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FACTUAL REPORT
IVANHOE IRRIGATION DISTRICT
CENTRAL VALLEY PROJECT, CALIFORNIA

Tulare Basin District
Fresno, California

April 1949

Jack W. Rodner
District Manager

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BUREAU OF RECLAMATION
REGION II

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CENTRAL VALLEY PROJECT, CALIFORNIA

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District Manager

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Tulare Basin District
318 Patterson Bldg.
Fresno, Calif.

April 13, 1949

To: Regional Director
From: District Manager, Fresno
Subject: Factual Report, Ivanhoe Irrigation District, Central Valley
Project, California.

1. Transmitted herewith is a report entitled as shown above, containing supporting information for use in obtaining Departmental approval of contract with the Ivanhoe Irrigation District. The contract, which was approved by resolution of the district's board of directors dated April 5, 1949, is based on this report and on the technical studies which support it.

2. The report presents agricultural, water supply, and economic aspects of the district, describes the supplemental water supply to be provided and the distribution system to be constructed, and establishes by economic analysis the district's ability to pay for the water service and to repay the cost of constructing the distribution system.

3. The report has been prepared by the staff of the Tulare Basin District with the close cooperation of the Regional Office and with the full understanding and helpful assistance of the board of directors and staff of the Ivanhoe Irrigation District.

John R. [Signature]

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SUMMARY

The Ivanhoe Irrigation District is in Tulare County, California, about 50 miles southeast of Fresno. Its gross area is 11,117 acres, of which 8,865 acres were irrigated in 1946. Ultimate net irrigable area is 9,968 acres, to be attained by development of 1,103 acres not now irrigated. Assessable area as determined by the district is 10,607 acres. The district can receive water from the Friant-Kern Canal, which forms its eastern boundary. Contract negotiations between the district and the Bureau of Reclamation culminated in approval of a contract by resolution of the district's board of directors dated April 5, 1949. The contract provides for water service and for construction of a concrete pipe lateral distribution system. The district will pay \$3.50 per acre-foot canalside for Class 1 water and \$1.50 for Class 2. Estimated total cost of the distribution system is \$1,589,807. This amount will be repaid by the district during a 40-year period at the rate of \$3.99 per acre per year on a net irrigable area basis. Total water cost to landowners, including Central Valley Project water, pumping from ground water, distribution system repayment, and operation and maintenance, will be \$16.50 per acre annually, or \$6.09 per acre-foot on a farm delivery requirement basis.

Climate of the district is semiarid, with mild winters and hot, dry summers. Frost-free period is about 254 days. Average seasonal rainfall is 12.62 inches, of which 5.60 inches represent effective precipitation. Topography is generally smooth and gently sloping westward. Elevation above sea level ranges from 425 to 350 feet.

About 90 percent of the district is underlain by hardpan at depths ranging from 18 to 30 inches. Class 1 land, having no limitations, occupies only 22 acres; Class 2, slight to moderate limitations, 8,598 acres; Class 3, moderate to severe, 2,185 acres; Class 4, severe, 58 acres; and Class 6, unsuitable, 254 acres. Little difference is noted in productivity of the various classes. The lower classes present more difficult reclamation and management problems. The hardpan limitation has been largely overcome by subsoiling and blasting and by specialization in shallow rooted crops.

Principal crops and areas occupied are: Grapes, 3,889 acres; citrus fruits, 2,424 acres; deciduous fruits, 748 acres; truck crops, 600 acres; irrigated grain and hay, 403 acres; miscellaneous field crops, 275 acres; olives, 198 acres; irrigated pasture, 123 acres; cotton, 113 acres; and alfalfa, 92 acres.

Under the estimated ultimate crop pattern the following changes in areas are expected: Grapes, plus 511 acres; citrus fruits, plus 576; deciduous fruits, plus 352; truck crops, plus 100; irrigated grain and hay, minus 303; miscellaneous field crops, minus 157; olives, plus 102; irrigated pasture, plus 27; alfalfa, plus 8; and cotton, minus 113. Cotton is expected to disappear from the district, to be replaced by higher-income, better adapted, specialty crops.

Present farm delivery requirement is 23,667 acre-feet, or 2.67 acre-feet per acre per year. Estimated ultimate farm delivery requirement is 26,987 acre-feet annually, or 2.71 acre-feet per acre. Consumptive use at present is 21,117 acre-feet, or 2.38 acre-feet per acre. Ultimately, it will be 24,077 acre-feet, or 2.42 acre-feet per acre. Crop irrigation requirement is 16,862 acre-feet, or 1.90 acre-feet per acre, at present, as compared with 19,292 acre-feet, or 1.94 acre-feet per acre, ultimately.

The district's water supply is provided by rainfall, by underground percolation from St. Johns River, Cottonwood Creek and Wutchumna Ditch, and by surface diversion of runoff of Kaweah River and its tributaries and from Cottonwood Creek. Irrigation water is applied to the land by means of privately-owned pumps and farm distribution systems. Depth to ground water, which was 10 to 15 feet at time of earliest record, had increased to about 66 feet by 1947.

Initial supplemental water supply to be furnished from the Friant-Kern Canal is intended to replenish the water table to a mean depth of 55 feet and to furnish the difference between average annual use and natural supply. Ultimate supplemental supply is intended to supply only the difference between consumptive use of crops and optimum natural supply. During the first five years after beginning of delivery of supplemental water the district may receive any quantity of water it applies for up to the maximum in each class. During the next 10 years the district will take whatever quantity was decided upon at end of the initial five-year period. At end of the 10-year period, the district will exercise its option for maximum quantity or decide upon actual quantity desired from that time on. Ultimate maximum quantity of Class 1 water is 7,700 acre-feet a year. Contractual maximum of Class 2 is 7,880 acre-feet, and contingent supply is 3,700 acre-feet. The contingent supply is to be made available to the district if required because of future changes in ground-water conditions.

Average gross income from all crops at 1939-44 prices is estimated at \$275 per acre, while total average farm costs are \$197 per acre. Thus the weighted average annual payment capacity of land now developed in the district is \$78 per acre. Under ultimate conditions, payment capacity will be an estimated \$99 per acre, as compared with total water costs of \$16.50 per acre. Increase in ultimate payment capacity will come about through present nonbearing acreage reaching bearing status and development of presently nonirrigated land to high income specialty crops.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION II

Tulare Basin District
Fresno, California

April 1949

FACTUAL REPORT
IVANHOE IRRIGATION DISTRICT
CENTRAL VALLEY PROJECT, CALIFORNIA

INTRODUCTION

1. Purpose and scope. - Purpose of this report is to present information supporting the terms of a contract between the United States and the Ivanhoe Irrigation District, providing for irrigation water service to be furnished to the district through facilities of the Central Valley Project, California, and for construction of a lateral distribution system for the district. The report will further be used to substantiate a request of the Congress for appropriation of the funds required to cover the cost of constructing a lateral distribution system for the district. Scope of the report includes a description of the district, a discussion of present and future agricultural and water supply problems, a description and estimate of cost of the distribution system, determination of quantities of supplemental water to be supplied the district by the project, and an analysis of the district's capacity to pay for water service and to repay the cost of the distribution system, as required under the Reclamation project acts.

2. Water users' organization. - The Ivanhoe Irrigation District is organized under California laws pertaining to the formation and operation

of irrigation districts. Its affairs are conducted by a board of directors consisting of a president and six members, all of whom are farmers or have agricultural interests in the district, as follows: President, Angus S. McKellar; board members, Edward R. Davis (also Secretary of the district), Eugene Green, Stanley V. Miller, Leonard J. Peltzer, Walter K. Winton, and James H. Young. Other officers include: E. I. Foemster, attorney; George Reed, assessor; Joseph T. Fitzgerald, treasurer; Mrs. Leonora Baughman, tax collector and assistant secretary; and Harold Shawl, engineer.

3. Contractual history. - Contract negotiations with the district began March 10, 1948, when the district requested the Bureau of Reclamation to make studies of water supply and land use to determine necessary supplemental water requirements and the feasibility of constructing a distribution system. During the following months technical studies prepared by the Bureau of Reclamation in response to these requests have been reviewed and concurred with by district officials. These activities culminated in a resolution by the district's board of directors dated April 5, 1949, approving a draft of contract providing for water service and for the construction of a lateral distribution system for the district.

4. History and development. - The Ivanhoe Irrigation District was organized January 8, 1948, with gross area of 11,117 acres. The organization resulted from an election in which the vote was 170 for and 70 against formation of the district. At the same time, seven directors, an assessor, a tax collector, and a treasurer were elected.

A previous attempt to form a district containing about 16,000 acres failed to carry at an election held February 13, 1937.

5. Although the organization of the district is a recent development, irrigation agriculture in the area has been practiced for approximately 30 years. The district is in a thermal area protected by the foothills of the Sierra Nevada and is primarily devoted to growing permanent tree and vine crops. By 1946, about 90 percent of the lands in the district had been developed for irrigated farming, of which 82 percent was planted in grapes, citrus fruits, deciduous fruits, and olives.

