State of California
DEPARTMENT OF PUBLIC WORKS
Sacramento

Division of Water Rights
707 Forum Building

October 17, 1924.

Mr. Edward Hyatt, Jr.,
Chief of Division of Water Rights,
Sacramento, California

Attention Mr. Gordon Zander, Hydraulic Engineer.

Dear Sir:-

There is transmitted herewith a report on the water master service in Hat Creek Valley, Shasta County, California, for the period from May 31, 1924, to October 8, 1924, inclusive.

The report describes the regulation and distribution of water in accordance with the provisions of the decree entered by the Superior Court in the case of Doyel, et al, vs. Massie, et al, sets forth the progress that has been made in the installation of headgates and measuring devices on the various ditches in accordance with the provisions of paragraph 29 of said decree, and contains a financial statement showing the cost of the water master service and the sources from which such cost was met.

Respectfully submitted,

PAUL V WHEATLEY
Water Master

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REPORT ON WATER MASTER SERVICE

IN

HAT CREEK VALLEY, SHASTA COUNTY, CALIFORNIA

DURING SEASON OF 1924

INTRODUCTION

Under date of May 14, 1924, a decree was entered by the Superior Court of the State of California, in and for the County of Shasta, in the matter of David Doyel, et al, vs. Harvie Massie, et al, establishing the relative rights of all water users from Hat Creek above its confluence with Rising River.

Under the decree, the water users on Hat Creek above its confluence with Rising River are divided into two classes designated as Upper Users and Lower Users, and during the period between May 1st and October 27th of each year the users in each class are permitted to use during alternate irrigation periods of ten days each, such irrigation heads as are necessary for the irrigation of their lands, provided such heads do not exceed certain allotments specified for each user, which allotments are based upon an allowance of four miner's inches per acre of land irrigated. Certain minimum flow allotments are made to each ditch during the alternate periods in which irrigation is not being practiced, in order to protect the ditches from damage which might result from their being alternately wet and dry, and in order to provide water for domestic and stock watering purposes. The total of the minimum flow allotments to the Upper Users is 405 miner's inches, and that to the Lower Users is 365 miner's

inches. Provision is made that should the flow of Hat Creek be insufficient during any irrigation period to supply the water users of the class then entitled to irrigate with their irrigating heads, and at the same time supply the minimum flow allotments to the users in the other class, then during the continuance of such shortage, the excess water of the creek over and above the amount necessary to supply the minimum flow allotments shall be divided among the users of the class entitled to irrigate in the ratio that their allotments bear to each other.

The decree provides that the owners of each ditch shall install, under the supervision of an engineer appointed by the Division of Water Rights, such permanent headgates and measuring devices as shall be required and approved by the Division.

The decree also provides that upon request of any party thereto the Division of Water Rights may appoint a water master to distribute the water in accordance with the terms thereof, if, upon investigation, it appears to the Division that the necessity therefor exists. All costs and expenses of distribution of water through the agency of such water master are to be borne by the parties, Indiansoccupying government land excepted, in proportion to the amount of water allotted to each.

On May 21, 1924, a request for the appointment of a water master, signed by five of the plaintiffs in the action of Doyel et al vs. Massie, et al, was received by the Division of Water Rights. Immediately thereafter a field investigation was made by Hydraulic Engineer Gordon Zander, from which it appeared that there was urgent necessity for the immediate appointment of a water master. Accordingly Mr. Harrison Smitherum was temporarily appointed water master, assuming his duties in the field on May 30th.

Thereafter Mr. Paul V. Wheatley was formally appointed water master for Hat Creek Valley for the 1924 season, under authority contained in paragraph 28 of the decree, and assumed his duties in the field on June 6th. Mr. Smitherum remained in the Valley until June 10th, in order to assist the water master in becoming familiar with the territory and with conditions.

