January 7, 1953

FEATHER-YUBA PROJECT

WATER DEMAND

To the Yuba County Water Board

and

To the Board of Directors of

Yuba County Water District

Gentlemen:

The Foothill Area between the Feather and Yuba Rivers above Elevation 150 has been classified as to suitability for growing irrigated crops, by the State Division of Water Resources.

The classification was made by counties. A LAND CLASSIFICATION MAP has been prepared for the proposed Feather-Yuba Project by tracing the classifications in colors from the two separate Butte & Yuba County maps. This color map is mounted on a cardboard and is available for use, if desired, in public meetings.

For reproduction purposes, and for the application of Service Areas, a tracing of the composite color map was made with the total Irrigable Land shaded. The total irrigable land has been planimetered by service areas. The result of the planimetering is shown on Table 1, Ultimate Water Demand.

The State Office estimated that the average consumptive use of the various crops which might be grown in the Foothill Area

would be 25.3 inches in depth per acre cultivated. It was also assumed that such consumptive use should represent 80% of the water applied in irrigation. The average consumptive use would vary with altitude, from as much as 30" depth at the edge of the Valley to 20" at the upper limit of cultivation. It was also assumed that as much as 80% of all the land classified as irrigable might ultimately demand water. These data were used in estimating the ultimate water demand in Table 1.

After discussion with the Yuba County Farm Advisor and the directors of the Yuba County Water District it was estimated that the present demand for water in the higher service areas for which the water must be diverted from the Power Stream above one or both of the proposed power plants is not likely to exceed 25% of the possible ultimate demand for a long enough period to warrant the installation of power generators to utilize the remaining portion of the water which may ultimately be demanded above the power houses, and that if a greater demand should develop sooner the value of the water for irrigation could equal the amount of revenue obtainable for power, so that the repayment of revenue bonds would not be impaired. Table 2 shows an estimated probable initial water demand.

Table 3 covers the necessary diversions for supplying existing water uses and 25% of the remaining estimated ultimate water demand for the higher service areas and a greater amount for the lower areas. Below the Honcut Power House the amount of water available from the Power Stream during the irrigation

season will supply the estimated initial demand with the Honcut Reservoir dam built only high enough to act as an afterbay. At any time when the irrigation demand warrants doing so, the entire winter flow of the power stream below the Honcut Power House may be made available for irrigation by increasing the storage capacity of Honcut Reservoir, without diminishing the power revenue of the system. All the power generated under this "Minimum Project" would be Prime Power & remain so, with no steam plant required.

The locations, elevations and canal capacities will be indicated on prints from tracings of the various U.S.G.S. Quadrangle Maps involved. These tracings show the section lines, the main roads and streams. From these prints the canals may be transferred to U.S.G.S. Quadrangle Maps by any one interested in their own particular locality.

Whether or not the ultimate water demand for the Feather-Yuba Foothill Area will follow the pattern of the Land Classification Map, only time can tell. However that classification covering the entire area and made by a public agency of the State is certainly the best available relative measure of the ultimate needs of the various service areas.

Table 1 indicates this relative need for water by the two counties involved is as follows:

Butte County	70,600 A.F.
Yuba County	95,500 A.F.
Total	166,100 A.F.

Analyses of U.S.G.S. Water supply records and a preliminary estimate of the dependable and available dry period water supply (1929-34) indicate that there is available from the sources used in the "Minimum Project" now under consideration and the local foothill drainage areas the following dependable water supply.

From high level sources sufficient for the needs of the Clipper Mills Service Area	7,400 A.F.
From the "Minimum Project"	161,200 A.F.
From the Honcut Drainage Area	10,000 A.F.
From French Dry Creek Drainage Area	30,000 A.F.
Total	208,600 A.F.

There is yet to be studied the economic advisability of adding a possible 11,800 A.F. from Fall River and South Branch of Middle Fork which was suggested in the State Water Plan. Also the economic advisability of building an Indian Valley Reservoir on North Yuba, suggested by private interests some years ago. Such a reservoir could supply the water demand of the existing P.G.&E Power Plants on the Yuba River and permit the diversion of the low water flows of Canyon Creek and Slate Creek thru the Feather-Yuba Project. That would increase the flow thru the Power Stream by about 40,000 A.F. thru the 1929-34 dry period.

Respectfully submitted,

E. A. Bailey
Consulting Engineer

EAB:jf

A

REPORT OF THE

IRRIGATION

AND

HYDRO-ELECTRIC POTENTALITIES

OF

UPPER YUBA AND BUTTE COUNTIES

PREPARED FOR THE

YUBA COUNTY WATER DISTRICT

BOARD OF DIRECTORS

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JANUARY 1953

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SECTION 1. INTRODUCTION.

AUTHORIZATION & HISTORY: This report presents the results of a preliminary investigation and study of the feasibility of constructing a combined irrigation and power development project in Upper Yuba and Butte Counties for the benefit of both Yuba and Butte Counties and the people residing therein. This investigation and study was made at the request of the Yuba County Water District.

The general idea of such a development is not new. The California State Engineer and his representatives have made extensive studies of the water resources and land use possibilities in this area and have formed a general plan of the ultimate possibilities of such a development. The Oroville-Wyandotte Irrigation District has spent considerable money, time and effort in the investigation of a power project that would utilize much of the water resources of the area and would benefit the Oroville-Wyandotte water users in lower Butte County. The services of an excellent consulting engineer were retained for this investigation and comprehensive report was issued in November of 1950. This latter project has now reached an advanced planning stage.

The U. S. Bureau of Reclamation has made preliminary investigations of the watersheds with which we are concerned in conjunction with the Central Valley Project, Feather River Division - Wyandotte Unit. Although these investigations were

preliminary in nature, a reconnaissance geology report of the damsites herein considered, prepared by Geologist R. L. Gamer in 1949, has proved helpful in this investigation.

A brief history of general water development in Yuba County is as follows:

The farm bureau was organized in Yuba County in 1918. William Harrison was appointed as farm advisor on a cooperative basis with the University of California, U. S. Department of Agriculture and Yuba County. In Mr. Harrison's annual report of December 1918, he reported to the University that farmers of the county felt the need for more irrigation water and more irrigated crops for satisfactory economy in the county. Secretary Lane was contacted and a request made that the U. S. Department of Interior and Reclamation Bureau make a survey of possible increase in irrigation water and water storage in the mountains. At that time the bureau had no funds allotted for this work. The 1919 census showed 20,773 acres under irrigation in Yuba County. The area of Yuba County is reported as 408,000 acres, this meaning approximately five percent of the county was under irrigation. At various times through the years, the matter of Irrigation water was taken up with committees and estimates made of possible reservoir sites, but no definite action taken.

In 1938, a program of work meeting was held in Marysville with 44 leading men in the county attending. This group included bankers, businessmen, farmers and representatives of

governmental agencies. The entire day was spent in analyzing total possibilities of Yuba County in working out a long-time plan for development. One of the most important subjects placed on the program was a long-time study of all possible sources of irrigation water which could be developed for use in Yuba County. Assistance was given the committee by the U. S. Department of Agriculture Bureau of Agricultural Economics with headquarters in Berkeley. J. Winter Smith, irrigation engineer for the Bureau of Agricultural Economics, made many trips to Yuba County and spent considerable time in going through the mountain area to investigate possible sources of water storage. In a preliminary report by J. Winter Smith, he stated that further study should be made of the areas known as the Yuba-Butte Ridge, including Little Grass Valley, Lost Creek, Sly Creek, New York Flat, French Dry Creek, Honcut and other areas. Mr. Smith reported possibilities that reasonably priced irrigation water could be stored in these areas.

Each year at the annual program of work conference for the farmers of Yuba County, the program of water studies and development was one of the important subjects of the annual program of work. Information was secured from various sources, such as U. S. Bureau of Reclamation, State Division of Water Resources, private engineers, the U. S. Bureau of Agricultural Economics and various other sources for information. This information was compiled and a preliminary study made of thirteen reservoir sites, the data largely being preliminary from governmental sources.

The Yuba County Farm Bureau appointed a committee of 23 to make an active study of the water situation in the early 40's and the Chamber of Commerce of Marysville appointed a committee. Later the Yuba County Board of Supervisors appointed an irrigation investigational committee of five from each supervisorial district--a total of 25 persons. These committees worked together in trying to formulate a plan, under the General chairmanship of Frank Harding, who devoted a great deal of time and effort to the work. Yuba County Farm Advisor, Merl D. Collins was a constant advisor to the Committee.

By 1948 the committees had made a decision that the committee should file on water sufficient to handle considerable area. The investigation suggested that approximately half of the county could possibly be irrigated. The program was set up to endeavor to get between 50,000 and 60,000 acres under irrigation within ten years and to continue on the study and filings on waters until an estimated 150,000 acres might be put under irrigation. This committee later recommended that the Board of Supervisors employ a part-time engineer to begin preliminary studies. Engineer E. A. Bailey was employed in this position and assembled together much of the information that led to the plan selected for study.

In 1951 the committee recommended that the county form a department of water resources and employ a full-time engineer, continuing to retain Mr. E. A. Bailey as its supervisory consultant. This was brought before the Board of Supervisors

and the department established February 1, 1952. The data secured from various sources by this newly formed department was county-wide in nature covering general information for the various projects on which the county had filings and desired further preliminary studies. The information thus obtained clearly indicated that the formation of a district would be necessary to carry on the more detailed studies required to promote and realize a definite project. This was accomplished in June of 1952 with the formation of the Yuba Co. Water District, Mr. E. A. Bailey was then retained as the District's Engineer to work on their specific details along with his county-wide studies for the Yuba County Water Resources Board.

SCOPE: The investigation with which this report is concerned has attempted to devise an economically feasible plan that would conserve the water resources of the area for the ultimate irrigation requirements of the suitable lands in both Butte and Yuba Counties, and that would provide as much power supply as possible in drops through the system. Such a plan would provide a prime power revenue to offset the costs of construction and would provide irrigation water for the initial requirements of lands in upper Butte and Yuba Counties and for lands in lower Butte and Yuba Counties without dependence upon high initial assessments against irrigable land.

SECTION 2. GENERAL CONSIDERATIONS

NEED: The need for such a project has been keenly felt by the people of both counties concerned. The Oroville-Wyandotte Irrigation District has an immediate need for more storage capacity in order to supply the irrigation demand in lower Butte County. The people of Yuba County have a definite need for irrigation water for the development of their irrigable lands. The benefit to the State as a whole would be great. The large increases in population in the last few years have left California with a shortage of power, a shortage of production in dairying industries, and inability to supply the demand for many other agricultural products. Development of this project would be a step toward alleviation of that condition.

The total area of Yuba County is 408,320 acres. The area irrigated as reported by the 1950 census is 39,947 acres. The irrigated acreage is approximately ten percent of the total for the county. Land use surveys indicate that approximately one-half of the land in the county could be irrigated. Preliminary studies of the entire county would indicate a possibility of one-third, or 136,000 acres, which may eventually be successfully irrigated, if water can be secured at a reasonable cost per acre.

Engineering studies by the U. S. Bureau of Reclamation, State Division of Water Resources and the Yuba County Department

of Water Resources, show that winter run-off of rivers and streams in or adjacent to the county, if impounded in reservoirs, would be more than sufficient to irrigate 136,000 acres of land. The major percentage of this land would grow irrigated pasture crops.

The number of people living on farms has shown a small percentage of gain. The population of the incorporated cities has made a small gain, while the small landholders, of approximately one to five acres outside of the cities and not farming, have increased many thousands in numbers. This situation has greatly increased the costs of schools, charities, hospitalization, pensions, law enforcement and many other items in the county budget, with comparatively little increase in assessed valuation of the county. There is definite need of a much larger county valuation to avoid further increases in the tax rate.

AREA COVERED & WATER REQUIREMENT: The Foothill Area between the Feather and Yuba Rivers above Elevation 150 has been classified as to suitability for growing irrigated crops, by the State Division of Water Resources.

A seperate classification was made for each county. A LAND CLASSIFICATION MAP has been prepared, in conjunction with this report for the proposed Feather-Yuba Project, based on the combined classification data of both Yuba and Butte Counties.

The total irrigable land has been computed by service areas. The results of this computation is recorded in Table 1, Ultimate Water Demand.

The State Office estimates that the average consumptive use in the Foothill Area would be 25.3 inches in depth per acre cultivated. Such consumptive use should represent 80% of the water applied in irrigation. The average consumptive use would vary with altitude, from as much as 30" depth at the edge of the Valley to 20" at the upper limit of cultivation. It was assumed that as much as 80% of all the land classified as irrigable might ultimately demand water. This data was used in estimating the ultimate water demand recorded in Table 1.

The ultimate water demand for the Feather-Yuba Foothill Area may not follow the pattern of the Land Classification Map, however, that classification covering the entire area undoubtably gives a fairly reliable overall index to the ultimate demand along with a measure of the ultimate needs of the various service areas.

Table 1 indicates this relative ultimate need for water by the two counties involved is as follows:

Butte County	70,600 A.F.
Yuba County	95,500 A.F.
Total	166,100 A.F.

Analyses of U.S.G.S. water supply records and a preliminary estimate of the dependable and available dry period water supply (1929-34) indicate that there is available from the sources used in the "Minimum Project" now under consideration and the local foothill drainage areas the following dependable water supply:

PHOTOGRAPHS

A

LITTLE GRASS VALLEY DAMSITE

B

LITTLE GRASS VALLEY RESERVOIR

From high level sources sufficient for the needs of the Clipper Mills Service Area	7,400 A.F.
From the "Minimum Project"	161,200 A.F.
From the Honcut Drainage Area	10,000 A.F.
From French Dry Creek Drainage Area	30,000 A.F.
Total	208,600 A.F.

It has been concluded that the demand for water in the higher service areas will not exceed 25% of its ultimate demand for a period sufficiently long enough to amortize the cost of construction. Table 2 shows the estimated initial water demand.

WATERSHED: Studies made by the State Engineer's Office and by the U. S. Bureau of Reclamation indicate the watersheds most able to supply the needs are those of the South Fork of the Feather River and of part of the North Fork of the Yuba River. Topography, yield, and distances have further reduced these possibilities to certain damsites and diversion works, located in such a manner as to make development an economic feasibility. These sites are well known and, as mentioned earlier in this report, much preliminary study of them has been done by others. Detailed descriptions of the rainfall characteristics, type of land in the watersheds, cover, etc., have not been included in this report since excellent material is available in listed references for these descriptions.

POWER DEMAND: There is at present a definite demand for more hydroelectric power in California. This is reflected in the

large construction program now under way for the Pacific Gas & Electric Company and in the ability of the Bureau of Reclamation to sell all the power it can produce. The westward movement of so called "heavy" industries has created a large demand for more power. The activities of the Atomic Energy Commission in the State of Nevada has brought the Federal Government into the market for electric power from California. The recent contract between the Oakdale and South San Joaquin Irrigation Districts and the Pacific Gas and Electric Company is also an indication of the expanding market for electric power. There is, therefore, no reason to doubt the marketability of power produced by this project, if at a reasonable figure in line with other recent power contracts.

SECTION 3. ENGINEERING DATA.

PROJECT FEATURES: After an extensive study of the land classification maps of the areas concerned and of the many alternate methods of developing the minimum total yield of the available water resources, the following features are proposed as a minimum requirement for the initial development of the area. Within each main feature there have been investigations of alternate conduit routes, dam heights and locations, construction methods, and construction and financing possibilities.

1. A storage reservoir and dam at the Little Grass Valley damsite on the South Fork of the Feather River in Sec. 31, T. 22 N., R. 9 E., M.D.B&M.

2. A diversion dam on the So. Fork of the Feather River in Sec. 29, T. 21 N., R. 8 E., and a tunnel or conduit to Lost Creek Reservoir from this diversion.

3. A diversion dam on Canyon Creek in Sec. 10, T. 20 N., R. 9 E., and a diversion tunnel from the diversion dam to Slate Creek.

4. A diversion dam on Slate Creek in Sec. 1, T. 20 N., R. 8 E., and a diversion tunnel to carry both the Slate and Canyon Creek water to the proposed Lost Creek Reservoir.

5. Lost Creek Dam and Reservoir. Dam in Sec. 24, T. 20 N., R. 7 E.

Challenge Power Development. Power House in Sec. 18, T. 19 N., R. 7 E.

7. Honcut Power Development. Power House in Sec. 18, T. 18 N., R. 6 E.

8. The following initial Irrigation works:

A. New York Flat Reservoir. Dam in Sec. 25, T. 19 N., R. 6 E.

B. Rackerby Canal.

C. Dobbins Canal.

D. Honcut Afterbay.

E. Bangor Canal.

In general, these features follow the comprehensive plan of the State Engineer with the difference that this plan is proposed as a minimum plan, economically feasible, for the initial needs of the area concerned.

YIELD: Although no stream flow records exist for all of the drainage areas with which we are concerned, excellent records have been kept by the U. S. Geological Survey of the flow of the North Yuba River near Goodyear's Bar and of the flow of the South Fork of the Feather River near La Porte. The Pacific Gas and Electric Company have records of the flow in the North Yuba River at Colgate Powerhouse Head Dam and of the stage of Bullard's Bar Reservoir on the North Yuba River. By comparing drainage areas, and cover, and by the use of an isohyetal map showing the distribution of rainfall in the Sierra Nevada, good estimates of the probable yield of the proposed system have been made. It is an accepted fact, borne out by rainfall and runoff records kept by the State Division of Water Resources and the United States Geological

Survey, that the worst dry period that has occured in the past one hundred years is that six year period between 1929 and 1934. It is upon this six year dry period that the following yield figures are based and such a basis should allow a suitable margin of safety for design. It is to be expected that the yield so determined will be a minimum yield and in other years a surplus of water at all diversion and storage points will exist. With these facts in mind, a summary of yield data for the various parts of the system is as follows:

(1) Little Grass Valley Reservoir Drainage Area:
D.A. = 27.3 square miles. Records were kept of the flow of the South Fork of the Feather River near La Porte by the U. S. Geological Survey through most of the dry period and estimates made by the U. S. Bureau of Reclamation for the damsite drainage area form a good basis for determining the yield. A storage of 50,500 A.F. and a gross yield of 37,000 A.F. less 3,000 A.F. for Summer flow and evaporation will yield 34,100 A.F. net supply, on a 4 month draft basis. An additional 2600 A.F. of spilled water can be picked up downstream by the South Fork Diversion System.

(2) South Fork of the Feather River between Little Grass Valley Reservoir and the South Fork diversion:
D.A. = 11.8 square miles. By comparisom with the data available for the L.G.V. drainage area it is expected that this portion of the system will yield 16,600 A.F.

(3) Canyon Creek Drainage Area:
D.A. = 39.9 square miles. By comparisom with the data

available for flow in the North Yuba at and below Goodyear's Bar, projected monthly and daily flows have been computed. Downstream prior rights of the Pacific Gas and Electric Company are entitled to all of the dry month flow. However, flood waters in the wet months will allow a yield of **42,900** A.F.

(4) Slate Creek Drainage Area:

D. A. = 47 square miles. By an investigation similiar to the Canyon Creek study, the yield will be **51,500** A.F.

(5) Lost Creek Drainage Area:

D.A. = 30 square miles. From records kept by the U.S.G.S. from October 1929 through September 1941. (corrected for storage and diversion) and from records of the U.S.G.S. for flow in the South Fork of the Feather at Enterprise from October 1920, through September 1929, and from October 1941 through September 1945, an annual yield of 40,000 A.F. can be expected.

(6) New York Flat Reservoir (including water picked up from French Dry Creek and Costa Creek):

The entire Drainage Area above the Brownsville gage will yield 11,400 A.F. with 14,000 A.F. Storage. However, by building minimum storage at New York Flat and the Challenge Afterbay, a yield of 7,500 A.F. is expected for the minimum plan.

The yield of the component parts of the total drainage area concerned is detailed by accompanying flow records and mass diagrams (Appendix 1). Operational charts showing the inflows and releases at each of the proposed reservoirs during the 1929 - 1934 Dry Period are also included. A summary, Table 4, shows the system operation on an annual basis for the dry period, with all diversions and losses indicated.

Table 3 covers the necessary diversions for supplying existing water uses and 25% of the ultimate water demand for the higher service areas and the present estimated demand for the lower areas. Below the Honcut P.H. the amount of water available from the Power Stream during the irrigation season will supply the estimated initial demand with the Honcut Reservoir constructed only to act as an afterbay. At any time when the irrigation demand warrants doing so, the entire winter flow of the power stream below the Honcut P.H. may be made available for irrigation by increasing the storage capacity of the Honcut Reservoir, without diminishing the power revenue of the system.

LITTLE GRASS VALLEY RESERVOIR: This is a well known reservoir site and has been recognized by almost every water development study made of the region. It is an integral part of the Oroville Wyandotte Irrigation District's present plan for development. The consulting engineer now employed by the O. W. I. D. has made an advanced planning study and cost estimate of this feature which is used as a basis for estimates included herein. An independent study of yield and area-capacity curves has been made and they have agreed very closely with those made by the O. W. I. D. engineer.

This damsite was known by the Bureau of Reclamation as Rimrock Damsite. Under this name the reconnaissance geology pertinent to the site and nearby construction materials is described in Mr. Gamer's report for the Bureau of Reclamation.

Topography of the region is shown on the U.S.G.S. "American House" quadrangle at a scale of 1:24000 with a 25 foot contour interval. A reservoir site map was made for the U. S. Bureau of Reclamation by Fairchilde Aerial Surveys in 1946. Area capacity data is based upon this map, which is on a scale of 1 inch equals 400 feet with a 10 foot contour interval. A reproduction of the area capacity curve is shown in Plate 5.

The O.W.I.D., in their present plan of development, have proposed a rock fill type of structure, built to 50,500 acre feet capacity. This writer concurs with this in general; however, a saving in the required capacity of Lost Creek Reservoir could be attained by building Little Grass Valley to a capacity of 60,000 acre feet, since storage here appears to

be more economical in the top portion than similiar storage at Lost Creek. This should create no operational problems. It is believed further that field investigations necessary before construction may show that an earthfill dam would be possible, with a saving in construction cost. This possibility is dependent upon the location of sufficient quantities of impervious core material and pervious blanket material.

No major problems are anticipated in obtaining ownership of the reservoir area or in obtaining necessary rights of way for construction.

Preliminary cost estimates, as shown in Table 6, are based upon the O.W.I.D. plan for a rockfill type of dam at 50,500 A.F. capacity, as are the yield figures in Table 4, and the operational chart figures in Appendix No. 2.

SOUTH FORK DIVERSION SYSTEM: This diversion dam and tunnel, together with the necessary headworks are also common to both this plan and the O.W.I.D. plan. The O.W.I.D. engineer has made advanced planning designs and estimates as he has for the Little Grass Valley Reservoir. In conjunction with this report, the hydraulic data, tunnel size and dam location has been checked and found to be the same as is contemplated by the O.W.I.D.

Preliminary cost estimates, shown in Table 6, are based upon the O.W.I.D. plan and upon geological notes made from a study of the Geological Folio Maps of the Bidwell Bar and Downieville 30' U.S.G.S. quadrangles. It appears that this tunnel will be in granite all the way. Probably only 10% will require concrete lining.

