

DEPARTMENT OF PUBLIC WORKS

STATE OF CALIFORNIA

REPORTS OF THE
DIVISION OF WATER RESOURCES
Edward Hyatt, State Engineer

REPORT ON
WATER MASTER SERVICE
ON
HAT CREEK
SHASTA COUNTY, CALIFORNIA
FOR SEASON OF 1929

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By Harrison Smitherum, Water Master

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Sacramento, California
May 1930

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STATE OF CALIFORNIA
Department of Public Works

SACRAMENTO

DIVISION OF WATER RESOURCES
401 PUBLIC WORKS BUILDING

EDWARD HYATT, STATE ENGINEER
CHIEF OF DIVISION

May 15, 1930

Mr. Edward Hyatt,
State Engineer,
Sacramento, California.

Dear Sir: Attention: Mr. Gordon Zander, Hydraulic Engineer

There is transmitted herewith a report covering water master service on Hat Creek, Shasta County, California, during the period from May 1st to October 10, 1929.

The report describes the methods and practices followed in the distribution of the waters of Hat Creek in accordance with the provisions of the Doyel, et al., vs. Massie, et al. decree, and presents the results obtained by this distribution.

Respectfully submitted,

Harrison Smithers
Water Master.

REPORT ON WATER MASTER SERVICE
ON
HAT CREEK, SHASTA COUNTY, CALIFORNIA
FOR
SEASON OF 1929

INTRODUCTION

Water master service on Hat Creek for the 1929 Season extended over the period from May 13th to October 10th, during which time the waters of the stream were distributed in accordance with the provisions of the Doyel, et al. vs. Massie, et al. decree, entered May 14, 1924 in the Superior Court of Shasta County, California. The provisions of this decree are discussed in the "Report on Water Master Service in Hat Creek Valley, Shasta County, California, During Season of 1924" by Paul V. Wheatley, Water Master, October 1924.

A petition to the Division of Water Rights, signed by three parties to the decree above mentioned, requesting that a water master be appointed for Hat Creek for the 1929 Season was received at the office of the Division on May 2, 1929. On May 11, 1929, the Chief of the Division of Water Rights appointed Harrison Smitherum water master for the 1929 Season.

The water master assumed his duties in the field on May 13th, two days after the commencement of the second irrigation period, and administered his office as defined in the Hat Creek Decree until October 10th, two days subsequent to the beginning of the seventeenth irrigation period, at which time it was apparent that supervision of diversions was no longer necessary.

PRECIPITATION

Precipitation records applicable to the Hat Creek area are kept by the Pacific Gas and Electric Company in co-operation with the United States Weather Bureau at Hat Creek Power Plant No. 1. This station is located below Cassel, at an elevation of 3010 feet. The records as published in the climatological reports of the United States Weather Bureau, cover the period from 1921 to 1929. This period embraces the years during which water master service has been in operation on Hat Creek, and also covers the greater portion of the cycle of dry years which has been prevalent through out the State since 1916. The record is of such short duration that the mean or normal precipitation computed therefrom is of little or no weight, but it is here presented for the purpose of comparing the precipitation during the 1928-1929 season with that for the other years of record.

A summary of the available records is submitted at the end of this report in Table 1.

In Table 2, also submitted at the end of this report, the precipitation for the seasonal year 1928-1929 has been compared with the mean precipitation for the seasonal years 1921 to 1929.

From Table 1, it is to be noted that the season of 1928-1929, with a total precipitation of 12.99 inches, was the third driest season of record. The season of 1923-1924 with 7.81 inches of precipitation was the driest season, while the season of 1925-1926, when 12.69 inches of precipitation were recorded, was the second driest.

From Table 2, the total precipitation for the seasonal year 1928-1929 was 81 per cent of the mean seasonal precipitation for the period of record. The precipitation for the period October 1st to May 1st for the seasonal year was 88 per cent of the mean precipitation for the same period, while for the period May 1st to September 30th, the precipitation for 1928-1929 was only 51 per cent of the mean for that period. With the exception of June, precipitation for this latter period was almost entirely lacking.

Heavy rainfall, which occurred on June 15th and 16th, accounted for 61 per cent of the total precipitation for June. Following this storm the flow of Hat Creek increased to a peak of 248 cubic feet per second and then rapidly decreased to its sustained summer flow of approximately 100 cubic feet per second, indicating that the storm had melted the remaining snow at the head of Hat Creek. This premature melting of the snow and the lack of rainfall in May accounts for Hat Creek reaching its sustained summer flow stage at an earlier date than is normally to be expected.

WATER SUPPLY

Flow of Hat Creek above All Diversions.

A record of the flow of Hat Creek above all diversions for the period May 1st to October 8th, 1929, is presented in Table 3, submitted at the end of this report. Table 3 is a composite record obtained by adding the flow in the Harvey Wilcox, Gray, Stevenson, Hall and Shearin ditches to the flow of Hat Creek at the United States Geological Survey measuring station, which station is located below the intakes of the above named ditches. The record gives the total flow of Hat Creek available to meet the demands therefrom, incident to the distribution of the waters of the stream in accordance with the provisions of the Doyel vs. Massie decree.

In the following table there is presented a comparison of water supply conditions on Hat Creek for the 1929 Season with the other seasons of record.

Season May 1 - October 8	Average Flow of Hat Creek Above All Diversions C.F.S.	Average Delivery in Per Cent of Total Irrigation Allotment
1924	No record	(a) 67
1925	143	85
1926	122	72
1927	(b) 143	(b) 86
1928	136	78
1929	115	64

- (a) Period May 31st to October 8th
(b) Period May 11th to September 28th

Records of the flow of Hat Creek above all diversions are not available for the 1924 Season, but it is probable that the flow of the

stream for that season was less than in 1929. However, due to the reclamation of mud flow lands, the demand on the stream was greater in 1929 than in 1924, therefore, water supply conditions on Hat Creek during the 1929 season reached the most critical stage experienced since water master service was begun on the stream in 1924.

DEMAND ON WATER SUPPLY

The demand on the flow of Hat Creek in distributing the waters of that stream in accordance with the provisions of the Doyel vs. Massie decree comprises the amounts of water set forth in the various paragraphs and schedules of the decree, certain additional allotments not provided for in the decree, and the amount of water lost in the channel of Hat Creek between the uppermost and lowermost diversions. The various items and amounts constituting this demand during the 1929 season have been summarized in Tables 4 and 5, submitted at the end of this report. Table 4 gives the demand for the Upper Users' periods, while Table 5 presents similar data for the Lower Users' periods.

