ESTIMATED POTENTIAL WATER NEEDS

FOR THE EASTERN GRAND PRAIRIE REGION

BY IRRIGATION SCHEDULING

by

Richard C. Peralta, Paul W. Dutram

and

Paul Killian

Authors are respectively, Assistant Professor,
Water Management Researcher and Research Assistant
Agricultural Engineering Department
University of Arkansas
Fayetteville, AR 72701

TABLE OF CONTENTS

"WATER NEEDS FOR THE EASTERN GRAND PRAIRIE REGION"

I. Project Objectives

1. Prepare maps showing the annual, monthly and peak weekly volume of irrigation water required in each 3 mile by 3 mile cell of the study area for the selected cropping pattern. Maps are presented for "average" and "dry" climatological conditions.

II. Procedures

1. Review the characteristics of the soil associations in the delineated area.

2. Determine the most water intensive reasonable crop which can be grown in each quarter square kilometer sub cell.

3. Develop irrigated water balances for the selected crops.

4. Estimate the maximum potential annual, monthly and peak weekly irrigation water demand for average and dry years for each 3 mile by 3 mile cell.

5. Prepare a written report and necessary maps.

III. Results

The potential crop usage of each quarter kilometer square in the Eastern Grand Prairie Region (Map 1) was determined based on soil designations from the 1977 Arkansas Resource Data Information System (RIDS) study and crop recommendations from the Soil Conservation Service's County Soil Surveys. Table 1 contains crop recommendations for particular soil types. Total acreages of rice, soybeans, and wheat were determined by aggregation for each 3 mile by 3 mile cell. (Cotton was exempted due to the historically low cotton acreages in this study area.)

The study area was assessed using a wheat-soybean single year double-cropping system for those areas recommended by the Soil Conservation Service for soybeans but not recommended for rice. For those areas which are recommended for rice, a fallow-rice-wheat-soybean two year rotation was utilized. These assumptions were made in order to obtain estimates of the maximum practical potential need for irrigation water in the study area.

Estimates of pumping for each month of average and dry seasons are found in Table 2. These are based upon 16 seasons of daily water balance simulation and irrigation scheduling. A more detailed description of the process and simulation programs is contained in Arkansas Agricultural Experiment Station Report Series No. 285 "Assessment of Potential Irrigation Needs in the Bayou Meto Watershed". Estimates do not include amounts which may be necessary for leaching to correct any potential salt buildup problems. Nor are losses incurred prior to delivery to the field included. Efficiences of the irrigation system are considered in the calculation. Footnotes following the table contain references important in the following discussion. (It should be noted that any fish production operations could place an additional significant demand on available water if it is determined to be of adequate quality.)

1. Rice

An average irrigation period of June 1st to September 1st was used, based on the recommendation of the Extension Service expert on rice. Data from the period 1965-1979 was averaged and used to represent an average season. The study area experienced the least amount of summer rainfall in 1980 since the mid-50's drought. 1980's summer climatological data was therefore selected to represent a typical dry summer season. A daily water balance program was written and used to determine the irrigation water requirements for both an average and the 1980 season.

Leakage through the levees of flood irrigated rice is included in the seepage term. Other than that, a contoured levee irrigation system for flood irrigated rice is essentially 100% efficient. Therefore, the pumping requirements (in acre in./acre) are identical to the irrigation water requirements computed. Pumping requirements are listed in Table 2.

2. Soybeans

An average irrigation period of June 1st to September 9th was used. Irrigation water requirements were established by utilizing a daily simulated water balance. Approximately 60% of the soybean acreage is furrow irrigated at a system efficiency of 55% and approximately 40% is flood irrigated (in contour levees) at a system efficiency of 75%. Again 1980 climatological data was used as the base for a typical dry season. Pumping requirements are listed in Table 2.

3. Wheat

An average irrigation period of April 1st to May 25th was used based on information from Dr. Fred C. Collins, University of Arkansas. A water balance approach, as with soybeans, was utilized in establishing irrigation water requirements. The model indicated that wheat would have required more irrigation in 1977 than any other year because of the temporal distribution of rainfall in that growing season. A center pivot sprinkler system with an 82% system efficiency was chosen as the most practical if wheat is to be irrigated. Pumping requirements are listed in Table 2.

4. Computations

The monthly irrigation water value for each cell was computed in the following manner: The water need for "rice" was determined by summing the monthly rice and soybean needs and dividing by two to yield a spatially average need. This reflects the fact that, due to the two year rotation,

one half the "rice" land is in rice and one half in soybeans in any given year. This need was multiplied by the number of square miles of "rice" land per cell to yield the water need for land assigned to rice in that cell. The soybean water need was multiplied by the number of square miles of soybean land per cell to determine a monthly irrigation water need for the land assigned to soybeans in that cell. The sum of the rice and soybean irrigation needs were calculated for each cell for June through September.

In April and May only wheat is irrigated. In addition to that land recommended only for wheat, it was assumed that all the soybean land and half the "rice" land would be double-cropped with wheat. The monthly irrigation water need for wheat was based on those assumptions.

The peak weekly need will occur during the first week in June when the rice fields are initially flooded. Soil moisture conditions at that time of year are no different in a dry season than in an average season. Therefore, the number of square miles of "rice" land per cell was divided by two and multiplied by the amount necessary for initial flooding to yield the values for peak weekly need per cell.

Maps 2-4 show the boundaries and 3 mile by 3 mile cells for each county in the study area (Maps 2 and 4 are overlain with the RIDS quarter square kilometer subcells). Figures 1-6 show the monthly potential irrigation water needs of the Eastern Grand Prairie region for an average season in acre-feet. Figure 7 shows the annual potential irrigation water needs of the study area for an average season. Figures 8-13 show the monthly potential irrigation water needs of the Eastern Grand Prairie region for a dry season in acre-feet. The dry season values are a composite of the 1977 wheat season and 1980 rice and soybean seasons. They

should be treated as such. Figure 14 shows the annual potential irrigation water needs of the study area for a dry season. Figure 15 shows the potential irrigation water need per cell for the peak week.

