural producers faced with an uncertain surface-water supply used a strategy that maximized their net return well below the intended level of irrigation. The intended level of irrigation water supply is about 111,800 acre-feet delivered at the farm headgate (Moseley, personal communication). During the period of record from 1949 to 1965, this intended level of irrigation was never met. If irrigation water supply were constant at the intended level, uncertainty would no longer exist, and the maximum net revenue would be expected to occur at the intended level. Also, maximum net return is expected to be greater than at the present level because more efficient use of irrigation water would probably occur.

At present the target of irrigation is 37,283 acres within the District. Even if additional water were made available this target would not change because there is no additional irrigable acreage available (Moseley, personal communication).

CONCLUSIONS

Several facts and relationships that must be known before a plan for management of water resources of Humboldt River basin can be formulated are determined in this study of Lovelock Valley. Three major questions that are answered include:

(1) What has been the value of the water resources to the users?

(2) What have been the losses in net revenue resulting from an insufficient supply of irrigation water?

(3) Is there a demand for additional water?

The value of water may be defined as average value or marginal value. Average value in this study was defined as net revenue divided by number of acre-feet of surface water delivered. Average value at maximum production during 1953 to 1963 was $4.88 per acre-foot and maximum average value was $5.84 per acre-foot. Marginal value is defined as value of the next unit of input to the production process. Highest marginal value during 1953 to 1963 was $15.71 when 12,500 acre-feet was delivered. Marginal value linearly declines and becomes zero when 89,900 acre-feet is delivered. Beyond where the marginal value of water equals zero, there is theoretically no further demand for water as maximum production has been reached.

When surface-water deliveries are below the level for maximum production, losses in net revenue occur. A total loss in net revenue occured when there was a 76 percent irrigation shortage. A cumulative frequency analysis of surface-water deliveries showed that a total loss in net revenue occurred 15 percent of the time during 1953 to 1963.

Question of demand for additional water was partially answered. Agricultural producers were unable to produce at the maximum level 65 percent of the time during 1953 to 1963, due to an uncertain surface-water supply. Present maximum level of production is well below what could be achieved if intended level of irrigation water delivery, 111,800 acre-feet, were constant. During the period 1949 to 1965 intended level of irrigation never occurred. Availability of additional water would not change the present target of irrigation, 37,283 acres, because there is no additional irrigable acreage in the valley.

Other relationships derived in this study were:

(1) Price is not the primary determining factor in the strategy of the agricultural producer in Lovelock Valley.

(2) Available surface-water supply is the primary determining factor in the strategy.

(3) General strategy of the agricultural producer is to keep acreage of alfalfa relatively constant regardless of expected water supply in any one year and to adjust annually acreage of small grains and pasture to make use of irrigation water in excess of the consumptive requirements of alfalfa.

(4) Significant technological change biased the aggregate production function used in analysis of the value of water as evidenced by the introduction of large acreages of sugar beets.

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APPENDICES

Appendix A

Data Used in Analysis of Effect
of
Previous Prices on Production

DATA USED IN ANALYSIS OF EFFECT

OF UNIT PRICE ON PRODUCTION

Barley

Acres Irrigated	Previous Year's Price	Previous Trend	Previous Two Year Average	Previous Three Year Average
5,070	$1.19	$ .13	$1.26	$1.26
9,890	1.32	0	1.32	1.28
6,670	1.32	-.08	1.26	1.28
4,670	1.20	-.20	1.10	1.17
2,441	1.00	.20	1.10	1.13
2,036	1.20	.48	1.44	1.29
2,134	1.68	.32	1.84	1.63
3,910	2.00	-.79	1.61	1.63
34	1.21	-.16	1.13	1.42
1,747	1.05	.15	1.13	1.15
1,356	1.20	.14	1.13	1.10
1,980	1.06	.02	1.07	1.11
3,226	1.08	.15	1.16	1.12
257	1.23	-.03	1.22	1.17
0	1.20	-.12	1.15	1.17
2,402	1.08	-.12	1.15	1.17
1,242	1.10	-.02	1.09	1.13
2,372	1.09	-.01	1.10	1.09
4,101	1.17	.06	1.13	1.12

