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Two temperature-based evapotranspiration (ET) estimating methods, the Soil Conservation Service-modified Blaney-Criddle (SCS-BC) and the Food and Agriculture Organization-modified Blaney-Criddle (FAO-BC) were examined and compared. Results indicated that the SCS-BC method seriously underpredicted crop ET at relatively high-altitude and semiarid locations. Since much of Oregon possesses these attributes, new estimates of crop ET were calculated using a modified FAO-BC computer model. The modifications of the FAO-BC method were: a) downward adjustment of temperature data to account for aridity at the site of measurement based upon site records and personal communication with observers; b) conversion from grass to alfalfa reference ET to calibrate estimates with Kimberly, Idaho; c) adjustment of the standard deviations of ET estimates to account for the reduction of variance that occurs when long-term secondary data (wind speed, humidity, and solar

radiation) are used; and d) modification of FAO crop coefficients to allow their use with alfalfa reference ET estimates. An effective precipitation procedure was used with calibrated ET estimates to make predictions of crop irrigation requirements for 14 temperature stations across Oregon. Duration of development stages of economically significant crops near these stations were obtained by personal contact and a questionaire sent to county extension agents. Results were given as estimates of crop consumptive use and irrigation requirements for economically significant crops in the vicinity of each station. Frequency analyses were presented with each estimate to indicate consumptive use and irrigation requirements for 5,7,8, and 9 out of 10 years and 19 out of 20 years. Recommendations were made concerning the availability of data and refinement of the procedure used for these estimates.

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Irrigation Requirements for Selected Oregon Locations

1. INTRODUCTION

1.1 Statement of the Problem

Estimates of the consumptive use (i.e., evapotranspiration) of water by crops are important to all concerned with the collection, storage, distribution and use of irrigation water. Consumptive use (CU) is the amount of water transpired by an actively growing plant plus the water evaporated from the soil surface surrounding the plant. The units of this quantity are length per unit of time. Estimates of consumptive use are essential tools for the design and management of irrigation and drainage systems, and the prediction of evapotranspiration (ET) as an element of the hydrologic cycle. As competing users of a limited water supply seek to divide what water is available, these estimates will acquire a new significance and their soundness must be assured.

Estimates of the consumptive use of water have been calculated for the Pacific Northwest. These estimates serve as a guide for determining the seasonal irrigation requirement of crops at various locations. The irrigation requirement (IR), as used in this paper, is the amount of water required to meet the consumptive use of a crop.

Effective precipitation is that portion of rainfall that goes directly toward meeting the consumptive use of a crop. Effective precipitation is not part of the irrigation requirement, nor is that water required for conveyance losses, wind drift or leaching requirements.

James et al (1982) provided estimates for Washington based on the Blaney-Criddle method, as presented in Food and Agriculture Organization Paper No. 24 Revised (Doorenbos and Pruitt, 1977). This work will be referred to as FAO-24, and the method as the FAO-BC. Estimates were calculated for Idaho by Allen and Brockway (1983) using the FAO-BC, but they incorporated changes to account for elevation and aridity at the site of temperature measurement. The most recent consumptive use estimates for Oregon were given by Watts et al (1968). This work presented estimates of consumptive use and irrigation requirements for 27 areas of the state. The estimates were based on the SCS-modified Blaney-Criddle method, as detailed in USDA-SCS Technical Release No. 21 (1964).

There is recent evidence indicating that the SCS-BC can underpredict crop consumptive use at arid locations. A study by Jensen (1974) compared predictions made by the SCS-BC with lysimeter records at various sites. Low-elevation, semihumid locations gave the best agreement between the two. At arid locations and higher elevations,

a pronounced difference between the SCS-BC and lysimeter measurements was observed. Pennington (1980) found the SCS-BC to underestimate the consumptive use of alfalfa. Other work by Erpenbeck (1981) compared predictions of crop water use made with the SCS-BC and the FAO-BC (among other methods), with gravimetric measurements of water use by alfalfa. The conclusion made was that the FAO-BC was superior to seven other temperature-based methods.

A significant portion of eastern Oregon is arid, and many locations where irrigation is required are at considerable elevation. Because the SCS-BC was used to make the most recent estimates of consumptive use for Oregon, and this method has been demonstrated to underestimate consumptive use under conditions important to Oregon, a project to make new estimates using the FAO-BC method was undertaken.

1.2 Objectives

The primary objective of this work was the development of tabulated values of consumptive use and irrigation requirements for various sites in Oregon using the FAO-BC method. An additional objective was the verification and use of computer programs written by Ryan and Cuenca (1984) with more stations than reported in their

initial estimate of Oregon crop water requirements with a modified FAO-BC method.

A further objective was the statistical prediction of various confidence intervals for these stations, in addition to the mean, for consumptive use estimates across Oregon. These frequency analyses, useful for design, were available for only a portion of the Oregon estimates by Watts, et al.(1968).

Another objective was the gathering of accurate crop-stage information, and the expression of these data in a form appropriate for use with the FAO-BC method.

Incidental to these objectives was the transfer of climatic data available on magnetic tape to floppy disk storage to permit use with a microcomputer.

2. LITERATURE REVIEW

2.1 Temperature-Based Consumptive Use Estimation

2.1.1 Original Blaney-Criddle Method

Blaney and Criddle (1950) developed a simple formula for determining crop consumptive use for the western United States, using temperature and daytime hours as input data. This method has been widely used by the Soil Conservation Service of the USDA, and considerable data were collected for the determination of the coefficients to be used for particular crops. These data were obtained from gravimetric samples analyzed for water content during various stages of the growing season (Allen, 1985). The Blaney-Criddle formula is:

$$U = 25.4\ KF = 25.4\ K \sum(tp/100) \qquad (1)$$

where:

U = consumptive use of the crop for the given time period, mm

K = empirical crop consumptive use coefficient

F = sum of monthly consumptive use factors during the period, mm

t = mean monthly temperature, degrees F

p = percentage of daytime hours of the year occuring during the period in question (see table 1)

Table 1. Mean monthly percentage of annual daylight hours for different latitudes.

Latitude North (degrees)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	8.50	7.66	8.49	8.21	8.50	8.22	8.50	8.49	8.21	8.50	8.22	8.50
5	8.32	7.57	8.47	8.29	8.65	8.41	8.67	8.60	8.23	8.42	8.07	8.30
10	8.13	7.47	8.45	8.37	8.81	8.60	8.86	8.71	8.25	8.34	7.91	8.10
15	7.94	7.36	8.43	8.44	8.98	8.80	9.05	8.83	8.28	8.26	7.75	7.88
20	7.74	7.25	8.41	8.52	9.15	9.00	9.25	8.96	8.30	8.18	7.58	7.66
25	7.53	7.14	8.39	8.61	9.33	9.23	9.45	9.09	8.32	8.09	7.40	7.42
30	7.30	7.03	8.38	8.72	9.53	9.49	9.67	9.22	8.33	7.99	7.19	7.15
32	7.20	6.97	8.37	8.76	9.62	9.59	9.77	9.27	8.34	7.95	7.11	7.05
34	7.10	6.91	8.36	8.80	9.72	9.70	9.88	9.33	8.36	7.90	7.02	6.92
36	6.99	6.85	8.35	8.85	9.82	9.82	9.99	9.40	8.37	7.85	6.92	6.79
38	6.87	6.79	8.34	8.90	9.92	9.95	10.10	9.47	8.38	7.80	6.82	6.66
40	6.76	6.72	8.33	8.95	10.02	10.08	10.22	9.54	8.39	7.75	6.72	6.52
42	6.63	6.65	8.31	9.00	10.14	10.22	10.35	9.62	8.40	7.69	6.62	6.37
44	6.49	6.58	8.30	9.06	10.26	10.38	10.49	9.70	8.41	7.63	6.49	6.21
46	6.34	6.50	8.29	9.12	10.39	10.54	10.64	9.79	8.42	7.57	6.36	6.04
48	6.17	6.41	8.27	9.18	10.53	10.71	10.80	9.89	8.44	7.51	6.23	5.86
50	5.98	6.30	8.24	9.24	10.68	10.91	10.99	10.11	8.46	7.45	6.10	5.65
52	5.77	6.19	8.21	9.29	10.85	11.13	11.20	10.12	8.49	7.39	5.93	5.43
54	5.55	6.08	8.18	9.36	11.03	11.38	11.43	10.26	8.51	7.30	5.74	5.18
56	5.30	5.95	8.15	9.45	11.22	11.67	11.69	10.40	8.53	7.21	5.54	4.89
58	5.01	5.81	8.12	9.55	11.46	12.00	11.98	10.55	8.55	7.10	4.31	4.56
60	4.67	5.65	8.08	9.65	11.74	12.39	12.31	10.70	8.57	6.98	5.04	4.22

Lower case letters signify monthly calculations, i.e.:

$$u = 25.4\ kf = 25.4\ k(tp/100) \quad (2)$$

where:

u = monthly consumptive use, mm

k = monthly crop use coefficient

f = monthly consumptive use factor, (tp/100)

2.1.2 SCS-Modified Blaney-Criddle Method

USDA Technical Release No. 21 (1964) presented a modified form of the Blaney-Criddle equation for computing monthly consumptive use. This modification consisted of an expansion of the crop use coefficient as follows:

$$k = k_c * k_t \quad (3)$$

where:

k_c = monthly crop use coefficient

k_t = temperature coefficient

The equation for k_t is:

$$k_t = 0.0173\ t - 0.314 \quad (4)$$

subject to k_t greater than or equal to 0.30, where t is mean monthly temperature in degrees F. The modified crop use coefficient of equation 3 is used in place of the crop use coefficient of equation 2.

2.1.3 FAO-Modified Blaney-Criddle Method

The FAO modification of the Blaney-Criddle method (FAO-BC) arose from the observation that temperature and day length are not sufficient to describe the effect of climate on vegetation (Doorenbos and Pruitt, 1977). It was noted that although temperature and day length may be the same for similar climates, the consumptive use of crops could vary widely. Nonetheless, a strong correlation between ET and the product of temperature and percentage of daytime hours (the Blaney-Criddle f-factor) existed. Doorenbos and Pruitt made use of this fact by performing a statistical analysis of weather data and measured ET from some twenty world-wide locations. Using daily, weekly and 10-day data, the relationships between ET of a grass reference crop and the f-factor were classified according to ranges of minimum relative humidity, ratio of actual to maximum possible sunshine hours, and wind speed. The results of this analysis were presented in FAO-24. The details of the FAO-BC method are presented in the Theory section of this paper.

2.2 Comparison of SCS-BC and FAO-BC

A comparison of 16 consumptive use estimating methods at ten international sites was undertaken by the Irrigation Water Requirements Committee of the ASCE (Jensen, 1974). The performance of the SCS-BC when compared with lysimeter data from three sites is shown in figure 1. The agreement of the SCS-BC at Coshocton, Ohio (figure 1c) was good, especially for the latter part of the growing season. Coshocton is a semihumid site at 1181 feet elevation. Figure 1b shows the comparison of the SCS-BC for Davis, California, a semiarid site at 59 feet elevation. In this case the SCS-BC underestimates crop water requirements for the entire growing season, with peak demand underpredicted by about 19 percent. Figure 1a represents the reletively high-altitude (3920 feet), semiarid site of Kimberly, Idaho. In this case water requirements were seriously underpredicted, with peak demand underestimated by about 28 percent. A comparison of the SCS-BC with alfalfa hay was made by Pennington (1980) at seven sites in Nevada. In this case the SCS-BC seasonal estimates averaged 30 percent low when compared with lysimeter records. Erpenbeck (1981) compared the SCS-BC and FAO-BC (among other methods) with gravimetric measurements of water use by alfalfa. These comparisons are shown in

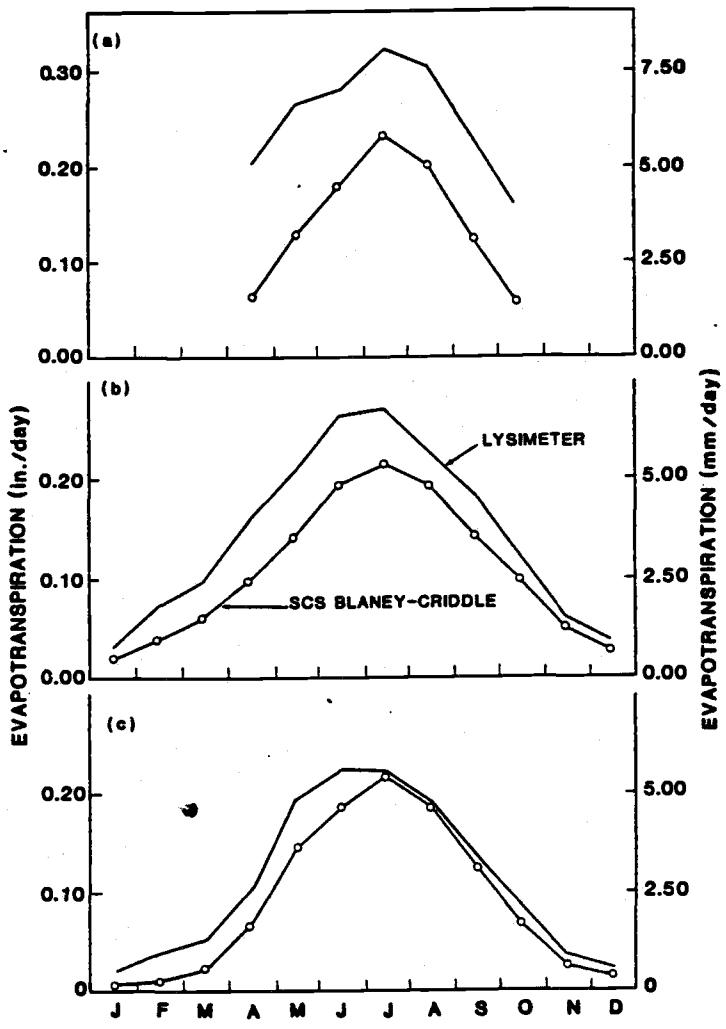

Figure 1. Comparison of crop water use at three sites measured by lysimeter with estimates using SCS modified Blaney-Criddle method (taken from Burman et al, 1983): a) Kimberly, Idaho, 1965-1969, alfalfa hay; b) Davis, California, 1959-1966, mowed rye grass; c) Coshocton, Ohio, 1948-1965, grass legume hay.

figure 2. The theoretical lines in this figure indicate the results that would be obtained if the ET estimation method was a perfect predictor of crop consumptive use, with an intercept of zero and slope equal to one.

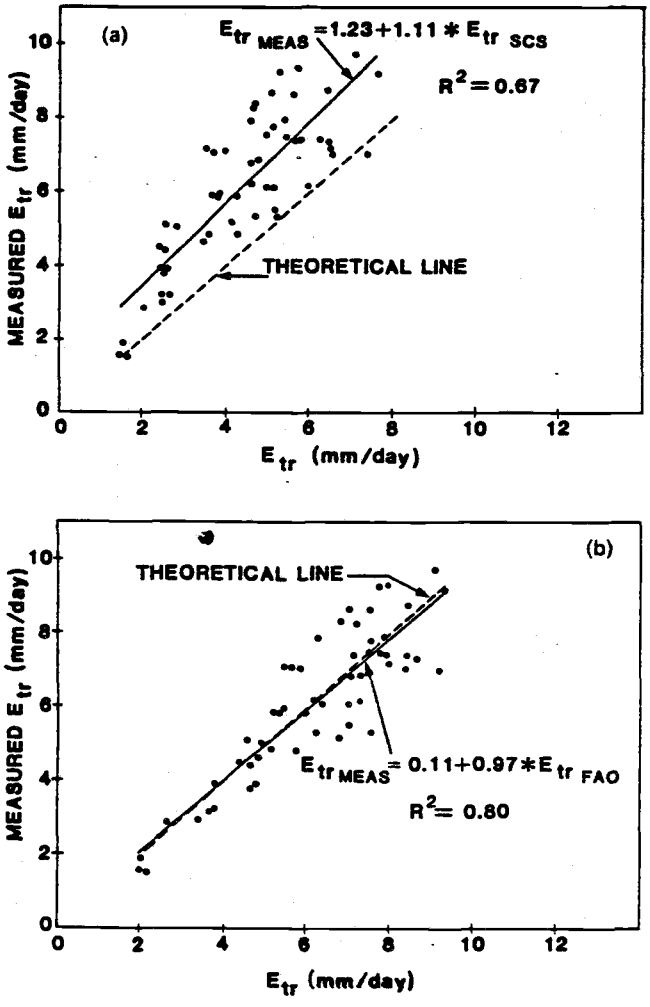

Figure 2. Linear regression of measured reference ET with crop water use estimated by (a) SCS modified Blaney-Criddle and (b) FAO modified Blaney-Criddle methods (taken from Burman et al, 1983).

The coefficient of determination for the linear regression on the FAO-BC (0.80) compared with that for the SCS-BC (0.67), indicates that the FAO-BC is superior to the SCS-BC in explaining crop water use. A statistical t test performed by Erpenbeck (1981) indicated that the hypothesis of a slope of 1.0 for the regression on the FAO-BC could be accepted with 99 percent certainty. These results were obtained from data representing 59 periods of observation, spanning 34 months of active growing season (Erpenbeck, 1981).

2.3 Consumptive Use Estimates for Idaho

The FAO-BC was used by Allen and Brockway (1983) to revise previous consumptive use estimates for Idaho. The FAO-BC was selected because of its performance as compared to a modified Penman equation developed by Wright (1982b). The Wright-1982 method was calibrated to daily ET measurements made with a lysimeter growing a well-watered, disease-free stand of alfalfa. Modifications to the FAO-BC were made in this study to correct for elevation (as suggested by Doorenbos and Pruitt, 1977) and to perform calibration with lysimeter results taken from Kimberly, Idaho. At high-elevation sites like Kimberly, the day-night temperature fluctuation can be extreme and the average daily temperature used in the

SCS-BC method indicates a lower temperature than the plant typically experiences during the day. Estimates unadjusted for this effect will underpredict actual crop consumptive use and lead to errors in irrigation system design and water resource allocation.

2.4 Feasibility of Revising Consumptive Use Estimates for Oregon

Ryan and Cuenca (1984) conducted a feasibility study to determine if the methods of Doorenbos and Pruitt (1977) and Allen and Brockway (1983) could be applied to the state of Oregon. Three test sites east of the Cascades (Hermiston, Madras and Vale) and two west of the Cascades (Medford and Salem) were selected. The FAO-BC method was selected for these trials because the studies already performed in Washington (James et al, 1982) and Idaho (Allen and Brockway, 1983) indicated that this method would be more accurate than any other temperature-based method. Two computer programs were written to calculate reference ET and irrigation requirements for various crops at the five test sites. The first program, OSUETO, used the methods of FAO-24 and Allen and Brockway (1983) to compute reference ET. The second program, CROPUSE, used FAO-24 crop coefficients and and effective rainfall procedure to compute irrigation requirements.

The results of this study indicated a substantial difference between the predictions of the FAO-BC and existing SCS-BC estimates, especially for eastern Oregon. The differences were much less pronounced for western Oregon. They concluded that accurate growing season, crop development stage, and crop coefficient data would be required to provide a sound basis for revised estimates of crop consumptive use.

The fact that Ryan and Cuenca (1984) did not adjust mean monthly temperatures to account for station aridity (as suggested by Allen and Brockway, 1983), could account for some of the more extreme departures from the original Oregon estimates by Watts et al (1968). Indeed, the sensitivity of the FAO-BC method to temperature could lead to as much as 20 percent higher estimates of ET for a four degree C increase in station temperature (Allen and Brockway, 1983). The aridity adjustment suggested by Allen and Brockway (1983) to account for the temperature sensitivity of the FAO-BC method, and used to modify the input data of this work, is described in the Procedure section.

3. THEORY

3.1 Potential Evapotranspiration

The rate of evapotranspiration depends on the local climate, plant type and variety, and the wetness of the soil surrounding the plant. As a soil dries, progressively longer increments of time are required to evaporate and transpire equivalent amounts of water. The concept of potential evapotranspiration was used by Penman (1948) and others to describe ET without having to account for the effects of varying soil moisture content. Thus, potential evapotranspiration is the amount of water lost by the soil and plant surface when the soil is kept in as wet a state as possible (field capacity). The rate of ET is then dependent only on the plant and the demands of the meteorological environment. This is expressed in units of latent heat transfer per unit of area or its equivalent depth of water per unit of area.

Van Bavel (1966) observed that potential ET occurs only when the vapor pressure at the evaporating surface is at the saturation point and adequate air mixing occurs. The difficulty in attaining and verifying true potential ET has led to various interpretations of this condition.

Penman (1948) used clipped grass to represent potential ET. Jensen (1974) represented potential ET with

alfalfa 30 to 50 cm tall. Doorenbos and Pruitt (1977) suggested an extensive grass cover 8 to 15 cm tall. Because of the ambiguity of this concept the idea of reference ET was developed.

3.2 Reference Evapotranspiration

To obtain accurate estimates of crop ET, all significant crop and environmental variables need to be considered. These include climate, soil moisture status, crop type and variety, and stage of growth. Each location provides a unique combination of these variables at a particular time. Reference ET provides a standard or measure against which crops and irrigation requirements at different locations can be compared.

Doorenbos and Pruitt (1977) have defined reference ET as "the rate of evapotranspiration from an extensive surface of 8 to 15 cm, green grass cover of uniform height, actively growing, completely shading the ground, and not short of water." Jensen et al (1970) proposed that reference ET be defined as "the upper limit of maximum evapotranspiration that occurs under given climatic conditions with a field having a well-watered agricultural crop with an aerodynamically rough surface, such as alfalfa with 30 to 45 cm of top growth."

Both grass and alfalfa have been used as reference crops for ET calculations. Grass reference ET will be referred to as ET_o, and alfalfa reference ET as ET_r.

3.3 FAO Blaney-Criddle Method

Published in 1977, FAO-24 was intended to serve as a guide for determining crop water requirements. Four methods were presented: Blaney-Criddle, Radiation, Penman, and Pan Evaporation. Each method requires a different set of input data. The Blaney-Criddle method was chosen for this study because of the common availability of temperature measurements across the state of Oregon. The following describes the FAO Blaney-Criddle method, and how the results of Allen and Brockway (1983) were applied to the FAO-BC for selected Oregon locations.

3.3.1 Correlation of ET with Temperature

As mentioned previously, a strong correlation was found to exist between reference ET and the Blaney-Criddle f-factor. Doorenbos and Pruitt (1977) correlated reference ET and a modified form of f:

$$f = p(0.46\ T + 8.13) \qquad (5)$$

where p is the percent of annual daylight hours during the period in question (usually a month), and T is the mean temperature during the same period. An example plot of the relation of measured grass reference ET and f is

shown in figure 3. As can be seen, the relationships are linear, with a different intercept and slope for each location depending on climate. The intercept of the regression equations is labeled a, and is a function of site relative humidity and solar radiation. The slope is labeled b, and is a function of relative humidity, solar radiation, and wind speed at a particular location. Using daily, weekly, and ten-day data from some twenty world-wide locations, the a and b coefficients were classified according to ranges of minimum relative humidity (RH_{min}), ratio of actual to possible sunshine hours (n/N), and daytime windspeed at two meters above the ground surface (U_2). The coefficient a is based on the equation:

$$a = 0.0043\ RH_{min} - n/N - 1.41 \qquad (6)$$

Table 2 gives the value of b as a function of RH_{min}, n/N, and U_2. A regression equation for b was also presented by Frevert et al (1982):

$$b = a_o + a_1 RH_{min} + a_2(n/N) + a_3 U_2 + a_4 RH_{min}(n/N) + a_5 RH_{min}\ U_2 \qquad (7)$$

where the regression coefficients are as follows:

$a_o = 0.81917$, $a_1 = -0.0040922$, $a_2 = 1.0705$,

$a_3 = 0.065649$, $a_4 = -0.0059684$, $a_5 = -0.0005967$.

Because the coefficients a and b modify the f-factor, whose principal climatic variable is temperature, temperature is denoted as a primary variable, and estimated

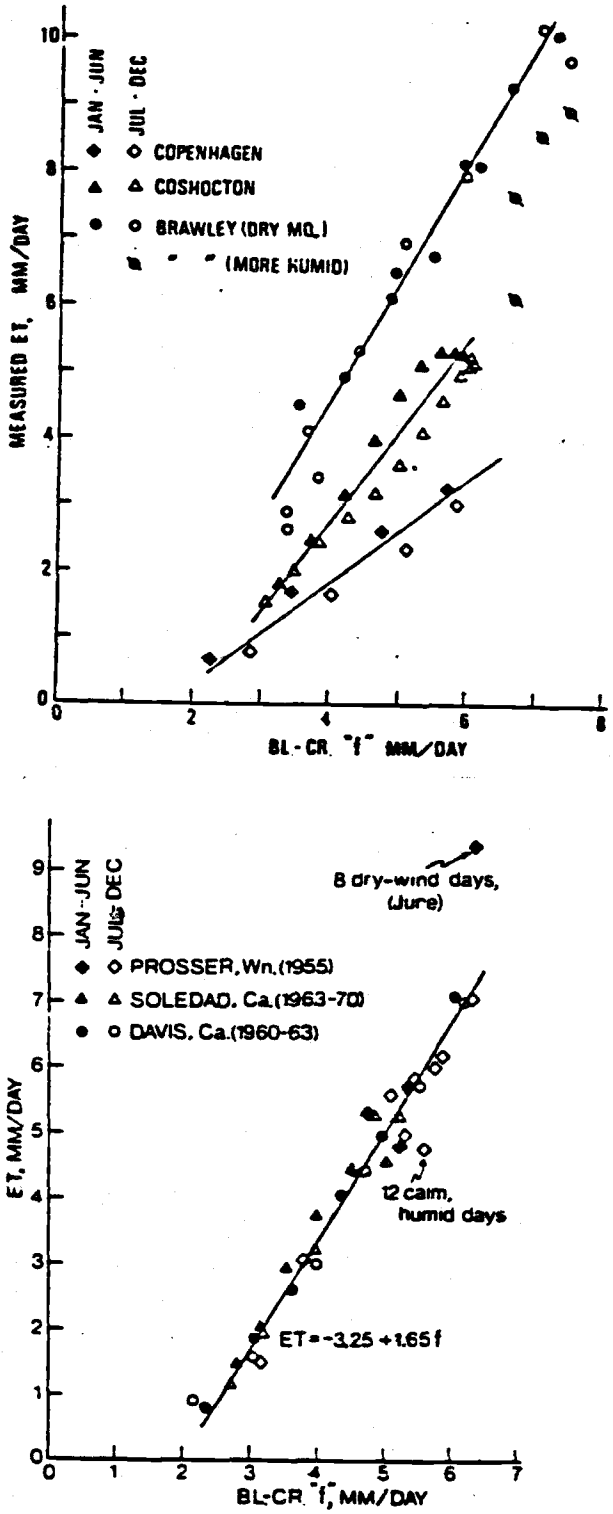

Figure 3. Blaney-Criddle f-factor versus measured evapotranspiration (mm/d) for different climates (taken from Doorenbos and Pruitt, 1977).

Table 2. Values of b as a function of RHmin, n/N, and U_2 (taken from Doorenbos and Pruitt, 1977).

n/N	RHmin %						
	0	20	40	60	80	100	
0	0.84	0.80	0.74	0.64	0.52	0.38	
0.2	1.03	0.95	0.87	0.76	0.63	0.48	
0.4	1.22	1.10	1.01	0.88	0.74	0.57	
0.6	1.38	1.24	1.13	0.99	0.85	0.66	U_2 day = 0 m/sec
0.8	1.54	1.37	1.25	1.09	0.94	0.75	
1.0	1.68	1.50	1.36	1.18	1.04	0.84	
0	0.97	0.90	0.81	0.68	0.54	0.40	
0.2	1.19	1.08	0.96	0.84	0.66	0.50	
0.4	1.41	1.26	1.11	0.97	0.77	0.60	
0.6	1.60	1.42	1.25	1.09	0.89	0.70	U_2 day = 2 m/sec
0.8	1.79	1.59	1.39	1.21	1.01	0.79	
1.0	1.98	1.74	1.52	1.31	1.11	0.89	
0	1.08	0.98	0.87	0.72	0.56	0.42	
0.2	1.33	1.18	1.03	0.87	0.69	0.52	
0.4	1.56	1.38	1.19	1.02	0.82	0.62	
0.6	1.78	1.56	1.34	1.15	0.94	0.73	U_2 day = 4 m./sec
0.8	2.00	1.74	1.50	1.28	1.05	0.83	
1.0	2.19	1.90	1.64	1.39	1.16	0.92	
0	1.18	1.06	0.92	0.74	0.58	0.43	
0.2	1.44	1.27	1.10	0.91	0.72	0.54	
0.4	1.70	1.48	1.27	1.06	0.85	0.64	
0.6	1.94	1.67	1.44	1.21	0.97	0.75	U_2 day = 6 m/sec
0.8	2.18	1.86	1.59	1.34	1.09	0.85	
1.0	2.39	2.03	1.74	1.46	1.20	0.95	
0	1.26	1.11	0.96	0.76	0.60	0.44	
0.2	1.52	1.34	1.14	0.93	0.74	0.55	
0.4	1.79	1.56	1.32	1.10	0.87	0.66	
0.6	2.05	1.76	1.49	1.25	1.00	0.77	U_2 day = 8 m/sec
0.8	2.30	1.96	1.66	1.39	1.12	0.87	
1.0	2.54	2.14	1.82	1.52	1.24	0.98	
0	1.29	1.15	0.98	0.78	0.61	0.45	
0.2	1.58	1.38	1.17	0.96	0.75	0.56	
0.4	1.86	1.61	1.36	1.13	0.89	0.68	
0.6	2.13	1.83	1.54	1.28	1.03	0.79	U_2 day = 10 m/sec
0.8	2.39	2.03	1.71	1.43	1.15	0.89	
1.0	2.63	2.22	1.86	1.56	1.27	1.00	

or measured RH_{min}, n/N and U_2 are denoted as secondary variables (Doorenbos and Pruitt, 1977).

The complete equation as given by Doorenbos and Pruitt can now be written as:

$$ET_o = a + b(p(0.46\ T + 8.13)) \quad (8)$$

where:

ET_o = grass reference ET over the time period, mm/d

T = mean daily temperature over the time period, degrees C

p = mean daily percentage of total annual daytime hours from table 3 for a given month and latitude

a,b = the intercept and slope, respectively, of the ET versus f relationship for given values of RH_{min}, n/N and U_2. RH_{min} is in percent, n/N as a decimal, and U_2 in m/s.

With the suggested elevation correction of plus ten percent per thousand meters of elevation, equation 8 becomes:

$$ET_o = (a + b(p(0.46\ T + 8.13)))(1.0 + E/10000) \quad (9)$$

where E is expressed in meters.

Table 3. Mean daily percentage of annual daytime hours for different latitudes (taken from Doorenbos and Pruitt, 1977).

Latitude North / South*	Jan / July	Feb / Aug	Mar / Sept	Apr / Oct	May / Nov	June / Dec	July / Jan	Aug / Feb	Sept / Mar	Oct / Apr	Sept / May	Oct / June
60 deg	0.15	0.20	0.26	0.32	0.38	0.41	0.40	0.34	0.28	0.22	0.17	0.13
58	0.16	0.21	0.26	0.32	0.37	0.40	0.39	0.34	0.28	0.23	0.18	0.15
56	0.17	0.21	0.26	0.32	0.36	0.39	0.38	0.33	0.28	0.23	0.18	0.16
54	0.18	0.22	0.26	0.31	0.36	0.38	0.37	0.33	0.28	0.23	0.19	0.17
52	0.19	0.22	0.27	0.31	0.35	0.37	0.36	0.33	0.28	0.24	0.20	0.17
50	0.19	0.23	0.27	0.31	0.34	0.36	0.35	0.32	0.28	0.24	0.20	0.18
48	0.20	0.23	0.27	0.31	0.34	0.36	0.35	0.32	0.28	0.24	0.21	0.19
46	0.20	0.23	0.27	0.30	0.34	0.35	0.34	0.32	0.28	0.24	0.21	0.20
44	0.21	0.24	0.27	0.30	0.33	0.35	0.34	0.31	0.28	0.25	0.22	0.20
42	0.21	0.24	0.27	0.30	0.33	0.34	0.33	0.31	0.28	0.25	0.22	0.21
40	0.22	0.24	0.27	0.30	0.32	0.34	0.33	0.31	0.28	0.25	0.22	0.21
35	0.23	0.25	0.27	0.29	0.31	0.32	0.32	0.30	0.28	0.25	0.23	0.22
30	0.24	0.25	0.27	0.29	0.31	0.32	0.31	0.30	0.28	0.26	0.24	0.23
25	0.24	0.26	0.27	0.29	0.30	0.31	0.31	0.29	0.28	0.26	0.25	0.24
20	0.25	0.26	0.27	0.28	0.29	0.30	0.30	0.29	0.28	0.26	0.25	0.25
15	0.26	0.27	0.27	0.28	0.29	0.29	0.29	0.28	0.28	0.27	0.26	0.25
10	0.26	0.27	0.27	0.28	0.28	0.29	0.29	0.28	0.28	0.27	0.26	0.26
5	0.27	0.27	0.27	0.28	0.28	0.28	0.28	0.28	0.28	0.27	0.27	0.27
0	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27

*Southern latitudes: apply 6 mo difference as shown.