REFERENCES

1. Arkansas Resource Information Data System (RIDS), Arkansas Soil and Water Conservation Commission, Little Rock (1977).

2. Soil Survey of Arkansas County, Arkansas, USDA/SCS (1972).

3. Soil Survey of Monroe County, Arkansas, USDA/SCS (1978).

4. Soil Survey of Lonoke and Prairie Counties, Arkansas, USDA/SCS (1981).

5. Ferguson, J.A., and Langston, J. "Energy and Irrigation System Selection." Arkansas Extension Service Leaflet (1981).

6. Stegman, E.C., Bauer, A., Zubriski, J.C., and Bauder, J. "Crop Curves for Water Balance Irrigation Scheduling in S.E. North Dakota." North Dakota State University, Fargo (Jan. 1977).

7. Peralta, R. and Dutram, P. W. "Assessment of Potential Irrigation Needs in the Bayou Meto Watershed." Arkansas Agricultural Experiment Station Report Series No. 285 (1984).

Acadia silty clay loam - Woodland
Amagon silt loam - Rice
Amagon silt loam, heavy substratum - Rice
Amy silt loam, frequently flooded - Woodland
Calhoun silt loam - Rice
Calhoun silt loam (0-1% slopes) - Rice
Calloway silt loam - Rice
Calloway silt loam (0-1% slopes) - Rice
Caspian silt loam (0-1% slopes) - Soybeans
Commerce silt loam (0-1% slopes) - Rice
Commerce silt loam, frequently flooded - Soybeans
Crowley silt loam - Rice
Crowley silt loam (0-1% slopes) - Rice
Crowley and Stuttgart silt loams - Rice
Dubbs silt loam (0-1% slopes) - Soybeans
Dubbs silt loam (1-3% slopes) - Soybeans
Enders stony fine sandy loam (8-15% slopes) - Woodland
Falaya silt loam - Soybeans
Grenada silt loam (0-1% slopes) - Rice
Grenada silt loam (1-3% slopes) - Rice
Grenada silt loam (3-8% slopes) - Small Grain
Hebert silt loam - Soybeans
Hebert silt loam (0-1% slopes) - Soybeans
Jackport silty clay loam (0-1% slopes) - Rice
Jackport silty clay loam (1-3% slopes) - Soybeans
Keo silt loam (0-1% slopes) - Soybeans
Keo silt loam (1-3% slopes) - Soybeans
Kobel silty clay (0-1% slopes) - Rice
Kobel silty clay loam, frequently flooded - Soybeans
Leadvale silt loam (1-3% slopes) - Soybeans
Leadvale silt loam (3-8% slopes) - Soybeans
Linker-Enders - Mountainburg Complex (12-25% slopes) - Woodland
Loring silt loam (1-3% slopes) - Soybeans
Loring silt loam (3-8% slopes) - Soybeans
Loring silt loam (8-12% slopes) - Woodland
Loring - MaKamie Complex (8-20% slopes) - Pasture
McKamie silt loam (0-1% slopes) - Rice
McKamie silt loam (1-3% slopes) - Soybeans
Miller silty clay - Soybeans
Moreland silty clay (1-3% slopes) - Rice
Moreland silt loam (3-8% slopes) - Soybeans
Norwood silt loam - Soybeans
Norwood silty clay loam, gently undulating - Soybeans
Oaklimeter silt loam, occasionally flooded - Soybeans
Perry silty clay - Rice
Perry silty clay (0-1% slopes) - Rice
Perry silty clay, frequently flooded - Woodland
Portland silty clay (0-1% slopes) - Rice
Portland silty clay loam - Rice

TABLE 1 (continued)

Rilla silt loam - Soybeans
Rilla silt loam (0-1% slopes) - Soybeans
Rilla silt loam (1-3% slopes) - Soybeans
Sacul fine sandy loam (3-8% slopes) - Pasture
Sawyer silt loam (3-8% slopes) - Pasture
Sharkey clay - Woodland
Smithdale sandy loam (5-8% slopes) - Pasture
Stuttgart silt loam (0-1% slopes) - Rice
Stuttgart silt loam (1-3% slopes) - Rice
Stuttgart silt loam (3-8% slopes) - Small Grain
Taft silt loam (0-2% slopes) - Soybeans
Tichnor silt loam - Rice
Tichnor silt loam, frequently flooded - Soybeans
Yorktown silty clay - Woodland

TABLE 2: Irrigation Water Pumping Estimates by Water Balance (in)

Crop	Period	Conditions	Evapotrans-piration[1]	Precipitation	Seepage[3]	Runoff[4]	Change in Soil Moisture[5]	Irrig. Water Required[6]	Irrig. Sys. Efficiency[7]	Pumping Required[8]	Irrigation Period[9]
Rice	June	avg	6.5	3.7	1.6	1.8	---	11.2*	100%	11.2*	
		dry	7.2	1.5	1.6	0.0	---	12.3*	100%	12.3*	
	July	avg	7.6	3.4	1.7	0.4	---	6.3	100%	6.3	
		dry	9.7	0.3	1.7	0.0	---	11.1	100%	11.1	
	August	avg	6.9	3.4	1.7	1.1	---	6.3	100%	6.3	
		dry	9.0	0.2	1.7	0.0	---	10.5	100%	10.5	
	Seasonal	avg	21.0	10.5	5.0	3.3	---	23.8*	100%	23.8*	6/1 - 9/1
		dry	25.9	2.0	5.0	0.0	---	33.9*	100%	33.9*	6/1 - 9/1