DISTRIBUTION OF WATER

The water master assumed his duties in the Valley on May 30th, a day prior to the beginning of the fourth irrigation period, and the distribution of the waters of Hat Creek began at 6:00 a.m. May 31st, in accordance with the terms of the decree.

From a current meter measurement taken on Hat Creek above all diversions, it was found that the flow of the creek was insufficient to supply maximum allotments to the Lower Users and at the same time provide the Upper Users with their minimum flow allotments. As provided for in the decree minimum flows were to be supplied to the Upper Users and the remaining flow divided among the Lower Users in the ratio that their allotments bear to each other. Due to lack of knowledge of creek channel losses and possible return flow from irrigation and the importance of not wasting water below the lowest diversion, it was decided to determine the proper percentage to be applied to the Lower Users allotments by trial. Distribution was therefore started on the basis of 100% allotment to Lower Users.

The Upper and Lower Users were instructed to regulate their diversions to minimum and maximum flows, respectively, as provided for in Schedules II and III of the decree. The diversions were later measured by current meter and regulated to the correct flows by the water master.

On the basis of 100% delivery to Lower Users, the available flow proved only sufficient for the users above the Reynold's Dam. The users below received little or no water. The allotments were therefore reduced to various percentages of the maximum until all users received their pro rata of water. Over the fourth irrigation period, May 31st to June 10th, the Lower Users received approximately 62% of their maximum allotments.

Distribution throughout the period required many changes in the allotments to the various diversions. Rotation was practiced between ditches requiring numerous changes in addition to those necessary to pro rate the water. Due to the extreme dryness of Hat Creek channel over some three or four miles of its course, caused by the failure of the Upper Users to supply minimum flows to the Lower Users during the third irrigation period, it was necessary to reduce the diversions above the Reynolds Dam for varying periods to 75%, 50% and 25% of their maximum allotments and finally to approximately minimum flows, before the creek bed was filled and suitable irrigation heads delivered to the Doyle and Geissner ranches. The diversions below the Reynolds Dam were regulated as water became available to them.

Difficulty was encountered and the efficiency of distribution greatly hampered in making necessary changes because of the lack of suitable control works and measuring devices on the ditches. The dams were temporary structures of rock, brush and miscellaneous boards, built to such heights as to insure diversion of the maximum capacity of the ditches. Most of the ditches lacked headgates and none were equipped with measuring devices. In operation, water turned out of an upper ditch was automatically diverted by the ditches down stream. Due to lack of measuring devices very little co-operation could be had from the users

in regulating diversions. Every change required re-measurement by current meter and the personal supervision of the regulation by the water master on each ditch affected. In many cases it was necessary to tear out portions of dams to by-pass excess water.

The entire time of the water master was devoted to pro rating the water to the Lower Users. No progress was made in the installation of headgates and measuring devices on the ditches.

On June 9th, 1924, current meter measurements were taken of the flow of Hat Creek at the Alec Brown gaging station, also of the diversions above this station, to determine the amount of water available for distribution to the Upper Users for the irrigation period beginning June 10, 1924. Making what was thought to be ample allowance for losses in the channel and adding to this estimate the 9.125 second feet total Lower Users' minimum flow allotment, it was estimated that 86% of the Upper Users' allotment of 103.5 second feet could be delivered. Accordingly the different ditches of the Upper Users were alloted 86% of their maximum allotments, the measurements being made by current meter. On account of there being few headgates and no diversion works, great difficulty was experienced in keeping a uniform flow of water in the various ditches. In regulating the ditches of the extreme Upper Users, it was found that any excess water turned out of these ditches was generally diverted into the next ditch below, this of course being due to the absence of headgates to regulate the flow.