CANYON CREEK DIVERSION SYSTEM: There exists on Canyon Creek the possibility of creating a storage reservoir with a minimum bore diversion tunnel, or a diversion dam with a tunnel large enough to carry the entire available flood flow during the wet months with very little loss. Canyon Creek does not have a good damsite which would allow economical storage and so a detailed comparison of storage costs versus tunnel enlargement costs has been made.

Results of these comparisons show no need for storage on Canyon Creek if a 510 cfs tunnel is bored. This appears the most economical construction.

The diversion dam should be of large enough capacity to level out a 24 hour flow during snow melt periods when the hourly variations are large. Inspection of recording gage records kept by the Nevada Irrigation District of the flow past Milton Reservoir, a similiar type of structure in a similiar snow melt area, show that the daily flow fluctuation is from 80% of the daily average for a 12 hr. period to 120% of the daily average for the next 12 hr. period. An increase of 20% over 510 cfs is a total of 102 acre feet in 12 hours. This would be adequate dam capacity.

Expected yield takes into account the tunnel and diversion dam capacities.

The U.S.G.S. "Goodyear's Bar" Quadrangle at a scale of 1:24000 shows the possible locations for the diversion dam. The damsite is shown to be at elevation 3810 in streambed. No check surveys have been run into this area and the exact location of the diversion weir has not been chosen. It would

be a low concrete overpour type of structure, probably not exceeding 30' in height. No major construction problems are anticipated in this rocky terrain. The exact location of the dam is dependent upon gaining maximum head to reduce the diameter of the tunnel to Slate Creek. Present paper location gives an inlet elevation 3820 and outlet elevation of 3650 for the tunnel, with a length of 22,150'.

The geological study shows that this tunnel will be in Greenstone, Granite and Slates. One mile may need support and lining. Some water may be encountered in the slate at the lower end during construction.

Cost estimates for the dam and tunnel are as shown in Table 6.

SLATE CREEK DIVERSION SYSTEM: A similar type of structure is contemplated here as for Canyon Creek and a diversion dam with a 1020 cfs capacity tunnel will satisfy the requirement.

The diversion dam should form large enough storage capacity to level out a 24 hour flow of Slate Creek during show melt periods when the hourly variations are large. 120 A.F. should be sufficient.

Topography is given by the U.S.G.S. "Strawberry Valley" Quadrangle at a scale of 1:24000. A 50' concrete overpour dam is contemplated, based upon this topography. As for the Canyon Creek Structure, field surveys will have to be made to determine final elevations.

The tunnel required will be of 13½ foot unlined bore and will have a length of 14,100 feet. It will lie in Granite,

Serpentine and Greenstone. Approximately 1 mile will need support and lining in the Serpentine. Some water may be encountered in the Serpentine.

Cost estimates for the dam and tunnel are as shown in Table 6.

LOST CREEK RESERVOIR: The damsite herein considered is located approximately 1200 feet downstream from the existing concrete arch dam of the Oroville-Wyandotte Irrigation District and is also known in U. S. Bureau of Reclamation reports as Mooreville Damsite. In general this is a heavily forested region with a deep soil overlying serpentine and amphibolite bedrocks. A description of general reconnaissance geology is given in Mr. Gamer's report to the Bureau of Reclamation.

Area-capacity curves for the reservoir area were prepared by Mr. E. A. Bailey from recent U.S.G.S. Quadrangle Maps. The maps were made from aerial photographs taken by Fairchild Aerial Surveys, Inc. for the U.S. Bureau of Reclamation.

This is the largest single structure in the entire development plan. In order to develop the yield of all the watersheds desired in this project, a high earth fill dam is contemplated. After study of the combined mass diagrams there appears two or more alternatives in dam height to study from an economy viewpoint. The physical features of construction offer no grave problems at any height up to the maximum at spillway lip elevation of 3535 feet and dam crest at 3550 feet. Two alternatives are concerned with the downstream economy of the Challenge power development. One alternative is to start this power development system from a tunnel inlet near "Eagle Gulch"

in the proposed Lost Creek Reservoir inundated area at an elevation of 3336 feet. This elevation of tunnel inlet leaves a deadwater storage in Lost Creek Reservoir of 18,000 Acre Feet and gives an 800 foot head at Challenge Powerhouse. An alternative would be to take out of the bottom of Lost Creek Reservoir near the dam at an elevation of 3200 feet. This alternative would allow decreasing the required storage by the 18,000 acre feet with no decrease in developed yield.

Decreasing the storage by 18,000 acre feet means that the necessary dam height can be decreased and a saving of dam mass will be possible.

There are other advantages of this low level outlet. The gain in available head in the Slate Creek and South Fork diversion tunnels will decrease their required size and costs. The tunnel at this low outlet can also be enlarged and integrated into the emergency outlet system for flood flow during construction. Another advantage is a more economical forebay site for peaking water obtained at the lower forebay elevation.

Disadvantages are the increased excavation in the off-the-side spillway and the loss of head at Challenge Powerhouse. The low level outlet appears more economical and has been used for estimates and preliminary plans.

The operational chart gives a required storage of 140,000 acre feet for Lost Creek Reservoir with 50,500 acre feet capacity at Little Grass Valley Reservoir. This could be safely reduced to 130,000 acre feet if Little Grass Valley Reservoir was raised to 60,000 acre feet. At 140,000 acre feet capacity, the area and capacity curves show a water

surface elevation of 3508 feet and, allowing 12' freeboard, the top of dam would be at elevation 3520. As in the case of Slate and Canyon Creeks, no check levels have been run in this vicinity. U.S.G.S. sheets show the stream bed at the axis to be at elevation 3180. Using this figure the height of dam will be 340 feet maximum.

No difficulty is anticipated from foundation material. The dam will overlie amphibolite bedrock which is hard, competent and watertight. Grout take should be light. Maximum stripping for cutoff should be 35 to 40 feet at dam crest for each abutment and grow less as the streambed is approached.

An abundance of the red silty clay of the region is available for impervious core material. Soil tests prepared by O. J. Porter and Company of Sacramento show that this material is entirely suitable for core material for an earthfill dam.

A preliminary dam section has been chosen and analyzed by the "Swedish Arc" method of analysis, as required by the State Department of Safety for Dams, and has been found to be adequate for preliminary estimating of quanities.

Gravel and rock suitable for quarrying, for the toe drain and gravel blankets of the dam, are available within economical haul distance of the site.

The spillway proposed is ideal for an earthfill dam, being an off-the-side type, spilling into "Owl Gulch". It is anticipated that proper operation of the diversion headworks will offer almost complete control of all inflow to the reservoir except from Lost Creek Drainage Area and therefore only extraordinary flood conditions in Lost Creek will cause large

PHOTOGRAPHS

C

LOST CREEK DAMSITE

D

LOST CREEK RESERVOIR

flows to be discharged over this spillway. There will be some erosion control necessary below the spillway in Owl Gulch but there are no improvements or structures that would cause a hazard.

An operational chart is included in Appendix 2 upon which all inflows, drafts, evaporation, and fish releases are shown. This chart is based upon the 1929-1934 dry period. A preliminary design sheet, Plate 2, shows the dam section, area-capacity, curves and general plan. Preliminary cost estimates are as shown in Table 6.

CHALLENGE POWER DEVELOPMENT: The main outlet at Lost Creek Reservoir will be from a low level through an enlarged section of the existing tunnel leaving very little deadwater in the reservoir. The conduit beyond the reservoir outlet will consist of a tunnel for the first section, comprising some 15,500 feet of new tunnel. A stilling basin and/or other energy dissipating installation will be necessary between the outlet and the tunnel entrance because of the high operating head. No difficulty in tunneling is anticipated and 3/4 of a mile of lining should be all that is required. It is probable that the enlarged section of the existing outlet tunnel can be used for diversion of stream flow during construction.

A possible alternate for the first tunnel section is 20,000 ft. of bench flume and some 5000 ft. of canal, meeting the second section near Oroleve Creek where the tunnel outlet is proposed. A disadvantage of this bench flume construction is the possibility of slides in the broken country along Lost Creek. An advantage is the saving of probably $1,000,000 in construction cost. Preliminary cost estimates have assumed that the tunnel section will be used.

From Oroleve Creek, the second section of conduit will consist of an open, unlined canal through the deep soil of the region. Cross slopes will average less than 20 percent. Conveyance losses should be very small in this impervious clay soil.

The first canal section ends at a siphon near Woodleaf. This siphon will have a profile length of 1200 feet and will consist of a steel pipe, 90 inches in diameter. Some concrete saddles will be necessary, and concrete inlet and outlet structures. Maximum head on this siphon is 48 feet.

From the Woodleaf Siphon to the proposed forebay will be a canal similar to the first canal section approximately 4000 feet in length. Cross slope should not exceed 20% and the conveyance loss will be small in this impermeable red clay soil. Very little rock excavation will be necessary.

The forebay site is a bowl shaped pocket that drains into Indian Creek from the north. Excavation of the uphill portion of the forebay site will increase capacity and provide fill material to form the downhill dike section across the low side of the bowl. 900 acre feet of storage will be provided for peaking at the Challenge powerhouse.

The penstock from the forebay to Challenge powerhouse will consist of one section in lined pressure tunnel and one section in steel pipe laid on the surface of the ground. Pressure tunnel will be a circular section, inside of which is a ¼" steel liner. Concrete will be placed between the steel liner and the tunnel walls. The penstock pipe on the surface of the ground will consist of 90" diameter steel pipe.

The proposed Challenge Powerhouse will be located in Golden Gate Ravine near its junction with Costa Creek. Tailwater elevation will be 2430. It is proposed that a draft tube will allow the powerhouse to be raised considerably above tailwater, allowing future decrease in operating head if downstream conditions require the tailwater to be raised. Installed capacity will be 23,000 K. W.

An afterbay of 800 acre feet capacity is proposed on Costa Creek which has a good site for a concrete overpour type dam.

Flew through the powerhouse and other preliminary power plant data is given in Table 5. Cost estimates are as given in Table 6. Preliminary design drawings are shown on Plate 3.

HONCUT POWER DEVELOPMENT: An earth canal from Challenge afterbay to the proposed New York Flat Resevoir comprises the first section of conduit. It will be mostly in impervious clay soil and will require little rock excavation.

New York Flat Reservoir is described in a later section on Irrigation Works and will be used to store enough water for summer irrigation diversion. From New York Flat a canal leads to a Siphon, 1000 feet long across French Dry Creek. From this Siphon a canal section goes around Ruff Hill to another Siphon across Dry Creek to Hansonville Hill, and then around Hansonville Hill in canal to a forebay near the top of Hedge Hill. Pressure tunnel and penstock of a total length of approximately 9500 feet carry the water down to Honcut Powerhouse on Honcut Creek. Tailwater elevation will be 915 feet. Installed capacity is expected to be 39,000 K. W. and total head without losses will be 1391 feet. Preliminary power data is given in Table 5. Cost estimates are as given in Table 6. Preliminary layout and design drawings appear on Plate 4.

Honcut Reservoir, described under Irrigation Works, will act as the afterbay for this powerhouse.

IRRIGATION WORKS

A. NEW YORK FLAT RESERVOIR: New York Flat Reservoir would be constructed only high enough to store the amount of water needed for initial irrigation diversion. This storage would consist of a portion of the winter runoff from the drainage basins of New York and Costa Creeks, along with the sufficient water from the winter power releases at the Challenge Power House to match an equal amount to be diverted from the power stream for irrigation during the summer months. Reservoir operation would be such that the power stream reaching the Honcut Forebay would remain uniform throughout the entire year, while the diversions for irrigation would follow the seasonal demand.

Irrigation demand will require an initial storage of 12,000 acre feet, which can be developed by an earth-fill dam of 90 feet maximum height. At this height, the maximum water surface elevation is 2373 feet and crest length is approximately 880 feet. Construction materials are available nearby for this type of structure. Much of the preliminary reconnaissance of the damsite area has been done by others. The damsite is also known as Foss Damsite to the Bureau of Reclamation.

B. RACKERBY CANAL: This canal is to be constructed with an initial capacity of 18.6 cfs. and a length of 10 miles. It will return to the Forbestown Ditch sufficient water for Kelley Hill and other high ridges in Butte County

PHOTOGRAPHS

E

NEW YORK FLAT DAMSITE

F

NEW YORK FLAT RESERVOIR

which can only be reached by siphon from Lake Wyandotte. The water is returned to the Forbestown Ditch after it has passed thru the Challenge Power House, thus developing some power yield.

The initial diversion will allow 30% more water for the areas now being irrigated and will be sufficient for 25% of the estimated ultimate demand for Service Area "B" and that portion of "G" that lies on the north side of Honcut and Dry Creeks not irrigated at present.

C. DOBBINS CANAL: This canal, with initial capacity of 18.4 cfs., is planned to carry 25% of the estimated ultimate demand of that portion of Service Area "G" east of French Dry Creek. It would leave the power conduit at the northeasterly end of the Ruff Hill siphon and extend around Ruff Hill about 10 miles to the head waters of Dobbins Creek.

Dobbins Canal is considered as a main canal for Area "G" from which water users associations or other mutual organizations may construct laterals to reach all parts of the Dobbins and Oregon House areas.

It would be possible to deliver from this canal to the Browns Valley Ditch, the relatively small amount of water needed for the three ranches now using water below the section of that ditch in the Yuba River canyon. Such delivery would allow the Browns Valley Irrigation District to lease their entire 47 cfs. of their canal to the P.G. & E. for power use, in case that district builds the Virginia Ranch Reservoir to supply the major portion of their district which lies in the lower foothill area.

D. HONCUT AFTERBAY: In order to provide a minimum necessary regulation of releases below the Honcut powerhouse, an afterbay of 400 acre feet is required. Such a regulatory storage could be obtained by an earthfill dam for which materials are available right in the streambed and adjacent hillsides.

An excellent site for a small earthfill dam is available below the powerhouse and above the well known Honcut Damsite. The site is at streambed elevation of 825. Powerhouse tailwater limits the maximum watersurface to 915 feet and the necessary freeboard fixes the dam crest at 925 feet. Crest length would be 800 feet and maximum height 75 feet. An off-the-side spillway as part of the structure can be developed with a reasonable amount of excavation.

This afterbay will serve as a diversion point for the Bangor Canal to the north and any future canals to the south.

E. BANGOR CANAL: A canal to provide irrigation water to the Oroville Wyandotte Irrigation District lands will have its diversion point at Honcut Afterbay. This canal will provide for all the O. W. I. D. present requirement below a grade contour of elevation 915 at Honcut Creek and approximately 835 at the head of the Oroville Lateral north of the Mt. Ida Siphon; and will include capacity for 30% initial expected increase in water demand. O. W. I. D. requirements that are above this grade contour

will be served by the Rackerby Canal--Forbestown Ditch system diverted at New York Flat.

Capacity of the Bangor Canal will vary from 65 cfs. at the head to 10 cfs. at its junction with the Oroville Lateral. A summary of the component parts of the entire length is as follows:

Section 1. Honcut Afterbay to Bangor Ditch

35,000 lineal feet at 65 cfs capacity

Section 2. Bangor Ditch to Owens Ravine

60,000 lineal feet at 52 cfs capacity

Section 3. Owens Ravine to O.W.I.D. Canal in Sec. 30, T.19 N., R.5 E.,

10,000 lineal feet at 26 cfs capacity

Section 4. O.W.I.D. Canal to Oroville Lateral

25,000 lineal feet at 10 cfs capacity.

This canal will deliver present use water and 30% for added expansion to the existing Oroville Lateral, the Wyandotte Lateral, and to the Palermo Canal above Hillcrest Divide to supply the "North Ditch" and "South Ditch" of that canal so that the existing Palermo Canal water may be used for expansion in Area "A-1".

The Bangor Canal is planned to deliver to the existing "Bangor Ditch" twice the amount of water now being used, and could be designed at a larger capacity if necessary for the lands west and north of Bangor.

Preliminary cost estimates for the various Irrigation Works are included in Table 6 and the suggested initial capacities are as shown in Table 3. Preliminary layout and designs are shown on the pertinent plates listed in the Table of Contents of this report.

SECTION 4. CONCLUSIONS AND RECOMMENDATIONS

ADEQUACY OF DATA: While this report is of a preliminary nature, most of the data used is of excellent quality. Final construction estimates will have to be based upon further field investigations. Because of certain allowances made, however, the overall costs considered in this preliminary report should closly approximate those resulting from the final studies.

CONCLUSIONS: Upon the analysis of the information contained in tables 4, 5, and 6 it becomes quite evident that the project as outlined is within the realm of economic feasibility. All of the structural features required to provide the projected power revenues indicated have been included in the estimate, along with the principal irrigation features necessary to supply present area demands and expected increases for those lands already irrigated and the anticipated irrigation requirements of the lands that will be made available for irrigation with the realization of the project.

The power revenues expected are based on the rates recently established in negotiations between private electric vendors and certain irrigation districts in California.

The program as proposed provides irrigation allotments for the upper level portions of the area. This provision is fundamental because these allotments will never again be available to the service of these areas if not included in the initial development of the concerned resources.

RECOMMENDATIONS: It is recommended that the program selected for adoption be one that fully considers the ultimate requirements of all the lands serviceable from the resources to be appropriated. The proper solution to this problem lies in the joint participation of the two existing districts in a comprehensive program of planning and development. Also considering and encouraging the inclusion into one or the other of these districts all of those lands within the area suitable for irrigation but not yet included in one of the districts. The project as outlined in the foregoing report is one that satisfies the minimum requirements of such a program.

It is further recommended that the following programs be set up for future study as a means of supplementing the foregoing minimum plan as presented:

1. A study of other projects for the lower lands of Yuba County should be made with the possibility in view of firming the water supply for the Bullard's Bar Power Plant on North Yuba River so that all the Prior Right waters of Canyon & Slate Creeks can be included in the Feather-Yuba Project.

This could add at least 30,000 A.F. more water to the project, increasing the installed capacity by 10,000 KW and the addition of 50,000,000 KWH of firm energy.

2. Some study should be given to the possibility of adding some 12 or 15,000 A.F. of water from Fall River and South Branch.

3. Studies should be made to determine the dependable revenue from sales of irrigation water.

APPENDIX NO. 1

YIELD DATA

Little Grass Valley Reservoir

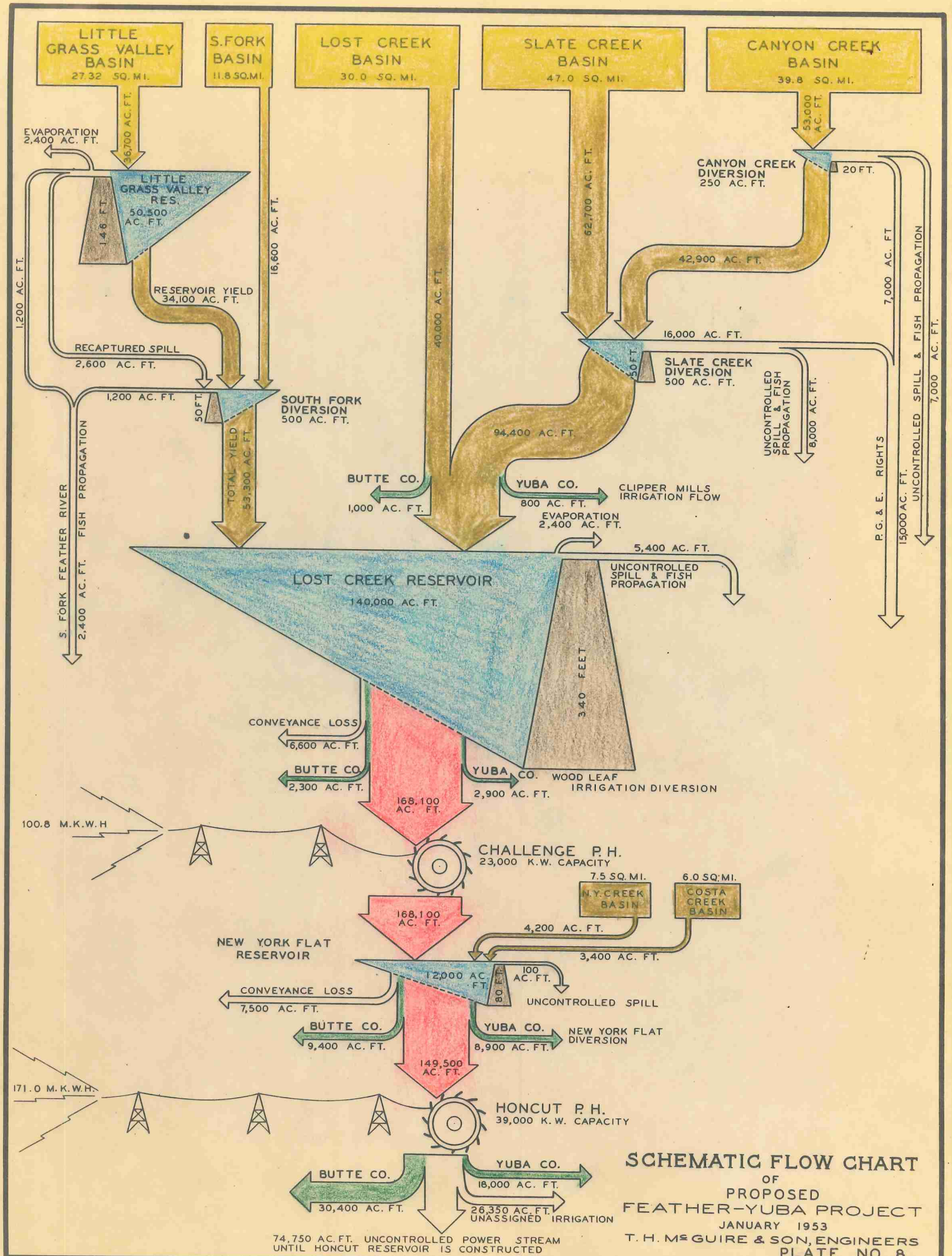
South Fork Diversion

Canyon Creek

Slate Creek

Lost Creek

French Dry Creek at Brownsville



SCHEMATIC FLOW CHART
OF
PROPOSED
FEATHER-YUBA PROJECT
JANUARY 1953
T. H. McGUIRE & SON, ENGINEERS
PLATE NO. 8

LITTLE GRASS VALLEY
RUN-OFF OF SOUTH FORK FEATHER RIVER NEAR LA PORTE
Unit 1000 A.F. - Drainage Area 27.3 Sq. Miles
From USGS Record & USBR Est.