The various items in Tables 4 and 5, where based upon the authority of the Doyel vs. Massie decree, are self-explanatory. The additional allotments not provided for in the decree have been fixed by agreement between the water master and the water user receiving such allotment. The reasons for granting these additional allotments are explained below.

The irrigation and minimum flow allotments to the United States Forest Service are necessary due to the fact that, although not a party to the Doyel vs. Massie suit, the Forest Service is a recognized water user on Hat Creek.

The minimum flow allotment to Sullivan became necessary to provide stock and domestic water for Sullivan's use after he had elected to take his irrigation allotment in a rotation head instead of a continuous flow head.

The minimum flow allotment to Vernon March was allowed to correct an inadvertant ommission in the decree.

Hal A. Shearin claims a right to the use of the waters of Hat Creek as a riparian owner. He has agreed to irrigate during the Upper Users' periods, but no amount of water has been fixed as the measure of his water right. During the 1929 Season, Shearin's diversion averaged approximately 1.00 cubic foot per second.

The item of channel losses in Hat Creek is explained in the following chapter.

CHANNEL LOSSES

To determine the channel losses in Hat Creek simultaneous measurements of the flow of the stream and of all diversions therefrom were made at frequent intervals during the critical flow period (June 20 - October 8) of the 1929 Season. The mean of 16 measurements made during the periods when the Upper Users were receiving their irrigation allotments showed the conveyance loss to be 14 cubic feet per second, while 21 measurements made during the Lower Users' periods gave a mean conveyance loss of 24 cubic feet per second.

A summary of the measurements and the resultant channel losses is presented in Table 8 submitted at the end of this report. In arriving at the mean channel losses the periods from May 1 to June 20 have been eliminated on account of the widely fluctuating flow of Hat Creek.

Similar measurements made during the 1928 season gave conveyance losses of 14 cubic feet per second and 21 cubic feet per second for the Upper and Lower Users' periods, respectively.

AVAILABLE WATER SUPPLY
COMPARED WITH DEMAND

The mean flow of Hat Creek for the period from May 1 to October 8, 1929 was 115 cubic feet per second, or approximately 72.5 per cent of the average demand of 159 cubic feet per second.

A comparison of the flow of Hat Creek above all diversions with the demand on the water supply for the 1929 Season is shown graphically on Plate 1, submitted at the end of this report. The graph representing the flow of Hat Creek was plotted from the data presented in Table 3, while the demand curve is based upon the data contained in Tables 4 and 5.

A graph representing the combined diversions from Hat Creek during the 1929 Season is also shown on Plate 1. The difference between this curve and the graph of the flow of Hat Creek is the measure of the channel losses in the stream.

DISTRIBUTION OF WATER

Determination of Percentage of Irrigation Allotments Available.

The United States Geological Survey measuring station on Hat Creek below Cave Camp is used as the control in determining the amount of water available for distribution. This station, however, is located below the Harvey Wilcox, Gray, Stevenson, Hall and Shearin ditches, therefore, it is necessary to add the combined flow of these ditches to the flow at the measuring station, the resultant figure being the discharge of the creek above all diversions. The amount of water available for distribution for irrigation during any particular period is the difference between the discharge of the creek above all diversions and the fixed demand on the water supply, such as the minimum flow allotments to the users of the opposite class, channel losses, and all other allotments not subject to proration. The various items and amounts constituting the fixed demands during the Upper and Lower Users' periods are set forth in Tables 4 and 5, respectively. The ratio of the amount of water available for irrigation to the total decreed irrigation allotments gives the percentage of the aforesaid irrigation allotments that can be delivered.

Simultaneous measurements of the flow of Hat Creek above all diversions and of the combined irrigation allotments being delivered were made at frequent intervals during the 1929 Season. The results of these measurements have been plotted on Plate 2, submitted at the end of this report, showing in graphic form the relation of the per cent of irrigation allotments delivered to the flow of Hat Creek above all diversions. This diagram should prove useful in estimating the percentage of the irrigation allotments that can be delivered with a given flow of Hat Creek above all diversions.

Method of Distributing Irrigation Allotments.

Two days prior to the beginning of each ten day rotation period the flow of Hat Creek above all diversions was determined and the percentage of allotments available for distribution to the class of users entitled to irrigation heads of water was computed. On the day preceding the change date, each of these users was notified in writing as to the percentage of allotments, the amount of his allotment, and the gage reading on his measuring device necessary to deliver such allotment. On the day of the change the water master inspected and regulated the various ditches to the correct amounts. The stream usually settled down to a steady flow on the day following the change, and the ditches were again inspected and reregulated. Thereafter inspection of the ditches was made at frequent intervals during each period for the purpose of obtaining data relative to channel losses, or to reregulate diversions when changes in the flow of the stream indicated that an adjustment of allotments was necessary.

Normally the regulation on the change day should proceed from the uppermost diversion downstream, with an allowance of time between diversions to permit the flow of the stream to become stabilized at the point of intake of any ditch before that ditch is regulated. However, it soon became apparent that this method could not be followed, due to the tendency of certain water users to divert far in excess of their allotted amounts of water at the beginning of the irrigation period, and to failure on the part of others to cut their ditches to minimum flow allotments at the end of the period. This practice delayed the time required for the flow of the stream to become stabil-

ized and thus resulted in a considerable loss of water to the extreme lower diverters in both the Upper and Lower Users classes. After the first few periods, it was found that the best results could be obtained, insofar as quickly stabilizing the flow of the stream was concerned, if the Harry Wilcox Ditches, the Ratledge-Opdyke - Forest Service Ditch, the Opdyke Ditch, the Ratledge-Lonquist Ditch and the Henry Lonquist Ditches were inspected and regulated as soon as possible after 6:00 o'clock on the morning of every change day. At times during the 1929 Season various of the ditches were inspected just prior to 6:00 o'clock A.M. on the change dates to prevent or detect any irregularity in the observance of the provisions of the decree.

Method of Distributing Minimum Flow Allotments.

In Schedules II and IV of the Doyel vs. Massie decree certain amounts of water have been allotted to the various Hat Creek ditches to provide the owners thereof with water for domestic and stock watering purposes and to prevent damage to the ditches by drying out during the respective non-irrigation periods. It, however, has become the practice of the water users to pool their minimum flow allotments and use the same through one ditch for irrigation purposes. In the case of partnership ditches the amount of water allotted to the ditch has been divided between the several owners by agreement. In accordance with these practices, the minimum flow allotments are distributed to the owners of the ditches rather than to the ditches, as specified in Schedules II and IV.

The pooled minimum flow allotments of the Upper and Lower Users, and the ditches in which their allotments were carried during the 1929 Season are shown in Tables 6 and 7, respectively, submitted at the end of this report.