GENERAL DESCRIPTION

6. Location. - The Ivanhoe Irrigation District is in Tulare County, about 50 miles southeast of Fresno and 8 miles northeast of Visalia, the county seat. It occupies portions of Townships 17 and 18 South, Ranges 25 and 26 East, of the Mt. Diablo Base and Meridian. The Friant-Kern Canal forms the district's eastern boundary for a distance of about $3\frac{1}{2}$ miles. The district extends westward from the canal a maximum distance of about 6 miles and its greatest dimension north and south is roughly 5 miles.

7. Ivanhoe, a town of about 1,800 population, is the site of district headquarters. It is outside of, but adjacent to, the southwestern boundary of the district, and is largely dependent upon the agriculture of the district. Redbanks, with population estimated at 100, is the only community development inside the district boundary.

8. The Friant-Kern Canal, a major feature of the Central Valley Project, now being constructed to serve the east side of the San Joaquin

Valley, will deliver water to the district at a point about 67 miles south of Friant Dam and Millerton Lake.

9. The location map, plate 1, shows the Ivanhoe Irrigation District with relation to the Friant-Kern Canal, and presents also a small index map of California showing location of the district in the state.

10. Physical geography. - The district lies, in part, in the foothills of the Sierra Nevada, on the transition slopes between the foothills and the valley floor, and on the valley floor. General slope is to the west at an average rate of about 15 feet to the mile. Elevation above sea level ranges from 425 to 350 feet.

11. Cottonwood Creek cuts through the northeast corner of the district, flowing in a northwesterly direction. The principal water course through the district is the Wutchumna Ditch, running in a northwesterly direction with a branch extending southwesterly. This ditch diverts water from Kaweah River at a point 1.5 miles above McKay Point, where Kaweah River divides into St. Johns River and Kaweah Branch.

12. Soils. - About 90 percent of the district consists of an old alluvial plain or terrace lying between St. Johns River and Cottonwood Creek. It is characterized by genrly rolling terrain and strongly developed soils, underlain by hardpan at depths ranging from 18 to 30 inches. The remainder of the district consists of small areas of foothill lands, recent stream deposits adjoining Cottonwood Creek, and adobe clay soils that occury the smooth valley plain near the foothills.

13. Climate. - Climate in the Ivanhoe Irrigation District is typical of the San Joaquin Valley, being semiarid and characterized by mild winters and hot, dry summers. Mean annual temperature at Visalia,

8 miles southwest of the district, has been 62.6° F. over a 58-year period. Average annual minimum and maximum temperatures have been 47.0° and 77.6° respectively, over a 32-year period, during which absolute minimum was 13° and absolute maximum was 115°. Average seasonal rainfall for the Ivanhoe area is 12.62 inches, based on 42-year records at Orange Cove, Lindsay, Visalia, and Lemon Cove. Rain falls principally during the period December to April. It is estimated that 5.60 inches represent effective precipitation.

14. Thermal conditions. - The foothills in and near the district provide a measure of thermal protection to the entire area. This advantage makes possible successful low-cost production of citrus, Emperor grapes, and truck crops on comparatively mediocre soils, improves suitability for irrigation, and has influenced to a large extent the kind of crops grown in the area. Weather Bureau data indicate a 42-year average of 275 frost-free days at Lemon Cove, a 32-year average of 239 at Lindsay and a 16-year average of 250 at Orange Cove, records at all of these stations being applicable to the Ivanhoe District.

15. Population. - It is estimated that population of the district was 1,000 in 1948, exclusive of the town of Ivanhoe. An increase to about 1,150 is expected under ultimate development. The increase is estimated on the basis that 100 persons will settle on the 1,103 acres of excess lands and 50 on other lands not irrigated at present.

16. Marketing and processing. - The district is well provided with facilities for processing, handling, and marketing its agricultural products. Facilities available to the district at Ivanhoe, Woodlake, Visalia, Lindsay, and Selma include 9 citrus packing houses; 5 table

grape and deciduous fruit packing houses; 1 packing house handling table grapes, vegetables, and deciduous fruit; 3 olive processing plants; 3 cotton gins (at Visalia); 2 fig canneries; 3 wineries; 3 feed and seed stores; 2 shook companies; and 2 commercial crop spraying and dusting concerns.

17. Marketing is an important function in the district in nearly every month of the year. Emperor grapes, navel and Valencia oranges, and olives are harvested from October to May. Plums move to market in June and July. During all of these months carloads of fruit and grapes are being shipped to all major markets in the United States. Eastern sales are made on the basis of local packing house brand names recognized as denoting grade and quality.

18. Transportation facilities. - Branch lines of the Atchison, Topeka & Santa Fe Railway and the Southern Pacific Railroad serve the district. Three truck lines have headquarters in Ivanhoe and transport grapes, fruits, and vegetables to all principal California markets.

AGRICULTURE AND LAND USE

19. Areas. - Gross area of the district is 11,117 acres, and the ultimate net irrigable area is 9,968 acres. The difference between these figures, amounting to 1,149 acres, represents land occupied or used for secondary roads, farmsteads, packing sheds, schools, rights-of-way of Wutchumna Ditch and of the Friant-Kern Canal, and Class 6 non-irrigable land. Actual net irrigated area in 1946 was 8,865 acres. Assessable area as indicated by district officials is 10,607 acres.

20. Land ownership. - As of September 1945 there were 258 owner-ships in the district, of which 254 were owned by individuals and 4 by

corporations. Individual owners, constituting 98.4 percent of all owners, were in possession of 9,781 acres, or 88 percent of the district's gross area. These ownerships were combined into 215 farms or operatorships. The average size farm unit thus is about 51 acres.

21. Excess land. - Excess land in the district totals 1,103 acres, or 9.9 percent of the gross area. Of the 254 individual owners, only one holds excess land, and he has about 165 acres in excess of 160 acres per individual owner (320 acres for man and wife). One corporation owns 1,098 acres in the district, and of this 938 acres, or 8.4 percent of the district's gross area, is in excess of acreage limitations applicable under Reclamation law. These figures are significant in that they show that only a small portion of the district will be affected in any way by the acreage limitation, and that 85 percent of the total excess land is held by one corporation.

22. Table 1 presents a summary of size of holdings in the district as of September 1945, and shows the distribution of excess land ownership.

23. Financial status and credit facilities. - Bankers serving the area regard lands of the district as good loan risk because of its excellent crop yields, general freedom from prolonged frosts, and the relatively favorable depth to underground water. Between 35 and 40 percent of the farms in the district have real property loans, many of which are nearly paid out. The Federal Land Bank, charging 4 percent interest, has the largest number of loans in the area. Local banks also make long term loans to farmers, most of these being at 6 percent interest and running for 5 or 10 years. Long term loans are made on

TABLE 1 - Summary of size of holdings - September 1945

Owned by other than corporations:

: Ownerships :			Area		: Excess land	
: Percent :			: Percent		: Percent of	
Size of	:	: of :	:	: of	:	: total dis-
ownership:	Number	: total	: Total	: total	: Total	: trict acreage
<u>Ac.</u>		<u>%</u>	<u>Ac.</u>	<u>%</u>	<u>Ac.</u>	<u>%</u>
40 or less	191	74.0	3,864	34.8	-	-
41-80	43	16.6	2,631	23.7	-	-
81-120	8	3.1	769	6.9	-	-
121-160	4	1.6	538	4.8	-	-
161-320	7	2.7	1,494	13.4	-	-
321-640	1	.4	485	4.4	165	1.5
SUB-TOTAL	254	98.4	9,781	88.0	165	1.5

Owned by corporations:

40 or less	1	.4	28	.2	-	-
41-80	1	.4	80	.7	-	-
121-160	1	.4	130	1.2	-	-
641-1,280	1	.4	1,098	9.9	938	8.4
SUB-TOTAL	4	1.6	1,336	12.0	938	8.4
TOTAL	258	100.0	11,117	100.0	1,103	9.9

the basis of 60 percent of appraised "normal" value of land and improvements. Usual loans by crops are as follows:

Crop	:	Loan per acre
		\$
Table grapes		150.00
Citrus		150.00
Deciduous fruit		100.00 to 150.00
Olives		150.00 to 160.00
Other irrigated crop land		60.00

24. Farm buildings and equipment. - Average age of farm residences and buildings in the district is about 20 years, corresponding roughly to the average age of citrus trees and vines. Buildings, grape trellises, pumps, well equipment, and the closed pipe irrigation systems in general use throughout the area are all in good repair.

25. Labor requirements. - Requirements for itinerant labor in the Ivanhoe Irrigation District are not high. There is a well distributed demand for labor throughout the year, maintaining a fairly permanent local farm labor force. The addition of 1,103 acres to irrigated crops, as expected under ultimate development, should not present a serious labor problem to growers in the district.

26. Land classification and land management. - A semi-detailed land classification of the Ivanhoe Irrigation District was made in October 1948. The land classification map, plate 2, shows the various land classes and indicates the determining classification factors by means of composite symbols which are explained in the legend. The land classes represent varying degrees of suitability for irrigation,

determined by evaluation of the factors of soil, topography, and drainage, in relation to adapted crops, productivity, and land management.