Crop	Period	Conditions	Evapotrans -piration[1]	Precipi- tation	Seepage[3]	Runoff[4]	Change in in Soil Moisture[5]	Irrig. Water Required[6]	Irrig. Sys. Efficiency[7]	Pumping Required[8]	Irrigation Period[9]
Soy- beans	June	avg	2.4	3.7	---	2.2	-0.9	0.0	61.6%	0.0	
		dry	2.6	1.5	---	0.0	-1.1	0.0	61.6%	0.0	
	July	avg	4.6	3.4	---	0.7	-0.6	1.3	61.6%	2.1	
		dry	5.9	0.3	---	0.0	-0.6	5.0	61.6%	8.1	
	August	avg	5.1	3.4	---	1.0	0.0	2.7	61.6%	4.4	
		dry	6.7	0.2	---	0.0	-0.2	6.3	61.6%	10.2	
	September	avg	0.9	1.1	---	0.2	+0.3	0.3	61.6%	0.5	
		dry	1.3	0.1	---	0.0	0.0	1.2	61.6%	2.0	
	Seasonal	avg	13.0	11.6	---	4.1	-1.2	4.3	61.6%	7.0	6/1 - 9/9
		dry	16.5	2.1	---	0.0	-1.9	12.5	61.6%	20.3	6/1 - 9/9
Wheat	April	avg	4.6	4.8	---	2.2	-1.1	0.9	82%	1.1	
		dry	5.1	4.6	---	2.7	-1.7	1.5	82%	1.8	
	May	avg	4.4	4.4	---	1.9	-0.4	1.5	82%	1.8	
		dry	5.1	0.6	---	0.0	0.0	4.5	82%	5.5	
	Seasonal	avg	9.0	9.2	---	4.1	-1.5	2.4	82%	2.9	4/1 - 5/25
		dry	10.2	5.2	---	2.7	-1.7	6.0	82%	7.3	4/1 - 5/25

@ to convert from in. to cm. multiply by 2.54
* includes 5 acre-inch irrigation (1 inch to attain saturation and 4 inches of cover flood)

NOTE: All climatological data is from NOAA records for Stuttgart 9ESE, Arkansas, (1965-1979 for rice and soybeans, and 1965-1980 excluding 1977 for wheat for an average season; 1980 for rice and soybeans, and 1977 for wheat for a dry season) during the irrigation periods stated.

TABLE 2: Continued

1. All evapotranspiration was pan evaporation x .80 x the appropriate crop coefficients (with respect to its phe-
   nologic development). Crop coefficients: rice - see 2; soybeans - modified from N. Dakota Research Report
   #66, Stegman et al (Jan. 1977); wheat - modified from N. Dakota Research Report #66, Stegman et al (Jan. 1977).

2. Personal communication, James A. Ferguson, University of Arkansas, Fayetteville, Arkansas.

3. Daily portion of 5" seasonal loss.[2]

4. By computer model. For rice: runoff equaled all impounded water on a rice field whenever the flood exceeded
   6" (levees drained to prevent overflow damage)[2] For soybeans and wheat: runoff equalled any amount which at
   any time exceeded soil moisture at field capacity or the maximum amount which can infiltrate in a single event.

5. By computer model. Initial soil moisture for soybeans equalled 5" (assuming 2 1/2 ft. rooting depth), and
   for wheat equalled 4" (assuming 2 ft. rooting depth).

6. Rice: evapotranspiration - rainfall + seepage + runoff.
   Soybeans and Wheat: evapotranspiration -rainfall + change in soil moisture + runoff.

7. Rice: any losses due to inefficiency were included in the seepage term.[2] Soybeans: combination of estimates
   of 60 percent furrow irrigated at 55% efficiency and 40% flood irrigated at 75% efficiency[10]. Wheat: using
   center pivot sprinkler irrigation system[10].

8. Irrigation water required ÷ irrigation system efficiency.

9. Rice: personal communication, Bobby A. Huey, University of Arkansas, Rice Research & Extension Center,
   Stuttgart, Arkansas.
   Soybeans: personal communication, H. Don Scott, University of Arkansas, Fayetteville, Arkansas.
   Wheat: personal communication, Fred C. Collins, University of Arkansas, Fayetteville, Arkansas.