3.3.2 Crop Coefficients

By calculating ET_0 , the effect of climate on the grass reference crop is determined. To find the consumptive use of the crop in question, Doorenbos and Pruitt (1977) presented a set of crop coefficients (k_c) where:

$$ET_{crop} = k_c \, ET_0 \qquad (10)$$

The value of k_c, a ratio of crop ET to reference ET, is not constant throughout the growing season, as figure 4 illustrates for corn at Kimberly, Idaho. Four general stages of crop development are used to approximate what is actually a continuous crop coefficient function. These stages are given in table 4.

Table 4. Four Stages of the Growing Season

Stage	Description
1. Initial	Planting to 10% ground cover
2. Crop Development	From the initial stage to effective full ground cover (70-80%)
3. Midseason	From effective full cover to onset of maturation, as indicated by changes in leaf color or leaf loss
4. Late Season	From the end of midseason to full maturity (harvest)

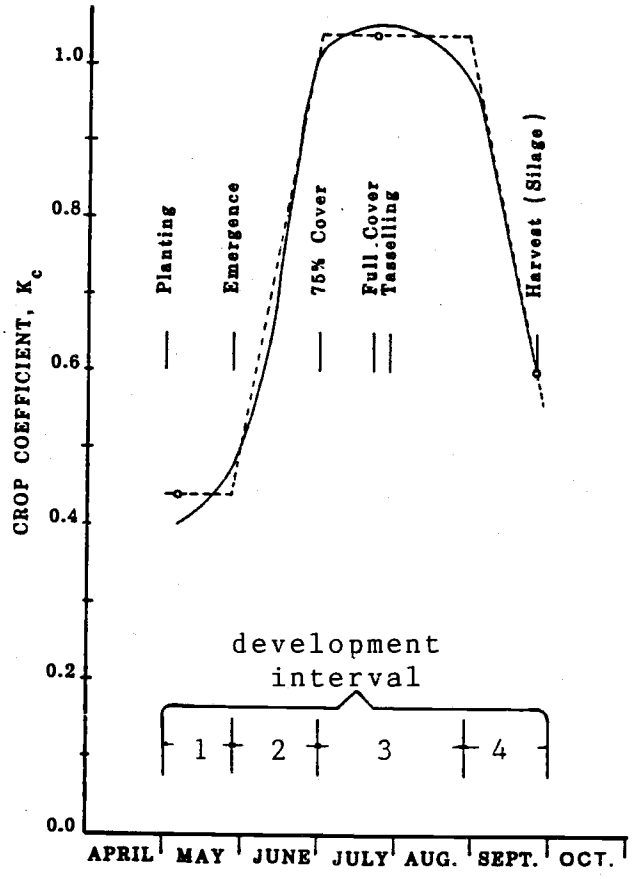

Figure 4. Example of crop ET coefficient curve constructed using the procedures of Doorenbos and Pruitt (1977). Taken from Burman et al (1983).

The duration of crop development stages should be derived from local information. If these data are not available, their lengths may be approximated from suggested values given in FAO-24.

The following describes the components and construction of a crop coefficient curve. The crop coefficient for the initial stage is assumed constant and can be obtained from figure 5, which is based upon the probability of rainfall or frequency of irrigations and the rate of ET for the initial stage.

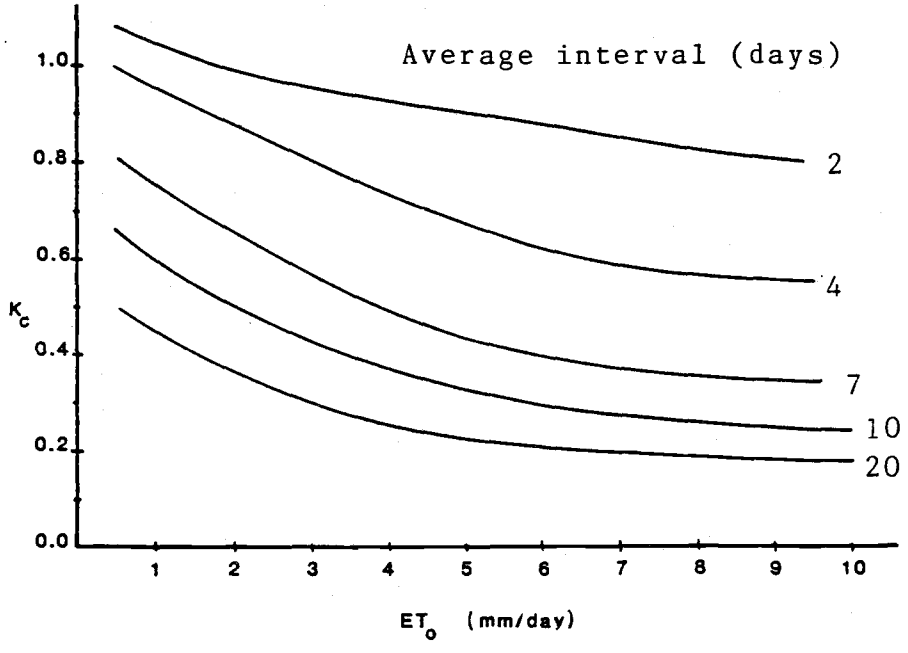

Figure 5. Average crop coefficients for grass reference ET for the initial period as related to the average recurrence interval of irrigation and/or significant rain (taken from Burman et al ,1983).

The initial stage crop coefficient can also be obtained from the following regression equations developed by El Kayal (1983):

for d<4:

$$k_{ci} = (1.286 - 0.27 \log(d))\exp((-0.01 - 0.042 \log(d))ET_o) \quad (11)$$

for d>=4:

$$k_{ci} = 2d^{-0.49}\exp((-0.02 - 0.04 \log(d))ET_o) \quad (12)$$

where:

k_{ci} = initial stage crop coefficient

d = recurrance interval of irrigation and/or significant rainfall, days

log = natural logrithm

ET_o = evapotranspiration for the initial period, mm/d

The initial stage crop coefficient is drawn on the plot of stage versus k_c as a horizontal line, spanning the initial period. Next, the stage three and four crop coefficients are determined from FAO-24 for the crop in question. The stage three (midseason) coefficient is drawn as a horizontal line spanning the midseason period. The stage two (crop development) coefficient can then be drawn in as a line connecting the end of the initial period line and the beginning of the mid-season line. The stage four coefficient is plotted as

a point at the end of the late season period, and a line is drawn connecting the end of the midseason line with this point. FAO crop coefficients for stages two, three and four vary with humidity and windspeed. FAO stage three and four coefficients for many crops are presented in the appendix.

This crop coefficient curve is not to be confused with the "crop use coefficient" of the original Blaney-Criddle method and the subsequent SCS modification. These early Blaney-Criddle crop use coefficients were not based on the concept of reference ET, and must not be used with the FAO-BC method.

Allen and Brockway (1983) compared the grass-based coefficients of FAO-24 with alfalfa-based coefficients developed by Wright (1981). The grass-based coefficients were divided by 1.15, the general alfalfa/grass coefficient suggested by Doorenbos and Pruitt (1977) for conditions similar to Kimberly, before comparison. Good agreement was obtained between the two. This suggests the possible use of the many crop coefficients presented by Doorenbos and Pruitt with an alfalfa-based ET_r to predict crop consumptive use. The idea of using alfalfa reference ET_r, obtained by the product of grass-based ET_o and a reference ratio (discussed later), with grass-based coefficients divided by 1.15, forms the basis of the consumptive use estimates presented in this paper.

3.4 FAO-BC Consumptive Use Estimates and Calibration

"Estimating Consumptive Irrigation Requirements for Crops in Idaho," by R.G. Allen and C.E. Brockway, 1983, was a study which compared the four consumptive use estimating methods presented in FAO-24 and the Jensen-Haise, SCS-modified Blaney-Criddle, standard Penman, and Wright-modified Penman methods. Daily weather data from the USDA-ARS Snake River Conservation Research Center at Kimberly, Idaho, were used to calculate consumptive use. This study was undertaken to select a particular ET method to revise consumptive use and irrigation requirement estimates for Idaho. Procedures that account for aridity at the site of temperature measurement, calibration with lysimeter records, and the adjustment of variance of consumptive use estimates arose from this work. These procedures are described in the following three sub-sections.

3.4.1 Station Aridity

Air temperature is the most commonly measured climatic parameter taken in Oregon. Temperature measurements are usually taken from maximum/minimum thermometers situated in small, white, Stevenson-type shelters supported about four feet above the ground surface. Frequently these shelters are located at airports, where temperature is only one of a series of regularly monitored parameters. The nature of the ground surface immediately below the shelter may be bare soil, weeds, or irrigated turf. The shelter may also be located on a building roof. The area surrounding the shelter can vary from regularly irrigated farmland, trees and bodies of water to asphalt roads, buildings and parking lots. The nature of the surroundings has an impact on the temperatures in and around the shelter (Allen and Brockway, 1983).

A study by Allen (1983) measured differences in daily maximum and minimum air temperatures between arid and irrigated locations in southern Idaho during 1981. Table 5 gives the average departure of temperatures of the arid sites from the irrigated sites and the aridity effects used to adjust temperature data for the estimates of Allen and Brockway (1983).

Table 5. Average monthly departure of air temperatures over arid areas from air temperatures over irrigated areas in southern Idaho during 1981, and aridity effect used in adjusting data (taken from Allen and Brockway, 1983).

Month	Temperature Departure, degrees C			
	Maximum	Minimum	Average	Aridity*
April	2.7	2.4	2.5	1.0
May	1.3	0.6	0.9	1.5
June	2.4	1.8	2.1	2.0
July	4.8	2.9	3.8	3.5
August	5.2	4.3	4.7	4.5
September	3.3	2.7	3.0	3.0
October	0.3	1.6	0.9	0.0

*aridity effect used to adjust mean monthly temperatures

The aridity factors above were modified as described later and subtracted from the monthly mean temperatures of each year of record used in the revised Idaho estimates (Allen, 1985). The use of these aridity factors for Oregon is described in the Procedure Section.

3.4.2 Effects of Data Averaging

Table 6 compares the results of the FAO-BC method when daily versus monthly input data were used.

Table 6. Average monthly values of ET_o calculated using the FAO-BC method, with daily and monthly weather data at Kimberly, Idaho (taken from Allen and Brockway, 1983).

	Grass reference ET_o, mm/d						
	APR	MAY	JUN	JUL	AUG	SEP	OCT
Daily*	3.50	5.46	6.99	7.94	6.81	4.76	2.67
Monthly**	3.52	5.44	6.94	7.93	6.81	4.73	2.63

* Daily values for mean air temperature, solar radiation, daytime wind speed, and relative humidity.

**Monthly averages of mean air temperature, solar radiation, daytime wind speed, and relative humidity.

These results were derived using a fourteen-year period of weather data from 1965-1978, collected at Kimberly. As can be seen, very little difference existed between the daily and monthly calculations. Allen and Brockway (1983) concluded that the use of the FAO-BC with long-term averages for all secondary variables, rather than daily values, will introduce little error into the calculation of consumptive use.

In another comparison, monthly consumptive use at Kimberly was calculated using fourteen-year averages of wind speed, relative humidity and solar radiation (see table 7). Little difference existed between the calculations using fourteen-year and monthly averages. The significance of this observation is that consumptive use estimates can be formulated using long-term averages of secondary variables, and monthly averages of temperature, and introduce little error into the calculation. This is the general form of climatic data most widely available for Oregon.

Table 7. Average monthly values of ET_o and ET_r calculated using FAO-BC and Wright-1982 methods at Kimberly, Idaho, 1965-1978. Adapted from Allen and Brockway (1983).

		APR	MAY	JUN	JUL	AUG	SEP	OCT
		Grass Reference ET_o, mm/d						
FAO-BC short-term	Mean*	3.52	5.44	6.94	7.94	6.81	4.73	2.63
	Std Dev	0.78	0.80	0.76	0.39	0.79	0.62	0.42
FAO-BC long-term	Mean**	3.46	5.44	7.07	8.03	6.79	4.73	2.63
	Std Dev	0.38	0.39	0.30	0.22	0.40	0.41	0.23
		Alfalfa Reference ET_r, mm/d						
Wright-1982	Mean	4.20	6.21	7.54	7.99	6.84	5.12	3.19
	Std Dev	0.70	0.65	0.75	0.42	0.69	0.54	0.31

*Using monthly mean air temperature and monthly mean minimum relative humidity, wind speed, and percent sunshine hours.

**Using monthly mean air temperature and long-term (14-year) average monthly minimum relative humidity, wind speed, and percent sunshine hours.

FAO-BC values include a 10 percent upward adjustment per 1000 meters of elevation.

3.4.3 Calibration of Consumptive Use Estimates

The results of the Wright-1982 method, a modified Penman equation, are also listed in table 7. This method was calibrated to daily lysimeter measurements of ET by alfalfa at Kimberly, Idaho, and was considered by Allen and Brockway (1983) as Kimberly reference ET. Ratios of Kimberly reference ET to FAO-BC long-term ET indicate the relative goodness of fit of the two methods, and provide reference ratios used to modify predictions made by the FAO-BC method (and others presented in FAO-24). The reference ratio is expressed by:

$$RR_i = ET_{ri}/ET_{oi} \qquad (13)$$

where:

RR_i = reference ratio for month i

ET_{ri} = alfalfa reference ET for month i, as calculated by Wright-1982 method

ET_{oi} = grass reference ET for month i, as calculated by FAO-BC method

These monthly ratios were multiplied with FAO-BC grass reference ET (with long-term secondary data) to obtain alfalfa reference ET_r. Each monthly ET prediction of each year of record was multiplied by these ratios, which are listed in table 8.

Table 8. Reference ratios used to convert grass reference ET_o, as estimated by the FAO-BC method with long-term secondary data, to an alfalfa reference ET_r at Kimberly, Idaho.

Month	Reference Ratio
APR	1.21
MAY	1.14
JUN	1.07
JUL	1.01
AUG	1.00
SEP	1.08
OCT	1.22

Table 7 also lists the standard deviations of monthly ET estimates, in addition to the mean monthly values of ET. The deviations of the FAO-BC with short-term (monthly) input data were similar to that of the Wright-1982 method. The FAO-BC with long-term data displayed a marked reduction of variance when compared with the Wright-1982 method. This was because the FAO-BC with short-term data employed monthly averages of temperature, wind speed, humidity and solar radiation, while the long-term FAO-BC used a monthly average temperature and fourteen-year averages of wind speed, humidity and solar radiation. Because the variation in estimates made with long-term secondary data was reduced, Allen

and Wright (1983) suggested that monthly standard deviations of estimates based on the FAO-BC with long-term secondary data be multiplied by the factors shown in table 9.

Table 9. Standard deviation adjustment ratios used to correct for reduction in variance of ET estimates of FAO-BC method using long-term secondary data.

Month	Adjustment Ratio
APR	1.70
MAY	1.64
JUN	2.70
JUL	2.22
AUG	2.13
SEP	1.61
OCT	1.35

The result is the adjusted standard deviation, σ_{etr}, and can be used for frequency analysis of monthly ET estimates.

3.5 Effective Precipitation

The net irrigation requirement for a particular crop is calculated by the difference between the consumptive use estimate and the effective precipitation expected at that location and time. Effective precipitation is that portion of rainfall that goes directly toward meeting the consumptive use requirement of a crop. This does not include that which percolates past the root zone in excess of leaching requirements, or which runs off the soil surface. Units of effective precipitation are length per unit of time. The relationship of effective precipitation to the irrigation requirement is given by:

$$IR_m = (CU_m * L_m) - EP_m \qquad (14)$$

where:

IR_m = monthly net irrigation requirement, mm

CU_m = average monthly consumptive use, mm/d

L_m = number of days of crop growth in given month

EP_m = effective precipitation during the period of the month having crop growth

Long-term average monthly precipitation values were computed as part of the CROPUSE program for later use with the effective precipitation method described in the next paragraph.

The Soil Conservation Service, using results of a soil moisture balance for 22 stations, developed a method of estimating effective rainfall (SCS, 1967; Dastane, 1974). This method is executed by entering table 10 with values of monthly mean rainfall and monthly mean consumptive use, and interpolating for the estimate of mean monthly effective rainfall. Direct use of table 10 assumes a net irrigation application of 75 mm for each irrigation event. If other application depths are typical, table 11 provides multiplication factors which modify the table 10 estimate.

Table 10. Average monthly effective rainfall as related to mean monthly rainfall and mean monthly consumptive use (taken from Burman et al, 1983).

Monthly mean rainfall (mm)	Mean monthly consumptive use (mm)[a]						
	50	100	150	200	250	300	350
25.0	16.2	18.0	19.7	22.0	25.0	25.0	25.0
50.0	32.2	35.7	39.0	43.7	50.0	50.0	50.0
75.0	46.2	52.7	57.5	63.7	73.7	75.0	75.0
100.0	at 60.7	67.7	74.2	83.0	95.0	100	100
125.0		81.5	90.5	102	115	125	125
150.0		95.2	106	120	136	150	150
175.0		at 160	120	135	154	170	175
200.0			133	145	168	188	200
250			150	170	194		
300				190	215		
350				200	232		
400					247		

[a] Based on a net irrigation application of 75 mm.

Table 11. Multiplication factors to relate monthly effective rainfall obtained from table 10 to net depth of irrigation application. Taken from Jensen (1980).

* *d* (mm)	Factor	*d* (mm)	Factor
10.0	0.620	60.0	0.63
15.0	0.676	70.0	0.990
20.0	0.728	80.0	1.004
25.0	0.770	90.0	1.012
30.0	0.808	100.0	1.020
35.0	0.842	125.0	1.040
40.0	0.876	150.0	1.060
50.0	0.930	175.0	1.070

*d is net irrigation application.

4. PROCEDURES

The data required to calculate consumptive use estimates by the methods described above includes average monthly temperature and precipitation, minimum relative humidity, wind speed at two meters above the ground, and percent sunshine hours. The following describes the sources and use of these data.

4.1 Primary Data Used for Consumptive Use Estimates

Mean monthly temperature and precipitation data for fourteen Oregon locations were made available by the OSU Office of the State Climatologist. These data were originally on magnetic tape, and were transferred to mini-floppy disks for use on a Northstar Horizon II microcomputer.

Station selection was based upon the desire to encompass significant agricultural regions of the state where irrigation is practiced. Although it would be desireable to formulate ET estimates for more locations than were included in this study, this was hindered by the lack of high-quality temperature and precipitation data available on magnetic tape. Because of the statistical predictions made as part of the OSUETO/CROPUSE programs, many years

of record were required for accuracy. Since hand entry of such large amounts of data into computer files would have required many hours better spent on other aspects of this project, this study was limited to selection from files presently available on magnetic tape. Table 12 gives elevation, latitude, and years of record for those stations selected.

4.2 Determination of Station Aridity

Each monthly mean temperature of each year of record was adjusted for station aridity. Each site of temperature measurement was rated on a scale of 0-100 percent aridity (see table 13) by use of the following equation taken from Allen and Brockway (1983):

$$\begin{aligned} \text{Cumulative aridity} = {} & 0.4(\text{site aridity}) \\ & + 0.5(\text{area aridity}) \\ & + 0.1(\text{region aridity} \end{aligned} \qquad (15)$$

where site, area, and region aridity were estimated on a scale of 0-100 percent. The determination of site, area and region aridity was made by the use of site descriptions made available by the Office of the State Climatologist on a standard form (B-44), and personal communication with some temperature observers. The cumulative aridity rating (as a decimal) was multiplied with each of the aridity factors given previously in table 5.

Table 12. Station elevation, latitude, and years of record. *

Station	Elevation (feet)	Latitude (degrees)	Years of Record
Baker KBKR	3444	44.78	1941,1942, 1950-1981
Bend	3600	44.07	1931-1982
Eugene WB AP	364	44.12	1941,1942, 1948-1982
Headworks, Portland Water Bureau	748	45.45	1931-1982
Heppner	1950	45.32	1931-1982
Hermiston	624	45.82	1928-1982
Hood River Exp. Sta.	500	45.68	1931-1982
Lakeview	4756	42.18	1931-1982
Madras	2256	44.38	1928-1982
Medford Exp. Sta.	1457	42.30	1938-1982
Pendleton WB AP	1489	45.68	1948-1982
Roseburg WB AP	505	43.23	1950-1965
Salem WB AP	200	44.92	1928-1982
Vale 1W	2300	44.00	1928-1982

*Station is source of temperature and precipitation data.

Table 13. Determination of site, area, and region aridity of selected temperature stations.

Station	Aridity, percent** Site	Area	Region	Cumulative*
Baker KBKR	50	50	100	55
Bend	50	80	100	70
Eugene WB AP	100	50	50	70
Headworks, Portland Wtr. Bureau	90	0	80	44
Heppner	100	90	80	93
Hermiston	0	50	50	30
Hood River Exp. Sta.	70	50	30	56
Lakeview	0	70	100	45
Madras	70	90	100	83
Medford Exp. Sta.	30	50	80	45
Pendleton WB AP	100	80	90	89
Roseburg WB AP	75	85	80	81
Salem WB AP	100	50	30	68
Vale 1W	100	70	100	85

*calculated with equation 15

**basis: 0, irrigated sod, in river bend, etc.
30, irrigated grass pasture, near water
50, trees, rolling hills, no irrigation
70, near roads, residential, no lawns
80, dry timbered hills
90, timbered hills and rocky buttes
100, municipal works, airport, desert

and the resulting monthly aridity adjustment factors were subtracted from the average monthly temperatures of each year of record used. The results were adjusted average monthly temperatures that reflect those expected in a large, irrigated invironment over a well-watered stand of grass or alfalfa.

4.3 Secondary Data Used for Consumptive Use Estimates

Secondary data of daytime wind speed, minimum relative humidity, and percent of actual-to-possible sunshine hours were required for the estimates presented in this work. Wind speed and minimum relative humidity data (see table 14) were collected from Pacific Northwest River Basins Commission (PNWRBC) Climatological Handbook (1968). PNWRBC data for humidity were presented as frequency analyses for each hour of the day. Frequency of occurrence within bracketed intervals of humidity (e.g., 1 to 19, 20 to 29, 30 to 39, etc.)ranging from zero to 100 are given for each hour of the day. Minimum daily relative humidity was found by calculating the product of an hourly percentage probability of occurance within an interval and the midpoint of that interval of humidity. These products were summed for all intervals of humidity for that hour of the day, giving an hourly average humidity. The minimum hourly average humidity selected usually occured between 1500 and 1600 hours.

Table 14. Secondary weather parameters.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Baker KBKR												
n ratio(n/N)	0.59	0.57	0.67	0.74	0.78	0.79	0.93	0.85	0.86	0.76	0.58	0.54
min.RH (%)	70.0	64.2	55.1	38.9	41.5	44.6	30.0	30.8	31.0	39.6	56.4	73.7
daywind (m/s)	2.53	2.71	3.29	3.37	3.34	3.02	2.70	2.33	2.64	2.40	2.28	2.43
Bend												
n ratio(n/N)	0.63	0.55	0.68	0.67	0.72	0.72	0.81	0.80	0.76	0.77	0.60	0.60
min.RH (%)	62.8	53.3	45.1	34.2	35.0	34.8	30.0	30.0	30.0	42.1	52.2	60.0
daywind (m/s)	3.00	3.00	3.32	3.20	2.93	2.95	2.73	2.53	2.56	2.61	2.73	2.91
Eugene WB AP												
n ratio(n/N)	0.46	0.40	0.53	0.58	0.64	0.63	0.74	0.72	0.68	0.57	0.43	0.40
min.RH (%)	77.9	71.7	64.6	51.5	51.7	50.7	37.7	39.4	40.7	62.8	74.7	81.2
daywind (m/s)	2.90	2.54	2.99	2.89	2.82	2.87	3.31	2.82	2.75	2.18	2.16	2.55
Headwks., Portland Wtr.Bureau												
n ratio(n/N)	0.49	0.40	0.53	0.56	0.62	0.52	0.63	0.66	0.65	0.55	0.41	0.39
min.RH (%)	76.4	71.0	62.6	52.4	54.0	56.3	48.4	48.7	49.6	63.7	73.0	78.8
daywind (m/s)	3.22	2.81	2.87	2.35	2.30	2.27	2.49	2.26	2.09	2.16	2.55	3.16
Heppner												
n ratio(n/N)	0.45	0.45	0.65	0.72	0.76	0.72	0.85	0.83	0.78	0.68	0.45	0.42
min.RH (%)	71.2	63.7	49.7	37.0	37.4	33.6	30.0	30.0	30.0	48.2	56.6	61.1
daywind (m/s)	2.73	3.00	3.53	3.62	3.43	3.63	3.43	3.16	3.04	2.77	2.68	3.00

Table 14. Secondary weather parameters (cont).

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Hermiston												
n ratio(n/N)	0.45	0.45	0.65	0.72	0.76	0.72	0.85	0.83	0.78	0.68	0.45	0.42
min.RH (%)	71.2	63.7	49.7	37.0	37.4	33.6	30.0	30.0	30.0	48.2	56.6	61.1
daywind (m/s)	2.73	3.00	3.53	3.62	3.43	3.63	3.43	3.16	3.04	2.77	2.68	3.00
Hood River Exp.Sta.												
n ratio(n/N)	0.56	0.57	0.70	0.77	0.80	0.80	0.93	0.88	0.83	0.75	0.53	0.53
min.RH (%)	74.8	66.9	54.9	40.6	40.0	40.7	33.7	37.3	35.6	51.6	67.4	75.7
daywind (m/s)	1.70	1.99	2.90	4.14	4.53	4.63	4.88	4.49	3.20	1.50	1.66	1.87
Lakeview												
n ratio(n/N)	0.60	0.55	0.66	0.69	0.73	0.76	0.82	0.81	0.78	0.74	0.60	0.61
min.RH (%)	67.0	62.8	50.0	35.4	38.5	35.0	30.0	30.0	30.6	40.6	55.0	70.9
daywind (m/s)	2.21	2.13	2.88	2.71	2.80	2.50	2.29	2,18	2.00	1.88	1.88	1.68
Madras												
n ratio(n/N)	0.63	0.55	0.68	0.67	0.72	0.72	0.81	0.80	0.76	0.77	0.60	0.60
min.RH (%)	62.8	53.3	45.1	34.2	35.0	34.8	30.0	30.0	30.0	42.1	52.2	60.0
daywind (m/s)	3.00	3.00	3.32	3.20	2.93	2.95	2.73	2.53	2.56	2.61	2.73	2.91
Medford Exp.Sta.												
n ratio(n/N)	0.46	0.54	0.67	0.73	0.80	0.82	0.93	0.91	0.82	0.70	0.51	0.42
min.RH (%)	72.7	60.9	50.5	39.3	39.5	30.0	30.0	31.0	48.1	65.7	65.7	79.1
daywind (m/s)	1.49	1.49	2.11	2.34	2.44	2.54	2.45	2.26	1.63	1.29	1.06	1.16

Table 14. Secondary weather parameters (cont).

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pendleton WB AP												
n ratio (n/N)	0.53	0.51	0.67	0.74	0.80	0.79	0.92	0.90	0.80	0.73	0.54	0.52
min.RH (%)	71.2	63.7	49.7	37.0	37.4	33.6	30.0	30.0	30.0	48.2	56.6	61.1
daywind (m/s)	2.73	3.00	3.53	3.62	3.43	3.63	3.43	3.16	3.04	2.77	2.68	3.00
Roseburg WB AP												
n ratio (n/N)	0.47	0.48	0.61	0.70	0.77	0.77	0.91	0.87	0.78	0.64	0.47	0.44
min.RH (%)	72.7	64.8	57.3	48.0	47.3	46.7	37.6	37.9	41.4	58.6	71.5	76.1
daywind (m/s)	1.56	1.53	1.85	1.96	2.15	2.16	2.57	2.37	1.92	1.44	1.37	1.34
Salem WB AP												
n ratio (n/N)	0.40	0.49	0.58	0.62	0.71	0.72	0.90	0.86	0.75	0.62	0.54	0.41
min.RH (%)	77.0	70.1	64.1	51.6	49.8	51.0	39.6	40.8	41.8	61.1	73.1	80.0
daywind (m/s)	3.15	2.79	3.12	2.85	2.70	2.70	2.90	2.77	2.61	2.57	2.61	3.06
Vale 1W												
n ratio (n/N)	0.60	0.57	0.69	0.76	0.79	0.81	0.93	0.88	0.84	0.79	0.58	0.57
min.RH (%)	67.2	62.7	43.2	30.9	33.3	30.5	30.0	30.0	30.0	38.1	57.3	72.9
daywind (m/s)	2.14	2.29	3.04	3.04	2.92	2.76	2.36	2.10	1.91	1.96	1.75	1.96

Average daytime windspeed was calculated in the same manner, but averaged over the period from 0700 to 1900 hours. Most windspeed data (both windspeed and direction) are measured at about 6.7 m above the ground surface (Weiss, 1981). The PNWRBC values were adjusted down to a two meter height by the following equation (Burman et al., 1983):

$$U_2 = U_z \, (2/z)^{0.2} \qquad (16)$$

where:

U_2 = windspeed at 2 meter height, m/s

U_z = windspeed at 6.7 meter height, m/s

z = 6.7 meters

In some cases windspeed and relative humidity data were not available at the selected temperature station, so substitutions were made as listed in table 15.

The remaining secondary parameter of percent sunshine hours (n/N) was calculated from either estimated or actual solar measurements (see table 15). Satterlund and Means (1979) presented monthly average global radiation (direct plus diffuse) data for the Pacific Northwest. These estimates were based on measurements taken at various locations, and used in a computer model that took into account the effects of cloud cover and atmospheric disturbance. High-quality global radiation

Table 15. Station substitutions for secondary parameters.

Station	nratio	min.RH[3]	daywind[3]
Baker KBKR	Baker[1]	Baker AP	Baker AP
Bend	Bend[2]	Redmond AP	Redmond AP
Eugene WB AP	Eugene[2]	Eugene AP	Eugene AP
Headworks, Portland Water Bureau	Portland[1]	Portland AP	Portland AP
Heppner	Hermiston[2]	Pendleton AP	Pendleton AP
Hermiston	Hermiston[2]	Pendleton AP	Pendleton AP
Hood River Exp. Sta.	Dallesport[1]	Dallesport AP	Dallesport AP
Lakeview	Whitehorse[2]	Klamath F.	Klamath F.
Madras	Bend[2]	Redmond AP	Redmond AP
Medford Exp. Sta.	Medford[1]	Medford AP	Medford AP
Pendleton WB AP	Pendleton[1]	Pendleton AP	Pendleton AP
Roseburg WB AP	Roseburg[1]	Roseburg AP	Roseburg AP
Salem WB AP	Corvallis[2]	Salem AP	Salem AP
Vale 1W	Ontario[1]	Ontario AP	Ontario AP

sources:

(1) Satterlund and Means, 1978 (estimated data)

(2) OSU Atmospheric Science Department (actual data)

(3) Pacific Northwest River Basins Commission, 1968 (actual data)

data were provided by the OSU Atmospheric Science Department for some locations. Percent sunshine hours data were calculated by ratios of either estimated or actual global solar radiation to daily clear sky global solar radiation at the surface of the earth (Jensen, 1974). In some cases global radiation data were not available at the selected temperature station. Substitutions for these cases are listed in table 15.