Irrigated Pasture

Acres Irrigated	Previous Year's Price	Previous Trend	Previous Two Year Average	Previous Three Year Average
1,799	$3.37			
3,360	4.50	$1.13	$3.94	$3.75
4,351	3.37	-1.13	3.94	3.75
3,948	3.37	0	3.37	3.75
3,692	5.00	-4.00	4.19	3.91
3,214	2.50	-2.50	3.75	5.50
3,294	5.00	2.50	3.75	4.17
2,311	3.60	-1.40	4.30	3.70
1,896	4.51	.91	4.06	4.37
532	4.55	.04	4.53	4.22
1,851	4.57	.02	4.56	4.54
2,100	4.50	- .07	4.54	4.54
2,850	4.46	.04	4.48	4.51
2,003	4.47	.01	4.48	4.48

Adapted from Statistical Appendix to Crop Report and Related Data, U.S. Bureau of Reclamation, Department of the Interior.

Wheat

Acres Irrigated	Previous Year's Price	Previous Trend	Previous Two Year Average	Previous Three Year Average
5,840	$1.95	$ .43	$1.74	$1.26
5,475	2.10	.15	2.03	1.28
4,817	2.00	-.10	2.05	1.28
3,322	1.74	-.26	1.87	1.17
5,660	1.92	.18	1.83	1.13
4,556	1.96	.04	1.94	1.29
5,499	2.20	.10	2.08	1.63
4,411	2.10	-.10	2.10	1.63
0	2.10	0	2.10	1.42
6,208	2.10	0	2.10	1.15
6,161	1.65	-.45	1.88	1.10
7,796	1.62	-.03	1.64	1.11
5,735	1.68	.06	1.65	1.12
2,121	1.74	.06	1.71	1.17
72	1.91	.17	1.83	1.17
5,735	1.84	-.07	1.88	1.17
6,100	1.93	.09	1.89	1.13
4,796	1.75	-.18	1.84	1.09
3,320	1.35	-.40	1.53	1.12

Alfalfa

10,398	$23.00	$ 7.00	$19.50	$19.50
8,154	22.50	- .50	22.75	20.50
11,954	25.00	2.50	23.50	23.50
12,981	21.20	-3.72	23.14	22.93
14,817	18.00	-3.28	19.64	21.43
15,700	20.00	2.00	19.00	19.76
16,954	30.00	10.00	25.00	22.67
15,601	18.00	-12.00	24.00	22.67
16,293	20.00	2.00	19.00	22.66
15,278	26.00	6.00	23.00	21.34
14,486	20.00	-6.00	23.00	22.00
15,447	18.00	-2.00	19.00	21.33
16,674	20.00	2.00	19.00	19.33
16,575	26.00	6.78	23.39	21.59
15,553	27.35	.57	20.07	24.71
15,720	23.20	-4.15	25.28	25.78
15,310	20.00	-3.20	21.60	23.52
14,704	25.20	5.20	22.60	22.80
13,770	23.00	-1.95	24.23	22.82

Appendix B

Selected Crop Data
for
Humboldt Project
1939-1965

SELECTED CROP DATA
HUMBOLDT PROJECT
1939-1965

Barley

Year	Acres	Percent of Total Acres	Yield Bu./Ac.	Yield Total	Value Per Unit	Value Per Acre	Value Total
1939	607	5.1	46	27,791	$ .53	$24.26	$ 14,729
1940	897	7.5	41	36,793	.43	17.63	15,821
1941	1,741	14.8	52	90,542	.72	37.44	65,190
1942	2,968	23.6	52	154,331	.75	39.00	115,748
1943	2,074	17.1	32	107,832	1.08	56.16	116,457
1944	3,196	19.5	52	161,933	.98	50.96	158,694
1945	2,126	11.8	45	95,683	1.19	53.56	113,863
1946	2,386	11.1	48	114,513	1.32	63.35	151,157
1947	5,070	20.7	35	177,457	1.32	46.20	234,243
1948	9,890	39.4	28	276,760	1.20	33.58	332,112
1949	6,670	26.6	35	233,450	1.00	35.00	233,450
1950	4,600	18.1	33	151,998	1.20	39.60	182,398
1951	2,441	9.6	33	80,553	1.68	55.44	135,329
1952	2,036	8.0	30	61,080	2.00	60.00	122,160
1953	2,134	7.3	40	85,360	1.21	48.40	103,285
1954	3,910	13.0	45	175,950	1.05	47.25	184,747
1955	34	.2	50	1,700	1.20	60.00	2,040
1956	1,747	6.1	46	77,623	1.06	47.10	82,280
1957	1,356	5.1	50	68,417	1.08	54.49	73,890
1958	1,980	6.8	46	90,833	1.23	56.43	111,725
1959	3,226	11.3	43	138,718	1.20	51.60	166,426
1960	257	1.2	27	6,939	1.08	29.16	7,494
1961	--	--	--	--	--	--	--
1962	2,402	9.1	57	136,914	1.10	62.70	150,605
1963	1,242	9.1	57	63,342	1.09	55.59	69,043
1964	2,372	8.2	61	144,692	1.17	71.37	169,290
1965	4,101	14.1	90	369,491	1.10	99.00	406,440