YEAR	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	TOTAL
1921-22	0.1	0.4	1.6	1.6	9.0	6.2	14.0	28.7	21.5	1.4	0.1	0.3	84.8
1922-23	0.1	0.8	6.4	4.4	1.4	3.6	14.9	12.8	3.6	0.5	0.2	0.3	49.0
1923-24	0.1	0.2	0.1	0.1	5.6	1.7	4.1	1.7	0.1	0.1	0.2	0.1	14.1
1924-25	0.2	1.0	0.6	0.2	21.5	5.1	14.0	14.0	3.6	0.5	0.3	0.8	62.8
1925-26	0.1	0.5	0.1	1.5	12.0	3.2	16.1	6.6	0.9	0.2	0.1	0.4	41.7
1926-27	0.1	8.8	3.3	4.3	21.5	9.4	17.2	17.8	7.6	0.8	0.1	0.3	91.2
1927-28	0.1	5.6	2.6	3.2	5.2	23.7	12.1	8.2	0.9	0.2	0.1	0.1	62.0
1928-29	0.1	0.3	0.5	0.4	1.8	4.2	6.9	15.9	4.3	0.7	0.1	0.1	35.3
1929-30	0.1	0.1	12.7	3.0	5.3	6.6	18.0	11.7	2.5	0.3	0.1	0.1	60.5
1930-31	0.1	0.5	0.3	0.9	1.3	6.7	6.4	3.0	0.8	0.1	0.1	0.1	20.3
1931-32	0.4	0.3	1.3	2.1	1.5	7.5	14.8	23.6	9.6	0.8	0.2	0.1	62.2
1932-33	0.1	0.1	0.2	0.2	0.2	0.9	6.3	11.7	10.1	0.7	0.1	0.1	30.7
1933-34	0.1	0.2	1.1	3.9	5.4	7.0	6.7	2.9	0.4	0.1	0.1	0.1	28.0
1934-35	0.1	1.5	0.7	5.0	1.9	5.0	25.9	23.5	8.3	0.5	0.1	0.1	72.6
1935-36	0.1	0.2	0.1	12.8	18.9	6.4	17.7	15.5	6.3	0.8	0.1	0.4	79.3
1936-37	0.1	0.2	0.1	0.1	3.9	7.8	13.6	25.7	9.1	0.8	0.3	0.3	62.0
1937-38	0.1	6.0	17.8	4.2	24.0	19.3	15.8	31.0	21.7	1.9	0.2	0.4	142.4
1938-39	0.1	0.6	0.1	0.1	0.8	2.9	10.7	5.4	1.3	0.1	0.2	0.6	22.9
1939-40	0.3	0.1	0.2	14.9	20.9	18.5	14.9	6.5	1.7	0.1	0.1	0.1	78.3
1940-41	0.1	1.1	8.7	14.4	16.4	9.0	17.7	29.1	8.6	1.4	0.2	0.6	107.3

12/17/52

LITTLE GRASS VALLEY

(ACCUMULATED) RUN-OFF OF SOUTH FORK FEATHER RIVER NEAR LA PORTE

Unit 1000 A. F. - Drainage Area 27.3 Sq. Miles

From USGS Record & USBR Est.

WATER YEAR	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
1921-22	0	0	2	4	13	19	33	62	83	85	85	85
1922-23	85	86	92	97	98	102	117	129	133	133	134	134
1923-24	134	134	134	134	140	142	146	148	148	148	148	148
1924-25	148	149	150	150	172	177	191	205	208	208	209	210
1925-26	210	210	210	212	224	227	243	250	251	251	251	251
1926-27	252	260	264	268	290	299	316	334	342	342	342	343
1927-28	343	348	351	354	359	383	395	403	404	404	405	405
1928-29	405	405	406	406	408	412	419	435	439	440	440	440
1929-30	440	440	453	456	461	468	486	498	500	500	500	500
1930-31	501	501	501	502	504	510	517	520	520	521	521	521
1931-32	521	521	523	525	526	534	549	572	582	583	583	583
1932-33	583	583	583	584	584	585	591	603	613	613	614	614
1933-34	614	614	615	619	624	631	638	641	641	641	642	642
1934-35	642	643	644	649	651	656	682	705	714	714	714	714
1935-36	714	715	715	727	746	753	770	786	792	793	793	794
1936-37	794	794	794	794	798	806	819	845	854	855	855	856
1937-38	856	862	880	884	908	927	943	974	996	997	998	998
1938-39	998	999	999	999	1000	1003	1013	1019	1020	1020	1020	1021
1939-40	1021	1021	1021	1036	1057	1076	1091	1097	1099	1099	1099	1099
1940-41	1099	1100	1109	1124	1140	1149	1167	1196	1204	1206	1206	1206

SOUTH FORK FEATHER RIVER DIVERSION

11.8 SQUARE MILES DRAINAGE AREA

Runoff available for diversion to Lost Creek Through Tunnel
(Months of November through June, Entire stream flow
for months of July through October left untouched to allow for
fish propagation)

Year	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
1927-28	2.4	1.1	1.4	2.2	10.2	5.2	3.5	0.4	26.4
1928-29	0.1	0.2	0.2	0.8	1.8	3.0	6.8	1.8	14.7
1929-30	0.0	5.5	1.3	2.3	2.8	7.7	5.0	1.1	25.7
1930-31	0.2	0.1	0.4	0.6	2.9	2.8	1.3	0.3	8.6
1931-32	0.1	0.6	0.9	0.6	3.2	6.4	10.1	4.1	26.0
1932-33	0.0	0.1	0.0	0.1	0.4	2.7	5.0	4.3	12.6
1933-34	0.1	0.5	1.7	2.3	3.0	2.9	1.2	0.2	11.9
1934-35	0.6	0.3	2.1	0.8	2.1	11.1	10.1	3.6	30.7

Note: Quantities of thousands of acre feet obtained by multiplying a comparative drainage area factor by Little Grass Valley Reservoir site records from USGS & USBR

Runoff Factor= $\frac{11.8}{27.3}$ = 43% of Little Grass Valley runoff

SOUTH FORK FEATHER RIVER DIVERSION

11.8 SQUARE MILES DRAINAGE AREA

Run off available for diversion to Lost Creek Through Tunnel
(Months of November through June.)
MASS ORDINATES

Year	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
1927-28	2.4	3.5	4.9	7.1	17.3	22.5	26.0	26.4	26.4
1928-29	26.5	26.7	26.9	27.7	29.5	32.5	39.3	41.1	41.1
1929-30	41.1	46.6	47.9	50.2	53.0	60.7	65.7	66.8	66.8
1930-31	67.0	67.1	67.5	68.1	71.0	73.8	75.1	75.4	75.4
1931-32	75.5	76.1	77.0	77.6	80.8	87.2	97.3	101.4	101.4
1932-33	101.4	101.5	101.5	101.6	102.0	104.7	109.7	114.0	114.0
1933-34	114.1	114.6	116.3	118.6	121.6	124.5	125.7	125.9	125.9
1934-35	126.5	126.8	128.9	129.7	131.8	142.9	153.0	156.6	156.6

Note: Quantities of thousands of acre feet obtained by multiplying a comparative drainage area factor by Little Grass Valley Reservoir site records from USGS & USBR

Run off Factor= $\frac{11.8}{27.3}$ = 43% of Little Grass Valley runoff

CANYON CREEK RUNOFF
39.8 SQUARE MILES DRAINAGE AREA
At Dam Site in Sec. 10, T.20N, R. 9E
Monthly in 1000 A.F. Units
Estimated from USGS Records at & below GOODYEAR BAR
Factors: .208156 up to Jan. 1, 1931, & .182563 after Jan. 1, 1931

Water Year	O	N	D	J	F	M	A	M	J	J	A	S	Annual
1922	1.8	2.1	3.2	4.1	5.2	7.2	13.9	40.2	38.3	8.5	3.6	2.2	130.3
1923	2.5	2.9	6.9	6.0	4.6	6.6	13.5	23.1	12.4	5.8	3.4	2.5	90.2
1924	2.5	1.7	1.8	2.1	4.5	2.6	5.7	4.1	1.7	1.2	1.0	1.0	29.9
1925	2.0	2.6	3.3	3.8	16.2	8.4	15.6	18.4	7.1	2.9	2.1	1.8	84.2
1926	1.9	2.1	2.8	2.7	8.3	8.0	17.0	9.6	3.4	1.8	1.4	1.2	60.2
1927	1.6	9.1	6.0	7.1	20.7	14.6	19.3	27.7	22.1	5.8	2.8	2.1	138.9
1928	2.3	5.8	3.7	4.7	5.1	34.3	18.9	22.3	4.8	2.5	1.7	1.5	107.6
1929	1.7	1.8	2.4	2.0	2.4	4.2	6.1	12.5	6.2	2.2	1.5	1.2	44.2
1930	1.4	1.2	11.6	4.6	7.2	9.9	15.5	13.7	7.1	2.6	1.8	1.7	78.3
1931	1.5	2.0	1.5	2.4	2.4	5.4	6.2	5.0	2.3	1.2	0.9	0.8	31.6
1932	1.4	1.4	4.1	4.1	5.0	10.3	13.6	26.1	17.1	4.2	2.0	1.5	90.8
1933	1.4	1.4	1.5	1.6	1.6	4.4	8.7	12.6	12.8	2.6	1.5	1.2	51.3
1934	1.6	1.6	3.3	4.4	5.3	10.2	8.5	4.8	2.2	1.3	1.0	0.9	45.1
1935	1.2	2.6	2.7	4.0	5.3	6.0	24.7	27.6	16.3	3.6	1.9	1.4	97.3
1936	1.7	1.7	1.9	11.7	14.8	13.3	21.8	23.8	12.5	3.7	2.1	1.7	110.7

CANYON CREEK RUNOFF-At Dam Site in Sec. 10, T 20N, R 9E-Monthly in 1000 A. F. Units

Water Year	O	N	D	J	F	M	A	M	J	J	A	S	Annual
1937	1.5	1.5	1.6	1.6	5.0	8.0	15.3	27.5	11.1	3.2	1.8	1.4	79.5
1938	1.6	3.2	18.8	4.6	4.2	8.5	17.5	49.5	46.2	10.3	3.5	2.0	169.9
1939	2.3	2.3	2.1	2.3	2.1	7.0	11.5	6.4	2.5	1.5	1.2	1.1	42.3
1940	1.4	1.2	1.7	13.5	19.9	28.5	22.4	21.1	7.6	2.7	1.8	1.7	123.5
1941	1.7	3.3	11.1	7.2	16.0	15.1	15.3	32.4	14.1	4.9	2.6	1.9	125.6
1942	1.8	2.4	14.3	17.9	16.2	9.1	21.0	25.2	23.4	7.1	3.0	2.1	143.5
1943	1.9	5.8	7.2	19.7	11.2	22.7	23.8	19.6	10.4	3.9	2.3	1.7	130.2
1944	1.9	1.9	2.0	2.6	3.7	6.5	8.7	19.6	8.7	3.0	1.8	1.4	61.8
1945	1.6	3.9	6.1	4.3	14.9	7.0	13.4	22.4	10.6	3.4	2.0	1.5	91.1
1946	2.2	4.3	15.4	9.5	4.8	8.9	17.3	23.5	9.4	3.3	2.0	1.6	102.4
1947	1.7	4.2	3.8	2.3	6.6	10.7	10.8	8.5	4.9	1.9	1.3	1.1	57.8
1948	2.3	2.2	1.7	8.4	2.8	3.8	17.6	22.1	16.4	4.4	2.2	1.6	85.5
1949	1.6	2.2	2.0	1.7	1.9	5.9	16.2	18.3	6.3	2.2	1.6	1.2	61.1
1950	1.2	1.5	1.5	7.0	10.1	10.9	20.5	23.8	13.6	4.0	2.1	1.6	97.8

SLATE CR. RUNOFF - At Dam Site in Sec. 1, T. 20N, R. 8E - Monthly in 1000 A.F. Units
Estimated from USGS Records at & below GOODYEAR BAR
D.A.= 47.0sq.mi. Factors: .24958 to Jan. 1, 1931, & .21889 after Jan. 1, 1931

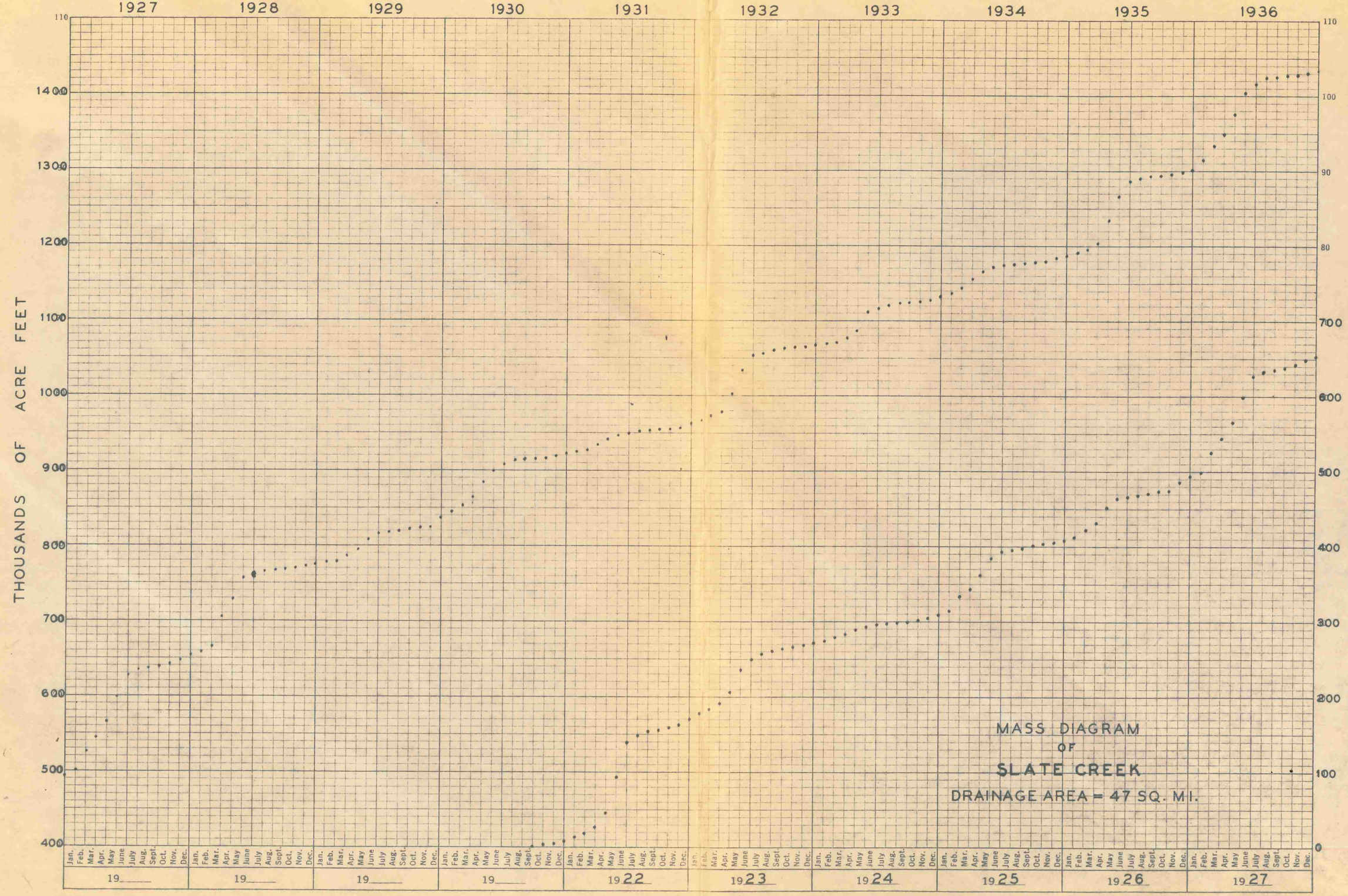
Water Year	O	N	D	J	F	M	A	M	J	J	A	S	Annual
1922	2.1	2.5	3.8	4.9	6.3	8.7	16.6	48.1	45.9	10.2	4.3	2.6	156.0
1923	3.0	3.4	8.3	7.2	5.5	7.9	16.2	27.6	14.8	6.9	4.0	3.0	107.8
1924	3.0	2.1	2.1	2.5	5.4	3.1	6.8	4.9	2.0	1.5	1.3	1.1	35.9
1925	2.4	3.1	3.9	4.5	19.5	10.1	18.7	22.1	8.5	3.5	2.5	2.1	100.9
1926	2.3	2.5	3.3	3.3	9.9	9.6	20.4	11.4	4.0	2.1	1.6	1.5	71.9
1927	1.9	10.9	7.2	8.5	24.8	17.5	23.1	33.2	26.5	6.9	3.4	2.5	166.4
1928	2.8	6.9	4.4	5.7	6.2	41.2	22.7	26.8	5.8	3.0	2.0	1.9	129.4
1929	2.0	2.1	2.9	2.4	2.9	5.2	7.3	15.0	7.4	2.6	1.9	1.5	53.2
1930	1.6	1.5	13.8	5.5	8.7	11.9	18.6	16.5	8.5	3.1	2.1	2.0	93.8
1931	1.8	2.4	1.9	2.9	2.9	6.5	7.4	6.0	2.8	1.4	1.0	1.0	38.0
1932	1.6	1.8	4.9	4.9	5.9	12.3	16.3	31.3	20.5	5.0	2.4	1.8	108.7
1933	1.6	1.8	1.8	1.9	1.9	5.3	10.4	15.1	15.3	3.1	1.8	1.8	61.8
1934	1.9	1.9	4.0	5.3	6.4	12.2	10.3	5.7	2.6	1.5	1.1	1.1	54.0
1935	1.4	3.1	3.3	4.8	6.3	7.2	29.5	33.1	19.5	4.4	2.3	1.8	116.7
1936	2.0	2.0	2.3	13.9	17.7	16.0	26.1	28.5	15.0	4.4	2.5	2.0	132.4

12/15/52

SLATE CREEK RUNOFF-at Dam Site in Sec. 1, T.20N, R. 8E - Monthly, in 1000 A.F. Units

Water Year	O	N	D	J	F	M	A	M	J	J	A	S	Annual
1937	1.8	1.8	1.9	2.0	6.0	9.6	18.3	32.9	13.3	3.8	2.3	1.8	95.5
1938	1.9	3.8	22.5	5.5	5.0	10.2	21.0	59.3	55.3	12.3	4.1	2.4	203.3
1939	2.8	2.8	2.5	2.8	2.5	8.4	13.8	7.7	3.0	1.9	1.4	1.3	50.9
1940	1.8	1.4	2.0	16.2	23.9	34.3	26.9	25.3	9.2	3.3	2.1	2.0	148.4
1941	2.1	4.0	13.3	8.5	19.2	18.1	18.3	38.8	16.8	5.8	3.1	2.3	150.3
1942	2.1	2.9	17.1	21.5	19.4	10.9	25.1	30.2	28.0	8.5	3.6	2.5	171.8
1943	2.3	6.9	8.7	23.6	13.4	27.3	28.5	23.5	12.4	4.6	2.8	2.0	156.0
1944	2.3	2.3	2.4	3.1	4.5	7.8	10.4	23.5	10.4	3.6	2.1	1.6	74.0
1945	1.9	4.6	7.3	5.2	17.8	8.4	16.1	26.9	12.7	4.1	2.4	1.8	109.2
1946	2.6	5.2	18.5	11.3	5.8	10.7	20.7	28.1	11.2	4.0	2.4	2.0	122.5
1947	2.0	5.0	4.6	2.8	7.9	12.8	12.9	10.1	5.9	2.3	1.6	1.3	69.2
1948	2.8	2.6	2.0	10.1	3.3	4.5	21.1	26.5	19.6	5.3	2.6	1.9	102.3
1949	1.9	2.6	2.4	2.0	2.3	7.0	19.4	22.0	7.5	2.6	1.9	1.5	73.1
1950	1.5	1.9	1.8	8.4	12.1	13.1	24.6	28.5	16.3	4.8	2.5	1.9	117.4

12/15/52



359-200LG KEUFFEL & ESSER CO.
Ten Years by Months × 110 (10 per unit) divisions.
MADE IN U.S.A.

SLATE CREEK

SH'T. 1 OF 3 SH'TS.
2/5/53 EAB.

THOUSANDS OF ACRE FEET

2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200

110
100
90
80
70
60
50
40
30
20
10
0

Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

1935 1936 1937 1938 1939 1940 1941 1942 1943 1944

MASS DIAGRAM
OF
SLATE CREEK
DRAINAGE AREA= 47 SQ. MI.

SLATE CREEK

SH'T. 2 OF 3 SH'TS.

359-200LG KEUFFEL & ESSER CO.
Ten Years by Months × 110 (10 per unit) divisions.
MADE IN U.S.A.

THOUSANDS OF ACRE FEET

3100
3000
2900
2800
2700
2600
2500
2400
2300
2200

110
100
90
80
70
60
50
40
30
20
10
0

Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

1942 1943 1944 1945 1946 1947 1948 1949 1950 19____

MASS DIAGRAM
OF
SLATE CREEK
DRAINAGE AREA = 47 SQ. MI.

SLATE CREEK
SH'T. 3 OF 3 SH'TS.