This condition was duplicated in almost every ditch, making it necessary to start at the uppermost user's ditch and regulate each ditch in succession down the stream. Even then it was found that the proper proportion of water was hard to maintain in the ditches. Dams would break and cause a raise in the ditches below, or the accumulation of drift would cause the dams to divert more water than was intended, thus lowering the ditches

below. During the fifth irrigation period the decreed minimum flow was delivered to each of the Lower Users, but on account of the small quantity of water alloted to each ditch, the ditches being large in proportion, it was not practicable to measure the flow with current meter. As a matter of fact, the water master's time was so completely taken up in measuring and regulating the Upper Users' irrigation water that he had no opportunity to regulate the Lower Users' minimum flow, other than to satisfy himself that all the Lower Users had some flow in their ditches.

In the sixth irrigation period, 56% of their maximum allotments was delivered to the Lower Users.

In the seventh irrigation period 85% of their maximum allotments is estimated to have been delivered to the Upper Users. In this period it became apparent to the water master that there would be insufficient water to provide 85% to the Upper Users, in the following periods, and still furnish the Lower Users with their minimum flows, as certain of the Upper Users were claiming additional water alloted for mud flow lands and L. H. Sullivan changed from a continuous flow basis to a rotation, thereby doubling his allotment during the Upper Users periods. A series of current meter measurements were made in the Hat Creek channel and it was determined that from 70% to 75% of their maximum allotments was probably all that could be allowed the Upper Users. As this information was not secured in full until late in the period no change was made in the Upper Users' ditches.

The amounts of water delivered from the eighth to the sixteenth irrigation period, inclusive, averaged 58% to the Lower Users and 70% to the Upper Users. These deliveries were adequate to generally allow a fair irrigation and at the same time provide for the decreed minimum flows.

In several instances the Lower Users suffered interruption of their minimum flow. These interruptions are directly chargeable to the

absence of headgates on the Upper Users ditches. In a typical case, two of the Upper Users were rotating their water allotments. The upper of these two users completed his irrigation and turned his water into the Creek, notifying his neighbor, some six miles below, to take the water for the remaining days of the period, which was done. However the water which was released by the upper irrigator was diverted by the several dams into the several intervening ditches, unknown to the ditch owners. There was, consequently, an abrupt fall in Hat Creek below the lower irrigator, causing the extreme Lower Users to be without minimum flows for several days.

During the last three or four irrigation periods of the water master service, on account of cool nights and heavy dews, the land did not dry out as much between irrigation periods as it had theretofore; consequently there was an increase in the duty of water during these latter periods.

During the last two irrigation periods of the water master service, certain of the parties did not utilize their entire quotas, allowing their neighbors to operate their ditches to capacity.

The irrigation period commencing on October 8th found little demand for irrigation water, and Hat Creek was discharging about twenty second feet below the lowest diversion on October 8th and 9th.

The average estimated deliveries to the users, expressed in percentages of their full irrigating allotments as provided for in the decree, for each of the irrigation periods covered by the water master service, are shown in Table I attached hereto. It will be noted that the Upper Users received an estimated average of 76% of their full irrigating allotments and the Lower Users received an estimated average of 58% of their full irrigating allotments, during the entire period of water master service.

The difference between the average percentages of their full allotments delivered to the Upper and Lower Users is largely accounted for by the fact that in the decree it is provided that certain areas of irrigable land, which were irrigated prior to the mud flow from Mt. Lassen in 1915 but which have not as yet been reclaimed, should have an equal right with the lands now irrigated when they are reclaimed, and that the irrigation water for such lands should be delivered during the irrigation periods in which the owners thereof now receive their irrigating heads. Of this mud flow land, there are 152 acres which will receive water during the Upper Users periods and only 12 acres which will receive water during the Lower Users periods. No water was delivered to any of the mud flow land until after the eighth irrigation period. Commencing with the ninth irrigation period, water was delivered for approximately 110 acres of mud flow land during the Upper Users periods.

In addition to the mud flow land there are about 80 acres of irrigable land on the Claybough homestead, which if irrigated, would logically come in the Upper Users periods. Allowance for this land was made in preparing the division of the water users into the two classes as recommended in the report of the referee to the court in the case of Doyel, et al vs. Massie, et al.