Source: Statistical Appendix to Crop Report and related data, U.S. Department of the Interior, Bureau of Reclamation, 1939-1965.

Oats

Year	Acres	Percent of Total Acres	Yield Bu./Ac.	Yield Total	Value Per Unit	Value Per Acre	Value Total
1939	75	0.6	40.0	3,000	$ .40	$16.00	$1,200
1940	38	0.3	40.0	1,520	.40	16.00	600
1941	103	0.8	39.8	4,104	.50	19.92	2,052
1942	197	1.5	40.0	7,868	.80	32.00	6,294
1943	115	0.9	40.0	4,600	.88	35.20	4,048
1944	458	2.7	40.0	18,316	.80	31.99	14,652
1945	628	3.5	40.0	27,288	.80	32.81	21,830
1946	226	1.0	39.9	9,024	.88	35.14	7,941
1947	560	2.2	63.0	35,280	.88	55.44	31,046
1948	891	3.5	24.3	21,692	.90	21.91	19,522
1949	622	2.4	50.0	31,110	.72	36.01	22,399
1950	808	3.1	47.0	37,976	1.12	52.64	42,533
1951	327	1.2	42.9	14,042	1.12	48.09	15,727
1952	158	0.6	25.0	3,950	1.00	25.00	3,950
1953	58	0.1	35.0	2,030	.96	33.60	1,949
1954	293	0.9	50.0	14,650	.80	40.00	11,720
1955	--	--	--	--	--	--	--
1956	155	0.5	75.0	11,562	.88	65.65	10,175
1957	116	0.4	61.0	7,062	.88	53.58	6,215
1958	79	0.2	68.0	5,375	.91	61.91	4,891
1959	78	0.2	69.0	5,382	.96	66.24	5,167
1960	13	0.1	49.0	637	.96	47.08	612
1961	--	--	--	--	--	--	--
1962	173	0.6	103.0	17,819	.89	91.67	15,859
1963	165	0.6	37.0	6,105	.86	31.82	5,250
1964	19	0.1	66.0	1,254	.85	56.10	1,066
1965	47	0.1	46.3	2,188	.85	39.36	1,860