In addition to the pooling of minimum flow allotments certain other practices in the operation of the Hat Creek ditches have been permitted since water master service was begun on the stream. These practices were continued during the 1929 Season as follows:

The Stevenson Main Ditch was permitted to divert a minimum flow of approximately 1.00 cubic foot per second instead of the 0.25 cubic foot per second specified in Schedule II. This is necessary to supply suitable water for drinking purposes at the Stevenson cabin located about 1/4 mile below the head of the ditch. The water not consumed by transportation losses and for domestic and stock watering purposes is returned to Hat Creek without undue loss.

The Hall Ditch was permitted to divert in excess of its irrigation and minimum flow allotments at all times, although the Hall sawmill was not in operation during the 1929 Season. Also the 0.50 cubic foot per second of water allotted to this ditch for the transportation of sawdust from the mill was given to Hall throughout the season as part of his irrigation and minimum flow allotments. The excess water in the Hall Ditch is necessary to preserve timber flumes and header boxes appurtenant to the sawmill, and is returned to Hat Creek. The amount of water used by Hall is determined by the difference between the amount of water at the Parshall Measuring Flume

below the head of the ditch and the amount of water returned to Hat Creek at the rectangular weir at the end of the ditch, and it is assumed that the 0.50 cubic foot per second of water allotted for sawdust transportation covers the conveyance loss in the ditch, incident to keeping the sawmill flume and header box wet.

In the past the Heryford Upper Ditch has been permitted to carry in excess of the Heryford minimum flow allotment for the purpose of operating a small power wheel at the Heryford ranch house. The power wheel, however, has now fallen into disuse and this practice was somewhat curtailed during the 1929 Season. This practice should be entirely done away with until such time as there is actual use of the water for power purposes.

The Ratledge-Opdyke-Forest Service Ditch was allowed a minimum flow allotment of 2.50 cubic feet per second. Of this amount Ratledge and Opdyke were permitted to use 0.375 cubic foot per second of water each, the remaining 1.75 cubic feet per second being required to supply suitable water for household use at the Hat Creek Ranger Station located at the end of the ditch.

The Ratledge-Lonquist Ditch was permitted to carry in excess of its minimum flow allotment of 0.75 cubic foot per second in order to supply suitable drinking water at the Ratledge house and to operate a small power wheel, the excess water being returned to Hat Creek below the house. This privilege, however, was violated several times during the 1929 Season, as noted in a following chapter under Violations of the Decree.

The Harry Lonquist House Ditch was permitted at all times to carry a head of water sufficient to operate the Harry Lonquist power

plant. This water was returned to the stream through the power plant or through the Lonquist-Reynolds - Bidwell Ditch.

The Lonquist - Reynolds - Bidwell Ditch was permitted to carry in excess of Bidwell's minimum flow allotment, the excess water being spilled back to Hat Creek at the Bidwell house. This was necessary due to fluctuations in the flow of the ditch caused by the operation of the Harry Lonquist power plant, and unsatisfactory means of control at the head of the ditch.

Water Stage Registers Installed to Aid Distribution

In addition to the water stage register at the United States Geological Survey measuring station, two water stage registers were maintained at critical points on Hat Creek. One register was installed at the county road bridge at the R. A. Wilcox ranch and the other just above Harry Lonquist's abandoned power dam. The continuous records obtained by these registers were observed from day to day, and from a study of the same, the cause of any change in the stage of the stream could be fixed within very narrow limits.

Summary of Distribution and Resultant Water Deliveries.

The 1929 Season was an unusually critical one. Cold weather in May kept Hat Creek at a low stage during the greater part of the month. A heavy rain storm which occurred on June 15th and 16th increased the flow of the creek for a few days, but had the effect of taking off the snow then remaining on the ground at the higher elevations, thereby causing the creek to decrease to its summer flow stage at an earlier date

than usual. At no time was the flow of Hat Creek sufficient to supply the demand on the stream throughout any ten day period.

For the sixteen periods from May 1st to October 8th, the average flow of Hat Creek above all diversions was 115 cubic feet per second. For this same period the average of the combined diversions amounted to 95 cubic feet per second, or 82.5 per cent of the available water supply. Of the 115 cubic feet per second total water supply, 20 cubic feet per second, or 17.5 per cent was dissipated by channel losses, and 13.5 cubic feet per second, or 11.5 per cent, was required to satisfy minimum flow and other fixed allotments, leaving 81.5 cubic feet per second, or 71 per cent of the available water, to supply the irrigation allotments subject to proration. This was sufficient to supply only 64 per cent of the average irrigation allotment of 126.5 cubic feet per second.

The Upper Users in eight irrigation periods were delivered an average of 86 cubic feet per second, or 69 per cent, of their total irrigation allotment of 123 cubic feet per second. The maximum irrigation allotment distributed to the Upper Users for a ten day period was 90 per cent, while the minimum irrigation allotment received by this class of users was 58 per cent.

The Lower Users received an average of 77 cubic feet per second, or 59 per cent of their total irrigation allotment of 130 cubic feet per second, for the eight periods during which they were entitled to irrigation heads. The maximum ten day average delivery to the Lower Users was 85 per cent, and the minimum delivery 46 per cent.

A summary of the water deliveries on Hat Creek for each of the sixteen irrigation periods from May 1st to October 8th is presented in Table 8, submitted at the end of this report.

USE OF WATER

Table 9, submitted at the end of this report, gives the irrigated area to be supplied and the full irrigation allotment of each water user on Hat Creek for the 1929 Season. The acreages and allotments are further segregated into the Upper and Lower classes. The total irrigated area of the Upper Users is 1214.4 acres, while that for the Lower Users amounts to 1313.9 acres. The amounts of water delivered to supply these areas are set forth in Table 8, submitted at the end of this report.

There was delivered to the Upper Users an average of 86 cubic feet per second in 8 periods (80 days). This amounts to a total delivery of 13,643 acre feet for 1214.4 acres, or a use of 11.2 acre feet per acre. In terms of continuous flow for the 160 day period from May 1st to October 8th this is equivalent to a use of 1 cubic foot per second to each 28.2 acres of irrigated land, or 1.42 Miners Inches (6 inch pressure) per acre.

The Lower Users received an average of 77 cubic feet per second of water in 8 periods (80 days) to irrigate 1313.9 acres. This amounts to a total delivery of 12,215 acre feet, or a use of 9.2 acre feet per acre, and is equivalent to a continuous flow for the 160 day period from May 1st to October 8th of 1 cubic foot per second to each 34.1 acres of irrigated land, or 1.17 Miners Inches (6 inch pressure) per acre.