4.4 Calculation of Monthly Statistics

Fequency analyses were performed as part of the OSUETO/CROPUSE programs. Predictions, based on the standard normal distribution, were made for four probability of occurance intervals in addition to the mean. The standard normal distribution was selected because results by Jensen (1974) indicated a normal distribution for ET. Mean and standard deviation for calibrated ET_r values were computed for each month of each year of record, with standard deviations adjusted as described in the Theory section. Given a probability level, the OSUETO program interpolated into a table of standard normal variables for the correct value. Frequency analyses were then performed according to the equation:

$$ET_{ri} = Z * \sigma_{etr} + ET_{rm} \qquad (17)$$

where:

ET_{ri} = ET_r at desired probability level, mm/d

Z = standard normal variable

σ_{etr} = adjusted standard deviation of ET_r values, mm/d

ET_{rm} = mean ET_r, mm/d

4.5 Crop Selection

1983 harvest statistics for Oregon were obtained from the OSU Cooperative Extension Service to determine the economically significant crops of each county. Selection of crops for this study was limited by the availability of crop coefficients (as presented in the appendix).

A questionaire was sent to each county extension office included in the study requesting information concerning crop-stage development dates: planting, 70-80 percent ground cover, full (effective) cover, and harvest (maturity). This information had to be expressed in terms of the four stages of the growing season described in FAO-24 (see table 4).

The interval in days from planting to 70-80 percent ground cover, obtained from county agents, was taken to correspond to the combination of suggested initial and crop development periods described in FAO-24.

An example of suggested intervals for corn (maize) is shown in table 16.

Table 16. Intervals defining growth stages of corn (maize, grains). Taken from Burman et al (1983).

Location	Planting time	Duration of stages (days)				Total growth period (days)
		Initial	Crop development	Mid-season	Late season	
East African highland	Spring	30	50	60	40	180
Warm desert climates	Late cool season	25	40	45	30	140
Subhumid Nigeria	June	20	35	40	30	125
India	October	20	35	40	30	125
Southern Spain	Early April	30	40	50	30	150

The length of the initial period was calculated as the product of the interval given by county agents (from planting to 70-80 percent ground cover) and the ratio of suggested initial period to the sum of suggested initial and crop development periods. For example, in table 16 the sum of initial and crop development periods for corn (maize) in the East African highland is 80 days. If questionaire information indicated that the period from planting to 70-80 percent ground cover was actually 101 days, than the initial period was estimated as 101*(30/80) = 38 days.

The estimated crop development period was then found by the difference between the actual 101 days and 38 estimated days, i.e., 63 days. Similarly, the interval in days from 70-80 percent ground cover to harvest, obtained from county agents, was taken to correspond to the combination of suggested midseason and late season periods described in FAO-24. The length of the midseason period was calculated as the product of the interval given by county agents and the ratio of suggested midseason period to the sum of suggested midseason and late season periods. Referring again to table 16 and the East African highland, the sum of suggested midseason and late season periods is 100 days. If questionaire information indicated that the period from 70-80 percent ground cover to harvest was 110 days, then the midseason period was estimated as 110*(60/100) = 66 days. The estimated late season period was then found by the difference between 110 actual days and 66 estimated days, i.e., 44 days. If a choice of suggested FAO-24 intervals was required for a given crop and location, that which had a length of growing season comparable with that reported by county agents was selected for use in the above procedure. Table 17 gives location, crops, and crop stage lengths used for the estimates presented in this study.

Table 17. Locations, crops, and crop stage lengths used for consumptive use and irrigation requirement estimates.

Station	Crop	Estimated Planting date (mo.-day)	Development interval (days) 1	2	3	4
Baker						
KBKR	Alfalfa hay	4-10	* (174 days)			
	Field corn	5-05	15	51	50	33
	Fruit trees	4-15	* (178 days)			
	Onions	4-20	15	66	45	22
	Pasture grass	3-20	* (224 days)			
	Peas	4-10	10	30	44	22
	Potatoes	4-25	30	47	57	34
	Spring grain	4-01	12	33	61	31
	Sweet corn (early)	5-15	17	49	39	8
	Sweet corn (late)	6-20	11	29	48	10
Bend	Alfalfa hay	4-10	* (174 days)			
	Pasture grass	3-20	* (224 days)			
	Peas	4-10	10	30	44	22
	Potatoes	4-25	30	47	57	34
	Spring grain	4-01	12	33	61	31
	Sweet corn (early)	5-15	17	49	39	8
	Sweet corn (late)	6-20	11	29	48	10
	Winter grain	3-05**	12	21	76	46

*Only total length of season given for perrenials

**Effective planting date (spring green-up)

Table 17. Locations, crops, and crop stage lengths used for consumptive use and irrigation requirement estimates.

Station	Crop	Estimated Planting date (mo.-day)	Development interval (days) 1	2	3	4
Eugene WB AP	Alfalfa hay	4-01	* (212 days)			
	Field corn	5-05	27	44	40	27
	Fruit trees	4-20	* (178 days)			
	Green beans	5-10	17	28	22	9
	Melons	5-20	17	24	45	22
	Onions	4-15	14	23	65	37
	Pasture grass	3-10	* (251 days)			
	Peas	2-29	23	27	35	18
	Spring grain	4-15	25	41	32	19
	Squash	5-10	19	27	54	33
	Sweet corn	5-12	21	32	57	11
	Table beets	4-30	25	31	31	13
	Tomatoes	5-01**	23	31	35	23
	Winter grain	4-01**	37	73	41	25
Headworks, Portland Water Bureau	(all data identical with Eugene WB AP)					
Heppner	Alfalfa hay	4-10	* (174 days)			
	Field corn	5-05	15	51	50	33
	Fruit trees	4-01	* (192 days)			
	Pasture grass	3-20	* (224 days)			
	Peas	3-15	25	31	47	24
	Spring grain	3-01	25	50	44	27
	Winter grain	3-05	14	27	67	41
Hermiston	Alfalfa hay	3-01	* (210 days)			
	Field corn	5-01	36	48	43	26
	Onion	3-25	40	70	50	21
	Pasture grass	3-01	* (214 days)			
	Potato (early)	3-20	35	42	24	16
	Potato (mid)	4-10	34	39	44	27
	Potato (late)	4-25	34	39	41	24
	Spring grain	3-15**	25	57	50	31
	Winter grain	3-01**	28	56	40	25

* Only total length of season given for perrenials

** Effective planting date (spring green-up)

Table 17. Locations, crops, and crop stage lengths used for consumptive use and irrigation requirement estimates.

Station	Crop	Estimated Planting date (mo.-day)	Development interval (days) 1	2	3	4
Hood River Exp. Sta.	Alfalfa hay	4-10	* (174 days)			
	Field corn	5-05	15	51	50	33
	Fruit trees	4-15	* (178 days)			
	Onions	4-20	15	66	45	22
	Pasture grass	3-20	* (224 days)			
	Peas	4-10	10	30	44	22
	Potatoes	4-25	30	47	57	34
	Spring grain	4-01	12	33	61	31
	Sweet corn (early)	5-15	17	49	39	8
	Sweet corn (late)	6-20**	11	29	48	10
	Winter grain	3-05	12	21	55	45
Lakeview	Alfalfa hay	5-15	* (107 days)			
	Pasture grass	4-01	* (197 days)			
	Potatoes	5-15	17	39	58	35
	Spring grain	5-15**	17	30	48	29
	Winter grain	4-05	17	30	50	30
Madras	Alfalfa hay	4-10	* (174 days)			
	Onions	4-20	15	66	45	22
	Pasture grass	4-12	* (195 days)			
	Peas	4-10	10	30	44	22
	Potatoes	5-10	24	28	58	35
	Silage corn	5-05	15	51	50	33
	Spring grain	4-01**	12	33	61	31
	Winter grain	3-15	9	17	76	22

* Only total length of season given for perrenials

** Effective planting date (spring green-up)

Table 17. Locations, crops, and crop stage lengths used for consumptive use and irrigation requirement estimates.

Station	Crop	Estimated Planting date (mo.-day)	Development interval (days) 1	2	3	4
Medford Exp.Sta.	Alfalfa hay	3-29	* (219 days)			
	Fruit trees	4-01	* (214 days)			
	Pasture grass	3-01	* (261 days)			
	Potatoes	5-10	24	28	63	38
	Spring grain	4-15**	20	27	61	31
	Winter grain	3-05	15	42	66	40
Pendleton WB AP	Alfalfa hay	3-01	* (210 days)			
	Field corn	5-01	36	48	43	26
	Onions	3-25	40	70	50	21
	Pasture grass	3-01	* (214 days)			
	Potato (early)	3-20	35	42	24	16
	Potato (mid)	4-10	34	39	44	27
	Potato (late)	4-25	34	39	41	24
	Spring grain	3-15**	28	57	50	31
	Winter grain	3-01	28	56	40	25
Roseburg WB AP	Alfalfa hay	3-15	* (200 days)			
	Fruit trees	3-20	* (195 days)			
	Pasture grass	3-01	* (259 days)			
	Peas	3-15	16	20	50	22
	Spring grain	3-15	21	26	61	31
	Sweet corn	5-01**	23	38	46	30
	Winter grain	3-05	34	42	41	20
Salem WB AP	(all data identical with Eugene WB AP)					

* Only total length of season given for perrenials

** Effective planting date (spring green-up)

Table 17. Locations, crops, and crop stage lengths used for consumptive use and irrigation requirement estimates.

Station	Crop	Estimated Planting date (mo.-day)	Development interval (days) 1	2	3	4
Vale 1W	Alfalfa hay	4-03	* (204 days)			
	Dry beans	5-17	22	33	35	17
	Field corn	5-03	30	41	56	33
	Fruit trees	4-08	* (190 days)			
	Green beans	5-17	22	33	39	13
	Onions	4-04	38	64	31	17
	Pasture grass	3-27	* (218 days)			
	Peas	4-04	25	31	35	17
	Potatoes	4-14	33	38	55	33
	Spring grain	3-28	36	46	34	17
	Sweet corn	5-03**	28	42	27	6
	Winter grain	2-09**	37	75	39	24

*Only total length of season given for perrenials

**Effective planting date (spring green-up)

4.6 Computer Implementation

The OSUETO program (see Appendix) was modified to accept input data other than that included in the feasibility study of Ryan and Cuenca (1984). The program was also altered to accept primary input data in a more compact form than as originally written by Ryan and Cuenca (1984).

A test of the OSUETO program was conducted using the Salem input data set with ETO, the consumptive use program written by Doorenbos and Pruitt (1977) for FAO-24. Salem was selected to minimize the elevation adjustment made by OSUETO. Small constant differences were noted between the output of these two programs, and attributed to the elevation correction and the calibration of OSUETO estimates with Kimberly, Idaho.

The CROPUSE program (see Appendix) was run for each station, with local crop information provided by county extension agents. The results follow in section 5.

4.7 Summary of Procedures

The following is a list of procedures required to formulate estimates of consumptive use and irrigation requirements as presented in this work:

a) gather temperature and precipitation data and express as 12 mean monthly values for each year of record.

b) rate the aridity of the site of temperature measurement and perform the downward adjustment as given by Allen and Brockway (1983), and described in section 4.2.

c) gather secondary data of daytime wind speed at two meters above the ground surface, minimum relative humidity, and the ratio of actual-to-possible sunshine hours.

d) calculate grass reference ET_o for each month of each year of record as given by equation 9 (see page 22).

e) multiply the resulting monthly ET_o estimates by the reference ratios (see table 8) given by Allen and Brockway (1983) to convert to an alfalfa reference ET_r calibrated with the Wright-1982 equation and the climate of southern Idaho.

f) divide the resulting calibrated ET_r values by 1.15, the general alfalfa/grass coefficient of Doorenbos and Pruitt (1977) to enable the use of the many grass-based crop coefficients of FAO-24.

g) calculate the mean and standard deviation of ET_r values for each month of the year.

h) adjust the standard deviation of ET_r values with the coefficients given by Allen and Wright (1983) that correct for the loss of variance experienced when long-term (14-year) averages of secondary data are used with the FAO-BC method (see table 9).

i) perform frequency analyses of these calibrated consumptive use estimates using equation 17.

j) gather crop development information and express in a form appropriate for use with the FAO-BC method (see section 4.5).

k) calculate long-term monthly average precipitation and use the effective precipitation method described in section 3.5 to calculate irrigation requirement estimates according to equation 14.

5. RESULTS AND DISCUSSION

5.1 Results: Consumptive Use and Irrigation Requirements

The succeeding pages (table 18) give consumptive use and irrigation requirement estimates for fourteen Oregon locations. The estimates for each location begin on the following pages: Baker, 62; Bend, 72; Eugene, 80; Headworks, Portland Water Bureau, 94; Heppner, 108; Hermiston, 115; Hood River, 124; Lakeview, 135; Madras, 140; Medford, 148; Pendleton, 154; Roseburg, 163; Salem, 170; and Vale, 184.

Consumptive use and irrigation requirement estimates are given in inches for each month of the growing season. Frequency analyses, based on the standard normal distribution, are given for each crop for 7,8, and 9 out of 10 years and 19 out of 20 years, in addition to the mean (5 out of 10 year) frequency of occurrence.

The crops reported for each station are listed alphabetically. The two sections following table 18 (5.2 and 5.3) describe the assumptions inherent in these results, and some comments concerning their interpretation.

5.1.1 Baker

Table 18. Consumptive Use and Irrigation Requirement.

BAKER

CONSUMPTIVE USE (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	2.66	2.92	3.08	3.29	3.47
MAY	5.52	5.85	6.05	6.32	6.55
JUN	6.16	6.75	7.12	7.62	8.03
JUL	7.98	8.29	8.48	8.75	8.97
AUG	6.38	6.77	7.01	7.34	7.61
SEP	4.92	5.28	5.50	5.81	6.06
OCT					
NOV					
DEC					
TOTAL	33.61	35.87	37.24	39.13	40.70

IRRIGATION REQUIREMENT (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	2.20	2.45	2.61	2.82	3.00
MAY	4.53	4.85	5.04	5.30	5.52
JUN	5.15	5.73	6.06	6.52	6.90
JUL	7.50	7.80	7.99	8.24	8.46
AUG	5.91	6.30	6.53	6.85	7.11
SEP	4.45	4.80	5.02	5.31	5.55
OCT					
NOV					
DEC					
TOTAL	29.74	31.92	33.23	35.04	36.53

Table 18. Consumptive Use and Irrigation Requirement.

BAKER

CONSUMPTIVE USE (inches): FIELD CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.45	1.49	1.51	1.54	1.57
JUN	4.62	5.04	5.29	5.64	5.92
JUL	9.24	9.60	9.82	10.12	10.38
AUG	7.50	7.96	8.24	8.63	8.95
SEP	4.26	4.58	4.77	5.03	5.25
OCT					
NOV					
DEC					
TOTAL	27.07	28.67	29.63	30.97	32.06

IRRIGATION REQUIREMENT (inches): FIELD CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.76	0.79	0.81	0.84	0.86
JUN	3.68	4.09	4.33	4.66	4.93
JUL	8.72	9.07	9.28	9.59	9.84
AUG	7.00	7.45	7.72	8.09	8.41
SEP	3.80	4.11	4.30	4.56	4.77
OCT					
NOV					
DEC					
TOTAL	23.95	25.51	26.44	27.74	28.81

Table 18. Consumptive Use and Irrigation Requirement.

BAKER

CONSUMPTIVE USE (inches):	FRUIT TREES (peaches, pears, plums, apricots)				
MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.96	1.05	1.11	1.19	1.25
MAY	2.90	3.08	3.18	3.33	3.45
JUN	4.21	4.62	4.87	5.21	5.50
JUL	6.30	6.55	6.70	6.91	7.08
AUG	5.03	5.34	5.53	5.79	6.01
SEP	3.63	3.89	4.06	4.28	4.47
OCT	0.56	0.60	0.62	0.66	0.68
NOV					
DEC					
TOTAL	23.59	25.14	26.07	27.37	28.44

IRRIGATION REQUIREMENT (inches):	FRUIT TREES				
MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.66	0.74	0.80	0.88	0.94
MAY	2.01	2.17	2.27	2.41	2.53
JUN	3.28	3.68	3.92	4.25	4.52
JUL	5.86	6.11	6.25	6.46	6.62
AUG	4.61	4.91	5.09	5.34	5.55
SEP	3.17	3.44	3.60	3.82	4.00
OCT	0.48	0.52	0.52	0.57	0.59
NOV					
DEC					
TOTAL	20.08	21.57	22.48	23.73	24.76

Table 18. Consumptive Use and Irrigation Requirement.

BAKER

CONSUMPTIVE USE (inches): ONIONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.40	0.42	0.43	0.44	0.45
MAY	2.39	2.47	2.52	2.58	2.63
JUN	4.89	5.33	5.60	5.97	6.27
JUL	8.45	8.79	8.99	9.27	9.50
AUG	6.76	7.18	7.44	7.79	8.08
SEP	2.07	2.23	2.32	2.45	2.55
OCT					
NOV					
DEC					
TOTAL	24.96	26.42	27.29	28.49	29.48

IRRIGATION REQUIREMENT (inches): ONIONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.31	0.33	0.34	1.71	1.76
MAY	1.53	1.61	1.65	1.71	1.76
JUN	3.94	4.36	4.62	4.97	5.26
JUL	7.96	8.28	8.48	8.75	8.97
AUG	6.29	6.70	6.94	7.28	7.56
SEP	1.88	2.03	2.12	2.25	2.36
OCT					
NOV					
DEC					
TOTAL	21.91	23.31	24.15	25.31	26.26

Table 18. Consumptive Use and Irrigation Requirement.

BAKER

CONSUMPTIVE USE (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.74	0.83	0.88	0.96	1.02
APR	4.00	4.39	4.63	4.95	5.22
MAY	5.81	6.16	6.37	6.66	6.90
JUN	6.48	7.11	7.49	8.02	8.45
JUL	8.40	8.73	8.93	9.21	9.44
AUG	6.71	7.13	7.38	7.73	8.01
SEP	5.18	5.56	5.79	6.12	6.38
OCT	2.94	3.15	3.28	3.46	3.61
NOV					
DEC					
TOTAL	40.25	43.05	44.75	47.09	49.03

IRRIGATION REQUIREMENT (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.58	0.65	0.69	0.75	0.80
APR	3.31	3.69	3.92	4.24	4.50
MAY	4.81	5.14	5.34	5.62	5.85
JUN	5.46	6.06	6.41	6.89	7.27
JUL	7.90	8.23	8.42	8.69	8.91
AUG	6.24	6.64	6.88	7.22	7.50
SEP.	4.70	5.07	5.29	5.61	5.87
OCT	2.49	2.70	2.83	3.00	3.15
NOV					
DEC					
TOTAL	35.49	38.17	39.78	42.01	43.84

Table 18. Consumptive Use and Irrigation Requirement.

BAKER

CONSUMPTIVE USE (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.05	1.11	1.15	1.20	1.24
MAY	5.52	5.94	6.13	6.40	6.62
JUN	7.26	7.96	8.39	8.98	9.47
JUL	6.97	7.25	7.41	7.64	7.83
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	20.89	22.26	23.08	24.22	25.16

IRRIGATION REQUIREMENT (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.64	0.71	0.74	0.79	0.83
MAY	4.62	4.93	5.11	5.37	5.58
JUN	6.19	6.84	7.21	7.75	8.22
JUL	6.62	6.89	7.05	7.28	7.46
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	18.08	19.36	20.12	21.18	22.09

Table 18. Consumptive Use and Irrigation Requirement.

BAKER

CONSUMPTIVE USE (inches): POTATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.20	0.21	0.21	0.22	0.23
MAY	1.53	1.56	1.58	1.60	1.61
JUN	4.31	4.69	4.92	5.23	5.49
JUL	9.18	9.54	9.76	10.06	10.31
AUG	7.52	7.98	8.26	8.65	8.97
SEP	5.17	5.56	5.79	6.11	6.37
OCT	0.72	0.77	0.80	0.84	0.88
NOV					
DEC					
TOTAL	28.61	30.30	31.31	32.71	33.86

IRRIGATION REQUIREMENT (inches): POTATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.17	0.18	0.19	0.19	0.20
MAY	0.73	0.76	0.77	0.79	0.81
JUN	3.37	3.74	3.97	4.27	4.51
JUL	8.66	9.01	9.22	9.52	9.77
AUG	7.02	7.47	7.74	8.12	8.43
SEP	4.70	5.07	5.29	5.60	5.86
OCT	0.63	0.67	0.70	0.74	0.77
NOV					
DEC					
TOTAL	25.28	26.90	27.88	29.23	30.35

Table 18. Consumptive Use and Irrigation Requirement.

BAKER

CONSUMPTIVE USE (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.72	1.84	1.92	2.01	2.08
MAY	6.01	6.36	6.57	6.86	7.11
JUN	7.26	7.96	8.39	8.98	9.47
JUL	8.38	8.71	8.92	9.19	9.42
AUG	1.47	1.57	1.62	1.70	1.76
SEP					
OCT					
NOV					
DEC					
TOTAL	24.85	26.45	27.41	28.75	29.84

IRRIGATION REQUIREMENT (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.11	1.23	1.29	1.38	1.45
MAY	5.00	5.33	5.54	5.82	6.04
JUN	6.19	6.84	7.21	7.75	8.22
JUL	7.89	8.21	8.41	8.68	8.90
AUG	1.30	1.39	1.45	1.52	1.59
SEP					
OCT					
NOV					
DEC					
TOTAL	21.50	23.00	23.90	25.15	26.19

Table 18. Consumptive Use and Irrigation Requirement.

BAKER

CONSUMPTIVE USE (inches): SWEET CORN (early)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.75	0.77	0.78	0.78	0.79
JUN	3.35	3.63	3.79	4.02	4.20
JUL	8.57	8.90	9.10	9.38	9.60
AUG	7.49	7.95	8.23	8.62	8.94
SEP	0.72	0.77	0.80	0.85	0.88
OCT					
NOV					
DEC					
TOTAL	20.88	22.02	22.70	23.65	24.43

IRRIGATION REQUIREMENT (inches): SWEET CORN (early)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.43	0.44	0.44	0.45	0.45
JUN	2.44	2.71	2.87	3.09	3.27
JUL	8.07	8.39	8.59	8.85	9.07
AUG	6.99	7.44	7.71	8.09	8.40
SEP	0.68	0.73	0.76	0.80	0.84
OCT					
NOV					
DEC					
TOTAL	18.62	19.71	20.37	21.28	22.03

Table 18. Consumptive Use and Irrigation Requirement.

BAKER

CONSUMPTIVE USE (inches): SWEET CORN (late)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY					
JUN	0.51	0.52	0.52	0.52	0.53
JUL	5.97	6.14	6.25	6.40	6.52
AUG	7.52	7.98	8.26	8.65	8.97
SEP	4.74	5.09	5.30	5.60	5.84
OCT					
NOV					
DEC					
TOTAL	18.73	19.73	20.34	21.17	21.86

IRRIGATION REQUIREMENT (inches): SWEET CORN (late)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY					
JUN	0.36	0.37	0.37	0.38	0.38
JUL	5.54	5.71	5.81	5.96	6.08
AUG	7.02	7.47	7.74	8.12	8.43
SEP	4.35	4.69	4.90	5.18	5.42
OCT					
NOV					
DEC					
TOTAL	17.27	18.25	18.83	19.64	20.30

5.1.2 Bend

Table 18. Consumptive Use and Irrigation Requirement.

BEND

CONSUMPTIVE USE (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	2.48	2.75	2.91	3.13	3.32
MAY	5.02	5.40	5.64	5.95	6.22
JUN	5.88	6.45	6.79	7.26	7.65
JUL	6.84	7.21	7.44	7.75	8.01
AUG	5.62	6.04	6.29	6.64	6.93
SEP	4.30	4.60	4.78	5.02	5.23
OCT					
NOV					
DEC					
TOTAL	30.15	32.45	33.84	35.77	37.36

IRRIGATION REQUIREMENT (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	2.18	2.44	2.60	2.82	3.00
MAY	4.25	4.62	4.84	5.14	5.40
JUN	5.10	5.64	5.97	6.42	6.79
JUL	6.48	6.84	7.06	7.37	7.62
AUG	5.28	5.68	5.93	6.28	6.56
SEP	3.97	4.26	4.44	4.68	4.88
OCT					
NOV					
DEC					
TOTAL	27.25	29.49	30.84	32.71	34.25

Table 18. Consumptive Use and Irrigation Requirement.

BEND

CONSUMPTIVE USE (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.86	0.96	1.02	1.10	1.16
APR	3.73	4.13	4.37	4.71	4.99
MAY	5.29	5.69	5.93	6.27	6.55
JUN	6.19	6.79	7.15	7.64	8.06
JUL	7.20	7.59	7.83	8.16	8.43
AUG	5.92	6.36	6.62	6.99	7.30
SEP	4.53	4.84	5.03	5.29	5.50
OCT	2.90	3.13	3.27	3.46	3.62
NOV					
DEC					
TOTAL	36.62	39.48	41.22	43.62	45.61

IRRIGATION REQUIREMENT (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.70	0.78	0.83	0.91	0.98
APR	3.27	3.66	3.90	4.24	4.51
MAY	4.51	4.89	5.12	5.44	5.71
JUN	5.40	5.97	6.31	6.78	7.16
JUL	6.83	7.21	7.44	7.77	8.03
AUG	5.57	6.00	6.26	6.62	6.92
SEP	4.19	4.50	4.69	4.94	5.15
OCT	2.36	2.59	2.72	2.91	3.07
NOV					
DEC					
TOTAL	32.82	35.60	37.28	39.61	41.53

Table 18. Consumptive Use and Irrigation Requirement.

BEND

CONSUMPTIVE USE (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.37	1.47	1.53	1.61	1.67
MAY	5.28	5.66	5.89	6.21	6.47
JUN	6.94	7.60	8.00	8.56	9.02
JUL	5.98	6.30	6.50	6.77	7.00
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	19.55	21.03	21.92	23.15	24.16

IRRIGATION REQUIREMENT (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.09	1.19	1.25	1.33	1.39
MAY	4.49	4.86	5.08	5.38	5.64
JUN	6.12	6.74	7.11	7.61	8.04
JUL	5.71	6.03	6.22	6.49	6.71
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	17.41	18.82	19.66	20.82	21.78

Table 18. Consumptive Use and Irrigation Requirement.

BEND

CONSUMPTIVE USE (inches): POTATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.30	0.33	0.34	0.35	0.36
MAY	2.23	2.32	2.37	2.43	2.48
JUN	4.64	5.03	5.27	5.59	5.85
JUL	7.91	8.33	8.59	8.95	9.25
AUG	6.63	7.12	7.42	7.83	8.17
SEP	4.52	4.83	5.02	5.28	5.50
OCT	0.71	0.76	0.80	0.84	0.88
NOV					
DEC					
TOTAL	26.94	28.73	29.80	31.28	32.49

IRRIGATION REQUIREMENT (inches): POTATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.28	0.30	0.31	0.32	0.33
MAY	1.55	1.63	1.68	1.74	1.78
JUN	3.91	4.29	4.51	4.82	5.06
JUL	7.52	7.94	8.19	8.54	8.83
AUG	6.26	6.74	7.03	7.44	7.77
SEP	4.19	4.50	4.68	4.93	5.14
OCT	0.60	0.65	0.68	0.72	0.75
NOV					
DEC					
TOTAL	24.31	26.05	27.09	28.51	29.68

Table 18. Consumptive Use and Irrigation Requirement.

BEND

CONSUMPTIVE USE (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	2.12	2.29	2.39	2.52	2.63
MAY	5.56	5.97	6.22	6.57	6.85
JUN	6.94	7.60	8.00	8.56	9.02
JUL	7.14	7.53	7.76	8.09	8.36
AUG	1.19	1.28	1.33	1.41	1.47
SEP					
OCT					
NOV					
DEC					
TOTAL	22.95	24.67	25.71	27.15	28.33

IRRIGATION REQUIREMENT (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.70	1.87	1.96	2.09	2.19
MAY	4.77	5.16	5.40	5.73	6.01
JUN	6.12	6.74	7.11	7.61	8.04
JUL	6.77	7.15	7.38	7.70	7.96
AUG	1.06	1.15	1.20	1.27	1.33
SEP					
OCT					
NOV					
DEC					
TOTAL	20.41	22.06	23.05	24.41	25.54

Table 18. Consumptive Use and Irrigation Requirement.

BEND

CONSUMPTIVE USE (inches): SWEET CORN (early)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.15	1.20	1.22	1.25	1.27
JUN	3.88	4.19	4.37	4.61	4.81
JUL	7.48	7.87	8.11	8.44	8.72
AUG	6.61	7.10	7.39	7.80	8.14
SEP	0.63	0.67	0.70	0.73	0.76
OCT					
NOV					
DEC					
TOTAL	19.75	21.02	21.79	22.84	23.70

IRRIGATION REQUIREMENT (inches): SWEET CORN (early)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.81	0.85	0.88	0.90	0.93
JUN	3.16	3.46	3.64	3.88	4.07
JUL	7.10	7.49	7.72	8.05	8.31
AUG	6.24	6.72	7.01	7.41	7.74
SEP	0.60	0.65	0.67	0.71	0.73
OCT					
NOV					
DEC					
TOTAL	17.92	19.17	19.92	20.94	21.79

Table 18. Consumptive Use and Irrigation Requirement.

BEND

CONSUMPTIVE USE (inches): SWEET CORN (late)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY					
JUN	0.82	0.85	0.86	0.88	0.89
JUL	5.59	5.83	5.97	6.17	6.33
AUG	6.63	7.12	7.42	7.83	8.17
SEP	4.14	4.43	4.60	4.84	5.03
OCT					
NOV					
DEC					
TOTAL	17.18	18.22	18.85	19.71	20.42

IRRIGATION REQUIREMENT (inches): SWEET CORN (late)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY					
JUN	0.63	0.66	0.67	0.68	0.69
JUL	5.25	5.49	5.62	5.82	5.97
AUG	6.26	6.74	7.03	7.44	7.77
SEP	3.87	4.15	4.32	4.56	4.75
OCT					
NOV					
DEC					
TOTAL	16.02	17.04	17.65	18.49	19.19

Table 18. Consumptive Use and Irrigation Requirement.

BEND

CONSUMPTIVE USE (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	1.27	1.39	1.46	1.56	1.64
APR	4.12	4.57	4.84	5.21	5.52
MAY	5.92	6.37	6.64	7.02	7.33
JUN	6.75	7.40	7.79	8.33	8.78
JUL	4.50	4.75	4.90	5.10	5.27
AUG	0.30	0.32	0.33	0.35	0.37
SEP					
OCT					
NOV					
DEC					
TOTAL	22.86	24.79	25.96	27.57	28.91

IRRIGATION REQUIREMENT (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.84	0.96	1.02	1.12	1.20
APR	3.66	4.09	4.36	4.72	5.02
MAY	5.11	5.54	5.81	6.17	6.46
JUN	5.94	6.55	6.92	7.41	7.81
JUL	4.19	4.43	4.58	4.78	4.95
AUG	0.28	0.30	0.32	0.33	0.35
SEP					
OCT					
NOV					
DEC					
TOTAL	20.01	21.88	23.01	24.53	25.78

5.1.3 Eugene

Table 18. Consumptive Use and Irrigation Requirement.

EUGENE

CONSUMPTIVE USE (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	2.80	2.98	3.09	3.24	3.37
MAY	3.83	4.00	4.11	4.26	4.38
JUN	4.38	4.71	4.92	5.20	5.43
JUL	5.54	5.82	5.99	6.22	6.41
AUG	4.49	4.73	4.88	5.08	5.24
SEP	3.59	3.77	3.88	4.02	4.15
OCT	1.88	1.98	2.03	2.11	2.18
NOV					
DEC					
TOTAL	26.51	28.00	28.89	30.14	31.17

IRRIGATION REQUIREMENT (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.97	1.13	1.23	1.37	1.48
MAY	2.35	2.51	2.62	2.76	2.88
JUN	3.41	3.74	3.94	4.20	4.43
JUL	5.34	5.61	5.78	6.01	6.20
AUG	3.88	4.11	4.26	4.45	4.61
SEP	2.50	2.67	2.77	2.91	3.03
OCT	0.00	0.00	0.00	0.00	0.16
NOV					
DEC					
TOTAL	18.45	19.78	20.59	21.71	22.78

Table 18. Consumptive Use and Irrigation Requirement.

EUGENE

CONSUMPTIVE USE (inches): FIELD CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	2.11	2.17	2.20	2.25	2.29
JUN	3.79	4.05	4.20	4.41	4.58
JUL	6.92	7.27	7.48	7.77	8.00
AUG	5.70	6.00	6.18	6.44	6.65
SEP	2.02	2.12	2.18	2.26	2.33
OCT					
NOV					
DEC					
TOTAL	20.53	21.60	22.24	23.13	23.85

IRRIGATION REQUIREMENT (inches): FIELD CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.93	0.98	1.01	1.06	1.09
JUN	2.84	3.09	3.24	3.44	3.61
JUL	6.71	7.05	7.25	7.54	7.77
AUG	5.04	5.33	5.51	5.76	5.96
SEP	1.39	1.48	1.54	1.62	1.69
OCT					
NOV					
DEC					
TOTAL	16.91	17.94	18.56	19.42	20.13

Table 18. Consumptive Use and Irrigation Requirement.