Wheat

Year	Acres	Percent of Total Acres	Yield Bu./Ac.	Yield Total	Value Per Unit	Value Per Acre	Value Total
1939	2,145	18.1	27	58,324	$ .60	$16.31	$ 34,994
1940	2,460	20.6	30	73,797	.74	22.20	54,610
1941	1,565	13.3	30	46,956	.99	29.70	46,486
1942	1,499	11.9	30	44,976	1.06	31.80	47,675
1943	1,287	10.6	30	38,664	1.35	40.56	52,194
1944	2,006	12.2	30	54,201	1.38	41.39	74,797
1945	3,298	18.4	28	92,336	1.52	42.56	140,351
1946	6,477	30.1	30	194,313	1.95	58.50	378,910
1947	5,840	23.8	28	163,506	2.10	58.80	343,363
1948	5,475	21.8	25	136,198	2.00	49.75	272,396
1949	4,817	19.2	28	134,876	1.74	48.72	234,684
1950	3,300	13.0	33	109,626	1.92	63.36	210,482
1951	5,660	22.2	33	186,780	1.96	64.68	366,089
1952	4,556	18.0	30	136,680	2.20	66.00	300,696
1953	5,499	18.7	30	164,970	2.10	63.00	346,437
1954	4,411	14.7	35	154,385	2.10	73.50	324,208
1955	--	--	--	--	--	--	--
1956	6,203	21.6	40	254,100	1.65	67.54	419,265
1957	6,161	23.1	39	240,300	1.62	63.19	389,286
1958	7,796	26.7	40	312,367	1.68	67.31	524,777
1959	5,735	20.1	40	229,400	1.74	69.60	399,156
1960	2,121	10.1	33	69,993	1.91	63.03	133,686
1961	72	.4	21	1,512	1.84	38.64	2,782
1962	5,735	21.6	47	269,545	1.93	90.71	520,222
1963	6,100	23.2	49	305,000	1.75	87.50	533,750
1964	4,796	16.7	49	235,004	1.35	66.15	317,255
1965	3,320	11.4	104	310,931	1.35	140.27	419,757

Alfalfa

Year	Acres	Percent of Total Acres	Yield Tons/Ac.	Yield Total	Value Per Unit	Value Per Acre	Value Total
1939	6,581	55.4	3.6	23,934	$ 7.50	$ 27.28	$ 179,505
1940	6,474	54.4	4.0	25,894	5.00	20.00	129,470
1941	6,599	56.4	3.5	23,095	9.00	31.50	207,855
1942	7,270	57.8	3.5	25,445	14.00	49.00	356,230
1943	8,128	67.0	3.5	28,447	20.00	70.00	568,940
1944	11,078	67.5	3.2	33,703	16.00	46.13	248,143
1945	10,623	59.3	2.9	30,807	16.00	46.40	492,912
1946	10,416	48.3	3.4	35,375	23.00	78.11	813,625
1947	10,398	42.4	3.1	32,235	22.50	69.75	725,288
1948	8,154	32.6	3.0	24,405	25.00	74.83	610,125
1949	11,954	47.9	3.7	34,590	21.28	68.57	735,990
1950	13,000	51.1	3.4	44,135	18.00	61.28	794,437
1951	14,817	58.3	3.5	51,860	20.00	70.00	1,037,200
1952	14,515	57.2	4.0	59,245	30.00	113.21	1,777,350
1953	16,289	55.5	4.0	65,821	18.00	69.88	1.184,778
1954	15,601	52.1	4.0	62,404	20.00	80.00	1,248,080
1955	16,293	80.4	2.5	40,732	26.00	65.00	1,059,032
1956	15,278	53.2	3.8	57,448	20.00	75.20	1,148,960
1957	14,496	54.2	3.5	50,249	18.00	62.44	904,682
1958	15,478	53.1	3.2	48,398	20.00	62.54	967,960
1959	16,670	58.4	2.8	46,607	26.78	74.98	1,250,278
1960	16,575	79.0	2.8	46,410	27.35	76.58	1,269,314
1961	15,553	96.3	2.8	43,588	23.20	64.96	1,010,314
1962	15,720	59.4	3.5	55,020	20.00	70.00	1,100,400
1963	15,310	58.3	3.4	52,054	25.20	85.68	1,311,760
1964	14,704	51.1	3.2	47,053	23.25	74.40	1,093,982
1965	13,770	47.4	3.6	49,242	24.00	85.82	1,181,808

Silage or Ensilage

Year	Acres	Percent of Total Acres	Yield Tons/Ac.	Yield Total	Value Per Unit	Value Per Acre	Value Total
1939	183	1.5	7.6	1,392	$ 5.00	$ 38.03	$ 6,960
1940	300	2.5	8.0	2,404	3.50	28.00	8,414
1941	52	0.4	7.0	362	5.00	34.81	1,810
1949	22	0.1	8.0	176	30.00	240.00	528
1950	153	0.6	6.0	918	9.00	12.00	8,262
1951	642	2.5	7.0	4,494	10.00	70.00	44,940
1952	--	--	--	--	--	--	--
1953	--	--	--	--	--	--	--
1954	628	2.0	10.0	6,280	10.00	100.00	62,800
1955	--	--	--	--	--	--	--
1956	578	1.9	8.4	4,832	10.00	83.60	48,320
1957	161	0.5	13.0	2,094	9.00	117.06	18,846
1958	214	0.7	13.9	1,977	12.34	171.61	36,724
1959	207	0.7	10.9	2,256	12.54	136.67	28,290
1960	6	0.1	19.0	114	12.50	237.50	1,425
1961	--	--	--	--	--	--	--
1962	364	1.3	15.4	5,606	10.00	154.01	56,060
1963	487	1.8	23.7	11,542	10.00	237.00	115,420
1964	1,443	4.9	16.3	23,521	8.00	130.00	188,168
1965	1,675	5.7	17.4	29,115	8.00	139.00	232,920