AVAILABLE RUNOFF IN SLATE & CANYON CREEKS

6 YEAR DRY PERIOD

Year	Month	Runoff at Goodyear's Bar 1000 A.F.	North Yuba Flow at Colgate Hd. dam 1000 A.F.	Surplus at Colgate Hd. Dam 1000 A.F.	Flow in Canyon Creek at Diversion Site 1000 A.F.	Flow in Slate Creek at Diversion Side 1000 A.F.	Tot. Avail. Slate & Canyon Cr. 1000 A.F.
1928	Oct.	10.9	17.5		2.3	2.8	
	Nov.	27.8	No Data		5.8	6.9	
	Dec.	17.6	45.2	1.8	3.7	4.4	8.1
	Jan.	22.5	57.0	13.6	4.7	5.7	10.4
	Feb.	24.6	89.2	48.6	5.1	6.2	11.3
	Mar.	165.0	458.1	414.7	34.3	41.2	75.5
	Apr.	91.0	170.2	128.2	18.9	22.7	41.6
	May	107.0	125.8	82.4	22.3	26.8	49.1
	June	23.1	45.1	3.1	4.8	5.8	
	July	11.9	27.0		2.5	3.0	
	Aug.	8.2	18.3		1.7	2.0	
	Sept.	7.4	11.1		1.5	1.9	
Yrly Total		517.0		692.4	107.6	129.4	196.0

REVISED
Dec.17, 1952

AVAILABLE RUNOFF IN SLATE & CANYON CREEKS

6 YEAR DRY PERIOD

Year	Month	Runoff at Goodyear's Bar 1000 A.F.	North Yuba Flow at Colgate Hd. dam 1000 A.F.	Surplus at Colgate Hd. Dam 1000 A.F.	Flow in Canyon Creek at Diversion Site 1000 A.F.	Flow in Slate Creek at Diversion Site 1000 A.F.	Tot. Avail. Slate & Canyon Cr. 1000 A.F.
1929	Oct.	8.2	11.3		1.7	2.0	
	Nov.	8.7	12.1		1.8	2.1	
	Dec.	11.4	19.5		2.4	2.9	
	Jan.	9.5	29.2		2.0	2.4	
	Feb.	11.5	41.2		2.4	2.9	
	Mar.	20.4	55.0	11.6	4.2	5.2	9.4
	Apr.	29.3	84.6	42.6	6.1	7.3	13.4
	May	60.1	120.1	76.7	12.5	15.0	27.5
	June	29.7	57.0	15.0	6.2	7.4	13.6
	July	10.8	19.4		2.2	2.6	
	Aug.	7.4	17.7		1.5	1.9	
	Sept.	6.0	9.3		1.2	1.5	
Yrly Total		213 .0		145.9	44.2	53.2	63.9

REVISED
Dec. 17, 1952

AVAILABLE RUNOFF IN SLATE & CANYON CREEKS

6 YEAR DRY PERIOD

Year	Month	Runoff at Goodyear's Bar 1000 A.F.	North Yuba Flow at Colgate Hd. Dam 1000 A.F.	Surplus at Colgate Hd. Dam 1000 A.F.	Flow in Canyon Creek at Diversion Site 1000 A. F.	Flow in Slate Creek at Diversion Site 1000 A.F.	Tot. Avail. Slate & Canyon Cr. 1000 A.F.
1930	Oct.	6.6	12.1		1.4	1.6	
	Nov.	5.8	8.9		1.2	1.5	
	Dec.	55.5	137.9	94.5	11.6	13.8	25.4
	Jan.	22.0	75.2	31.8	4.6	5.5	10.1
	Feb.	34.5	109.0	69.8	7.2	8.7	15.9
	Mar.	47.7	140.9	97.5	9.9	11.9	21.8
	Apr.	74.4	169.4	127.4	15.5	18.6	34.1
	May	65.8	139.6	96.2	13.7	16.5	30.2
	June	34.3	66.7	24.7	7.1	8.5	15.6
	July	12.7	23.4		2.6	3.1	
	Aug.	8.8	19.5		1.8	2.1	
	Sept.	8.1	17.4		1.7	2.0	
Yrly Total		376.0		541.9	78.3	93.8	153.1

REVISED
Dec. 17, 1952

AVAILABLE RUNOFF IN SLATE & CANYON CREEKS

6 YEAR DRY PERIOD

Year	Month	Runoff at Goodyear's Bar 1000 A.F.	North Yuba Flow at Colgate Hd. Dam 1000 A.F.	Surplus at Colgate Hd. Dam 1000 A.F.	Flow in Canyon Creek at Diversion Site 1000 A. F.	Flow in Slate Creek at Diversion Site 1000 A.F.	Tot. Avail. Slate & Canyon Cr. 1000 A.F.
1931	Oct.	7.1	16.1		1.5	1.8	
	Nov.	9.5	12.0		2.0	2.4	
	Dec.	7.4	17.9		1.5	1.9	
	Jan.	11.3	27.2		2.4	2.9	
	Feb.	11.4	37.3		2.4	2.9	
	Mar.	25.5	38.2		5.4	6.5	
	Apr.	29.6	60.7	17.3	6.2	7.4	13.6
	May	24.4	48.9	5.5	5.0	6.0	11.0
	June	10.9	20.9		2.3	2.8	
	July	6.1	11.8		1.2	1.4	
	Aug.	5.0	11.2		0.9	1.0	
	Sept.	4.9	10.8		0.8	1.0	
Yrly Total		153.0		41.4	31.6	38.0	24.6

REVISED
Dec. 17, 1952

AVAILABLE RUNOFF IN SLATE & CANYON CREEKS

6 YEAR DRY PERIOD

Year	Month	Runoff at Goodyear's Bar 1000 A.F.	North Yuba Flow at Colgate Hd. Dam 1000 A.F.	Surplus at Colgate Hd. Dam 1000 A.F.	Flow in Canyon Creek at Diversion Site 1000 A.F.	Flow in Slate Creek at Diversion Site 1000 A.F.	Tot. Avail. Slate & Canyon Cr. 1000 A.F.
1932	Oct.	7.8	11.4		1.4	1.6	
	Nov.	7.9	23.0		1.4	1.8	
	Dec.	22.5	56.8	13.4	4.1	4.9	
	Jan.	22.6	69.1	25.7	4.1	4.9	9.0
	Feb.	27.2	79.5	38.9	5.0	5.9	10.9
	Mar.	56.4	132.6	89.2	10.3	12.3	22.6
	Apr.	74.4	166.6	124.6	13.6	16.3	29.9
	May	143.0	240.5	197.1	26.1	31.3	57.4
	June	93.4	139.7	97.7	17.1	20.5	37.6
	July	22.8	39.3		4.2	5.0	
	Aug.	11.1	17.9		2.0	2.4	
	Sept.	8.1	14.1		1.5	1.8	
Yrly Total		497.0		586.6	90.8	108.7	167.4

REVISED
Dec. 17, 1952

AVAILABLE RUNOFF IN SLATE & CANYON CREEKS

6 YEAR DRY PERIOD

Year	Month	Runoff at Goodyear's Bar 1000 A.F.	North Yuba Flow at Colgate Hd. Dam 1000 A.F.	Surplus at Colgate Hd. Dam 1000 A. F.	Flow in Canyon Creek at Diversion Site 1000 A. F.	Flow in Slate Creek at Diversion Site 1000 A. F.	Tot. Avail. Slate & Canyon Cr. 1000 A.F.
1933	Oct.	7.8	18.2		1.4	1.6	
	Nov.	7.8	15.2		1.4	1.8	
	Dec.	8.2	14.2		1.5	1.8	
	Jan.	8.6	15.5		1.6	1.9	
	Feb.	8.7	15.2		1.6	1.9	
	Mar.	24.0	61.8	17.4	4.4	5.3	9.7
	Apr.	47.6	111.1	69.0	8.7	10.4	19.1
	May	68.9	139.0	95.6	12.6	15.1	27.7
	June	70.2	114.4	72.4	12.8	15.3	28.1
	July	14.2	26.8		2.6	3.1	
	Aug.	8.1	18.5		1.5	1.8	
	Sept.	6.6	13.8		1.2	1.8	
Yrly Total		281.0		254.4	51.3	61.8	84.6

REVISED
Dec. 17, 1952

AVAILABLE RUNOFF IN SLATE & CANYON CREEKS

6 YEAR DRY PERIOD

Year	Month	Runoff at Goodyear's Bar 1000 A.F.	North Yuba Flow at Colgate Hd. Dam 1000 A.F.	Surplus at Colgate Hd. Dam 1000 A.F.	Flow in Canyon Creek at Diversion Site 1000 A.F.	Flow in Slate Creek at Diversion Site 1000 A. F.	Total Avail. Slate & Canyon Cr. 1000 A.F.
1934	Oct.	8.9	10.7		1.6	1.9	
	Nov.	8.5	17.6		1.6	1.9	
	Dec.	18.3	42.0		3.3	4.0	
	Jan.	24.0	68.5	25.1	4.4	5.3	9.7
	Feb.	29.3	80.7	41.5	5.3	6.4	11.7
	Mar.	55.6	103.3	59.9	10.2	12.2	22.4
	Apr.	46.8	76.0	34.0	8.5	10.3	18.8
	May	26.1	48.7	5.3	4.8	5.7	10.5
	June	12.3	22.3		2.2	2.6	
	July	7.1	15.4		1.3	1.5	
	Aug.	5.4	12.1		1.0	1.0	
	Sept.	5.2	10.7		0.9	1.1	
Yrly Total		247.0		692.4	45.1	54.0	73.1

REVISED
Dec. 17, 1952

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RUNOFF AVAILABLE AT SLATE & CANYON CREEKS--6 YEAR DRY PERIOD

BY MONTHS

Water Year	O	N	D	J	F	M	A	M	J	J	A	S	Annual Tot. (1000 A.F.)
1928			8.1	10.4	11.3	63.2	41.6	49.1					183.7
1929						9.4	13.4	27.5	13.6				63.9
1930			23.1	10.1	15.9	21.8	34.1	30.2	15.6				150.8
1931							13.6	11.0					24.6
1932				9.0	10.9	22.6	29.9	56.3	37.6				166.3
1933						9.7	19.1	27.7	28.1				84.6
1934				9.7	11.7	22.4	18.8	10.5					73.1

LOCATION Sec. 24, T. 20N, R. 7E.
Estimated Natural

RECORD FROM USGS & USBR Est.

RUNOFF OF Lost Creek at Lost Creek Damsite

UNIT 1000A.F. DRAINAGE AREA 30 SQ. MILES

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
1920-21	2.3	13.4	11.1	19.7	8.8	19.1	14.5	10.9	4.0	1.5	0.9	0.8	107.0
21-22	0.7	0.5	2.3	2.9	9.5	9.3	13.3	27.2	8.0	2.3	1.0	0.6	77.6
22-23	0.9	0.9	6.2	5.2	3.2	4.8	14.3	6.6	2.4	1.2	0.7	0.7	47.1
23-24	1.3	0.4	0.6	1.3	9.1	2.0	1.7	1.6	2.0	0	0.7	0.3	21.0
24-25	1.3	1.2	1.5	2.0	20.1	7.4	13.4	7.4	2.6	1.9	2.3	2.1	63.2
25-26	1.2	0.7	0.8	2.3	11.2	4.1	16.2	3.2	1.9	1.3	1.4	1.3	45.6
26-27	2.2	5.4	3.7	5.6	26.3	14.7	17.6	9.4	3.9	2.6	3.2	2.5	97.1
27-28	1.7	2.7	1.9	3.7	5.7	29.5	12.8	4.5	2.2	1.8	2.0	1.7	70.2
28-29	1.4	0.8	1.0	0.9	3.0	4.8	4.7	5.5	2.6	1.7	1.5	1.5	29.4
29-30	0.8	0.6	9.4	4.8	7.6	11.0	8.6	5.2	2.3	1.4	1.2	1.0	53.9
30-31	1.0	1.7	1.2	2.6	2.6	4.9	2.3	1.5	1.3	0.7	0.4	0.6	20.8
31-32	1.2	1.1	4.0	3.9	3.7	10.1	12.8	10.6	4.0	1.8	1.1	0.8	55.1
32-33	0.9	1.0	1.0	1.2	0.9	4.2	7.6	7.9	3.1	1.4	0.8	0.7	30.7
33-34	1.2	0.9	4.1	5.7	7.3	5.5	2.9	2.3	1.5	1.0	0.6	0.7	33.7
34-35	1.0	2.1	2.5	4.8	6.2	5.6	25.1	13.9	3.3	2.0	1.3	1.0	68.8
35-36	1.2	1.2	2.0	12.2	19.1	12.0	14.1	5.4	3.7	1.5	2.2	3.0	77.6
36-37	1.2	1.1	1.0	0.9	3.9	5.7	13.8	17.5	4.0	2.2	1.2	1.1	53.4
37-38	1.3	4.9	15.3	7.4	11.0	28.7	25.3	27.3	9.1	3.6	2.0	1.7	137.6
38-39	2.0	1.7	2.3	3.3	1.7	6.6	6.4	2.3	1.7	1.2	0.8	1.7	31.7
39-40	1.5	0.9	1.5	14.6	24.1	24.5	13.4	4.5	2.7	2.4	1.5	1.3	92.9
40-41	1.4	2.1	13.3	13.6	23.1	19.9	17.8	15.9	5.0	2.7	2.0	1.5	118.3
41-42	1.9	1.2	10.9	16.3	18.4	7.8	17.7	12.0	5.5	3.6	3.1	2.3	100.7
42-43	1.8	2.7	5.6	18.3	10.0	19.5	14.1	5.8	3.5	2.8	2.4	2.1	88.6
43-44	0.9	0.5	0.8	1.9	3.7	7.0	6.5	9.2	3.1	1.3	0.9	0.8	36.6
44-45	0.7	2.8	4.0	3.4	16.3	6.5	9.3	9.0	3.0	1.9	1.7	0.5	59.1

Oct. 1929-Sept. 1941 USGS Record Corrected for Storage and Diversion;
Oct. 1920-Sept. 1929, Oct. 1941-Sept. 1945 Estimated by correlation with South Fork Feather at Enterprise; 1920-21 and 1923-24 Further Adjusted By Annual Correlation with Enterprise Record.

MASS DIAGRAM OF LOST CREEK DRAINAGE AREA

SEC. 24, T. 20 N., R. 7 E., M.D.B.&M.

BUTTE COUNTY, CALIFORNIA

DRAINAGE AREA = 30 SQ. MI.

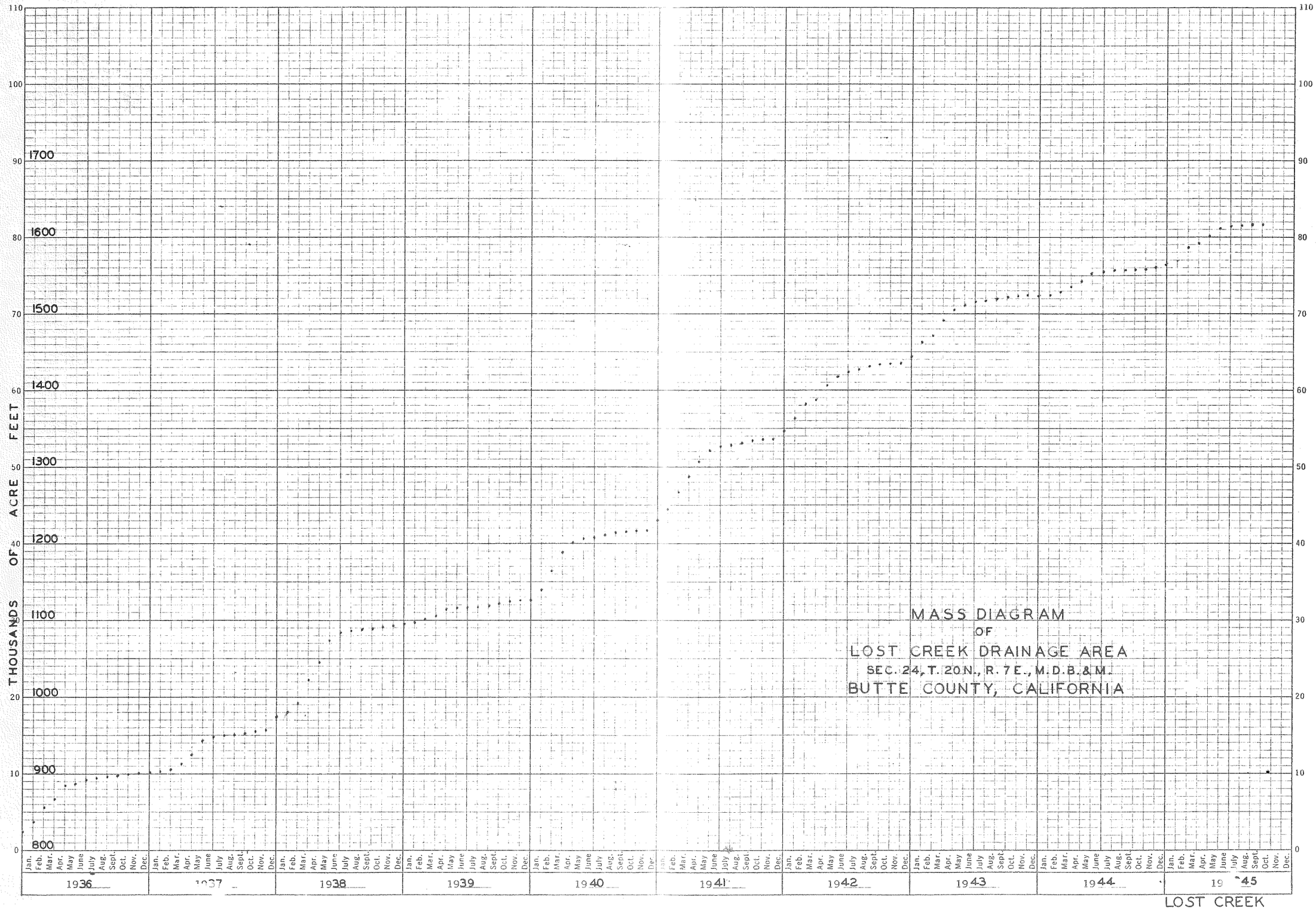
GROSS YIELD 40,000 ACRE FEET ON UNIFORM DRAFT WITH 37,000 A.F. OF STORAGE REQUIRED IN 1923-1934

STORAGE = 37,000 A.F.

YIELD = 40,000 A.F.

THOUSANDS OF ACRE FEET

LOST CREEK
SEC. 24, T. 20 N., R. 7 E., M.D.M.



MASS DIAGRAM
OF
LOST CREEK DRAINAGE AREA
SEC. 24, T. 20 N., R. 7 E., M.D.B.&M.
BUTTE COUNTY, CALIFORNIA

LOST CREEK
SEC. 24, T. 20 N., R. 7 E., M.D.M.

1927 1928 1929 1930 1931 1932 1933 1934 1935

THOUSANDS OF ACRE FEET

THOUSANDS OF ACRE FEET

STORAGE = 14,000 A.F.

YIELD = 11,400 A.F.

DRAINAGE AREA = 19.00 SQ. MI.
TOTAL YIELD AT GAUGE = 11,400 ACRE FEET
STORAGE REQUIRED FOR UNIFORM DRAFT = 14,000 A.F.
12/31/52 E.A.B.

MASS DIAGRAM
OF
FRENCH DRY CREEK - BROWNSVILLE GAUGE
SEC. 25, T. 19 N., R. 6 E., M.D.B.&M.
YUBA COUNTY, CALIFORNIA

Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

19____ 19____ 19____ 1920 1921 1922 1923 1924 1925 1926

EST. AS 39% OF OREGON CREEK

MASS DIAGRAM
FRENCH DRY CREEK-BROWNSVILLE GAUGE

APPENDIX NO. 2

OPERATIONAL CHARTS

Lost Creek Reservoir

Little Grass Valley Reservoir

MASS DIAGRAM DATA-LOST CREEK RESERVOIR-6 YEAR DRY PERIOD 1927-1934

RESERVOIR CAPACITY 140,000 A.F. AT LOST CREEK-36,600 A.F. YIELD FROM L.G.V. RESERVOIR

Water Year	Mo.	So. Fk. F.R. Diversion	Slate and Canyon Cr.	Lost Creek	Little Grass Valley Draft	Mass Ord.	Deductions Evap.	Deductions Fish	Draft	Storage
1928	O			1.7		1.7	0.3			1.4
	N	2.4		2.7		6.8	0.1	0.3		6.1
	D	1.1	8.1	1.9		17.9	0.1	0.3		16.8
	J	1.4	10.4	3.7		33.4	0.1	0.3		31.9
	F	2.2	11.3	5.7		52.6	0.1	0.3		50.7
	M	10.2	60.0	29.5		152.3	0.1	0.3		140.0 10.0-Spill
	A	5.2	41.6	12.8		211.9	0.1	0.3		140.0 59.2-Spill
	M	3.5	49.1	4.5	6.6-Spill	275.6	0.3	0.3	14.1	140.0 49.0-Spill
	J	0.4		2.2	0.6-Spill	278.8	0.3	0.3	13.6	129.0
	J			1.8	9.0	289.6	0.3		14.1	125.4
	A			2.0	9.0	300.6	0.3		14.1	122.0
	S			1.7	9.0	311.3	0.3		13.6	118.80

MASS DIAGRAM DATA-LOST CREEK RESERVOIR-6 YEAR DRY PERIOD 1927-1934
RESERVOIR CAPACITY 140,000 A.F. AT LOST CREEK-36,600 A.F. YIELD FROM L.G.V. RESERVOIR

Water Year	Mo.	So. Fk. F.R. Diversion	Slate and Canyon Cr.	Lost Creek	Little Grass Valley Draft	Mass Ord.	Deductions Evap.	Fish	Draft	Storage
1929	O			1.4	9.0	321.7	0.3		14.1	114.8
	N	0.1		0.8		322.6	0.1	0.3	13.6	101.7
	D	0.2		1.0		323.8	0.1	0.3	14.1	88.4
	J	0.2		0.9		324.9	0.1	0.3	14.1	75.0
	F	0.8		3.0		328.7	0.1	0.3	12.7	65.7
	M	1.8	9.4	4.8		344.7	0.1	0.3	14.1	67.2
	A	3.0	13.4	4.7		365.8	0.1	0.3	13.6	74.3
	M	6.8	27.5	5.5		405.6	0.3	0.3	14.1	99.4
	J	1.8	13.6	2.6		423.6	0.3	0.3	13.6	103.2
	J			1.7		425.3	0.3		14.1	90.5
	A			1.5	9.0	435.8	0.3		14.1	86.6
	S			1.5	9.0	446.3	0.3		13.6	83.2

MASS DIAGRAM DATA-LOST CREEK RESERVOIR-6 YEAR DRY PERIOD 1927-1934
RESERVOIR CAPACITY 140,000 A.F. AT LOST CREEK-36,600 A.F. YIELD FROM L.G.V. RESERVOIR

Water Year	Mo.	So. Fk. F.R. Diversion	Slate and Canyon Cr.	Lost Creek	Little Grass Valley Draft	Mass Ord.	Deductions Evap.	Fish	Draft	Storage
1930	O			0.8	9.0	456.1	0.3		14.1	78.6
	N			0.6	9.0	465.7	0.1		13.6	74.5
	D	5.5	25.4	9.4		506.0	0.1	0.3	14.1	100.3
	J	1.3	10.1	4.8		522.2	0.1	0.3	14.1	102.0
	F	2.3	15.9	7.6		548.0	0.1	0.3	12.7	114.7
	M	2.8	21.8	11.0		583.6	0.1	0.3	14.1	135.8
	A	7.7	34.1	8.6	1.1-Spill	635.1	0.1	0.3	13.6	140.0 33.3-Spill
	M	5.0	30.2	5.2	11.4-Spill	686.9	0.3	0.3	14.1	140.0 37.1-Spill
	J	1.1	15.6	2.3	2.2-Spill	708.1	0.3	0.3	13.6	140.0 7.0-Spill
	J			1.4	9.0	718.5	0.3		14.1	136.0
	A			1.2	9.0	728.7	0.3		14.1	131.8
	S			1.0	9.0	738.7	0.3		13.6	127.9

MASS DIAGRAM DATA-LOST CREEK RESERVOIR-6 YEAR DRY PERIOD 1927-1934

RESERVOIR CAPACITY 140,000 A.F. AT LOST CREEK-36,600 A.F. YIELD FROM L.G.V. RESERVOIR

Water Year	Mo.	So. Fk. F.R. Diversion	Slate and Canyon Cr.	Lost Creek	Little Grass Valley Draft	Mass Ord.	Deductions Evap.	Deductions Fish	Draft	Storage
1931	O			1.0	9.0	748.7	0.3		14.1	123.5
	N	0.2		1.7		750.6	0.1	0.3	13.6	111.4
	D	0.1		1.2		751.9	0.1	0.3	14.1	98.2
	J	0.4		2.6		754.9	0.1	0.3	14.1	86.7
	F	0.6		2.6		758.1	0.1	0.3	12.7	76.8
	M	2.9		4.9		765.9	0.1	0.3	14.1	70.1
	A	2.8	13.6	2.3		784.6	0.1	0.3	13.6	74.8
	M	1.3	11.0	1.5		798.4	0.3	0.3	14.1	73.9
	J	0.3		1.3		800.0	0.3	0.3	13.6	61.3
	J			0.7	9.0	809.7	0.3		14.1	56.6
	A			0.4	9.0	819.1	0.3		14.1	51.6
	S			0.6	9.0	828.7	0.3		13.6	47.3