EUGENE

CONSUMPTIVE USE (inches): FRUIT TREES (peaches, pears, plums, apricots)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.54	0.58	0.60	0.63	0.65
MAY	2.25	2.36	2.42	2.51	2.58
JUN	3.35	3.61	3.76	3.97	4.15
JUL	4.89	5.13	5.28	5.49	5.66
AUG	3.97	4.18	4.30	4.48	4.63
SEP	2.96	3.10	3.19	3.31	3.41
OCT	0.63	0.66	0.68	0.71	0.73
NOV					
DEC					
TOTAL	18.59	19.62	20.24	21.10	21.81

IRRIGATION REQUIREMENT (inches): FRUIT TREES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.89	0.98	1.04	1.12	1.18
JUN	2.42	2.66	2.81	3.02	3.19
JUL	4.70	4.94	5.09	5.29	5.46
AUG	3.36	3.57	3.69	3.87	4.01
SEP	1.90	2.04	2.12	2.24	2.33
OCT					
NOV					
DEC					
TOTAL	13.26	14.19	14.75	15.77	16.42

Table 18. Consumptive Use and Irrigation Requirement.

EUGENE

CONSUMPTIVE USE (inches): GREEN BEANS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.75	1.80	1.83	1.88	1.91
JUN	4.36	4.68	4.87	5.14	5.35
JUL	4.84	5.08	5.23	5.44	5.60
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	10.95	11.57	11.94	12.45	12.87

IRRIGATION REQUIREMENT (inches): GREEN BEANS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.82	0.87	0.89	0.93	0.96
JUN	3.40	3.71	3.89	4.15	4.36
JUL	4.69	4.93	5.08	5.28	5.45
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	8.91	9.51	9.87	10.36	10.77

Table 18. Consumptive Use and Irrigation Requirement.

EUGENE

CONSUMPTIVE USE (inches): MELONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.92	0.94	0.95	0.97	0.98
JUN	3.77	4.02	4.17	4.38	4.55
JUL	6.39	6.71	6.90	7.17	7.40
AUG	4.81	5.07	5.22	5.44	5.61
SEP	0.41	0.43	0.44	0.45	0.47
OCT					
NOV					
DEC					
TOTAL	16.29	17.16	17.68	18.41	19.01

IRRIGATION REQUIREMENT (inches): MELONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.47	0.48	0.48	0.49	0.50
JUN	2.82	3.06	3.21	3.41	3.58
JUL	6.17	6.49	6.69	6.95	7.17
AUG	4.19	4.44	4.59	4.79	4.96
SEP	0.36	0.37	0.38	0.40	0.41
OCT					
NOV					
DEC					
TOTAL	14.00	14.84	15.35	16.05	16.62

Table 18. Consumptive Use and Irrigation Requirement.

EUGENE

CONSUMPTIVE USE (inches): ONIONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.04	1.08	1.11	1.15	1.18
MAY	3.95	4.12	4.23	4.37	4.48
JUN	5.15	5.55	5.78	6.11	6.39
JUL	6.49	6.82	7.02	7.29	7.52
AUG	4.60	4.84	4.99	5.19	5.36
SEP					
OCT					
NOV					
DEC					
TOTAL	21.23	22.41	23.13	24.11	24.93

IRRIGATION REQUIREMENT (inches): ONIONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.15	0.20	0.22	0.26	0.29
MAY	2.47	2.63	2.73	2.86	2.97
JUN	4.16	4.54	4.77	5.08	5.34
JUL	6.28	6.60	6.80	7.07	7.29
AUG	3.98	4.22	4.36	4.56	4.72
SEP					
OCT					
NOV					
DEC					
TOTAL	17.04	18.18	18.88	19.83	20.61

Table 18. Consumptive Use and Irrigation Requirement.

EUGENE

CONSUMPTIVE USE (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	1.35	1.45	1.52	1.60	1.68
APR	3.13	3.33	3.46	3.63	3.77
MAY	4.28	4.48	4.60	4.76	4.90
JUN	4.90	5.27	5.50	5.81	6.07
JUL	6.19	6.50	6.69	6.95	7.17
AUG	5.02	5.29	5.45	5.68	5.86
SEP	4.02	4.21	4.33	4.50	4.63
OCT	2.25	2.36	2.43	2.52	2.60
NOV	0.37	0.41	0.44	0.47	0.50
DEC					
TOTAL	31.50	33.31	34.40	35.93	37.18

IRRIGATION REQUIREMENT (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.26	1.45	1.56	1.71	1.84
MAY	2.77	2.96	3.08	3.24	3.37
JUN	3.91	4.27	4.49	4.79	5.04
JUL	5.98	6.29	6.48	6.74	6.95
AUG	4.40	4.65	4.81	5.02	5.20
SEP	2.90	3.09	3.21	3.37	3.50
OCT	0.00	0.24	0.28	0.34	0.39
NOV					
DEC					
TOTAL	21.23	22.96	23.91	25.21	26.29

Table 18. Consumptive Use and Irrigation Requirement.

EUGENE

CONSUMPTIVE USE (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	1.35	1.44	1.49	1.56	1.62
APR	3.31	3.52	3.65	3.83	3.97
MAY	4.93	5.16	5.30	5.49	5.65
JUN	1.94	2.09	2.18	2.30	2.41
JUL					
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	11.53	12.21	12.62	13.18	13.65

IRRIGATION REQUIREMENT (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.43	1.62	1.73	1.89	2.02
MAY	3.40	3.61	3.73	3.90	4.05
JUN	1.64	1.78	1.87	1.99	2.09
JUL					
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	6.46	7.00	7.33	7.78	8.16

Table 18. Consumptive Use and Irrigation Requirement.

EUGENE

CONSUMPTIVE USE (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.00	1.04	1.07	1.11	1.14
MAY	3.04	3.14	3.20	3.29	3.35
JUN	5.29	5.68	5.92	6.25	6.53
JUL	6.63	6.97	7.17	7.45	7.68
AUG	0.62	0.66	0.68	0.70	0.73
SEP					
OCT					
NOV					
DEC					
TOTAL	16.58	17.49	18.04	18.80	19.43

IRRIGATION REQUIREMENT (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.11	0.16	0.18	0.22	0.25
MAY	1.60	1.70	1.75	1.83	1.90
JUN	4.29	4.67	4.90	5.22	5.48
JUL	6.42	6.75	6.95	7.23	7.45
AUG	0.53	0.56	0.57	0.60	0.62
SEP					
OCT					
NOV					
DEC					
TOTAL	12.95	13.83	14.36	15.09	15.69

Table 18. Consumptive Use and Irrigation Requirement.

EUGENE

CONSUMPTIVE USE (inches): SQUASH

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.73	1.78	1.81	1.85	1.88
JUN	4.10	4.40	4.58	4.82	5.03
JUL	6.06	6.37	6.55	6.81	7.02
AUG	4.81	5.06	5.22	5.43	5.61
SEP	2.10	2.20	2.27	2.35	2.42
OCT					
NOV					
DEC					
TOTAL	18.80	19.81	20.42	21.27	21.96

IRRIGATION REQUIREMENT (inches): SQUASH

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.80	0.84	0.87	0.91	0.94
JUN	3.14	3.43	3.61	3.84	4.04
JUL	5.85	6.15	6.34	6.59	6.80
AUG	4.19	4.44	4.58	4.79	4.96
SEP	1.47	1.57	1.63	1.71	1.78
OCT					
NOV					
DEC					
TOTAL	15.45	16.44	17.03	17.85	18.52

Table 18. Consumptive Use and Irrigation Requirement.

EUGENE

CONSUMPTIVE USE (inches): SWEET CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.56	1.60	1.63	1.66	1.69
JUN	4.08	4.36	4.53	4.76	4.95
JUL	7.16	7.52	7.74	8.04	8.29
AUG	5.81	6.12	6.31	6.57	6.78
SEP	1.31	1.38	1.42	1.47	1.52
OCT					
NOV					
DEC					
TOTAL	19.92	20.98	21.62	22.50	23.23

IRRIGATION REQUIREMENT (inches): SWEET CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.72	0.76	0.78	0.81	0.84
JUN	3.12	3.39	3.56	3.79	3.97
JUL	6.94	7.29	7.51	7.81	8.05
AUG	5.15	5.45	5.63	5.88	6.09
SEP	1.03	1.10	1.14	1.19	1.23
OCT					
NOV					
DEC					
TOTAL	16.96	17.99	18.62	19.48	20.19

Table 18. Consumptive Use and Irrigation Requirement.

EUGENE

CONSUMPTIVE USE (inches): TABLE BEETS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.06	0.06	0.06	0.07	0.07
MAY	2.49	2.57	2.61	2.67	2.72
JUN	4.56	4.89	5.09	5.37	5.60
JUL	6.68	7.01	7.22	7.50	7.73
AUG	1.14	1.20	1.23	1.29	1.33
SEP					
OCT					
NOV					
DEC					
TOTAL	14.92	15.73	16.22	16.89	17.44

IRRIGATION REQUIREMENT (inches): TABLE BEETS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.06	0.06	0.06	0.06	0.06
MAY	1.10	1.17	1.21	1.26	1.31
JUN	3.59	3.91	4.10	4.37	4.59
JUL	6.46	6.80	7.00	7.28	7.51
AUG	1.02	1.08	1.12	1.17	1.21
SEP					
OCT					
NOV					
DEC					
TOTAL	12.23	13.02	13.49	14.14	14.67

Table 18. Consumptive Use and Irrigation Requirement.

EUGENE

CONSUMPTIVE USE (inches): TOMATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	2.52	2.60	2.64	2.70	2.75
JUN	4.99	5.36	5.58	5.89	6.14
JUL	7.34	7.71	7.93	8.24	8.50
AUG	2.85	3.01	3.10	3.22	3.33
SEP					
OCT					
NOV					
DEC					
TOTAL	17.70	18.67	19.25	20.05	20.71

IRRIGATION REQUIREMENT (inches): TOMATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.13	1.20	1.24	1.29	1.34
JUN	4.01	4.36	4.57	4.87	5.11
JUL	7.11	7.48	7.70	8.01	8.26
AUG	2.48	2.63	2.72	2.84	2.95
SEP					
OCT					
NOV					
DEC					
TOTAL	14.73	15.66	16.23	17.01	17.65

Table18 . Consumptive Use and Irrigation Requirement.

EUGENE

CONSUMPTIVE USE (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.90	1.99	2.04	2.11	2.17
MAY	2.92	3.02	3.07	3.15	3.21
JUN	4.49	4.80	4.99	5.26	5.47
JUL	7.03	7.38	7.59	7.88	8.13
AUG	5.90	6.22	6.41	6.67	6.89
SEP	2.02	2.11	2.17	2.26	2.32
OCT					
NOV					
DEC					
TOTAL	24.26	25.52	26.28	27.33	28.18

IRRIGATION REQUIREMENT (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.23	0.27	0.31	0.37	0.42
MAY	1.49	1.58	1.63	1.70	1.76
JUN	3.52	3.83	4.01	4.26	4.47
JUL	6.81	7.16	7.36	7.65	7.89
AUG	5.24	5.54	5.73	5.99	6.20
SEP	1.26	1.35	1.41	1.49	1.55
OCT					
NOV					
DEC					
TOTAL	18.56	19.73	20.46	21.46	22.29

5.1.4 Headworks, Portland Water Bureau

Table 18. Consumptive Use and Irrigation Requirement.

HEADWORKS

CONSUMPTIVE USE (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	2.62	2.82	2.95	3.12	3.26
MAY	3.73	3.95	4.08	4.26	4.40
JUN	3.70	3.98	4.15	4.39	4.58
JUL	4.43	4.65	4.79	4.97	5.12
AUG	3.94	4.17	4.31	4.50	4.66
SEP	3.09	3.25	3.35	3.49	3.61
OCT	1.74	1.86	1.93	2.03	2.11
NOV					
DEC					
TOTAL	23.26	24.69	25.56	26.75	27.74

IRRIGATION REQUIREMENT (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.51	0.65	0.75	0.88	0.99
JUN	1.01	1.24	1.38	1.57	1.73
JUL	3.54	3.76	3.89	4.06	4.21
AUG	2.69	2.92	3.05	3.24	3.39
SEP	0.54	0.67	0.76	0.87	0.97
OCT					
NOV					
DEC					
TOTAL	8.29	9.23	9.82	10.62	11.29

Table 18 . Consumptive Use and Irrigation Requirement.

HEADWORKS

CONSUMPTIVE USE (inches): FIELD CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	2.07	2.15	2.19	2.25	2.30
JUN	3.19	3.40	3.52	3.69	3.83
JUL	5.45	5.71	5.87	6.09	6.28
AUG	4.91	5.19	5.37	5.61	5.80
SEP	1.70	1.79	1.85	1.93	1.99
OCT					
NOV					
DEC					
TOTAL	17.32	18.24	18.80	19.56	20.19

IRRIGATION REQUIREMENT (inches):FIELD CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY					
JUN	0.57	0.75	0.85	0.99	1.11
JUL	4.52	4.77	4.93	5.14	5.32
AUG	3.63	3.89	4.06	4.28	4.47
SEP	0.27	0.31	0.33	0.36	0.39
OCT					
NOV					
DEC					
TOTAL	8.99	9.72	10.16	10.77	11.28

Table 18. Consumptive Use and Irrigation Requirement.

HEADWORKS

CONSUMPTIVE USE (inches): FRUIT TREES (peaches, pears, apricots, plums)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.51	0.55	0.57	0.61	0.63
MAY	2.20	2.32	2.40	2.50	2.59
JUN	2.83	3.05	3.18	3.35	3.50
JUL	3.91	4.11	4.22	4.39	4.52
AUG	3.48	3.68	3.80	3.97	4.11
SEP	2.55	2.68	2.76	2.88	2.97
OCT	0.58	0.62	0.65	0.68	0.70
NOV					
DEC					
TOTAL	16.05	17.00	27.58	18.38	19.03

IRRIGATION REQUIREMENT (inches): FRUIT TREES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY					
JUN	0.33	0.46	0.56	0.71	0.84
JUL	3.03	3.22	3.34	3.49	3.63
AUG	2.25	2.44	2.56	2.72	2.86
SEP	0.25	0.30	0.34	0.39	0.44
OCT					
NOV					
DEC					
TOTAL	5.86	6.43	6.80	7.32	7.76

Table18 . Consumptive Use and Irrigation Requirement.

HEADWORKS

CONSUMPTIVE USE (inches): GREEN BEANS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.72	1.79	1.82	1.87	1.91
JUN	3.66	3.93	4.08	4.30	4.48
JUL	3.83	4.02	4.14	4.30	4.43
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	9.22	9.73	10.04	10.47	10.82

IRRIGATION REQUIREMENT (inches): GREEN BEANS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY					
JUN	0.97	1.19	1.32	1.50	1.64
JUL	3.16	3.35	3.46	3.62	3.74
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	4.13	4.54	4.78	5.11	5.39

Table 18. Consumptive Use and Irrigation Requirement.

HEADWORKS

CONSUMPTIVE USE (inches): MELONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.92	0.95	0.97	0.99	1.01
JUN	3.20	3.41	3.53	3.71	3.85
JUL	5.06	5.31	5.46	5.67	5.85
AUG	4.16	4.40	4.55	4.75	4.92
SEP	0.34	0.36	0.37	0.38	0.40
OCT					
NOV					
DEC					
TOTAL	13.68	14.43	14.88	15.51	16.02

IRRIGATION REQUIREMENT (inches): MELONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY					
JUN	0.58	0.76	0.86	1.01	1.12
JUL	4.15	4.39	4.53	4.73	4.90
AUG	2.90	3.14	3.28	3.48	3.64
SEP	0.23	0.24	0.25	0.26	0.27
OCT					
NOV					
DEC					
TOTAL	7.87	8.53	8.93	9.48	9.93

Table 18. Consumptive Use and Irrigation Requirement.

HEADWORKS

CONSUMPTIVE USE (inches): ONIONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.99	1.04	1.08	1.12	1.15
MAY	3.81	4.01	4.13	4.30	4.44
JUN	4.27	4.59	4.79	5.06	5.28
JUL	5.09	5.34	5.50	5.71	5.88
AUG	3.97	4.20	4.34	4.53	4.69
SEP					
OCT					
NOV					
DEC					
TOTAL	18.12	19.19	19.83	20.72	21.45

IRRIGATION REQUIREMENT (inches): ONIONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.56	0.70	0.79	0.91	1.02
JUN	1.47	1.74	1.90	2.13	2.33
JUL	4.18	4.42	4.57	4.77	4.94
AUG	2.72	2.94	3.08	3.26	3.42
SEP					
OCT					
NOV					
DEC					
TOTAL	8.93	9.80	10.33	11.08	11.71

Table 18. Consumptive Use and Irrigation Requirement.

HEADWORKS

CONSUMPTIVE USE (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	1.30	1.41	1.48	1.57	1.65
APR	2.93	3.16	3.29	3.49	3.64
MAY	4.17	4.41	4.56	4.76	4.92
JUN	4.14	4.45	4.64	4.90	5.12
JUL	4.95	5.20	5.35	5.55	5.72
AUG	4.41	4.66	4.82	5.03	5.21
SEP	3.45	3.64	3.75	3.90	4.03
OCT	2.08	2.22	2.30	2.42	2.52
NOV	0.33	0.37	0.40	0.43	0.46
DEC					
TOTAL	27.77	29.53	30.59	32.06	33.27

IRRIGATION REQUIREMENT (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.82	1.00	1.11	1.26	1.38
JUN	1.37	1.62	1.78	1.99	2.19
JUL	4.05	4.28	4.43	4.62	4.79
AUG	3.14	3.39	3.54	3.75	3.91
SEP	0.84	1.00	1.09	1.22	1.32
OCT					
NOV					
DEC					
TOTAL	10.22	11.29	11.94	12.83	13.59

Table 18. Consumptive Use and Irrigation Requirement.

HEADWORKS

CONSUMPTIVE USE (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	1.31	1.40	1.46	1.53	1.59
APR	3.06	3.29	3.43	3.62	3.78
MAY	4.72	4.99	5.16	5.38	5.57
JUN	1.61	1.73	1.81	1.91	1.99
JUL					
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	10.70	11.42	11.85	12.44	12.94

IRRIGATION REQUIREMENT (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.23	1.44	1.59	1.79	1.95
JUN	0.68	0.79	0.86	0.96	1.04
JUL					
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	1.91	2.23	2.45	2.74	2.99

Table 18 . Consumptive Use and Irrigation Requirement.

HEADWORKS

CONSUMPTIVE USE (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.95	1.00	1.03	1.07	1.11
MAY	2.97	3.10	3.18	3.28	3.36
JUN	4.40	4.73	4.92	5.19	5.42
JUL	5.22	5.48	5.63	5.85	6.03
AUG	0.55	0.58	0.60	0.63	0.65
SEP					
OCT					
NOV					
DEC					
TOTAL	14.09	14.89	15.37	16.03	16.57

IRRIGATION REQUIREMENT (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.00	0.00	0.15	0.21	0.27
JUN	1.58	1.85	2.01	2.25	2.46
JUL	4.30	4.55	4.70	4.91	5.08
AUG	0.38	0.40	0.42	0.44	0.45
SEP					
OCT					
NOV					
DEC					
TOTAL	6.26	6.80	7.27	7.81	8.25

Table 18. Consumptive Use and Irrigation Requirement.

HEADWORKS

CONSUMPTIVE USE (inches): SQUASH

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.70	1.76	1.80	1.85	1.89
JUN	3.45	3.69	3.84	4.04	4.20
JUL	4.80	5.04	5.18	5.38	5.54
AUG	4.17	4.41	4.56	4.77	4.93
SEP	1.78	1.88	1.94	2.02	2.08
OCT					
NOV					
DEC					
TOTAL	15.90	16.78	17.31	18.05	18.65

IRRIGATION REQUIREMENT (inches): SQUASH

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY					
JUN	0.79	0.99	1.12	1.28	1.42
JUL	3.90	4.13	4.26	4.46	4.61
AUG	2.91	3.15	3.29	3.49	3.65
SEP	0.30	0.34	0.36	0.42	0.47
OCT					
NOV					
DEC					
TOTAL	7.91	8.61	9.04	9.64	10.16

Table18 . Consumptive Use and Irrigation Requirement.

HEADWORKS

CONSUMPTIVE USE (inches): SWEET CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.54	1.59	1.62	1.66	1.70
JUN	3.42	3.65	3.79	3.98	4.13
JUL	5.62	5.90	6.07	6.30	6.50
AUG	5.00	5.30	5.47	5.72	5.92
SEP	1.11	1.17	1.20	1.25	1.29
OCT					
NOV					
DEC					
TOTAL	16.70	17.61	18.16	18.92	19.54

IRRIGATION REQUIREMENT (inches): SWEET CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY					
JUN	0.77	0.96	1.08	1.23	1.36
JUL	4.69	4.96	5.12	5.34	5.53
AUG	3.72	3.99	4.16	4.38	4.57
SEP	0.39	0.44	0.48	0.52	0.56
OCT					
NOV					
DEC					
TOTAL	9.56	10.35	10.83	11.48	12.02

Table 18 . Consumptive Use and Irrigation Requirement.

HEADWORKS

CONSUMPTIVE USE (inches): TABLE BEETS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.06	0.06	0.06	0.06	0.07
MAY	2.45	2.54	2.60	2.67	2.72
JUN	3.83	4.10	4.27	4.50	4.68
JUL	5.29	5.55	5.71	5.93	6.11
AUG	0.99	1.05	1.08	1.13	1.17
SEP					
OCT					
NOV					
DEC					
TOTAL	12.62	13.30	13.72	14.29	14.75

IRRIGATION REQUIREMENT (inches): TABLE BEETS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY					
JUN	1.11	1.34	1.47	1.66	1.81
JUL	4.37	4.62	4.77	4.98	5.16
AUG	0.75	0.81	0.84	0.89	0.93
SEP					
OCT					
NOV					
DEC					
TOTAL	6.24	6.77	7.09	7.53	7.90

Table 18. Consumptive Use and Irrigation Requirement.

HEADWORKS

CONSUMPTIVE USE (inches): TOMATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	2.47	2.57	2.62	2.69	2.75
JUN	4.13	4.43	4.61	4.86	5.06
JUL	5.72	6.00	6.17	6.41	6.60
AUG	2.45	2.59	2.68	2.80	2.90
SEP					
OCT					
NOV					
DEC					
TOTAL	14.77	15.59	16.08	16.76	17.31

IRRIGATION REQUIREMENT (inches): TOMATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY					
JUN	1.36	1.60	1.75	1.95	2.13
JUL	4.78	5.05	5.21	5.44	5.63
AUG	1.70	1.83	1.91	2.03	2.12
SEP					
OCT					
NOV					
DEC					
TOTAL	7.83	8.48	8.88	9.42	9.88

Table18 . Consumptive Use and Irrigation Requirement.

HEADWORKS

CONSUMPTIVE USE (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.81	1.91	1.97	2.05	2.11
MAY	2.86	2.98	3.05	3.14	3.22
JUN	3.72	3.97	4.13	4.34	4.51
JUL	5.44	5.70	5.86	6.08	6.27
AUG	4.99	5.28	5.46	5.71	5.91
SEP	1.68	1.77	1.83	1.90	1.96
OCT					
NOV					
DEC					
TOTAL	20.50	21.62	22.30	23.22	23.98

IRRIGATION REQUIREMENT (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY					
JUN	1.02	1.23	1.36	1.53	1.67
JUL	4.51	4.76	4.92	5.13	5.30
AUG	3.71	3.98	4.14	4.37	4.56
SEP					
OCT					
NOV					
DEC					
TOTAL	9.24	9.97	10.42	11.03	11.78

5.1.5 Heppner

Table 18. Consumptive Use and Irrigation Requirement.

HEPPNER

CONSUMPTIVE USE (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	2.84	3.06	3.19	3.37	3.52
MAY	5.77	6.11	6.31	6.60	6.83
JUN	6.59	7.16	7.50	7.97	8.36
JUL	7.55	7.95	8.19	8.52	8.80
AUG	6.38	6.78	7.03	7.37	7.65
SEP	4.79	5.05	5.20	5.42	5.60
OCT					
NOV					
DEC					
TOTAL	33.93	36.11	37.42	39.25	40.76

IRRIGATION REQUIREMENT (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	2.26	2.47	2.59	2.77	2.92
MAY	4.73	5.05	5.24	5.51	5.74
JUN	5.68	6.21	6.53	6.97	7.31
JUL	7.27	7.66	7.89	8.22	8.49
AUG	5.96	6.36	6.60	6.93	7.20
SEP	4.22	4.47	4.62	4.82	4.99
OCT					
NOV					
DEC					
TOTAL	30.11	32.21	33.48	35.23	36.66

Table 18. Consumptive Use and Irrigation Requirement.

HEPPNER

CONSUMPTIVE USE (inches): FIELD CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.44	1.48	1.50	1.53	1.55
JUN	4.90	5.29	5.52	5.84	6.11
JUL	8.74	9.20	9.48	9.86	10.18
AUG	7.50	7.98	8.27	8.67	9.00
SEP	4.12	4.34	4.48	4.66	4.82
OCT					
NOV					
DEC					
TOTAL	26.71	28.29	29.24	30.56	31.65

IRRIGATION REQUIREMENT (inches):

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.72	0.75	0.77	0.80	0.82
JUN	4.06	4.43	4.65	4.96	5.21
JUL	8.44	8.89	9.16	9.54	9.85
AUG	7.05	7.52	7.80	8.19	8.52
SEP	3.56	3.78	3.9	4.09	4.24
OCT					
NOV					
DEC					
TOTAL	23.83	25.36	26.29	27.57	28.64

Table 18. Consumptive Use and Irrigation Requirement.

HEPPNER

CONSUMPTIVE USE (inches): FRUIT TREES (apples, cherries)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.71	1.84	1.92	2.03	2.12
MAY	3.65	3.86	3.99	4.17	4.32
JUN	5.90	6.40	6.71	7.13	7.48
JUL	7.95	8.37	8.62	8.97	9.26
AUG	6.71	7.14	7.40	7.76	8.06
SEP	4.79	5.05	5.20	5.42	5.60
OCT	0.66	0.70	0.73	0.76	0.79
NOV					
DEC					
TOTAL	31.37	33.36	34.57	36.24	37.62

IRRIGATION REQUIREMENT (inches): FRUIT TREES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.95	1.07	1.15	1.25	1.33
MAY	2.67	2.88	3.00	3.18	3.32
JUN	5.01	5.50	5.79	6.19	6.52
JUL	7.66	8.07	8.32	8.66	8.95
AUG	6.29	6.71	6.96	7.31	7.60
SEP	4.22	4.47	4.62	4.82	4.99
OCT	0.52	0.55	0.56	0.59	0.61
NOV					
DEC					
TOTAL	27.32	29.24	30.40	32.00	33.32

Table 18. Consumptive Use and Irrigation Requirement.

HEPPNER

CONSUMPTIVE USE (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.98	1.05	1.09	1.15	1.20
APR	4.27	4.60	4.79	5.06	5.29
MAY	6.08	6.43	6.65	6.95	7.19
JUN	6.94	7.53	7.89	8.39	8.80
JUL	7.95	8.37	8.62	8.97	9.26
AUG	6.71	7.14	7.40	7.76	8.06
SEP	5.04	5.31	5.48	5.71	5.89
OCT	2.75	2.92	3.02	3.16	3.27
NOV					
DEC					
TOTAL	40.73	43.35	44.94	47.15	48.96

IRRIGATION REQUIREMENT (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.69	0.76	0.80	0.86	0.91
APR	3.39	3.71	3.90	4.16	4.38
MAY	5.02	5.36	5.56	5.84	6.07
JUN	6.01	6.56	6.90	7.34	7.71
JUL	7.66	8.07	8.32	8.66	8.95
AUG	6.29	6.71	6.96	7.31	7.60
SEP	4.46	4.72	4.88	5.10	5.28
OCT	2.02	2.17	2.27	2.40	2.52
NOV					
DEC					
TOTAL	35.54	38.06	39.58	41.68	43.39

Table 18. Consumptive Use and Irrigation Requirement.

HEPPNER

CONSUMPTIVE USE (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.43	0.45	0.46	0.48	0.49
APR	2.26	2.41	2.49	2.61	2.70
MAY	6.56	6.95	7.18	7.50	7.76
JUN	7.69	8.34	8.74	9.29	9.75
JUL	5.10	5.37	5.53	5.76	5.95
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	22.05	23.52	24.41	25.64	26.65

IRRIGATION REQUIREMENT (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.25	0.26	0.27	0.28	0.28
APR	1.47	1.60	1.68	1.79	1.88
MAY	5.48	5.84	6.05	6.34	6.59
JUN	6.71	7.30	7.66	8.18	8.62
JUL	4.95	5.22	5.38	5.60	5.79
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	18.86	20.23	21.04	22.20	23.16

Table 18. Consumptive Use and Irrigation Requirement.

HEPPNER

CONSUMPTIVE USE (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.88	0.92	0.95	0.98	1.01
APR	2.85	3.05	3.17	3.34	3.47
MAY	6.47	6.84	7.07	7.39	7.65
JUN	7.66	8.31	8.71	9.26	9.71
JUL	3.69	3.88	4.00	4.16	4.29
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	21.54	23.01	23.90	25.12	26.13

IRRIGATION REQUIREMENT (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.21	0.22	0.22	0.23	0.25
APR	2.02	2.21	2.32	2.48	2.61
MAY	5.39	5.75	5.96	6.24	6.48
JUN	6.68	7.27	7.62	8.15	8.59
JUL	3.51	3.70	3.82	3.98	4.11
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	17.80	19.15	19.95	21.08	22.05

Table 18. Consumptive Use and Irrigation Requirement.

HEPPNER

CONSUMPTIVE USE (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.95	1.01	1.04	1.08	1.12
APR	4.37	4.70	4.90	5.17	5.40
MAY	6.74	7.14	7.38	7.71	7.98
JUN	7.43	8.06	8.45	8.98	9.42
JUL	4.34	4.57	4.70	4.89	5.05
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	23.83	25.47	26.46	27.84	28.97

IRRIGATION REQUIREMENT (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.32	0.35	0.38	0.42	0.45
APR	3.49	3.81	4.00	4.26	4.48
MAY	5.65	6.02	6.24	6.54	6.78
JUN	6.46	7.05	7.39	7.88	8.30
JUL	4.10	4.33	4.47	4.66	4.81
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	20.02	21.55	22.47	23.75	24.83

5.1.6 Hermiston

Table 18 . Consumptive Use and Irrigation Requirement.

HERMISTON

CONSUMPTIVE USE (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	2.60	2.75	2.85	2.98	3.08
APR	4.57	4.90	5.09	5.37	5.59
MAY	6.54	6.88	7.09	7.37	7.60
JUN	7.30	7.78	8.07	8.47	8.80
JUL	8.38	8.77	9.00	9.33	9.60
AUG	7.17	7.50	7.70	7.98	8.20
SEP	4.49	4.70	4.83	5.01	5.16
OCT					
NOV					
DEC					
TOTAL	41.06	43.28	44.63	46.49	48.03

IRRIGATION REQUIREMENT (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	2.11	2.26	2.35	2.47	2.58
APR	4.12	4.44	4.63	4.89	5.10
MAY	6.03	6.36	6.56	6.83	7.05
JUN	6.78	7.24	7.52	7.90	8.22
JUL	8.19	8.58	8.81	9.13	9.40
AUG	6.96	7.28	7.48	7.75	7.97
SEP	4.21	4.42	4.55	4.73	4.88
OCT					
NOV					
DEC					
TOTAL	38.40	40.58	41.89	43.70	45.20

Table 18 . Consumptive Use and Irrigation Requirement.

HERMISTON

CONSUMPTIVE USE (inches): FIELD CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.42	1.43	1.43	1.44	1.44
JUN	3.17	3.32	3.41	3.53	3.63
JUL	8.51	8.89	9.12	9.44	9.70
AUG	8.46	8.85	9.08	9.40	9.67
SEP	4.78	5.01	5.15	5.34	5.50
OCT					
NOV					
DEC					
TOTAL	26.33	27.49	28.18	29.15	29.94

IRRIGATION REQUIREMENT (inches): FIELD CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.03	1.04	1.04	1.05	1.05
JUN	2.74	2.89	2.98	3.10	3.20
JUL	8.32	8.70	8.92	9.24	9.50
AUG	8.23	8.61	8.84	9.16	9.42
SEP	4.46	4.68	4.82	5.00	5.16
OCT					
NOV					
DEC					
TOTAL	24.77	25.92	26.60	27.55	28.32

Table18 . Consumptive Use and Irrigation Requirement.