27. The most widespread limitation to suitability for irrigation is hardpan, which underlies more than 90 percent of the district at depths ranging generally from 18 to 30 inches. This limitation has been so largely overcome by subsoiling and blasting and by specialization in shallow rooted crops, together with existing favorable thermal conditions, that the principal differentiation between classes is in depth to hardpan rather than in the presence of the hardpan itself. While such lands are generally considered to be of inferior quality, in this district they have been under irrigation for a number of years and have demonstrated generally high productivity. Variations in productivity appear to be more closely correlated with land management than with soil characteristics, except in areas of extremely shallow hardpan. The lands are grouped by major classes as shown in the following tabulation:

Land class	: Limitations in suitability : for irrigation	: Gross : area <u>ac.</u>	: Percent of : total area <u>%</u>
1	None	22	0.2
2	Slight to moderate	8,598	77.3
3	Moderate to severe	2,185	19.7
4	Severe	58	0.5
6	Extreme; unsuitable for irrigation	<u>254</u>	<u>2.3</u>
Total		11,117	100.0

28. Description of land classes. - Class 1 land is capable of producing high yields of any climatically adapted crop at minimum cost. Class 2 has slight to moderate restrictions in productivity or ease of management because of minor limitations in soil topography, or drainage. About 93 percent of this class of land is underlain by hardpan at depths of 18 to 30 inches, the remainder being small areas of adobe clay soils, light loamy sand soils, hardpan soils with undulating relief, and heavy soils with slopes of 4 to 8 percent. Class 3 has moderate to severe limitations in soil, topography, or drainage, about 80 percent of it having hardpan at depths generally less than 18 inches. The remainder is also hardpan soil with strongly rolling or hogwallow relief. Class 4 is unsuitable for general cropping because of severe limitations, but has limited utility for special crops. Class 6, consisting of foothill lands and drainage channels, is unsuitable for irrigation because of extreme limitations.

29. Crop production and land management. - There are only 22 acres of Class 1 land in the district and none of this had been irrigated prior to 1946. Class 2 lands includes a wide variety of physical conditions which are reflected in the type of management required and crop adaptation, but which have little effect on its productivity for crops grown at present. Depth to hardpan varies widely but averages about 24 inches. No consistent correlation could be observed between hardpan depth and crop growth. Good growth was noted occasionally even where the hardpan was only 8 to 12 inches deep. In such cases good growth and production have been made possible by blasting the hardpan to permit root penetration. Predominant crops on Class 2 lands are citrus and grapes. Other

crops include deciduous fruits, olives, figs, winter vegetables, alfalfa, and irrigated pasture.

30. Class 3 land, in general, is poorly adapted to deep rooted crops, although fair stands of alfalfa have been obtained after intensive and costly subsoiling. These lands require more difficult and more costly management than Class 2 land because of their generally shallow soils and the greater frequency of infertile areas exposed in leveling operations. The growth of citrus and grapes on Class 3 land is comparable to that on Class 2, but the growth of deciduous trees is noticeably inferior.

31. Class 4 land is on the lower slopes of the Venice Hills, and consists of heavy textured soils overlying unconsolidated rocks and boulders. The land surface is smooth, but the gradient ranges from 12 to 20 percent. This land is unsuited to general cropping and is additionally handicapped by the necessity of lifting water to it. Thermal conditions are favorable, however, and most of the Class 4 land is now in citrus and winter vegetables.

32. Within the Ivanhoe District the less adaptable crops are not grown extensively enough to provide comparisons in yields between the various land classes. Yields typical of the district as a whole are as follows:

Crop	:	Yield per acre
Oranges		350-450 field boxes
Olives		2-4 tons
Grapes		6-8 tons
Figs		5-6 tons
Plums		4-6 tons
Tomatoes		450-800 crates
Beans		500-600 crates

33. Weeds. - A reconnaissance weed survey was made by the Bureau of Reclamation in October 1948 for the purpose of observing the extent of weed infestations in the district. This survey was not sufficiently detailed to provide an estimate of monetary losses in the district due to weeds. Based on estimates made in other districts, losses in the Ivanhoe District would be about \$3 to \$5 per irrigated acre annually, or from \$30,000 to \$50,000 under ultimate conditions. These losses are confined largely to cultural and control costs caused by weed growth and the cost of water consumed by weeds, as it is believed that crop yields are not materially reduced by weeds. A program of general weed control before weed infestations become more widespread would be of considerable monetary value to the district over a prolonged period of time.

34. Present crop development - year 1946. - Out of a total of 8,865 acres of net crop area in 1946, grapes occupied 3,889 acres. The second most prominent crop was citrus, with 2,424 acres. These two crops, totaling 6,313 acres, represented 71.3 percent of the total net crop area. Areas of other crops were: Deciduous fruits, 748 acres; truck crops, 600 acres; grain and hay, 403 acres; miscellaneous field crops, 275 acres; olives, 198 acres; irrigated pasture, 123 acres; cotton 113 acres; and alfalfa, 92 acres.

35. Estimated future crop development. - The future crop pattern of the district has been estimated after due consideration of numerous factors comprising past and present acreage trends of each crop; land use capabilities and trends in cropping; estimated future market conditions; and opinions of qualified agricultural officials and farmers.

As a result of the survey, it is predicted that cotton will disappear from the list of crops grown in the district, and that there will be sharp reductions in acreage of irrigated grain and hay and miscellaneous field crops.

36. The disappearance of cotton is predicated on the fact that yield of cotton is low in the district and land values are high. This leads to the belief that the small area now occupied by cotton will eventually be given over to higher-income, better adapted, specialty crops. It is believed that practically all land now undeveloped will eventually be used for citrus and grapes.

37. Under the projected ultimate crop pattern, it is estimated that grapes will occupy 4,400 acres and citrus fruits 3,000 acres. Total of these crops will be 7,400 acres, or 74 percent of the ultimate net irrigated area of 9,968 acres. Ultimate net areas of other crops are estimated as follows: Deciduous fruits, 1,100 acres; truck crops, 700 acres; olives, 300 acres; irrigated pasture, 150 acres; miscellaneous field crops, 118 acres; alfalfa, 100 acres; and irrigated grain and hay, 100 acres. Table 2 shows the areas occupied by the various crops in the present and ultimate crop patterns.

38. Livestock. - The Ivanhoe Irrigation District is not well adapted to livestock. There are only two livestock enterprises in the district, one composed of about 100 head of beef cattle, the other of about 30 head. Three poultry farms are operated, with about 1,500 to 2,000 birds each. Total estimated value of livestock in 1948 was \$51,950, of which beef cattle accounted for \$36,700.

TABLE 2 - Crop areas and farm delivery requirements, present (1946) and ultimate

Crop	Area		Farm del. req. Ac.-ft. per ac.	Total requirement	
	Present Ac.	Ultimate Ac.		Present Ac.-ft.	Ultimate Ac.-ft.
Irrig. pasture	123	150	4.50	554	675
Alfalfa	92	100	4.00	368	400
Truck crops	600	700	2.50	1,500	1,750
Deciduous orchard	743	1,100	2.75	2,057	3,025
Olives	198	300	2.25	446	675
Citrus	2,424	3,000	2.25	5,454	6,750
Grapes	3,689	4,400	3.00	11,667	13,200
Cotton	113	--	2.75	311	--
Misc. field crops	275	118	2.15	591	254
Irrig. hay & grain	403	100	1.00	403	100
Dbl. cropped	200	100	1.58	316	158
Total	8,865 ^(a)	9,968 ^(a)		23,667	26,937

(a) Excludes double cropped area

39. It is expected that the total livestock numbers in the district will decrease with the importation of supplemental water. This will result from conversion of present pasture lands to intensified fruit and vegetable crop production.

40. Farm delivery requirements. - Farm delivery requirements for the 8,865 acres of land irrigated in 1946 are estimated at 23,667 acre-feet of water, an average of 2.67 acre-feet per acre per year. Under conditions of ultimate development, with 9,968 acres irrigated, the estimated farm delivery requirement is 26,987 acre-feet annually, or 2.71 acre-feet per acre.

41. Table 2 shows net areas of the various crops, unit farm delivery requirements by crops, and total farm delivery requirements, present (1946) and ultimate.

42. Consumptive use. - Consumptive use as of 1946 is estimated at 21,117 acre-feet, or 2.38 acre-feet per acre for the 8,865 acres irrigated. Ultimate consumptive use is 24,077 acre-feet at the rate of 2.42 acre-feet per acre per year, for the 9,968 acres irrigated. Net crop irrigation requirement, determined by deducting effective precipitation from consumptive use, is 16,862 acre-feet, or 1.90 acre-feet per acre per year at present, and ultimately will be 19,292 acre-feet, or 1.94 acre-feet per acre per year.