MASS DIAGRAM DATA-LOST CREEK RESERVOIR-6 YEAR DRY PERIOD 1929 - 1934

RESERVOIR CAPACITY 140,000 A.F. AT LOST CREEK-36,600 A.F. YIELD FROM L.G.V.RESERVOIR

Water Year	Mo.	So. Fk. F. R. Diversion	Slate and Canyon Cr.	Lost Creek	Little Grass Valley Draft	Mass Ord.	Deductions Evap.	Deductions Fish	Draft	Storage	
1932	O			1.2		829.9	0.3		14.1	34.1	
	N	0.1		1.1		831.1	0.1	0.3	13.6	21.3	
	D	0.6		4.0		835.7	0.1	0.3	14.1	11.4	
	J	0.9	9.0	3.9		849.5	0.1	0.3	14.1	10.7	
	F	0.6	10.9	3.7		864.7	0.1	0.3	12.7	12.8	
	M	3.2	22.6	10.1		900.6	0.1	0.3	14.1	34.2	
	A	6.4	29.9	12.8		949.7	0.1	0.3	13.6	69.3	
	M	10.1	57.4	10.6		1027.8	0.3	0.3	14.1	132.7	
	J	4.1	37.6	4.0	9.3 Spill	1082.8	0.3	0.3	13.6	140.0	
										33.5	Spill
	J			1.8	9.0	1093.6	0.3		14.1	136.4	
	A			1.1	9.0	1103.7	0.3		14.1	132.7	
	S			0.8	9.0	1113.5	0.3		13.6	128.0	

MASS DIAGRAM DATA-LOST CREEK RESERVOIR-6 YEAR DRY PERIOD 1929 - 1934

RESERVOIR CAPACITY 140,000 A.F. AT LOST CREEK - 36,600 A.F. YIELD FROM L.G.V. RESERVOIR

Water Year	Mo.	So. Fk. F. R. Diversion	Slate and Canyon Cr.	Lost Creek	Little Grass Valley Draft	Mass Ors.	Deductions Evap.	Fish	Draft	Storage
1933	O			0.9	9.0	1123.4	0.3		14.1	123.5
	N			1.0		1124.4	0.1		13.6	110.8
	D	0.1		1.0		1125.5	0.1	0.3	14.1	97.4
	J			1.2		1126.7	0.1		14.1	84.4
	F	0.1		0.9		1127.7	0.1	0.3	12.7	72.3
	M	0.4	9.7	4.2		1142.0	0.1	0.3	14.1	72.1
	A	2.7	19.1	7.6		1171.4	0.1	0.3	13.6	87.5
	M	5.0	27.7	7.9		1212.0	0.3	0.3	14.1	113.4
	J	4.3	28.1	3.1		1247.5	0.3	0.3	13.6	134.7
	J			1.4		1248.9	0.3		14.1	121.7
	A			0.8	9.0	1258.7	0.3		14.1	117.1
	S			0.7	9.0	1268.4	0.3		13.6	112.9

MASS DIAGRAM DATA-LOST CREEK RESERVOIR - 6 YEAR DRY PERIOD 1929 - 1934

RESERVOIR CAPACITY 140,000 A.F. AT LOST CREEK - 36,600 A.F. YIELD FROM L.G V. RESERVOIR

Water Year	Mo.	So. Fk. F.R. Diversion	Slate and Canyon Cr.	Lost Creek	Little Grass Valley Draft	Mass Ord.	Deductions Evap.	Deductions Fish	Draft	Storage
1934	O			1.2	9.0	1278.6	0.3		14.1	108.7
	N	0.1		0.9	9.0	1288.6	0.1	0.3	13.6	104.7
	D	0.5		4.1		1293.2	0.1	0.3	14.1	94.8
	J	1.7	9.7	5.7		1310.3	0.1	0.3	14.1	97.4
	F	2.3	11.7	7.3		1331.6	0.1	0.3	12.7	105.6
	M	3.0	22.4	5.5		1362.5	0.1	0.3	14.1	122.0
	A	2.9	18.8	2.9		1387.1	0.1	0.3	13.6	132.6
	M	1.2	10.5	2.3		1401.1	0.3	0.3	14.1	131.9
	J	0.2		1.5		1402.8	0.3	0.3	13.6	119.4
	J			1.0		1403.8	0.3		14.1	106.0
	A			0.6	9.0	1413.4	0.3		14.1	101.2
	S			0.7	9.0	1423.1	0.3		13.6	97.0

13.6 30 | 408 00
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FEATHER-YUBA PROJECT
MASS DIAGRAM DATA
LOST CREEK RESERVOIR
6 YEAR DRY PERIOD

Water Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1928	1.7	6.8	17.9	33.4	52.6	152.3	211.9	275.6	278.8	289.6	300.6	311.3
1929	321.7	322.6	323.8	324.9	328.7	344.7	365.8	405.6	423.6	425.3	435.8	446.3
1930	456.1	465.7	506.0	522.2	548.0	583.6	635.1	686.9	708.1	718.5	728.7	738.7
1931	748.7	750.6	751.9	754.9	758.1	765.9	784.6	798.4	800.0	809.7	819.1	828.7
1932	829.9	831.1	835.7	849.5	864.7	900.6	949.7	1027.8	1082.8	1093.6	1103.7	1113.5
1933	1123.4	1124.4	1125.5	1126.7	1127.7	1142.0	1171.4	1212.0	1247.5	1248.9	1258.7	1268.4
1934	1278.6	1288.6	1293.2	1310.3	1331.6	1362.5	1387.1	1401.1	1402.8	1403.8	1413.4	1423.1

NOTE: This table includes runoff from the South Fork Diversion, Lost Creek, Slate Creek, Canyon Creek, and Little Grass Valley Reservoir Draws.

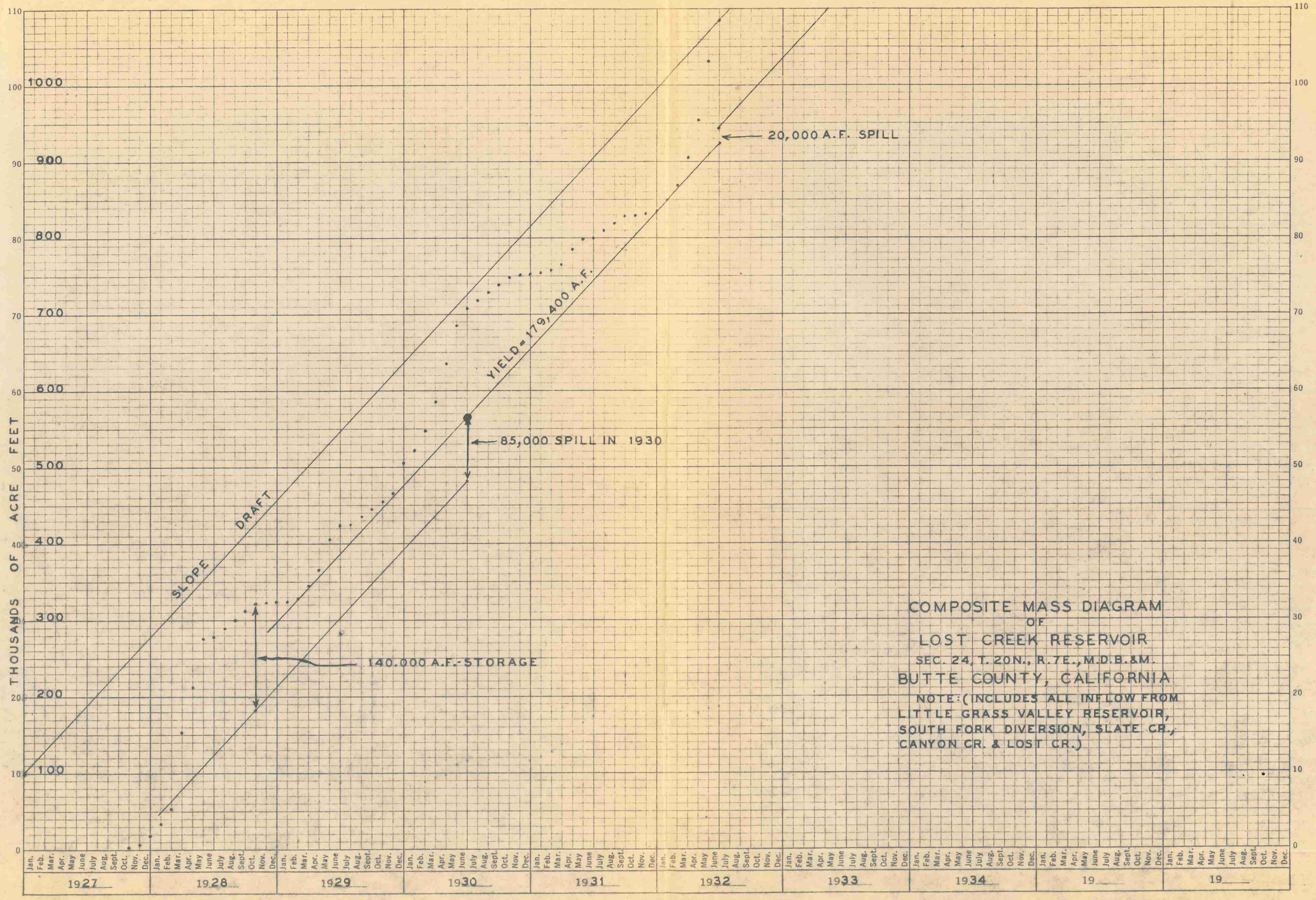
FEATHER-YUBA PROJECT

CUMULATIVE STORAGE - 6 YEAR DRY PERIOD

LOST CREEK RESERVOIR

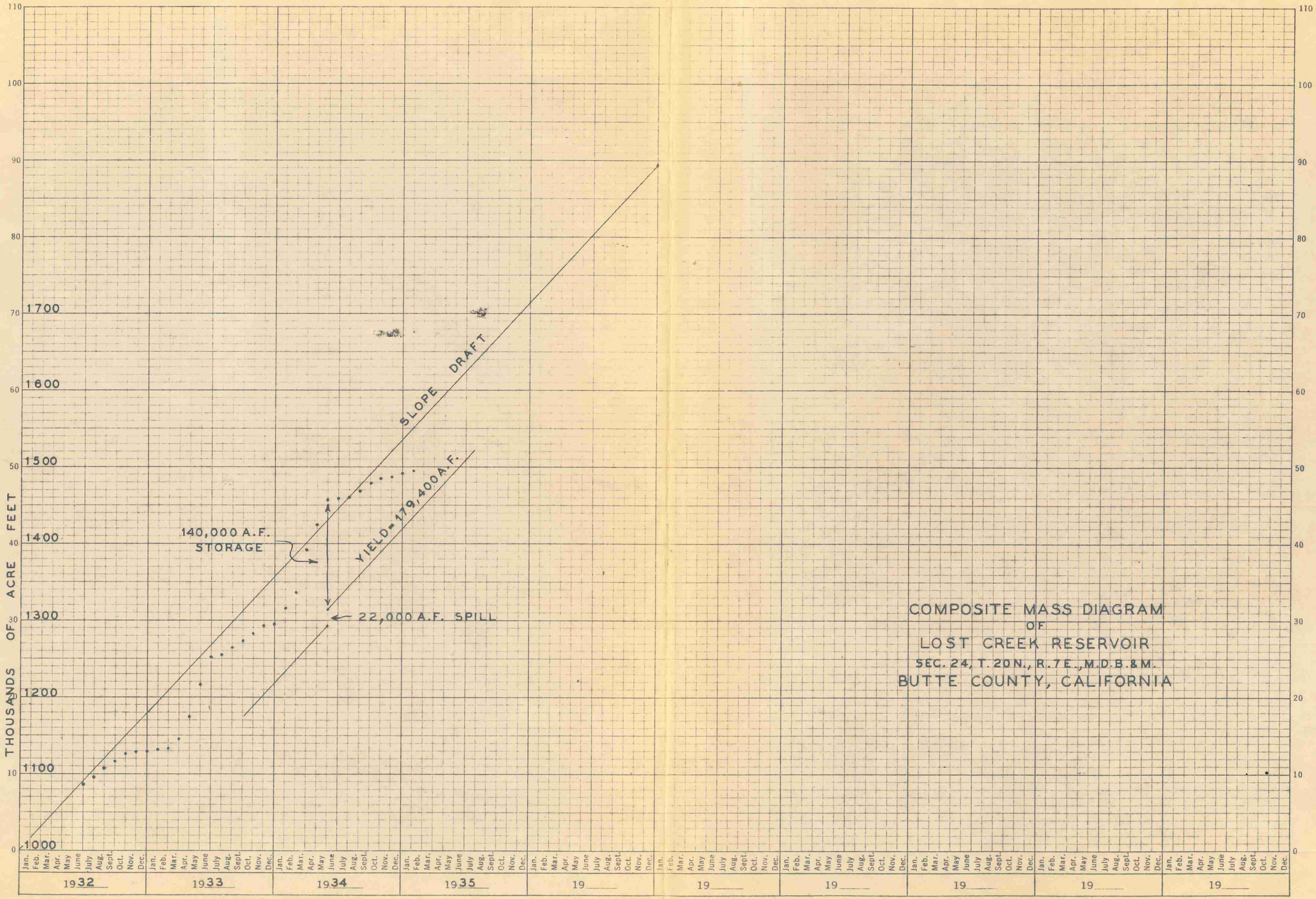
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
1928	1.4	6.1	16.8	31.9	50.7	140.0 Spill 10.0	140.0 Spill 59.2	140.0 Spill 49.0	129.0	125.4	122.0	118.8
1929	114.8	101.7	88.4	75.0	65.7	67.2	74.3	99.4	103.2	90.5	86.6	83.2
1930	78.6	74.5	100.3	102.0	114.7	135.8	140.0 Spill 33.3	140.0 Spill 37.1	140.0 Spill 7.0	136.0	131.8	127.9
1931	123.5	111.4	98.2	86.7	76.8	70.1	74.8	73.9	61.3	56.6	51.6	47.3
1932	34.1	21.3	11.4	10.7	12.8	34.2	69.3	132.7	140.0 Spill 33.5	136.4	132.1	128.0
1933	123.5	110.8	97.4	84.4	72.3	72.1	87.5	113.4	134.7	121.7	117.1	112.9
1934	108.7	104.7	94.8	97.4	105.6	122.0	132.6	131.9	119.4	106.0	101.2	97.0

NOTE: This table based upon 140,000 A.F. Storage and 179,900 A.F. yearly draw, including 36,600 A.F. from L.G.V. Reservoir. Fish flows for Lost Creek have been included. Fish flows for the South Fork below the diversion dam and evaporation from Lost Creek Reservoir have also been included.



COMPOSITE MASS DIAGRAM
OF
LOST CREEK RESERVOIR
SEC. 24, T. 20N., R. 7E., M.D.B.&M.
BUTTE COUNTY, CALIFORNIA
NOTE: (INCLUDES ALL INFLOW FROM LITTLE GRASS VALLEY RESERVOIR, SOUTH FORK DIVERSION, SLATE CR., CANYON CR. & LOST CR.)

LOST CREEK RESERVOIR



LOST CREEK RESERVOIR

LITTLE GRASS VALLEY RESERVOIR - 36,600 A. F. YIELD - 50,500 A.F. CAPACITY
Mass Diagram Data and Reservoir Operation - 6 Year Dry Period 1928-1934

Water Year	Month	Inflow	Mass ORD	Deductions Evap	Deductions Fish	Draw	Storage
1928	O	0.1	0.1	0.3	0.6		0.8
	N	5.6	5.7	0.1	0.3		4.4
	D	2.6	8.3	0.1	0.3		6.6
	J	3.2	11.5	0.1	0.3		9.4
	F	5.2	16.7	0.1	0.3		14.2
	M	23.7	40.4	0.1	0.3		37.5
	A	12.1	52.5	0.1	0.3		49.2
	M	8.2	60.7	0.3		Spill 6.6	50.5
	J	0.9	61.6	0.3		Spill 0.6	50.5
	J	0.2	61.8	0.3		9.0	41.4
	A	0.1	61.9	0.3		9.0	32.2
	S	0.1	62.0	0.3		9.0	23.0

LITTLE GRASS VALLEY RESERVOIR - 36,600 A.F. YIELD - 50,500 A.F. CAPACITY
Mass Diagram Data and Reservoir Operation - 6 Year Dry Period 1928-1934

Water Year	Month	Inflow	Mass ORD	Deductions Evap	Deductions Fish	Draw	Storage
1929	O	0.1	62.1	0.3		9.0	13.8
	N	0.3	62.4	0.1	0.3		13.7
	D	0.5	62.9	0.1	0.3		13.8
	J	0.4	63.3	0.1	0.3		13.8
	F	1.8	65.1	0.1	0.3		15.2
	M	4.2	69.3	0.1	0.3		19.0
	A	6.9	76.2	0.1	0.3		25.5
	M	15.9	92.1	0.3	0.3		40.8
	J	4.3	96.4	0.3	0.3		44.5
	J	0.7	97.1	0.3	0.3		44.6
	A	0.1	97.2	0.3		9.0	35.4
	S	0.1	97.3	0.3		9.0	26.2

LITTLE GRASS VALLEY RESERVOIR - 36,600 A.F. YIELD - 50,500 A.F. CAPACITY
Mass Diagram Data and Reservoir Operation - 6 Year Dry Period 1928-1934

Water Year	Month	Inflow	Mass ORD	Deductions Evap	Deductions Fish	Draw	Storage
1930	O	0.1	97.4	0.3		9.0	17.0
	N	0.1	97.5	0.1		9.0	8.0
	D	12.7	110.2	0.1	0.3		20.3
	J	3.0	113.2	0.1	0.3		22.9
	F	5.3	118.5	0.1	0.3		27.8
	M	6.6	125.1	0.1	0.3		34.0
	A	18.0	143.1	0.1		Spill 1.4	50.5
	M	11.7	154.8	0.3		Spill 11.4	50.5
	J	2.5	157.3	0.3		Spill 2.2	50.5
	J	0.3	157.6	0.3		9.0	41.5
	A	0.1	157.7	0.3		9.0	32.3
	S	0.1	157.8	0.3		9.0	23.1

LITTLE GRASS VALLEY RESERVOIR - 36,600 A.F. YIELD - 50,500 A.F. CAPACITY
Mass Diagram Data and Reservoir Operation - 6 Year Dry Period 1928-1934

Water Year	Month	Inflow	Mass ORD	Deductions Evap	Deductions Fish	Draw	Storage
1931	O	0.1	157.9	0.3		9.0	13.9
	N	0.5	158.4	0.1	0.3		14.0
	D	0.3	158.7	0.1	0.3		13.9
	J	0.9	159.6	0.1	0.3		14.4
	F	1.3	160.9	0.1	0.3		15.3
	M	6.7	167.6	0.1	0.3		21.6
	A	6.4	174.0	0.1	0.3		27.6
	M	3.0	177.0	0.3	0.3		30.0
	J	0.8	177.8	0.3	0.3		30.2
	J	0.1	177.9	0.3		9.0	21.0
	A	0.1	178.0	0.3		9.0	11.8
	S	0.1	178.1	0.3		9.0	2.6

LITTLE GRASS VALLEY RESERVOIR - 36,600 A.F. YIELD - 50,500 A.F. CAPACITY
Mass Diagram Data and Reservoir Operation - 6 Year Dry Period 1928-1934

Water Year	Month	Inflow	Mass ORD	Deductions Evap	Deductions Fish	Draw	Storage
1932	O	0.4	178.5	0.3	0.3		2.4
	N	0.3	178.8	0.1	0.3		2.3
	D	1.3	180.1	0.1	0.3		3.2
	J	2.1	182.3	0.1	0.3		4.9
	F	1.5	183.8	0.1	0.3		6.0
	M	7.5	191.3	0.1	0.3		13.1
	A	14.8	206.1	0.1	0.3		27.5
	M	23.6	229.7	0.3	0.3		50.5
	J	9.6	239.3	0.3		Spill 9.3	50.5
	J	0.8	240.1	0.3		9.0	42.0
	A	0.2	240.3	0.3		9.0	32.9
	S	0.1	240.4	0.3		9.0	23.7

LITTLE GRASS VALLEY RESERVOIR - 36,600 A.F. YIELD - 50,500 A.F. CAPACITY
Mass Diagram Data and Reservoir Operation - 6 Year Dry Period 1928-1934

Water Year	Month	Inflow	Mass ORD	Deductions Evap	Deductions Fish	Draw	Storage
1933	O	0.1	240.5	0.3		9.0	14.5
	N	0.1	240.6	0.1	0.3		14.2
	D	0.2	240.8	0.1	0.3		14.0
	J	0.2	241.0	0.1	0.3		13.8
	F	0.2	241.2	0.1	0.3		13.6
	M	0.9	242.1	0.1	0.3		14.1
	A	6.3	248.4	0.1	0.3		20.0
	M	11.7	260.1	0.3	0.3		31.1
	J	10.1	270.2	0.3	0.3		40.6
	J	0.7	270.9	0.3	0.3		40.7
	A	0.1	271.0	0.3		9.0	31.5
	S	0.1	271.1	0.3		9.0	22.3

LITTLE GRASS VALLEY RESERVOIR - 36,600 A.F. YIELD - 50,500 A.F. CAPACITY
Mass Diagram Data and Reservoir Operation - 6 Year Dry Period 1928-1934

Water Year	Month	Inflow	Mass ORD	Deductions Evap	Deductions Fish	Draw	Storage
1934	O	0.1	271.2	0.3		9.0	13.1
	N	0.2	271.4	0.1		9.0	4.2
	D	0.1	271.5	0.1	0.3		3.9
	J	3.9	275.4	0.1	0.3		7.4
	F	5.4	280.8	0.1	0.3		12.4
	M	7.0	287.8	0.1	0.3		19.0
	A	6.7	294.5	0.1	0.3		25.3
	M	2.9	297.4	0.3	0.3		27.6
	J	0.4	297.8	0.3	0.3		27.4
	J	0.1	297.9	0.3	0.3		26.9
	A	0.1	298.0	0.3		9.0	17.7
	S	0.1	298.1	0.3		9.0	8.5

LITTLE GRASS VALLEY RESERVOIR - 36,600 A.F. YIELD - 50,500 A.F. CAPACITY
Mass Diagram Data and Reservoir Operation - 6 Year Dry Period 1928-1934

Water Year	Month	Inflow	Mass ORD	Deductions Evap	Deductions Fish	Draw	Storage
1935	O	0.1	298.2	0.3		5.0	3.3
	N	1.5	299.7	0.1	0.3		4.4
	D	0.7	300.4	0.1	0.3		4.7
	J	5.0	305.4	0.1	0.3		9.3
	F	1.9	307.3	0.1	0.3		10.8
	M	5.0	312.3	0.1	0.3		15.4
	A	25.9	338.2	0.1	0.3		39.9
	M	23.5	361.7	0.3		Spill 12.6	50.5
	J	8.3	370.0	0.3		Spill 8.0	50.5
	J	0.5	370.5	0.3		9.0	41.7
	A	0.1	370.6	0.3		9.0	32.5
	S	0.1	370.7	0.3		9.0	23.3

1927 1928 1929 1930 1931 1932 1933 1934 1935

THOUSANDS OF ACRE FEET

700 600 500 400 300 200

3000 DEF.

SPILL 10,000

2500 DEF.

WITH 50,500 A.F. STORAGE

GROSS DRAFT 37,000 A.F. DURING 4 SUMMER MO'S.
EVAPORATION AVERAGE 950 AC. X 2.33 = 2,200
UNSTORED AVERAGE - JULY, AUG., & SEPT. = 700
TOTAL DEDUCTIONS 2,900

NET YIELD — 34,100 A.F.

WITH SPILL OF 20,000 IN THE YEAR OF 1930
" " " 10,000 " " " " 1932

12/22/52
E.A.B.