Alfalfa Seed

Year	Acres	Percent of Total Acres	Yield Cwt./Ac.	Yield Total	Value Per Unit	Value Per Acre	Value Total
1956	405	1.3	1.7	690	$20.00	$ 34.07	$ 13,800
1957	452	1.6	2.9	1,292	35.00	100.04	45,220
1958	210	0.7	5.4	1,125	18.00	96.43	20,250
1959	140	0.4	2.3	322	25.68	59.06	8,269
1960	90	0.5	1.6	144	22.00	35.20	3,168
1961	--	--	--	--	--	--	--
1962	170	0.6	6.8	1,156	39.00	256.20	45,084
1963	494	1.8	3.7	1,828	22.00	81.41	40,216
1964	637	2.1	2.7	1,720	35.30	95.32	60,716
1965	864	2.9	4.5	3,889	35.00	157.55	136,127

Sugar Beets

Year	Acres	Percent of Total Acres	Yield Cwt./Ac.	Yield Total	Value Per Unit	Value Per Acre	Value Total
1939	1,549	13.0	11.5	17,504	4.70	53.11	32,269
1962	75	0.2	9.2	690	14.00	128.80	9,660
1963	360	1.3	20.2	7,272	13.00	262.60	94,536
1964	1,550	5.3	19.5	30,225	13.00	253.50	392,925
1965	1,067	3.6	20.5	21,926	21.93	213.71	228,030

Years	Total Acres Irrigated	Crop Value
1939	11,876	$ 365,927
1940	11,695	261,273
1941	11,728	359,004
1942	12,577	589,754
1943	12,139	811,058
1944	16,421	940,965
1945	17,928	1,008,217
1946	21,537	1,610,367
1947	24,506	1,639,386
1948	25,085	1,611,450
1949	25,028	1,520,841
1950	25,414	1,574,894
1951	25,438	1,811,494
1952	25,365	2,497,848
1953	29,363	1,940,291
1954	29,960	2,080,968
1955	20,275	1,100,552
1956	29,795	1,861,092
1957	27,642	1,955,674
1958	29,536	1,907,601
1959	28,775	2,057,687
1960	22,822	1,588,213
1961	16,443	1,139,332
1962	27,771	2,070,583
1963	26,690	2,320,002
1964	29,240	2,449,050
1965	28,999	2,876,899

Appendix C

Data Used in the Computation of a Criterion Function for Lovelock Valley

VALUE AND COSTS OF CROP PRODUCTION

IN LOVELOCK VALLEY

YEAR 1953

Crop	Acres	Yield	Average Unit Price	Total Gross Value	Production Cost/Acre	Total Production Cost	Net Return
Barley	2,134	85,360	$ 1.13	$ 96,457	$40,$50	$ 88,561	$ 7,896
Oats	58	2,030	.88	1,786	$30	1,740	46
Wheat	5,499	164,970	1.68	277,150	$42,$47	241,955	35,195
Alfalfa	15,601	62,404	22.77	1,420,939	$62	967,262	453,677
Ensilage	--	--	--	--	--	--	--
Irrigated Pasture	3,360	44,805	4.32	193,557	$38	127,680	65,877
Other Hay	--	--	--	--	--	--	--
Alfalfa Seed	--	--	--	--	--	--	--
Sugar Beets	--	--	--	--	--	--	--
TOTAL	26,652			$1,989,889		$1,427,198	$562,691
						Irrigation water assessment	-126,741
						Net Revenue	$435,950