10. Ferguson, J. A., and Langston, J. "Energy and Irrigation System Selection." Arkansas Extension Service
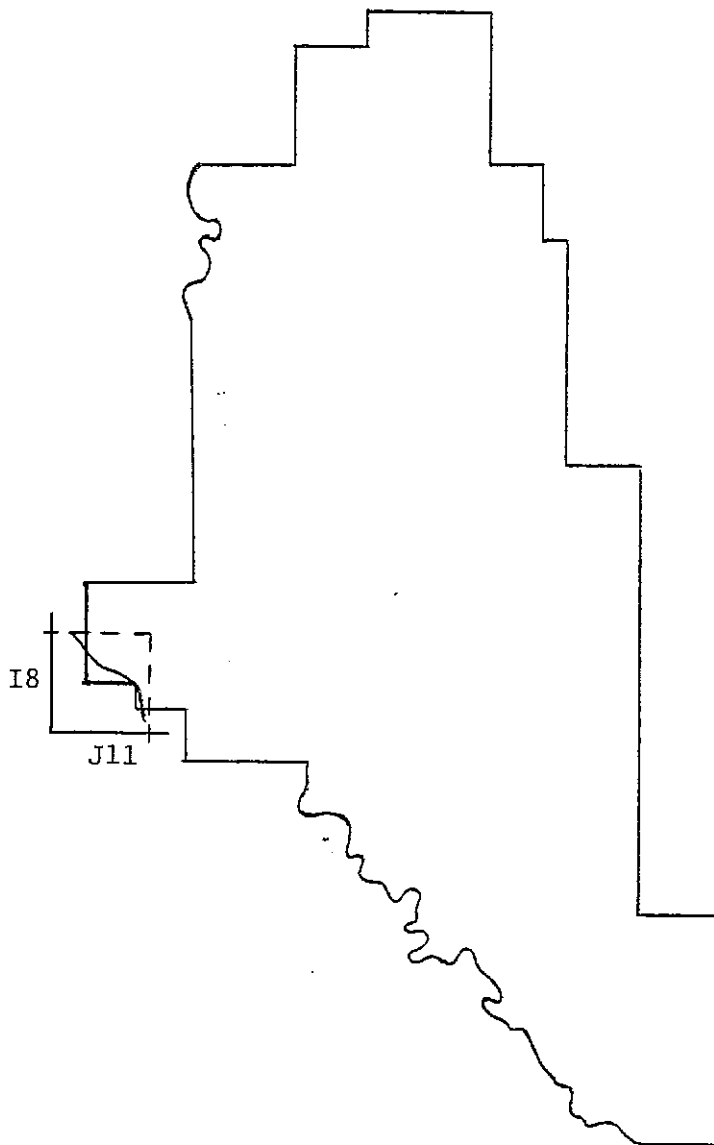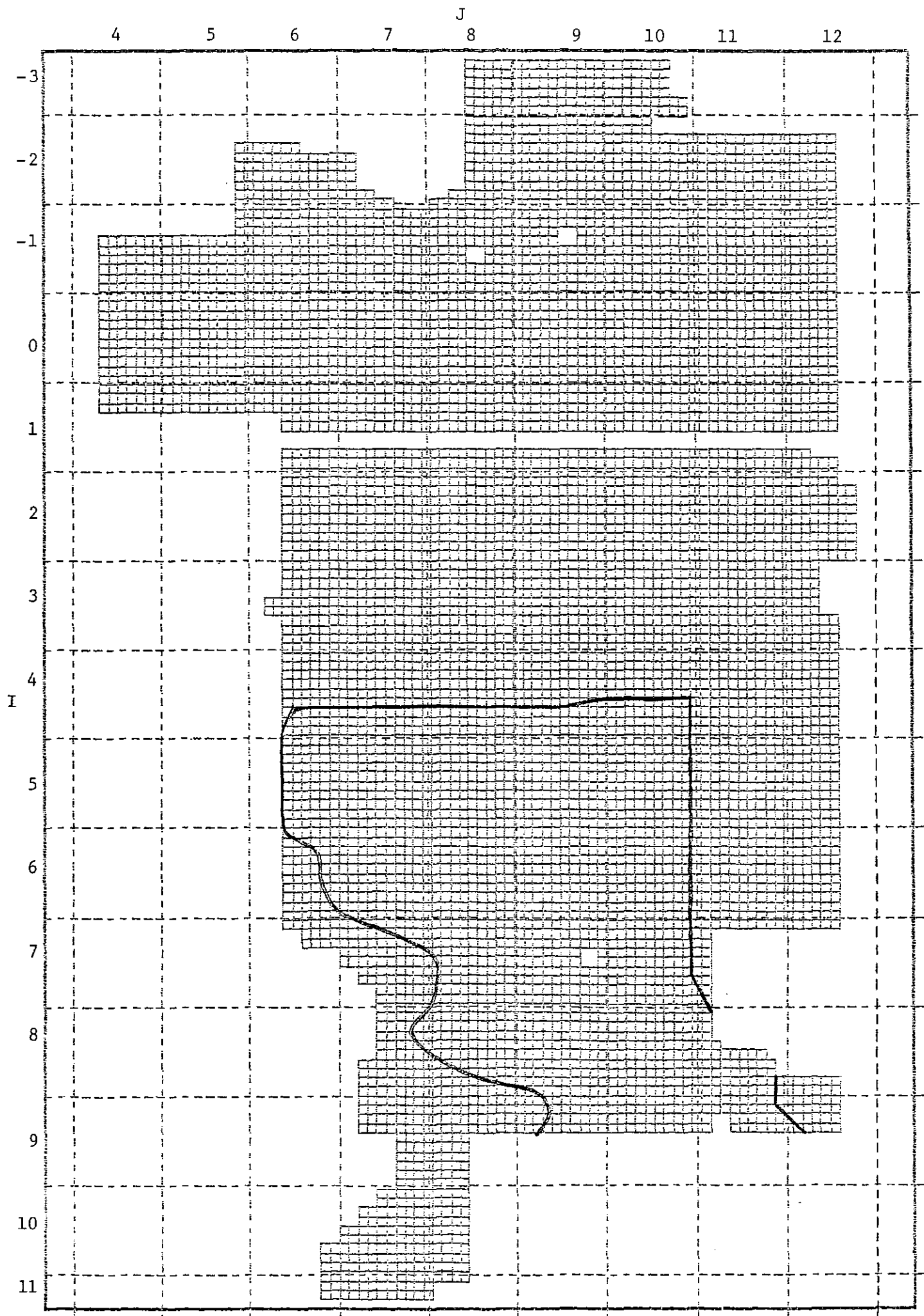   