WITH 60,000 A.F. STORAGE

GROSS DRAFT 40,000 A.F. DURING 4 SUMMER MO'S.
EVAPORATION AVERAGE 1,100 AC. X 2.33 = 2,500
UNSTORED AVERAGE - JULY, AUG., & SEPT. = 700
TOTAL DEDUCTIONS 3,200

NET YIELD — 36,800 A.F.

WITH SPILL OF 10,000 IN THE YEAR OF 1930, NO DEFICIENCIES

DRAINAGE AREA = 27.3 SQ. MI.

MASS DIAGRAM
OF
LITTLE GRASS VALLEY RESERVOIR
DAMSITE LOCATED ON THE
SOUTH FORK OF THE FEATHER RIVER
SEC. 31, T. 22 N., R. 9E., M.D.B.&M.
PLUMAS COUNTY, CALIFORNIA

3000 DEF.

THOUSANDS OF ACRE FEET

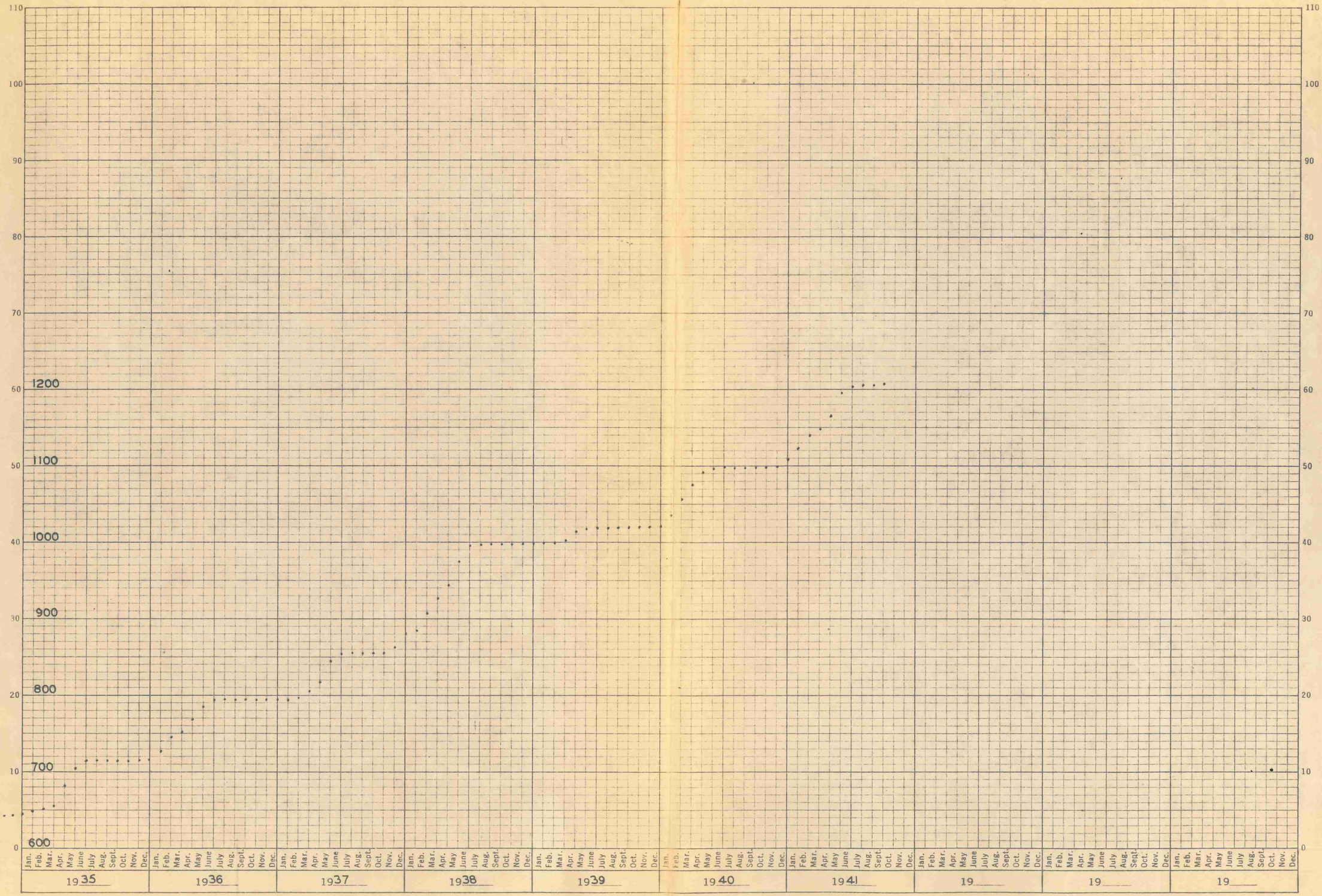
500 300 200 100

Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

19 19 19 1922 1923 1924 1925 1926 1927 1928

359-200LG KEUFFEL & ESSER CO.
Ten Years by Months X 110 (10 per unit) divisions.
MADE IN U.S.A.

LITTLE GRASS VALLEY
MASS DIAGRAM



LITTLE GRASS VALLEY

R.4 E. R.5 E. R.6 E. R.7 E. R.8 E. R.9 E.

T. 22 N.

T. 21 N.

T. 20 N.

T. 19 N.

T. 18 N.

T. 17 N.

T. 16 N.

T. 15 N.

MIDDLE FORK FEATHER RIVER

S. BRANCH

FEATHER RIVER

LITTLE GRASS VALLEY RES.

CASCADE

LA PORTE

BUTTE CO.

SIERRA CO.

FEATHER FALL RIVER

SOUTH FORK DIV.

SLATE CREEK DIV.

CANYON CREEK DIV.

N. FORK FEATHER RIVER

LUMPKIN

FEATHER FALLS

LOST CREEK RES.

STRAWBERRY

MIDDLE FORK FEATHER RIVER

SOUTH FORK FEATHER RIVER

FORBESTOWN

YUBA SLATE CANYON RIVER

LAKE WYANDOTTE

CHALLENGE P.H.

WOODLEAF

OROVILLE

FEATHER RIVER

RACKERBY DIV.

NEW YORK FLAT RES.

CHALLENGE

NORTH YUBA RIVER

WYANDOTTE

PALERMO

APPROXIMATE LIMITS OF AREA TO BE IRRIGATED

HONCUT P.H.

BULLARDS BAR RES.

BANGOR DIV.

DOBBINS DIV.

BANGOR

LAKE MILDRED

DOBBINS

YUBA RIVER

MIDDLE

HONCUT

LAKE FRANCIS

SWUBA CREEK

YUBA CO.

NEVADA CO.

BUTTE CO.

YUBA CO.

NORTH HONCUT CREEK

SOUTH HONCUT

HONCUT

LOMA RICA

DEER CREEK

FEATHER RIVER

BROWNS VALLEY

DRY

ENGLEBRIGHT RES.

SUTTER CO.

YUBA CO.

YUBA

MARYSVILLE

YUBA CO.

NEVADA CO.

FEATHER-YUBA PROJECT

GENERAL LOCATION MAP

- PROJECT SYMBOLS

SIPHONS & PENSTOCKS-HH

TUNNELS - = = = = = =

CANALS & FLUMES-

POWERHOUSES -

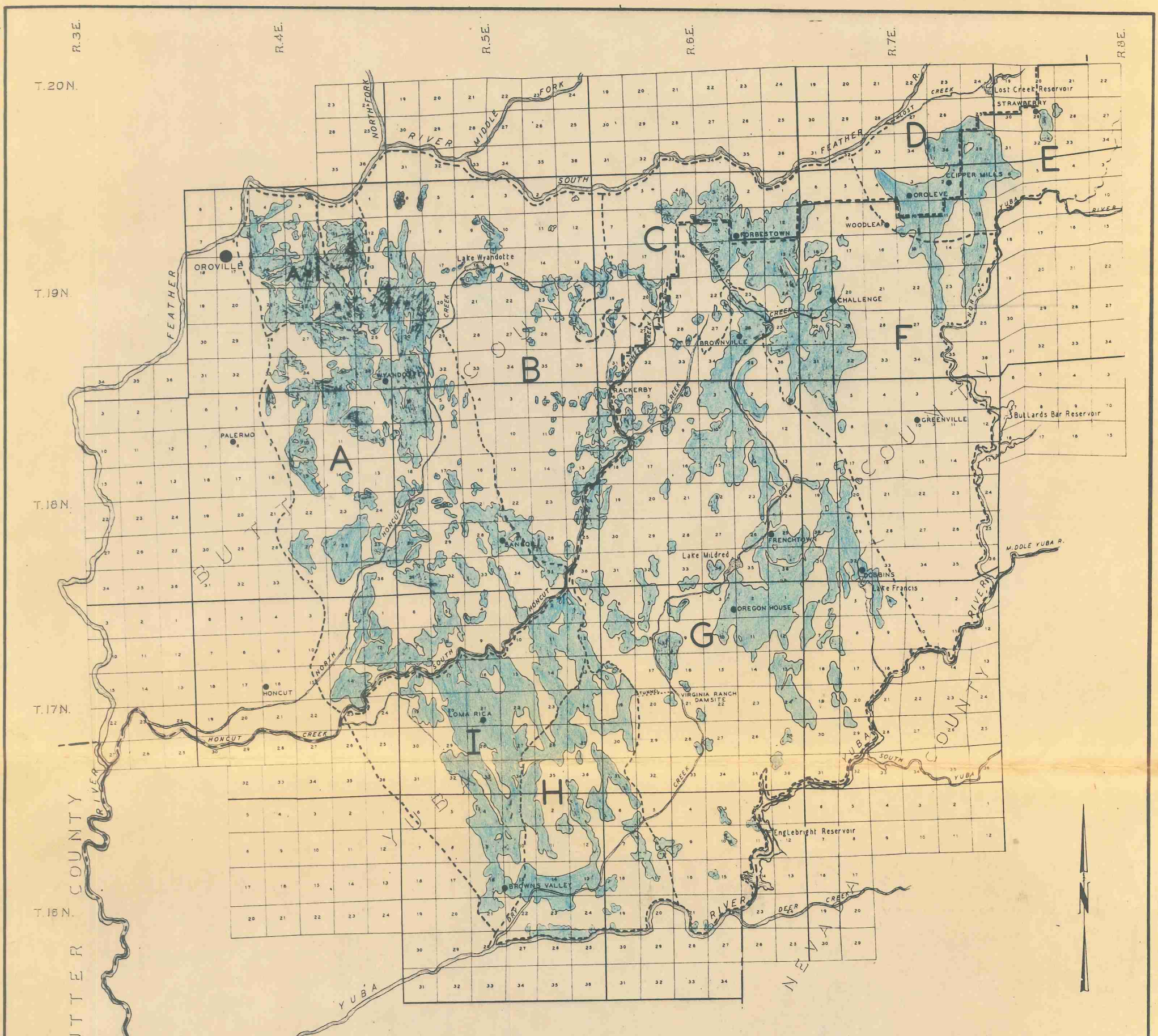
0 1/2 1 2 3 4 5 6

SCALE IN MILES

PLATE NO. 1

T. H. McGUIRE & SON, ENGINEERS GRASS VALLEY, CALIF. NOVEMBER 1952

REVISED 2-2-53



STATE LAND CLASSIFICATION
OF
IRRIGABLE AREAS
FEATHER-YUBA FOOTHILL AREA

SCALE IN MILES

SYMBOL	AREA	80% PROBABLE ULT. IRRIGATED ACRES	ULTIMATE WATER DEMAND-ACRE FT.
	BUTTE COUNTY		
D	CLIPPER MILLS, ABOVE LOST CR. RES.	2,088	4,176
C	WOODLEAF-CHALLENGE	2,274	5,230
B	NEW YORK FLAT	3,978	10,741
A	BANGOR	13,660	40,980
A-1	PALERMO	3,145	9,435
	TOTAL	25,145	70,562
	YUBA COUNTY		
E	CLIPPER MILLS, ABOVE LOST CR. RES.	1,608	3,216
F	WOODLEAF-CHALLENGE	4,652	10,700
G	NEW YORK FLAT	12,446	33,604
I	HONCUT	10,526	31,578
H	VIRGINIA RANCH	5,463	16,389
	TOTAL	34,695	95,487
	COMBINED TOTALS	59,840	166,049

T.H. McGUIRE & SON, ENGINEERS

GRASS VALLEY, CALIF.

E.A. BAILEY, CONSULTING ENGINEER

PLATE NO. 7

DECEMBER 1952

OWID Present Use 9500 ac ft sales 1951 and 1952

31000 ac ft diversions

500 ac ft domestic sales in winter

24,300 acres in district

15,900 ac. irrigable

27,500 ac - diverted

5,500 ac - served

22,000 - lost

490 / 1000

12000 ac ft domestic / 365 = 35 ac ft/day

17.5 cfs uniform flow

700 ms. flow per day

1400 residences served

3

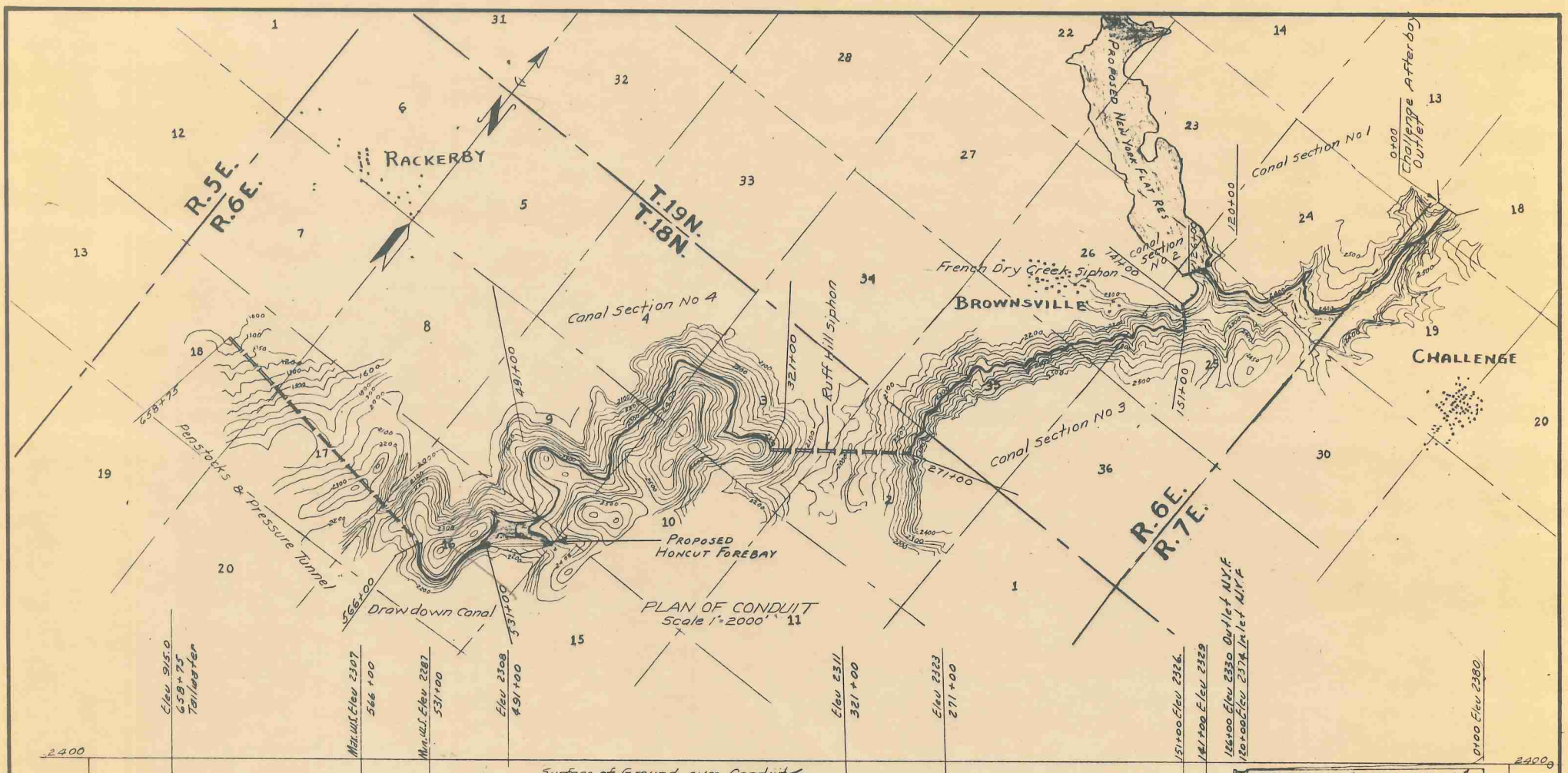
4200 population

State 100,000 ac. ft } ULTIMATE

Brunner 110,000 ac ft }

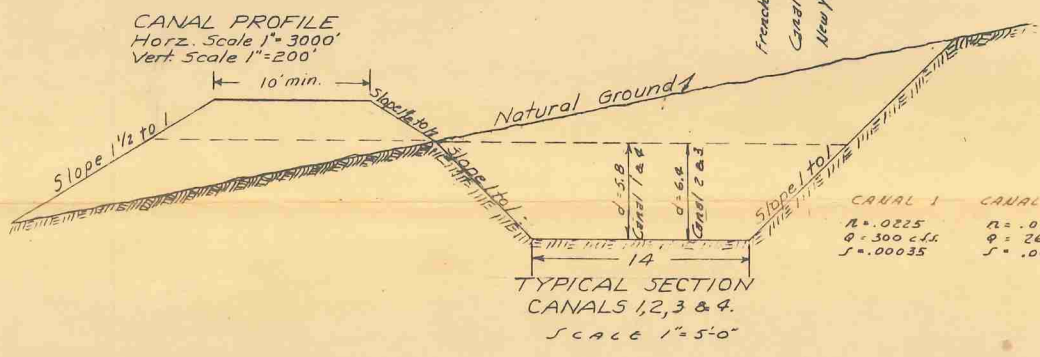
$1362 per ac ft

	acres	a. f.
Lost Creek	15,1620	27,000
Butte	5,000	9,100
Yuba	10,329	17,900
	16,000	38,000
Butte	4,281	9,000
Yuba	12,237	28,000
Palermo	19,229	72,000
Brown.	22,000	55,000
TOTAL	73,000	192,000
	41,000	127
	32,000	65,000
		(70,000)



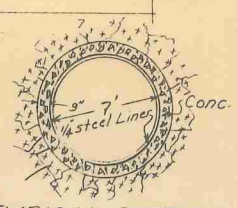
640
583
57

CANAL PROFILE
Horz. Scale 1"=3000'
Vert. Scale 1"=200'

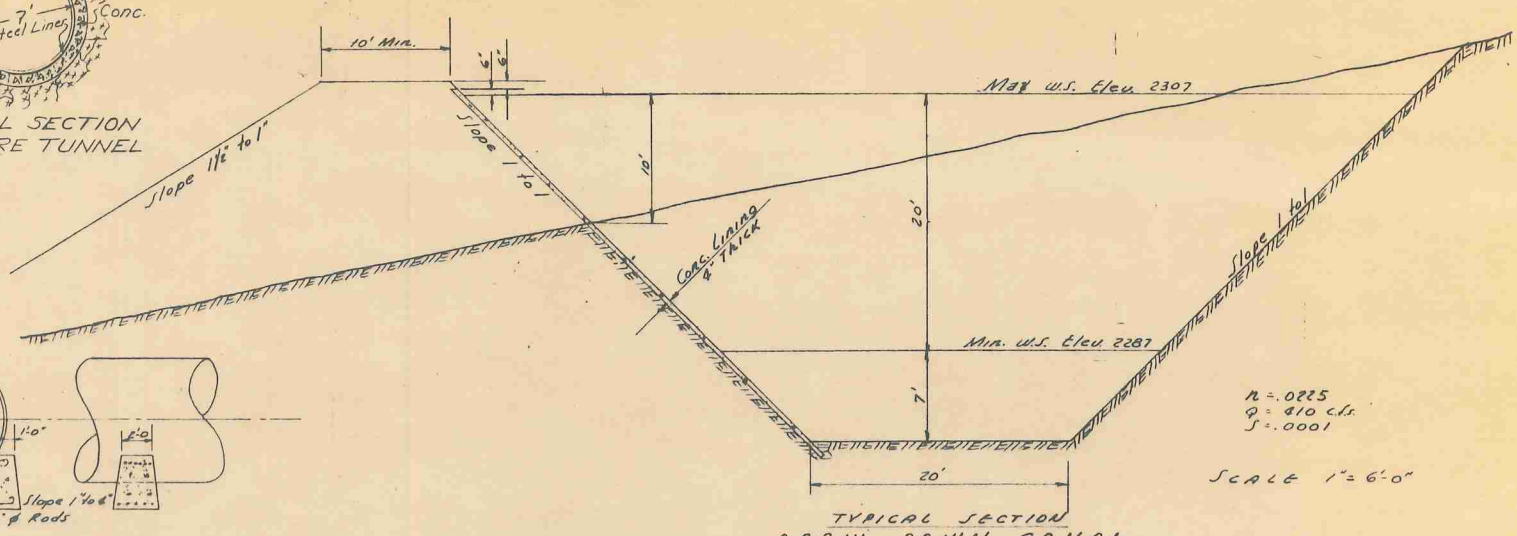


CANAL 1	CANAL 2 & 3	CANAL 4
n=.0225	n=.025	n=.025
Q=300 c.f.s.	Q=266 c.f.s.	Q=245 c.f.s.
S=.00035	S=.0002	S=.0002

TYPICAL SECTION
CANALS 1, 2, 3 & 4.
SCALE 1"=5'-0"



TYPICAL SECTION
PRESSURE TUNNEL



SCALE 1"=6'-0"

TYPICAL SECTION
DRAW DOWN CANAL

TYPICAL SECTION
STEEL PIPE SIPHON
AT
FRENCH DRY CREEK & RUFF HILL

Q = 266 c.f.s.	Q = 245 c.f.s.
D = 90"	D = 90"
K_s = .52	K_s = .52
H_f = 3	H_f = 2.5
P.L. = 1000 ft.	P.L. = 3000 ft.