If all the mud flow land together with the 80 acres of irrigable land on the Claybough homestead is put under irrigation, there will be 1278 acres of land to receive water in the Upper Users periods and 1340 acres of land to receive water in the Lower Users periods. It is believed that the slight difference in acreage between the two classes will be compensated for because of the fact that the full maximum irrigating heads allotted in the decree to the Doyel and Giessner ranches will probably never be needed on those ranches.

Another factor which entered into the difference in average per cent deliveries is the greater losses in the channel of the creek in the case of the Lower Users, because of the greater distance that the water must be conveyed. This condition was greatly aggravated this year due to the fact that the channel of the creek was practically dry below the Morris ranch for several weeks prior to the commencement of water master service. As a result the channel losses in delivering the water to the Lower Users during the fourth irrigation period were abnormally high. It is believed that the difference due to channel losses can be minimized by never permitting any portion of the channel of the creek to become entirely dry, and that if care is used in this regard the difference due to this cause will be practically a negligible factor.

INSTALLATION OF STRUCTURES

Upon the arrival of the water master at Hat Creek his time was thereafter completely taken up with the regulation of the various ditches for several months. It was not until the early part of August that any progress was made in the installation of headgates and measuring devices.

Each ditch was inspected by the water master to determine the best location and type of headgate and measuring device. On account of there being very little grade in most of the ditches, making the installation of weirs impracticable, submerged orifices were recommended in most cases. In all ditches where there was sufficient grade, however, weirs were recommended. These recommendations were communicated to the ditch owners.

The Indian ditch owners did not co-operate with the water master in the matter of installing headgates. Most of them lacked the mechanical ability to build the structures and further objected to bearing any part of the cost.

In only one Indian ditch, the Joe Wilson Ditch, was any work done, and in this ditch a headgate was built, but not as recommended by the water master.

It is suggested as a remedy for the condition existing in the Indian ditches, that the various interested white water users bear the expense of installing the headgates and measuring devices in the Indian Ditches, as a matter of expediency.

Excepting the Indians, all of the water users showed a willingness to comply with the provisions of the decree affecting headgates and measuring devices, excepting in the following instances where structures were not installed up to the time the water master left the Valley on October 9, 1924:

Mr. Harry Wilcox had failed to install measuring devices on the Harry Wilcox Upper, Harry Wilcox Middle, Harry Wilcox Lower, and Hawkins Ditches.

Mr. Harry Lonquist had failed to install a measuring device on the Harry Lonquist Ditch.

Messrs. Harry Lonquist, Fay and Clare Brown, and L. H. Sullivan, who are co-owners of the Reiger Ditch, had failed to install a measuring device on that ditch. The failure to install this structure was due to a disagreement among the several owners as to their relative responsibilities in this installation.

Some difficulty was experienced in that some of the ditch owners did not follow the specifications in building their measuring devices, resulting in some few structures not being acceptable as measuring devices. The most general conditions arising were: not making weir crests of sufficient height; not allowing access of air below weir crest; not making submerged orifices of exact cross sectional area; not making submerged orifices sharp edged; not making weirs sharp crested. However, it is believed that in most cases these conditions can be corrected so that at least fairly approximate measurements can be made.

Under date of September 23, 1924, a letter was mailed to Mr. Harry Wilcox by the water master notifying him of his failure to comply with the provisions of the decree pertaining to the installation of headgates and measuring devices, and instructing that he complete the required headgates and measuring devices without further undue delay.

Under date of October 9, 1924, letters were mailed to Messrs. Lonquist, Fay and Clare Brown, and L. H. Sullivan, instructing that they proceed with the installation of the measuring device on the Rieger Ditch. In the letter to Mr. Harry Lonquist, he was also instructed to install a measuring device on the Harry Lonquist Ditch.

Copies of all of the above mentioned letters were sent to the Chief of the Division of Water Rights.

Table IV attached to this report shows the status of headgate and measuring device installation, as of October 8, 1924.