HERMISTON

CONSUMPTIVE USE (inches): ONION

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.17	0.17	0.17	0.17	0.18
APR	1.29	1.33	1.36	1.38	1.41
MAY	2.82	2.90	2.96	3.03	3.08
JUN	5.65	5.99	6.19	6.48	6.71
JUL	8.79	9.20	9.44	9.78	10.06
AUG	7.70	8.06	8.27	8.57	8.81
SEP	3.41	3.57	3.67	3.81	3.92
OCT					
NOV					
DEC					
TOTAL	29.83	31.23	32.06	33.22	34.17

IRRIGATION REQUIREMENT (inches): ONION

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.15	0.15	0.15	0.16	0.16
APR	0.91	0.95	0.97	1.00	1.02
MAY	2.38	2.47	2.52	2.59	2.64
JUN	5.18	5.51	5.71	5.98	6.21
JUL	8.60	9.01	9.25	9.58	9.86
AUG	7.48	7.83	8.04	8.33	8.57
SEP	3.19	3.36	3.45	3.59	3.70
OCT					
NOV					
DEC					
TOTAL	27.89	29.26	30.09	31.23	32.16

Table 18 . Consumptive Use and Irrigation Requirement.

HERMISTON

CONSUMPTIVE USE (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	2.74	2.90	3.00	3.13	3.24
APR	4.82	5.16	5.36	5.65	5.88
MAY	6.89	7.24	7.46	7.76	8.00
JUN	7.68	8.19	8.49	8.91	9.26
JUL	8.82	9.23	9.48	9.82	10.10
AUG	7.55	7.90	8.11	8.40	8.64
SEP	5.45	5.71	5.87	6.09	6.27
OCT					
NOV					
DEC					
TOTAL	43.94	46.32	47.76	49.75	51.40

IRRIGATION REQUIREMENT (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	2.24	2.40	2.49	2.63	2.74
APR	4.36	4.69	4.89	5.16	5.39
MAY	6.36	6.71	6.91	7.20	7.44
JUN	7.15	7.63	7.93	8.33	8.67
JUL	8.63	9.03	9.28	9.62	9.90
AUG	7.33	7.67	7.88	8.16	8.40
SEP	5.11	5.36	5.52	5.73	5.91
OCT					
NOV					
DEC					
TOTAL	41.19	43.50	44.89	46.84	48.45

Table 18 . Consumptive Use and Irrigation Requirement.

HERMISTON

CONSUMPTIVE USE (inches): POTATO (early)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.30	0.31	0.31	0.32	0.32
APR	1.46	1.52	1.55	1.59	1.62
MAY	5.11	5.35	5.49	5.68	5.84
JUN	8.56	9.12	9.45	9.92	10.31
JUL	3.54	3.70	3.80	3.94	4.05
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	18.97	19.99	20.60	21.45	22.15

IRRIGATION REQUIREMENT (inches): POTATO (early)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.25	0.26	0.26	0.26	0.27
APR	1.07	1.13	1.16	1.20	1.23
MAY	4.64	4.87	5.00	5.19	5.34
JUN	7.99	8.53	8.86	9.32	9.70
JUL	3.47	3.64	3.74	3.87	3.99
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	17.43	18.42	19.01	19.84	20.53

Table 18. Consumptive Use and Irrigation Requirement.

HERMISTON

CONSUMPTIVE USE (inches): POTATO (midseason)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.81	0.83	0.84	0.86	0.87
MAY	2.51	2.58	2.62	2.67	2.72
JUN	7.39	7.86	8.14	8.54	8.86
JUL	9.88	10.34	10.61	11.00	11.32
AUG	7.13	7.45	7.65	7.93	8.15
SEP					
OCT					
NOV					
DEC					
TOTAL	27.72	29.06	29.87	30.99	31.91

IRRIGATION REQUIREMENT (inches): POTATO (midseason)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.59	0.61	0.62	0.63	0.64
MAY	2.08	2.15	2.19	2.24	2.29
JUN	6.87	7.32	7.59	7.97	8.28
JUL	9.68	10.13	10.41	10.79	11.11
AUG	6.91	7.23	7.43	7.70	7.92
SEP					
OCT					
NOV					
DEC					
TOTAL	26.13	27.45	28.24	29.34	30.24

Table 18. Consumptive Use and Irrigation Requirement.

HERMISTON

CONSUMPTIVE USE (inches): POTATO (late)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.21	0.22	0.22	0.22	0.23
MAY	1.53	1.55	1.55	1.56	1.57
JUN	4.96	5.25	5.42	5.66	5.85
JUL	9.78	10.23	10.51	10.89	11.20
AUG	7.98	8.35	8.57	8.88	9.13
SEP	1.30	1.36	1.40	1.45	1.49
OCT					
NOV					
DEC					
TOTAL	25.76	26.95	27.67	28.66	29.47

IRRIGATION REQUIREMENT (inches): POTATO (late)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.19	0.20	0.20	0.21	0.21
MAY	1.14	1.15	1.16	1.17	1.18
JUN	4.51	4.79	4.96	5.18	5.37
JUL	9.58	10.03	10.30	10.68	11.00
AUG	7.76	8.12	8.34	8.64	8.89
SEP	1.22	1.28	1.32	1.37	1.41
OCT					
NOV					
DEC					
TOTAL	24.39	25.57	26.27	27.25	28.05

Table18 . Consumptive Use and Irrigation Requirement.

HERMISTON

CONSUMPTIVE USE (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.47	0.48	0.49	0.50	0.51
APR	2.07	2.18	2.25	2.34	2.41
MAY	5.86	6.14	6.31	6.55	6.74
JUN	8.58	9.15	9.48	9.95	10.34
JUL	9.65	10.09	10.36	10.74	11.05
AUG	3.24	3.39	3.48	3.60	3.70
SEP					
OCT					
NOV					
DEC					
TOTAL	29.86	31.43	32.37	33.68	34.76

IRRIGATION REQUIREMENT (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.35	0.37	0.37	0.38	0.39
APR	1.67	1.77	1.84	1.92	1.99
MAY	5.36	5.63	5.80	6.03	6.22
JUN	8.02	8.56	8.89	9.35	9.74
JUL	9.45	9.89	10.16	10.54	10.85
AUG	3.10	3.25	3.34	3.46	3.56
SEP					
OCT					
NOV					
DEC					
TOTAL	27.94	29.47	30.40	31.68	32.75

Table 18. Consumptive Use and Irrigation Requirement.

HERMISTON

CONSUMPTIVE USE (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.93	0.97	0.99	1.02	1.04
APR	2.87	3.05	3.16	3.31	3.43
MAY	6.93	7.28	7.49	7.79	8.03
JUN	8.61	9.17	9.51	9.98	10.37
JUL	5.27	5.52	5.67	5.87	6.04
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	24.61	25.98	26.81	27.96	28.91

IRRIGATION REQUIREMENT (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.52	0.54	0.56	0.59	0.61
APR	2.44	2.61	2.72	2.87	2.99
MAY	6.40	6.74	6.95	7.23	7.46
JUN	8.04	8.58	8.91	9.37	9.76
JUL	5.14	5.38	5.53	5.73	5.90
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	22.54	23.86	24.66	25.79	26.72

5.1.7 Hood River

Table 18. Consumptive Use and Irrigation Requirement.

HOOD RIVER

CONSUMPTIVE USE (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	2.94	3.15	3.28	3.45	3.60
MAY	6.08	6.39	6.58	6.85	7.07
JUN	6.53	7.01	7.29	7.69	8.01
JUL	7.67	8.00	8.21	8.49	8.73
AUG	6.32	6.62	6.81	7.07	7.29
SEP	4.58	4.80	4.93	5.11	5.25
OCT					
NOV					
DEC					
TOTAL	34.12	35.98	37.10	38.66	39.95

IRRIGATION REQUIREMENT (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	2.19	2.39	2.52	2.69	2.83
MAY	5.23	5.54	5.72	5.98	6.18
JUN	5.92	6.38	6.65	7.03	7.34
JUL	7.50	7.83	8.04	8.32	8.55
AUG	6.01	6.31	6.50	6.75	6.96
SEP	3.81	4.02	4.15	4.32	4.46
OCT					
NOV					
DEC					
TOTAL	30.67	32.48	33.57	35.08	36.32

Table 18. Consumptive Use and Irrigation Requirement.

HOOD RIVER

CONSUMPTIVE USE (inches): FIELD CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.48	1.51	1.52	1.55	1.57
JUN	4.80	5.11	5.31	5.57	5.79
JUL	8.79	9.18	9.41	9.74	10.00
AUG	7.36	7.72	7.94	8.24	8.49
SEP	3.92	4.10	4.22	4.37	4.50
OCT					
NOV					
DEC					
TOTAL	26.34	27.62	28.40	29.46	30.34

IRRIGATION REQUIREMENT (inches): FIELD CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.89	0.92	0.94	0.96	0.98
JUN	4.24	4.55	4.74	4.99	5.20
JUL	8.62	9.00	9.23	9.55	9.82
AUG	7.03	7.39	7.60	7.90	8.14
SEP	3.16	3.34	3.45	3.60	3.73
OCT					
NOV					
DEC					
TOTAL	23.95	25.20	25.96	27.00	27.86

Table 18. Consumptive Use and Irrigation Requirement.

HOOD RIVER

CONSUMPTIVE USE (inches): FRUIT TREES (apples, pears, plums, apricots)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.06	1.14	1.18	1.25	1.30
MAY	3.20	3.36	3.47	3.60	3.72
JUN	4.47	4.79	4.99	5.26	5.48
JUL	6.05	6.32	6.48	6.70	6.89
AUG	4.99	5.23	5.38	5.58	5.75
SEP	3.38	3.53	3.63	3.76	3.87
OCT	0.45	0.47	0.49	0.51	0.53
NOV					
DEC					
TOTAL	23.60	24.85	25.61	26.67	27.54

IRRIGATION REQUIREMENT (inches):

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.57	0.64	0.68	0.74	0.79
MAY	2.44	2.61	2.70	2.84	2.95
JUN	3.92	4.24	4.43	4.69	4.91
JUL	5.90	6.17	6.33	6.55	6.73
AUG	4.71	4.95	5.09	5.29	5.46
SEP	2.63	2.79	2.88	3.01	3.11
OCT	0.25	0.26	0.27	0.28	0.29
NOV					
DEC					
TOTAL	20.42	21.64	22.38	23.40	24.24

Table 18. Consumptive Use and Irrigation Requirement.

HOOD RIVER

CONSUMPTIVE USE (inches): ONIONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.41	0.42	0.43	0.43	0.44
MAY	2.50	2.58	2.62	2.68	2.73
JUN	5.09	5.43	5.63	5.92	6.15
JUL	8.04	8.40	8.61	8.91	9.15
AUG	6.63	6.96	7.16	7.43	7.65
SEP	1.91	2.00	2.05	2.13	2.19
OCT					
NOV					
DEC					
TOTAL	24.57	25.78	26.50	27.50	28.32

IRRIGATION REQUIREMENT (inches): ONIONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.27	0.27	0.28	0.28	0.29
MAY	1.78	1.85	1.89	1.95	2.00
JUN	4.52	4.85	5.05	5.33	5.55
JUL	7.87	8.22	8.44	8.73	8.97
AUG	6.32	6.64	6.83	7.10	7.32
SEP	1.60	1.68	1.74	1.81	1.87
OCT					
NOV					
DEC					
TOTAL	22.36	23.53	24.23	25.20	26.00

Table 18. Consumptive Use and Irrigation Requirement.

HOOD RIVER

CONSUMPTIVE USE (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.90	0.97	1.00	1.06	1.10
APR	4.43	4.74	4.93	5.19	5.41
MAY	6.40	6.73	6.93	7.21	7.44
JUN	6.88	7.37	7.68	8.09	8.44
JUL	8.07	8.43	8.64	8.94	9.19
AUG	6.65	6.97	7.17	7.44	7.67
SEP	4.82	5.05	5.19	5.38	5.53
OCT	2.36	2.49	2.57	2.68	2.77
NOV					
DEC					
TOTAL	40.51	42.75	44.11	45.99	47.54

IRRIGATION REQUIREMENT (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.26	0.28	0.30	0.35	0.39
APR	3.29	3.60	3.78	4.03	4.23
MAY	5.54	5.86	6.05	6.31	6.53
JUN	6.26	6.73	7.02	7.41	7.74
JUL	7.90	8.25	8.47	8.76	9.01
AUG	6.34	6.66	6.85	7.12	7.34
SEP	4.05	4.26	4.39	4.57	4.72
OCT	0.95	1.07	1.14	1.24	1.32
NOV					
DEC					
TOTAL	34.58	36.71	38.00	39.80	41.28

Table 18. Consumptive Use and Irrigation Requirement.

HOOD RIVER

CONSUMPTIVE USE (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.09	1.14	1.17	1.21	1.24
MAY	6.11	6.41	6.60	6.85	7.06
JUN	7.63	8.19	8.52	8.98	9.36
JUL	6.64	6.93	7.11	7.35	7.55
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	21.47	22.67	23.39	24.39	25.22

IRRIGATION REQUIREMENT (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.44	0.49	0.52	0.55	0.58
MAY	5.26	5.55	5.73	5.98	6.17
JUN	6.98	7.50	7.82	8.25	8.63
JUL	6.51	6.81	6.98	7.22	7.42
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	19.20	20.35	21.04	22.01	22.80

Table 18. Consumptive Use and Irrigation Requirement.

HOOD RIVER

CONSUMPTIVE USE (inches): POTATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.20	0.20	0.21	0.21	0.21
MAY	1.54	1.56	1.57	1.59	1.60
JUN	4.46	4.74	4.92	5.16	5.35
JUL	8.74	9.12	9.35	9.67	9.94
AUG	7.38	7.74	7.96	8.26	8.51
SEP	4.77	4.99	5.13	5.32	5.47
OCT	0.57	0.60	0.62	0.64	0.67
NOV					
DEC					
TOTAL	27.64	28.96	29.76	30.85	31.76

IRRIGATION REQUIREMENT (inches): POTATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.16	0.17	0.17	0.17	0.17
MAY	0.87	0.89	0.90	0.92	0.93
JUN	3.91	4.19	4.26	4.59	4.78
JUL	8.56	8.94	9.17	9.49	9.75
AUG	7.05	7.41	7.62	7.92	8.17
SEP	3.99	4.21	4.34	4.52	4.66
OCT	0.34	0.36	0.37	0.38	0.40
NOV					
DEC					
TOTAL	24.88	26.16	26.93	27.99	28.86

Table 18. Consumptive Use and Irrigation Requirement.

HOOD RIVER

CONSUMPTIVE USE (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.82	1.91	1.96	2.03	2.09
MAY	6.55	6.88	7.08	7.36	7.59
JUN	7.63	8.19	8.52	8.98	9.36
JUL	8.00	8.35	8.56	8.86	9.10
AUG	1.48	1.55	1.59	1.66	1.71
SEP					
OCT					
NOV					
DEC					
TOTAL	25.48	26.88	27.72	28.89	29.85

IRRIGATION REQUIREMENT (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.84	0.93	0.98	1.04	1.09
MAY	5.68	6.00	6.19	6.45	6.67
JUN	6.98	7.50	7.82	8.25	8.63
JUL	7.83	8.18	8.39	8.68	8.92
AUG	1.37	1.44	1.48	1.54	1.59
SEP					
OCT					
NOV					
DEC					
TOTAL	22.70	24.05	24.86	25.97	26.90

Table 18. Consumptive Use and Irrigation Requirement.

HOOD RIVER

CONSUMPTIVE USE (inches): SWEET CORN (early)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.75	0.76	0.76	0.77	0.77
JUN	3.42	3.63	3.75	3.92	4.06
JUL	8.14	8.50	8.71	9.00	9.24
AUG	7.35	7.71	7.93	8.23	8.48
SEP	0.66	0.69	0.71	0.74	0.76
OCT					
NOV					
DEC					
TOTAL	20.33	21.29	21.86	22.66	23.31

IRRIGATION REQUIREMENT (inches): SWEET CORN (early)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.48	0.49	0.49	0.49	0.50
JUN	2.89	3.09	3.21	3.38	3.51
JUL	7.97	8.32	8.53	8.82	9.06
AUG	7.03	7.38	7.59	7.89	8.14
SEP	0.61	0.63	0.65	0.67	0.69
OCT					
NOV					
DEC					
TOTAL	18.98	19.91	20.48	21.26	21.90

Table 18. Consumptive Use and Irrigation Requirement.

HOOD RIVER

CONSUMPTIVE USE (inches): SWEET CORN (late)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY					
JUN	0.50	0.50	0.50	0.51	0.51
JUL	5.63	5.84	5.96	6.13	6.27
AUG	7.38	7.74	7.96	8.26	8.51
SEP	4.37	4.58	4.70	4.87	5.01
OCT					
NOV					
DEC					
TOTAL	17.88	18.66	19.12	19.77	20.30

IRRIGATION REQUIREMENT (inches): SWEET CORN (late)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY					
JUN	0.41	0.42	0.42	0.42	0.42
JUL	5.48	5.69	5.81	5.98	6.12
AUG	7.05	7.41	7.62	7.92	8.17
SEP	3.74	3.94	4.06	4.23	4.36
OCT					
NOV					
DEC					
TOTAL	16.69	17.45	17.91	18.54	19.07

Table 18. Consumptive Use and Irrigation Requirement.

HOOD RIVER

CONSUMPTIVE USE (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	1.03	1.09	1.12	1.17	1.21
APR	4.83	5.17	5.38	5.67	5.90
MAY	7.10	7.47	7.69	8.00	8.26
JUN	5.64	6.05	6.30	6.64	6.92
JUL	1.56	1.63	1.68	1.73	1.78
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	20.17	21.42	22.17	23.21	24.07

IRRIGATION REQUIREMENT (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	3.69	4.01	4.21	4.48	4.71
MAY	6.21	6.56	6.76	7.05	7.28
JUN	5.06	5.45	5.69	6.03	6.30
JUL	1.51	1.58	1.62	1.68	1.72
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	16.47	17.60	18.29	19.23	20.01

5.1.8 Lakeview

Table 18. Consumptive Use and Irrigation Requirement.

LAKEVIEW

CONSUMPTIVE USE (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	2.87	3.10	3.25	3.44	3.61
JUN	6.17	6.83	7.23	8.23	
JUL	7.28	7.68	7.92	8.26	8.54
AUG	5.78	6.18	6.42	6.75	7.02
SEP					
OCT					
NOV					
DEC					
TOTAL	22.11	23.79	24.82	26.23	27.40

IRRIGATION REQUIREMENT (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	2.31	2.54	2.68	2.87	3.03
JUN	5.18	5.80	6.17	6.68	7.08
JUL	7.06	7.45	7.69	8.02	8.30
AUG	5.52	5.91	6.15	6.48	6.75
SEP					
OCT					
NOV					
DEC					
TOTAL	20.06	21.70	22.69	24.05	25.16

Table 18. Consumptive Use and Irrigation Requirement.

LAKEVIEW

CONSUMPTIVE USE (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	3.76	4.22	4.50	4.90	5.22
MAY	5.51	5.96	6.23	6.61	6.93
JUN	6.50	7.19	7.61	8.19	8.67
JUL	7.66	8.09	8.34	8.70	8.99
AUG	6.51	6.95	7.22	7.59	7.90
SEP	4.87	5.20	5.40	5.67	5.90
OCT	1.40	1.51	1.57	1.67	1.74
NOV					
DEC					
TOTAL	36.19	39.11	40.88	43.33	45.35

IRRIGATION REQUIREMENT (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	2.92	3.37	3.65	4.03	4.34
MAY	4.38	4.81	5.07	5.43	5.72
JUN	5.49	6.14	6.52	7.04	7.47
JUL	7.43	7.85	8.10	8.45	8.74
AUG	6.22	6.66	6.92	7.29	7.59
SEP	4.47	4.79	4.98	5.25	5.47
OCT	1.03	1.14	1.20	1.29	1.37
NOV					
DEC					
TOTAL	31.93	34.75	36.45	38.78	40.70

Table 18. Consumptive Use and Irrigation Requirement.

LAKEVIEW

CONSUMPTIVE USE (inches): POTATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.74	0.76	0.77	0.78	0.79
JUN	3.85	4.21	4.42	4.71	4.95
JUL	8.38	8.84	9.12	9.50	9.82
AUG	7.29	7.78	8.09	8.50	8.85
SEP	4.88	5.21	5.41	5.69	5.92
OCT	0.79	0.85	0.89	.94	0.98
NOV					
DEC					
TOTAL	25.93	27.66	28.69	30.13	31.31

IRRIGATION REQUIREMENT (inches): POTATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.38	0.39	0.39	0.40	0.40
JUN	2.94	3.28	3.49	3.77	4.00
JUL	8.14	8.60	8.87	9.25	9.56
AUG	6.99	7.48	7.77	8.18	8.52
SEP	4.48	4.80	4.99	5.26	5.48
OCT	0.58	0.63	0.66	0.70	0.73
NOV					
DEC					
TOTAL	23.51	25.17	26.17	27.56	28.70

Table 18. Consumptive Use and Irrigation Requirement.

LAKEVIEW

CONSUMPTIVE USE (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.74	0.76	0.77	0.78	0.79
JUN	4.53	4.97	5.23	5.59	5.89
JUL	8.58	9.06	9.34	9.74	10.07
AUG	6.60	7.05	7.32	7.70	8.01
SEP	1.05	1.12	1.16	1.22	1.27
OCT					
NOV					
DEC					
TOTAL	21.50	22.95	23.82	25.03	26.02

IRRIGATION REQUIREMENT (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.38	0.39	0.39	0.40	0.40
JUN	3.60	4.02	4.28	4.62	4.90
JUL	8.34	8.81	9.09	9.48	9.80
AUG	6.31	6.75	7.02	7.39	7.69
SEP	0.88	0.95	0.99	1.05	1.10
OCT					
NOV					
DEC					
TOTAL	19.50	20.92	21.77	22.94	23.91

Table 18. Consumptive Use and Irrigation Requirement.

LAKEVIEW

CONSUMPTIVE USE (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.12	1.20	1.25	1.31	1.35
MAY	5.14	5.54	5.79	6.12	6.39
JUN	7.28	8.05	8.52	9.17	9.71
JUL	6.85	7.23	7.46	7.77	8.03
AUG	0.63	0.67	0.69	0.73	0.76
SEP					
OCT					
NOV					
DEC					
TOTAL	21.01	22.69	23.70	25.10	26.25

IRRIGATION REQUIREMENT (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.51	0.59	0.63	0.69	0.73
MAY	4.03	4.41	4.64	4.96	5.22
JUN	6.22	6.92	7.34	7.94	8.45
JUL	6.63	7.00	7.23	7.54	7.80
AUG	0.59	0.63	0.65	0.69	0.71
SEP					
OCT					
NOV					
DEC					
TOTAL	17.97	19.55	20.49	21.81	22.91

5.1.9 Madras

Table 18. Consumptive Use and Irrigation Requirement.

MADRAS

CONSUMPTIVE USE (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	2.60	2.81	2.94	3.12	3.27
MAY	5.31	5.66	5.88	6.17	6.42
JUN	6.08	6.62	9.95	7.40	7.78
JUL	6.93	7.24	7.42	7.69	7.90
AUG	5.76	6.15	6.38	6.71	6.98
SEP	4.35	4.61	4.77	4.98	5.16
OCT					
NOV					
DEC					
TOTAL	31.03	33.09	34.34	36.07	37.50

IRRIGATION REQUIREMENT (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	2.31	2.51	2.64	2.82	2.96
MAY	4.61	4.95	5.15	5.44	5.67
JUN	5.37	5.90	6.22	6.65	7.00
JUL	6.70	7.01	7.19	7.45	7.66
AUG	5.48	5.86	6.09	6.41	6.68
SEP	3.96	4.21	4.37	4.58	4.76
OCT					
NOV					
DEC					
TOTAL	28.43	30.44	31.66	33.34	34.73

Table 18. Consumptive Use and Irrigation Requirement.

MADRAS

CONSUMPTIVE USE (inches): ONIONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.40	0.41	0.42	0.43	0.44
MAY	2.32	2.42	2.48	2.56	2.62
JUN	4.83	5.24	5.48	5.82	6.09
JUL	7.34	7.67	7.87	8.14	8.37
AUG	6.11	6.52	6.77	7.12	7.40
SEP	1.83	1.94	2.01	2.10	2.18
OCT					
NOV					
DEC					
TOTAL	22.83	24.20	25.02	26.16	27.10

IRRIGATION REQUIREMENT (inches): ONIONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.34	0.36	0.36	0.37	0.38
MAY	1.70	1.80	1.86	1.93	1.99
JUN	4.18	4.57	4.80	5.12	5.39
JUL	7.11	7.43	7.63	7.90	8.12
AUG	5.82	6.23	6.47	6.81	7.09
SEP	1.67	1.78	1.85	1.94	2.01
OCT					
NOV					
DEC					
TOTAL	20.83	22.16	22.97	24.07	24.99

Table 18. Consumptive Use and Irrigation Requirement.

MADRAS

CONSUMPTIVE USE (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	2.48	2.68	2.80	2.97	3.11
MAY	5.59	5.96	6.19	6.50	6.75
JUN	6.40	6.97	7.31	7.79	8.19
JUL	7.29	7.62	7.82	8.09	8.32
AUG	6.06	6.47	6.72	7.06	7.34
SEP	4.58	4.85	5.02	5.25	5.43
OCT	2.33	2.49	2.58	2.71	2.82
NOV					
DEC					
TOTAL	34.73	37.04	38.43	40.37	41.97

IRRIGATION REQUIREMENT (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	2.22	2.41	2.53	2.70	2.84
MAY	4.88	5.24	5.45	5.75	6.00
JUN	5.68	6.24	6.56	7.02	7.38
JUL	7.06	7.38	7.58	7.85	8.07
AUG	5.78	6.18	6.42	6.76	7.04
SEP	4.19	4.45	4.62	4.84	5.02
OCT	1.98	2.13	2.23	2.35	2.46
NOV					
DEC					
TOTAL	31.78	34.03	35.39	37.26	38.80

Table 18. Consumptive Use and Irrigation Requirement.

MADRAS

CONSUMPTIVE USE (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.03	1.09	1.12	1.16	1.20
MAY	5.41	5.76	5.97	6.25	6.49
JUN	7.16	7.80	8.19	8.73	9.17
JUL	6.05	6.32	6.49	6.71	6.90
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	19.66	20.97	21.76	22.86	23.76

IRRIGATION REQUIREMENT (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.77	0.83	0.86	0.90	0.93
MAY	4.71	5.04	5.24	5.52	5.75
JUN	6.42	7.03	7.38	7.88	8.30
JUL	5.88	6.15	6.32	6.54	6.73
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	17.78	19.04	19.79	20.83	21.71

Table 18. Consumptive Use and Irrigation Requirement.

MADRAS

CONSUMPTIVE USE (inches): POTATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.95	0.97	0.98	0.99	1.00
JUN	4.26	4.60	4.80	5.09	5.32
JUL	8.16	8.53	8.75	9.06	9.31
AUG	6.77	7.22	7.50	7.88	8.20
SEP	4.16	4.41	4.56	4.76	4.94
OCT	0.07	0.08	0.08	0.09	
NOV					
DEC					
TOTAL	24.38	25.81	26.68	27.87	28.86

IRRIGATION REQUIREMENT (inches): POTATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.57	0.59	0.59	0.60	0.61
JUN	3.61	3.95	4.15	4.42	4.65
JUL	7.92	8.28	8.50	8.81	9.05
AUG	6.47	6.92	7.19	7.57	7.88
SEP	3.77	4.01	4.16	4.37	4.54
OCT	0.07	0.08	0.08	0.08	0.09
NOV					
DEC					
TOTAL	22.42	23.83	24.68	25.85	26.81

Table 18. Consumptive Use and Irrigation Requirement.

MADRAS

CONSUMPTIVE USE (inches): SILAGE CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.42	1.47	1.49	1.53	1.55
JUN	4.58	4.95	5.18	5.49	5.75
JUL	8.02	8.38	8.59	8.89	9.14
AUG	6.77	7.23	7.50	7.89	8.20
SEP	3.77	3.99	4.13	4.32	4.47
OCT					
NOV					
DEC					
TOTAL	24.56	26.02	26.90	28.12	29.12

IRRIGATION REQUIREMENT (inches): SILAGE CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.95	0.97	0.98	0.99	1.00
JUN	4.26	4.60	4.80	5.09	5.32
JUL	8.16	8.53	8.75	9.06	9.31
AUG	6.77	7.22	7.50	7.88	8.20
SEP	4.16	4.41	4.56	4.76	4.94
OCT	0.07	0.08	0.08	0.08	0.09
NOV					
DEC					
TOTAL	24.38	25.81	26.68	27.87	28.86

Table 18. Consumptive Use and Irrigation Requirement.

MADRAS

CONSUMPTIVE USE (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.70	1.80	1.85	1.93	2.00
MAY	5.79	6.16	6.39	6.71	6.97
JUN	7.16	7.80	8.19	8.73	9.17
JUL	7.28	7.60	7.80	8.08	8.30
AUG	1.33	1.42	1.48	1.55	1.61
SEP					
OCT					
NOV					
DEC					
TOTAL	23.26	24.79	25.79	27.00	28.05

IRRIGATION REQUIREMENT (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.30	1.40	1.46	1.54	1.60
MAY	5.07	5.43	5.65	5.96	6.21
JUN	6.42	7.03	7.38	7.88	8.30
JUL	7.05	7.37	7.56	7.83	8.06
AUG	1.23	1.32	1.37	1.44	1.51
SEP					
OCT					
NOV					
DEC					
TOTAL	21.06	22.54	23.43	24.64	25.67

Table 18, Consumptive Use and Irrigation Requirement.

MADRAS

CONSUMPTIVE USE (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.60	0.64	0.66	0.69	0.72
APR	4.17	4.51	4.71	4.99	5.22
MAY	6.26	6.68	6.93	7.28	7.56
JUN	6.99	7.61	7.99	8.51	8.95
JUL	2.08	2.17	2.23	2.31	2.37
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	20.10	21.61	22.52	23.79	24.83

IRRIGATION REQUIREMENT (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.45	0.48	0.50	0.52	0.54
APR	3.72	4.05	4.25	4.53	4.76
MAY	5.53	5.93	6.17	6.50	6.77
JUN	6.26	6.85	7.20	7.68	8.08
JUL	1.99	2.08	2.14	2.22	2.28
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	17.95	19.39	20.27	21.45	22.43

5.1.10 Medford

Table 18. Consumptive Use and Irrigation Requirement.

MEDFORD

CONSUMPTIVE USE (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.21	0.23	0.24	0.25	0.26
APR	3.59	3.85	4.01	4.23	4.41
MAY	5.04	5.29	5.45	5.66	5.84
JUN	5.85	6.33	6.62	7.02	7.36
JUL	6.74	7.05	7.23	7.49	7.70
AUG	5.81	6.14	6.35	6.63	6.86
SEP	4.26	4.48	4.61	4.79	4.94
OCT	2.47	2.60	2.68	2.79	2.88
NOV	0.05	0.05	0.06	0.06	0.06
DEC					
TOTAL	34.03	36.03	37.23	38.91	40.29

IRRIGATION REQUIREMENT (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.19	0.20	0.21	0.22	0.23
APR	2.73	2.99	3.14	3.35	3.53
MAY	4.07	4.32	4.46	4.67	4.84
JUN	5.11	5.57	5.85	6.24	6.55
JUL	6.52	6.82	7.00	7.25	7.45
AUG	5.48	5.81	6.01	6.29	6.52
SEP	3.64	3.85	3.97	4.15	4.30
OCT	1.16	1.27	1.34	1.44	1.53
NOV					
DEC					
TOTAL	28.90	30.82	31.99	33.61	34.94

Table 18 Consumptive Use and Irrigation Requirement.