Leaflet (1981).
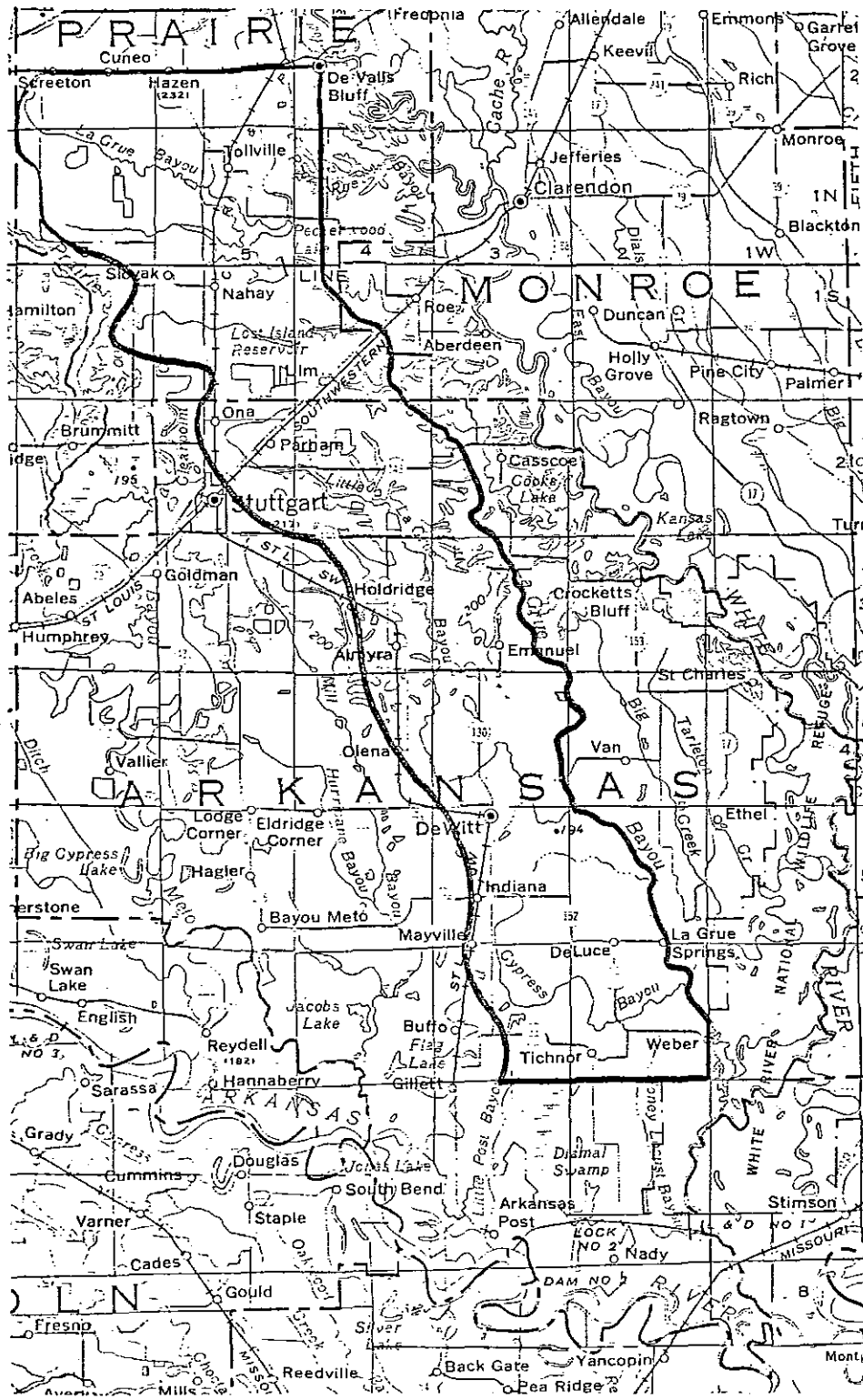
Map #1:   Eastern Grand Prairie Study Area
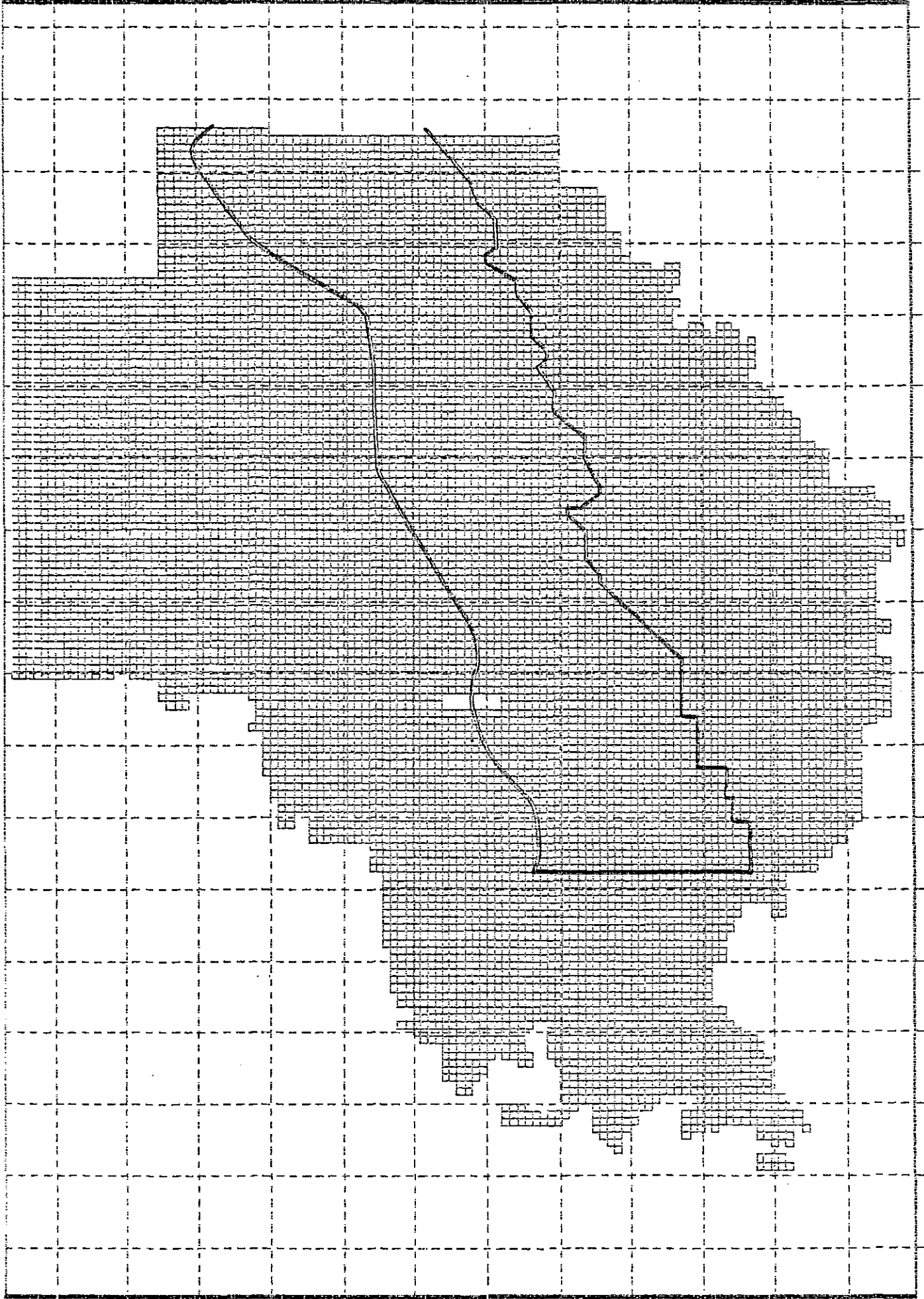
Map #2: Arkansas County