USE OF WATER

Table II attached to this report shows the estimated deliveries to the various ditches of the Upper Users, in acre feet, for the six irrigation periods during which water master service was rendered. It will be noted that during the 120 day period from May 31st to September 28th, an estimated total of 10,549 acre feet of water was delivered to the Upper Users. This quantity was used on 1156.2 acres of land, or at the rate of 9.1 acre feet per acre for the 120-day period, which is equivalent to a continuous flow of one second foot to approximately 26 acres.

Table III attached to this report shows the estimated deliveries to the various ditches of the Lower Users, in acre feet, for the seven irrigation periods during which water master service was rendered. It will

be noted that during the 140-day period from May 31st to October 18th, an estimated total of 10,349 acre feet of water was delivered to the Lower Users. This quantity was used on 1328.3 acres of land, or at the rate of 7.8 acre feet per acre for the 140-day period, which is equivalent to a continuous flow of one second foot to approximately 35.5 acres.

LOSSES OF WATER IN TRANSPORTATION

The estimated total discharge of Hat Creek during the period from May 31st to October 8th was 27,590.1 acre feet. The estimated total deliveries for irrigation and minimum flows during this period were 23,890.7 acre feet. The difference of 3699.4 acre feet, or 13.4% represents the net losses in transportation through the creek channel, due to evaporation and seepage.

The Upper Users, with an estimated total available flow of 12,735.9 acre feet, received total estimated deliveries of 11,635.5 acre feet; consequently their transportation loss was about 1098.4 acre feet, or 8.6%.

The Lower Users, with an estimated total available flow of 14,856.2 acre feet, received total estimated deliveries of 11,755.3 acre feet; consequently their transportation loss was about 3100.9 acre feet, or 20.8%.

VIOLATIONS OF DECREE BY WATER USERS

In general there was but little tendency on the part of the water users to attempt any violation of the terms of the decree. It was noted, however, that upon several occasions there was an excessive use of water by one of the Upper Users. In fairness it is pointed out that there were no measuring devices installed at the time and that current meter measurements were the only means of estimating the flow in the ditches. It is therefore possible that a water user might have had more water in his ditches than he realized or intended.

In one particular instance, however, there was no doubt but that the water user above referred to knew that the use of water by him at the time was a clear violation of the decree. At the time of this violation, the Upper Users were receiving their minimum flows and the Lower Users their maximum irrigating heads. The water master, accompanied by an engineer of the Division of Water Rights, in making an inspection of the Valley discovered oneof this party's ditches carrying its maximum head, and irrigating a field of alfalfa. The water master made a report to the Division of Water Rights covering this matter, and the attorneys for the Lower Users were also notified. Letters were mailed to the water user by the Division of Water Rights and by the various attorneys for the Lower Users, pointing out the fact that his use of water in this instance was an act in contempt of the Superior Court, and that any further complaint would cause him to be cited to appear before the Superior Court to answer thereto. No further violations occurred after these letters were sent out.

DISCUSSION

In discussing the operation of the water regulation on Hat Creek, and its effects on crop production several factors must be considered. It must be remembered that the season of 1924 was a period of drouth, the worst condition in fifty years of record. All over the state streams were reduced to dry channels, even the larger rivers fell to their lowest recorded discharges. The groundwater level steadily receded, until in many localities, the discharge of pumping plants installed in wells, was reduced by half.

In addition to the above, other climatic conditions were extremely unfavorable. Early frosts did great damage to hay crops. The early growing season was cold and crops grew very slowly. All of these conditions should be considered in making an estimate of the effect of Hat Creek water regulation upon the crops.

It is believed that, in general, the regulation of the Hat Creek water, according to the terms of the decree, was beneficial to the Hat Creek Valley. It is believed that more hay was raised in the Valley than would have been raised had there been no regulation. Certain of the water users report increased yields of hay per acre; others report a decreased production.