43. Development period. - It has been stipulated in the contract that the district should be allowed two years after completion of the distribution system as a development period during which no installments for repayment of the cost of construction of the distribution system need be made. Studies in the Friant-Kern Canal service area indicate

that a period of seven years should be allowed for undeveloped lands to reach full development, and that during that period such lands should not be required to make payments of construction charges. During the two-year development period the district may collect charges from operators of developed lands to build up a reserve sufficient to carry the undeveloped lands over a total period of seven years. Payments to the government will continue thereafter for 40 years. The payment period of the presently undeveloped lands will be at the discretion of the district; however, it is to be assumed that a full 40 years will be allowed the undeveloped lands beyond the seven-year development period. Under such an arrangement, presently undeveloped lands would continue to pay their share of the construction repayments to the district for five years after the district's obligation to the United States has been discharged.

WATER SUPPLY

44. Area studied. - The Ivanhoe Irrigation District occupies a portion of the Kaweah Delta, which has been divided, for the purpose of water supply studies, into several areas. The Ivanhoe area of 62,400 acres includes the district and is the most northerly of the Kaweah study areas. It is bordered on the south by the Mill Creek study area, on the north by the Alta Irrigation District, and on the west by other portions of the Kings River service area.

45. Specific yield. - Specific yield of the ground-water reservoir above the present water table of the Ivanhoe Irrigation District is 9 percent, while that below the water table within the area reached by

water wells is 11 percent. Granite is found at shallow depths beneath much of the area, and a deep trough extends east and west through the middle of the district. One very prominent aquifer was discovered, its presence being demonstrated by high specific yields and high specific capacities. Recharge is probably from Kaweah River. Tight soils make large scale artificial replenishment of the ground-water reservoir by water spreading impracticable and uneconomical.

46. Sources of water supply. - Water supply of the district is provided by rainfall, by underground percolation from St. Johns River, Cottonwood Creek, and Wutchumna Ditch and by surface diversion of runoff of Kaweah River and its tributaries, and from Cottonwood Creek.

47. Runoff, Kaweah River. - Kaweah River and its principal tributary, St. Johns River, pass to the south of the district, but are factors in the district's water supply. Mean annual runoff of Kaweah River at the United States Geological Survey gaging station near Three Rivers, about 12 miles upstream from the district, was 388,000 acre-feet for the period 1921-22 through 1946-47. There is some contribution to this flow from minor drainage and some deductions in the form of surface diversions and seepage losses below the gaging station. However, these factors vary in direct relation to the Kaweah runoff, and do not affect the basic relationship between runoff near Three Rivers and percolation to the district. Maximum runoff during the period mentioned was 870,900 acre-feet in 1937-38 and the minimum was 101,600 acre-feet in 1923-24.

48. Runoff, Cottonwood Creek. - Cottonwood Creek is an intermittent stream that flows from the north along the east side of Colvin Mountain, rounds the southerly point of the mountain, and then flows northwest

across the northeast corner of the district. At Morgan Canyon, where the stream leaves bedrock and enters alluvial fill, average annual runoff is estimated at 7,600 acre-feet. Above the station at Redbanks the estimated runoff is 9,700 acre-feet. At Redbanks, 12.6 miles downstream from Morgan Canyon, and close to the point where the stream enters the district, estimated runoff is 3,300 acre-feet annually. Estimated loss in the valley above Redbanks thus is 6,400 acre-feet. Lands in the valley irrigated from Cottonwood Creek use an estimated 5,000 acre-feet a year, leaving only a little more than 1,000 acre-feet to contribute to percolation into the district. However, this water merges with a much greater volume of percolation from Kaweah-St. Johns sources and is indistinguishable as far as effect on recharge to the district is concerned.

49. Rainfall. - Of the average seasonal rainfall in the district of 12.62 inches, 5.60 inches, or 0.48 acre-foot, is estimated as effective precipitation. This quantity of rainfall may be deducted from consumptive use to determine the net crop irrigation requirement. The quantity of irrigation water represented by this mean annual rainfall on the 8,865 acres irrigated in 1946 is 4,255 acre-feet; for the ultimate irrigated area of 9,968 acres it represents 4,785 acre-feet.

50. Surface supply. - Surface supply to the district is obtained from the Wutchumna Ditch, and averages about 1,500 acre-feet a year. Wutchumna entitlements are divided into 91 shares, of which seven landowners in the Ivanhoe District own 5-41/60 shares representing average annual entitlements of 2,700 acre-feet. Of these, however, 3 $\frac{1}{4}$ shares are applied to lands outside the district. These shares represent a total investment of about \$40,000 and each share yields an average of

520 acre-feet annually. Annual assessment for operation and maintenance averages \$150 per share. Since this water is privately owned and is not appurtenant to any land in the district, it is possible that future conditions may deprive the district of the use of it.

51. Transmission losses and seepage. - Streamflow and canal flow records are inadequate to furnish direct estimates of seepage losses within the district. Contributions to the water supply of the district from these sources are dealt with in the analysis of ground-water recharge.

52. Ground-water supply. - Earliest available records of water-table conditions in the district show average depths to water of from 10 to 15 feet. This was about 1916. By 1921, mean depth to water had increased to more than 24 feet. In 1934-35 mean depth to water had increased to 61.8 feet and a cone of overdraft had formed in the west central portion of the district. Between 1936 and 1945 a general recovery of the water table brought the mean water level to 50.8 feet. By 1946-47, the water table had receded to a slightly lower level than that of 1935, with mean depth to water of 65.7 feet.

53. In the early days of record, ground-water recharge apparently came entirely by percolation from the east and by seepage from Cottonwood Creek and Wutchumna Ditch. Growth of the agricultural area with its accompanying increase in pumping developed water-table slopes by 1929 that indicate some movement of ground water into the district from St. Johns and Kaweah Rivers.

54. Since 1922 there has been a total overdraft of 39,600 acre-feet in the district, averaging 1,500 acre-feet per year. During the

period 1922-47, average runoff has been 93 percent of normal and irrigated area of the district has averaged 6,100 acres. Accumulated change in storage during different periods is shown in the following tabulation:

Period	: Total : change Ac.-ft.	: Average annual : change Ac.-ft.	: Runoff % : of normal %	: Average : irrigated area Ac.
1922-35	-35,900	-2,600	69	4,900
1926-42	+10,700	+1,500	135	6,600
1943-47	-14,400	-2,900	104	8,300
1922-47	-39,600	-1,500	93	6,100

55. Pumping from ground water. - With the exception of the small supply from Wutchumna Ditch, which has been used only during the latter part of the period covered by the water supply study, the entire farm delivery requirement for the district is obtained by pumping from ground water. During the period 1922-47, the average quantity pumped has been 16,200 acre-feet annually. The annual quantity has varied to some extent according to the amount of precipitation and the storm pattern from year to year, but increased with the increase in irrigated area from an average of 12,900 acre-feet in 1922-24 to 22,400 acre-feet during 1945-47.

56. Specific capacity, yield, and cost of pumping. - Pump tests on a considerable number of wells in recent years show variations which are partly accounted for by differences in dates of testing, efficiency of equipment and efficiency of rate of pumping. Also part of the area is underlain at shallow depths by basement rocks and specific yield of materials is not uniform throughout the district. Specific capacity of wells located in the area of shallow cover is limited and decreases as

the water table lowers. At present, average yields vary from 505 gpm in the better pumping areas to 257 gpm in the poorer areas. Corresponding specific capacities are 58.5 to 22.9 gpm per foot of drawdown.

57. Using pump test data available and applying drawdown indicated by averages of specific capacity in different parts of the district, an estimate was made of pumping costs for average 1947 water-table conditions. The cost per acre-foot varied from about \$3.00 to \$5.25.

58. Ground-water recharge. - Overdraft being much less than net use of pumped water in the district, there obviously is recharge to the ground water underlying the district. This recharge is derived from underground percolation from Kaweah River sources to the east and south; percolation from Cottonwood Creek and the Martin Ranch area on the east and north; and seepage from Wutchumna Ditch.

59. The period 1936-47, in which water-table slopes into the district remained well developed, probably represents optimum recharge conditions. Recharge during this period varied between 9,300 acre-feet and 14,600 acre-feet annually, and averaged 12,800 acre-feet.

60. Summary of annual use and supply. - During the period 1936-47 consumptive use in the district has averaged 17,600 acre-feet annually. The supply is estimated as follows: Effective precipitation, 3,600 acre-feet; surface supply, 900 acre-feet; ground-water recharge 12,800 acre-feet; and quantity withdrawn from ground water, 300 acre-feet; total 17,600 acre-feet.

61. Quality of water. - Quality of the runoff from Kaweah River, which supplies the greater portion of the ground and surface supply to the district, is very good. Cottonwood Creek, which contributes a small quantity to the ground-water supply, has a slightly higher content of

dissolved solids, but is also very good water. Analyses of 59 samples in or near the district showed an average of 317 parts per million of total solids by evaporation, ranging from 85 to 530 ppm.