I8

J11

Map #3: Monroe County

Map #4: Prairie County

J	6	7	8	9	10	11	12	13	14	15	16
4	55.0	96.0	109.0	125.0	97.0						
5	142.0	271.0	289.0	270.0	302.0						
6	83.0	250.0	282.0	253.0	299.0						
7	2.0	74.0	261.0	234.0	300.0	4.0					
8		17.0	210.0	256.0	258.0	184.0					
9			7.0	218.0	250.0	278.0	103.0				
10				160.0	208.0	230.0	263.0	29.0			
11				8.0	131.0	227.0	263.0	129.0			
12						161.0	261.0	248.0			
13						158.0	259.0	298.0	61.0		
14						98.0	273.0	339.0	148.0		
15						2.0	203.0	284.0	176.0		
16							63.0	263.0	316.0	141.0	
17							42.0	273.0	292.0	227.0	
18								161.0	294.0	309.0	74.0
19								78.0	231.0	229.0	119.0

Figure 1: Potential Irrigation Water Need for the Eastern Grand Prairie Region in April for an Average Season in Acre-Feet

J \ I	6	7	8	9	10	11	12	13	14	15	16
4	90.0	157.0	178.0	204.0	159.0						
5	232.0	442.0	473.0	442.0	493.0						
6	136.0	409.0	461.0	414.0	490.0						
7	3.0	121.0	426.0	383.0	491.0	6.0					
8		28.0	344.0	418.0	422.0	301.0					
9			12.0	356.0	408.0	454.0	169.0				
10				262.0	340.0	377.0	431.0	47.0			
11				13.0	215.0	371.0	431.0	212.0			
12						263.0	428.0	405.0			
13						258.0	423.0	488.0	100.0		
14						161.0	446.0	554.0	243.0		
15						3.0	332.0	465.0	288.0		
16							102.0	429.0	517.0	231.0	
17							69.0	446.0	477.0	372.0	
18								264.0	481.0	506.0	120.0
19								128.0	377.0	374.0	195.0

Figure 2: Potential Irrigation Water Need for the Eastern Grand Prairie Region in May for an Average Season in Acre-Feet

I\J	6	7	8	9	10	11	12	13	14	15	16
4	562.0	975.0	781.0	735.0	646.0						
5	1442.0	2309.0	2347.0	2459.0	1052.0						
6	804.0	2315.0	2278.0	2001.0	1318.0						
7	9.0	634.0	2468.0	1940.0	1620.0	26.0					
8		164.0	1854.0	2598.0	2529.0	1623.0					
9			72.0	2217.0	2442.0	2462.0	738.0				
10				1629.0	2113.0	2344.0	2422.0	208.0			
11				78.0	1335.0	2307.0	2451.0	770.0			
12						1638.0	2604.0	1701.0			
13						1606.0	2459.0	2292.0	493.0		
14						1000.0	2431.0	1874.0	1026.0		
15						17.0	1891.0	1589.0	669.0		
16							637.0	2575.0	2064.0	409.0	
17							432.0	2546.0	2410.0	1721.0	
18								1476.0	1914.0	1603.0	288.0
19								608.0	1597.0	1854.0	1153.0

Figure 3: Potential Irrigation Water Need for the Eastern Grand Prairie Region in June for an Average Season in Acre-Feet

J / I	6	7	8	9	10	11	12	13	14	15	16
4	425.0	736.0	655.0	661.0	556.0						
5	1089.0	1831.0	1889.0	1914.0	1191.0						
6	615.0	1794.0	1837.0	1624.0	1335.0						
7	9.0	503.0	1900.0	1553.0	1506.0	22.0					
8		126.0	1457.0	1963.0	1929.0	1275.0					
9			54.0	1675.0	1864.0	1931.0	587.0				
10				1230.0	1596.0	1770.0	1837.0	157.0			
11				59.0	1008.0	1742.0	1862.0	615.0			
12						1237.0	1978.0	1296.0			
13						1213.0	1858.0	1765.0	372.0		
14						756.0	1858.0	1449.0	775.0		
15						13.0	1429.0	1237.0	573.0		
16							481.0	1945.0	1578.0	309.0	
17							327.0	1934.0	1820.0	1300.0	
18								1115.0	1446.0	1245.0	218.0
19								459.0	1218.0	1445.0	871.0

Figure 4: Potential Irrigation Water Need for the Eastern Grand Prairie Region in July for an Average Season in Acre-Feet

I \ J	6	7	8	9	10	11	12	13	14	15	16
4	534.0	926.0	868.0	904.0	746.0						
5	1369.0	2364.0	2457.0	2447.0	1774.0						
6	780.0	2287.0	2391.0	2122.0	1915.0						
7	13.0	649.0	2415.0	2013.0	2090.0	29.0					
8		161.0	1871.0	2470.0	2439.0	1637.0					
9			68.0	2106.0	2357.0	2478.0	759.0				
10				1547.0	2007.0	2226.0	2316.0	197.0			
11				74.0	1268.0	2191.0	2350.0	798.0			
12						1555.0	2495.0	1638.0			
13						1525.0	2336.0	2243.0	468.0		
14						950.0	2353.0	1846.0	975.0		
15						16.0	1796.0	1582.0	768.0		
16							605.0	2445.0	1998.0	389.0	
17							411.0	2440.0	2289.0	1635.0	
18								1402.0	1818.0	1589.0	274.0
19								578.0	1539.0	1849.0	1095.0