The average delivery to both classes of users for the 160 day period was 81.5 cubic feet per second, or 25,858 acre feet, for 2528 acres of irrigated land. This amounts to a use of 10.2 acre

feet per acre, and is equivalent to a continuous flow of 1 cubic foot per second to each 31 acres of irrigated land, or 1.29 Miners Inches (6 inch pressure) per acre.

The foregoing results are summarized in the following table.

Class of Users	Irrigable Acreage	Amount of Water Delivered.			
		Total Acre Feet	Acre Ft. per Acre	Acres per C.F.S.	*Miners Inches per Acre
Upper	1214.4	13,643	11.2	28.2	1.42
Lower	1313.9	12,215	9.2	34.1	1.17
All	2528.3	25,858	10.2	31.0	1.29

* Measured under a 6 inch pressure.

The above results represent a duty of water which would have obtained had the water delivered during the 16 irrigation periods been applied to the total acreage; and as such are comparable with the results obtained in previous years.

The total acreage entitled to receive water from Hat Creek, however, was not irrigated during the 1929 Season. Crop reports and reports on acreages irrigated were received from only one third of the total irrigated area. The one third reporting showed approximately 15 per cent less land irrigated in 1929 than their total irrigated area. Applying the same percentage to all the lands irrigated from Hat Creek,

as set forth in Table 9, it is estimated that approximately 2150 acres were adequately irrigated in 1929.

It, also, is to be noted that the results given in the above table do not take into account the amount of water delivered as minimum flow allotments. These allotments are used almost entirely for irrigation purposes, and, therefore, should be used, together with the amounts of water delivered as irrigation allotments, in computing the duty of water on the Hat Creek lands. In other words, the gross amount of water used on the Hat Creek lands is represented by the total of the combined diversions from the stream.

From Table 8, the average of the combined diversions for the 160 day period from May 1st to October 8th amounts to 95 cubic feet per second, or 30,142 acre feet. Applied to the 2150 acres of land irrigated in 1929, the duty of water is found to be 14 acre feet per acre, and is equivalent to a continuous flow of 1 cubic foot per second to each 22.6 acres of irrigated land, or 1.77 Miners Inches (6 inch pressure) per acre.

CROP PRODUCTION

Only nine water users, representing approximately one third of the acreage irrigated from Hat Creek, submitted reports on crop production for the 1929 Season. With but few exceptions those not submitting reports believe the Division has some ulterior purpose in securing a census of crop production. For those persons it is here stated that the Division has no interest in what or how much they produce other than for comparative purposes from year to year and as an aid in bettering water master service on the stream.

A summary of the reports received is given on Table 10, submitted at the end of this report.

MEASURING DEVICES

During the 1929 Season installation of measuring devices were made as follows:

Hall Ditch

A 3 foot timber Parshall Measuring Flume was installed on this ditch at the county road crossing above Hall's house, and a 4 foot timber rectangular weir was placed in the end of the ditch just above the point where Hall's mill water is returned to Hat Creek. These two structures replace the weirs installed by U. B. Gilroy in 1926, as the latter had become obsolete due to a change in Hall's irrigation practice. The amount of water being used by Hall for irrigation purposes is determined by simultaneous measurements on these two structures.

Wilcox Middle Ditch

A 3 foot timber Parshall Measuring Flume was installed just above the division fence between the Harry Wilcox and R. A. Wilcox ranches. This device serves to measure the R. A. Wilcox allotment of water in the Wilcox Middle Ditch.

Morris Upper Ditch

A 3 foot concrete Parshall Measuring Flume was installed in this ditch at a point about 1/4 mile below the head, and replaces a 6 foot rectangular weir formerly installed at the same point. Some

dissatisfaction was expressed that this device should be located at such a distance below the head of the ditch. The upper portion of the ditch, however, silts badly with sand which might bank up below a structure located near the head of the ditch and cause submergence. As presently located the structure has a free discharge at all times. The amount of seepage loss that may occur between the head of the ditch and the measuring device is negligible.

Lonquist-Reynold East Side Ditch

A 3 foot concrete Parshall Measuring Flume was installed in this ditch to replace a 3 foot rectangular weir, and has given very satisfactory results.

The various water users on Hat Creek have been advised that the Parshall Measuring Flume has been adopted by the Division as the standard measuring device and that as the measuring devices now in use become unserviceable, they should be replaced by Parshall Measuring Flumes of a size to be recommended by the water master.

The matter of installing a Parshall Measuring Flume on the Opdyke Ditch to replace a rated flume section, which has become unserviceable, was taken up with Mr. Perry Opdyke in 1928 and again in 1929. This structure, however, had not been installed at the close of the 1929 Season.

Mr. Glen Ratledge, lessee of the Chas. B. Heryford ranch, made arrangements with Mr. Heryford to install a Parshall Measuring Flume in the Heryford Upper Ditch to replace a submerged orifice which had washed out. This structure, however, had not been installed at the close of the 1929 season.

Henry Lonquist was advised to install a Parshall Measuring Flume in the Henry Lonquist Upper Ditch to replace a submerged orifice, which was destroyed when the ditch was cleaned.

On the remaining ditches, excepting the Indian ditches, an effort has been made by the water users to maintain serviceable measuring devices, consequently, no pressure was brought to bear on these owners to install Parshall Measuring Flumes, though such replacement was recommended.

The measuring devices on the Hat Creek ditches as existing at the close of the 1929 Season are listed in Table 11, submitted at the end of this report.

VIOLATIONS OF DECREE BY WATER USERS

Perry Opdyke

(1) Using water in excess of minimum flow allotment during Lower Users' period May 11th to May 21st.

(2) On July 30th, water turned out of Opdyke Ditch just prior to arrival of water master at 7:30 A.M. The ditch should have been cut to its minimum flow allotment at 6:00 A.M.

(3) On July 30th at about 7:35 A.M., water was being used for irrigation purposes on the Opdyke upper meadow under the Ratledge-Opdyke-Forest Service Ditch, however, upon arrival of the water master at the head of the ditch at 7:40 A.M., the ditch had been cut to its minimum flow allotment. Apparently the water had been turned out of the ditch just prior to the arrival of the water master, instead of at 6:00 A.M.

(4) On September 18th, at 5:50 A.M. just prior to the opening of the fifteenth irrigation period, the Opdyke Ditch was found to be diverting a flow of 3.40 cubic feet per second, or 2.40 cubic feet per second in excess of the minimum flow allotment of 1.00 cubic foot per second which the ditch should have been carrying at that time.

(5) In addition to the illegal usages of water above mentioned, Perry Opdyke is either extremely careless or willfully negligent in limiting the flow in the Opdyke Ditch to its minimum flow allotment of 1.00 cubic foot per second during the Lower Users' irrigation periods.