VALUE AND COSTS OF CROP PRODUCTION

IN LOVELOCK VALLEY

YEAR 1954

Crop	Acres	Yield	Average Unit Price	Total Gross Value	Production Cost/Acre	Total Production Cost	Net Return
Barley	3,910	175,950	$ 1.13	$ 198,824	$40,$50	$ 162,265	$ 36,559
Oats	293	14,650	.88	12,892	$30	8,790	4,102
Wheat	4,411	154,385	1.68	259,367	$42,$48	195,848	63,519
Alfalfa	15,601	62,404	22.77	1,420,939	$62	967,262	453,677
Ensilage	628	6,280	10.24	64,307	$76	47,728	16,579
Irrigated Pasture	4,351	58,020	4.32	205,646	$38	165,338	85,308
Other Hay	736	1,472	17.96	26,437	$12	8,832	17,605
Alfalfa Seed	--	--	--	--	--	--	--
Sugar Beets	--	--	--	--	--	--	--
TOTAL	29,930			$2,233,412		$1,556,063	$677,349
						Irrigation water assessment	-126,741
						Net Revenue	$550,608

VALUE AND COSTS OF CROP PRODUCTION IN

LOVELOCK VALLEY

YEAR 1955

Crop	Acres	Yield	Average Unit Price	Total Gross Value	Production Cost/Acre	Total Production Cost	Net Return
Barley	34	1,700	$ 1.13	$ 1,921	$41,$50	$ 1,440	$ 481
Oats	--	--	--	--	--	--	--
Wheat	--	--	--	--	--	--	--
Alfalfa	16,293	40,732	22.77	927,468	$53	863,529	63,939
Ensilage	--	--	--	--	--	--	--
Irrigated Pasture	3,948	7,896	4.32	34,111	$38	150,024	-115,913
Other Hay	--	--	--	--	--	--	--
Alfalfa Seed	--	--	--	--	--	--	--
Sugar Beets	--	--	--	--	--	--	--
TOTAL	20,275			$963,500		$1,014,993	-$ 51,493
						Irrigation water assessment	-126,741
						Net Revenue	-$178,334

VALUE AND COSTS OF CROP PRODUCTION

IN LOVELOCK VALLEY

YEAR 1956

Crop	Acres	Yield	Average Unit Price	Total Gross Value	Production Cost/Acre	Total Production Cost	Net Return
Barley	1,747	77,623	$ 1.13	$ 87,714	$40,$50	$ 72,500	$ 15,214
Oats	155	11,562	.88	10,175	%30	4,650	5,525
Wheat	6,208	254,100	1.68	426,888	$43,$48	279,360	147,528
Alfalfa	15,278	57,448	22.77	1,308,090	$61	931,958	376,132
Ensilage	578	4,832	10.24	49,480	$76	43,928	5,552
Irrigated Pasture	3,692	44,304	4.32	191,393	$38	140,296	51,097
Other Hay	282	383	17.96	6,861	$12	3,384	3,477
Alfalfa Seed	405	690	27.92	19,265	$92	37,260	-17,995
Sugar Beets	--	--	--	--	--	--	--
TOTAL	28,345			$2,099,866		$1,513,336	$586,530
				Irrigation water assessment			-126,741
						Net Revenue	$459,789

VALUE AND COSTS OF CROP PRODUCTION

IN LOVELOCK VALLEY

YEAR 1957

Crop	Acres	Yield	Average Unit Price	Total Gross Value	Production Cost/Acre	Total Production Cost	Net Return
Barley	1,356	68,417	$ 1.13	$ 77,311	$41,$50	$ 57,426	$ 19,885
Oats	116	7,062	.88	6,215	$30	3,480	2,735
Wheat	6,161	240,300	1.68	403,704	$43,$49	279,710	123,994
Alfalfa	14,486	50,249	22.77	1,144,170	$59	854,674	289,496
Ensilage	161	2,094	10.24	21,443	$76	12,236	9,207
Irrigated Pasture	4,341	52,092	4.32	225,037	$38	164,958	60,079
Other Hay	747	1,723	17.96	30,945	$12	9,204	21,741
Alfalfa Seed	452	1,292	27.92	36,124	$92	41,584	-5,460
Sugar Beets	--	--	--	--	--	--	--
TOTAL	27,840			$1,944,949		$1,423,272	$521,677
						Irrigation water assessment	-126,741
						Net Revenue	$394,936