Figure 5: Potential Irrigation Water Need for the Eastern Grand Prairie Region in August for an Average Season in Acre-Feet

I \ J	6	7	8	9	10	11	12	13	14	15	16
4	27.0	47.0	52.0	59.0	47.0						
5	69.0	131.0	140.0	131.0	141.0						
6	41.0	122.0	136.0	122.0	141.0						
7	1.0	36.0	127.0	113.0	142.0	2.0					
8		8.0	102.0	125.0	126.0	89.0					
9		3.0	107.0	122.0	135.0	42.0					
10			79.0	102.0	113.0	119.0	10.0				
11			4.0	64.0	111.0	121.0	45.0				
12					79.0	128.0	85.0				
13					77.0	119.0	118.0	24.0			
14					48.0	122.0	98.0	49.0			
15					1.0	91.0	85.0	48.0			
16						31.0	124.0	104.0	20.0		
17						21.0	125.0	116.0	83.0		
18							71.0	92.0	85.0	14.0	
19							29.0	80.0	100.0	56.0	

Figure 6: Potential Irrigation Water Need for the Eastern Grand Prairie Region in September for an Average Season in Acre-Feet

I\J	6	7	8	9	10	11	12	13	14	15	16
4	1693.0	2935.0	2645.0	2690.0	2252.0						
5	4342.0	7350.0	7596.0	7664.0	4961.0						
6	2459.0	7178.0	7388.0	6539.0	5504.0						
7	36.0	2018.0	7598.0	6239.0	6155.0	88.0					
8		505.0	5840.0	7830.0	7703.0	5109.0					
9			217.0	6678.0	7443.0	7739.0	2398.0				
10				4907.0	6366.0	7060.0	7387.0	648.0			
11				234.0	4021.0	6948.0	7478.0	2569.0			
12						4933.0	7893.0	5372.0			
13						4837.0	7453.0	7205.0	1518.0		
14						3013.0	7483.0	6161.0	3217.0		
15						52.0	5742.0	5242.0	2523.0		
16							1919.0	7781.0	6578.0	1499.0	
17							1303.0	7764.0	7405.0	5338.0	
18								4490.0	6046.0	5337.0	988.0
19								1882.0	5042.0	5851.0	3489.0

Figure 7:   Annual Potential Irrigation Needs for the Eastern Grand Prairie
Region for an Average Season in Acre-Feet

I \ J	6	7	8	9	10	11	12	13	14	15	16
4	90.0	157.0	178.0	204.0	159.0						
5	232.0	442.0	473.0	442.0	493.0						
6	136.0	409.0	461.0	414.0	490.0						
7	3.0	121.0	426.0	383.0	491.0	6.0					
8		28.0	344.0	418.0	422.0	301.0					
9			12.0	356.0	408.0	454.0	169.0				
10				262.0	340.0	377.0	431.0	47.0			
11				13.0	215.0	371.0	431.0	212.0			
12							263.0	428.0	405.0		
13							258.0	423.0	488.0	100.0	
14							161.0	446.0	554.0	243.0	
15							3.0	332.0	465.0	288.0	
16							102.0	429.0	517.0	231.0	
17							69.0	446.0	477.0	372.0	
18								264.0	481.0	506.0	120.0
19								128.0	377.0	374.0	195.0

Figure 8: Potential Irrigation Water Need for the Eastern Grand Prairie Region in April for a Dry Season in Acre-Feet

I \ J	6	7	8	9	10	11	12	13	14	15	16
4	276.0	478.0	545.0	624.0	487.0						
5	708.0	1352.0	1444.0	1349.0	1508.0						
6	415.0	1250.0	1410.0	1265.0	1496.0						
7	10.0	371.0	1302.0	1171.0	1500.0	18.0					
8		86.0	1052.0	1278.0	1290.0	919.0					
9			35.0	1089.0	1247.0	1387.0	515.0				
10				800.0	1038.0	1151.0	1316.0	144.0			
11				38.0	655.0	1132.0	1316.0	647.0			
12						804.0	1307.0	1237.0			
13						788.0	1292.0	1491.0	304.0		
14						491.0	1363.0	1693.0	742.0		
15						8.0	1014.0	1420.0	880.0		
16							313.0	1312.0	1580.0	705.0	
17							212.0	1363.0	1458.0	1137.0	
18								807.0	1469.0	1546.0	368.0
19								392.0	1152.0	1142.0	595.0

Figure 9: Potential Irrigation Water Need for the Eastern Grand Prairie Region in May for a Dry Season in Acre-Feet

	6	7	8	9	10	11	12	13	14	15	16
4	617.0	1070.0	858.0	807.0	709.0						
5	1583.0	2536.0	2577.0	2701.0	1156.0						
6	883.0	2542.0	2501.0	2197.0	1447.0						
7	9.0	697.0	2710.0	2131.0	1779.0	28.0					
8		180.0	2036.0	2853.0	2777.0	1782.0					
9			79.0	2435.0	2682.0	2704.0	811.0				
10				1789.0	2321.0	2574.0	2659.0	228.0			
11				85.0	1466.0	2533.0	2691.0	845.0			
12						1798.0	2859.0	1868.0			
13						1763.0	2701.0	2517.0	541.0		
14						1099.0	2669.0	2058.0	1127.0		
15						19.0	2077.0	1744.0	735.0		
16							700.0	2827.0	2267.0	450.0	
17							475.0	2796.0	2647.0	1890.0	
18								1621.0	2102.0	1760.0	317.0
19								668.0	1754.0	2036.0	1266.0