As a general statement, it may be said that all of the Lower Users were greatly benefited by water regulation. In the case of many of them, it is believed that without regulation, no water would have been available for irrigation during the irrigation periods from May 31 to September 30, 1924. This condition would probably have existed from the A. L. Doty farm on down the stream. Such a condition has existed prior to this year, in seasons of much greater discharge of Hat Creek.

Certain of the Upper Users were undoubtedly injured by the water regulation. The Harry Wilcox farm is an outstanding instance. On this farm it has been the custom to irrigate by the wild flooding method, using very large irrigating heads, and by such means land too rough to cover by using smaller heads could be irrigated. The ditch system on this farm is inadequate and the land has very few irrigation checks or borders. Mr. Wilcox was quite seriously handicapped in attempting to irrigate these lands in their present condition, using the restricted flow allotted, but it is believed that his difficulties can to some extent, at least, be eliminated by a better preparation of the lands to receive water and by the employment of additional help in irrigating.

The Fay and Clare Brown farm also may be included in the list of those injured by the water regulation. In this connection it may be stated that for the first several periods this farm utilized its own allotment of water alone. The last several periods the allotment of the L. H. Sullivan allotment farm was also used, Mr. Brown taking the combined flow 4½ days, and Mr. Sullivan taking it for 5½ of each irrigation period. It was noted that by this rotational scheme, each of the parties was able to irrigate a greater acreage than under the original plan.

Prominent as an example of the larger and better administered farms among the Upper Users is that of the Opdyke Brothers, comprising about 177 acres. For the past several years the owners of this property have been preparing their land for irrigation. Some minor levelling was done, but in the main, the preparation consisted of the building of new lateral ditches and the construction of field checks. Mr. Perry Opdyke stated that it was realized that water regulation was imminent, and that the old system of irrigation on his property would then prove inadequate. This farm was nearly always completely irrigated each irrigation period. To accomplish this it was necessary

to keep an irrigator almost constantly employed day and night. It was the practice for the irrigator to get up at four hour intervals during the night and attend to the irrigation. In two cuttings of hay, this ranch produced over 400 tons, or about 2½ tons per acre. A third crop of approximately 90 tons could have been cut had it not been thought more profitable to pasture it off with cattle. It is pertinent to remark that the production on this ranch for 1923, under no water regulation, was less than that of 1924.

Rotation of water was practiced by many of the water users with decided advantage. In general, by thus applying water at a greater rate, a greater acreage was irrigated.

Considering the Hat Creek Valley as a whole, it is believed that the regulation of water was a decided benefit. Under conditions of normal rain and snowfall during the winter, thus building up the ground-water level and causing a normal run-off from the watershed, it is believed that there will be more than ample water to irrigate all the irrigable lands in the Valley, under the rotation schedule provided for in the decree.

RECOMMENDATIONS

In order to facilitate the delivery of water to the ditches some better diversion works are needed than the temporary dams at present installed at the heads of most of the ditches.

On account of the ease with which water can in most cases be diverted from Hat Creek, there has been but little attention paid to diversion works. In fact, throughout the entire length of Hat Creek above Rising River, there can be found but one permanent and efficient structure for diverting and regulating the flow. Nearly all the water users adhere to

the old practice of building loose rock wing dams to turn water into their ditches, rebuilding as often as it becomes necessary. Since the commencement of the water master service it has been necessary to remove these dams, at least in part, after each period of maximum use, restoring them again when it is next time to irrigate.

In addition to the advantages that would be obtained from good diversion dams in ease of handling diversions, a further advantage could be obtained from their installation so as to raise the water level of Hat Creek sufficiently to permit the use of weirs to measure the flow of water into the ditches.

It is therefore recommended that permanent diversion dams of the flashboard type be constructed at the head of each ditch.