VALUE AND COSTS OF CROP PRODUCTION

IN LOVELOCK VALLEY

YEAR 1958

Crop	Acres	Yield	Average Unit Price	Total Gross Value	Production Cost/Acre	Total Production Cost	Net Return
Barley	1,980	90,833	$ 1.13	$ 102,641	$40,$50	$ 82,170	$ 20,471
Oats	79	5,375	.88	4,730	$30	2,370	2,360
Wheat	7,796	312,367	1.68	524,777	$43,$48	350,819	173,958
Alfalfa	15,477	48,398	22.77	1,102,022	$57	882,189	219,833
Ensilage	214	2,977	10.24	30,484	$76	16,264	14,220
Irrigated Pasture	3,294	39,508	4.32	170,675	$38	125,172	45,503
Other Hay	98	131	17.96	2,353	$12	1,176	1,177
Alfalfa Seed	210	1,125	27.92	31,410	$92	19,320	12,090
Sugar Beets	--	--	--	--	--	--	--
TOTAL	29,148			$1,969,092		$1,479,480	$489,612
						Irrigation water assessment	-126,741
						Net Revenue	$362,871

VALUE AND COSTS OF CROP PRODUCTION

IN LOVELOCK VALLEY

YEAR 1959 Crop	Acres	Yield	Average Unit Price	Total Gross Value	Production Cost/Acre	Total Production Cost	Net Return
Barley	3,226	138,718	$ 1.13	$ 156,751	$40,$50	$ 133,879	$ 22,872
Oats	78	5,382	.88	4,736	$30	2,340	2,396
Wheat	5,735	229,400	1.68	385,392	$43,$48	258,075	127,317
Alfalfa	16,674	46,687	22.77	1,063,063	$54	900,396	162,667
Ensilage	207	2,256	10.24	23,101	$76	15,732	7,369
Irrigated Pasture	2,311	9,706	4.32	41,930	$38	87,818	-45,888
Other Hay	171	359	17.96	6,447	$12	2,052	4,395
Alfalfa Seed	140	322	27.92	8,990	$92	12,880	-3,890
Sugar Beets	--	--	--	--	--	--	--
TOTAL	28,542			$1,688,410		$1,413,172	$275,238
				Irrigation water assessment			-126,741
						Net Revenue	$148,497

VALUE AND COSTS OF CROP PRODUCTION

IN LOVELOCK VALLEY

YEAR 1960

Crop	Acres	Yield	Average Unit Price	Total Gross Value	Production Cost/Acre	Total Production Cost	Net Return
Barley	257	6,939	$ 1.13	$ 7,841	$38,$49	$ 10,190	$ -2,349
Oats	13	637	.88	561	$30	390	171
Wheat	2,121	69,993	1.68	117,588	$42,$48	94,172	23,416
Alfalfa	16,575	46,410	22.77	1,056,756	$55	911,625	145,131
Ensilage	6	114	10.24	1,167	$76	456	711
Irrigated Pasture	1,896	7,394	4.32	31,942	$38	72,048	-40,106
Other Hay	--	--	--	--	--	--	--
Alfalfa Seed	90	144	27.92	4,020	$92	8,280	-4,260
Sugar Beets	--	--	--	--	--	--	--
TOTAL	20,958			$1,219,875		$1,097,161	$122,714
				Irrigation water assessment			-126,741
						Net Revenue	- $ 4,027

VALUE AND COSTS OF CROP PRODUCTION

IN LOVELOCK VALLEY

YEAR 1961

Crop	Acres	Yield	Average Unit Price	Total Gross Value	Production Cost/Acre	Total Production Cost	Net Return
Barley	—	—	—	—	—	—	—
Oats	--	--	--	--	--	--	--
Wheat	72	1,512	$ 1.68	$ 2,540	$41,$46	$ 3,096	$ 556
Alfalfa	15,553	43,548	22.77	991,588	$55	855,415	136,173
Ensilage	--	--	--	--	--	--	--
Irrigated Pasture	532	1,064	4.32	4,596	$38	20,216	-15,620
Other Hay	--	--	--	--	--	--	--
Alfalfa Seed	--	--	--	--	--	--	--
Sugar Beets	--	--	--	--	--	--	--
TOTAL	16,157			$998,724		$878,727	$119,997
					Irrigation water Assessment		-126,741
						Net Revenue	-$ 6,744