MEDFORD

CONSUMPTIVE USE (inches): FRUIT TREES (peaches, pears, apricots, plums)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.90	2.04	2.12	2.24	2.33
MAY	2.96	3.11	3.20	3.33	3.43
JUN	4.47	4.84	5.06	5.37	5.63
JUL	5.95	6.22	6.38	6.60	6.79
AUG	5.12	5.42	5.60	5.85	6.05
SEP	3.51	3.69	3.79	3.94	4.07
OCT	1.60	1.68	1.73	1.80	1.86
NOV					
DEC					
TOTAL	25.52	27.00	27.90	29.14	30.16

IRRIGATION REQUIREMENT (inches): FRUIT TREES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.14	1.27	1.34	1.45	1.54
MAY	2.07	2.21	2.30	2.42	2.52
JUN	3.78	4.14	4.36	4.65	4.89
JUL	5.73	6.00	6.16	6.38	6.56
AUG	4.82	5.11	5.28	5.52	5.72
SEP	2.90	3.07	3.17	3.32	3.44
OCT	0.44	0.50	0.53	0.58	0.62
NOV					
DEC					
TOTAL	20.87	22.29	23.14	24.32	25.30

Table 18. Consumptive Use and Irrigation Requirement.

MEDFORD

CONSUMPTIVE USE (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	2.46	2.63	2.73	2.87	2.99
APR	4.01	4.30	4.48	4.72	4.93
MAY	5.63	5.92	6.09	6.33	6.52
JUN	6.54	7.08	7.40	7.85	8.22
JUL	7.54	7.88	8.08	8.37	8.60
AUG	6.49	6.87	7.09	7.41	7.67
SEP	4.77	5.00	5.15	5.35	5.52
OCT	2.76	2.91	2.99	3.12	3.22
NOV	0.43	0.47	0.50	0.54	0.57
DEC					
TOTAL	40.63	43.06	44.52	46.56	48.23

IRRIGATION REQUIREMENT (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	1.15	1.30	1.39	1.52	1.62
APR	3.14	3.43	3.60	3.84	4.04
MAY	4.64	4.91	5.08	5.31	5.49
JUN	5.77	6.29	6.59	7.02	7.36
JUL	7.30	7.63	7.83	8.12	8.35
AUG	6.15	6.52	6.75	7.05	7.31
SEP	4.13	4.36	4.50	4.69	4.85
OCT	1.42	1.55	1.63	1.75	1.84
NOV					
DEC					
TOTAL	33.70	36.00	37.38	39.29	40.86

Table 18. Consumptive Use and Irrigation Requirement.

MEDFORD

CONSUMPTIVE USE (inches): POTATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.57	1.60	1.61	1.64	1.65
JUN	5.05	5.42	5.65	5.95	6.20
JUL	8.89	9.29	9.53	9.86	10.14
AUG	7.65	8.09	8.36	8.73	9.04
SEP	4.87	5.12	5.26	5.47	5.64
OCT	0.65	0.68	0.71	0.73	0.76
NOV					
DEC					
TOTAL	28.68	30.20	31.12	32.39	33.43

IRRIGATION REQUIREMENT (inches): POTATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.99	1.02	1.04	1.06	1.08
JUN	4.34	4.70	4.91	5.20	5.45
JUL	8.63	9.02	9.26	9.59	9.87
AUG	7.29	7.72	7.99	8.35	8.65
SEP	4.23	4.47	4.61	4.81	4.97
OCT	0.42	0.45	0.46	0.48	0.49
NOV					
DEC					
TOTAL	25.92	27.38	28.27	29.49	30.51

Table 18. Consumptive Use and Irrigation Requirement.

MEDFORD

CONSUMPTIVE USE (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.95	0.99	1.01	1.04	1.06
MAY	4.37	4.55	4.65	4.80	4.92
JUN	7.71	8.34	8.72	9.26	9.69
JUL	8.89	9.29	9.53	9.86	10.14
AUG	4.48	4.74	4.89	5.11	5.29
SEP					
OCT					
NOV					
DEC					
TOTAL	26.39	27.90	28.81	30.07	31.11

IRRIGATION REQUIREMENT (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.58	0.61	0.63	0.66	0.68
MAY	3.42	3.60	3.70	3.84	3.96
JUN	6.89	7.47	7.81	8.32	8.75
JUL	8.63	9.02	9.26	9.59	9.87
AUG	4.18	4.44	4.59	4.81	4.98
SEP					
OCT					
NOV					
DEC					
TOTAL	23.70	25.13	26.00	27.22	28.24

Table 18. Consumptive Use and Irrigation Requirement.

MEDFORD

CONSUMPTIVE USE (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	1.25	1.31	1.35	1.41	1.45
APR	3.84	4.11	4.27	4.49	4.67
MAY	6.64	6.97	7.18	7.46	7.69
JUN	7.71	8.34	8.72	9.26	9.69
JUL	6.87	7.17	7.36	7.62	7.83
AUG	1.13	1.20	1.23	1.29	1.34
SEP					
OCT					
NOV					
DEC					
TOTAL	27.43	29.11	30.12	31.52	32.67

IRRIGATION REQUIREMENT (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.23	0.29	0.32	0.37	0.41
APR	2.98	3.24	3.39	3.61	3.79
MAY	5.61	5.92	6.11	6.36	6.58
JUN	6.89	7.47	7.81	8.32	8.75
JUL	6.64	6.94	7.12	7.38	7.59
AUG	1.02	1.08	1.12	1.18	1.22
SEP					
OCT					
NOV					
DEC					
TOTAL	23.35	24.93	25.88	27.22	28.33

5.1.11 Pendleton

Table 18. Consumptive Use and Irrigation Requirement.

PENDLETON

CONSUMPTIVE USE (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	2.52	2.68	2.78	2.92	3.03
APR	4.35	4.66	4.84	5.10	5.31
MAY	6.34	6.69	6.90	7.17	7.43
JUN	7.40	8.02	8.39	8.90	9.33
JUL	8.44	8.91	9.19	9.58	9.91
AUG	7.15	7.63	7.92	8.32	8.65
SEP	4.47	4.74	4.91	5.14	5.32
OCT					
NOV					
DEC					
TOTAL	40.67	43.32	44.92	47.14	48.98

IRRIGATION REQUIREMENT (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	1.79	1.94	2.04	2.16	2.27
APR	3.63	3.93	4.11	4.36	4.56
MAY	5.44	5.78	5.98	6.25	6.48
JUN	6.75	7.33	7.68	8.16	8.58
JUL	8.13	8.59	8.87	9.25	9.57
AUG	6.74	7.20	7.48	7.87	8.19
SEP	4.08	4.35	4.52	4.74	4.92
OCT					
NOV					
DEC					
TOTAL	36.56	39.13	40.67	42.80	44.57

Table18 . Consumptive Use and Irrigation Requirement.

PENDLETON

CONSUMPTIVE USE (inches): FIELD CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.40	1.41	1.41	1.42	1.42
JUN	3.24	3.44	3.56	3.73	3.86
JUL	8.58	9.04	9.31	9.70	10.01
AUG	8.43	8.99	9.33	9.80	10.19
SEP	4.76	5.05	5.23	5.47	5.67
OCT					
NOV					
DEC					
TOTAL	26.41	27.93	28.85	30.12	31.16

IRRIGATION REQUIREMENT (inches): FIELD CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.70	0.71	0.72	0.72	0.72
JUN	2.70	2.90	3.02	3.18	3.31
JUL	8.26	8.71	8.99	9.36	9.68
AUG	7.99	8.53	8.86	9.32	9.71
SEP	4.31	4.60	4.77	5.00	5.20
OCT					
NOV					
DEC					
TOTAL	23.96	25.46	26.35	27.58	28.6

Table18 . Consumptive Use and Irrigation Requirement.

PENDLETON

CONSUMPTIVE USE (inches): ONIONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.16	0.17	0.17	0.17	0.18
APR	1.26	1.30	1.32	1.35	1.38
MAY	2.76	2.86	2.92	3.00	3.06
JUN	5.75	6.20	6.47	6.84	7.14
JUL	8.86	9.35	9.64	10.05	10.39
AUG	7.68	8.19	8.50	8.93	9.28
SEP	3.40	3.61	3.73	3.90	4.05
OCT					
NOV					
DEC					
TOTAL	28.99	31.67	32.75	24.25	35.47

IRRIGATION REQUIREMENT (inches): ONIONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.14	0.14	0.15	0.15	0.15
APR	0.65	0.69	0.72	0.74	0.77
MAY	1.99	2.08	2.14	2.21	2.27
JUN	5.15	5.53	5.84	6.20	6.49
JUL	8.54	9.02	9.31	9.71	10.05
AUG	7.25	7.75	8.05	8.47	8.81
SEP	3.10	3.30	3.43	3.60	3.74
OCT					
NOV					
DEC					
TOTAL	26.82	28.57	29.63	31.09	32.29

Table 18 Consumptive Use and Irrigation Requirement.

PENDLETON

CONSUMPTIVE USE (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	2.65	2.82	2.93	3.07	3.19
APR	4.58	4.90	5.10	5.37	5.59
MAY	6.67	7.04	7.26	7.57	7.83
JUN	7.79	8.44	8.83	9.37	9.82
JUL	8.88	9.38	9.67	10.09	10.43
AUG	7.53	8.03	8.33	8.75	9.10
SEP	5.43	5.76	5.96	6.24	6.47
OCT					
NOV					
DEC					
TOTAL	43.53	46.37	48.08	50.46	52.42

IRRIGATION REQUIREMENT (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	1.92	2.08	2.17	2.31	2.43
APR	3.85	4.17	4.36	4.62	4.83
MAY	5.76	6.11	6.32	6.60	6.84
JUN	7.12	7.72	8.09	8.62	9.05
JUL	8.57	9.05	9.34	9.75	10.09
AUG	7.10	7.59	7.89	8.30	8.64
SEP	4.96	5.28	5.47	5.75	5.97
OCT					
NOV					
DEC					
TOTAL	39.28	42.00	43.64	47.85	

Table 18 . Consumptive Use and Irrigation Requirement.

PENDLETON

CONSUMPTIVE USE (inches): POTATO (early)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.30	0.31	0.31	0.32	0.32
APR	1.42	1.47	1.50	1.55	1.58
MAY	4.97	5.22	5.36	5.56	5.73
JUN	8.68	9.40	9.83	10.44	10.93
JUL	3.56	3.76	3.88	4.05	4.18
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	18.93	20.15	20.89	21.91	22.75

IRRIGATION REQUIREMENT (inches): POTATO (early)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.22	0.23	0.23	0.24	0.24
APR	0.80	0.86	0.89	0.93	0.96
MAY	4.13	4.37	4.51	4.70	4.86
JUN	7.95	8.64	9.07	9.67	10.17
JUL	3.46	3.65	3.77	3.94	4.07
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	16.56	17.75	18.46	19.47	20.30

Table 18. Consumptive Use and Irrigation Requirement.

PENDLETON

CONSUMPTIVE USE (inches): POTATO (midseason)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.79	0.81	0.82	0.84	0.85
MAY	2.47	2.55	2.59	2.65	2.70
JUN	7.51	8.11	8.48	8.99	9.41
JUL	9.95	10.50	10.84	11.30	11.68
AUG	7.11	7.58	7.87	8.26	8.59
SEP					
OCT					
NOV					
DEC					
TOTAL	27.82	29.55	30.60	32.04	33.23

IRRIGATION REQUIREMENT (inches): POTATO (midseason)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.46	0.47	0.48	0.49	0.49
MAY	1.71	1.78	1.83	1.88	1.93
JUN	6.84	7.42	7.76	8.24	8.65
JUL	9.61	10.16	10.50	10.96	11.34
AUG	6.69	7.15	7.43	7.82	8.14
SEP					
OCT					
NOV					
DEC					
TOTAL	25.32	26.99	27.99	29.39	30.55

Table 18. Consumptive Use and Irrigation Requirement.

PENDLETON

CONSUMPTIVE USE (inches): POTATO (late)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.20	0.21	0.21	0.22	0.22
MAY	1.52	1.54	1.55	1.56	1.57
JUN	5.05	5.43	5.66	5.97	6.23
JUL	9.85	10.40	10.73	11.18	11.56
AUG	7.96	8.49	8.81	9.25	9.62
SEP	1.29	1.37	1.42	1.49	1.54
OCT					
NOV					
DEC					
TOTAL	25.88	27.44	28.38	29.67	30.74

IRRIGATION REQUIREMENT (inches): POTATO (late)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.18	0.18	0.19	0.19	0.19
MAY	0.82	0.84	0.85	0.86	0.86
JUN	4.48	4.85	5.06	5.36	5.61
JUL	9.51	10.06	10.39	10.84	11.22
AUG	7.52	8.04	8.35	8.79	9.14
SEP	1.18	1.26	1.31	1.37	1.43
OCT					
NOV					
DEC					
TOTAL	23.70	25.22	26.15	27.41	28.46

Table 18 . Consumptive Use and Irrigation Requirement.

PENDLETON

CONSUMPTIVE USE (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.45	0.47	0.48	0.49	0.50
APR	1.83	1.92	1.98	2.05	2.11
MAY	5.39	5.66	5.83	6.05	6.24
JUN	8.65	9.37	9.80	10.40	10.90
JUL	9.87	10.41	10.74	11.20	11.58
AUG	3.92	4.18	4.34	4.55	4.74
SEP					
OCT					
NOV					
DEC					
TOTAL	30.10	32.01	33.16	34.75	36.06

IRRIGATION REQUIREMENT (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.29	0.30	0.30	0.31	0.32
APR	1.20	1.29	1.34	1.41	1.46
MAY	4.53	4.79	4.95	5.17	5.35
JUN	7.92	8.61	9.03	9.63	10.13
JUL	9.53	10.08	10.41	10.86	11.24
AUG	3.61	3.87	4.03	4.25	4.42
SEP					
OCT					
NOV					
DEC					
TOTAL	27.08	28.93	30.06	31.63	32.93

Table 18 . Consumptive Use and Irrigation Requirement.

PENDLETON

CONSUMPTIVE USE (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.91	0.95	0.97	1.00	1.03
APR	2.74	2.91	3.01	3.15	3.27
MAY	6.72	7.08	7.30	7.60	7.85
JUN	8.73	9.45	9.89	10.50	11.00
JUL	5.31	5.61	5.79	6.03	6.24
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	24.40	25.99	26.96	28.29	29.38

IRRIGATION REQUIREMENT (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.31	0.33	0.33	0.36	0.38
APR	2.06	2.22	2.32	2.46	2.57
MAY	5.80	6.15	6.35	6.63	6.86
JUN	7.99	8.69	9.12	9.73	10.23
JUL	5.09	5.38	5.55	5.79	6.00
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	21.26	22.76	23.68	24.97	26.04

5.1.12 Roseburg

Table 18. Consumptive Use and Irrigation Requirement.

ROSEBURG

CONSUMPTIVE USE (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	1.18	1.24	1.28	1.33	
APR	3.49	3.73	3.87	4.07	
MAY	4.76	5.00	5.15	5.34	
JUN	5.30	5.77	6.06	6.46	
JUL	6.53	6.93	7.17	7.50	
AUG	5.49	5.79	5.98	6.23	
SEP	4.13	4.36	4.49	4.68	
OCT					
NOV					
DEC					
TOTAL	30.88	32.82	33.99	35.62	

IRRIGATION REQUIREMENT (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.00	0.00	0.20	0.23	
APR	2.11	2.34	2.47	2.66	
MAY	3.41	3.63	3.76	3.95	
JUN	4.43	4.89	5.16	5.55	
JUL	6.42	6.82	7.06	7.39	
AUG	5.22	5.52	5.70	5.95	
SEP	3.50	3.72	3.86	4.04	
OCT					
NOV					
DEC					
TOTAL	25.10	26.92	28.22	29.78	

Table 18. Consumptive Use and Irrigation Requirement.

ROSEBURG

CONSUMPTIVE USE (inches): FRUIT TREES (peaches, pears, apricots, plums)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.65	1.77	1.83	1.93	
MAY	2.51	2.63	2.71	2.81	
JUN	3.62	3.95	4.15	4.42	
JUL	5.15	5.47	5.66	5.92	
AUG	4.33	4.57	4.72	4.92	
SEP	3.04	3.21	3.31	3.45	
OCT	0.05	0.05	0.05	0.05	
NOV					
DEC					
TOTAL	20.36	21.65	22.43	23.51	

IRRIGATION REQUIREMENT (inches): FRUIT TREES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.48	0.56	0.61	0.68	
MAY	1.27	1.38	1.45	1.55	
JUN	2.81	3.12	3.32	3.58	
JUL	5.06	5.37	5.56	5.82	
AUG	4.08	4.32	4.47	4.67	
SEP	2.43	2.60	2.70	2.83	
OCT	0.04	0.05	0.05	0.05	
NOV					
DEC					
TOTAL	16.18	17.40	18.15	19.18	

Table 18. Consumptive Use and Irrigation Requirement.

ROSEBURG

CONSUMPTIVE USE (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	2.27	2.38	2.45	2.54	
APR	3.67	3.92	4.07	4.28	
MAY	5.01	5.26	5.42	5.63	
JUN	5.57	6.08	6.38	6.80	
JUL	6.87	7.29	7.55	7.90	
AUG	5.78	6.10	6.29	6.56	
SEP	4.35	4.59	4.73	4.93	
OCT	2.61	2.73	2.80	2.90	
NOV	0.41	0.46	0.49	0.53	
DEC					
TOTAL	36.55	38.81	40.18	42.07	

IRRIGATION REQUIREMENT (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	2.29	2.53	2.67	2.87	
MAY	3.64	3.87	4.01	4.21	
JUN	4.70	5.18	5.47	5.88	
JUL	6.77	7.18	7.43	7.78	
AUG	5.51	5.82	6.01	6.27	
SEP	3.72	3.95	4.09	4.29	
OCT	0.74	0.85	0.91	0.99	
NOV					
DEC					
TOTAL	27.36	29.62	30.88	32.63	

Table 18. Consumptive Use and Irrigation Requirement.

ROSEBURG

CONSUMPTIVE USE (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.54	0.56	0.58	0.59	
APR	3.35	3.57	3.70	3.88	
MAY	5.52	5.79	5.96	6.19	
JUN	5.92	6.45	6.78	7.22	
JUL					
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	15.32	16.37	17.01	17.89	

IRRIGATION REQUIREMENT (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.97	2.19	2.31	2.49	
MAY	4.11	4.36	4.51	4.73	
JUN	5.02	5.54	5.85	6.27	
JUL					
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	11.10	12.08	12.67	13.48	

Table 18. Consumptive Use and Irrigation Requirement.

ROSEBURG

CONSUMPTIVE USE (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.52	0.54	0.55	0.57	
APR	2.67	2.84	2.94	3.08	
MAY	5.52	5.79	5.96	6.19	
JUN	6.13	6.69	7.02	7.48	
JUL	4.47	4.75	4.91	5.14	
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	19.32	20.61	21.38	22.46	

IRRIGATION REQUIREMENT (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.35	1.50	1.59	1.72	
MAY	4.11	4.36	4.51	4.73	
JUN	5.23	5.76	6.08	6.51	
JUL	4.38	4.65	4.82	5.05	
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	15.06	16.27	17.00	18.01	

Table 18. Consumptive Use and Irrigation Requirement.

ROSEBURG

CONSUMPTIVE USE (inches): SWEET CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.76	1.81	1.83	1.87	
JUN	4.49	4.87	5.11	5.43	
JUL	7.56	8.02	8.30	8.69	
AUG	6.27	6.62	6.83	7.12	
SEP	2.07	2.19	2.25	2.35	
OCT					
NOV					
DEC					
TOTAL	22.15	23.51	24.32	25.45	

IRRIGATION REQUIREMENT (inches): SWEET CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.61	0.65	0.67	0.70	
JUN	3.65	4.03	4.25	4.55	
JUL	7.45	7.91	8.18	8.57	
AUG	5.99	6.33	6.54	6.82	
SEP	1.81	1.92	1.99	2.08	
OCT					
NOV					
DEC					
TOTAL	19.51	20.84	21.63	22.73	

Table 18. Consumptive Use and Irrigation Requirement.

ROSEBURG

CONSUMPTIVE USE (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.83	0.86	0.88	0.90	
APR	2.09	2.22	2.29	2.39	
MAY	5.07	5.32	5.47	5.68	
JUN	6.12	6.68	7.01	7.47	
JUL	2.62	2.78	2.87	3.01	
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	16.74	17.85	18.52	19.45	

IRRIGATION REQUIREMENT (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.82	0.93	1.00	1.09	
MAY	3.69	3.92	4.06	4.25	
JUN	5.22	5.75	6.07	6.50	
JUL	2.56	2.72	2.82	2.95	
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	12.30	13.33	13.95	14.80	

5.1.13 Salem

Table 18. Consumptive Use and Irrigation Requirement.

SALEM

CONSUMPTIVE USE (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	2.86	3.07	3.20	3.37	3.52
MAY	4.14	4.37	4.51	4.71	4.87
JUN	4.54	4.88	5.08	5.36	5.59
JUL	5.69	5.96	6.13	6.36	6.54
AUG	4.81	5.04	5.19	5.38	5.54
SEP	3.64	3.80	3.90	4.04	4.15
OCT	1.98	2.08	2.14	2.23	2.30
NOV					
DEC					
TOTAL	27.66	29.21	30.15	31.44	32.51

IRRIGATION REQUIREMENT (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.17	1.36	1.48	1.64	1.77
MAY	2.73	2.96	3.09	3.28	3.43
JUN	3.55	3.88	4.07	4.34	4.57
JUL	5.42	5.68	5.84	6.07	6.25
AUG	4.38	4.60	4.74	4.93	5.09
SEP	2.55	2.71	2.80	2.94	3.05
OCT					
NOV					
DEC					
TOTAL	19.80	21.29	22.18	23.42	24.44

Table 18. Consumptive Use and Irrigation Requirement.

SALEM

CONSUMPTIVE USE (inches): FIELD CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	2.21	2.29	2.33	2.38	2.43
JUN	3.86	4.10	4.24	4.44	4.60
JUL	7.05	7.38	7.58	7.85	8.08
AUG	6.04	6.33	6.51	6.76	6.96
SEP	2.02	2.11	2.16	2.24	2.30
OCT					
NOV					
DEC					
TOTAL	21.17	22.20	22.82	23.68	24.38

IRRIGATION REQUIREMENT (inches): FIELD CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.10	1.16	1.20	1.25	1.29
JUN	2.89	3.12	3.26	3.46	3.61
JUL	6.75	7.07	7.27	7.54	7.76
AUG	5.57	5.86	6.03	6.27	6.47
SEP	1.40	1.48	1.53	1.61	1.67
OCT					
NOV					
DEC					
TOTAL	17.70	18.70	19.30	20.13	20.81

Table 18. Consumptive Use and Irrigation Requirement.

SALEM

CONSUMPTIVE USE (inches): FRUIT TREES (peaches, pears, apricots, plums)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.56	0.60	0.62	0.65	0.68
MAY	2.43	2.57	2.65	2.77	2.86
JUN	3.47	3.73	3.88	4.10	4.28
JUL	5.02	5.26	5.41	5.61	5.77
AUG	4.24	4.45	4.58	4.75	4.89
SEP	3.00	3.13	3.21	3.33	3.42
OCT	0.66	0.70	0.72	0.75	0.77
NOV					
DEC					
TOTAL	19.39	20.44	21.07	21.95	22.68

IRRIGATION REQUIREMENT (inches): FRUIT TREES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.24	0.26	0.27	0.29	0.30
MAY	1.13	1.26	1.33	1.44	1.52
JUN	2.52	2.77	2.91	3.12	3.30
JUL	4.76	5.00	5.14	5.33	5.50
AUG	3.82	4.02	4.14	4.32	4.46
SEP	1.95	2.07	2.15	2.26	2.35
OCT					
NOV					
DEC					
TOTAL	14.42	15.37	15.95	16.75	17.42

Table 18. Consumptive Use and Irrigation Requirement.

SALEM

CONSUMPTIVE USE (inches): GREEN BEANS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.84	1.90	1.94	1.99	2.03
JUN	4.46	4.77	4.96	5.21	5.43
JUL	4.92	5.16	5.30	5.50	5.66
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	11.22	11.83	12.20	12.70	13.11

IRRIGATION REQUIREMENT (inches): GREEN BEANS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.96	1.02	1.05	1.10	1.13
JUN	3.47	3.78	3.96	4.20	4.41
JUL	4.72	4.95	5.09	5.28	5.44
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	9.15	9.74	10.10	10.59	10.98

Table 18. Consumptive Use and Irrigation Requirement.

SALEM

CONSUMPTIVE USE (inches): MELONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.97	1.00	1.01	1.04	1.05
JUN	3.84	4.09	4.23	4.43	4.59
JUL	6.50	6.81	6.99	7.25	7.47
AUG	5.09	5.34	5.49	5.70	5.87
SEP	0.40	0.42	0.43	0.45	0.46
OCT					
NOV					
DEC					
TOTAL	16.80	17.65	18.16	18.87	19.44

IRRIGATION REQUIREMENT (inches): MELONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.52	0.54	0.56	0.58	0.60
JUN	2.87	3.11	3.25	3.44	3.60
JUL	6.21	6.51	6.70	6.95	7.16
AUG	4.65	4.89	5.03	5.24	5.40
SEP	0.36	0.37	0.38	0.39	0.41
OCT					
NOV					
DEC					
TOTAL	14.61	15.42	15.92	16.60	17.16

Table 18. Consumptive Use and Irrigation Requirement.

SALEM

CONSUMPTIVE USE (inches): ONIONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.05	1.11	1.14	1.18	1.22
MAY	4.24	4.46	4.59	4.77	4.92
JUN	5.29	5.68	5.92	6.24	6.51
JUL	6.60	6.92	7.11	7.37	7.59
AUG	4.86	5.10	5.24	5.44	5.60
SEP					
OCT					
NOV					
DEC					
TOTAL	22.04	23.26	23.99	25.01	25.85

IRRIGATION REQUIREMENT (inches): ONIONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.25	0.30	0.33	0.37	0.40
MAY	2.83	3.04	3.17	3.34	3.49
JUN	4.28	4.65	4.88	5.19	5.45
JUL	6.31	6.62	6.81	7.07	7.28
AUG	4.43	4.66	4.80	4.99	5.15
SEP					
OCT					
NOV					
DEC					
TOTAL	18.09	19.27	19.97	20.95	21.76

Table 18. Consumptive Use and Irrigation Requirement.

SALEM

CONSUMPTIVE USE (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	1.42	1.52	1.58	1.66	1.72
APR	3.20	3.43	3.57	3.77	3.93
MAY	4.62	4.88	5.04	5.26	5.44
JUN	5.08	5.45	5.68	5.99	6.25
JUL	6.36	6.67	6.85	7.10	7.31
AUG	5.37	5.64	5.80	6.01	6.20
SEP	4.07	4.25	4.36	4.52	4.64
OCT	2.37	2.49	2.56	2.66	2.74
NOV	0.40	0.44	0.47	0.50	0.53
DEC					
TOTAL	32.89	34.77	35.90	37.47	38.77

IRRIGATION REQUIREMENT (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.48	1.69	1.82	2.00	2.15
MAY	3.20	3.45	3.59	3.79	3.96
JUN	4.07	4.43	4.65	4.95	5.20
JUL	6.07	6.37	6.55	6.80	7.01
AUG	4.92	5.18	5.33	5.54	5.72
SEP	2.96	3.14	3.25	3.40	3.52
OCT	0.29	0.38	0.43	0.51	0.57
NOV					
DEC					
TOTAL	23.00	24.64	25.63	26.99	28.12

Table 18. Consumptive Use and Irrigation Requirement.

SALEM

CONSUMPTIVE USE (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	1.41	1.49	1.54	1.60	1.66
APR	3.36	3.60	3.74	3.94	4.11
MAY	5.28	5.58	5.76	6.01	6.21
JUN	1.99	2.14	2.23	2.35	2.46
JUL					
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	12.04	12.81	13.27	13.91	14.43

IRRIGATION REQUIREMENT (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.62	1.84	1.98	2.16	2.31
MAY	3.81	4.08	4.25	4.67	
JUN	1.68	1.82	1.91	2.03	2.13
JUL					
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	7.12	7.75	8.13	8.66	9.11

Table 18. Consumptive Use and Irrigation Requirement.

SALEM

CONSUMPTIVE USE (inches): SQUASH

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.82	1.88	1.91	1.96	2.00
JUN	4.19	4.48	4.65	4.89	5.08
JUL	6.16	6.46	6.63	6.88	7.08
AUG	5.09	5.34	5.49	5.69	5.87
SEP	2.10	2.20	2.25	2.33	2.40
OCT					
NOV					
DEC					
TOTAL	19.36	20.34	20.94	21.75	22.43

IRRIGATION REQUIREMENT (inches): SQUASH

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.93	0.99	1.03	1.07	1.10
JUN	3.21	3.49	3.66	3.89	4.08
JUL	5.88	6.17	6.34	6.58	6.78
AUG	4.65	4.89	5.03	5.23	5.40
SEP	1.48	1.57	1.62	1.70	1.76
OCT					
NOV					
DEC					
TOTAL	16.15	17.10	17.68	18.47	19.12

Table 18. Consumptive Use and Irrigation Requirement.

SALEM

CONSUMPTIVE USE (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.01	1.06	1.09	1.13	1.16
MAY	3.24	3.37	3.45	3.56	3.65
JUN	5.43	5.82	6.06	6.39	6.66
JUL	6.76	7.09	7.28	7.55	7.77
AUG	0.68	0.71	0.73	0.76	0.78
SEP					
OCT					
NOV					
DEC					
TOTAL	17.11	18.05	18.61	19.38	20.02

IRRIGATION REQUIREMENT (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.20	0.25	0.28	0.32	0.35
MAY	1.88	2.00	2.08	2.18	2.27
JUN	4.41	4.79	5.01	5.32	5.58
JUL	6.47	6.78	6.98	7.24	7.46
AUG	0.60	0.63	0.65	0.68	0.70
SEP					
OCT					
NOV					
DEC					
TOTAL	13.56	14.46	15.00	15.74	16.35

Table 18. Consumptive Use and Irrigation Requirement.

SALEM

CONSUMPTIVE USE (inches): SWEET CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.63	1.69	1.72	1.76	1.79
JUN	4.16	4.43	4.59	4.81	5.00
JUL	7.29	7.64	7.85	8.14	8.38
AUG	6.16	6.46	6.64	6.90	7.10
SEP	1.32	1.38	1.41	1.46	1.50
OCT					
NOV					
DEC					
TOTAL	20.56	21.59	22.22	23.07	23.77

IRRIGATION REQUIREMENT (inches): SWEET CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.84	0.89	0.92	0.96	0.99
JUN	3.18	3.44	3.60	3.82	3.99
JUL	6.98	7.33	7.53	7.82	8.06
AUG	5.69	5.98	6.16	6.40	6.61
SEP	1.04	1.10	1.14	1.18	1.22
OCT					
NOV					
DEC					
TOTAL	17.74	18.74	19.35	20.19	20.87

Table 18. Consumptive Use and Irrigation Requirement.

SALEM

CONSUMPTIVE USE (inches): TABLE BEETS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.06	0.06	0.06	0.07	0.07
MAY	2.62	2.71	2.76	2.84	2.89
JUN	4.66	4.99	5.18	5.45	5.68
JUL	6.80	7.12	7.32	7.59	7.81
AUG	1.20	1.26	1.30	1.35	1.39
SEP					
OCT					
NOV					
DEC					
TOTAL	15.34	16.15	16.63	17.29	17.84

IRRIGATION REQUIREMENT (inches): TABLE BEETS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.06	0.06	0.06	0.06	0.06
MAY	1.30	1.38	1.43	1.50	1.55
JUN	3.67	3.99	4.17	4.43	4.65
JUL	6.50	6.82	7.01	7.28	7.50
AUG	1.12	1.18	1.22	1.27	1.31
SEP					
OCT					
NOV					
DEC					
TOTAL	12.65	13.43	13.90	14.54	15.06

Table 18. Consumptive Use and Irrigation Requirement.

SALEM

CONSUMPTIVE USE (inches): TOMATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	2.65	2.74	2.80	2.87	2.92
JUN	5.11	5.47	5.69	5.99	6.24
JUL	7.47	7.83	8.05	8.34	8.59
AUG	3.02	3.16	3.25	3.38	3.48
SEP					
OCT					
NOV					
DEC					
TOTAL	18.25	19.21	19.79	20.58	21.23

IRRIGATION REQUIREMENT (inches): TOMATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.33	1.41	1.46	1.53	1.58
JUN	4.11	4.45	4.66	4.95	5.18
JUL	7.17	7.51	7.73	8.02	8.26
AUG	2.75	2.90	2.99	3.11	3.21
SEP					
OCT					
NOV					
DEC					
TOTAL	15.35	16.28	16.83	17.60	18.23

Table 18. Consumptive Use and Irrigation Requirement.