Figure 10: Potential Irrigation Water Need for the Eastern Grand Prairie Region
in June for a Dry Season in Acre-Feet

I \ J	6	7	8	9	10	11	12	13	14	15	16
4	965.0	1672.0	1578.0	1649.0	1358.0						
5	2473.0	4284.0	4456.0	4428.0	3265.0						
6	1409.0	4139.0	4338.0	3850.0	3512.0						
7	23.0	1176.0	4368.0	3650.0	3818.0	53.0					
8		290.0	3389.0	4461.0	4409.0	2964.0					
9			124.0	3804.0	4261.0	4487.0	1375.0				
10				2795.0	3626.0	4022.0	4185.0	356.0			
11				134.0	2290.0	3958.0	4247.0	1446.0			
12						2810.0	4509.0	2960.0			
13						2755.0	4220.0	4058.0	846.0		
14						1717.0	4254.0	3341.0	1761.0		
15						30.0	3245.0	2863.0	1398.0		
16							1093.0	4418.0	3613.0	702.0	
17							742.0	4410.0	4136.0	2953.0	
18								2533.0	3285.0	2876.0	495.0
19								1044.0	2782.0	3348.0	1979.0

Figure 11: Potential Irrigation Water Need for the Eastern Grand Prairie Region in July for a Dry Season in Acre-Feet

I\J	6	7	8	9	10	11	12	13	14	15	16
4	1037.0	1797.0	1740.0	1844.0	1506.0						
5	2658.0	4662.0	4868.0	4797.0	3778.0						
6	1520.0	4479.0	4740.0	4214.0	4005.0						
7	26.0	1280.0	4718.0	3982.0	4295.0	58.0					
8		313.0	3681.0	4795.0	4751.0	3219.0					
9			133.0	4088.0	4592.0	4870.0	1497.0				
10				3003.0	3896.0	4322.0	4502.0	383.0			
11				144.0	2461.0	4253.0	4571.0	1577.0			
12						3019.0	4853.0	3189.0			
13						2961.0	4534.0	4383.0	909.0		
14						1845.0	4586.0	3613.0	1892.0		
15						32.0	3487.0	3102.0	1548.0		
16							1175.0	4747.0	3895.0	755.0	
17							797.0	4746.0	4444.0	3173.0	
18								2722.0	3530.0	3113.0	532.0
19								1122.0	2997.0	3628.0	2126.0

Figure 12: Potential Irrigation Water Need for the Eastern Grand Prairie Region in August for a Dry Season in Acre-Feet

I \ J	6	7	8	9	10	11	12	13	14	15	16
4	102.0	177.0	200.0	229.0	179.0						
5	261.0	498.0	531.0	497.0	551.0						
6	153.0	461.0	519.0	465.0	548.0						
7	4.0	137.0	480.0	431.0	550.0	7.0					
8		32.0	387.0	472.0	475.0	338.0					
9			13.0	402.0	460.0	511.0	160.0				
10				295.0	383.0	425.0	446.0	38.0			
11				14.0	242.0	418.0	454.0	170.0			
12						297.0	482.0	318.0			
13						291.0	445.0	446.0	89.0		
14						181.0	461.0	370.0	186.0		
15						3.0	343.0	322.0	183.0		
16							115.0	466.0	391.0	74.0	
17							78.0	471.0	437.0	312.0	
18								267.0	347.0	321.0	52.0
19								110.0	300.0	377.0	209.0

Figure 13: Potential Irrigation Water Need for the Eastern Grand Prairie Region
in September for a Dry Season in Acre-Feet

I\J	6	7	8	9	10	11	12	13	14	15	16
4	3087.0	5351.0	5100.0	5358.0	4398.0						
5	7915.0	13774.0	14349.0	14214.0	10751.0						
6	4516.0	13280.0	13969.0	12407.0	11497.0						
7	76.0	3781.0	14005.0	11748.0	12434.0	171.0					
8		931.0	10889.0	14277.0	14125.0	9523.0					
9			396.0	12173.0	13650.0	14414.0	4527.0				
10				8944.0	11604.0	12870.0	13540.0	1196.0			
11				427.0	7329.0	12664.0	13710.0	4897.0			
12						8992.0	14437.0	9978.0			
13						8817.0	13616.0	13383.0	2790.0		
14						5493.0	13779.0	11629.0	5951.0		
15						95.0	10497.0	9917.0	5032.0		
16							3498.0	14200.0	12264.0	2917.0	
17							2375.0	14233.0	13599.0	9838.0	
18								8214.0	11214.0	10122.0	1884.0
19								3464.0	9363.0	10905.0	6370.0

Figure 14: Annual Potential Irrigation Water Needs for the Eastern Grand Prairie Regaon for a Dry Season in Acre-Feet

I \ J	6	7	8	9	10	11	12	13	14	15	16
4	251.0	435.0	349.0	328.0	288.0						
5	643.0	1031.0	1047.0	1098.0	470.0						
6	359.0	1033.0	1016.0	893.0	588.0						
7	4.0	283.0	1101.0	866.0	723.0	12.0					
8		73.0	827.0	1159.0	1128.0	724.0					
9			32.0	989.0	1090.0	1099.0	329.0				
10				727.0	943.0	1046.0	1081.0	93.0			
11				35.0	596.0	1029.0	1094.0	344.0			
12						731.0	1162.0	759.0			
13						717.0	1098.0	1023.0	220.0		
14						446.0	1085.0	836.0	458.0		
15						8.0	844.0	709.0	299.0		
16							284.0	1149.0	921.0	183.0	
17							193.0	1136.0	1076.0	768.0	
18								659.0	854.0	715.0	129.0
19								271.0	713.0	827.0	515.0

Figure 15: Peak Weekly Potential Irrigation Water Needs for the Eastern Grand Prairie Region in Acre-Feet