VALUE AND COSTS OF CROP PRODUCTION

IN LOVELOCK VALLEY

YEAR 1962

Crop	Acres	Yield	Average Unit Price	Total Gross Value	Production Cost/Acre	Total Production Cost	Net Return
Barley	2,402	136,914	$ 1.13	$ 154,713	$41,$51	$ 102,085	$ 52,628
Oats	173	17,819	.88	15,681	$30	5,190	10,491
Wheat	5,735	269,545	1.68	452,836	$43,$49	260,369	192,467
Alfalfa	15,720	55,020	22.77	1,258,805	$59	927,480	331,325
Ensilage	364	5,606	10.24	57,405	$76	27,664	29,741
Irrigated Pasture	1,851	17,029	4.32	73,565	$38	70,338	3,227
Other Hay	--	--	--	--	--	--	--
Alfalfa Seed	170	1,156	27.92	32,276	$92	15,640	16,636
Sugar Beets	75	690	15.48	10,681	$137	10,275	406
TOTAL	26,490			$2,055,962		$1,419,041	$636,921
				Irrigation water assessment			-126,741
						Net Revenue	$510,180

VALUE AND COSTS OF CROP PRODUCTION

IN LOVELOCK VALLEY

YEAR 1963

Crop	Acres	Yield	Average Unit Price	Total Gross Value	Production Cost/Acre	Total Production Cost	Net Return
Barley	1,242	63,342	$ 1.13	$ 71,576	$41,$50	$ 52,599	$ 18,977
Oats	165	6,105	.88	5,372	$30	4,950	422
Wheat	6,100	305,000	1.68	512,400	$43,$49	276,940	235,460
Alfalfa	15,310	52,020	22.77	1,184,495	$58	887,980	296,515
Ensilage	487	11,542	10.24	118,190	$76	37,012	81,178
Irrigated Pasture	2,100	10,080	4.32	43,546	$38	79,800	-36,254
Other Hay	--	--	--	--	--	--	--
Alfalfa Seed	494	1,828	27.92	51,038	$92	45,448	5,590
Sugar Beets	360	7,272	15.48	112,570	$177	63,720	48,850
TOTAL	26,258			$2,099,187		$1,448,449	$650,738
						Irrigation water assessment	-126,741
						Net Revenue	$523,997

Average Annual Assessment
for
Irrigation Water

1.	Repayment for Rye Patch Dam and Reservoir	$29,680
2.	Repayment on Rehabilitation and Betterment Contract	6,150
3.	Average Drainage Costs	1,275
4.	Average Operation and Maintenance Cost	77,183
5.	Average Current Expense	12,453
	Total Average Assessment	$126,741

Adapted from data supplied by the Pershing County Water Conservation District.

Appendix D

Data on Irrigation Deliveries
and Losses

IRRIGATION DELIVERIES

AND LOSSES

Year	Rye Patch Release	Head of Canal	Lateral Losses	Delivered to Farm
1949	111,442	106,354	19,139	87,215
1950	113,090	105,620	21,630	83,999
1951	131,162	118,742	25,735	93,007
1952	410,719	114,888	24,379	90,509
1953	127,788	119,453	23,574	95,879
1954	92,156	91,982	20,714	71,268
1955	17,476	18,253	5,585	12,668
1956	126,578	124,272	33,762	90,510
1957	120,188	105,480	21,267	84,214
1958	142,428	116,504	16,968	99,536
1959	97,908	88,296	16,460	71,636
1960	47,076	39,684	11,515	28,169
1961	20,941	17,208	3,707	13,501
1962	113,360	104,952	20,092	84,530
1963	97,928	88,154	18,594	69,560
1964	133,332	109,470	14,188	95,282
1965	134,414	107,894	30,868	77,026

Quantities in Acre-feet

Source: Pershing County Water Consevation District