(6) Failure to install a suitable measuring device in the Opdyke Ditch.

J. Ratledge

(1) On July 30th at 9:00 A.M., water in excess of the minimum flow allotment was being used on the Ratledge ranch from the Ratledge-Lonquist Ditch. This water should have been turned back to the creek at 6:00 A.M. on the above date.

In order that there may be a potable supply of water at the Ratledge ranch house for household use, and to permit of the operation of a small power wheel, it has been the practice of the water master to allow water in excess of the minimum flow allotment to flow in the Ratledge-Lonquist Ditch during the Upper Users' minimum flow periods, with the understanding that the excess water would be returned to Hat Creek just below the Ratledge house. On the above date the lateral ditch through which the water should have been returned to the creek was checked up and the water was being spread over the adjacent alfalfa field. This use was not only a violation of the decree, but also a violation of a trust placed in Mr. Ratledge to see that this water was returned to the creek without the necessity of the water master patrolling the ditch.

Henry Lonquist

(1) On July 31st, this party was found to be diverting 2 cubic feet per second of water in excess of his irrigation allotment. This excess flow was measured in the Henry Lonquist Upper Ditch at a time when Lonquist's total irrigation allotment was being diverted through the Henry Lonquist Lower Ditch.

(2) Failure to turn water out or have water turned out of Ratledge-Lonquist Ditch on August 19th, and use of same on the Henry Lonquist ranch up to about 7:40 A.M. Use from this ditch by Lonquist should have ceased at 6:00 A.M. on the above date.

(3) Failure to turn water out or have water turned out of Ratledge-Lonquist Ditch on September 8th, and use of same on the Henry Lonquist ranch up to about 8:00 A.M. Use from this ditch by Lonquist should have ceased at 6:00 A.M. on the above date.

(4) Failure to install a suitable measuring device in the Henry Lonquist Upper Ditch.

Glenn Ratledge (lessee C. B. Heryford ranch)

(1) Carelessness and willful neglect in regulation of Heryford ditches. On numerous occasions these ditches were found to be carrying in excess of the amounts of water allotted to them.

W. P. Hall

(1) On August 28th, Mr. Hall was found to be diverting his irrigation allotment one day in advance of the Upper Users' period opening on August 29th.

C. B. Heryford

(1) Failure to install a suitable measuring device on the Heryford Upper Ditch.

WATER RIGHTS
INITIATED BY APPLICATION TO
DIVISION OF WATER RESOURCES

The status of the several rights to the use of the waters of Hat Creek, initiated by application to the Division of Water Resources, is given in the following table:

Applica- tion No.	Permit No.	Applicant	Amount C.F.S.	Acreage to be Irriga- ted	Time Fixed for Completion of Use
2878	2026	W. W. Brown	0.85	17	Dec. 1, 1930
4449	2626	Inigo Jones	1.00	40	July 1, 1930
4659	2607	Hal A. Shearin	1.00	40	Dec. 1, 1932
4700	2608	Carrie K. Hall	1.25	50	Dec. 1, 1931

Application 4436 of the Red River Lumber Company to appropriate 190 cubic feet per second from Hat Creek for power purposes was cancelled without prejudice upon request of the applicant.

FINANCIAL STATEMENT

Water master service in Shasta County during the 1929 Season covered Hat, Burney, North Cow, Oak Run, and Clover Creeks. The work on these streams was carried on as a unit, and was financed partly by subscription from the water users and partly by contribution by the Division of Water Resources.

No segregation was made in the expense of conducting the work on each stream. The total unit cost of the service on the five stream systems was \$0.54 per acre of irrigated land. The cost to the water users was slightly less than \$0.27 per acre, the remaining cost having been borne by the Division of Water Resources.

An itemized statement of the receipts and expenditures follows.

FINANCIAL STATEMENT

SHASTA COUNTY WATER DISTRIBUTION

1929 SEASON

oOo

RECEIPTS

Contributed by Water Users on Burney Creek.....	300.00	
Contributed by Water Users on Hat Creek	700.00	
Contributed by Water Users on North Cow Creek.....	478.33	
Contributed by Water Users on Oak Run Creek	94.47	
Contributed by Water Users on Clover Creek	400.05	
Contributed by Division of Water Resources	<u>2000.00</u>	3972.85

DISBURSEMENTS

Salaries and wages	2984.97	
Field Expenses	945.98	
Printing and Blueprinting	<u>41.90</u>	3972.85

TABLES

TABLE 1

PRECIPITATION DATA
HAT CREEK, SHASTA COUNTY - ELEVATION 3010 FEET

Monthly, Seasonal and Average Amounts of Precipitation in Inches.

Season	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Seasonal
1921-22	0.30	0.47	3.82	0.85	6.41	2.13	0.38	1.91	1.40	0	0.60	0	18.27
1922-23	1.58	2.26	4.85	2.36	0.32	0.03	2.04	1.18	3.29	0.17	0.30	1.70	20.08
1923-24	1.16	0.37	1.46	1.30	1.31	1.04	.73	T	T	0	0.34	0.10	7.81
1924-25	2.28	1.40	1.99	1.01	4.12	1.12	1.37	1.98	1.49	0.09	0.18	1.86	18.89
1925-26	0.58	2.26	0.48	2.57	2.45	0.75	2.39	1.06	0	0.04	0.10	0.01	12.69
1926-27	1.18	4.41	0.88	1.63	4.70	1.77	2.89	2.01	0.63	T	T	0.29	20.39
1927-28	0.87	4.84	0.36	1.83	1.36	4.87	1.05	1.76	0.08	0.14	0.14	0.16	17.46
1928-29	0.50	2.69	2.64	0.92	1.65	1.17	1.85	0.05	1.52	0	0	0	12.99
Mean	1.06	2.35	2.06	1.56	2.79	1.61	1.59	1.24	1.05	0.05	0.21	0.51	16.08

TABLE 2

PRECIPITATION DATA
HAT CREEK, SHASTA COUNTY

PRECIPITATION FOR THE SEASON YEAR 1928-1929
COMPARED WITH MEAN FOR SEASONAL YEARS 1921-1929

Month	Precipitation in Inches		Per Cent of Total Mean	
	Mean 1921-1929	Seasonal Year 1928-1929	Mean 1921-1929	Seasonal Year 1928-1929
October	1.06	0.50	6.5	3.1
November	2.35	2.69	14.7	16.7
December	2.06	2.64	12.8	16.4
January	1.56	0.92	9.7	5.7
February	2.79	1.65	17.4	10.3
March	1.61	1.17	10.0	7.3
April	1.59	1.85	9.9	11.5
May	1.24	0.05	7.7	0.3
June	1.05	1.52	6.5	9.5
July	0.05	0	0.3	0
August	0.21	0	1.3	0
September	0.51	0	3.2	0
TOTALS	16.08	12.99	100.0	80.8

TABLE 3

DAILY DISCHARGE, IN CUBIC FEET PER SECOND, OF
HAT CREEK ABOVE ALL DIVERSIONS, FOR THE IRRIGATION
SEASON OF 1929.