62. Water management plan for district. - Although the water supply contract with the district stipulates a definite quantity of Class 1 water and a maximum and minimum quantity of Class 2 water, this stipulation does not go into effect until after the initial 5-year period. During the initial period the district may receive in any year whatever quantity of water it applies for up to the maximum in each class. Upon completion of the 5-year period, and during the next 10 years after that period, whatever quantity of water between the maximum and minimum is decided upon at end of the 5-year period will be paid for by the district each year. This quantity can be increased by the district up to the maximum from year to year. It can also decrease the quantity by agreement with the government.

63. At end of the 10-year period, or 15 years after the first delivery of Friant-Kern water, the district will be required to exercise its option for the maximum quantity or decide upon the actual quantity required from that time on. Purpose of these periods is to allow the district sufficient time for development of all its irrigable land and to observe the effects of a supplemental water supply on water-table conditions.

64. Supplemental water supply. - The purpose of furnishing a supplemental water supply to the district is to eliminate overdraft and to maintain reasonable well yields and pumping levels. In order to maintain optimum natural supply and to prevent excessive outflow of

percolating water to the west, it is desirable to maintain water-table conditions similar to those prevailing in 1936-47, with an average mean depth to water of 55 feet in the district, with a cyclic fluctuation of about 10 feet.

65. Delivery of water under operating conditions is planned for 1952. Under 1947 conditions, 10,000 acre-feet of water were needed to replenish ground water to a mean depth of 55 feet. Under normal runoff, average overdraft 1948-52 will be 7,000 acre-feet a year. Thus a total of about 45,000 acre-feet will be needed to bring the water table to depth of 55 feet by 1952.

66. It has been determined that the use of Class 2 water in the district will not be practical after the water table has been restored to optimum levels, so long as present water management practices are followed in and adjacent to the district. The Class 2 water to be supplied will be available for use prior to 1952 and also during the initial 5-year period for attaining desired water-table conditions. It is also proposed that a contingent supply of Class 2 water be made available to the district to be used if required by future changes in ground-water conditions. Such changes might be brought about, for instance, by changes in the regime of the Wutchumna Ditch and changes in water management practices in the area north and east of the district.

67. Initial supplemental supply is intended to replenish the water table to a mean depth of 55 feet if a deficiency exists at that time and to furnish the difference between average annual use and natural supply.

68. Ultimate supplemental supply is intended to supply only the

difference between consumptive use of crops and the optimum natural supply that can be developed by the district.

69. Pumping requirements. - Pumping load in the district, whether done by the district or by individuals, will be equal to the farm delivery requirement that is not satisfied by surface supply and rainfall. Ultimate average annual pumping under the present ground-water regime is 17,800 acre-feet, with maximum monthly requirement of 2,310 acre-feet.

70. Monthly demand schedule. - Tables 3, 4, and 5 present schedules covering the possible contingencies that may have to be met under initial or ultimate conditions. Table 3 assumes that ground-water replenishment is completed before 1952 and that average supply from percolation and seepage continue as they are at present. Under ultimate conditions, the maximum demand is 2,850 acre-feet of Friant-Kern water in June and maximum pumping capacity required is 2,710 acre-feet in September in years when average surface supply is available. In years with no surface supply, maximum pumping would be 2,920 acre-feet in May. Table 4 assumes present ground-water regime and maximum supply in order to replenish any ground-water deficiency at a maximum rate. Maximum average Friant-Kern water is 3,340 acre-feet in June. Maximum average pumping is 2,090 acre-feet in September. Ground-water replenishment would average 5,000 acre-feet annually. Table 5 assumes that under ultimate conditions the district will have to use all of the contingent Class 2 supply because of changes affecting the annual supply. Maximum average Friant-Kern supplemental supply would be 3,130 acre-feet in June. Maximum average monthly pumping would be 2,840 acre-feet in May.

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TABLE 3-3-~~306~~ Estimated 1952 and ultimate monthly demand. Present ground-water regime
and no ground-water replenishment

Month	1952					Ultimate				
	:Pot. of farm : del. req. :	Total : req. :	Surface : supply :	Class : l :	Pump :	:Pct. of farm : del. req. :	Total : req. :	Surface : supply :	Class : l :	Pumping demand
	%		Acre-feet			%		Acre-feet		
Jan.	.10	20	50 (a)	-	-	.11	30	50	-	-
Feb.	.47	110	80	-	30	.25	70	80	-	-
March	6.82	1,610	160	-	1,450	6.35	1,710	160	-	1,550
April	9.36	2,220	260	-	1,960	8.81	2,380	260	-	2,120
May	12.07	2,860	340	190	2,330	12.44	3,360	340	440	2,580
June	19.28	4,560	300	2,500	1,680	19.53	5,270	300	2,850	2,120
July	17.40	4,120	130	2,140	1,850	17.31	4,670	130	2,280	2,260
Aug.	16.67	3,950	40	1,990	1,920	16.59	4,480	40	2,130	2,310
Sept.	10.04	2,370	30	-	2,340	10.16	2,740	30	-	2,710
Oct.	5.59	1,330	40	-	1,290	6.00	1,620	40	-	1,580
Nov.	1.70	400	30	-	370	1.91	520	30	-	490
Dec.	.50	120	40	-	80	.54	150	40	-	110
TOTAL	100.0	23,670	1,500(a)	6,900	15,300(b)	100.0	27,000	1,500(a)	7,700	17,830(b)

(a) Excess supply available 30 ac.-ft.

(b) Less excess supply

TABLE ~~422~~⁴ Estimated 1952 monthly demand. Present ground-water regime and ground-water replenishment at maximum rate

Month	: Percent of	:	:	:	Supplemental supply		
	: farm delivery	:	Total	: Surface	:	: Average	: Pump
	: requirement	:	requirement	: supply	:	Class 1 : class 2	: average
	%			Acre-foot			
Jan.	.10		20	50 ^(a)	-	-	-
Feb.	.47		110	80	-	30	-
Mar.	6.82		1,610	160	-	910	540
April	9.36		2,220	260	-	920	1,040
May	12.07		2,860	340	-	920	1,600
June	19.28		4,560	300	2,420	920	920
July	17.40		4,120	130	2,620	-	1,370
Aug.	16.67		3,950	40	2,410	-	1,500
Sept.	10.04		2,370	30	250	-	2,090
Oct.	5.59		1,330	40	-	-	1,290
Nov.	1.70		400	30	-	-	370
Dec.	.50		120	40	-	-	80
TOTAL	100.00		23,670	1,500	7,700	3,700	10,800

(a) Excess supply available 30 acre-feet.

TABLE 5
42- Estimated ultimate monthly demand. Reduced ground-water supply replaced by Class 2 water.

Month	: Pct. of farm : del. req. %	: Total : req.	: Surface : supply	: Supplemental supply		: Net pumping		
				Class 1	Class 2 Avg (b)	Average	Max.	Min.
				Acre-feet				
Jan.	.11	30	30	-	-	-	-	-
Feb.	.25	70	110 ^(a)	-	-	-	-	-
Mar.	6.35	1,710	160	-	920	630	1,550	-
Apr.	8.81	2,380	290	-	930	1,160	2,090	100
May	12.44	3,360	520	-	930	1,910	2,840	560
June	19.53	5,270	340	2,210	920	1,800	2,720	760
July	17.31	4,670	20	2,710	-	1,940	1,940	1,940
Aug.	16.59	4,480	-	2,480	-	2,000	2,000	2,000
Sept.	10.16	2,740	-	300	-	2,440	2,440	2,440
Oct.	6.00	1,620	-	-	-	1,620	1,620	1,620
Nov.	1.91	520	10	-	-	510	510	510
Dec.	.54	150	20	-	-	130	130	130
TOTAL	100.00	27,000	1,500 ^(a)	7,700	3,700 ^(c)	14,100	17,800	9,920

- (a) Excess supply 40 ac.-ft.
(b) Maximum 1,960 and 1,980 ac.-ft.
(c) Contractual 7,900 ac.-ft.

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IRRIGATION IMPROVEMENTS

71. Existing irrigation system. - Irrigation in the district at present is accomplished by farmer-owned facilities, usually a pumping plant and a closed pipe system. The pumping plant is commonly electrically driven.

72. Planned irrigation system. - A preliminary design layout and cost estimate have been made for a lateral distribution system to serve the Ivanhoe Irrigation District with water from the Friant-Kern Canal. Layout of the distribution system is shown on Plate 4. The system as designed will consist of about 48 miles of concrete pipe, with three main gravity laterals running west from the Friant-Kern Canal. In each main gravity lateral a low head lift pump is provided for irrigating land that cannot be reached by gravity flow. Sublaterals will run north and south from the main laterals at half-mile intervals, with service outlets to each farm ownership of 5 acres or more.

73. C118 standard concrete irrigation pipe is assumed for use in all pipe lines under heads not exceeding 20 feet and in sizes ranging from 8 inches to and including 24 inches in diameter. Reinforced concrete pipe is used in lines with heads greater than 20 feet regardless of size and in all lines of 24 inches in diameter and larger. The system as designed will require 252,360 lineal feet of pipe, in sizes ranging from 8 inches to 54 inches in diameter.