The greater part of the lands irrigated from Hat Creek are not properly checked for economical irrigation. No doubt, under the old system of unrestricted use of water, they were irrigated, but under a restricted and definite allotment it becomes necessary to conserve the water. This can best be accomplished by proper ditch and lateral location, and by the checking of the land in such a manner that irrigation heads are confined to definite areas, and not allowed to meander about over the fields, as is now the case on many of the Hat Creek ranches. Levelling the lands, however, except for the removal of local knolls and the filling of small depressions, is not recommended on account of the many out-croppings of ledges of lava rock with which the district is underlaid.

As previously mentioned, there is a loss in transportation through the channel of the creek in the case of the Lower Users of approximately 20%. This loss can be materially reduced by straightening and cleaning out

the channel of Hat Creek between the Morris and Doyel ranches. Great accumulations of sand and driftwood retard the flow and in many cases have filled up the channel. It is believed that work in cleaning and straightening this portion of the channel will be amply recompensed in the reduction of transportation losses.

It is further recommended that a standard type of gage be used at all gaging stations on the creek and on all of the ditches. This would facilitate the work of the water master in reading the gages. Enameled metal gage plates, of the type used by the United States Geological Survey, can be obtained through the Division of Water Rights at a cost of about one dollar per three-foot section

FINANCIAL STATEMENT

HAT CREEK VALLEY WATER MASTER SERVICE

MAY 31, 1924, TO OCTOBER 8, 1924, INCLUSIVE

RECEIPTS

Hat Creek Water Users through W. D. Tillotson, Attorney	$ 866.65	
J. S. Ratledge	4.43	
		$ 871.08
Division of Water Rights:		
Supervision (estimated)	150.00	
Miscellaneous Expense	37.73	
Automobile Expense	245.91	
Lodging and Meals	267.20	
Water Master Salary	85.14	
		785.98
Total.		$1657.06

DISBURSEMENTS

Water Master Salary	$ 956.22	225/mo.
Lodging and Meals	267.20	
Automobile Expense	245.91	
Miscellaneous Expense	37.73	
Supervision (estimated)	150.00	
Total.		$1657.06

COST DATA

HAT CREEK VALLEY WATER MASTER SERVICE

MAY 31, 1924, TO OCTOBER 8, 1924, INCLUSIVE

Total Acreage Irrigated.	2453.3 acres
Total Cost Water Master Service.	$1657.06
Total Cost per Acre.	$ 0.66½

Contributed by Water Users	$ 871.08
Contributed by Division of Water Rights.	785.98
Cost per Acre to Water Users	0.35
Cost per Acre to Division of Water Rights.	0.31½

Percent of Cost borne by Water Users	52.6%
Percent of Cost borne by Division of Water Rights.	47.3%

TABLE I

ESTIMATED DELIVERIES ON NAT CREEK

1924 SEASON

Period		Estimated Delivery in Percentage of Full Allotments	
No.	Dates	Upper Users	Lower Users
1	May 1 - May 11	No Water Master Service	
2	May 11 - May 21		
3	May 21 - May 31		
4	May 31 - June 10		62
5	June 10 - June 20	86	
6	June 20 - June 30		56
7	June 30 - July 10	85	
8	July 10 - July 20		60
9	July 20 - July 30	75	
10	July 30 - Aug. 9		50
11	Aug. 9 - Aug. 19	67	
12	Aug. 19 - Aug. 29		50
13	Aug. 29 - Sept. 8	70	
14	Sept. 8 - Sept. 18		57
15	Sept. 18 - Sept. 28	70	
16	Sept. 28 - Oct. 8		70
17	Oct. 8 - Oct. 18	No Water Master Service	
18	Oct. 18 - Oct. 28		
	Average	76	58