Day	May	June	July	August	Sept.	Oct.
1	119	129	115	102	99	103
2	123	125	114	102	100	103
3	124	128	112	103	99	103
4	127	129	110	103	99	103
5	125	131	109	104	99	103
6	121	131	107	104	100	103
7	121	132	110	104	100	103
8	123	128	110	103	99	
9	127	131	109	104	99	
10	127	131	103	104	99	
11	134	131	108	104	99	
12	142	125	105	104	99	
13	143	126	105	102	99	
14	143	127	105	100	99	
15	142	167	108	99	98	
16	152	177	108	98	98	
17	155	146	108	96	98	
18	153	135	108	97	99	
19	155	132	105	98	97	
20	158	126	104	99	96	
21	165	129	100	102	96	
22	165	128	100	100	96	
23	165	126	100	102	100	
24	162	123	100	102	103	
25	155	123	100	100	102	
26	147	122	99	100	102	
27	141	121	99	100	103	
28	140	119	99	99	102	
29	139	118	99	99	102	
30	138	116	100	99	103	
31	139		100	99		
Total Sec.:						160 day
Feet Days:	4370	3912	3259	3132	2984	721
Mean						Period
Sec. Feet	141	130	105	101	99	103
Max.						115
Sec. Feet	165	177	115	104	103	103
Min.						117
Sec. Feet	119	116	99	96	96	103
Total						96
Ac. Feet	8666	7757	6462	6210	5917	1430
						36442

TABLE 4

DEMAND ON WATER SUPPLY DURING
UPPER USERS PERIODS
1929 SEASON

ITEM	AUTHORITY	AMOUNT-CFS,
Irrigation allotments to Upper Users	: Decree - Schedule 1	: 103.500
Irrigation allotments to Upper Users for reclaimed mud flow lands	: Decree - Par. 21 and : 1927 survey	: 12.530
Irrigation allotment to Sullivan	: Decree - Par. 30	: 4.600
Irrigation allotment to United States Forest Service	: By agreement with Hat Creek : Ranger	: 2.500
Irrigation allotment to Hal A. Shearin	: Claim of riparian right	: 1.000
: Allotment to Hall for sawmill use	: Decree - Par. 11	: 0.500
Minimum flow allotments to Lower Users	: Decree - Schedule IV	: 9.125
Minimum flow allotment to Vernon March	: Allowed by Water Master	: 1.000
Allowance for conveyance loss in Reiger Ditch	: Decree - Par. 13 & Measurements	: 1.500
Channel loss in Hat Creek	: Measurements	: 14,000
	: TOTAL	: 150.255

NOTE: The first four items, totaling approximately 123 cubic feet per second, constitute the allotments subject to proration. The remaining items constitute a fixed demand of approximately 27 cubic feet per second, which amount is to be deducted from the available water supply in order to determine the amount of water available for the allotments subject to proration.

TABLE 5

DEMAND ON WATER SUPPLY DURING
LOWER USERS PERIODS
1929 SEASON

ITEM	AUTHORITY	AMOUNT C.F.S.
Irrigation allotments to Lower Users	Decree-Schedule III	129.000
Irrigation allotments to Lower Users for reclaimed mud flow lands	Decree-Paragraph 22 and 1927 Survey	1.200
Allotment to Hall for sawmill use	Decree-Paragraph 11	0.500
Minimum flow allotments to Upper Users	Decree-Schedule II	10.125
Minimum flow allotment to Sullivan	Allowed by Water Master	0.500
Minimum flow allotment to United States Forest Service	By agreement with Hat Creek Ranger	1.750
Allowance for conveyance loss in Reiger Ditch	Decree-Paragraph 13 and measurements	1.500
Channel loss in Hat Creek	Measurements	24.000
	TOTAL	168.575

NOTE: The first two items, totaling approximately 130 cubic feet per second, constitute the allotments subject to proration. The remaining items constitute a fixed demand of approximately 39 cubic feet per second, which amount is to be deducted from the available water supply in order to determine the amount of water available for the allotments subject to proration.

TABLE 6

MINIMUM FLOW ALLOTMENTS AS
DISTRIBUTED TO UPPER USERS
DURING 1929 SEASON

Name of User	Ditch	Pooled Allotment C.F.S.	Ditch Total C.F.S.
Harvey Wilcox	Harvey Wilcox Upper	0.50	0.50
Vint Stevenson	Stevenson Main	0.25	0.25
Sidney Gray	Gray	0.125	0.125
W. P. Hall	Hall	(a) 1.00	1.00
Alec Brown	Alec Brown	0.125	0.125
Harry Wilcox	Wilcox Middle	1.25	2.50
R.A. Wilcox Estate	Wilcox Middle	1.00	
Holiday Brown	Wilcox Middle	0.25	
McGarry Snook	Wilcox-Davis	0.25	0.25
William Valentine	Valentine Lower	0.50	0.50
C. B. Heryford	Heryford Upper	0.75	0.75
Edith Snook	Edith Snook	0.125	0.125
J. S. Ratledge	Ratledge-Lonquist	0.375	0.75
Henry Lonquist	Ratledge-Lonquist	0.375	
J. S. Ratledge	Ratledge-Opdyke-Forest Service	0.375	2.50
Perry Opdyke	Ratledge-Opdyke-Forest Service	0.375	
Forest Service	Ratledge-Opdyke Forest Service	1.75	
Perry Opdyke	Opdyke	1.00	1.00
Asa Doty	Morris Lower	1.50	1.50
C. & F. Brown	Reiger	0.50	2.50
L. H. Sullivan	Reiger	0.50	
Transportation Loss	Reiger	1.50	
TOTAL			14.375

(a) Domestic and stock water 0.50 cubic feet per second
Water for sawdust conveyance 0.50

TABLE 7

MINIMUM FLOW ALLOTMENTS AS
DISTRIBUTED TO LOWER USERS
DURING 1929 SEASON

Name of Water User	Ditch	Pooled Allotment and Ditch Total C.F.S.
Henry Lonquist	:Henry Lonquist Lower	: 1.50
Vernon March	:Morris Upper	: 1.00
Harry Lonquist	:Harry Lonquist House	: 0.50
Harry Lonquist and A. N. Reynolds	:Lonquist-Reynolds East Side	: 2.00
Ralph Bidwell	:Lonquist-Reynolds-Bidwell	: 0.50
Jeff Bone	:Jeff Bone Lower	: 0.25
Lee Bone	:Lee Bone	: 0.25
Julia Wilson	:Julia Wilson	: 0.25
Sam Williams	:Sam Williams	: 0.25
Joe Wilson	:Joe Wilson	: 0.25
Allan Brown and W. W. Brown	:Brown Middle	: 1.50
Charley Snooks	:	: (a) 0.125
David Doyel et al	:Doyel	: 1.00
Bertha Geissner	:Bertha Geissner	: 0.25
Otto Geissner	:Otto Geissner	: 0.50
TOTAL		: 10.125

(a) Charley Snooks' allotment assumed to be absorbed by other Indian ditches.