74. Depth of water in the Friant-Kern Canal is assumed to be 10 feet minimum for hydraulic gradient determinations. Line capacities over the entire system are based on 1 cfs per 100 acres, with minimum capacity of 0.5 cfs and maximum of 2 cfs under 5 feet of head at all

farm service outlets. Outlets are placed at the highest elevation along property lines where feasible. Main laterals are designed for 20 feet of head. Sublateral heads vary from 20 feet at main lateral junction boxes to 5 feet at farm service outlets.

75. A balancing reservoir with capacity to hold, if necessary, an 8-hour peak flow of four farm service outlets, will serve as a regulator for each main lateral. Low head flow line recording meters are provided in the design for each sublateral leading off a main lateral. A Fresno type flow meter with tubing for manometer connection is provided for each farm service outlet.

76. Cost of planned irrigation system. - Estimated capital cost of the system as designed is \$1,589,807. This represents an average cost of \$143.01 per acre for the district's gross area of 11,117 acres, or \$149.88 per acre for the assessable area of 10,607 acres as determined by the district. Based on a 40-year repayment period without interest, the annual payment to be made by the district will be \$39,745 or \$3.75 per acre on the assessable area. On the basis of the ultimate net irrigable area of 9,968 acres, repayment costs for the distribution system will be \$3.99 per acre per year.

77. Annual costs to wateruser. - Estimated annual costs to the wateruser for supplemental water, pumping from ground water, distribution system repayment, and operation and maintenance, are shown

in the following tabulation:

Cost item	: Cost per acre per year		
	:Gross area:	Assessable area:	Ult.irrig.area
	:11,117 ac.:	10,607 ac.	: 9,968 ac.
	\$	\$	\$
CVP water, 7,700 a.f. at \$3.50	5.64	5.91	6.29
Pumping, 19,300 a.f. at \$3.25(a)	2.42	2.54	2.70
Dist. system repayment	3.58	3.75	3.99
Operation and maintenance	3.16	3.31	3.52
Total	14.80	15.51	16.50
Cost per acre-foot(b)	5.46	5.72	6.09

(a) Includes 1,500 ac.-ft. annual surface supply from Mutchumna Ditch which may be lost to district by future developments.

(b) At 2.71 acre-feet farm delivery requirement per year.

PAYMENT CAPACITY

78. Payment capacity defined. - Payment capacity is defined as the maximum amount of farm income estimated to be available to the water user annually over the period for which the contract will be in effect to meet all water costs after satisfying certain priority claims on gross farm income, including: Cash farm operating or production costs, except for water, and including normal replacement or depreciation costs for capital goods and equipment; costs necessary to retain the farm, such as taxes and debt service payments; and a net amount equivalent to \$1,600 at 1939-44 price levels, or \$2,300 at present prices, as a family living allowance.

79. In determining payment capacity of the Ivanhoe Irrigation District, all important considerations involved in approved methods of farm management studies have been taken into account. Analyses were developed on a crop budget basis for the more important crops, which in turn were

considered representative of costs and returns for other crops in the same general category. Analyses made on this basis are supported by representative farm budget analyses for typical crop combinations prevailing or expected to prevail for farm units in the area.

80. Types of farming-cultural practices. - Irrigation farming in the district has been confined largely to specialty crop combinations or individual crop enterprises. Principal crops now grown in the district include: Grapes (mostly Red Emperor table grapes); citrus fruit (mostly navel oranges); deciduous fruits (plums, figs and peaches); olives; milo maize; grain; and grain hay. Double-cropping is practiced on about 200 acres at present, but this has been reduced to 100 acres in the ultimate estimated crop pattern because the percentage of permanent crops is expected to be higher. If unfavorable price relationships prevail with respect to citrus and grapes, a greater diversification of farming may take place, but the present high investment in groves and vineyards makes such a change unlikely.

81. Modal size of farms. - A study was made to determine the most typical size of full-time farm in the district. As is to be expected where grapes and citrus are the predominant crops, a large proportion of the operating units at Ivanhoe are 20 acres or less in area, 28 percent being 10 acres or less, and an additional 26 percent being from 11 to 20 acres. The total area of these small units, however, represents only 49 percent of the total area of the district. For the remaining 81 percent of the district, it was determined that a modal size of 40 acres prevails for grapes, citrus, deciduous fruits, olives, field crops, and irrigated pasture, while for truck crops the modal size is 20 acres.

On many farms, of course, several of these crops are grown in combination.

82. Crop yields and gross income. - Gross crop income from 8,865 acres irrigated in 1946 at 1939-44 crop prices revised for market outlook was \$2,438,507.66, or \$275.12 per acre. Of this, grapes accounted for \$964,400 and citrus \$783,200. Using the same crop yields and prices for the 9,968 acres expected to be irrigated under ultimate development, total gross income is \$3,155,930.44, or \$307.16 an acre. Of this total, grapes represent gross income of \$1,230,000 and citrus \$1,045,000. These figures are shown in Table 6. Unit income values shown in this table are based on average prices received by California farmers for the years 1939-44, inclusive, revised for certain crops to reflect long-term market outlook.

83. In adjusting the 1939-44 average prices where market outlook studies indicated such an adjustment to be desirable the base price of table and wine grapes was reduced by 30 percent and raisin varieties by 25 percent. For navel oranges the 1939-44 price was reduced by 20 percent. For navel oranges the 1939-44 price was reduced by 20 percent, for Valencia oranges by 30 percent, and for plums by 10 percent. For alfalfa hay the 1939-44 price was increased \$1.00 per ton to reflect the premium prices paid for quality hay raised in this area.

84. Selection of the 1939-44 period as a base for forecasting average agricultural prices to be received during the contract's effective period was made after consultation with and agreement by qualified officials of the Department of Agriculture and the Bureau of Reclamation. During that period, average agricultural prices in the United States were about 44 percent above the average that prevailed during the period 1910-14, which was used for determining parity prices,

TABLE 6 - Present and ultimate crop yields and values using 1939-44 crop prices revised for market outlook

Crops	Net area		Unit	Yield		Value per unit		Value per acre		Total value (a)	
	1946	Ultimate		Present	Ultimate	Present	Ultimate	Present	Ultimate	Present	Ultimate
	Ac.	Ac.				\$	\$	\$	\$	\$	\$
<u>Irrigated</u>											
Irrigated pasture	123	150	Ton equivalent	5.5	5.5	18.07	18.07	99.38	99.38	12,223.74	14,907.00
Field crops	1,083 (b)	418 (c)	ton	2.1	2.7	27.68	21.96	58.13	59.30	62,954.64	24,788.76
Truck crops	600	700	lb.	14,000	12,900	.0380	.0422	531.31	543.10	318,786.00	380,170.00
Grapes	3,889	4,400	ton	6.1	6.9	40.65	40.51	247.98	279.51	964,394.22	1,229,844.00
Citrus fruits	2,424	3,000	pkd. box	213	229	1.52	1.52	323.12	348.27	783,242.88	1,044,810.00
Deciduous fruits	748	1,100	ton	4.8	4.8	67.81	68.03	325.50	326.54	243,474.00	359,194.00
Olives	198	300	ton	1.92	2.40	141.87	141.87	271.91	340.72	53,838.18	102,216.68
Total irrigated	8,865 (d)	9,968 (d)						275.12	316.61	2,438,913.66	3,155,930.44
Total non-irrigated	996	-						2.55	-	2,525.94	-
Total cropped area	9,861 (d)	9,968 (d)						273.11	307.16	2,691,507.66	3,155,930.44

- (a) Total value is equivalent to gross crop income
 (b) Includes 200 acres double cropped
 (c) Includes 100 acres double cropped
 (d) Those are net acres

and prices for various major crops grown on irrigated land were in a fairly normal relationship to one another.

85. Crop yields by land class. - Consideration was given to yields by land class to determine whether separate analyses of payment capacity by land class was warranted. It was determined that there was no measurable difference in yields that could be attributed to differences in land classes. All evidence points to the fact that proper soil management of lower classed lands, after leveling, grading, subsoiling, and other required reclamation work has been done, erases the measurable differences in ability of the lands to produce.

86. Production costs. - Determinations of all costs of farming operations, including cultural, harvesting, material, interest (debt service), state and county tax costs, etc., were based generally on favorably accepted studies and other data developed by R. L. Adams, L. W. Fluharty, and A. Shultis, of the University of California, and from county officials and agricultural credit agencies in the area. Appropriate adjustment of cost factors used in their studies was made to equate these factors to the 1939-44 price-cost base. Adaptations and adjustments also were made in order to reflect known and observed local conditions and types of farming operations.

87. Capital costs. - (a) Land. - Capital costs assigned to various major crops were determined after careful investigation. Values used were those that prevailed in the period 1939-44, and include land (and trees or vines), farm buildings (existing farmstead), and improvements. These range from \$1,050 for Valencia oranges to \$250 for truck crops, field crops, or irrigated pasture.