TABLE II

ESTIMATED DELIVERIES FOR IRRIGATION TO UPPER USERS

DURING PERIODS BETWEEN MAY 31, 1924, AND SEPTEMBER 28, 1924

DITCH	Irrigate Acreage	Max. allotment as per Decree: Sec. Ft.	Acre feet for 6 Irrigation Periods	Estimated Total Delivery during the 6 Irrigation Periods in a.f.
Harvey Wilcox - Upper*	30.7	* 2.00	238.0	180.9
		1.06	126.1	95.9
Harvey Wilcox - Lower*	30.7	* 2.00	238.0	180.9
		1.06	126.1	95.9
Stevenson*	44.0	* 2.00	238.0	180.9
		2.38	283.2	215.3
Gray	10.0	1.00	119.0	90.4
Hall*	32.4	3.25	386.8	294.0
Alec Brown	4.7	0.50	59.5	45.2
Hawkins	22.0	2.25	267.8	203.5
Harry Wilcox - Upper	72.1	7.13	848.5	644.9
Harry Wilcox - Middle	243.2	24.25	2886.0	2193.3
Harry Wilcox - Lower	10.5	1.00	119.0	90.4
Rube Wilcox - Davis	50.4	5.00	595.0	452.2
Valentine - Upper	11.8	1.13	134.5	102.2
Valentine - Lower	2.1			
Heryford - Upper	14.7	1.50	178.6	135.7
Heryford - Middle	5.6	0.50	59.5	45.2
Heryford - Lower	14.7	1.50	178.6	135.7
Edith Snook	2.4	0.50	59.5	45.2
Ratledge - Henry Lonquist	61.6	5.38	640.3	486.6
Ratledge - Opdyke - U. S. Forest Service	72.2	9.25	1100.8	836.6
Opdyke	119.6	11.88	1413.8	1074.5
Morris - Upper	111.3	11.13	1324.6	1006.7
Morris - Lower	111.4	11.13	1324.6	1006.7
Reiger	78.1	7.88	934.2	710.0
Total	1156.2	116.63	13880.0	10548.8

*Includes additional acreage alloted water on account of lands submerged by mud flow from Mt. Lassen in 1915 (see Paragraph 21 Hat Creek Decree)

TABLE III

ESTIMATED DELIVERIES FOR IRRIGATION TO LOWER USERS

DURING PERIOD BETWEEN MAY 31, 1924, AND OCTOBER 18, 1924

DITCH	Irrigated Acreage	Max. allotment as per Decree Sec.Ft.	Acre feet for 7 Irrigation Periods	Estimated Total Delivery during the 7 Irrigation Periods in a.f.
Morris - Upper	134.8	13.50	1874.4	1087.0
Harry Lonquist	6.2	0.75	104.1	60.4
Reiger	84.6	3.75	520.7	302.0
Lonquist-Reynolds-Bidwell	150.7	15.00	2082.6	1207.9
Lonquist-Reynolds-East Side	34.8	3.50	485.9	281.9
Lonquist-Reynolds-Middle	31.2	3.00	416.5	241.6
Reynolds Canal	39.6	4.00	555.4	322.1
Henry & Fritz Lonquist - Upper	18.0	4.63	642.8	372.8
Henry & Fritz Lonquist Lower	73.9	4.50	624.8	362.4
Opdyke	1.2	0.125	18.0	10.5
Jeff Bone - Upper	2.2	0.50	69.4	40.3
Jeff Bone - Lower	5.2	0.50	69.4	40.3
Lee Bone	9.1	1.00	138.8	80.5
Sam Williams	8.0	0.75	104.1	60.4
Julia Wilson	54.4	5.50	763.6	442.9
Joe Wilson	28.2	2.75	381.8	221.5
Ellen Brown - Upper	30.2	3.00	416.5	241.6
Ellen Brown - Lower	31.8	3.25	451.2	261.7
Ellen Brown & W.W.Brown	116.7	11.50	1596.7	926.1
Doyle	180.3	20.00	2776.9	1610.6
Hat Creek (No ditch)	86.5	8.75	1214.9	704.6
Bertha Geissner	121.0	10.25	1423.1	825.4
Otto Geissner	79.7	8.00	1110.7	644.2
Total	1328.3	128.525	17842.3	10348.7