TABLE 8

WATER DELIVERIES ON HAT CREEK
1929 SEASON

Irrigation Period	Dates	Average Flow	Average	Channel Loss		Average Irrigation		Delivery	
		of Hat Creek above all Diversions C.F.S.	Combined Diver- sions C.F.S.	C. F. S. Upper Users	Lower Users	C. F. S. Upper Users	Lower Users	Per cent of Upper Users	Full Allot ments Lower Users
1	May 1 - May 11	124	(a) 110	(a) 14		(a) 97		(a) 79	
2	May 11 - May 21	150	124		26		110		85
3	May 21 - May 31	152	124	28		111		90	
4	May 31 - June 10	130	114		16		100		77
5	June 10 - June 20	140	118	22		105		85	
6	June 20 - June 30	122	96		26		82		63
7	June 30 - July 10	110	96	14		83		67	
8	July 10 - July 20	107	84		23		70		54
9	July 20 - July 30	100	86	14		73		59	
10	July 30 - Aug. 9	102	78		24		64		59
11	Aug. 9 - Aug. 19	101	85	16		72		58	
12	Aug. 19 - Aug. 29	100	76		24		62		48
13	Aug. 29 - Sept. 8	100	87	13		74		60	
14	Sept. 8 - Sept. 18	99	74		25		60		46
15	Sept. 18 - Sept. 28	99	85	14		72		58	
16	Sept. 28 - Oct. 8	103	79		24		65		50
Mean		115	95	(b) 14	(b) 24	86	77	69	59

(a) Estimated

(b) Mean for periods June 20 - October 8

TABLE 9

ACREAGES TO BE SUPPLIED
AND
DECREED IRRIGATION ALLOTMENTS
1929 SEASON

Water User	Irrigated Area to be supplied		Decreed Full Irrigation allotment	
	Upper Users	Lower Users	Upper Users Sec. Feet	Lower Users Sec. Feet
R. E. Bidwell		(a) 99.9 ✓		9.95
Harry Bob		34.0 ✓		10.00
J. & L. Bone		13.1 ✓		3.50
Alec Brown	4.7 ✓		0.50	1.50
Allan Brown		124.1 ✓		12.25
Fay & Clare Brown	32.1 ✓		3.25	
Holiday Brown	11.2 ✓		1.125	
W. W. Brown		79.1 ✓		8.00
Asa Doty	222.7 ✓		22.25	
David Doyel		242.3 ✓		24.25
Bertha Geissner		121.0 ✓		12.25
Otto Geissner		79.7 ✓		8.00
Chas. S. Gray	10.0		1.00	
W. P. Hall	(b) 32.4 ✓		3.25	
Chas. Heryford	35.0 ✓		3.50	
Harry A. Lonquist		98.7 ✓		9.75
Henry Lonquist	18.8 ✓		1.875	9.25
Sofia Lonquist		114.7 ✓		11.50
Vernon March		134.8 ✓		13.50
Opdyke Bros.	177.3 ✓		17.75	
J. Ratledge	44.3 ✓		4.375	
A. N. Reynolds	(See Sofia Lonquist)			
Edith Snook	2.4 ✓		0.50	
McGarry Snook	21.7 ✓	1.0	2.125	
Charley Snook		20.0		0.50
Vint Stevenson	(c) 77.3 ✓		7.705	
L. H. Sullivan	46.0 ✓		4.60	
U. S. Forest Service	11.1		2.50	
Wm. Valentine	13.9 ✓		1.625	
Harry Wilcox	181.1 ✓		18.00	
Harvey Wilcox	(d) 61.4 ✓		6.125	
R. A. Wilcox Estate	(e) 211.42 ✓		21.075	
Sam Williams		11.4 ✓		1.25
Joe Wilson		28.2 ✓		2.75
Julia Wilson		20.4 ✓		2.00
TOTALS	1214.40	1313.90 1295.00	123.155	130.25

- (a) Includes 12.0 acres of reclaimed mud flow land.
- (b) " 5.0 " " " " " " "
- (c) " 53.3 " " " " " " "
- (d) " 40.0 " " " " " " "
- (e) " 27.0 " " " " " " "

TABLE 10

CROP PRODUCTION ON LANDS IRRIGATED FROM HAT CREEK
1929 SEASON

Owner	Crop	Acres	Total Yield		Yield per Acre	
			Sacks	Tons	Sacks	Tons
R. E. Bidwell	Meadow Hay	20		25		1.3
	Alfalfa	70		150		2.1
	Garden	1				
	Orchard	1				
	Pasture	5				
W. W. Brown	Alfalfa	70		140		2.0
David Doyel	Meadow Hay	25		40		1.6
	Alfalfa	25		30		1.2
	Wheat Hay	6		12		2.0
	Wheat	40	330	21.4	8.5	0.5
	Pasture	80				
W. P. Hall	Meadow Hay	10.		10		1.0
	Alfalfa	14.		14		1.0
	Sudan	.75		1		1.3
	Pasture	17.				
Harry A. Lonquist	Alfalfa	95		180		1.9
	Wheat	8	60	3.9	7.5	4.9
	Garden	1				
	Plowed	3				
	Pasture (Total of 107 acres including all lands)					
A. Reynolds (Sofia Lonquist)	Meadow Hay	15		15		1.0
	Alfalfa	52		100		1.9
	Wheat	8	80.0	5.2	10.0	0.7
	Pasture	3.5				
Vint Stevenson	Meadow Hay	20				
	Alfalfa	70	(Eaten off by deer)			
	Pasture	90				
Wm. Valentine	Pasture	60				
Harvey Wilcox	Meadow Hay)					
	Alfalfa)	30		16		0.5
	Pasture	30				

Yield when given in sacks was converted to yield in tons, using weight per sack as follows:
Wheat 130 lbs. per sack
Barley 100 lbs. " "
Oats 90 lbs. " "