(b) Machinery and equipment. - Analysis was made of equipment necessary under reasonable management for each crop enterprise studied. Prices used were those of 1939-44, depreciated 50 percent.

(c) Farm irrigation system - A closed pipe system of water distribution was included among the capital costs on which interest was calculated for orchard and vine crops. Truck and field crops are irrigated by open ditches, so this capital cost item is not included for these crops.

(d) Assessed valuation. - In determining the portion of capital costs attributable to state and county taxes, the 1948 average assessed valuations were used, and it was found that these represent 15.6 percent of present land values. Weighted average assessed valuation of land, buildings, improvements, and equipment for all irrigated land in the district is about \$152 per acre. Assessments for all irrigated land is \$57.40 per acre, regardless of land class. Average assessments for farm buildings, fences, pumps, pipe lines, and improvements are \$27.00 per acre. For farm machinery and equipment, assessments averaged \$10.00 per acre. Assessments for all these items totaled \$94.40. In addition, assessments of \$110.00 per acre were made on citrus land, \$65.00 on grapes, \$100.00 on olives, \$50.00 on peaches, \$65.00 on plums, \$45.00 on figs, and \$10.00 on alfalfa and irrigated pasture. Average tax rate for seven school districts in the area was \$5.87 per \$100 of assessed valuation. In addition, for citrus there is an added tax rate for red scale protection which averages \$0.39 per \$100 of valuation, assessed against growing improvements only. This adds \$0.43 per acre to the regular taxes on citrus. Taxes range from \$12.33 per acre for citrus fruits to \$6.08 for alfalfa and irrigated pasture.

(e) Interest on farm mortgage indebtedness. - An interest rate of 3 percent has been applied to the average investment in land, buildings, farm machinery and equipment. This item has been deducted from gross crop income of the various crops.

(f) Miscellaneous costs. - An additional cost item has been included in each crop enterprise, amounting to 5 percent of the total of all other costs to cover unspecified expense items such as compensation insurance, incidental electric power, and unforeseen contingencies.

88. Farm family living exemption. - In determining the payment capacity of water users, after all costs incidental to the operation and retention of the farm have been deducted from the gross income, \$1,600 is allowed as a farm family living exemption. As are all other costs in this study, this is based on 1939-44 prices. It is intended to indicate the point at which the average farm family begins to lay aside from its net income, savings in such form as life insurance, savings deposits, etc. It is not a maximum amount available for family living, but simply represents a minimum family living exemption which the Bureau of Reclamation recognizes prior to the payment of water costs.

89. Payment capacity, pre-project. - For the 8,865 net irrigated acres now being farmed in the district, the weighted average annual payment capacity is \$77.84 per acre, representing a total payment capacity of \$690,152. Average gross income for all crops at 1939-44 prices is estimated at \$275.12 per acre, while average farm costs are \$197.28 per acre.

90. Payment capacity, ultimate. - For the 9,968 irrigated acres anticipated under ultimate development, weighted average annual payment capacity is estimated at \$99.19 per acre, or a total for the district of \$988,735. These are increases of \$22 and \$298,583 over present per-acre and total payment capacities, respectively. This is due largely to the projected smaller nonbearing acreages of fruit, grapes, and olives and reduced acreages of low income field crops under conditions of ultimate development.

91. Comparison of water costs and payment capacity. - Under ultimate conditions, costs of water on a net irrigable area basis are expected to average \$16.50 per acre per year, or \$6.09 per acre-foot, based on the ultimate farm delivery requirement of 2.71 acre-feet per acre. Estimated payment capacity for the entire district of \$99.19 per acre gives ample assurance of the ability of the waterusers to pay this expected cost. It is concluded, therefore, that justification exists for furnishing a supplemental water supply to, and constructing a distribution system for, the Ivanhoe Irrigation District.

P L A T E S

Plate 1	Ivanhoe Irrigation District and Vicinity
Plate 2	Land Classification
Plate 3	1946 Crop Map
Plate 4	Distribution System Preliminary Layout

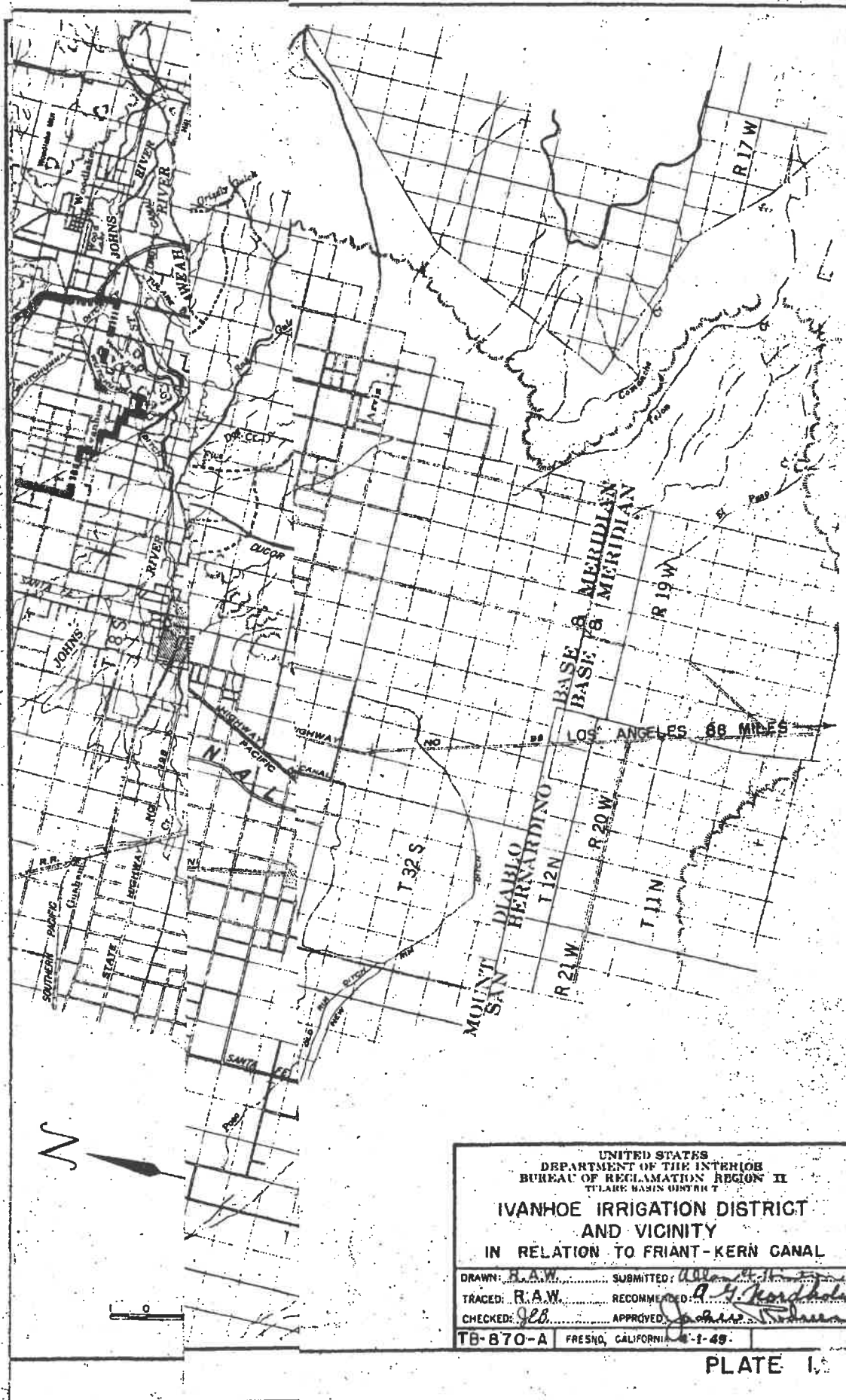
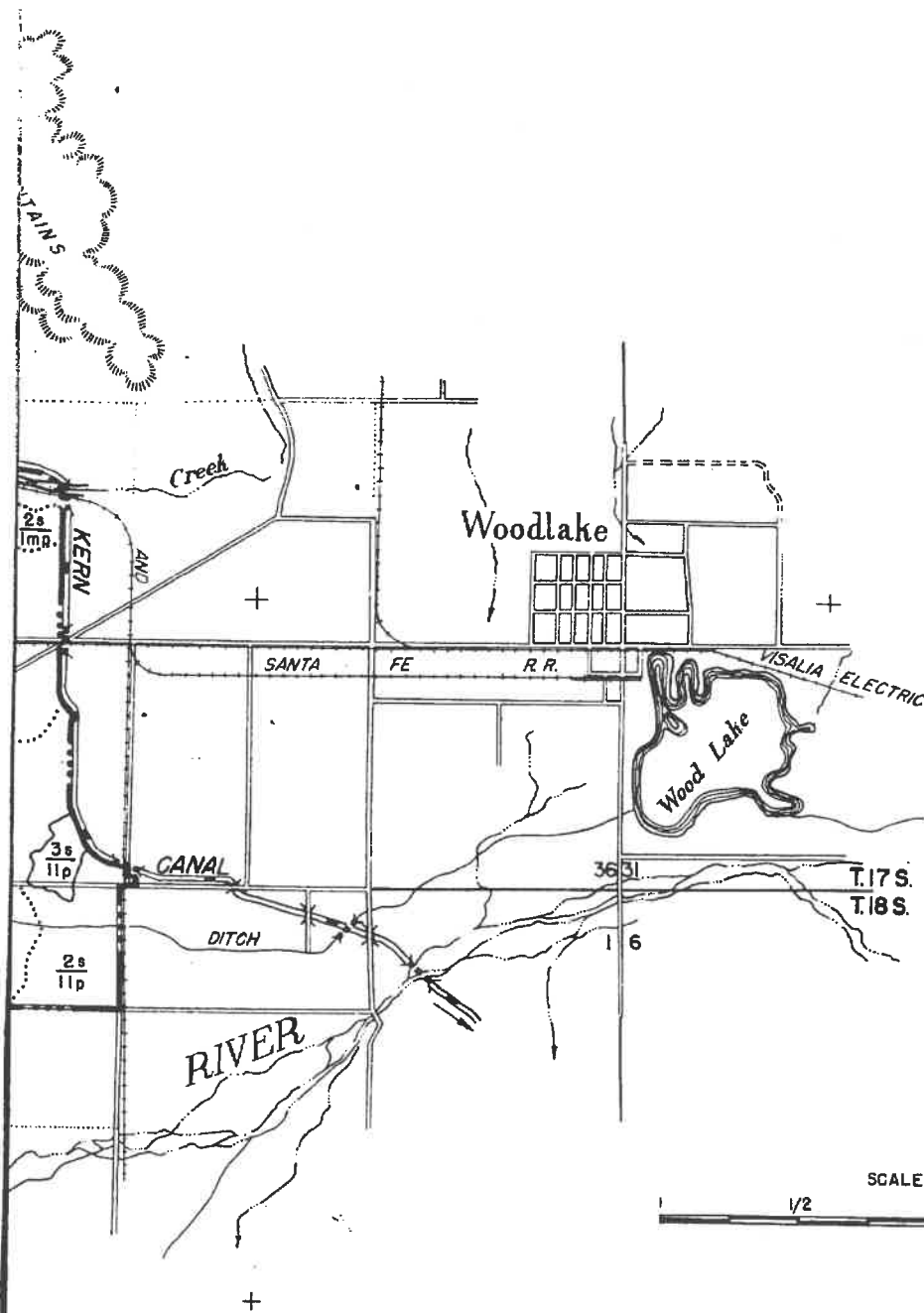