SALEM

CONSUMPTIVE USE (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.92	2.02	2.08	2.15	2.21
MAY	3.11	3.24	3.31	3.41	3.49
JUN	4.55	4.86	5.04	5.29	5.50
JUL	7.04	7.37	7.57	7.84	8.07
AUG	6.15	6.45	6.63	6.88	7.09
SEP	2.00	2.09	2.14	2.22	2.28
OCT					
NOV					
DEC					
TOTAL	24.77	26.02	26.76	27.79	28.63

IRRIGATION REQUIREMENT (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.36	0.43	0.48	0.55	0.60
MAY	1.76	1.87	1.94	2.04	2.11
JUN	3.56	3.86	4.04	4.28	4.48
JUL	6.74	7.06	7.26	7.53	7.75
AUG	5.67	5.97	6.14	6.39	6.59
SEP	1.25	1.34	1.39	1.46	1.52
OCT					
NOV					
DEC					
TOTAL	19.35	20.53	21.25	22.23	23.04

5.1.14 Vale

Table 18. Consumptive Use and Irrigation Requirement.

VALE

CONSUMPTIVE USE (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	4.36	4.68	4.88	5.15	5.38
MAY	6.46	6.84	7.07	7.39	7.65
JUN	7.59	8.33	8.77	9.39	9.90
JUL	8.45	8.82	9.04	9.36	9.61
AUG	6.65	7.07	7.32	7.66	7.95
SEP	4.77	5.07	5.25	5.50	5.71
OCT	2.41	2.52	2.59	2.68	2.76
NOV					
DEC					
TOTAL	40.68	43.32	44.92	47.13	48.96

IRRIGATION REQUIREMENT (inches): ALFALFA HAY

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	3.87	4.20	4.39	4.65	4.87
MAY	5.74	6.11	6.32	6.63	6.87
JUN	6.88	7.56	7.98	8.57	9.07
JUL	8.22	8.58	8.81	9.11	9.37
AUG	6.35	6.75	7.00	7.34	7.62
SEP	4.41	4.70	4.88	5.12	5.32
OCT	2.04	2.15	2.21	2.30	2.38
NOV					
DEC					
TOTAL	37.49	40.05	41.58	43.73	45.50

Table 18. Consumptive Use and Irrigation Requirement.

VALE

CONSUMPTIVE USE (inches): DRY BEANS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.66	0.66	0.66	0.66	0.66
JUN	3.67	3.95	4.12	4.35	4.53
JUL	9.68	10.11	10.36	10.72	11.01
AUG	6.14	6.53	6.76	7.08	7.34
SEP					
OCT					
NOV					
DEC					
TOTAL	20.16	21.24	21.89	22.79	23.53

IRRIGATION REQUIREMENT (inches): DRY BEANS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.49	0.49	0.49	0.49	0.49
JUN	3.08	3.36	3.52	3.75	3.92
JUL	9.44	9.86	10.11	10.46	10.76
AUG	5.84	6.22	6.45	6.76	7.02
SEP					
OCT					
NOV					
DEC					
TOTAL	18.85	19.92	20.57	21.45	22.18

Table 18. Consumptive Use and Irrigation Requirement.

VALE

CONSUMPTIVE USE (inches): FIELD CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.34	1.35	1.36	1.36	1.37
JUN	4.28	4.64	4.85	5.15	5.38
JUL	9.62	10.04	10.30	10.65	10.94
AUG	7.91	8.41	8.70	9.12	9.46
SEP	4.85	5.15	5.34	5.59	5.81
OCT	0.65	0.68	0.70	0.72	0.75
NOV					
DEC					
TOTAL	28.65	30.27	31.25	32.59	33.70

IRRIGATION REQUIREMENT (inches): FIELD CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.82	0.83	0.84	0.85	0.85
JUN	3.68	4.03	4.24	4.53	4.75
JUL	9.38	9.79	10.05	10.40	10.69
AUG	7.58	8.07	8.36	8.76	9.10
SEP	4.49	4.79	4.96	5.21	5.42
OCT	0.56	0.59	0.61	0.63	0.65
NOV					
DEC					
TOTAL	26.51	28.10	29.06	30.37	31.45

Table 18. Consumptive Use and Irrigation Requirement.

VALE

CONSUMPTIVE USE (inches): FRIUT TREES (peaches, pears apricots, plums)

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.70	1.82	1.90	2.00	2.09
MAY	3.40	3.60	3.72	3.89	4.03
JUN	5.19	5.70	6.00	6.42	6.77
JUL	6.67	6.96	7.14	7.39	7.59
AUG	5.25	5.58	5.78	6.05	6.28
SEP	3.51	3.73	3.87	4.05	4.21
OCT	0.91	0.95	0.98	1.01	1.04
NOV					
DEC					
TOTAL	26.63	28.34	29.38	30.82	32.01

IRRIGATION REQUIREMENT (inches): FRUIT TREES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.35	1.47	1.55	1.65	1.74
MAY	2.77	2.96	3.08	3.25	3.38
JUN	4.57	5.05	5.35	5.76	6.10
JUL	6.46	6.75	6.93	7.17	7.37
AUG	4.97	5.29	5.48	5.75	5.98
SEP	3.16	3.38	3.52	3.70	3.85
OCT	0.71	0.74	0.76	0.79	0.82
NOV					
DEC					
TOTAL	23.99	25.66	26.66	28.07	29.24

Table 18. Consumptive Use and Irrigation Requirement.

VALE

CONSUMPTIVE USE (inches): GREEN BEANS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.66	0.66	0.66	0.66	0.66
JUN	3.36	3.61	3.76	3.96	4.12
JUL	8.49	8.86	9.09	9.40	9.65
AUG	6.77	7.20	7.45	7.80	8.10
SEP					
OCT					
NOV					
DEC					
TOTAL	19.29	20.33	20.95	21.81	22.52

IRRIGATION REQUIREMENT (inches): GREEN BEANS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.49	0.49	0.49	0.49	0.49
JUN	2.78	3.02	3.17	3.37	3.52
JUL	8.26	8.63	8.85	9.15	9.41
AUG	6.47	6.88	7.13	7.47	7.76
SEP					
OCT					
NOV					
DEC					
TOTAL	17.99	19.02	19.63	20.47	21.17

Table 18. Consumptive Use and Irrigation Requirement.

VALE

CONSUMPTIVE USE (inches): ONIONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.08	1.11	1.12	1.14	1.16
MAY	2.22	2.28	2.32	2.37	2.40
JUN	5.43	5.92	6.21	6.61	6.93
JUL	8.84	9.22	9.46	9.78	10.04
AUG	6.72	7.14	7.40	7.75	8.04
SEP					
OCT					
NOV					
DEC					
TOTAL	24.29	25.67	26.50	27.64	28.58

IRRIGATION REQUIREMENT (inches): ONIONS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.69	0.72	0.73	0.75	0.77
MAY	1.63	1.69	1.72	1.77	1.80
JUN	4.80	5.26	5.55	5.93	6.25
JUL	8.60	8.98	9.21	9.53	9.79
AUG	6.42	6.83	7.07	7.42	7.70
SEP					
OCT					
NOV					
DEC					
TOTAL	22.14	23.48	24.29	25.40	26.32

Table 18. Consumptive Use and Irrigation Requirement.

VALE

CONSUMPTIVE USE (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.44	0.48	0.50	0.53	0.55
APR	4.92	5.28	5.50	5.81	6.06
MAY	6.80	7.20	7.44	7.78	8.05
JUN	7.99	8.76	9.23	9.88	10.42
JUL	8.89	9.28	9.52	9.85	10.12
AUG	7.00	7.44	7.70	8.07	8.37
SEP	5.02	5.33	5.52	5.79	6.01
OCT	3.31	3.46	3.55	3.68	3.79
NOV					
DEC					
TOTAL	44.36	47.23	48.97	51.38	53.38

IRRIGATION REQUIREMENT (inches): PASTURE GRASS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.41	0.44	0.46	0.49	0.51
APR	4.39	4.74	4.95	5.25	5.49
MAY	6.07	6.45	6.68	6.99	7.25
JUN	7.25	7.97	8.42	9.06	9.59
JUL	8.66	9.04	9.28	9.60	9.87
AUG	6.69	7.12	7.37	7.73	8.03
SEP	4.65	4.96	5.14	5.40	5.61
OCT	2.79	2.95	3.04	3.17	3.27
NOV					
DEC					
TOTAL	40.91	43.66	45.34	47.68	49.63

Table 18. Consumptive Use and Irrigation Requirement.

VALE

CONSUMPTIVE USE (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	1.15	1.19	1.21	1.23	1.24
MAY	5.18	5.45	5.61	5.84	6.02
JUN	9.03	9.90	10.43	11.17	11.77
JUL	6.22	6.50	6.66	6.89	7.08
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	21.58	23.04	23.91	25.12	26.12

IRRIGATION REQUIREMENT (inches): PEAS

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.76	0.80	0.81	0.84	0.85
MAY	4.50	4.76	4.92	5.13	5.31
JUN	8.22	9.08	9.61	10.34	10.95
JUL	6.09	6.37	6.53	6.76	6.95
AUG					
SEP					
OCT					
NOV					
DEC					
TOTAL	19.58	21.00	21.87	23.07	24.06

Table 18. Consumptive Use and Irrigation Requirement.

VALE

CONSUMPTIVE USE (inches): POTATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.65	0.67	0.68	0.69	0.70
MAY	2.21	2.28	2.31	2.36	2.40
JUN	7.44	8.14	8.56	9.15	9.63
JUL	10.05	10.49	10.76	11.13	11.44
AUG	7.63	8.11	8.39	8.79	9.12
SEP	2.69	2.86	2.96	3.10	3.22
OCT					
NOV					
DEC					
TOTAL	30.67	32.54	33.67	35.23	36.51

IRRIGATION REQUIREMENT (inches): POTATOES

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR	0.49	0.51	0.51	0.52	0.53
MAY	1.62	1.68	1.72	1.76	1.80
JUN	6.73	7.39	7.78	8.34	8.81
JUL	9.80	10.24	10.51	10.88	11.19
AUG	7.31	7.77	8.06	8.45	8.77
SEP	2.48	2.64	2.75	2.89	3.00
OCT					
NOV					
DEC					
TOTAL	28.43	30.24	31.32	32.84	34.10

Table 18. Consumptive Use and Irrigation Requirement.

VALE

CONSUMPTIVE USE (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.09	0.10	0.10	0.10	0.10
APR	1.29	1.33	1.35	1.38	1.40
MAY	3.58	3.74	3.83	3.96	4.07
JUN	8.35	9.14	9.63	10.30	10.85
JUL	9.19	9.60	9.84	10.18	10.46
AUG	0.59	0.63	0.65	0.68	0.70
SEP					
OCT					
NOV					
DEC					
TOTAL	23.09	24.54	25.40	26.60	27.58

IRRIGATION REQUIREMENT (inches): SPRING GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.09	0.09	0.09	0.09	0.10
APR	0.85	0.89	-.91	0.94	0.96
MAY	2.95	3.10	3.19	3.32	3.42
JUN	7.58	8.34	8.81	9.47	10.02
JUL	8.95	9.35	9.59	9.93	10.21
AUG	0.56	0.59	0.61	0.64	0.67
SEP					
OCT					
NOV					
DEC					
TOTAL	20.98	22.36	23.21	24.40	25.38

Table 18. Consumptive Use and Irrigation Requirement.

VALE

CONSUMPTIVE USE (inches): SWEET CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	1.35	1.37	1.37	1.38	1.39
JUN	4.57	4.97	5.20	5.52	5.78
JUL	9.70	10.13	10.38	10.74	11.03
AUG	3.24	3.44	3.56	3.73	3.87
SEP					
OCT					
NOV					
DEC					
TOTAL	18.86	19.90	20.52	21.37	22.07

IRRIGATION REQUIREMENT (inches): SWEET CORN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR					
APR					
MAY	0.83	0.85	0.86	0.86	0.87
JUN	3.97	4.35	4.58	4.89	5.14
JUL	9.45	9.88	10.13	10.49	10.78
AUG	3.13	3.33	3.45	3.62	3.76
SEP					
OCT					
NOV					
DEC					
TOTAL	17.39	18.41	19.02	19.86	20.55

Table 18. Consumptive Use and Irrigation Requirement.

VALE

CONSUMPTIVE USE (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	1.18	1.26	1.31	1.38	1.43
APR	3.38	3.61	3.75	3.95	4.11
MAY	6.69	7.08	7.31	7.63	7.90
JUN	9.03	9.90	10.43	11.17	11.77
JUL	7.27	7.59	7.78	8.05	8.27
AUG	0.10	0.11	0.11	0.12	0.12
SEP					
OCT					
NOV					
DEC					
TOTAL	27.64	29.55	30.70	32.29	33.61

IRRIGATION REQUIREMENT (inches): WINTER GRAIN

MONTH	5 OF 10	7 OF 10	8 OF 10	9 OF 10	19 OF 20
JAN					
FEB					
MAR	0.70	0.78	0.83	0.89	0.94
APR	2.87	3.10	3.24	3.44	3.60
MAY	5.96	6.33	6.55	6.86	7.11
JUN	8.22	9.08	9.61	10.34	10.95
JUL	7.05	7.37	7.56	7.82	8.04
AUG	0.10	0.11	0.11	0.12	0.12
SEP					
OCT					
NOV					
DEC					
TOTAL	24.91	26.77	27.90	29.47	30.76

5.2 Assumptions

The results in table 18 give maximum consumptive use and irrigation requirements for well-watered, disease-free stands of the crops indicated. Interpretation of these results should be made with care to review the assumptions made in their development. Perhaps the most important assumption is that secondary weather parameters used with station temperature data were truly representative of the temperature site. In some cases no secondary data were available at the temperature site, and substitutions were made (see table 15).

Another basic assumption was that calibration with Kimberly lysimeter data produced results transferrable to Oregon. Much of eastern Oregon shares the relatively high-altitude, semiarid climate of Kimberly, so predictions for eastern Oregon should represent actual conditions at the growing site (within the accuracy of the estimating method). The calibration with Kimberly was applied to western Oregon stations as well, because no other calibration techniques were available.

These predictions were based upon the assumption

that water quality and quantity were not limiting factors. Similarly, optimum soil structure, fertility, and plant population density were assumed to exist. These assumptions underly the presentation of maximum consumptive use, rather than mean values.

5.3 Interpretation

Application of these results to the prediction of maximum consumptive use rates can be made directly. The frequency analyses of consumptive use and irrigation requirements were intended to serve as a tool for the design of irrigation system components. Estimates applied to crops already in the field should be used in light of the above assumptions, and after considering the health and vigor of the crop as compared with a crop performing exceptionally well. Less-than-optimum performance reduces the irrigation requirement, although how much a reduction is justified was not investigated.

As mentioned in section 3.3.2 (see page 28), the general alfalfa/grass coefficient of 1.15 (Doorenbos and Pruitt, 1977) was used as part of the OSUETO computer program to enable the use of FAO-24 crop coefficients with calibrated ET_r values. It should be noted that 1.15 is an average coefficient for maximum alfalfa growth in a dry climate with light-to-moderate wind. More detail on this coefficient for different climatic regimes can be found in FAO-24.

The results for alfalfa hay presented for each station do not reflect the effects of repeated cuttings. For a dry climate with light-to-moderate winds, about a 65 percent reduction of alfalfa ET below maximum rate occurs immediately after a cutting. The mean value between cuttings is about 83 percent of maximum ET values (Doorenbos and Pruitt, 1977). A stand of alfalfa will attain mean consumptive use rates about two weeks after cutting (Doorenbos and Pruitt, 1977).

Various categories of corn were presented. Field corn refers to corn grown for grain. "Silage" corn was reported for Madras, and was calculated using field corn crop coefficients.

Fruit tree estimates were calculated for orchards without a ground cover crop (clean cultivated, weed-free). Two groups of fruit tree coefficients were used. Apples and cherries consume more water during the hottest summer months (Doorenbos and Pruitt, 1977), and were considered sepatate from peaches, pears, apricots and plums. Unless a county agent reported a specific fruit tree (e.g., apples, for Heppner), estimates were calculated for the latter group. Maximum consumptive use for apples and cherries for June, July and August is about 12 percent greater than that of peaches, pears, apricots and plums (Doorenbos and Pruitt, 1977). Suggested reductions of consumptive use for various stages of tree ground cover are given in FAO-24.

Estimates for melons, squash, tomatoes, and table beets were presented for the Willamette region stations only. The occurrence of these crops outside of this area is predominantly limited to that produced for local fresh vegetable markets. Extension data concerning their development stages were lacking.

Estimates for peas were calculated for nine of the fourteen stations included in this report. Estimates for onions, where present, were given for dry onions, not green varieties. Potato estimates were given for single plantings only, except for Pendleton and Hermiston, where good extension data were provided for early, midseason, and late season varieties.

FAO-24 crop coefficients for barley are identical with those for wheat. The results presented for spring grain were calculated using crop coefficients for barley. Results for winter grain (fall-seeded grain) were calculated using the same crop coefficients.

Estimates for pasture grass are also presented. Similar to alfalfa hay, the pasture grass estimates do not reflect the effects of cutting. Grasses will not exhibit as great a decline in consumptive use

after cutting as does alfalfa. This is because considerable vegetation is left on the ground. Grasses grown for hay attain maximum consumptive use rates six to eight days after cutting (Doorenbos and Pruitt, 1977).

6. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

The SCS-modified and FAO-modified Blaney-Criddle methods were examined and compared. The SCS-BC method was found to underestimate crop consumptive use at relatively high-altitude and semiarid locations. Because much of eastern Oregon possesses these attributes, estimates of consumptive use and irrigation requirements were undertaken using the FAO-BC method.

Secondary data of wind speed and minimum relative humidity were taken from the Pacific Northwest River Basins Commission Climatological Handbook (1968). Solar radiation data were taken from either estimated or actual solar radiation measurements.

Primary data (temperature and precipitation) were obtained from NOAA computer records maintained by the OSU Climatic Research Institute. Temperature data were modified downward by use of a procedure that rated the aridity of the temperature measurement site. This procedure adjusted these data to temperatures expected in a large, irrigated environment. Rating of site aridity was accomplished by the use of NOAA B-44 forms and personal communication with some temperature observers.

Grass reference evapotranspiration was calculated with a plus ten percent correction per 1000 m of elevation. Grass reference ET-values were converted to alfalfa reference ET calibrated with a modified Penman equation developed by Wright (1982b). This conversion calibrated the grass reference ET estimate with the climate of Kimberly, Idaho.

Crop development data were obtained by personal communication and a questionaire mailed to county extension agents.

Statistical predictions of consumptive use and irrigation requirements for various confidence intervals were made using adjusted standard deviations of the calibrated FAO-BC estimates. This procedure corrected for the loss of variation experienced by using long-term averages of secondary data. This was accomplished by using standard deviation adjustment ratios suggested by Allen and Wright (1983), and produced variations comparable with the Wright-1982 method.

These results are expected to be more accurate than the SCS-BC estimates of Watts et al (1968) because: a) the FAO-BC method was used. This method has been demonstrated to be a better predictor of consumptive use for conditions important to eastern Oregon; b) the method used in these estimates was locally calibrated with the Wright-1982 method, thus reflecting the climatic

conditions of southern Idaho. This should give good estimates of consumptive use for eastern Oregon; c) the elevation correction of plus ten percent per 1000 meters of elevation was used. The maximum upward adjustment for elevation was 14.5 percent for Lakeview, at 4756 ft asl; d) a more specific set of crop data was used for these estimates than was used by Watts et al (1968). The planting and harvest dates of that study were based upon a mean monthly temperature of 45 degrees F for planting, and the first killing frost for the date of harvest. The crop data used for this study were obtained from field information provided by county extension agents.

A comment regarding local calibration was made by Jensen (1974); "no single existing [ET-estimating] method using meteorological data is universally adequate for all climatic regimes, especially for tropical areas and for high elevations, without some local or regional calibration." The FAO-BC method was calibrated world-wide, with each location uniquely expressed by the combination of a and b coefficients used in equation 8. The SCS-BC method was developed for the western U.S., but even in that region, the SCS-BC when used in intermountain climates must be locally calibrated (Jensen, 1980). The estimates of Watts et al (1968) were not locally calibrated.

6.2 Conclusions

Consideration of the literature reviewed and the results obtained in this study led to the following conclusions:

1) The estimates of consumptive use and irrigation requirements for eastern Oregon are generally higher than the estimates of Watts et al (1968). These differences may exist due to: a) the inherent tendency of the SCS-BC method to underestimate ET at relatively high-altitude and semiarid locations; b) the lack of local calibration of the SCS-BC method with local climate, as was performed for this study; c) differences of crop growing season information.
2) The estimates of consumptive use and irrigation requirements for western Oregon are generally similar to the estimates of Watts et al (1968). In most cases the difference is within the assumed accuracy of the FAO-BC method. Differences of crop growing season information may account for additional change from the Watts et al (1968) estimates for western Oregon.
3) The greatest differences from the Watts et al (1968) estimates generally occured early and late in the growing season, with smaller differences noted during the months of higher ET (i.e.,

June, July, and August).

4) The use of an effective precipitation method by Dastane (1974) resulted in smaller differences between the predicted consumptive use and irrigation requirements of this study than was noted in the estimates of Watts et al (1968). The method by Dastane (1974) disregards deep percolation or runoff from the calculation. The Watts et al (1968) estimates subtracted average total monthly precipitation from the monthly consumptive use for the irrigation requirement.

6.3 Recommendations for Future Research

The intent of this work was the presentation of consumptive use and irrigation requirements for important agricultural crops of Oregon. The following recommendations could extend the accuracy and applicability of future Oregon consumptive use estimates.

If accurate estimates of consumptive use are to be made for more locations than included in this work, data and procedures that allow local calibration of the FAO-BC method need to be developed. The installation of an agricultural meteorological network across Oregon would permit estimates at more locations. A study of arid versus irrigated environments could provide the basis for aridity factors derived for an Oregon climate. In addition, personal visits to temperature sites would greatly enhance the ascessment of station aridity.

A procedure should be developed to adjust humidity data in a manner similar to the temperature adjustment. Most humidity data were taken from airport locations, where aridity is greater than that expected in an agricultural environment.

Lysimeter experiments are necessary to develop reference ratios for calibration of western Oregon estimates. Without calibration, the estimates for

western Oregon will remain less certain than those for eastern Oregon.

Development of a microcomputer data base of climatic and crop information would take advantage of the recent proliferation of small, personal computers. This would provide for the immediate updating of consumptive use estimates as new data became available, without the necessity of a large mainframe computer.

Remote sensing and satelite imagery techniques could provide crop development information for extensive areas of the state.

Crop development information for vegetables could be obtained from local canneries, rather than from extension staff, and provide very accurate data. A series of estimates could be given that reflect the staggered planting/harvest schedules required for vegetable processing, instead of an arbitrary selection of one planting from many.

If the utility of future consumptive use estimates is to be extended, then other information should accompany the estimates. Yield versus ET, and yield versus applied irrigation water relationships would display the consequences of decision-making when various confidence intervals are selected. In addition, procedures that give mean consumptive use, rather than maximum values, would reflect the water requirements of actual crops in

the field. The quantitative determination of the effects of cutting on alfalfa and pasture grass would also reflect the actual water requirement, rather than the maximum consumptive use of an ideal stand.

Long-term average monthly precipitation values were used as part of the OSUETO/CROPUSE programs to compute net irrigation requirement estimates (Ryan and Cuenca, 1984). Further research that recognizes the variability of the precipitation record may be required if a more detailed analysis is desired.

The quality and quantity of the waters of the state of Oregon have become important political issues. Water must be allocated among competing users of a limited supply. The use of Columbia River water is a good example of this competition. Hydropower, irrigation, and fishery management all require a portion of the total river flow, and conflict among these interests is not uncommon.

If decisions concerning the amount of irrigation water required by growers across Oregon are to be made on a rational basis, then accurate consumptive use estimates must be available. The consumptive use and irrigation requirement estimates presented in this work are an attempt to meet this need.

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8. APPENDICES

8.1

FAO-24 crop coefficients for different stages of crop growth and prevailing climatic conditions (taken from Doorenbos and Pruitt, 1977).

Crop	Humidity		RHmin >70%		RHmin <20%	
	Wind m/sec		0-5	5-8	0-5	5-8
	Crop stage					
All field crops	initial	1	Use Fig. 7			
"	crop dev.	2	by interpolation			
Artichokes (perennial-clean cultivated)	mid-season at harvest	3	.95	.95	1.0	1.05
	or maturity	4	.9	.9	.95	1.0
Barley		3	1.05	1.1	1.15	1.2
		4	.25	.25	.2	.2
Beans (green)		3	.95	.95	1.0	1.05
		4	.85	.85	.9	.9
Beans (dry) Pulses		3	1.05	1.1	1.15	1.2
		4	.3	.3	.25	.25
Beets (table)		3	1.0	1.0	1.05	1.1
		4	.9	.9	.95	1.0
Carrots		3	1.0	1.05	1.1	1.15
		4	.7	.75	.8	.85
Castorbeans		3	1.05	1.1	1.15	1.2
		4	.5	.5	.5	.5
Celery		3	1.0	1.05	1.1	1.15
		4	.9	.95	1.0	1.05
Corn (sweet) (maize)		3	1.05	1.1	1.15	1.2
		4	.95	1.0	1.05	1.1
Corn (grain) (maize)		3	1.05	1.1	1.15*	1.2
		4	.55	.55	.6 *	.6
Cotton		3	1.05	1.15	1.2	1.25
		4	.65	.65	.65	.7
Crucifers (cabbage, cauliflower, broccoli, Brussels sprout)		3	.95	1.0	1.05	1.1
		4	.80	.85	.9	.95
Cucumber		3	.9	.9	.95	1.0
Fresh market		4	.7	.7	.75	.8
Machine harvest		4	.85	.85	.95	1.0
Egg plant (aubergine)		3	.95	1.0	1.05	1.1
		4	.8	.85	.85	.9
Flax		3	1.0	1.05	1.1	1.15
		4	.25	.25	.2	.2
Grain		3	1.05	1.1	1.15	1.2
		4	.3	.3	.25	.25
Lentil		3	1.05	1.1	1.15	1.2
		4	.3	.3	.25	.25
Lettuce		3	.95	.95	1.0	1.05
		4	.9	.9	.9	1.0
Melons		3	.95	.95	1.0	1.05
		4	.65	.65	.75	.75
Millet		3	1.0	1.05	1.1	1.15
		4	.3	.3	.25	.25

FAO-24 crop coefficients for different stages of crop growth and prevailing climatic conditions (taken from Doorenbos and Pruitt, 1977).

Crop	Humidity		RHmin	> 70%	RHmin	< 20%
	Wind m/sec		0-5	5-8	0-5	5-8
Oats	mid-season	3	1.05	1.1	1.15	1.2
	harvest/maturity	4	.25	.25	.2	.2
Onion (dry)		3	.95	.95	1.05	1.1
		4	.75	.75	.8	.85
(green)		3	.95	.95	1.0	1.05
		4	.95	.95	1.0	1.05
Peanuts (Groundnuts)		3	.95	1.0	1.05	1.1
		4	.55	.55	.6	.6
Peas		3	1.05	1.1	1.15	1.2
		4	.95	1.0	1.05	1.1
Peppers (fresh)		3	.95	1.0	1.05	1.1
		4	.8	.85	.85	.9
Potato		3	1.05	1.1	1.15	1.2
		4	.7	.7	.75	.75
Radishes		3	.8	.8	.85	.9
		4	.75	.75	.8	.85
Safflower		3	1.05	1.1	1.15	1.2
		4	.25	.25	.2	.2
Sorghum		3	1.0	1.05	1.1	1.15
		4	.5	.5	.55	.55
Soybeans		3	1.0	1.05	1.1	1.15
		4	.45	.45	.45	.45
Spinach		3	.95	.95	1.0	1.05
		4	.9	.9	.95	1.0
Squash		3	.9	.9	.95	1.0
		4	.7	.7	.75	.8
Sugarbeet		3	1.05	1.1	1.15	1.2
		4	.9	.95	1.0	1.0
	no irrigation last month	4	.6	.6	.6	.6
Sunflower		3	1.05	1.1	1.15	1.2
		4	.4	.4	.35	.35
Tomato		3	1.05	1.1	1.2	1.25
		4	.6	.6	.65	.65
Wheat		3	1.05	1.1	1.15	1.2
		4	.25	.25	.2	.2

Note: Many cool season crops cannot grow in hot, dry climates. Values of k_c are given for latter conditions since they may occur occasionally, and result in the need for higher k_c values, especially for tall rough crops.