TABLE 11

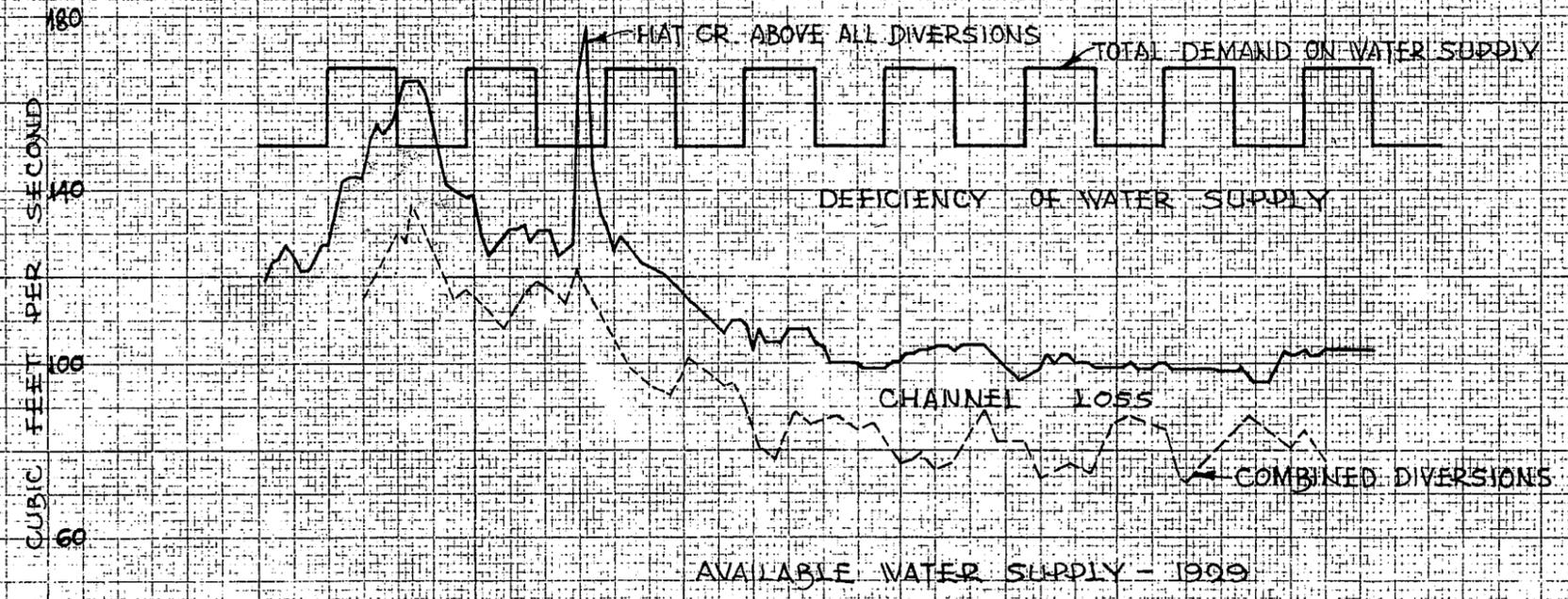
MEASURING DEVICES ON HAT CREEK DITCHES
1929 SEASON.

Name of Ditch	Type of Measuring Device	Zero Datum Gage Reading in Feet
Harvey Wilcox Main	4 ft. Rectangular Weir	7.0
Harvey Wilcox Upper Channel	4 ft. Cipolletti Weir	1.5
Harvey Wilcox Lower Channel	1.5 ft. Rectangular Weir	0.0
Gray	0.50 sq.ft. submerged orifice	0.0
Stevenson Upper	2 ft. Cipolletti Weir	0.0
Stevenson Main	4 ft. Cipolletti Weir	0.0
Stevenson Channel	0.50 sq. ft. submerged orifice	0.0
Hall	3 ft. Parshall Meas. Flume and 4 ft. Rectangular Weir	0.0
Shearin Upper	----	---
Shearin Lower	----	---
Alec Brown	----	---
Hawkins	3 ft. Cipolletti Weir	4.0
Wilcox Upper	4 ft. Cipolletti Weir	5.0
Wilcox Middle	Rated Staff Gage (Weir Control)	5.25
Wilcox-Davis	3 ft. Rectangular Weir	0.0
Valentine Upper	1.5 Rectangular Weir	2.0
Valentine Lower	----	---
Heryford Upper	Rated Staff Gage	---
Heryford Middle	0.25 sq. ft. orifice	1.0
Heryford Lower	Rated Staff Gage	---
Edith Snock	----	---
Ratledge-Opdyke Forest Serv.	Rated Staff Gage	---
Ratledge-Longquist	5 ft. Rectangular Weir	5.0
Opdyke	Rated Staff Gage	---
Henry Longquist Upper	Rated Staff Gage	---
Henry Longquist Lower	Rated Staff Gage (Weir control)	5.0
Reiger	8 ft. Rectangular Weir	4.0
Morris Upper	3 ft. Parshall Measuring Flume	0.0
Morris Lower	4 ft. Rectangular Weir	0.0
Harry Longquist House	Rated Staff Gage	---
Longquist-Reynolds-Bidwell	7 ft. Rectangular Weir	7.0
Longquist-Reynolds East Side	3 ft. Parshall Measuring Flume	0.0
Reynolds Dam	Staff Gage in Hat Creek below dam	---
J. Bone Upper	----	---
J. Bone Lower	----	---
Lee Bone	Rated Staff Gage	---
Julia Wilson	Rated Staff Gage	---
Sam Williams	Rated Staff Gage	---
Joe Wilson	Rated Staff Gage	---
Allan Brown Upper	1.50 sq.ft. submerged orifice	0.0
Allan Brown Middle	7' Rectangular Weir	2.0
Allan Brown Lower	Rated Staff Gage	---
Doyel	6 ft. Rectangular Weir	0.0
Bertha Geissner	Rated Staff Gage	---
Otto Geissner	Rated Staff Gage	---

NOTE: Rating curves have been prepared for the ditches equipped with staff gages. These curves are on file at the office of the Division and copies of the same are available upon request.

JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER
5 10 15 20 25 5 10 15 20 25 5 10 15 20 25 5 10 15 20 25 5 10 15 20 25 5 10 15 20 25 5 10 15 20 25 5 10 15 20 25 5 10 15 20 25 5 10 15 20 25 5 10 15 20 25 5 10 15 20 25

DIAGRAM SHOWING
FLOW OF HAT CREEK
ABOVE ALL DIVERSIONS
COMPARED WITH
DEMAND ON WATER SUPPLY
1929



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