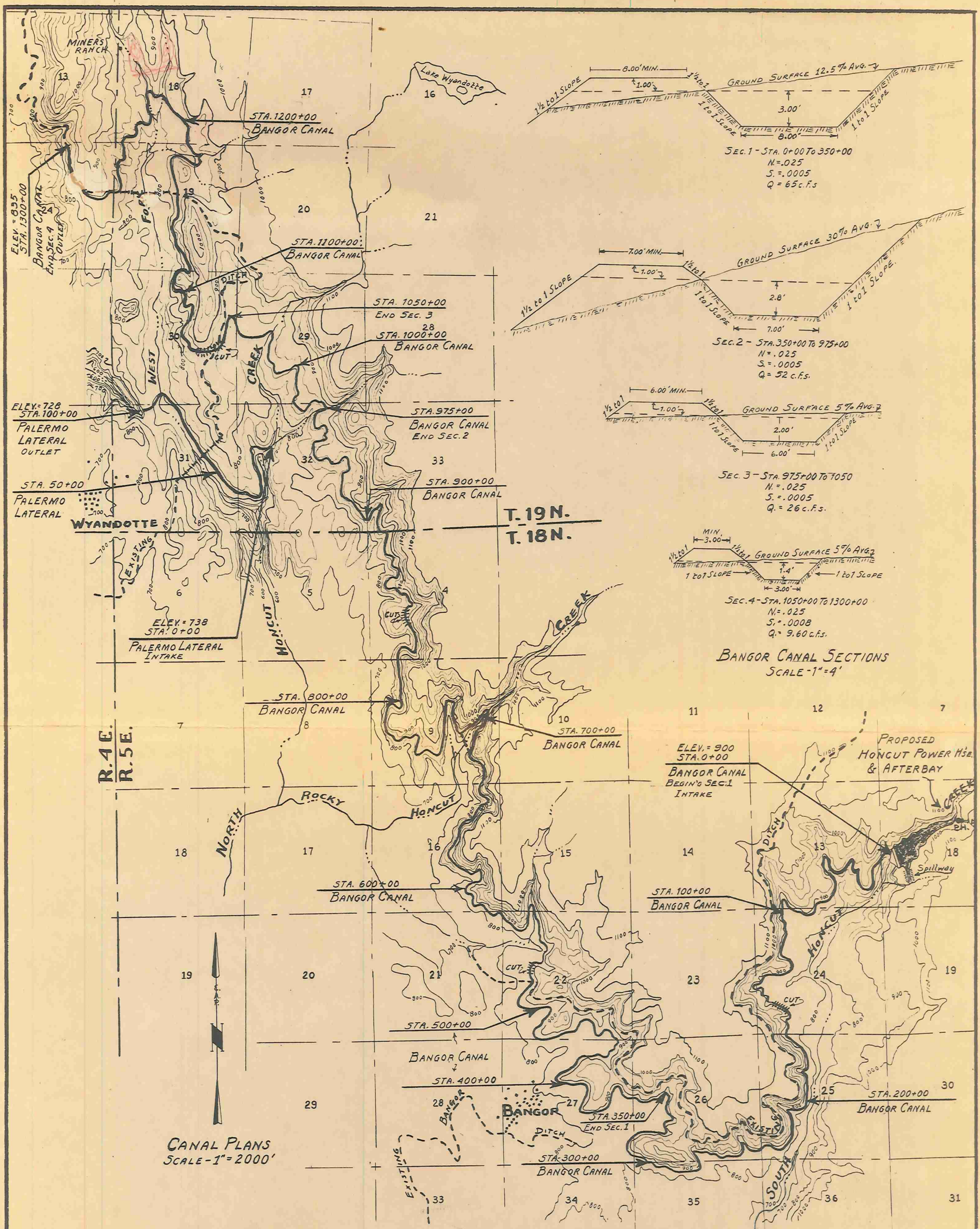
DRAWN BY	E. A. Phillips
CHECKED BY	H. P. B.
PREPARED BY	P. J.
SUBMITTED BY	T. S.
APPROVED BY	E. A. B.

YUBA COUNTY WATER DISTRICT
BROWNSVILLE CALIFORNIA

T. H. McGUIRE & SON CONSULTING ENGINEERS
GRASS VALLEY CALIFORNIA

FEATHER - YUBA PROJECT
HONCUT POWER DEVELOPMENT
CONDUIT DETAILS

PLATE NO. 4



CANAL PLANS
SCALE - 1" = 2000'

SEC. 1 - STA. 0+00 TO 350+00
N = .025
S. = .0005
Q = 65 c.f.s

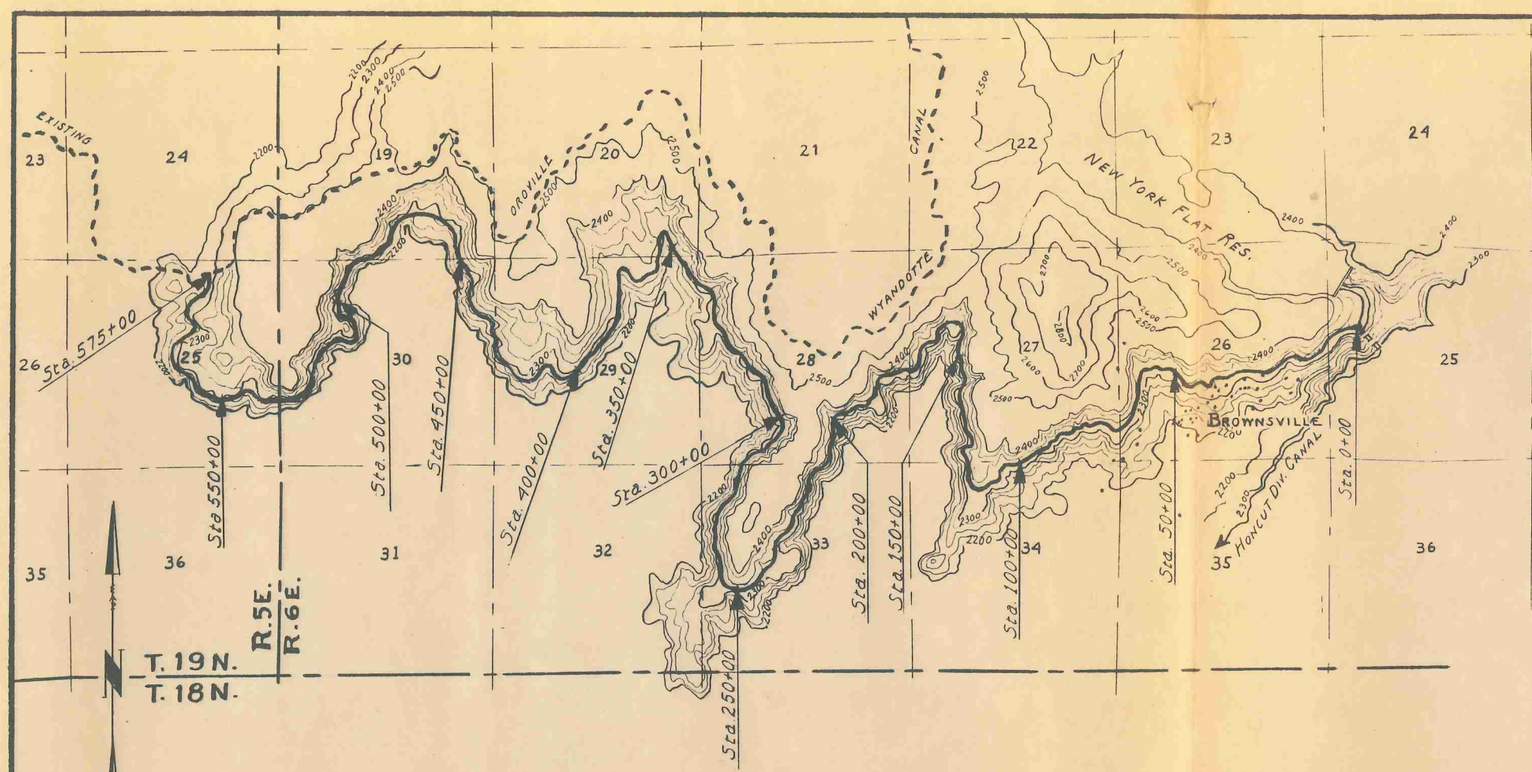
SEC. 2 - STA. 350+00 TO 975+00
N = .025
S. = .0005
Q = 52 c.f.s.

SEC. 3 - STA. 975+00 TO 1050
N. = .025
S. = .0005
Q. = 26 c.f.s.

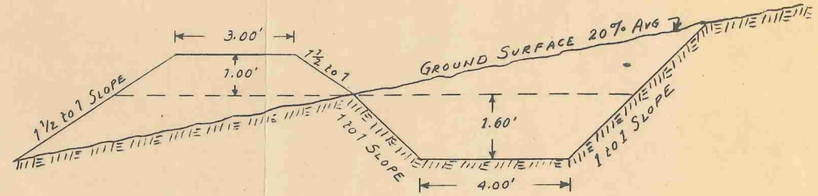
SEC. 4 - STA. 1050+00 TO 1300+00
N. = .025
S. = .0008
Q. = 9.60 c.f.s.

BANGOR CANAL SECTIONS
SCALE - 1" = 4'

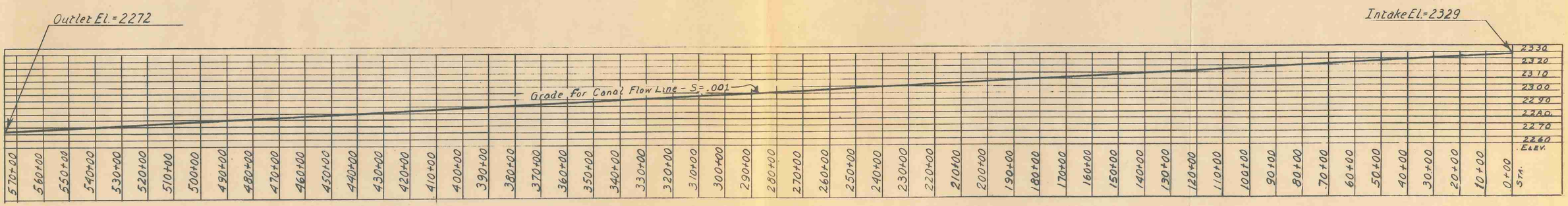
BANGOR CANAL, PROFILE
HORIZ. SCALE - 1" = 10,000'
VERT. SCALE - 1" = 100'



CANAL PLAN
SCALE - 1" = 2000'



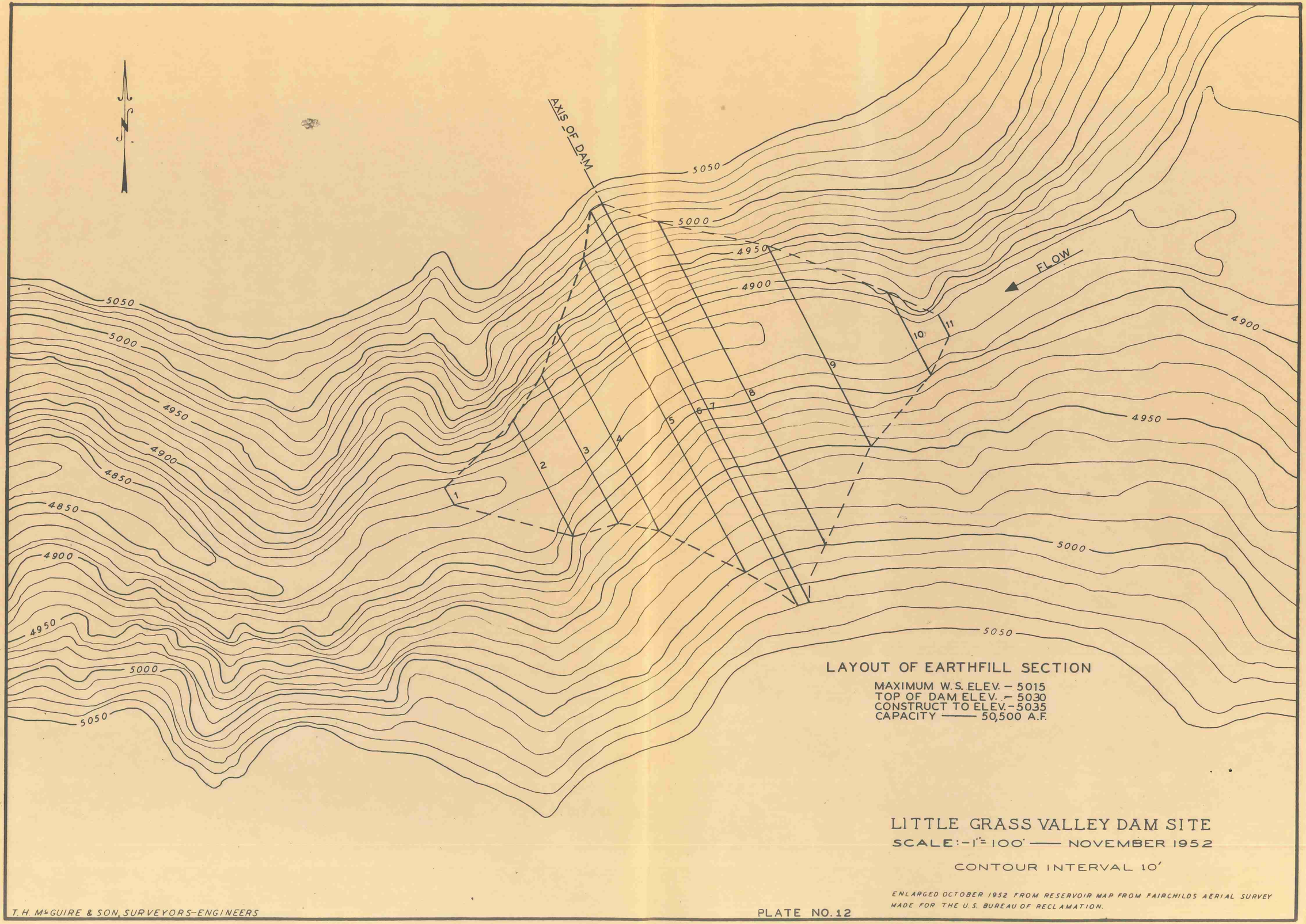
TYPICAL CANAL SECTION
SCALE - 1" = 2'
STA 0+00 TO STA. 570+00
N. = .025
S. = .001
Q. = 18.6 C.F.S.



CANAL PROFILE
HORIZ. SCALE - 1" = 2000'
VERT. SCALE - 1" = 40'

DRAWN BY: E.A. Phillips	YUBA COUNTY WATER DISTRICT BROWNSVILLE CALIFORNIA
CHECKED BY: .	T. H. McGUIRE & SON CONSULTING ENGINEERS GRASS VALLEY CALIFORNIA
PREPARED BY: .	FEATHER - YUBA PROJECT IRRIGATION WORKS - RACKERBY CANAL PLAN & DETAILS
SUBMITTED BY: .	JANUARY 1953
APPROVED BY: .	

PLATE NO. 9



LAYOUT OF EARTHFILL SECTION

MAXIMUM W.S. ELEV. – 5015
TOP OF DAM ELEV. – 5030
CONSTRUCT TO ELEV. – 5035
CAPACITY —— 50,500 A.F.

LITTLE GRASS VALLEY DAM SITE

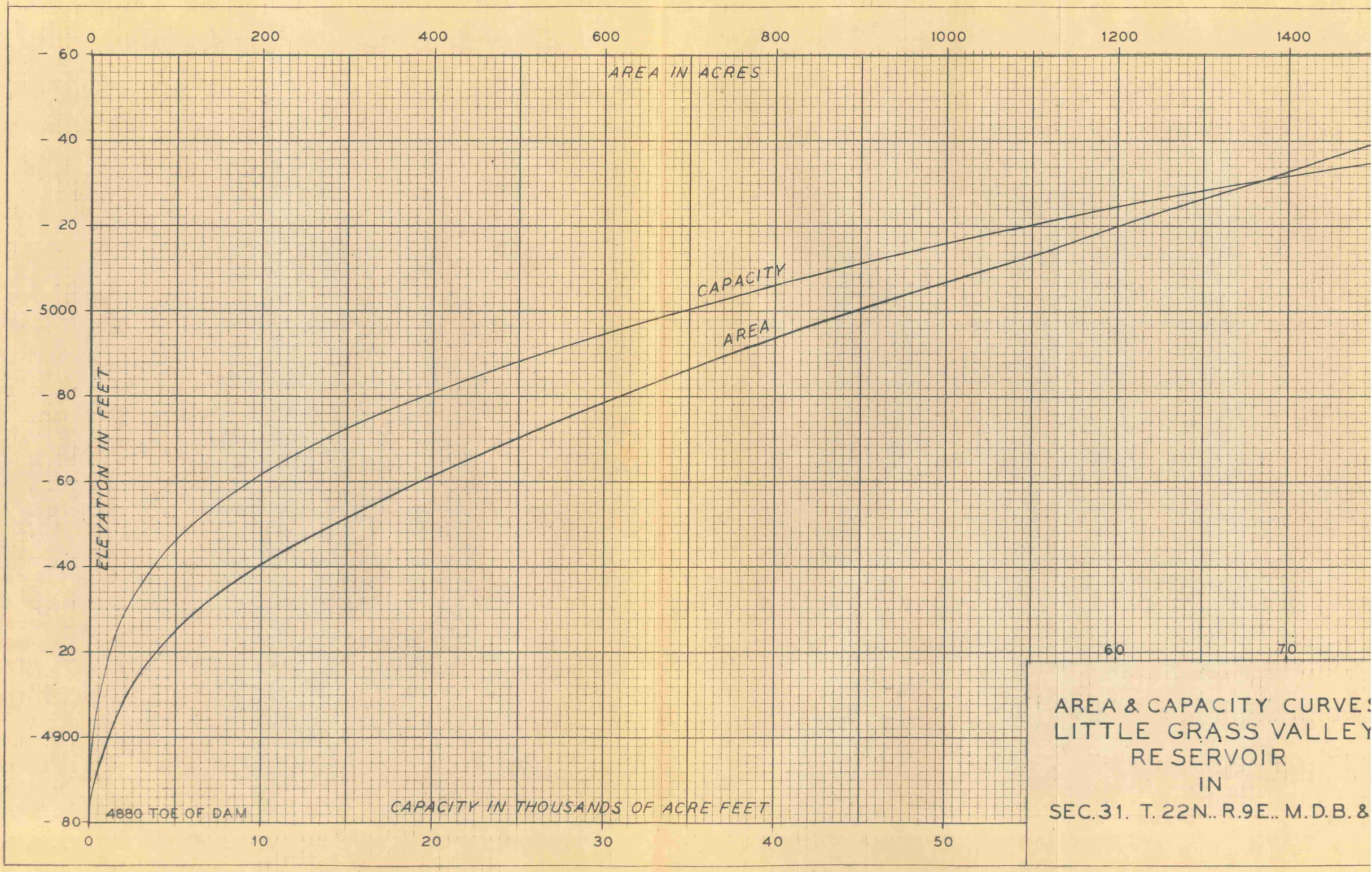
SCALE: - 1" = 100' —— NOVEMBER 1952

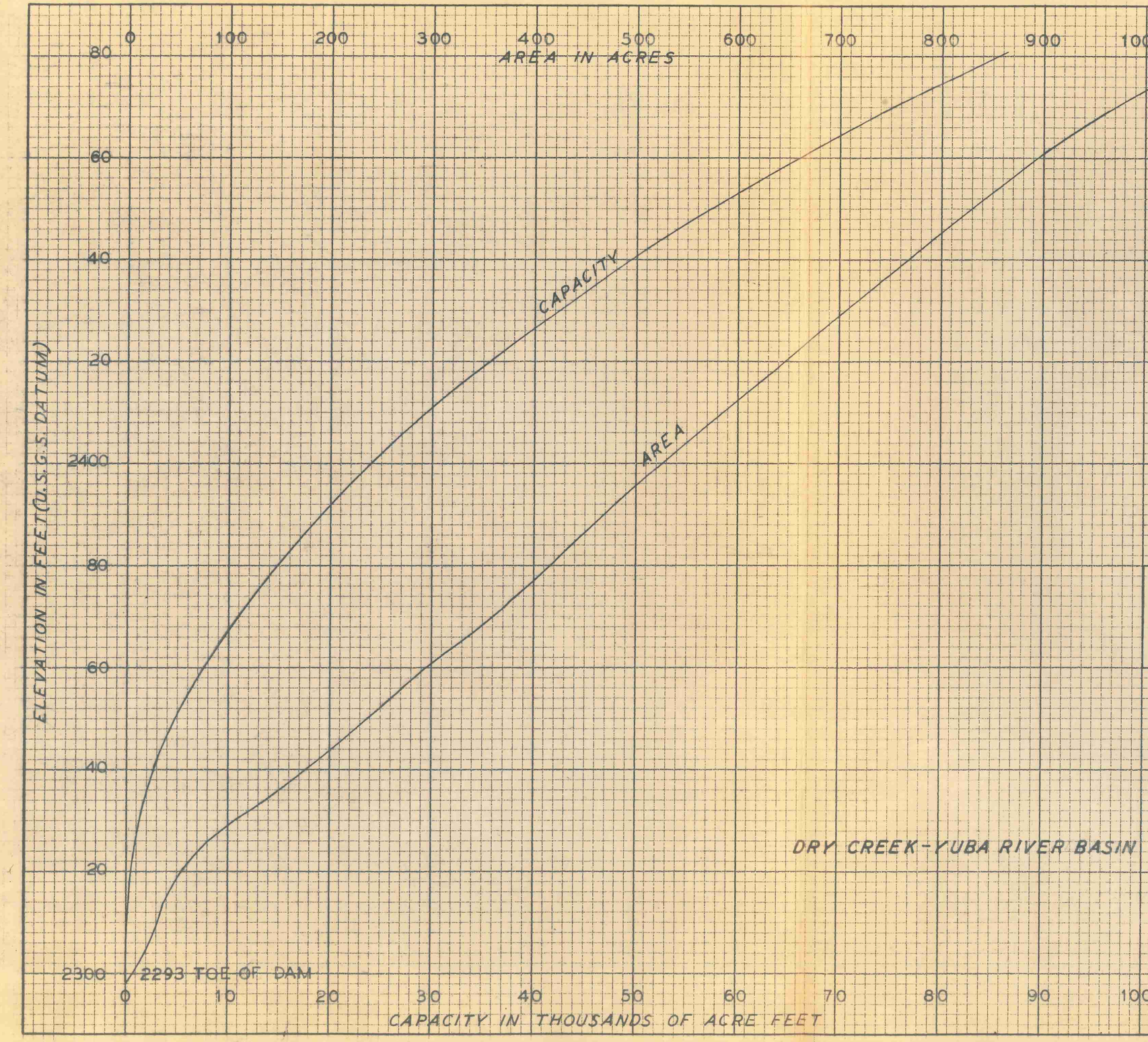
CONTOUR INTERVAL 10'

ENLARGED OCTOBER 1952 FROM RESERVOIR MAP FROM FAIRCHILDS AERIAL SURVEY MADE FOR THE U.S. BUREAU OF RECLAMATION.