PLATE I

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UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION REGION II TULARE BASIN DISTRICT			
IVANHOE IRRIGATION DISTRICT LAND CLASSIFICATION			
DRAWN: L. J. M.	SUBMITTED: <i>[Signature]</i>		
TRACED: L. J. M.	RECOMMENDED: <i>[Signature]</i>		
CHECKED: <i>[Signature]</i>	APPROVED: <i>[Signature]</i>		
TB 1061 - B	FRESNO, CALIFORNIA	2-9-48	

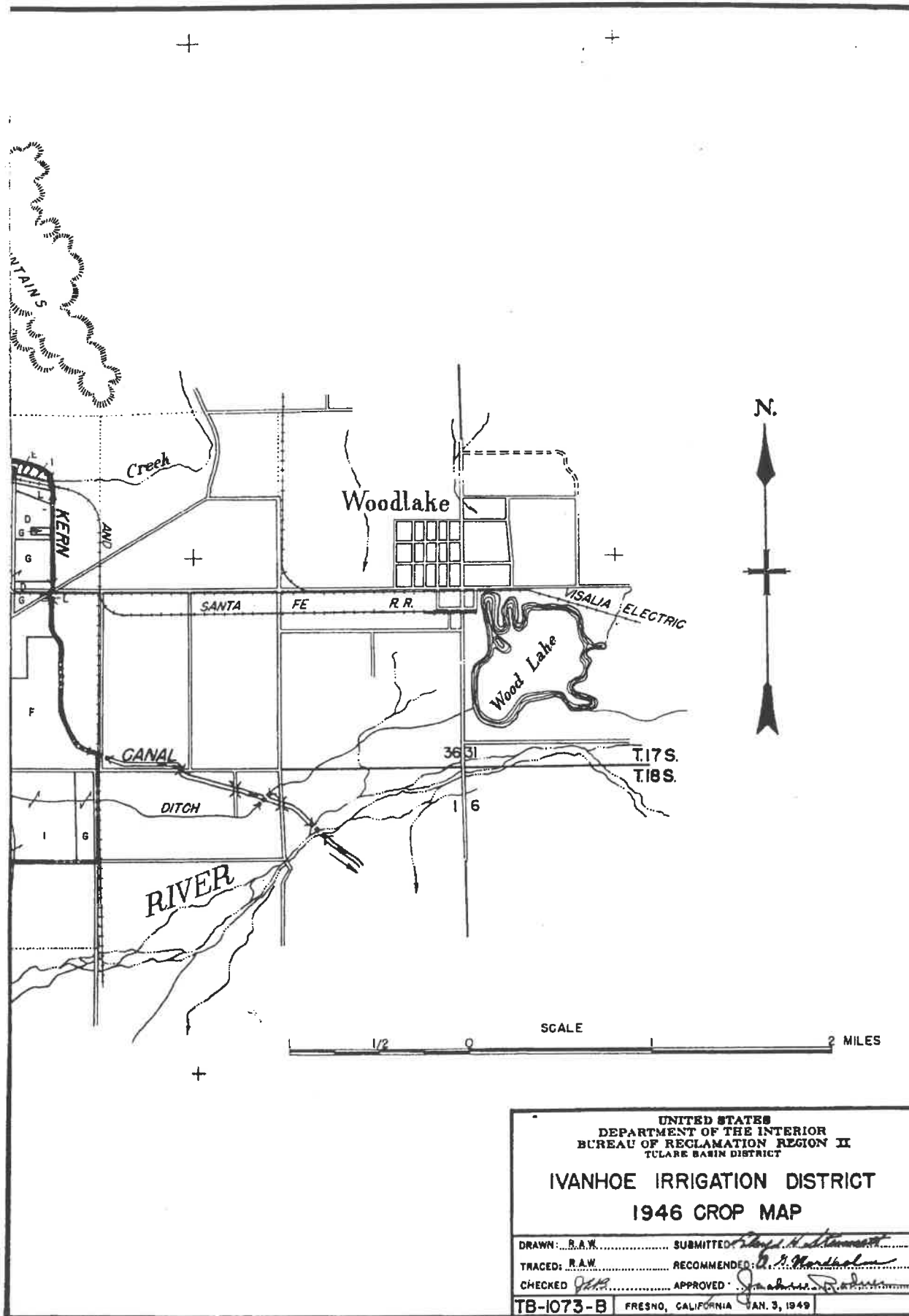


PLATE 3

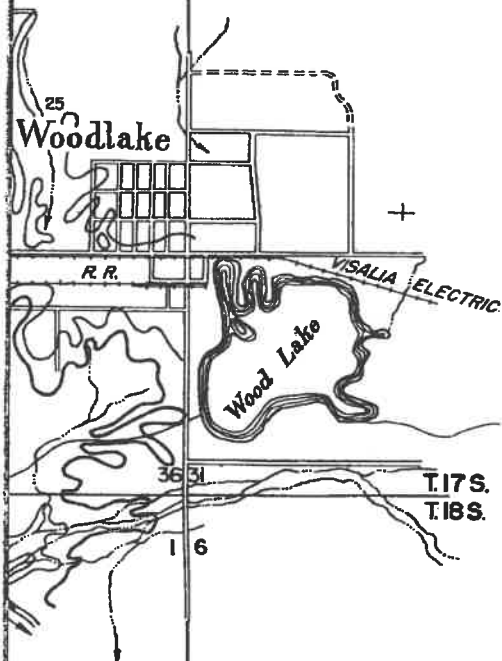
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EXPLANATION

- Ivanhoe Irrigation District Boundary
- Friant-Kern Canal
- Pump
- H Static Lift in Feet
- Q Capacity in Cubic Feet Per Second
- Reservoir
- 2.7 3.0 Former Service Outlets Numerals Indicate Flow In C.F.S. (Indicated on Main Laterals Only)

3637+33
LATERAL 68.9
Q=46.7

R.26E. R.27E.



STA. 3684+40
LATERAL 69.8
Q=46.7

SCALE 2 MILES

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION REGION II
TULARE BASIN DISTRICT

IVANHOE IRRIGATION DISTRICT DISTRIBUTION SYSTEM PRELIMINARY LAYOUT

DRAWN: H.N.B. SUBMITTED: *[Signature]*
TRACED: R.A.W. RECOMMENDED: *[Signature]*
CHECKED: *[Signature]* APPROVED: *[Signature]*

TB-868-B FRESNO, CALIFORNIA 4-49

PLATE 4

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