8.2 "OSUETO"

```
10    REM*****************************************************************
20    REM                      THIS COMPUTER PROGRAM
30    REM                         WAS WRITTEN BY
40    REM                    PHILLIP RYAN AND RICHARD CUENCA,
50    REM                         AND MODIFIED BY
60    REM                      DANIEL L. BASKETFIELD,
70    REM                AGRICULTURAL ENGINEERING DEPARTMENT,
80    REM                OREGON STATE UNIVERSITY, CORVALLIS, OR.
90    REM*****************************************************************
100    REM    THIS PROGRAM CALCULATES A LOCALLY CALIBRATED
110    REM    GRASS REFERENCE ET AND VARIOUS CONFIDENCE
120    REM    INTERVALS, IN ADDITION TO THE MEAN.
130    REM*****************************************************************
140    REM    INPUT DATA\
150    REM     A FILE OF MEAN MONTHLY TEMPERATURE
160    REM     A FILE OF SECONDARY DATA (MINIMUM RELATIVE
170    REM     HUMIDITY, WIND SPEED, AND PERCENT SUNSHINE
180    REM*****************************************************************
190    REM    OUTPUT DATA\
200    REM     A LISTING OF MEAN MONTHLY ETO, AND
210    REM     ASSOCIATED STANDARD DEVIATIONS OF ETO-VALUES
220    REM
230    REM     A DATA FILE OF ETO VALUES TO BE USED WITH "CROPUSE"
240    REM*****************************************************************
250   DIM P(5,13),B(7,7,7),R1(7),N1(7),U1(7),L1(7),E1(13),M(13),R2(13)
260   DIM R(13),N(13),U(13),B1(13),P1(13),A(13),M$(83),E(83,13)
270   DIM S1(13),S(13),F(22),Z(22),X(10),Y(10),E3(13,10),M1$(83),S2(13)
280   INPUT"CHOOSE A STATION: ",S$
290   N$=S$
300   S1$=S$(1,3)+",2"
310   IF LEN(S$)>8 THEN S$=S$(1,7)
320   S$="T"+S$+",2"
330   OPEN#1,S1$
340   REM     READ SECONDARY DATA
350   READ#1,K1,K2,E,L
360   E=E/3.28
370   FOR I=1 TO 12
380    READ#1,U(I),R(I),N(I)
390    IF U(I)>10 THEN U(I)=10
400   NEXT
410   CLOSE#1
420   FOR X=1 TO 12
430   REM    READ REFERENCE RATIOS
440     READ R2(X)
450   NEXT
460   FOR X=1 TO 6
470     FOR Y=1 TO 6
480       FOR Z=1 TO 6
490   REM    READ TABLE OF B-VALUES
500         READ B(X,Y,Z)
```

```
510       NEXT
520     NEXT
530   NEXT
540   FOR G=1 TO 4
550     FOR F= 1 TO 12
560   REM    READ TABLE OF P-VALUES
570       READ P(G,F)
580     NEXT
590   NEXT
600   FOR Y=1 TO 6
610    REM    READ TABLE BOUNDS OF P-TABLE
620     READ R1(Y),N1(Y),U1(Y),L1(Y)
630   NEXT
640    REM    THIS NEXT SECTION SETS VALUES OF A, B, AND P
650    REM    FOR EACH MONTH OF EACH YEAR OF RECORD
660   FOR M=1 TO 12
670     F1=0
680     F2=0
690     FOR I3=2 TO 6
700       IF F2=1 THEN 800
710       FOR I2=2 TO 6
720         IF F1=1 THEN 770
730         FOR I1=2 TO 6
740           IF R(M)>R1(I1-1) AND R(M)<=R1(I1) THEN EXIT 760
750         NEXT
760         F1=1
770         IF N(M)>N1(I2-1) AND N(M)<=N1(I2) THEN EXIT 790
780       NEXT
790       F2=1
800       IF U(M)>U1(I3-1) AND U(M)<=U1(I3) THEN EXIT 820
810       NEXT
820       FOR J=2 TO 4
830         IF L>L1(J-1) AND L<=L1(J) THEN EXIT 870
840       NEXT
850     STOP
860    REM    INTERPOLATE TO SET P
870       Q1=(L-L1(J-1))/(L1(J)-L1(J-1))
880       P1(M)=P(J-1,M)+Q1*(P(J,M)-P(J-1,M))
890    REM    INTERPOLATE TO SET B
900       X1=(R(M)-R1(I1-1))/(R1(I1)-R1(I1-1))
910       X2=(N(M)-N1(I2-1))/(N1(I2)-N1(I2-1))
920       X3=(U(M)-U1(I3-1))/(U1(I3)-U1(I3-1))
930       Y1=B(I3-1,I2-1,I1-1)+X1*(B(I3-1,I2-1,I1)-B(I3-1,I2-1,I1-1))
940       Y2=B(I3-1,I2,I1-1)+X1*(B(I3-1,I2,I1)-B(I3-1,I2,I1-1))
950       Z1=B(I3,I2-1,I1-1)+X1*(B(I3,I2-1,I1)-B(I3,I2-1,I1-1))
960       Z2=B(I3,I2,I1-1)+X1*(B(I3,I2,I1)-B(I3,I2,I1-1))
970       V1=Y1+X2*(Y2-Y1)
980       V2=Z1+X2*(Z2-Z1)
990       B1(M)=V1+X3*(V2-V1)
1000    REM    CALCULATE A-VALUE
```

```
1010      A(M)=0.0043*R(M)-N(M)-1.41
1020    NEXT
1030  REM   OPEN FILE OF TEMPERATURE
1040  OPEN#2,S$
1050   REM   ELEVATION CORRECTION
1060  H=1+E/10000
1070   REM   PERIOD OF RECORD COUNTER
1080  R=K2-K1
1090  FOR K=0 TO R
1100    READ#2,Y
1110    FOR M=1 TO 12
1120      READ#2,T
1130   REM   CALCULATE F-FACTOR
1140      F=25.4 * P1(M)*T/100
1150   REM   CALCULATE ETR, AND DIVIDE BY 1.15 TO BE
1160   REM   ABLE TO USE FAO CROP COEFFICIENTS
1170      E(K,M)=(A(M)+B1(M)*F)*H*R2(M)/1.15
1180   REM   SUM ETR FOR EACH MONTH OF EACH YEAR
1190      E1(M)=E1(M)+E(K,M)
1200      IF K<>R THEN 1230
1210   REM   COMPUTE MEAN ETR
1220      M(M)=E1(M)/(R+1)
1230    NEXT
1240  NEXT
1250   REM   PRINT HEADER
1260  !"MONTH",TAB(20),"MEAN",TAB(40),"STAN DEV"
1270  !
1280   REM   THIS NEXT SECTION COMPUTES THE VARIANCE,
1290   REM   AND PRINTS MONTHLY ETO AND STD. DEV.
1300  FOR M=1 TO 12
1310    M1=M
1320    IF M>6 THEN M1=M-6
1330    IF M<>1 AND M<>7 THEN GOTO 1360
1340    W=1
1350    READ M$
1360    FOR K=0 TO R
1370   REM   CALCULATE SUM OF SQUARES
1380      S1(M)=(E(K,M)-M(M))^2.0+S1(M)
1390    NEXT
1400    REM   CALCULATE STD. DEV.
1410     S(M)=(S1(M)/R)^0.5
1420     W2=M1*10
1430     !M$(W,W2),TAB(20),M(M),TAB(40),S(M)
1440     W=W+10
1450  NEXT
1460  !
1470  !
1480    REM   REFERENCE RATIOS (ALLEN AND BROCKWAY, 1983)
1490    DATA 0,0,1.21,1.21,1.14,1.07,1.01,1.00,1.08,1.22,1.22,0
1500    REM   TABLE OF B-VALUES
```

```
1510  DATA 0.84,0.80,0.74,0.64,0.52,0.38
1520  DATA 1.03,0.95,0.87,0.76,0.63,0.48
1530  DATA 1.22,1.10,1.01,0.88,0.74,0.57
1540  DATA 1.38,1.24,1.13,0.99,0.85,0.66
1550  DATA 1.54,1.37,1.25,1.09,0.94,0.75
1560  DATA 1.68,1.50,1.36,1.18,1.04,0.84
1570  DATA 0.97,0.90,0.81,0.68,0.54,0.40
1580  DATA 1.19,1.08,0.96,0.84,0.66,0.50
1590  DATA 1.41,1.26,1.11,0.97,0.77,0.60
1600  DATA 1.60,1.42,1.25,1.09,0.89,0.70
1610 DATA 1.79,1.59,1.39,1.21,1.01,0.79
1620 DATA 1.98,1.74,1.52,1.31,1.11,0.89
1630 DATA 1.08,0.98,0.87,0.72,0.56,0.42
1640 DATA 1.33,1.18,1.03,0.87,0.69,0.52
1650 DATA 1.56,1.38,1.19,1.02,0.82,0.62
1660 DATA 1.78,1.56,1.34,1.15,0.94,0.73
1670 DATA 2.00,1.74,1.50,1.28,1.05,0.83
1680 DATA 2.19,1.90,1.64,1.39,1.16,0.92
1690 DATA 1.18,1.06,0.92,0.74,0.58,0.43
1700 DATA 1.44,1.27,1.10,0.91,0.72,0.54
1710 DATA 1.70,1.48,1.27,1.06,0.85,0.64
1720 DATA 1.94,1.67,1.44,1.21,0.97,0.75
1730 DATA 2.18,1.86,1.59,1.34,1.09,0.85
1740 DATA 2.39,2.03,1.74,1.46,1.20,0.95
1750 DATA 1.26,1.11,0.96,0.76,0.60,0.44
1760 DATA 1.52,1.34,1.14,0.93,0.74,0.55
1770 DATA 1.79,1.56,1.32,1.10,0.87,0.66
1780 DATA 2.05,1.76,1.49,1.25,1.00,0.77
1790 DATA 2.30,1.96,1.66,1.39,1.12,0.87
1800 DATA 2.54,2.14,1.82,1.52,1.24,0.98
1810 DATA 1.29,1.15,0.98,0.78,0.61,0.45
1820 DATA 1.58,1.38,1.17,0.96,0.75,0.56
1830 DATA 1.86,1.61,1.36,1.13,0.89,0.68
1840 DATA 2.13,1.83,1.54,1.28,1.03,0.79
1850 DATA 2.39,2.03,1.71,1.43,1.15,0.89
1860 DATA 2.63,2.22,1.86,1.56,1.27,1.00
1870   REM   TABLE OF P-VALUES
1880 DATA .21,.24,.27,.30,.33,.34,.33,.31,.28,.25,.22,.21
1890 DATA .21,.24,.27,.30,.33,.35,.34,.31,.28,.25,.22,.20
1900 DATA .20,.23,.27,.30,.34,.35,.34,.32,.28,.24,.21,.20
1910 DATA .20,.23,.27,.31,.34,.36,.35,.32,.28,.24,.21,.19
1920   REM   TABLE BOUNDS OF P VALUES
1930 DATA 0,0,0,42
1940 DATA 20,.2,2,44
1950 DATA 40,.4,4,46
1960 DATA 60,.6,6,48
1970 DATA 80,.8,8,50
1980 DATA 100,1.0,10,52
1990 DATA "JANUARY   FEBRUARY  MARCH     APRIL     MAY       JUNE
2000 DATA "JULY      AUGUST    SEPTEMBER OCTOBER   NOVEMBER  DECEMBER
```

```
2010 FOR K1=1 TO 21
2020   REM   READ NORMAL DISTRIBUTION STATISTICS
2030   READ F(K1),Z(K1)
2040 NEXT
2050 FOR M=3 TO 11
2060   REM   READ STANDARD DEVIATION ADJUSTMENT RATIOS
2070   READ R5
2080   S2(M)=S(M)/R5
2090 NEXT
2100 FOR I=1 TO 5
2110   REM   READ PROBABILITY LEVELS
2120   READ P
2130 FOR K2=2 TO 21
2140   REM   INTERPOLATE FOR F(Z) USING PROBABILITY LEVELS
2150   IF P>=F(K2-1) AND P<F(K2) THEN EXIT 2170
2160 NEXT
2170 Q2=(P-F(K2-1))/(F(K2)-F(K2-1))
2180 Z1=Z(K2-1)+Q2*(Z(K2)-Z(K2-1))
2190 FOR M=3 TO 11
2200   REM   ESTIMATE ETO FOR DESIRED PROBABILITY LEVELS
2210   E3(M,I)=M(M)+S2(M)*Z1
2220 NEXT
2230 NEXT
2240   REM   THIS NEXT SECTION PRINTS RESULTS
2250 FOR M=3 TO 11
2260     IF M<>3 THEN 2290
2270     W=20
2280     READ M1$
2290     IF M<>7 THEN 2320
2300     W=1
2310     READ M1$
2320   !M1$(W,W+9),TAB(12),%6F2,M(M),TAB(25),
2330   W=W+10
2340   FOR I=2 TO 5
2350     !%6F2,E3(M,I),"      ",
2360   NEXT
2370 !
2380 NEXT
2390 !
2400 !
2410 IF LEN(N$)>7 THEN N$=N$(1,7)
2420   REM   THE NEXT SECTION CREATES AND WRITES
2430   REM   THE ET-FILE USED BY "CROPUSE"
2440 CREATE "E"+N$,10,3
2450 OPEN#5,"E"+N$
2460 FOR I=1 TO 12
2470   FOR J=1 TO 5
2480     WRITE#5,E3(I,J)
2490   NEXT
2500 NEXT
```

```
2510 CLOSE#5
2520   REM   TABLE OF Z AND F(Z) VALUES
2530 DATA .5,0
2540 DATA .5398,.1,.5793,.2,.6179,.3
2550 DATA .6554,.4,.6915,.5,.7,.52441
2560 DATA .7257,.6,.758,.7,.7881,.8
2570 DATA .8,.84179,.8159,.9,.8413,1.0
2580 DATA .9,1.28167,.9332,1.5,.95,1.645
2590 DATA .9772,2.0,.99,2.32667,.9938,2.5
2600 DATA .9987,3.0,.9997,3.4
2610   REM   STD. DEV. ADJUSTMENT RATIOS
2620 DATA .80,.59,.61,.37,.45,.47,.62,.74,.96
2630   REM   PROBABILITY LEVELS
2640 DATA .5,.7,.8,.9,.95
2650 DATA"JANUARY   FEBRUARY  MARCH     APRIL     MAY       JUNE
2660 DATA"JULY      AUGUST    SEPTEMBER OCTOBER   NOVEMBER  DECEMBER
2670 END
```

8.3 "CROPUSE"

```
10    REM************************************************************
20    REM    THIS COMPUTER PROGRAM WAS WRITTEN BY
30    REM    PHILLIP RYAN AND RICHARD CUENCA,
40    REM    AGRICULTURAL ENGINEERING DEPARTMENT,
50    REM    OREGON STATE UNIVERSITY, CORAVALLIS, OR.
60   REM************************************************************
70!" "
80!"THIS PROGRAM CAN BE USED TO GIVE WATER USE ESTIMATES FOR"
90!"ANY ANNUAL OR PERENNIAL CROP THAT CAN BE ASSIGNED WATER"
100!"USE COEFFICIENTS ACCORDING TO METHODS PRESENTED IN FAO-24."
110!"ALFALFA AND PASTURE GRASS ARE PREPROGRAMMED AS AN OPTIONAL"
120!"CROP SELECTION FOR EACH RUN. WATER USE COEFFICIENTS ARE"
130!"AUTOMATICALLY DETERMINED FOR THESE CROPS DEPENDING ON"
140   REM*****************************************************************
150!"LOCAL HUMIDITY."
160!" "
170!"TYPE CONT TO CONTINUE"
180  STOP
190!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!
200!"OPERATION OF THIS PROGRAM REQUIRES SOME FAMILIARITY WITH CROP"
210!"WATER COEFFICIENTS AS DESCRIBED BY FAO-24. BE PREPARED TO SUPPLY"
220!"THE FOLLOWING INFORMATION: 1)DATES OF GROWING SEASON AND LENGTH"
230!"IN DAYS; 2)LENGTH IN DAYS OF CROP DEVELOPMENT STAGES FOR ANNUAL"
240!"CROPS AS DESCRIBED IN FAO-24; 3)TYPICAL SPRINGTIME IRRIGATION"
250!"INTERVAL FOR DESIRED CROP; 4)FAO-24 STAGE 3 AND 4 CROP "
260!"COEFFICIENTS FOR ANNUAL CROPS; 5)MONTHLY CROP COEFFICIENTS"
270!"FOR PERENNIAL CROPS"
280   REM*****************************************************************
290!
300!"TYPE 'CONT' TO CONTINUE"
310 STOP
320!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!
330!"MONTHLY CROP COEFFICIENTS FOR PERENNIAL CROPS MAY BE PUT ON"
340!"A DATA DISC PLACED IN DRIVE 2. THE FILENAME MUST BE THE EXACT"
350!"CROP NAME USED IN 'CROPUSE'. GOOD LUCK!!"
360   REM*****************************************************************
370!\!\!\!\!\!\!\!
380   DIM L(13),M(13,6),K(351),K1(13,6),V$(60),W(13,6),N1$(20)
390   DIM T(13),P(13),U(16),R(40),R7(40,20),I7(13,7),P9(13),F8(31),F9(31)
400 REM ADJUSTMENT RATIOS FOR EFF. PRECIP.,TYPICAL NET IRRIG. DEPTH.NE.75MM.
410   FOR I=1 TO 30
420     READ F8(I),F9(I)
430   NEXT
440 REM TOP ROW OF EFF. PRECIP. TABLE
450   FOR I=1 TO 15
460     READ U(I)
470   NEXT
480 REM LEFT COL. OF EFF. PRECIP. TABLE INCL. ROWS FOR MEAN RAIN WHEN
490 REM EFF. PRECIP. BECOMES EQUAL TO CONSUMPTIVE USE
500   FOR I=1 TO 37
```

```
510     READ R(I)
520   NEXT
530 REM EFFECTIVE PRECIPITATION VALUES.
540   FOR I=1 TO 37
550    FOR J=1 TO 15
560      READ R7(I,J)
570    NEXT
580   NEXT
590 REM LINES 522-528 ADJ. RATIOS FOR EFFECTIVE PRECIP., IRRIG. .NE. 75MM.
600   DATA 10,.62,12.5,.65,15,.676,17.5,.703,18.75,.72,20,.728,22.5,.749
610   DATA 25,.77,27.5,.79,30,.808,31.25,.818,32.5,.826,35,.842,37.5,.86
620   DATA 40,.876,45,.905,50,.93,55,.947,60,.963,65,.977,70,.99,75,1
630   DATA 80,1.004,85,1.008,90,1.012,95,1.016,100,1.02,125,1.04,150,1.06
640   DATA 175,1,07
650 REM TOP ROW OF EFFECTIVE PRECIP. TABLE
660 DATA 0,25,50,75,100,125,150,175,200,225,250,275,300,325,350
670 REM LEFT COL. EFF. PRECIP. TABLE, WITH MEAN RAIN WHEN EFF. PRECIP.=CU.
680  DATA 0,12.5,25,37.5,40.4,50,62.5,75,79.8,87.5,100,112.5,119.8
690  DATA 125,137.5,150,160.3,162.5,175,187.5,200,201.3,225,242.9
700  DATA 250,275,284.9,300,325,327.6,350,370.7,375,400,414.4,425,450
710 REM LINES 570-940 ARE EFFECTIVE PRECIPITATION TABLE
720  DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
730  DATA 0,7.5,8.0,8.7,9.0,9.2,10.0,10.5,11.2,11.7,12.5,12.5,12.5
740  DATA 12.5,12.5,0,15,16.2,17.5,18,18.5,19.7,20.5,22,24.5,25,25,25,25,25
750  DATA 0,22.5,24,26.2,27.5,28.2,29.2,30.5,33,36.2,37.5,37.5,37.5,37.5,37.5
760   INPUT"ENTER STATION NAME: ",S1$
770  DATA 0,25,25.9,28.1,29.4,30.1,31.4,32.8,35.4,38.7,40.4,40.4,40.4,40.4
780  DATA 40.4,0,25,32.2,34.5,35.7,36.7,39,40.5,43.7,47,50,50,50,50,50
790  DATA 0,25,39.7,42.5,44.5,46,48.5,50.5,53.7,57.5,62.5,62.5,62.5,62.5
800  DATA 62.5,0,25,46.2,49.7,52.7,55,57.5,60.2,63.7,67.5,73.7,75,75,75,75
810  DATA 0,25,50,52.4,55.6,58.3,60.8,63.8,67.5,71.4,77.8,79.8,79.8,79.8,79.8
820  DATA 0,25,50,56.7,60.2,63.7,66,69.7,73.7,77.7,84.5,87.5,87.5,87.5,87.5
830  DATA 0,25,50,63.7,67.7,72,74.2,78.7,83,87.7,95,100,100,100,100
840  DATA 0,25,50,70.5,75,80.2,82.5,87.2,92.7,98,105,111,112,112,112
850  DATA 0,25,50,75,78.8,84.6,87.2,92.2,98.1,103.8,110.8,116.8,119.6
860  DATA 119.6,119.6,0,25,50,75,81.5,87.7,90.5,95.7,102,108,115,121,125,125
870  DATA 125,0,25,50,75,88.7,95.2,98.7,104,111,118,126,132,137,137,137
880  DATA 0,25,50,75,95.2,102,106,112,120,127,136,143,150,150,150
890  DATA 0,25,50,75,100,108,112,119,127,134,143,151,158,160,160
900  DATA 0,25,50,75,100,109,113,120,128,135,145,153,160,162,162
910  DATA 0,25,50,75,100,115,120,127,135,143,154,164,170,175,175
920  DATA 0,25,50,75,100,121,126,134,142,151,161,170,179,185,187
930  DATA 0,25,50,75,100,125,133,140,148,158,168,178,188,196,200
940  DATA 0,25,50,75,100,125,134,141,149,159,169,0,0,0,0
950  DATA 0,25,50,75,100,125,144,151,160,171,182,0,0,0,0
960  DATA 0,25,50,75,100,125,150,158,167,180,191,0,0,0,0
970  DATA 0,25,50,75,100,125,150,161,170,183,194,0,0,0,0
980  DATA 0,25,50,75,100,125,150,171,181,194,205,0,0,0,0
990  DATA 0,25,50,75,100,125,150,175,185,198,209,0,0,0,0
1000  DATA 0,25,50,75,100,125,150,175,190,203,215,0,0,0,0
```

```
1010  DATA 0,25,50,75,100,125,150,175,198,213,224,0,0,0,0
1020  DATA 0,25,50,75,100,125,150,175,200,214,225,0,0,0,0
1030  DATA 0,25,50,75,100,125,150,175,200,220,232,0,0,0,0
1040  DATA 0,25,50,75,100,125,150,175,200,225,239,0,0,0,0
1050  DATA 0,25,50,75,100,125,150,175,200,225,240,0,0,0,0
1060  DATA 0,25,50,75,100,125,150,175,200,225,247,0,0,0,0
1070  DATA 0,25,50,75,100,125,150,175,200,225,250,0,0,0,0
1080  DATA 0,25,50,75,100,125,150,175,200,225,250,0,0,0,0
1090  DATA 0,25,50,75,100,125,150,175,200,225,250,0,0,0,0
1100   S2$=S1$
1110   IF LEN(S1$)>7 THEN S1$=S1$(1,7)
1120 REM OPENS AND READS ETO FILE ESTAB. BY OSUETO FOR STATION, THAN CLOSES
1130   OPEN#1,"E"+S1$
1140   FOR I=1 TO 12
1150 REM READ THE YEARS OF RECORD
1160     READ L(I)
1170 REM FOR 5 PROBABILITY LEVELS
1180     FOR J=1 TO 5
1190       READ#1,M(I,J)
1200     NEXT
1210  NEXT
1220  CLOSE#1
1230 REM READS FILE WITH AVG. MONTHLY PRECIP. FOR STATION IN QUESTION
1240   OPEN#5,"P"+S1$(1,2)
1250   READ#5,Y9
1260   FOR K=1 TO 12
1270     READ#5,P(K)
1280   NEXT
1290  INPUT"ANNUAL CROPS? ",A1$
1300  IF A1$(1,1)="N" THEN 1850
1310  INPUT"ENTER CROP NAME: ",N1$
1320  INPUT"LENGTH OF 4 CROP DEVELOPMENT STAGES(DAYS): ",L1,L2,L3,L4
1330  INPUT"ENTER FIRST DAY OF GROWING SEASON (MONTH,DAY; I. E. 4,15): ",M,D
1340  INPUT"ENTER NORMAL SPRING IRRIGATION INTERVAL FOR REGION (DAYS): ",D1
1350  INPUT"ENTER STAGE 3 AND 4 CROP COEFFICIENTS (FAO-24): ",B3,B4
1360  INPUT"ENTER NET DEPTH OF TYPICAL IRRIGATION APPLICATION (MM): ",D5
1370 REM EFFECTIVE PRECIP. ADJUST. RATIO SUBROUTINE
1380  GOSUB 3960
1390 REM DAYS IN FIRST MONTH OF GROWING SEASON
1400  Q1=L(M)-D+1
1410 REM FOR FIRST MONTH
1420  Q2=M
1430 REM CUMULATIVE DAYS TO END OF EACH STAGE
1440  S1=L1
1450  S2=L1+L2
1460  S3=L1+L2+L3
1470  S4=L1+L2+L3+L4
1480  FOR J=1 TO 5
1490   IF S1>=L(M)-D+1 THEN 1540
1500 REM X5 = MULTIPLIER FOR 1ST MONTH OF GROWING SEASON
```

```
1510 REM X6, X7, MULTIPLIERS FOR 2ND AND 3RD MONTH OF GROWING SEASON
1520  X5=1\X6=0\X7=0
1530  GOTO 1590
1540  IF S1>=L(M)-D+1+L(M+1) THEN 1570
1550  X5=(L(M)-D+1)/S1\X6=(S1-(L(M)-D+1))/S1\X7=0
1560  GOTO 1590
1570  X5=(L(M)-D+1)/S1\X6=L(M+1)/S1\X7=(S1-(L(M)-D+1)-L(M+1))/S1
1580 REM TRYING TO GET AVG. ETO OF INITIAL STAGE
1590  E1=X5*M(M,J)+X6*M(M+1,J)+X7*M(M+2,J)
1600  IF D1>=4 THEN 1650
1610 REM B1 FROM P. 229 OF ASAE DESIGN AND OPER. IRRIG. SYSTEMS
1620  B1=(1.286-0.27*LOG(D1))*EXP((-.01-.042*LOG(D1))*E1)
1630 PRINT"FIRST STAGE KC= ",B1
1640  GOTO 1660
1650  B1=2*D1^(-.49)*EXP((-.02-.04*LOG(D1))*E1)
1660  FOR I=1 TO S1
1670    K(I)=B1
1680  NEXT
1690  FOR I=S1+1 TO S2
1700    K(I)=((B3-B1)/(S2-S1))*(I-S1)+B1
1710  NEXT
1720  FOR I=S2+1 TO S3
1730    K(I)=B3
1740  NEXT
1750  FOR I=S3+1 TO S4
1760    K(I)=((B4-B3)/(S4-S3))*(I-S3)+B3
1770  NEXT
1780  GOSUB 3080
1790  NEXT
1800  GOSUB 2600
1810  GOSUB 2990
1820  INPUT"ANOTHER ANNUAL? ",A2$
1830  IF A2$(1,1)="N" THEN 1850
1840  GOTO 1310
1850  INPUT"PERENNIAL CROPS (OTHER THAN ALFALFA AND PAST. GRASS)? ",A3$
1860  IF A3$(1,1)="N" THEN 2250
1870  INPUT"ENTER CROP NAME: ",N1$
1880  INPUT"ENTER BEGINNING OF GROWING SEASON(MONTH,DAY): ",M,D
1890  INPUT"ENTER END OF GROWING SEASON(MONTH,DAY): ",M8,D8
1900  INPUT"ENTER NET DEPTH OF TYPICAL IRRIGATION APPLICATION (MM): ",D5
1910  GOSUB 3960
1920  !"IS THE CROP COEFFICIENT FOR THIS CROP ON THE DATA DISC?"
1930  !"(IF YOU DON'T KNOW, TERMINATE PROGRAM EXECUTION (CONTROL C) AND"
1940  INPUT"CHECK THE DATA DISC CATALOG): ",A4$
1950  IF A4$(1,1)="Y" THEN 2070
1960  !"MONTHLY CROP COEFFICIENTS MUST BE MANUALLY INPUT."
1970  !"ENTER ZERO FOR NON-GROWING SEASON MONTHS."
1980  !"BEGIN DATA ENTRY WITH COEFFICIENT FOR JANUARY."
1990 Q1=L(M)-D+1
2000 Q2=M
```

```
2010 Z5=M8
2020 Z6=D8
2030  FOR I= 1 TO 12
2040    INPUT"KC = ",K(I)
2050  NEXT
2060  GOTO 2130
2070  IF LEN(N1$)>8 THEN N1$=N1$(1,8)
2080  OPEN#2,N1$+",2"
2090  FOR I=1 TO 12
2100    READ #2,K(I)
2110  NEXT
2120  CLOSE#2
2130  FOR J=1 TO 5
2140    X=L(M)-D+1
2150    K1(M,J)=K(M)*X/L(M)
2160    K1(M8,J)=K(M8)*D8/L(M8)
2170    FOR I=M+1 TO M8-1
2180     K1(I,J)=K(I)
2190   NEXT
2200 NEXT
2210  GOSUB 2600
2220   GOSUB 2990
2230  INPUT"ANOTHER PERENNIAL? ",A5$
2240  IF A5$(1,1)="Y" THEN 1870
2250  INPUT"ALFALFA AND PASTURE GRASS(IF 'NO' EXECUTION WILL TERMINATE)? ",A6$
2260  IF A6$(1,1)="N" THEN END
2270  !\!\!"FOR ALFALFA"
2280  !
2290  INPUT"ENTER BEGINNING OF GROWING SEASON(MONTH,DAY): ",M,D
2300  INPUT"ENTER LENGTH OF GROWING SEASON(DAYS): ",S4
2310  INPUT"IS GROWING SEASON GENERALLY HUMID OR DRY? ",A7$
2320  INPUT"ENTER NET DEPTH OF TYPICAL IRRIGATION APPLICATION (MM): ",D5
2330  GOSUB 3960
2340  IF A7$(1,3)="DRY" THEN F1=.05 ELSE F1=0.0
2350 Q1=L(M)-D+1
2360 Q2=M
2370  G9=.85+2*F1
2380 G8=.95+F1
2390 G=G+1
2400 IF G=1 THEN Z=G9 ELSE Z=G8
2410 IF G=1 THEN N1$="ALFALFA" ELSE N1$="PASTURE GRASS"
2420 IF G=3 THEN END
2430 FOR I=1 TO S4
2440   K(I)=Z
2450 NEXT
2460 FOR J=1 TO 5
2470 GOSUB 3080
2480 NEXT
2490 GOSUB 2600
2500 GOSUB 2990
```

```
2510 IF G=2 THEN END
2520 !\!\!
2530 !"FOR PASTURE GRASS"
2540 GOTO 2280
2550 DATA 31,28,31,30,31,30
2560 DATA 31,31,30,31,30,31
2570 DATA "JANUARY   FEBRUARY  MARCH     APRIL     MAY       JUNE      "
2580 DATA "JULY      AUGUST    SEPTEMBER OCTOBER   NOVEMBER  DECEMBER  "
2590 END
2600 FOR I=1 TO 12
2610   FOR J=1 TO 5
2620     W(I,J)=K1(I,J)*M(I,J)*L(I)/25.4
2630   NEXT
2640 NEXT
2650 RESTORE 2570
2660 !
2670     !"CONSUMPTIVE USE: ",S2$
2680 !
2690 !TAB(33),N1$
2700     !
2710     !TAB(34),"INCHES"
2720 !
2730 !"MONTH",TAB(12),"5 OF 10    7 OF 10    8 OF 10    9 OF 10    19 OF 20"
2740 !
2750 FOR I=1 TO 12
2760   IF I<>1 AND I<>7 THEN 2790
2770   W=1
2780   READ V$
2790   !V$(W,W+9),TAB(12),%6F2,
2800   FOR K=1 TO 5
2810     !%6F2,W(I,K),"      ",
2820   NEXT
2830   W=W+10
2840   !
2850 NEXT
2860 !
2870 !"TOTAL",TAB(12),
2880 FOR K=1 TO 5
2890   FOR M=1 TO 12
2900     T(K)=T(K)+W(M,K)
2910   NEXT
2920   !%6F2,T(K),"      ",
2930   T(K)=0
2940 NEXT
2950 !
2960 !
2970 GOSUB 3310
2980 RETURN
2990 FOR I=1 TO 12
3000   FOR J= 1 TO 5
```

```
3010      K1(I,J)=0
3020    NEXT
3030  NEXT
3040  FOR I=1 TO 350
3050    K(I)=0
3060  NEXT
3070  RETURN
3080  X=L(M)-D+1
3090  FOR I=1 TO X
3100    T=T+K(I)
3110  NEXT
3120  K1(M,J)=T/L(M)
3130  T=0
3140  FOR I=M+1 TO 12
3150    FOR K=X+1 TO X+L(I)
3160      Z8=Z8+1
3170      T1=T1+K(K)
3180      IF K(K)=0 AND Z9=0 THEN GOTO 3200
3190      GOTO 3230
3200      Z9=1
3210      Z6=Z8-1
3220      Z5=I
3230    NEXT
3240    Z8=0
3250  K1(I,J)=T1/L(I)
3260  X=K-1
3270  T1=0
3280  NEXT
3290  Z9=0
3300  RETURN
3310  FOR I=1 TO 12
3320      P9(I)=P(I)
3330      IF I=Q2 THEN P9(I)=P9(I)*Q1/L(Q2)
3340      IF I=Z5 THEN P9(I)=P9(I)*Z6/L(Z5)
3350      P9(I)=P9(I)*25.4
3360    FOR J=1 TO 5
3370      U2=W(I,J)*25.4
3380      IF U2<350 THEN 3410
3390      P7=P9(I)
3400      GOTO 3600
3410      R1=1.44615+1.54608*U2+4.22378E-04*U2^2
3420      IF P9(I)>=R1 THEN GOTO 3590
3430      FOR K=2 TO 15
3440        IF U2<=U(K) THEN EXIT 3460
3450      NEXT
3460      N=K
3470      FOR K=2 TO 37
3480        IF P9(I)<=R(K) THEN EXIT 3500
3490      NEXT
3500      M=K
```

```
3510      R5=(U2-U(N-1))/(U(N)-U(N-1))
3520      R6=(P9(I)-R(M-1))/(R(M)-R(M-1))
3530      P5=R7(M-1,N-1)+R6*(R7(M,N-1)-R7(M-1,N-1))
3540      P6=R7(M-1,N)+R6*(R7(M,N)-R7(M-1,N))
3550      P7=P5+R5*(P6-P5)
3560      IF P7>P9(I) THEN P7=P9(I)
3570      IF P7>U2 THEN GOTO 3590
3580      GOTO 3600
3590      P7=U2*F7
3600      I7(I,J)=(U2-P7)/25.4
3610    NEXT
3620  NEXT
3630  RESTORE 2570
3640  !
3650  !"IRRIGATION REQUIREMENTS : ",S2$
3660  !
3670  !TAB(33),N1$
3680  !
3690      !TAB(34),"INCHES"
3700  !
3710  !"MONTH",TAB(12),"5 OF 10    7 OF 10    8 OF 10    9 OF 10    19 OF 20"
3720  !
3730  FOR I=1 TO 12
3740    IF I<>1 AND I<>7 THEN 3770
3750    W=1
3760    READ V$
3770    !V$(W,W+9),TAB(12),%6F2,
3780    FOR K=1 TO 5
3790      !%6F2,I7(I,K),"      ",
3800    NEXT
3810    W=W+10
3820    !
3830  NEXT
3840  !
3850  !"TOTAL",TAB(12),
3860  FOR K=1 TO 5
3870    FOR M=1 TO 12
3880      T(K)=T(K)+I7(M,K)
3890    NEXT
3900    !%6F2,T(K),"      ",
3910      T(K)=0
3920   NEXT
3930  !
3940  !\!\!
3950  RETURN
3960   FOR I=1 TO 30
3970     IF D5 > F8(I) THEN 4010
3980  REM EFFECTIVE PRECIPITATION ADJUSTMENT RATIO
3990     F7=(D5-F8(I-1))/(F8(I)-F8(I-1))*(F9(I)-F9(I-1))+F9(I-1)
4000     EXIT 4020

4010   NEXT
4020   RETURN
```