T. H. McGUIRE & SON, SURVEYORS-ENGINEERS

PLATE NO. 12


0
200
400
600
800
1000
1200
1400
AREA IN ACRES
- 60
- 40
- 20
- 5000
- 80
ELEVATION IN FEET
CAPACITY
AREA
- 60
- 40
- 20
- 4900
- 80
4880 TOE OF DAM
0
10
20
30
40
50
CAPACITY IN THOUSANDS OF ACRE FEET
60
70
AREA & CAPACITY CURVES
LITTLE GRASS VALLEY
RESERVOIR
IN
SEC. 31. T. 22N.. R. 9E.. M.D.B. &



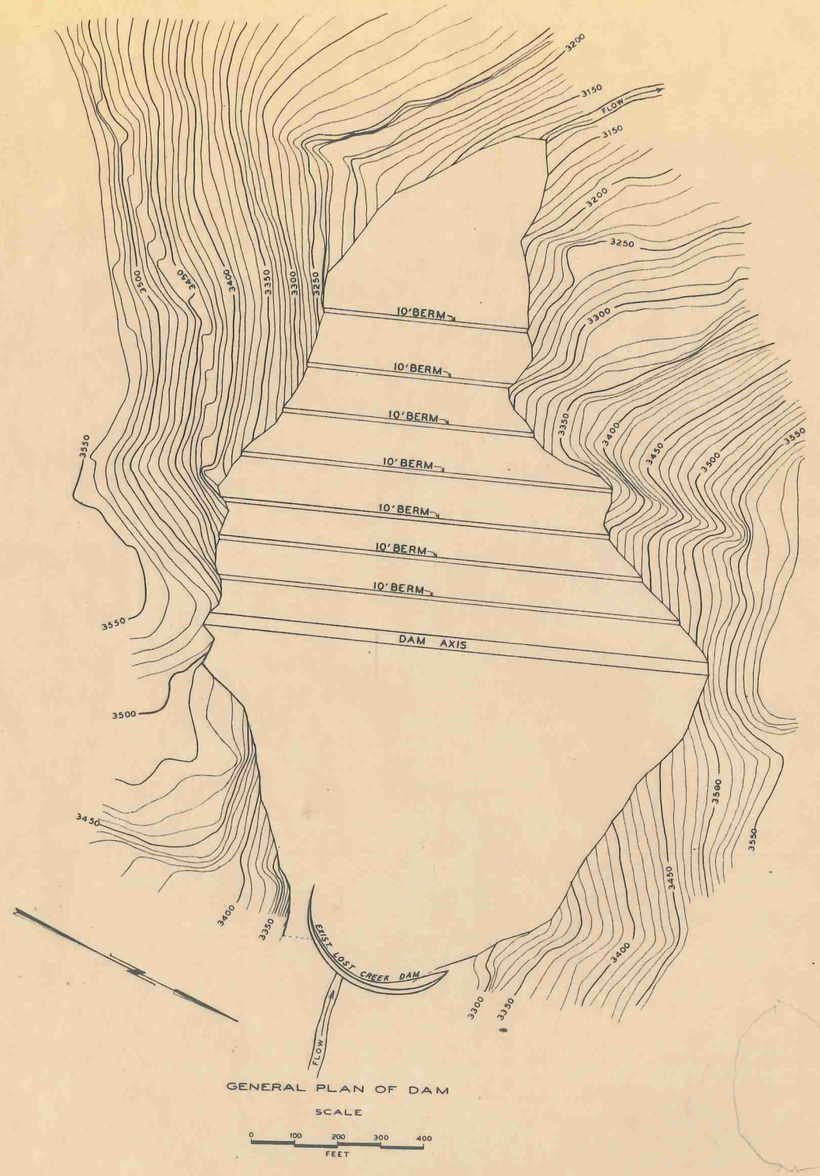
NOTE:
FROM FAIRCHILD AERIAL SURVEYS OF MAY 194
(MAPS G.I. 774D & 775D, CONTOUR INTERVAL 10')
PLANIMETERED CONTOUR INTERVAL 10'.

DRY CREEK-YUBA RIVER BASIN

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

AREA & CAPACITY CURVES
NEW YORK FLAT RESERVOI
SEC. 25. T. 19 N., R. 6 E., M.D.B.&M

CHICO, CALIF., SEPT. 20, 1948

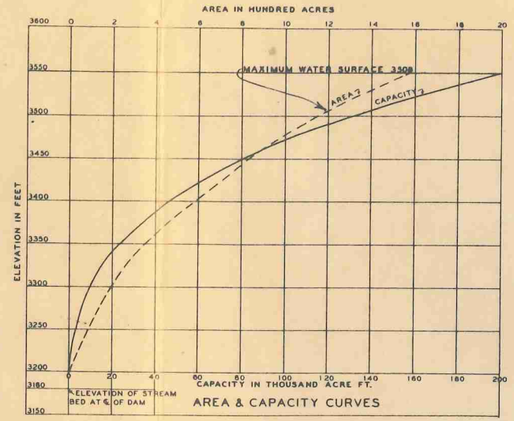


GENERAL PLAN OF DAM

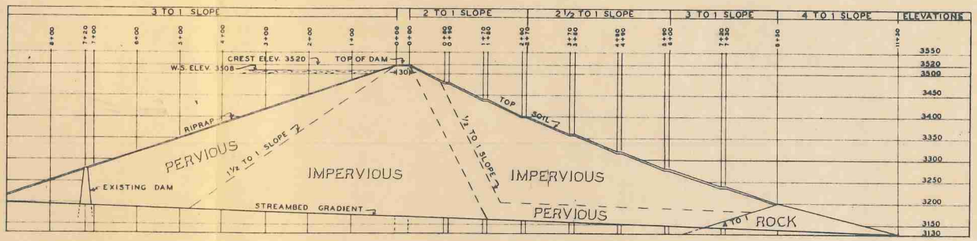
SCALE

0 100 200 300 400

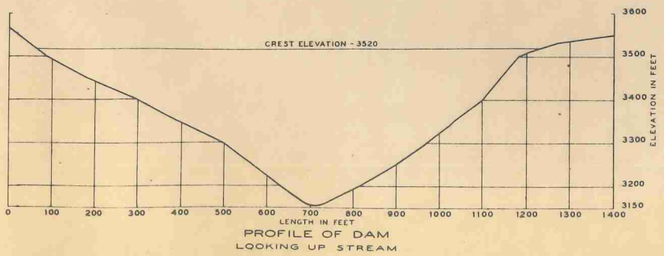
FEET



AREA & CAPACITY CURVES



SECTION OF DAM



PROFILE OF DAM
LOOKING UP STREAM

YUBA COUNTY WATER DISTRICT

BROWNSVILLE CALIFORNIA

T.H. McGUIRE & SON CONSULTING ENGINEERS

GRASS VALLEY CALIFORNIA

FEATHER-YUBA PROJECT

LOST CREEK RESERVOIR

PLAN & SECTIONS

JANUARY 1953

PLATE NO. 2

35

FEATHER-YUBA PROJECT
ULTIMATE WATER DEMAND

Letters A1 & A to I inclusive, refer to Service Area Symbols on Land Classification Map.

Name, Location & Elevations of Service Areas	Irrigable Land All Classifications		Probable Ultimate Irrigation 80%		Average Consumptive Water Use Depth in Inches	Applied Depth 125% in Feet	Ultimate Water Demand	
	Butte Co. Ac.	Yuba Co. Ac.	Butte Co. Ac.	Yuba Co. Ac.			Butte Co. A.F.	Yuba Co. A.F.
CLIPPER MILLS Area above Lost Cr. Res. Elev. 3300-3800	2,610-D	2,010-E	2,088-D	1,608-E	19.8	2.0	4,176-D	3,216-E
WOODLEAF Diversions above Challenge P.H. Elev. 2300-3300	2,843-C	5,815-F	2,274-C	4,652-F	22.2	2.3	5,230-C	10,700-F
NEW YORK FLAT Diversions above Honcut P.H. Elev. 800-2300	4,973-B	15,558-G	3,978-B	12,446-G	25.6	2.7	10,741-B	33,604-G
HONCUT Below Honcut P.H. Elev. 150-1000								
BANGOR	17,075-A		13,660-A		29.0	3.0	40,980-A	
PALERMO	3,931-A1		3,145-A1		29.0	3.0	9,435-A1	
HONCUT		13,158-I		10,526-I	29.0	3.0		31,578-I
VA. RANCH		6,829-H		5,463-H	29.0	3.0		16,389-H
TOTALS	31,432	43,370	25,145	34,695			70,562	95,487

Table 1.

FEATHER-YUBA PROJECT
PROBABLE INITIAL WATER DEMAND

Water in 1000 A.F. Units.

Letters A-1 & A to I inclusive refer to Service Areas on Map.

Name, Location, Elevations, Service Areas	Ultimate Water Demand		Dry Period Use		Diff. is Ultimate New Demand		Initial Demand 25% Ult. New Above Power Houses	
	Butte Co.	Yuba Co.	Butte Co.	Yuba Co.	Butte Co.	Yuba Co.	Butte Co.	Yuba Co.
CLIPPER MILLS Area above Lost Cr. Res. Elev. 3300-3800	4.2-D	3.2-E	____	____	4.2-D	3.2-E	1.0-D	0.8-E
WOODLEAF Diversions above Challenge P.H. Elev. 2300-3300	5.2-C	10.7-F	2.2-C	____	3.0-C	10.7-F	0.8-C	2.7-F
NEW YORK FLAT Diversions above Honcut P.H. Elev. 800-2300	10.8-B	33.6-G	5.9-B	____	4.9-B	33.6-G	8.6-B*	8.4-G
HONCUT below Honcut P.H. Elev. 150-1000							Unlimited Below Power Houses	
BANGOR	41.0-A	____	7.6-A	____	33.4-A	____	25.0-A	____
PALERMO	9.4-A1	____	9.4-A1	____	0.0-A1	____	0.0-A1	____
HONCUT	____	31.6-I	____	9.3-I	____	22.3-I	____	18.0-I
VA. RANCH	____	16.4-H	____	4.7-H	____	11.7-H	____	0.0-H
TOTALS	70.6	95.5	25.1	14.0	45.5	78.7	35.4	29.9

*Includes Present Water use on Hills within "B"

TABLE 2

FEATHER-YUBA PROJECT

Suggested INITIAL DIVERSIONS from Power Stream for Irrigation

Service Areas Letters Correspond to Areas on Land Classification Map	Water in 1,000 A. F. Units Includes Canal Losses Butte Co.	Yuba Co.	Total Diversion	Max. Capacity CFS
WOODLEAF (Above Challenge Power House)	"C"	"F"		
To Forbestown Canal--Existing & new demand	2.3			
For new demand south & east of Woodleaf		2.9	5.2	
NEW YORK FLAT (Above Honcut Power House)	"B"			
To Rackerby Canal				
For Kelley Hill Ditch--Present use + 30% new	4.3			
For Area "B" -- of ult. new demand	1.7			
For Area "G" under Rackerby Canal	0.4			
For Conveyance Losses	.4			
Total Rackerby Canal	6.8			18.58
To Dobbins Canal		"G"		
For 25% of ult. new demand		7.3		18.40
For Willow Glenn & Chitterden Ridge 25% new demand		4.5		11.60
Totals	6.8	11.8	18.6	
HONCUT (Below Honcut Power House)				
To Bangor Canal				
For Oroville Lateral	4.8			9.42
For Wyandotte Lateral	6.1			15.60
For Palermo Lateral	9.9			25.35
For Bangor Ditch	4.0			10.00
Main Canal Losses	2.0			
Total Annual to Bangor Canal	26.8 A.F.			
Honcut South Canal		18.0	44.8	
County Totals	35.9	32.7	68.6	

Table 3

FEATHER-YUBA WATER PROJECT

WATER SUPPLY DATA FOR MINIMUM PROJECT

(Including initial irrigation requirement and excluding P.G. & E. Co. dry period water from Canyon and Slate Creeks.)

SOURCE OF SUPPLY	Gross Yield (1000 A.F.)	DEDUCTIONS, LOSSES and DIVERSIONS	Net Supply (1000 A.F.)
Little Grass Valley Reservoir (50,500 A.F. Storage & 4 months draft)	37.0	Summer flow and evaporation 2.9	34.1
So. Fk. of Feather River below L.G.V. (including L.G.V. Spill ave. 2.6 picked up.)	19.2	No diversion July thru October. No loss in tunnel diversion. Avg. of 6 year dry period.	19.2
Lost Creek Drainage Area	40.0	Reservoir evaporation. 2.4 (Prior rights delivered to O. W.I.D. at a lower point.)	37.6
Canyon Creek	56.9	Prior Rights 14.0	42.9
Slate Creek	68.2	Prior Rights 16.7	51.5

Total Yield thru Lost Creek Reservoir	185.3
Deduction for Fish Propagation in Lost Creek	-3.6
Deduction for Spilled Water	-1.8
Net Yield at Inlet to Challenge Conduit	179.9
Deduction for Conveyance Loss (8 mi. @½% per mi.)	-6.6
Initial Woodleaf Irrigation Diversion (incl. conveyance losses.)	-5.2
Net Flow through Challenge Powerhouse	168.1
New Hork Flat Initial Irrigation Diversion (incl. conveyance losses.)	-18.6
Add Dry Creek Runoff at Brownsville Diversion	+7.5
Net Flow Into Honcut Powerhouse Conduit	157.0
Deduction for Conveyance Loss (10 mi. @½% per mi.)	-7.5
Net Flow Thru Honcut Powerhouse	149.5

Table 4.

PRELIMINARY DATA RELATIVE TO POWER PLANTS

Based on an annual flow through Challenge P. H. of 168,100 ac. ft.)
Based on an annual flow through Honcut P. H. of 149,500 ac. ft.)

		Challenge P.H.	Honcut P.H.
Forebay Elev.:	Maximum	3170	2307
	Minimum	3150	2287
	Average	3160	2297
Tailwater Elev.:	Average	2430	915
Average Static Head		730 Ft.	1382 Ft.
Assumed Friction Losses		36	62
Effective Head		694 Ft.	1320
Peak Draft		460 S.F.	410 S.F.
Plant Efficiency		85%	85%
Peak Capability		23,000	39,000
KW per cfs at Peak		50 KW	95.2 KW
Million KWH per year		100.8	174.6
Installed Capacity		23,000	39,000

Expected Annual Cost:
(34,250,000.00 Capital Expenditure)

Interest:	(3.00%)	$1,027,500.00
Amortization 40 yrs.	(1.326%)	454,155.00
Operation and Maint.	(1%)	342,500.00
Replacements and Contigencies	(0.75%)	256,875.00
TOTAL ANNUAL COST		$2,081,030.00

Expected Annual Power Revenue (Based upon the prices set for power and energy in the recent contract between the South San Joaquin and Oakdale Irrigation Districts and the Pacific Gas and Electric Company.):

Annual estimated usable output 271.8 million KWH	
Valued at 2.7 mills per KWH:	$ 733,860.00
62,000 KW Installed Capacity at $23.70 per year per KW:	1,469,400.00
	$2,203,260.00

NOTE: This table based upon dry year operation only. Energy revenue computed for 365 day operation at 50% L.F. Conduits have actually been designed for 60% L.F. to allow 6 mos. per year operation at this L.F. in wet periods. Probable average energy revenue will be $33,000.00 per year more than listed above.

(Revised 2/1/53)

Table 5.

PRELIMINARY COST ESTIMATE
of
REVISED FEATHER-YUBA PLAN

(Revised Feb. 1, 1953)

1.	**Little Grass Valley Storage** 50,500 ac. ft. Reservoir	$ 2,764,000.00
2.	**South Fork Diversion** Diversion Dam 14,000 ft. Tunnel 7½ ft. Bore Inlet Works	1,870,000.00
3.	**Canyon Creek Diversion** 20 ft. Diversion Dam 22,150 ft. Tunnel, 9 ft. Bore	2,072,000.00 2,940,000.00
4.	**Slate Creek Diversion** 50 ft. Diversion Dam 14,100 ft. Tunnel 13½ ft. Bore (2800 ft lining)	2,500,000.00 3,200,000.00
5.	**Lost Creek Storage** 140,000 ac. ft. Reservoir	8,131,000.00 13,500,000.00
6.	**Challenge Power Development** (230 cfs Av. Flow) (20,000 Ft. Bench Flume) Or (15,500 Ft. Tunnel) (24,000 Ft. Canal) Or (19,000 Ft. Canal) 2,000 Ft. Syphons 5,760 Ft. Profile Length Penstock 23,000 KW Power Plant 900 ac. Ft. Forebay	6,653,000.00 8,410,000.00
7.	**Honcut Power Development** (205 cfs Av. Flow) 30,500 Ft. Canal 6,000 Ft. Syphon 750 ac. ft. Forebay 3,500 Ft. Drawdown Canal 9,500 Ft. Penstock & Tunnel 39,000 KW Power Plant	7,625,000.00 9,870,000.00
8.	**Works Required to Firm Irrigation Yield** 12,000 ac. ft. New York Flat Reservoir 800 ac. ft. Challenge Afterbay 12,000 ft. Costa Creek--N. Y. Flat Canal 26 mi. Bangor Canal 400 ac. ft. Honcut Afterbay 10 mi. Rackerby Canal 8 mi. Dobbins Canal	2,635,000.00 4,252,000.00
	Total Estimated Project Cost Including 25% for Financing, Engineering, Overhead & Contingencies.	$34,250,000.00

Access — 500,000.00

$47,750,000.00

Table 6.

EARNEST A. BAILEY
Consulting Engineer

Falling Acorns, Banner Ridge
Nevada City, California

February 13, 1953

To the Directors of
Yuba County Water District
Brownsville, California

Gentlemen:

As authorized by your board and as detailed in my letter to the firm of consulting engineers, T. H. McGuire & Son, that firm has completed the first preliminary study of the "Basic Engineering" as the first step in determining the economic feasability of your Feather-Yuba Project. This study indicates that such a project is economically feasable.

The next step should be the study of the possibility of increasing the revenue without unduly increasing the construction cost.

Such a study should include:

1. Determine the feasability of building the Little Grass Valley Dam of earth rather than of rock fill, and higher to provide more storage in that reservoir. This should allow a decrease in the height of the more expensive Lost Creek Dam.

Some reserve storage might also be provided in the Little Grass Valley Reservoir to insure the dry period irrigation draft while allowing more secondary power draft in the fall months during wet period years.

2. A study of other projects for the lower lands of Yuba County should be made with the possibility in view of firming the water supply for the Bullard's Bar Power Plant on North Yuba River so that all the Prior Right waters of Canyon and Slate Creeks can be included in the Feather-Yuba Project.

This could add at least 30,000 A.F. more water to the project, increasing the installed capacity by 10,000 KW and the addition of 50,000,000 KWH of firm energy.

3. Some study should be given to the possibility of adding some 12 or 15,000 A.F. of water from Fall River and South Branch.

4. Studies should be made to determine the dependable revenue from sales of irrigation water.

Very truly yours,

E. A. Bailey.

E. A. BAILEY

EAB/jf

FEATHER-YUBA PROJECT

Ultimate Diversions From Power Stream For Irrigation

Based on State Land Classification Map

Service Areas Letters Correspond to Areas on Land Classification Map	Water in 1000 A.F. Units Butte Co.	 Yuba Co.	Totals
CLIPPER MILLS	4.2 D	3.2 E	7.4
WOODLEAF	5.2 C	10.7 F	15.9
N.Y.F.	10.8 B	33.6 G	44.4
Below HONCUT			
Bangor Canal	41.0 A		
Palermo Canal	9.4 A-1		
Honcut South		31.6 I	
Va. Ranch		16.4 H	
			98.4
	70.6	95.5	166.1

Compare With Table 3

FEATHER-YUBA PROJECT

ULTIMATE POWER
With Ult. Irrig. Deductions

Total Yield Thru Lost Cr. Res. would be 185.3 of Table 4 - Clipper Mills use of 7.4 =		177.9
Deductions for Fish Propagation		3.6
Net entering Conduit		174.3
Spill should be eliminated by Clipper Mills use	0.0	
Conveyance Loss 8 mi. @ ½%	-7.0	
Woodleaf Ult. Diversion	-15.9	-22.9
Net Flow Thru Challenge P.H.		151.4
N.Y.F. Ult. Diversions	-44.4	
Add Dry Cr. Run off Conserved	7.5	
	-36.9	-36.9
Net Flow entering Conduit		114.5
Conveyance Loss 10 mi. @ ½%		-5.7
Net Flow Thru Honcut P.H.		108.8

Ult. Prime Power

at Challenge P.H. - 151,400 x 694 x .82 =	86.0	Mill.KWH
at Honcut P.H. 108,800 x 1321 x .82 =	118.0	" "
	204.0	" "

$\frac{204.0}{271.8} = .75\%$

Initial Power Revenue, $2,203,260 x 75% = $1,655,000 Permanent Prime Power Revenue

Compare with Table 4

EARNEST A. BAILEY
Consulting Engineer

Falling Acorns, Banner Ridge
Nevada City, California

February 17, 1953

Mr. A. D. Edmonston
State Engineer
Sacramento, California

Dear Mr. Edmonston:

As directed by the Yuba County Water District Board of Directors, there is submitted herewith a copy of a preliminary study of the Feather-Yuba Project, by the T. H. McGuire and Son, Consulting Engineers.

This report is based on what the writer has called a "Minimum Project" which depends only on the 6 year Dry Period water supply from South Fork Feather and from Lost, Slate and Canyon Creeks, with a partial utilization of the head waters of French Dry Creek. The indications are that these sources of supply are sufficient to provide the probable ultimate irrigation water demand of the entire foothill area of both Butte and Yuba Counties with the addition of local runoff from the Honcut and French Dry Creek drainage areas.

With an initial demand of 25% of the ultimate demand of the upper areas for which water must be diverted above one or both of the power houses, which the directors believe will be sufficient until the cost of the project is amortized, the indications are that the project is economically feasible.

The prime power revenue alone, based on the same rates as used in the contract recently negotiated between the South San Joaquin and Oakdale Irrigation Districts and the Pacific Gas & Electric Co., will amortize the Minimum Project cost and its maintainence. This includes three initial irrigation main canals.

Two of these, the Rackerby and Bangor initial canals are necessary to return to Oroville-Wyandotte Irrigation District that portion of their present use water which will be utilized through the proposed project. These two canals are designed to also carry 25% and 30% more water for initial new demand. The Dobbins initial main canal is necessary to deliver 25% of the ultimate demand water of the Dobbins-Oregon House Service Area to points within reach of local laterals for that area.

The indications are that local improvement associations

or districts can provide for the construction of all irrigation laterals.

Your attention is invited to a copy of the writer's letter to the Directors which indicates studies yet to be made which should increase both water supply and revenue without undue increase in project cost. This should increase the ecomonic feasibility of the project.

Your attention is also invited to the two tables accompanying the letter to the directors which show that when irrigation of the upper areas above the power plants has reached the ultimate demand there will still remain 75% as much prime power for revenue. After the entire initial project has been amortized the power revenue may be used to reduce the cost of irrigation.

The attention of all parties concerned has been repeatedly invited to the fact that the first efforts of the writer toward the working out of a Feather-Yuba Project began some years ago at the request of Mr. J. E. Alley, then Engineer for the Oroville-Wyandotte Irrigation District, which was then in need of two or three thousand acre feet more water. The cooperation of the Oroville-Wyandotte Irrigation District suddenly ceased when one of the directors of the district took over the water problems of the district when Mr. Alley resigned to accept a better offer with the Paradise Irrigation District.

Notwithstanding this termination of cooperation on the part of the district the writer has continued his efforts to find an economically feasible comprehensive irrigation plan for the entire Feather-Yuba Foothill area of equal benefit for all these landowners of Butte County, including those within and without the irregular boundaries of the district, as well as for the landowners within Yuba County and has repeatedly expressed his belief that any such project, to be successful, must be constructed and operated as a joint project by and for the landowners of both counties.

He acknowledges with thanks and deep appreciation the great assistance of many engineers and geologists in the U. S. Bureau of Reclamation and in the various offices of your State Water Resources Division, and in the office of T. H. McGuire & Son, Consulting Engineers and of Ted Schwartz, Contracting Engineer.

He believes that the project as outlined in this preliminary report with such increase in water and power as may be found practicable by the further studies indicated, is the best that can be devised not only for the entire foothill area, but particularly for Oroville-Wyandotte Irrigation District because

it will not only deliver an increased and dependable water supply directly to the greater part of that district within a few miles from the lower power house, but will provide, after the amortization of the first cost of the initial project, a permenant prime power revenue, their share of which can be applied to the reduction of the irrigation costs.

Respectfully submitted,

E. A. Bailey.

E. A. BAILEY
Supervising Engineer,
Yuba County Water District.

EAB/jf